

Mute Swan Management Plan for Maryland



Maryland Department of Natural Resources
Wildlife and Heritage Service

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MUTE SWAN MANAGEMENT PLAN

EXECUTIVE SUMMARY

This plan describes the status and impacts of mute swans in Maryland. It is a guidance document that provides direction and objectives for the Maryland Department of Natural Resources (DNR) to manage this overabundant species through 2020 and beyond.

Mute swans are an invasive, nonnative species in Maryland. The population originated from the escape of five birds in 1962 from an aviculture collection in Talbot County. Prior to 1986, the swan population grew slowly and remained at <500 swans. However, swans increased dramatically after 1986 from 264 in 1986 to 3,955 in 1999 (Figure 1). Following the implementation of the first mute swan management plan in 2003 and resolution of legal issues, the DNR initiated a concerted population control effort in 2005 aimed at reducing the population to <500 birds. The population control effort reduced the population to 208 by 2010 (Figure 1).

Adverse ecological effects have occurred because of this invasive species. The mute swan population threatens the protection and restoration of SAV beds in areas of critical importance to the Bay's living resources. Concentrations of foraging swans can severely impact submerged aquatic vegetation (SAV) beds and restoration plantings. Foraging by swans during the growing season reduces plant survival and the plant's ability to reproduce. A large swan population reduces the availability of SAV for wintering waterfowl and other fish and wildlife populations dependent upon SAV. Large numbers of mute swans have displaced state-threatened species of colonial waterbirds (terns and skimmers) from their island nest sites. The antagonistic behavior exhibited by breeding mute swan pairs toward other native wetland birds can prevent native waterfowl from using traditional nesting and feeding areas. In some cases, mute swans kill other wetland bird species. Mute swans also impact humans. The aggressive behavior by some breeding swan pairs instills fear into citizens, preventing them from using their shoreline property and adjacent waters.

To address these concerns, the DNR appointed a Mute Swan Task Force in 1999 to develop management recommendations. The Task Force compiled a comprehensive summary of information about mute swan ecology, population dynamics, and management that can be viewed at <http://www.dnr.state.md.us/wildlife/mstfpc.html>.

The cornerstone of the Mute Swan Task Force recommendations was the protection of native species and their habitats from the effects of mute swans. The Task Force recommended that the DNR establish Swan-Free Areas, areas where mute swans would be excluded or removed to protect critically important habitats and wildlife resources. The same year, the DNR Waterfowl Advisory Committee endorsed the Task Force recommendations, but further recommended a rapid reduction of the mute swan population and the elimination of State protection for the species. The

recommendations provided by these two advisory groups, along with biological and wildlife management principles and public input, were considered in the development of the goals, strategies, and objectives contained within the 2003 management plan. A review of the accomplishments achieved under the 2003 management plan is included in Appendix E.

With the implementation of the 2003 plan, the DNR reduced the number of mute swans in the Maryland portion of the Bay to 208 birds by 2010. As a result, the impacts to living resources and people have declined. The DNR also promulgated regulations that guide captive mute swan management and prohibit the sale, transfer, importation and exportation of mute swans. In addition, the DNR completed research that provided evidence that mute swan grazing, especially during spring and fall SAV growth and reproductive periods and in SAV restoration plantings, is an impediment to achieving the objectives identified in the Vital Habitat Protection and Restoration Section of the Chesapeake 2000 Agreement.

The 2003 management plan suggested a five-year timeline for the plan to be assessed and revised based on progress towards the plan's goals and objectives. Thus, in early 2009, the DNR assembled a Mute Swan Advisory Committee representing various Chesapeake Bay conservation interests to review the status of the mute swan population and its ecological significance in Maryland's Chesapeake Bay waters. The Committee was directed to provide guidance on the most appropriate strategy to manage mute swans to ensure the long-term protection of important Chesapeake Bay living resources. Following their review, the Committee recommended that the DNR continue its egg-addling program to prevent swan recruitment. However, they recommended that the DNR not use managed hunting as a population control measure. The Committee's majority report recommended that the DNR reduce the mute swan population to as low a level as can be achieved (Appendix A). Further reduction of the current population will result in fewer swans being killed over the long term. In April 2010, the DNR Migratory Game Bird Advisory Committee endorsed the Mute Swan Advisory Committee recommendations, but reaffirmed their 2003 recommendation that the DNR eliminate State protection for the species.

The overall management goal is to manage the mute swan population in Maryland at a level that (1) minimizes the impacts to Maryland's native species and habitats; (2) is consistent with the objectives of the Chesapeake 2000 Agreement; and (3) minimizes conflicts with humans. To achieve this goal, the management of mute swans shall be conducted in an effective, efficient manner, consistent with accepted wildlife management practices.

Specific management objectives to achieve this goal are as follows:

- Continue to provide public outreach that facilitates and increases understanding of the status of the mute swan population in Maryland, its impacts on the Chesapeake Bay ecosystem, and the problems it creates for humans.
- Reduce the mute swan population to as few birds as possible, consistent with activities to protect, restore and enhance the Bay's Living Resources.

- Prevent the escape and reproduction of captive mute swans.
- Reduce conflicts between mute swans and people by permitting a wide variety of effective and efficient control methods.
- Monitor the size and distribution of the mute swan population and evaluate the effectiveness of management actions.

INTRODUCTION

Mute swans are not native to Maryland or North America. Mute swans from Europe were introduced along the Atlantic coast as early as the late 1800's. However, sizeable numbers were not imported until after the turn of the century. Initial introductions occurred mainly in the New York City area. Estate owners and public officials sought mute swans to add elegance and charm to the visual beauty of public parks and estate ponds. Some swans eventually escaped or were deliberately released into the wild and subsequently established breeding populations. Currently, over 10,500 mute swans occupy coastal and freshwater habitats along the Atlantic coast from New Hampshire to Florida. Large numbers also occupy the Great Lakes, Washington State, southern Ontario, and British Columbia.

The first recorded observations of mute swans in the tidewater areas of Maryland occurred when three birds were observed near Ocean City in February 1954 and then again when three swans were seen near Gibson Island, Anne Arundel County, in January 1955. These likely were transient birds forced south by severe winter weather. The mute swan population in Maryland's portion of the Chesapeake Bay has been attributed to the escape of five captive birds along the Miles River in Talbot County during a spring storm in March 1962. Following this accidental introduction, the mute swan population grew slowly for two decades. However, after the mid-1980s, the swan population underwent dramatic growth and range expansion, rising to about 4,000 birds by 1999.

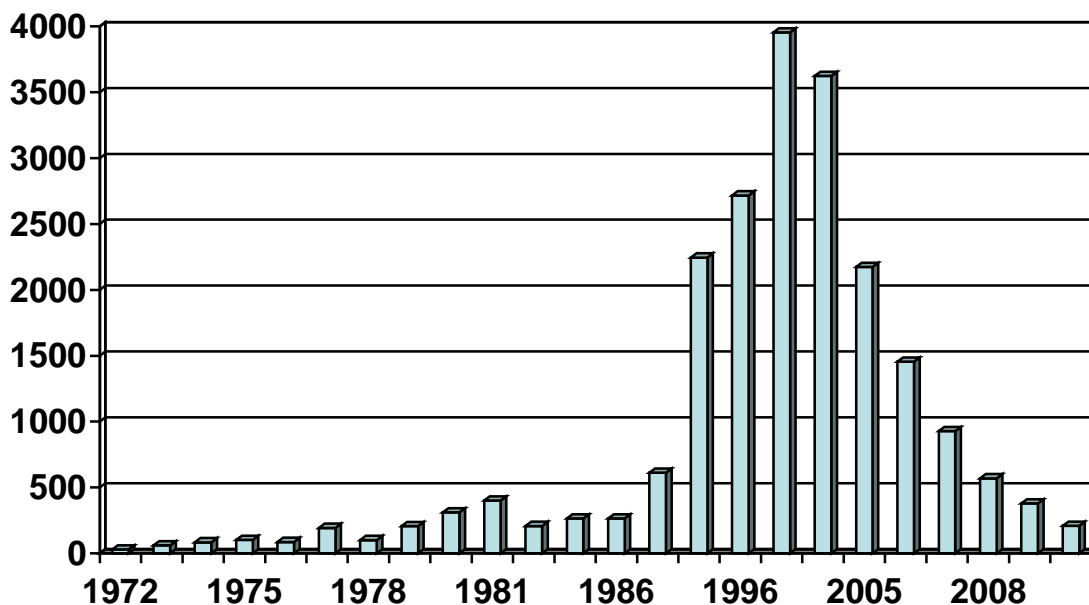
Although valued for their aesthetic beauty, the mute swan is one of the world's most aggressive species of waterfowl. In Maryland, aggressive mute swan pairs have become a nuisance, preventing people from using their shoreline properties and riparian waters where swans vigorously defend their nest and young during the breeding season. Concomitant with the rise in mute swan numbers in the 1990s, conflicts between mute swans and native wildlife increased, including the displacement of colonial waterbirds and native waterfowl from nesting and feeding areas. Furthermore, mute swan grazing on submerged aquatic vegetation (SAV) reduced the amount of SAV available to several native waterfowl species and other fish and wildlife. Although the impacts upon SAV are not well quantified, it is clear that maintaining a large mute swan population in Chesapeake Bay poses a threat to the remaining SAV beds and the establishment of new SAV beds, and therefore, is an impediment to achieving the goals of the Chesapeake 2000 Agreement.

This management plan describes the status and impacts of mute swans in Maryland. It is a guidance document that provides direction, objectives, and strategies for the DNR to manage this species through 2020 and beyond. Progress made toward achieving management objectives will be assessed annually.

STATUS AND DISTRIBUTION

The mute swan population in Maryland's portion of the Chesapeake Bay originated when five birds escaped from an aviculture collection along the Miles River in Talbot County in March 1962. A pair of these birds bred successfully that summer, and the flock increased to more than 100 by 1974. Prior to 1986, the swan population grew slowly and remained at <500 swans. However, swans increased dramatically after 1986 from 264 in 1986 to 3,955 in 1999 (Figure 1). During this period, the population grew at an annual rate of about 23%. A number of factors could have led to this increase, including milder winters and reduced mortality due to lead poisoning associated with the ban on lead shot for waterfowl hunting. Banding studies demonstrate that mute swans rarely move more than 30 miles from their original banding site. Therefore, immigration of swans from other states was an unlikely source of the population expansion. Following the implementation of the first mute swan management plan in 2003 and resolution of legal issues, the DNR initiated a concerted population control effort in 2005 aimed at reducing the population to <500 birds. The population control effort reduced the population to 208 in 2010 (Figure 1).

