
ATLANTIC FLYWAY MUTE SWAN MANAGEMENT PLAN

Prepared by the Snow Goose, Brant, and Swan Committee

July 2015

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EXECUTIVE SUMMARY

Mute swans are a non-native, invasive species, brought to North America from Eurasia for ornamental purposes in the late 1800s. Free-ranging mute swans became established in the Atlantic Flyway during the early 1900s and expanded rapidly throughout New England, the Mid-Atlantic and into the Great Lakes Region. From 1986-2002, the population in the Atlantic Flyway more than doubled from approximately 6,300 birds to more than 14,000 swans. Both historical and more recent studies have documented the impacts that mute swans have on the ecological integrity of North American wetlands and the wildlife that depend on these wetlands. In response to this concern, the Atlantic Flyway Council adopted a Mute Swan Management Plan in 2003, and many states implemented management programs which reduced the flyway-wide population to about 9,000 birds by 2011.

Notwithstanding these recent population reductions, there is a continued need to coordinate management actions among Atlantic Flyway and other conservation partners to continue to reduce the mute swan population to a level that eliminates ecological impacts to quality habitats and native species, reduces human conflicts, and prevent further range expansion into unoccupied areas. This updated management plan reflects the Atlantic Flyway Council's continued support for efforts by member states and partner organizations to accomplish this goal.

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PREFACE

The four Flyway Councils are administrative bodies established in 1952 to represent the state/provincial wildlife agencies and work cooperatively with the U.S. Fish and Wildlife Service, Canadian Wildlife Service, and Mexico for the purpose of protecting and conserving migratory game birds in North America. The Councils have prepared numerous management plans to date for most populations of swans, geese, ducks, doves, pigeons, woodcock, and sandhill cranes in North America. These plans typically focus on populations, which are the primary unit of management, but may be specific to a species or subspecies. Management plans serve to:

- Identify common goals.
- Establish priority of management actions and responsibility for them.
- Coordinate collection and analysis of biological data.
- Emphasize research needed to improve management.

Flyway management plans are products of the Councils, developed and adopted to guide state and federal agencies who cooperatively manage migratory and wetland waterbirds under common goals. Management strategies are recommendations and do not commit agencies to specific actions or schedules. Fiscal, legislative, and priority constraints influence the level and timing of implementation.

INTRODUCTION

Mute swans (*Cygnus olor*) are indigenous to Eurasia and were introduced into North America as a decorative waterfowl for parks, zoos, and private estates during the late 1800s (Baldassarre 2014). More than 500 mute swans were imported from 1910 through 1912 (Phillips 1928). Subsequently, small numbers of birds escaped into the wild and began reproducing. These early introductions to the wild are believed to have occurred along the Hudson River in 1910 and on Long Island, New York in 1912 (Bull 1964). Allin (1994) and Allin et al. (1987) reported earliest sightings of feral mute swans by states and provinces (Appendix A). Some have challenged the tenet that mute swans were not native to North America (Alison and Burton 2008) but Askins (2009) and Elphick (2009) provided evidence on their non-native status. This was affirmed by the U.S. Fish and Wildlife Service when it published a final list of non-native bird species to which the Migratory Bird Treaty Act does not apply (USFWS 2005).

The first records of mute swans in the Atlantic Flyway Mid-Winter Waterfowl Survey (MWS) were in 1954 and during the early 1960s. During 1966, the MWS count was over 2,100 mute swans and waterfowl managers first expressed concern over their growing numbers. A general lack of information on mute swan populations in North America prompted early studies by Willey (1968) and Reese (1980), who investigated their biology and population dynamics in Rhode Island and in the Chesapeake Bay region of

Maryland, respectively. Both studies found that their respective populations were growing rapidly and recommended initiation of control programs.

Since that time, numerous studies have investigated the negative impacts that mute swans have on wetland habitats and other wildlife species (see Guillaume et al. 2014 for review). Further, Guillaume et al. (2014) made a compelling case for mute swans to be considered invasive species in North America given that they were artificially introduced, their population increased quickly, and mute swans may have a competitive advantage over native species.

Given the scientific evidence of the negative impacts of mute swans on North American wildlife and their habitats and the growing number of these birds in the Atlantic Flyway, some state wildlife agencies established population control policies and programs in an attempt to slow or reverse population growth. However, some state wildlife agencies have been unable to implement effective management programs partially due to differences between individual state laws and also strong public opposition to any interference with these popular birds, especially in urban and suburban areas. Coordination and partnership building on a flyway-wide basis will be needed to meet the objectives outlined in this plan.

BACKGROUND

POPULATION TRENDS

An earlier review of the history of mute swans in the Atlantic Flyway by Allin et al. (1987) predicted that the population would double by the year 2000, based on the mean 5.6% annual growth rate indicated by the MWS (1954-1987). In actuality the Atlantic Flyway mute swan population increased by more than 2.2 times by 1999 to over 12,650 birds (Appendix B). In 1985, the Atlantic Flyway Council (AFC) initiated a Mid-Summer Mute Swan Survey (MSMSS) to document the status and more accurately track the growth rate of this non-native species. This survey has been conducted every 3 years during the birds' molt period in mid-July through late August. This survey provides a more accurate count because mute swans are the only swan species being observed, unlike the MWS when tundra swans (*Cygnus columbianus*) are present. The first MSMSS was completed in 1986 and thereafter, in 1989, 1993, 1996, 1999, 2002, 2005, 2008 and 2011. From 1986 to 2002, the MUSW population significantly increased ($R^2 = 0.9890$, $F_{1,4} = 360.5$, $P < .05$) by approximately 483 swans per year before significantly decreasing ($R^2 = 0.946$, $F_{1,2} = 35.12$, $P = .03$) from 2002 through 2011 by approximately 618 swans per year (Figure 1). Between 1986 and 2002, the Atlantic Flyway population grew 125% to 14,344 birds, equivalent to 2.2 times what it was in 1986. Between 2002 and 2011, the population decreased approximately 36% to an estimated 9,202 individuals in 2011. Although the MSMSS likely provides a reasonably reliable representation of the population status of mute swans in the Atlantic Flyway, several shortcomings exist including increased cost to participating state agencies, non-standardized survey guidelines and implementation, and limited survey participation

outside of known high mute swan density areas. There has been a desire for some time in the Atlantic Flyway to determine if some other established survey(s) could replace the MSMSS and track population trends over time. A number of existing waterfowl surveys occurring in the Atlantic Flyway were reviewed to ascertain if any would provide a reasonable surrogate to the MSMSS. Surveys considered included the annual mid-winter survey, Atlantic Flyway Waterfowl Breeding Plot Survey, USGS Breeding Bird Survey and the National Audubon Society's Christmas Bird Count (CBC). This review concluded that the CBC provided the best alternative to the current MSMSS (Figure 2).

