Pre-Decisional Environmental Assessment

Nutria Marsh Damage Reduction

Lead Agency:

U.S. Department of Interior
U.S. Fish and Wildlife Service
Chesapeake Bay Field Office
Blackwater National Wildlife Refuge

Cooperating Agencies:

State of Maryland
Department of Natural Resources

U.S. Department of Agriculture
Animal and Plant Health Inspection Service
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Introduced in the 1940's to bolster Maryland's Eastern Shore fur industry, the nutria, a South American aquatic rodent, has been implicated in the loss of emergent marsh vegetation along the Blackwater, Transquaking, and Chicamacomico Rivers in Dorchester County. Nutria are herbivorous and vegetation loss has coincided with the increase in nutria populations. Marsh loss was detected from photographs as early as the 1950s and this loss has escalated over the past two decades coinciding with a decline in the fur industry and a resultant overpopulation of nutria in lower Maryland Eastern Shore marshes. The overabundance of nutria and the alarming loss of marsh has prompted federal legislation to eradicate or control nutria and recover marshes damaged by nutria (Executive Order 13112 and Public Law 105-322, Appendix B). Marsh loss is also a major concern to the U.S. Fish and Wildlife Service and the Chesapeake Bay Program's Wetland Workgroup whose goal is to achieve *"no net loss"* of marshes within Chesapeake Bay. In 1994, the workgroup recognized the adverse effects of nutria on Bay marshes and adopted objectives to reduce nutria damage. To address nutria damage, a collaborative partnership between 24 federal and state agencies, private organizations, local businesses, and private landowners was established in 1995.

The proposed program would study nutria ecology, nutria damage to tidal marshes and the potential to eradicate or suppress nutria populations in Maryland. This EA analyzes the needs, proposed alternatives, and effects of reducing nutria damage at Tudor Farms, Fishing Bay Wildlife Management Area, the Blackwater National Wildlife Refuge, and potentially along Maryland's Eastern Shore and other areas infested with nutria. The nutria damage reduction and marsh recovery program would consist of three components. The components are: 1) Public Outreach, 2) 3-Year Nutria Research Project, and 3) Operational Nutria Damage Reduction Program in Chesapeake Bay and other nutria infested marshes in Maryland.

List of Acronyms and Abbreviations Used for this Document

APHIS	Animal and Plant Health Inspection Service (USDA agency)
AVMA	American Veterinary Medical Association
BNWR	Blackwater National Wildlife Refuge
BO	Biological Opinion
CDFG	California Department of Fish and Game
CEQ	President's Council on Environmental Quality
CFR	Code of Federal Regulations
COMAR	Code of Maryland Regulations
CWA	Clean Water Act
DM	Departmental Manual
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
EO	Executive Order
EPA	U. S. Environmental Protection Agency
ESA	Endangered Species Act of 1973
F	Fahrenheit
FIFRA	Federal Insecticide, Rodenticide and Fungicide Act
FDA	Food and Drug Administration
IACUC	Institutional Animal Care and Use Committee
IWDM	Integrated Wildlife Damage Management
MDA	Maryland Department of Agriculture
MEPA	Maryland Environmental Policy Act
MDNR	Maryland Department of Natural Resources
MOU	Memorandum of Understanding
NEPA	National Environmental Policy Act
NHPA	National Historical Preservation Act
PL	Public Law
ppt	Part Per Thousand
T&E	Threatened and Endangered
UMES	University of Maryland Eastern Shore
USACE	U. S. Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service (USDI agency)
USGS	United States Geological Survey
WMA	Wildlife Management Area
WS	Wildlife Services (USDA-APHIS program)