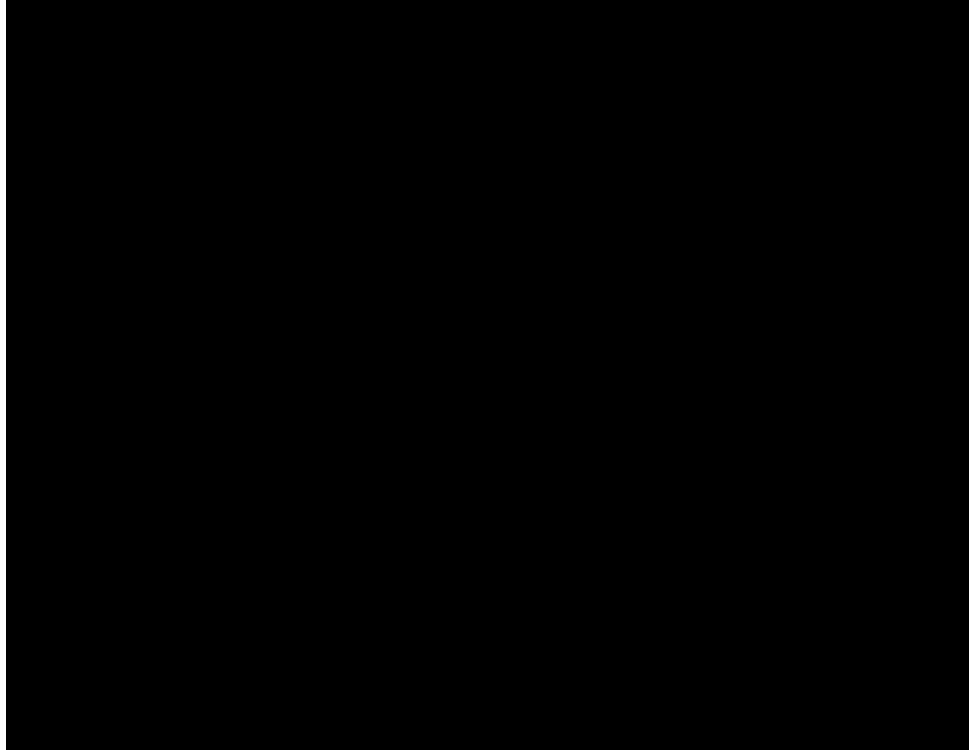
Figure 1: Number of Mute Swans in Maryland 1972-2010.



Since 2005, mute swans have become less common throughout Maryland's tidewater tributaries (Figure 2). Although most nest on the edges of tidal wetlands, a few pairs nest on inland reservoirs, ponds, shallow impoundments, and dredge

spoil ponds. The most recent survey of mute swans in the State was conducted in September 2010. The survey does not include the small number of captive swans that are kept under State permit. During this survey, the largest numbers of mute swans were located in the upper Bay at Aberdeen Proving Grounds in Harford County and in the mid-Bay, from Fishing Bay (Dorchester County) to Rock Hall (Kent County) on the Eastern Shore (Figure 2). However, swans continue to inhabit most Maryland tidal tributaries.

Figure 2: Distribution of Mute Swans in Maryland, September 2009.

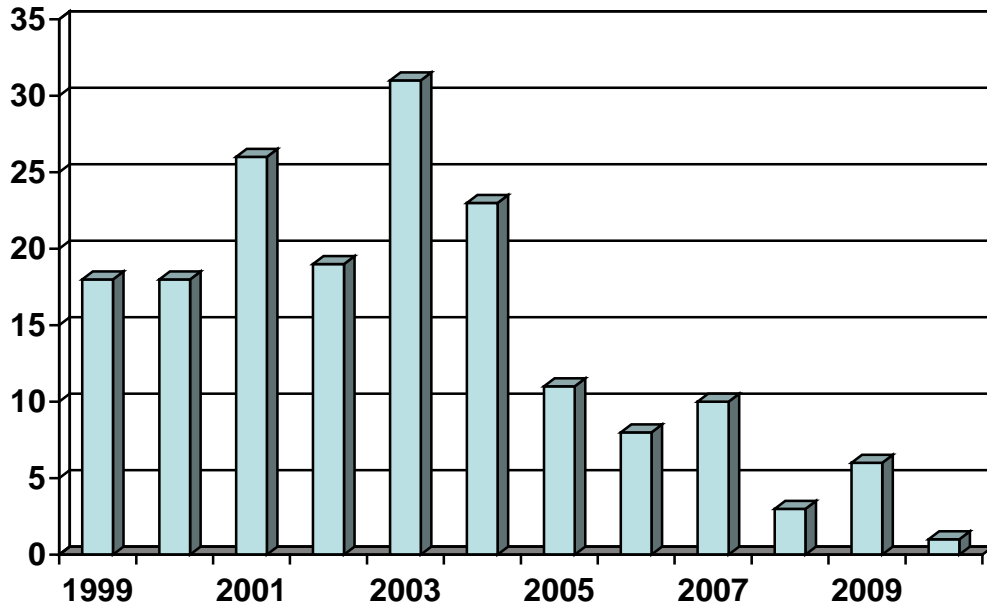


ECOLOGICAL IMPACTS AND CONFLICTS

Impacts to Public Safety and Use of Private Property

Despite their aesthetic appeal, mute swans are a problem for some people. Some adult swans threaten or directly attack people who get too close to their nest or young. The aggressive behavior exhibited by these large birds can pose a safety risk, especially to small children and persons swimming or in small watercraft. Although the potential for injury is low, many people who experience this display of aggressive behavior are fearful of it. This behavior prevents some shoreline landowners from using their shoreline property and adjacent waters during the nesting and brood-rearing season. Since 2003, the number of mute swan complaints received from the public has declined in proportion to the decline in the number of breeding mute swans (Figure 3).

Figure 3: Number of mute swan complaints in Maryland 1999- 2010 (USDA Wildlife Services).



Grazing Impacts upon Submerged Aquatic Vegetation

Unlike the native tundra swans that only spend winter months in the Bay, the nonnative mute swan inhabits the Bay year-round. Mute swans feed solely on SAV and other plant material. While foraging, each bird consumes an average of about 8 pounds of SAV each day, including leaves, stems, roots, stolons, and rhizomes. Wintering tundra swans also feed on SAV but also consume clams, waste grain, and green grain crops in agricultural fields. Mute swans, on the other hand, feed exclusively in shallow wetlands in Maryland where they consume large amounts of SAV. They also utilize large amounts of emergent vegetation for nest building. Adult mute swans tend to paddle and rake the substrate to dislodge SAV for them and their cygnets; thus, more SAV is destroyed and uprooted than is eaten. At high densities, mute swans can overgraze an area, causing a substantial decline in SAV at the local level.

This consumption of SAV has raised serious concerns among shoreline property owners and resource managers. Submerged aquatic vegetation is critical to the health and well-being of a myriad of Bay organisms. Not only does SAV protect water quality and prevent erosion, it also provides food and shelter for fish, shellfish, invertebrates, and waterfowl. For example, research has shown that the density of juvenile blue crabs is 30 times greater in SAV beds than in unvegetated areas of the Bay.

Recent research has shown that mute swans in Maryland spend more time feeding (38.4%) than in non-foraging activities, including swimming (21.8%), resting (18.4%), self-maintenance (18.6%), agonistic activity (1.7%), and disturbance-induced activities (1.2%). Also mute swans in flocks spend more time feeding than those in pairs and birds in larger flocks spend more time feeding than those in smaller flocks. Feeding intensity is not influenced by seasons (spring and summer).

The abundance and distribution of SAV has been greatly reduced during the last 30 years. The decline of SAV has been attributed primarily to elevated levels of nutrients and suspended sediments. However, the grazing of SAV by mute swans places additional pressure on this already stressed and vital resource. Grazing of SAV by mute swans reduces the capacity of the remaining SAV beds in the Bay to support wintering waterfowl and other fish and wildlife populations. Food habit studies show that widgeon grass and eelgrass are the most important foods of mute swans in winter and spring. These SAV species are also important foods for many other wintering waterfowl species.

Although other factors have contributed to the reduction of SAV in the Bay, there is sufficient information to conclude that mute swans are having a deleterious impact on SAV in the Bay. Bay scientists and shoreline property owners report concentrations of foraging swans severely impacting SAV beds. Citizen tributary organizations have had SAV and emergent plant restoration projects damaged by mute swans, thwarting efforts to improve water quality. The cost of replanting one 0.06 ha restoration site damaged by mute swans in the South River exceeded \$4,000.

Mute swan grazing on SAV has been observed by research scientists, including feeding on reproductive shoots before they mature. Swan foraging on SAV during the spring and summer growing season has been shown to reduce plant survival and reproduction, reducing SAV abundance in subsequent years. Over time, areas with high densities of mute swans exhibit a decrease in plant diversity and abundance, sometimes becoming devoid of SAV.

An enclosure study conducted at 18 sites on Maryland's Eastern Shore documented that mute swan grazing had a substantial adverse impact on percent cover, shoot density, and canopy height of SAV. At the end of the study, mean percent cover, shoot density, and canopy height in the controls were lower by 79%, 76%, and 40%, respectively, as compared to those in 2-year enclosures that prevented swan grazing.

In 2007, researchers also developed a predictive model to determine the effect of mute swan grazing along with other potential factors upon SAV for the entire Bay. Based on biology and current knowledge of SAV and mute swans in the Bay, researchers developed a suite of candidate models that could potentially predict SAV cover decline in the bay. Each model had mute swan population and/or one or more other potential environmental factors as independent variables (predictors) and SAV-percent-cover decline as the dependent variable. It was clear that mute swans contribute to SAV decline, but swans are not the most important factor. Mute swans likely cause a synergistic effect with abiotic variables, resulting in increased SAV decline

in the Bay. They concluded that mute swan control should be used along with other practices to combat SAV decline in the Chesapeake Bay.

The presence of a mute swan population in the Bay is in conflict with public policies aimed at restoring the Chesapeake Bay. Grazing by mute swans, especially during spring and fall SAV growth and reproductive periods and in SAV restoration plantings, is an impediment to achieving the objectives identified in the Vital Habitat Protection and Restoration Section of the Chesapeake 2000 Agreement (Appendix B). In particular, mute swan grazing is an impediment to achieving the goal to “Preserve, Protect and Restore those habitats and natural areas vital to the survival and diversity of the living resources of the Bay and its tributaries.” In 2003, the Chesapeake Bay Program adopted the *Strategy to Accelerate the Protection and Restoration of Submerged Aquatic Vegetation in the Chesapeake Bay*, which set a goal of restoring 185,000 acres of SAV in the Bay and its tidal tributaries by 2010.

Impacts to Property and Agricultural Resources

Few instances of property damage by mute swan have been reported. Currently, there is no evidence to suggest that mute swans are causing any impact to agriculture in Maryland. Elsewhere in the U.S., mute swans have caused economic losses to agricultural crops. In New Jersey, mute swans have caused several thousands dollars of damage to commercial cranberry crops. In Washington State and British Columbia, Canada, mute swans feed in agricultural fields and cause damage to small grain crops (i.e., winter wheat and canola). In Europe, mute swans cause damage to pastures.

Direct Impacts to Native Wildlife

The accidental and intentional introduction of exotic waterfowl has negative ecological impacts on native species. Adverse effects are particularly likely if the introduced species is aggressive, competes with other waterfowl for food or habitat and/or hybridizes with native species. The aggressive behavior exhibited by some mute swans toward humans is commonly directed toward other waterfowl. Observations in Maryland and findings reported in scientific literature support the fact that territorial mute swans can be very aggressive towards other waterfowl, displacing native species from their breeding and foraging habitats.