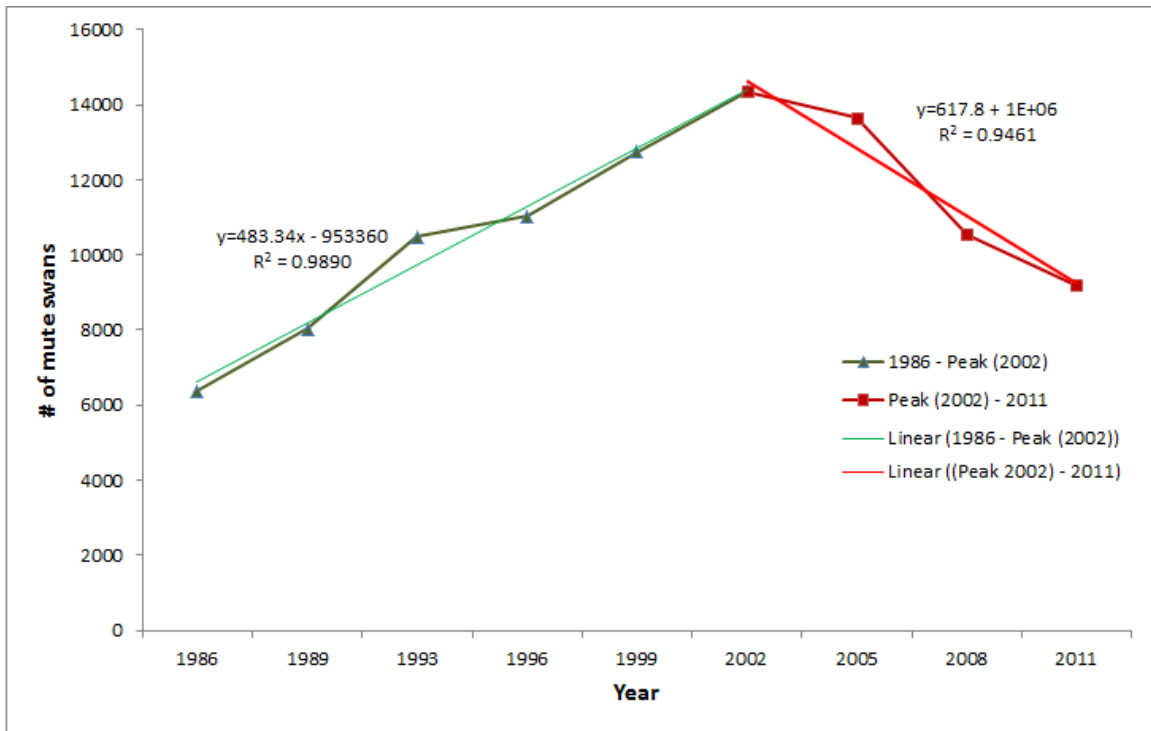


Figure 1. Linear regression of Mute Swan population trends determined using the Atlantic Flyway Mid-Summer Mute Swan Survey, 1986 - 2011.

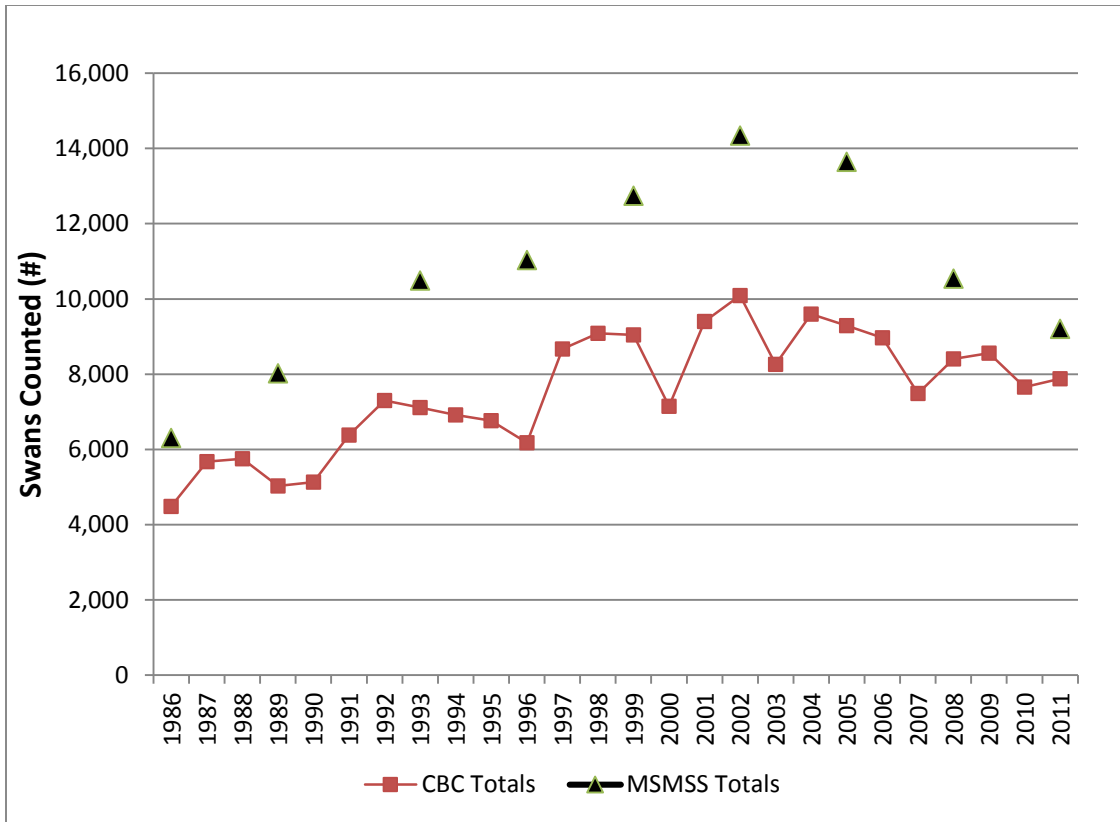


Figure 2. Mid-summer mute swan population estimates between 1986 and 2011 as determined by the mid-summer mute swan survey (MSMSS) and the Christmas Bird Count (CBC).