Chapter 1: PURPOSE and NEED for NUTRIA DAMAGE REDUCTION & MARSH RECOVERY

1.0 Introduction & Background

Wetlands are among the most productive ecosystems in the world, yet over half the Nation's original wetlands have been damaged (U. S. Environmental Protection Agency (EPA) 1995). The decline of wetlands and tidal marshes in Maryland is potentially due to several factors including human development, sea level rise, global warming, land subsidence, increased salinity, marsh burning, and herbivory by nutria (*Myocastor coypus*), an introduced South American aquatic rodent. Without intervention, Chesapeake Bay marshes, which provide significant ecological, cultural and economic benefits in their natural state, may disappear because of nutria damage to the vegetative mat within the next decade. Resource managers have little ability to control many of the possible factors of marsh declines, but they can potentially manage nutria populations to reduce and prevent further nutria damage to marsh ecosystems. In addition, the signing of the Invasive Species Executive Order 13112 on February 3, 1999 and Public Law (PL) 105-322 (Appendix B) by President Clinton illustrates the national concern over the negative impact non-native, invasive species, in this case nutria, have on the nation's natural resources.

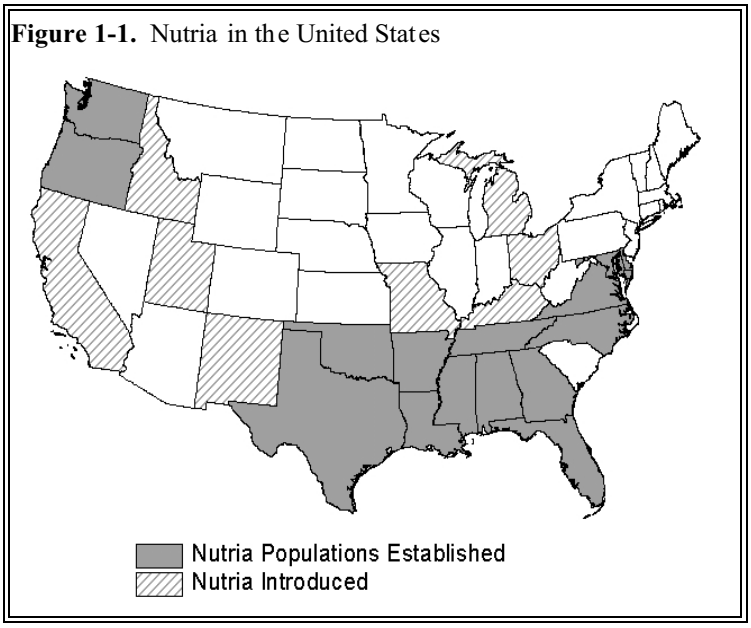


Figure 1-1. Nutria in the United States

Nutria are large, semi-aquatic, surface feeding rodents (similar to beaver (*Castor canedensis*) that were first introduced in the United States in 1899 (Willner et al. 1979). Nutria introduction into Chesapeake Bay occurred in 1943 with attempts to stimulate the local fur farming economy (Maryland Department of Natural Resources (MDNR) 1997). Nutria introduction efforts included the establishment of an experimental fur production facility on the Blackwater National Wildlife Refuge (BNWR) in Dorchester County, Maryland. Nutria escaped from the facility and were released by private entrepreneurial trappers. The population quickly expanded from less than 150 in 1968 to an estimated 50,000 in Dorchester County today. Every Maryland county south of the Chesapeake Bay Bridge has reported nutria and the range and distribution of this invasive species is expanding. Nutria are on the western shore in the Patuxent and Potomac Rivers. Currently nutria are established in 15 states (Figure 1-1) (Bounds 2000).

Marsh loss from nutria digging and feeding on the root mat is the greatest direct impact of nutria (Haramis 1997, 1999). When nutria dig root mats, erosion of marsh soils from wave action results, lowering marshland elevations. The resulting loss of marsh vegetation and elevation totals thousands of acres each year and the associated saltwater intrusion complicates marsh recovery. It is estimated that 65% of Chesapeake Bay coastal marshes have been lost since the 1700's and the effects from nutria add adverse pressures on an already fragile ecosystem (Tiner and Burke 1995). The BNWR is losing about 500-1000 acres/year from nutria damage and several times that amount is lost over the entire BNWR/Fishing Bay estuary (G. Carowan, U.S. Fish and Wildlife Service (USFWS) 2000, pers. comm.). These losses drastically affect the BNWR's ability to meet wildlife management objectives and maintain a healthy Chesapeake Bay ecosystem. To determine if nutria are contributing to marsh vegetation loss,