Mute swans occupy and defend relatively large territories of wetland habitat during nesting, brood rearing and foraging, and thus compete with native birds for habitat. Not only do they displace native waterfowl from breeding and staging habitats, they have been reported to attack, injure, or kill other wetland birds. This is especially true of male swans defending either their nesting territories or cygnets.

The most serious instance of conflict between native wildlife and mute swans occurred in the early 1990's, when a large flock of mute swans (600-1,000 swans) caused the abandonment of nesting sites for state-threatened colonial nesting birds at Tar Bay in Dorchester County. These colonial nesting birds nested on oyster shell bars

and beaches that were used by swans as loafing sites. Tar Bay was the only area in the Maryland portion of the Bay where black skimmers and least terns nested on natural sites.

Prior to the recent reduction of the mute swan population in Maryland, there was concern among wildlife managers that the increase in mute swans in Maryland is contributing to factors that have suppressed the number of tundra swans that winter in the State. Recent research has shown that tundra swans are spending less time in the Bay and migrating south to winter in greater numbers in North Carolina. However, mute swan pairs have been observed exhibiting aggression toward wintering tundra swans in Maryland, driving them from foraging areas and protected coves used for winter shelter. Recent research conducted in Maryland has documented that mute swans pairs exhibit aggression, including physical attacks, toward tundra swan decoys when introduced into their breeding territory.

Food habit studies show that tundra swans and mute swans do compete for limited SAV food resources, but tundra swans feed on invertebrates and agricultural foods to a greater extent. The extent to which aggressive behavior and competition from mute swans is related to the inability of the state's wintering tundra swan population to increase is unknown.

Mute swans consume large amounts of SAV that might otherwise be available to native waterfowl. This competition for space and food imposed by mute swans reduces the carrying capacity of breeding, staging, and wintering habitats for native species of migratory waterfowl in Chesapeake Bay where mute swans are established. Numbers of several waterfowl species (e.g., redhead, canvasback, American widgeon, black ducks, and Atlantic brant) dependent upon SAV have declined in the Bay. The declines in these wintering waterfowl populations in the Bay are attributed to the reduced abundance of SAV. Except for black ducks, continental populations of these species are quite healthy, at or above North American Waterfowl Management Plan objectives.

POSITIVE VALUES AND USE

Aesthetic Values

For centuries, mute swans have symbolized beauty, purity, elegance, and wealth in art and legend. Mute swans provide enjoyment for many people, who photograph, paint, draw, or just watch them. They are very large, conspicuous birds that are now widely distributed along Maryland tidal shorelines, including many areas occupied by waterfront residential homes. Mute swans have little or no fear of humans perhaps because of their domestic origin. Some people also derive enjoyment from feeding waterfowl, including mute swans, and can become emotionally attached to individual swans, sometimes treating them like pets.

Economic Values

Mute swans are sold for display on ponds and lakes. They have also been sold as a biological control for removing unwanted filamentous green algae from small lakes and ponds. In some instances, they are purchased to reduce nuisance problems associated with resident Canada geese. The current purchase price of a breeding pair

of mute swans is \$1,000-1,500. However, DNR regulations now prohibit the sale and trade of mute swans in the State.

LEGAL DEFINITION AND PUBLIC POLICIES

Legal Status

In Maryland, mute swans are regulated by the DNR and included in the statutory definition of Wetland Game Birds (Natural Resources Article [NR], Section 10-101) (Appendix B). This law does not list the specific names of native species of waterfowl that winter in Maryland, but only identifies ducks, mergansers, brant, geese, and swans as wetland game birds. The State law was promulgated prior to the accidental introduction of mute swans in Maryland. The law gives DNR the authority to allow the taking of wetland game birds during an open hunting season, although no swan season has been opened in the State since 1918. Further, it gives the DNR the authority to regulate the possession, sale, trade, exportation, and importation of mute swans in Maryland (NR Article Section 10-903). Currently, the take of mute swans in Maryland is authorized by permit to enable property owners and land managers to resolve public safety and natural resources conflicts caused by mute swans on their property.

Currently, there is no open hunting season for mute swans in the U.S. However, several states that surround Maryland allow mute swans to be taken year round. In Delaware, mute swans are considered an exotic, invasive species with no state protection. The Delaware Department of Natural Resources and Environmental Control specifically mention mute swans in their waterfowl hunting regulation synopsis advising waterfowl hunters that they may be legally taken while waterfowl hunting. The Pennsylvania Game Commission considers the species as an unprotected bird, with no State protection. Additionally, the Virginia Department of Game & Inland Fisheries legally classifies the mute swan as a nuisance species with no State protection.

Public Policies Pertaining to Invasive Species and Mute Swans

Several federal, regional and state public policies address the concerns associated with invasive species and specifically are directed at the management of mute swans (Appendix C). An invasive species is defined as a species that is (1) non-native (or alien) to the ecosystem under consideration and (2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

- On March 24, 1996, the USFWS enacted a policy directing managers to control mute swans on federal lands, including National Wildlife Refuges, to protect the habitats from degradation and damage by mute swans.
- The National Invasive Species Act (NISA) (1996) (16 U.S.C. § 4701. et seq.) established an Aquatic Nuisance Species Task Force (ANSTF) to assess whether aquatic nuisance species threaten the ecological characteristics and economic uses of U.S. waters. The ANSTF is also directed to evaluate approaches for reducing risk of adverse consequences associated with

unintentional introduction of aquatic species. The NISA also authorized funding for state and regional management of aquatic non-indigenous species plans, research on aquatic nuisance species prevention and control in major aquatic systems, including the Chesapeake Bay.

- On August 1, 1997, over growing concern for the impacts mute swans were having on habitats important to migratory birds, particularly waterfowl, the Atlantic Flyway Council (AFC) adopted a policy directing its member government agencies to manage and control mute swans. The AFC is an administrative body comprised of 23 state and provincial wildlife agencies, including Maryland, in the easternmost flyway.
- Executive Order 13112 enacted February 13, 1999, by the President of the United States, directs all federal government agencies to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause. The order further directs federal agencies to refrain from actions likely to increase invasive species problems.
- The Chesapeake 2000 Agreement is a cooperative agreement signed by the Governor's of Maryland, Pennsylvania, and Virginia, Mayor of the District of Columbia, Chesapeake Bay Commission, and the Environmental Protection Agency representing the federal government. The Agreement includes goals that address invasive species and SAV restoration. Specifically, the Agreement directs the jurisdictions to identify non-native, invasive species, which are causing or have the potential to cause significant negative impacts to the Bay's aquatic ecosystem. Further, the Agreement requires the development and implementation of management plans for those species deemed problematic to the restoration and integrity of the Bay ecosystem. In December 2001, the mute swan was identified as one of the priority species requiring regional management planning and population control.
- In 2001, Maryland Natural Resources Article, Section 10-211 was enacted, requiring the DNR to establish a program to control the population of mute swans and authorizing the DNR to include the managed harvest of adult mute swans in this program.
- In 2002, the Maryland General Assembly adopted Senate Joint Resolution 15 urging the USFWS to act with expedience to craft and conduct appropriate regulatory processes under the MBTA which would allow Maryland to establish a method of controlling the mute swan population and to mitigate the mute swan population's impact permanently and statewide
- In July 2003, the AFC adopted an Atlantic Flyway Mute Swan Management Plan 2003-2013. The goal of this management plan is to reduce mute swan populations in the Atlantic Flyway to levels that will minimize negative ecological impacts to wetland habitats and native migratory waterfowl and to prevent further range expansion into unoccupied areas. Specific management objectives include: (1) Increase public awareness of mute swans, their status as an

introduced and invasive species, and their impacts on native wetland ecosystems and other species of wildlife; (2) Reduce the population of mute swans to less than 3,000 birds by 2013 as measured by the Atlantic Flyway Mid Summer Mute Swan Survey; (3) Prevent mute swans from further expanding their range and establishing new breeding populations; and (4) Develop and implement guidelines and regulations for keeping captive mute swans by aviculturists, public zoos, and educational facilities.

- In 2005, U.S. Fish and Wildlife Service's (USFWS) Chesapeake Bay Program adopted a bay-wide mute swan management plan. The goal of the plan is to manage the mute swan population in the Bay region at a level that: (1) Minimizes impacts on native wildlife, important habitats and local economies; (2) Minimizes conflict with humans; and (3) Is in agreement with *Chesapeake 2000* goals for underwater bay grasses and invasive species.

CONCLUSIONS AND MANAGEMENT RECOMMENDATIONS

As of January, 2011, the DNR has reduced Maryland's mute swan population to <200 birds in accordance with humane standards, scientific findings, and the laws of Maryland. This reduction is considered by the DNR and the 2003 Mute Swan Task Force to be in the best interest of the Chesapeake Bay ecosystem. The DNR has demonstrated through a population model that using lethal control to maintain a population of about 500 adults would result in more swans being killed over the long term than if the swan population was reduced to as low a level as can be achieved. In other words, continued aggressive reduction of the current population will result in fewer swans being killed over the long term than attempting to maintain the current population. Ending the present population reduction effort would lead to rapid population growth that would ultimately mean that more mute swans would have to be killed to maintain a population level of 500 swans.

The DNR believes the mute swan population should be reduced to as low a level as can be achieved to protect critically important SAV beds and allow for the restoration of SAV, as well as minimize swan impacts to native wildlife and habitats. The management of mute swans in the Bay complements other efforts to protect and restore these habitats and should be viewed as part of a more comprehensive Bay restoration effort.

MANAGEMENT GOAL AND POPULATION OBJECTIVE

Management Goal

Manage the mute swan population in Maryland at a level that (1) minimizes the impacts on native wildlife and their habitat; (2) is consistent with the objectives of the Chesapeake 2000 Agreement; and (3) minimizes conflicts with humans.

Long-term Population Objective

Reduce the mute swan population to as few birds as possible, consistent with activities to protect, restore and enhance the Bay's Living Resources. Aggressive

reduction of the current population will result in fewer swans being killed over the long term. Achieving the long-term objective will eliminate the adverse ecological impacts on native wildlife and habitats and most human safety problems caused by mute swans. While it may be impossible to achieve in the immediate term, complete elimination of mute swans in the wild is the best ecological solution for the health of the Chesapeake estuary.

MANAGEMENT OBJECTIVES AND STRATEGIES

Mute swan population management objectives and strategies for the next decade and beyond are listed on the next several pages.

Public Outreach and Education

Implementation of mute swan management in Maryland must occur concurrently with an effort to educate and inform Maryland citizen's about mute swans. Public awareness about mute swans and the problems they cause increased greatly during implementation of the original mute swan plan for Maryland. These communication and education efforts should continue and seek to convey an understanding of the status of the mute swan population in Maryland, the impact of mute swans in the Bay's ecosystem, and the problems they create for people.