IMPACTS ON THE NATURAL ENVIRONMENT

Impacts on Wetland Habitat

In a study on the Chesapeake Bay, Fenwick (1983) found that mute swans could consume on average 43% (females) and 35% (males) of their body weight daily. Based on these calculations, mute swans have the ability to consume more than 3.6 kilograms (8 pounds) of submerged aquatic vegetation (SAV) per day. This supported the prior work of Willey and Halla (1972) who determined that mute swans in Rhode Island consumed 3.8 kilograms (8.4 pounds) of SAV each day. Approximately another 9 kilograms (20 pounds) per day of SAV may be uprooted during feeding, which can negatively impact the viability of aquatic plant beds (Gilham 1956, Willey 1968, Willey and Halla 1972, Ciarancia et al. 1997). Thus, in an area of high concentrations, mute swans can have a major impact on aquatic ecosystems. Similarly, in coastal Sweden, Mathiasson (1973) calculated that 45 mute swans consumed 8,635 kilograms (18,997 pounds) of sea lettuce during a 45-day period, or about 4.3 kilograms (9.4 pounds) per

swan per day, and determined that they could eliminate some plant species from an ecosystem.

Netherlands studies by Nierheus and Van Ierland (1978) noted that mute swans were responsible for 87% of the consumption of eelgrass (*Zostera marina*) beds used by birds. Chasko (1986) observed significant reductions of SAV in small Connecticut ponds used by breeding mute swan pairs. Reichholf (1984) found that swans removed about 20% of available vegetation within breeding territories. Allin and Husband (2003) documented up to a 95% reduction in SAV due to mute swans in shallow water (≤ 0.5 m) environments in Rhode Island. These studies support previous research noting overgrazing of SAV by mute swans in shallow water environments (Gillham 1956, Jennings et al. 1961, Berglund et al. 1963, Willey 1968, Mathiasson 1973, Charman 1977, Nierheus and Van Ierland 1978, Scott and Birkhead 1983, Ryley and Bowler 1994). These earlier studies reported that in some cases swans eliminated individual plant species from some wetlands. In Chesapeake Bay, Maryland, Tatu et al. (2007b) found a 90% reduction in percent cover of SAV in shallow water environments (≤ 0.75 m) due to herbivory by mute swans. Further, Tatu et al. (2007c) modeled SAV abundance in Chesapeake Bay, Maryland and found mute swans to be a contributor to, but not the most important factor in SAV decline.

Sousa et al. (2008) studied the habitat use of mute swans on the Chesapeake Bay, Maryland using GPS technology and satellite telemetry. Diurnal and nocturnal habitat use was similar and use of habitats was not in proportion to availability. Rather, swans used aquatic habitats for a greater portion of the time, and the authors concluded that SAV was likely to be negatively impacted by swans in the Chesapeake Bay.

Assessments of time-activity budgets of mute swans in Maryland during 2003 and 2004 show that swans spend more time feeding (38.4%) than any other diurnal activity (Tatu et al. 2007a). The researchers also found that flocked mute swans ($n \geq 3$) foraged for a greater percentage of time than did singles and paired swans. Of the flocked swans, those in larger flocks foraged for an even greater percentage of time than those in smaller flocks. This further supports prior findings that areas with large mute swan flocks may be at the greatest risk for negative impacts to aquatic ecosystems.

Westward expansion of mute swans into the Mississippi Flyway has raised concerns of mute swan impacts on wetlands that differ in size, structure, seasonal depth and SAV species composition. In a study of Illinois River Valley wetlands, Stafford et al. (2012) found a 34% reduction in below-ground SAV biomass in areas outside of swan exclosures. Swan densities on the study wetlands were lower than many of those observed in the Atlantic Flyway, suggesting that further mute swan population increases in the Mississippi Flyway will exacerbate negative impacts on wetlands. These findings support the many Atlantic Flyway studies that link mute swans to significant SAV reduction.

Both European and American studies noted that mute swans fed on the same SAV used by other waterfowl (Gillham 1956, Jennings et al. 1961, Willey and Halla 1972, Mathiasson 1973, Charman 1977, Nierheus and Van Ierland 1978, Scott and Birkhead

1983, Perry et al. 2003, Bailey et al. 2007). In a recent review of the effects of mute swans on wetlands, Guillaume et al. (2014) reviewed European and North American mute swan populations and concluded that the North American population met the criteria for a biological invasion (Valéry et al. 2008) and should be actively controlled.

Impacts on Native Waterfowl

Competition for feeding and breeding habitats makes mute swans a threat to native waterfowl. Some mute swans will tolerate other waterfowl nesting within their territory; however older pairs are less tolerant (C. Allin, personal communication). Due to their strong territoriality, some pairs will vigorously defend nest and brood sites from intrusion by other swans, ducks, and geese. They may even kill the intruding pair and/or their young (Stone and Masters 1970, Reese 1980, Kania and Smith 1986). Territorial defense allows mute swan pairs to protect food resources needed to support their offspring.

Year round residency of mute swans on shallow wetlands can reduce SAV availability for native wintering waterfowl. Kremetz (1991) noted that a reduction in wintering black duck (*Anas rubripes*) numbers correlated with the decline of SAVs. Studies of canvasback (*Aythya valisneria*) and redhead (*Aythya americana*) population declines in the Chesapeake Bay appear to be related to reductions in SAV (Haramis 1991).

Little is known at this time regarding potential conflicts between mute swans and native North American swans, (i.e., trumpeter [*Cygnus buccinator*] and tundra swans). Johnson (Kellogg Bird Sanctuary, unpublished report) reported on four anecdotal conflicts between trumpeter swans and mute swans in Michigan during early spring, 1990-1996. In those incidents trumpeter swans prevailed. In Maryland, wintering tundra swans declined about 40% since the 1990s. This time period coincided with when mute swans reached peak abundance in Chesapeake Bay, Maryland. As such, there is a concern that the decline in tundra swans in Maryland may be attributable to the decline in SAV partially due to mute swan grazing and/or aggressive interactions of mute swans toward tundra swans. Mute swan pairs have been observed exhibiting aggression toward wintering tundra swans, driving them from foraging areas and protected coves used for winter shelter (L. Hindman, Maryland Department of Natural Resources, personal communication).

