Introduction

Tundra swans (Cygnus columbianus) are divided into 2 populations for management purposes, the Eastern Population (EP) and the Western Population (WP) (Figure 1). These are based on migration or wintering tendencies and not breeding distributions or genetic differences.

The purpose of this plan is to provide guidelines for the cooperative management of EP tundra swans among the 4 Flyways. It provides Goals, Objectives, and Strategies for maintaining desired population levels and maintaining or expanding current distribution patterns throughout the range of breeding, migration, and wintering habitats.

Appendix A provides information on distribution and population delineation; Appendix B presents current data bases; and Appendix C updates the EP Hunt Plan. This Management Plan, including the appendices, is scheduled to be reviewed and revised every 10 years. Updating of Appendices A and B will be conducted on an annual basis or as necessary.

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Prepared for: The Atlantic, Mississippi, Central and Pacific Flyway Councils
Prepared by: The Ad Hoc Eastern Population Tundra Swan Committee, July, 1998

GOALS AND OBJECTIVES

THE MANAGEMENT GOAL IS: TO MAINTAIN EP TUNDRA SWANS AT A POPULATION LEVEL THAT WILL PROVIDE OPTIMUM RESOURCE BENEFITS FOR SOCIETY CONSISTENT WITH HABITAT AVAILABILITY AND INTERNATIONAL TREATIES.

Opportunities for this resource to provide benefits to the general public are determined by the population size, its geographic and temporal distribution, and by interaction between uses. Information obtained through research and surveys provides data on which management decisions are based. Accordingly, objectives and strategies are presented for each of the following guidelines.

POPULATION GUIDELINES

OBJECTIVE A: The population objective is 80,000 EP tundra swans based on a 3-year average population index from the Midwinter Waterfowl Survey (MWS) in the Atlantic Flyway.

The population objective is set at a level that provides population viability and reasonable benefits to society for both viewing and harvest opportunities. The objective is changed from the population objective of 60,000 - 80,000 in the previous plan used to account for normal population fluctuations and the low precision of the MWS. However, an objective of 80,000 is based more realistically upon the optimal level to satisfy public demand for enjoyment and appreciation of this resource and the desire to maintain or expand distributions of EP swans throughout their range. Also, this population level is sufficient to support both subsistence and sport harvest without affecting future population viability. Management agencies can cooperatively agree to manage the population within a range of 60,000 to 100,000 through adjustments in harvest regulations. A population above 80,000 would provide more benefits to the public. A 3-year average of the MWS, rather than an annual index, is used to reduce the effects of variability from year to year. If the survey is incomplete for any reason, the average of the most recent complete surveys will be used as an index to the population.

The number of EP tundra swans has nearly doubled over the past 30 years (Figure B-1), ($R^2=0.54$, $P< .01$). In 1983, the 3-year average population index first exceeded 80,000, which was the upper population objective established in the 1982 EP Tundra Swan Management Plan and the goal in the North American Waterfowl Management Plan (1994 Revision) for this population. The population index has since remained above that level, peaking at about 100,000 in 1992. During the last 20 years, no statistical trend in the population has been observed.

STRATEGY A-1: Maintain and improve population surveys.

Rationale: Numbers of EP tundra swans are estimated annually during the MWS conducted in early January. These data provide an index to population trends but have low precision due to a lack of a basis for standard error calculations. However, since swans are very visible on the wintering grounds, except when snow cover exists, the 3-year average winter indices may closely estimate the minimum population size and trend.

Because the EP winter range is limited to only 6 mid-Atlantic states, the MWS is a practical means of monitoring the status of EP swans, as well as monitoring changes in winter distribution. In order to maintain its comparability among years, Standard Operating Procedures must be explicit and maintained. There is also a need to reduce variability and measure the precision of these midwinter estimates using new analytical methods. This improved capability will help to better monitor the population status and determine when management actions are needed to achieve management objectives.

Breeding surveys on EP swans have been conducted for several years along the north slope of Alaska and in certain areas of the Northwest Territories (NWT), Canada. These surveys provide useful population information for specific habitats and for individual study purposes, but have limited application towards monitoring continental population trends. Because of the vast distribution of tundra swans throughout the arctic, a comprehensive, range-wide breeding ground survey is not practical. This fact underscores the importance of improving MWS estimates.

Recommendation: Improve precision and reduce variability of MWS estimates surveys using new analytical methods. Coordinate survey coverage and methods with affected wintering states.

Responsibilities: Atlantic Flyway States, US Fish and Wildlife Service (USFWS).

Recommendation: Conduct photographic inventories of tundra swans in the wintering states during the MWS period, in order to evaluate the MWS as an indicator of the population size of the EP.

Responsibilities: US Fish and Wildlife Service, Atlantic Flyway States.

STRATEGY A-2: Minimize non-hunting mortality.

Rationale: Swans are prone to ingestion of spent lead shot, and perhaps even lead fishing sinkers, which may cause lead poisoning mortality. These losses can be substantial when swans are concentrated in areas known to have large deposits of lead from decades of shooting. The most notable example of this occurred at Mattamuskeet National Wildlife Refuge where an estimated 7,200 swans died from lead poisoning over a 5-year period (Blus, 1994). It is important to continue to enforce non-toxic shot requirements for hunting waterfowl and educate waterfowl hunters regarding the need for and use of non-toxic shot.

Total mortality attributed to diseases in EP tundra swans is unknown. Avian cholera, (Pasteurella multocida) has been responsible for losses of wintering WP swans, and avian cholera is known to occur in other waterfowl throughout their range. Losses of swans due to visceral gout are reportedly more common in Maryland than those caused by either lead poisoning or avian cholera (L. Hindman, MD Wildlife Division, pers. comm.). It is important to continue to monitor concentrations of EP Tundra swans for signs of disease and minimize situations which favor disease transmission wherever practical.