the U.S Geological Survey (USGS), MDNR and USFWS conducted exclosure studies where nutria were fenced from certain areas (Haramis 1996). Preliminary results suggest that vegetation recovers following exclusion of nutria, producing a healthier marsh (Haramis 1997, 1999). However, fencing methodologies are laborious, exclude other wildlife from areas, and fencing materials have a short lifetime of effectiveness. Thus, the methodology is impractical (Haramis 1997, 1999).

To address Maryland's nutria problem, the MDNR contracted Dr. L. M. Gosling to visit the Eastern Shore in 1994. In Great Britain, Dr. Gosling led a 10-year program that successfully eliminated nutria (Gosling and Baker 1989), and he identified several weaknesses in Maryland-specific nutria information (Appendix C). Dr. Gosling recommended that the MDNR implement a program of intensive nutria monitoring and damage reduction, compare damage reduction strategies, and learn more about nutria behavior using a combination of radio-telemetry and mark/recapture techniques. Part of the proposal would begin a 3-year research project designed to develop strategies to reduce nutria populations and accompanying marsh damage, and recover previously damaged marshes. The research results could be used to implement operational nutria damage reduction programs in Chesapeake Bay and other areas infested with nutria. The proposed program follows the recommendations of Dr. Gosling and represents the combined efforts of 24 federal and state agencies, private organizations, local businesses, and private landowners to address nutria damage and marsh recovery in Maryland. By working cooperatively with universities, state, federal and private agencies, a quantitative understanding of the effects of nutria on marsh ecology and opportunities for recovering marsh habitats is gained.

Public cooperation and support are vital to conserve the biodiversity and valuable habitat of Chesapeake Bay and adjacent marshes. A major focus of the proposed program is to educate the public about the critical importance of Chesapeake Bay marshes to Maryland's economy, natural resources, and the overall health and productivity of the Chesapeake Bay. Due to the complexity of this problem and the need to take actions to preserve Maryland's marshes, the 24 federal, state, and private organizations have cooperatively developed a plan to reduce nutria damage and recover marsh ecosystems.

This Environmental Assessment (EA) analyzes alternatives to reduce or eradicate nutria populations and the accompanying nutria damage. The nutria damage reduction can only be accomplished through nutria population reduction and is used as part of a damage reduction decision model (Slate et al. 1992). The imminent threat of damage or loss of resources is often sufficient for actions to be initiated. The need for action, in part, is derived from threats to resources, President Clinton's Invasive Species Executive Order 13112 and PL 105-322 which *"authorizes the Secretary of the Interior to provide financial assistance to the State of Maryland for a pilot program to develop measures to eradicate or control nutria and restore marshland damaged by nutria"* (see Section 1.2).

1.1 Purpose for Reducing Nutria Damage & Recovering Marshes

The proposed program is designed to investigate strategies to protect Chesapeake Bay marshes from nutria damage, with possible implementation of operational damage reduction efforts in other areas infested with nutria. The program would be supported and funded, in part, through Congressional action PL 105-322. The goal of the proposed program is to: *(1) develop methods to restore marshland damaged by nutria* (PL 105-322)*, (2) eradicate nutria populations in Maryland, and (3) eradicate or control nutria in other States.* The development of methods to reduce nutria populations is a prerequisite for developing a successful marsh recovery program, addressing the threat that nutria pose to marshes, and cultivating a better understanding of the importance of preserving Maryland and America's marshes (Appendix D).

