PROCEEDINGS AND PAPERS OF THE TWELFTH TRUMPETER SWAN SOCIETY CONFERENCE

RESTORING THE TRUMPETER SWAN TO THE UPPER MIDWEST

6-9 SEPTEMBER 1989

MINNEAPOLIS, MINNESOTA

Judy Voigt Englund, Editor

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Donna Compton

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Laurence N. Gillette

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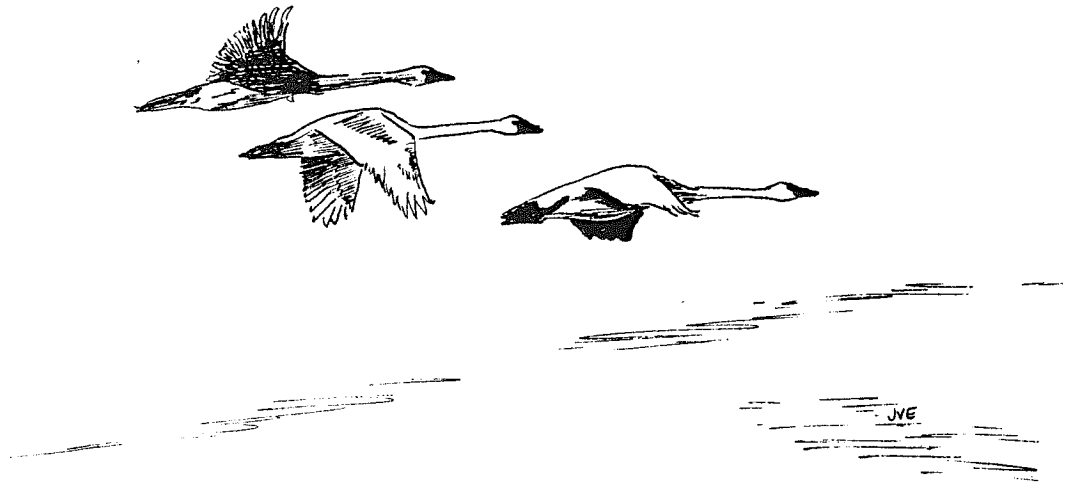
PREFACE

Restoring the Trumpeter Swan to the Upper Midwest was the theme of the 12th Trumpeter Swan Society Conference. Historically, the prairie pothole region was the most productive swan habitat in North America. This entire population was wiped out prior to the turn of the century by market hunting. Restoring migratory populations of Trumpeters has proven to be enormously complex. The purpose of this Conference was to examine the problems confronting swan managers and to develop a management plan for Trumpeter Swans in the Mississippi Flyway.

The Conference focused on Trumpeter Swan restorations and management in the Upper Midwest. It included reports on ongoing programs to restore Trumpeter Swans in South Dakota, Minnesota, Wisconsin, Michigan, and Ontario, as well as efforts to reestablish migratory traditions. Other sessions included papers on the impact of Tundra Swan hunting on Trumpeter Swans, the status of Trumpeters in the Rocky Mountains, Alaska, and western Canada, research projects, propagation techniques, the effects of lead poisoning, and the availability of eggs and swans from wild populations.

This publication is a compilation of the papers given and much of the discussion (in summary form) from the Conference in Minneapolis, Minnesota, in September 1989. It includes the current, state-of-the-art research and management techniques for Trumpeter Swans. It also provides historical information on Trumpeter populations and the names and addresses of those "in the know" for further information.



ACKNOWLEDGEMENTS

It is doubtful that any Conference attendees were aware of the tremendous amount of work that went into each day of the Conference to allow it to proceed with no apparent effort. Thanks go to the following people and agencies for their skill in organizing this Conference, and for their generous gifts of time:

Larry Gillette - Hennepin Parks
Program Chair
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Martha Jordan - The Trumpeter Swan Society

A special commendation goes to Kate Anderson and her volunteer crew for their availability at the Conference for anything and everything, especially the unexpected. They provided service at its best. THANKS! And, Clay Jobes single-handedly put together a fantastic collection of art, all donated, had it framed, and got it sold. The effort, as well as the money earned, is to be applauded. Sincere thanks also go to the artists for their donations.

Donations came from Hennepin Parks ($1,000), the Minnesota Waterfowl Association ($500), U. S. Fish and Wildlife Service ($2,500), and varying amounts from a number of individuals in support of the Conference as well as publication of the presented papers.

The "meat" of the Conference was ably organized by Larry Gillette. The speakers gave all participants a heightened awareness of current management needs of Trumpeters.

As I said at the Conference, "It is easy to be depressed about the condition of the world and feel that all efforts toward improving those conditions are, in fact, futile. It is far more difficult to rally support for, and maintain momentum in, efforts to improve environmental conditions." We participated in a rally at the Conference -- we must now pursue the challenges raised with diligence.

Donna Compton
Conference Chair

My thanks go to Donna Compton for encouragement and support during the editing of these Proceedings, and to Jeanne Ullmer for endless hours on Pagemaker rendering these pages in printable form.

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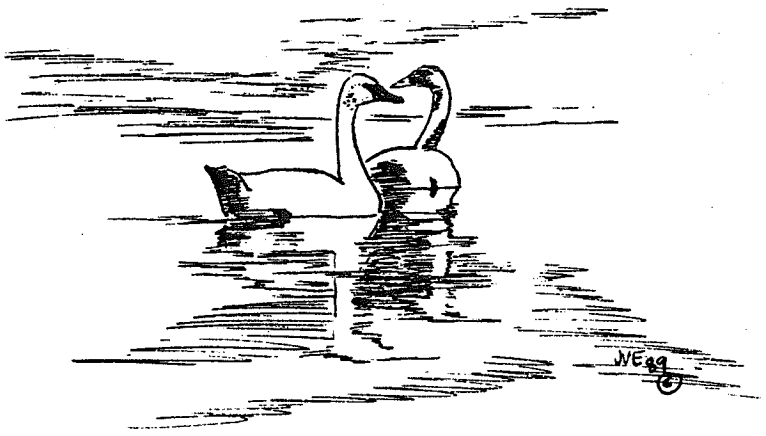

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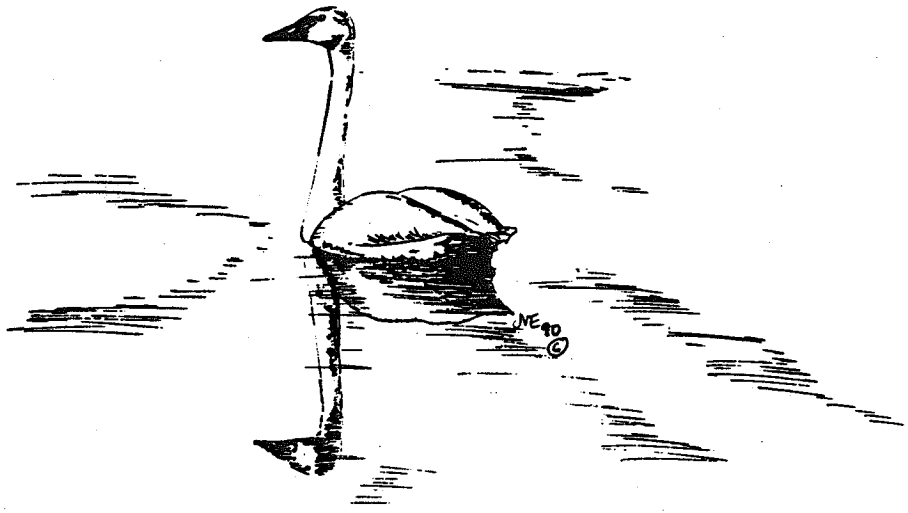
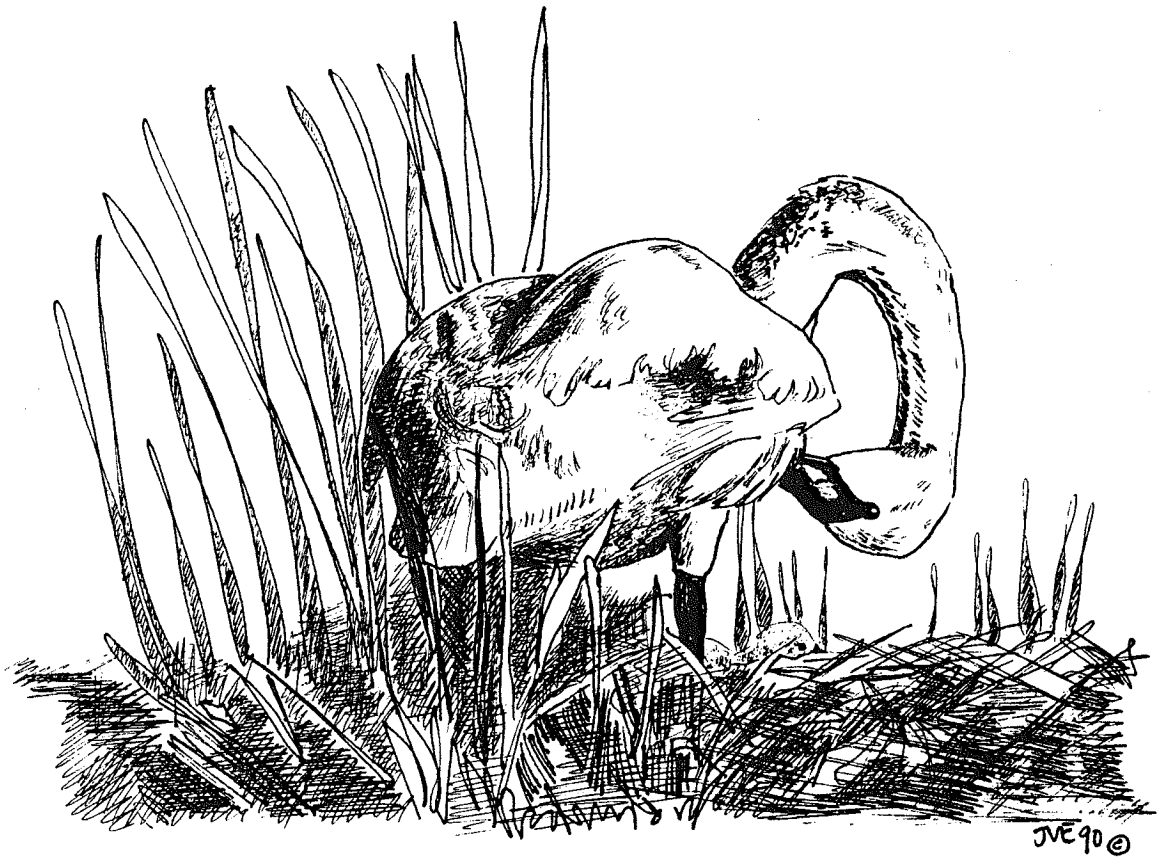
BANQUET ADDRESS

TRUMPETER SWAN RESEARCH

ROCKY MOUNTAIN POPULATION



WELCOME AND INTRODUCTION



KEYNOTE ADDRESS: TWELFTH TRUMPETER SWAN SOCIETY CONFERENCE

James C. Gritman

Good morning. I'm happy to be here this morning to help kick off the Twelfth Trumpeter Swan Society Conference.

Let me begin by saying that there is a lot of good news in the waterfowl world today, and I want to share some of the headlines with you. Many of you already know that the North American Waterfowl Management Plan is improving habitat for ducks, geese, and swans across the continent. We are delighted that several goose populations are at all-time highs. It is also pleasing to note that Tundra Swans are abundant in many areas. The President of the United States wants to establish a policy of no net loss of wetlands. The U. S. Fish and Wildlife Service (USFWS) has been aggressively working to restore over 3,500 wetlands on private lands in the Upper Midwest. We have been protecting waterfowl and endangered species habitat through easements on and fee title transfers of Farmers Home Administration inventory lands under authority of the 1985 Food Security Act. And, hopefully, we are seeing the beginning of the end of the drought conditions which have devastated duck numbers over the last decade.

Unfortunately, there is also some bad news. Duck populations are at or near all-time lows, and we are especially concerned about Pintails, Blue-winged Teal, and Canvasbacks. Pintail and Blue-wing numbers have never been lower.

All of you are aware of the loss of Trumpeter Swans to lead poisoning here in the Twin Cities area last winter. It was a tragic loss, and it will likely take years for the Hennepin Parks population to recover. Problems like this will become less common after the phasing-out of lead shot for waterfowl hunting is completed in 1991.

During the drought of the 1980's, agricultural interests have wreaked havoc with the dry wetland basins all across the prairie pothole region of the United States and Canada. Many wetlands that had previously been spared from severe degradation or destruction, because of their normal wetness, have been lost forever. When water returns to the prairies, those basins will not be available to host ducks, shorebirds, and furbearers as they had since the retreat of the glaciers.

The impacts of the drought have not been restricted to prairie ducks, however. Rocky Mountain Trumpeter Swans have suffered along the Henry's Fork of the Snake River in Idaho. The USFWS was recently petitioned to list this population as threatened. In its initial review, the USFWS has determined that listing the Rocky Mountain Trumpeter Swan Population "may be warranted." The USFWS has until May 1990 to make its final determination. The situation last winter was extreme because of the combination of abnormally low temperatures and low water conditions in Island Park Reservoir. In most years, sufficient water is held in the reservoir to allow enough discharge during the winter to maintain suitable habitat downstream of the reservoir. This past winter, the discharge was insufficient to maintain the open water, and many Trumpeter Swans starved. Meetings have been held with the Bureau of Reclamation and the local power and irrigation districts to discuss the problem and to find a solution. At this point, it looks positive for maximizing winter flows in the future. Other actions are also underway to establish additional wintering areas where weather conditions are less severe.

While I'm here with you this morning, I want to touch on a number of issues relating specifically to Trumpeter Swans. A few years ago, a Trumpeter Swan Management Plan was prepared. That plan has been accepted by all of the flyway councils. From the USFWS perspective, we believe the North American Trumpeter Swan Management Plan is working well. It is due for review and updating in 1990. One of the things we would like to see addressed in that review is more inter-flyway coordination in an effort to deal with restoration flocks which migrate across flyway boundaries.

We are quite satisfied with the states and flyway councils taking the lead in restoring Interior Population Trumpeter Swans, and are anxious to work with them as much as we can. They are doing a good job, considering all of the difficulties and unknowns involved in restoration programs. I hope they will be able to keep up the good work.

Another point regarding Trumpeter Swan restorations is that the USFWS will not set priorities for these projects. Individual states will have to take their restoration proposals to their flyway council and the flyway council will prioritize the projects. This is the system which has been used for several years in the Mississippi Flyway, and it is working well.

That philosophy is right in line with USFWS policy on the expansion of Trumpeter Swan populations. USFWS policy states that expansion of Trumpeter Swan distribution will be allowed to occur primarily as a result of normal pioneering. Low priority is given by the USFWS to expansion by artificial means. However, the USFWS will consider participation in flyway council-endorsed state programs to restore Trumpeter Swans by artificial means on a case-by-case basis. To us, this means we are willing to assist in providing release sites on refuges where we believe it is appropriate, and that we are anxious to help find ways to establish migration patterns for Trumpeters which will minimize their losses during severe winter weather.

Some of you are concerned about the potential and real conflicts between Trumpeter Swan restorations and Tundra Swan hunting. The 1984 North American Trumpeter Swan Management Plan recognizes that occasional, chance killings of Trumpeters will occur during legal Tundra Swan hunts. At the same time, the hunting plans for both the Eastern and Western Tundra Swan Populations call for avoiding the accidental taking of Trumpeters by not allowing Tundra Swan hunting in areas frequently used by Trumpeters, or by timing the seasons to not permit swan hunting when the likelihood of Trumpeters being present is high. As Tundra Swan hunting becomes more popular and more widespread, and as restoration efforts for Trumpeters are expanded, these conflicts could become more prevalent. To minimize this problem, we strongly encourage waterfowl biologists, nongame biologists, the USFWS, and the flyway councils to work together in the early planning stages of all proposed swan hunts and restoration projects.

Before leaving you today, I want to say a few more words about our wetland restoration efforts in the Upper Midwest. I mentioned earlier that we have restored over 3,500 wetlands. That amounts to over 10,000 acres of wetland habitat that is benefiting wildlife and the people who enjoy wildlife. Additionally, we are in the process of acquiring 551 Conservation Easements on Farmers Home Administration inventory lands. Those easements will protect 38,000 acres of important wetland, floodplain, and endangered species habitat. Obviously, not many, if any, of these wetlands will ever be used by Trumpeter Swans, but because of these restorations, some people may become more appreciative of the values of wetlands and the wildlife associated with them. That appreciation is essential for gaining support for other wetland protection and management efforts, and those larger projects may be important to swans. The point is, habitat availability is limiting the populations of many wetland wildlife species. A few short years ago, I would not have believed the USFWS would be able to get such a positive response from landowners toward wetland restoration. It's incredible to me that we've been able to accomplish as much as we have. We hope the USFWS will be able to continue this work under the 1990 Farm Bill, which Congress will be developing next year.

In closing, I want to recognize The Trumpeter Swan Society (TTSS) for the effort it has put into the well-being of these magnificent birds. The USFWS views TTSS as a clearinghouse for information about Trumpeters and about activities related to them. We also see TTSS as a catalyst for maintaining an active interest in Trumpeter Swans. We think you have done an excellent job in fulfilling this role.

There are a number of USFWS people here from across the country. Several of them will be making presentations this week. Feel free to visit with them this week and ask them questions about swans in their home Region.

The USFWS is proud to be one of the sponsors of this conference, and it's been my pleasure to be here this morning. I hope you have a very enjoyable and productive meeting.

NONCONSUMPTIVE VALUES OF WILDLIFE --THE ROLE OF THE TRUMPETER SWAN

Dave C. Lockman[1]

Hunting has historically been a traditional wildlife activity, as has fishing. Hunting revenues have been important to state economies, and have supported state and federal wildlife management efforts and programs. We, as wildlife managers, are also in the recreation business. We are in an increasingly urbanizing society. Hunter numbers are decreasing, and nonconsumptive wildlife uses are increasing. Outdoor recreation is also increasing. The trends and challenges of the future are for nonconsumptive wildlife recreation.

We preserve by promoting awareness. We are creating our own environment for polarizing and alienating certain user groups when we categorize wildlife as game and nongame. We forget to acknowledge that we are all wildlife enthusiasts. Wildlife is wildlife. It is all important to the land. We cannot change people's values about wildlife, but education is the key to changing public attitudes about consumptive vs. nonconsumptive use.

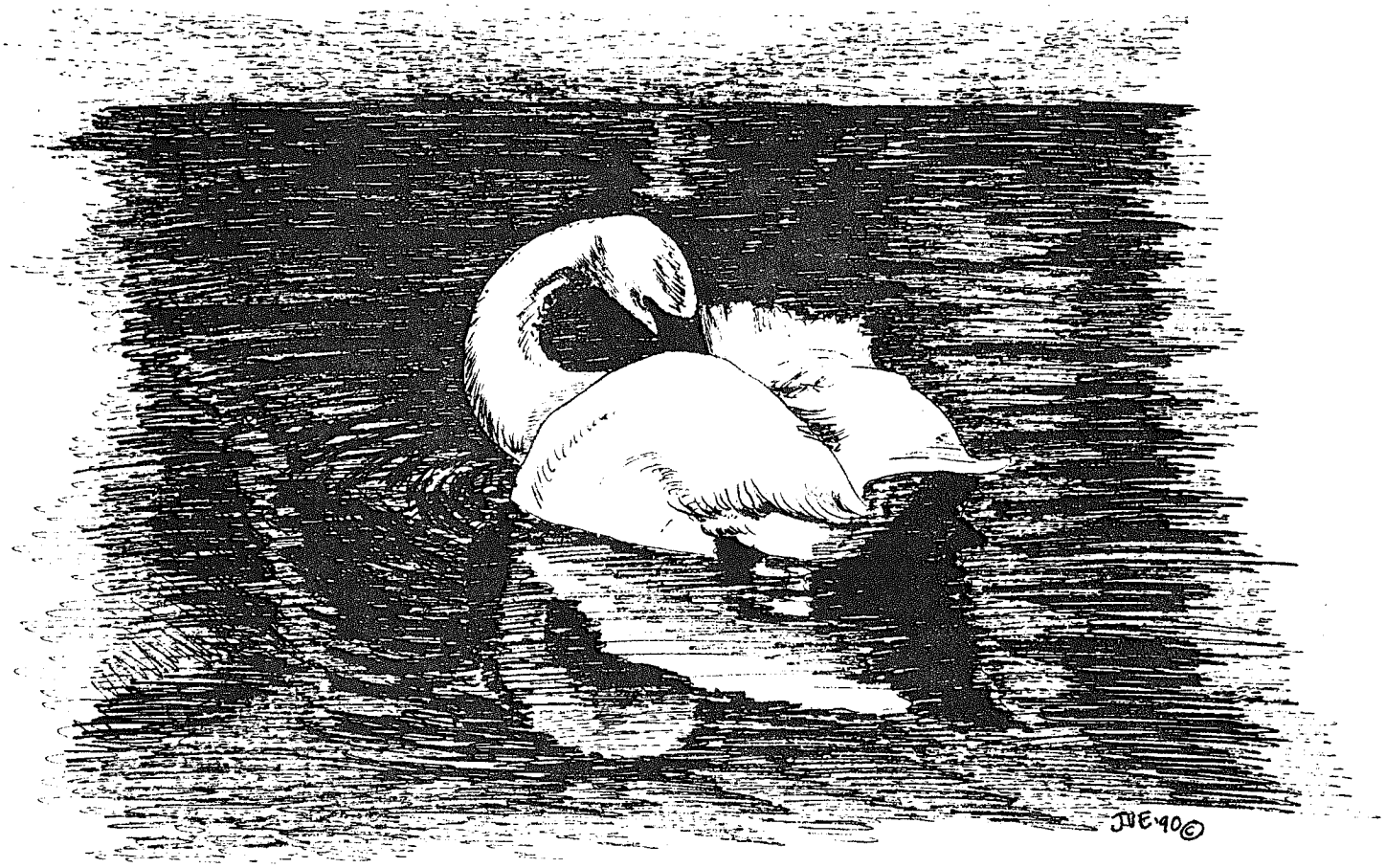
Wyoming, for example, is well known for its big game hunting opportunities. However, Wyoming provides many nonconsumptive uses. There are 102 hunted wildlife species in the state, and 401 nonhunted species. The most visible species are elk, deer, bison, and swans. They don't have to be hunted to be enjoyed. There are unlimited opportunities for viewing wildlife.

Currently, Wyoming is increasing its wildlife awareness through education. We want to change the public's attitudes, not values, about wildlife. One Visitor's Center has already been built, and four more are in production. Black-footed ferrets are displayed at the completed Visitor's Center, and we have the opportunity to teach about managing species in abundance vs. managing species with low populations. We can educate the public about threatened and endangered species, as well as about the more common animals.

The Trumpeter Swan Society should support a Visitor's Center, in the Skagit Valley for example, even before additional habitat acquisition is undertaken. We need to create the awareness that there is a problem with certain Trumpeter Swan populations before we can work on a solution. Education promotes awareness, and promotes new funding sources for wildlife management.

[1]Transcribed from tapes of the Conference.

PACIFIC COAST POPULATION



ALASKAN TRUMPETER SWAN STATUS REPORT

Bruce Conant[1]

ABSTRACT

There are about 12,000 Trumpeter Swans now in Alaska. Overall numbers seem to be increasing steadily. However, there is not strong support from the Regional Office, U. S. Fish and Wildlife Service (USFWS), for conducting a complete 1990 population survey. Funding is needed, and support from Trumpeter Swan Society members and other Regions of the USFWS will be needed. In addition, the Canadian Wildlife Service will have to conduct a survey in neighboring provinces in coordination with the USFWS survey to gain a complete understanding of Trumpeter Swan numbers in Alaska and surrounding areas.

[1] Transcribed from tapes of the Conference.

MIGRATION AND WINTERING RESIGHTINGS OF TRUMPETER SWANS FROM CENTRAL ALASKA

Rodney J. King

ABSTRACT

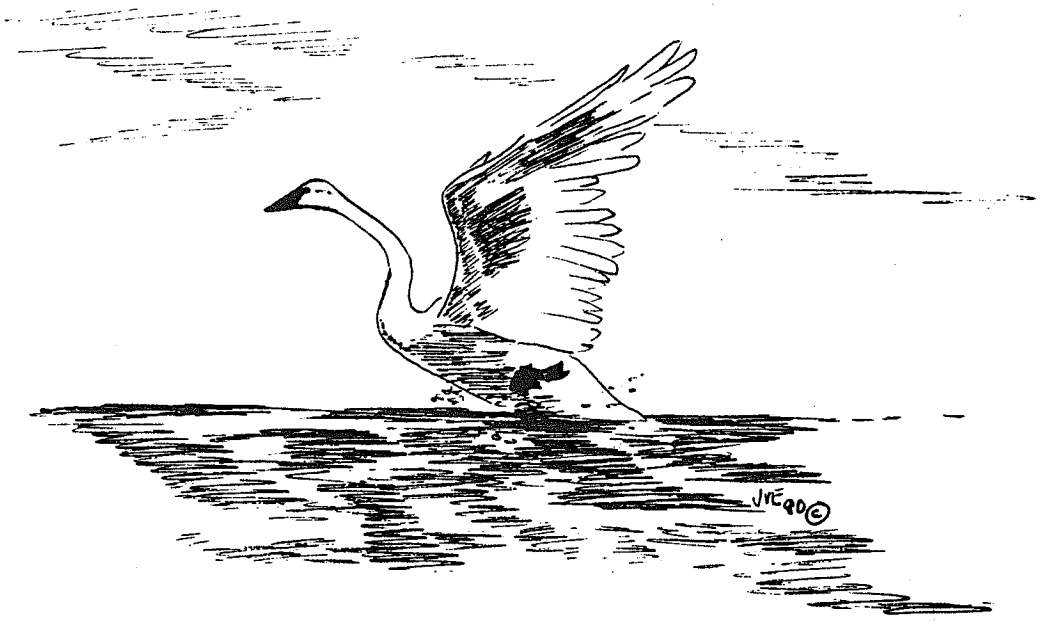
From 1982 through 1988, blue neck bands were placed on Trumpeter Swans in central Alaska. A total of 262 swans was banded, 230 of which were banded in the Minto Flats, located 50 km west of Fairbanks. Of the 262 birds neck banded, 90 individual birds (34 percent) have been identified from 147 different resighting records. A total of 21 resightings (14 percent) occurred from spring migration through the breeding season (April through August). Fifty-nine resightings (40 percent) occurred during fall migration (September through November), and 67 resightings (46 percent) occurred on wintering areas (December through March). Of the 90 individual birds resighted, 64 were hatching-year birds and 26 were more than 1 year old. Only 12 of the hatching-year birds (42 percent) were observed on more than one occasion. Resightings include 52 from Alaska (35 percents), 9 from Yukon Territory (6 percent), 18 from British Columbia mainland (12 percent), 24 from Vancouver Island, B.C. (16 percent), and 44 from the state of Washington (30 percent).

SWAN MIGRATION ROUTES IN THE NELCHINA BASIN, ALASKA, DURING SPRING MIGRATION 1989

Brian A. Cooper, James G. King, and Robert J. Ritchie

ABSTRACT

During spring 1989, movement patterns of swans within the Nelchina Basin, Alaska, were examined from three ground stations and by aerial surveys. Tundra Swans (Cygnus columbianus) entered the Nelchina Basin from the northeast near Nabesna (62°22'N, 143°00'W) and followed the Copper River until reaching a point approximately 15 km upstream from the village of Gakona (62°18'N, 145°18'W), where they split into two corridors. One corridor exited the basin via Chickaloon Pass (61°47'N, 148°28'W), and the other exited via the upper Susitna River Basin. Trumpeter Swans (Cygnus buccinator) entered the basin from the northeast near Nabesna and from the south near Chitina (61°31'N, 144°26'W). Whether swans entering the Nelchina Basin near Chitina came from the Pacific coast via the Copper River or from the Chitina River Drainage was not determined. Based on our observations, it appeared that roughly equal numbers of Trumpeter Swans entered the Nelchina Basin near Chitina and Nabesna.



THE STATUS OF TRUMPETER SWANS WINTERING IN SOUTHWESTERN BRITISH COLUMBIA IN 1989

Richard W. McKelvey

INTRODUCTION

The Pacific Coast Population (PCP) of Trumpeter Swans (Cygnus buccinator) breeds in Alaska, and winters primarily on the west coast of North America from southeastern Alaska to southern Washington. More than half of the Population is believed to winter in British Columbia, with the most important area being the southwest portion of the province. Wintering populations of swans have been counted on an irregular basis in that area over the past 10 to 15 years. In general, the number of swans recorded has increased. The results of some recent surveys and observations are presented in this paper to demonstrate the growing importance of the area to swans.

METHODS

Surveys were conducted in three areas in southwestern British Columbia in the winter of 1988-89. An aerial survey was conducted around Vancouver Island 6-8 February 1989, and ground surveys were conducted on the Fraser River Delta 10 and 13 March 1989, and in the Upper Fraser Valley 14 March 1989. In addition, a midwinter survey in the Kamloops area was conducted from the ground by R. Howie. All surveys used standard procedures to observe, record, and identify the species of swans involved. Additional data were obtained from sighting cards sent into the Canadian Wildlife Service by professional and amateur ornithologists over the past 5 years.

RESULTS AND DISCUSSION

Vancouver Island

A total of 2,722 swans was seen on Vancouver Island, 17.6 percent of which were cygnets. That was more than a two-fold increase since the aerial survey of Vancouver Island conducted in February 1978. The numbers of swans seen on the west, north, and northeast coasts of Vancouver Island were approximately the same as those seen in the 1978 survey (Table 1). The numbers seen on the southeast coast, however, had increased dramatically. The largest concentration, probably to no one's surprise, was in the Comox area. Approximately 1,100 swans were seen there, or about 10 percent of the total Alaska population.

Most of the swans were believed to be Trumpeter Swans, based on recent ground counts between Chemainus and Comox (K. Morrisson, pers. comm.). Mute Swans (Cygnus olor) were seen on the Chemainus River estuary, but those have been deleted from the numbers reported here.

Table 1. The number of swans seen on Vancouver Island during aerial surveys in the winters of 1977-78 and 1988-89.[1]

Area	Survey Date 1977-78	1988-89	Percent change
West coast	441	446	+ 1.1
North coast	50	81	+ 62.0
Northeast coast	114	47	- 58.8
Southeast coast	570	2148	+276.8
Total	1175	2722	+131.7

[1]Data from McKelvey, Richard W. 1979. Swans wintering on Vancouver Island, 1977-1978. Canadian Field-Naturalist 93(4):433-436.

Fraser River Delta

The surveys on the Fraser River Delta revealed a total of 448 and 500 swans on the two respective dates. The second survey included two additional areas on the foreshore that could not be observed on the first survey. When comparing similar areas, the numbers seen on the Fraser River Delta were 448 and 458. In the period 1982 to 1984, the peak number of swans seen on the delta and foreshore did not exceed approximately 150 birds. Juveniles were recorded only on the survey of 10 March, and accounted for 11.2 percent of the total, a somewhat lower proportion than was seen on Vancouver Island. Tundra Swans were heard, but could not be consistently identified.

Upper Fraser Valley

A number of areas in the Upper Fraser Valley have been surveyed over the years for wintering swans, including the Harrisson Bay/Harrisson River area, Nicomen Slough, and the Pitt Lake area. More recently, swans have also been observed in the Sumas Prairie/Lakemount Lake area. It is unclear when swans first began to use the latter area, but in 1987-88, at least 150 birds were seen there. On 14 March 1989, 319 birds were observed, 16.0 percent of which were juveniles. Tundra Swans were estimated to account for about 75 percent of that flock, and probably a similar proportion of the flock seen in 1987-88. Tundra Swans are also seen in the

other Upper Valley swan flocks, but in much lower proportions. Most are believed to be Trumpeter Swans.

Recent sightings in the Harrisson Bay, Nicomen Slough, and Pitt Lake areas are shown in Table 2. The numbers reported from those areas fluctuate somewhat, but approximate averages would be 100 Trumpeter Swans each at Harrisson Bay and Nicomen Slough, and 150 at Pitt Lake.

Table 2. Recent sightings of swans in the Upper Fraser Valley as recorded on sighting cards sent to the Canadian Wildlife Service.

Harrisson Bay	Nicomen Slough	Pitt Lake
Nov 1988 - 116	Jan 1985 - 38	Jan 1984 - 110
	Feb 1985 - 102	Jan 1985 - 176
		Dec 1986 - 310
		Jan 1987 - 172
		Mar 1987 - 120

Kamloops

Swan surveys have been conducted in the Kamloops area in early January since 1975. Trumpeter Swans were recorded very infrequently until 1985, when 50 birds were seen. Numbers have increased since, with 116 Trumpeter Swans and 403 Tundra Swans seen in January 1989. All the Trumpeter Swans were seen in one flock. The proportion of cygnets was 19.0 percent.

CONCLUSION

Allowing for approximate numbers of Tundra Swans in the above locations, southwestern British Columbia is winter home to about 3,500 Trumpeter Swans. If these have come only from the Alaska population, as all collar sightings to date indicate, the area is providing habitat for about 30 percent of that population. Obviously, as the human population continues to encroach, monitoring of the swan population will be required to ensure that its habitat requirements can be maintained.

ACKNOWLEDGEMENTS

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TRUMPETER AND TUNDRA SWAN SURVEY IN WESTERN WASHINGTON AND OREGON -- JANUARY 1989

Martha Jordan

INTRODUCTION

The first comprehensive swan survey for western Washington and Oregon was conducted in January 1989. The survey was a cooperative effort of The Trumpeter Swan Society (TTSS), the U. S. Fish and Wildlife Service (USFWS), and the Washington Department of Wildlife (WDW). Washington was surveyed west of the Cascade Mountains. The Oregon survey included the coastal zone, and from Portland south through the Willamette Valley. The time period for the survey coincided with the midwinter waterfowl surveys conducted annually by state and federal wildlife agencies.

The purpose of this survey was to document the population and distribution of Tundra and Trumpeter Swans wintering in western Washington and Oregon. State and federal agencies routinely count swans during their monthly and midwinter aerial surveys in many areas of Washington and Oregon. Private citizens make a few ground counts on a semi-regular basis in areas of Trumpeter Swan concentrations. However, a comprehensive count was needed because many areas of swan use are outside these established waterfowl survey routes.

Many individuals contributed to the success of the 1989 survey. The USFWS conducted the surveys in Oregon and in south and southwest Washington. The WDW surveyed the central area around Puget Sound. TTSS surveyed the remaining areas of the state including the Olympic Peninsula and Snohomish, Skagit, Whatcom, and San Juan Counties. Private donations and WDW provided funding for a private airplane for TTSS surveys.

METHODS

The northwest survey was conducted using aerial, ground, or both techniques, depending on the geographical location. Surveys were conducted between 6 and 18 January 1989. The aerial surveys were conducted from a fixed-wing aircraft using a pilot-observer and one to two other observers. One observer navigated. Area maps were used, and locations, numbers, and age ratios (adult/juvenile where possible) were recorded on a portable battery-operated tape recorder. Flying altitude varied according to terrain, but generally averaged 100 to 200 ft, at 90 to 110 mph.

The type of aircraft varied with the number of individuals participating in midwinter surveys, and with aircraft availability. However, the most frequently used aircraft were a DeHaviland Beaver and Cessna 185.

Systematic aerial surveys were made to identify locations and numbers of swans. Routes were chosen for optimum coverage of known and suspected swan habitats. The surveyors modified the routes if sighting reports from areas outside the original track were received. Because of budget restrictions and time constraints within the agencies, some routes were not surveyed as comprehensively as proposed.

Aerial photographs were taken of the large flocks of Tundra Swans on Sauvie Island and Ridgefield National Wildlife Refuge. Photographs were taken at an elevation of 50 to 200 feet looking directly down on the swans. These photographs were used for possible determination of adult juvenile ratios. These photos, in the form of slides, were then viewed under a microscope of 3 to 6 power and/or projected on a large wall or screen. Other photographs were taken at various locations for documenting habitat use by Trumpeter Swans.

RESULTS AND DISCUSSION

During the Washington surveys, a total of 2,155 Tundra Swans and 930 Trumpeter Swans was counted. In Oregon, the count was 5,740 Tundra Swans. During the survey period, incidental sightings of 10 Trumpeter Swans were recorded from Polk County in Oregon. The Tundra Swan distribution between Oregon and Washington varies from year to year. This variance is due to the large flocks moving from Sauvie Island in Oregon to just across the Columbia River at Ridgefield National Wildlife Refuge in Washington on the day of the midwinter survey.

A total of 7,895 Tundra Swans was counted in Washington and Oregon (Table 1). This compares to the 1988 approximate total of 5,125 Tundras, for an overall increase of 35 percent. The increase for the Willamette Valley-Vancouver- Woodland Bottoms area was 52 percent. Comparisons for earlier years were not available for analysis. However, the Tundra Swan population has substantially increased in the survey area over the past 5 years.

The Trumpeter Swan population in the Skagit Valley has been surveyed yearly for the past 10 years, primarily by volunteers. A limited statewide survey was conducted in 1983, and the Olympic Peninsula and Southwest Washington were surveyed in 1984. The federal and state wildlife agencies and TTSS conducted the 1983 and 1984 surveys. These surveys were not as intensive as the 1989 survey.

In 1983, there were 707 Trumpeters in Washington State. While the distribution of swans was similar to what it was in

the 1989 survey, the numbers in each area varied. Most numbers have gone up, some significantly, or remained stable, and a few have gone down (Table 2). Most notably, the population in the Skagit-Whatcom Counties area appears to have substantially increased.

The winter use of the Olympic Peninsula has increased from 58 in 1984 to 101 in 1989, a gain of 42 percent. The adult juvenile ratio for this area in 1983 was 12 percent. In 1989 the ratio was 16 percent. The principal areas of increased use were the general vicinity of Cape Flattery, and from Crocker Lake to Port Angeles along the Straits of Juan de Fuca.

Two areas, San Juan and Pacific Counties, had approximately a 40 percent decrease in use. However, the distribution was similar to the 1984 surveys. The reason for this decrease in swan numbers is unknown.

The Trumpeter adult juvenile ratio varies from year to year, with a low of 11 percent in 1986 and a high of 27 percent in 1988. The Skagit Valley consistently has a higher percentage of juveniles than other areas. This is primarily due to the fact that other areas have different habitat types which support smaller numbers of swans in family units with more adult non-breeders or pairs without cygnets. The distribution of Trumpeters in the Skagit Valley varies throughout the winter season, and from year to year. It also appears that yearly changes in crop plantings affect swan distribution. The purpose of this swan survey was not to document distribution in the Skagit Valley over time. During the comprehensive winter survey, the Trumpeters were clumped into two fields, both near Cook Road and the Burlington Hills. The weather was clear with a wind of 20 mph, with gusts to 35 mph. Weather was most likely a factor in the distribution of the birds.

Table 1. 1989 survey of Tundra Swans in Oregon and Washington by location.

State	County	Location	Total #
OREGON	Columbia	Scapoose	1,110
	Columbia Multnomah	Sauvie Island	4,035
	Washington	Gaston/Wapato Lake	19
		Tualitin Valley	202
	Yamhill	Newberg	10
	Marion	Berry Creek	30
	Lincoln	Halsey	325
	Tillamook	Tillamook Bay	2
		Nestucca Bay	3
	Lane	Siuslaw Bay at S jetty pond	4
	Total Tundra Swans -- Oregon		5,740
WASHINGTON	Cowlitz	Deer Island	55
		Woodland Bottoms	215
		Kalama Bottoms	37
		RND	8
	Clark	Ridgefield NWR	592
		La Center Bottoms	175
		Vancouver Lake Bottoms	6
	Skagit	Skagit Valley (Juveniles: 146)	843
	Whatcom	S & W of Ferndale	242
	Wakiakum	Grays Bay	19
		Puget Island	3
	Snohomish	Snohomish River Delta	5
	Total Tundra Swans -- Washington		2,155
	TOTAL TUNDRA SWANS		7,895

Table 2. 1989 Survey of Trumpeter Swans in Washington by location.

County	Location	Total #	Juveniles	%Juveniles
San Juan	San Juan Island	35	5	14
Jefferson	Quilcene Bay	7	3	43
	Crocker Lake	6	0	0
	Eagle Creek Pond	5	1	20
	Hoh River	2	0	0
Clallum	Cape Flattery	20	4	20
	Fairview Pond	12	3	25
	Aldwell Lake	16	2	12.5
	Dickey Lake	2	0	0
Grays Harbor	Quinalt Lake	24	3	12.5
	W & S of Quinalt Lake	4	0	0
	S & E of Queets	3	0	0
Pacific	Willapa NWR	12	--[1]	--
	Peninsula Lakes	15	3	20
Whatcom	Nooksack River Delta	39	4	10
	Wiser Lake	2	0	0
	Fields- south & west of Ferndale	111	24	22
Skagit	Skagit Valley	566	176	31
	Grandy Lake	4	--	--
	Depression Lake	10	--	--
Island	Dugualla Bay	14	--	--
Mason	Duckabush	6	--	--
Pierce	Flett Dairy	3	--	--
	Kreger Lake	1	--	--
Cowlitz	Silver Lake Additional survey by USFWS counted 25 no ages noted.	11	2	18
	TOTAL TRUMPETERS	930		
	Total Juveniles Reported		230	
	Overall Adult/Juvenile Ratio			26.6
	Average Adult/Juvenile Ratio			13.7

[1] No adult/juvenile differentiation made.

In Oregon, no distinction between swan species was made during the aerial surveys. Differentiation of Trumpeters from Tundras usually requires ground surveys. Thus, it cannot be determined if the numbers of Trumpeters in Oregon have actually changed during the past 5 years. Intensive survey efforts for Trumpeters in Oregon would probably find them more widely distributed and in higher numbers than have been reported.

During the winter season, there were several incidental sightings of Trumpeter Swans in Oregon. The distribution of Trumpeters during November through January was generally in the central Willamette Valley from Salem to Corvallis. No adult/juvenile data was provided by any observers. These sightings are presented in Table 3.

Several biologists from state and federal agencies suggested trying aerial photography for determination of adult/juvenile counts. We tried aerial photography in the Sauvie Island-Columbia River area because ground truthing was impractical.

A large number of photos were taken, but only those shot at or below 100 feet and looking directly down on the swans proved useful for juvenile differentiation. The technique was used on Tundra Swans in large flocks where good adult/juvenile aerial or ground counts were not possible. Because this limitation left a small sample size of slides, only 301 Tundra Swans were counted with 47 juveniles, for a ratio of 16.3 percent. This compares to 17.3 percent Tundra juveniles counted by ground in the Skagit Valley. This difference is well within the variance seen between count areas. Photos are an excellent method for obtaining adult/juvenile ratios in areas that are inaccessible by land. These photos must be taken from the proper elevation and angle.

RECOMMENDATIONS

The midwinter waterfowl survey routes are well established and allow for comparison of information from year to year. However, the best and most used swan habitats, especially for Trumpeters, do not occur on these established routes. Because of this situation, agency counts of Trumpeter Swan populations are usually in error and should not be used for total population estimates. Also, they do not reflect the real dynamics of Trumpeter Swan populations.

The USFWS conducts Trumpeter and Tundra Swan breeding ground surveys every 5 years. Both state and federal agencies have suggested that a survey of the wintering grounds be conducted during the midwinter waterfowl surveys following the breeding surveys. The next breeding survey is scheduled for the summer of 1990. A comprehensive wintering survey would need to be conducted in January 1991.

TTSS members and other biologists recommended that both aerial and ground comprehensive surveys for Trumpeter and Tundra Swans be conducted at least once every 5 years for the Pacific Coast Population of swans. Survey routes need to include all known and reported Trumpeter and Tundra Swan habitats in Washington, Oregon, and California. A coordinator for such an effort could be available through TTSS if funding for such a position can be obtained. A search for funding is currently being made by TTSS.

Table 3. Trumpeter Swan sightings in Oregon during the 1988-89 winter season.

County	Location	Total Number	Date
Polk	SW of Monmoth	9	11-15-88
	Basket Slough, near Ankeny NWR	4	11-26-88
	Airlee, near PD	10	1-05-89
Benton	Flying over Finley NWR in flock of Tundras	1	12-03-88

Reliable identification of Trumpeter and Tundra Swans in the field has been a problem. Training in field identification is needed to insure accurate counts. Information on swan identification needs to be more widely distributed within the agencies. Identification information and slide aids are available from TTSS's Washington State Working Group.

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A PLAN TO ENHANCE OREGON'S TRUMPETER SWAN POPULATION

Gary L. Ivey and Christopher G. Carey

INTRODUCTION

Historical Trumpeter Swan (Cygnus buccinator) accounts are sparse from European explorers, trappers, and settlers who invaded the North American continent. Nearly 200 years of market hunting of Trumpeter Swans for their skins and meat during the 18th and 19th centuries brought the species to near extinction, eliminating them from most of their former range.

Banko (1960) summarized historic breeding records for Trumpeters in North America, and provided a figure showing their hypothetical former breeding range. He did not include Oregon within the historic breeding range of Trumpeters, because there were no historic accounts of Trumpeters breeding in the state. Banko's range map was constructed from written reports of early explorers, trappers, and naturalists. It is very possible that Trumpeters did breed in Oregon in the past, and, if not eliminated by European settlers, were possibly extirpated by an earlier invasion of the area by Native Americans.

Fossil remains of the Trumpeter Swan from the late Pleistocene were found at Fossil Lake, Oregon (Wetmore 1956). Bendire (1877) collected a Trumpeter Swan at Malheur Lake on 24 March 1877. Prill (1922) observed a pair of Trumpeters on the Blitzen River (now part of Malheur National Wildlife Refuge) between 25 May and 15 June 1921. Other historical migration records of Trumpeter Swans in Oregon are summarized by Cornely et al. (1985). More recent migration records of Trumpeters in the state were listed by Paullin (1986).

Trumpeter Swans were first introduced into Oregon at Malheur National Wildlife Refuge (NWR) in 1939, and nesting first occurred in 1958. The history and status of this Trumpeter population from 1939 through 1984 was summarized by Cornely et al. (1985). The population increased after 1958 and peaked at 77 individuals following the 1980 breeding season. However, it has experienced drastic fluctuations and has declined in recent years (Table 1). Nesting pairs reached a peak of 19 in 1980, but declined to only two pairs and a total of 18 individuals by the spring of 1989.

The two nesting pairs in 1989 represent only 11 percent of the objective level (18 pairs) identified in Oregon's Nongame Wildlife Management Plan (Marshall and Haight 1986). After 30 years, the population has nearly returned to the level it was in 1958 when the first nesting occurred. If some action isn't taken to increase the Malheur flock, it is feared it will no longer remain a viable population.

PROBLEMS

The Malheur Trumpeter population was established from a few nesting pairs which were introduced from Red Rock Lakes National Wildlife Refuge (RRLNWR), Montana. Therefore, it is a highly inbred population, and genetic variability is assumed to be very low. This has probably lowered the population's productivity.

Factors which have limited Trumpeter Swan production on Malheur NWR include the destructive impacts of carp (Cyprinus carpio) populations on the aquatic food resources, and deteriorated water delivery facilities which have hindered proper wetland management. Ponds which have high carp numbers or poor water control facilities have not been used by nesting Trumpeter Swans. The refuge staff is working to solve these problems. However, a more serious problem has contributed to the population's decline. Migration.

Based on an 8-year study of collared swans (1980-88), the Malheur Trumpeter population was shown to be essentially sedentary (Ivey 1990). Most of the flock wintered in irrigation canals and the Blitzen River at the south end of the Refuge. During periods of extreme cold, ice-free open water areas became scarce and food resources were rapidly depleted. Feeding areas were often defended by adult pairs, which kept subordinate adults and subadults away. When food was scarce, many subordinate swans apparently died from starvation.

Trumpeter Swans were fed grain during the winter at the display pond at Refuge headquarters until 1976, when the feeding program was ceased. The population continued to grow after 1976. Malheur Lake was sprayed with Rotenone, a fish toxicant, to kill high carp populations in 1978. Excellent crops of sago pondweed (Potamogeton pectinatus), an important food, were produced in the lake from 1979 to 1981. By 1982, carp were again so abundant in the lake that aquatic plant production was poor. Many of the Trumpeters continued to winter at the display pond, however, after winter feeding ended. The pond supported good aquatic plant foods and was free of carp. In 1982, Malheur Lake rose to record levels and carp gained access to the pond, decimating its aquatic food resources. Loss of the display pond as a winter feeding area was likely a major factor in hastening the recent decline in the population.

Comparing fall and spring population counts (Table 1), winter mortality has averaged 24 percent during the past 10 years and has been as high as 45 percent. Young birds have endured the highest mortality rates. High winter mortality, resulting primarily from winter food shortages, has limited the population's growth. Because the swans haven't learned to migrate,

Table 1. Summary of Trumpeter Swan Numbers for Malheur National Wildlife Refuge, Oregon 1958-89.

Year	Midwinter population	Spring population	Fall population	Nesting pairs	Young fledged
1958	31	17	25	2	4
1959	20	36	23	0	0
1960	21	24	24	--	14
1961	42	39	26	4	3
1962	23	20	16	2	3
1963	21	19	43	5	17
1964	45	32	36	3	6
1965	30	30	40	4	11
1966	40	40	45	6	12
1967	45	30	45	4	12
1968	45	40	45	5	11
1969	40	42	50	4	14
1970	50	40	50	7	13
1971	38	39	60	8	22
1972	50	29	45	7	13
1973	32	28	40	6	4
1974	36	28	38	5	9
1975	15	32	40	5	7
1976	30	22	31	--	8
1977	17	32	33	3	0
1978	7	32	37	11	13
1979	41	26	31	11	33
1980	65	57	68	19	15
1981	77	53	62	15	9
1982	65	49	55	13	17
1983	52	43	72	10	17
1984	63	46	46	10	6
1985	51	36	40	7	2
1986	33	22	43	9	24
1987	49	44	52	9	14
1988	24	39	41	5	8
1989	33	18	--	2	3

the major limiting factor appears to be winter food shortages in the Refuge area.

Contrary to the conclusions of the collaring study, which took place during a prolonged wet weather cycle, the midwinter data suggest that some Trumpeters do migrate from the area, particularly during dry years when food resources are limited. However, their winter destination remains unknown. During the winter of 1987-88, two collared Malheur Trumpeters did migrate. One was shot in Nevada (near Yerington) during a Tundra Swan (C. columbianus) hunt, and the other wintered on Lake Almanor in northeast California. Unfortunately, the bird which migrated to California did not return to Malheur NWR. It was observed about 25 miles south of Vale, Oregon during May 1988, and was found dead at the same location in July.

In summary, the major problem facing the Oregon Trumpeter flock appears to be high winter mortality, caused primarily by the population's nonmigratory behavior and a local shortage of winter food due to harsh winter conditions. In addition, low genetic variability may have lowered the productivity of the population.

PROPOSED PROJECT

Out of concern for the Trumpeters, the authors initiated a project in 1988 to enhance the swan population. A proposal was drafted, outlining project goals and identifying preliminary tasks to be completed before preparing a detailed project plan. Endorsement was received from both the Oregon Department of Fish and Wildlife (ODFW) and the U. S. Fish and Wildlife Service (USFWS) to proceed with the proposal.

The project goals are: (1) to increase the size of the Trumpeter Swan breeding population in Oregon and (2) to expand the breeding and wintering range of the Trumpeter. Ideally, the ranges in Oregon would be contiguous, and swans would learn to migrate to favorable winter areas. The proposed project area includes large wetland basins within Harney, Klamath, and Lake Counties. Both Lake and Klamath Counties contain an abundance of wetlands which appear suitable for Trumpeter Swans. Major wetland sites within these areas include the marshes at Summer Lake, Sycan Marsh, Klamath Forest NWR, Chewaucan Marsh, and the Warner Basin marshes.

HABITAT SURVEYS

During summer 1988 and winter 1989, potential breeding and wintering sites for Trumpeter Swans were evaluated. Good breeding areas should contain productive wetlands with an abundance of food near suitable wintering habitat. Good wintering areas must have ice-free, open water areas (even during extremely cold periods) with an abundance of food. The initial project efforts focused on two areas which are owned and managed by ODFW and USFWS, Summer Lake Wildlife Area (WA) and Klamath Forest NWR, respectively. If the project were a success at these areas, swans would most likely expand and colonize other wetlands in the area.

Of the areas evaluated, Summer Lake, WA (in central Lake County) appeared to be most suitable as breeding habitat. This area is located 80 miles west of Malheur NWR. Summer Lake is a 17,000-acre wetland, supporting an abundance of aquatic vegetation. Vast acreages of sago pondweed with no carp, associated with adequate emergents for nesting and brood cover, make this a highly suitable area for nesting Trumpeter Swans. This area could potentially support about 15 nesting swan pairs.

Summer Lake was visited on 5 February 1989, when record-breaking cold temperatures occurred. Minimum temperatures were -20°F. Open water occurred along about 4 miles of the Anna River, along the entire Link Canal, and at Schoolhouse Lake. In total, approximately 300 acres of water were available. About 500 Tundra Swans and at least two Trumpeter Swans were present. The presence of this large number of wintering swans indicated there was no shortage of food.

Klamath Forest NWR, in central Klamath County, is a 38,000-acre refuge. The Klamath Forest Marsh encompasses about 20,000 acres, and the remainder of the area was recently purchased by USFWS and has yet to be developed for wildlife management. The marsh area appears to support adequate aquatic food resources. However, it is largely overgrown with dense emergent vegetation, with the exception of Big and Little Wocus Bays on the south end. These two bays could currently support about five nesting pairs of Trumpeter Swans. The marsh could potentially support even more Trumpeters if it were opened up by controlling emergent vegetation. The newly acquired area also has potential for additional pairs. Depending on how this area is developed and managed in the future, the entire Refuge could potentially support 20 to 30 Trumpeter Swan pairs.

The Sprague, Williamson, Sycan, and Wood Rivers are very near Klamath Forest NWR (the Williamson flows through the Refuge), and within 20 to 60 miles of Summer Lake. These rivers are very similar to the Henry's Fork of the Snake River in Idaho, where a major segment of the Rocky Mountain Trumpeter Swan Population winters.

These rivers were visited on 4 February 1989, when low temperatures were -20°F, to survey their potential as wintering swan habitat. This was unusually cold weather for these areas. The Sprague River is about 60 miles in length, and even under these severe conditions, about 70 percent of the river was ice-free and aquatic plant foods appeared plentiful. About 185 Tundra Swans were counted wintering along the Sprague River during the survey. Both the Wood and Williamson Rivers were totally ice-free, and appeared to contain good food resources. In our judgement, these rivers could provide excellent winter habitat for a substantial number of Trumpeter Swans. In comparison to the Henry's Fork of the Snake River, which provides about 9 miles of winter Trumpeter Swan habitat (C. Mitchell, pers. comm.), these four rivers could provide about 100 miles of winter habitat.

POLICIES, GUIDANCE, AND DIRECTION RELATING TO THE MALHEUR SWAN FLOCK

The Oregon Wildlife Code decrees to not allow for the loss of any indigenous wildlife species from the State. The Oregon Nongame Management Plan lists an objective of 18 breeding pairs of Trumpeter Swans. Without special management attention, it is improbable that this objective will be reached in the future.

The Malheur NWR Master Plan (USFWS 1985) lists an objective of 30 Trumpeter Swans produced annually from the Refuge. The North American Management Plan for Trumpeter Swans (NAMPTS), prepared by the Flyway Councils (1984), lists the following objectives:

1. Prevent Trumpeter Swans from becoming either threatened or endangered...

2. Manage free-ranging Trumpeter Swans to provide optimum recreational benefits.

3. ....phase out supplemental feeding programs...

4. Develop...interpretive and other educational programs...

5. ....preserve...wintering and breeding Trumpeter Swan habitat...

6. Design, coordinate, and implement management practices which instill a migratory strategy in and expansion of range by Trumpeter Swans while minimizing constraints placed on practices required in the management of waterfowl species and accomplishment of waterfowl management objectives.

One management guideline provided by NAMPTS is that hunting of other waterfowl will not be precluded because of chance-killing of Trumpeter Swans, and that specific conflicts between waterfowl species' population management objectives (including recreation objectives) and strategies will be resolved by the Subcommittee representatives in the states incurring the conflict.

NAMPTS also identifies the following as a recommendedmanagement guideline for the Malheur Trumpeter flock:

"The Refuge staff, with assistance of Oregon Department of Fish and Wildlife and possibly agencies from adjacent states, should determine if there are sites suitable for overwintering some of Malheur's swans. If biologically and politically suitable sites can be found, then develop and implement a plan that would result in a tradition for migration to areas outside Harney Basin."

ENHANCEMENT PLAN PROJECT OBJECTIVES:

1. Teach the Malheur flock to migrate.

2. Improve habitat conditions for Trumpeters wintering at Malheur NWR.

3. Expand the nesting range of Trumpeters to other suitable areas in southeast and southcentral Oregon (Harney, Klamath, and Lake Counties).

4. Increase the Oregon population goal to 75 breeding pairs.

5. Improve the genetic variability of the population.

If Malheur Trumpeter Swans were to migrate to favorable wintering areas, winter mortality would likely decrease. Establishing nesting swans in other areas would result in a larger, more secure population. Finally, improving genetic variability in the population would create a healthier, more productive swan flock.

PROPOSED PROJECT STRATEGIES

Establish a Steering Committee

The Steering Committee would be composed of four to six individuals, with representatives from ODFW, USFWS, and The Trumpeter Swan Society (TTSS), and would possibly include other agency personnel and private individuals. The Committee would guide project operation, solicit donations to fund the project, decide how to spend project money, and resolve any conflicts which arise from the project.

Seek project funding

Some funds from USFWS and ODFW would be expected to carry out the project. However, it is proposed that the major costs of this project would be funded by soliciting donations from private individuals, groups, and corporations. The Steering Committee would appoint some individual or group to take the lead in soliciting donations for the project.

Cost of this project is estimated at $5,000 to $50,000 per year, depending on which project strategies are selected. This project would span 15-20 years. However, the major costs would be incurred during the first 5 years. Thereafter, annual costs would be substantially reduced.

PROPOSED IMPLEMENTATION

PHASE 1: Develop a migrational tradition in the Malheur NWR flock, and improve habitat conditions for swans wintering on the Refuge.

1. Improve habitat conditions for swans at Malheur NWR.

   a. Reduce winter mortality in the population by winter feeding during extreme winter weather periods when swans wintering at Malheur might be subject to starvation.

   b. Rehabilitate Sodhouse Spring (carp control and dike work) to provide additional winter feeding habitat for the swans wintering at Malheur.

2. Move family groups.

   This strategy would involve capturing a few swan family groups at Malheur NWR during November or December and moving them to Summer Lake WA as a wintering site. Birds could be trapped using baited, swim-in traps, similar to those used for ducks. Parent swans would have their primary feathers pulled so they would remain flightless on high quality winter habitat for about 60 days.

   This strategy is based on the theory that swans learn to migrate to winter sites by following their parents. The young follow their parents the first year and return to favorable winter areas on their own or in flocks with other swans thereafter.

   Trumpeter Swans of the Lacreek NWR flock in South Dakota have pioneered south into nesting habitat in Nebraska, but migrate back north to Lacreek in the fall, where their parents taught them to winter (King 1987).

3. Move nonbreeding subadults.

   This strategy involves moving molting, nonbreeding subadults from Malheur NWR to Summer Lake WA during July or August. The birds would be forced to remain at Summer Lake until they regained flight, and would be expected to return to Malheur after the molt. Hopefully, they would return to Summer Lake as a wintering site.

   All birds moved would be banded, color-marked, and equipped with a radio transmitter for future identification and monitoring. During transit, Trumpeters would be carefully handled, following guidelines provided by TTSS. Small numbers of birds would be moved so that the Malheur NWR flock would not be decimated if the birds died or did not return.

   Trumpeter Swans are expected to have a better chance of survival at Summer Lake than swans wintering at Malheur NWR. There is a chance that the transported swans would not return to Malheur, but would stay in the area to which they were transplanted, where they may eventually nest. This accomplishes another project goal, that of expanding the range of nesting Trumpeters.

Costs of this phase of the project are expected to be in the range of $5000 per year.

PHASE 2: Expand the breeding range of Trumpeter Swans.

This phase of the plan is modeled after Minnesota's successful Trumpeter Swan Restoration Program (Minnesota DNR 1988). The Minnesota project involved acquiring Trumpeter eggs from Alaska, hatching and rearing them, and releasing subadult (usually 2-year-old) swans onto suitable breeding marshes. In 1988, two pairs of these swans raised cygnets in the wild. Very

explicit project details covering the techniques and strategies involved are described by Matteson (1986).

1. Acquire Trumpeter Swans from other sources for range expansion phase.

   a. Use Tristate Trumpeters for expansion efforts.
   Acquire Trumpeter Swans (eggs, juveniles, adults) of the Rocky Mountain stock from private propagators and/or other refuges, supplemented with swans or eggs from Malheur NWR, for release at Summer Lake WA and Klamath Forest NWR.

   b. Use Alaskan Trumpeter Swans for range expansion phase.
   Acquire Trumpeter Swan eggs from Alaska and other sources (e.g. private propagators), supplemented with swans or swan eggs from Malheur NWR, for release at Summer Lake WA and Klamath Forest NWR. A few swans would also be introduced at Malheur NWR to improve genetic variability in the Malheur flock.

2. Raise Trumpeter Swans for release at selected marshes for range expansion phase.

   a. Establish two Trumpeter Swan rearing facilities.
   Two separate facilities for hatching, rearing, and maintaining captive (flightless) Trumpeter Swans would be established in Oregon. These areas could be operated on ODFW or USFWS properties and managed by ODFW or USFWS staff (with project funds).

   b. Contract Trumpeter Swan rearing to private individuals.
   At least two different individuals would be hired under contract to hatch and rear Trumpeter Swans and maintain captive (flightless) flocks until birds were ready for release at selected marshes.

3. Release Trumpeter Swans at selected marsh areas.

   Adult Trumpeters and 2-year-olds would be paired and placed on suitable breeding marshes during spring. Birds would essentially "fledge" on these areas and would be expected to imprint on them and eventually nest there.

4. Monitor the Trumpeter Swans in the Project.

   All birds moved would be banded, color-marked, and equipped with a radio transmitter for future identification and monitoring. During transit, Trumpeters would be carefully handled, following guidelines provided by TTSS.

Costs of this phase of the project are estimated to range from $20,000 to $50,000 per year for about 5 years, depending on selected strategies, with reduced costs thereafter.

PROJECT CHRONOLOGY

Pending approval of the Pacific Flyway Council, the following timetable is anticipated:

1989

-Establish Steering Committee to oversee project operation.	November
-Steering Committee will fine tune plan.	December

1990

-Prepare information to present to public.	January
-Explore alternatives for acquiring swans or eggs.	January
-Initiate efforts to acquire private funds for project.	January
-Initiate efforts to establish/contract rearing facilities.	February
-Request swan eggs from Alaska, if appropriate.	February
-Acquire swans or eggs.	April-June
-Initiate a hunter education program for Summer Lake WA.	July
-Move molting subadults from Malheur NWR to Summer Lake.	July-August
-Move Malheur family group, if deemed appropriate.	November
-Monitor project swans.	All year

1991-1996

-Continue to acquire swan stock from other sources.
-Release swans at breeding marshes.
-Monitor project swans.

CONCLUSION

Now is the time to take action to save the declining Malheur Trumpeter Swan flock. We believe that the strategies outlined above will meet this goal. It is very important to "beef-up" the Malheur flock before it becomes too small to remain a viable population.

While Malheur NWR supports an abundance of excellent breeding habitat for Trumpeter Swans, a shortage of winter feeding habitat is limiting the local population. Although winter feeding is contrary to NAMPTS guidelines, it is recommended as a short-term emergency measure to minimize winter starvation of the Malheur Trumpeters.

Following guidelines provided by NAMPTS, strategies have been identified which should lead to natural migration to a suitable winter site for the Malheur flock. We predict that Trumpeter Swans will have a better chance of survival at Summer Lake WA than swans wintering at Malheur NWR. Attempts to actively teach Malheur Swans to migrate to Summer Lake should decrease the chances of Malheur Trumpeters migrating into Tundra Swan hunting zones in Nevada.

The Oregon Trumpeter Swan population could be greatly enhanced by increasing its breeding range. A number of large wetland complexes in southeast and southcentral Oregon appear highly suitable for nesting Trumpeters. These areas lack carp, and, in some cases, contain excellent wintering habitat. Establishing nesting Trumpeters outside of Malheur

NWR at other Oregon marshes would lead to a more secure and healthy Trumpeter Swan population.

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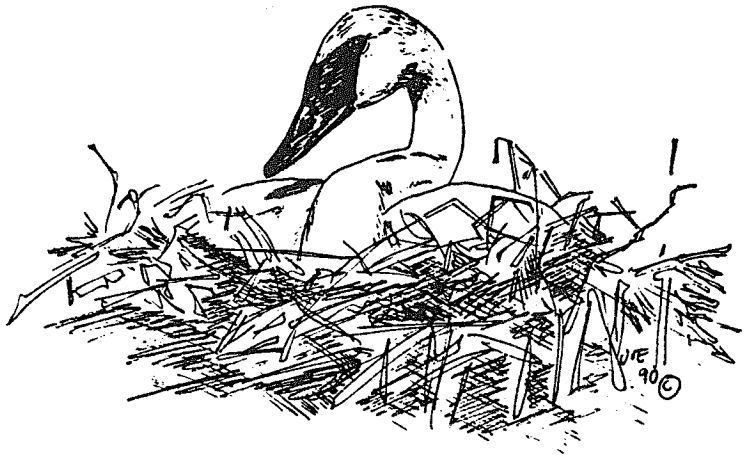
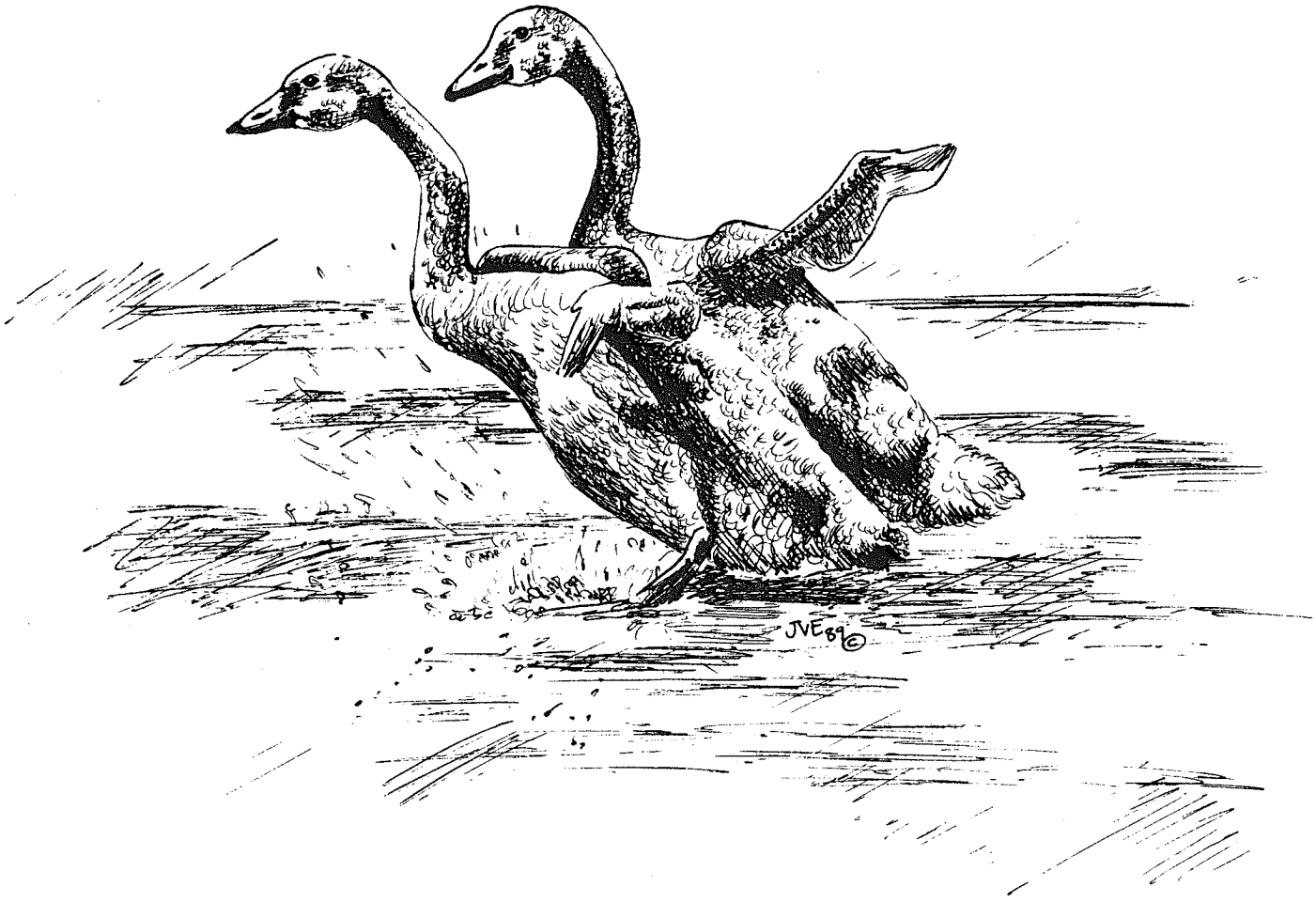


FUTURE AVAILABILITY OF EGGS AND SWANS



INTRODUCTION TO THE AFTERNOON SESSION

Laurence N. Gillette, Moderator

INTRODUCTION

The goal of The Trumpeter Swan Society (TTSS) is "to maintain existing wild Trumpeter Swan populations and to restore the bird to as much of its original range as possible." TTSS tries to use its biennial conference as a major element in its efforts to fulfill its goal. Not only does it provide a common meeting ground for the exchange of information, the conference provides opportunities for swan experts to discuss problems with which they have been confronted. While few of the problems can be resolved at a conference, the participants are given a chance to become familiar with each situation and the views of others and to make suggestions in how the situations may be resolved.

Tomorrow will be devoted to restoring the Interior Population of Trumpeter Swans, and it is the primary reason for holding the conference in Minneapolis. This afternoon addresses three long-standing situations which need additional discussion. They are:

1. The distribution of eggs and swans taken from the wild.
2. Marking protocol for Trumpeter Swans.
3. The impact of Tundra Swan hunting on Trumpeter Swan restoration and management and the TTSS draft position paper on Tundra Swan hunting.

Hopefully, the presentation today will give you sufficient background to allow you to discuss them with our Directors and among yourselves during the balance of the conference. We request your participation in resolving these issues.

FUTURE AVAILABILITY OF EGGS AND SWANS

The first issue is the disposition of Trumpeter eggs or birds collected from the wild. At present, the flyway councils decide on the distribution of eggs. Priority is given to restoration programs over private propagators. The Federal permitting system places restrictions on who may possess birds derived from the wild and how the swans or their offspring may be used. There were reasons for imposing these restrictions when the regulations were written, but are these reasons still valid in light of the continued increase in Trumpeters in Alaska? Have other needs developed that should supercede the original reasons for the present priority and permitting systems? Private propagators and zoos have provided many of the swans used in restorations to date, yet the quality of their stock and the genetic diversity of the collective captive pool is in question. We may have been better off if we had given propagators and zoos a higher priority when we started taking eggs from the wild.