Objective: Increase public awareness of mute swans and their impacts upon the Bay's Living Resources

Strategy A-1: Target programs to specific demographic groups, as well as shoreline owners and watershed community residents. There is a need to increase public awareness of the difference between mute swans and native tundra swans and the impacts that mute swans have on the Chesapeake Bay ecosystem. Emphasis should also be placed on discouraging the winter-feeding of mute swans, which likely increases their winter survival.

Population Management and Resource Protection

The aggressive egg-addling program that began in 2001 will continue, with the objective of reducing reproductive output (i.e., cygnet production) by at least 60%. In addition to efforts by State and federal wildlife managers, the DNR will continue to involve nongovernmental organizations such as those concerned with tributary conservation.

Population modeling and experience in other states demonstrates that egg addling, while a valuable tool is unlikely to reduce the size of the swan population. For example, in Rhode Island, a long-term egg-addling program reduced recruitment by 80%, but the number of nesting pairs continued to grow. Further, egg addling does not address the impacts on SAV and other living resources caused by mute swans.

To achieve the management goals and objectives within this plan, it will be necessary to continue to remove subadult and adult swans using lethal means. The removal of subadult and adult mute swan from the wild will be linked to the protection of key resource areas.

Management actions identified in Strategies B-1 and B-2 that will be used to further reduce the swan population within areas of the State that are authorized under NR Article, Section 10 - 206 (Appendix B). Maryland DNR personnel are experienced and professional in their use of wildlife control methods, and methods are applied in accordance with humanely standards. For situations where it is necessary and practical to capture and euthanize swans, the DNR follows euthanasia methods recommended by the American Veterinary Medical Association.

Objective: Reduce the mute swan population to as few individuals as possible, quickly and efficiently, consistent with activities to protect, restore and enhance the Bay's Living Resources.

Strategy B-1: The DNR will continue to implement an aggressive egg addling effort to reduce hatching success by at least 60%. Implementation of this strategy will reduce the number of swans that would have to be removed by lethal means to achieve the long-term population objective. The DNR will make every effort to treat all swan nests located in public waters and on private property with landowner permission. The DNR will continue to involve local tributary organizations and other nongovernmental organizations to addle swan eggs.

Strategy B-2: The DNR will continue to remove mute swans from the State using lethal methods. Lethal methods will include both shooting and live capture and euthanasia. Swans killed under this strategy may be utilized for educational and scientific purposes.

The DNR will not authorize the relocation of swans within Maryland, including same-sex pairs, to natural habitats in Maryland. The relocation of mute swans into unoccupied habitats would increase the distribution of mute swan in Maryland.

The relocation of same-sex pairs does not prevent breeding if a bird of the opposite sex locates and enters the relocation site. The possibility of breeding with wild, opposite-sex birds is high and would contribute to expansion of the breeding population, which is contrary to the objective of this management plan and USFWS and Atlantic Flyway Council policies.

Mute swans may be captured and relocated to other jurisdictions outside of Maryland. However, any relocation of swans to other jurisdictions shall be done only with the approval of the government agency responsible for wildlife conservation in that jurisdiction and in accordance with any flyway mute swan management plan, policy, law, or regulation.

Strategy B-3: The DNR will continue to work with other states, flyway councils,

the International Association of Fish and Wildlife Agencies to facilitate efficient population management of this species.

Strategy B-4: The DNR will work with the Maryland General Assembly to amend existing state law (NR Article, Section 10-101), which classifies the mute swan as a Wetland Game Bird. The statute should be amended to include only native migratory game bird species. The DNR will also encourage the Maryland General Assembly to amend NR Article, Section 10-101, by adding the mute swan, Australian black swans, and other invasive, non-native bird species to the list of unprotected birds in Maryland. Presently, the only non-native, unprotected birds listed in this law are the English house sparrow and European starling.

Captive Mute Swan Management

Captive swans that either escape or are released may be insignificant in terms of numbers, but they can dramatically affect distribution by introducing swans to new areas of the State. The possession of captive mute swans is now regulated (COMAR 08.03.09.13) (Appendix D). Existing State permits authorizing mute swan possession include restrictive conditions that prevent the purchase, sale and exportation and importation of mute swans. The permit restrictions also prohibit reproduction and the release and escape of mute swans into the wild. After August 31, 2009, in general, no new permits will be issued to possess captive mute swans in Maryland. If a person reports that he or she possessed a mute swan prior to the end of the grandfathering period the request to possess the bird(s) will be reviewed on a case-by-case basis.

Objective: Prevent the escape and reproduction of captive mute swans.

Strategy C-1: Strictly enforce captive mute swan regulations that prohibit the sale, trade, barter, and importation of mute swans, or their eggs, in Maryland.

Strategy C-2: Annually inspect each facility where captive mute swans are held to ensure that permit conditions are being followed.

Strategy C-3: Annually advise licensed wildlife rehabilitators to contact the DNR whenever a mute swan is brought to their facility for rehabilitation. The DNR will make every effort to place the swan(s) in captivity at a facility permitted to possess mute swans. In the event that this is not possible, a Maryland licensed veterinarian or trained DNR employee will humanely euthanize the swan(s).

Relief of Human Safety and Nuisance Conflicts

Natural Resources Article, Sections 10-205 and 10-206 (Appendix B) authorize the DNR to resolve conflicts between mute swans and people by allowing either the capture or lethal removal of mute swans.

Objective: Reduce conflicts between mute swans and people.

Strategy D-1: The DNR with the U.S. Department of Agriculture's Wildlife Services will continue to provide technical information and guidance to property

owners who are experiencing nuisance, safety, and habitat depredation problems caused by mute swans. Wildlife Services and DNR personnel may suggest the use of nonlethal, lethal, or a combination of techniques to resolve swan conflicts. The recipient of technical assistance is responsible for securing the required State permit before implementation of recommended, lethal control actions.

Population Monitoring and Research

Objective: Monitor the size and distribution of the mute swan population and the effectiveness of management actions.

Strategy E-1: Conduct an annual spring aerial survey of mute swans in the tidal portions of the Bay to determine the locations of active mute swan nests and subadult and adult swans to facilitate effective egg addling and removal of swans from Swan-Free Areas.

Strategy E-2: Conduct an annual summer aerial survey of mute swans on the tidal portions of the Bay to determine the size and distribution of the swan population. This survey will also be used to measure the effectiveness of population control efforts and provide the locations of swans for removal from Swan-Free Areas, and other population control efforts.

Objective: Conduct additional research that will increase understanding of the role of mute swans in the Chesapeake Bay ecosystem and their impacts on living resources. This research should contribute to achieving mute swan management goals and objectives.

Strategy F-1: Complete ongoing research to determine the role of interspecific competition between mute swans and tundra swans.

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APPENDIX A: Mute Swan Advisory Committee and Migratory Game Bird Advisory Committee Recommendations

2009 Mute Swan Advisory Committee

The DNR's 2003 mute swan management plan was scheduled for a revision during the spring of 2009. In accordance with the need to review the status of the mute swan population and its ecological significance in Maryland's Chesapeake Bay waters, in early 2009, Secretary of Natural Resources John R. Griffin convened a group of representatives with various Chesapeake Bay conservation interests.

The Mute Swan Advisory Committee (hereafter Committee) was asked to advise the DNR on the most appropriate strategy to manage mute swans to ensure the long-term protection of important Chesapeake Bay living resources.

Report of the Mute Swan Advisory Committee

The Mute Swan Advisory Committee (hereafter Committee) was able to reach complete consensus on a number of important issues, which are unanimously forwarded as recommendations to the Secretary of Natural Resources for his consideration. These are:

- 1. DNR personnel should continue its egg-addling program to prevent recruitment of additional mute swans into the Chesapeake Bay population*
- 2. The DNR should not use managed hunting as a population control measure.*
- 3. The mute swan is not native to North America.*

There was not complete agreement among the Committee membership as to the way forward for mute swan management in Maryland and as a result, the Committee divided into two groups to prepare recommendations for the Secretary. The resulting "majority" report follows:

Majority Recommendation: Continue mute swan population reduction.

We believe that the mute swan is an environmental hazard to the Chesapeake Bay ecosystem and that the DNR should continue to reduce the feral mute swan population. It should be the objective of the DNR to reduce the mute swan population to as low a level as can be achieved.

1. The mute swan is a non-native bird that was accidentally introduced into the Chesapeake Bay ecosystem.
2. Mute swans are a clear and formidable threat to native wildlife species in Maryland, particularly to ground nesting colonial birds, which are undergoing population decline, in some cases into threatened and endangered status.

3. Mute swans feed aggressively upon Chesapeake Bay submerged aquatic vegetation and can have substantial detrimental impacts to this already stressed resource and hinder its restoration.
4. The laws of the State of Maryland (NR Article, Sec. 10-211) require the DNR to control Maryland's mute swan population.
5. The lethal control efforts that the DNR has undertaken to reduce mute swan numbers have been effective and humane.

A Threat to Native Wildlife

The mute swan is one of the world's most aggressive species of waterfowl. In Maryland, aggressive mute swan pairs have become a nuisance, preventing people from using shorelines where swans vigorously defend their nest and young during the breeding season. However, the effect that their aggressive behavior has had on native wildlife species is the greatest cause for concern. There are numerous reports of mute swans hazing and driving off other birds, including native tundra swans. Mute swans are responsible for the decline and loss of the northernmost nesting colony of black skimmers in the Chesapeake Bay. Restoration of this and other declining native birds simply cannot be accomplished in habitat they must share with mute swans. The inherent contradiction of any argument over how many swans is "too many" is that a single mute swan pair that displaces a declining native species may be too many.

A Threat to the Chesapeake Ecosystem

Mute swans are voracious feeders on the Chesapeake's submerged aquatic vegetation (SAV). The diet of mute swans consists nearly entirely of SAV. An adult mute swan eats an average of eight pounds of SAV daily. SAV is both an important ecosystem in itself and an important nursery area for the fish and crabs that are critical to the Chesapeake Bay estuary. SAV has declined throughout the Bay because of water quality impairment. When the mute swan population neared 4,000 animals, it has been calculated in published literature that mute swans could consume nearly 10% of all SAV each year, further stressing a habitat already well below its restoration goal. Clearly, without continued controls, mute swans are a threat to the native grass beds that remain.

Most waterfowl eat some SAV, but native species, with a few exceptions, are seasonal (fall-winter-spring) visitors to the Chesapeake Bay and consume SAV during its dormant time after seeds have been released. However, mute swans feed on SAV throughout the year, including during seed set. This lowers the potential for re-growth or expansion by these ecologically valuable plants.

Restoration of SAV is a major goal of the Chesapeake Bay restoration effort. Unfortunately, only 42% of the agreed upon goal of 185,000 acres has been achieved. The Bay states agreed to meet this goal by 2010. Various techniques have been experimented with to plant SAV. In some cases, SAV plantings have been destroyed by relatively few mute swans, necessitating the installation of fences in the restoration design – a feature that makes the restoration plot both more costly and smaller.