Other documented causes of non-hunting losses include collisions, usually with transmission lines, illegal or malicious shooting, and predation, primarily of eggs and cygnets, on the breeding grounds. The relative importance of these losses remains unknown. Success of efforts to reduce mortality from disease and human-caused non-hunting factors may have an influence on our ability to maintain population goals and maximize resource benefits.

Recommendations: Continue to monitor the incidence of non-hunting mortality, including lead poisoning, illegal shooting, and disease. Continue non-toxic shot education effort.

Responsibilities: All cooperating agencies.

Distribution Guidelines

OBJECTIVE B: Maintain geographic and temporal distributions that are consistent with the welfare of EP Tundra swans, available habitats, and public interests.

Tundra swans are valued by people living throughout the range, for reasons which include sustenance, recreation, and aesthetics. Management actions which would tend to redistribute tundra swans would likely impact those people. However, farmers and others who feel the negative affects of too many swans might welcome fewer swans. Should numbers of EP swans increase, management actions which encourage a wider distribution may become appropriate, provided that the needs of swans, their habitat, and public opinion are all considered.

STRATEGY B-1: Evaluate existing management programs and practices to determine how they influence distribution of EP tundra swans.

Rationale: Tundra swans exhibit strong attachment to traditional breeding, migrating, and wintering habitats. Impacts of management actions should be identified and efforts should be made by all cooperating agencies to maintain historic use patterns and seasonal abundance of EP swans. To minimize conflicts with farming interests, management efforts should encourage the use of natural aquatic foods rather than increased dependence on agricultural crops. Existing habitat management practices in general should be evaluated with respect to impacts on historic and present EP swan distributions.

Recommendations: Closely monitor EP swan distribution and changes in use of habitat, which are indicated by results of the MWS and other periodic aerial surveys. Investigate any significant changes suspected to be the result of management actions, and implement corrective measures.

Responsibilities: All cooperating agencies in the EP tundra swan range.

STRATEGY B-2: Protect traditional EP winter areas from loss or degradation and support efforts to restore traditional habitats which have been degraded.

Rationale: Habitat integrity is essential to the health of EP swans and is necessary to prevent shifts from traditional areas. This effort requires continued support for wetland protection, water quality improvements, and input into government and private actions which may affect policy over agriculture, industry, wetlands, water, and other land uses.

Recommendation: Identify and manage critical wetland habitats to provide sanctuary and an abundance of natural aquatic foods.

Responsibilities: USFWS, AFC, and the state wildlife agencies of Maryland, North Carolina, and Virginia.

Public Use Guidelines

OBJECTIVE C: Provide opportunities for maximum recreational and subsistence use of EP tundra swans consistent with population and distribution guidelines.

EP tundra swans are valued for viewing, photography, and hunting during migration and on breeding and wintering areas. The continuation of these use opportunities is in the public interest ensuring that population and distribution guidelines can be achieved and maintained into the future.

STRATEGY C-1: Provide for viewing, photography, and aesthetic uses while minimizing unnecessary disturbances during breeding and while at staging and concentration sites used by EP tundra swans during migration and wintering periods.

Rationale: EP tundra swans are conspicuous birds that attract considerable public attention, especially when found in concentrations near urban centers, highways, and other areas where they are accessible for viewing. However, concentration sites are limited, often in remote areas, and there exist few opportunities to develop others. Therefore, it is prudent to develop new opportunities to maintain and enhance existing public use opportunities without creating hazards to aircraft, highway traffic, agriculture, or increasing risks to swans themselves.

Recommendation: Develop viewing areas for the public to observe and photograph EP swans.

Responsibilities: All cooperating agencies.

STRATEGY C-2: Provide for recreational hunting opportunities by maintaining and initiating programs consistent with population and distribution guidelines.

Rationale: The tundra swan is a game species, as are all members of the family Anatidae, and hunting of the species is provided for by the Migratory Bird Act of 1916 (Serie and Bartonek, 1991b). Hunting is an important public use of EP tundra swans, and hunting opportunities are eagerly sought by waterfowlers throughout the range of EP swans in the United States. An environmental assessment entitled "Proposed Hunting Regulations on Eastern Population Whistling (Tundra) Swans, 1984" (USDI, unpubl. rep. Washington, D. C., 1984) was prepared by the USFWS to evaluate the potential impact of hunting in the U.S. on EP swans and the first EP Hunt Plan was appended to the EP Management Plan in 1988 (Serie and Bartonek, 1991b). EP swans have been hunted in the United States since 1983 (beginning in Montana) and are now hunted in 5 states. The 1997 hunting season resulted in a harvest (including un-retrieved loss) of 4,081 birds (Table B-3).

Recommendation: Continue to monitor the harvest of EP tundra swans under guidelines of the approved hunt plan.

Responsibilities: All cooperating agencies where hunting is permitted.

Recommendation: Improve and maintain support for the Cooperative North American Shotgunning Education Program (CONSEP). Support research to determine which shotshell loads are most efficient in bagging swans. Promote efforts to reduce un-retrieved losses and improve hunter performance and responsibility when hunting tundra swans.

Responsibilities: All cooperating agencies where hunting is permitted.

STRATEGY C-3: Provide for subsistence use of EP tundra swans by promoting a managed harvest consistent with conservation of the resource.