TRUMPETER SWAN MARKING PROTOCOL

We have discussed various aspects of swan marking at each of the last three conferences. Discussions covered the advisability of capturing swans for marking, the inability of the Bird Banding Lab to process collar reports adequately, and the limitations of the present protocol system for the subpopulation studies that are needed by today's managers.

Today, we will be addressing the last question. The present system for marking swans was designed to investigate all species of swans on an international scale. It was devised by the International Waterfowl and Wetland Research Bureau almost 20 years ago. Has this marking protocol answered the questions it was designed to do? Is it adequate to answer the questions we have for Trumpeter Swans today? How many deviations from the system can be tolerated before the system breaks down? These are some of the questions we would like to address today.

TTSS POSITION PAPER ON TUNDRA SWAN HUNTING

Tundra Swan hunting has always been a concern for TTSS, but it was one that has increased rapidly in importance since 1984. The key issue is that hunters cannot distinguish between Trumpeter Swans and Tundra Swans in the field. Therefore, Trumpeter Swans will probably be shot if they are in an area open to hunting Tundra Swans. Obviously, from the TTSS standpoint, the potential severity of the problem increases as additional areas are open for Tundra Swan hunting.

TTSS has prepared a draft position paper on Tundra Swan hunting to try to deal with this issue. Understanding the Tundra Swan hunting plans approved by the flyway councils and the U. S. Fish and Wildlife Service is essential for evaluating the draft position paper. These plans will be presented in a few minutes. The draft position paper will be read immediately after, followed by prepared comments and general discussion. Assuming the Board decides to continue, a revised draft will be prepared by December for Board approval so that it can be presented to the flyway council technical sessions in February 1990.

Keep in mind that the Tundra Swan hunting plans attempt to keep the widest variety of options open, even though hunting will likely never occur in many of the areas offered this opportunity. Likewise, TTSS may never succeed in establishing Trumpeters throughout all of the species' former range for reasons other than Tundra hunting. Conflicts between the two plans will not be as great as might be perceived at first glance.

IMPACTS ON TRUMPETER SWANS (Cygnus buccinator) FROM EGG COLLECTION ACTIVITIES IN MINTO FLATS, ALASKA

Rodney J. King

INTRODUCTION

This report summarizes a 3-year experimental program addressing the impacts of egg removal on breeding Trumpeter Swans (Cygnus buccinator) in the population at Minto Flats, Alaska. Fifty eggs in late stages of incubation were removed from nests each year during 1986, 1987, and 1988. Eggs from the removal program are being used in a restoration project conducted by the Minnesota Department of Natural Resources (DNR), under permit from the U. S. Fish and Wildlife Service (USFWS) and Alaska Department of Fish and Game (ADF&G), in accordance with guidelines established by the Pacific Flyway Study Committee for Trumpeter Swans.

Since 1981, the Minto Flats area was monitored annually for spring nesting and fall productivity. Average swan use in the study area is summarized in Table 1. This information established a baseline prior to 1986, for determining the effects of egg collection on swan populations.

Trumpeter Swans have been steadily increasing in Alaska since 1968 (Conant et al. 1988). Swan numbers in the study area (1986-1988) are listed in Table 2, according to U. S. Geological Survey (USGS) map numbers. Swan numbers in the study area are compared to 1981-1985 averages in Table 3. Significant increases have occurred in every population category except "number of singles" and "flocked birds" during 1986. The number of broods increased 70 percent in the collection area and 159 percent in the control area during 1987, when compared to the 1981-85 average (Table 3). The number of cygnets in the study area has increased during 5 of the last 6 years. A portion of the young produced during this period has now reached breeding age, thus providing an opportunity for swans to expand into many lakes previously unoccupied in the Minto Flats area. All swan habitat in Minto Flats has a higher density of swans than in 1981. The highest densities occur within the study area. All 3 years of the study recorded paired swans with broods substantially higher than the 1981-85 average (bottom of Table 2). In addition to an increased number of cygnets, the number of pairs has increased 41 percent from an average of 169 (1981-85, Table 3) to 239 (1988, Table 2). Total swans in the study area increased annually to 97 percent above the average by 1988 (Table 3).

OBJECTIVES

The objectives of the study were to: (1) assess the impact of collecting Trumpeter Swan eggs on local productivity in successive years, (2) determine the impact of disturbance from collection activities on individual nest success and cygnet survival, and (3) develop recommendations and quotas for future removal of eggs for Trumpeter Swan restoration projects.

Table 1. Average Trumpeter Swan populations in Minto Flats, Alaska, study area, 1981-85.

Map Name & No.	Broods	Pairs	Singles	Flocked	Cygnets	Total birds
Fairbanks D-4[1]	11.5	31.8	4.5	21.2	42.9	132.2
Fairbanks D-5[1]	29.6	75.4	9.2	61.4	105.4	326.8
Livengood A-4[2]	10.8	28.8	7.2	84.4	38.3	187.5
Livengood A-5[2]	10.4	33.22	4.5	42.4	40.6	153.9
Total study area average	62.3	169.2	25.4	209.4	227.2	800.4

[1] Egg collection maps
[2] Control area maps

Average brood size = 3.6
Average percent pairs with brood = 36.8
Average percent young in population = 28.4

METHODS

Four major Trumpeter Swan production areas in Alaska were considered for egg collection activities (Minto Flats in the Lower Tanana Unit, Nelchina Basin in the Gulkana Unit, Copper River/Bering River Deltas in the Gulf Coast Unit, and the Cook Inlet Unit, Figure 1). Minto Flats, located approximately 36 miles west of Fairbanks, was the area selected for the following reasons: (1) the study area was close to the Migratory Bird Management Office in Fairbanks, (2) land status is under the jurisdiction of the State of Alaska, (3) many nesting lakes are readily accessible by float plane, and (4) there is a high density of nesting Trumpeter Swans.

The study area encompasses approximately 730 square miles of Trumpeter Swan habitat, and is located in the northeastern section of Minto Flats (Figure 2). It is characterized by a myriad of permanent and semi-permanent lakes, generally surrounded by boreal forest or open meadows mixed with Carex spp. and grasses. Spruce (Picea spp.), paper birch (Betula papyrifera), aspen (Populus tremuloides), willow (Salix spp.), and alder (Alnus spp.) are the dominant boreal species. Wetlands are maintained by periodic flooding and sub-surface regeneration from the Tolovana River on the north and west, the Chatanika River on the north, Goldstream Creek on the south and east, and the Tanana River to the south and west. Wetlands are highly eutrophic and are characterized by Carex spp., water milfoil (Myriophyllum spp.), pondweed (Potamogeton spp.), and duckweed (Lemna spp.).

Table 2. Trumpeter Swan population in Minto Flats study area, 1986-88.

Map No.	Broods 1986	Broods 1987	Broods 1988	Cygnets 1986	Cygnets 1987	Cygnets 1988	Pairs[3] 1986	Pairs[3] 1987	Pairs[3] 1988
D-4[1]	20	23	18	63	81	68	38	40	36
D-5[1]	42	47	50	130	146	171	96	89	99
A-4[2]	17	27	26	57	101	108	44	46	52
A-5[2]	13	28	26	45	108	95	41	43	52
Total	92	125	120	295	436	442	219	218	239

Map No.	Singles 1986	Singles 1987	Singles 1988	Flocked 1986	Flocked 1987	Flocked 1988	Total Swans[3] all columns 1986	Total Swans[3] all columns 1987	Total Swans[3] all columns 1988
D-4[1]	8	1	3	11	84	145	158	246	288
D-5[1]	4	3	3	36	68	98	362	395	470
A-4[2]	8	2	6	29	78	315	182	273	533
A-5[2]	7	5	6	31	105	81	165	301	286
Total	27	11	18	107	335	639	867	1218	1577

[1] Egg collection maps.
[2] Control area maps.
[3] Pairs doubled when calculating total swans.

	1981-85	1986	1987	1988
Average brood size	3.6	3.2	3.5	3.7
Percent pairs w/brood	36.8	42.0	57.3	50.2
Percent young in population	28.4	34.0	35.8	28.0

Table 3. Comparison of production changes between egg collection area vs control area in Minto Flats, Alaska.

	Average 1981-85	1986	1987	1988
		Egg collection area		
Broods	4.1	62 (+51)[1]	70 (+70)	68 (+65)
Cygnets	148.3	193 (+30)	227 (+53)	239 (+61)
Pairs[2]	107.2	134 (+25)	129 (+20)	135 (+26)
Singles	13.7	12 (-12)	4 (-71)	6 (-56)
Flocked birds	82.6	47 (-43)	152 (+84)	243(+194)
Total	459.0	520 (+13)	641 (+40)	758 (+65)
		Control area		
Broods	21.2	30 (+42)	55(+159)	52(+145)
Cygnets	78.9	102 (+29)	209(+165)	203(+157)
Pairs[2]	62.0	85 (+37)	89 (+44)	104 (+68)
Singles	11.7	15 (+28)	7 (-40)	12 (+2)
Flocked birds	126.8	60 (-53)	183 (+44)	396(+212)
Total	341.4	347 (+2)	577 (+69)	819(+140)
Study Area Total	**800.4**	**867 (+8)**	**1218 (+52)**	**1577 (+97)**

[1] Number in parentheses denotes percent change from 1981-85 average.
[2] Number of pairs is doubled for total.

Table 3A. Average brood size, 1981-85, Minto Flats, Alaska.

	Control area	Egg collection area	
		w/o coll. nests	with coll nests
1986	3.1	3.5	3.1
1987	3.8	3.5	3.2
1988	3.9	3.8	3.5
1981-85	3.7	3.6	--

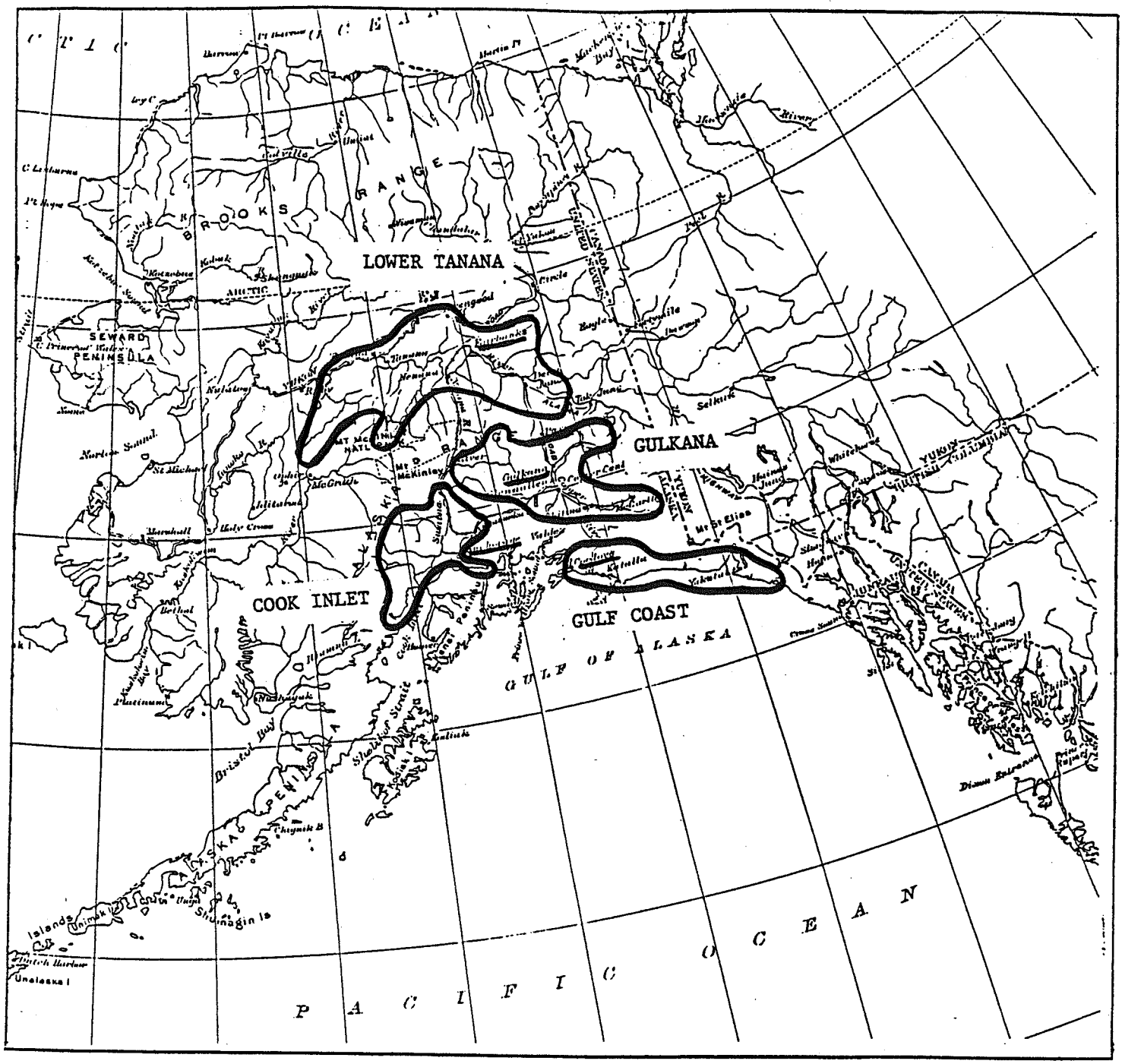


Figure 1. Trumpeter Swan habitat where future egg removal could be considered.

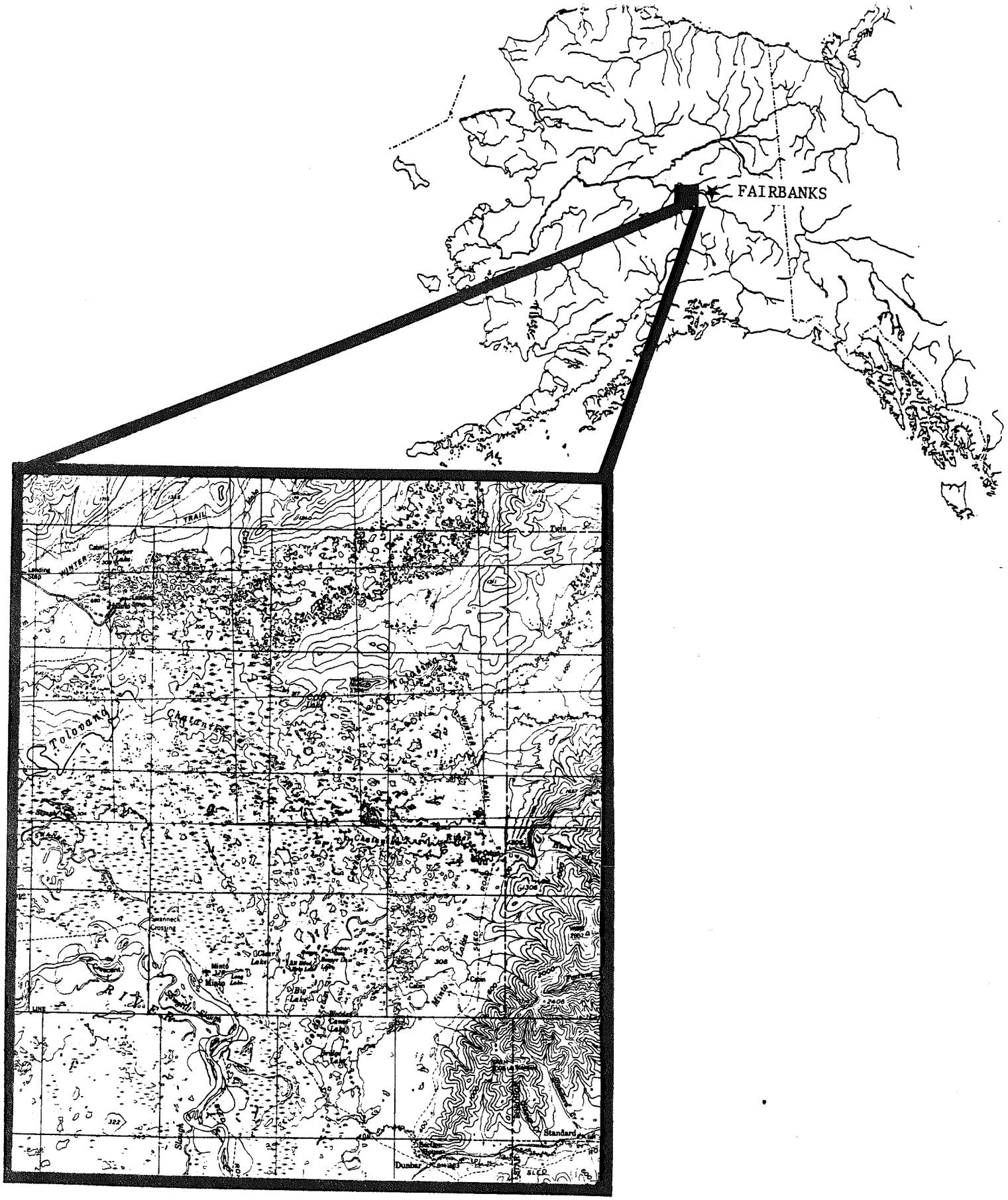


Figure 2. Location of the Minto Flats study area in Alaska.

The study area is contained within four 1:63,360 scale USGS quadrangle maps. Two quadrangle maps (Fairbanks D-4 and D-5) were established as the area of egg collection, and two quadrangle maps (Livengood A-4 and A-5) were established as the control area, where no egg collection activities occurred during the 3-year study (Figure 3).

Collection and monitoring activities included the following guidelines:

1. Nest survey flights were flown in the study area to determine lake occupancy and nest attendance for establishing approximate nest initiation.

2. After plotting the exact location of nests within the study area, nest sites for egg collection were determined on the basis of safe landing and take-off sites on the lake by a float-equipped Cessna 185.

3. At the nest site, all eggs were "candled" to determine fertility, and then measured. The eggs with the largest diameter were collected for the restoration program. In accordance with collection guidelines established by the Pacific Flyway Council, all but two fertile eggs were removed from the nest.

4. An aerial survey was flown within 1 week of egg collection to determine immediate effects from collection activities.

5. Aerial surveys of the egg collection nest sites were flown intermittently into late fall. These surveys, as well as a general aerial survey over the study area in September, were used to compare productivity and cygnet mortality between collection and control areas.

RESULTS

Fifty eggs (the number authorized annually for 3 years) were collected from sixteen nests each year in 1986 and 1987, and from thirteen nests in 1988. The average clutch size was 5.25 in 1986 (Table 4), 5.30 in 1987 (Table 5), and 6.15 in 1988 (Table 6). All collections were accomplished on 1 day each year (10 June 1986 and 1988, and 9 June 1987). After the collection, nest success and cygnet survival were monitored by several overflights during the remainder of the summer. Results of these surveys are summarized in Tables 4, 5, and 6.

Nest/egg hatching success

Hatching success and cygnet survival for each year are summarized in Tables 7 and 8. Data for number of eggs actually hatched were calculated only for collection sites. Due to time constraints to other USFWS projects, only egg collection sites were monitored immediately after hatching. These data, compared with productivity data (number of cygnets at each lake in fall), give an estimate of cygnet loss between hatching and fledging. Nest success (at least one egg hatching from a nest) recorded during the first post-hatch survey for collection sites was 75, 81, and 77 percent in 1986, 1987, and 1988, respectively (Table 7). The number of cygnets present at each collection site during the fall productivity survey (approximately 3 months later) was recorded to document the loss of cygnets. The percent of nests considered successful in the fall was 62, 50 and 62 percent recorded in 1986, 1987, and 1988 (Table 7). These data were compared to cygnet loss in the control area. Because a hatch survey was not conducted over the complete study area, the average clutch size from the collection nests (Tables 4-6) was used as the base number for the control nests. Nest success at collection sites during the productivity survey (Table 7) is compared to nest success in the control area (Table 8) where 73, 89, and 68 percent of the nests hatched in 1986, 1987, and 1988, respectively.

To measure the significance of egg collection activities, a Chi Square (X^2) test was derived by using a 2 X 2 contingency table with a 90 percent confidence level. There was no significant difference during the productivity survey between hatching at nests in the collection area and the control area in 1986 and 1988 ($X^2 = 0.67612$, $p > .90$ in 1986 and $X^2 = 0.17982$, $p > .90$ in 1988). However, in 1987, egg collection activities appeared to have a significant effect on hatching success ($X^2 = 12.2691$, $p > .90$).

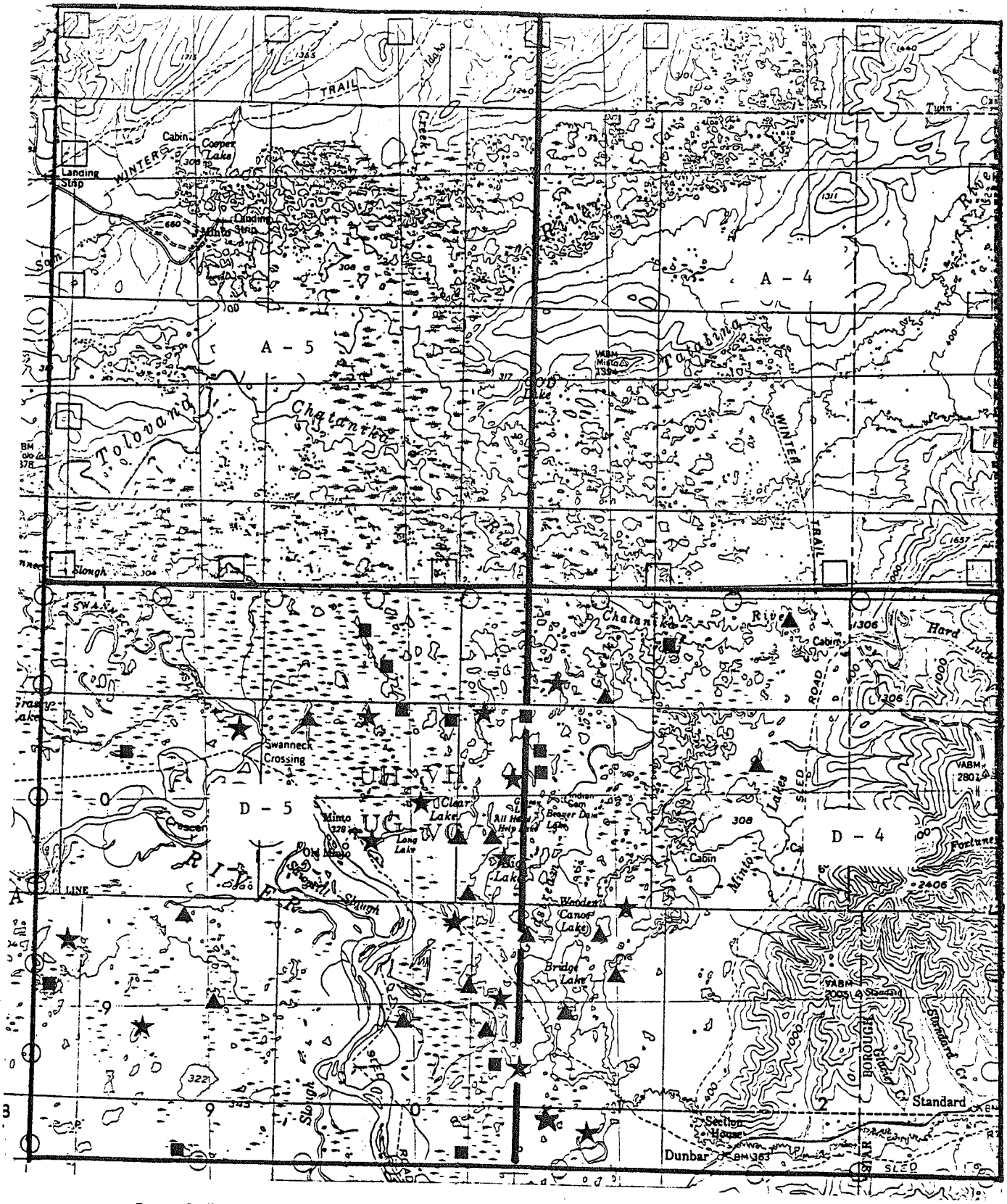
Productivity of all nests in the study area, regardless of egg collection activity, are compared to the productivity of nests outside the study area (Table 9). Productivity for all nests in the collection area indicates nest success is the same with or without egg collection in 1986 and 1987, but not 1988 (Table 9).

Cygnet survival

Cygnet survival is defined as a cygnet on the original nest lake, or within close proximity, during the fall productivity survey. Cygnet survival in the control and collection areas (Tables 7 and 8) was compared using the following method:

> Possible cygnets at the egg collection nests were known by counting the number of fertile eggs left in each nest (Tables 4, 5, and 6). The number of "possible cygnets" in the control area during the productivity survey was obtained by multiplying the average clutch size of the egg collection nests (5.25 in 1988, 5.3 in 1987, and 6.15 in 1988) by the number of nests recorded during the June nest survey (Table 8). By comparing the "possible cygnets" to actual number of cygnets observed during the fall productivity survey, survival was calculated for the egg collection sites and estimated for nest sites in the control area. Cygnet survival by nest site is documented in Tables 4, 5, and 6 for all egg collection sites, and summarized in Table 7. Cygnet survival for all nests in the control area is summarized in Table 8. Results from productivity surveys conducted during fall for all swans are found in Tables 2 and 3. Comparison of brood size with and without egg collection nests is summarized at the bottom of Table 3.

Cygnet survival at egg collection nests during the productivity survey was 36 percent, 32 percent, and 38 percent over the 3-year period (Table 7). Cygnet survival in the control area was generally higher at 47 percent in 1986 and 43 percent in 1988, and significantly higher at 64 percent in 1987 (Table 8).



Legend: Control area: □
Egg collection area: ○
1986 egg collection sites: ▲
1987 egg collection sites: ★
1988 egg collection sites: ■

Figure 3. Study area for Trumpeter Swan egg removal impacts, Minto Flats, AK.

Table 4. Trumpeter Swan nest and egg collection data with cygnet survival for 1986.

Nest ID number	No. eggs in clutch	No. eggs collected	No. fertile eggs left	June 12 (pair)	June 22 (pair)	August 16 (no. cyg.)	September 17 (no. cyg.)
43-50 (A)	6	4	2	off[2]	off	0	0
95-109 (B)	5	3	2	on	on	2	2
96-113 (C)	4	2	2	on	on	0	0
32-32 (I)	6	4	2	on	off	Not present	0
19-13 (H)	6 (one addled)	3	2	on	on	0	0
18-16 (D)	7	5	2	on	on	1	1
14-19 (O)	3	1	2	on	on	1	0
24-28 (N)	5	3	2	off	on	2	1
8-4 (M)	5	3	2	off	on	0	0
2-4 (K)	6	4	2	on	on	2	1
0-44 (L)	7	5	2	off	on	1	1
3-5 (J)	5	3	2	on	on	2	2
44-36 (E)	4	2	2	on	on	2	1
14-14 (F)	6	4	2	off	on	2	2
27-29 (G)	5	3	2	on	off	0	0
0-24 (P)	4	1	3	off	off	3	1
Total	84[1]	50	33	10 on/6 off	12 on/4 off	10/18[3]	9/12

[1] Average clutch size = 5.25 eggs.
[2] Position of adult relative to nest during aerial survey.
[3] Twenty-three different cygnets were observed between June 22 and August 16 surveys.

Table 5. Trumpeter Swan nest and egg collection data with cygnet survival for 1987.

Nest ID number	No. eggs in clutch	No. eggs collected	No. fertile eggs left	June 14 (pair)	June 26 no./pr.)	July 17 (no. cyg.)	August 10 (no. cyg)	September 9 (no. cyg)
4	5	3	2	off[2]	off	Not present	Not present	0
23	5	3	2	on	2	2[3]	1	1
41	5	3	2	on	on	2	2	1
12	6	4	2	off	off	1	Not present	Not present
14	4	2	2	on	Not present	1	1	1
127	7	5	2	off	2	0	0	0
49	5	3	2	on	0	1	1	Not present
62	6	2	4	on	4	2	2	2
93	4	2	2	off	on	2	2	2
103	4	2	2	on	on	1	0	0
71	7	5	2	off	off	0	Not present	0
28	6(1 egg jiggles)	4	2	on	2	2	2	1
65	5	3	2	on	on	1	0	0
19	5	3	2	on	off	0	0	0
36	6(1 egg infertile)	3	2	off	2	2	2	2
38	5(1 egg jiggles)	3	2	on	off	1	1	1
Total 16 Nests	85[1]	50	34	10 on/6 off	5/12[4]	12/18[5]	9/14	8/11

[1] Average clutch size = 5.3.
[2] Position of adult at nest during survey.
[3] Number in column indicates number of cygnets with pair on nesting lake.
[4] First number is total broods in column/second number is total cygnets in column.
[5] Twenty-two different cygnets observed during the June 26 and July 17 surveys.

Table 6. Trumpeter Swan nest and egg collection data with cygnet survival for 1988.

Nest ID number	Clutch size	No. eggs coll.	Fert. eggs left	June 12 (pair)	June 20 (pair)	July 21 cygnets	Sept. 9 cygnets
1-5 (A)	5	3	2	on[2]	off	2	2
6-10 (B)	5	3	2	off	off	1	1
11-15 (C)	5	3	2(1 jiggles)	on	on	1	1
16-24 (D)	9	7	2(1 jiggles)	on	off	0	0
25-31 (E)	7	5	2	on	on	1	1
32-38 (F)	7	5	2(1 jiggles)	off	off	0	0
39-43 (G)	5	3	2	off	off	1	0
44-49 (H)	6	4	2	on	on	2	2
50-56 (I)	7	5	2	on	on	2	2
57-63 (J)	7	4	2(+1 infert.)	on	on	1	1
64-69 (K)	6	4	2	off	off	1	1
70-74 (L)	5	3	2	off	off	0	0
79-84 (N)	6	1	5	on	on	5	0
Total	80[1]	50	29	8on/5off	6on/7off	10/17[3]	8/11[4]

[1] Average clutch size = 6.15 eggs.
[2] Position of adult relative to nest during aerial survey.
[3] Denotes number of broods observed over number of cygnets observed.
[4] Seventeen different cygnets were observed between July 21 and September 9.

Table 7. Nest success and cygnet survival from egg collection sites.

	No. of nests	No. of broods	% Nest[1] success	Possible cygnets	Observed cygnets	% Cygnet survival
			Immediate post-hatch survey			
1986	16	12	75	33	23	70
1987	16	13	81	34	22	65
1988	13	10	77	29	17	59
			Fall productivity survey			
1986	16	10	62	33	12	36
1987	16	8	50	34	11	32
1988	13	8	62	29	11	38

[1] Nest was considered successful if at least one cygnet was observed.

Table 8. Productivity of nest sites in the control area where no eggs were collected.

	No. nests	No. broods	% Nest[1] success	Possible[2] cygnets	Obs. cygnets	% Cygnet survival
			Fall productivity survey			
1986	41	30	73	215	102	47
1987	62	55	89	329	209	64
1988	77	52	68	474	203	43

[1] Nest was considered successful if at least one cygnet was observed.
[2] Possible cygnets calculated from average clutch size at egg collection nest sites:

1986 mean = 5.25 and n = 16
1987 mean = 5.30 and n = 16
1988 mean = 6.15 and n = 13

Table 9. Productivity and cygnet survival in egg collection area.

	No. nests	No. broods	% Nest success	Possible[1] cygnets	Cygnets obs.	% Cygnet survival
			Fall productivity survey (all nests)			
1986	91	54	59	427	198	46
1987	84	62	74	445	216	48
1988	95	60	63	584	227	39
			Fall productivity survey (without egg collection nests)			
1986	75	44	59	394[2]	175	44
1987	68	50	74	360[2]	120	33
1988	55	43	78	338[2]	149	44

[1] Possible cygnets calculated from combination of actual expected from egg collection nests and average clutch size at bottom of Table 8.
[2] Possible cygnets calculated from average clutch size at bottom of Table 8.

During 1986 and 1988, cygnet survival was independent of nest visitation ($X^2 = 1.41362$, $p > .90$ in 1986 and $X^2 = 0.26798$, $p > .90$ in 1988), i.e., nest visitation was not significant to cygnet survival between collection nests and control area nests. However, during 1987, cygnet survival was significantly lower at the visited nests ($X^2 = 12.5422$, $p > .90$). The breeding and production data during 1987 could appear suspect in both categories indicating significant effects from egg collection activities. Other factors have also been analyzed, such as weather, water levels, and other types of disturbance. There were not any apparent physical factors occurring in the study area which may have biased the data.

Nest site faithfulness

During 1987 and 1988, nest site faithfulness was monitored. Faithfulness was measured as whether or not a pair nested on the same lake the year after egg collection. All nest sites in the study area in 1986 and 1987 were resurveyed for pair and brood use during 1987 and 1988 (Tables 10, 11, and 12). A summary table for nest site faithfulness in the control area and at egg collection sites is found in Table 11, and a summary for all nest sites is found in Table 13. In the control area, 50 percent of the nests used in 1986 and 1987 were used in the succeeding year, and at collection nests, 84 percent were used in the succeeding year (Table 10). In the control area, 53 percent were occupied by a brood in the immediate fall (1986 and 1987) (Table 11), and at collection nests, 56 percent were occupied by a brood in the immediate fall. In the control area in all 3 years, 59 percent were occupied by broods in the immediate fall, and at collection nests, 58 percent were occupied in the immediate fall (Table 10).

This is the only comparison where the control area data was higher than the nest collection data. It appears to be insignificant. Occupation of the nest site lake by a brood in the second fall after nesting occurred 41 percent of the time in 1986 and 1987 control nests, and 59 percent of the time in 1986 and 1987 collection nests (Table 11). It appears that the one-time nest site visit during a previous year does not influence breeding activities on the lake in the succeeding year.

Nest site faithfulness in noncollected nests is compared to all other nonvisited nests in the study area in Table 12. All nonvisited nest sites are summarized in Table 13. There is a substantial difference in the percent use between active nests in 1986 and 1987 and nests in succeeding years (Table 13). Collection nests were occupied at a rate of 84 percent, compared to 50 percent for the control area, 59 percent for other nests in the collection area, and 55 percent for all nonvisited nest sites in the study area (Table 13). One other discrepancy was between "active nests 1986-87" and "brood in second fall," where collection nests were higher at 59 percent brood use compared to 41 percent in the control area, 37 percent in "other nests" in the collection area, and 39 percent for all nonvisited nests in the study area (Table 13).

Trumpeter Swan subpopulations

Recent continuous long-term nesting data for Trumpeter Swans in Alaska is available only from the Minto Flats and Copper River Delta (King et al. 1981, Conant et al. 1983, King 1984, and Cain et al. 1985). Productivity estimates for Trumpeter Swans in Alaska exist for 11 subpopulations (Conant et al. 1988), and are previously documented by King and Conant (1981). When reviewing this data, it appears that there are four subpopulations in Alaska that could support an egg removal program. Pairs and single swan observations during nesting and brood rearing are reliable indicators of reproductive success and potential of the population. Any subpopulation with a significantly increasing reproductive potential (pairs and singles) and increasing productivity (percent young in the population) could be considered for an egg removal program without significant population decreases.

Subpopulations in Alaska with a substantial base population prior to 1975 and a subsequent major increase in pairs and singles, as well as a number of good productivity years, were considered. Using the above criteria, any subpopulation that recorded at least 100 percent increase in pairs and singles

from 1975 to 1985 (Conant et al. 1988) was considered for a collection program. Those subpopulations which met the above criteria are Gulf Coast (Copper River and Bering River Deltas), Gulkana (Nelchina Basin), Cook Inlet (north and west of Anchorage), and Lower Tanana (Minto Flats area), located in Figure 1. Total swan populations in these areas are estimated at more than 1,100 each in the Gulf Coast and Cook Inlet units, and more than 3,500 each in the Gulkana and Lower Tanana units (Hodges et al. 1987).

Annual nesting data for Trumpeter Swans is available only for the Gulf Coast and Lower Tanana River units. In the Copper and Bering River Delta areas (Gulf Coast unit), the annual mean number of nests during 1984-88 has been 126.8 (tabulated from 11 USGS quadrangle maps). During the same time period in the Minto Flats study area, the annual mean number of nests has been 128.4 (data from four USGS quadrangle maps). The mean number of broods was 60.2 and 92.8 in the Copper River/Bering River area and the Minto Flats study area, respectively, during 1984-88. Total swan population and number of broods in the Cook Inlet unit is comparable to the Gulf Coast unit, and likewise the Gulkana unit is comparable to the Lower Tanana unit (Hodges et al. 1987).

Table 10. Nest lake faithfulness of Trumpeter Swan pairs in the control area vs egg collection nest sites in Minto Flats, Alaska.

No. of nests	Active nest same lake 1987	Active nest same lake 1988	Brood on nest lake 1986	Brood on nest lake 1987	Brood on nest lake 1988
			Control area		
1986 = 57	28 (49)[1]	30 (53)	22 (38)	22 (38)	21 (37)
1987 = 62	--	31 (50)	--	41 (66)	27 (44)
1988 = 77	--	--	--	--	52 (68)
			Egg collection sites		
1986 = 16	13 (81)	13 (81)	10 (62)	12 (75)	11 (69)
1987 = 16	--	14 (88)	--	8 (50)	7 (44)
1988 = 13	--	--	--	--	8 (62)

[1] Number in parentheses denotes percent.

Table 11. Summary of Table 10.

Nested 1986-87		Nested succeeding year
Control area	119	59 (50)[1]
Coll. sites	32	27 (84)
Nested 1986-87		Brood in immediate fall
Control area	119	63 (53)
Coll. sites	32	18 (56)
Nested 1986-87-88		Brood in immediate fall
Control Area	196	115 (59)
Coll. Sites	45	26 (58)
Nested 1986-87		Brood second succeeding fall
Control Area	119	49 (41)
Coll. Sites	32	19 (59)

[1] Number in parentheses denotes percent.

Table 12. Nest lake faithfulness of Trumpeter Swan pairs at noncollected sites in the egg collection area vs all other nonvisited nests in the study area.

Active nest	Active nest same lake 1987	Active nest same lake 1988	Brood on nest lake 1986	Brood on nest lake 1987	Brood on nest lake 1988
		Egg collection area (without collection sites)			
1986 = 75	44 (59)[1]	28/67 (42)	35 (47)	21/67 (31)	21/62 (34)
1987 = 74	--	44 (59)	--	32/73 (44)	28/66 (42)
1988 = 69	--	--	--	--	32 (46)
		All nonvisited nest sites			
1986 = 132	72 (54)	58/124 (47)	57 (43)	43/124 (35)	42/119 (35)
1987 = 136	--	75 (55)	--	73/135 (54)	55/128 (43)
1988 = 146	--	--	--	--	84 (58)

[1] Number in parentheses denotes percent.

DISCUSSION

Trumpeter Swans have been increasing throughout Alaska during the last 15 years. Occasional late spring snowmelt, flooding during nesting, or general inclement weather (during nesting, hatching, or early cygnet development) occurs within some subpopulations almost annually. This generally happens during different years in different subpopulations, and has resulted in some decreased annual increments. However, during the past decade, favorable breeding and brood rearing conditions have allowed the Alaskan population to continue to increase overall. Once Trumpeter Swans saturate the available habitat, the population should level off. Barring a general climatic calamity, we will continue to see Trumpeter Swans in previously unoccuppied habitat, probably for the next several years.

Minto Flats is representative of this trend. The population in the prime historical habitat continues to increase. Although the perimeter habitat of Minto Flats has not been surveyed in 3 years, we can assume that those areas are also experiencing an increase in swan numbers. As Trumpeters continue to increase in Minto Flats, it may become more difficult to analyze the effects of any one factor on the total population.

Eggs vs fledged cygnets

In the control area with no disturbance, approximately 50 percent of the eggs resulted in "fledged" cygnets (Table 8). Using the "fledged" cygnet category is as accurate an approximation for cygnet survival as possible under the constraints outlined previously. This explains the rationale for using the average clutch size data at collection sites and applying it to all other nests in the study area. In collection nests, approximately 35 percent of the remaining eggs resulted in fledged cygnets. There appears to be approximately 50 percent cygnet survival from eggs in natural nests to fledging under the best breeding and brood rearing conditions (the last 3 years in Minto Flats). After analyzing collection activities, there appear to be no significant detrimental effects from a one-time visit to the nest by a float plane during late incubation periods. However, two criteria were adhered to closely during collection activities which could have a detrimental effect if not followed: (1) all egg collections were made on mild, warm days and (2) prior planning in the form of extensive aerial nest surveys permitted the minimum of time spent in the vicinity of the nest lake and on the lake during collection of eggs.

Cygnet survival

Cygnet survival was independent of the visit in 2 of 3 years. Some bias may exist in the hatchability of eggs and cygnet survival at egg collection nests. During the 3 years of egg collection, all eggs were measured at each visited nest. To ensure the best hatchability of collected eggs, and thus the best possible success of the restoration program, the largest fertile eggs were collected. This may have influenced hatchability and survival of cygnets from smaller eggs. This hypothesis should be analyzed in further years of collection.

Nest lake faithfulness

Nest lake faithfulness by paired birds was significantly higher on egg collection sites than on control area sites (Table 10). Although there is a significant amount of movement of pairs to nest on different lakes on succeeding years (50 percent in the control area), it appears that this shift may occur more readily by pairs that have just reached breeding age and are selecting permanent territories that may be used many years. This pioneering by young pairs should be studied further. Disturbance that influences swan movement from the breeding lake may be dependent on the number of years the pair has nested on the lake. Although only the male and/or female of four adult pairs of swans have been collared in Minto Flats, these pairs have shown complete fidelity to the original nest lake where they were captured. At least one of the pairs was captured and continued to nest outside the egg collection area. Only long term studies and surveys can give us answers to fidelity and pioneering efforts by Trumpeter Swans.

Table 13. Summary of all nest and brood observations in the study area.

	Active nest 1986-87	Nest in succeeding year	Active nest 1986-87	Brood in immediate fall
Control area	119	59 (50)	119	63 (53)
Collection nests	32	27 (84)	32	18 (56)
Other collection area nests[1]	149	88 (59)	148	67 (45)
All noncollected nest sites[2]	268	147 (55)	267	130 (49)

	Active nest 1986-87-88	Brood in immediate fall	Active nest 1986-87	Brood in second fall
Control area	196	115 (59)	119	49 (41)
Collected nests	45	26 (58)	32	19 (59)
Other collection area nests[1]	217	99 (46)	133	49 (37)
All noncollected nest sites[2]	351	214 (61)	252	98 (39)

[1] Denotes all non-visited nest sites in the collection area.
[2] Represents all nests sites in the study area where there were no egg collections.

Trumpeter Swan subpopulations

Of the estimated 10,649 Trumpeter Swans in Alaska in 1987 (Hodges et al. 1987), four subpopulations made up approximately 90 percent of the total population. The Gulf Coast and Cook Inlet units each supported 10 percent of the total, while Gulkana and Lower Tanana units contained 36 and 34 percent of the total, respectively. These figures approximate percent proportions of the subpopulations in previous years. The above four units should be considered in any future egg removal programs.

Egg removal impacts

Egg removal activities did not appear to retard breeding or brood rearing activities, nor have significant effects on the total population in the Minto Flats study area. To understand the impact to future populations, the study area should be monitored more than 3 years.

The following scenario was considered when estimating the impacts of egg removal to recruitment in a free-flying population of Trumpeter Swans in Minto Flats, and may or may not apply to other subpopulations:

1. Assuming 50 percent of the eggs in a clutch produce a fledged cygnet, removal of 50 eggs for reintroduction purposes would reduce the Minto Flats cygnet population at fledging by 25 birds.

2. Half of 25 surviving cygnets are estimated to be females (12.5 birds). Although no studies of migrating Trumpeter Swans in the wild have revealed overwinter cygnet mortality, cygnets collared in Minto Flats are resighted at a rate of approximately 35 percent (King 1985). Although conditions are not ideal for resighting marked birds in Minto Flats, very few collared birds are observed in nonbreeding flocks (that segment of the population which represents mostly young nonbreeding birds and is more readily located from aerial surveys). Assuming 30 percent over-winter mortality in cygnets occurs from fall to spring, there would be approximately 9 of the fledged females returning the first year (.70 X 12.5 = 8.75).

3. Resighting records in the Skagit Valley, WA, indicate that at least two known-age collared Trumpeter Swans from the Minto Flats population bred in their 4th year (Russell Canniff, Everett, WA, pers. comm.).

   If we assume a minimum of 10 percent per year mortality for the 3 years from juvenile age to breeding age (year 4), we could expect approximately 6.4 females to be alive at assumed breeding age (2nd=7.87; 3rd=7.08; 4th=6.37).

4. These 6.4 females could expect a mean brood success rate of 42 percent (8 years data from the Minto Flats study area in Table 2) or approximately 2.7 broods with a mean of 3.5 cygnets per brood (Table 2). This could result in 10 cygnets produced annually to fledging from the original 12.5 females when they became 4 years old (6.4 females X .43 brood success/female =2.75 broods @ 3.5 cygnets/brood = 9.6 cygnets).

5. These 9.6 cygnets would represent approximately 3 percent of the average annual cygnet population during 1981-88 within the study area, 2 percent of the Lower Tanana River unit in 1985 (a low productivity year), and .006 percent of the total Alaskan cygnet population in 1985.

6. For ease of calculation, if we disregard a continued probable 10 percent mortality per year of adult females (in 3 above), approximately 193 cygnets could be produced to flight during a 20-year period (20 yrs X 9.6 cygnets/yr = 192.6).

Other tables may be constructed which would evaluate the impact of the removed eggs to recruitment in the population. The example above is, in the author's opinion, the most simplistic. It appears that at this time and with current productivity rates, the Alaskan Trumpeter Swan population can sustain annual removal of eggs.

RECOMMENDATIONS

1. Continue to remove Trumpeter Swan eggs from the Alaskan population. The removal of 50 eggs appears to have no significant effect on the present population. Removal of more than 50 eggs should be preceeded by annual nesting surveys within the subpopulations proposed for the egg removal program.

2. Subpopulation units that appear viable to sustain an egg removal program would be Lower Tanana, Gulkana, Gulf Coast, and Cook Inlet (Figure 1). Remove no more than 50 eggs from either the Lower Tanana unit or the Gulkana unit and no more than 25 eggs from the Gulf Coast unit or the Cook Inlet unit. These four units could be prioritized for egg collection activities after considering the following criteria:

   a. Some mortality factors affecting production in the subpopulations include:

      i. Lower Tanana is affected by occasional flooding of nests, but generally has favorable weather conditions. Yet, birds often have farther to migrate which might affect survival (King 1985).

      ii. Gulkana is at a higher elevation than any Alaskan Trumpeter Swan subpopulation. Although the general area may have favorable nesting conditions, the shortened ice-free period may be significant to cygnet fledging and possible increased mortality.

      iii. Gulf Coast swans have wide fluctuations in nest success and cygnet survival due to inclement weather at critical times of nesting and early brood rearing, yet these birds have the shortest distance to migrate and possibly less mortality occurs to fledged cygnets.

      iv. Cook Inlet can have sustained inclement weather, but breeding habitat may be more vulnerable to human encroachment.

   b. Land status where collection activities take place must comply with environmental assessment requirements by the land administering agency and with consideration given to private inholdings.

   c. If eggs are collected in the Gulkana or Cook Inlet units, nesting surveys should be implemented to document extent of use and success of nesting pairs.

3. No subpopulation should sustain more than 3 consecutive years of egg collection activities without an opportunity to analyze effects from collecting activites and to assess the population trend. This can be accomplished by conducting annual fall productivity surveys in collection area subpopulations.

4. A monitoring study should be implemented for each unit where eggs are collected. The study should include at a minimum a productivity survey of all Trumpeter Swan habitat occurring on each USGS 1:63,630- scale map where egg collecting has occurred.

5. Costs for the survey(s) and actual egg collection should be reimbursed by the egg recipients if assisted by the USFWS.

6. Access to lakes selected for egg collection should be via float plane until effects of other types of access can be analyzed. A study other than basic monitoring activity should address the impacts of using helicopters, boats, walking, etc.

7. The total clutch of eggs in each collection nest should be removed from the nest. This will result in disturbance to fewer nesting pairs to achieve the allowed quota and will not involve a decision for criteria as to which fertile eggs are to be left in the nest. On the negative side of complete clutch removal (which has not been addressed here) is the possibility that the breeding pair may abandon the nesting lake in future years if complete egg clutches are removed.

8. Collection activities may occur without the assistance of the USFWS or ADF&G, but must be under approved guidelines, which include:

   a. The USFWS and ADF&G jointly will approve areas (units) for egg collection.

   b. All egg collection nest sites must be mapped as accurately as possible on USGS 1:63,630-scale maps and a copy furnished to both the USFWS and ADF&G.

   c. Data for each egg collection nest site should include, at minimum, clutch size, number of fertile eggs, egg size, and general nest structure information such as material, size, distance to edge of water, and attendance by adults.

   d. Nest visits must be coordinated to allow only a minimum of time on the nest lake.

These recommendations are by the author only and are subject to the approval of the Regional Director, USFWS, the Commissioner, ADF&G, and the Pacific Flyway Council.

ACKNOWLEDGEMENTS

I would like to thank all who have assisted me in the collection of Trumpeter Swan data in the Minto Flats area over the last 8 years. There have been too many assistants to name without missing someone. Although many have been volunteers as well as employees, all have had a dedicated interest in the Trumpeter Swan. Without their help, this data would not have been collected. All have been stalwart in spending many hours in flight while recording data under trying conditions, as we attempted to be exact in marking nest and swan locations among a maze of lakes and meadows. I thank particularly my dedicated wife/companion/biologist C. M. VanZant-King, son J. R. King, and K. Bollinger, all of whom carried the bulk of the observations.

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RESULTS OF THE 1988 CAPTIVE TRUMPETER SWAN SURVEY

Donna Compton

The Trumpeter Swan Society cooperates with the U. S. Fish and Wildlife Service (USFWS) in its effort to count all Trumpeter Swans in North America in 5-year intervals. The Society is responsible for counting captive swans, which includes keeping track of the number of people who have birds, identifying new owners, and updating addresses and phone numbers. However, things change so fast in the propagation business, it would be unreasonable to limit the captive swan survey to 5-year intervals. A 1988 survey was used to get a ballpark estimate of the number of Trumpeters in captivity, and to update the captive swan mailing list.

A request for information was sent to each of the known propagators, using 1985 survey information. The survey form asked for the age and sex of the birds in possession and for names and addresses of persons to whom birds were sold. A follow-up form was sent to those who did not respond to the first request. No further effort was made to contact those who did not respond to the second request. The information needed from zoos was obtained from the International Species Inventory System (ISIS) report.

The 144 respondents to the survey had 678 Trumpeters in their possession. Of that total, 184 were cygnets. Ninety-four of the 184 were to be released as part of restoration projects, including birds hatched from Alaskan eggs. Based on the number of nonrespondents and the number of birds these propagators had in 1985, it is suspected that the 1988 figures are quite low. Budget constraints would not allow a telephone follow-up, so the number of owners and birds missed could only be estimated. The estimate is also likely to be low, but closer to the actual count. It is estimated that there were about 178 Trumpeter propagators and about 750 captive birds in 1988. The history of Trumpeters in captivity, as we know it, is given in Table 1.

In future years, particularly in the 5-year survey, telephone follow-ups will be necessary to get accurate figures. It will also be necessary to request information from the USFWS enforcement office 1 year in advance to obtain its list of permittees with Trumpeters. Canadian propagators will be more difficult to track. Canada's privacy laws prohibit licensing agencies from providing the Society with a list of propagators. The Ontario provincial government has been kind enough to survey missed propagators for us. However, propagators voluntarily respond to this request, and no follow-up request can be made. No such agreement was reached with other provinces, for lack of time. That effort should be made for the 1990 survey.

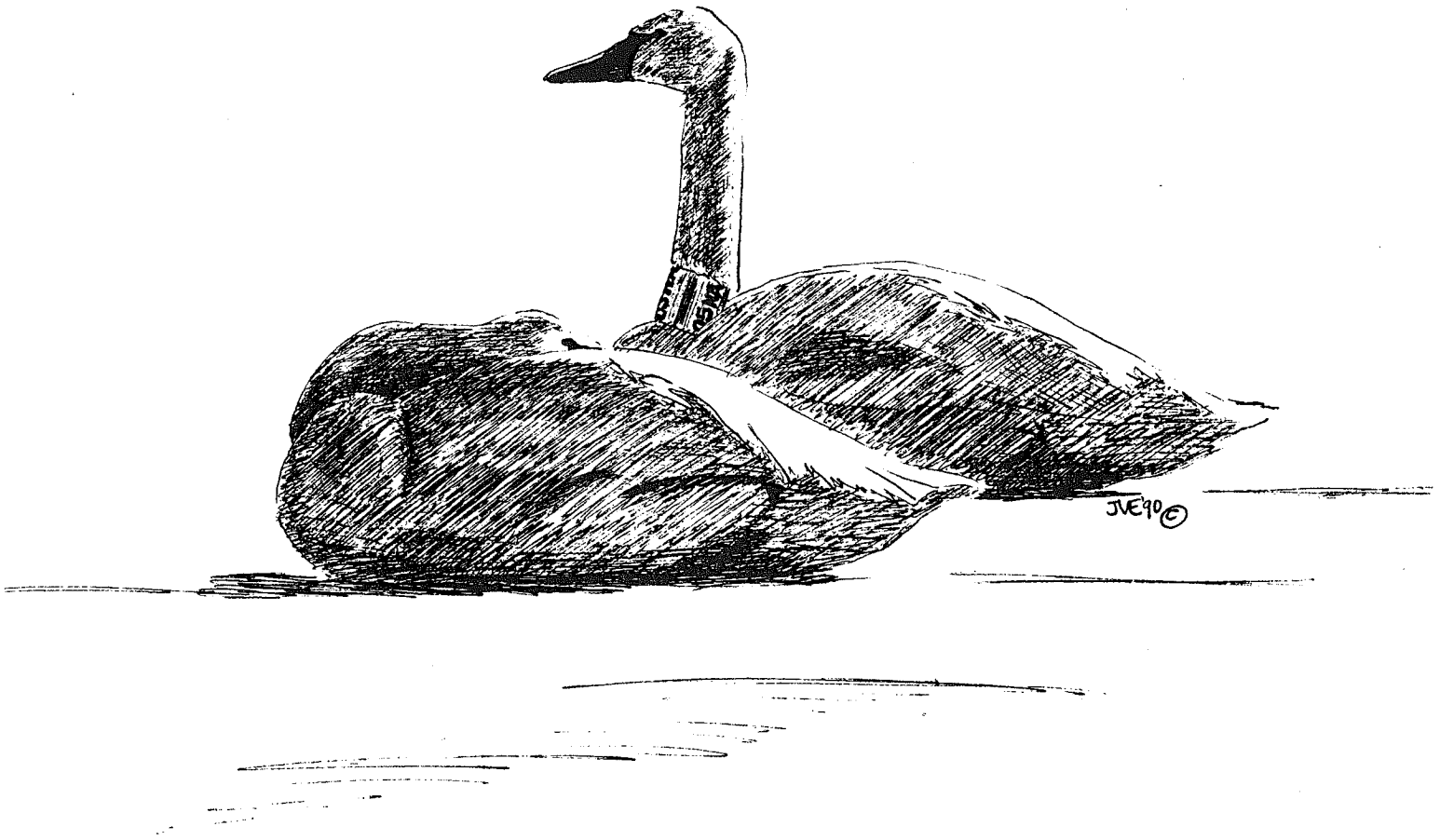
Future surveys should be improved to make the survey form easier to fill out, and a self-addressed envelope should be included. It is quite expensive to call a large number of nonrespondents. Perhaps some kind of incentive program would improve the response to the mailed request and, in the end, be more cost-effective than a follow-up effort.

The steadily-increasing number of captive propagators of Trumpeters seems to offer an obvious source of stock for restoration efforts. Cooperation between agencies and propagators would benefit both interests. Propagators need good breeding stock and a place to sell/donate excess birds. They need laws that permit them to raise birds and make money from the sale of those birds, but also allow them ways to benefit the species that are supported by the agencies. The restorations need good-quality, releasable birds, with a low price tag and less overhead for their projects. The propagators know how to hatch and raise birds, and they have the facilities to do so. The agencies know what criteria make a good releasable bird and when, where, and how to release the birds. The agencies and the propagators need each other -- all that is left to do is make the arrangements. The Trumpeter Swan Society's Captive Trumpeter Swan Survey has laid the groundwork -- now it is up to the agencies to woo the cooperation of the propagators with contractual agreements that will benefit both endeavors.

Table 1. Captive Trumpeter Swan survey results, 1974-88.

	Year					
	1974	1979	1981	1983	1985	1988
Captive Trumpeters	157	252	286	419	611	750 approx.
Trumpeter owners	59	61	77	88	150	178 approx.

TRUMPETER SWAN MARKING PROTOCOL



TRUMPETER SWAN BANDING PROTOCOL -- A SURVEY OF THE BANDERS

Donna Compton

The original purpose of this project was to determine who was doing what with visual markers on swans of all species in North America. The Office of Migratory Birds, Bird Banding Lab (BBL) has not until now had the ability to track collar codes back to the bander. The responsible bander and the assigned U. S. Fish and Wildlife Service leg band codes were computerized, but there was no tracer to the visual markers, either collars or wing tags. The Trumpeter Swan Society volunteered to assist in creating a master list of banders using visual markers on Trumpeter, Tundra, and Mute Swans. This list was published in November 1988. No attempt was made to correlate the assigned U. S. Fish and Wildlife Service leg band codes with the visual marker codes.

It was discovered that several project coordinators were interested in deviating or were already deviating from the protocol system for visual markers set up by W. J. Sladen for all species of swans in North America (1973). All of the deviations had been authorized by the BBL, and the issue of manually tracking sightings of these deviant markers back to the bander is not yet impossible. However, as the number of banders and projects increases, some confusion is anticipated. It was apparent that the banders were not content to stay within the protocol and that the BBL was willing to allow exceptions. It was also apparent that the orientation of the alphanumerics on the collar (a subject not addressed in the original protocol) was also a potential source of confusion, as each researcher proceeded to devise a unique orientation specific to his project. Therefore, a survey of the banders was conducted to determine if, in fact, changes in the protocol should be recommended to better facilitate their needs.

It is necessary to outline the primary features of Sladen's protocol prior to evaluating the responses of the banders to the survey:

- Five collar colors were assigned to five regions of the continent (yellow, blue, red-orange, green, and black). The same color was to be used for all three species in each region.

- Alphanumeric code types were assigned to each species.

Trumpeters	2 numbers/2 letters
Tundras	1 letter /3 numbers
Mutes	2 letters/2 numbers

- Only letters that were easily distinguishable from one another and from numbers were to be allowed (A, C, E, F, J, K, M, P, R, T, V, Y).

- Duplication of alphanumeric codes would not be authorized for use in two different colors at the same time. In other words, there could not be banders using the EE series in two different regions of the continent at the same time, even though the collar colors would be different. Exceptions would only be made as available codes were depleted, and, in that event, care would be taken to assign duplicate codes to populations of birds unlikely to experience any range overlap.

Deviations from the above protocol are listed in Table 1. In some cases, the deviations were relatively minor and unlikely to cause confusion, but, in other cases, the potential exists to have a very confusing situation. The Izembek National Wildlife Refuge, Alaska, codes are, in themselves, very confusing and would require an informed observer to accurately read and report the codes. However, the birds being studied were nonmigratory, and the majority of the sightings were indeed likely to come from trained observers and not from the general public.

In several cases, deviations have been made in the alphanumeric code protocol. As stated earlier, the alphanumeric code was designed to differentiate the three swan species. In most situations, it is likely that species determination could be made by inference. Either the other species present have not been collared, or the other species do not commonly occur at a given location at all or do not occur that location at the time of year that the marked birds were observed. Alaska and the wintering range for the Alaskan Tundras and Trumpeters are the notable exceptions. Although it is difficult to glean information from incomplete sightings, changes in the alphanumeric code were made to increase the size of certain portions of the code and, thus, increase the likelihood that the most critical portions of the collar could be read.

The survey was sent to the banders requesting their input on the feasibility of continuing within Sladen's protocol and having it work for their projects and/or recommendations that would better serve their projects. Eighteen banders responded to the survey. The responses included a wide range of suggestions, ranging from continuing with the protocol as it is, to eliminating the constraints and letting each researcher do as he wishes. The changes recommended, with justification where available, the numbers of banders supporting the idea, and comments on the feasibility are listed in Table 2. The survey form did not suggest any options for changing the protocol, and many banders did not have any recommendations. There was not a lot of support for any one issue. Therefore, I am not ready to make recommendations to let the protocol stand or on how to revise it, but will summarize the responses for consideration.

Table 1. Swan bander **deviations** from Sladen's protocol.

Species	Band or tag color with alphanumeric code color	Code	General location
Trumpeters	Red w/white	01-200 AA	Northwest Territories
	Yellow w/black	3A3A-3Z3Z 4A4A-4Z4Z 01-100 AC	Elk Island National Park, Alberta
	Green w/white	01-100 MA 01-00 R 01-00 C	Montana
	Green w/white	01-00 SMY L 01-00 Y 01-00	Wyoming
Tundras	Blue w/white	T3 01-00[1] T3 A-Z, 1-0 T3 AA-ZZ 01-00 A-Z, 1-0 1-0, A-Z AA-ZZ	Izembek NWR, Alaska
	Gray w/black	P 001-500	North Carolina
	Yellow w/black	A 001-000	Northwest Territories

[1] The difficulty with this code was the way it was to be printed on the collar. The T3 was to be very small and the other two numbers would then be much larger and still fit on the collar.

The majority of support for change was in collar color assignment. Under Sladen's protocol, Trumpeter, Tundra, and Mute Swans are all banded with the same color within a region. There were strong suggestions that different species should have different colors within a region. Another reason given for color change was to provide good visibility from the air. As assigned by Sladen, yellow is the color for most interior continent birds. Yellow does not show up well enough to be useful in remote areas where sightings from the air are the most common.

Sladen's list of five colors includes only primary, easily-distinguished colors (yellow, blue, red-orange, green, and black). These colors should be distinguishable, even with the inevitable fading of the collar and dye lot variations. Colors other than the five such as gold, turquoise, light blue, light green, orange, and purple could easily be confused with the original five. Brown and gray could possibly offer two additional distinguishable colors. Expansion of color assignments could take one of two directions. The first is multiple colors on the collars. No more than two colors should be used. Simplicity will aid accuracy on the part of the observer. The second option would be to duplicate color usage, but not codes, in different regions of the continent where non-overlapping populations exist. (In other words, green could be used on Mississippi Flyway Trumpeters rather than yellow because it is quite unlikely that West Coast birds, also green, would ever be seen in the Mississippi Flyway.)

Sladen's protocol did not spell out the orientation of the code on the collar, but, based on the recommended size of the figures, it assumed orientation A in Figure 1. The banders have come up with variations B, C, and D, designed to increase the size of the most important portion of their alphanumeric codes. Variations C and D were completely unique systems in the regions used, and the small figures were not really necessary for identification of the project or the individual. Variation B is commonly used for Tundra Swans.

To date, the plastic leg bands used have always matched the collar code and color. Sladen's protocol called for placement of the USFWS band on the left tarsus of known-aged birds and on the right for unknown-aged birds. Instead, most of the banders were differentiating the sex of the bird with the leg bands, placing the metal band on the right leg for males and on the left leg for females. The plastic colored band is always placed on the opposite leg from the metal band.

Table 2. Changes recommended by swan banders.

Recommended changes	Justification	Number of supporters	Comments
Different colors should be used for different species within a region or flyway.	Allow for obvious distinction between species.	1	Probably not necessary in all regions of the continent, Alaska being the notable exception.
Different color collars for all Mutes.		1	Adult Mutes should be easily distinguishable from other species.
Collar colors need to be easily observable from aircraft.	Remote area surveys can only be done by aircraft.	2	Perhaps patagial tags would be more visible from the air than collars.
	Collars need to be more obvious, even on the ground.	1	
Orientation on collar be changed to variation B.	More letter codes could be used.	1	Works well on Tundras, but not so well on Trumpeters or Mutes because of the required alphanumeric codes.
	Alphanumerics could all be larger and more easily read.	1	
Change alphanumeric code requirements.	To increase the size of figures.	1	This would be an option for non-migratory flocks only.
	The flock in question is 95% non-migratory and only a 2-digit code is needed.	1	
Allow the use of symbols instead of alphanumerics.	Easier to read.	1	Difficult for the public to describe.
Delete the portion of the protocol stating that same the codes cannot be used on collars of different colors.	Code duplication on different colors is already being done.	1	This would make official what is already necessary for lack of available codes.
Use leg bands to differentiate sexes rather known or unknown aged birds.	This information seems more useful in the event that the collar cannot be read.	1	USFWS band, male right, female left.
Abandon the protocol and go with ad hoc arrangement.	There are too many others using the same colors.	1	The danger of duplication would be great, and it would be very difficult to monitor.

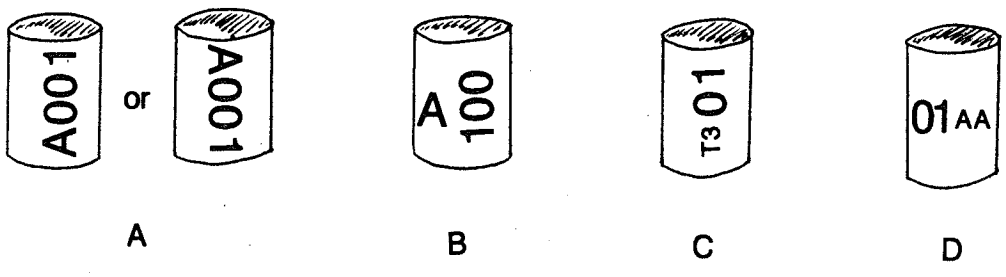


Figure 1. Orientations of alphamuneric codes presently in use on swan collars.

No protocol has been developed for patagial tags. They have traditionally been used by banders wishing to have more flexibility in design and alphanumerics available than the collar protocol allowed. Eventually, as successful designs emerge, standardization of materials, size, and shape would likely increase the success of the tags. If the public can be trained to accurately report a variety of color combinations and alphanumerics, these tags may be the ticket for those programs desiring unique markers immediately indentifiable to their programs. It is also possible that patagial tags would be more visible from the air than collars. This could perhaps solve the problem of visibility of markers from the air in remote locations.

The majority of the banders were following the Sladen protocol for codes and color. Unless the idea of protocol is to be abandoned, it is imperative that all banders commit to at least the alphanumeric codes to allow absolute definition of species. The general public observer cannot be expected to differentiate the three swan species, with the possible exception of adult Mutes from the other two species.

The attempt here is to set the stage for recommending changes in the protocol without muddling up the protocol system. Whatever decisions are made , the authorization must continue to go through the BBL in Maryland. If there is a better way to accommodate the needs of the banders, we must find it, the BBL will institute it, and The Trumpeter Swan Society will monitor the success.

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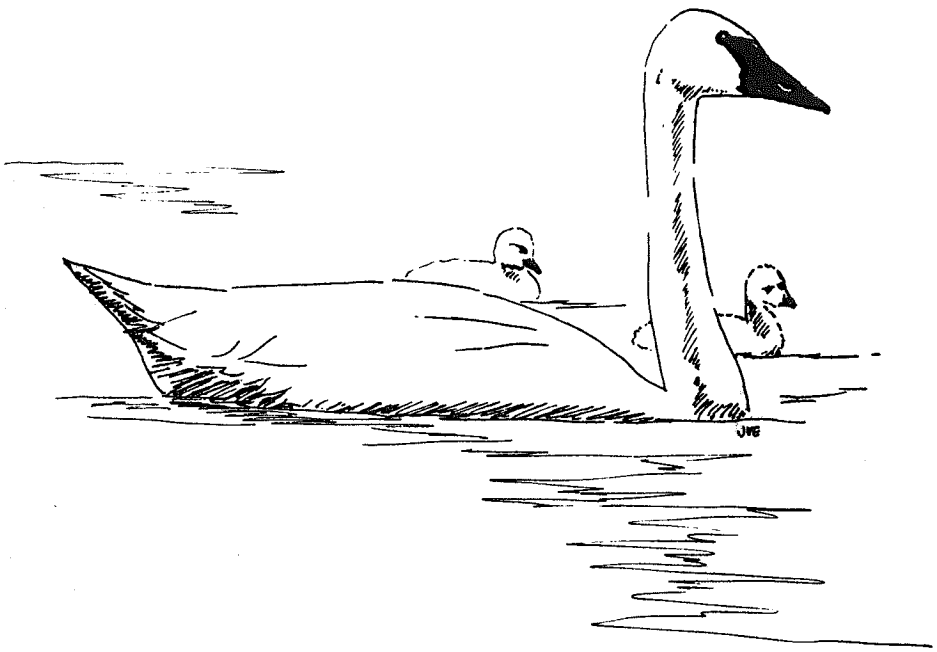


THE DEVELOPMENT OF A PATAGIAL TAG FOR TRUMPETER SWANS

Steven M. Kittelson

The stimulus to use patagial tags as a method of marking Trumpeter Swans (Cygnus buccinator) released in the Minnesota Department of Natural Resources (MN DNR) Trumpeter Swan Restoration Program was prompted by the death of one captive swan and the near death of another due to collar icing. The incident occurred in early February 1986 during a period of sub-zero temperatures at the Carlos Avery Wildlife Office, Forest Lake, MN. The two swans had a large buildup of ice on their collars. The estimated weight of the ice was 0.68 to 1.14 kg (1.5 to 2.5 pounds) per collar.

Patagial tags are being used on Trumpeter Swans in Alberta and Ontario by Shandruk and Lumsden, respectively, and have been used successfully on other species, as well. Lumsden tried modified livestock ear tags on swans in Ontario, and had functional tags after 3 years of use (Lumsden, pers. comm. 1987). Mossman used a fabricated wing tag on Turkey Vultures in Wisconsin and indicated the tags showed little wear after 5 years on marked wild birds (Mossman, pers. comm. 1987). He also indicated the same tags had been used successfully on vultures in Florida and Minnesota.

The wing tags provide advantages to the MN DNR program in addition to eliminating the collar icing problem. The tags allow differential marking of birds by sex, project, and year, if desired. However, the materials come in a limited number of colors, and using different colors for different years of release in Minnesota may have precluded others from using those colors or may have created confusion. In Minnesota, orange tags with black numerals were chosen for all released birds, with males marked on the right and females on the left patagium.

In 1987, Allflex brand Maxi-livestock ear tags were used. The advantages of using the factory tags included ready availability, and proven durability of materials and construction. The tags proved to be durable after 3 years on released swans. However, they were shorter than the tags used by Lumsden (attachment point to base was 8.5 cm vs 13.0 cm), and numbers became all or partially covered by the covert feathers. This made the tags difficult to read without observing the birds over a long period of time, when numerals often became visible as the bird moved or as the wind blew the feathers. These undesirable characteristics, however, showed the need for a different design.

The design selected for use on the swans released in 1988 was similar to the Turkey Vulture tags used by Mossman in Wisconsin. They were hand-made using a vinyl extrusion-coated polyester fabric (18 oz/sq yd - TXN18), from Cooly, Inc., 305 Bedford St., Madison, WI. The numerals were painted on the tags with a gloss vinyl ink (Naz-Dar - GV112), thinned with Naz-Dar vinyl thinner (VF-180). These products are available from Midwest Sign and Screen Printing Supply Company, 2120 Myrtle Avenue, St. Paul, MN 55114.