In addition to calling for the restoration of the Bay's SAV, the Chesapeake 2000 Agreement among the states and federal government calls for control of damaging exotic species. Six problematic species were identified and the mute swan is one of them. Therefore, Maryland is under an obligation to effectively control mute swans.

An Exotic Species

While opponents of lethal control of mute swans have continually cited various reasons for their purported belief that the mute swan is native to North America, there is no serious scientific debate upon the subject. The mute swan is clearly an exotic species, and today's population grew directly from a few birds that escaped captivity in 1962. While being an exotic does not necessitate being a harmful or invasive species, it does set aside claims that it is deserving of Threatened, Endangered, or any other special conservation status.

Not a Natural Resource

There is no good biological reason for maintaining a feral population of mute swans. As long as there is a pair of mute swans capable of reproduction in the wild there will be a need for the DNR to continually monitor them and prevent them from re-establishing a larger and more ecologically damaging population. Moreover, the contention that Maryland residents would somehow be deprived of their rights to enjoy viewing mute swans does not withstand logical examination. Marylanders may enjoy viewing elephants, crocodiles or pandas, but they do not suffer from having to go to contained facilities to watch them. There is no inherent right to unlimited access to animals even on private property if they present an ecological, economic, or safety threat to persons or property, much less a right to maintain a menagerie on public lands or waters. There are provisions for privately maintaining non-breeding pairs under controlled conditions. Marylanders can observe our native tundra swans and a variety of other waterfowl during the winter months.

Not a "Scapegoat"

There is no single cause for the decline of the ecological integrity of the Chesapeake estuary. It is a combination of many factors, some small and some large, each playing a part in degrading the Bay. Excess nitrogen and phosphorous from farms, sewage treatment plants, and air emissions cause eutrophication and subsequent 'dead zones'. Impervious surfaces in headwaters cause stream bank erosion and siltation. Toxic chemicals occasionally make fish dangerous to eat. In addition, invasive species, including the mute swan, nutria, the rapa whelk, and many other species in this category, put additional pressure on an already stressed system and the native species that must inhabit it. Each of these factors requires a solution and no single solution will cure them all. However, to suggest that only the largest of the watershed's myriad ills is worth society's efforts to solve them is not sensible. It is possible to address multiple stressors, regardless of magnitude of each, simultaneously.

The contention that Maryland is using the mute swan as a 'scapegoat' for the various challenges facing the Chesapeake Bay restoration effort that State and Federal Agencies have not been able to solve is not credible. Beside the fact that mute swans

have been scientifically shown to be a threat to SAV and native wildlife, the same agencies are committing huge amounts of effort to solving pollution, siltation, and, most notable, other invasive species. Nutria control alone costs nearly \$ 1,000,000.00 per year in Maryland, more than ten times the highest-ever annual cost of mute swan control.

While the mute swan is not the Chesapeake's greatest threat, years of study and experience in Maryland and elsewhere in North America have proven it a serious one. Moreover, it is a threat that the DNR has come remarkably close to actually resolving. Bringing the population of mute swans from nearly 4000 to about 500 today - an 80% reduction - is a substantial achievement. Bringing that number even lower – to a level that can be controlled for the long-term with minimal manpower and capital expenditure – would be an almost singular event in the checkered history of the Chesapeake Bay restoration effort, because it would effectively end the damage.

The Evidence is Compelling

The body of scientific evidence that has been assembled in order to make this decision is clear and compelling. In our deliberations on this issue, we examined the literature that was used to construct the original Maryland Mute Swan Management Plan and reviewed the work that has been conducted since the plan was issued in 2003, including work conducted here in Maryland. We are confident that a clear case has been made that the mute swan is a serious ecological liability in Maryland.

A Competitor for Scarce DNR Resources

Every mute swan activity that the DNR undertakes – whether it is monitoring the population, adding eggs, killing adults, or responding to public complaints and inquiries takes important resources away from the conservation of native wildlife species and habitat conservation projects that are desperately needed. It would not be responsible for the DNR to continue to allocate substantial limited resources to maintain the current large population of birds. A continuing feral mute swan population level near the current (approximately) 500 birds would be a constant and perpetual source of competition for scarce conservation resources.

The Law

The law of the State of Maryland is crystal clear concerning the mute swan: § 10-211. Population control of mute swan

- (a) Program established.- The DNR shall establish a program to control the population of the nonnative bird species known as the mute swan.

That the intent of the legislature was that the control program should include lethal control of adult swans is shown by the following section:

- (b) Scope of program.- The program established under this section, where appropriate, may include:
 - (1) The managed harvest of adult mute swans; and

(2) The solicitation of licensed hunters to participate in the managed harvest of adult mute swans established under this subsection [2001, ch. 679]

The DNR (correctly in our view) chose to use an integrated approach of removing adults and egg addling by wildlife professional staff rather than managed harvest (hunting) to reduce mute swan numbers to their current level. This should remain the strategy going forward.

A Humane Solution

The DNR's lethal control operations in the mute swan control effort have been guided by the American Veterinary Medical Association's (AMVET) Guidelines for Humane Euthanasia which incorporates the best available definitions of what constitutes a humane procedure. It is the same set of criteria that is used by animal shelters throughout the country. We believe that the lethal control effort that the DNR has conducted has been humane, as well as safe and effective. It has been demonstrated that egg addling alone is insufficient to halt the growth of a mute swan population in North America because the adult swans are long-lived (25 years) and 100% addling cannot be achieved. Maryland DNR staff demonstrated through a straightforward model that using lethal control to maintain a population of 500 adults would result in more swans being killed over the long term than if the swan population was reduced to as low a level as can be achieved. In other words, the continuing aggressive reduction of the current population will result in fewer swans being killed over the long term than attempting to maintain the current population. Ending lethal control would lead to rapid population growth that would ultimately mean that more mute swans would have to be killed to maintain a population level of 500 swans.

The DNR has been very successful in reducing Maryland's mute swan population in accordance with humane standards, scientific findings, the laws of Maryland, and the best interest of the Chesapeake Bay ecosystem. We believe that it is very important for this population reduction effort to continue to reduce the mute swan population to as low a level as can be achieved.

Lee Karrh, Chesapeake Bay Program SAV Workgroup
Dr. Matthew C. Perry, US Geological Survey, Patuxent Wildlife Research Center
Kirk Mantay, Ducks Unlimited, Inc.
Ladd Johnson, Chairman, Maryland Migratory Game Bird Advisory Committee
Chris Dollar, Maryland Wildlife Advisory Commission
Dr. Kent Mountford, Ecologist and Historian
Dr. Chris Haney, Defenders of Wildlife
Jonathan McKnight, Maryland Department of Natural Resources
Larry McGowan, U.S. Fish and Wildlife Service, Blackwater National Wildlife Refuge
Gerald W. Winegrad, Former Maryland Senator, University of Maryland

Date: May 15, 2009

DNR Migratory Game Bird Advisory Committee Recommendations

On April 9, 2010, the DNR Waterfowl Advisory Committee endorsed the majority report of the Mute Swan Advisory Committee and recommended that the mute swan population be reduced to as few individual as possible. The Committee also recommended that the legal protection for the species be removed by amending the existing definition of NR Article, Section 10-201 to include only native species of wetland game birds. In addition, the Committee recommended that NR Article, Section 10-201 be amended to include the mute and Australian black swan as unprotected birds, along with the European starling and English house sparrow.

APPENDIX B: Maryland Statutes Pertaining to Mute Swan Management

Statutes within the Annotated Code of the Public General Laws of Maryland that pertain to management actions identified in this plan:

Natural Resources Article (NR), Section 10-101 includes the definition of wetland game birds. "Wetland game birds" mean brant, coots, ducks, gallinules, geese, mergansers, rails, snipe, and swan or any part, egg, offspring, or dead body of any of them. This section also defines unprotected birds. "Unprotected bird," means any English sparrow and European starling or any part, egg, offspring, or dead body of any of them.

NR Article, Section 10-205 authorizes the Department of Natural Resources (DNR) to adopt regulations to enlarge, extend, restrict or prohibit hunting, possessing, purchasing, shipping, carrying, transporting, or exporting wildlife.

NR Article, Section 10-206 authorizes the DNR to reduce the wildlife population in any county, election district, or other identifiable area after a thorough investigation reveals that protected wildlife is seriously injurious to agricultural or other interests in the affected area. The method of reducing the population is at the DNR's discretion.

NR Article, Section 10-211 requires the DNR to establish a program to control the population of mute swans; authorizing the DNR to include the managed harvest of adult mute swans in this program; authorizing the DNR to solicit licensed hunters to participate in the managed harvest of adult mute swans; and generally relating to the management of the mute swan population.

NR Article, Section 10-903 provides statutory authority for the DNR to adopt regulations that prohibit or restrict the importation, exportation, sale, release, or possession of wildlife not native to Maryland on a finding that the wildlife is harmful to native wildlife or to natural ecosystems.

NR Article, Section 10-905 prescribes the Game Husbandry License. The license specifies which species of game birds, which can be bred, raised, protected, or sold and for what purpose, the type of fencing or other requirements necessary to prevent undesirable mixing of native wildlife and the captive game birds, and any other conditions necessary to ensure adequate protection of native wildlife.

NR Article, Section 10-908 prescribes the Wildlife Cooperator Permit. The permit allows any properly accredited person desiring to assist the DNR in the control of wildlife

injurious to agriculture or other interests, or to provide care and treatment of sick or injured wildlife for rehabilitation and release back into the wild. The DNR may adopt regulations governing the issuance, revocation, terms, and conditions of the permit.

APPENDIX C: Public Policies that Guide DNR Swan Management

There is no central federal authority over exotics, but there are some laws that do apply when federal funds or authority crosses paths with exotic species.

The Chesapeake 2000 Agreement

The Agreement (<http://chesapeakebay.net/agreement.htm>), signed by the Governors of Maryland, Pennsylvania, Virginia, the Mayor of the District of Columbia, Chesapeake Bay Commission, and the Environmental Protection Agency representing the federal government includes the following relevant goals:

Living Resources: Restore, enhance and protect the finfish, shellfish and other living resources, their habitats and ecological relationships to sustain all fisheries and provide for a balanced ecosystem.

Exotic Species:

- 1) By 2001, identify and rank non-native, invasive aquatic and terrestrial species, which are causing or have the potential to cause significant negative impacts to the Bay's aquatic ecosystem;
- 2) By 2003, develop and implement management plans for those species deemed problematic to the restoration and integrity of the Bay's ecosystem.

Vital Habitat Protection and Restoration: Preserve, protect and restore those habitats and natural areas that are vital to the survival and diversity of the living resources of the Bay and its rivers.

Submerged Aquatic Vegetation (SAV): Recommit to the existing goal of protecting and restoring 114,000 acres of SAV.

- 1) By 2002, revise SAV restoration goals and strategies to reflect historic abundance, measured as acreage and density from the 1930s to the present. The revised goals should include specific levels of water clarity, which are to be met in 2010. Strategies to achieve these goals will address water clarity, water quality and bottom disturbance.
- 2) By 2002, implement a strategy to accelerate protection and restoration of SAV beds in area of critical importance to the Bay's living resources.