Impacts on Other Wildlife

In Chesapeake Bay, Maryland mute swans impacted state-threatened species by trampling which caused nest abandonment in a colony of black skimmers (*Rynchops niger*), and least terns (*Sterna antillarum*) (Williams 1997, Therres and Brinker 2003). Similar observations were made in Michigan in 2011 at a black tern (*Chlidonias niger*) colony where mute swans nested in the tern colony, and only a few tern nests were reported, down from the 54 reported in 2009 (USDA 2012). Ciaranca et al. (1997) also reported that mute swans attacked furbearers and small rodents.

Loss of SAV also will affect habitat used as shelter and food of fish, shellfish, and macro-invertebrates (Krull 1970, Hurley 1991). Loss or reduction of SAV will have a direct effect on marine fishery nursery habitats within shallow coastal waters.

IMPACTS ON THE HUMAN ENVIRONMENT

Impacts on Agriculture

Grazing by mute swans on upland grasses and canola crops is a concern to European farmers. Scott (1984) reported on the quality of territory required by mute swans in England and noted the accessibility of upland pasture for grazing as one of four aspects. Others (Gillham 1956, Eltringham 1963, Minton 1971, Bacon 1980, Sears 1989) also note the use of upland pastures and fields of winter wheat and grasses by foraging mute swans.

In the Atlantic Flyway, few complaints concerning mute swan damage to agriculture have been documented. Small numbers of mute swans have been observed feeding on turf grass and rye grass crops where SAV resources were considered to be limited (L. Hindman, Maryland Department of Natural Resources, personal communication). Although swans cause damage to commercial cranberry crops during winter in New Jersey, most of that damage is due to tundra swans (Castelli and Applegate 1989); however, small numbers of mute swans are sometimes mixed with tundra swans and involved in these complaints (N. Rein, USDA, Wildlife Services, personal communication).

Over 200 bird species carry Newcastle's Disease Virus (NDV) but most birds do not exhibit clinical signs of disease (Kaleta and Baldauf 1988). Despite several outbreaks of NDV since the 1990s in Canada and the U.S., little is known about the role of wild birds in disease maintenance and transmission. Pedersen et al. (2014) found that 60% of mute swans were exposed to NDV but detection of active viral shedding was less common (8.7%). The role that mute swans might serve in the maintenance of NDV is concerning given the demonstrated ability of wild birds to transmit NDV to commercial poultry flocks (Heckert et al. 1996), the high mortality experienced by poultry infected with NDV (Alexander 1997), and the tremendous value of the poultry industry in the Mid-Atlantic Region. Further, Pedersen et al. (2014) recommended additional mute swan disease monitoring in an effort to protect the multi-billion dollar poultry business.

Diseases and Human Health Risks

While transmission of disease from waterfowl to humans has not been well documented, the potential exists (Wobeser and Brand 1982, Hill and Grimes 1984, Graczyk et al. 1997) particularly for immunosuppressed individuals (Graczyk et al. 1998). There are several pathogens carried by mute swans which could potentially have implications for human health.

Mute swans have been found to carry several parasites and bacteria which cause diarrheal infections in humans including *Cryptosporidium parvum*, and *Giardia lamblia*

(Majewska et al. 2009, Papazahariadou et al. 2008) and *Salmonella* spp. (Pedersen et al. 2014). Guo et al. (2012) determined that mute swans carried Avian Bornavirus and that the disease was widespread in wild mute swans in the northeastern United States. Dubey et al. (2013) found that the prevalence of the parasite *Toxoplasma gondii* in mute swans was 8.5%.

Avian influenzas are primarily diseases of birds caused by influenza A viruses. Mute Swans have been of particular concern in the spread of High Pathogenic Avian Influenza (HPAI) Type H5N1 in Eurasia. Recent AIV surveillance reports from several European countries suggest that mute swans were predominantly affected suggesting an increasing role of mute swans in the epidemiology of HPAIV H5N1 (Nagy et al. 2007). Further, Kalthoff et al. (2008) found adult mute swans to be highly susceptible to HPAI H5N1, but previously exposed birds could shed virus asymptotically and contribute to spread of the virus through the environment.

The public has expressed concern in areas with high densities of Canada geese over the possibility of disease transmission to humans from contact with goose feces material or contaminated water (Conover and Chasko 1985, Allan et al. 1995, Cooper and Keefe 1997, Smith et al. 1999, Feare et al. 1999). Although Converse et al. (2001) found relatively little risk of human disease from exposure to Canada goose feces; no studies regarding potential pathogens in mute swan feces have been reported.

A more detailed discussion of human disease implications from mute swans can be found in USDA (2012). However, despite the disease implications discussed above and the fact that many people are concerned about disease transmission from waterfowl feces, the Centers for Disease Control and Prevention (1998) suggest the risk of infection is low. Continued surveillance and testing is warranted to determine routes of transmission and risk assessment of disease incidents that could be caused by mute swans.

Human Safety Concerns

Bird strikes to aircraft can be catastrophic to crew and passengers, damage aircraft, and disrupt air travel (Dolbeer et al. 2012). Given the large size of mute swans, they can be particularly hazardous to aircraft. Between 1994 and 2011 the Federal Aviation Administration reported eight collisions between mute swans and aircraft (FAA 2012).

Territorial defense by mute swans has been directed against humans that approach nests or young. A strike with their carpal wing joint is capable of serious injury to the recipient. Allin (1981) reported on mute swans attacking humans. Swan attacks have been known to turn over canoes, kayaks, and small fishing boats. North Carolina had two reported incidents of mute swans attacking people during 2001 requiring one person to seek medical treatment (J. Fuller, North Carolina Wildlife Resources Commission, personal communication). Connecticut (M. Huang, Connecticut Department of Environmental Protection, personal communication) reported four documented incidents of mute swans attacking people since 2001. An Illinois man died

in 2012 when a mute swan contributed to his drowning (Golab 2012). In New Jersey (NJ Division of Fish and Wildlife, unpublished data), the mean annual number of swan complaints increased 45% from 1990-2000 ($n=11$) to 2001-14 ($n=16$). Although personal injuries are rare, having to avoid territories defended by mute swans renders some water areas unusable during the peak time for swimming, boating, fishing or other outdoor recreation.