The tags were designed with a rectangular base for the number and a neck tapering up to the point of attachment. They were attached using the same numbered rivets as the livestock ear tags. The length from the attachment point to the base was 16 cm. The width across the base was 9.5 cm. The numerals were approximately 7.0 cm high.

The advantages of this type of tag were the ability to make the tags in any size or shape desired, and the flexibility and lightness of the material. Disadvantages included the amount of time required to manufacture the tags, and the noxious fumes involved with the inks and cements that were required during construction.

The durability of the tags on Trumpeter Swans turned out to be very different from that found with vultures. Durability varied from bird to bird, as some were less tolerant and repeatedly pulled on the tag. Several of the tags curled at the edges and the polyester frayed as the vinyl coating was removed from the surface. The ink showed various levels of durability as well. This may have been due to the highly volatile nature of the ink and the difficulty of keeping it properly thinned. The ink needed to form a bubble on the surface that would allow the solvent to soften the vinyl before the ink was dry.

Experimentation with different shapes and styles and a multi-layered version using the same material was done on captive swans during the winter of 1988-89. The laminated styles did not curl, but the problems with the ink and some fraying remained. Some large versions extended into the water and there was limited icing on the bottom edge during periods of extreme cold. Laminated versions also lacked flexibility.

Using the knowledge gathered in 1987 and 1988, a new tag was designed and used in 1989. The materials used by the livestock ear tag companies had proven durability characteristics and the appropriate size and shape were better understood. Consultation with the Fearing Company, 490 Villaume Avenue, South St. Paul, MN 55075 (phone 612/455-1621), a manufacturer of livestock ear tags, helped determine the material specifications and methods needed to design the tag. A polyurethane (Dow 2102-80A) with the desired flexibility and UV light resistance qualities was selected. The specific product was not stocked by the distributors, and a special order was not economically feasible. The distributors suggested that remnants are sometimes available from larger orders in various colors.

The Fearing Company suggested that we obtain the clear raw materials from their distributor and Fearing would donate the color concentrate with the UV light inhibitor. We could have the product extruded in sheet form by locating a small extrusion machine. The distributor, General Polymers Division of Ashland Chemical Co., 3500 West Highway 13, Burnsville, MN 55337 (phone 612/890-3930), donated the clear polyurethane pellets. The Plastics and Machine Tooling Departments at Hennepin County Technical College, 9000 Brooklyn Boulevard, Brooklyn Park, MN 55445 (phone 612/425-3800), took on the project as a learning experience for their students. They extruded the raw materials into the appropriate sheet form and cut the blank tags from the polyurethane. The tags were then taken to the Fearing Company, where they donated the stamping of the numerals, numbered attachment rivets, and address labels for the tags. The two companies and the technical college have indicated a willingness to work with others on the construction of patagial tags.

The resulting tag is very flexible and highly resistant to damage. The numbers are hot-stamped into the surface of the tag and are very resistant to fading and abrasion. The tag measures 15 cm long (attachment point to the bottom end) and 7.5 cm wide at the base, tapering from just above the numerals to 3.0 cm wide at the attachment point. Numerals are 4.5 cm high.

Results from observations to date are encouraging. The tags are showing good durability and visibility. Reports from the public do not indicate problems beyond those encountered with other markers. Comments have been received that the orange tag sometimes looks like an injury on the wing when viewed at a distance. Observations will continue to determine the long-term durability of the tag.

COMMENTS FROM THE AUDIENCE ON COLLAR AND WING TAG USE

Laurence N. Gillette, Moderator

Martha Jordan suggests that Trumpeters and Tundras be collared with different colors in Alaska. No one can tell what species they are seeing when the birds come to Washington.

Joe Johnson suggests we stick to protocol.

Len Shandruk suggests that red collars be used on Trumpeters, yellow on Tundras.

Donna Compton says that we need to decide on a collaring scheme, no matter what we choose, and stick to it.

Martha Jordan says citizens aren't being paid to read collars, and they need to be as simple as possible.

Bill Sladen retorts that colors don't mean a thing to a scientist. We need to have the codes read to find out who the individual is.

Joe Johnson recommends setting up a subcommittee to work on this issue.

Carrol Henderson relayed that the Twin Cites, MN, public has learned to respond to marked swans, and knows who to call with what information. Public relations can have an immensely positive impact.

TTSS POSITION PAPER ON TUNDRA SWAN HUNTING

THE TRUMPETER SWAN SOCIETY DRAFT POSITION PAPER ON TUNDRA SWAN HUNTING[1]

Prepared by Laurence N. Gillette for review by the Board of Directors of the Trumpeter Swan Society, December 1988

INTRODUCTION

The Trumpeter Swan Society has been debating how to address potential, proposed, and existing hunting seasons for Tundra Swans for more than a decade. It has been one of the most difficult issues our Society has had to face. Although the goal of The Trumpeter Swan Society is "to maintain existing wild Trumpeter Swan populations and to restore the Trumpeter to as much of its original range as possible," there has been a considerable difference between what is biologically possible and what is politically possible in setting a realistic restoration goal. While we need to be aware of the political ramifications of our actions, we must also attempt to influence the political possibilities in ways that will enhance Trumpeter Swan restoration and management.

The Society is not anti-hunting, it is pro Trumpeter Swan. It has an obligation to point out potential conflicts with its goal and to try to resolve these conflicts. The Society cannot ignore management plans for other species that have the potential to adversely affect the Society's ability to achieve its goal. The Tundra Swan is the only species of waterfowl for which the Society has significant concern. As management plans for Tundra Swans have evolved, so has the position of The Trumpeter Swan Society on Tundra Swan hunting. It is hoped that this statement will remove any ambiguity on the position of The Trumpeter Swan Society on Tundra Swan hunting and that the statement and future actions by the Society will influence how Tundra Swans are managed in a way that will benefit Trumpeter Swans.

[1]**Editor's Note:** This is the version of the postion paper that was distributed to the Board of Directors and others for comment in June 1989. Comments were received, and presented at the 12th Conference. A revised Position Paper was then prepared, and issued in January 1990. The final revision is printed at the end of this section.

BACKGROUND

The Society believes that Trumpeter Swan restoration or range expansion is impossible in any area open to Tundra Swan hunting. Hunters cannot reliably distinguish between Tundras and Trumpeters. The two species are almost identical in appearance, both species may use the same feeding and loafing sites, and the two species intermingle occasionally. Since Trumpeters are usually less wary than Tundras, and since their behavior and flight patterns make them easier targets, it must be assumed that a Trumpeter Swan that spends any appreciable time in an area open for Tundra Swan hunting will be shot.

The Society believes that, except for the Tundra Swan, there are no legally hunted species of waterfowl which should be confused with the Trumpeter Swan. In theory, hunting other waterfowl (Tundra Swans excluded) should have no impact on Trumpeters. In actuality, it does. However, despite the fact that Trumpeters are shot occasionally by hunters, the Society believes that public education and law enforcement should be sufficient to keep the problem at an acceptable level during duck and goose seasons.

The Society also recognizes the tremendous contributions sportsmen have made toward preserving habitat essential for Trumpeters and in supporting Trumpeter Swan restoration programs. Curtailing waterfowl seasons where not essential to promote restoration of Trumpeters does not seem to be a fair way to treat those who have done so much for all waterfowl.

In the early 1970's, The Trumpeter Swan Society stated that it would not oppose pre-existing waterfowl seasons in order to protect Trumpeter Swans from the risk of being shot. In so doing, The Trumpeter Swan Society decided to accept existing Tundra Swan seasons in all of Utah and in limited portions of Nevada and Montana, because the impact on the nonmigratory Trumpeters in the Tristate flock was assumed to be minimal. The Society also accepted subsistence hunting for Tundras in Alaska and Canada, because it did appear to impact on Trumpeters significantly.

The Trumpeter Swan Society reaffirmed its original position on waterfowl hunting in 1984. It also continued to accept Tundra Swan hunts in Montana, Utah, and Nevada, despite evidence that Trumpeters were occasionally shot. The decision was influenced by two facts. First, the population was still growing despite occasional shootings, and second, the Society did not fully appreciate the need for additional winter range to safeguard the Rocky Mountain Population.

The Board of Directors of The Trumpeter Swan Society voted not to oppose a Tundra Swan season proposed for South Dakota in 1984 (the proposed season was not implemented), despite widespread concern by Board members that the location was in the heart of the Trumpeters' former range. They voted against opposition because only a few Trumpeters had been reported in the proposed hunting area during the preceding decade, and because the Directors were concerned that opposition to hunting Tundra Swans would cause numerous state Flyway representatives to oppose the North American Trumpeter Swan Management Plan and restoration programs being proposed for the Central and Mississippi Flyways. Support by the flyway councils was and still is essential for restoration of Trumpeters in the Central and Mississippi Flyways. Political concerns outweighed biological possibilities.

The Trumpeter Swan Society's Board took no action a year later when a Tundra Swan season was proposed for North Carolina, but this time the reason was entirely different. The Directors felt the proposed hunting area in North Carolina was sufficiently removed from potential Trumpeter Swan restoration areas that it posed no threat to these efforts. The Board also supported using hunting as a management tool to control nuisance populations of Tundra Swans as long as it was done at the sites where the problems were occurring.

In 1988, The Trumpeter Swan Society decided that it could not postpone developing a position paper on Tundra Swan hunting any longer. The Society was not trying to operate by deception or betrayal. The Society did not take a concilliatory position on Tundra Swan hunting in 1984 with the intent of changing its position once the North American Management Plan for Trumpeter Swans was approved by the flyway councils. However, the Society found it necessary to reevaluate its position on Tundra Swan hunting because of the following events which have taken place since 1984 and which impact directly on the management of Trumpeter Swans:

1. The "Eastern Population Tundra Swan Sport Hunting Plan" was released. It allows for a potential harvest of 9,000-10,000 Tundra Swans annually (10 percent of the total population), which would be divided as follows:

   . 33% Production Areas (3% Alaska [Game Management Area 26], 2% Yukon, and 28% NWT),

   . 33% Migration Areas (11% Saskatchewan, Manitoba, and Ontario, 11% Central Flyway, and 11% Mississippi Flyway),

   . 34% Wintering Areas (Atlantic Flyway).

   This plan includes the potential for hunting Tundra Swans in a much larger area than was ever envisioned by the Society in 1984.

2. The Mississippi Flyway Council has approved the concept of sport hunting of Eastern Population Tundra Swans. As outlined in the revised "Eastern Population Tundra Swan Sport Hunting Plan," it would allow at least five states (Minnesota, Wisconsin, Michigan, Ohio, and Iowa) and several provinces in the Mississippi Flyway the opportunity to institute Tundra Swan seasons. Although there was no indication of interest by any of these states at the time the concept was approved, the option is there. It could have a devastating effect on existing Trumpeter restorations.

3. Trumpeter Swan Restoration programs are underway in Minnesota, Wisconsin, Michigan, and Ontario. Hunting of Tundra Swans in the Mississippi Flyway south of the Canadian border is incompatible with Trumpeter Swan restoration efforts in the Upper Midwest and is in direct conflict with the restoration goals for Trumpeter Swans as stated in the North American Management Plan for Trumpeter Swans which was approved by the Mississippi Flyway Council. Hunting of Tundra Swans in Canada would not impact existing programs in the near future, but it would preclude restoration efforts there and may limit expansion of restorations in the United States.

4. Both North and South Dakota have expressed renewed interest in holding Tundra Swan seasons in the eastern portions of these two states. North Dakota held a limited season in 1988. While there may be no immediate significant impact on Trumpeter Swans, since there are only a few records of Trumpeters in this area in recent decades, (Harold Burgess lists three locations in the Proceedings of the 9th Trumpeter Swan Society Conference in 1984), there is the potential for future conflict with current restoration programs. Hunting of Tundras in the Dakotas will not result in the failure of the Minnesota restoration project, but it may eventually restrict the range expansion of the restored flock.

5. Harvest of Tundra Swans on the East Coast, which is now limited to North Carolina and Virginia, may be expanded as far north as New Jersey. If Trumpeter restorations in Ontario and Michigan are successful, there could be conflicts in the mid-Atlantic states.

6. Tundra Swan hunting was expanded in 1988 by several counties in both Montana and Nevada from what it was in previous years. Trumpeters frequent these areas only irregularly, and data is insufficient to make any adequate assessment of the impact the hunts may have on Trumpeters.

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. The Society could no longer address each individual proposal in a piece-meal fashion. An overall position paper was needed.

POSITION STATEMENT REGARDING TUNDRA SWAN HUNTING

The Trumpeter Swan Society has reevaluated its position, or lack of it, regarding Tundra Swan hunting in light of the events described under "Background." As stated before, the Society is not anti-hunting. However, since the Society is

convinced that it is impossible to successfully restore or manage a population of Trumpeter Swans in an area where Tundra Swan hunting is allowed, it has to draw limits as to when and where Tundra Swan hunting is acceptable.

With these points in mind, The Trumpeter Swan Society adopts the following position with regard to Tundra Swan hunting:

1. The Trumpeter Swan Society opposes proposed expansion of Tundra Swan hunting seasons in areas: 1) which presently have significant numbers of Trumpeters, 2) where there is a high probability that Trumpeters will appear due to restoration efforts, including nesting areas, migration corridors, and winter habitat (pertains primarily to the Mississippi Flyway south of the Canadian border), or 3) which may eventually be needed as expanded winter habitat (primarily for the Rocky Mountain and Pacific Coast Populations).

2. The Trumpeter Swan Society will refrain from immediate comment on Tundra Swan hunts that are held in areas within the original range of the Trumpeter Swan if there are few recent records of Trumpeters in these areas or if the potential for Trumpeter restoration in these areas is uncertain (for example, lead contamination may make former habitat unusable for Trumpeters). The Trumpeter Swan Society may request that Tundra Swan hunting be curtailed at a later date if the areas are determined to contain adequate Trumpeter Swan habitat and if Trumpeters begin to expand into the hunted areas on their own as a result of range expansion or migration from established or restored flocks. It is not possible to predict with 100-percent accuracy what Trumpeter Swans will do, what habitats they will find suitable, or what migration routes they will establish. We do not know which restoration efforts will succeed and which will fail. The Society favors letting Trumpeter Swans show us what they can or cannot do before making a decision on some of the existing or potential Tundra Swan hunts. If Trumpeter Swans begin moving into a hunted area, or if Trumpeters begin to appear in the annual harvest, it only makes sense that the state or states involved and the Society would both want to reevaluate their positions.

3. Although the Society does not oppose existing Tundra Swan hunts in Montana, Nevada, and Utah at this time, it may call for further reevaluation in the future. Expanding winter habitat is recognized now as being critical to the long-term survival of the Rocky Mountain Population of Trumpeters. Current management efforts to encourage Trumpeters to migrate along the east face of the Rockies in Wyoming may satisfy this need. However, it is impossible to determine if these efforts will be adequate. The Society believes that more time is needed to determine if sufficient wintering sites can be established elsewhere, and that more data is necessary to assess the magnitude of Trumpeter harvests in the Tundra Swan hunts. Some Trumpeter mortality has occurred, but it does not appear to have been sufficient to prevent the Rocky Mountain population as a whole from growing.

4. The Trumpeter Swan Society does not oppose Tundra Swan hunting in areas that are outside the original range of the Trumpeter Swan or in areas which, in the view of the Society, have little likelihood of ever being suitable for Trumpeters.

5. The Trumpeter Swan Society accepts the use of recreational hunting as a management tool to control nuisance populations of Tundra Swans, but only in the immediate location of the problem. Limited losses of Trumpeters, at levels above what would be acceptable at other locations, may be necessary to regulate local populations of Tundra Swans. Harvests must be carefully monitored.

DISCUSSION

The intent of this position statement is clear. However, it may be somewhat vague, by necessity, as to when and where the Society may find it necessary to oppose a Tundra Swan hunt. We do not want to restrict Tundra Swan hunting unless it is necessary to protect Trumpeters. There are numerous gray areas subject to interpretation and debate. For example, how many Trumpeters can be shot before mortality is considered to be significant? The Society must make this determination for each individual subpopulation. The loss of only a few swans would be significant for a new restoration or pioneering family unit. Higher losses could be sustained for an established population as long as the population remains stable or continues growing. Each situation may be different, and differences of opinion will likely exist between government agencies and the Society.

To try to avoid confusion and speculation about what this position statement means for each Tundra Swan hunting area, either proposed or existing, each Flyway is described in more detail.

Atlantic Flyway

The Society does not oppose Tundra Swan hunting from Virginia south. The Society refrains from comment at this time on any Tundra Swan hunting elsewhere in the Atlantic Flyway, pending the outcome of ongoing restorations in Michigan and Ontario. If these Trumpeters begin migrating to the Atlantic Coast, the Society may request modifications in Tundra Swan seasons (if any exist) north of Virginia. It is impossible to predict which areas the Trumpeters may choose to use or even if they will migrate to the Atlantic. Only time will tell.

The Mississippi Flyway

As mentioned earlier, restoration efforts in Minnesota, Wisconsin, Michigan, and Ontario increase the likelihood of encountering Trumpeters anywhere where Tundra Swans are found in the Mississippi Flyway south of the Canadian border. Therefore, the Society opposes hunts in that portion of the Mississippi Flyway which lies within the contiguous United States. Tundra Swan hunting would negatively impact ongoing Trumpeter Swan restorations. It would be inconsistent with the Society's goals and the North American Management Plan for Trumpeter Swans.

The Society refrains from comment on potential Trundra Swan hunting in the Canadian provinces in this flyway at this time. Although it would prefer that it never occur, such hunting would not impact on existing restorations at present, but it may curtail population expansion to the north in the future, assuming ongoing restorations are successful.

Central Flyway

The primary concern for the Society is to protect the established Trumpeter Swan flock that originated at Lacreek National Wildlife Refuge and the newly-restored flocks in Minnesota. Therefore, the Society opposes Tundra Swan hunting in the western half of North and South Dakota and in the Central Flyway states south of South Dakota (no hunts have been proposed, and Tundras do not frequent these states regularly). Migrant Trumpeters from both South Dakota and Minnesota have been observed in Nebraska, Kansas, Oklahoma, and Texas. Any Tundra Swan hunting in these states would jeopardize a migratory population nesting to the north.

A secondary concern is Tundra Swan hunting in areas which have the potential for Trumpeter Swans or are adjacent to Trumpeter populations. Specifically, this involves the newly-established Tundra Swan hunt in eastern North Dakota and a proposed hunt for northeastern South Dakota. Hunting Tundra Swans in these areas does not appear to affect the populations in Minnesota or South Dakota at present. Trumpeters have been found only rarely in the existing or proposed hunting areas. However, the Society believes these areas contain suitable nesting habitat for Trumpeters and hopes that it is just a matter of time before Trumpeters begin pioneering into these areas. Although the Society refrains from comment at this time, it will probably oppose either or both of these hunts if evidence indicates that Trumpeters are pioneering (not straying) from restorations nearby. We are willing to let the swans show us what they can do before calling for restrictions on Tundra Swan hunting.

Likewise, parts of eastern Montana, Wyoming, and Colorado may become important habitat for Trumpeters from the Rocky Mountain Population or the South Dakota restored flock (Lacreek NWR). Here, again, the Society withholds comment, pending more data and time to see what the swans do.

Although The Trumpeter Swan Society would like to see Trumpeters introduced throughout the prairie pothole country of Canada, the Society refrains from comment on any potential Tundra Swan hunts in eastern Saskatchewan and Manitoba, since Trumpeters do not presently exist there. The Society believes that western Saskatchewan should be excluded from consideration for Tundra Swan hunting to protect Trumpeters from Cypress Hills and Alberta.

Pacific Flyway

The Society opposes any Tundra Swan hunting in British Columbia, Alberta, Western Montana, Idaho, western Wyoming, Washington, and Oregon, due to the presence of large numbers of Trumpeters. Fortunately, no such hunts are proposed, so there appears to be no immediate conflict.

As mentioned before, more data is needed on the importance of Utah and Nevada as winter habitat or migration corridors for Trumpeters before the Society will consider taking a position. The outcome of experiments to expand winter range in Wyoming will be critical in this decision.

The potential for Trumpeters in California is unclear, so the Society refrains from comment at this time.

Tundra and Trumpeter Swans are spatially separated over parts of Alaska. The Society does not oppose Tundra Swan hunts in those parts of Alaska with little or no potential for Trumpeters. However, it cannot be assumed that Trumpeters have reached the limits of their range expansion in this State. They may continue to expand beyond their present boundaries. The Society would oppose any proposed hunt in any part of Alaska that is used significantly by Trumpeters.

The Yukon Territory and Northwest Territories are similar to Alaska. Trumpeter Swans and Tundra Swans are both present, but there appears to be potential for spatial separation. The Society would oppose any proposed hunt in any part of the Yukon or Northwest Territories that is used significantly by Trumpeters.

CONCLUSION

It is inevitable that some Trumpeter Swans will be lost during waterfowl hunting seasons. However, hunting Tundra Swans increases the risk of harvesting Trumpeters to an unacceptable level if done where Trumpeters are present. Expanding populations of Trumpeter Swans will eventually be affected by existing Tundra Swan hunting seasons, and, conversely, continued expansion of Tundra Swan seasons will eventually impact on existing Trumpeter populations. Since the Trumpeter Swan Society believes that Trumpeter Swans cannot survive in an area open to Tundra Swan hunting, it is only a matter of time before conflicts arise.

To date, Canada does not allow Tundra Swan hunting. The U. S. Fish and Wildlife Service and the states which have Tundra Swan seasons have done a good job in avoiding conflicts with Trumpeter Swans, at least as the populations existed when the seasons were established. However, nothing is static. The Trumpeter Swan Society and everyone involved in Tundra Swan and Trumpeter Swan management will have to continually monitor the changing situations and periodically review and modify their positions. The Society will continue to point out where situations exist which could be detrimental to Trumpeter Swans and attempt to have conditions changed to favor the Trumpeter. The Society has tried to develop a policy that leaves the maximum potential for Tundra Swan hunting without seriously affecting Trumpeters. However, in doing so, the Society has guaranteed that it will have to modify its position in the future. Eventually, choices will have to be made as to whether an area will be used as habitat for Trumpeter Swans or for Tundra Swan hunting. The Society has tried to delay decisions on specific areas until it is certain that conflicts exist. When the Society makes a decision, it will be in favor of the Trumpeter Swan.

AN OVERVIEW OF TUNDRA SWAN HUNTING

Stephen D. Wilds

With the enactment of the Migratory Bird Treaty Act in 1918, the legal hunting of swans in North America ended. That closure remained in effect until 1962, when Utah was authorized by the U. S. Fish and Wildlife Service (USFWS) to conduct a limited Tundra Swan hunting season. Portions of Nevada and Montana were offered Tundra Swan seasons in 1970 and 1971, respectively. Those hunting opportunities marked the beginning of a new era for swan hunting.

Since that time, Tundra Swan management plans have been developed for an Eastern and a Western Population. Specific hunting plans have been written for both populations.

The hunting plans are alike in that they both lay out the criteria for requesting, conducting, and evaluating a hunt, for rangewide permit allocations, for when hunts may be authorized, and for mandating that state permits be issued to all hunters. Winter population surveys are a prerequisite for states hunting Eastern Population birds, and, while they are not mandatory requirements of states hunting Western Population swans, these surveys are routinely done and are the basis for population management.

All new swan seasons are considered experimental for their initial 3 years. Upon completion of an evaluation of that experimental period, the hunt may become operational if no significant problems have been encountered.

With all waterfowl hunting, and especially Tundra Swan hunting, there is the potential for the killing of a Trumpeter Swan. The hunting plans for both the Eastern and Western Populations specifically address that possibility by clearly stating that Tundra Swan hunting should not be allowed in areas frequently used by Trumpeter Swans, or at times they are likely to be hosting Trumpeters. It is recognized that some Trumpeter Swans will be killed during Tundra Swan seasons. Waterfowl biologists, nongame biologists, the USFWS, and the flyway councils should work together to minimize the potential for the accidental taking of Trumpeters.

Tundra Swan seasons have been conducted in the Pacific Flyway since 1962. The first ones were held in the Central Flyway in 1983, and the Atlantic Flyway participated in its first swan season in 1984. A lot has been learned since those initial hunts. We now know a lot more about the success rates of hunters, the magnitude of the harvest, subsistence hunting, and the impact hunting has had on swan populations.

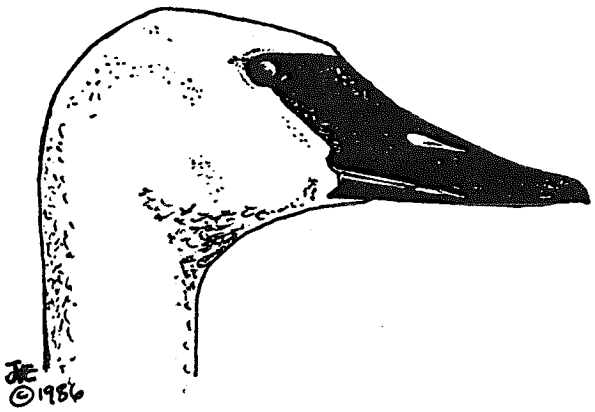
In the Western Population, we know the harvest rate, i.e., the proportion of the fall flight taken by sport hunting, is 3.5 percent or less. We also know that the average annual harvest since 1962 has been 1,157 birds. Recent investigations of subsistence hunting indicate that about 5,300 Tundra Swans per year are taken in just the Yukon-Kuskokwim Delta.

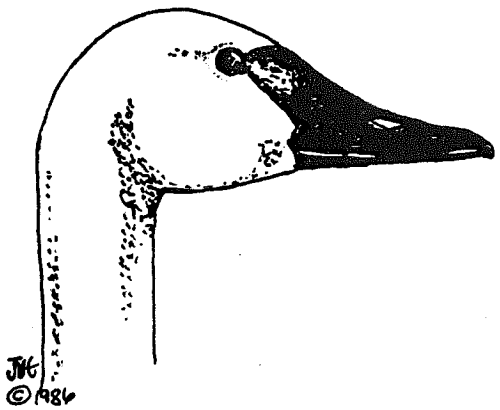
The harvest objective for the Western Population is to annually harvest the maximum number of swans available and still maintain a long-term winter population of at least 38,000 birds. Changes in sport hunting opportunities will be used to achieve this objective. The allowable sport harvest calculations will include a 20 percent crippling loss, and the number of permits issued will be based on a 31 percent success rate. To the extent possible, permit numbers will be stabilized for 3-year periods.

The Eastern Population Tundra Swan Sport Hunting Plan deals with harvest objectives in a somewhat less definitive way than does the hunting plan for the Western Population, because there are fewer data from previous hunting seasons on which specifics can be based. The harvest objective for Eastern Population swans is 9,000 to 10,000 annually, based on a 10 percent harvest rate of the 3-year average 1985-87 winter index of 93,200. Harvest guidelines will be stabilized on a 5-year basis, and the allowable harvest goal includes a 20 percent crippling loss. Subsistence harvest is not included in the current permit allocation formula, because it is believed to be significantly less than it is for the Western Population. It can be added when more information becomes available if it is appropriate. If the 3-year average winter index falls below 65,000, additional harvest restrictions will be considered. Closure will be considered if the 3-year average index drops below 60,000. Reopening Eastern Population swan hunting will be considered when the average index again reaches 65,000.

Currently nine states (Alaska, Nevada, Utah, Montana, North Dakota, South Dakota, New Jersey, Virginia, and North Carolina) are authorized to hold Tundra Swan hunting seasons. In 1988, all of these states, except South Dakota and New Jersey, had swan seasons. With the present high Tundra Swan populations, it is surprising that there is not more interest in swan hunting. It appears unlikely, however, that more than one or two additional states will request the opportunity to hunt swans. In Canada, only the Northwest Territories are likely to seek a Tundra Swan season, and even then the harvests would be in the form of subsistence hunting. It is important to recognize, however, that many areas with substantial Tundra Swan populations will likely never hunt swans because of social opposition. There is strong opposition to killing swans in most provinces and some states. Other areas where Tundra Swan hunting could be permitted will not be opened because the potential for accidentally killing Trumpeter Swans is too high.

The swan hunting plans which have been developed provide a good set of guidelines for allowing and evaluating swan hunting. It is imperative that all of us work together to allow the wise use of this resource while at the same time not jeopardize the well-being of Trumpeter Swans.





TUNDRA SWAN HUNTING IN NORTH DAKOTA -- RESULTS OF THE FIRST SEASON

Michael A. Johnson and Stanley C. Kohn

Tundra Swans (Cygnus columbianus) were given protection from unregulated hunting by the Migratory Bird Treaty Act of 1916. The Act also declared Tundra Swans a migratory game bird, and closed swan hunting for 10 years. It provided for hunting seasons not exceeding 3-1/2 months between 1 September and 10 March.

The Eastern Population of Tundra Swans has increased at a rate of 2 to 3 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 Tundra Swans (approved by the four flyway councils in 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 3-year average population index derived from winter surveys in the Atlantic Flyway. The most recent (1987-89) 3-year average of 86,850 birds is above the upper end of the objective population (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 Tundra Swans is guided by the Eastern Population Tundra Swan Sport Hunting Plan (approved by the four flyway councils in 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. Modern day hunting of the Eastern Population of Tundra Swans 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 Tundra Swan hunting season. While the Dakotas did not take advantage of this swan season framework, Montana conducted its first hunt on Eastern Tundra Swans in the fall of 1983, and has continued with a season every year since then.

METHODS

North Dakota held its first modern-day Eastern Tundra Swan hunting season in 1988. Because demand for this initial season was largely unknown, we elected to offer 400 of the 1,000 permits allowed. It was anticipated that this would result in a total harvest of 200 swans. The swan season was considered a trophy season and permits were issued by lottery, with both residents and nonresidents eligible to apply. Permits were free. Applications had to be submitted on a standard U. S. Postal Service postcard. No phone applications were accepted. The application period ran from 3-31 August 1988.

Successful applicants were notified about details of the season by letter (Figure 2). Each hunter was issued a tag, which also served as their hunting permit, allowing them to take one swan during the season (Figure 3). Swan hunters are also required to have a Federal Duck Stamp. Steel shot was required within steel shot zones, which included all state and federal wildlife areas, and Towner, Ramsey, Nelson, Bottineau, Griggs, McIntosh, and Sargent counties.

The season opened on 8 October and closed on 13 November 1988. Shooting hours were sunrise to sunset. The bag and possession limit was one swan per hunter per season. The area open to hunting included all of North Dakota east of ND State Highway Number 3 (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.

RESULTS

A total of 2,004 applications was received and 400 permits were issued. Individuals from 12 states received swan permits (Table 1). Most permits (326) went to North Dakota residents. Most nonresident permits went to Minnesota (49), followed by Wisconsin (9), and Illinois (5).

Table 1. Number of questionnaire respondents and active hunters by state of residence during the 1988 North Dakota swan hunting season.

State	Number of Respondents	Number of Hunters
North Dakota	318	241
Minnesota	49	37
Wisconsin	9	6
Illinois	5	2
California	2	2
Colorado	2	2
Indiana	2	1
Kansas	1	1
Montana	1	1
Ohio	1	1
South Dakota	1	0
Vermont	1	1
Total	392	295

Questionnaires were returned by 392 (98 percent) of the 400 permittees. A total of 295 (74 percent) permittees hunted swans. The percent of active nonresident hunters (73 percent) was similar to that of North Dakota residents (76 percent). Resident hunters hunted an average of 2.8 days compared to 3.0 days for nonresidents. Sixty-four percent of the active swan hunters were successful in bagging a swan, with a total harvest of 187 birds. The reported age composition of the bag was 27 juveniles and 159 adults. Hunters reported an unretrieved kill of 25 birds, giving a total estimated kill of 212 swans.

Swans were harvested in 24 of the 27 counties within the open hunting area. Fifty percent of the harvest occurred in five counties as follows: Kidder (36), Stutsman (23), Barnes (15), Benson (13), and Nelson (12).

Figure 6 depicts the North Dakota swan harvest by week. Thirty swans were harvested the first week of the season, with the harvest peaking during the week of 22-28 October, when 60 swans were taken.

Comments received from questionnaire respondents are listed in Table 2. By far, the most frequent comment indicated some type of favorable support for the swan season (52 respondents). Fifteen respondents encouraged expanding the hunting unit, and another eight requested an increase in number of permits in 1989.

Table 2. Comments on 1988 North Dakota Tundra Swan season received on the harvest questionnaire.

Number	Comment
52	Indicated support for the swan season.
15	Wanted to expand the area open to hunting in 1989.
8	Wanted to increase the number of permits in 1989.
3	Wanted to use lead shot for swans.
2	Wanted expanded hunting hours to 1/2-hour before sunrise.
1	Did not hunt swans in 1988 because it cost too much.
1	Did not support a swan season.
1	Wanted a 12 ga. minimum requirement for hunting swans.
1	Expressed concern about the number of swans crippled.
1	Wanted a longer (more days) swan season in 1989.
1	Wanted party hunting allowed for swans.

North Dakota's first modern-day swan hunting season was considered a success. No significant problems were encountered, and the season was well received by both the public and the hunters. Many additional hours of waterfowl hunting recreation were provided to the season participants. A proposed Tundra Swan hunting season for 1989 includes additional permits and additional area open to hunting.

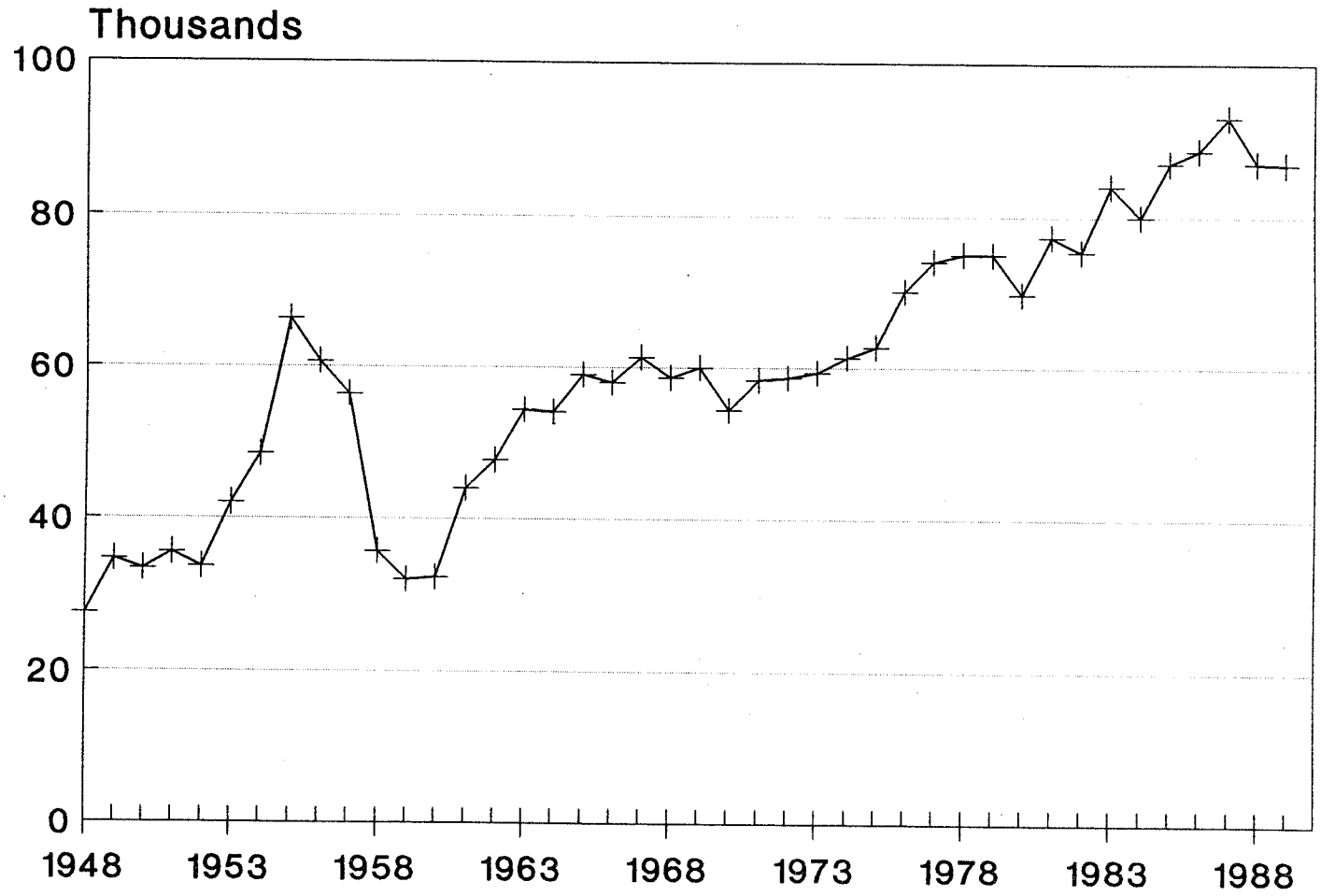


Figure 1. Three-year running averages of indices to the Eastern Tundra Swan Population, 1948. Data from Midwest Waterfowl Inventory.

" VARIETY IN HUNTING AND FISHING "

NORTH DAKOTA GAME AND FISH DEPARTMENT

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

Dear Waterfowler:

Congratulations, you have received a North Dakota Tundra Swan Hunting Permit for the fall of 1988. Because this is the first Tundra Swan Season in our state in 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 8 through November 13, 1988

Shooting Hours: Sunrise to Sunset

Open Area: All of North Dakota east of N.D. State Highway Number 3

Bag Limit: 1 swan per hunter per season

License Requirements: In addition to a valid 1988 North Dakota Swan Tag all swan hunters are required to have in their possession while hunting the following valid licenses. Residents: General Game Stamp, Small Game and Habitat Stamp; Nonresidents: Small Game and Habitat License, General Game 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.

Dale L. Henegar
COMMISSIONER

Paul T. Schadewald
ACTING 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 in all steel shot zones (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,

Mike

Michael A. Johnson, Supervisor
Migratory Game Bird Management

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Figure 2. Letter sent to all swan hunters in North Dakota, 1988.

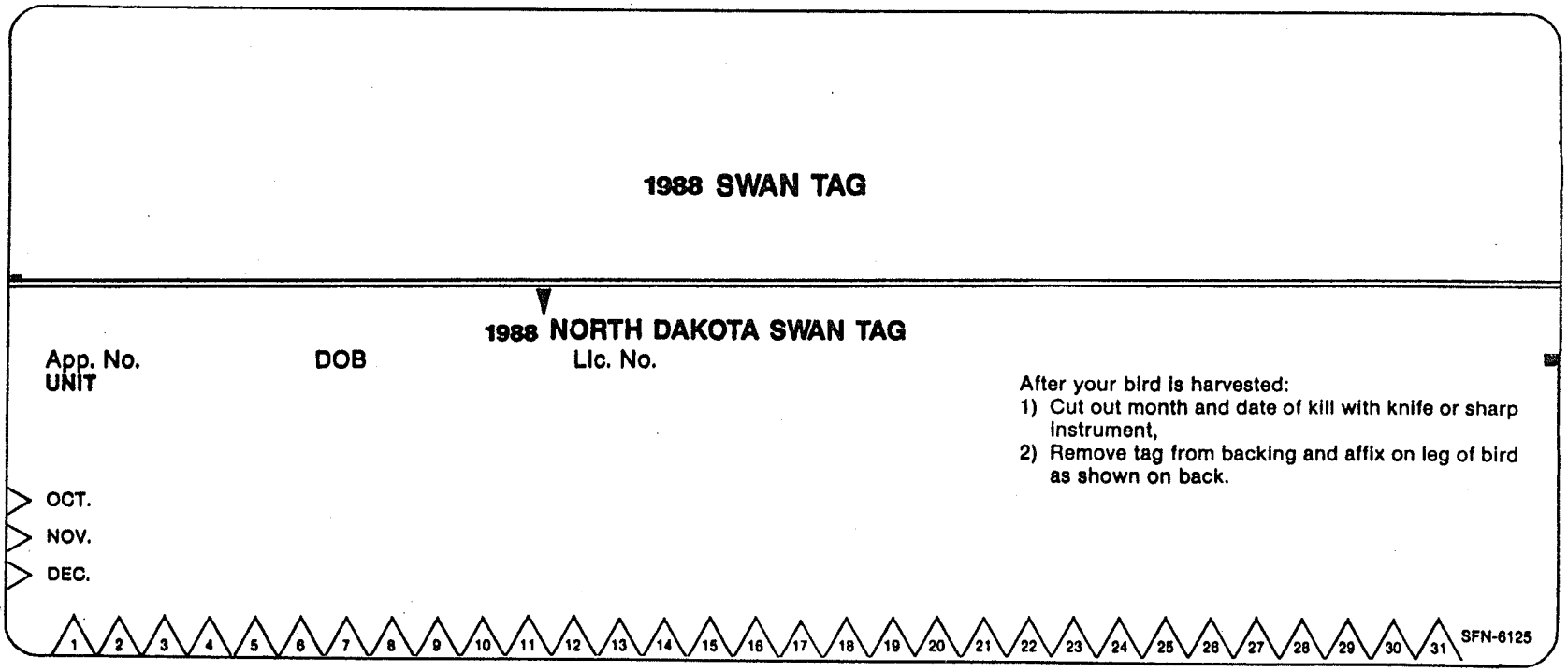


Figure 3. Leg tag issued to swan hunters in North Dakota, 1988.

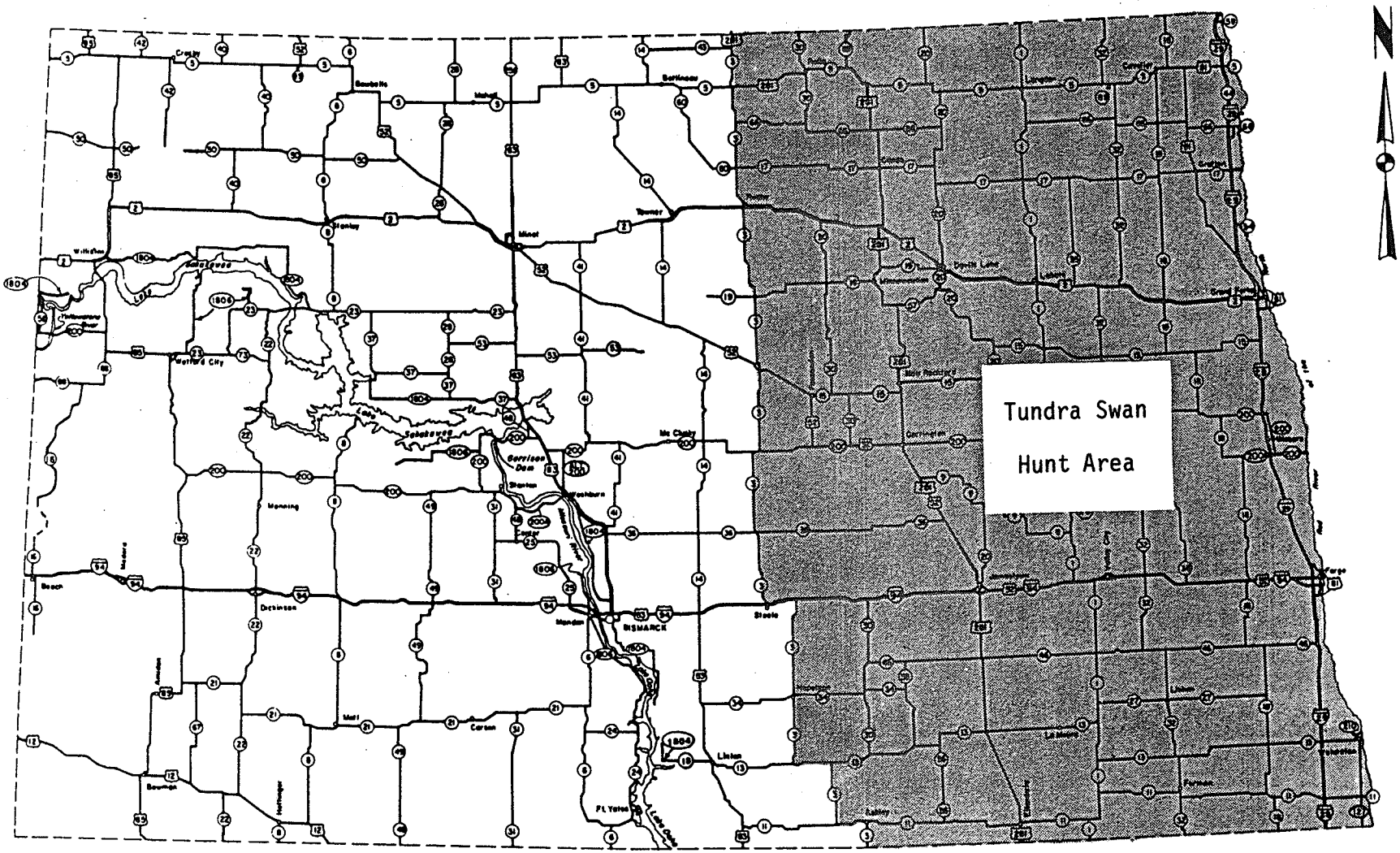
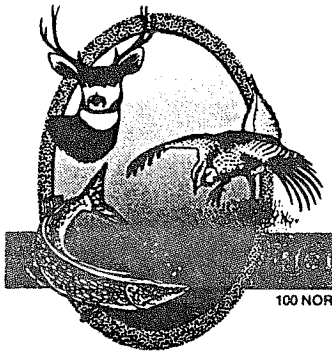


Figure 4. Tundra Swan hunting area in North Dakota, 1988.



" VARIETY IN HUNTING AND FISHING "

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

Dear Swan Hunter:

We need your help in determining the results of the 1988 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. Did you get a swan? Yes _____ No _____

   If yes, please answer the following:

   Date shot: |____|____|
   Month Day

   Location: _____ _____
   Nearest Town County

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

4. Did you knock down any swans which you could not retrieve? Yes __ No _____
5. Please provide any additional comments you desire on the back.

Dale L. Henegar
COMMISSIONER

Paul T. Schadewald
ACTING DEPUTY COMMISSIONER

Figure 5. Questionnaire sent to all swan hunters in North Dakota, 1988.

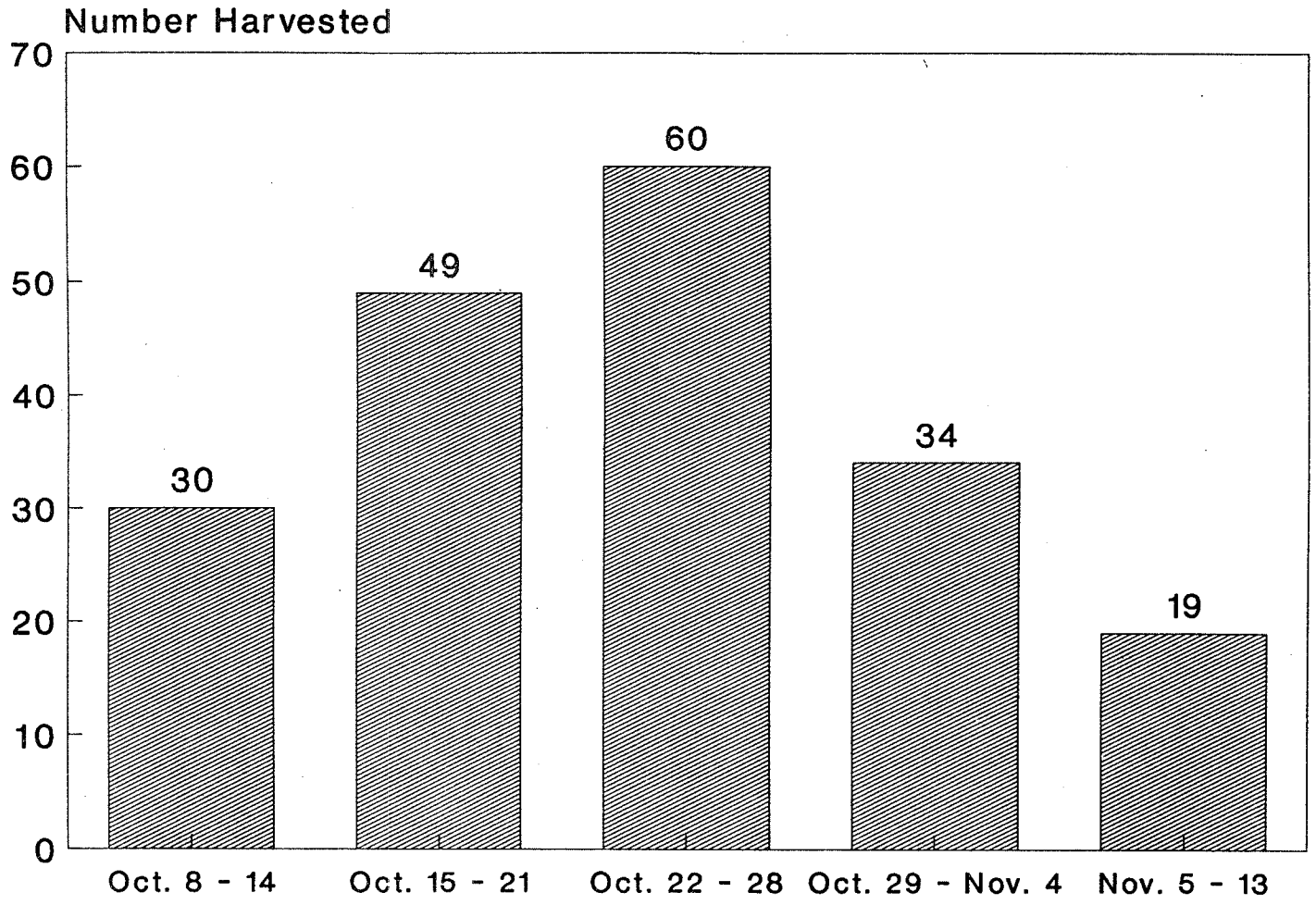


Figure 6. Harvest of Tundra Swans by week in North Dakota, 1988.

POSITION STATEMENT ON TUNDRA SWAN HUNTING IN THE CENTRAL FLYWAY RELATIVE TO POTENTIAL CONFLICTS WITH TRUMPETER SWAN RESTORATION -- ADOPTED 28 JULY 1989

Central Flyway Waterfowl Council

The Central Flyway Waterfowl Council (Council) recognizes and appreciates The Trumpeter Swan Society's (TTSS) commitment to the conservation of the Trumpeter Swan. Similarly, we ask that TTSS recognize that the Council is responsible for policy-making decisions for a much wider array of migratory birds which inhabit the Central Flyway. Responsible migratory bird management from the Council's perspective cannot be restricted to a single species.

The Council, as well as all other waterfowl management agencies in North America, has recently joined in a concerted international effort to conserve our remaining waterfowl resources and their habitats in writing the North American Waterfowl Management Plan. This is a crucial time for all of us to put away our differences and strive to pull together in this common cause.

The Council endorsed the North American Management Plan for Trumpeter Swans. These guidelines clearly state that for all populations discussed, "Hunting of other waterfowl will not be precluded because of the chance-killing of Trumpeter Swans." Our Council continues to endorse this philosophy, first stated in discussions with Don Hammer and other TTSS members in 1980. That year, the Council voiced support for both TTSS and the Mississippi Flyway Council in plans to restore Trumpeter Swans in the Mississippi Flyway.

Our recommendations for establishing and expanding swan hunting areas in the Central Flyway since 1980 do not preclude maintenance or expansion of Trumpeter Swan flocks in this flyway. Trumpeters will occasionally be shot by mistake in Tundra Swan hunting areas. We also recognize that some are lost every year to vandalistic shooting, and some are mistaken for Snow Geese or other game birds. This Council does not believe that such losses jeopardize the future of the Trumpeter Swan population.

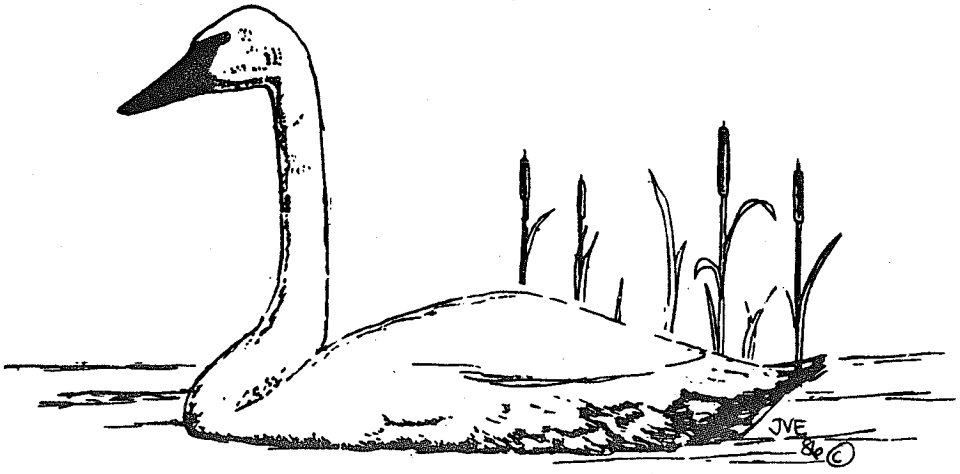
The success of Snow Goose and Sandhill Crane hunts in the state of New Mexico in areas frequented by Whooping Cranes attest to the ability of managers and hunters to work together to all but eliminate the accidental shooting of these rare birds. Similarly, it would be erroneous for us to assume that Tundra Swan hunting in any area precludes successful restoration of Trumpeter Swans there, or even that accidental shooting of a significant number of Trumpeter Swans is a certainty. The collective experience of the flyway states over the last 20 years has shown conclusively that individual birds and flocks of birds can be afforded adequate protection through a coordinated effort of agencies and individuals committed to that end. This requires an active, hands-on approach. TTSS members, as well as conservation agency personnel in the respective states/provinces, must work with law enforcement, information and education personnel, and the waterfowl hunting public to describe the need for the restoration effort and the desirability of preventing accidental shooting of these birds. TTSS will benefit not only through increased awareness and commitment on the part of the hunters to protect the Trumpeters, but will also gain a higher profile and increased public support for Trumpeter Swan preservation and restoration efforts.

The Central Flyway Waterfowl Council recognizes that swan hunting is probably distasteful to many members of TTSS, and that they choose to admire the grace, beauty, and majesty of swans with a camera or binoculars rather than in a hunting situation. This Council, while appreciating the aesthetic qualities of migratory birds, accepts responsibility for all who appreciate waterfowl, to develop policies and programs which will ensure their enjoyment for future generations. Enjoyment of these birds for some, at least, is through their pursuit during regulated sport hunting seasons. This regulated harvest is allowed wherever it is demonstrated that a harvestable surplus exists in the population. This is our basic philosophy as it relates to hunting of all migratory game birds, including swans.

The Eastern Population of Tundra Swans has been on a steady increase since the 1960's. Although these swans do significant economic damage to crops on their wintering areas, their population status alone permits a limited annual sport harvest. We view Eastern Tundra Swans as an internationally shared resource, one to be viewed and hunted by persons throughout their range, not just on their wintering grounds. Were it our stated goal to allow the harvest of a population only in areas where they concentrate to such an extent that they cause damage, most of the Central Flyway would not be open for the taking of ducks or geese.

The Council strongly urges TTSS to join with us and other responsible agencies to insure successful implementation of the North American Waterfowl Management Plan. In regard to specific conflicts with existing or proposed Tundra Swan hunts, the Council encourages TTSS to appoint a representative to meet with the Central Flyway Waterfowl Technical Committee at its March meetings. It is also recommended that TTSS cooperate with the Council and individual states and provinces to develop a hands-on approach to management of swan hunts, designed not to limit, discontinue, or oppose them, but to have them proceed with a greater understanding

and appreciation for the presence of Trumpeter Swans in the Central Flyway. Support for Trumpeter Swan restoration requires incorporation of all recreational interests.



PACIFIC FLYWAY COUNCIL COMMENTS ON THE DRAFT POSITION STATEMENT ON TUNDRA SWAN HUNTING

Don Childress

The Pacific Flyway Council (Council) opted to send a representative to this meeting in hopes of creating an atmosphere of cooperation and communication on the issue of Tundra Swan hunting. The Council recognizes the position of The Trumpeter Swan Society (TTSS) and its efforts to see the continued expansion of the Trumpeter Swan into its former range. TTSS also represents a singleness of purpose in this endeavor.

It is relatively easy for TTSS to develop a position statement that promotes that singleness of purpose. However, recognizing the long term consequences of such an action is more difficult and important when considering such an action. You heard Gary Ivey give the comments from the Study Committee and the Council on his proposal for the Malheur flock. The uncertainty of the draft position statement of TTSS and the pending petition to list the Trumpeter Swan are overriding factors in that decision.

The Council acknowledges that Tundra Swan hunting may seemingly be an obstacle to restoration efforts of the Trumpeter Swan. We are not convinced, however, that they are as insurmountable as presented. Unilateral position statements against hunt programs may present more of a real obstacle than the hunting of swans.

The Council's responsibilities are broader than Tundra Swan hunting or Trumpeter Swan restoration. As directors of wildlife agencies, Council members must consider the ramifications on other activities and programs as well.

A number of definitive statements in this draft document would lead one to believe that Tundra Swan hunting and Trumpeter Swan restoration are totally incompatible. We don't believe this is the case or that evidence would support these statements.

It is acknowledged that Tundra Swan hunting and Trumpeter Swan restoration efforts provide a complexity to the issues. They should not, however, be perceived to be mutually exclusive. The opportunity exists to see a continued expansion of Trumpeter Swans. Hunt programs and those responsible for their administration need to be cognizant of those opportunities. The design or modification of those hunts can be made to minimize the impacts. The Council believes that both programs can move forward if both groups are willing to work together.

There are a number of projects that will be discussed here over the next few days which will attest to those opportunities. The merits of those projects and Trumpeter Swan restoration must stand on their own. All of them deserve careful consideration as to their applicability. Hunt programs deserve the same scrutiny.

The position of TTSS and its recognition of the biological and political ramifications of restoration and management of the Trumpeter Swan is imperative. The Council believes that open communication between TTSS and the Council is the only realistic solution to moving forward in this arena. The forthcoming review of the plan will provide this opportunity.

COMMENTS FROM A TUNDRA SWAN RESEARCHER

Dr. William Sladen[1]

The United States and Australia are the only countries in the world which are shooting swans ("harvest management," as the managers put it). Elsewhere, and for the vast majority of Americans, swans are elegant emblems of wetland conservation that have been completely protected for some 70 years. One day a hunter is fined $500 for a big white bird in his boat, and the next day he is allowed to shoot one. That sounds very inconsistent to me. Following are my comments on The Trumpeter Swan Society's (TTSS) position paper on Tundra Swan hunting.

1. The TTSS position paper on Tundra Swan hunting relates only to the former range of the Trumpeter Swan. TTSS should be encouraging restoration of the Trumpeter in the east, and certainly not pursing the Eastern Population of Tundra Swans. A large population of Trumpeters used to go down the Chesapeake Bay into North Carolina, and down the Mississippi Flyway. We should be encouraging swans to return to the Mississippi Flyway. TTSS members should consider themselves as worthy guardians of swans, and should look ahead ecologically in planning for the next 50 or more years. They should take into consideration both scientific knowledge and concern for swans, and society's desire for good public relations throughout the U. S. If you want interested members from the east in your Society, I suggest strongly that you include former eastern and Mississippi winter ranges of the Trumpeter Swan in your position paper. That virtually eliminates the need for approving a Tundra Swan hunt, for there will be no further reason to support a Tundra Swan hunt. In fact, as I say below, to be consistent, an experimental Trumpeter Swan hunt should really be encouraged in Alaska. After all, Trumpeters have done extremely well recently, and they're certainly much more plentiful in Alaska than they are in poor little Virginia and New Jersey.

2. The position paper also ignores the Mute Swan menace. Unless quick and firm action is taken, this menace may ultimately put anything we attempt to do to help Trumpeter and Tundra winter range out of business. Just 30 years ago, the Mute was not even on the Maryland bird list. Now it is abundant, and increasing by 40 percent.

3. I've suggested that "nuisance" concerns were totally eliminated from your position paper. There are better ways of controlling nuisance activities, if they can be proved as a threat to agriculture, than by providing fuel for the antihunters and angering most good hunters and the vast majority of citizens by shooting swans. People are outraged at the way the Tundra Swan hunt is being used in the east as an experimental hunt. Yes, the Tundra Swan has regained reasonable numbers and the population is steadily increasing. But, the population is probably still a fraction of what it was originally. However, that does not justify the hunting of a big white bird which can be used much more effectively in a nonconsumptive fashion. Hunting is apparently going out. Let's put swans in the category of nonconsumption.

   Let's take, as an example, the Virginia hunt. A letter in December (1988) to the Governor of Virginia was finally answered in May of 1989. The population, according to January 1988 figures, includes North Carolina - 48,800 (they've been hunting 4 years), Maryland - 22,100 (no hunt, to the best interest of the resource and the citizens of Maryland), Virginia - 5,300 (they have issued 600 permits), New Jersey - 2,800. Mute Swans numbered 1,600 in New Jersey, and they're not doing anything about the Mutes.

   From our Tundra Swan research, we believe the Virginia swans could be a subpopulation. These swans have also suffered low productivity in the last 3 years. Low productivity, with a possible subpopulation. And it has been decided that the birds should be shot over a 90-day period, from 1 November to 31 January. I think this is a very serious decision to make.

4. Studies have shown that the Tundra Swans make a nonstop migration to get away from the hunt in North Dakota, a 1200-mile journey from the Dakotas to their wintering range in the fall. I just wonder if everybody is aware that, by their regulations, they're not even letting the swans settle in once they reach the east coast. This has been done for a number of years for geese, but it's not being done for swans. Allow them to settle in. They don't arrive in the Chesapeake Bay until late November, and they're being shot in significant numbers from then until the beginning of January. The hunters are being given an opportunity to hunt these birds out of the sky as they are coming in from migration, and it's a very predictable flight.

   I have seen this wonderful sight of swans settling in, especially at Virginia Beach. Your game and fish departments should be encouraging citizens, especially

[1] Transcribed from tapes of the Conference.

school children, to see this truly wondrous sight, and not allow the birds to be shot from the skies. At least give them a break until they come in.

5. Crop damage. There's no evidence, other than from select farmers in Virginia, that significant crop damage exists. It does not make sense to me and my colleagues that you justify hunting to lessen this potential damage. The damage, if it so exists, will go on regardless of the relatively few birds that are killed in a hunt. You deal with nuisance birds or flocks where the nuisance occurs (this is in your position paper), at the time of the year, usually after the hunting season, when they are being a nuisance. Do not deal with them by opportunistic shooting east of Route 95 (Virginia). I will bet a case of the best British Bass ale that I can discourage Tundras from a specific field without killing a bird, if the farmers fear they are damaging their winter grain. If I were to be asked how to manage the Tundra swans, I would say, "Clear out the Chesapeake Bay and get them out of the farmers' fields and into the water. Get the aquatic vegetation growing again." We should all be working on cleaning up the Chesapeake Bay instead of shooting swans. In fact, to many farmers in Maryland, the spectactular sight of these majestic big white birds is a greater source of enjoyment than the potential damage they might do. Letters from farmers supporting this can be provided.

6. There's not sufficient data to support Tundra Swan hunting. More data should be collected, if these birds are going to be hunted.

7. In Virginia, it seems that hunting swans is nothing more than recreation. If this is so, then it is high time that the nonhunting citizens play a more significant role in decision making regarding hunting, especially when it concerns a resource that the vast majority of people appreciate, as I've said before, as an international emblem of wetland conservation.

COMMENTS ON THE SOCIETY'S POSITION PAPER ON TUNDRA SWAN HUNTING

Dave C. Lockman[1]

I have reviewed The Trumpeter Swan Society's (TTSS) position paper on Tundra Swan hunting. The North American Management Plan for Trumpeter Swans defines a conflict between Trumpeter population maintenance and range expansion and Tundra Swan hunting. The resolutions proposed, for lack of anything better at the time, were to increase hunter education and enforcement. Both of these are very cursory, and old standbys, but have some resolve. I believe that, at present, this document defines the problem. Now we, the so-called Trumpeter Swan "in-the-know's," must begin to offer some resolutions to these conflicts. These resolutions must be realistic and workable in a white-bird-hunting and Trumpeter-range-expansion framework. Workable resolutions can only be accomplished if principal individuals in each region are willing to take the time to sit down and work out strategies and resolve to implement them. This cannot be accomplished by building communication barriers and further alienating interests. I believe this document would further alienate some professionals from whom we should seek to gain interest. I understand the concern and intent of this position paper. However, I don't believe it will work in favor of the Trumpeter Swan. I offer the following thoughts and comments on the position paper.

Today there is but a remnant of the former Trumpeter Swan range in the lower 48 states. This has been amply delineated in the Introduction. The current range has been delineated based on consistent seasonal habitat occupancy by swans. Trumpeters have only been documented in occupied areas. As the Rocky Mountain Population and mid-continent restoration flocks have increased in more recent years, widely dispersed documentation of Trumpeters is occurring outside of the currently delineated range. It is of interest to note that the observations are rarely of a group larger than five or six birds (denoting a family group), and rarely of a group at the same location 2 years in a row. The fact that we are not seeing any build-up in Trumpeter numbers outside of the currently occupied range is likely a result of: 1) a high mortality of dispersers outside the current range and 2) a tendency for Trumpeters to migrate and use habitats as family groups, pairs, and sibling groups. These factors operate simultaneously to decrease the probability of dispersers to "settle in" and secure new habitats, and develop a tradition for using these new habitats. This phenomena is most operative in pioneering new winter range, and least operative in expanding breeding range. To me, the logical deduction lies in two operative factors: mortality and habitat security.

The increased mortality risk associated with pioneering and eventually occupying new habitats is a significant deterrent to successful range expansion (whether natural or human-induced). Accidental death (e.g., power lines, fences), lead poisoning, and illegal killing are the most commonly mentioned sources of Trumpeter mortality. Illegal killing is most prevalent in the current Tristate range. This illegal killing has been a result of malicious intent or "mistaken for a Snow Goose." There are no Tundra Swan hunts here! Trumpeters have been killed for Snow Geese, as have Tundras, throughout the west. Managers have never been serious about documenting the rate of Trumpeter harvest in Tundra Swan hunts. Trumpeter killing has been documented in Utah, but at what rate? I don't know of anyone who has investigated the vulnerabillity of Trumpeters during a Tundra Swan hunt. Montana and Utah would be good areas to investigate. Methods for minimizing accidental killing of Trumpeters should also be investigated. Time of the hunting season, Trumpeter security areas, habitat use variations, species segregation, behavior differences, permit quotas, hunter education, hunter control, size and location of hunt areas relative to closure areas, and location of hunt areas relative to adjacent suitable habitat could all affect the vulnerability of Trumpeters in a Tundra Swan hunt.

Few, if any, potential winter areas, fall staging areas, or migration corridors outside the current range have been evaluated. Power line and fence collisions are a major source (about 60 percent) of recorded mortality in Wyoming. Young swans and older swans pioneering new habitats appear to be at a high risk of accidental death.

The risk of mortality of any kind appears to increase if swans are not given the opportunity to "settle in" in a new habitat, become conditioned to new disturbances, and develop a sense of security in their new surroundings. Persistent disturbances encourage them to move, and this increases their risk of mortality.

Managing small populations is the art and science of maximizing the survival and productivity of individuals. This is in contrast to managing large populations, where the population is managed generally, and one or a few limiting factors affecting population growth are managed. Few wildlife managers are comfortable with, or understand, our concerns for managing small populations. This became apparent to me watching biologists on the continent wrestle with declining Mallard, Pintail, and Dusky Canada Goose numbers.

I believe that TTSS should scrap the Tundra Swan position paper. I don't believe we have thoroughly evaluated the

[1] Transcribed from tapes of the Conference.

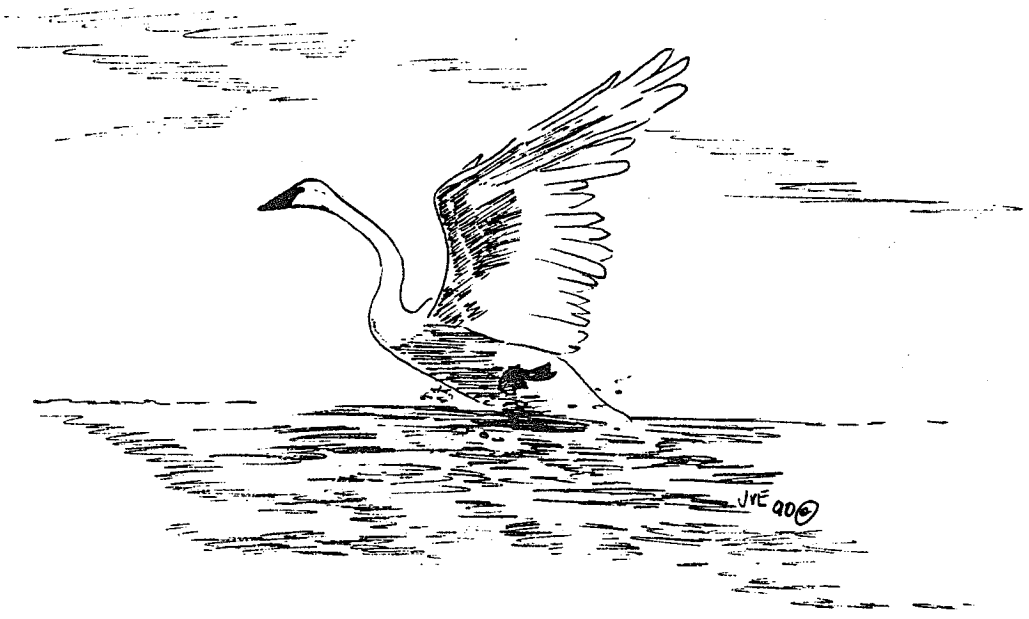
factors affecting range expansion. I don't believe it needs more research. I do, however, believe the first step will be that of getting a few of the right people together in each flyway. Identify the problems. Identify strategies (site-specific) for resolving these problems. Identify a well-orchestrated program to implement strategies. Make the program realistic and feasible. Develop coordination by working with those individuals important to successful implementation of the program. Develop support by informing professional managers and interest groups of these programs and their value to the swans and people alike.

Frankly, a small nucleus of people must develop the program in each region. That nucleus must make a commitment to go out and involve others in implementation. Nothing works when it appears to be shoved down one's throat.

I must admit that these comments were written rather hurriedly. Frankly, I'm glad the position paper was written. I appreciate Larry Gillette's tenacity and grit. I do believe the problems are bigger than just Tundra Swan hunting conflicts. We are short on resolutions, and should address all mortality factors within management capabilities.

The 12th Trumpeter Swan Society Conference in September should be aimed at identifying problems, and methods of resolving these problems. Who gets together in each region? How do they get together? I feel that we are talking about population management plan updates, aimed more specifically and with stronger commitments.

We should also submit recommendations for inclusion in Tundra Swan management plans. But, we must supply realistic, feasible, and effective recommendations for conflict resolution -- and, if necessary, on a case-by-case basis.