Executive Order 13112 of February 3, 1999 - Invasive Species Laws & Regulations

Executive Order 13112 signed by President Bill Clinton directs each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law, to (1) identify such actions, and (2) subject to the availability of appropriations, and within Administrative budgets limits, use relevant programs and authorities to (i) prevent the introduction of invasive species; (ii) detect

and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner; (iii) monitor invasive species populations accurately and reliably; (iv) provide for restoration of native species and habitat conditions in ecosystems that have been invaded; (v) conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species; and (vi) promote public education on invasive species and the means to address them.

National Invasive Species Act

The National Invasive Species Act of 1996 (amends the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990) and creates the Aquatic Nuisance Species Task Force (ANSTF). Although it was created to specifically deal with ballast water issues (zebra mussel), it does include other items. It specifically mentions the Chesapeake Bay as in need of attention because it is the largest recipient of ballast water on the East Coast. The Chesapeake Bay Program has an ex-officio member on the ANSTF.

In part, the purpose of the act includes the prevention of unintentional introduction and dispersal of nonindigenous species into the waters of the United States and to develop and carry out environmentally sound control methods to prevent, monitor and control unintentional introductions of nonindigenous species from pathways other than ballast water.

The ANSTF, under Sec. 1202(c)(2) Implementation - Whenever the ANSTF determines that there is a substantial risk of unintentional introduction of an aquatic nuisance species by an identified pathway and that the adverse consequences of such an introduction are likely to be substantial, the ANSTF shall, acting through the appropriate federal agency, and after an opportunity for public comment, carry out cooperative, environmentally sound efforts with regional, state and local entities to minimize the risk of such an introduction.

Under Sec. 1202 (e) Control - The ANSTF may develop cooperative efforts to control established aquatic nuisance species to minimize the risk of harm to the environment and the public health and welfare. The ANSTF can develop a control program to achieve a targeted level of control.

U.S. Fish and Wildlife Service Policy to Control Mute Swans on Federal Lands:

Letter from USFWS Director dated March 26, 1996, to USFWS Regional Directors directing all USFWS managers to take effective steps to control mute swans on lands under their jurisdiction to protect those habitats from degradation and destruction by mute swans. Further the managers were directed to increase public awareness as an integral part of the policy to control mute swans on USFWS lands. This policy affects management of swans on the USFWS Chesapeake Marshland National Wildlife Refuge Complex (Blackwater, Martin, Barren Island, Susquehanna, Bishops Head, and Spring Island) and Eastern Neck National Wildlife Refuge within the state. No state permit is needed by federal agencies to control swans on federal lands.

Maryland Senate Joint Resolution 15

A Senate Joint Resolution concerning Natural Resources - Mute Swans - Federal Agency Control Measures for the purpose of urging the U.S. Fish and Wildlife Service to act with expedience to craft and conduct appropriate regulatory processes which will allow Maryland to establish a method of controlling the mute swan population and to mitigate the mute swan population's impact permanently and statewide; urging the U.S. Department of the Interior to appeal a certain holding; and generally relating to certain federal agency measures to control the mute swan population.

Whereas, the bird species known as the mute swan is not native to the Chesapeake Bay; and

Whereas, surveys of the Chesapeake Bay indicate that the mute swan population is growing at an alarming rate, increasing from less than 100 birds in 1973 to nearly 4,000 in 1999; and

Whereas, mute swans negatively impact native species and habitats in parts of the Chesapeake Bay by displacing State-listed nesting waterbirds and removing large amounts of submerged aquatic vegetation which is vital to all life in the Bay; and

Whereas, mute swans have repeatedly disrupted efforts to restore submerged aquatic vegetation, obstructing progress toward the Chesapeake 2000 Agreement goal of restoring 114,000 acres of the vegetation by 2010; and

Whereas, the U.S. Court of Appeals for the District of Columbia ruled that mute swans are protected by U.S. Fish and Wildlife Service regulations governing activities involving direct contact with protected birds under the Migratory Bird Treaty Act; and

Whereas, the Maryland General Assembly passed House Bill 728 during the 2001 Legislative Session, requiring the DNR to establish a program to control the State's mute swan population; and

Whereas, the urgent need to plan and implement mute swan population control measures and to mitigate mute swan impacts increases exponentially each year; now therefore, be it

Resolved by the General Assembly of Maryland, that the U.S. Fish and Wildlife Service is urged to act with expedience to craft and conduct appropriate regulatory processes which will allow Maryland to establish a method of controlling the mute swan population and to mitigate the mute swan population's impact permanently and statewide; and be it further

Resolved, that the United States Department of the Interior is urged to appeal the holding of the U.S. Court of Appeals for the District of Columbia that declared the mute swan to be a migratory bird protected under international treaties; and be it further

Resolved, that a copy of this Resolution be forwarded by the Department of Legislative Services to the Honorable Parris N. Glendening, Governor of Maryland; the Honorable Thomas V. Mike Miller, Jr., President of the Senate of Maryland; the

Honorable Casper R. Taylor, Jr., Speaker of the House of Delegates; the Honorable Barbara A. Mikulski, U.S. Senate, 709 Hart Senate Office Building, Washington, D.C. 20510; the Honorable Paul S. Sarbanes, U.S. Senate, 309 Hart Senate Office Building, Washington, D.C. 20510; the Honorable Wayne T. Gilchrest, U.S. Congress, 2245 Rayburn House Office Building, Washington, D.C. 20515; the Honorable Robert L. Ehrlich, Jr., U.S. Congress, 1632 Longworth House Office Building, Washington, D.C. 20515; the Honorable Benjamin L. Cardin, U.S. Congress, 2267 Rayburn House Office Building, Washington, D.C. 20515; the Honorable Albert R. Wynn, U.S. Congress, 434 Cannon Office Building, Washington, D.C. 20515; the Honorable Steny H. Hoyer, U.S. Congress, 1705 Longworth House Office Building, Washington, D.C. 20515; the Honorable Roscoe G. Bartlett, U.S. Congress, 2412 Rayburn House Office Building, Washington, D.C. 20515; the Honorable Elijah E. Cummings, U.S. Congress, 1632 Longworth House Office Building, Washington, D.C. 20515; the Honorable Constance A. Morella, U.S. Congress, 2228 Rayburn House Office Building, Washington, D.C. 20515; the Honorable Gale A. Norton, Secretary of the Interior, U.S. Department of the Interior, 1849 C Street NW, Washington, D.C. 20240; Mr. Marshall Jones, Director (Acting), U.S. Fish and Wildlife Service, 1849 C Street NW, Washington, D.C. 20240; and Mr. Jon Andrew, Chief, U.S. Fish and Wildlife Service, Division of Migratory Bird Management, 4401 N. Fairfax Drive, Arlington, VA 22203.

Atlantic Flyway Council Policy (August 1, 1997) to Control Mute Swans in the Atlantic Flyway:

The policy endorses the following actions:

- 1) State and provincial wildlife agencies, if they do not already have the authority, should seek to gain authority over the sale and possession of mute swans and their eggs.
- 2) The sale of mute swan adults, young or their eggs should be prohibited.
- 3) States should seek to eliminate all importing and exporting of mute swans without a special purpose permit issued by the state wildlife agency.
- 4) Mute swan captured due to nuisance complaints, sickness, or injury should be removed from the wild or be euthanized.
- 5) Egg addling program where feasible should be encouraged.
- 6) Both 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 level that will have minimal impacts to native wildlife species or habitats.

APPENDIX D: Maryland Regulations Pertaining to Mute Swan Management

08.03.09.13

.13 Possession and Trade of Captive Mute Swans.

A. Except as provided in §B of this regulation, it shall be a violation to buy, sell, barter, trade, or transfer any mute swan or mute swan eggs to or from another person.

B. Prior to March 1, 2009, a permittee may sell or transfer mute swans to a person residing in another state if the permittee has:

(1) A letter from the state agency responsible for managing wildlife in the destination state authorizing the import of mute swans; and

(2) A letter from the Service authorizing the export of mute swans from the State.

C. A person may not possess a mute swan unless permitted under this regulation. Possession shall include any mute swan held in an enclosure, pinioned to prevent its escape, or otherwise confined on a person's property.

D. A person may apply, through August 31, 2009, for a permit to possess a mute swan by completing a form prescribed by the Service. After that date, the Service may not issue permits allowing the possession of mute swans.

E. A person permitted to possess mute swans shall:

(1) Render all mute swans incapable of flight by:

(a) Surgically pinioning one wing; or

(b) Confining mute swans in a completely closed enclosure that prevents escape;

(2) Addle or destroy all mute swan eggs to prevent the production of cygnets;

(3) Mark all mute swans with a metal leg band inscribed with the owner's name, address, and telephone number; and

(4) Submit an annual report and permit renewal as specified by the Service.

F. Addling under §E(2) of this regulation may include shaking, pricking, freezing, and oiling by coating the eggs with 100 percent food-grade corn oil.

G. It is a violation of this regulation to release any mute swan to the wild.

H. A permittee shall notify the Director or the Director's designee of any escape of mute swans into the wild within 48 hours after learning of the escape.

I. Permittees shall be subject to inspection by the DNR at any reasonable hour.

J. Any violation of any provision or restriction of the permit constitutes a violation of this regulation.

APPENDIX E: Review of 2003 Plan Accomplishments

The 2003 plan established goals, objectives and specific strategies to accomplish them. Much work was conducted on mute swan and a great deal of new information was obtained to assist managers. This section is a quick checklist of the status of each strategy for each plan objective. More comprehensive discussion occurs in the related rationale statements for the new plan.

Public Outreach and Education

Implementation of mute swan management in Maryland must occur concurrently with an effort to educate and inform Maryland citizen's about mute swans. These programs should convey an understanding of the status of the mute swan population in Maryland, the impact of mute swans in the Bay's ecosystem, and the problems they create for people.

Objective: Increase public awareness about mute swans and their impact to the Bay's Living Resources

Strategy A -1: Conduct a statewide, random survey of public knowledge, perceptions and values regarding mute swans in Maryland.

In 2005, the Gemstone Research Team affiliated with the University Maryland conducted a statewide voter survey to assess the Maryland public awareness of the mute swan and attitudes toward control mechanisms given the harmful effects the mute swan is having on the Bay.

Mason-Dixon Polling and Research Inc., was contracted to help format and perform the actual survey and provide basic statistics on the responses. The format of the survey was a telephone survey that consisted of 33 questions. The population sample was obtained from a random sample of Maryland residents that were stratified geographically based on either zip code or county. The minimum number of responses required to obtain a meaningful conclusion from the survey that was representative of the entire region was determined to be 600. The actual survey was performed on February 23-25, 2005. A total of 625 registered voters were surveyed.

The results from the survey overwhelmingly favored the fact that the public was uneducated on the mute swan, and further that if a problem did exist, a vast majority would vote in favor of controlling the swan population, regardless of their overall aesthetic appeal.