Property Damage

Deposition of Canada goose feces has been implicated in the eutrophication of small ponds and lakes as well as contamination of swimming areas, parks, and docks (Conover and Chasko 1985, Cooper and Keefe 1997). Undoubtedly, the same water quality degradation and damage problems associated with an abundance of mute swan feces would also apply. Congregations of mute swans on beaches or in drinking water supplies may increase coliform bacteria counts and render waters unusable for those purposes.

In an evaluation of wetland, island, and SAV restoration projects on the Chesapeake Bay, Erwin and Beck (2007) reported mute swans to be a nuisance and undesirable species at some sites. The presence of the swans and the impacts of their foraging on the restoration work necessitated the contracting of United State Department of Agriculture, Wildlife Services personnel to control adult swans and their nests.

Population Management

Mute swans are long-lived species (Baldassarre 2014) where population growth is governed by adult survival more than recruitment (Ellis and Elphick 2007). As such, population management strategies which include reducing adult survival are more likely to be successful than strategies which target nest and egg treatment. A mute swan population model developed by Ellis and Elphick (2007) showed that at least 17% of the population needed to be removed annually to be reasonably certain to reduce the mute swan population. In addition, this model also showed that recruitment would need to be reduced more than 72% to be 90% certain of reducing the population. Hindman and Harvey (2004) found similar results from population modeling in Maryland. Further, Ellis and Elphick (2007) suggested that an intensive period of adult culls was the most efficient option considering biological effectiveness, economic cost, and would minimize the total number of mute swans that would be culled over the long term. As is to be expected for charismatic species such as mute swans, direct population control is controversial. Initiation and long-term success of mute swan management will depend on obtaining support from a broad range of stakeholder groups (Bomford and O'Brien 1995; Decker et al. 2015).

HISTORY OF LEGAL STATUS, PUBLIC POLICY AND POPULATION CONTROL

Legal status in the Unites States

Prior to 2001, mute swans were not protected by the Migratory Bird Treaty Act (MBTA)

because they were not native to North America. As such, management authority was held by the states. From 1999 to 2004, a series of litigious actions ensued among several parties which culminated in the Migratory Bird Treaty Reform Act (MBTRA; see USDA 2012 for detail of these court cases). The MBTRA was explicit by stating that the Act "...applies only to migratory bird species that are native to the United States or its territories". Further language indicates, "native to the United States or its territories as the result of natural biological or ecological processes." MBTRA further required the USFWS to publish a list of non-native bird species, not covered by the MBTA, "even though they may belong to biological families referred to in the treaties that the MBTA implements." The USFWS published this list in 2005 which specifically eliminated mute swans and many other non-native species from protection of MBTA (USFWS 2005). Currently, the legal status of mute swans varies by state and management decisions are made by the states without any federal oversight.

Management of mute swans occurs on a state-by-state basis according to applicable state laws and regulations. In some Atlantic Flyway states, mute swans receive no legal protection and may be taken by any means at any time. Conversely, other states fully protect mute swans and take of mute swans can occur only through issuance of permits. Due to the various legal definitions, state wildlife agency policies and public attitudes, some states have been able to implement aggressive control actions while others have had limited ability to control mute swan populations. Population control techniques vary by state, but include shooting by agency employees or their designees, egg addling, capture and euthanasia, prohibiting releases and requirements that captive birds be pinioned.

Prior to the development of the 2003 Atlantic Flyway Mute Swan Management Plan and prior the series of court decisions beginning in 2001, both the Atlantic Flyway Council and the federal government recognized the growing concerns related to the expanding population of mute swans at that time. This led the AFC in 1997 to approve and adopt a policy (Appendix C) to control mute swans. In addition, in 1998, the USFWS issued a policy statement directing refuge managers on National Wildlife Refuges in Regions 1-7 to take effective steps to control mute swans and prevent destruction and degradation of wetland habitats.

In 1999, the President of the United States signed Executive Order 13112 on Invasive Species. This defined Invasive Species, viz. an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health, and directed all federal government agencies to prevent the introduction of invasive species and provide for their control. It also was intended to minimize the economic, ecological, and human health impacts that invasive species cause and to refrain from actions likely to increase invasive species problems.

Legal Status in Canada

Even though recognized as non-native, the mute swan is protected under the federal Migratory Bird Convention Act (MBCA). Therefore, management authority resides with

the federal government with limited provincial involvement. The inclusion of mute swans under MBCA occurs because original protection was given to families of birds rather than a listing of individual species; therefore the mute swan is afforded protection as being a member of the family *Anatidae*. Removing mute swans from MBCA protection is controversial due to its special status as the “Queen’s bird” and this change would be viewed as substantial since an amendment of the Act may be required and negative public response expected. The Canadian Wildlife Service (CWS) is open for discussion for removing mute swans from protection, but to date there has been limited public and provincial support. In Canada, possession of mute swans by aviculturists is controlled and the release of mute swans into the wild is prohibited. Also, mute swans cannot be taken by any means, except under a permit issued by CWS. The CWS is currently issuing permits to its staff to control mute swans on National Wildlife Areas. In 1999, the Atlantic Region of CWS prepared a policy on mute swans. This action was taken prior to any establishment of a feral population, and the policy is now being extended to include all of Canada. There are currently no feral mute swan populations in the Atlantic Region (Newfoundland and Labrador, Prince Edward Island, Nova Scotia and New Brunswick).

REVIEW OF ATLANTIC FLYWAY MUTE SWAN PLAN ACCOMPLISHMENTS, 2003-2014

The 2003 plan established objectives and specific tasks to accomplish them. Due to the change in legal status provided by the Migratory Bird Treaty Reform Act in 2004, some Atlantic Flyway states initiated or intensified management operations. This section reviews the status of each task for each of the 2003 plan objectives.

OBJECTIVE A: Increase public awareness of mute swans, their status as an invasive species, and their impacts on native wetland ecosystems and other species of wildlife.

Strategy A-1: Develop and implement a comprehensive mute swan communication program for the Atlantic Flyway working closely with individual states and provinces.

A comprehensive communication program was not developed, although some state agencies developed their own communication strategies for increasing public awareness of mute swans.