A SUMMARY OF ADDITIONAL COMMENTS SUBMITTED FOR THE TRUMPETER SWAN SOCIETY'S POSITION PAPER ON TUNDRA SWAN HUNTING

Compiled by Laurence N. Gillette

You've heard the responses on The Trumpeter Swan Society (TTSS) draft position paper from the Central and Pacific Flyways, the International Waterfowl and Wetlands Research Bureau, and a biologist from Wyoming. Numerous other individuals submitted thought-provoking responses. Although the responses are too lengthy to be read at the Conference, I believe it is essential that their major points be presented. I have tried to extract the most important comments from each letter to be presented here. Hopefully, they will not suffer from being taken out of context. I will read the author's name, affiliation, and major comments regarding the draft paper. Editorial comments appear in parentheses. I have included some of my own thoughts at the end.

HAROLD BURGESS
PAST PRESIDENT, TTSS
RETIRED USFWS REFUGE MANAGER, LACREEK NWR

1. "I consider that Tundra Swan hunting in all of Utah precludes the opportunities for RMP Trumpeters to reestablish migration tradition. For instance, they cannot even safely establish a migration route through the Ouray NWR, Utah area to Havasu NWR in Arizona."

2. "It is my understanding that Tundra Swans migrate through the eastern Dakotas for about 2 weeks in mid November. Trumpeters pioneering from other areas would return to stage by that time." (Harold believes that time and place restrictions on hunting may work.)

3. "Trumpeters are migratory and wintering in northern California where few Tundras winter. A closed zone there may protect Trumpeters."

ROLF KRAFT
USFWS REFUGE MANAGER, LACREEK NWR

1. Rolf takes exception to the position paper. He be lieves the statement in the NAMPTS is adequate. That plan states that, "The hunting of other water fowl should not be precluded because of the chance-killing of Trumpeter Swans, and that educational and increased enforcement efforts should be employed where swans are being shot."

2. "The position paper is premature and the scope is too broad. We don't have any real problems, and there is no need for a nationwide policy now."

GARY HERRON
NEVADA DEPT. OF WILDLIFE

1. "The sociological aspect of restoring Trumpeter Swans to historical ranges is an admirable endeavor of TTSS. However, if resulting restoration plans were suspect of curtailing or eliminating long-standing Tundra Swan hunting in the Pacific Flyway, the restoration efforts would most certainly encounter biological and political suicide."

2. He submits corrections of erroneous statements on the history and presents status of Tundra Swan hunting in Nevada.

3. The statement that "Tundra Swans are the only legally-hunted species that hunters compare with Trumpeter Swans" is erroneous; hunters occasionally confuse Snow Geese with Tundra Swans and probably Trumpeters.

DUANE SHROUFE
ARIZONA GAME AND FISH DEPARTMENT

1. "Since very few swans occur in Arizona, the State defers comment to states having swans. I expect we will support the Pacific Flyway Council's position."

ART HUGHLETT
RETIRED, USFWS

1. "Although I feel I could defend the position taken by TTSS, it might be more acceptable to state administrators if a few adjectives were toned down and cooperation with everyone imaginable were stressed."

2. "Those few states where real or imagined conflicts could exist will be the big hurdle."

JOHN ANDERSON
NATIONAL AUDUBON SOCIETY

1. "I agree that Trumpeter restoration is impossible in any area open to Tundra Swan hunting. I also believe Trumpeter restoration and range expansion should have priority over any proposed Tundra Swan hunt, except in parts of Nevada, Montana, North Carolina, and other states where Tundra hunting is well established."

2. "Although I am an ardent waterfowl hunter, I believe any expansion of Tundra Swan hunting is politically unwise, because it offers the anti-hunters political clout which they'll be only too willing to use against any and all hunting."

DENNIS LUSZCZ
NORTH CAROLINA WILDLIFE RESOURCES COMMISSION

1. "Our State has supported the reintroduction of Trumpeter Swans into a portion of their historic range. . . We are concerned, however, with The Trumpeter Swan Society's apparent change in policy on Tundra Swan seasons in this flyway."

2. "Where we do not concur is with the Society's belief that Tundra Swan hunting is in most cases incompatible with reintroduction of Trumpeter Swans. . . . Trumpeter Swans entering such an area (Tundra Swan hunting area) will be buffered by the presence of these Tundra Swans, and should not necessarily be subjected to significantly higher mortality rates."

3. "I would urge the Society to reconsider the inflexible position that management of the much more numerous Tundra Swan be suspended with expansion of Trumpeter Swan populations."

WILLIAM BAILEY, JR.
CHAIRMAN, CENTRAL FLYWAY COUNCIL
NEBRASKA GAME AND PARKS COMMISSION

1. "We agree that it is time for increased communication in regard to this issue. . . . Hopefully, these discussions at your September meeting will be just the first step in increased communication and cooperation be tween the Society and the Central Flyway."

BARRY REISWIG
FORMER USFWS REFUGE MANAGER, RED ROCK LAKES NWR

1. "I think the first thing the Society needs to do is develop a listing of areas on the continent where we want Trumpeter Swans to be, in other words, a master list of reintroduction sites. . . . After that, working with the flyways will be easier, because we will have a concrete plan from which to work."

MARTHA JORDAN
TTSS WASHINGTON WORKING GROUP,
SNOHOMISH, WA

1. "It has become clear through my attendance at the Pacific Flyway Technical meetings that Nevada, and to some extent Utah, are not favorable to Trumpeter Swan expansion in any form. They appear more concerned with hunting waterfowl than with conserving the biological resource -- which may include hunting. I understand that waterfowl hunting is important. However, there need to be strong reminders to the USFWS and state agencies that there are other considerations when managing waterfowl populations."

   "I believe that the Society needs to take a firm stand on the issue of Trumpeter protection. If our views are not universally accepted, then so be it. If we do not challenge the system when it is clearly not correct, then I think we have failed in our role to carry out the goals of the Society. I urge the Society to adopt a stronger position in both word and action regarding the Tundra Swan hunting issue."

LARRY GILLETTE
WILDLIFE MANAGER, HENNEPIN PARKS
VICE PRESIDENT, TTSS

With the exception of the Pacific Flyway Council's comments, I've had the benefit of being able to review the comments on the draft position paper and think about them. I'd like to share some of my thoughts with you, and I hope you will let me and the other officers or Directors know how you feel about this position paper during the Conference. Although these are my opinions, probably they are shared by the majority of the Directors of our Society.

I am convinced that Trumpeter Swans that are in an area open to Tundra Swan hunting <u>when</u> the season is open <u>will</u> be shot for the following reasons:

1. Hunters cannot distinguish between the two species of swans with any certainty under field conditions.

2. The behavior of the Trumpeter Swan makes it more susceptible to hunting:

   a. It is less wary, especially in the Interior Region, where it lives in close proximity to man.

b. Its flight patterns make it an easier target.
c. Trumpeters do not flock as Tundras do. There is less opportunity to be wary, and cygnets which lose their parents will not be able to join a flock for guidance.

The first statement is considerably different from the one that is in the position statement on page 2, which reads, "The Society believes that Trumpeter Swan restoration or range expansion is impossible in any area open to Tundra Swan hunting." Impossible may be too strong a word. Swans which nest in areas which will be open for Tundra Swan hunting may move to staging areas outside the hunting area before the season begins. Migrant Trumpeters may not leave staging areas until after Tundra seasons are closed along the migration route. Trumpeters may establish migration corridors which bypass Tundra Swan hunting areas. Then, again, they may not. We don't know for sure what will happen.

Sometime in the early 1970's, TTSS adopted a policy stating, "(The Society) would not oppose waterfowl seasons in order to protect Trumpeter Swans from the risk of being shot." Tundra Swan seasons were held only in one county in Nevada, two counties in Montana, and all of Utah at that time.

TTSS started inserting the word "pre-existing" by 1984 so that the policy read, "It would not oppose pre-existing waterfowl seasons in order to protect Trumpeter Swans from the risk of being shot." At this time, Tundra hunting had been initiated in North Carolina, two more counties were added in Nevada, and Tundra hunts were proposed for North and South Dakota. TTSS did not oppose any of those "pre-existing" seasons at that time, but "pre-existing" referred to any hunt held prior to 1984.

By 1988, Tundra Swan hunts were being held in North Dakota and Virginia, and another county was added to the list of those open in Montana. Tundra Swan hunting plans were being circulated for approval, which provided the option for greatly increased Tundra Swan hunting. Additional areas are proposed for 1989. It has been this continuous increase in Tundra Swan hunting or the potential for additional hunts that has caused TTSS to revise its original policy and consider issuing a position paper regarding Tundra Swan hunting. The ground rules have been changed beyond what anyone imagined 15 years ago, and TTSS must adapt to the new game. Although we have not actually approved any Tundra hunt to date, I believe that TTSS cannot afford to remain silent if the number of hunts continues to expand.

There are two statements in the North American Management Plan for Trumpeter Swans that have been widely quoted. The first is, "Hunting of other waterfowl will not be precluded because of the chance-killing of Trumpeter Swans."

I support this statement for all species, except Tundra Swans, for reasons spelled out previously.

For me, "chance-killing" needs further definition. Is it:

1. An occasional swan accidentally shot as another species?

2. A swan that wanders into an area open to Tundra hunting?

3. A small, regular annual harvest of Trumpeters which migrate through an area open to Tundra hunting?

4. A continuous removal of Trumpeters which try to pioneer into an area open to Tundra hunting?

5. Other?

It is difficult to support the statement without knowing how chance-killing is defined.

The other statement is that, "Education and increased enforcement efforts should be employed where swans are being shot." While I agree that this approach should be adequate to control shootings of Trumpeters in most cases, the technique is totally inadequate for areas open for Tundra Swan hunting. Neither option will work where hunters can't distinguish between species.

Remember that the North American Management Plan for Trumpeter Swans was prepared by the U. S. Fish and Wildlife Service and the flyway councils. Although TTSS had an opportuniuty to review it and submit comments, it is not our plan, and it does not include all the suggestions we submitted.

GENERAL COMMENTS FROM THE AUDIENCE

Harold Burgess: "The Central and Pacific Flyways have invited us to participate in their discussions. The situation has changed dramatically, and we should take advantage of that. "

Jim King: "Investigation and planning needs to be completed before TTSS can take a position on Tundra Swan hunting. "

Jim Bartonek: "Conflicts will likely occur in Utah and Nevada. "

Dave Lockman: "The RMP is the next step. We must evaluate winter expansion to the south. "

Bill Sladen is very concerned about Trumpeter numbers being shot within present hunting practices. He would like very much to see this worked into the proposal. What are we asking for? Male/female differentiation is ridiculous. Trumpeter/Tundra differentiation is more practical.

Dave Lockman: "In place of a position paper, send letters to the flyway councils, offering the assistance of TTSS."

Jim Bartonek: "Examine harvest data frequently, considering the economics. Check stations could operate by taking 'mug shots' of the swans, to determine species. "

Don Childress: "Don't try to placate. TTSS has a single purpose. Solicit the councils to overcome the obstables that the Society and the councils face together. We need to identify the unknowns in the harvests. "

Jim King: "The Society already has a position...we want to restore the Trumpeter to as much of its original range as possible. The councils need some space to complete hunts. But, how much space do they want? "

THE TRUMPETER SWAN SOCIETY POSITION PAPER ON TUNDRA SWAN HUNTING

Approved January 1990

The Trumpeter Swan Society (TTSS) is dedicated to restoring the Trumpeter Swan to as much of its former range as possible. Although TTSS remains a single-purpose organization, it has concluded that management of Trumpeter Swans cannot 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, TTSS'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. TTSS 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.

TTSS is committed to fulfilling these management objectives. However, TTSS 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 (USFWS) cannot both be completely implemented without coming into conflict with each other. Hunters cannot 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 TTSS'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. TTSS 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 the following:

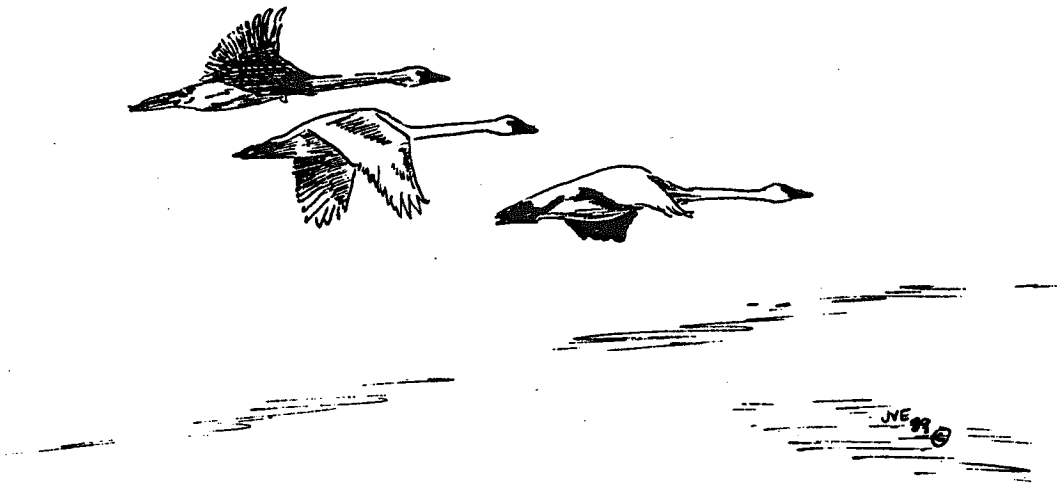
1. Area- and site-specific measures to minimize the potential for Trumpeter Swan losses during Tundra Swan hunting seasons must be developed and implemented. TTSS recognizes recreational and subsistence harvesting of Tundra Swans within a sound management framework. However, it believes that hunting conflicts with Trumpeters have been poorly identified and resolutions inadequately defined and implemented. TTSS 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.

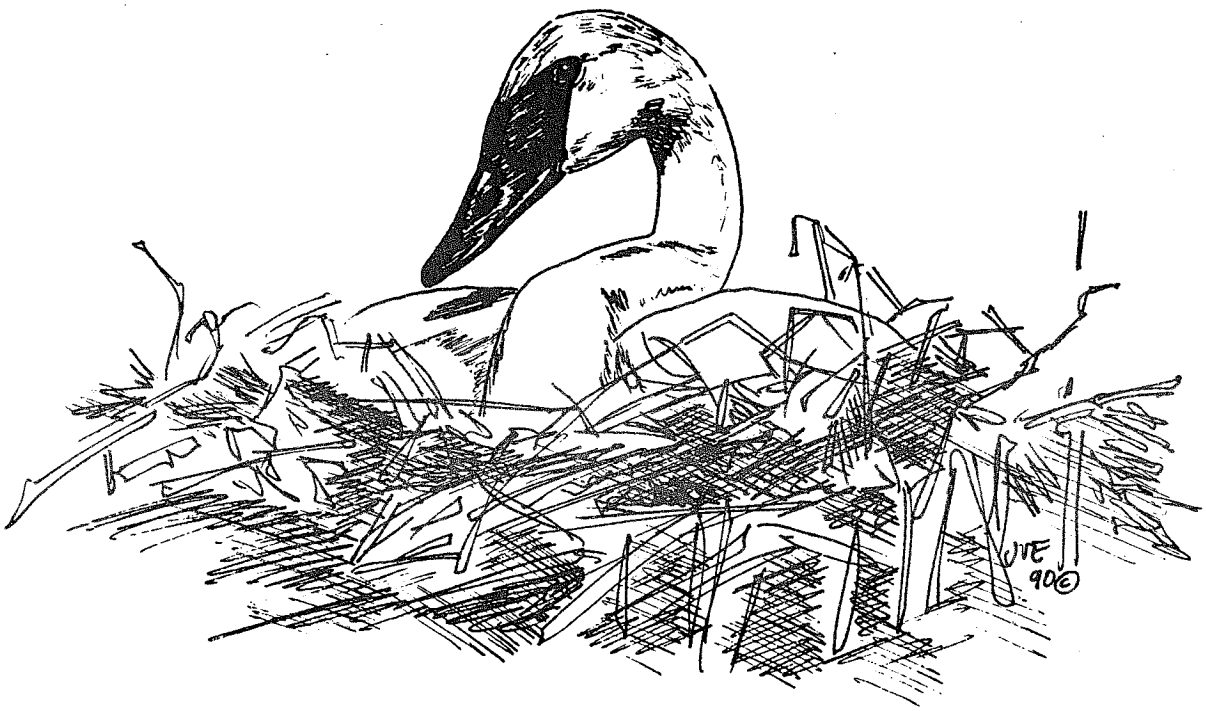
3. States outside of current Trumpeter Swan range, but within the scope of range expansion efforts, should be encouraged to provide representation and participation in the current flyway subcommittees. Participation should include planning and implementing range expansion programs and evaluation of potential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

with the flyway councils and their appropriate subcommittees in the development of management plans which will benefit both species.



RESTORATION EFFORTS IN THE UPPER MIDWEST

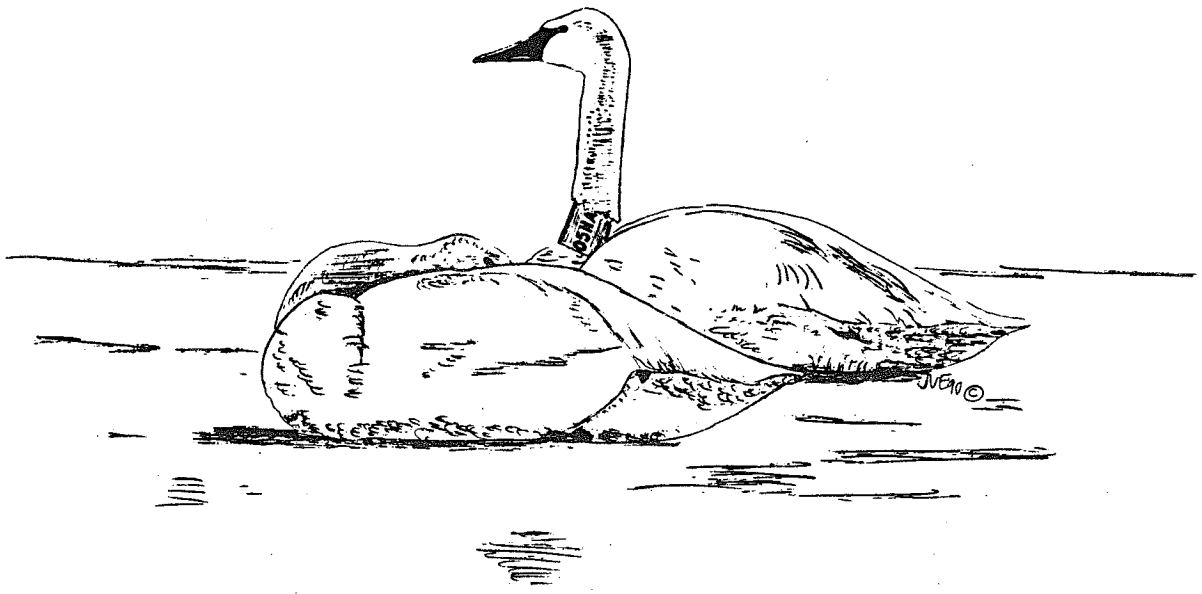


INTRODUCTION TO THE MORNING SESSION

Carrol L. Henderson[1]

Many people in the restoration business consider Trumpeter Swans to be a wilderness species. There is no wilderness in Minnesota, per se, so one wonders why Trumpeter reintroduction is even being attempted here. Over the past 8 to 10 years of my experiences with swan restoration in Minnesota, there have been numerous roadblocks to restoration, including bureaucratic, philosophical, and economical roadblocks. Restoring Trumpeter Swans is not cheap. Over the past decade, each bird released in Minnesota at 2 years of age represents an investment of about $2000.00. The bottom line is, you can't get swans cheaply. If you try, you're going to kill or lose birds. It is expensive, and time consuming, and it's taken a long time to find funding sources for these birds. The nongame wildlife checkoff is one source that is now available. We have finally breached some roadblocks, and states and provinces are proceeding with restoration plans. They're finding funding, and we have some progress to report. Following are reports of restoration efforts in the Upper Midwest, beginning with Rolf Kraft on the Lacreek National Wildlife Refuge and surrounding area.

[1] Transcribed from tapes of the Conference.



STATUS REPORT OF THE LACREEK TRUMPETER SWAN FLOCK

Rolf H. Kraft

ABSTRACT

A total of 247 Trumpeter Swans, including 78 cygnets, returned to Lacreek National Wildlife Refuge (NWR) following the 1988 breeding season. This compares to 268 Trumpeters (including 86 cygnets) in 1987, 229 Trumpeters (including 63 cygnets) in 1986, and 187 Trumpeters (including 43 cygnets) in 1985. This is a 9 percent decrease in production over last year, and an 8 percent decrease in total swans. Overall, production was average, with the decrease in swans considered a normal variation. An aerial survey of the breeding area was not conducted in 1988. However, 24 Trumpeter Swans were captured and collared, increasing the number of marked birds in the wild.

The recessive leucistic gene that produces yellow feet in Trumpeters is becoming more common every year, with some birds now showing a faint yellow lore. The Missouri transplant program was discontinued in 1988 due to restructuring of fiscal priorities in the Missouri Department of Conservation. However, the Trumpeter pair that was transplanted to Mingo NWR in 1982 successfully raised a cygnet to flight in 1988. Trumpeter Swan 43RA, collared in Cherry County, NE, in July 1987, was observed in January 1988 near Russellville, AR. Trumpeter Swan 20RA, transferred to Mingo in 1986, returned to Lacreek in July 1988 and remained on the Refuge throughout the winter. A pair of swans, 31FA and mate, were observed on the Refuge in mid December 1988, and were later observed in northeast Nebraska. Some migration is occurring.

POPULATION REPORT

A total of 247 Trumpeter Swans, including 78 cygnets, returned to Lacreek National Wildlife Refuge (NWR) following the 1988 breeding season. This compares to 268 Trumpeters (including 86 cygnets) in 1987, and 229 Trumpeters (including 63 cygnets) in 1986 (Table 1). This is a 9 percent decrease in production over last year, and an 8 percent decrease in total swans. The majority of the 1987-88 wintering Trumpeter Swan flock dispersed in February, with only about 60 birds remaining on the Refuge. The March blizzard and refreezing of area lakes then forced the return of 160 swans, where they remained until late March.

Fall Trumpeter Swan populations began building on 23 November with 60 birds on the Refuge, and peaked on 29 November with 247 birds. Overall, production was average, and the decrease considered a normal variation. Fairly severe ice buildup was noted on three swan collars. This is the first incidence of major icing on swans. The swan feeders were not filled until 30 November (approximately 10 days after the majority of the local lakes froze over), in an attempt to force some of the birds to migrate. No movement was noted due to the delay in initiating feeding.

The Trumpeters began to disperse in the early part of February 1989, with 5,075 swans using Cedar Creek Trout Pond # 2 and the Todd Dam west of the Refuge. The remaining birds were using Pool 5 adjacent to the grain feeders. The severe cold in mid February brought many of them back to the feeders. The majority of the Trumpeter Swan flock finally dispersed during March, with only about 15 remaining on the Refuge in April. A nesting pair and six subadults were observed near the town of Colony in extreme northeast Wyoming. No late summer information is available.

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

Breeding season	Adults	Cygnets	Total
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

The incidence of leucistic birds appears to be increasing. This recessive genetic trait produces cygnets with mottled-yellow to full-yellow feet, and white juvenile plumage in some cygnets, instead of the normal grey. Full leucistic cygnets are as white as their parents, and can be mistaken for adults in late summer when their sizes are comparable. The foot coloring carries over to adulthood, and one instance of a yellow lore has been observed on a subadult. Two nesting pairs have histories of producing at least one leucistic cygnet every year.

PRODUCTION REPORT

The 1989 aerial production survey was conducted on 2, 3, 4, 12, and 19 August. The survey included Bennett, Todd, Jackson, Mellette, Shannon, Pennington, and Perkins Counties in South Dakota, and Cherry, Sheridan, Garden, Grant, McPherson, and Arthur Counties in Nebraska. A total of 231 Trumpeter Swans was observed, including 51 nesting pairs, 30 broods with 79 cygnets, and 46 nonbreeders in 10 flocks. The aerial survey was not conducted in 1988, but the 1989 data show a significant increase in subadult birds. The total number of adults, which includes flocked subadults and young unproductive pairs, increased 38 percent over 1987 (Table 2). Flocked birds increased 44 percent, and nesting pairs without broods (primarily first time or inexperienced nesters) increased 91 percent. These increases indicate excellent survival and an expanding population. As these subadults form pairs and become successful breeders, swan production on the high plains should increase rapidly. Pairs with broods increased 30 percent over 1987, but poor habitat conditions, caused by the drought, resulted in a 3 percent decrease in production in 1989. The expanding population should increase pioneering for winter migration, but also places a greater demand on wildlife professionals to find suitable wintering areas, and help the swans find them.

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

Year	Adults	Pairs	Broods	Cygnets	Total swans
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

John Smith, Missouri Department of Conservation, reported that the original pair of Trumpeter Swans transplanted to Mingo NWR in 1982 successfully raised a cygnet to flight stage in 1988. Dense vegetation at Mingo interferes with observations during the summer, and no report of 1989 production has been received.

REFUGE PRODUCTION

Six pairs of swans nested on the Refuge in 1989 (Table 3). The pair on Pool 7 hatched two cygnets, but lost one in August. The pair on Pool 8 is an old established pair, and they hatched six cygnets prior to 6 June. Pool 8 was drawn down for aeration after the brood hatched, and the pair moved the brood to Pool 7. Unfortunately, they lost five cygnets by the end of August and fledged only one bird.

The two pairs on Pool 6 hatched three and two cygnets on the north and south ends of the pool, respectively. This is the fourth year in a row that the pair on the south end produced a leucistic cygnet. The pair on Pool 9 hatched only one cygnet in 1989 and lost it. This pair has had a rocky history, beginning in 1980 when they established a territory in Pool 9. They nested in 1981, but no production was observed until 1982, when they hatched five and fledged three. In 1984, they hatched one and lost it, but then hatched seven and fledged five in 1985. No production was observed again in 1986, but they fledged four in 1987, and hatched and fledged two cygnets in 1988. This on-and-off nesting success is unusual in swans, as they normally have loss problems early in their nesting careers, but steadily improve with experience. The pair on Pool 11, another established pair, hatched two cygnets, but lost them both during the summer. The severe drought and improved access for predators are probably factors in the losses sustained during the summer of 1989.

Six pairs of swans also nested on the Refuge in 1988. The pair on Pool 2 lost their nest in a flood and did not renest. The pair on Pool 8 hatched five and fledged one. Two pairs nested on Pool 6. The pair on the north end hatched two and fledged one, while the pair on the south end hatched and fledged one leucistic cygnet. The pair in Pool 9 hatched and fledged two, while the pair on Pool 11 hatched five and fledged three. The pair that nested on Pool 11 raised their young on Pool 9A. Most of the decrease in fledged cygnets for 1988 can be attributed to the pair in Pool 8 that lost four out of five hatchlings. The loss was very unusual, as this pair normally fledges all they hatch.

First flights normally occur the last 2 weeks in September. With hatching occurring between 1 and 15 June, the hatch-to-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 after hatch. An opportunity to reaffirm this estimate occured this year, as the pair on the north end of Pool 6 hatched three cygnets on 23 May, and they fledged on 31 August, 101 days after hatching.

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

Year	Nesting pairs	Broods	Cygnets hatched	Cygnets fledged
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[1]	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

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

MIGRATION ATTEMPTS

One of the earliest indications of winter migration in the Lacreek flock came in December 1976. The breeding 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 came in December 1978, with the discovery of a banded pen with two cygnets dead at the Thomas Hill Reservoir near Macon, MO.

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. Two of the birds released in Missouri have since returned to Lacreek NWR. Swan 23FA, released at Mingo NWR in 1985, returned to Lacreek on 5 December 1986. Swan 20RA, transferred to Mingo in 1986, returned to Lacreek in July 1988. This bird remained over the winter, and was last seen at Lacreek near the end of March in 1989. Of the 35 swans transferred to Missouri between 1982 and 1987, six adults and one cygnet remained as of late fall 1988. Though several nesting attempts were made and some hatching occurred over the years, only one cygnet was successfully fledged. The cygnet (fledged in 1988) represents the only known production to occur in Missouri as a result of this program. The program is now on hold, pending reconsideration by the Missouri Department of Conservation.

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 December 1983, six unmarked adults and five cygnets were observed near Dumas, AR, and on 28 December 1983, eight unmarked adults and five cygnets were observed near Ada, OK. Other unmarked Trumpeters were reported near Perry, OK, on 6 January 1984, near Cedar Bluff, KS, on 26 November 1985, near Emporia, KS, on 12 December 1985, and one cygnet with five adults was reported near Mangum, OK, on 8 February 1986. The 1986 Lacreek 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 be continuing. Following the midwinter peak of 268 for the 1987 breeding season (4 January 1988), the Lacreek population declined sharply to 192 on 20 January. This rapid loss of an estimated 76 birds indicates that some migration must be occurring. That number of birds could not have died without some evidence. An aerial survey of the surrounding swan wintering habitat failed to reveal any of the missing birds. Four collared swans were among the missing (15FA, 25FA, 26FA, 27FA). The collared birds were last observed on the Refuge on 18 December 1987. Unfortunately, they were not seen later in the south.

The missing collared swans all had two traits in common -- independence and a history of escape. Bird 15FA is an old pen, originally collared 53TY in 1973, and paired with an unmarked cob. They nested on North Cody Lake, southeastern Bennett County, SD, for many years. The pair likes isolation and usually stays on North Cody Lake over the winter. Bird 25FA is a pen that was captured for the Missouri Transplant Program in 1985, but escaped the refuge holding pen. Birds 26FA and 27FA are both pens that were captured on Scotchman Lake, and collared for the Missouri program in 1986. As reported in the August 1986 status report, these two and 19FA got away and were observed crossing the sandhills on foot during an aerial survey a few days later. They were presumed lost, but 26FA and 27FA were observed during the fall of 1986, and again in December 1987. Unfortunately, 19FA was never seen again. The second confirmed evidence of a southern winter migration from Lacreek NWR occurred in 1988. Swan 43RA, collared during the 1987 summer on Clubhouse Lake, Cherry County, NE, 12 miles south of the Refuge, was observed 18-24 January 1988, on Lake Dardanelle, near Russellville, AR. Another Trumpeter (20RA), transferred via aircraft to Mingo NWR in 1986, returned to the vicinity of Lacreek in July and was still on the Refuge at the close of the year. Bird 31FA and its mate were observed on the Refuge until mid December, then disappeared for a short time. They were eventually sighted in northeast Nebraska on a public power canal, where they remained until the close of the year.

Banding and collaring of adults and subadults will continue in the vicinity of Lacreek NWR, to provide an increasing pool of marked birds. But, more needs to be done. There is no doubt that considerable winter pioneering and some migration is taking place, but the loss in birds, though undocumented, must be significant. We, as professionals, 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 in finding it.

HENNEPIN PARKS TRUMPETER SWAN RESTORATION UPDAT E

Donna Compton

Hennepin Parks has been in the Trumpeter Swan business since 1966, when a pair of birds was received from Red Rock Lakes National Wildlife Refuge in Montana. Over the next few years, 40 additional subadult birds were received from the same source and released in Minnesota.

The program was changed in 1973 when all remaining birds were taken back into captivity, and an intensive captive breeding program was instituted. The captive flock was then rebuilt from a low of 13 in 1973 to 38 in 1979.

Eight Trumpeter Swans were released from captivity in 1979, beginning the next phase of the project. The Hennepin Parks flock currently includes a free-flying component, with several breeding pairs, as well as a captive breeding program. The offspring of captive birds are held captive until 2 years of age, and are then artificially paired and released from selected locations both inside and outside of Hennepin Parks' property. All cygnets in the program are raised by adult swans, and even the captive cygnets remain with the adults throughout their first year. When the adults are ready to nest, the cygnets are removed to other refuges and held in subadult groups until released at 2 years of age.

The free-flying segment of the flock is getting close to being truly wild. Many of the pairs raise their cygnets without any human intervention. However, whenever possible, additional food is provided two times per day on an over-the-water platform for the cygnets of free-flying pairs to ensure adequate nutrition and to mildly habituate the birds to people.

Overall, mortality within the free-flying flock has been very high. This past winter, the majority of the losses could be attributed to lead poisoning. However, migration is taking a high toll, as well. Currently, the Hennepin Parks flock numbers 31 captive birds and 50-60 free-flying birds. It is difficult to estimate the number of free-flying birds in September because they are still dispersed outside Hennepin Parks properties to a large degree, and they are quite mobile. It is also difficult to get an accurate count of unmarked, free-flying birds, assuring that there is no duplication in counting.

The progress of the Hennepin Parks flock is illustrated in Figure 1, beginning in 1980, the year following the first releases. The upper line represents the total flock, and the lower line represents the free-flying portion of the flock. Production continued to outweigh mortality through 1984. However, in spite of good production, the free-flying portion lost some ground from 1982 to 1983. This was probably due to the increasing number of free-flying birds with proportionally higher losses in this group. In 1983, a large number of birds were released. The only birds held back were those that were less than 2 years of age or that were established as captive breeding pairs. From 1984 to 1986, although the total flock size declined, the number of free flyers increased. Again, the overall decline can be explained by mortality exceeding production, a new situation for this flock of captive breeders and predominantly subadult free flyers. The divergence at the end of Figure 1 occurred during the last lead poisoning episode. Again, it indicates higher proportional losses among the free flyers.

Future plans for this flock include releasing all offspring of captive pairs at 2 years of age, and allowing all offspring of free-flying birds to fly with their parents each fall. It is expected that total flock numbers will fluctuate between 70 and 100 birds, with no hope of breaking the population threshold (100 free-flying birds) unless we can determine some way to curb mortality, especially lead poisoning.

Another issue of interest in managing this flock and others is determining the most successful age at which to release the offspring of captive birds. Success is measured by whether or not the birds reach sexual maturity and actually breed before they die. Figure 2 is an illustration of the ages at which birds were released from Hennepin Parks with several categories of their destinies: (1) died without reproducing, (2) successfully nested, and (3) still alive as of December 1988 and could reproduce in future years.

Of the total 85 birds that had been released as cygnets by December 1988, only one bird successfully reproduced. It should be noted here that these birds did not fly free alone, they were allowed to fly free with their parents. In December 1988, there was still a large contingent alive (32) that could eventually reproduce, but it is expected that most of those 32 birds will die before breeding. (As of September 1989, the 32 were already reduced to 20.) There have not been as many birds released as 1 year olds, but the percentage of birds achieving successful reproduction was much higher than for those released as cygnets (12% versus 1%). The difference is even more pronounced between birds released as 2 year olds and cygnets (25% versus 1%). One could argue that this comparison does not take into account the mortality of birds being held for future release. However, very few birds are lost while in captivity. If the count of cygnets alive in September is considered 100 percent, 90 percent of the birds raised to fledging age as captives survive for release as 2 year olds. Early cygnet losses occur equally in the free-flying and captive segments of the flock, and are factored out of the comparison by taking total flock counts in September rather than in July.

Based on the above information, the most favorable release age appears to be 2 years. However, because many of the birds released as cygnets remain available to join the successfully reproducing contingent (20), only time will tell if the assump-

tions made here will hold true. Hennepin Parks swan managers have some serious thinking to do -- most of the birds released today are released as cygnets with free-flying parents, and high mortality has been keeping these birds from achieving reproductive success. Progress toward the goal of 100 free-flying birds with 15 breeding pairs among them may only be achieved with a change in management strategy. The management options available include: (1) increasing production in some way, (2) managing to curb mortality, (3) releasing birds at an older age to get them closer to breeding before subjecting them to the hazards of life, (4) obtaining large numbers of subadult birds for immediate release, hoping to exceed the limiting threshold, or (5) some combination of the above. The solution will likely be a combination of these options. In addition, the two neighboring restorations in northern Minnesota and Wisconsin are currently supplementing Hennepin Parks' efforts. It is possible that these additional birds will make the difference between success or failure for the Hennepin Parks restoration.

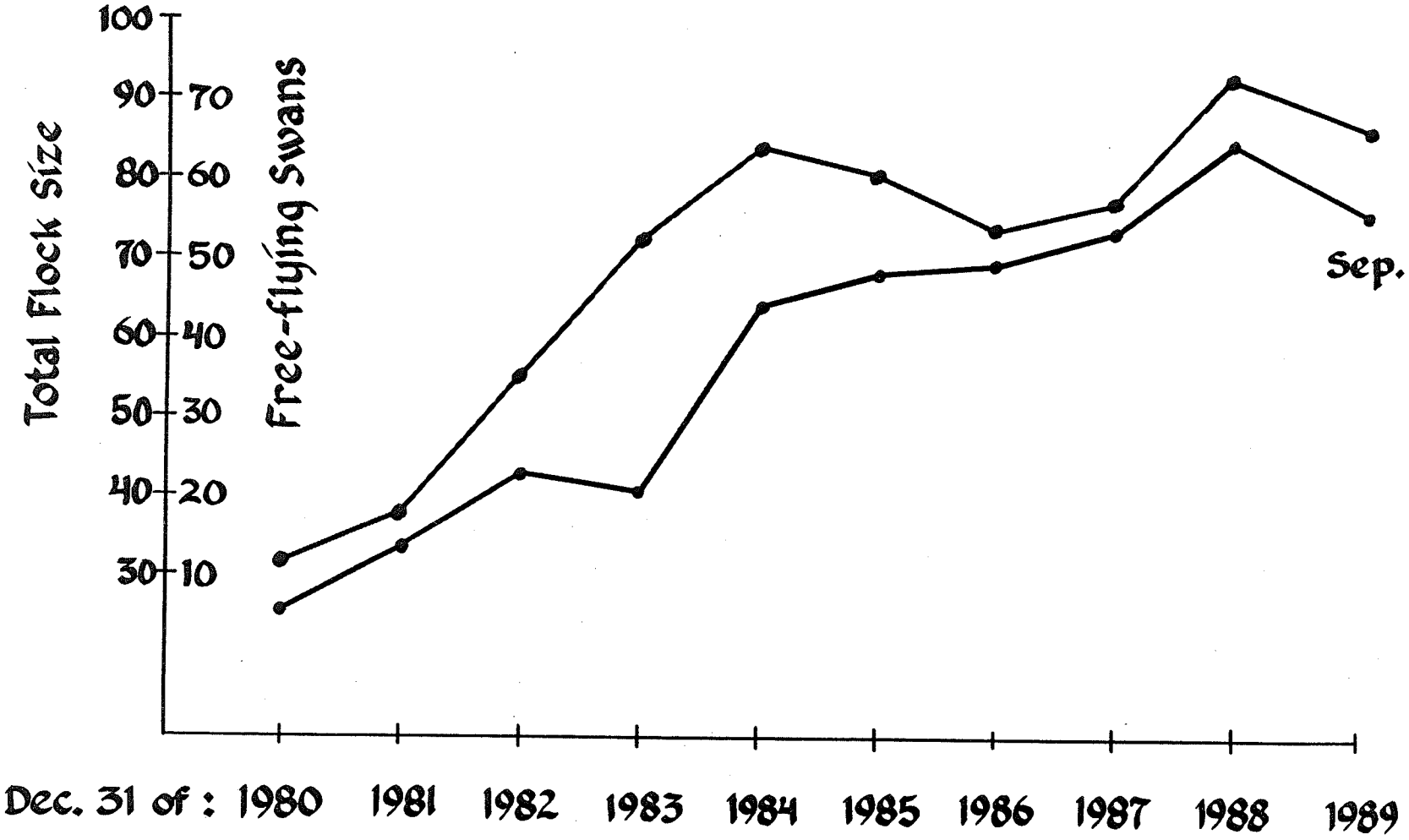


Figure 1. Hennepin Parks Trumpeter Swan flock size, 1980-89.

Figure 2. Numbers and ages of Trumpeter Swans released from Hennepin Parks from 1979 through December 1988.

AN UPDATE OF MINNESOTA'S TRUMPETER SWAN RESTORATION EFFORTS -- THE CAPTIVE REARING PROGRAM

Steven M. Kittelson

A plan to expand Minnesota's Trumpeter Swan reintroduction efforts beyond Hennepin Parks (formerly the Hennepin County Park Reserve District) began in August 1979. Representatives from the Minnesota Department of Natural Resources (MN DNR), The Trumpeter Swan Society, the Fergus Falls Izaak Walton League, the West Central Bird Club, Hennepin Parks, and the U. S. Fish and Wildlife Service met in Fergus Falls, MN, to discuss the feasibility of Trumpeter Swan restoration in selected areas of western Minnesota. The natural resources required for making such a project successful were available. MN DNR Nongame Program funding, donated from Minnesota Income and Property Tax forms, was available to fund the restoration effort. And, the swan population in Alaska was increasing steadily, and became a source of birds not previously available.

The goal of the MN DNR project is to establish a migratory, breeding population of at least 15 pairs of Trumpeter Swans in western Minnesota by 1995.

Flyway approval was obtained, and swans were actively reared beginning in 1982. Swans were obtained from egg collections in the wild, and egg and cygnet donations from the Minnesota Zoo and the Brookfield Zoo (Chicago). Additional swans were acquired from private propagators.

Swans acquired during the first two seasons came from egg collections at Lacreek National Wildlife Refuge (1982) and Red Rock Lakes National Wildlife Refuge (1983). In addition, cygnets from Hennepin Parks were reared to gain more experience with hand-rearing swans and to test state facilities. All swans reared the first 2 years were transferred to Hennepin Parks at 13 weeks-of-age to supplement that flock (Table 1).

In 1984, the Minnesota Zoo and the Brookfield Zoo began providing eggs, cygnets, and subadult swans to the project, and swans were first overwintered at the Carlos Avery Wildlife Office near Forest Lake, MN. This was in preparation for the first release in 1987. Additional swans were added to this release group in 1985 from zoo sources, and, for the first time, from a private propagator.

In 1986, Minnesota became the first state to obtain approval and collect eggs from the wild in Alaska, with the first of three annual egg collections. Fifty eggs were collected and transported to Minnesota for hatching and inclusion into the release program. One hundred more eggs were collected in 1987 and 1988 to add to the other sources of swans. Another valuable source was used for the first time in 1987, when cygnets were purchased from the Delta Waterfowl Research Station in Manitoba, Canada. Under a cooperative agreement, seven of the Alaskan cygnets reared in 1987 and 1988 were transferred to the Wisconsin DNR for their newly-established restoration project.

The incubation and rearing techniques described at the last Trumpeter Swan Society Conference in Seattle, WA, were continued in 1988. In 1989, no eggs were collected, and the project moved into the next phase--supplementing the flock with birds hatched at other facilities. Twenty-four cygnets were added to the project from previously-mentioned facilities and from the Alaska Zoo in Anchorage.

Table 1. MN DNR Trumpeter Swan captive rearing summary, 1982-89.

	1982	1983	1984	1985	1986	1987	1988	1989	Total
Eggs acquired	8	12	14	8	52	50	50	0	194
Cygnets hatched	5	8	11	8	44	43	37	0	157
Swans acquired	0	6	27	24	16	32	24	24	153[1]
Total Swans	5	14	38	32	60	75	61	24	310

[1]Includes swans hatched at the Minnesota Zoo and held there until release, and swans temporarily held for other programs.

The swans were again transported to their release area in northwestern Minnesota by the Minnesota Air National Guard. In May 1989, a training flight was used to fly the birds to Detriot Lakes, MN, on a C-130 transport plane. Dog kennels continue to be the best containers for moving swans. The release attracted a large crowd, including a number of local media stations. Attention from swan releases and from fall publicity campaigns continue to educate waterfowl hunters and the general public alike to the presence of swans in their area, and encourage the public to report swan sightings.

Veterinary care has been obtained through The Raptor Center, University of Minnesota, St, Paul. This involves routine health checks on captive birds, and treatment of all swans as required. Necropsies are conducted to determine causes of death where possible. Mortalities in the captive flock have totalled 86 since 1982. The highest number, 32 (37.2%) is from predation, with 31 swans lost in one incident in 1987 when a mink entered the brooding facility. Other mortality factors include infection - 14 (16.3%), accidental injury - 10 (11.6%), lead poisoning - 9 (10.5%), aspergillosis - 8 (9.3%), physical defects - 3 (3.5%), transport stress - 1 (1.2%), and undetermined causes - 9 (10.5%).

A total of 157 (80.9%) Trumpeter eggs hatched from 1982 to 1988, including 123 (82.0%) of 150 Alaskan eggs. Another 153 swans have hatched at other locations to date, for a total of 310 swans associated with the program. This number includes swans that have been exchanged or taken in and reared throughout the course of the project, to accommodate such things as flooded nests at the Minnesota Zoo, and orphaned young at Hennepin Parks. These birds have then been returned to another program. Over 40 swans have been transferred out of the MN DNR program.

Agreements are in place to add additional swans to the program in 1990, 1991, and 1992 from captive rearing facilities. It is hoped that these facilities will produce a minimum of 60 swans in the next 3 years.

A total of 92 swans has been released through 1989, with another 108 projected by 1994 (Table 2). The survival of released birds and their offspring will determine whether or not additional swans will be released beyond 1994, to supplement production and increase genetic diversity.

This has been the first project to collect, raise, and release Trumpeter Swans on this large scale. Much has been learned in the past 8 years, and it is hoped that this knowledge will assist others in programs to restore Trumpeters to as much of their former range as possible. Other papers presented at this conference will give more information on mortality, treatment, and post-release statistics.

Table 2. MN DNR Trumpeter Swan release summary, 1987-94.

	1987	1988	1989	1990	1991	1992	1993	1994	Total
Number of swans released	21	44	27	38[1]	22[1]	18[1]	15[1]	15[1]	200[1]
Natural reproduction[2]	-	1	3	?	?	?	?	?	?

[1] Based on the number of swans currently in captivity, and expected reproduction.
[2] Number survived to fledging.

MINNESOTA DEPARTMENT OF NATURAL RESOURCES TRUMPETER SWAN RESTORATION EFFORTS -- 1989 STATUS REPORT

Margaret E. Hines

INTRODUCTION

By the late 1800's, Trumpeter Swans (Cygnus buccinator) were extirpated from Minnesota by market-hunting for feathers and meat. Hennepin Parks began a program to restore Trumpeters to the southern portion of the state in 1969. In an effort to reestablish Trumpeter Swans throughout the state, the Minnesota Department of Natural Resources (MN DNR) collected eggs from Trumpeter Swans in Alaska, and obtained young swans from the Minnesota Zoo, the Brookfield Zoo, Minnesota's Hennepin Parks, the Delta Waterfowl Research Station, and a few private breeders. All swans remained captive until 2 years of age.

The swans were then released into the wetlands of Becker County. Located in westcentral Minnesota, Becker County was chosen as the release area due to its abundance of wetlands, and because the Tamarac National Wildlife Refuge offered many prime wetlands that were closed to hunting. In the springs of 1987-89, 21, 44, and 27 swans were released, respectively. The project goal is to establish 15 breeding pairs of Trumpeter Swans in Minnesota.

SITE SELECTION

Before swans could be released, wetlands were carefully chosen to best suit the needs of the swans (Hines 1991). Sites were selected to provide optimum food and cover for the newly-released pair and for potential future broods. In the hope that pairs would return to the release site the following year to set up a territory, sites were evaluated according to the availability of nesting sites, brood cover, and loafing areas. Additional information regarding lakeshore development, hazards on or around the wetland, and hunting, fishing, and leeching activity was also noted on each wetland. Suitable areas were then prioritized for use. A detailed description of wetland selection is given in the following paper.

RELEASE DATES

Release dates were initially set in late April to avoid heat stress during transport and to allow the swans the greatest amount of time to imprint onto their release site before gaining flight. Release dates were eventually modified, however, to accommodate aggression by returning swan pairs. In 1988, one swan pair returned to the release area and attempted to defend a wetland occupied by a newly-released pair of swans. The newly-released pair was at a dangerous disadvantage with their clipped wings. Therefore, in 1989, swans were released in early May to allow returning swans the opportunity to select territories before release sites were chosen. After experiencing yet another conflict with a returning swan, the 1990 release date will be in late May when returning swans' territories are more stable and nesting swans are incubating.

FALL MIGRATION/WINTERING SITES

Trumpeter Swans are generally the last waterfowl to migrate in the fall. Most swans remain on their release sites until late September/early October when they begin to explore the surrounding wetlands. By early November, the smaller wetlands have frozen and the swans have moved to larger lakes in the area. The larger lakes freeze during the third or fourth week in November, forcing the last of the swans out of the area. By mid December, most swans have settled into their wintering areas.

For the first 2 years, Trumpeter Swan wintering sites have occurred mostly in ice-free river areas ranging from 25 miles south of the release area to as far away as Iowa and Kansas. In 1988, some swans ended their migration only 25 miles from the release area. Landing in various open river areas, the swans become incorporated into flocks of ducks and geese being fed daily by landowners along the rivers. With food and water provided, the swans had no incentive to fly farther.

The Des Moines River in Des Moines, Iowa, wintered swans for the first two winters after release. Swans have also been sighted in lakes and rivers throughout Iowa and eastern Kansas, but they did not remain at those locations for very long.

In 1987, two aerated wintering sites were established for the swans in the event that they did not migrate. One of the sites contained a pair of wing-clipped swans to act as decoys. No free-flying swans used either aerated site and the decoy pair was unable to maintain open water during sub-zero temperatures. Eleven of the 13 fall migrants returned to the release area the following spring. Therefore, we found aeration to be unnecessary for our project.

SPRING MIGRATION/SUMMER RESIDENTS

Trumpeter Swans are generally the first waterfowl to migrate in the spring. By early April, some of the first Trumpeters are seen in open rivers and flowages until the ice is off their

desired marsh. Breeding pairs are on their wetlands and laying eggs as early as the second week in May. Nonbreeding pairs may take another month to settle into a wetland.

Many migrating swans from the first 2 release years have returned to the general release area. As mentioned earlier, in the spring of 1988, 11 of the 13 fall migrants from the 1987 release group returned to the release area. This is 85 percent of the fall migrants or 52 percent of the 21 swans from that release group. In the spring of 1989, the rate of 1987-released swans returning to the area dropped to 33 percent.

Also in the spring of 1989, 14 of the 28 fall migrants from the 1988 release group returned to the release area. This is 50 percent of the fall migrants or 32 percent of the 44 swans from that release group. The low return rates for the spring of 1989 may be partially attributed to the high incidence of lead poisoning that fall and winter. This was due to very low water levels throughout the region that year. Many of our swans died or were held captive and treated over the winter.

As swans establish pair bonds and migratory traditions, the rate of return in the spring should increase. This return to the release area has proved to be valuable for mate selection by single swans.

Some swans disperse after reaching the release area. Swans have been reported in late spring west of Grand Forks, ND, near Baudette, MN, and east near Hinckley, MN.

CURRENT STATUS

Only the 1987 and 1988 release groups have completed a yearly cycle to include the hazards of migration and the waterfowl hunting season. Therefore, I have chosen to exclude the 1989 release group in summarizing the status of released swans. The status of the first two release groups is given in Table 1. The "Dead" column may include swans that have been permanently injured and will remain captive. Swans that have not been sighted in the last month or 2 have been listed as "Missing." Those included in the "Survival" column are those we are now monitoring. They may have returned to the release area or may have established a territory elsewhere in the state. The status of surviving swans is further detailed in Table 2.

Table 1. Status of released Trumpeter Swans.

Release group (N)	% Dead (N)	%Missing (N)	%Total known survival (N)
1987 (21)	29 (6)	29 (6)	43 (9)
1988 (44)	23 (10)	34 (15)	43 (19)
Mean (65)	25 (16)	33 (21)	43 (28)

Table 2. Summary of total known Trumpeter Swan survival.

Release group (N)	Nesting	On territory	Unpaired	Injured/sick rereleased
1987 (9)	7	0	2	0
1988 (19)	3	6	3	7
Totals (28)	10	6	5	7

As stated in Table 1, 16 (25%) of the 1987- and 1988-released Trumpeter Swans are known to be dead. Most swan deaths (six) were attributed to lead poisoning. In addition, one swan was shot, one was hit by a car, one flew into a power line, and five died of unknown causes.

As of September 1989, there were 21 missing swans. There have been reports of swans with patagium tags near the Minnesota/Canada border and into North Dakota. It is likely that some of the missing swans are alive.

The total number of 1987- and 1988-released Trumpeter Swans known to be alive is 28. Ten swans from the first two release groups occupied five territories and attempted to nest this year. Each pair was breeding for the first time. Of the five nesting attempts, two pairs laid eggs which did not hatch. One pair hatched three cygnets and lost all three within 1 week of hatching. Another pair hatched five cygnets and lost four of them periodically between 1 and 8 weeks. Predation by snapping turtles or Great Horned Owls is the suspected cause of mortality on both breeding territories. A third breeding pair hatched two cygnets which are still alive. This brings the 1989 production to three cygnets.

Besides the breeding pairs, six swans were paired and appeared to be occupying territories and five swans were unpaired. The seven remaining swans were injured or sick over the 1988-89 winter, rehabilitated, and rereleased with the 1989 release group.

The Trumpeter Swan release program is beginning to take hold. If we add the three cygnets and 28 surviving swans to 27 surviving swans from the 1989 release group, we arrive at 58 for the total number of swans we are now monitoring.

We are also beginning to make progress in reaching our goal of 15 Trumpeter Swan breeding pairs. With the five nesting pairs and three territorial pairs, we have the potential for eight nesting pairs for the 1990 breeding season. This would bring the total number of breeding pairs just over halfway to the goal of 15 breeding pairs for this reintroduction effort.

The swan releases will soon taper off. There will be one more major release of swans. In 1990, we will be releasing 38 swans. In the springs of 1991-94, there will be minor releases of 15-20 swans. We hope to have a self-sustaining population of Trumpeter Swans in westcentral Minnesota by 1995.

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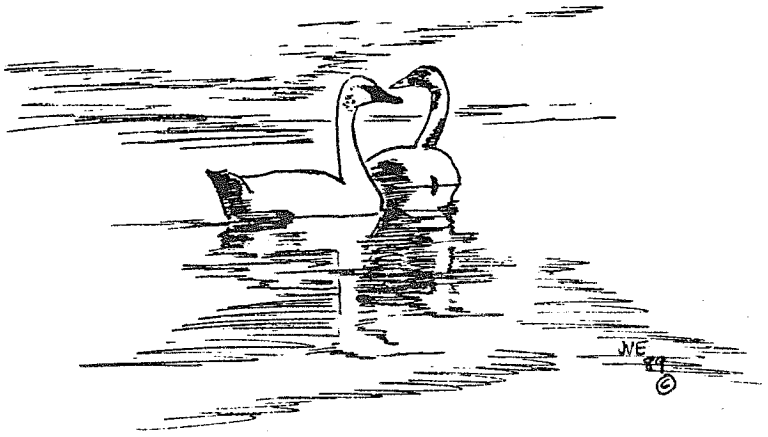

MINNESOTA DEPARTMENT OF NATURAL RESOURCES TRUMPETER SWAN RESTORATION EFFORTS -- THE SELECTION OF WETLANDS FOR THE RELEASE OF 2-YEAR-OLD TRUMPETER SWANS

Margaret E. Hines

Trumpeter Swans (Cygnus buccinator) once nested in the wetlands of Minnesota. Man extirpated the Trumpeter Swan from Minnesota by the late 1800's by market-hunting swans for their feathers and meat. Hennepin Parks began reintroducing Trumpeters to southern Minnesota in 1969. In 1982, the Minnesota Department of Natural Resources (MN DNR) Nongame Program began a project to reintroduce Trumpeter Swans to select wetlands of westcentral Minnesota.

Becker County was chosen as the release area for the reintroduction project not only for its abundance of wetlands, but also because Tamarac National Wildlife Refuge offered many prime wetlands that were closed to hunting. A survey method was developed to evaluate wetlands and arrive at a priority list for potential Trumpeter Swan release sites.

Sites were carefully chosen to not only provide food and cover for the released pair, but also for the availability of nesting sites, brood cover, and loafing areas in the event that the pair returns to nest. Information on lake size, depth, bottom composition, and the abundance and variety of invertebrates and wetland vegetation was gathered for each wetland surveyed. Additional information was recorded regarding lakeshore development, hazards on or around the lake, and hunting, fishing, and leeching activities. This survey is further detailed in Appendix A.

The various wetland characteristics were given a numerical value according to their quality (Appendix B). Values for all wetland characteristics were then added to arrive at a final rating. The final rating was used to rank all potential release sites.

To date, 73 wetlands have been surveyed in Becker, Nicollet, and Ottertail Counties for the reintroduction effort. Thirty-three of those sites are considered to be suitable release sites and have been placed on a priority list according to their rating.

Wetlands generally have high ratings when submergent and emergent vegetation are plentiful. A wetland with a high rating, however, may be rejected if it has a rich waterfowl hunting history with a high probability of swans picking up spent lead pellets while foraging for grit. Hunting history and bottom composition of the wetland should be used to determine the likelihood of swans ingesting lead shot. Besides the presence of lead shot, wetlands are rejected as release sites primarily due to a lack of adequate emergent or submergent aquatic vegetation, a high level of activity on the wetland, or the presence of power lines across flight paths in and out of the wetland.

Those sites successfully supporting swans for a year may be reused in other release years if returning swans do not choose those sites as nesting territories. The lakes must also be greater than 1 mile from a wetland occupied by a territorial pair. Release sites in areas closed to waterfowl hunting should be relied on heavily, especially during drought years when lead poisoning becomes a major cause of mortality.

Thus far, only a few swans have returned to their specific release site. They more often return to the general release area. This does not discount the need to complete these surveys. We need to provide the swans with the best quality wetlands available to maintain the health of the newly-released swans and to accommodate swans that may return to nest at the wetland.

This method of releasing 2-year-old Trumpeters as pairs to select wetlands has proven to be an effective method of reestablishing the Trumpeter Swan to Minnesota. There has been a 43 percent survival rate for the 65 swans released in the first 2 years, and a few pairs have already nested and raised cygnets. Barring any major catastrophes, we should reach our goal of 15 breeding pairs within the next 5 years.

APPENDIX A. TRUMPETER SWAN WETLAND SURVEY FORM.

LAKE NAME - **SURVEY DATE -**

LAKE SPECIFICATIONS:

COUNTY, TOWNSHIP AND SECTION -
ACREAGE -
DEPTH - Maximum depth is noted for the lake if it available. Otherwise, depth at the sample site is noted.
DREDGE SAMPLES - An Eckman dredge is used to sample bottom soil textures. If appropriate, the depth of the layer is also noted. Texture categories were adopted from Howe and Carlson (1969) and are as follows:

1. Rock, ledge - Rock formations appearing as outcrops not broken into boulders or large slabs.
2. Boulders - All rock over 10 inches in diameter other than ledge rock.
3. Rubble - Rock from 3 inches to 10 inches in diameter.
4. Gravel - All rock material between 1/8 inch and 3 inches in diameter.
5. Sand - Inorganic particles from 2.0 - 0.5 mm in diameter. Sands or sandy loams may be distinguished by a gritty feel when rubbed between the fingers and by their lack of consistence or stickiness.
6. Silt - Inorganic particles which are 0.5 to 0.002 mm in diameter. Silts and silt loams usually are not as sticky as clays and have a more velvety feeling when rubbed between the fingers.
7. Clay - Inorganic particles less than 0.002 mm in diameter. Clays usually are somewhat sticky and have more consistence than silty material.
8. Loam - A mixture in varying percentages of sand, silt, and clay. Loam soils or bottoms may be designated by the dominant type present - e.g., silt loam, clay loam, or sandy loam
9. Muck - Well decomposed material largely of organic origin, usually has a deep black color and is quite soft and without consistence.
10. Peat - Partially decomposed organic material, usually of brownish color and has more consistence than muck.
11. Detritus - Organic material in which large pieces, such as sticks, leaves, remnants of decayed aquatic plants, etc., form at least 85 percent of the total mass of soil.
12. Marl - A whitish calcareous material composed principally of carbonates derived from photosynthetic activity and accumulated mollusk shells.

FOOD/COVER SPECIFICATIONS:

INVERTEBRATES - A listing is made of the inverte brate types observed in sampling amongst lush beds of submergents or the bases of emergents.
PLANT PROFILE - Vegetation sampling methods are adapted from Howe and Carlson (1969).

Submergents: At each sampling station, a metal rake was used to recover samples of submerged vegetation. Four samples were taken within a 6-foot radius. Density ratings for each species represent the amount of that species recovered on the four casts of the rake. In clear, shallow water, recovery values are estimated. The following density values are used:

Recovery Value	Density
5 (rake loaded on all 4 casts of rake)	Rank
4 (present on all 4 casts)	Lush
3 (present on only 3 of 4 casts)	Moderate
2 (present on only 2 of 4 casts)	Scattered
1 (small amount on only 1 of 4 casts)	Sparse

Emergents: Density ratings of emergent vegetation were based on visual estimations. The area should be considered as the area within the reach of the rake in four different directions. The following density values are used:

Recovery Value	Density
4	Abundant
3	Common
2	Occasional
1	Scarce

NESTING SITES - General notes should be made regarding the quality and availability of potential nesting sites.
BROOD COVER - General notes should be made regarding the quality and availability of potential brood cover.
LOAFING SITES - General notes should be made re garding the availability of potential loafing sites.

DEVELOPMENT/ACTIVITY:

OWNERSHIP - Ownership of the surrounding parcels of land should be noted.
BOAT TRAFFIC - History of the lake should be obtained to determine the frequency of boat traffic on the lake.
HUNTED - History of the lake should be obtained to determine both past and present waterfowl hunter use. The hunting history of a wetland should be derived from many sources including landowners, state or federal game personnel, and local Conservation Officers. Then there is a greater likelihood of sifting out a biased report from a person excited by the possibility of having Trumpeter Swans on the wetland.
FISHED/LEECHED - History of the lake should be obtained to determine whether the lake is fished or leeched.
ACCESS - The method and ease of access to the lake should be noted.
POWER LINES - The presence and hazards of any powerlines adjacent to the lake should be noted.
DAMS/CULVERTS/BRIDGES - The presence of any of these structures on the lake should be noted.
EROSION - The presence and extent of erosion bordering the lake should be noted.
UNDER MANAGEMENT? - Private or public management of the lake or surrounding parcels of land should be noted.

MUSKRAT SIGN - Evidence of muskrat use of the lake should be noted since Trumpeter Swans may nest on muskrat houses.
OTHER WILDLIFE - Other wildlife known to use the lake area should be listed.
PROXIMITY TO OTHER BODIES OF WATER - Other lakes within a few miles of the lake may be listed.

RATING: see Appendix B.

*** ADAPTED FROM MINNESOTA DEPARTMENT OF CONSERVATION. 1969 REVISION.**

APPENDIX B. A METHOD OF RATING POTENTIAL TRUMPETER SWAN RELEASE SITES.

RATING CATEGORY	RATING
Acreage	1 - Less than 20 acres 2 - Greater than 20 acres
Lake Bottom	1 - 1" - 4" sediment on lake bottom 2 - 4" - 1' sediment on lake bottom 3 - 1' + sediment on lake bottom
Invertebrates	1 - Scarce 2 - Moderate, typical 3 - Abundant
Vegetation	Submergents of excellent food value (Appendix C) rated mostly: 1 - Scattered to Moderate 2 - Moderate 3 - Moderate to Lush **add 1** - For valued plants available throughout the lake Emergents (cattail/sedges/rushes/wild rice) rated mostly: 1 - Occasional 2 - Moderate 3 - Abundant **add 1** - For interspersion throughout lake or islands away from shore
Landowners/Privacy	1 - County forfeit land, State land, USFWS Waterfowl Production Area Tribal Land 2 - Five + private landowners 3 - One to five private landowners, Tamarac National Wildlife Refuge, or State Park **add 1** - For no roads adjacent to lake
Waterfowl Hunting	1 - Has a public access or regular waterfowl hunting pressure 2 - 1 - 5 hunting episodes per season 3 - No waterfowl hunting or closed to waterfowl hunting
Leeching	1 - Leeched 2 - Not leeched

The values for each rating category are then added to arrive at a final rating. The final rating for each wetland is then used in ranking the potential release sites.

APPENDIX C. PREFERRED SUBMERGENT AQUATIC VEGETATION USED TO DETERMINE POTENTIAL TRUMPETER SWAN RELEASE SITES.

COMMON NAME	SCIENTIFIC NAME	FOOD VALUE TO WATERFOWL[1]
Watershield	Brasenia Schreberi	Fair-Excellent
Muskgrass	Chara spp.	Good-Excellent
Lesser duckweed	Lemna minor	Fair-Excellent
Star duckweed	Lemna trisulca	Fair-Excellent
Bushy pondweed	Najas flexilis	Excellent
Water smartweed	Polygonum amphibium	Good-Excellent
Smartweed	Polygonum spp.	Good-Excellent
Sago pondweed	Potamogeton pectinatus	Excellent
Greater duckweed	Spirodela polyrhiza	Fair-Excellent
Wild celery	Vallisneria americana	Excellent
Wild rice	Zizania aquatica	Excellent

[1] From Martin, A. C. and F. M. Uhler. 1951.

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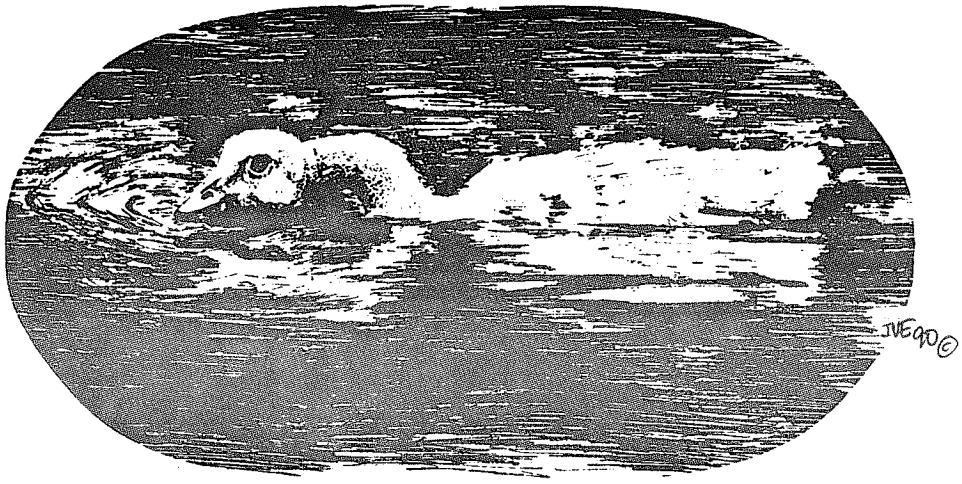
Minnesota Department of Conservation, Department of Game and Fish, Section of Technical Services. 1969 Revision. Game lake survey manual, Federal Aid Project FW-1-R. 71 pp.



ONTARIO TRUMPETER SWAN RESTORATION PROGRAM -- PROGRESS REPORT 1989

Harry G. Lumsden

The year 1989 was the most disappointing yet for the Ontario Trumpeter Swan Restoration Program. In January, five cooperators were caring for four mature pairs, and an additional pair with a 3-year-old female. At the end of that month, three mature females and one male were dead. The cause of death for two, which were rushed to the Veterinary College at Guelph, was infection with the bacterium Clostridium perfringens.

With the help of Ken Kalenak, some of the losses were replaced in March with breeding-age Trumpeters from the United States. This was, however, too late to form pair bonds for breeding in 1989. One mature pair, placed in a new home in the fall of 1988, failed to breed, but the 3-year-old female laid 12 eggs in one clutch. These eggs were removed as they were laid, and put under Mute Swans for incubation, but they proved to be infertile.

We entered 1989 with four feral Trumpeters on the northwest shore of Lake Ontario. Three were foster-raised by Mute Swans in 1986, and the fourth, a wild-caught bird, escaped from the breeding program. Two foster-raised birds had formed a pair bond in 1988 and behaved as if they might breed. However, on the night of 21 April, the female flew into hydro wires and was killed. The remaining foster-raised male has been with a Mute Swan since the summer of 1988, and may have formed a pair bond. No female Trumpeter was available as a mate for this bird. Out of five foster-raised Trumpeters which have reached 3 years or older, this was the only one to pair with a Mute Swan.

The five surviving wild-caught Trumpeters released at the Lee Brown Marsh on Long Point in 1988 wintered in Pennsylvania. Three returned to Long Point in the spring and summer of 1989. One was found dead on the Prairie Lake Road near Wawa, and one has not been reported since 14 December 1988. One of the two captive-raised Trumpeters released with the wild-caught birds returned to Long Point in May, and again in June 1989. The other died of lead poisoning.

In the 7 years since the restoration program started, 71 fertile eggs have been placed in Mute Swan nests for foster raising. Of these, 66 percent hatched, a proportion well within the range for wild Trumpeters. However, of the 47 cygnets hatched, only 11 (23 percent) survived to flight stage. This is well below the performance of wild Trumpeters in the west, and may be due in part to the presence of snapping turtles in this part of Ontario. A comparison of longevity of the flying cygnets with that calculated for the Grand Prairie population shows that survival was very similar (Table 1) (Turner 1981).

A shortage of eggs has slowed progress toward establishing Trumpeters again in Ontario. We have had an average of about 10 fertile eggs per year for use in Ontario. Had we been able to use 50 eggs per year, it is likely that we would now have breeding Trumpeters in the wild in the Province.

Table 1. Survival rate of fostered Trumpeter Swans in Ontario compared with survival in the Grande Prairie population (Turner 1981).

Age	Number entering period	Number surviving period	Ontario survival (%)	Grande Prairie survival (%)
1st year	11	7	64	43
2nd year	7	5	71	71
3rd year	5	4	80	80
4th year	2	1	50	50
5th year	1	0	0	82

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WISCONSIN'S TRUMPETER SWAN RECOVERY PROGRAM

Sumner W. Matteson

The Wisconsin Department of Natural Resources (DNR) completed its Trumpeter Swan Recovery Plan in 1986, and began implementation in 1987. The recovery goal is to establish at least 20 breeding and migratory pairs of Trumpeter Swans in Wisconsin by the year 2000. The recovery plan covers three strategies: (1) cross-fostering, (2) captive parent-rearing of cygnets, and (3) isolation-rearing of Alaskan cygnets. These recommended techniques have showed some degree of success in other Trumpeter Swan reintroduction programs, and have provided us with considerable latitude in working towards the
recovery goal.

The project began with cross-fostering. Our experience proved to be quite negative. In 1987, a total of 20 Trumpeter Swan eggs was placed under four pairs of Mute Swans. No cygnets fledged (Mossman and Matteson 1989)[1].

In 1988, a total of 15 Trumpeter Swan eggs was placed under three Mute Swan pairs. Although all of the eggs hatched, only two cygnets survived to fledge, and both suffered from lead poisoning (Mossman and Matteson 1989)[1]. Cross-fostering was discontinued in 1989. It has not proven cost-effective, given our limited resources.

A second prong of the recovery approach was the captive parent-rearing of cygnets. It is expected that three young, captive pairs in southern Wisconsin will eventually breed and produce young, perhaps beginning in 1990 or 1991. Their cygnets would be held in captivity until age 23 months, then paired with unrelated birds and released at selected wetland sites.

Currently, the major emphasis in the program involves the release of 23-month-old subadults, which originated as eggs from either local avicultural or wild Alaskan parents. Eggs are hatched in incubators, and the cygnets raised for 3 months with minimal human contact. They are then wing-clipped and released to enclosed ponds, where they remain until age 23 months. When they reach this age, they are released as wing-clipped pairs in the wild, at potential breeding sites.

In the future, the program could change significantly depending on the outcome of ongoing research involving the release of cygnets imprinted on life-sized decoys, raised in a semi-wild setting, and allowed to fly free at fledging (Abel 1991).