Rationale: EP tundra swans have been harvested for subsistence since man first inhabited North America. This traditional harvest is nutritionally and culturally important to native people occupying the northern portion of the range of EP tundra swans. All users of EP swans must be encouraged to become active partners in the management process if conservation of the EP is to be assured for the future.

Recommendation: Encourage active participation of native peoples in management programs under the recently amended U.S.-Canada Migratory Bird Treaty.

Responsibilities: CWS, USFWS, Flyway Councils, Native governments.

STRATEGY C-4: Improve estimates of subsistence harvest.

Rationale: Management of EP tundra swans can be improved with better data on the size of the subsistence harvest. Harvest estimates from the 5 hunt states are considered reliable, but the total subsistence harvest of EP tundra swans is unknown. It is believed to be less than 5,000 birds annually. There are an estimated 8,000 subsistence hunters in the NWT and 5,000 subsistence hunters in the other Canadian provinces and Alaska (R. Bromley, NWT Dept of Renewable Resources, and T. Rothe, AK Dept. of Fish and Game, pers. comm.). However, not all subsistence hunters have an opportunity to take EP swans, and the annual harvest for those hunters who take swans appears to be low. Studies of the subsistence harvest in the Inuvik region of the NWT are currently underway. With the revised U.S.-Canada Migratory Bird Treaty will come the responsibility of native peoples to participate in management, including improvement of estimates of subsistence harvest.

Recommendations: Design and implement subsistence harvest surveys.

Responsibilities: CWS, USFWS, NWT, Alaska

Research and Survey Guidelines

OBJECTIVE D: Develop new and improved databases needed for management of the EP.

Effective implementation of this plan requires improved information on the population status, breeding, migration, and wintering distribution, and other biological factors of EP swans. A coordinated research program is essential if resources are to be properly focused for the development of essential baseline data. Acquiring this information is dependent upon close cooperation among wildlife agencies and native peoples in breeding, migration, and wintering areas because funding sources are limited. Research programs must also be flexible due to the dynamic nature of waterfowl populations and habitat.

STRATEGY D-1: Continue development of a computer population model of the EP which can be used as a tool for developing management strategies. Improve estimates of survival and recovery rates and other parameters required for population modeling of the EP.

Rationale: A good population model can be a useful tool in decision-making for wildlife managers; however, any simulation model is only as good as the data upon which it is based. A basic population model (EPSWAN) has been prepared for the EP, but it has not been adequately tested. Some population parameters, such as immature and adult survival and recovery rates and annual productivity, need to be estimated with higher precision and incorporated into the modeling.

Tundra swans are longer lived and have lower reproductive rates than geese and other waterfowl. Survival and recovery rate estimates would be helpful in better understanding the effects of harvest regulations. A post-season leg-banding study would provide an estimate of average annual survival rates of after-hatching-year swans, but it requires capture of a large number of swans (>2,000/year) and does not provide information on first-year mortality. A pilot banding effort now underway will determine the usefulness of this technique.

The use of neck collars in migration and wintering areas in conjunction with a core of trained observers is an alternative technique if enough swans cannot be leg banded to achieve desired precision. This technique will also provide good information on movements and affiliations of birds with migration and wintering areas, but has limited application in remote breeding areas. Pre-season banding or neck collaring, either in breeding areas or Canadian staging areas, will be required to obtain survival and recovery rates for immature birds. Such a study should be a long-range goal.

Indices to productivity are derived from counts of gray-plumaged young and white-plumaged adults and sub-adults observed in flocks and from the number of young observed in family groups during fall and early winter. These productivity estimates are obtained from ground observations and aerial photographs in New Jersey, Maryland, Virginia, and North Carolina. Production estimates are based on counts taken at the same locations each year, but the sampling effort has not been comparable among years. Since the counts are made during November and December after most swan hunting is over in the Central Flyway, they provide a minimal estimate of young produced. Also, observations have not been allocated properly among wetland and upland habitats based on the composition of age classes present at these sites. Thus, Standard Operating Procedures (SOP) for this survey need to be reviewed and changed to improve the reliability of these productivity data.

Alternatively, age-ratios can be obtained through state harvest surveys, but these are not adjusted for vulnerability, and are representative only of birds using the hunted areas. The productivity surveys will be useful in continued development of population models and as an indicator of relative annual reproductive performance of the EP.

Recommendation: Continue development of a computer population model which can be used for identifying key data needs and as a tool for determining optimum harvest levels of EP tundra swans.

Responsibilities: All cooperating agencies.

Recommendation: Continue post-season leg banding of swans in Atlantic Flyway wintering states. Evaluate feasibility of this technique for improving estimates of other than first year survival rates of EP swans.

Responsibilities: US Fish and Wildlife Service, Atlantic Flyway states.

Recommendation: Develop and implement a pre-season leg banding or neck collar study of EP swans.

Responsibilities: All cooperating agencies.

Recommendation: Revise the Productivity SOP to improve the reliability of parameter estimates.

Responsibilities: Atlantic Flyway Council (AFC), USFWS.

Recommendation: Continue the productivity surveys to provide an index to annual recruitment.

Responsibilities: Atlantic Flyway Council (AFC), USFWS.

STRATEGY D-2: Obtain improved information on location of key breeding areas, and affinities of birds from these areas to migration and wintering areas. Determine movement patterns and population affinities within and between important wintering areas.

Rationale: A better understanding of key habitats and relationships between breeding, migration, and wintering areas will improve our capability to meet management objectives while providing for conservation of the resource. Satellite telemetry provides the best information and is particularly valuable for determining affinities between breeding and wintering areas. Cost of the methodology is high, however, which limits the number of birds which can be marked. More limited information on a larger sample of marked birds can be obtained through neck collar studies using a system of active observers.