Strategy A-2: Survey public attitudes on mute swans, management programs, and the effectiveness of outreach programs.

A statewide telephone survey was conducted in Maryland (Hindman and Tjaden 2014) that determined that the majority of Maryland citizens were supportive of mute swan control.

OBJECTIVE B: Reduce the population of mute swans in the Atlantic Flyway to less than 3,000 birds by 2013 as measured by the Atlantic Flyway Mid-Summer Mute Swan Survey.

Although a substantial population reduction was achieved since 2003, the goal of 3,000 birds was not met. The estimated mute swan population in the Atlantic Flyway in 2011 was 9,202. With the exception of the Ontario/Lower Great Lakes region, all regions and nearly all individual states/provinces of the flyway experienced reductions in the mute swan population. The Chesapeake Bay area achieved a 92% reduction with an aggressive, integrated management approach. Survey results from Ontario suggest an increase of 123% in the mute swan population in that region.

Strategy B-1: Remove adult mute swans and/or reduce the annual survival rate of adult birds using direct population control methods by agencies or through regulated hunting seasons by the public.

Since the 2003 plan, several states began or continued to utilize direct control methods. Because mute swans are no longer protected by MBTA, hunting seasons may be prescribed by individual states. Although mute swans are not protected in some states, no states have a mute swan specific hunting season. However, some states do not provide protection for mute swans during the waterfowl hunting season and some states due to legal classification allow mute swans to be taken at any time.

Strategy B-2: Continue to reduce recruitment of mute swan populations through egg treatment programs.

Many states utilize egg treatment along with lethal control in an integrated approach while other states use egg treatment as their primary means to control mute swan populations.

Strategy B-3: Implement a general depredation order for control of mute swans in the Atlantic Flyway.

With the passage of the Migratory Bird Treaty Reform Act in 2004, mute swans were no longer protected by the MBTA. Therefore, a general depredation order was not needed.

Strategy B-4: States with legislation in place that prohibits mute swan control options should seek to have this legislation recalled or modified.

Several states did modify the classification of mute swans thereby allowing greater control options.

OBJECTIVE C: Prevent mute swans from further expanding their range and from occupying areas with important ecological values.

Strategy C-1: Prohibit relocation and release of any mute swans within any area of any state/province of the Atlantic Flyway.

Because mute swans are no longer protected by MBTA, relocation and release is handled by individual states. Several states did enact rules prohibiting or reducing swan relocations or releases.

Strategy C-2: Areas with higher potential for ecological or sociological conflicts should be given highest priority for population reduction programs prescribed to satisfy Objectives A and B.

Maryland focused population management efforts on Chesapeake Bay SAV beds critical to migrating and wintering waterfowl. In New Jersey, population reduction efforts were targeted at waterfowl impoundments with high SAV density that are used by migrating and wintering waterfowl.

Strategy C-3: Develop and implement a full range of non-lethal techniques to discourage use by mute swans in sensitive areas where population reduction is not appropriate.

Non-lethal techniques are certainly utilized and recommended in areas where population reduction cannot be accomplished; however, the degree to which a full range of non-lethal techniques have been utilized in situations is unknown. We are unaware of any additional non-lethal harassment techniques that have been developed.

OBJECTIVE D: Develop and implement guidelines and regulations for keeping captive mute swans by aviculturists, public zoos, and educational facilities.

Strategy D-1: Develop jurisdictional policies for possession of mute swans in captivity.

Maryland addressed this concern through rule-making.

Strategy D-2: Consider stricter federal and state penalties and improve enforcement for non-compliance with regulations for keeping mute swans in captivity and unlawful release of mute swans into the wild.

Several states did enact regulations prohibiting or reducing mute swan releases. Compliance with these regulations is largely unknown.

OBJECTIVE E: Monitor changes in mute swan numbers and their distributions to evaluate the effectiveness of management actions and develop research programs to assess what effects these changes have on wetland habitats and other wildlife.

Strategy E-1: Conduct the Atlantic Flyway Mid-Summer Mute Swan Survey a minimum of every three years.

The mid-summer survey was conducted once every 3 years up to and including 2011 during the plan period. However, as noted earlier, this survey was discontinued because Christmas Bird Counts were found to be a useful monitoring tool for mute swans in the Atlantic Flyway.

Strategy E-2: Incorporate use of GIS technology during the MSMSS to more accurately measure changes in distribution of mute swans within the Atlantic Flyway.

Cooperators were instructed to collect geo-referenced locations of swans during the mid-summer survey. However, varying implementation of the survey by cooperators and a lack of rigorous survey protocols made interpretation to changes in distribution difficult.

Strategy E-3: Continue research to evaluate the effects of mute swans on migratory birds, their habitat and other indigenous living resources as well as management programs associated with this plan.

Several research projects were conducted in the Atlantic Flyway and elsewhere that documented the effects of mute swans on a variety of natural resources. Many of these studies are mentioned in the preceding sections.

ATLANTIC FLYWAY MANAGEMENT GOAL

THE MANAGEMENT GOAL IS:

TO REDUCE AND MAINTAIN THE MUTE SWAN POPULATION AT A LEVEL THAT ELIMINATES ECOLOGICAL IMPACTS TO QUALITY HABITATS AND NATIVE SPECIES, REDUCES HUMAN CONFLICTS, AND PREVENT FURTHER RANGE EXPANSION INTO UNOCCUPIED AREAS.

Rationale: The mute swan is a non-native invasive species in North America. Unfortunately, introduction of this species in the late 1800s did not consider detrimental effects on native wildlife and their habitats. These effects include but are not limited to reduction of SAV, direct territorial aggression and competition for habitat resources. These conflicts with native wildlife are in addition to those stresses caused by expanding human populations in the eastern United States and Canada.

Proper stewardship by wildlife agencies should promote the maintenance of native biological diversity and ecosystem integrity and oppose the modification and degradation of natural biomes by invasive species. In addition, wildlife agencies should be responsive to desires from the public to minimize mute swan conflicts related to human health and safety as well as damage to agricultural resources. This Management

Plan recommends that feral mute swans within the Atlantic Flyway be reduced to prescribed target levels to minimize negative impacts to native habitats and wildlife. Further, mute swan management should limit the expansion of the current core population of birds into new or current low density areas. Both population reduction and limiting range expansion will also address the number and intensity of human conflicts related to mute swans.