The year 1989 marked the first of 8 years that Wisconsin DNR personnel planned to collect Alaskan Trumpeter Swan eggs. The 1989 goal was to collect 60 Trumpeter eggs, 40 for the Wisconsin restoration program, and 20 for the Michigan restoration program. Randy Jurewicz (Chief, Wisconsin DNR Bureau of Endangered Resources Nongame Section), Joe Johnson (biologist, Kellogg Bird Sanctuary, Michigan), and I flew in a Cessna Citation 501 SP, piloted by Terry and Mary Kohler of the Windway Capital Corporation, Inc. We departed on 5 June for a 12-hour flight to Fairbanks.

On 6 June, U. S. Fish and Wildlife Service (USFWS) pilot/biologist Rod King flew Randy and me to a base camp at Minto Flats, a vast wetland complex several thousand acres in size. Here, at a USFWS cabin, Randy heated hot water to prepare three black box-like suitcases (loaned by the Minnesota DNR) that had been adapted to house Wisconsin's 40 eggs (14, 14, and 12 eggs, respectively). Randy also "baby-sat" two wooden crates designed and built by Joe Johnson that would receive the first 20 eggs collected.

The collection procedure was the same adhered to by Minnesota DNR during the previous 3 years, when Trumpeter eggs were collected at Minto Flats. The plane taxied as close as possible to each nest, located previously by Rod King. At each nest, each egg was marked with a letter signifying the individual nest, and a number (beginning with 1), until all eggs in the nest were assigned with the letter and numbered sequentially. Each egg was measured with a caliper, and candled with a field candler provided by the Minnesota DNR.

Candling consisted of: (1) holding the egg vertically in the palm of the left hand, with the rounder, larger end of the egg facing toward the sun, (2) holding a coffee can (ends covered in black rubber with holes cut to fit the egg) raised toward the sun, allowing light to illuminate the air cell when the egg was held in front of the can, and (3) examining the egg to determine if there was a sharp demarcation line between the air cell and the dark mass of the embryo, and if much of the egg appeared dark when held up to the light; this indicated a viable embryo in the later stages of development. Nonviable or "dead" eggs often appeared largely translucent or opaque when held up to the light, or had an irregular or poorly defined demarcation line between the air cell and embryo, as well as translucent areas and no discernible blood vessels.

In accordance with USFWS guidelines, two fertile eggs were left in each nest. Each collected egg was placed in a small suitcase. Once in the plane, the eggs were transferred into one of the three large black suitcases. When a suitcase was full, we flew back to base camp. Randy met us to take the full suitcase and hand us an empty one.

[1]**Editor's Note:** Mossman and Matteson (1989) was presented at the conference, but the paper was unavailable for these Proceedings.

By 3:00 pm, we had collected Michigan's 20 eggs. At a prearranged time, Joe Johnson arrived at the cabin in a chartered bush plane and transported the eggs back to his motel room.

By 11:30 pm, all 60 eggs had been collected. Three of these eggs were unknowingly collected from a Tundra Swan nest. Joe Johnson also later detected (en route to Milwaukee), by smell, that one of the collected Trumpeter eggs was addled, leaving Wisconsin with a total of 36 viable Trumpeter eggs. It took a total of 13 hours to collect all 60 eggs. This was longer than expected, because 14 of 26 Trumpeter nests contained one or more addled eggs. An extensive and rapid snow pack melt had resulted in the flooding or near-flooding of several nests. The clutch size at the 26 Trumpeter nests ranged from 4 to 6, with a mean of 5.1 eggs/nest. A total of 101 of 134 (75 percent) of the Trumpeter Swan eggs examined were judged to be viable (including the one egg later detected by Joe Johnson's nose as "bad").

The return trip to Milwaukee took 10 hours. A Radio Shack digital thermometer with a heat sensor attached to a cord proved reliable in providing accurate temperatures for each of the Wisconsin suitcases. We placed the sensor near the center of the suitcase and recorded readings hourly from outside the suitcase. The temperature of the three Wisconsin boxes averaged 92.5° F (range = 88.9-95.6), 90.8° F (range = 80.0-97.2), and 86.6° F (range = 79.9-89.2). We were especially concerned about the readings of the third suitcase, because Minnesota DNR personnel had advised keeping the temperature reading in the low 90's during the flight.

As it turned out, our fears were unwarranted. Of 39 eggs placed into two incubators at the Milwaukee County Zoo, 38 (97 percent) hatched – all between 11 June and 27 June. The Tundra Swan eggs were the first to hatch. The Trumpeter Swan eggs began to hatch on 13 June.

Credit for the excellent hatching success goes, in large part, to Milwaukee County Zoo curator Ed Diebold and his staff. The contribution of the Kohlers to our effort was also important, because of the few stops needed during the speedy return trip from Alaska to Wisconsin. Within 13 hours of collecting the last egg, all Wisconsin eggs were in zoo incubators. And, who knows, maybe a little skill was exhibited in the field candling as well.

Last, but certainly not least, if it hadn't been for Rod King's expertise in flying onto and off of the many lakes we visited, none of the above would have been possible.

In Michigan, 19 of the 20 eggs successfully hatched. In total, 54 of 56 (96 percent) Alaskan Trumpeter Swan eggs placed in incubators successfully hatched. All three Tundra Swan eggs also hatched.

Except for 10 Alaskan cygnets used in the experimental research project by Abel (these birds were flown to the Crex Meadows Wildlife Area in northwestern Wisconsin at age 26 days), the remaining Trumpeter Swan cygnets were maintained at the Milwaukee County Zoo until age 5 weeks, at which time they were transported to two captive-rearing sites in southern Wisconsin.

All in all, 1989 was a very good year. Thirty-two of 35 Alaskan cygnets survived, nine in the experimental flock and 23 in the captive flock. The experimental flock also included eight cygnets hatched from eggs produced by captive parents. On 14 April, the first six captive-reared subadults were released in the vicinity of Crex Meadows. Three have survived.

In addition, for the first time in over 100 years, a pair of Trumpeters has nested in Wisconsin and apparently produced two young. This pair, refugees from the Hennepin Parks flock, nested in western Wisconsin in 1989. This is a trend that began in 1985 when a Hennepin Parks pair displaced a pair of Mute Swans on the Gordon Flowage in Douglas County, northwestern Wisconsin.

During the spring of 1990, a total of 18 subadults will be released. The experimental release of cygnets will continue, and more cygnets will also be added to the captive flock for eventual release as subadults. And, perhaps Trumpeters from Minnesota will continue to come to Wisconsin. The influx of these birds gives new meaning to our Department of Tourism's slogan: "Escape to Wisconsin."

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MICHIGAN'S TRUMPETER SWAN RESTORATION PROGRAM

Wilbur C. (Joe) Johnson

In 1986, the Michigan Department of Natural Resources Nongame Program embarked on an ambitious Trumpeter Swan Reintroduction Program, in cooperation with the Michigan State University Kellogg Bird Sanctuary, The Trumpeter Swan Society, The U. S. Fish and Wildlife Service (USFWS), several zoological parks, private aviculturalists, and many Habitat Foundations in Michigan. As a cooperating state in the North American Plan, Michigan is attempting to establish at least two, and possibly three, self-sustaining populations of Trumpeters Swans by the year 2000. Each population will number about 100 swans. The reintroduction of this species will enhance Michigan's natural resource heritage, restore diversity, and, perhaps most importantly, create a symbol that reflects upon the quantity and quality of our wetland resource base.

Methods include, but are not limited to: (1) cross-fostering with feral Mute Swans, (2) releasing 2-year-old swans from both avicultural and Alaskan stock, (3) selectively placing pinioned pairs, from which the young would be allowed to fly free, and (4) possibly translocating wild-caught Pacific Coast Trumpeters.

During recent waterfowl inventories, biologists counted an excess of 1700 feral European Mute Swans in Michigan. It seemed logical to attempt to cross-foster Trumpeters under this nonnative species. During the field seasons of 1986 through 1989, a total of 44 viable Trumpeter eggs were placed under Mute Swan females. An acceptable number, 31 eggs, hatched. However, only six cygnets survived to flight. The technique worked, but not well, with much of the failure attributed to predation losses and parental abandonment.

In 1987, in recognition that cross-fostering was an unproven, experimental method, Michigan began to acquire parent-reared Trumpeter cygnets for release as 2-year-olds. If pair bonds develop, the birds are released as pairs. If bonds do not develop, they are released as sibling groups on adjacent wetlands, where natural pairings should occur when they mature. The first release took place in 1989, when two "pairs" and five siblings were released in southwest Michigan.

The second release of 12 swans is scheduled for 1990, and 18 cygnets were captive-reared in 1989 for release in 1991. The suspension of cross-fostering allowed biologists to redirect egg resources to captive rearing. The cygnets were produced at Kellogg, the Kansas City Zoo, and the Detroit Zoo. The goal is to release 20 swans per year through 1993.

A second rear-and-release program involving Alaskan stock was initiated in 1989. Swans from this program will be used to introduce a second population in another part of Michigan. By attempting to keep the two populations separate, biologists will be able to study any differences in survival, migration, and productivity between avicultural and Alaskan bloodlines.

THE ALASKA CONNECTION
COLLECTION AND REARING HIGHLIGHTS - 1989

Mid-afternoon on 5 June 1989, biologists from Wisconsin and Michigan left for Minto Flats, Alaska on a joint venture to collect 60 Trumpeter Swan eggs, 20 for the Michigan restoration program and 40 for Wisconsin. A private jet was provided by the Windway Foundation of Cheboygan, WI. Staff from the Minnesota Department of Natural Resources provided guidance from their previous experiences in egg collection techniques, handling, and transportation. This allowed Wisconsin biologists to plan and execute an extremely effective trip. An unprecedented 95 percent of all eggs collected (97 percent of viable eggs) hatched. This can probably be attributed to an expedient return from collecting to our home states.

Egg collection and handling

A significant number of Trumpeter Swan nests near Minto Flats were at or near inundation on 6 June, due to unanticipated rapid snow melt and runoff from nearby mountain ranges. Approximately 1/4 of the nests visited were determined to contain two or fewer viable eggs, and none were collected. Approximately 3/4 of the nests contained three or more viable eggs, and one to six eggs were removed. At least two viable eggs were left at each site.

A total of 60 eggs were removed from 21 nests. The average number taken was 2.86 per nest. Clearly, nest failure due to flooding was not uniform throughout the wetland. Nonetheless, a grueling 14 hours were spent collecting and tending the eggs on Minto Flats.

Each nest was given an alpha designation, and each egg within the nest a numeric designation. The 20 eggs allocated to Michigan were taken from seven of the first eight nests visited (A through H). Collection occurred between 10:40 am and 3:00 pm on 6 June. A second plane was chartered to bring the first 20 eggs back to Fairbanks, awaiting the return of the Wisconsin biologists and the remaining eggs.

Communications with the biologists in the "bush" indicated a return to the Fairbanks Airport at approximately 1:00 am. By 1:30 am, the flight crew, all three biologists, and the eggs were in the air for the trip home. Complete changes of hot water surrounding the eggs were made at approximately 3-hour intervals, at Juneau, Great Falls, and Milwaukee. Individual egg case temperatures were boosted in flight by recycling

water back through the plane's coffee machine. During the first 5 hours of the flight, egg case temperatures ranged from 85° F to 90° F, approximately 5° below the desired level. The transfer cases were constructed and insulated to accommodate embryos that had been incubated 20 to 25 days. These were embryos capable of generating enough heat to potentially overheat the egg case. No matter how hot the water was, or how frequently it was changed, we were unable to maintain optimum temperatures in one Wisconsin and both Michigan cases. In-flight modifications to the amount of insulation between the hot water bottles and the core of the cases corrected this deficiency, resulting in temperatures maintained between 92° F and 95° F for the remainder of the return flight.

We believe the outstanding hatchability of the eggs can be partially attributed to the expeditious return to our respective states. Total time lapsed between Fairbanks and the incubators in Michigan was 11 hours and 15 minutes! For the eggs returned to Michigan, the maximum time interval from nests on Minto Flats to the incubator was 28 hours (nest A). The minimum interval was 22 hours (nest H).

Incubation and hatch

Upon return to the Kellogg Bird Sanctuary on 7 June, all 20 eggs were candled, determined to be fertile, and placed in a Humidare Hatchette Incubator set at 99.5° F dry and 84-86° F wet. The eggs were turned automatically at 4-hour intervals. The blunt end of each egg was tilted toward vertical. We noted during the initial candling that the air cells were extremely small for eggs that theoretically contained 20-day-plus embryos.

We were confident that all eggs contained embryos, but, because of somewhat low temperatures during transport combined with nest flooding, a nagging question remained about them still being alive. The USFWS has developed a very sensitive egg viability testing device that is capable of detecting embryonic heartbeat and movement in any egg incubated more than 10 days. While we had taken this device all the way to the cabin on Minto Flats, strong winds apparently moved the entire cabin to such a degree that biologists could not be sure if the eggs contained living embryos at the time of collection. The eggs were allowed 24 hours to stabilize. Then, on 9 June, with a great deal of apprehension, all eggs were tested. To our amazement, movement and/or heartbeat could be detected in all 20 eggs. The eggs were tested in such a manner at weekly intervals until hatch. Success at this point depended on the ability to artificially incubate the eggs for an unknown length of time. The eggs were not washed. However, they were misted and randomly turned 180 degrees along their axis, with care taken to maintain the developing air cell as vertical as possible. As the respective hatch dates approached, we again became concerned with our techniques, as the air cells appeared to be exceedingly large (an indication of low humidity and excessive evaporation).

On 16 and 17 June, the first clutch of eggs hatched from nest D. While all four pipped, only three emerged completely from their shells. It should be noted that pipped or vocalizing eggs were transferred to a Jamesway, Model 252B, incubator for hatching (99° F dry, 86-88° F wet). Five additional clutches, totaling 13 cygnets, hatched between 21 and 23 June. The final clutch, from nest H, hatched on 25 and 26 June. There was only a 10-day span between the first and 20th egg hatched. Within-clutch synchrony was also narrow, with the last cygnet emerging within 24 hours of the first. To enhance this synchrony, eggs were placed in contact with one another, to insure "inter-egg communication."

Using a 33-day incubation span, and calculating back from the date of hatch, it was determined that at the time of collection and transport the oldest embryos were 22 days, the majority were about 16 days, and the youngest were only 12 days old. Trumpeter cygnets hatched by Wisconsin exhibited an almost identical patterm, with 15 June representing the first and 27 June the last date of hatch. Our favorite protagonist biologist from Wisconsin gave us reason for concern when he called 10 June to see how "our" eggs were doing, and announced that their first clutch was hatching. Unknown to him at the time, the first three cygnets to hatch (nest P) were Tundra Swans, which have a much shorter incubation period.

Clearly, the successful transport and hatching of these relatively young embryos has widened the window of time within which eggs could be collected from Alaska. Minnesota's experience with embryos over 25 days of age suggests that eggs should be collected at an earlier stage. Conventional wisdom indicated that eggs could be transported, with the greatest chance of success, between day 20 and day 25. Our experience in 1989 suggests that embryos between 11 and 22 days of incubation can be successfully transported and artificially incubated. It is not clear, however, whether or not 1989 was a typical year for clutch completion and initiation of incubation within the population of swans nesting on Minto Flats. A 10-12 day period is very narrow, but perhaps not unexpected in sub-arctic nesting waterfowl. With the above knowledge, it is clear why the air cells were small and egg case temperatures were below optimum.

Rearing

Each original clutch of eggs was hatched in a "pedigree" tray. Cygnets were toe-clipped to identify each family group. Family groups were combined into "sibling" groups of six or seven for rearing purposes. Precautions were taken not to combine any broods with more than seven days difference in age.

All cygnets were removed from the hatcher unit 24 hours after hatching. They were maintained for 3 days in a 20-gallon aquarium to insure that feeding and drinking behaviors were normal. "Sibling" groups were maintained in secure indoor brooders at night and outdoor brooders on warm sunny days for approximately 3 weeks. Supplemental heat was provided during this period. Between week 3 and week 5, groups were transferred to secure outdoor brooding pens without supplemental heat. These pens were 12 feet by 40 feet, with one quarter being shelter. Final rearing was accomplished by placing each group in an 8-foot by 12-foot water brooder in a remote pond choked with duckweed. At 14 weeks, all cygnets were wing-clipped and released onto this pond in their respective family groups. Group integrity remains strong in the artificially constructed "families."

Water and duckweek, consisting of Lemna, Spirodella, and Wolffia, were available at all times. Cygnets had daily access to swimming pools for the first 3 weeks, and free access to swimming areas 24 hours per day from 3 weeks on. Precautions were taken to prevent chilling due to exposure to swim-

ming water during the first 3 weeks. Commercial waterfowl food, consisting of 21 percent protein Duck Starter crumble mix, was fed the first 10 days. On day ten, 18 percent protein Duck Grower pellets (course ground) were blended with the Duck Starter. From day 13 until 5 weeks of age, Duck Grower became the sole source of artificial food given to the cygnets. From 5 weeks on, swans were fed equal parts of Duck Grower pellets, whole corn, and wheat. Grit was made available at 3 weeks of age, 2 weeks prior to offering whole grain.

Of the 19 cygnets hatched, 18 were reared and are currently being maintained as one flock. If pair bonds form between unrelated individuals, we will release them as such. If pairing does not occur, they will be released as sibling groups on adjacent wetlands, and assume that free choice pairs will develop when the birds mature. This group is scheduled to be released in 1991. This is an attempt to parallel the natural history of this species. Our limited experience to date suggests that permanent pair bonds do not develop in swans less than 2 years old.

With a little luck and a great deal of effort, Michigan will soon be releasing numerically significant numbers of Trumpeter Swans. There is broad and enthusiastic support for our program.

MINNESOTA TRUMPETER SWAN MORTALITY, JANUARY 1988 - JUNE 1989

Laurel A. Degernes, DVM and Rodney K. Frank, DVM

Mortality records kept on Trumpeter Swans (Cygnus buccinator) that have died in Minnesota have been incomplete in the past. Documented mortality losses in the 1980's have included shooting, powerline collision, lead poisoning, aspergillosis, predation, and other miscellaneous diseases and traumatic injuries (Gillette 1988, Gillette 1990, Kittleson 1990).

Necropsies (animal autopsies) have been conducted since 1986 on as many swans as possible at The Raptor Center, University of Minnesota. This is an effort to gain a better understanding of the problems faced by Trumpeters in Minnesota, as well as to provide a central clearinghouse for swan mortality data. Histopathology studies were also conducted, in selected cases, to determine or confirm the cause of death. Studies were performed at the Department of Diagnostic Investigations at the University of Minnesota. Prior to 1986, there was no clearinghouse for mortality data for the various agencies involved in Trumpeter Swan restoration. In addition, feedback from various diagnostic laboratories was often delayed, and there was inconsistency in the type of data collected and reported. The causes of swan mortality reported in this paper include data from Hennepin Parks, Minnesota Department of Natural Resources Nongame Program (MN DNR), and Wisconsin Bureau of Endangered Resources (cygnets housed in Minnesota refuges). There are undoubtably many swans unaccounted for and presumed dead ("missing in action") that have not been included in these results.

During the period January 1988 through June 1989, 74 Trumpeter Swans were necropsied at the Raptor Center (Table 1). Lead poisoning accounted for the highest number of deaths (40), including 35 that died during the fall and winter of 1988-89. While lead poisoning was listed as the cause of death in these birds, it is important to note that other secondary diseases or problems may have also contributed to the death of the swans (Table 2). Any one of the primary histologic (microscopic) diagnoses listed could have ultimately killed the swan, and, in some cases, a combination of problems was observed in these lead-poisoned swans. Some of the problems resulted from the direct toxic effect of lead on the tissues (kidney or vascular damage). Other diseases may be secondary to the immunosuppressive effect of lead toxicity, including bacterial septicemia (body-wide bacterial infection), aspergillosis (fungal respiratory disease), and schistosomiasis (a multi-organ invasion of fluke parasites).

One unusual problem observed in four birds that died during treatment (2 to 6 weeks) involved vascular damage to the upper half of the duodenal loop of the small intestine. The devitalized wall of the intestine ulcerated and bled, with clotted blood occluding the lumen of the gut.

The second leading cause of death was aspergillosis, an often fatal respiratory disease caused by Aspergillus fumigatus. Inhalation of fungal spores from moldy or damp food or bedding is the most likely source of the disease. Five swans died of the typical form of aspergillosis, in which the lungs and/or air sacs were extensively infiltrated by the fungal organism. It is interesting to note that the six swans that died of tracheal aspergillosis did not have fungal lesions elsewhere in the respiratory system. Perhaps Trumpeters are predisposed to tracheal aspergillosis due to the elongated, looped trachea within the keel. It is speculated that air flow patterns through these bends of the trachea may allow spores to settle out in certain sections. An overwhelming dose of fungal spores or a localized immune system failure may allow the fungal organisms to grow and occlude the airway.

Traumatic injuries accounted for a surprisingly small number of mortalities, with no documented shooting deaths reported during the period. Increased hunter education efforts on the part of MN DNR and Hennepin Parks is undoubtably responsible for this reduction in preventable mortality. During the 18-month period, there was one power line death, one swan hit by a car, one cygnet killed by a mink, and one cygnet that died of head injuries (probably inflicted by other swans).

Miscellaneous disease included one case of botulism poisoning in a Hennepin Parks subadult swan during the hot summer of 1988. An unusual nerve cell cancer (ganglioneuroma) was the cause of death in another subadult swan. This softball-sized tumor adjacent to the left kidney caused progressive weakness and weight loss. The bird was euthanized after the tumor was discovered during an exploratory surger

A 4-month-old free-flying cygnet died acutely when an aneurysm ruptured in the wall of the right atrium of the heart. Amyloidosis was diagnosed in three cygnets between 6 and 9 months of age. The excessive deposition of amyloid in liver, spleen, and other organs was thought to be secondary to chronic problems such as lameness, bacterial disease, or other stresses. Visceral gout was observed in one cygnet, the result of kidney disease. Waste products (urates) are normally excreted by the kidneys, but with kidney failure, these urates precipitate out in the joints and on the surface of abdominal and thoracic organs. The underlying cause of the kidney failure is unknown. Lameness resulting from a "slipped" hock joint tendon (Achilles tendon) resulted in the death or euthanasia of four cygnets. Another cygnet was euthanized after a 6-month lameness resulting from a bone problem in one foot.

Table 1. Causes of swan mortality in Minnesota: January 1988 - June 1989.

Categories of mortality	1988			1989 (6 mos)			Combined sub-categories	Category total	Category-% of total
	Cygnets	Adults	Total	Cygnets	Adults	Total			
Lead poisoning	-	10	10	7	23	30	40	40	54.1%
Aspergillosis									
a. Lung/air sac lesions	1	1	2	1	3	4	6		
b. Tracheal lesions	-	5	5	1	-	1	6	12	5.4%
Trauma									
a. Power line	-	-	0	-	1	1	1		
b. Mink predation	1	-	1	-	-	0	1		
c. Hit by car	-	1	1	-	-	0	1		
d. Head trauma	1	-	1	-	-	0	1		
e. Shooting	-	-	0	-	-	0	0	4	5.4%
Misc.diseases									
a. Amyloidosis	2	-	2	1	-	1	3		
b. Neoplasia (cancer)	-	1	1	-	-	0	1		
c. Botulism	-	1	1	-	-	0	1		
d. Visceral gout	-	-	0	1	-	1	1		
e. Aneurysm	1	-	1	-	-	0	1		
f. Slipped tendon	3	-	3	1	-	1	4		
g. Chronic lameness	-	-	0	1	-	1	1	12	16.2%
Congenital diseases									
a. Deformed legs	1	-	1	-	-	0	1		
b. Imperforate vent	1	-	1	-	-	0	1	2	2.7%
No diagnosis determined									
a. Scavenged/decomposed	2	-	2	-	1	1	3		
b. No lesions found	-	1	1	-	-	0	1	4	5.4%
								74 Total	

Table 2. Complications of lead poisoning in Trumpeter Swans[1].

Histologic Diagnoses	No./n	% of total
Renal nephrosis (kidney damage)	9/32	28.1
Fibrinoid vascular necrosis (blood vessel damage)	4/32	12.5
Aspergillosis	6/32	18.8
Bacterial septicemia (body-wide bacterial infection)	4/32	12.5
Schistosomiasis (multi-organ invasion by fluke parasite)	1/32	3.1

[1] Thirty-two of 40 lead-poisoned swans were examined histologically (microscopically). These primary or secondary complications of lead poisoning, in many cases, directly contributed to the death of the swan.

Congenital problems with deformed legs or imperforate vent (no vent opening for elimination of feces and urates) were diagnosed in two newly-hatched cygnets. The incidence of congenital problems is undoubtably higher than reported due to the difficulty in finding these cygnets before predation or scavenging.

Lastly, the underlying cause of death was not determined in three swans because of scavenging or advanced decomposition, and in one swan because of lack of any gross or microscopic abnormalities.

SUMMARY

Lead poisoning and aspergillosis accounted for over 70 percent of the mortality of Trumpeter Swans during 1988 and the first half of 1989. The loss of 42 adult and subadult swans will seriously set back restoration efforts in Minnesota. On the other hand, losses due to traumatic injuries such as power line strikes and shooting were very low, in part due to luck, but also due to increased public education and awareness.

The most important use of these mortality data will be to gain a better understanding of the perils facing Trumpeters in Minnesota, and to make changes to try to prevent the "preventable" losses. Increased hunter and public education, enforcement of the lead shot ban for waterfowl hunting, and changes in management practices in the refuges are all important to insure the future of these birds.

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THE MINNESOTA TRUMPETER SWAN LEAD POISONING CRISIS OF 1988-89

Laurel A. Degernes, DVM

Minnesota Trumpeter Swan (Cygnus buccinator) restoration efforts suffered a major setback during the winter of 1988-89. Drought conditions during the previous 2 years lowered water levels significantly, allowing swans to reach previously inaccessible lake bottoms containing spent lead shot. The shot was ingested along with sand and gravel required for digestion. Many of the affected swans came from one wintering area in Hennepin Parks that had not been hunted in over 23 years. Statewide, Minnesota banned lead shot for waterfowl hunting in 1987.

While lead poisoning is not a new problem for Minnesota Trumpeters, the incidence from January 1988 - June 1989 was significantly higher than previously reported (Gillette 1988). Lead poisoning was responsible for 23 percent of the documented deaths in 1987 (Degernes and Redig 1990) and 54 percent from January 1988 - June 1989 (Degernes and Frank 1991). Mortality studies for the past decade in other Trumpeter Swan populations in the western states have shown zero lead-related mortality in some states (AK, OR, WY), approximately 20 percent mortality in Idaho and Montana, and as high as 61.5 percent mortality in Washington (Blus et al. 1989).

METHODS

All sick and dead Trumpeter Swans owned by Hennepin Parks, Minnesota Department of Natural Resources (MN DNR), and Wisconsin Department of Natural Resources (WI DNR) were taken to The Raptor Center at the University of Minnesota for treatment or necropsy (animal autopsy).

Lead poisoning was diagnosed on the basis of clinical signs (weakness, depression, weight loss, green diarrhea, and variable neurological abnormalities), radiographic evidence of metallic shotgun pellets in the gizzard (the absence of pellets did not rule out lead poisoning), and hematology parameters -- including anemia, and blood lead levels exceeding 0.5 parts per million (ppm) (Degernes et al. 1989). Blood lead analysis was conducted by the Minneapolis Health Department using Anodic Stripping Method.

Swans that were dead on arrival (DOA) were thoroughly necropsied and tissues were collected from suitable carcasses for histopathology. Lead poisoning was diagnosed on the basis of gross and microscopic lesions and liver lead analysis (atomic absorption spectrophotometry).

RESULTS

The 57 swans that developed lead poisoning between January 1988 and February 1989 were part of an estimated statewide population of 240 birds (fall 1988 census of free-flying and captive swans). Included in this group were 44 swans that were admitted for treatment at The Raptor Center and 13 swans that were DOA. Seventeen swans were successfully treated and released to captive refuges and 27 swans died during treatment (one after 57 days of treatment).

Blood lead levels

All of the swans treated for lead poisoning had blood lead levels >0.5 ppm (Tables 1 and 2). The mean blood lead level upon admission was 2.41 ppm, yet any level exceeding 1.0 ppm is considered to be a seriously elevated lead level. The swans that were successfully treated had slightly lower initial blood lead levels compared to the swans that died, but the difference was not significant (One Way ANOVA, $p>0.05$).

Table 1. Initial and final blood lead levels.

Group	Initial blood lead (ppm[1]) mean + S.D./n/range	Final (pre-release) blood lead (ppm) mean + S.D./n/range
Combined[2]	2.41±1.33 / 42 / 0.54-7.09	
Treated/ released[3]	2.12±1.18 / 17 / 0.54-4.73	0.23±0.15 / 17 / 0.03-0.60
Treated/ died[4]	2.62±1.40 / 25 / 0.55-7.09	

[1] ppm = parts per million.
[2] Includes all birds that were alive at the time of admission.
[3] Includes those birds that were successfully treated and released.
[4] Includes those birds that died during treatment.

Tissue lead levels

Liver samples were collected from all swans at the time of necropsy except when unavailable due to scavenging. In these

TABLE 2. Categories of lead exposure, Minnesota Trumpeter Swans.

Category	Blood ld. Rng. (ppm)	Clinical signs	Prognosis	Patient summary tot.	surv.	died.	Pb[1]	ALAD[2]	TPP[3]	FPP[4]	ZPP[5]
I.	<0.50	Usually none	Good without RX	20[6]	20	0	0.06 + 0.02 20 0.03 - 0.11	4833.0 + 1068.0 16 2871 - 7470	93.8 + 27.8 20 60 - 160	34.2 + 23.8 20 14 - 83	60.0 + 8.2 20 46 - 78
II.	0.50 - 0.99	Subclinical signs: mild depression weight loss, anemia & green diarrhea	Good with Rx	6	3	3	0.68 + 0.11 6 0.54 - 0.78	644.4 + 347.8 5 433 - 1262	542.2 + 959.1 6 95 - 2490	358.2 + 766.5 6 16 - 1920	182.3 + 195.5 6 68 - 570
III.	1.00 - 1.99	More pronounced clinical signs as listed above plus weakness and neurological abnormalities	Fair to good with Rx	10	6	4	1.62 + 0.24 10 1.23 - 1.94	488.6 + 111.0 8 305 - 680	1234.0 + 738.4 7 262 - 2450	868.0 + 598.2 7 111 - 1880	366.0 + 146.2 7 154 - 570
IV.	2.00 - 3.99	Progressively worse clinical signs as noted above	Poor to fair with Rx	20	6	14	2.60 + 0.50 20 2.0 -3.55	394.2 + 327.0 18 69 - 1418	1320.0 + 1181.0 16 184 - 4170	953.8 + 988.2 16 59 - 3290	365.4 + 247.0 16 125 - 880
V.	>4.00	Similar to category IV	Usually very poor with Rx	6	2	4	4.85 + 1.13 6 4.05 - 7.09	318.8 + 148.7 6 229 - 618	845.4 + 583.3 5 518 - 1800	587.4 + 535.3 5 285 - 1460	258.0 + 48.3 5 233 - 340

[1] Pb - blood lead (ppm)
[2] ALAD - delta-aminolevulinic acid dehydratase (nM PBG/ml RBC/hr)
[3] TPP - total protoporphyrin (ug Proto/dl RBC)
[4] FPP - free (erythrocytic) protoporphyrin (ug Proto/dl RBC)
[5] ZPP - zinc protoporphyrin (ug Proto/dl RBC)
[6] 20 - normal captive refuge swans with no history of lead exposure

cases, clotted blood and/or humerus samples were collected. The average liver lead level was 17.6 ppm for all swans that were DOA or died within 24 hours after admission (Table 3). Values >6.0 ppm are generally considered diagnostic. However, two swans with lower liver lead levels (2.6, 4.5 ppm) had other gross and microscopic lesions consistent with lead poisoning. Two birds had liver lead levels >33 ppm.

Lead levels in the clotted blood samples were elevated (range 3.2-7.6 ppm), as were the lead levels in the three humerus samples tested (mean 11.1 ppm).

Table 3. Tissue lead levels (ppm).

Tissue	Mean + S.D.	n	Range
Liver	17.6 ± 10.1	13	2.6 - 34.8
Clotted Blood	5.4	2	3.2 - 7.6
Humerus	111.1 ± 1.3	3	9.6 - 12.1

Origin and month of admission

Fifty-three of 57 swans originated from Minnesota while one bird came each from Iowa, Wisconsin, and Washington. The largest concentration of swans (33) came from Sunny Lake in Carver County, located west of Minneapolis. This traditional swan winter refuge had been used by Hennepin Parks for over 20 years without a documented case of lead poisoning. Twenty-two of the Sunny Lake swans were wing-clipped or pinioned, most of which were cygnets or subadults being housed for MN DNR or WI DNR programs. The remainder were free-flying swans wintering at the refuge. All of the Sunny Lake swans were admitted during January-February 1989 (Table 4).

The remainder of the birds admitted for lead poisoning were free-flyers from other areas of the state, including 10 MN DNR swans from Becker County in western Minnesota. Four of these swans were from one lake, and they developed lead poisoning during June-July 1988 (two treated/released and two DOA). The remainder came in during the winter. Four Hennepin Parks swans from one lake in Wright County were caught in December after the lake froze and the birds became too weak to evade capture (all eventually died during treatment).

The out-of-state swans included one MN DNR male that had migrated to southwest Iowa (treated/released), one WI DNR cygnet that was part of the Mute Swan cross-fostering program (treated/released), and one Washington cygnet sent by Martha Jordan (died after 6 weeks of treatment).

The highest incidence of lead poisoning occurred during the month of January (36), followed by December (9), and February (4) (Table 4).

Breakdown by age, sex, flight status, and agency

Over two-thirds of the lead poisoned swans were adults (32) or subadults (8) (Table 5), with ages ranging from 6 months to 14 years. There was an even distribution of males and females, however nine cygnets that were treated and released were not sexed. Nearly 60 percent of the swans were free-flyers, while the remainder were wing-clipped or pinioned.

While all three of the agencies involved in Trumpeter Swan restoration in Minnesota and Wisconsin were hit hard by lead poisoning losses during the winter of 1988-89, Hennepin Parks suffered the greatest losses (22 birds) (Table 6). MN DNR losses included six subadults and six adults, while WI DNR lost five cygnets.

Table 4. Lead poisoning incidence by month (January 1988 - February 1989).

Month	Total	Percent of 18-mo. total	No. treated and released	No. treated and died	No. "Dead on Arrival"
January[1]	36	63.2	12	18	6
February[2]	4	6.8	0	2	2
March	0	0	0	0	0
April	1	1.7	0	0	1
May	1	1.7	0	0	1
June	2	3.4	0	0	2
July	2	3.4	0	0	2
August	0	0	0	0	0
September	0	0	0	0	0
October	2	3.4	1	1	0
November	0	0	0	0	0
December	9	15.8	2	6	1
Total	57		17	27	13

[1] 34/36 swans were admitted in January 1989.
[2] 3/4 swans were admitted in February 1989.

Table 5. Lead poisoning incidence by age, sex, and flight status.

Category		Number of Swans	Percent of total	No. treated/ released	No. treated and died	No. "Dead on Arrival"
I. Age						
	cygnet(<1 yr)	17	29.8	10	6	1
	subadult (1-2 yr)	8	14.0	1	2	5
	adult(>2 yr)	32	56.2	6	19	7
II. Sex						
	male	24	42.1	4	12	8
	female	24	42.1	4	15	5
	unknown[1]	9	15.8	9	0	0
III. Flight Status						
	free-flying	34	59.6	7	19	8
	captive (clipped or pinioned)	23	40.4	10	8	5

[1] Includes nine unsexed cygnets that were treated and released.

Table 6. Lead poisoning incidence by agency.

Agency	Number of swans	Percent of total	No. treated and released	No. treated and died	No. "Dead on arrival"
Hennepin Parks	24	42.1	2	18	4
MN DNR	17	29.8	5	4	8
WI DNR[1]	15	26.3	10	4	1
Washington[2]	1	1.8	0	1	0
Total	57		17	27	13

[1] 14/15 cygnets were being captively managed in MN when they developed lead poisoning.
[2] Cygnet sent to Minnesota by Martha Jordan, Snohomish, WA.

DISCUSSION

As blood lead levels increase, the severity of clinical signs (symptoms) worsen and the prognosis for successful treatment decreases. However, there were some notable exceptions, indicating that one cannot always predict the outcome of treatment based upon clinical signs and initial blood lead levels. Three birds with moderately low blood lead levels (<1.0 ppm) died during treatment -- two due to kidney failure and one following surgical removal of lead shot from the gizzard. Two cygnets with extremely elevated blood lead levels (4.7 ppm) were successfully treated and released.

The incidence of lead poisoning during the winter of 1988-89 was unusually high due to drought conditions lowering water levels state-wide, and the high concentration of swans wintering at Sunny Lake. Several conclusions can be made: (1) lead poisoning in Trumpeter Swans is a state-wide problem, (2) drought conditions will exacerbate the problem of lead exposure in swans due to increased accessibility of lead shot in lake bottoms, (3) lead shot that was deposited by hunters over 2 decades ago is still available to swans, and (4) soft and muddy lake substrate does not guarantee unavailability of lead shot for aggressive bottom-feeders such as swans.

While there was no difference in survivability between males and females, the cygnets had a higher treatment success than the subadults and adults. Most of the cygnets were wing-clipped and were monitored more closely and captured for testing and treatment earlier, resulting in a higher success rate. Since most of the cygnets were human-raised, it is possible that they were better able to withstand the stress of treatment and captivity than the free-flyers. Most of the free-flyers were very weak and debilitated by the time they could be captured, resulting in a much lower survival rate.

Hennepin Parks lost 20 percent of their flock due to lead poisoning in 1988-89, including 19 reproductively mature adults. Many bonded pairs were lost or split, which will seriously set back flock expansion. In contrast, MN DNR lost approximately 10 percent of their birds to lead poisoning. WI DNR lost approximately 23 percent of their newly-acquired flock of birds (all were cygnets).

SUMMARY

The 17 swans that were successfully treated for lead poisoning were maintained in lead-free refuges for 3 or more months to closely monitor their health. Follow-up blood tests and exams revealed that all were doing well. Six of these birds have subsequently been re-released, nine will remain in captivity until released as 2-year-olds in spring 1990, one pinioned female will permanently remain in captivity as a breeder, and one adult died of aspergillosis (fungal respiratory infection) 2 months after treatment. Long-term survivability and reproductive potential will be studied over the next few years.

The winter of 1988-89 was unquestionably disastrous for Trumpeter Swans in Minnesota. While the monetary costs of treatment have been extremely high (estimated at $75,000), donations have covered most of these costs. However, no monetary donation can replace the loss of genetic diversity and reproductive potential of the 40 swans that died of lead poisoning, and it may take many years for the population to recover.

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WAYS TO REDUCE THE POTENTIAL FOR LEAD POISONING IN TRUMPETER SWANS

Laurence N. Gillette

Lead poisoning has been a serious problem for Trumpeter Swans and all waterfowl for decades. Blus et al. (1989) concluded that, "Trumpeter Swans seem particularly vulnerable to lead-induced toxicosis associated with ingestion of shot and fishing sinkers because of their method of feeding and a seemingly high susceptibility to lead toxicosis." This is understandable, because Trumpeter Swans prefer to nest on permanent wetlands which have been and still are used extensively for hunting ducks. They feed frequently on the bottom by sifting through the sediments, which increases the possibility of ingesting lead compared with other waterfowl.

Data from Hennepin Parks and The Raptor Center support Blus' conclusion. Lead poisoning has become the number one cause of mortality for Trumpeter Swans at Hennepin Parks. Lead poisoning has become so prevalent that it may prevent the establishment of self-sustaining Trumpeter populations in Minnesota, unless something is done to counteract it. Given this pessimistic prediction, what can be done to reduce the probability of swans ingesting lead pellets? Suggestions presented in this paper pertain primarily to the Midwest. They may not be applicable universally.

Conversion from lead to steel shot for waterfowl hunting is the obvious first step. Numerous states, including Minnesota and Wisconsin, have already converted, and nationwide conversion is mandatory by 1991. Although this will undoubtedly help, recent experiences indicate that spent lead pellets will remain accessible to swans for decades under certain situations.

Lead pellets will be more readily available to swans in some marshes than in others, due to past hunting history and the composition of bottom sediments. Extremely "hot" marshes should be identified by bottom sampling or by review of the history of use, and swans should be chased off dangerous areas whenever they fly in. Usually, it only takes one or two chases before swans will abandon an area.

The behavior of Trumpeter Swans makes creating wetlands an attractive alternative for protecting swans in restorations. They are long-lived birds that develop permanent attachments to nesting marshes, and have well-defined traditions of use for wetlands during other times of the year. Once a pair has started nesting in a "safe" marsh, they will continue to do so. Restoration programs should make every effort to release swans on safe marshes, and using restored or newly-created wetlands is the most practical way to do so.

Creating wetlands just for Trumpeter Swans would be prohibitively expensive. Fortunately, wetlands are created for other reasons as well. Hennepin Parks restored many of its original wetlands soon after organization, and most of its Trumpeters are nesting on those restored areas. Sherburne National Wildlife Refuge has created 13 large impoundments in the last 15 years. None have been hunted, and many have potential for swans. Wetlands are being created throughout western Minnesota throughout the Farmland Initiative, as will be described by our next speaker. Sufficient lead-free wetlands are available for Trumpeter nesting marshes, if we can get the swans to use them. For restoration projects, judicious releases and occasional reinforcement of use patterns should be adequate to do the job.

Safe nesting marshes are only part of the picture. Trumpeters also need lead-free staging and wintering sites. Although I believe swans can be directed or attracted to "safe areas," it requires a greater level of commitment than has been demonstrated for most restoration projects. Managers hope they can simply release swans and have them fend for themselves. This will not work in areas with high lead levels, and that includes most of the Upper Midwest.

Staging areas are those locations where Trumpeters congregate in the fall prior to migration. Maintaining a few captive swans in a lake or wetland and providing food is usually sufficient to attract most of the swans from the surrounding area. Staging areas will attract birds from late August through freeze-up in December. Hennepin Parks maintains several staging areas on lakes with high visibility but restricted public access. They become popular viewing areas during the fall and are relatively inexpensive to maintain, since the only expense is a few bushels of corn per week and the time required to put it out.

Finally, selecting safe winter sites and getting swans to use them is essential. Maintaining open water in lead-free marshes and providing food and a few decoy swans is sufficient in northern areas, since most alternative sites will be frozen. But, this technique becomes expensive, and it is contradictory to our desire to establish a migratory population.

An easier approach may involve selecting nontypical wintering sites such as river channels below dams and warm-water discharge points where water is kept ice-free as a result of some other manmade function. Hennepin Parks has been providing swan food to people living near several of these sites. They volunteer to feed the swans during the winter and are helping to gradually develop a tradition of use within the swan

population. The time and expense is minimal for Hennepin Parks. (Techniques to induce swans to migrate to desired locations will be discussed in another paper.)

The combination of protected nesting, staging, and wintering sites is adequate to protect swans through 90 percent of their adult lives. Swans marked 54NC and 55NC provide an example of this type of movement (Figure 1). They have nested on a forestry impoundment in northern Minnesota for the past 4 years. Each fall, they return to Lake Rebecca Park Reserve during the first week of October, shortly after the cygnets reach flight stage, where they join as many as 20 other swans at the staging area. By late December, the pair and their young move to the Mississippi River, just downstream from a power plant where they spend the winter. People living along the river provide supplemental food. The family heads back north by mid March but does not return to the nesting marsh until mid April. It is unknown where they go during this time, but rivers and streams or seasonally-flooded wetlands are the only places with water. This routine has protected this pair and has not represented a financial burden to Hennepin Parks. Although the swans survive, it may not be considered a successful restoration by some because the swans are not entirely independent, and they do not migrate from Minnesota.

While the techniques described above may be adequate to protect adult swans from lead poisoning, they will not be adequate for subadults. Non-nesting subadults tend to wander erratically, especially when looking for secluded places to molt or trying to find suitable nesting territories. They explore a multitude of marshes which increases the chance of exposure to lead.

While we may not be able to protect Trumpeter Swans from exposure to lead pellets all of the time, we can reduce the risks by adjusting our management activities. Obviously, such extensive activity may not be appropriate or possible for swans in more remote regions, but it does provide us with an alternative, and it may be a price we will have to pay for depositing lead throughout the wetland environment.

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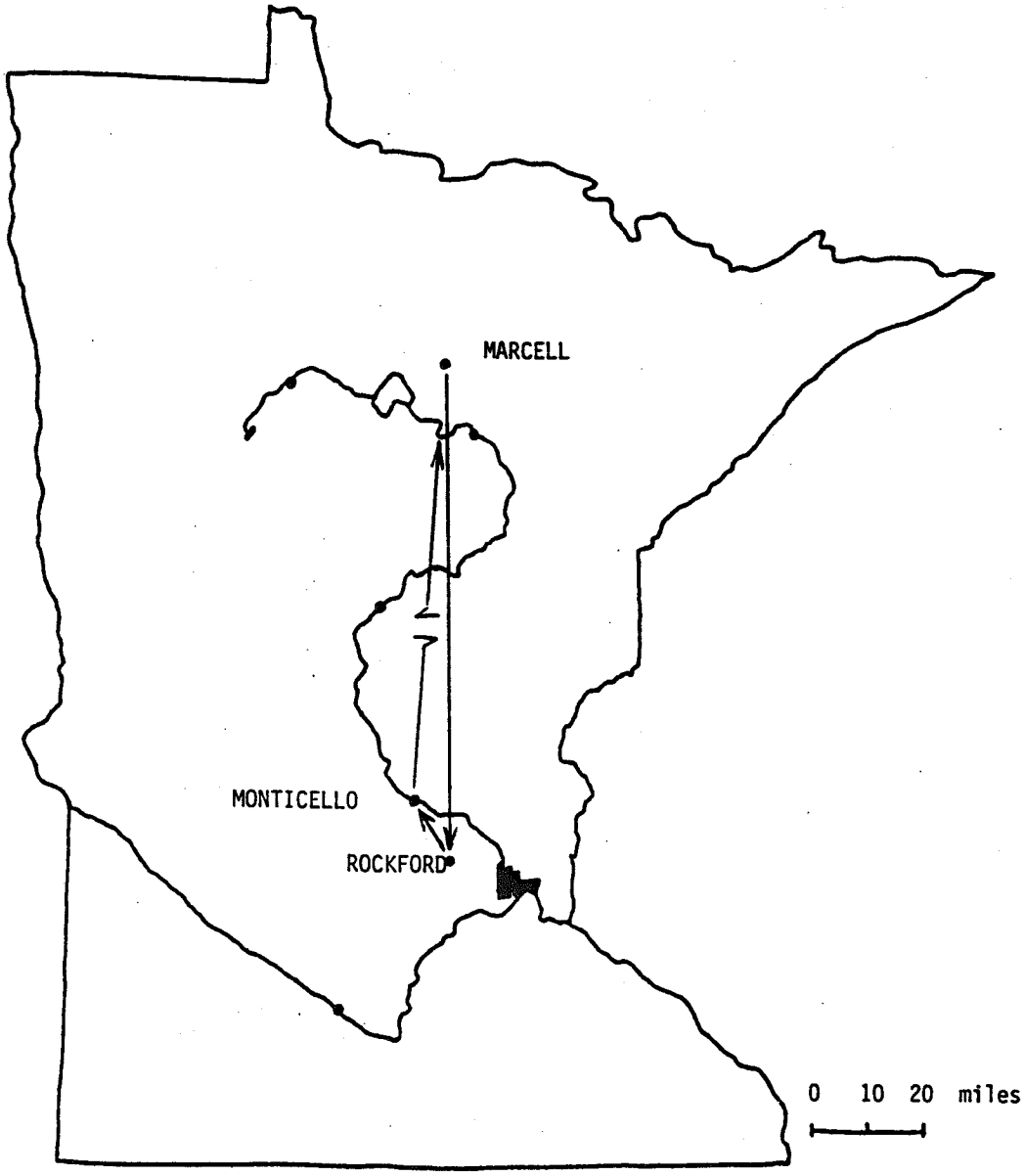

Figure 1. Annual movements of Trumpeter Swans with collars 54NA and 55NA.

THE NORTH AMERICAN WATERFOWL MANAGEMENT PLAN

David E. Sharp and James Bradley Bortner

INTRODUCTION

North America is blessed with an abundance and diversity of wetlands. Wetland complexes and associated uplands are some of the most productive lands on the continent. They are an integral part of the landscape, and they provide a wide array of ecological, hydrologic, social, and economic benefits. The loss of our Nation's wetland resources has been dramatic. By the mid 1970's, more than half of the wetlands in the 48 contiguous states had been lost (Tiner 1984). Regional impacts have been much more severe, exceeding 90 percent losses in many areas. In addition to the numerical destruction, the widespread degradation in quality through unwise land use practices has further threatened this precious natural resource (Anonymous 1988). During this period, many wetland-dependent wildlife populations also declined. In fact, duck numbers reached all-time lows in 1985.

The conservation community responded to these disturbing trends. However, for the most part, their efforts were generally the result of diligent, independent work. The signing of the North American Waterfowl Management Plan (NAWMP) brought the hope that all wetland interests could focus their efforts through innovative strategies to achieve a common goal. The NAWMP is a broad international policy agreement between the United States and Canada. The document was signed in May 1986 and has a 15-year horizon through the year 2000. It is continental in scope and addresses the precipitous decline of wetland habitats and dependent populations of wildlife. The cost of achieving its ambitious goal of a healthy wetland ecosystem will be large, currently estimated to exceed $1.5 billion for the habitat features alone (Anonymous 1986).

To aggressively tackle a continental environmental crisis of this proportion, the NAWMP calls for action from grassroots coalitions of federal, state, and private partners. These cooperative partnerships, or "joint ventures," help focus efforts to develop and implement new innovative strategies advocated by the NAWMP. For the conservation community, successful implementation and realization of its lofty goals would undoubtedly be the conservation challenge for the remainder of the century (Patterson and Nelson 1988).

The NAWMP not only recognized the ecological importance of the continent's wetlands, but also the hundreds of species of plants and animals that are linked to them. Unfortunately, extensive biological information related to population dynamics for many of these wetland-dependent species, including accurate data on population size, was extremely limited except for waterfowl. Therefore, the NAWMP identified interrelated waterfowl and habitat objectives. There were, however, several additional reasons for focusing on waterfowl, including: (1) the waterfowl population status also represents the population status of other wetland-dependent species, (2) waterfowl is a shared continental resource that is protected by international treaties, (3) waterfowl are of great economic importance, (4) these water birds have high visibility and interest, and (5) waterfowl are sensitive to environmental impacts that affect habitat quality.

GOALS AND OBJECTIVES

The ultimate goal of the NAWMP is to encourage the wise management and conservation of wetland habitats as indicated by waterfowl population size on a broad front in North America. To achieve this goal, it was necessary to set forth interrelated habitat and waterfowl population objectives. This comprehensive approach was critical in bridging the gap between the objective number of wetlands and the more subjective quality of wetland habitats. It was realized that special efforts would have to be made to protect and enhance buffer zones and pioneer new programs to strike a balance between the agricultural community and wildlife interests (Sparrowe and Patterson 1987).

Habitat component

Habitat objectives relate directly to establishing the initial habitat joint venture areas in the United States and Canada. The following habitat objectives were identified in the NAWMP.

1. To protect and enhance 3.6 million acres of habitat in the Prairie Habitat Joint Venture in Canada.
2. To protect and enhance 1.1 million acres in the Prairie Pothole Joint Venture in the United States.
3. To protect 686,000 acres in the Lower Mississippi Valley and Gulf Coast Joint Ventures in the United States.
4. To protect and restore 80,000 acres of habitat in the Central Valley Joint Venture in the United States.
5. To protect 10,000 acres of habitat in the Great Lakes-St. Lawrence Basin Joint Venture in the United States.
6. To protect 50,000 acres of habitat in the Atlantic Coast Joint Venture in the United States.
7. To protect 70,000 acres of habitat in the Eastern Habitat Joint Venture in Canada.

These preliminary estimates do not contain elements of all implementation strategies, and, as such, represent minimum values. Total acreage objectives will be refined or, in some cases, expanded in joint venture plans that will be finalized during the fall and winter of 1989-90. An additional joint venture, the Playa Lakes Joint Venture in the United States, will be added in October 1990. In the future, several other habitat areas of major concern that are identified in the NAWMP will be organized into joint ventures.

Waterfowl population component

The NAWMP identified continental population objectives for 36 species of waterfowl, including 29 species of ducks, five species of geese, and two species of swans. It set goals for a continental breeding population of 62 million ducks and a fall flight of more than 100 million ducks. In addition, wintering goals of six million geese and 152,600 swans were established. Specific objective levels were established for the 10 most common species of ducks, 15 populations of Canada Geese, five populations of Snow Geese, four populations of White-fronted Geese, two populations of Brant, two populations of Tundra Swans, three populations of Trumpeter Swans, and the Ross' Goose. These objectives should be sufficient to maintain populations of waterfowl and their habitats at levels acceptable to people who use and enjoy them.

The highest densities of breeding ducks are found in the central portion of the continent, and population estimates for this area are the most reliable index of abundance for several important species (Henny et al. 1972). Population estimates from the decade of the 1970's for the area annually surveyed serve as numerical objectives for the 10 most common duck species. Mallard, Pintail, and Black Duck populations were designated as immediate international priorities by the NAWMP. The top priority for protection is the prairie pothole breeding habitat for Mallards and Pintails in both the United States and Canada.

To a large extent, goose and swan populations nest in widely distributed areas across the continent, therefore reliable breeding population estimates were not available. In contrast to ducks, winter survey information is the most reliable index to abundance for many of these populations. Annual population estimates from the decade of the 1970's, or flyway-approved management plan population goals, serve as numerical objectives for these species. With respect to the Trumpeter Swan, the NAWMP set objective levels for three populations to be achieved and maintained by the year 2000 (Table 1).

Table 1. The 1980-85 population trend, 1985 fall index, and objective levels identified in the North American Waterfowl Management Plan for the three free-ranging populations of Trumpeter Swans.

Population	1980-85 Trend	1985 Fall index	Objective
Pacific Coast	Increasing	9,578	10,000
Rocky Mountain	No change	1,111	2,000
Interior	No change	209	600

IMPLEMENTATION STRATEGIES

Establishing joint ventures in high-priority habitat areas was an initial recommendation of the NAWMP. Partnerships have been formed in nine habitat areas (Table 2). To facilitate organization, coordinators were appointed in each habitat joint venture. In addition, special attention was directed at improving our databases for arctic-nesting geese and Black Ducks by establishing two international species joint ventures. This network of grassroots coalitions of federal, state, and provincial agencies that are integrated with private conservation organizations, businesses, and individuals serves as the mechanism for implementing the NAWMP.

The NAWMP advocates the use of five basic strategies to facilitate on-the-ground progress, including: (1) protection of habitat, (2) restoration of habitat, (3) creation/development of habitat, (4) enhancement of habitat, and (5) management actions.

The stepping-down of the NAWMP's objectives to the joint venture level and fine tuning these components to develop a unique approach for each joint venture will continue to evolve as we plot our progress toward meeting the objectives of the NAWMP. Changes will be incorporated into 5-year revisions of the NAWMP. The first revision is scheduled for 1990.

RELATIONSHIP TO THE TRUMPETER SWAN

The Trumpeter Swan has been designated as a species of international priority, and its management has been addressed in several resource management plans. The North American Management Plan for Trumpeter Swans, completed in 1984, incorporated many of the same goals, objectives, and strategies that were identified in National Species of Special Emphasis Plans, Regional Resource Plans, flyway management plans, individual population plans, and state/provincial plans. The winter population goals stated in these plans were similar and were used to establish the objective levels identified in the NAWMP. The 1984 plan for the Trumpeter Swan was endorsed by the four flyway councils for their respective regional initiatives. This plan is due to be revised in the near future, when it becomes fully endorsed, and it should be transmitted to the NAWMP Committee for consideration. After approval and compliance with environmental and regulatory review requirements in each country, it would be appended to the NAWMP. If agreement cannot be reached

Table 2. Habitat and species joint ventures established by the North American Waterfowl Management Plan (Anonymous 1986).

Country	Habitat joint venture	Coordinator
Canada	Prairie Habitat Joint Venture	A.J. (Sandy) Macaulay
Canada	Eastern Habitat Joint Venture	Raymond Sarrazin
U. S.	Prairie Pothole Joint Venture	J. Mitchell King
U. S.	Lower Great Lakes/ St. Lawrence Basin Joint Venture	Raymond Whittemore
U. S.	Atlantic Coast Joint Venture	Richard Dyer
U. S.	Lower Mississippi Valley Jt. Ven.	Charles Baxter
U. S.	Gulf Coast Joint Venture	Jerry Johnson
U. S.	Central Valley Joint Venture	David Paullin
U. S.	Playa Lakes Joint Venture	Harvey Miller

Country	Species joint venture
Canada/U. S.	Black Duck Joint Venture
Canada/U. S.	Arctic Goose Joint Venture

within the committee, it would be the responsibility of the federal representatives of each country to put together a plan using the best information available from cooperating management agencies and other reliable sources.

At a minimum, the revised plan should answer the following questions: (1) What is the current status and trend of each population? (2) What are the population objectives? (3) Is all breeding habitat being utilized at optimum levels? (4) What problems affect the management of these populations? (5) What are the recommendations for resolving these problems and achieving the objectives? (6) What information would be used to monitor the status of the populations and what agency would be responsible for providing that information? Potential conflicts with management efforts for the Tundra Swan and other implementation problems should also be recognized and addressed in the planned revision of the Trumpeter Swan plan.

The conservation of wetland habitats across North America will undoubtedly be beneficial to the future of many wetland-dependent species. The long term protection and enhancement of public and private lands within the breeding, migration, and wintering habitats advocated by the NAWMP will be beneficial to many species of waterfowl, including Trumpeter Swans.

ACCOMPLISHMENTS IN IMPLEMENTING THE NAWMP

In the first 2 years after the NAWMP was signed, newly-formed joint venture teams worked hard to develop creative strategies to help meet the goals and objectives of the NAWMP. During this period, partners adopted organizational structures that would allow strong coordination and support during the implementation phase. Preliminary planning and administrative tasks dominated progress during this early phase.

Beginning a year ago last April, the decade of drought that had gripped the important prairie nesting areas intensified and caught the attention of the public on national news. The U. S. Fish and Wildlife Service (USFWS) elevated implementation of the NAWMP to its highest priority. This was quickly followed by a strengthening of support for the Plan from Ducks Unlimited, The Nature Conservancy, and other partners on the "soon to be organized" U. S. Implementation Board. The difficult process of putting the complex arrangements together to transfer first-step monies across the border were being negotiated by the National Fish and Wildlife Foundation. Meanwhile, in Canada, support was shown by firmly establishing their federal commitment in the budget process for the next 5-year budget cycle.

By the end of last summer, the habitat joint ventures were organized and teams of partners were making progress in stepping-down NAWMP goals to the joint venture level. The United States and Canadian offices for the NAWMP were established and, during October, the U. S. Implementation Board had its organizational meeting.

On 27 September 1988, the Quill Lakes Project in Saskatchewan was dedicated as the first project for the NAWMP.

The U. S. Office for the NAWMP intensified its effort of bringing other federal agencies into the NAWMP. The Forest Service launched its companion program, "Taking Wing," while the Bureau of Land Management announced its program, "Autumn Wings." Several Tribal Councils working with the Bureau of Indian Affairs announced the "Circle of Flight" program for the northcentral United States. Cooperative agreements were signed with the Department of Defense and the Army Corps of Engineers. Dialogue continues with the Bureau of Reclamation, Farmers Home Administration, Soil Conservation Service, Agricultural Stabilization and Conservation Service, and the Environmental Protection Agency.

By freeze up last fall, the North Central Region of the USFWS had completed disrupting 2,000 drainage tiles or ditches in

their eight-state region. This tremendous accomplishment kindled the hope of possibly restoring vast numbers of drained wetlands on private lands.

As 1989 began, the Environmental Protection Agency announced its "no net loss" policy for wetlands, and President Bush declared his commitment to a kinder, gentler environmental policy. On the wave of this optimism and the groundswell of support at the local level, the U. S. Implementation Board was busy pulling together the largest lobbying effort ever amassed in support of a natural resource conservation issue.

At the joint venture level, significant progress was being made in several areas, including the completion of significant on-the-ground efforts in implementing the NAWMP. Protection efforts were intensified by NAWMP partners in all joint ventures. The most noteworthy was the Central Valley Joint Venture, achieving protection on about one-quarter of its 80,000-acre objective, and Cameron Prairie Refuge becoming the first National Wildlife Refuge acquired under the NAWMP. It was the Nation's 447th refuge.

Enhancement projects were completed in many areas, including aggressive private lands efforts. Private land wetland restoration projects were continued in the Prairie Pothole Region, bottomland hardwoods, and the Central Valley. Interest in improving agricultural lands for waterfowl spawned the launching of several programs by several partners. USFWS efforts to coordinate waterfowl management with agricultural programs, such as "Partners for Waterfowl Tomorrow," was expanded in several areas. Successful Farming's program, "Farming in the Flyways," is an effort by a farm-oriented magazine to encourage farmers to share information on ways to manage wildlife in their farming operations. Several state programs encouraged improvement of stewardship on agricultural lands, including Minnesota's "Reinvest in Minnesota" program and California's private lands program. In Canada, Ducks Unlimited's "Prairie Care" programs are encouraging farming practices that help wildlife.

In the past several months, significant progress has been made on launching major projects, or "flagships," in each joint venture. These projects are excellent examples that demonstrate how partners can work together to achieve a common goal. In the past couple of months, many of these projects have been officially dedicated, including: (1) Cape May National Wildlife Refuge, NJ, (2) Crystal Springs, SD, (3) Lake Thompson, SD, (4) Merrit Marsh, IA, (5) Consumnes River, CA, and (6) the private lands portion of the Chenier Plain Project, LA. North Dakota will hold a week-long dedication of their massive Chase Lake Prairie Project this month.

Efforts are underway to evaluate and track the NAWMP progress in meeting its goals and objectives. Joint venture plans will be completed during this upcoming fall and winter period, and more detailed state implementation and project plans will follow.

CONCLUSION

The NAWMP outlines a new approach. It is bigger than ducks, geese, and swans. It is more than federal and state agencies. It must be more than acquisition, management, and enhancement of public lands. Above all, it will be essential to seek new approaches in funding sources, habitat enhancement, and more intensive management programs that are based on data collection methods that drive a comprehensive habitat management program, and not just a regulatory cycle.

Funding from federal sources remains a major concern. The NAWMP is not a "federal pot of gold," rather, it encourages partners to focus efforts on a common goal and seek new funding sources. Commitments of federal, state, and private dollars need to be solidified if the target of $100-120 million per year is to be reached. Ducks Unlimited has pledged to raise an additional $300 million for the NAWMP. The International Association of Fish and Wildlife Agencies and the National Fish and Wildlife Foundation are working to improve the commitment from the states. The introduction of the Senate and House versions of the North American Wetlands Conservation Bill (Mitchell Bill), combined with the President's support, gives hope that increased federal commitment will be forthcoming.

The first 2 years were dominated by preliminary planning and administrative tasks. During this period, partners adopted new organizational structures to ensure strong coordination and support during the implementation phase. In 1989, the third year of implementation, the sound foundation built during the first years and rapidly accelerating pace allowed significant on-the-ground progress to be realized at the joint venture level. At the national level, the U. S. Implementation Board and the U. S. Section of the NAWMP Committee were directing their energies toward the legislative and funding issues of the NAWMP. It is obvious that in a 3-year period, the NAWMP has been transformed from an initial policy document into strong international partnership actions supported by a vast network of grassroots coalitions of federal, state, and provincial agencies, conservation organizations, businesses, and individuals.

We are optimistic that the downward trends in waterfowl populations and losses of wetlands can be reversed. Since the turn of the century, our nation has gradually shifted from a national policy of wetland destruction to one of wetland conservation. Enthusiasm is high in all circles and the momentum is building as joint ventures are being developed and implemented. We encourage The Trumpeter Swan Society to support the NAWMP and become active in joint venture efforts to protect and restore North America's wetland resource and our waterfowl heritage.

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U.S. FISH AND WILDLIFE SERVICE FARMLAND INITIATIVES

Richard Schultz

The destruction of our Nation's natural resources has become a very important issue. In less than 200 years, over half of our original productive topsoil has been lost through wind and water erosion. This problem, combined with the unwise use and improper disposal of toxic chemicals, has contaminated our precious surface and ground water resources to the point of grave concern by those who depend on these waters for their everyday needs. Likewise, only 99 million acres of our original 215 million acres of wetlands exist today. The majority of these wetlands were converted for agricultural purposes. Consequently, the benefits associated with wetlands and floodplain areas, such as ground water recharge, soil erosion control, and reduction of downstream flooding, have been lost as these areas were converted to other uses. Populations of wildlife dependent upon these wetlands for survival have also decreased to near record-low levels.

With the passage of the Food Security Act of 1985, natural resource agencies across the country were provided with an excellent opportunity to identify, restore, and preserve a variety of these important resources located on both public and private lands. This legislation was unique in that it began to integrate natural resource conservation with our Nation's agricultural policy. In a general way, the conservation provisions of the Act set out to: (1) reduce the conversion of wetlands to croplands through the "Swampbuster" provisions of the Act, (2) prevent the conversion of grasslands into highly erodible croplands through the "Sodbuster" provisions of the Act, (3) protect important resources through conservation easements on lands held by the Farmers Home Administration (FmHA), and (4) retire up to 45 million acres of highly erodible croplands through the Conservation Reserve Program (CRP).

The U. S. Fish and Wildlife Service (USFWS), in cooperation with other federal and state agencies, has played a very active role in implementing the Food Security Act at the ground level. Specifically, the USFWS in the Upper Midwest has provided assistance to the U. S. Department of Agriculture (USDA) in implementing Swampbuster, provided assistance to the Farmers Home Administration in identifying and protecting important natural resources on inventory lands, and restored a large number of wetlands located on Conservation Reserve Program lands and adjacent private lands.

SWAMPBUSTER CONSULTATION

As mandated by the Act, the USFWS provides technical advice to the Agricultural Stabilization and Conservation Service (ASCS) concerning commenced determination exemptions for Swampbuster. Over the past 2 years, personnel from our agency have consulted with ASCS at county and state levels on over 2,000 commenced determination cases. Likewise, the USFWS has provided technical assistance to the Soil Conservation Service (SCS) in minimal effect determinations. We have also participated wherever possible on SCS mapping teams across the Midwest, which purpose is to identify and map all wetlands located on private lands.

Without getting into specifics, our success in protecting wetlands through our consultations with ASCS has been mixed. It appears to us that ASCS county committees are uncomfortable in making decisions that will deny USDA program benefits to their friends and neighbors. Recent information also suggests that ASCS has consulted the USFWS on less than 50 percent of their commenced determination cases throughout the Midwest, which is also contrary to the law.

Our success in working with the SCS has also had mixed results. Our agencies have concurred on those minimal effect exemption cases that are clear-cut and without controversy. However, where a producer is found in violation of Swampbuster, the SCS, as an agency, appears to go to great extremes to find an exemption for that producer. In our opinion, many of these exemptions are based on incorrect interpretations of the law, and are inconsistent with the implementing regulations. Recently, the SCS has modified its field guidance, which will result in reclassifying a large number of farmed wetlands to prior converted cropland, based on the presence or absence of drainage facilities. Consequently, a large number of wetlands with inadequate drainage facilities will be exempted from Swampbuster, and will eventually be converted to cropland.

FARMERS HOME ADMINISTRATION CONSERVATION EASEMENTS

Section 1314 of the Food Security Act authorizes the FmHA to establish conservation easements for protecting important resources on their inventory properties. The USFWS has worked very closely with FmHA in the last few years in identifying these important resources, and in proposing conservation easements for their protection. Since 1987, personnel of Region 3 have reviewed over 1,730 inventory properties totaling over 260,000 acres. Of these, a total of 551 conservation easements have been proposed, consisting of nearly 38,000 acres of wetlands, floodplain, riparian corridors, and endangered species habitat. These proposed easements range in size from 0.6 acre to over 1,000 acres. The average size of these easements is approximately 68 acres. In many cases, proposed conservation easements contain restorable wetlands. Up through 1989, over 400 wetlands have been restored by USFWS personnel or by private contractors on these lands. Eventually, all of these properties will be administered as part

of the National Wildlife Refuge System.

The USFWS has also assisted FmHA wherever possible in implementing Section 1318 of the Act. In this provision, FmHA is authorized to place conservation easements on property subject to debt restructure in exchange for partial debt relief. Unfortunately, the opportunities for protecting important resources through this provision have been very limited. This is due, in part, to a wide range of options that delinquent borrowers presently have, and many of these options do not include the use of conservation easements.

WETLAND RESTORATION PROGRAM

One of the most successful activities associated with the Farm Bill in Region 3 has been the private lands wetland restoration program. When we began, our goal was to restore all wetlands that were located on CRP lands. In recent months, we have expanded this program to include wetland restorations on non-CRP private lands as well.

When 1989 comes to a close, the USFWS, in cooperation with other public and private organizations, will have restored over 4,000 wetlands, totalling over 12,000 acres. These restorations range in size from 0.1 acre to over 50 acres. The majority of this work occurred on private landowner properties, where landowners voluntarily agreed to the restorations. A significant portion of the wetland restorations occurred in the historical Prairie Pothole Regions of Minnesota and Iowa. We have also had good opportunities for restoring wetlands in other parts of the Region as well, including northeastern Indiana and northeastern Wisconsin.

Once the landowner agreed to participate in the program, wetland restorations were completed either with the use of USFWS equipment and personnel or with private heavy equipment contractors. The average cost of restoring a wetland that was drained with a surface drainage ditch was approximately $400. The average cost of restoring a wetland that was drained with a subsurface drainage tile was approximately $150.

FUTURE OPPORTUNITIES

Remedies for Swampbuster problems and for FmHA Conservation Easement Programs will be discussed in the development of the 1990 Farm Bill. It is also in this forum that additional opportunities for resource conservation on many public and private lands will be addressed. Whatever form the 1990 Farm Bill finally takes, it is likely that the USFWS will play a significant role in its implementation.

Wetland restoration through USFWS programs is also largely dependent upon future agricultural policy. Generally speaking, nationwide agricultural policies and practices that encourage the management and preservation of important soil and water resources will benefit waterfowl and other species of wildlife. On the other hand, agricultural policies and practices that promote increased commodity production at the expense of conserving important soil and water resources will be detrimental to to all wildlife populations. Additional opportunities for wetland restoration on private lands may also come as a result of major legislation designed to restore and protect these wetland resoures. It should be noted that any successful program for restoring wetlands on private lands will need to include adequate economic incentives for participating landowners. Without additional legislation promoting the restoration of wetlands, the USFWS in the Upper Midwest will, at a minimum, continue to assist landowners and others in the restoration and preservation of these important resources.