Recommendation: Complete the delineation of key breeding areas already in progress.

Responsibilities: NWT, Alaska.

Recommendation: Develop and implement a satellite telemetry study of EP tundra swan movements.

Responsibilities: All cooperating agencies

Appendix A

DISTRIBUTION AND POPULATION DELINEATION

The delineation of the EP and WP tundra swans is based upon over 5,000 band recoveries from over 11,000 swans that were banded at breeding, migration, and wintering areas during 1924-92. While the range-wide bandings are not representative, band recoveries were sufficient to show differences between birds breeding on the North Slope and eastwards throughout Canada (EP oriented) from those breeding in the Kotzebue Sound-Selawik-Noatak Area and southwards through Alaska (WP oriented). Observations of breeding ground neck-banded and tarsus-banded tundra swans by Limpert et al. (1991) show similar delineation of WP and EP on their wintering areas. Recoveries of winter-banded swans in the Atlantic Flyway reinforces the delineation of the 2 populations in Alaska. However, when compared to most other waterfowl species, tundra swans show a remarkable fidelity between breeding and wintering areas, with minimal cross-over.

Breeding

EP tundra swans nest largely in the Northwest Territories (NWT), with smaller numbers breeding in Alaska, Manitoba, Ontario, and northern Quebec. In the NWT, concentrations totaling 11,000 to 15,000 swans are known to occur in several areas of the western arctic, from the MacKenzie Delta east to the Parry Peninsula and peaking on the Tuktoyaktuk Peninsula at between 5,500 and 12,000 birds (Hines and Westover 1991, Hines et al. 1992), in the Rasmussen Lowlands (about 6,000 in the mid-1970s, McLaren and McLaren, 1984), and on the Kent Peninsula (>1,800, Bromley and Stenhouse 1993). Extensive areas of moderate density occur north of Coppermine, on southern Victoria and King William Islands and at the mouth of the Tingmeak River in Queen Maud Migratory Bird Sanctuary (Bromley and Stenhouse 1993), and low densities occur west of Hudson Bay (Allen and Hogg 1978). Small numbers occur throughout most of the tundra areas above the tree line and along the southern parts of islands in the Arctic Archipelago (e.g. Banks, Royal Geographic Society, and Baffin islands) in the NWT, in northern Yukon (Hines and Westover 1991), along west Hudson Bay in Manitoba and Ontario (Godfrey 1986) and in northern Quebec (Heyland et al. 1970).

In Alaska, EP tundra swans breed primarily in the arctic coastal plain north of the Brooks Range (North Slope). This region is characterized by wet tundra overlying well-developed permafrost features in fine marine sediments. The central and western parts of the region have numerous complexes of vernal ponds and lakes with emergent beds; Arctophila fulva, a grass, is an important element of territories for nesting and feeding (Derksen et al. 1981). Highest swan densities are found near the central Beaufort Sea coast, in the Teshekpuk Lake and Colville River Delta areas (Derksen et al. 1981; T. Rothe, Alaska Department of Fish and Game unpubl. data), as well as parts of the Arctic NWR (Platte and Brackney 1987). Systematic aerial surveys of the North Slope during 1986-1992 indicated an average of 8,000 swans (range 6,200-11,200), or 8-10% of the Eastern Population (Brackney and King 1993).

Neck-collar marking studies by W.J.L. Sladen in the early 1970's (Limpert et al. 1991) first suggested that the westernmost extent of the EP and an interface with the WP occurred in the Kotzebue Sound region. However, collar marker and radio telemetry work by Spindler and Hall (1991) substantiated that most swans from Kotzebue Sound migrate through interior Alaska and winter in California. Although there is some interchange, Point Hope is a practical demarcation line between the populations (Limpert et al. 1991).

Migration

The inner delta of the MacKenzie River is the staging area for Alaskan and western Canadian EP tundra swans during the fall migrations. From this point, the birds move to the Athabasca Lake delta in northern Saskatchewan and Alberta where they may associate with perhaps half of all WP tundra swans. There is limited interchange of WP tundra swans from all breeding areas to Atlantic Coast wintering areas. Jensen (1971) reported swans switching wintering areas, e.g., 3 of 14 swans banded in Utah were subsequently recovered in the Atlantic Flyway. Limpert et al. (1991) reported that only 11 individuals (<1%) of 4,194 EP swans marked on the wintering grounds were later recovered in the WP. It is speculated that EP tundra swans from the central Canadian arctic move directly to the Athabasca Lake delta en route to the mid-Atlantic coast, and that probably some swans from the Bering Sea region of Alaska also stop here. Additional birds have been reported on Great Slave Lake (Bellrose, 1976). North Dakota is the next major fall migration stop-over for the majority of the population, but some birds stop on large lakes or rivers in Montana, South Dakota, Minnesota, Iowa, Illinois, Indiana, Wisconsin, Ontario, and Michigan, especially on the west end of Lake Erie. Sago pondweed (Potamogeton pectinatus) (Earnst, 1994) and wild celery (Vallisneria americana) are important food plants at

most of the major migration stops. The eastern Canadian breeding populations of EP tundra swans move southward along the eastern shore of Hudson and James Bays across Lake Erie to the wintering grounds.

The return migration in the spring is essentially a reversal of the fall migration, but more stops are made and migration is at a more leisurely pace. The west end of Lake Erie, Saginaw Bay, and lakes in portions of west-central Michigan, Wisconsin, and North Dakota are intermediate resting areas. The Lake Athabasca delta is the major western concentration area for EP swans prior to their final move to the MacKenzie and Anderson River deltas and other specific breeding areas. EP tundra swans from eastern and central Canada probably move directly northward from Lake Erie and North Dakota to their breeding grounds.