In the United States, decisions regarding mute swan management rest entirely with the states. As such, it is incumbent for state wildlife agencies individually, and collectively, to take the lead on mute swan management decisions. In Canada, management authority resides with the federal government. However, changes to legal status or a relaxing of allowable control actions will likely not occur without involvement from provincial governments and non-government organizations. Population objectives may be reassessed and adjusted following the timeframe of this Plan.

MANAGEMENT OBJECTIVES AND STRATEGIES

OBJECTIVE A: Monitor changes in mute swan numbers and their distributions to evaluate the effectiveness of management actions.

Strategy A-1: Track trends in population utilizing the annual Christmas Bird Count (CBC).

Prior to 2013, the AF tracked mute swan numbers through the mid-summer mute swan survey (MSMSS). This survey served the management community well, but was a logistical and financial burden to states implementing the survey. A review of several potential surrogates including the Breeding Bird Survey, annual mid-winter waterfowl survey and the CBC indicated that the CBC reasonably tracks the results of the MSMSS over time. The CBC is an annual survey headed by the National Audubon Society and conducted throughout the flyway by volunteers, with no financial or manpower burdens to state agencies. In addition, the CBC provides for annual estimates of mute swan abundance whereas the former MSMSS only provided estimates on a triennial basis.

OBJECTIVE B: Reduce the population of mute swans in the Atlantic Flyway to less than 2,000 birds by 2025 as measured by the Christmas Bird Count.

The upper limit of 2,000 swans is consistent with the previous goal of 3,000 birds as measured by the MSMSS. It represents the maximum desired level based upon consultations between federal, state, and provincial wildlife agencies within the forum of the AFC. Within the overarching flyway goal of 2,000 mute swans, individual state and provincial targets should be developed by state and provincial wildlife agencies or regional working groups. These groups will decide how best to communicate state/regional target levels to constituents based upon needs and requirements within each jurisdiction.

Strategy B-1: Remove adult mute swans and/or reduce the annual survival rate of adult birds using direct population control methods by state or federal agencies or their designees.

Removal of adult and subadult birds from the population is the most effective way to reduce numbers of mute swans in the Atlantic Flyway to achieve population goals. Although regulated hunting by the public is a preferred method of controlling overabundant wildlife populations, many mute swans occur in areas such as urban sites where hunting by the public is not feasible. These areas will require direct intervention by personnel of wildlife agencies or authorized individuals.

Strategy B-2: Encourage states to allow sport hunting of mute swans, where a legal option.

Similar to direct removal by agency staff, sport hunting of mute swans has the ability to reduce the annual survival of adult birds and may be the most effective way to reduce numbers of mute swans in the Atlantic Flyway to meet population goals. Sport hunting can take the form of specific seasons for mute swans or simply allowing mute swans to be taken during seasons open for other species.

Strategy B-3: Further reduce recruitment of mute swan populations through expanded egg treatment programs and implement simple permitting strategies for the general public to treat/destroy mute swan nests and eggs.

Although not as effective as direct mortality of adults in reducing mute swan numbers, egg treatment programs can contribute to reaching population target levels. This strategy reduces the number of birds entering the nonbreeding population and reduces the number of adult birds that would have to be culled (Hindman et al. 2014). This strategy can also be used in areas where humane removal of adult birds is not feasible or acceptable to the local public. States should strive to implement nest and egg treatment programs that can be applied by the general public on a wide scale. Individual state programs could be modeled after the federal Canada Goose Nest and Egg Depredation Order.

Strategy B-4: States with legal barriers in place that prohibit mute swan control options should seek to have these barriers removed or modified.

Achieving and maintaining flyway populations at desired levels will require earnest commitments from all states, provinces, and federal governments. States with agency regulations that prohibit mute swan control options should immediately consider adopting new regulations while those states that are prevented from controlling mute swans by state law/statute should assess opportunities within their state legislatures for making changes. Individual jurisdictions that remain legally prevented from implementing effective control programs potentially serve as a source population of mute swans.

OBJECTIVE C: Build partnerships with government and non-government (NGO) agencies regarding mute swan management.

Effective wildlife management, particularly for species with perceived charisma such as mute swans, requires stakeholder participation and engagement. Although complete consensus from all stakeholders regarding mute swan management is not likely to occur, endorsement from key stakeholders including land owners and natural resource groups is critical for management actions to move forward. Further, government and particularly NGOs have an important role to play in issuing statements or policy regarding mute swan management both on their own lands and at various geographic levels.

Strategy C-1: Establish regional swan management working groups.

A regional approach to mute swan management is appropriate for much of the AF, especially where individual states/provinces share common water bodies (i.e. Chesapeake Bay, Delaware Bay, Lake Ontario). Increased coordination of management actions and a better understanding of mute swan movements (in a regional context) should inform how best to make progress toward population goals.

Strategy C-2: Conduct stakeholder meetings within states.

Given the political landscape and varying public opinions for mute swan management across the flyway, it will be incumbent for some jurisdictions to fully engage a range of stakeholders prior to management actions. Stakeholder meetings can be an effective way to engage other agencies (local and state) and coordinate management activities at various geographic scales.

OBJECTIVE D: Prevent mute swans from further expanding their range and from occupying areas with important ecological values.

Strategy D-1: Prohibit relocation and release of any mute swans within any area of any state/province of the Atlantic Flyway.

States and provinces that currently do not have free ranging mute swans should prevent the establishment of breeding populations within their borders. Also, those with existing breeding populations should prevent mute swans from spreading into new areas. Further, mute swans captured due to damage complaints, sickness, or injury should be removed from the wild and placed in captivity or be euthanized. This may require some states to develop strategies and implement control programs.

Strategy D-2: Habitats with higher wildlife value should be given priority for management programs prescribed to satisfy Objective B.

Habitats with the highest wetland wildlife value, including but not limited to wildlife management areas, SAV beds, impoundments, shallow marshes, and colonial waterbird nesting sites frequently have the highest use by native wildlife and should receive highest priority for mute swan management.

Strategy D-3: Develop and implement non-lethal techniques to discourage use by mute swans in sensitive areas where population reduction may not be possible and where swans will not be dispersed to colonize new areas.