1.2 Need for Action to Reduce Nutria Damage

The need for action is based on the requisite to protect marshes for social, cultural, wildlife, and economic purposes. Marshes help maintain environmental quality by purifying natural waters, filtering nutrients, chemicals, organic pollutants and sediments, and producing food which supports aquatic and terrestrial life. Marshes function as excellent water filters because they are between land and open water. In addition, marsh vegetation helps minimize erosion by increasing sediment stability, and reducing wave action and velocity (Dean 1979). Maryland's remaining marshes have become increasingly valuable as a public resource because the distribution and functional health of this habitat has been drastically reduced.

The natural resources of Chesapeake Bay are highly valued by the public. Chesapeake Bay marshes are recognized as some of the most important wetlands in the United States and have received global recognition as *"Wetlands of International Importance"* under the 45-nation Ramsar Convention Treaty (Tiner and Burke 1995). Loss of critical wetland affects the health of the Chesapeake Bay ecosystem, impacts state and local economies and decreases fish and wildlife productivity.

The natural resources of Chesapeake Bay significantly contribute to the economic well-being of Maryland, and also enhance the quality of life of Maryland's citizenry. Maryland's marshes are used for multiple purposes including: fishing, hunting, trapping, bird watching, wildlife viewing/photography, berry and timber harvest, agriculture, and livestock production. These marshes also serve as important spawning or nursery sites for many fin-fish and shellfish. Chesapeake Bay provides more than $60 million annually in commercial fin-fish and shellfish catches. Major tributaries of Chesapeake Bay account for about 90% of the striped bass (*Morone saxatilis*) spawned on the East Coast (Bergren and Lieberman 1977). Metzgar (1973) found that 44 fish species in Dorchester County used marshes for spawning, nursery, and feeding. In 1995, the catch of blue crab (*Callinectes sapidus*), Maryland's most abundant and valuable shellfish, was 40.3 million pounds valued at $29 million (Holiday and O'Bannon 1996). The BNWR/Fishing Bay estuary supports one of the most important blue crab nurseries in Chesapeake Bay. In addition, $275 million was spent directly on recreational fishing with a total economic impact to Maryland of $524 million.

Chesapeake Bay is also vitally important to birds and other wildlife, including waterfowl, shorebirds, and migratory songbirds (Appendix E). About 348 species of birds have been recorded in Maryland and almost half of those regularly use marshes (Tiner and Burke 1995). About one million waterfowl winter on Chesapeake Bay which represents 35% of all waterfowl in the Atlantic Flyway (Chesapeake Bay Program 1990). More than 4,500 jobs and $31 million in state and federal tax revenues are directly related to hunting and non-consumptive activities associated with migratory waterfowl and birds in Maryland (Southwick Associates 1995). The overall economic benefits to Maryland from hunting waterfowl and other wildlife species dependent upon marshes are estimated at more than $300 million annually (USFWS 1995).

Although nutria were introduced to support the fur industry, private fur trappers and hunters have not kept pace with the animal's ability to reproduce. From a fur trapper's and hunter's perspective, nutria are less valuable than other furbearers such as the muskrat (*Ondatra zibethica*). Nutria pelts are of inferior quality, limited value and time-consuming to process. Likewise, global demand for nutria pelts is very sporadic. Fur markets and the profits from nutria pelts have declined for a variety of reasons such as fashion trends, U.S. exchange rates, and the political and economic trends in consumer nations (MDNR 1997). The difficulty in reducing nutria populations has been demonstrated at Tudor Farms, a 7,000 acre privately-owned complex managed for wildlife in Dorchester County. Despite an annual harvest of 4,000 to 5,000 nutria annually, the nutria population appears unaffected. Population estimates at Tudor Farms range from 13,000 to 20,000 animals (Ras 1999), and nutria continue to degrade the marsh. The BNWR also has a nutria harvest program whereby up to 8,500 nutria are harvested annually, however, population estimates remain at about 50,000 animals.