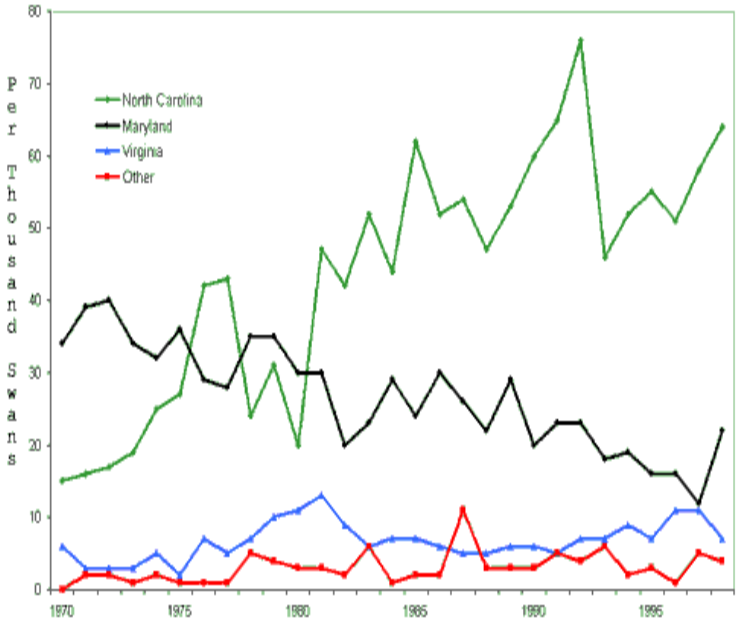
Wintering

Tundra swans have been reported wintering in each of the 3 eastern flyways; however, the Atlantic Flyway is the primary wintering area for this population. The distribution of EP swans wintering in the Atlantic Flyway has changed (Figure A-1) since 1970. The number of swans wintering in the vicinity of Chesapeake Bay, Maryland has declined while the number wintering further south along coastal North Carolina has increased steadily. During 1994-98, an average of 66% of EP swans wintered in North Carolina, while 20% wintered in Maryland, and 11% in Virginia.

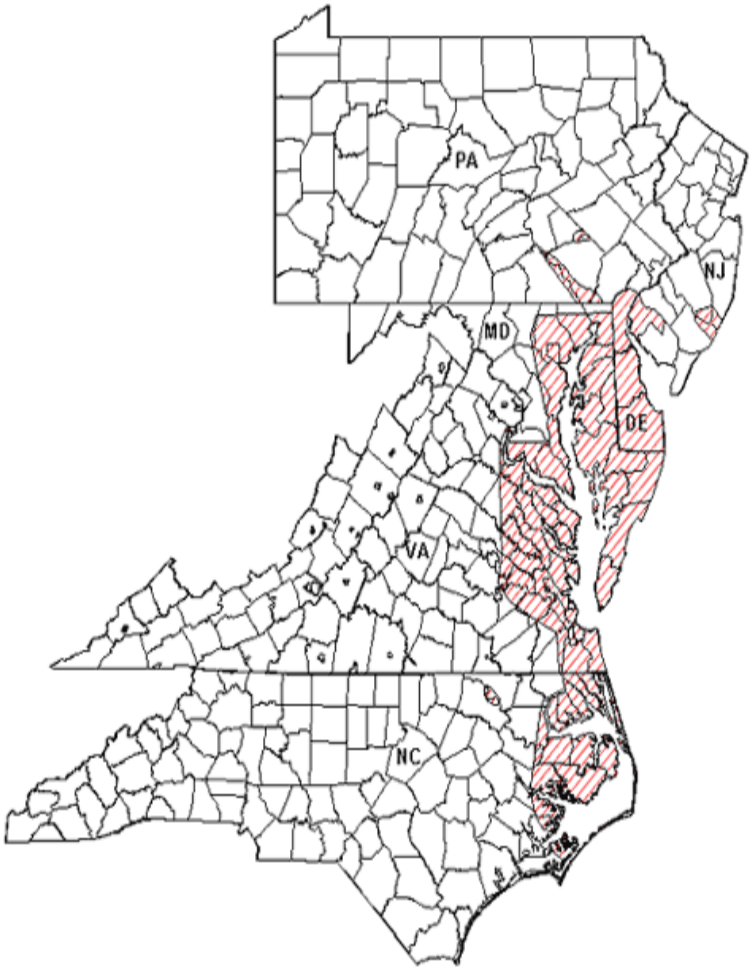
Wintering EP tundra swans have traditionally depended heavily on wetland habitats with abundant submerged aquatic vegetation. Due to degraded water quality in recent years, many of these areas no longer provide this food base. In other areas, man-made impoundments provide the only dependable food supply. During the winter of 1969-70, weather conditions made food in coastal areas inaccessible to swans, and feeding in agricultural fields was first observed (Munro, 1981). Since that time, field feeding by swans has become commonplace, with winter wheat, barley, corn and soybean stubble most frequently used. This shift to large scale field feeding has permitted some expansions of the wintering range to occur. Damage to small grain sprouts, by swans, occurs, particularly during prolonged wet weather periods. However, reports of this damage appear to have diminished in areas which have been open to hunting. The most important regions in the EP wintering range include the lower Susquehanna River in Pennsylvania, Chesapeake and Delaware Bays and their tributaries in Delaware, Maryland, New Jersey, and Virginia, Back Bay and Currituck Sound in Virginia and North Carolina, and areas adjacent to Albemarle and Pamlico Sounds in northeastern North Carolina (Figure A-2). Over half of the EP winters in the latter area which encompasses Pea Island NWR, and Pungo, Phelps, and Mattamuskeet Lakes.