ESTABLISHING A MIGRATORY POPULATION OF TRUMPETER SWANS IN THE UPPER MIDWEST

HISTORY OF TRUMPETER SWAN RESTORATION TO THE UPPER MIDWEST

Harold H. Burgess and Ruth L. Burgess

Conservationists have been restoring Trumpeters for the past 50 years (Banko 1960). Ruth and I have been directly involved since our assignment to Lacreek National Wildlife Refuge (NWR) in 1972 (the Dave Weaver age). We are now retired at Weslaco, Texas, near Llano Grande Lake, at the extreme potential wintering range of Trumpeter Swans (and Trumpeter Swan managers) in the United States. And, we are singing our "Swan Song."

During the past 50 years, about 500 Trumpeters have been translocated from the wild for restoration (Burgess 1986 and Burgess et al. 1990). That is only 10 Trumpeters per year. That is a very small investment for the results we have achieved -- four additional flocks in the Pacific Flyway, and a new restored Interior Population of about 500 Trumpeters in the Central and Mississippi Flyways. The following paper will concentrate on the Interior, or restored Midwest, Population.

In 1955 and 1956, Trumpeters were translocated from Red Rock Lakes National Wildlife Refuge (RRLNWR) to Delta Waterfowl Research Station, Manitoba, to supplement a few Interior Canada Trumpeter Swans held there. These produced over 100 fledgelings. Some were released in the surrounding marshes, and many more were supplied to other rearing centers. Because the released swans disappeared in a few years, the project was considered a failure. Yet, reports and rumors continue of swans summering on Swan Lake, Manitoba, of swans staging on the Saskatchewan River west of The Pas (D. Hjertas, pers. comm.), and of swans along the North Dakota/Minnesota border before they were restored to that area (Leach 1976).

In the late 1950's, a task force consisting of Arthur Hawkins, Ross Hanson, Henry Hansen, and others searched for a Trumpeter Swan restoration site east of the Rockies. They chose Lacreek NWR because of its sandy, spring-fed reservoirs which remained partially open in winter. Manager C. A. Hughiett translocated 57 RRLNWR Trumpeter cygnets to Lacreek NWR during the early 1960's, and mothered them until he was replaced by Jim Monnie. Jim was followed by John Ellis, Vic Hall, tne Burgesses, and finally the present refuge manager, Rolf Kraft. Due to Great Horned Owl predation and other mortality factors, only 17 subadults were eventually released to the wild. However, they were long-lived and productive. They, and their offspring, pioneered to Valentine NWR and many other Nebraska sand hill marshes, to old stock ponds in South Dakota within a 100-mile radius, and to the northeastern edge of Wyoming and southern edge of North Dakota. Trumpeters from the Lacreek flock were used to start the Crescent Lake NWR and Missouri restoration programs. Eggs from the Lacreek flock were used in the Minnesota Department of Natural Resources trial incubation runs in 1984, when RRLNWR eggs became unavailable.

About 250 Lacreek Trumpeters stage at Lacreek NWR each fall, while others brave the winters in open waters elsewhere or migrate south as far as Russelville, Arkansas, and probably Edna, Texas. At the same time, a subflock developed at the William Mahon State Wildlife Refuge in extreme southwest Nebraska. Trumpeters from Mahon's flock pioneered south into Kansas, west into Wyoming, and north into the original Lacreek breeding range. The two groups and their satellites comprise the Lacreek flock.

A flock of about 100 Trumpeters was restored to Minnesota by Hennepin Parks starting in the late 1960's, with the encouragement of Bob Burwell, Fred King, Clifton French, and others, and with the management of Robley Hunt, David Weaver, Larry Gillette, and their staffs. The Hennepin Parks flock has pioneered west, north, and east to summer, and south through Minnesota, Iowa, Missouri, Oklahoma, Kansas, and eastern Nebraska to winter. However, no sustained migration south has resulted from their movements.

A program of foster parenting Trumpeter Swan eggs and cygnets with feral Mute Swans was suggested by the late Ross Hanson over 20 years ago. Harry Lumsden, Wildlife Research Section, Ontario Ministry of Natural Resources, took up the challenge with a scholarly review of available literature, a good survey of available sites, and experimantal egg hatching during the spring of 1982. Problems arose with egg collecting, egg transport, Mute male aggression, snapping turtle predation, and political indifference or opposition. As problems arose, Harry and his staff challenged them.

Canadian Trumpeter eggs were not available from the wild after 1983, and the project had to depend on eggs from a few captive Trumpeters in Ontario and the United States. In 1987, a plan was approved to supplement Ontario's program with adult Pacific Coast Population birds live-trapped in British Columbia. Mr. Lumsden retired from the Ministry of Natural Resources in 1988, but continued with the restoration program under the Federation of Outdoor Naturalists. His progress is reported elsewhere in these Proceedings.

The Minnesota Department of Natural Resources (MN DNR) Nongame Program started efforts to restore the Trumpeter to western and southern Minnesota using aviculturist, RRLNWR, and Lacreek NWR eggs in 1982 and 1983. The 11 cygnets produced were added to the Hennepin Parks flock. Since 1984,

Trumpeter eggs have been collected in Alaska, and hatched and reared at the Carlos Avery Game Farm. These have been supplemented by cygnets produced by the Minnesota Zoo, Brookfield Zoo, Delta Wildlife Research Station, Dellwood Wildlife Foundation, and others. The MN DNR Nongame Program project is reported in detail elsewhere in these Proceedings. However, it is significant to report that they have released about 90 subadults, that all of their swans must migrate, that they have lost only about 30 percent of their swans released in 1987 and 1988, and at least five pairs attempted nesting in 1989.

An experimental winter migration restoration was started in Missouri in 1982, by translocating a family of two adults and three cygnets to Mingo NWR from Lacreek NWR. Missouri continued this program for 5 additional years, moving a total of 35 Trumpeters to Mingo by 1987. The original adult pair remained and nested at Mingo several times. At least two Trumpeters returned to Lacreek, and at least seven birds remained in Missouri as of 18 November 1988. Missouri also occasionally winters Trumpeters from Minnesota, South Dakota, and Canada.

A Mute/Trumpeter cross-fostering program was started in Michigan in 1986, using eggs from zoos and private propagators. They had difficulties with egg mortality, aggressive cobs, excessive snapping turtle and Great Horned Owl predation, and disease. Michigan decided to put its cross-fostering experiment on hold, and chose to go to an artificial incubation, hand-rearing, and direct release program in 1989. They joined with Wisconsin to collect Alaskan Trumpeter eggs. Of 20 eggs, 19 cygnets hatched, and as of 4 August 1989, only one cygnet was lost to disease. The young were growing fast, and it was obvious that providing adequate safe space will become challenging, particularly after additional cygnets from zoos and aviaries are added.

A mixed program of experimental cross-fostering and artificial rearing began in Wisconsin in 1987. There were difficulties with egg mortality, Mute Swan cob aggression, snapping turtle predation, and disease. Only one cross-fostered cygnet was raised in 1987. Two cygnets were raised in 1988, but both died later of lead poisoning. Wisconsin began cooperating with Minnesota and others in a captive-rearing program. There were 11Trumpeters in the program in 1987, and 44 in 1988. In 1989, 20 Alaskan eggs were added to the program, and details are presented elsewhere in these Proceedings.

After our years of experience with these magnificent birds, we have some thoughts about Trumpeter Swan restoration that we would like to share:

1. Most Trumpeter restoration efforts are experimental, whether labeled so or not. This is because we must deal in small numbers. Experiments are initiated to learn. Some observers have labeled the Missouri wintering restoration and the Mute/Trumpeter cross-fostering experiments failures. They are not! We have learned much. These experiments have uncovered a number of problems. Many of these would occur with any swan restoratoin program. Problems are challenges. With out problems, there would be no need for researchers, biologists, or managers. Be thankful that you have problems to challenge. The Trumpeter Swan restoration/Tundra Swan hunting issue may be a great opportunity for problem solvers.

2. All of our restoration efforts have been in former breeding areas. Some, such as Lacreek NWR and Mingo NWR, have been where Trumpeters could both breed and winter. Most are in areas where the Trumpeter must migrate. Mortality is high where Trumpeters must learn new migration patterns. We need to find safe corridors and wintering areas, and attract those migrants by providing live decoys or decoy flocks, and by protecting those areas from disturbance.

3. Many aviculturists and zoos have stepped forward with donated eggs or swans, when other sources failed, to keep the Ontario, Minnesota, Michigan, and Wisconsin restoration programs alive. In addition, private propagators have maintained a source of breeding stock that could be purchased when misfortune broke up a breeding pair. Since 1968, The Trumpeter Swan Society (TTSS) has been the clearinghouse that maintains liaison between captive Trumpeter breeders and restorers. TTSS makes a biennial survey of captive Trumpeter breeders, publishes a trade sheet, and, every 5 years, cooperates with the U. S. Fish and Wildlife Service survey of the world's Trumpeter Swans. Both TTSS and the aviculturists are low-profile people whose efforts go unnoticed too often. Let us give TTSS, the aviculturists, and all of the Trumpeter Swan restorers a big hand.

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NEED FOR A COORDINATED RESTORATION APPROACH FOR THE INTERIOR POPULATION OF TRUMPETER SWANS

Laurence N. Gillette

Last February, I attended the Mississippi Flyway Council Technical Committee meeting in Little Rock, Arkansas, as a representative of The Trumpeter Swan Society. Joe Johnson was the Chair of the Trumpeter Swan Committee. Approximately 10 waterfowl biologists attended the 1-1/2 hour meeting. With the exception of Joe and myself, no one else had any involvement with Trumpeter restoration programs, and most knew almost nothing about their own state or provincial programs. (Carrol Henderson, the Nongame Supervisor for Minnesota, is on the Committee, but other commitments kept him from attending.)

The U. S. Fish and Wildlife Service (USFWS) is responsible for all migratory waterfowl. It discharges this responsibility through the flyway councils. The waterfowl biologists at the technical sessions are preoccupied with game species. Unfortunately, the Trumpeter Swan is the only species of waterfowl in the Midwest that is managed as a nongame species. Programs for swans are funded by nongame programs and are developed and implemented by nongame biologists.

As a result, restoration plans for the Interior Population of Trumpeter Swans were developed independently by each nongame program or equivalent counterpart. This approach might be adequate for nonmigratory species that will live year-round within the boundaries of one state. However, restorations of Trumpeter Swans in Minnesota, Wisconsin, Michigan, and Ontario will only be successful if the birds develop a migratory tradition. Letting inexperienced Trumpeters develop migration routes by trial and error is an extremely costly approach, and probably won't work until we enlist the southern states in an organized plan of action.

We are on the verge of sending relatively large numbers of Trumpeters down the Mississippi River and its tributaries. Many of the states to the south are anxious to receive them (at least in the nongame sections). The efforts of all states need to be coordinated to be successful.

The authors of the North American Management Plan for Trumpeter Swans (NAMPTS) realized the need for this coordination when they proposed "to establish an Interior Population Subcommittee to coordinate the overall management and reintroduction of Interior Population swans." The Interior Population Subcommittee would include representatives from the technical committees of the Central, Mississippi, and Atlantic Flyways, from the USFWS and Canadian Wildlife Service, and from other appropriate federal, state, and/or provincial agencies. Nongame specialists can be included in the Interior Population Subcommittee to develop the plan. This is the mechanism through which we can develop an overall coordinated plan.

Five years ago, when the original plan was developed, Lacreek National Wildlife Refuge and Hennepin Parks were the only two locations within the former range of the Interior Population with significant numbers of swans. Now, the number of agencies and individuals involved with swans has grown. States involved in restorations have enough experience with Trumpeters to be able to develop a sound management plan.

Considering NAMPTS is up for review in 1990, the time is right to develop an overall management plan for the Interior Population of Trumpeter Swans in which each state or province could participate. It should include techniques for increasing survival and establishing migratory patterns. I believe we need a coordinated plan and should make the commitment of trying to complete it by February 1991, for review by the Flyway Council Technical Committees. This will happen only if each agency makes a commitment of personnel and funding. We are spending so much on restoration programs now, it only makes sense to make a little extra effort to coordinate all restoration efforts into a more effective program, which will increase the chances of success for all of them.

U. S. FISH AND WILDLIFE SERVICE INVOLVEMENT IN THE RESTORATION OF INTERIOR POPULATION TRUMPETER SWANS

Stephen D. Wilds

In pristine times, it is believed that breeding Trumpeter Swans occupied a vast area that extended from southern Illinois and northern Missouri north to James Bay, all across the northern Great Plains, and nearly all of Canada west of Quebec into the southern half of Alaska. After white men arrived in the central part of North America, exploitation of this species reduced its numbers to the point that early 20th century ornithologists expected them to soon be extinct. Fortunately, Trumpeter Swans are not extinct, but they were certainly extirpated from nearly all of their former range. Alaska has been their only stronghold. Remnant populations have hung on in the northern Rocky Mountains of the United States and Canada.

It has long been the goal of many people who are keenly interested in Trumpeter Swans to see these magnificent birds restored to as much of their former range as possible. The tremendous habitat changes that have taken place throughout much of that range, the shortage of birds to restock those remaining areas which are suitable, and the relatively low priority which public wildlife agencies have assigned to Trumpeter Swan restoration efforts have made that road to successful reestablishment long and arduous.

Nowhere throughout the Trumpeter's former range has the loss of habitat been more severe than it has been in the northcentral section of the continent. Trumpeter Swans which now occupy that geographic area are termed the "Interior Population." In spite of this extensive habitat loss, the Upper Midwest has been the area where the most has been done to restore Interior Population Trumpeter Swans. It was the interest of a few die-hard supporters of Trumpeters that resulted in the longterm restoration work which has been conducted through Hennepin Parks. Several additional states have expressed increased interest in swan restorations over the last few years as nongame funds have become available.

Largely because of nongame funding, restoration projects have been started in Wisconsin and Michigan, and expanded in Minnesota by the Department of Natural Resources (DNR). Ontario is also attempting to restore nesting Trumpeters. With persistence and the knowledge gained through these efforts, there is hope that finally we will be able to establish several viable breeding flocks of Interior Population Trumpeter Swans.

My assignment today is to discuss the role the U. S. Fish and Wildlife Service (USFWS) has played in restoring Interior Population Trumpeters, and what the USFWS might do in the foreseeable future for these birds.

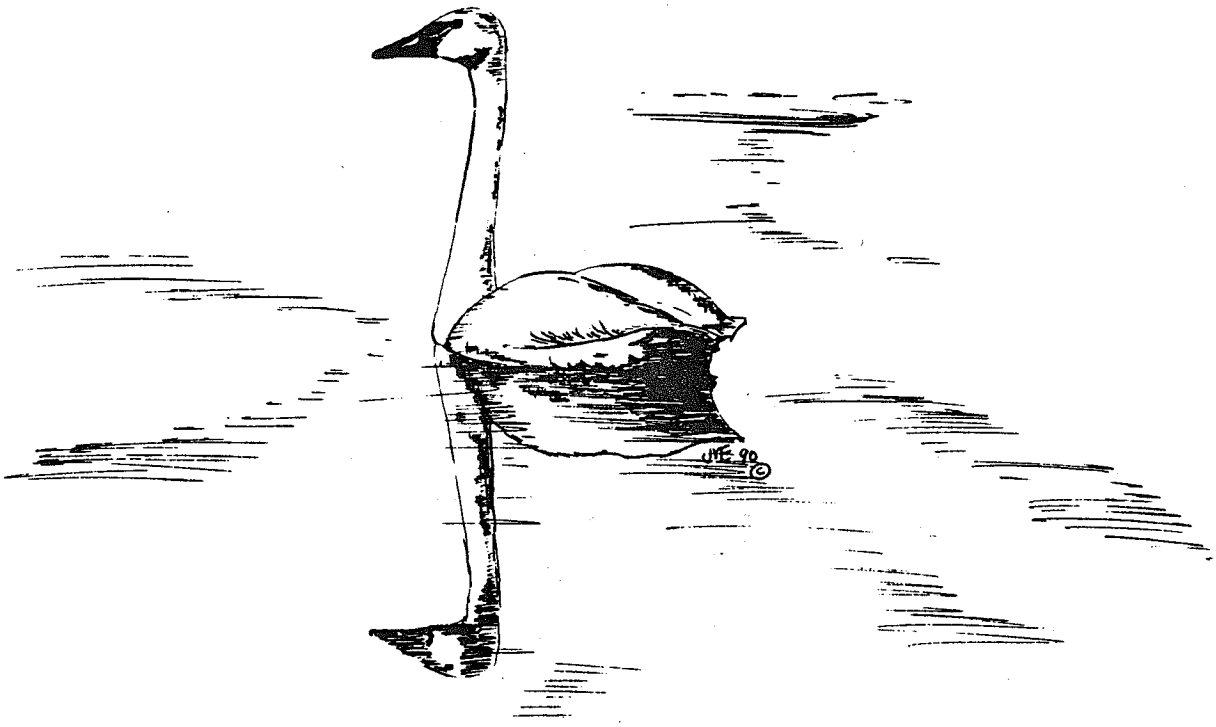
In 1962, the USFWS undertook a Trumpeter Swan restoration project at Lacreek National Wildlife Refuge (NWR) in South Dakota using birds from Red Rock Lakes National Wildlife Refuge (RRLNWR). Rolf Kraft gave you the details of the Lacreek restoration project this morning. In an effort to instill migratory habits in the Lacreek Trumpeters, a project was undertaken between the State of Missouri, Lacreek NWR, and Mingo NWR, in which family groups of swans (later a shift was made to subadults) were trapped at Lacreek and flown to Mingo. It was hoped that the transplanted swans would enjoy the winter in southeast Missouri, migrate back to Lacreek for the breeding season, and then return to Mingo the following winter of their own volition. It did not work. Several of the birds made their way back to Lacreek, but none of those that did so ever returned to Mingo.

As the Minnesota DNR developed its plans to reestablish nesting Trumpeter Swans, the USFWS had many discussions with them about potential release sites. Three sites which have large amounts of USFWS-owned lands were identified as high quality, potential release areas. Those sites were Sherburne NWR, just northwest of the Twin Cities, the Fergus Falls Wetland Management District (only some of the specific release sites were to be on USFWS lands), and Tamarac NWR near Detroit Lakes. As the time to select a site drew near, Sherburne was rejected because of the belief that Hennepin Parks swans would soon pioneer onto the Refuge, and, therefore, a release at Sherburne was unnecessary. The Fergus Falls site did not have the local support needed to optimize its chances for success. So, the decision was made to use Tamarac NWR and several nearby state areas for Minnesota's first release project.

The staff at Tamarac NWR worked with Minnesota DNR personnel to determine the acceptability of specific wetlands. They assisted with the actual releases, and have helped keep tabs on the birds. Throughout the project, USFWS employees have been involved, but it must be made clear that this is a Minnesota DNR project. The USFWS provided the land for the releases and some personnel support, but the money and by far the majority of the labor and coordination have been provided by Minnesota DNR.

There are many problems confronting all species of waterfowl today, and for that reason, the USFWS has not been able to rank Interior Population Trumpeter Swan restorations high on its list of problems which must be handled. That does not mean we are not interested. We would be delighted to see a number of viable breeding populations reestablished. We do not, however, intend to support the establishment of nonmi-

gratory flocks in northern areas. Along those lines, we hope that techniques can be developed which will rekindle the migratory behavior of Trumpeters so that the threat of winter starvation can be minimized. And, we would like to see the Mississippi and Central Flyways put together a plan which would lay out a course of action for dealing with restored flocks which migrate across flyway boundaries. The USFWS is willing to assist with these projects, but other priorities prohibit us from accepting the lead role.



OPTIONS FOR ESTABLISHING MIGRATORY POPULATIONS OF INTERIOR POPULATION TRUMPETER SWANS

Laurence N. Gillette

In a way, this paper, "Options for Establishing Migratory Populations," could be considered to be a combination of the two papers I presented earlier today. It will be successful only if it involves a coordinated effort by numerous states, and the techniques suggested for controlling the movements of Trumpeters to reduce lead poisoning can also be used to establish a migratory tradition. Although the techniques suggested are directed primarily to the Interior Population, they will have some application for the other two populations, as well.

Over the past decade, we have learned a number of facts about Trumpeter Swans which should help us in our efforts:

1. Although Trumpeters may migrate as sibling units, subadult associations, or loosely-associated flocks, it is the family unit consisting of the adults and their immediate offspring that is the primary social and migratory unit. Cygnets learn the migration route from their parents. Orphaned or lost cygnets have great difficulty joining other family units.

2. Trumpeters establish strong bonds to nesting, staging, and wintering sites. They will faithfully maintain use patterns once they are established.

3. Trumpeters are attracted to areas where other Trumpeters are present.

4. Trumpeter Swans stay as far north as possible during winter. This is determined by the availability of open water and food. The further north they remain, the more sedentary they are during the coldest winter months.

5. Swans have a high degree of adaptability. They will adjust to varied situations if they are given sufficient time and inducement.

6. Swans have learned to use winter sites which were not historically available to them. Areas of open water maintained by manmade alterations such as dams, power plants, and locks are all suitable for swans. Farm ponds with aerators or deep water reservoirs may also be used, especially if food is provided. Most of these alternatives have the advantage of being lead-free.

7. We can influence where swans go through several techniques.

8. Some birds will attempt to migrate, even if winter refuges are provided.

9. Swans that are very tame (but not imprinted) during fall and winter will revert back to behave as wild birds during spring and summer. Winter feeding will not alter the wildness of the birds during the nesting season.

10. Swans migrating from Hennepin Parks have dispersed over a broad area (Figure 1). Such a broad dispersal over the wintering range increases the chance of lead poisoning.

These facts may seem very elementary and self evident, but they should not be overlooked. Attempting to exceed the capacity of the birds to adapt, or trying to force them to do what is against their nature, will result in failure.

Two approaches will be emphasized. One is to encourage swans in any movements they initiate on their own, as long as the destinations are considered "safe." The second is to try to attract swans to predetermined locations.

Notice that I have used the words encourage and attract, rather than harass, haze, and force, in describing procedures to get Trumpeters to migrate. We are entering an era when the only animals that will thrive or even survive are those that can coexist with man and adapt to the altered environments man has created. Trumpeter Swans must learn to live in close proximity to man and adapt to the new water habitats that are available if the species is to be restored, especially in the Midwest.

Repeated hazing to force Trumpeters to migrate will inhibit any adaptation and will make them less likely to accept new locations. Swans are long-lived animals that learn and remember. Once they learn to fear something, such as the presence of people, it will be very difficult to overcome. Managers need to concentrate on positive inducements and work to maintain the trust of the birds for the greatest chance of success.

Swans, like other waterfowl, become more active in the fall. They will fly from place to place, and, eventually, some will make exploratory trips in search of new winter habitat. Usually they move south, but not always. The first migrations for released swans are completely by trial and error. It is important that these birds be encouraged to move by making new sites attractive to them, as opposed to forcing them out of old sites by cutting off food and/or water, or by hazing.

Figure 1. Area utilized by Hennepin Parks Trumpeter Swans 1984 -89.

It is also important that as many swans as possible survive the preliminary exploratory trips if a tradition is to be established. Therefore, I believe swans should be fed whenever they appear on an open water site which is considered to be relatively lead free, regardless of the type of open water or the direction and distance traveled. Providing food should increase the chance that the birds will return in future years. Feeding does not assure that swans will become sedentary. Some may, but others will not. Some swans will continue pioneering further south. They should be encouraged with food as they go. Eventually, feeding at more northern stops could be discontinued, and the swans would most likely continue on to the next established wintering site.

This approach provides better care for the swans, it will increase survival, and it is not very expensive if volunteers are solicited to do feeding. It will work only if the swans are not afraid of people. The swans must stay while food is put out for them. Eventually, this will get them far enough south to selected spots to be independent.

The second approach involves selecting good migratory stopover and wintering sites, then encouraging swans to use them with the use of food and captive swans. It is far more labor intensive, but the captive swans will increase the chances of swans being attracted to a site if they fly anywhere in the vicinity.

Once again, a network of sites should be selected to increase the chance that sites will be found through initial random movements. Some of the initial sites should be near release sites (within several hundred miles) to increase the chance of being located. As with the previous technique, the more northerly sites may be abandoned after a migratory pattern is established. Eventually, most swans could be directed to a few lead-free wintering sites.

As an added benefit, captive decoys could be encouraged to reproduce to provide additional swans for restoration programs. The decoy swans may also be used for public education in areas where swans appear very infrequently. Changes in the federal permitting system may be required for proper deployment of decoy swans.

The two approaches would probably be most successful if used to complement each other. Our chance of success will be increased by keeping options open. We need to reward swans wherever they go, maintain their trust in man, and use flightless swans as decoys to attract migrants to preferred wintering sites. The basic message of this paper is that we will do a far better job in getting swans to migrate and establish a migratory tradition if our efforts are directed toward encouraging them rather than toward discouraging them.

Encouragement may not be necessary forever. Once a migratory tradition has been established by a large population of swans, it should become self-sustaining without feeding at intermediate stops.

I realize that the concepts of increased artificial feeding and use of decoy birds are contrary to the objectives of the North American Management Plan for Trumpeter Swans, and that numerous managers have conducted programs to reduce public feeding. However, I am speculating that it may be more cost-effective to encourage the swans until a migration tradition is established. Finally, I am concerned that we may have reached a point of environmental deterioration where it will be necessary to resort to extremely artificial measures to maintain numerous wildlife populations, Trumpeter Swans included.

THE ROLE OF THE PRIVATE CITIZEN IN RESTORING TRUMPETER SWANS

Gary Barrett

Good afternoon. My name is Gary Barrett. I live on a farm west of Armstrong, Iowa. My wife, Heidee, is a Registered Nurse. Our daughter, Hillary, became a teenager this year, and we have a very busy 7-year-old son, Charles. We farm 850 acres, raising corn and soybeans. We do not have the usual farm livestock of cattle and hogs, instead we raise elk, white-tailed deer, various types of geese, and Trumpeter Swans.

Larry Gillette asked me to share some thoughts and feelings on the role of the private propagator in Trumpeter Swan restoration. I have always been deeply interested in native wildife, particularly those species that are no longer present throughout much of their original range, or whose numbers have declined severely. This led to my interest in the beautiful Trumpeter Swan. Unlike bison and elk, which cannot be reintroduced into most of their former range due to human conflict, the Trumpeter Swan can be reintroduced. It would mean a great deal to me, as well as other nature lovers and swan fanciers, to see these graceful, elegant birds gliding back home again to Iowa after a 100-year absence.

For these reasons, I obtained copies of the Minnesota, Ontario, Wisconsin, and Missouri restoration plans in the fall of 1987. I sent them to Doug Reeves, the Iowa Department of Natural Resources (DNR) nongame biologist at the time. I had various visits with Doug concerning the possibility of Iowa becoming involved in low-level swan restoration, to coincide with our neighboring states. In the spring of 1989, talks continued with Jim Hansen, Doug's successor. Iowa needs only a low-level restoration effort because of the programs already in place in the surrounding states, especially Minnesota. With a few swans placed in prime locations in Iowa, we might get some interaction between Iowa and Minnesota birds, and eventually encourage migration as well as new breeding pairs. Somehow, the swans restored to these northern areas must be encouraged to expand their nesting and wintering ranges further south, to eliminate problems similar to those out west (Red Rock Lakes National Wildlife Refuge).

I feel that Union Slough National Wildlife Refuge (NWR) would be an excellent location to try and establish a couple of breeding pairs in Iowa. It is located in Kossuth County, in northcentral Iowa. It is comprised of approximately 2,200 acres, of which 1,100 acres are wetlands, including five pools. It lies almost directly south of our present location (Bloomington, MN), putting it in a good path to attract any southerly-moving swans. Iowa has had a sprinkling of Trumpeters migrating into and through the state. Last winter, a female returned to the Des Moines area with a new male. She had spent part of the previous winter with three other swans on the Des Moines River. Wing tags on the swans identified them as birds released by the Minnesota DNR. In recent years, several birds from the Hennepin Parks and Minnesota DNR flocks have been seen in Iowa. Even though Iowa may not have an abundance of available open water with adequate winter food to support many swans, getting them there may be a stepping stone to more southerly destinations, which could offer them new winter habitats.

In the spring of 1989, I also visited with John Guthrie, Refuge Manager at Union Slough NWR. Harold Burgess is a past manager of the Refuge. I also visited briefly with Mathias Kurshbaum in the Twin Cities, MN. He is the Area Supervisor for the Union Slough complex. In my conversations with various state and federal agency personnel, I offered to place one of my pairs of Trumpeter Swans on the Refuge, with the hope of them nesting. The cygnets would be managed in whatever manner was agreeable with the agencies involved. Some of my thoughts on cygnet management include:

1. Iowa-reared cygnets could be allowed to fly free, with the hopes that they might bring back Minnesota or Wisconsin mates.

2. Iowa-reared cygnets might be taken to Minnesota at freeze up, wintered in Minnesota, and allowed to fly free in the spring. They might then return to Iowa with some Minnesota birds. This may not be possible, however, without parental guidance.

3. Open water could be created on Union Slough to allow my pinioned pair to overwinter there. If open water poses a problem, my pair and their offspring could be caught at freeze up and wintered on their present pond. Cygnets of the year could be wing-clipped, and returned to Union Slough with their parents the fol lowing spring. They could then be left to fend for themselves the second fall.

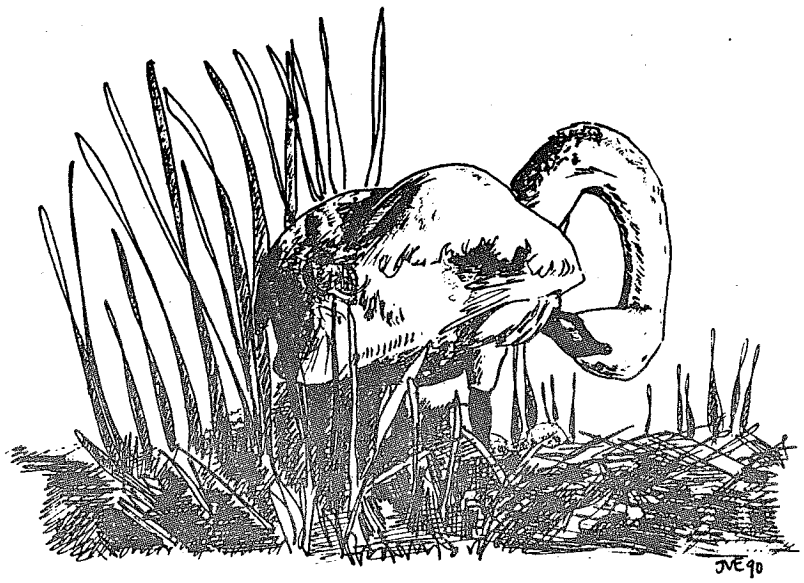
4. Iowa-reared cygnets could be caught and sexed, with females sent to Minnesota and males left in Iowa with unrelated females.

5. Union Slough offspring could be hand reared.

In closing, I would like to present some thoughts as a private citizen. There are other suitable areas within the state of Iowa that might be considered for placing a pair of decoy swans, but based on its location, size, lack of hunting, lack of lead shot, food availability, and isolation, Union Slough would be a prime place for possible swan expansion. Hopefully, it would broaden the base of the Trumpeter's domain, and add to its chance of survival. Union Slough would provide a few new nesting sites in former Trumpeter breeding range, while at the same time enabling our children to see a part of our former natural heritage.

Regardless of what takes place, I will do my best to promote

the goals and objectives of The Trumpeter Swan Society. And, I hope that some day the sighting of a family group of Trumpeters winging its way south across the state of Iowa may become a reality.



IOWA'S ROLE IN TRUMPETER SWAN RESTORATION

James L. Hansen

Iowa can play an important role in the restoration of Trumpeter Swans in the Midwest, even though no Trumpeters have been released in the State. Free-flying Trumpeter Swans from restoration efforts in Minnesota and other states need migration and wintering areas, and Iowa is located in a position to supply some of those needs.

Suitable, safe areas for swans should have minimal chances for both hunting mortality and lead poisoning. Although accidental shootings are always possible, there are no plans to propose a Tundra Swan season in Iowa, even though the State would probably qualify for a few hundred permits. As for lead poisoning, thus far it appears that the swans are selecting areas where there is little or no chance of lead poisoning.

In the last two winters, Trumpeter Swans have been seen in groups of one to six on 11 different areas. Of the 11 sites, one was a city sewage lagoon, one was a large farm pond, four were man-made impoundments in urban areas, three were rivers in urban areas, one was a river in a rural area, and one was a natural marsh. In some of the 11 areas, swans have been fed shelled corn by private citizens. Of the sightings, only the one on a natural marsh was in an area that could have lead poisoning potential. By the time Trumpeter Swans arrive in Iowa in December or January, marshes, some of which have been heavily hunted, are normally frozen over and are unavailable. The chances of lead poisoning in the state should also be declining, since Iowa has required steel shot for all waterfowl hunting since 1985.

It has been suggested that Iowa use live Trumpeters as decoy birds to attract migrating Trumpeters to lead-free areas. One area that has been mentioned is Union Slough National Wildlife Refuge in northcentral Iowa, since there has been no waterfowl hunting there for decades. However, there is no point in putting decoy birds there or in any other shallow wetland, because these areas are frozen over before swans even arrive. The swans seem to be doing well in selecting lead-free areas, and we do not feel that decoy swans are needed at this time.

The Iowa Department of Natural Resources will continue to monitor migrating and wintering Trumpeter Swans through its own personnel and by soliciting observations from others. We will continue to report sightings of marked swans, arrival dates, and departure dates to the agencies that marked the birds. We will also continue our program of restoring, maintaining, and improving wetlands to provide habitat for Trumpeter Swans and other wildlife.

It is possible that Iowa will begin a program some time in the future to restore Trumpeter Swans as a nesting species, but no decision has been made as yet.

A PROPOSAL TO RESTORE WINTER MIGRATION IN TRUMPETER SWANS BY ESTABLISHING BREEDING PAIRS IN THE WINTERING AREA

Rolf H. Kraft

The greatest threat to Trumpeter Swans in the contiguous United States is limited winter habitat. The high plains and Minnesota flocks are expanding their breeding ranges and the populations are increasing, but the survival of these populations depends on artificial feeding. As these populations continue to increase, greater and greater demands are placed on winter feeding programs, while stress and the potential for disease also increases. The population increases have encouraged pioneering, and evidence of winter movement has been documented in Missouri, Kansas, Oklahoma, and Arkansas. The problem is that pioneering from a hostile northern environment to unknown wintering grounds is unnatural and extremely risky for the birds involved. The high mortality associated with reverse pioneering severely limits success, and progress will continue to be very slow.

Though pioneering is the way migration routes are initially established in nature, the natural evolution of migration routes always develops from south to north in the northern hemisphere, not the other way around. All birds, in their evolution, began in areas where year-round survival was assured. Only as breeding populations increased beyond the carrying capacity of local habitats did certain species begin to pioneer to other areas to nest and reproduce. Many species pioneered north in the spring and found suitable breeding grounds, but when harsh winter weather threatened their survival, these birds knew where they came from and could return to suitable habitat for the winter.

Human beings, in their "infinite wisdom," have manipulated wildlife species in many ways, being particularly successful at introducing waterfowl onto suitable breeding grounds. Nature always provided a "virtually unnoticed" helping hand though, in the form of naturally migrating birds of the same species that could guide the introduced birds to traditional wintering grounds. This concept worked exceptionally well with Canada Geese, as most areas where breeding birds were introduced still had remnant populations of migrating birds. This is not the case with the artificially restored populations of Trumpeter Swans. When the Trumpeter Swans were restored to historical breeding grounds at Lacreek National Wildlife Refuge (NWR) in South Dakota and at Hennepin Parks in Minnesota, no remnant populations of wild Trumpeters remained. As a result, there were no wild migrating swans to act as guide birds and both populations became residential and required artificial feeding for winter survival.

Both breeding populations became successful and have increased in size. As the numbers of free flying subadults increased, some of these birds have pioneered to seek natural wintering areas. Birds from both populations have been documented in areas far enough south to assure winter survival, but no true migration of any flock to any specific wintering area has been established. True migrating flocks following natural migration routes will probably develop over time, but the cost in pioneering birds will be heavy.

The wildlife profession created these circumstances by introducing this species into breeding areas without adequate consideration for winter survival. That situation must be corrected for Trumpeter Swans on the high plains and in Minnesota to become a wild and free-ranging species independent of artificial feeding. The only realistic way to establish natural migration routes is to establish breeding populations in suitable habitat far enough south to assure year-round survival, and allow those populations to expand and pioneer north on their own. With their winter survival assured, these birds will eventually establish migration routes north and connect with the existing breeding populations. When that happens, these naturally-migrating birds will act as guide birds for the existing residential flocks and a natural migration of the entire population will follow. Some old residential birds will, no doubt, remain attracted to the artificial feeders, but most of the younger birds will probably migrate. Only when Trumpeter Swans can breed north and migrate south, without the help of humans, can we consider the Central and Mississippi Flyway flocks fully restored.

USE OF IMPRINTED SWANS TO ESTABLISH A MIGRATORY POPULATION

William Carrick[1]

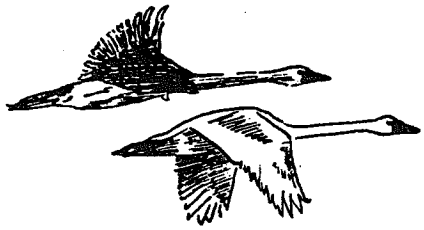
Establishing a migratory tradition with Interior Population Trumpeter Swans is a major concern for those restoring Trumpeter Swans. Dr. Carrick and Bill Lishman have suggested imprinting cygnets to ultralight aircraft as a method of inducing birds to migrate in the fall, and return to their natal areas in the spring. Carrick and Lishman have successfully imprinted geese to ultralight and fixed-wing aircraft and power boats, and have induced short migrations using this method. They are extrapolating from their experience with Canada Geese in suggesting that Trumpeter Swans be imprinted to aircraft their first fall, and taught to migrate to appropriate wintering areas.

In order for this method of imprinting and migration to be successful, The Trumpeter Swan Society and appropriate federal and state personnel first need to identify suitable wintering areas for Interior Population Trumpeter Swans, and obtain permission from all landowners, agencies, and personnel concerned for conducting this migration experiment. Birds must be imprinted their first year, when their desire to migrate seems strongest. From Carrick and Lishman's experience, birds held their first winter and then let go have lost their desire to migrate.

Carrick and Lishman have worked with their imprinted birds at least every day, for 2 or more hours per day. The geese were trained morning and evening, and sometimes at noon. The more time spent with them, the more attached the birds became to humans and to their surrogate migratory parent. The critical period for imprinting geese to aircraft seems to be when they are just learning to fly. Carrick's imprinted birds returned to their flock after their training with aircraft or boat, and they did not experience any problems "readjusting to being geese." Lishman feels that ultralight aircraft may be a solution to the Trumpeter Swan migration problem.

What happens once the swans are on the wintering ground? Leave them. Sneak the aircraft away when they're not looking. Lishman suggests that, with Trumpeter Swans, it may help to fly them back in the spring. However, he doesn't think it will be necessary. He suggests looking for ideal flying conditions when moving them in the fall.

[1] This is a summary of comments made by Dr. Carrick while presenting film footage on his work imprinting geese to boats, planes, and ultralight aircraft.



GENERAL DISCUSSION OF IDEAS ON ESTABLISHING MIGRATORY POPULATIONS

David K. Weaver, Moderator

Jim Bartonek, regarding the need for a coordinated restoration approach:

"This idea was identified in the 1985 management plan. There seem to be individual approaches by separate flyways, but we need the three flyways to get together to look at a coordinated approach. Those of us who work with state, federal, and provincial agencies should take that message back to our groups. The Trumpeter Swan Society (TTSS) could formally request the Director of the U. S. Fish and Wildlife Service and Director General of the Canadian Wildlife Service to provide the opportunity for the three flyway councils and TTSS to convene. The councils are comprised of individuals of state, federal, and provincial agencies, and each of these groups have the public's broader interest at heart. Although there may tend to be game biologists representing many of these views, the directors that sit on these councils are responsible for both game and nongame. Long-term goals and better cooperation need to be achieved, to eliminate the "state project here and state project there" approach. Maybe regional projects could be achieved. This is often accomplished for game projects, through the federal aid program, where we have several states joined together in a cooperative effort. Funding is more readily available for this type of approach. Maybe something comparable could be worked out if there were general widespread support. Larry's point is well taken. This could be a realistic approach. "

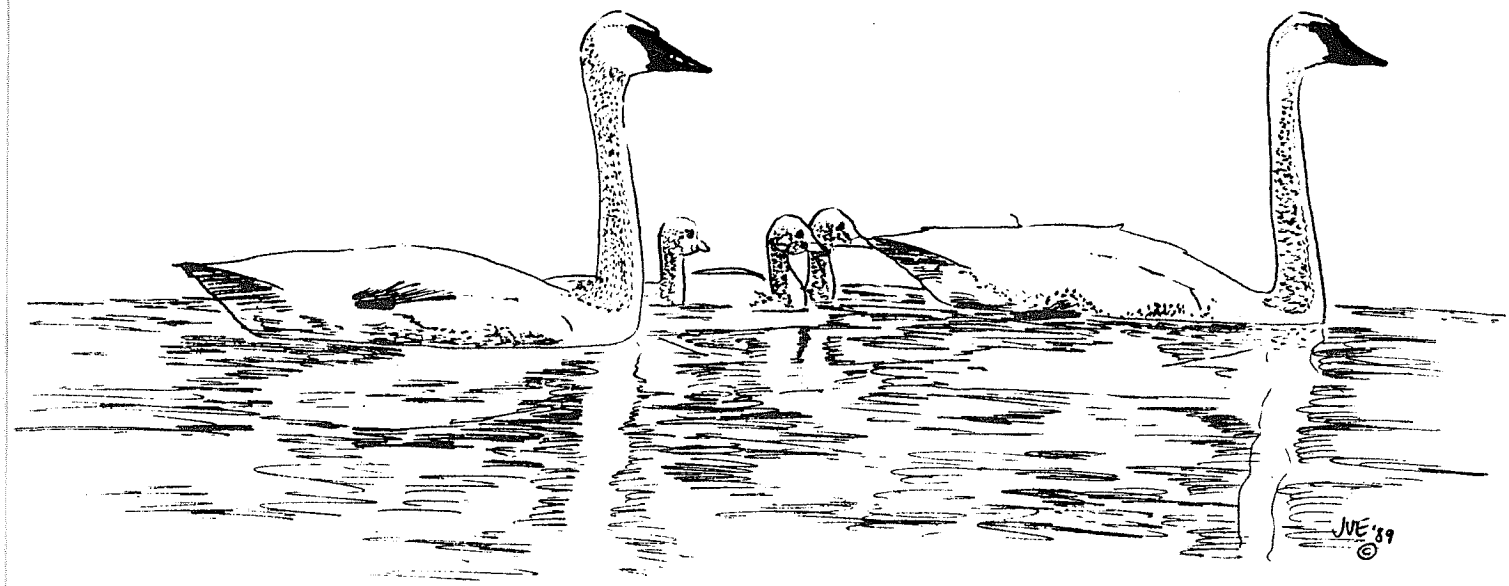
Art Hughlett:

"I was very much interested in what Rolf had to say about the need for establishing safe southern breeding areas for Trumpeter Swans, hoping that birds that nested in the south would eventually follow age-old traditions and go back north, meeting flocks that we already have established in the north, and training them to return south. It makes sense that in certain locations we have too many swans in the north. I'm thinking especially about the Henry's Fork of the Snake River, where we had the starvation problem last winter, which may occur again in spite of ourselves....Rolf was talking about the number of subadult birds in the population that winter at Lacreek, now 250 birds total, with a big percentage of subadults. When they start nesting and try to bring their young back to that small Refuge to a limited amount of open water in the winter, there's going to be an overcrowding situation and there's going to be a "nuisance" population of birds there. I think that we have a potential for moving some birds from selected areas in the Upper Midwest to more southerly areas where they might nest and begin a northern migration. I certainly think that it's something that we ought to consider very seriously. Rolf, I commend you for your foresight in bringing this to our attention. "

Joe Johnson:

"I support Rolf's viewpoint. It's something we've been talking about for quite some time. As you begin to attempt southern nesting in mid-latitude states, these birds would also function as winter decoys for the wayward Minnesota birds. They would perform two functions which we desperately need. "

PROPAGATION TECHNIQUES



TRANSPORT OF TRUMPETER SWAN EGGS AND CYGNETS

Donna Compton

ABSTRACT

The Board of Directors of The Trumpeter Swan Society has requested that expertise on transporting Trumpeter eggs and cygnets be included in the next printing of A Guideline for Propagation of Captive Trumpeter Swans. A number of transport experts have been consulted. Their recommendations will be reviewed, and included in this manual. Consultants include: Ray Erickson, Rod Gable, Carrol Henderson, Joe Johnson, Ken Kalenak, Steve Kittelson, George Knapp, Forrest Lee, Harry Lumsden, Jim Pichner, and Len Shandruk. A summary of their recommendations follows.

EGG COLLECTION AND TRANSPORT

The best time to collect and transport Trumpeter Swan eggs is during the second half of incubation, between 15 and 25 days. Transport, even for short distances, should be avoided during the first 7 days of incubation. With the above exception, eggs can be moved at almost any time if they are to be transported for short distances. Transport of unincubated eggs is the second best option. Eggs must be completely fresh. Eggs should be collected as they are laid, rather than waiting until the clutch is complete. Fresh eggs are much easier to translocate than partially-incubated eggs. However, they are much harder to hatch. Foster incubation under a variety of species has resulted in better hatchability.

The most important action to avoid in handling Trumpeter Swan eggs is jarring or abrupt movement. In addition, the internal temperature of the egg transport container must be maintained between 95°F and 99°F. All other care given to the eggs will be wasted effort if these conditions are not met. The eggs may be stabilized in either a vertical position, with the large end up, or a horizontal position. Eggs within the 15-25-day optimal collection time period will generate their own heat and may, indeed, generate enough to eliminate the need for a supplemental heat source within the carrying case. However, it would be risky to assume that there will be enough heat generated, and that it will be evenly distributed. Particular care must be taken to keep the temperature below 100°F; 103°F for 20 minutes or more means dead eggs.

CYGNET TRANSPORT

Cygnets 2 to 4 days old can be easily moved. After this initial period of time, they should not be transported until they are ready to be clipped. It is best to try to avoid capture or transport of the birds when they are actually molting or in the early stages of regrowth. During this period, the birds are most subject to stress-related problems and feather damage. Birds should be moved in plastic dog kennels. The kennels restrict the swan's ability to see, allow for adequate ventilation, limit swan injuries, and are easy to keep clean. Ambient temperatures during transport should be less than 70°F. Bedding inside the crate should be shredded paper, clean astroturf, fresh or dried grasses, or cat litter.

Birds that will have to endure a long trip (over 12 hours) should be hydrated prior to and immediately following transport to avoid dehydration. It is unlikely they will eat or drink of their own accord while inside the kennel. A slow release process is recommended for both wild-caught and captive-reared birds, although it is much more critical for wild-caught birds. However, holding the birds for any length of time must not in any way endanger the birds. Slow release in whatever form ensures that the birds are less stressed and more accustomed to companion birds when released.

As in everything, a wide variety of techniques have been successful in transporting eggs and cygnets. The most reliable methods that will work in the widest variety of circumstances have been included here.

TRUMPETER SWAN MULTIPLE AND CONTINUOUS CLUTCHING: A SUMMARY

Jimmy Pichner

The increase in Trumpeter Swan restoration programs throughout North America has placed a strain on the number of captive swans available. Therefore, there is renewed interest in methods that will increase the annual reproductive rates of individual swan pairs. This paper attempts to summarize some of the methods commonly used, and their results.

Six questionnaires (Figure 1) were sent to a select list of zoos and private waterfowl breeders to acquire information on methods used to maximize reproduction. Four of six questionnaires were returned. The data from these questionnaires was combined with data from the Minnesota Zoological Garden, and the results are summarized in this paper.

The three methods used to increase reproductive rates in Trumpeter Swans were: (1) multiple clutching, (2) continuous clutching, and (3) a combination of methods 1 and 2. Eggs which were removed from the birds were incubated in a number of different ways, including, but not limited to, artificial (mechanical), bantam chickens, and other swans, including cross-fostering under Mute Swans.

There are four primary areas of concern about the use of these methods:

1. Can these methods really increase reproduction?
2. Under what conditions can these methods be used?
3. Do these methods affect the long-term reproduction of individual swans?
4. Are hand-reared birds acceptable for release?

The first three questions will be addressed in this paper. The fourth question will be addressed in a future paper.

Double and continuous clutching were the most common techniques used by the respondents to increase productivity of individual pairs of swans. In double clutches, second clutches averaged 5.0 eggs per nest (ranging from 3 to 7) in 13 second clutches as compared to 7.2 eggs per nest (ranging from 3 to 14) in 17 first clutches. This compares to average clutch sizes of 4.3 and 5.25 eggs per nest in wild populations in Wyoming and Alaska, as reported by Lockman et al. (1987) and King (1988).

Seventeen double clutches were attempted. Thirteen were successful. When eggs were removed between 0-10 days after incubation began on the first clutch, renesting occurred 75 percent of the time (Figure 2). In the four cases where second clutches were not laid, incubation of the first clutch was not initiated before May 8 (May 8, May 8, early June, May 9, respectively).

Nine of the 13 second clutches (69.2 percent) produced cygnets, as compared to 14 of 17 first clutches (82.4 percent). However, a higher percentage of eggs hatched from second clutches (44.6 percent, N=65) than from first clutches (35.8 percent, N=123). The lower hatching rate for first clutches may be due to problems with the artificial incubation methods used.

Seventeen first clutches produced 2.5 cygnets/nest as compared to 2.2 cygnets/nest for 13 second clutches. Pairs that were double-clutched (N=13) produced 5.6 cygnets/pair, and overall hatchability was 45.6 percent.

Eight continuous clutches, two of which were also double clutches, produced clutches of 10.3 eggs per nest (ranging from 5 to 16) with 3.5 cygnets produced/clutch for a 34.1 percent hatchability.

A comparison of the two cases of double/continuous clutching to the single continuous clutches produced some interesting information. Two double/continuous clutches produced 15.5 eggs/pair and 7 cygnets/pair. First clutches averaged 9.5 eggs (ranging from 7 to 12) with 5 cygnets produced/clutch for a 52.6 percent hatchability. Second clutches averaged 6.0 eggs (ranging from 5 to 7) with 2 cygnets produced/pair for a 33.3 percent hatchability. Overall, these nests produced 7 cygnets/nest for 45.2 percent hatchability. Four continuous clutches averaged 12.8 eggs (ranging from 11 to 16), with 3.5 cygnets produced/clutch for a 34.1 percent hatch. Table 1 summarizes all of the above data.

Eggs removed from the nesting Trumpeter Swans were incubated in a number of different ways. Because of the variability in the conditions under which eggs were removed and the conditions under which they were set, it was not possible to analyze the different methods. However, some comments can be made about the methods used. First, each breeder has a method that suits his or her particular need and with which he or she is most comfortable. Second, the chosen method may be determined by the program for which the eggs are being removed, e.g., cross-fostering under Mute Swans. And third, little if any difference in hatchability could be detected among methods.

All respondents reported that the increased reproduction by these birds due to double or continuous clutching has had no apparent effect on the birds' health or reproductive potential. Many of the birds were 13 years old or more and still producing well.

In summary, either double or continuous clutching can be used as a method of increasing reproductive potential in captive Trumpeter Swans without harm to the health or reproductive potential of the swans. The main problem with the technique is the variable hatching success of alternate incubation methods. If hatchability could be improved, reproduction of individual pairs could be doubled. The reasons and methods for success have been discussed by Pichner (1987), Lumsden (1988), and Lumsden et al. (1988).

ACKNOWLEDGEMENTS

I thank G. Ekberg, V. Grannis, K. Kalanak, and H. Lumsden, for without their assistance this paper would not have been possible. I thank also the Minnesota Zoological Garden's Conservation Biologist Gerry Binczik for his editorial assistance in preparing this paper, Zoologist Brad Geizsler and Zookeepers Steve Christenson and Tony Fisher for their work with the swans, Curator Nick Reindl who started the program and continues to provide his steadfast support and assistance, and the Minnesota Zoological Garden for supporting the program.

Table 1. Summary of double and continuous clutching of Trumpeter Swan pairs.

Method/ clutch	Total # eggs laid	Total # hatched	Average # eggs/clutch	Cygnets hatched/clutch	Percent hatch
1st Double (N=17)	123	44	7.2	2.6	35.8
2nd Double (N=13)	65	29	5.0	2.2	44.6
Combined (N=13)	160	73	12.3	5.6	45.6
Continuous (N=8)	82	28	10.3	3.5	34.1
Continuous w/o DoubleClutch (N=4)	51	14	12.8	3.5	27.5
Continuous Double clutch (N=2)	31	14	15.5	7.0	45.2
1st clutch	19	10	9.5	5.0	52.6
2nd clutch	12	4	6.0	2.0	33.3

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TRUMPETER SWAN MULTIPLE CLUTCH QUESTIONAIRE

Name:

Do you multiple clutch or continuous clutch your Trumpeter swan?

Please provide information below:

YEAR	PAIR 1	PAIR 2	PAIR 3	PAIR 4
Clutch 1				
Date 1st egg laid				
Date inc. initiated				
Total # eggs laid				
Date eggs removed				
How incubated				
# eggs hatched				
Fate of unhatched eggs				
Clutch 2				
Date 1st egg laid				
Date inc. initiated				
Total # eggs laid				
Date eggs removed				
How incubated				
# eggs hatched				
Fate of unhatched eggs				
Continuous clutching				
Date 1st egg laid				
# of eggs removed				
Date eggs removed				
Total # eggs in nest before egg removal started				
Total # eggs laid				
How incubated				
# eggs hatched				
# eggs hatched by swans				
Fate of unhatched eggs				

REMARKS: Please use the back of the sheet for any additional comments or criteria you have for multiple or continuous clutching.

Figure 1. Trumpeter Swan multiple clutch questionnaire.

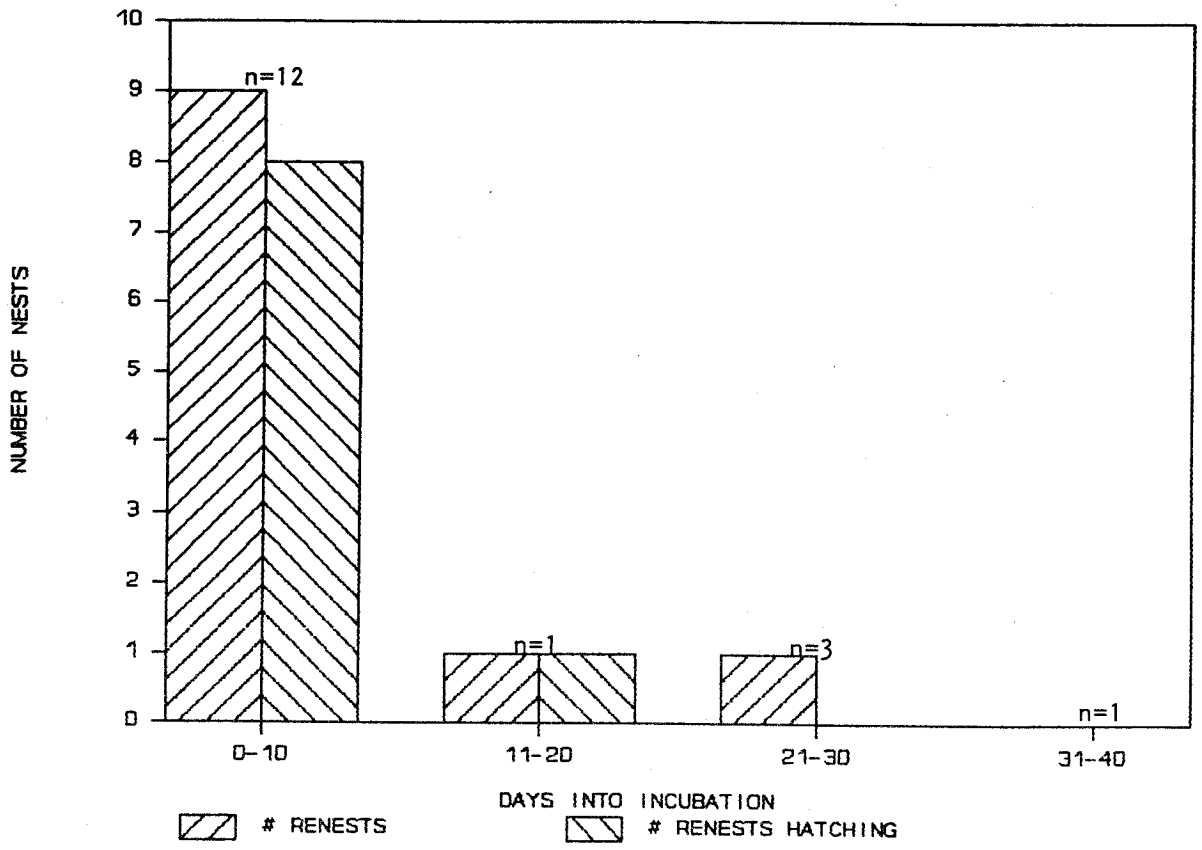

Figure 2. Number of Trumpeter Swan pairs renesting and hatching eggs in relation to how many days elapsed from the start of incubating the first clutch.

FEATHER STRESS IN TRUMPETER SWANS

John J. Moriarty

Until 1 month ago, I worked with critters (herps) that did not have to worry about feather problems. My avian physiology background is comprised of having read the course description in the University of Minnesota graduate catalog. With those great credentials, I would like to present some information on feather stress in Trumpeter Swans.

The reason feather stress was suggested to me as a topic is that there are several Hennepin Parks birds that show repeated feather development problems. Other swan fanciers have also noted various stress problems. Feather stress is of concern to Hennepin Parks wildlife officials because poor feather development or excessive feather breakage is detrimental to free-flying birds. Many captive birds are never allowed to fly, so feather stress is not a problem for them. The free-flying birds need to have good feathers to maintain their flight capability throughout the winter and spring, when they are migrating or returning to their nesting sites.

Some researchers have speculated that feather stress is caused by nutrient deficiencies. This is questionable because, if nutrition were the cause, why do only random birds develop this problem within one flock? Others say the cause is genetic. This would mean that some programs, including ours, would need to replace or add birds from new genetic stock. This is currently difficult to do, since there have been no genetic studies to determine the available genotypes. There are still others that say feather stress is a manifestation of fright molt. This may be the case in some instances, but not the majority.

So what is feather stress? In Hennepin Parks birds, stress is manifested in three forms. One is when the rachi of the developing feathers are bent. This bending will also distort the barbs. Another form is when the rachis splits. The third form, which is the stress or faults studied in other bird groups, is when the barbules do not develop along a pair of barbs. This may be found repeatedly along the length of the feather. These faults lead to breaks in the feathers. The fright molt phenomena, which is when the blood flow is restricted to the quill under severe stress, should lead to a fault mark on the feather (King and Murphy 1984). Repeated marks would not be expected if fright was the cause, since our birds are handled only rarely during feather development. King and Murphy (1984) showed that fault bars developed in White-crowned Sparrows each time the birds were handled. Falconers have noticed faults in raptors for years. They are commonly associated with nutritional deficiencies (Parrish, pers. comm.). Falconers call these faults hunger traces. Lee (1982) reported severe faults in a group of fledgling Aleutian Canada Geese. Lee speculated the defects were a combination of poor nutrition and stress.

There is one type of feather mark that appears as a bar on the feather, but this mark occurs in normal development. Growth marks show up on many of the feathers, sometimes in conjunction with stress marks (Michener and Michener 1938, Wood 1950). Growth marks are simply a variation in color, and do not weaken the feather itself.

To understand stress marks, one must discover how widespread the problem is within captive and/or wild swan flocks. A survey of captive birds will help in determining the extent of stress marks. Another consideration needs to be the actual cause of stress marks. Parrish (pers. comm.) is currently studying this phenomena in raptors. It could be that stress marks are only a symptom, caused by many different problems. The concern of feather stress in swans may be unneeded if it can be shown, as with raptors, that the presence of faults is not detrimental to flight.

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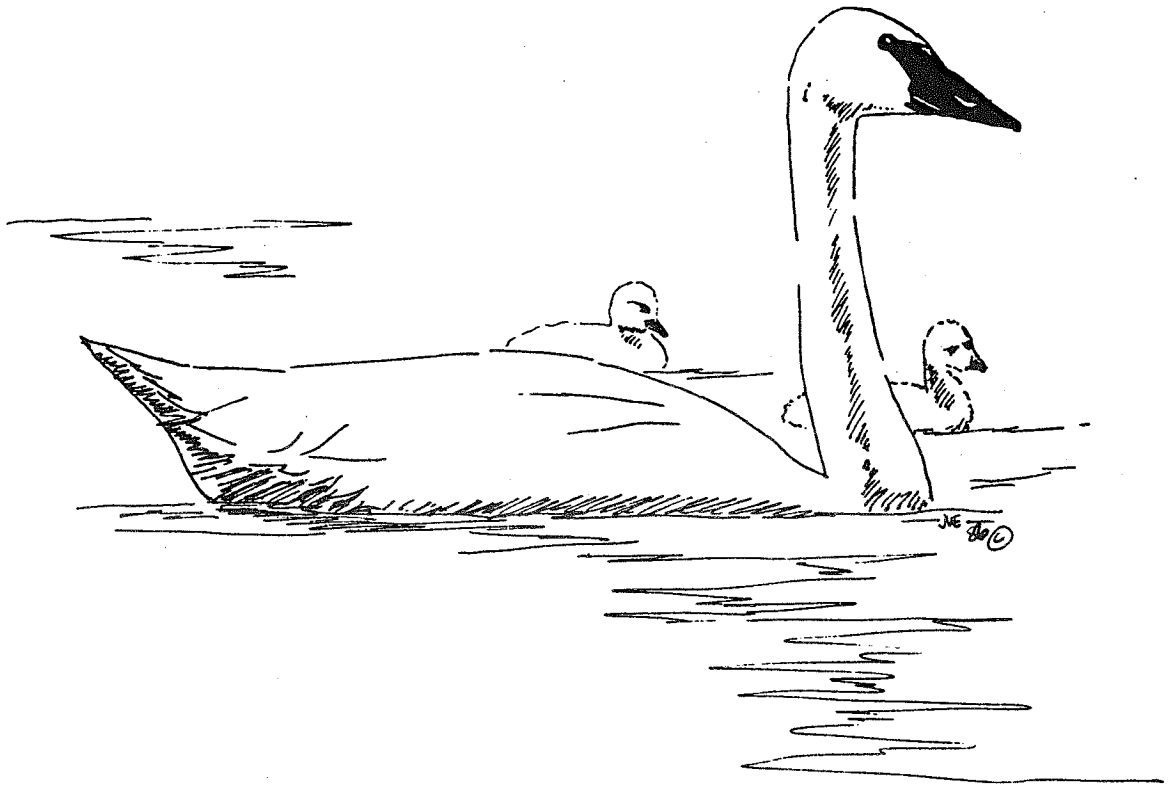


REFLECTIONS ON 40 YEARS OF WATERFOWL MANAGEMENT

Harvey K. Nelson

INTRODUCTION

Most of the members of The Trumpeter Swan Society have a wealth of experience in waterfowl and other related wetland activities in addition to their experience with swans. Many of you are in about the same age group as I, and have been directly involved with, or have observed, some rather startling changes to our environment over the past 40-50 years, specifically to waterfowl and their habitats. Thus, rather than talk more about specific Trumpeter Swan issues that you have already spent considerable time on over the past few days, I would like to share with you some of my insights into the changing waterfowl scene over the past 40 years, and to look a bit at the future.

I would also like to share some personal feelings with you. As a young lad, I grew up on a farm on the edge of the prairie in western Minnesota. I remember the flocks of waterfowl that darkened the skies during spring and fall. That situation didn't last. The great drought of the 1930's ravaged the lands. Dust clouds, not flocks of waterfowl, darkened the skies. The hardships our family endured were the same ones faced by hundreds of thousands of farm families across the country. Because my father was a duck hunter, I was keenly aware of the plight of waterfowl and other wetland wildlife. When I returned from World War II and went to the University of Minnesota, I settled on a career in fish and wildlife management. As a member of a farm family and as a young man interested in wildlife, I have never forgotten that we all rely on the land. In fact, those feelings are as strong today as when I entered this profession nearly 40 years ago.

PERIODS OF CHANGE

Major periods of change have occurred in this country at roughly 10- to 15-year intervals. For simplification, I'm going to try to quickly summarize significant changes and events by 10-year periods. We can begin with the "dustbowl days" of the 1930's, when this Nation's economy hit an all-time low. The U. S. and Canadian prairies, and the Great Plains region, in general, were devastated. The potholes disappeared, large marshes and lakes dried up, and stream flows ceased.

This was also a tough time for prairie waterfowl and other water birds. On the positive side, a new conservation movement was organized in Canada and the U. S. to address the plight of the continent's wetlands and waterfowl. Building on the Migratory Bird Treaty Act of 1916, "More Game Birds In America" was founded in 1931. This was the forerunner to Ducks Unlimited, Inc., organized in the U. S. in 1936, and Ducks Unlimited Canada, organized in 1938. They began active cooperative programs to retain water, and restore wetlands and waterfowl nesting habitat. J. N. "Ding" Darling began his crusade for waterfowl and wetlands in the U. S., followed by the Migratory Bird Conservation Stamp Act of 1934, and expansion of the National Wildlife Refuge System. The first international duck census was conducted in the mid 1930's, banding programs were started, and the development of an information base began under the guidance of the U. S. Biological Survey. More restrictive hunting regulations were developed. The initiation of the Civilian Conservation Corps and Works Progress Administration in the U. S. provided a source of manpower and funds to assist these efforts. More importantly, the drought broke and water began to return to the prairies in 1938-39.

The 1940's witnessed improved water and habitat conditions, followed by increased waterfowl populations. The full brunt of World War II came to bear during 1941-45. Emphasis shifted to national defense and military support for Allied Forces around the world. Idle lands again went under the plow, but wildlife populations, especially waterfowl, thrived during that period with little hunting activity for 4-5 years. Following World War II, we entered a new era of fish and wildlife conservation efforts. Many returning servicemen became avid sportsmen and the demands on the waterfowl resource again increased. Intensive agriculture and subsidized wetland drainage posed new problems in the late 1940's. Conservationists like Aldo Leopold, the "Father of Wildlife Management," and Richard Doer, Minnesota's "Father of the Wetlands Program," identified the need for a new land use ethic, stressing the importance of preserving wetland ecosystems.

During the 1950's, there was a recognized need to expand the wildlife habitat base across the country by adding new units to the National Wildlife Refuge System and state wildlife management areas, and to include habitat protection and development practices in farm programs. By the mid 1950's, the wetlands drainage controversy increased.

In 1958, PL85-585 established the accelerated wetlands acquisition program as an amendment to the Duck Stamp Act. This was later extended by the Wetlands Loan Act of 1961, and the first large scale small wetlands protection program on private lands got underway in the U. S. prairie region. During the early 1950's the Flyway Councils were formed, and the first truly coordinated federal/state cooperative waterfowl management programs emerged. More systematic population surveys, and banding and harvest surveys, were developed. During the mid 1950's, we experienced the highest duck populations ever recorded. Spring breeding populations probably exceeded 100 million, and the fall flight may have been twice that number. High populations of Mallards and Pintails

brought on new concerns over crop depredation by ducks in the Canadian and U. S. prairies. At the same time, we entered a new era of intensive population management of Canada Geese, a system which is still with us today in various forms, sometimes successful, sometimes not.

New developments during the 1950's continued to tax the ingenuity of waterfowl biologists and administrations through the 1960's and beyond. We reached a better understanding with the U. S. Department of Agriculture (USDA) on wetland drainage and land retirement programs, i.e., Soil Bank and set-aside acres. Building on the success of the space program, the climate for research and development improved substantially in the Administration and the U. S. Congress. The U. S. Fish and Wildlife Service (USFWS) established the Northern Prairie Wildlife Research Center at Jamestown, North Dakota, in 1963. This center was built to expand research on wetland ecology, land management practices, and waterfowl population ecology. The Canadian Wildlife Service established a similar research facility at Saskatoon, Saskatchewan. A number of new research projects were launched to identify factors limiting duck production and to develop new intensive management practices to improve waterfowl habitat conditions on public and private lands. The period 1960-62 brought a recurrence of the drought, accompanied by a sharp decline in prairie ducks and the adoption of more restrictive regulations. Fortunately, there was a rapid recovery from the drought beginning in 1963, with minor setbacks in 1965 and 1968. However, conditions remained relatively stable through the early 1970's.

The 1970's were a time of moderate duck population levels, with increases in most goose populations and Tundra Swan populations. Duck Stamp sales and hunter activity remained strong. It was also a period of increased emphasis on more intensive management of public lands. The Water Bank Act, passed in 1970, was a significant step. The Preamble to that act says it all: "The Congress finds that it is in the public interest to preserve, restore, and improve the wetlands of the Nation, and thereby to conserve surface waters to preserve and improve habitat for migratory waterfowl and other resources, to reduce runoff, soil and wind erosion and contribute to flood control, to contribute to improved water quality and reduce stream sedimentation, to contribute to subsurface moisture, to reduce acres of new land coming into production and to retire lands now in agriculture production to enhance the natural beauty of the landscape and to promote total water management planning." It was also a time when support for research again declined throughout the Federal Government. The late 1970's saw cutbacks in USFWS waterfowl and habitat research activities -- right at the time many new projects were producing significant results. On the positive side, the Bicentennial Land Heritage Program gave the National Wildlife Refuge System a badly needed shot in the arm to handle operations and maintenance deficiencies.

The 1980's began with more austere budgets for natural resources programs under the Reagan Administration. The USFWS had to tighten its belt once again, even with new responsibilities and expanding programs. By the mid 1980's, strong public sentiment again focused on the plight of wetlands and migratory bird resources, the deteriorating condition of public lands, and a general weakening of federal natural resource programs. We began to get some fiscal relief. We also began to experience another drought period. A critical situation developed by 1985, when we experienced the lowest pothole densities and perhaps the lowest duck populations since the 1930's. That year saw the return to some of the most restrictive waterfowl hunting regulations since 1962. Meanwhile, we were just completing a 5-year period of stabilized hunting regulations. That study ended in 1985. We didn't learn much about the impact of regulations, but we learned a great deal more about duck mortality and survival which equated to low annual recruitment rates. It reinforced previous concerns that prairie nesting ducks were being seriously affected by continual habitat loss and degradation, and severely impacted by nest predation to the extent average annual nesting success had dropped to less than 10 percent in many important breeding areas in Canada and the northcentral U. S. Waterfowl population ecologists tell us that it requires a nest success rate of 15 percent or more, with good survival of young to flight stage, to maintain a stable population. Habitat conditions and annual recruitment rates were indeed worse than earlier studies indicated, but the principal factor limiting duck production was, and is, mammalian predation. We were losing ground in spite of more intensive management. New approaches needed to be developed, even though drought conditions became worse and continued through this year.

Beginning about 1985, some promising new developments appeared on the horizon. The most significant developments were the Food Security Act of 1985 (Farm Bill), the signing of the North American Waterfowl Management Plan (NAWMP) in 1986 by Canada and the U. S., and the Emergency Wetlands Resources Act of 1986. In 1988-89, we have seen renewed interest by the Bush Administration to move forward with a new national wetlands initiative as a result of recommendations published in the final report by the National Wetlands Policy Forum. This past year, we have seen renewed interest by the U. S. Congress to enact new legislation, to be called the North American Wetlands Conservation Act, to support the North American Waterfowl Management Plan and related wetlands initiatives. I would like to expand on these issues a bit more in concluding my presentation this evening.