1.2.1 Damage Caused by Nutria

The nutria's digging and surface feeding behavior is extremely destructive to marsh vegetation. Nutria forage directly on the vegetative root mat, leaving the marsh pitted with digging sites and fragmented with deeply cut swimming canals. In the face of rising sea levels, nutria damage is particularly problematic because it accelerates erosion associated with tidal currents and wave action and also facilitates salt water intrusion into marsh interiors. The situation is extremely delicate within the tidal marshes of the Blackwater River because much of the marsh is underlain by a layer of *"fluid mud"* that is easily eroded once the vegetative root mat becomes fragmented. Because this erosion is more rapid then natural soil deposition, marshes degraded by nutria do not naturally recover.

Nutria are extremely prolific, reproducing throughout the year and having two to three litters annually (Brown 1975, Willner et al. 1979). On average, nutria have five young, but a female may have as many as 13 per litter (Nowak 1991). To compound the problem, nutria have no natural predators to help reduce populations and populations have exploded causing significant impacts to native wildlife, fish, shellfish, plants and marsh ecosystems. Nutria weigh on average up to 18 pounds which is 5-10 times the size of the native muskrat. As a result, Maryland's muskrat populations are threatened and declining because of competition from the non-native nutria and loss of marsh habitats (R. Colona, MDNR 2000, pers. comm.).

1.3 Proposal to Reduce Nutria Damage

Previous researchers in Europe and the United States found that nutria control becomes more difficult as population densities decrease (Lowery 1974, Gosling et al. 1988, Gosling and Baker 1989, Ras 1999). Specific biological information necessary to reduce nutria damage effectively in Maryland is lacking. Research data from Maryland would facilitate reducing nutria damage (Appendix C). The proposed nutria damage reduction/eradication program would initiate 3 years of intensive research designed to develop damage reduction strategies (live, foot-hold and body-gripping (conibear-type) trapping, snaring, shooting, pesticides, and trained dogs) to understand nutria. The research results would be used to implement an operational nutria damage reduction program in Chesapeake Bay and other Maryland marshes where nutria populations have been established. This proposal would investigate the impact of nutria population reduction on movement, health, and reproductive behavior of nutria in a logical and systematic approach, and the ability to recover nutria damaged marsh vegetation (Bounds and Carowan 2000, Bounds et al. 2000). The objectives of the research can be found in Section 1.5. The data gathered during the research phase of the program would help determine the sex and/or age of the nutria to be targeted, the best time of the year to conduct operational damage reduction efforts, and the most effective damage reduction strategies/methods.

To measure the objectives (Section 1.5) of this program, the proposal would use a three-site (BNWR, Fishing Bay Wildlife Management Area (WMA), Tudor Farms) study design with an un-treated and two treated area at each site. As part of the study, about 3,000 nutria in the three sites (six areas) would be live-trapped and identified by tagging and radio collaring to generate accurate population estimates. Two areas at each site would undergo intensive nutria population reduction (treated area). The other areas would not be subject to nutria population reduction and serve as reference areas. Population estimates would be repeatedly generated in all areas to relate the population dynamics of each area to animal movement, behavior, general health and reproduction.

This EA evaluates the proposal in relation to the methods by which nutria damage reduction can be carried out to protect marshes (i.e., trapping, snaring, shooting, chemical, etc.). The program area encompasses the three sites on Maryland's Eastern Shore (BNWR, Fishing Bay WMA, Tudor Farms). If the proposed research study identifies techniques or methodologies that reduce nutria damage or eradicate nutria populations, they will be implemented

as part of the proposed action in other nutria-infested areas in Maryland, with the potential to use the findings to implement damage reduction programs in the other nutria-infested marshes in Maryland. The purpose of this EA is to assess the alternatives, including comprehensive nutria damage reduction (Bounds and Carowan 2000) in relation to the quality of the human environment.

1.4 Location of the Proposed Program and Affected Environment (taken from BNWR 1999)

The environment affected by the proposed action would primarily be marshes in Maryland occupied by nutria. However, the initial action areas are BNWR, Fishing Bay WMA and Tudor Farms. Some effect could occur on the soils, hydrological, cultural, aesthetic, and socioeconomic resources of the area. Discussion of the affected environment and impacts will be limited to areas which have been identified as the most likely to be affected by the proposed action and other alternatives.