Figure 1A

Wintering distribution of Eastern Population of tundra swans by State Midwinter Waterfowl Survey 1970-1998



Primary Wintering Range of Eastern Population of Tundra Swans



Appendix B

CURRENT DATA BASES

Population Status

Presently, EP tundra swans comprise nearly 60% of the total estimated number of tundra swans in North America. Indices derived from the January MWS show that EP tundra swans have increased about 55% between periods 1955-57 and 1996-98, and currently, they are estimated to number about 90,000 birds (ave. pop. = 87,228 during 1996-98). During the past 30-year period, numbers show a significant upward trend in the winter count (Figure B-1). During the past 20 years, numbers increased, but the increase is not significant. Since 1987 the population count has been stable, fluctuating between 77 and 110 thousand birds.

Production

Since 1961, productivity has been estimated by standardized surveys conducted each November and December, on wintering areas in Maryland, Virginia, North Carolina, and New Jersey (Serie and Bartonek, 1991a). Spring weather on the breeding grounds is the major factor affecting production, although the taking of eggs for subsistence may be a factor in some local areas. Table B-1 shows percentages of cygnets and young/family in the wintering population.

Table B-1. Tundra swan productivity data for NJ, MD, VA, and NC, 1961-1997.

Mortality

Reported causes of mortality among EP tundra swans include hunting, disease (including lead poisoning), predation, collision, and drowning (Bartonek et al 1991). Because all causes of mortality may not be reported and known causes likely are not reported at the same rate, assessment of their relative importance is difficult. Among all mortality factors, hunting is probably most significant. About 4,000 EP swans are killed annually during regulated hunting seasons (Tables B-2 and B-3), and an unknown number (<5,000) are taken during unregulated (subsistence) hunting. Among non-hunting mortality factors, lead poisoning may be the most important. An estimated 7,200 swans died over 5 winters at Lake Mattamuskeet in North Carolina.

Bart et al. (1991) estimated survivorship of hatching-year tundra swans using adult/immature counts of birds across the EP range. Survival during the first migration averaged 52% and over the first winter averaged 76%. Nichols et al. (1992) estimated survival of tundra swans in Maryland and North Carolina in the 1970's, using observations of neck-banded birds. They estimated survival rates of adult male and female swans to be high (0.92). Estimates of survival of immature males were lower (0.81) and immature females the lowest (0.52).

Figure B-1. Eastern Population tundra swan indices as measured by the Midwinter Waterfowl Survey, 1957 - 98, annual counts and 3-year running averages.

Table B-2. Estimated retrieved harvest of the Eastern Population of tundra swans.

Table B-3. Estimated total harvest (retrieved and un-retrieved) of the Eastern Population of tundra swans.

Table B-1

Tundra swan productivity data for NJ, MD, VA, and NC, 1961-1997

Year	Immatures (%)	Average	Immature/ Family	Average	Sample Size
1961	15.0				2282
1962	15.9				2293
1963	14.7				2092
1964	12.1		2.09		8765
1965	12.1		2.10		15286
1966	11.2		2.24		20640
1967	9.0		1.80		9307
1968	10.1		1.81		16945
1969	4.9	11.6 (n=9)	1.56	1.93 (n=6)	5461
1970	14.9		1.87		4603
1971	14.6		2.02		8604
1972	4.4		1.69		
1973	14.6		2.03		
1974	17.4		1.79		1954
1975	18.5		1.74		569
1976	9.0		1.16		7912
1977	19.7		2.19		3684
1978	7.7		1.33	VA only, n=337	2384
1979	8.7	13.0 (n=10)	1.60	1.74 (n=10)	1433
1980	10.5		1.80		2060
1981	30.5		2.30		1479
1982	11.4		1.90		5576
1983	19.8		2.00		7537
1984	10.8		2.20		8913
1985	23.6		2.00		11395
1986	9.2		1.70		11978
1987	10.0		1.60		8210
1988	14.3		1.90		10260
1989	15.2	16.5 (n=10)	1.70	1.91 (n=10)	13836
1990	10.3		1.90		11604
1991	12.3		1.60		3719
1992	4.1		1.60		11800
1993	15.0		1.00		13320

1994	19.2		1.30		5210
1995	8.3		1.20		6898
1996	10.0		1.20		15290
1997	7.5	10.8 (n=8)	0.84	1.33 (n=8)	11552

Figure B-1

Eastern Population tundra swan indices as measured by the Midwinter Waterfowl Survey, 1957 - 98, annual counts and 3-year running averages