A more detailed account of much of the historical information I have highlighted can be found in the book FLYWAYS - Pioneering Waterfowl Management in North America, which we published in 1984. Some of you were contributing authors.

WHERE ARE WE TODAY?

Let me highlight a few significant issues and new developments. North America's habitat base for wildlife has deteriorated in the face of advances in agriculture, industry, urbanization, transportation, and the tapping of its bountiful natural resources. By the mid 1970's, over half of the wetlands in the lower 48 states had been destroyed, and losses are estimated to exceed 360,000 acres annually. The development of more intensive land use practices and wide-spread use of pesticides and other toxic chemicals continues to impact water quality. Cumulatively, these impacts have greatly altered the landscape and disrupted natural ecosystems.

This year's duck breeding population estimates and fall flight forecast reflect long-term habitat alterations and a decade of drought on prime nesting areas. Upland nesting ducks continue to exhibit extremely low recruitment rates and several

species are near all-time low levels. The 1989 duck breeding populations declined 8 percent from last year and were 24 percent below the 1955-88 average. The population estimates for Pintails, Blue-winged Teal, and Scaup fell to all-time lows. Mallards increased slightly. Nine of the 10 principal duck species populations were below last year's levels, and eight are well below their long-term averages and the objective levels established in the NAWMP.

The 1989 fall flight index of ducks was estimated to be 64 million, down 3 percent from last year, and the second lowest on record. In contrast, goose and swan populations remain relatively stable, and, in some cases, are increasing. In the Arctic this spring, conditions were favorable for populations in the western areas, but less so for populations in eastern areas. Another large fall flight is expected for most populations of geese nesting in the western and central Arctic and adjacent areas.

Wildlife management agencies have traditionally concentrated management programs on public lands. Because the vast majority of wildlife habitat remains on private land, new innovative approaches must be incorporated into comprehensive wildlife programs. Currently, federal and state agencies are reassessing the role of these efforts and investigating ways to encourage more intensive wildlife habitat programs on private lands.

One of the most important strategies for successful implementation of the NAWMP is the development of options for achieving long-term habitat protection and development in addition to traditional acquisition procedures. It involves efforts to promote land use practices on private lands that will benefit wildlife. "Partners for Waterfowl Tomorrow" is a USFWS program in the southeast to assist wildlife on private lands. Similar efforts have been initiated in other areas, including the important Prairie Pothole Region and California's Central Valley. "Farming the Flyways" is a program sponsored by the magazine Successful Farming, Ducks Unlimited, and the National Fish and Wildlife Foundation to encourage farmers to share information on ways to manage wildlife in their farming operations. Several state programs, like Minnesota's "Reinvest In Minnesota" and California's new private lands program will do much to conserve wildlife habitat on private lands. In Canada, Ducks Unlimited's new "Prairie Care" program is encouraging farming practices that will restore grasslands to help wildlife.

It's critical that we establish strong legislation to protect our continent's wetlands and support the NAWMP. Our partners want to see a stronger federal commitment than has been evident to date. Several members of Congress have taken recent action to do just that. As many of you know, Senator George Mitchell from Maine introduced legislation to establish the North American Wetlands Conservation Act. This legislation will not only create a major funding source for the NAWMP, but would establish a mechanism to distribute those funds required in Canada. So far, that bill has been receiving strong bipartisan support. A companion House Bill is scheduled for hearings on 14 September 1989. At the Ducks Unlimited Waterfowl Symposium on 8 June 1989, President Bush announced that he looked forward to signing such a bill before the end of this year. I am optimistic that this will happen. It will reinforce the Federal commitment and provide an annual funding base of about $30 million. Please follow this legislation. We need your support.

The development of new legislation and regulatory measures at the state level is an important component for advancing the NAWMP. For example, a Maine group called the Maine Wetlands Coalition is pushing for zoning and protective regulations to assure that wetlands are preserved. Here in Minnesota, the Reinvest In Minnesota program was started in 1986. That program provides new authority and resources to aid wetland protection and development. There was also a new proposal before the Minnesota legislature that could greatly expand such efforts -- the Environmental Trust Fund. The state lottery system should begin to build a portion of that fund by early 1990.

The NAWMP is reaching out to land management agencies in the federal government other than the USFWS. A companion program, "Taking Wing," has been launched by the U. S. Forest Service, and the Bureau of Land Management has launched the program "Autumn Wings." In the northcentral states, the Chippewa Tribes have been working with the Bureau of Indian Affairs in developing a wetlands and waterfowl program on reservation lands called "Circle of Flight." During the past year, cooperative agreements have been signed between the USFWS and the Department of Defense, the U. S. Army Corps of Engineers, and the National Association of Conservation Districts, all specific to the NAWMP. Existing agreements are being used to develop cooperative efforts with the Bureau of Reclamation, Farmers Home Administration, Soil Conservation Service, Agricultural Stabilization and Conservation Service, and the Environmental Protection Agency.

The habitat joint ventures being established under the NAWMP may offer opportunities to consider the future needs of Trumpeter Swans. I encourage you to keep in touch with the USFWS and the respective states as these projects come on line, and make your wishes known. The NAWMP Committee will also continue to be interested in the results of your continued restoration programs and Trumpeter Swan population objectives so that we are in sync with your current program.

MY PERSPECTIVE ON THE FUTURE

1. North American Waterfowl Management Plan. I believe the NAWMP is the most innovative, cooperative, international natural resources program ever attempted in wildlife management. It is the major conservation challenge of the remainder of this century. It is a reality, but we have to continue to build a more solid base of support.

2. National Wetlands Initiative. The U. S. Department of Interior and the USFWS need to play a strong role in the development of a new national program. We need to provide the leadership in wetlands management, whereas other agencies such as the Environmental Protection Agency and the Corps of Engineers are more directly responsible for the regulatory and development aspects. The USFWS is presently revising a draft policy document that will go forward as a Departmental position.

3. Food Security Act of 1985. The 1985 Farm Bill has provided new incentive to farmers and ranchers to employ sound soil and water conservation practices and to place highly erodible, marginal lands in permanent cover. While the Sodbuster and Swampbuster programs can make substantial contributions to fish and wildlife habitat, the Conservation Reserve Program (CRP) offers the greatest opportunity to place good, quality nesting cover on private lands and restore drained wetlands. This has already been demonstrated by USFWS Regions 3 and 6 programs conducted to date. The CRP acreage enrollment to date is about 35 million acres of the 45 million authorized. The proposed reauthorization of the Farm Bill in 1990 could increase that to 60 million acres. We should all encourage that and guard against opposing efforts that are being designed to decrease the effectiveness of CRP.

4. Congressional Action. We need to continue to build grassroots support for new wetlands, for habitat protection measures, and for implementing the NAWMP. Recent actions by certain members of the U. S. Congress and by the President are encouraging, but we need to collectively continue to expand that base of support through increased public awareness. I urge you to follow closely the related Bills now before the Congress.

5. National Conservation Organizations. I believe that in the coming years national conservation organizations will play an increasingly important role in shaping the course of conservation of the natural resources in North America. At the national level, united efforts by the conservation community have been effective in influencing policy and federal budgets. At the local level, cooperative support for programs such as the NAWMP will be instrumental in successfully implementing programs that independent efforts, no matter how well-intentioned, would not succeed. I encourage The Trumpeter Swan Society to continue its efforts on behalf of the Trumpeter Swan, but to continue to look for ways to interface with other ongoing efforts.

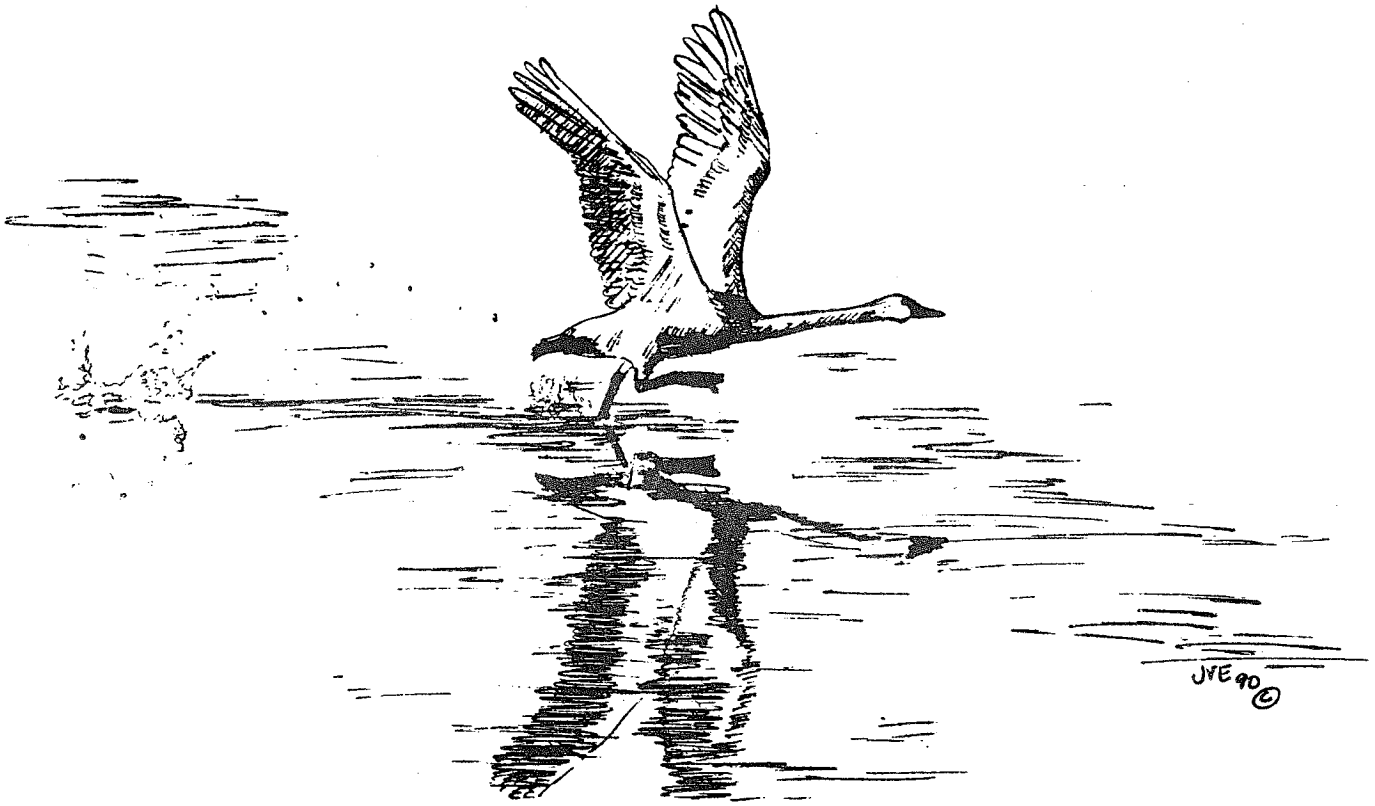
6. Species Management - Species Plans. The Trumpeter Swan and the Giant Canada Goose have similar historical ranges and, as such, are roughly ecological equivalents. Both have experienced extirpation from major portions of their range, but have recently benefitted from restoration efforts directed at their reestablishment. Comparatively, efforts for the Canada Goose have been much more successful, in fact, several populations are now reaching levels that are requiring special harvest regulations to control their numbers. In contrast, the Trumpeter Swan will require special management attention as advocated by the 1984 draft of the Management Plan.

   I believe that these types of species-specific approaches are biologically sound and will, in the future, prove to become an accepted way to help focus efforts on individual species. In addition to Trumpeter Swans and geese, several other waterfowl species would benefit from more intensive species management plans. The ultimate success in implementing such efforts will depend on the ability to develop plans that minimize conflicts with other migratory bird management efforts.

7. Broad Wetland Values. Wetland complexes and associated uplands are some of the most productive lands on the continent. They are an integral part of the landscape, and they provide a wide array of ecological, hydrologic, social, and economic benefits. Resource management plans for wetlands will have to broaden their focus beyond waterfowl and other wetland wildlife and acknowledge broad wetland values. This will help capture the sentiment of the public and political interests.

8. Restrictive Regulations - Ducks. Low recruitment rates and habitat losses have resulted in extremely low populations for many duck species. During periods of low populations we must adopt conservative regulatory measures for hunting in order to conserve breeding stocks. The restrictive regulations that were put in place in 1988 were, for the most part, maintained in 1989, and will likely remain until population trends are reversed.

Public attitudes across this country are shifting enough to make broad-scale wetlands protection and restoration a reality. I predict we'll see some sweeping changes in national and state wetlands policies during the next 2-5 years. I also predict we will see increased support for wildlife habitat protection, development, and management on private lands through expanded federal and state agricultural programs and cooperative wildlife agency programs.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NEW TREATMENTS FOR LEAD POISONED TRUMPETER SWANS

Laurel A. Degernes, DVM, Patrick T. Redig, DVM, and Martin L. Freeman, MD

The large number of lead poisoned Trumpeter Swans (Cygnus buccinator) admitted for treatment at The Raptor Center during the winter of 1988-89 afforded a unique clinical opportunity to investigate new treatment techniques. The basic protocol for treatment of lead poisoning in swans has been previously described (Degernes and Redig 1990). However, we had never before been presented with so many seriously ill swans with significantly elevated blood lead levels. Thirty-two of the 44 swans admitted for treatment had radiographic (x-ray) evidence of one or more shotgun pellets in the gizzard (range one to 56 pellets). Although steel and lead cannot be differentiated on x-ray, the presence of radiodense metallic shot pellets combined with other supportive evidence was regarded as highly significant. Because these lead pellets could further contribute to lead poisoning as the gizzard contractions ground them up, it was imperative to remove them as soon as possible.

CHELATION THERAPY

Calcium disodium EDTA (CaEDTA: Versonate, Riker Labs, St. Paul, MN) is the standard drug of choice for chemically binding lead ions in the blood and subsequent excretion, in bound form, by the kidneys (chelation) (Degernes and Redig 1990, McDonald 1984). This drug is diluted and administered intravenously for up to 6 weeks (twice daily, 3 or 4 days per week).

A new chelation drug is currently being investigated in the United States for lead poisoned children and industrial workers. This drug, meso 2,3-dimercaptosuccinic acid (DMSA: Aldrich Chemical Co., Milwaukee, WI) is given orally, is non-toxic, and has no known adverse side effect in people (Aposhian 1983, Graziano 1986). Since DMSA had not been used for lead poisoned birds before, we initially used it in a select group of birds, while we carefully monitored their vital signs, weight, and various hematology parameters (Degernes et al. 1989). No side effects were noticed in any of the patients treated with DMSA alone, or in combination with CaEDTA. The dose used was 250 mg DMSA twice daily (25-35 mg/kg body weight), 5 days each week, for up to 6 weeks. We found that this dose was extremely effective in removing lead from the blood. However, lead that is stored in the bones and soft tissue reservoirs in the body must move back into the blood (equilibration) before it can be chelated. Thus, it is necessary to chelate with DMSA, CaEDTA, or both for 3 to 6 weeks to effectively reduce the lead levels in the body. Blood lead levels may "rebound" when chelation treatment is stopped for 5 or more days in the early stages of treatment, due to lead ions moving from the tissue storage areas into the blood.

At this time, DMSA is still classified by the FDA as an experimental drug, and it is not readily available except by permit. Although we were not able to conduct any controlled clinical trials with DMSA, the drug appears to be as effective as CaEDTA in removing lead from the blood. The combination of CaEDTA and DMSA may be more effective than when either is used singly. In addition, no adverse side effects were noted with either drug singly or in combination, and DMSA has the advantage of being orally administered. We hope to be able to conduct controlled clinical trials with waterfowl in the near future.

LEAD REMOVAL FROM THE GIZZARD (GASTRIC LAVAGE/ENDOSCOPY PROCEDURE)

Many options have been proposed for removal of lead shot pellets from the gizzard in birds (McDonald 1984, Poole 1986). Conservative treatments to enhance the passage of shot from the gizzard include orally administered mineral oil, softened peanut butter, magnesium sulfate, Metamucil or other forms of laxatives, and/or force feeding grit material. None of these treatments were effective in the six swans treated. After the conservative treatments failed, surgery was done in two swans who each had 25 or more shotgun pellets in their gizzard. During surgery, it was impossible to locate all of the lead shot inside the gizzard due to the many crevices in the gizzard lining. One swan died during the night following surgery, and the second swan never fully recovered from surgery. She died approximately 5 weeks later of kidney problems.

When we were suddenly faced with over 20 newly-admitted lead poisoned swans with lead shot in their gizzards, it was imperative to develop an effective, rapid, and safe technique to remove the shot (Degernes et al. 1989). The technique was developed with the help of a human gastroenterology specialist, modifying similar procedures used to remove foreign bodies from human stomachs. First, the swan was anesthetized with Isofluorane (a very safe gas anesthetic agent), and a 1.5 m flexible polyvinyl chloride tube was passed down the esophagus into the gizzard. After the swan was tilted head down at a 45 degree angle on a surgery table, large quantities of water were pumped into the stomach to flush out most of the food, grit, and lead shot. Water pressure and gravity forced the gizzard contents to be washed into a collection bucket placed below the swan's head, and often visual examination of the grit revealed lead pellets. Repeated flushing of water and back-and-forth movement of the stomach tube facilitated washing out the gizzard contents. When grit was no longer washed out, radiographs (x-rays) of the head, neck, and abdomen were taken to determine whether all of the pellets had been removed. Occasionally, a few pellets would be

retained in the mouth or esophagus and were easily removed or flushed out.

With large numbers of lead pellets or with finely ground lead pieces, the gastric lavage technique described above was not always successful alone, necessitating removal of these pellets endoscopically. The Olympus Corporation loaned us a 1.5 m flexible human colonoscope with a video system that allowed us to visually examine and videotape the lining of the esophagus, proventriculus (first part of the stomach), and gizzard. An operating channel allowed us to pass a remote controlled cable with a tiny alligator forceps, which was used to retrieve any remaining lead shot pellets. With a little practice and patience, the lead shot pellets were readily located and removed, one at a time, after the majority of the food and grit was washed out. Follow-up x-rays were always taken to verify that all of the lead shot had been removed.

The entire procedure usually took 45-90 minutes per bird, including anesthesia time. No anesthetic deaths were encountered, despite the debilitated nature of the patients. However, one swan died during the gastric lavage procedure when the proventriculus ruptured. This bird had an impacted esophagus and proventriculus, and it is thought that the wall of the proventriculus was weakened due to the impaction and lack of gastrointestinal motility. Three other swans in poor condition died within 24 hours following this procedure. In spite of these losses, the combined gastric lavage/endoscopy technique proved to be extremely effective in eliminating further lead exposure, and can be credited with saving some patients that may otherwise have died.

SUMMARY

The new treatment techniques used for the lead poisoned Trumpeter Swans were borrowed or modified from our counterparts in the human medical field. Further studies, including controlled trials, are needed before any firm conclusions can be made based upon the new chelation agent DMSA. However, the lead removal technique utilizing gastric lavage and endoscopy is undoubtably a major improvement over orally administered products or surgical removal of lead shot from the gizzard.

ACKNOWLEDGEMENTS

We would like to extend sincere thanks and appreciation to all of the many volunteers who helped with the swan treatments, the Olympus Corporation for generously loaning us the colonoscope and video endoscopy equipment, and 3M Riker Labs for providing the Calcium EDTA (Versonate) used for many of the treatments.

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THE AGONISTIC BEHAVIOR OF NESTING TRUMPETER SWANS TOWARD OTHER WATERFOWL

Christine M. Lueck

INTRODUCTION

During the late 1800's and early 1900's, Trumpeter Swans (Cygnus buccinator) were hunted for food, skins, and plumage. Their numbers dropped below 100 in the 1930's. They were an easy target for hunters because of their visible white plumage, and because of their unwary behavior.

Since then, the United States and Canada have been working to restore Trumpeter Swan populations. The Suburban Hennepin Regional Park District (Hennepin Parks), in Minnesota, has been involved in Trumpeter reintroduction since 1966. The goal of the Hennepin Parks program is to establish 100 free-flying swans with 15 nesting pairs. In 1988, there were approximately 50 free-flying swans with 10 nesting pairs.

Trumpeter Swans are very territorial during the nesting season. They will defend a territory for mating, nesting, and raising their cygnets. According to Banko (1960), Trumpeter Swans will defend this territory from other swans, but allow other waterfowl species on this territory. More recent evidence, however, suggests that Trumpeter Swans may attack and sometimes kill Canada Goose (Branta canadensis) adults and goslings, as well as ducklings (Miceli 1987).

The objectives of this study were to: (1) record and describe agonistic behavior between Trumpeter Swans and other species of waterfowl, particularly Canada Geese and ducks, (2) determine the frequency and intensity of agonistic behavior, and determine if this behavior changed as the nesting season progressed through prelaying, laying, incubating, and post-hatching, and (3) monitor each Canada Goose nest on the swans' nesting marshes to determine its fate.

Study areas and birds

Trumpeter Swans were observed at two marshes in the Hennepin Parks system. Kasma Marsh is located in Lake Rebecca Park Reserve near Rockford, Minnesota, 40 miles west of Minneapolis. Starkey Beaver Pond is located in Baker Park Reserve near Maple Plain, Minnesota, 24 miles west of Minneapolis.

Kasma Marsh is an 18-acre open water marsh with an average depth of less than 3 feet and borders of reed canary grass (Phalaris arundinacea). The southeast corner of the marsh is heavily vegetated with clumps of cattail (Typha latifolia). There are three small islands approximately 150 feet from shore. The northeastern island was used as a nesting island by the swans in 1988. The swans on Kasma Marsh were uncollared free-flying birds. The pen (female) was 9 years old and the cob (male) was 6 years old at the time of the study. They had nested together for 3 years on Kasma Marsh prior to 1988.

Starkey Beaver Pond was created by a beaver dam which caused flooding of an old field and woodlot. The pond has many dead trees and shrubs in the water area. The pond is 15 acres with an average depth of 2 feet. The swans nested on an old muskrat house in the center of the pond. The swans on Starkey Beaver Pond were also uncollared free-flying birds. The pen was 6 years old and the cob was 10 years old. It was the first year they had nested together, although the pen had nested there during 3 previous years with a different mate.

These two marshes were chosen for observation for various reasons. Since both marshes had been observed by Miceli in 1987, a comparison of behavior would be possible. Both marshes had good vantage points for observation. And, the swans at both locations seemed undisturbed by the presence of people.

METHODS

Observations began 4 April 1988 and ended 10 June 1988. The observation site at Kasma Marsh was on a north-facing hill overlooking the entire marsh. The southeast corner of the marsh contained cattails, which made it impossible to observe waterfowl in that area.

The observation site at Starkey Beaver Pond was on a south-facing hill. There were numerous dead trees in the center of the pond in addition to live trees on the north shore, which obscured parts of the pond.

Trumpeter Swan behavior was observed for time intervals ranging from 2 to 8 hours, but a standard of 4-hour time intervals was kept whenever possible. Observations were concentrated in the morning hours, but a few evening intervals were included to determine if behavior varied.

Agonistic behavior of the swans was recorded as either a response to Canada Geese flying over or to waterfowl on the water. Only visible waterfowl were recorded. The response of waterfowl to this agonistic behavior was also recorded. Opportunities for agonistic behavior that had no response were also recorded. Categories of behavior included no response, quivering-wings display and calling, and attack. Cooper (1979) described quivering-wings display in which the wings are "partially extended and held parallel to the ground and

rapidly moved from the wrist." An attack consisted of a chase with or without contact. When waterfowl were attacked on the water, the total length of time was recorded using a wristwatch.

A 20x spotting scope was used to observe activity, and waterfowl locations were mapped every 15 minutes. Observations were grouped into prenesting, laying, incubating, and post-hatching periods, to determine if agonistic behavior toward other waterfowl species varied throughout the nesting period. Observation periods were determined by counting back from the date of hatch.

Frequency and duration of agonistic behavior were computed for each observation period. Frequency of agonistic behavior toward geese flying over was determined by the number of agonistic interactions per opportunity per hour during the observation periods. Frequency of interaction with geese on the water was measured by the number of interactions per hour. Duration of agonistic behavior was determined by the length of time the swans were engaged in agonistic behavior. Each opportunity was determined by calculating the number of times geese flew over or the average number of geese on the water at each 15-minute interval. Interactions per opportunity were calculated by the number of interactions divided by the number of opportunities.

Every visible Canada Goose nest on each marsh was monitored throughout the observation period. Agonistic behavior toward the adults or goslings was recorded, and the fate of each nest was determined as best as possible.

RESULTS FROM KASMA MARSH

Trumpeter Swan/Canada Goose interactions

The Trumpeter Swan nesting period was divided into four time periods, as follows:

Prelaying	4-7 April
Laying	8-17 April
Incubating	18 April-20 May
Post-hatching	20 May-10 June

Three cygnets hatched on 20 May. Results of Trumpeter Swan/Canada Goose interactions at Kasma Marsh are summarized in Table 1.

Interactions with Canada Geese occurred throughout the nesting period, and peaked during incubation. The one interaction during the prelaying period was with geese on the water, and it involved both swans performing quivering-wings display and calling.

During the laying period, two of the 45 goose flyovers resulted in both swans performed quivering-wings and calling. Of the three interactions on the water, all were attacks, one by the pen and two by the cob. The swans did not display before or after the attacks.

During the incubating period, there were 72 occasions in which geese flew over the marsh, but no interactions. Of the 31 interactions with geese on the water, three were preceded by quivering-wings display and calling, and six included quivering-wings display and calling after the attack was completed. The pen attacked geese 12 times, the cob 13 times, and both swans six times. The number of geese on the water diminished rapidly after the goslings hatched on 3 May and 10 May. After 10 May, no geese were allowed on the marsh.

During the post-hatching period, there were 19 occasions in which geese flew over the marsh, and 10 interactions. Both swans displayed quivering-wings and called for each of these interactions, and, on one occasion, both swans chased the geese away and then performed quivering-wings display and called. The swans did not allow any Canada Geese on the marsh, but there was one interaction when a goose landed on the water. The swans chased the goose away and then performed quivering-wings display and called.

Aggression of pen and cob toward Canada Geese

During the observation period, there were 36 interactions with Canada Geese on the water (Table 2). There were 12 interactions when geese flew over the marsh. Both swans reacted to flyovers with the quivering-wings display and calling.

Fate of Canada Goose nests

There were two goose nests on Kasma Marsh. One pair nested on an island 250 feet west of the swan nest. The other goose nest was in a clump of cattails at the southeast part of the marsh about 300 feet from the swan nest.

The nest at the west end of the marsh hatched four goslings on 3 May. The goslings were seen after the cob chased the goose off her nest. The pen joined the cob and continued to chase the adult geese. After 10 minutes, the adult geese led the goslings to shore. The swans continued to chase the adult geese when they arrived on the shore, but they ignored the goslings. Later that day, the goose family walked west over the hill to another marsh.

The nest at the southeast part of the marsh hatched five goslings on 10 May. There was only one adult with the goslings the day after hatch. They were on the shore out of sight of the swans. When the adult goose honked, the pen got off her nest and flew toward them. The pen landed near the goose family and chased the adult goose on shore. After a chase, the pen saw the goslings. She ran over them. There were no casualties at this time, but 50 minutes later, the pen got off her nest and repeated the activity. She circled and landed close to the family. She then chased the adult goose and attacked the goslings. This time, she killed one of the goslings. The goose family hid in the emergent vegetation southeast of the marsh. This was the last time the goose family was seen. It is assumed that they left the marsh soon after the second attack.

The response of Canada Geese to the agonistic behavior of the swans was also recorded. The geese did not stand up to the swans. They would avoid any direct confrontations by turning and fleeing from the attacking swans. When the geese were attacked near the nest or with goslings, the adults would flee but would return immediately. The geese never attempted attacking the swans. The nesting geese were not successfully chased off the marsh, but departed immediately following the hatch of their goslings.

Table 1. Results of Trumpeter Swan/Canada Goose interactions at Kasma Marsh.

	Prelaying	Laying	Incubating	Post-hatching
Hours observed-	9	17	49	40.75
Number of times geese flew over-	11	45	72	19
Number of interactions with geese that flew over-	0	2	0	10
Average duration of each interaction of flyovers (minutes)-	--	1	--	0.5
Interactions per opportunity with flyovers-	0	0.04	0	0.52
Average number of geese on water-	4.9	5.2	3.6 [1]	0
Number of interactions with geese on water-	1	3	31	1
Average duration of each interaction on water (minutes)	0.5	0.5	5.8	2
Interactions per hour-	0.11	0.18	0.63	0.02
Interactions per opportunity with geese on water-	0.20	0.58	8.61	0

[1]The number of geese on the water diminished rapidly, as the geese left the marsh after the goslings hatched.

Table 2. Aggression of pen and cob toward Canada Geese on the water at Kasma Marsh.

	Prelaying	Laying	Incubating	Post-hatching	Overall
Pen	0	1	12	0	13
Cob	0	2	13	0	15
Both	1	0	6	1	8
					36

Trumpeter Swan/Duck interactions

Throughout the entire observation period, despite continuous opportunity, there was no agonistic behavior toward adult ducks. The adult ducks did not seem bothered by the presence of the Trumpeter Swans. The average number of ducks present on the marsh is presented in Table 3. During the early part of this study, from 4 April to 29 April, duck migration was in progress. Migrants landed on the marsh. Species included Wood Duck (Aix sponsa), American Wigeon (Anas americana), Green-winged Teal (Anas crecca), Mallard (Anas platyrhynchos), Blue-winged Teal (Anas discors), Ring-necked Duck (Aythya collaris), Greater Scaup (Aythya marila), Lesser Scaup (Aythya affinis), Bufflehead (Bucephala albeola), Common Goldeneye (Bucephala clangula), Hooded Merganser (Lophodytes cucullatus), and Red-breasted Merganser (Mergus serrator). Ducks that were summer residents included Wood Duck, Mallard, Blue-winged Teal, and Hooded Merganser. There was also a Pied-billed Grebe (Podilymbus podiceps) pair that nested on the marsh. No interactions between the swans and the grebes were observed.

Trumpeter Swan/Duckling interactions

The ducklings first arrived on 24 May. The marsh was observed for 32.25 hours when the ducklings were present. During that time, only one interaction was seen that involved ducklings. The interaction occurred on 26 May when the cygnets were 6 days old. The swan family was approximately 50 feet from a Wood Duck family with seven ducklings approximately 17 days old (Bellrose 1976). The pen flew from the area where she had been feeding, toward the ducklings near the cattails in the southeast corner. She landed over the ducklings and pecked at them, but no casualties were found after the incident. The duration of the interaction was 1 minute. The pen did not display or call before or after the attack.

On 2 June, when the cygnets were 13 days old, an interesting observation was recorded. The swans were swimming in the same general area where the previous incident had occurred. Also present in the southeast corner were three Wood Duck broods with six, eight, and eight ducklings, respectively, all approximately 8-13 days old. Also present was one Hooded Merganser brood with eight ducklings, approximately 17 days old (Bellrose 1976). The swans showed no aggression or intention of aggression. When the swans swam toward the southeast, the duck broods all swam as fast as they could toward the cattails. The ducklings seemed to respond to the presence of the swans, but the swans did not react to this commotion.

Table 3. The average number of ducks per hour present on Kasma Marsh.

	Prelaying	Laying	Incubating	Post-Hatching
Mallard	2.9	3.5	5.3	4.2
Blue-winged Teal	1.8	2.2	8.5	7.0
Wood Duck	0.6	0.6	0.5	1.7
Other species	14.8	20.2	5.8	0.4

Interactions with other Trumpeter Swans

Agonistic behavior with other swans was also recorded. There were 15 opportunities for interaction with other Trumpeter Swans, where swans flew over or landed on Kasma Marsh (Table 4).

During the laying period, there were two opportunities where other Trumpeter Swans flew over. The nesting swans performed quivering-wings display and called one time, and made no reaction the other time. During incubation, the swans performed quivering-wings display and called seven times, and one time there was no display at all. During post-hatch, the swans performed quivering-wings display and called all five times that other swans were visible. During one of these interactions, the other swans actually landed on the marsh. The nesting pair displayed and then attacked the other swans. They also displayed after the intruding swans were successfully chased away.

Other observations

An interesting observation was recorded during the post-hatching period. The adult swans on Kasma Marsh flew away from the marsh four times, for an average of 9.75 minutes each. Two of the absences occurred when other swans flew over and the resident swans followed. The cygnets were 9 and 16 days old. There was no apparent reason for the other two incidents. The swans flew away to the north and returned from the same direction. The cygnets were 12 and 17 days old.

Table 4. Agonistic interactions of nesting Trumpeter Swans toward other Trumpeter Swans on Kasma Marsh.

	Prelaying	Laying	Incubating	Post-Hatching
Quivering-wings	0	1	7	4
Attack	0	0	0	0
Both	0	0	0	1
No reaction	0	1	1	0

RESULTS FROM STARKEY BEAVER POND

Trumpeter Swan/Canada Goose interactions

Observation at Starkey Beaver Pond began 11 April 1988. Observation periods were divided as follows:

Prelaying	4-10 April
Laying	11-20 April
Incubating	21 April-22 May
Post-hatching	23-30 May

Swan/goose observations at Starkey Beaver Pond are summarized in Table 5. These swans were not observed during the prelaying period. Five cygnets hatched on 23 May.

During the laying period, there were seven occasions in which geese flew over the marsh. There were no agonistic interactions. There were 16 interactions with geese on the water, all attacks. There were no displays prior to an attack. Three of

the interactions also included quivering-wings display and calling after the attack was completed.

During the incubating period, there were 29 occasions in which geese flew over the marsh. There were no interactions. There were 11 interactions with geese on the water, in which all were attacks initiated by the cob. There were no displays shown toward geese prior to or following an attack during the incubating period.

During post-hatch, there were 14 occasions in which geese flew over the pond. There were two interactions in which both swans performed quivering-wings display and called as the geese flew over the marsh. There was one interaction with geese on the water, which consisted of an attack initiated by the cob.

Table 5. Results of Canada Goose interactions at Starkey Beaver Pond.

	Prelaying	Laying	Incubating	Post-hatching
Hours observed-	0	8.75	29.75	9.50
Number of times geese flew over-	--	7	29	14
Number of interactions with geese that flew over-	--	0	0	2
Average duration of each interaction of flyovers-	--	--	--	0.5
Interactions per opportunity with flyovers-	--	0	0	0.14
Average number of geese on water-	--	17.7	0.9 [1]	1
Number of interactions with geese on water-	--	16	11	1
Average duration of each interaction on water (min.)-	--	5.0	4.9	3
Interactions per hour-	--	1.83	0.37	0.11
Interactions per opportunity with geese on water-	--	0.68	0.62	1.1

[1] The number of geese on the water rapidly diminished, as the geese left the marsh after the goslings hatched.

Aggression of pen and cob toward Canada Geese

During the observation period, there were 28 interactions with Canada Geese on the water (Table 6). Of the two occasions when geese flew over the marsh following the hatch of the cygnets, both swans reacted with the quivering-wings display and calling.

Table 6. Aggression of pen and cob toward Canada Geese on the water at Starkey Beaver Pond.

	Prelaying	Laying	Incubating	Post-hatching	Overall
Pen	0	4	0	0	4
Cob	0	10	11	1	22
Both	0	2	0	0	2
					28

Fate of Canada Goose nests

There were eight goose nests on Starkey Beaver Pond. Of these, four nests were not observed at hatching, so the fates are unknown. Apparently they left the pond as soon as possible. Of the other four, two nests hatched six goslings. These families were observed travelling along the south shore and eventually left the pond to the southeast toward another marsh. They were not harassed by the swans. The last two nests were observed at hatching for a short period. The cob harassed the adult geese, but the final fate was not observed. One nest was approximately 20 feet from the swan nest. The other three nests were approximately 100, 150, and 250 feet from the swan nest.

The response of the Canada Geese to the agonistic behavior of the swans was also recorded. The geese reacted the same as the geese at Kasma Marsh.

Trumpeter Swan/Duck interactions

Throughout the entire observation period, there was no agonistic behavior toward adult ducks, despite continuous opportunity. Summer residents included Wood Duck, Mallard, and Blue-winged Teal. Ducks seen during migration, other than at Kasma Marsh, included Northern Shoveler (Anas clypeata). The average number of ducks present is given in Table 7.

Table 7. The average number of ducks per hour on Starkey Beaver Pond.

	Prelaying	Laying	Incubating	Post-hatching
Mallard	--	13.3	6.9	3.2
Blue-winged Teal	--	16.2	6.9	3.7
Wood Duck	--	2.6	3.8	3.0
Other species	--	16.4	6.1	0.2

Trumpeter Swan/Duckling interactions

Starkey Beaver Pond was observed for 3.5 hours after duck broods hatched. Only one Wood Duck brood was present. No interactions were observed.

Interactions with other Trumpeter Swans

During the observation period, there were four interactions

with other Trumpeter Swans, all of which occurred during incubation (Table 8). As soon as the other swans flew over the pond, the pen left the nest and assumed a hiding posture (Balham 1952). The cob became alert to the swans, but did nothing. On three of these occasions, after the swans were out of sight, the nesting swans swam together and displayed quivering-wings and called. On the other occasion, the intruding swans landed on the pond with the same behavior exhibited by the pen while the cob was out of sight on another marsh to the northeast. After 10 minutes, the resident pen flew around the pond apparently looking for her mate. After 10 more minutes, he flew toward the intruding swans. The pen joined her mate, and they successfully chased the intruders away. Afterward, the swans performed the quivering-wings display and called.

Table 8. Agonistic interactions of nesting Trumpeter Swans toward other Trumpeter Swans at Starkey Beaver Pond.

	Prelaying	Laying	Incubating	Post-hatching
Quivering-wings	--	0	3	0
Attack	--	0	0	0
Both	--	0	1	0
No reaction	--	0	0	0

DISCUSSION

Agonistic behavior toward Canada Geese

The agonistic behavior of Trumpeter Swans stresses the importance of territoriality of swans (Banko 1960). This study was no exception. There were numerous times when the swans attacked Canada Geese and/or performed quivering-wings display. In one case, the swans actually killed a gosling.

Comparison of Kasma Marsh and Starkey Beaver Pond

Canada Goose interactions

For Canada Geese on the water at Kasma Marsh, the number of interactions per hour, the number of interactions per opportunity, and also the duration of each interaction progressively increased throughout the nesting period. The most interactions per opportunity and the most interactions per hour occurred during the incubating period, taking into account that more observation was done during the incubating period.

The number of interactions with geese on the water steadily increased throughout the incubating period until the goslings hatched and the goose families left the marsh.

The swans generally ignored geese that flew over Kasma until the cygnets hatched, at which time they were no longer tolerated. The swans displayed almost every time geese flew over the marsh. During the post-hatching period, the number of opportunities for interaction with geese flying over the marsh decreased, but the number of interactions increased considerably.

The results from Starkey Beaver Pond were quite different. For geese on the water, the number of interactions and the number of interactions per hour decreased from laying through incubating. However, the number of interactions per opportunity stayed the same for laying and incubating and then increased slightly during post-hatching. As indicated by the number of interactions per hour, the most intense period was during the laying period. There was a large number of geese at Starkey compared to the number of geese on Kasma Marsh.

For geese that flew over the marsh during the post-hatching period at Starkey Beaver Pond, there was a slight increase in response. Since there were no geese allowed at Kasma Marsh and very few at Starkey Beaver Pond, it seemed that the swans would not tolerate geese during this time.

Fate of Canada Goose nests

Despite occasional attacks of the swans on the nesting geese, apparently no goose nests were destroyed on either marsh. Goslings were attacked on two occasions. Other times, the swans attacked the adults but ignored the goslings. The attacks from the swans appeared to intensify at Kasma Marsh with the hatch of the goslings. On the two marshes, the geese left the swans' territories as soon as possible following the hatch of their goslings. They appeared to leave whether or not they were attacked, possibly the result of previous experiences with the swans on the marsh. Of the 10 goose nests at both locations, only one gosling was found dead from agonistic behavior of a swan. There does not appear to be enough mortality to deter Canada Geese from nesting on the same marsh as Trumpeter Swans, but they were not allowed to raise broods there.

Ducks

At both locations, the swans did not seem bothered by the presence of adult ducks. Overall, the ducks did not seem threatened by the presence of the swans, either. The swans did not threaten or display toward any species of adult duck.

Ducklings

From this study, the swans did not seem concerned with the presence of duck broods. One attack during 32.25 hours was not a lot of agonistic behavior toward the ducklings. According to Miceli (1987), after 77 hours of observation during the post-hatching period, there was a total of seven interactions with duck broods. As a result, three ducklings were killed when the cygnets were 2, 3, and 9 days old. Agonistic behavior decreased as the cygnets got older and/or the ducklings got older. Agonistic behavior continued through 23 June when the cygnets were 34 days old. During this study in 1988, no ducklings were killed. There was one interaction when the cygnets were 6 days old in which the pen attacked some ducklings, but no casualties were found.

Miceli concluded that long-term brood success was not affected by the presence of swans. During this study, there was only one attack by swans and the same conclusion was reached. It has been speculated that more ducklings survive on a marsh where Trumpeter Swans are nesting, because predators are intimidated by the presence of the swans.

Miceli also concluded that the frequency and duration of the

attacks subsided as the cygnets got older. Since there was only one attack on the ducklings when the cygnets were 6 days old, this conclusion cannot be applied. The swans were not bothered by the presence of ducklings during 1988. More study is needed to determine which is normal behavior.

Other Trumpeter Swans

Overall, the presence of other Trumpeter Swans was not tolerated at either location. At Kasma Marsh, the swans displayed quivering-wings and/or attacked other swans on all but two occasions. At Starkey Beaver Pond, the swans eventually displayed quivering-wings and/or attacked other swans on all but one occasion. The pen at Starkey Beaver Pond behaved very differently from the pen at Kasma Marsh for unknown reasons. When other swans landed on the water, the Starkey pen was bothered by their presence but waited for the cob to initiate an attack.

Since the behavior of the two pairs of swans studied varied to such a degree, the sample size was not adequate to make any conclusions about normal agonistic behavior of Trumpeter Swans. Additional study including additional nesting pairs are necessary.

SUMMARY

Two pairs of nesting, free-flying Trumpeter Swans were observed at their nesting marshes in southcentral Minnesota during the spring of 1988. Agonistic behavior toward swans and other waterfowl species, and foraging behavior were recorded.

The swans showed a significant amount of agonistic behavior toward Canada Geese, but allowed them to remain on the marshes until the goslings hatched, shortly after which the geese left. One gosling was killed during one attack by a swan. The swans did not show any agonistic behavior toward adult ducks, but on one occasion ducklings were attacked.

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HAND-REARING TRUMPETER SWANS WITH ADULT MODELS

Rebecca Abel[1]

ABSTRACT

Wisconsin has been involved with Trumpeter Swan reintroduction for 2 years. In 1989, a new technique for hand-raising cygnets was employed. This method involved imprinting cygnets on a surrogate decoy, and raising them in a wild setting before release. Three different groups of birds were incubated and hatched at the Milwaukee County Zoo, and ultimately moved to the Crex Meadows Wildlife Area at 4 days of age for rearing. Graduate students moved the decoy to appropriate feeding and roosting areas within the wetland, and supplemental food and shelter were provided as required. "Follow me" calls and alarm calls were played to the cygnets at appropriate times, and the cygnets responded accordingly. They learned to follow the decoy to feeding areas, and they learned to fear raptors, terrestrial predators (using a dog), and humans. Cygnets are currently being weaned from the decoy, and will hopefully be released at fledging.

[1]Transcribed from tapes of the Conference.

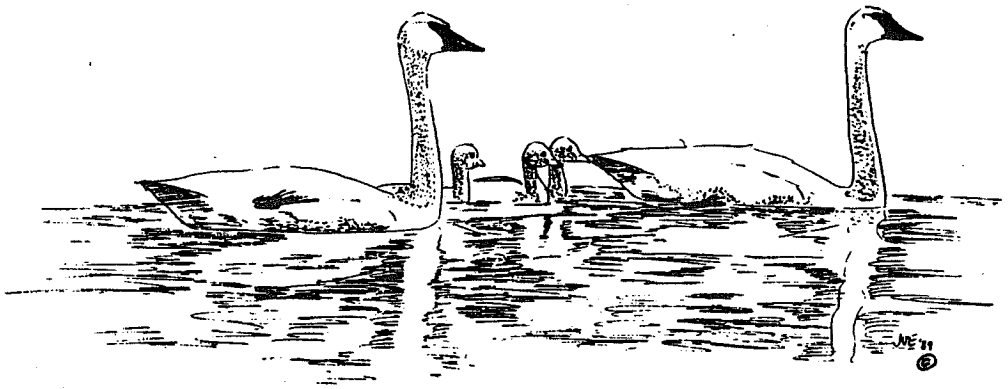
HABITAT USE BY TRUMPETER SWANS BREEDING ON THE COPPER RIVER DELTA, ALASKA

Todd Grant and Paul Henson

ABSTRACT

Trumpeter Swans breeding on the Copper River Delta, Alaska, were studied during the 1988 and 1989 breeding seasons. Activity time-budget and behavioral observations were conducted on six swan pairs nesting on territories located along the Copper River Highway. Data was collected on swan feeding ecology and breeding behavior, with additional observations taken of nearby swan staging areas, winter movements of marked swans, territorial behavior, and the effects of human disturbance on nesting swans.

Data is being analyzed, and results are yet unavailable. However, some trends are apparent. Equisetum sp. appears to be the predominant food resource of adult swans and cygnets. Invertebrate foods were rarely utilized. In addition, male swans appear to play a very important role in nest building, egg guarding, and possibly incubation. These behaviors may enhance the female's ability to build up important prelaying and preincubation food reserves.



THE MOVEMENTS, PRODUCTIVITY, AND HABITAT-USE PATTERNS OF TRUMPETER SWANS IN THE GREATER YELLOWSTONE AREA

John Squires

Following is a brief summary of a study researching Trumpeter Swans in the Greater Yellowstone area. The study is being conducted under the advice of Dr. Stan Anderson, Wyoming Cooperative Fish and Wildlife Research Unit. This research is in cooperation with the Wyoming Game and Fish Department and other state and federal agencies. Results are being analyzed, and are currently unavailable. However, an overview of our project is presented here so that all concerned might be aware of our activities, and possibly offer helpful comments regarding this research.

INTENT

The number of breeding Trumpeter Swans in the Tristate Subpopulation has declined in recent years. The causes of this decline are unclear. Within this region, the productivity of some Trumpeters has been monitored for a long time. The reproductive performance of some pairs has been documented since the 1930's, and virtually all pairs within Wyoming and neighboring areas have been monitored since 1982. These records indicate that approximately half of the pairs have had long histories of nonproductivity, while the other pairs have been consistently productive. The primary purpose of this study is to identify factors that influence the reproductive performance of Trumpeter Swans within the Tristate Region, based on these two classes of breeding birds. These include biotic and abiotic factors on both breeding and wintering sites.

OBJECTIVES

1. Determine how biotic and abiotic factors influence swan productivity, as follows.
   a. Document differences in macrophyte and macroin vertebrate productivity on spring and summer foraging areas used by traditionally productive and nonproductive pairs.
   b. Document differences in morphometric and hydrologic factors on spring and summer foraging areas used by traditionally productive and nonproductive pairs.
   c. Determine if chemical differences exist in the composition of macrophytes and water consumed by wintering and breeding swans on areas used by traditionally productive and nonproductive pairs.
   d. Document the level of human disturbance on both productive and nonproductive sites, and its relation to habitat variables.
   e. Document the effects that wintering swans have on macrophyte populations, and determine if macrophyte quality and quantity differ on areas used by traditionally productive and nonproductive pairs.
   f. Determine the nutritional characteristics of major winter forages and document the metabolizable energy available to foraging swans.
2. Document the following reproductive parameters for all known Wyoming-nesting Trumpeter Swans.
   a. Number of occupied nests.
   b. Number of active nests.
   c. Number of eggs laid (when possible to determine from aerial surveys).
   d. Number of successful nests.
   e. Number of cygnets hatched.
   f. Fledging success.
3. Develop swan habitat models capable of assessing potential Trumpeter Swan wintering and breeding habitats.

METHODS

Ornithologists have long known that a bird's reproductive performance can be influenced by its nutritional state. Past waterfowl studies have documented that productivity may be strongly influenced by food intake on wintering and breeding grounds.

Swans within Wyoming tend to use the same traditional areas throughout the year (Dave Lockman, pers. comm.). This study will primarily quantify relationships between food abundance on winter, spring, and summer use areas and the pair's reproductive performance.

Procedures for quantifying food abundance will not be explained in detail. However, the general procedure involves monitoring a collared swan while documenting the bird's activity, using instantaneous sampling procedures. Both the bird's activity and its location are recorded at 10-minute intervals during an observation day. Randomly selected feeding points are then sampled to quantify the abundance of macrophytes and invertebrates. Aquatic vegetation and invertebrates are collected on clipped plots using snorkeling gear. These collections are then taken to the lab for analysis.

The results are then compared with randomly selected sites within the area.

There is concern among biologists that wintering swans in the Tristate Region are negatively impacting their forage base at current population levels. We are attempting to quantify these impacts using two procedures: (1) reading transects located in swan use areas both before and after periods of swan use, and (2) establishing grazing exclosures to protect areas from swan herbivory. These areas will then be compared with adjacent areas that are grazed. We hope these two methods will allow us to determine the degree to which swans are impacting their wintering forage base.

FORAGE QUALITY AND FOOD HABITS STUDIES

The above procedures are designed to quantify forage. However, forage quality is also a major factor in determining an herbivore's diet. Therefore, we are also investigating forage quality, using two methods. First, forages are collected and analyzed on swan use areas during the season of swan use. These forages will be analyzed using detergent forage analysis techniques. The second procedure investigates forage quality by determining the metabolizable energy associated with major winter swan forages through captive feeding studies (metabolizable energy = food energy - fecal energy - urinary energy). In other words, captive swans will be fed forages to determine how well they are digested. These feeding trials will be conducted during December 1989.

Finally, all of our research activities require that we know what swans eat. There has not been a quantitative food habits study on Trumpeter Swans in the Tristate Region. We initiated such a study last year. We have collected 350 fecal samples from sites across the Tristate Region on winter, spring, and summer use areas. These samples are currently being analyzed using microhistological procedures. We feel the food habits data will be of great assistance in our interpretation of movement and activity data.

SUMMARY

This has been a very brief overview of research activities. If anyone would like to discuss any aspect of our study in greater detail, please feel free to call us at the Wyoming Cooperative Fish and Wildlife Research Unit (307-766-5415) in Laramie, Wyoming. We are very interested in any comments or suggestions that might be offered.

TRUMPETER SWAN WINTER HABITAT USE ON THE HENRY'S FORK OF THE SNAKE RIVER

Jeffrey W. Snyder

ABSTRACT

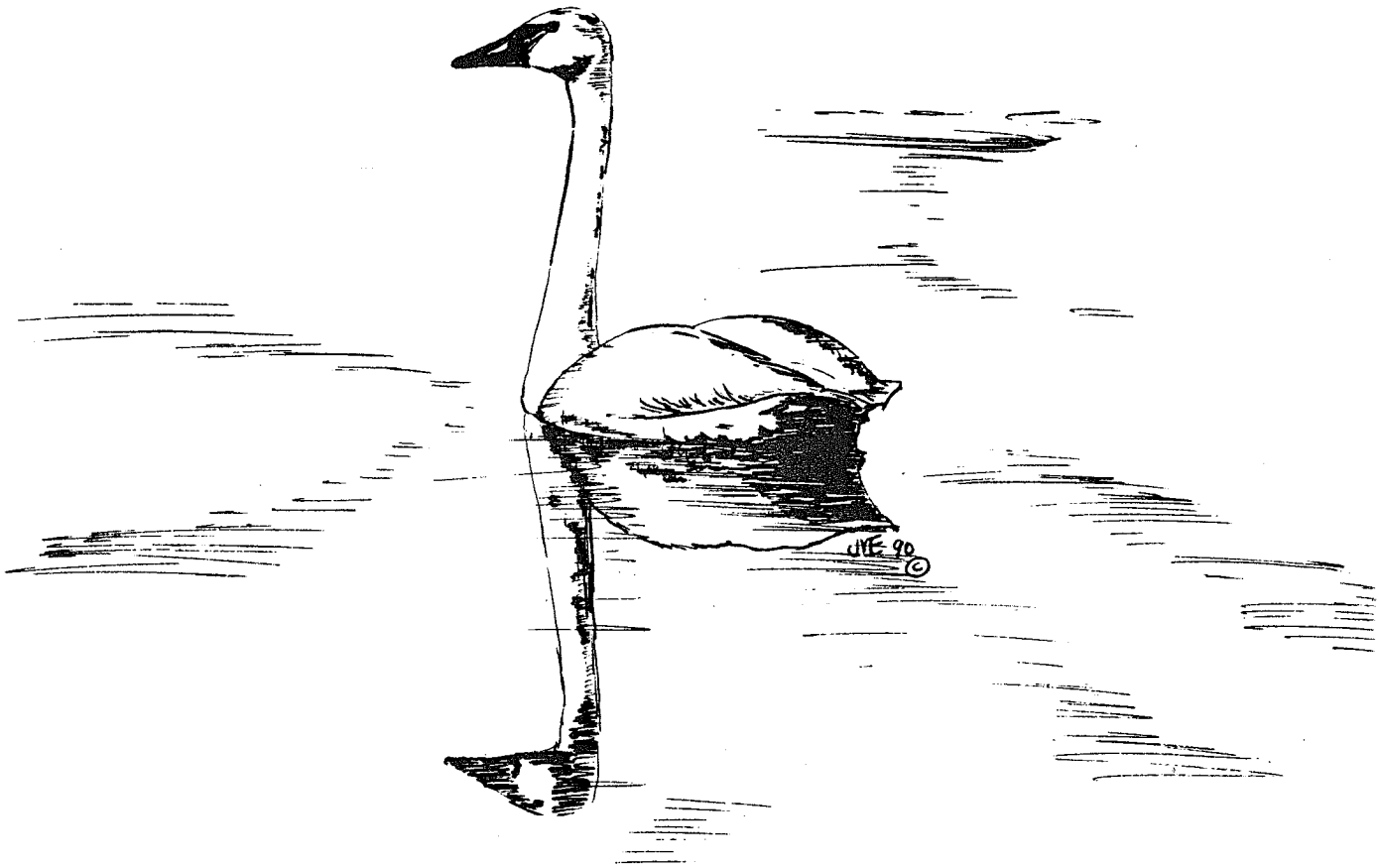
Trumpeter Swan (Cygnus buccinator) abundance and distribution, river ice formation and deformation, and aquatic macrophyte abundance and distribution were quantified during the 1987-88 and 1988-89 winter seasons along a 14.9 km reach of the Henry's Fork of the Snake River in southeast Idaho. There were highly significant differences in the number of adults, cygnets, and total swan use between 17 identified river sections. The use of the wintering ground by swans since 1979 has increased significantly, as well. Collared Canadian swans in the wintering ground were not randomly distributed, but consistently occupied river sections in East Harriman State Park. These collared swans from known family groups suggest a possible dominance hierarchy within the group of wintering swans for known feeding and roosting sites.

Eight species of aquatic macrophytes were identified in the wintering ground among 1,171 point intercept frames read, and there were highly significant differences in percent cover between each species of aquatic macrophyte and each river section, on average. Potamogeton pectinatus, Myriophyllum spicatum, and Elodea canadensis accounted for 18.4 percent, 15.0 percent, and 15.7 percent cover in the wintering ground, along with Rannunculus aquatilis (11.4%), Zannichellia palustris (10.3%), Potamogeton perfoliatus (3.3%), Callitriche hermaphroditica (2.7%), and Lemna trisulca (0.1%). Upstream river sections contained a significantly higher percent cover of aquatic macrophytes than downstream sections. The percent cover of bare ground was correlated significantly with distance downstream from the Island Park Dam. Related research on aquatic macrophyte transport in the upstream reaches found that peak macrophyte senescence occurred during January, and that macrophyte biomass was lowest during February and March. These results lead to the suggestion that the abundance and quality of aquatic macrophytes in the wintering ground may not be sufficient to sustain current numbers of swans throughout the winter.

Ice formation during the 1988-89 winter restricted Trumpeter Swan access to aquatic macrophytes during December, January, and February. Low discharges from the Island Park Dam and consistent periods of below-zero air temperatures during this time combined to freeze 94.0 percent of the wintering ground. It is hypothesized that swans occupying the wintering ground during this time did not maintain their physiological condition, and some were probably extended beyond their maximum starvation period. Fifty-three swan carcasses were collected between 4 February and 25 April 1989. Anchor ice also formed around macrophyte stems and scoured the river bottom during subsequent thawing of the wintering ground. This may have affected significant changes in the structure of the aquatic macrophyte community.

Ice formation on the wintering ground affects wintering swans in many ways. It may affect the social hierarchy for roosting and feeding sites, shifting swan distribution to springs or deep channeled river sections devoid of aquatic macrophytes. It prohibits Trumpeter Swans from feeding on macrophytes and physically scours the river bottom, which may ultimately affect the composition and structure of the macrophyte community. Therefore, ice formation on the wintering ground must be minimized to allow Trumpeter Swans maximum access to aquatic macrophytes.

Lack of migratory knowledge out of the Greater Yellowstone Ecosystem during the winter and significant increases in the number of swans occupying the wintering ground suggests that a bottleneck effect exists. These historical staging areas, prior to the swan's elimination from much of the North American continent, now serve as primary wintering areas, and have resulted in concentrating members of the Rocky Mountain Population of Trumpeter Swans into a few small, isolated wintering areas, each with inadequate natural food resources to sustain them for an entire winter. Learned winter migration paths among successive family generations and consistent protection of current wintering grounds are needed to eliminate this bottleneck effect and reduce existing threats to the already-precarious abundance of the Rocky Mountain Population of Trumpeter Swans.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STATUS OF THE ROCKY MOUNTAIN POPULATION OF TRUMPETER SWANS, THE RANGE EXPANSION PROJECT, AND CONDITIONS IN IDAHO

Gary C. Will

REVIEW OF THE NORTH AMERICAN MANAGEMENT PLAN FOR TRUMPETER SWANS

Before the Rocky Mountain Population (RMP) range expansion project is discussed, a review of the North American Management Plan for Trumpeter Swans (NAMPTS) (Trumpeter Swan Subcommittees 1984) is essential. This document identifies specific goals and objectives for the RMP and also provides guidelines for achieving range expansion.

The NAMPTS was completed in 1984. All four flyways contributed. The Plan's goal for Trumpeter Swans is to manage Trumpeters for numbers and distribution that will provide optimum benefits for human enjoyment as well as for the Trumpeter's own intrinsic values. Rangewide objectives follow.

1. Prevent the Trumpeter Swan from becoming either threat ened or endangered by maintaining a wintering population of 10,000 birds.

2. Provide for maximum recreational benefits.

3. Except as may be necessary to maintain Trumpeter Swans at Red Rock Lakes National Wildlife Refuge (RRLNWR) and Lacreek National Wildlife Refuge (NWR), phase out winter feeding and artificial maintenance of ice-free water by 2000.

4. Develop an interpretive and educational program by 1990.

5. Identify and protect all currently-used wintering and breeding habitat.

6. Design and implement practices to instill migratory behavior and range expansion, but minimize constraints on practices required to manage other waterfowl.

Specific objectives for the RMP follow.

1. Maintain a wintering population of 1,100 birds in the Tristate area.

2. Expand the distribution of wintering and nesting Trumpeter Swans in the Tristate area by establishing use of four new wintering areas in Montana, Wyoming, and eastern Idaho (two by 1990 and two more by 2000).

3. Achieve and maintain a breeding population in the Tristate and Interior Canada Subpopulations of at least 183 active nests (98 in the Tristate Subpopulation -- 25 in Idaho, 43 in Montana, and 30 in Wyoming, and 85 in the Interior Canada Subpopulation).

4. Maintain wintering areas in the Tristate region.

The NAMPTS identifies 16 specific management procedures for the RMP, of which three are important to this discussion, three address range expansion, and one addresses water flows on wintering areas in Idaho. These management procedures follow.

1. Establish new wintering areas. At present, nearly all Trumpeter Swans winter either at RRLNWR or at Harriman State Park, Idaho, and are at great risk to cata strophic loss. Procedures include: (1) develop a long-term strategy to expand winter distribution, (2) identify potential wintering sites in western states, British Columbia, and Mexico, (3) develop a relocation program for identified sites, (4) evaluate four potential wintering sites in Wyoming and identify other sites in the Tristate area, (5) recommend relocation programs for two sites to the Pacific Flyway Council in 1987, and (6) implement the relocation program in 1987.

2. Assure that hunting of other waterfowl will not be precluded because of the chance-killing of Trumpeter Swans. Educational and increased enforcement efforts should be employed where Trumpeter Swans are being shot.

3. Develop an agreement to guarantee adequate water flows down the Henry's Fork of the Snake River, Idaho, and by 1984 develop a contingency plan for wintering Trumpeters at Harriman State Park, Idaho, should an emergency situation occur.

PROGRESS TOWARD REACHING PLAN OBJECTIVES -- RMP RANGE EXPANSION

The RMP Subcommittee and cooperating agencies have implemented the NAMPTS and some progress has been made toward reaching objectives for establishing new wintering sites and ensuring adequate water flows down the Henry's Fork of the Snake River. However, much work still remains to be done. The following is a summary of what has been accomplished.

Establish new wintering sites

In 1987, the RMP Subcommittee developed a plan entitled

"Rocky Mountain Trumpeter Swan Population Range Expansion Project, 1988-93" (Rocky Mountain Population Trumpeter Swan Subcommittee 1988a). This expansion plan was approved by the Pacific Flyway Study Committee (PFSC) and Council in March 1988. It incorporated the current state-of-the-art information on RMP Trumpeters brought together by Gale et al. (1987), through the Montana Cooperative Wildlife Research Unit, in their draft publication on the history, ecology, and management of RMP Trumpeter Swans. The range expansion plan describes strategies and tasks which will be employed to expand the Trumpeter's range during the initial years of 1988-93. These strategies include the following.

1. Identify potential wintering sites within 150 km of the current Tristate winter range.

2. Evaluate potential sites, and identify the top four priorities.

3. Develop site-specific techniques to translocate Trumpeter Swans to the identified sites and establish a tradition of use.

4. Implement techniques to reduce the numbers of Trumpeter Swans currently wintering at RRLNWR and Harriman State Park.

5. Develop memoranda of understanding as needed between cooperators.

6. Develop a marking protocol.

7. Test and modify methods as necessary and redesign the project as needed to achieve optimal results in the most cost-effective and expedient manner.

Specific tasks identified in the expansion plan include the following.

1. Identify currently-used wintering areas. This has been done.

2. Evaluate winter habitats within 150 km of currently-used winter ranges. Part of this task has been completed. Several areas in Wyoming and Idaho have been evaluated. These include the Salt River, Wyoming, parts of the Snake River, Idaho, and Grays Lake NWR. Several additional areas in Wyoming and Idaho, and perhaps Montana, must still be evaluated.

3. Identify and evaluate potential winter habitats greater than 150 km from currently-used winter ranges. Little has been done on this task, but the Subcommittee believes potential areas may exist in Wyoming, Idaho, Utah, Nevada, Arizona, New Mexico, California, and Colorado.

4. Begin to establish winter use of the Salt River, Wyoming, by at least 75 Trumpeters. When this is achieved, or if the decision is made to terminate this project due to unforeseen problems, begin to establish winter use on the Snake River, Idaho. Considerable progress has been made on this task, and will be elaborated on later.

5. Concurrent with translocations, reduce the number of Trumpeter Swans using RRLNWR and Harriman State Park by making these areas unattractive. There has been no progress made on this task. This will be discussed in more detail later in this presentation.

6. Transplant swans, using: (1) cygnets produced from salvaged eggs, (2) salvaged cygnets, yearlings, and adults, and (3) yearlings from RRLNWR as sources of birds.

At present, the range expansion project is nearly on schedule and results to date seem promising.

Range expansion work actually began in 1983, with Wyoming's 5-year evaluation of wintering habitat in the Salt River drainage. The first transplant occurred in 1986, when two yearlings were moved from the Targhee National Forest, Idaho, to Grays Lake NWR. This was followed by 1987 and 1988 relocations of 27 Trumpeter Swans from various sources (both hand-reared and live-trapped) to the Salt River and Grays Lake. Fifteen additional yearling Trumpeter Swans were moved in 1988 to the Snake River on the Fort Hall Indian Reservation, Idaho. In July 1989, 15 more yearlings were moved from RRLNWR to Grays Lake. Monitoring of relocated Trumpeter Swans suggests that: (1) recent range expansion efforts have been partially successful and (2) relocated Trumpeter Swans tend to remain in new wintering areas when fall staging areas free from hunter disturbance are available. Wyoming has found that waterfowl sanctuaries benefited both Trumpeter Swans and local waterfowl hunters. And, as a follow-up to work already done on the Snake River on the Fort Hall Indian Reservation in 1988, additional birds will be released this month. In a gentle release, utilizing a temporary pen and supplemental feeding, an adult and several cygnets will be released. Cygnets will come from a private source and the adult will be a salvaged, flightless male. The Shoshone-Bannock Tribes will build the pen, provide all materials and manpower, and do much of the monitoring.

Efforts to reduce the number of Trumpeter Swans wintering at RRLNWR and Harriman State Park have been largely unsuccessful. Two procedures have been used to make these areas unattractive to wintering Trumpeters. These included: (1) delaying the beginning of feeding at RRLNWR and (2) increasing human activities and other practices at Harriman State Park. Feeding has been delayed for 1 week for each of the last 2 years. Feeding now begins about 2 weeks later, on 1 December rather than in mid November. There has been no evidence of Trumpeter Swans changing their movement traditions due to changes in feeding procedures. Likewise, efforts to make Harriman unattractive by creating disturbance have not resulted in any changes in traditions.

Contingencies for Harriman State Park

As directed by the NAMPTS, Idaho, in cooperation with the RMP Subcommittee and participating agencies, developed the Contingency Plan for Management of Wintering Trumpeter Swans in the Vicinity of Harriman State Park, Idaho (Rocky Mountain Population Trumpeter Swan Subcommittee 1988b). This plan was approved by the PFSC in 1988. It was implemented during the 1988-89 winter. Contingency actions identified in the plan include the following.

1. Work with the U. S. Bureau of Reclamation (BOR) to maintain a minimum water release of 100 cfs from Island Park Reservoir.

2. As described in a Memorandum of Understanding be tween the BOR and the U. S. Fish and Wildlife Service (USFWS), store additional water in Island Park Reservoir prior to 15 November for release during the winter.

3. During November and December, attempt to motivate Trumpeter Swans to leave the area by regulating water flows on the Henry's Fork to encourage ice formation.

4. If Trumpeter Swans show no tendency to leave the area by late December, increase flows to 400 cfs to flush ice, and use pulsing flows if water is in short supply or ice is heavy.

5. If Trumpeter Swans are in good condition, use human activity and zon guns, beginning in December, to make the area unattractive to them and encourage them to move south.

6. Emergency feed if necessary.

7. Trap and relocate Trumpeter Swans to more southern areas if determined feasible.

Disturbance of Trumpeter Swans last winter began the first of November and was discontinued in early December when an arctic cold front and accompanying blizzard dropped temperatures to -30°F, zon guns froze up, and physical condition of Trumpeter Swans began to deteriorate. During the month of disturbance, the Trumpeter Swans were displaced to adjacent areas during the day, but at night they returned to Harriman. Trumpeter Swans were stressed unnecessarily in late January and early February when the BOR hesitated in releasing adequate amounts of water to keep the Henry's Fork ice-free. Flows were kept below 100 cfs, which left food high and dry. Increases in water flows may have been delayed due to some confusion in communication between the Idaho Department of Fish and Game and the BOR. The BOR attempted to break up the ice on 18-20 January by increasing the flow to 357 cfs. This effort opened a portion of the river which later refroze when the flow was dropped to 105 cfs. Water flows were eventually increased to 732 cfs during the period 2-8 February, making open water and food available to Trumpeter Swans, but only after local and national news media drew attention to the issue and a fund raising drive was begun to buy water for release. Irrigators donated some water. About $15,000 was donated by the public for water. When food became unavailable, the Idaho Department of Fish and Game emergency-fed Trumpeter Swans using about 8 tons of wheat. In spite of this feeding effort, 50 to 100 Trumpeter Swans died at Harriman. Surviving Trumpeter Swans escaped the winter in very poor condition and experienced low production this spring.

The Subcommittee has decided to discontinue the disturbance project at Harriman due to poor success of this practice last winter.

Henry's Fork water agreement

According to the USFWS Boise Field Office, negotiations are still in progress between the USFWS, the BOR, power companies, and irrigators for a permanent solution to the water issue on Island Park Reservoir and the Henry's Fork. The USFWS has indicated that all parties support a tentative agreement, and they anticipate having a signed agreement by this fall. A meeting between the parties was scheduled for 8 September 1989 to continue the negotiations.

The approach the USFWS is taking is to seek a special assessment or tax on power generated in the winter using water released to keep the river ice-free, since the private power companies will benefit greatly from additional revenue. Monies collected would go into a special trust account to buy water from the State Water Bank if additional releases of water are necessary to keep the river ice-free. Monies not used for water would be used for the enhancement of Trumpeter Swan habitat and perhaps range expansion. The National Fish and Wildlife Foundation has expressed an interest in being the trustee of the account.

The water outlook for this winter for Island Park Reservoir and the Henry's Fork is good at present. The BOR is predicating it can release 250 to 300 cfs throughout the winter and also provide pulsing flows to flush ice if necessary. Additionally, water may be bought from the State Water Bank using the new trust account if conditions become severe. However, if drought conditions prevail for an extended period of time, all users on the Henry's Fork will suffer, including the Trumpeter Swans. Consequently, during periods of extreme water shortages, the RMP will still be at risk to catastrophic loss unless the population winters elsewhere.

Moving Trumpeter Swans from Harriman State Park

One of the contingencies mentioned earlier for Harriman State Park is to trap wintering Trumpeter Swans and physically move them to new wintering areas. Although the Subcommittee has discussed this a number of times, and there is considerable support for moving Trumpeter Swans, so far none have been moved. We hope that by the 1990-91 winter, the Subcommittee will have a pilot study developed, assembled sufficient money, materials, and manpower, reviewed all the literature on trapping Trumpeter Swans, talked to all the experts, and will be in a position to begin trapping and moving Trumpeter Swans to Wyoming and Idaho sites.

We are hoping that money donated last winter to buy water ($11,000), Jackson Lake, Wyoming, mitigation money ($15,000), and matching monies from the National Fish and Wildlife Foundation can be used to fund the trapping program. A total of $29,000 of mitigation money is being earmarked for RMP Trumpeter Swan range expansion. At least $14,000 will be used in Wyoming. The remaining $15,000 will be used in Idaho at Harriman State Park.

Study to evaluate new wintering sites in Idaho and other states

The USFWS Boise Field Office is in the process of developing a plan to evaluate potential wintering sites in Idaho and perhaps one or two other western states. If sufficient funding can be located, about $60,000, this 1-year study could begin as early as this fall. At the present time, the USFWS, National Fish and Wildlife Foundation, Henry's Fork Foundation, and

Idaho Department of Fish and Game are potential contributors. Information obtained from the study will be useful in selecting release sites for winter-trapped Trumpeter Swans from Harriman State Park and salvaged cygnets and adults.