One of the survey objectives was to assess the attitude of the public towards the DNR in relation with the mute swan. Of the respondents, 86.4 % supported the DNR in taking aggressive measures in controlling the mute swan population. Of those responding that aggressive measures would be necessary, 61.9% supported the use of lethal methods for control. An extension of both of these responses, 82.6% of the respondents thought it essential that the DNR should regulate the mute swan population because of the scientific evidence currently available. Seventy-two percent of respondents were confident in the DNR's methods in implementing a control mechanism that was both humane and effective in solving the mute swan problem.

Essentially all respondents, (90.4%) supported the DNR in allotting resources to increase public awareness in relation to the mute swan and the Chesapeake Bay. The numbers stated here provide unquestionable, substantial evidence that the public is in favor of mute swan control implemented by the DNR.

Another survey objective was to determine the public knowledge of the mute swan and the concern the public had of the Chesapeake Bay welfare. Almost all (99.6%) of respondents surveyed thought that the Chesapeake Bay was essential to Maryland's economy and ecological health. Of the respondents, 86.2% thought that if evidence existed that showed the mute swans did threaten the Bay, control or elimination of the population should be taken by the DNR in addressing this problem. The survey showed that the public has little exposure and knowledge of the mute swan species or other variations of swan species residing in the Chesapeake Bay. The survey also showed that if presented with evidence, the public would support control measures for the swan due to the opinion that the Bay's health was more important than a swan population.

Strategy A-2: Develop and implement a comprehensive mute swan communication program.

The DNR included information about mute swans, their impacts, and recent mute swans research on the invasive species and waterfowl sites: <http://www.dnr.state.md.us/wildlife/invintro.asp> and <http://www.dnr.state.md.us/wildlife/waterfowl.asp>. Additional information regarding mute swans and their management was frequently provided to the public in DNR responses to media inquiries and the periodic attempts by the Humane Society of the United States to raise the issue of swan population control.

Population Management and Resource Protection

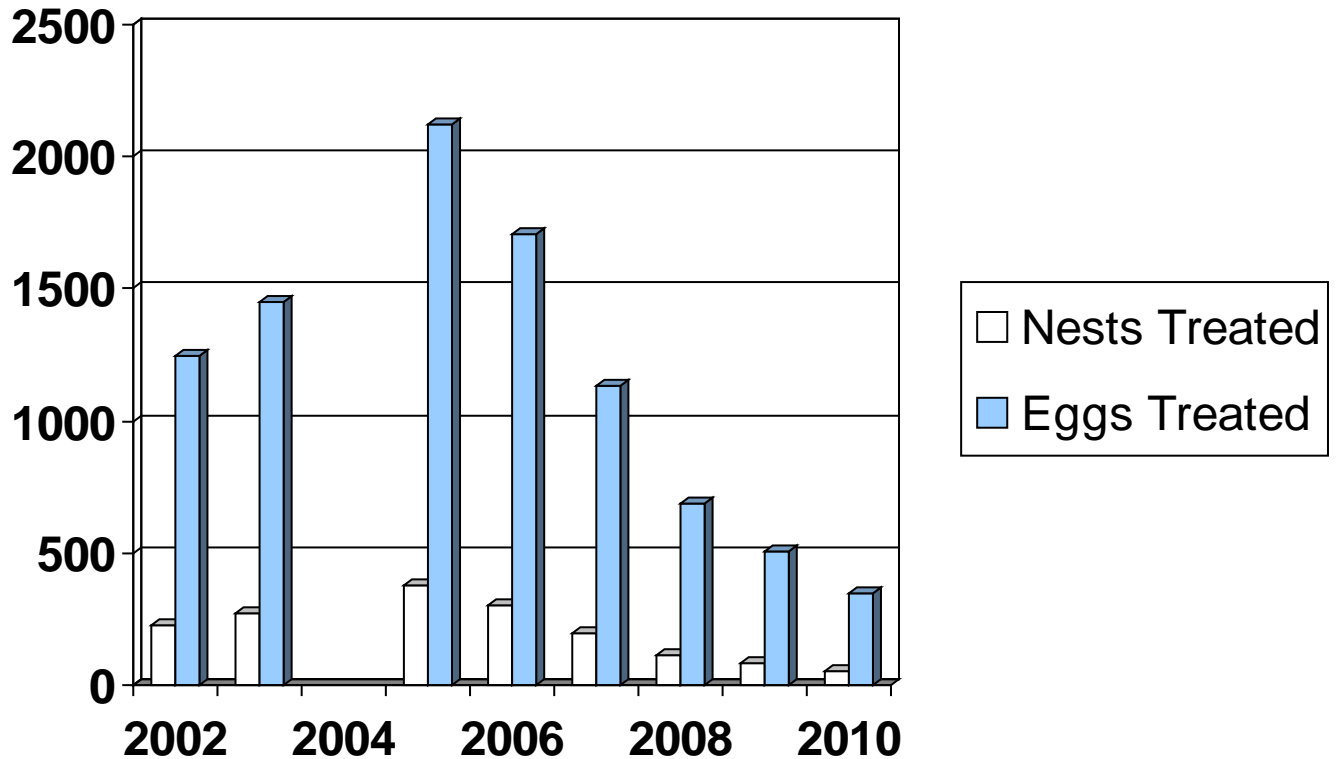
An aggressive egg-addling program began in 2001 and will be continued, with the objective of reducing reproductive output (e.g., cygnet production) by at least 60%. Population modeling and experience in other states demonstrates that egg addling, while a valuable tool, is unlikely to reduce the size of the swan population. Further, egg addling does not address the impacts on SAV and other living resources caused by an overabundance of mute swans.

To achieve the management goals and objectives within this plan, it will be necessary to remove subadult and adult swans. The removal of subadult and adult mute swan from the wild will be linked to the protection of key resource areas.

Objective: Exclude or remove all mute swans from Swan-Free Areas to afford protection to habitats critical to the Bay's Living Resources; reduce the mute swan population as quickly and efficiently as possible, consistent with activities to protect, restore and enhance the Bay's Living Resources.

Strategy B-1: The DNR will continue to implement an aggressive egg addling effort to reduce hatching success by at least 60%.

Each spring (April-May), DNR staff located mute swan nests by aerial surveys and treated as many swan nest as possible to reduce hatching success and to reduce the number of swans that would be killed. Between 2002 and 2010, 1,652 nests containing 9,199 eggs were treated or destroyed. No nest treatment was done in 2004 due to a federal court injunction filed by the Humane Society of the United States.



The DNR assisted the U.S. Fish and Wildlife Service and U.S. Congressman Wayne Gilchrist with the passage of the Migratory Bird Reform Treaty Act of 2004, which removed mute swans from the List of Migratory Birds (50 CFR 10.13), and thus, eliminated federal protection of the species. The result was management of the species was again delegated to state wildlife agencies.

Strategy B-2: Starting in 2003, the DNR will seek federal authorization (Depredation Order 50 CFR Part 21.41) to begin removing mute swans from Swan-Free Areas. Beginning in 2003, the DNR will initiate activities to either prevent or remove mute swans from occupying Swan-Free Areas.

The passage of the Migratory Bird Treaty Reform Act of 2004 eliminated federal regulatory authority for mute swans. Thus, beginning in the spring of 2005 the DNR began removing mute swans from Swan Free Areas. Using a combination of nest and egg treatment and lethal control of adult swans the population was reduced to 208 in 2010. Additional swans have been removed since the 2010 survey.

Strategy B-3: The DNR will work with other states, flyway councils, the International Association of Fish and Wildlife Agencies, and the USFWS to develop federal regulatory language to facilitate efficient population management.

The DNR assisted the Atlantic Flyway Council and the U.S. Fish and Wildlife Service's Chesapeake Bay Program with the development of mute swan management plans. The DNR also assisted U.S. Congressman Wayne Gilchrist with the passage of the Migratory Bird Treaty Reform Act of 2004.

Strategy B-4: The DNR will work with the Maryland General Assembly to amend existing state law (NR Article, Section 10-101), which classifies the mute swan as a Wetland Game Bird.

The statute should be amended to include only native migratory game bird species. The DNR will also encourage the Maryland General Assembly, consistent with federal regulations, to amend NR Article, Section 10-101, by adding the mute swan, Australian black swans, and other invasive, non-native bird species to the list of unprotected birds in Maryland. Presently, the only non-native, unprotected birds listed in this law are the English house sparrow and European starling.

Work on this strategy was delayed until the mute swan population was reduced to a level that no longer required a significant effort by the DNR to control this species.

Captive Mute Swan Management

Captive swans that either escape or are released may be insignificant in terms of numbers, but they can dramatically affect distribution by introducing swans to new areas of the state. State regulations and policies will be developed to prevent the release and escape of mute swans into the wild. Natural Resources Article, Sections 10-205, 10-903, and 10-905 (Appendix B) give the authority to the DNR to adopt regulations to restrict, possession, purchase, sale and exportation and importation of wildlife. Further, the DNR has the authority to require persons who possess mute swans to obtain a state permit.

Objective: Prevent the escape and reproduction of captive mute swans.

Strategy C-1: In 2003, promulgate regulations and/or add conditions to federal and state permits that prohibit the sale, trade, barter, and importation of mute swans, or their eggs, in Maryland.

The DNR promulgated regulations (COMAR 08.03.09.13) that prohibit the sale, trade, barter, and importation of mute swan, or their eggs, in Maryland.

Strategy C-2: Persons possessing mute swans now must possess either a Federal Waterfowl Sale and Disposal Permit or a federal Form 3-186. Persons possessing mute swans will be required by the DNR to secure a state permit. However, the DNR shall only permit the possession of mute swans at locations where swans have legally been held in captivity prior to enactment of state regulations. After this date, the DNR will not authorize any additional state permits to purchase or import mute swans.

The passage of the Migratory Bird Treaty Reform Act of 2004 removed mute swan from the List of Migratory Birds (50 CFR 10.13) thus, federal authorization to

possess mute swans is no longer required by federal law or regulation. Those persons who previously held mute swan in captivity in Maryland were notified that they had until August 31, 2009 to either get rid of their swans or obtain a DNR permit to possess the birds. Presently, 12 permittees have been authorized to keep up to 23 mute swans in captivity.

Strategy C-3: In 2003, promulgate state regulations or add conditions to all federal and state permits governing the possession of migratory birds, prohibiting the release of mute swans to the wild. Following capture of healthy swans and/or recovery of sick or injured swans, every effort will be made by the DNR to place the swans in captivity at a facility permitted to possess mute swans. In the event that this is not possible, swan(s) will be humanely euthanized by a veterinarian authorized by DNR in accordance with a federal permit.

The DNR promulgated regulations (COMAR 08.03.09.13) that prohibit the sale, trade, barter, and importation of mute swan, or their eggs, in Maryland. The permit also prohibits the release of birds to the wild in Maryland. Since the adoption of the 2003 plan, no sick or injured mute swans have been delivered to license wildlife rehabilitators.