1.4.1 Location

The BNWR, Fishing Bay WMA and Tudor Farms are located south of the Choptank River on the eastern side of the Chesapeake Bay. The areas are part of the Chesapeake Bay Ecosystem, the largest estuary in the United States. Isolated islands or small clumps of firm ground dot the marsh landscape. Surrounded by shallow sounds, marsh islands and adjacent waters are some of the Bay's most productive marsh areas. They produce the riparian and aquatic plant communities, which in turn provide optimum habitat for large concentrations of waterfowl, neotropical migrant birds, mammals, fish and crabs and other wildlife species.

The BNWR is located in Dorchester County, Maryland, about 12 miles south of Cambridge. BNWR is currently comprised of 23,054 acres of tidal marsh and open water, wooded marshes, loblolly pine and hardwood forests, and agricultural lands.

Fishing Bay WMA adjoins BNWR, and is located 18 miles southeast of Cambridge. It consists of approximately 25,000 acres of emergent tidal marsh, wet woodlands, and open water areas. The woodlands comprise about 4,000 acres and are typically dominated by loblolly pine.

Tudor Farms is a 7000-acre complex of privately owned land managed for wildlife. The area comprises a mosaic of emergent tidal marsh, small agricultural fields, impoundments, wooded marshes, and loblolly pine and hardwood forests.

1.4.2 Physical Resources

In this section, information is presented regarding the physical resources that could either be affected by or affect the proposed action. Specifically, this section will address climate, geology and soils, and hydrology.

1.4.2.2 Climate - Climatic conditions are influenced by the Atlantic Ocean and Chesapeake Bay, which moderate summer and winter temperatures. Summer temperatures reach into the upper 80s° Fahrenheit (F) and can climb into the 90s°F, with extremes of 100s°F. Winters are usually short, with temperatures averaging a low of 28°F. During the colder half of the year (October - March), a frequent succession of high and low pressure systems bring alternate surges of cold, dry air from the north and

warm, humid air from the south. During the summer, this pattern tends to break down as warm, moist air spreads northward from the south and southwest, and remains over the area much of the season. Average annual rainfall is about 43 inches. Normally, August is the wettest month and October the driest.

1.4.2.3 Geology and Soils - Marsh deposits in the program area began about 3,800 years ago. Many deposits are almost four yards thick in the oldest areas of the marsh, but average deposits are between two and three yards thick. Most of the material is loose, organic muck. The Blackwater and Little Blackwater Rivers are the major sources of inorganic sediments.

The three sites lie within the Mid-Atlantic Coastal Plain. The topography is flat with elevations ranging from 0 to 8 feet above mean sea level. Soils of the tidal marshes and other low-lying areas are mucky silt loam. These soils consist of deep organic deposits over estuarine sediments. All are poorly drained, with more rapid permeability in the organic deposits and slower permeability in the underlying deposits. These soils are typical of soils along tidally-influenced rivers, bays, and drainage ways and generally have a 0 to 1% slope (USDA 1997). Pendleton and Stevenson (1983) documented that marsh sediments averaged 58% organic matter.

Upland soils are typically silt-loams. These soils formed in silty deposits overlying sandy fluvio-marine sediments. These upland soils are typical of the lowland flats, which are also very deep, slowly permeable, and very poorly drained and generally have a 0 to 2% slope (USDA 1997).

1.4.2.4 Hydrology - The area derives its groundwater recharge mainly through infiltration of precipitation. Discharge occurs through seepage to streams, estuaries and the ocean. Coastal marshes are in these discharge zones. These marshes have complex hydrology, of which stream, groundwater and tidal flow all play a part. Forested marshes occur along the stream channels and are sustained by local and regional groundwater flow and flooding during storms. The poorly drained interior of the Delmarva Peninsula has a system of depressional palustrine marshes, narrow bands of palustrine marshes along rivers and ditches that drain from inland to the coasts. Extensive marshes occur along the coasts and inland bays. In the program area, brackish marshes grade into tidal freshwater marshes (Hayes 1996).