1989 TRUMPETER SWAN PRODUCTION IN IDAHO

In past years, Idaho has averaged about 20 nests in the Island Park area. This year, the number of nests dropped to about 15, of which nine or ten were successful. About 25 cygnets were hatched. At present, we know of only three or four that are still alive. About five of Idaho's nesting pairs have never fledged cygnets. Although the pairs hatch young, they do not survive.

Beginning next year, the Idaho Department of Fish and Game hopes to collect most of the eggs from these nests, have them incubated in Wyoming, and use the cygnets produced in the range expansion program.

SUMMARY

The NAMPTS identifies a number of problems that threaten the existence of the RMP of Trumpeter Swans. These include the following.

1. The RMP is extremely vulnerable to catastrophic losses during the winter from starvation and habitat destruction.

2. There is poor nest success and low brood survival.

3. There are inadequate water flows below Island Park Dam.

It is important to note that, because of these problems, the RMP likely qualifies for either "threatened" or "endangered" status, even though the RMP has been increasing, at least up until the temporary setback it experienced in 1989. It is also important to note that these major problems still exist, and permanent long-term solutions have not been fully developed. Because of this, and the compounding problems of last winter, the Idaho Chapter of The Wildlife Society (TWS) petitioned the USFWS in May of this year to list the RMP. For years, and with a great deal of frustration, TWS has watched the lack of significant progress toward solving critical problems which still limit the RMP. In short, TWS felt that, because of the near disaster last winter and the potential for similar conditions to recur, it was time to pressure responsible agencies to more aggressively pursue permanent solutions. And, from that standpoint, their approach seems to be working. We are seeing a greater emphasis being placed on solving the major problems, in particular the water issue on the Henry's Fork.

Overall, the future appears very favorable for the RMP. We have good operating plans in place, the water issue is being resolved, range expansion efforts seem promising, and cooperating agencies and private groups, such as The Trumpeter Swan Society, are more committed now than ever before to meeting goals and objectives for the RMP.

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STATUS OF THE GRANDE PRAIRIE AND NAHANNI TRUMPETER SWAN FLOCKS

Len J. Shandruk and Kevin J. McCormick

INTRODUCTION

The recovery of the Interior Canada Trumpeter Swan Subpopulation ranks prominently among waterfowl conservation success stories. Reduced to the brink of extirpation in the early 1900's, this Canadian Subpopulation has increased in numbers and expanded its range. Yet, today the Trumpeter is still one of the rarest and most vulnerable migratory bird species in Canada. In order to monitor breeding population status and the impact of management and development activities, a total Canadian breeding range survey was conducted in 1985 (McKelvey et al. 1988). In addition, more intensive monitoring of the Grande Prairie and Nahanni flocks has been conducted on an annual basis. This presentation summarizes survey results, flock size changes, and habitat relationships from 1985 to 1989.

METHODS

The Grande Prairie Trumpeter Swan surveys are conducted in early June and mid September of each year, using a Cessna fixed-wing aircraft flown at approximately 150 m agl and about 225 km/h. The flock monitoring in the Northwest Territories (NWT) is conducted during mid July and late August using a Bell 206L helicopter flown at a similiar altitude, but at a reduced speed of about 100 km/h. In both areas, a minimum of two observers accompany the pilot during the flight of a predetermined survey route. Upon sighting swans on a wetland, flight altitude and speed are reduced to determine the following.

1. The number of adults.
2. Collar color and collar code, if possible.
3. Breeding status.
4. Number of cygnets.

Data are recorded directly on 1:250,000 topographic maps of the study areas. Almost 200 wetlands are surveyed in the Grande Prairie area, while over 100 are surveyed in the Nahanni region annually.

In the Nahanni region we also capture, band, and collar molting adults during the July survey, and wing mark or collar cygnets in August or early September. All Trumpeter Swans transplanted from Grande Prairie to Elk Island National Park were banded, and the adults were collared and banded.

RESULTS AND DISCUSSION

Current Grande Prairie and Nahanni flock status

Grande Prairie flock

At Grande Prairie, 185 Trumpeter Swans were observed during the spring 1989 survey, while 242 swans were observed during spring 1988 (Table 1). The 1988 survey accounted for 78 total pairs, of which 44 appeared to be nesting. This is the highest number of nesting pairs ever observed in this region of Alberta. The total 1988 spring population of Trumpeters in this flock increased by 14 percent from 1987, while breeding pairs were up by 18 percent from 1987. In 1989, the harsh wintering conditions in the Tristate Region of Montana, Idaho, Wyoming resulted in a considerable decrease in total pairs and nests observed. Total pairs were down from 1988 by 24 percent, and nests decreased by 16 percent. Although the Grande Prairie flock experienced an estimated 48 percent death rate during the 1988-89 winter, the 1989 spring flock statisics are still similiar to the means for the last 5 years. A large portion of this observed winter mortality was undoubtly absorbed by the 1988 cygnet cohort.

Table 1. Spring surveys of the Grande Prairie Trumpeter Swan flock.

Year	Pairs	Nests	Other adults	Total
1985	56	27	28	140
1986	52	31	49	153
1987	66	42	77	209
1988	78	44	86	242
1989	64	37	57	185
Mean	63	36	59	186

September production surveys of the Grande Prairie flock for the period 1985 to 1989 determined total numbers, ranging from a low of 284 swans in 1985 to a peak of 361 in 1988 (Table 2). In 1989, total numbers decreased slightly to 341 swans. Cygnet production was relatively stable and averaged 100 cygnets per year in 29 to 30 broods, except for 1989, which numbered 81 cygnets in 27 broods, when the number of swans transplanted to Elk Island National Park is also considered. The number of lakes surveyed and the route followed was similar each year. Although the 1988 total flock size, numbers of breeding pairs, and cygnets produced were similar to that observed in 1987, the average brood size (n = 3.04) was lower.

A Student t-test indicated that the 1988 observations were not significantly different from the 5-year means at the 0.05 level. The lack of cygnet production by this flock in 1988 and 1989 may be attributed to harsher than normal habitat conditions on the wintering grounds in 1987-88 and 1988-89. The drier than normal 1988 summer in the Grande Prairie area may have also resulted in poorer cygnet production than should have normally been expected.

Although we removed 70 cygnets and anticipated a loss of eight adults from this flock as a result of our transplants to Elk Island Park since 1987, we have determined that the impact on flock production from these removals was minimal (Shandruk and Kay 1991).

Table 2. Fall flock status of Trumpeter Swans in the Grande Prairie Region.

Year	Pairs	Cygnets	Other adults	Total
1985	53	93 (25)[1]	85	284
1986	57	124 (33)	109	347
1987[2]	47	83 (25)	178	355
1988[2]	51	82 (27)	177	361
1989[2]	58	61 (23)	161	341

[1] ( ) Number of broods.
[2] Excludes adults and cygnets removed for Elk Island transplant.

Nahanni flock

The results of the 1986-89 production surveys of the NWT flock are summarized in Table 3. The 1987-89 results represent a composite of the two surveys which were conducted during each year (Shandruk and McCormick 1988). The 1986 survey revealed 65 adults (26 pairs) and 55 cygnets in 13 broods, whereas the 1987 survey produced 78 adults (34 pairs) and 69 cygnets in 19 broods. The 1988 survey revealed 73 adults (28 pairs) and 29 cygnets in 10 broods. The 1988 Nahanni production year was clearly less successful than all other years. The decline from 1987 was adults - 14 percent, cygnets - 58 percent, and broods - 53 percent. In 1989, flock numbers were found to be 64 adults, 28 pairs, and 62 cygnets in 15 broods. Thus, the total flock composition in 1989 was similiar to 1986.

These data suggest that the NWT flock encountered more severe wintering mortality during 1988 than it did in 1987 or 1989. The 1988 surveys also indicated that a significant number of adult birds may have disappeared from the study site. Five pairs, which successfully produced cygnets during previous years, were not located during our survey efforts in 1988. In total, seven experienced breeding pairs were either missing or not located in 1988. During our 1987 surveys, only one breeding pair was not accounted for. These data and observations provide strong evidence that the NWT flock may have suffered from a harsher than normal 1987-88 winter in the Tristate Region. This may have resulted in dead and debilitated birds unable to return to the summer breeding grounds. Another observation which supports this conclusion is that three collared Trumpeter Swans (Red 71AA, Red 81AA, and Red 31AA) spent the entire summer in the Tristate. This is the first time Canadian breeders have been observed and documented summering in the Tristate. The lack of migration by these normally very mobile swans may be a result of the impact of a severe winter compounded by marginal winter habitat and high disease or parasite loads. This would result in swans that had insufficient body energy reserves to undertake the spring migration. Thus, it is our contention that the NWT Trumpeters wintering on possibly poorer habitat encountered harsher than normal wintering conditions during the 1987-88 winter season.

Table 3. July flock status of the Trumpeter Swans in the Southern Mackenzie District, NWT.

Year	Pairs	Cygnets	Other adults	Total
1986	26	55(13)[1]	13	120
1987	34	69(19)	10	147
1988	28	29(10)	17	102
1989	28	62(15)	8	126
Mean	29	54(14)	12	124

[1] ( ) Number of broods.

Broods

Brood size of the Nahanni flock in 1988 was significantly smaller than in previous years (Table 4). This result may be attributed, in part, to the torrential rainfall which drenched the study area from 29 June-3 July. Rainfall amounted to 259 mm during this period and water levels at Nahanni Butte rose over 3 m above normal. As this rainfall occurred when the cygnets were approximately 8-10 days old, some mortality could be expected. In 1989, the production has rebounded to levels similiar to 1986. Differences between 1986 and 1987 were not significant.

In Grande Prairie, the average brood size ranged from a high of 3.76 in 1986 and a low of 2.65 cygnets/brood for 1989. Harsh winter conditions prior to the 1989 breeding season and recruitment of a large number of new and inexperienced breeding pairs in 1989 may also have contributed to the low mean brood size.

It is not possible to directly compare brood size data from these two flocks because the Nahanni data was obtained in late August and the Grande Prairie data during mid September. Considering this limitation, however, it is evident that the Nahanni flock has been somewhat more productive during recent years than Grande Prairie.

Table 4. Mean brood sizes for the Nahanni and Grande Prairie flocks.

Year	Grande Prairie	Nahanni
1985	3.72	--
1986	3.76	4.23
1987[1]	3.32	3.63
1988[1]	3.04	2.90
1989[1]	2.65	4.13

[1] Transplanted cygnets excluded from Grande Prairie mean brood size.

Population-habitat relationships

Grande Prairie flock

From 1959 to 1977, the Grande Prairie flock remained remarkably stable. Since 1978, the flock and the area surveyed has increased substantially. This stable flock status was due to winter habitat limitations (Gale 1988). The annual loss of swans from the Grande Prairie flock shows a significant correlation with winter severity in the Tristate. Because most of this flock did not use the supplemental feeding areas available at Red Rock Lakes National Wildlife Refuge (RRLNWR), they were vulnerable to severe cold weather. This reduced the availability of ice-free feeding sites utilized on the Snake River, and increased their energy demands. During the period from 1980 to 1985, this flock grew at approximately 11 percent per year. During the period from 1984 to 1988, higher population concentrations and colder winters on the wintering area reduced this growth rate to 5.5 percent per year. This recent growth of the Grande Prairie flock and the increases of the other Canadian flocks followed the increase in winter swan use of the Snake River at Harriman State Park, made possible by the restoration of higher water flows in 1968. Prior to this time, water releases from the upstream Island Park Dam were completely curtailed in January and February, after swans had settled in for the winter and during the coldest months when little habitat was available elsewhere. The increased water flows increased the availability and stability of the Snake River winter food resource near Harriman Park, and probably reduced the mortality rate of the Grande Prairie swans. This allowed the flock to grow and begin dispersal by the mid 1970's.

Nahanni flock

Trumpeter Swans were first observed in the Southern Mackenzie District of the NWT in 1970, but breeding was not recorded until 1977 (McCormick 1986). CWS began a detailed helicopter census of this flock in 1985. Our surveys indicate that this flock has grown by 11.8 percent over the last 4 years. Similar concentrations of breeding birds are not encountered in other parts of the breeding range. In 1988, this growth rate was reduced drastically due to difficult conditions on the wintering area and torrential rains during the cygnet hatch. It is anticipated that in the long term this flock will continue to increase, but not at the rates observed for the Grande Prairie flock. The Nahanni flock is probably near the limit of its northern range and seems to be pioneering new wintering areas in the United States. In addition to survey work on this flock, over 100 adults and 89 cygnets have been banded using the helicopter capture and release technique (Shandruk and McCormick 1988). Red-collared NWT Trumpeters have been observed throughout the Tristate, with major concentrations in the Teton basin near Driggs, Idaho. Red-collared Trumpeters have also been observed and confirmed wintering at Chico, California, and Ash Meadows and Los Almos, Nevada.

CONCLUSION

Our data indicate that two major Trumpeter Swan flocks in Canada have continued to increase since 1985, even though they have occasionally encountered harsh and unfavorable environmental conditions on the wintering and breeding grounds, and despite our removal of family groups from Grande Prairie for transplant to Elk Island National Park. These preliminary data also provide some indication that wintering habitat may begin to limit the growth and expansion of the Interior Canada Subpopulation. Major management efforts required to ensure expansion and security for the Interior Canada Subpopulation should be focused on efforts to maintain and diversify wintering habitats. Secondarily, we must continue to provide protection and management for breeding and staging habitats in Canada for the Trumpeter Swan.

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ELK ISLAND NATIONAL PARK TRUMPETER SWAN REINTRODUCTION --1989 PROGRESS REPORT

Len J. Shandruk and Robert Kaye

INTRODUCTION

A 3-year 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). This presentation details the third year of the project.

The objectives of this project were to: (1) diversify the summering and breeding range of Trumpeter Swans in Alberta and (2) diversify migration and wintering tradition. Project goals included the following.

1. Transplant 12 family groups, over the 3 years of the project, from the Grande Prairie flock to suitable wetlands in EINP.
2. Refine capture and transplant techniques.
3. Determine the impact of relocation on swans and if cygnets released at EINP will home to these areas.
4. Reintroduce a base population of Trumpeter Swans which will result in the establishment of 10 breeding pairs in EINP.
5. Evaluate the impact of swans on existing biotic resources at EINP.

METHODS

Project funding and guidelines

As a Wildlife-87 initiative, the Canadian Wildlife Service (CWS), Canadian Parks Service (CPS), and Friends of Elk Island Park Society (Friends) obtained funding through a Trumpeter Swan reintroduction project proposal submitted to World Wildlife Fund and Alberta Recreation, Parks, and Wildlife Foundation. In 1989, Alberta Recreation, Parks, and Wildlife Foundation contributed $10,000, CWS contributed $3,000, CPS contributed $2,000, and World Wildlife Fund contributed $5,000. The total funding committed to this project in 1989 was $20,000.

In 1989, the Friends assumed and administered budget management for the project. As in 1987 and 1988, capture, transport, and transplant permits were obtained from CWS and Alberta Fish and Wildlife Division. This project has been sanctioned by the Pacific Flyway Committee, The Trumpeter Swan Society, Alberta Fish and Wildlife Division, CPS, and CWS.

Guidelines regarding permits, agency responsibilities, public relations, and monitoring of the impact of removals and status of the transplants remain as outlined in the cooperative agreement (Shandruk and Winkler 1988).

Public relations

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 precapture, capture/transplant, and at pre- and post-migration 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 1989, more than 25 media releases were made through television, radio, and newspapers, to inform the public of the project status. An interpretive program and series of displays explaining the project and Trumpeter Swans has been developed at EINP, as well as a media package for release to newspapers and radio stations.

The Friends have initiated planning in 1989 for the construction of an interpretive kiosk near the Astotin Interpretive Center. Information on the Trumpeter Swan and the conservation project at EINP will be displayed on this kiosk. This year, the Friends have also developed an information brochure on the EINP Trumpeter Swan Conservation Project. This brochure will be used to solicit funding for the project, will be displayed at various locations in the park, and will be given out at special conservation events.

Field methods

An aerial survey of EINP and surrounding wetlands (including Beaverhill Lake) was flown on 31 May 1989, to determine whether any of the 1987- or 1988-transplanted cygnets migrated back to EINP. Another aerial survey was flown on 15 June 1989, to assess the spring breeding status of Trumpeter Swans and to select candidates for transplant from the Grande Prairie flock.

As a first step in the 1989 transplant, a short reconnaissance helicopter flight was flown in the Grande Prairie area on 14 August, to determine the molt status of candidate family groups. On 15 August, family groups were captured with the aid of an A-star helicopter, from which a salmon net was used to capture the birds. Only families with both parents flightless and at least three cygnets were considered for capture. The swans were sexed, weighed, measured, banded, radio collared, blood sampled, and placed in plastic kennels. In

1989, cygnets were leg banded but not collared. Four complete families of Trumpeter Swans, eight adults and 17 cygnets, were transported by horse trailer directly to EINP on 15 August 1989. At EINP, swan families were held in release pens for 20 minutes before release on specific wetlands in the southern portion of the park.

Four weeks later, on 15 September, another family with three cygnets was captured and transplanted to EINP. This transplant was to test whether flying adults could be captured with cygnets, and whether cygnets would respond to anti-parasite drugs. These birds were treated with Ivermectin and Dronsit to control internal parasites. In addition, the cygnets were given dextrose and electrolytes to reduce the stress of the capture and transplant.

Several aerial surveys of the south side of EINP and surrounding area were flown during late September and October 1989. Adult and cygnet status, locations, radio frequencies, and numbers of swans were documented during this survey.

A fall Trumpeter Swan production survey was flown on 14 September 1989 to aid in assessing the impact of the first transplant on the Grande Prairie cygnet population, and to determine fall flock status. Results of this survey aided in determining whether a second cygnet transplant would be undertaken. Detailed aerial survey techniques are also outlined in Shandruk and Winkler (1988).

Habitat monitoring

Ground monitoring of transplanted family groups was conducted weekly by the Warden Service in EINP. Aerial surveys of the park and surrounding area were conducted in May, August, September, and October. The October survey was conducted just prior to freeze up.

An aerial survey of wintering transplanted Trumpeter Swans is planned for early 1990, to determine habitat use and survival of transplants. This will be conducted in cooperation with the University of Wyoming Cooperative Wildlife Research Unit and the U. S. Fish and Wildlife Service (USFWS). State biologists and researchers will continue to monitor transplants to determine habitat use, distribution, and survival of swans until they leave the wintering area in late March 1990.

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 of Idaho, Montana, Wyoming, and adjoining areas.

Table 1. Status of Trumpeter Swans transplanted to Elk Island National Park, October 1989.

Swan	Sex	Collar	Leg band	Radio freq.	Lake
Adult	F	59AC	193900218	151.120	Walter[1]
Adult	M	79AC	193900217	-	Walter
Cygnet	M	Unmarked	193900220	-	Walter
Cygnet	M	Unmarked	193900221	-	Walter
Adult	M	61AC	193900009	151.090	Bailey
Adult	F	49AC	193900010	151.918	Bailey
Cygnet	F	Unmarked	193900167	-	Bailey
Cygnet	F	Unmarked	193900168	-	Bailey
Adult	M	60AC	193900181	151.070	Beaverhill
Adult	F	57AC	193900180	151.050	Beaverhill
Adult	M	55AC	193900182	151.965	Walter
Adult	F	62AC	193900178	151.020	Walter
Adult	M	48AC	193900179	151.738	Flyingshot

[1] Transplanted 15 September and treated for stress and parasites.

RESULTS AND DISCUSSION

Capture and transplant

On the morning of 15 August, over a period of 4 hours, four family groups of swans were captured from lakes in the Saddle Hills northwest of Grande Prairie. Two, four, five, and six cygnets, respectively, were captured with two adults in each of the four families. All swans were transported by horse trailer to EINP. Ground transport to EINP required about 8 hours. Cygnets were provided food and water during transport. Release techniques were similar to those described by Shandruk and Winkler (1988). One major change was that release pens were partitioned to keep cygnets separate from adults while being held in the release pens. This modification helped to protect cygnets from being trampled by their parents.

By approximately 1 September, the pairs transplanted to Flyingshot and Walter Lakes had lost all of their cygnets. The high parasite load, the stress of the move, and the length of time required by the adults to familiarize themselves to their transplanted lakes in the park were the major factors in cygnet mortality. Data from four dead cygnets supports this conclusion, as the necropsies revealed they died of starvation

and were in ultra-poor body condition when brought to EINP. The veterinary report supported the conclusion that the poor condition of the cygnets was a result of poor habitat conditions and parasitism on the breeding lakes, not from starvation on the transplant lakes. This situation prompted a decision to transplant more cygnets to EINP from Grande Prairie, but at an older age.

On 15 September 1989, three cygnets were captured from Ponita Lake, northwest of Grande Prairie, and transported to EINP for release on Walter Lake. It was determined by palpation of the keel that the female cygnet was in poor body condition, while the two males were in fair condition. As described in the methods section, this family group was treated with electrolytes, dextrose, and anti-parasite drugs prior to release on Walter Lake. Approximately 1 week later, it was observed that only two cygnets were accompanying the adults. Because the cygnets were not collared, it was presumed that the female which was in poor body condition had died. A search of the lake unfortunately did not recover the carcass. The very poor body condition of the female cygnet may have resulted in the poor response to the prerelease treatments. Thus, from our limited observations, we speculated that only cygnets of fair to good body condition may show a favorable response to medication prior to release on transplant lakes. These transplants are summarized in Table 2.

Habitat monitoring

Four sightings of 1987-transplanted cygnets were reported in EINP and surrounding area in April and May 1989. These were yellow collars #20 and #25. This is the second consecutive year that these birds have returned to the area from which they fledged.

During the spring aerial survey on 31 May 1989, two Trumpeter Swans and three Tundra Swans were located on Tawayik Lake. A subsequent ground survey the same day confirmed that the two Trumpeter Swans were the 1987-transplanted cygnets (yellow collars #20 and #25), which were also observed in the park last spring.

Initial monitoring of the four family groups released on 15 August 1989 was completed the very next day. Three of the six cygnets released on Walter Lake were found dead in the water. One cygnet from the seven released on Flyingshot Lake was also found dead. Another cygnet was found dead at Flyingshot Lake a few days later. The adult female yellow collar 47AC from Yoke Lake, released on Walter Lake 15 August, was found dead on a small wetland to the east of Walter Lake on 19 September. The cause of death of this adult was not determined, as the carcass was partially destroyed and was in a deteriorated condition when it was retrieved.

Table 2. Elk Island National Park Trumpeter Swan transplant summary, 1989.

Capture status 15 August			Release status 15 Aug.	17Aug.	18 Sept.
Source lake	A + C[1]	Release lake	A + C	A + C	A + C
Preston	2 + 5	Flyingshot	2 + 5	2 + 4	2 + 0
Lost Cygnet[2]	2 + 2	Bailey	2 + 2	2 + 2	2 + 2
Yoke	2 + 4	Flyingshot	2 + 4	2 + 4	1 + 0
Hume Creek	2 + 6	Walter	2 + 6	2 + 3	2 + 0
Capture status 15 September			**Release status 18 Sept.**	**22 Sept.**	**7 Oct.**
Ponita	2 + 3	Walter	2 + 3	2 + 2	2 + 2

[1] Adults plus cygnets.
[2] This pair transplanted to EINP in 1987.

The four cygnets which were found dead on 16 August were necropsied the next day. The birds were found to be in extremely emaciated body condition, 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 transplant of the birds. The birds also had significant parasite infestations, which caused severe impacting of the intestinal tract and interfered with nutrition.

By the end of August, none of the birds from the two family groups released on Flyingshot Lake could be located. All cygnets from these groups were assumed dead. The adult female (collar #62) from one group was later sighted on Flyingshot Lake in September, and the adult male (collar #48) was later sighted on Walter Lake, also in September. The adult pair (collars #57 and #60) from the other group were sighted at Beaverhill Lake on a few occasions in September.

The family group on Bailey Lake was observed several times throughout the summer. Both cygnets from this group survived and appeared in good condition whenever observed. These adults were tranplanted to Bailey Lake in 1987 and fledged three cygnets from EINP in 1987. This group was last observed on 4 October and we assume that they again fledged cygnets.

A second family group consisting of an adult pair and three cygnets was captured in Grande Prairie and released on Walter Lake 15 September. All birds were alive and appeared in good condition on 19 September. This family was again observed on 27 September, minus one cygnet which was assumed dead. The adult pair and remaining two cygnets were last observed on the lake 7 October.

Ground monitoring of Bailey and Walter Lakes on 19 October failed to turn up any observations of the remaining family groups. On 26 October, an aerial survey of the EINP/Beaverhill area was conducted, and no transplanted Trumpeter Swans were located. The wetlands in the park were not yet freezing, but it was believed the swans had left the area.

Aerial surveys

At Grande Prairie, a total of 185 Trumpeter Swans was observed during the spring 1989 survey, while 242 swans were observed during spring 1988 (Table 3). The 1988 survey accounted for 78 total pairs, of which 44 appeared to be nesting. This is the highest number of nesting pairs ever observed in this region of Alberta. The total 1988 spring population of Trumpeters in this flock increased by 14 percent from 1987, while breeding pairs were up from 1987 by 18 percent. In 1989, the harsh wintering conditions in the Tristate resulted in a considerable decrease in total pairs and nests observed. Total pairs were down from 1988 by 24 percent, and nests decreased by 16 percent. Although the Grande Prairie flock experienced an estimated 48 percent death rate during the 1988-89 winter, the 1989 spring flock statistics are still similiar to the means for the last 5 years.

September production surveys of the Grande Prairie flock were completed for the period 1985 to 1989. Total numbers went from a low of 284 swans in 1986 to a peak of 361 in 1988 (Table 4). In 1989, total numbers decreased to 341 swans. This is a very small decrease over that observed in 1988 (n = 361). Total cygnet production has been relatively stable at around 100 cygnets per year with an average of 29 to 30 broods, except for 1989 (n = 81), which had 27 broods. The number of lakes surveyed and route followed were similar during this entire period. Although the 1988 total flock size, numbers of breeding pairs, and cygnets produced were similar to that observed in 1987, the average brood size (n = 3.03) was lower. A Student t-test indicated that the 1988 observations were not significantly different from the 5-year means at the 0.05 level. The lack of cygnet production by this flock in 1988 and 1989 may be attributed to harsher than normal habitat conditions on the wintering grounds in 1987-88 and 1988-89. The drier than normal 1988 summer in the Grande Prairie area may have also resulted in poorer cygnet production than should have normally been expected.

Table 3. Spring surveys of the Grande Prairie Trumpeter Swan flock.

Year	No. of pairs	No. of nests	Other adults	Total swans
1985	56	27	28	140
1986	52	31	49	153
1987	66	42	77	209
1988	78	44	86	242
1989	64	37	57	185
Mean	63	36	59	186

Table 4. Fall flock status of Trumpeter Swans in the Grande Prairie region.

Year	Paired birds	Cygnets	Other adults	Total swans
1985	50	93 (25)[1]	141	284
1986	66	124 (33)	157	347
1987[2]	48	83 (25)	178	357
1988[2]	51	82 (27)	177	361
1989[2]	58	61 (23)	161	341

[1] ( ) Number of broods.
[2] Not including adults and cygnets removed for EINP transplant.

Transplant impact

Over the last 3 years, we have observed that five to seven adults of the eight to ten that were transplanted to EINP have returned to the original breeding lakes from which they were removed. Thus, the tranplant 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 7.90 percent per year over 3 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 4.60 percent to 3.20 percent per year over 3 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. If we assume a minimum winter mortality of 50 swans during 1988-89, then the tranplants had an actual impact of removing 11 birds from this population. Thus, we have concluded 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.

CONCLUSIONS AND RECOMMENDATIONS

Two cygnets transplanted to EINP in 1987 returned in 1988 and again in 1989. This provided unquestionable evidence that the transplant effort will result in establishing summering Trumpeter Swans at EINP. 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 assure eventual breeding at EINP.

From the results of the 1988 reintroduction, it was determined that a mid-July capture and transplant of family groups would not be attempted in 1989 because of the extremely high cygnet mortality. Eighteen of the 20 cygnets transplanted in July 1988 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 winter conditions experienced in the Tristate.

The 1989 family groups, totalling four adult pairs and seventeen cygnets, were captured in Grande Prairie and transplanted to EINP on 15 August. Only two cygnets from this transplant survived to migration. This poor survival rate was believed to be a combination of the cygnets' poor physical condition prior to transplant, as verified by laboratory necropsy reports, and possibly that the birds may have been too young to survive the stress of transplant.

With this in mind, another family group consisting of an adult pair and three cygnets was transplanted on 15 September. These birds were given a broad spectrum antibiotic and deworming medication 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 three cygnets survived to migration.

The adults relocated to Bailey Lake in 1989 were the same pair as had been relocated in 1987 to this same lake. This pair again had no known mortality of cygnets up to fledging. It is possible that adults familiar with their transplant lakes have better cygnet survival. It is also possible that adults with fewer cygnets have a better chance of surviving a transplant. These observations should be evaluated further when considering furture transplant techniques.

The successful capture of the adult pair in September demonstrated that adult birds could be caught after their molt period. In 1990, capture and transplant will be delayed until late August or early to mid September in hopes of improving cygnet survival. The birds will also be checked for general health condition and parasite infestations, and appropriate medication will be administered. Minor changes in logistics and field techniques will also be attempted to reduce stress, and time spent during capture, transport, and processing of the swans.

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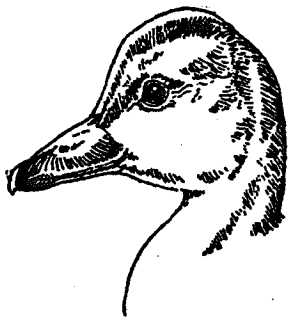

UPDATE ON TRUMPETER SWANS IN MONTANA, 1988-89

Carl D. Mitchell

INTRODUCTION

This report will summarize management actions and biological data pertaining to Trumpeter Swans (Cygnus buccinator) in Montana since the last report in February 1988 (Reiswig 1990). Although Trumpeter Swans pay no attention to political boundaries, this report will be limited to Montana. Reference will be made to participation in several major projects in Idaho and Wyoming, but details on project results will be included in those state update reports or in other papers at this Conference. Most of the activities relating to Trumpeters in Montana occur at Red Rock Lakes National Wildlife Refuge (RRLNWR), in the southwestern part of the state, and the emphasis in this paper will be on RRLNWR.

MANAGEMENT PROGRAMS

Winter feeding

The 1987-88 feeding program ran from 25 November to 15 April (inclusive). The entire stored ration of 2,000 bushels of hard red spring wheat was fed. This was the largest amount of wheat fed in one winter in RRLNWR history. The 1988-89 feeding program ran from 2 December to 28 April, and 1,598 bushels of hard red spring wheat were provided. Almost all of the wheat was broadcast into piles or rows from a small boat, unless bad weather prevented doing so. Feeding was conducted twice weekly, and the amounts fed on any given day varied from zero to 80 bushels.

The relatively large amount of wheat provided during recent winters is based on recommendations in Gale et al. (1987) and observations by Mitchell (1987). The amount fed daily is based on a formula developed by Mitchell (1987 and 1990). This approach appears to be working well.

Information on swans present, age ratios, site, number of bushels of wheat left uneaten, number of bushels provided and method used, numbers and species of other waterfowl present, and other notes of interest are recorded on each visit and are on file at RRLNWR. Data were also collected on behavior and activity patterns on wintering ponds during 1987-88. These data, along with similar information from 1986-87, await detailed analysis (see below).

Habitat management

Much of RRLNWR is designated wilderness, and habitat management options are limited. Water level manipulation is one available tool, and is used to prevent nest flooding and promote the growth of aquatic vegetation on various waters. A new (1987) water control structure built by Ducks Unlimited, Inc. (DU) on the west end of the Refuge allows for some control of water levels in Lower Red Rock Lake and the west side of the River Marsh. Our preliminary water management plan was not satisfactory, with water being held too deep and too long. A new water management plan is being prepared.

DU is also funding another pond construction project this year, and this should provide another nesting pond for Trumpeters. Trumpeters have nested on other DU projects here. At least one more pond construction project is in preparation for 1990. DU deserves considerable credit for funding these habitat projects.

Range expansion

In 1988, 28 Trumpeters from RRLNWR were moved to two locations in Idaho. In 1989, an additional 15 Trumpeters were moved to Grays Lake National Wildlife Refuge (NWR). Details are provided elsewhere in this Conference. Cygnets will be moved to a holding facility at Fort Hall Indian Reservation in September 1989. They will be "soft released" upon fledging. The 1988 releases were closely monitored, and results are reported in Luttschwager (1988). The 1989 releases are being monitored by the Wyoming Game and Fish Department, Southeast Idaho Refuge Complex, and Shoshone-Bannock Tribes. All range expansion projects have been approved by the Pacific Flyway Council (PFC).

Trumpeter Swans are also being reintroduced onto a private ranch near Livingston, Montana. The ranch and surrounding area held large numbers of Mute Swans (Cygnus olor) in recent years, but the ranch, with help from RRLNWR, Yellowstone National Park (YNP) and the state captured and removed most of the Mutes. Original plans were for RRLNWR to provide cygnets or subadult swans to the ranch to replace the Mute Swans, but delays due to concerns related to a petition to list the Rocky Mountain Population (RMP) of Trumpeters as threatened caused the ranch manager to obtain swans privately. This was possible due to a fund set up by YNP and the Yellowstone Natural History Association. Two pairs of Trumpeters were scheduled to be moved to the ranch on or about 1 September 1989. Future releases will depend on sufficient funds being donated to YNP's fund, or resolution of the petition to list Trumpeters as well as preparing a suitable management plan, which could result in swans becoming available again from RRLNWR. Conversely, if the captive Trumpeters do well, there may be no need to use wild birds.

Preliminary discussions on developing breeding habitat and moving molting subadults have taken place between the Hebgen Lake Ranger District of the Gallatin National Forest and the Refuge. Proposals are being prepared.

Other management actions

In April 1989, the Idaho Chapter of The Wildlife Society petitioned the U. S. Fish and Wildlife Service (USFWS) to list the RMP Trumpeters as threatened under the Endangered Species Act. The decision by USFWS Endangered Species biologists was that the petition may be warranted. The biological merits of the petition may be open to debate, but one noticeable result so far has been that states with Tundra Swan (Cygnus columbianus) and/or Snow Goose (Chen caerulescens) hunting programs have become very concerned that range expansion projects for Trumpeters will adversely impact those programs. These states are going to have to be involved from the start on new range expansion plans, and plans that do not address their concerns are going to have a difficult time getting approval by flyway councils. RRLNWR personnel have been attending the PFC meetings for the last few years to guarantee that a strong advocate for Trumpeter Swans, and our program, is present.

Both RRLNWR and the state of Montana have been actively involved in recent PFC and RMP Subcommittee meetings and planning in the past years. This is expected to continue. One significant improvement is the creation of a RMP swan coordinator, to monitor progress on assignments undertaken by RMP Subcommittee members. A schedule of duties and responsibilities for the members has also been drafted. Now, reference to a document will tell a cooperator who is responsible for a given task, and a call to the coordinator (currently RRLNWR's Project Leader) will result in a progress report on assigned tasks.

In an attempt to reduce Trumpeter Swan numbers at Harriman State Park last year, two RRLNWR staff spent 4 weeks harassing the birds. We used propane powered "zon guns" and hand-held "clough" pistols to create noise. The program was part of a PFC-approved contingency plan, and was implemented in response to predictions that the Henry's Fork of the Snake River would freeze. Low precipitation and resulting reduced releases from Island Park Reservoir were the ultimate problems.

Initial efforts at Harriman were encouraging, with an estimated one-half of the 100-150 swans moving. Unfortunately, a constant inflow of Trumpeters also occurred. It became clear that at least some of the swans merely moved out of our immediate area of operation, and then returned at night. Equipment failure and logistical problems caused by weather conditions also contributed to our difficulties. Under these conditions, we felt that our harassment was only causing the swans to deplete energy reserves that would be needed later in the winter, and the project was abandoned. Subsequent events were chronicled in The Trumpeter Swan Society Newsletter, Winter 1988-89/Spring 1989.

On another front, RRLNWR was involved in an attempt to stop a proposal that would have resulted in a groomed snowmobile trail running within 100 m of one of our wintering ponds. The road is currently open to snowmobile traffic, but use is relatively light and harassment only occasionally occurs. A groomed trail would presumably have increased snowmobile traffic, harassment, and probably vandalism and poaching. This portion of the proposal was dropped, but most of the county road from Red Rock Pass to Lakeview is still scheduled to be groomed. Whether or not this will increase traffic on the road past MacDonald Pond remains to be seen.

BIOLOGICAL INVESTIGATIONS

Area surveys

During the 1988 Midwinter Survey, 1,710 Trumpeter Swans were counted in the Tristate area. "White-birds" (i.e., adult and subadult swans in white plumage) totaled 1,308 (76 %), and 402 (24 %) were cygnets.

The 1988 Tristate survey resulted in counts of 464 white birds and 137 cygnets, for a total of 601 Trumpeters. This was the highest count since 1964, and was well above the long-term average. Most of the increase was probably due to exceptionally good cygnet production in 1987.

The 1989 Midwinter Survey tallied 1,743 Trumpeters, of which 1,452 (84 %) were white birds, and 291 (16 %) were cygnets. This was the highest count in the history of the survey, and yet the count should have been even higher. Apparently, cygnet mortality was high early in the winter, or mortality increased over all age classes, and/or some Trumpeters in the RMP may be moving to wintering sites outside the survey area.

Production

Production in 1988 was about average at RRLNWR. Thirty-four nests were occupied, mean clutch size was 5.75 (N=8), and an estimated 175 cygnets were hatched. The severe and prolonged drought that ensued caused water levels to recede to record-low levels. Considerable brood movement occurred, and considerable cygnet mortality occurred. Fifty-four cygnets fledged on the Refuge. Seventeen additional cygnets were fledged from off-Refuge sites, where drought-related mortality was even higher.

Production in 1989 was very poor. A hard winter presumably caused Trumpeters to move to their territories in poor condition. A cool, wet spring also inhibited early growth and production of aquatic plants, and the swans did not have an opportunity to recoup body condition and acquire energy and nutrient reserves for good reproduction. Nest numbers were down to about 15, nest attendance of observed pairs was generally poor, clutch size was 4.5 (N=7, range 4-6), and no more than 16 cygnets were ever observed at one time on the Refuge. Cygnet mortality began immediately post-hatch, and entire broods were lost. We anticipate fledging 15 cygnets from six broods at RRLNWR. Mean brood size is 2.5 (N=6, range 2-3). Off-Refuge, we should fledge eight cygnets (one brood each of two and six). The 1989 Tristate survey is scheduled for 11-15 September 1989.

While poor reproduction at RRLNWR is difficult to accept, it is important to remember that in spite of our management options and abilities, the climate in this region is such that occasionally natural conditions override management practices. Years like 1989 emphasize the need to continue range expansion projects.

Trumpeter Swan production on wetlands near Augusta, Montana, was apparently not monitored in 1988. Five white birds (one pair and three grouped birds) were observed on two ponds in 1989. No cygnets were observed. The Montana Department of Fish, Wildlife, and Parks monitors this flock.

Banding and collaring

Banding and marking studies were resumed at RRLNWR in 1988. These activities coincide with capture operations for our range expansion projects. Those birds not suitable for relocation due to age, sex, or physical condition are banded, collared with black and red collars, and returned to the marsh. The objectives of this program are to resume studies of seasonal movements, and to gather data on pairing and subsequent pair-specific reproduction. There are a number of biological questions that can be answered using observations of marked swans. Most of these focus ultimately on the consistency of reproductive output by specific pairs. If patterns are found between physical and/or behavioral characteristics (e.g., site fidelity, nest attendance, or brood movement), environment (e.g., nest pond, plant phenology, or spring weather) and reproductive output (e.g., clutch size, egg size, percent hatchability, or cygnet survival to fledging), then perhaps the swans and/or their environment can be managed to maximize successful relationships. It is unlikely that Refuge personnel will be able to collect all the necessary data, but if collaring continues, personnel know what to look for and what to record. Patterns should emerge if enough Trumpeter Swans are observed over a long enough period of time. Getting a university to conduct a succession of projects to answer these questions would be preferable to the current approach, but it is unlikely at present.

These investigations are based largely on studies invloving Mute Swans in Europe (Bacon 1981, Birkhead et al. 1983, Coleman and Minton 1979, A. E. Coleman, pers. comm. 1987, Mathiasson 1981, 1987, and others), and the work by Lockman et al. (1987) on Trumpeter Swans in Wyoming. A more detailed understanding of swan biology can only result in better and more enlightened management.

Brood movements and crecheing

Data on brood movements is being collected in conjunction with swan survey flights and other routine field work. It is anticipated that data will be collected for another 1 or 2 years, at which time the data will be analyzed. We hope to gain insight into brood habitat selection, the circumstances that influence brood amalgamation (crecheing), and cygnet survival.

Impact of Trumpeter herbivory on wintering sites on RRLNWR

During the late autumn and winter of 1989-90, we are going to measure aquatic plant and invertebrate populations in Culver and MacDonald Ponds. Our study objectives are to: (1) measure species composition, density, and biomass of aquatic macrophytes before, during, and after Trumpeter Swan occupancy, (2) measure species composition, density, and biomass of aquatic invertebrates before, during, and after Trumpeter Swan occupancy, (3) correlate changes in abundance and biomass of plants and invertebrates with Trumpeter Swan abundance and feeding habits over time, and (4) determine appropriate water level management and winter feeding actions to maximize benefits to Trumpeter Swans.

Trumpeter Swan behavior on wintering ponds

During the winters of 1986-87 and 1987-88, a total of 526.3 hours was spent collecting data on Trumpeter Swan activity patterns and behavior. Although most of the emphasis was on foraging activity, considerable data were collected on other behaviors. A preliminary report was prepared for the 1986-87 observations, but a thorough statistical analysis for those data and the 1987-88 data needs to be completed. We hope to accomplish this during the winter of 1989-90. A thorough analysis of swan behavior and activity patterns on our winter feeding area, when compared with similar data from flocks wintering under more natural conditions (Farley 1980, Hampton 1981, LeMaster 1981, McKelvey 1981), will allow managers to evaluate our winter feeding procedures and results from a different, and possibly more sensitive, viewpoint.

CONCLUSIONS

RRLNWR continues to be a major factor in Trumpeter Swan management in Montana, the Tristate area, and the Pacific Flyway. In addition to producing a significant proportion of the cygnets in the Tristate area, forage is provided for 15-25 percent of the RMP over the winter. Limited basic research on Trumpeters and their management is ongoing. Refuge staff are deeply involved in a number of cooperative programs and projects with a wide variety of state and federal agencies, individuals, and private organizations. This unusual involvement of Refuge personnel outside of Refuge boundaries has resulted in benefits to Trumpeter Swan populations and their habitats. We anticipate continuing this "activism" on behalf of Trumpeters for the foreseeable future.

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STATUS OF THE TRUMPETER SWAN IN YELLOWSTONE NATIONAL PARK

Terry McEneaney

Following the 1988 wildfires, the question most frequently asked of Yellowstone National Park (Yellowstone) personnel pertained to the status of the Trumpeter Swan and other wildlife. Many wildlife species are expected to benefit from wildfires due to nutrient cycling and the increase in vegetative diversity. In the case of Trumpeter Swans, they are expected to benefit since nutrients will accumulate in aquatic environments used by swans, namely lakes and rivers.

In order to understand the current status of Trumpeter Swans in Yellowstone, it is important to know how the area is managed. Yellowstone is a very diverse area, with a wide variety of wildlife species and landscape features to which a large number of people are attracted. In addition, the National Park Service maintains a policy of natural regulation in Yellowstone. Under this direction, park personnel are mandated to let nature take it's course, and manage not for one species but for multiple species in this dynamic all-encompassing ecosystem. Predation is an acceptable means of regulating wildlife populations. Wildfires are a natural course of events. The task of managing for naturalness, coupled with an annual human visitation of 2.4 million visitors, is an extremely difficult and challenging undertaking.

What exactly is Yellowstone doing for Trumpeter Swans? If a particular wildlife population is low, and we can demonstrate humans are further impacting the population, then mitigation techniques may be allowed on a case-by-case basis. Examples of this include the reintroduction of the Peregrine Falcon following the DDT era, and reestablishment of Whooping Cranes into the Greater Yellowstone Ecosystem. One Trumpeter Swan mitigation technique involved experimenting with floating nest platforms. Areas chosen for the experiment were areas where swans were exposed to large numbers of people and/or where flooding was demonstrated to be a problem. During a 3-year (1987-89) experimental period in the park using floating nest platforms, these artificial structures accounted for 33 percent of the entire fledged cygnets.

Protecting resources while allowing for the benefit and enjoyment of people is a difficult task for park managers. The installation of signs is a very effective method for controlling human use. Signs are most effective when their action is explained, e. g., closing an area to human use. Yellowstone has, without a doubt, one of the best law enforcement programs in North America for protecting Trumpeter Swans. It is estimated that over 1 million visitors view the Yellowstone 7-Mile Bridge Trumpeter Swans during any given year, with few incidents. The effectiveness of this program is a function of ranger involvement and personal commitment to secure the welfare of the swans.

Keeping the environment clean is important in order to protect the overall vigor of the Trumpeter Swan population. The use of lead in recent years has been extremely low. In Yellowstone we promote fly fishing and spin casting. Live bait fishing is not allowed in Yellowstone (with the minor exception of four streams where persons under 11 years of age are allowed to fish with worms) which virtually eliminates the lead sinker conflict.

Motorized vehicles today use primarily unleaded gasoline, so the leaded gasoline problem of years past has been curtailed. However, a current study of lake sediments revealed that lead lingers in the environment long after it is used. Analysis of lake sediments by Yellowstone researchers revealed lead present during eras of high regular gas consumption. Although no place in the world is free of environmental contaminants, Yellowstone is actively working on environmental contaminate monitoring to make sure the environment is as clean as possible. We will continue to closely monitor the environment for these and other pollutants.

Perhaps our most important project in recent years is the introduction of Trumpeter Swans into the Call of the Wild Ranch, just 5 miles south of Livingston, Montana. This ranch is owned by Mrs. Eva DePuy and is considered to be one of the most productive wetlands in the state of Montana. The DePuy's introduced Mute Swans into this area, and the population skyrocketed to the point where it exceeds 100 swans. Because of the Mute Swan threat to Trumpeter Swans and the importance of the Call of the Wild Ranch to waterfowl, a fund was established in Yellowstone to introduce captive-raised Trumpeter Swans onto the ranch. The purpose of the project is to: (1) establish a breeding population of Trumpeter Swans at the Call of the Wild Ranch, (2) allow all offspring produced from the introduced population to become free-flying, and therefore expand the range of the Trumpeter Swan, (3) increase the Trumpeter Swan population in the Greater Yellowstone Ecosystem, and (4) reduce potential conflicts between exotic Mute Swans and Trumpeter Swans. Two pairs of Trumpeters will be released in 1989. This is an exciting project in that it involves a team effort consisting of federal agencies (Yellowstone and Red Rock Lakes National Wildlife Refuge), a state agency (Montana Department of Fish, Wildlife, and Parks), private donors (L. Sargent, Chevron, Yellowstone Coalition, Yellowstone Association), and interested individuals (B. Auger, R. Elgas) working for a common cause

-- to establish a flock of Trumpeter Swans on private land (the Call of the Wild Ranch).

Population monitoring continues in Yellowstone on a yearly basis. It is becoming apparent that Yellowstone is an important area for wintering swans, particularly during the late fall and early spring and during extremely cold periods. The Yellowstone Trumpeter Swans have a long history of low productivity. The primary cause for this poor productivity has been linked to weather and predation. Pair occupancy in recent years has been extremely low. Lead poisoning and power line collisions outside of the park are suspect. Canada Geese have also been identified as potential competitors with Trumpeter Swans for nest sites and will be monitored closely for population changes. For the last 3 years (1987-89), swan production has been extremely low, averaging nine to 10 nesting pairs and five to seven cygnets fledged. The bottom line is that Trumpeter Swan numbers and territorial occupancy are both alarmingly low.

What is the future for Trumpeter Swans in Yellowstone? Since Trumpeter Swans occupy a range much larger than Yellowstone, the swans should be managed on an ecosystem basis. What happens outside of Yellowstone is just as important as what happens inside Yellowstone. It is important that we manage for the future. The first order of business should be to secure swan habitat. The second order of business should be to make the environment as clean as possible, thus eliminating hazards that swans may encounter. And, the last order of business should be to prepare and plan for increased developments and increased outdoor recreation demands. As the years go by, the wild area known as the Greater Yellowstone Ecosystem will get smaller, but the demands and the problems this area will face will only increase. It is up to us to have insight, and manage Trumpeter Swans for the future. If we are to manage and plan for the future, then teamwork is essential. I recommend the establishment of a small, yet effective, Greater Yellowstone Ecosystem Trumpeter Swan Working Group. This group should be comprised of the key players in swan management in the Ecosystem. By establishing a working group, we can lay aside our differences and work towards our similarities -- the welfare of the Trumpeter Swan.

U. S. FISH AND WILDLIFE SERVICE INVOLVEMENT IN WINTER MANAGEMENT OF THE ROCKY MOUNTAIN POPULATION OF TRUMPETER SWANS

Richard D. Bauer

The U. S. Fish and Wildlife Service (USFWS) is actively involved in cooperative management efforts related to the wintering problems of the Rocky Mountain Population of Trumpeter Swans. As part of the Pacific Flyway-approved Range Expansion Project and the Contingency Plan for Management of Wintering Trumpeter Swans in the Vicinity of Harriman State Park, Idaho, Region 1 of the USFWS plans on the following activities over the next year:

HENRY'S FORK WINTER WATER

Continue the lead in developing cooperative agreements with the Bureau of Reclamation, irrigation districts, and power companies to ensure adequate winter flows in the Henry's Fork of the Snake River. Our Boise Field Office has the lead on this issue.

WINTER HABITAT EVALUATION STUDY

Conduct a study to identify and evaluate potential Trumpeter Swan wintering areas in Idaho and Wyoming. Sites would be ranked and subsequently used in the range expansion effort. Cooperative funding is tentatively available to cover the majority of the cost. The Southeast Idaho National Wildlife Refuge Complex Office has the lead on this study, and would either hire another biologist or issue a contract to attain the needed information.

WINTER MONITORING EFFORTS

1. Monitor the locations of the 15 swans moved to Grays Lake this summer.
2. Help monitor the cygnets and adults yet to be transplanted to the Fort Hall Indian Reservation.
3. Coordinate the winter monitoring of the Henry's Fork and other waters where freezing could occur.
4. Aid Region 6 in the Midwinter Tristate survey.
5. Participate in public information efforts (the Wyoming Game and Fish Department has offered assistance).
6. Develop a pilot study for a possible winter trapping program at Harriman State Park.

The Southeast Idaho National Wildlife Refuge Complex Office has the lead for these efforts.

I believe these are positive efforts in helping to achieve the objectives presented in the North American Waterfowl Management Plan for Trumpeter Swans, and in keeping with the USFWS policy on Trumpeter Swan management.

STRATEGIES TESTED IN WYOMING FOR TRUMPETER SWAN RANGE EXPANSION -- 1989 PROGRESS REPORT[1]

Dave C. Lockman

The following paper summarizes the first year of the Wyoming portion of the Rocky Mountain Trumpeter Swan Population Range Expansion Project, 1988-93. This project was approved by the Pacific Flyway Council in March 1988. The Wyoming Game and Fish Commission approved this expansion project for Wyoming in July 1988. The project objectives and strategies were also identified in the North American Trumpeter Swan Management Plan, and in the Strategic Plan for Nongame Birds and Mammals in Wyoming.

PRELIMINARY INVESTIGATIONS

From 1983-87, the Salt River drainage was investigated for its capability to support wintering Trumpeter Swans. Natural color aerial photos were used to delineate potential wintering areas and sites on seven half-inch U. S. Geological Survey (USGS) quadrangle maps. Acreages of open water aquatic macrophyte communities available to winter use by swans were determined. Field surveys were conducted to determine aquatic plant species composition and abundance. All potential wintering sites were classified into one of four swan winter capability classes.

In July 1986, two yearling siblings were captured on Loon Lake within the Targhee National Forest, and translocated to Grays Lake National Wildlife Refuge (NWR). The male and female siblings were marked. To our knowledge, the yearling swans had never journeyed outside the current Tristate Trumpeter range. This experiment was conducted to determine whether the yearlings would remain at Grays Lake through the summer, whether they would move upon ice-up, where they would go to winter, and whether or not they would come back to Grays Lake in subsequent years or find their way back to the area of intial capture. The swans were taken to Grays Lake during their flightless molt, and released 14 July 1986 on the south end of the Grays Lake marsh. The pair remained at the Lake until mid September.

On 25 September, the pair arrived at a shallow pond on Christiansen Creek near Grover, Wyoming (Salt River drainage). They remained there until the waterfowl hunting season opened on 2 October. It was believed that waterfowl hunter activity in the area caused the swans to leave. On 12 October, the pair arrived on Rainey Creek in Swan Valley, Idaho. Rainey Creek is located on the Snake River drainage about 30 miles north of the Salt River's confluence with the Snake River. The landowners on Rainey Creek do not allow waterfowl hunting in the area occupied by the swans. They remained on Rainey Creek through October and early November.

On 18 November, the pair was observed on a creek near Grover, Wyoming. On 20 November, a call was received from a landowner that one of a marked pair of swans could not fly, and the mate had left the area. It appeared that the female had collided with a fence, and, although she could not fly, we could not capture her. It appeared that neither her wing nor body was seriously debilitated. We observed her, and on 22 November she also disappeared. Tundra swans were migrating through the area at this time.

In mid February, I was notified by the National Park Service (NPS) that a green-collared swan (#63) had wintered 18 December 1986 - 15 February 1987 on Lake Powell in a shallow bay near Wah Weap Marina. The swan wintered alone with a large flock of Redheads and Coots. On 3 April, #63 arrived on Rainey Creek, and remained until 9 or 10 April. I observed the male on 6 April. He was alone but appeared in excellent condition.

The male was not observed again until 25 June, when it was accompanied by an unmarked swan on Loon Lake. The male, at least collar #63, was not found in a July search during the middle of the molt. It is believed that the swan is still around, probably with a mate, but has lost his collar.

This experiment provided us with the following insights:

1. When relocated during the molt to a large marsh area, or at least an area where security from intensive disturbances can be found, the flightless period forces the birds to "settle in" and remain in the area.

[1] **Editor's Note:** This report summarizes the first year's activities of the 5-year Trumpeter Swan Population Range Expansion Project, which is detailed in the Proceedings of the 11th Trumpeter Swan Society Conference. In sum, the range expansion project in Wyoming pertains to two objectives: (1) maintain a wintering population of at least 1100 swans within the Tristate Region, and (2) expand the distribution of swans wintering and nesting in the Tristate Region by establishing a tradition for use of at least four new wintering sites within Montana, Wyoming, and eastern Idaho. Each site should have the capability of wintering 50-150 swans. Two sites should be evaluated and establishment attempted by 1990, and two additional sites by the year 2000.

2. Yearlings translocated to a new summer area will leave in the fall and seek a new winter area.

3. Fall staging sites, secure from hunter disturbance, may be required to encourage swans to remain in an area to winter.

4. Translocated yearling swans exhibited the capabilities to migrate and find winter sites, return to previously used habitats, and find their way back to the area of origin.

Had the female sibling not disappeared in migration, would the yearling pair have returned to Grays Lake? Would decoy swans, conditioned to human presence and located on protected habitat secure from excessive human disturbance, seduce migrating Trumpeters to settle in the Salt River drainage, remain through the hunting season, and later disperse and winter in the drainage?

In 1987, five cygnets were hand-reared from six eggs salvaged from a flooded nest site at Red Rock Lakes National Wildlife Refuge (RRLNWR), and a nonproductive site (Widget Lake) in Wyoming. The cygnets were raised to 80 days old. Only one of the cygnets was imprinted to Trumpeter vocalization and none were imprinted to Trumpeter adults. Three of the cygnets were released near Grover and two near Thayne, Wyoming on 26 August 1987. After a Golden Eagle killed one on 28 August at Grover, the remaining two were moved to the pond to accompany the two released near Thayne. On 29 August, an injured, flightless male was released with the four cygnets. The male was believed to be an old bird from the Madison River pair. This male was crippled from a power line collision near West Yellowstone in 1986, and transferred to the Wyoming Game and Fish Department for experimental use. The swan was kept on a ranch near Sheridan owned by Mr. Lambert Niedringhaus. The male was apparently experienced with young, as he attempted to assume the adult male's role in a family association. Although he was not agonistic to the brood, the brood initially remained segregated from the male. After about 5 days, they loafed together, but separated during feeding. The male actively tried to lead the brood in all activities. However, the brood would seldom follow his lead.

The male was observed on numerous occasions exhibiting threat and avoidance postures to mammalian and avian intruders (e.g., Osprey, Bald Eagles, Canada Geese, and red fox). The cygnets appeared to follow his lead when he became alert and would all leave the shore and enter the pond when he felt threatened.

The cygnets' flight feathers were fully developed by about mid September. Although not capable of flight, the old male was observed on numerous occasions trying to coerce the cygnets to fly by flapping across the pond. On 6 October, I observed the cygnets in a low-level flight across the pond. About 14 October, the cygnets were observed by the landowner in their first extended flight, to a creek about 3/4 mile north of the pond. From that time, they began daily flights to the creek, oftentimes remaining most of the day. On 19 October, one of the cygnets hit a power line and was killed. On 22 October, Lower Valley Power and Light personnel marked the power lines in their daily flight path. We feared that the old male might try and leave the pond, so he was captured and returned to the Sheridan facility on 27 October.

On about 10 November, the pond froze and the three siblings moved to the creek about 1/2 mile from the pond. The owner of the pond and land around the pond did not allow waterfowl hunting (this included the pond, hay meadows, grain field, and about 1/2 mile of Flat Creek, totalling over 200 acres). Waterfowl hunting was closely controlled by the landowners on adjacent creek areas used by the swans through November. Local hunters using the area were aware of the swans, and avoided disturbing them whenever possible. Many local people, including young folks, enjoyed observing the swans. The cygnets did not fear humans, and hunters and other visitors respected the swans. This tended to hold the swans in an area of about 500 acres.

These swans were not fed any supplements, and utilized submerged aquatic and shoreline vegetation or natural foodstuffs. On 2 February 1988, two of the cygnet group were captured and weighed. The female weighed 20.2 pounds, and the male 21.5 pounds. Both were in excellent body condition, suggesting that they had found adequate food resources through the winter. This also suggested that Flat Creek was providing sufficient food to support the other five to 11 swans from November through early February. On Flat Creek, most swan feeding activity appeared to be concentrated on pondweed tubers and other aquatic rootstocks. Muskgrass (Chara sp.), filamentous algae, water milfoil (Myriophyllum sp.), and sedge (Carex sp.) rootstocks were also used by the cygnet group.

In early March, the pond began to open up, and the cygnets began feeding on muskgrass beds and Sago tubers in the pond. By mid April, the adjacent native and introduced meadow grasses were beginning to green up. The cygnet group fed extensively along the creek and pond shorelines in the emerging green meadows from mid April through mid May. Wintering migrant swans had all left the Salt River drainage by mid March.

INITIAL PHASE OF TRISTATE RANGE EXPANSION PROJECT, 1988

The background, methods, and monitoring of the first expansion efforts were summarized by Luttschwager (1988). Thirteen yearling Trumpeters were released at Grays Lake NWR on 10 July 1988. On 25 August, four cygnets from the Sheridan facility were brought to the Salt River drainage. These cygnets were imprinted to and raised by adult Trumpeters to 67 days of age, before being brought to the Salt River. This sibling group was also raised near humans.

A 2-acre pond on the Porter Ranch was chosen as the release site. The cygnets were released (a hard release) on 25 August. They left the pond and were recaptured on the morning of 26 August. They were placed at Dave Lockman's home in a predator-proof 10-foot by 12-foot enclosure. A 4-foot-high net wire enclosure was constructed on a portion of the Porter pond on 30 August. The enclosure was about 120 feet by 100 feet, and included two shoreline loafing zones, a shallow water feeding area, and shoreline willow cover. The pond bottom was dominated by Sago pondweed and muskgrass. On 2 September 1988, a young adult female was obtained from the Idaho Fish and Game Department. She had been in captivity since early summer after dislocating a wing in a power line

collision near Idaho Falls. The female was in excellent condition. On 2 September, the four cygnets were released in the pond enclosure with the female. The cygnets "mothered up" to the her soon after release, but the female attempted to find a way out of the enclosure. Initially, she ignored the cygnets, and occasionally picked on them.

The landowner and his wife were asked to visit the swans each day and throw them a handful of hen scratch in a shallow, sandy area. By the fifth day, the female and her adopted young were accustomed to the couple, and associated them with a good experience. The female had developed a tolerance of the cygnets, and they followed her lead as if she were their parent.

On 13 September, a sibling gorup of three cygnets was removed from a wild surrogate swan pair at RRLNWR. They were released with the cygnets and female in the enclosure the same day. The adult female and the largest male cygnet began pecking and aggressively pursuing the smaller cygnet group immediately. The next morning, the female and the original cygnet group were turned out onto the pond. The smallest female of the RRLNWR group had been severely pecked the night before brood separation, and finally died on the 18th. As with the first brood and adult female, the Porters would visit the cygnets daily and reward them with a little whole grain. On 8 October, the two penned cygnets were released onto the pond with the adult and original four cygnets. The larger male of the RRLNWR group was accepted readily. The smaller female was not aggressively pursued, but was not as readily accepted into the brood.

On about 16 October, Mrs. Porter first observed the six cygnets in flight. On 26 October, one of the cygnets from Sheridan was ambushed by a red fox while loafing in the uplands about 30 feet from the shore. The cygnets have only been observed away from the pond in flight on a few occasions. The pond and a creek system downstream about 1200 feet have been used by the swan group through the fall and winter. The pond has a luxurient amount of Sago pondweed, muskgrass, milfoil, and buttercup (Ranunculus sp.) available to the swans. The swans have maintained good body condition through the winter.

Through the fall hunt period, hunters were excluded from the pond by the landowner. Many local residents and hunters have walked to the pond to observe the swans. This winter, numerous creeks within 1 1/2 miles of the decoy brood's pond have been used by four to eight Trumpeters, and five to eight Tundra Swans. On many occasions, swans have been observed feeding near the decoy group on the pond and associated creek. These decoy swans are also quite conditioned to man, and regard the pond as the center of their home range. The pond provides a secure habitat for the brood, and as the pond is adjacent to the Porter home and activities, has also seduced wintering swans to the area. These swans are utilizing feeding areas in relatively close proximity to human farm activities, and are developing a sense of security in using these habitats. These areas and the presence of the decoy swans (conditioned to man) are providing secure fall staging sites for incoming migrant swans. These conditions, coupled with a regulation waterfowl hunt closure of about 650 acres on the Salt River and a private land area not open to hunting, have enticed at least 31 swans to remain in the valley through the winter of 1988-89. The regulated hunt closure area has also helped improve duck and goose hunting in part of the valley by providing secure, nonviolate loafing areas and holding more waterfowl in the valley through the hunting season.

Prior to the waterfowl hunting season, over 100 posters were placed throughout the valley in business establishments, as well as at parking sites and entrances to private lands where swans might be found. The signs read:

> **DON'T SHOOT. HELP PROTECT OUR TRUMPETER SWANS.**
> **Trumpeter Swans are being restored in this area and we need your help for this effort to succeed.**

The landowner cooperation and public support locally for this effort have been exemplary, and have gone a long way toward protecting the swans.

Swans began arriving in the vicinity of the decoy swans at Grover and Thayne in early November. On 20 November, a group of seven swans were observed on Flat Creek in close proximity to the Thayne decoy birds (three yearlings). The group displayed five wing tags (red and yellow tags marking birds translocated to Grays Lake in the first phase of the expansion project), and had two untagged swans with metal leg bands. Through the winter, only four of the five wing tags could be read. These were numbers 30, 31, 33, and 34. This group of swans remained in the valley through the winter. They were not found on the Tristate survey, however, or seen from the ground shortly thereafter.

On 20 March 1989, a group of six adults, three with wing tags, were observed near the decoy group on the Thayne release pond. The ice was about half gone. Through the winter, at least 24 Trumpeters and seven Tundras, in addition to the nine decoy swans, used the valley's creek and pond habitats.

Although not confirmed, one area not searched in December and January was found to have two pairs of Trumpeters in mid February. Reportedly, the area contained four to 10 swans all winter. Therefore, it was likely that the drainage supported more than the 24 Trumpeters this winter.

By 18 March 1989, Sid Eliason's pond was beginning to open up. Six of the Grays Lake swans (at least three wing tags) and the three decoy swans were using the pond. All of the other swans had apparently left the valley, except the six Grays Lake swans, a single Tundra cygnet, and the nine decoy swans. By 11 April, there were only two swans left at Thayne and the Tundra Swan cygnet at Grover. The two swans at Thayne were on Eliason's pond, and may have begun setting up a territory. As of this date, that has not been confirmed. The two swans were both banded, and one was also tagged. Only one number, in the red section of the patagial marker, could be read. The leg band was read on the marked swan as 619-12551 (right leg). This was swan 38 from the Grays Lake transplant. The other swan was banded on the left leg, and the number has not been read to date. The two swans have acted territorially on a number of occasions while on the pond. However, they are either a sibling pair or a young, bonding pair. Only time will tell. This pair has been observed on numerous occasions feeding in close proximity to the three decoy swans in the meadows.

On 30 April 1989, Rod Drewien observed two leg-banded Trumpeters on the south end of the marsh at Grays Lake NWR. He was going to fly in early May to see whether he could locate any other Trumpeters on the Refuge. On this same date, the two swans were still at the Thayne site, indicating the swans observed at Grays Lake were different birds. Through 6 May, the two Grays Lake swans were still at Thayne, and it appeared that the pond was the focal area of their daily activity. The three decoy siblings seemed to be avoiding the pond and spending most of their time on Flat Creek. Tag #38 was not read during the winter months.

Since about 10 April, the swans left in the valley have been observed doing most of their feeding in the meadows (on emergent green grass growth) within 1/2 mile of their initial release areas. The two Grays Lake swans have become very accustomed to human activity, allowing a vehicle to stop within at least 100 feet, and even allowing humans to approach on foot to within 50 feet.

The six decoys at Grover began to pioneer to new ponds up to 1/2 mile from the release and wintering site. The adult female was still flightless. The five cygnets followed her overland, but occasionally flew ahead to open water areas. The six decoy swans left the winter pond about 5 April, when three goose pairs began to nest at the winter pond. The only visible aquatic vegetation on the pond by early April was Chara. By 3 May, the geese at the winter pond had hatched their young and, about that time, the decoy swans began using the pond each morning, feeding in the meadows between the pond and the river. Through April, and as of 6 May, a single Tundra cygnet remained in close proximity to the six decoy swans. The Tundra cygnet did not accompany the six to the release pond. Rather, it spent its loafing time on a small pond near the river. On 6 May, it was noted that one of the Grover decoy cynets had a broken or dislocated left leg. This swan was in close proximity to the adult female, four cygnets, and the Tundra Swan which were walking and feeding in the meadows between the release pond and the river. On the early morning of 7 May, the broken-legged cygnet flew into the release pond to join the adult female and four cygnets already at the pond.

The Salt River decoy swans, the Grays Lake transplant pair at Thayne, and the single Tundra cygnet will continue to be monitored through the summer by Dave Lockman and Dave Moody.

SUMMARY

It was apparent that the decoy concept, as applied on the Salt River, has been quite successful to date. Providing small, nonviolate release sites and secure fall staging areas, and conditioning the decoy swans to human activity, are crucial elements to winter range expansion and to maintining migratory linkages to the parent population.

LITERATURE CITED

Luttschwager, K. 1988. Rocky Mountain Trumpeter Swan population range expansion project, 1988-93. 1988 translocation project. U. S. Fish and Wildlife Service. Unpublished mimeo. 18pp.

CONCLUDING REMARKS

Larry Gillette, Donna Compton, Dave Weaver and Jim King[1]

Larry Gillette:

"I attended my first conference in 1973. That's when I first met Harold (Burgess) out at Lacreek. We spent time giving updates on swans here and there, and eating fried snapping turtles. I think over the years the quality of these conferences has certainly increased, and it's due, in part, to the increased knowledge of the Trumpeter Swan. And, we've been able to use this knowledge to define management plans for the swan, and to identify additional problems. One thing that stands out about this conference is that we are in the process of setting a new course that will enable us to resolve and solve some of these problems, whether they be biological or political. I think that's something to look forward to. We've made this progress only because of the dedication and commitment of those who are in this room and others who have attended this conference. Many of you have been attending these conferences on and off for the past 10 or 15 years, and it's only because of your involvement that we've come as far as we have. I thank you for your commitment, and your attendance and participation in this conference, and I look forward to seeing you at the next conference."

Donna Compton:

"I need to say thank you, as well. I really don't know how to say it thoroughly enough. All of you have contributed in big ways to this past week. There's no telling what great things future generations will have to say about our efforts here. It's easy to be depressed about the condition of the world, and feel all the efforts are futile. It's much more difficult to rally the support and the momentum towards making improvements in the environmental conditions of the world. We have definitely participated in a rally here, and we must now pursue the challenges raised with alot of diligence and effort. I tried to say thankyou to everyone along the way, to those of you who have been carrying on all of the tasks that I've been asking you to do. But, that's not enough. I'd like to have each of the group of organizers stand, and keep standing. Larry Gillette, Clay Jobes, Dave Weaver, Steve Kittleson, Carrol Henderson, Laurie Degernes, and the volunteers, with a special thanks to Kate Anderson, Jim Pichner, Vance Grannis, Steve Lewis, Cassie Ordway, Dan Kittock, Ann Bassett, Jim Basinger, and Martha Jordan. I really do appreciate it. "

Dave Weaver:

"Well, now that this one's over, we'll announce the next one. As Larry has said, enough things have happened, we're moving now and we can't slow down. So, 1 1/2 years from now, 13-16 February 1991, Salt Lake City. We hope you'll join us. There's alot to be done between now and then, and there's alot to be accomplished at that meeting. We hope to see you then. Thanks for coming. "

Jim King:

"I can't add much to what Larry said so eloquently just now, and Donna, and Dave. I just would like to reiterate that I'm always a little bit overwhelmed at this point in The Trumpeter Swan Society meeting, and I'm really excited about what I'm going to hear at the next one. I feel like the Society and the agencies that are working on Trumpeter Swans are really moving now, and I'll say again that I'm really looking forward to seeing you all at the next meeting, and some of you in the interim. Thank you. "

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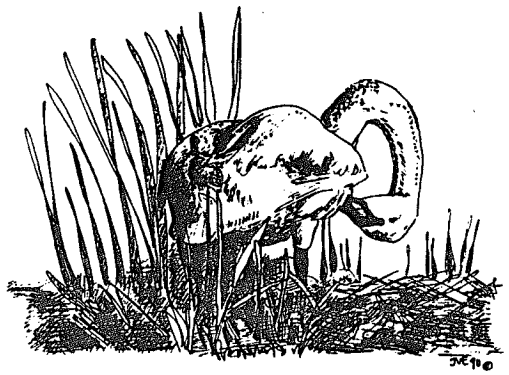
[1]Transcribed from tapes of the Conference.



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