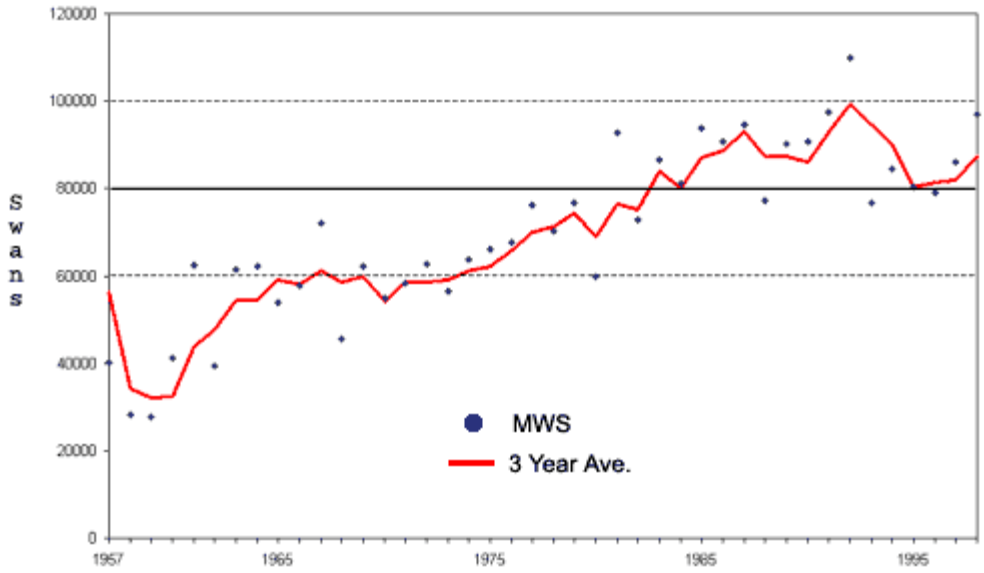


Table B-2

Estimated retrieved harvest of the Eastern Population of tundra swans.

YEAR	MT	ND	SD	NC	VA	TOTAL
1983	34					34
1984	22			313		335
1985	19			2523		2542
1986	41			2302		2343
1987	27			2684		2711
1988	25	191		2468	117	2801
1989	41	511		2128	133	2813
1990	59	474	339	2855	128	3855
1991	52	704	444	2940	205	4345
1992	37	833	814	2609	190	4483
1993	18	712	545	2773	130	4178
1994	62	690	483	3750	194	5179
1995	56	805	172	2833	217	4083
1996	61	571	233	2177	195	3237
1997	101	728	403	2325	217	3774
Average:						
1995-97	73	701	269	2445	210	3698

Table B-3

Estimated total harvest (retrieved and un-retrieved) of the Eastern Population of tundra swans.

YEAR	MT	ND	SD	NC	VA	TOTAL
1983	34					34
1984	23			334		357
1985	19			2783		2802
1986	41			2579		2620
1987	28			3007		3035
1988	27	217		2739	126	3109
1989	46	592		2364	151	3153
1990	62	575	407	3108	144	4296
1991	53	813	515	3169	219	4769
1992	37	979	955	2886	206	5063
1993	22	787	689	2994	137	4629
1994	64	775	589	3949	201	5578
1995	60	900	198	3193	224	4575
1996	66	634	250	2301	201	3452
1997	118	784	448	2505	226	4081
Average:						
1995-97	81	773	299	2666	217	4036

Appendix C

EP TUNDRA SWAN HUNT PLAN, JULY 1998

Introduction

The purpose of this plan is to establish guidelines for the cooperative harvest management of EP tundra swans. Because breeding and wintering areas for this population transcend vast geographic regions of North America and migration corridors intersect all flyways, this plan serves to coordinate the sport harvest among flyways and by regions within the United States. Although Canada does not currently allow a recreational harvest, this plan makes provision for such a program should a harvest in Canada be considered.

The development of a detailed harvest strategy is consistent with the public use guidelines identified in the Management Plan for EP Tundra swans (revised 1998). It is designed to meet the population goal of 80,000 birds based on a 3-year average population index from the Midwinter Waterfowl Survey (MWS). This goal was set to maintain population viability of tundra swans, provide sufficient numbers to fulfill the needs of all resource users, and to minimize conflict with other resource and economic values. In order to maintain population and distribution goals stated in the most current Management Plan, this Hunt Plan is scheduled for review at least every 5 years.

Harvest Objective

The original Hunt Plan, approved July, 1988, set a harvest rate objective of 10 percent based on the 3-year MWS average for 1985-87 (93,200). This objective was believed to be reasonable based on results of existing WP hunt programs assuming a 20 percent wounding rate, and subsistence harvest less than 5 percent of the population estimate. The actual harvest rate on EP swans for the last 3 seasons (1995-97) was estimated to be 4.58% (Table C-1), and the EP 3-year MWS average (88,097) remained above the 80,000 bird population goal. Only the harvest from the 5 hunt states is known. Subsistence harvest or other mortality cannot be estimated at this time. Currently only recreational harvest levels can be regulated. Since population and distribution guidelines are being met, this plan recommends that the level of recreational harvest remain at or near 5 percent during the next 5-year period.

Table C-1. Estimated harvest of EP tundra swans in MT, ND, SD, VA, and NC as a percent of WS 3-year averages.

States having EP swan seasons should avoid harvest of trumpeter swans (Cygnus buccinator) by temporal and/or spatial considerations wherever possible. However, EP tundra swan seasons should not be precluded by the possibility of an occasional trumpeter swan being shot. This policy is consistent with the Interior Population Trumpeter Swan Management Plan and has been endorsed by the Trumpeter Swan Society and the Central Flyway Council .

Permit System

A special permit system will continue to be used for the sport harvest of EP tundra swans. Each permit allows the taking of one swan. A 42% success rate was realized for permits issued for the last 3 seasons (1995-97). For simplicity and in order to prevent a significant increase in harvest, this hunt plan will continue to assume a harvest of one swan for every 2 permits issued (50% success rate). The system assumes that only one permit is issued per hunter per state per season. Issuance of more than one permit to a hunter by a state in the absence of sufficient applicants may require adjusting the success rate and has not yet been authorized by USFWS.

A permit with either an accompanying hunter-questionnaire response card and approved tag or some other method of validating the harvest, acceptable to the USFWS, must be used. The permittee must sign the permit to validate it and must have the permit on his person while swan hunting. Immediately upon harvesting a swan, the bird must be tagged and the date of harvest recorded.