Population control is the preferred method of reducing swan use of sensitive ecological areas. However, population control is not always appropriate or feasible due to sociological considerations. These situations require application of effective deterrents or harassment techniques designed to discourage swan use, as long as it does not result in range expansion into unoccupied areas.

OBJECTIVE E: Increase public awareness of mute swans, their status as an invasive species, and their impacts on native wetland ecosystems and other species of wildlife and continue research when necessary to evaluate effectiveness of management actions on habitats and native wildlife species.

Strategy E-1: Develop and implement a comprehensive mute swan communication program for the Atlantic Flyway working closely with individual states and provinces.

A critical need exists to increase public awareness of the need for maintaining and enhancing interrelationships between native wildlife and habitats. Many people do not appreciate the basic difference between native species and non-native invasive species including mute swans. The fact that some publics, particularly those in urban settings, do not value native species as important components of native ecosystems but favor more aesthetically appealing species introduced by man hampers a variety of conservation efforts. Communication programs must clearly convey impacts of mute swans on native resources, need for management actions, adverse impacts of releasing mute swans, and negative results of winter feeding.

Strategy E-2: Survey public attitudes on mute swans, management programs, and the effectiveness of outreach programs.

Lethal management of mute swans can elicit strong sentiments and opposition from some segments of society. Tailoring outreach programs to that segment of the population that is open to various management programs is critical to the implementation and ultimate success of management actions. Understanding the effectiveness of outreach programs and how they may be tailored may be best accomplished through targeted research and surveys.

Strategy E-3: Continue research to evaluate the effects of mute swans on migratory birds, their habitat and other indigenous living resources.

Over the past 10 years, additional research has been conducted to better understand the impacts of mute swans on native ecosystems. In some regards, these impacts have been well documented. However, because management decisions are solely left to state discretion, targeted research and survey work may be needed to influence policy makers and citizenry at the local level. Ideally, a well-designed study that can document impacts of mute swans prior to a removal program compared to conditions after removal is needed. Additional research on water quality impacts of mute swans, which often go overlooked, would also be useful.

OBJECTIVE F: Develop and implement guidelines and regulations for keeping captive mute swans by aviculturists, private landowners, public zoos, and educational facilities.

Strategy F-1: Develop jurisdictional policies for possession of mute swans in captivity.

Zoos, educational and research facilities, private aviculturists and other similar users have a need or desire to hold mute swans in captivity. A policy which defines these users and establishes stricter guidelines and requirements for ownership of mute swans is needed. Any mute swans kept in a free-range setting should be marked, pinioned or otherwise rendered flightless to ensure recognition and recovery of escaped birds. Captive mute swans should not be allowed to breed successfully unless any young produced will not be released or allowed to escape to the wild. This can be accomplished by maintaining single sex flightless pairs or flocks (Sladen & Rininger 2004), egg treatment, or surgical sterilization of male swans. Managers exhibiting mute swans should be encouraged to inform the public of the negative impacts associated with introduced invasive species in the wild.

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APPENDICES

Appendix A – Earliest known sightings of mute swans within states and provinces in the Atlantic Flyway

State/Province	Year	State/Province	Year
New York	1910	Quebec	1965
New Jersey	1919	New Hampshire	1967
Massachusetts	1922	West Virginia	1986
Rhode Island	1923	North Carolina	1989
Pennsylvania	1930's	Georgia	1989
Ontario	1934	Maine	1990
Virginia	1955	South Carolina	1993
Maryland	1910	New Brunswick	1993
Connecticut	1957	Vermont	1993
Delaware	1958		

Appendix B - Mid-summer mute swan survey results by region in the Atlantic Flyway from 1986 to 2011.

<i>Region</i>	<i>1986</i>	<i>1989</i>	<i>1993</i>	<i>1996</i>	<i>1999</i>	<i>2002</i>	<i>2005</i>	<i>2008</i>	<i>2011</i>
Ontario:									
Lower Great Lakes	615	811	1100	1200	NS	1373	2894	2357	3062
New England:									
Maine	3	12	6	8	7	0	0	4	0
New Hampshire	19	0	49	30	31	42	23	18	7
Vermont	0	0	4	11	0	0	1	0	0
Massachusetts	585	565	660	917	986	947	1046	1046	1046
Rhode Island	880	1044	1333	1206	1577	1367	1246	856	778
Connecticut	1452	1948	1707	1589	1609	1338	1043	1012	809
Subtotal:	2939	3569	3759	3761	4210	3694	3359	2936	2640
Upper Mid-Atlantic:									
Delaware	21	1	21	9	27	18	17	15	41
New York	1815	1966	2069	1644	2429	2848	2146	2624	1765
New Jersey	529	717	893	1019	1364	1602	1890	1253	1059
Pennsylvania	137	122	139	253	242	348	307	282	167
Subtotal:	2502	2806	3122	2925	4062	4816	4360	4174	3032
Chesapeake Bay:									
Maryland	264	611	2245	2717	3955	3624	2198	581	76
Virginia	60	145	231	419	488	563	725	373	241
Subtotal:	324	756	2476	3136	4443	4187	2923	954	317
Southeastern:									
West Virginia	0	0	2	6	9	17	20	9	11
North Carolina	0	6	29	5	18	14	59	81	10
South Carolina	3	0	3	0	0	27	30	30	30
Georgia	0	26	NS	NS	0	1	0	0	0
Florida	NS	46	NS	NS	NS	215	4	0	100
Subtotal:	3	78	34	11	27	274	113	120	151
Total:	6,383	8,020	10,491	11,033	12,742	14,344	13,649	10,541	9,202

Appendix C - ATLANTIC FLYWAY COUNCIL MUTE SWAN POLICY, August 1, 1997

- 1) State wildlife agencies should obtain the authority over sale and possession of mute swans and their eggs.
- 2) The sale of mute swans, their young, or eggs should be prohibited.
- 3) Eliminate all importing and exporting of mute swans without a special purpose permit issued by a state's wildlife agency.
- 4) Mute swans captured due to nuisance complaints, sickness, or injury should be removed from the wild or be euthanized.
- 5) Where feasible, egg-addling programs should be established.
- 6) State and federal wildlife agencies should institute programs to prevent the establishment and/or eliminate mute swans.
- 7) States and provinces should seek to make the mute swan an unprotected species if this is not already the case.
- 8) States should strive to manage mute swan populations at levels that will have minimal impact to native wildlife species or habitat.