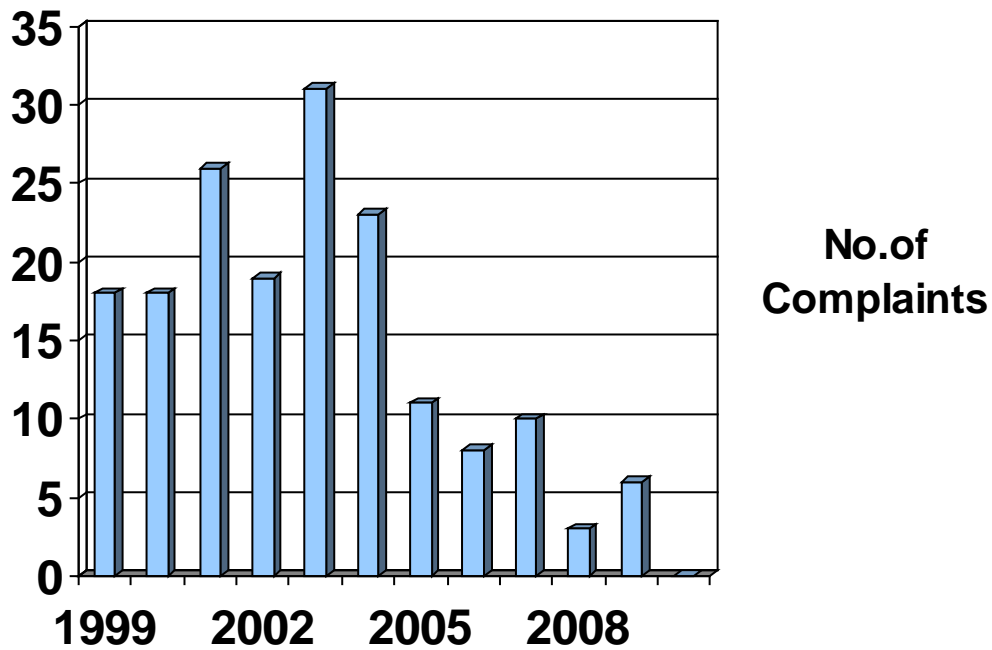
Relief of Human Safety and Nuisance Conflicts

Natural Resources Article, Sections 10-205 and 10-206 (Appendix B) authorize the DNR to resolve conflicts between mute swans and people by allowing either the capture or lethal removal of mute swans.

Objective: Reduce conflicts between mute swans and people.

Strategy D-1: The DNR with the U.S. Department of Agriculture's Wildlife Services will continue to provide technical information and guidance to property owners who are experiencing nuisance, safety, and habitat depredation problems caused by mute swans.

A minimum of 92 instances of conflicts between mute swans and people were recorded from 1999 to 2010 (USDA Wildlife Services). Technical assistance was provided by USDA Wildlife Services and DNR staff to assist property owners with problems caused by mute swans.



Strategy D-2: In 2003, the DNR shall seek a Federal Depredation Order that will authorize property owners, land or water management authorities, municipalities, and other responsible parties in Maryland to control or remove mute swans occurring on lands or waters under their jurisdiction.

The passage of the Migratory Bird Treaty Reform Act of 2004 removed mute swan from the List of Migratory Birds (50 CFR 10.13) thus, a federal Depredation Order was not needed to authorize property owners to remove problem swans. State permits (5-year duration) were issued to about 30 persons (17 currently active) authorizing them to remove swans causing depredation or public safety problems.

Population Monitoring and Research

Objective: Monitor the size and distribution of the mute swan population and the effectiveness of management actions.

Strategy E-1: Conduct an annual spring aerial survey of mute swans in the tidal portions of the Bay to determine the locations of active mute swan nests and breeding pairs to facilitate effective egg addling and removal of swans from Swan-Free Areas.

Aerial surveys were flown each April in 2003, 2005-2010 to locate active mute swan nests and subadult and adult swans for population control.

Strategy E-2: Conduct an annual summer aerial survey of mute swans on the tidal portions of the Bay to determine the size and distribution of the swan population. This survey will also be used to measure the effectiveness of population control efforts and provide the locations of breeding pairs for removal of swans from Swan-Free Areas, and

other population control efforts.

Aerial surveys were flown each September in 2005-2009. The number of swans declined from 3,624 in 2002 to 208 in 2010.

Objective: Conduct additional research that will increase understanding of the role of mute swans in the Chesapeake Bay ecosystem and their impacts on living resources. This research should contribute to achieving mute swan management goals and objectives.

Strategy F-1: Beginning in 2003, investigate further the role of mute swan herbivory on SAV growth, biomass, plant survival, and regeneration and reproduction, especially as it relates to the availability of SAV to wintering waterfowl and the achievement of SAV restoration goals.

The DNR funded two major studies to determine the role of swan grazing on SAV. These studies were conducted by graduate students from West Virginia and Cornell University.

Tatu et al. (2007a) measured vegetation characteristics (i.e., percent cover, shoot density, and canopy height) of SAV beds in controls (unfenced), 2-year exclosures, and 1-year exclosures at 18 sites in the Chesapeake Bay, Maryland, USA, to quantify the impact of herbivory by mute swans on SAV during 2003 and 2004. Mute swan herbivory had a substantial adverse impact on percent cover, shoot density, and canopy height of SAV. At the end of the study mean percent cover, shoot density, and canopy height in the controls were lower by 79%, 76%, and 40%, respectively, as compared to those in 2-year exclosures. During 2004, percent cover, shoot density, and canopy height increased by 26%, 15%, and 22%, respectively, between early and late seasons of SAV growth in exclosures, but they decreased by 36%, 41%, and 18%, respectively, in the controls. Paired mute swans predominantly occupied 6 of 7 moderate-depth sites (0.76-0.99 m), and these sites experienced less (i.e., 32–75%) SAV reduction. All (n = 7) shallow water sites (0.50-0.75 m) were predominantly occupied by mute swan flocks, and percent cover reduction of SAV was as high as 75-100% at these sites. Mute swan flocks also predominantly occupied three of the five deep-water sites (≥ 1 m) and one of seven moderate-depth sites, wherein we recorded considerable (i.e., 77-93%) SAV reduction. Thus, considering that flocks are more detrimental to SAV as compared to paired mute swans, we recommend that initial emphasis primarily be placed on controlling mute swans in flocks and secondarily on pairs.

Tatu et al. (2007b) studied the intensity of mute swan feeding activity in the Maryland portion of Chesapeake Bay between May - August 2003 and from March - August 2004. Mute Swans spent more time feeding (38.4%) than in non-foraging activities, including swimming (21.8%), resting (18.4%), self-maintenance (18.6%), agonistic activity (1.7%), and disturbance-induced activities (1.2%). Feeding intensity was not influenced by seasons (spring and summer). Mute Swans foraged more actively during the morning than they did midday. Mute Swans in flocks (2 three individuals) spent more time feeding than those in pairs and birds in larger flocks spent more time feeding than those in smaller flocks.

Tatu et al. (2007) developed a predictive model to determine the effect of mute swan herbivory along with other potential factors upon SAV for the entire bay. Based on biology and current knowledge of SAV and mute swans in the bay, researchers developed a suite of 15 *a priori* candidate models that could potentially predict SAV cover decline in the bay. Each model had mute swan population and/or one or more other potential environmental factors as independent variables (predictors) and SAV-percent-cover decline as the dependent variable. They generated data by measuring SAV percent cover reduction, water depth, extent of light penetration, salinity, and number of mute swan at 18 sites. Using these localized data, they further ranked all the candidate models through Akaike's Information Criterion (AICc) model selection. Based on the smallest value of AICc, they selected the predictive model including four predictors (water depth, extent of light penetration, salinity, and number of mute swans) as the most parsimonious model. Their research showed that it was clear that mute swans contribute to SAV decline, but it is not the most important factor. Mute Swans likely cause a synergistic effect with abiotic variables, resulting in increased SAV decline in the Bay. They concluded that mute swan control should be used along with other practices to combat SAV decline in the Chesapeake Bay.

Sousa et al (2008) tracked male mute swans ($n = 2$) in 2002 and in 2003 ($n = 3$) using Global Positioning System (GPS) in a 217,500-ha area of the Chesapeake Bay in Maryland. They quantified habitat use among four habitat categories (submerged aquatic vegetation, open water, shoreline, and upland) and between diurnal and nocturnal periods. Swans did not use habitats in proportion to their availability; they consistently used uplands less often than what was available within their home ranges. Most use occurred within submerged aquatic vegetation (SAV) and open water, which typically were the most abundant habitat types. When SAV was used, most locations were within sparse to moderately dense vegetation (11%-70% horizontal coverage). Diurnal and nocturnal use of habitats was similar. Although the sample size in our study was small, we believe this information is representative of the mute swan population in Chesapeake Bay because ground observations confirmed GPS-marked individuals always were within flocks ranging from 30-400 individuals. Given that mute swans were found in SAV frequently and are known to feed on it, they may negatively impact SAV coverage in the Chesapeake Bay. Control of mute swans in the Chesapeake Bay may be considered a viable conservation strategy for SAV restoration.

Strategy F-2: Beginning in 2003, determine the role of interspecific competition between mute swans and native wildlife, especially the impact of mute swans on wintering tundra swans.

Tatu (2006) reported that interspecific agonistic activity was carried out only by paired mute swans in Maryland. A feeding individual in a pair rushed aggressively towards a great blue heron when the heron waiting for its prey occurred in the proximity of the swan, which was swimming slowly while feeding. The heron was compelled to fly away due to the aggressive behavior, which took place twice during a single event. Loud hissing was directed towards humans when people closely approached paired swans with and without young. We speculate that more agonistic behavior probably occurred during mating and nesting which occurs between late February and early March.

Sousa et al. (unpubl. data) attempted to characterize and quantify the aggressive behavior of mute swans toward tundra swans in 2004 and 2005 in Maryland by using motorized decoys of tundra swan to measure the agonistic behavior of mute swans. Each encounter was recorded on video. Preliminary results show that nonbreeding swans in flocks showed no agonistic behavior toward tundra swan decoys. However, both busking display and physical attacks were made by paired mute swans toward tundra swan decoys. All aggressive encounters occurred in <3 minutes. Male mute swans were more aggressive than females (9:1)

Objective: Investigate the use of nonlethal swan population control methods.

Strategy G-1: The DNR will continue to evaluate nonlethal methods of controlling mute swans. Such methods shall include exclusion, hazing (e.g., harassment), and any other methods that may become available.

No evaluation of nonlethal methods was conducted by the DNR in recognition that they would be ineffective or impractical to protect living resources in Swan Free Areas.

Strategy G-2: The DNR will evaluate the effectiveness of sterilization of male swans as a method of reducing annual cygnet production at the local level. The use of this technique as a future management tool is conditional upon the success of this research. This technique will not be used as a general population control method. Rather, sterilization may be used at specific sites where the removal of breeding pairs may not be practical. The DNR will seek federal authorization (50 CFR 21.27) to conduct this investigation.

The DNR with the assistance of Dr. Glen Olson, USGS, Patuxent Wildlife Research Center, did perform sterilization on five adult male swans. Each sterilized bird and an additional five control birds were banded and neck banded. Preliminary results suggest that the surgery was successful.