Permit Distribution

In the 1988 Sport Hunting Plan, an effort was made to distribute hunting opportunities equitably, by regional zones, in both Canada and the United States. A formula for permit allocation was developed which gave equal consideration to all areas of North America frequented by EP swans.

The harvest distribution for the entire population was as follows:

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

Migration Zone - 33% (11% Saskatchewan, Manitoba, and Ontario, 11% Central Flyway states, and 11% Mississippi Flyway)

Wintering Zone - 34% (Atlantic Flyway)

Currently (1998), the following EP swan seasons have been authorized with assigned permit quotas:

Zone	State	Permits Assigned
Breeding	None	None
Migration	Montana *	500
	North Dakota	2,000
	South Dakota	1,500
Wintering	North Carolina	5,000
	Virginia	600
	New Jersey	200
Total		**9,800**

* Central Flyway portion

This permit allocation distribution is 42% Migration Zone and 58% Wintering Zone. No permits have been allocated to the Production Zone.

A state may routinely have insufficient applicants for available permits. Annually, any unused portion of these permits would be available for temporary redistribution to participating provinces, territories, and states requesting them. The first step in the re-allocation process should be within the respective flyway. If there are no unassigned permits available in the Flyway, the next step should be to request permits from within the zone. The final step should be to request permits from the other zones. Re-allocated permits would return to the area of origin if provinces or states within the area of origin make a request for a new tundra swan season. At least a one-year lead time would be needed for new season requests requiring re-allocation.

Permit distribution (including redistribution) within a Flyway should first be approved by the respective Flyway Council. Distribution of permits within a zone which includes more than one Flyway (breeding, migration), or between zones should be approved by the affected Flyway Councils. The Ad Hoc EP Tundra Swan Committee (Committee), responsible for updating the management and hunt plans, would be a good forum for originating and reviewing such proposals. In the United States, recommendations on permit actions from the Flyway Councils must also be approved by the USFWS following normal regulatory procedure. Councils should make their recommendations to the USFWS following their March meeting but no later than June 1 in order for the USFWS to propose permit allocation early in the regulation process.

An alternative to re-allocation of a state's unused permits would be for the USFWS to authorize a state to issue a second swan permit to interested hunters, from those permits remaining after the initial drawing. This alternative would require agreement from the other participating states. The state would then have to request this option from the USFWS through the appropriate Flyway Council. Currently, only Montana has expressed interest to the Committee in issuing second permits to hunters.

The authorized permits should remain at approximately current numbers (9,800) during the next 5-year period. In the event of a significant (>10%), sustained (3 consecutive years) increase in the 3-year MWS average, a slight increase (<500) in the permit ceiling may be considered, in order to accommodate new season requests.

Likewise, should the MWS 3-year average drop below the population goal for more than one year, reductions in permits should be considered. The Committee, following a review of available data and a determination that such a permit quota change is not to be in conflict with population and distribution guidelines, would be best qualified to make these recommendations to the Flyway Councils.

The present permit distribution among zones varies from the original permit allocation formula (33,33,34).

Because state requests for permits to date have not exceeded the number available, this distribution, in the absence of conflicts, will remain for the period of the plan. Distribution will be reconsidered if new season requests are approved by the Flyway Councils.

Population Status and Harvest Evaluation

All new seasons will be considered experimental for a 3-year period following their initiation. The results of operational and experimental hunting seasons will be monitored annually by each state by means of a special swan harvest survey. Population status will be measured by the January MWS and the results compared to objectives in the EP Tundra Swan Management Plan. Adjustments in experimental seasons or closures will be considered annually during the process of establishing migratory bird hunting regulations. Evaluation procedures will be in accordance to a Memorandum of Agreement between each state and the USFWS.

Table C-1

Estimated harvest of EP tundra swans in MT, ND, SD, VA, and NC as a percent of MWS 3-year averages

Year	Permits Available	Permits Issued	Total Harvest	MWS* Average	Success Rate (%)	Harvest Rate (%)
1983	500	109	34	80767	31.1	0.04
1984	1500	1108	357	87167	32.2	0.41
1985	6500	6120	2802	88633	45.8	3.16
1986	6500	6170	2620	93100	42.5	2.81
1987	6500	6139	3035	87500	49.4	3.47
1988	8100	7094	3109	87385	43.8	3.56
1989	8100	7211	3153	86083	43.7	3.66
1990	8600	8262	4296	92852	52.0	4.63
1991	10500	9804	4769	99263	48.6	4.80
1992	10500	10278	5063	94596	49.3	5.35
1993	10800	10112	4629	90303	45.8	5.13
1994	10800	10332	5578	80817	54.0	6.90
1995	10800	10391	4575	81626	44.0	5.60
1996	9800	9009	3452	86120	38.0	4.00
1997	9800	9199	4081	96544	44.0	4.22
Average 1995-97	**10133**	**9533**	**4036**	**88097**	**42.3**	**4.58**

* MWS figures for January following year indicated.

Evaluation Procedures

1) States will develop, print, and distribute permits to hunters wishing to participate in the season. The State will serially number or otherwise identify the permits and develop a list of the names and addresses of the permittees.

2) The State will provide each permittee with a swan harvest questionnaire to assess: (a) number of days hunted for swans, (b) if a swan was harvested, (c) location of harvest, (d) whether the head and neck plumage was white or gray colored, and (e) how many swans were knocked down but not retrieved. The permit should also request leg-band numbers and recovery information of harvested swans. An alternative would be to ask hunters if they harvested a leg-banded swan and urge that they report the recovery using the 1-800 band reporting number.

A follow-up survey (mail questionnaire or telephone) will be conducted if the response rate to the initial survey is below 75%. The State will summarize these findings in an annual report to the USFWS by the following July 15.

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