Surface water in the program area is derived from local precipitation. Tidal effects are observed in fluctuations in river and creek levels and on the marsh surface. Normal water level fluctuation between high and low tides is about 12 inches. Prevailing winds can compound or reduce lunar tide effects. Northerly winds drive tides out and southerly winds push tides in.

Water samples from the Blackwater River show that salinities in the river range from 0 to 19 parts per thousand (ppt) depending upon time of year and tide, and most dissolved oxygen levels fall within the range of 60 to 90%. Storm tides associated with hurricanes or northeast winter storms can cause extreme flooding of wetland areas, inundating areas with saltwater, which results in salt-saturated soils and tree mortality. Marshes of Maryland's Eastern Shore are typically brackish, estuarine marshes, which occur along the coast and for a considerable distance upstream in coastal rivers.

Federal policies require protection of water quality consistent with the Clean Water Act (CWA). Section 404 of the CWA authorizes the U.S. Army Corps of Engineers (USACE) to prohibit or regulate, through a permitting process, discharge of dredged or fill material into U.S. waters, including marshes. Special consideration of impacts on floodplains and marshes is also required by *Executive Orders* (EO) *11988 (Floodplain Management)* and *11990 (Protection of Marshlands)*. The USFWS have concluded that the proposed action is in full compliance with these wetland and floodplain procedures, and no further

compliance measures (e.g., statements of findings) are required.

1.4.3 Biological Resources

The program area consists of tidal marshes, open water, and woodlands. Agricultural crops are planted annually to provide winter food for migrating waterfowl. Corn, clover, millet, milo, buckwheat, and winter wheat are the main agricultural crops of the BNWR and Fishing Bay WMA.

1.4.3.1 Vegetation - The BNWR, Fishing Bay WMA and Tudor Farm marshes, typical of Maryland's Eastern Shore, are tidal, brackish, estuarine marshes. Because these brackish marshes form a wide transition zone between the more seaward marshes to inland marshes, they generally have a high diversity of plant species. Dominant plant species include extensive areas of black needlerush (*Juncus roemarianus*) intermixed with saltmarsh hay (*Spartina patens*), salt marsh cordgrass (*S. alterniflora*) saltgrass (*Distichlis spicata*), and Olney three-square bulrush (*Scirpus americanus*) (Tiner and Burke 1995). At the BNWR, these marshes have been managed through burning for years, resulting in the sub-climax species, Olney three-square bulrush being the dominant marsh vegetation, occurring in almost mono-specific stands (Pendleton and Stevenson 1983). However, saltmarsh hay, smooth cordgrass, saltgrass, and black needlerush are commonly interspersed among stands of Olney three-square bulrush.

Portions of the program area support one of the best and most diverse complexes of tidal saltwater marshes, tidal freshwater marshes, non-tidal marshes, upland islands, and Delmarva Bays in Maryland. These wetland communities incorporate at least ten different major tidal types and about fifteen types of non-tidal marshes. Tidal marsh communities within these parcels include salt marsh cordgrass, saltmeadow (*S. platens*), saltbush, black needlerush, arrow arum-pickerel weed (*Delcandra virginica*), broadleaf cattail (*Typha latifolia*), narrowleaf cattail *(T. angustifolia*), yellow pond lily (*Nuphar variegatum*), and tidal mudflats, which make this complex extremely diverse. Despite the exceptional quality of the marsh vegetation, the area can be classified as highly stressed and threatened. The program area is undergoing continuous erosion, resulting from nutria damage, altered hydrology, land subsidence, and sea level rise. The proposed action is designed to address the issues that are within human control.

Four forest cover types occur within the program area. These are loblolly pine (*Pinus taeda*), in which loblolly pine comprises at least 80% of the basal area of the stand; loblolly pine-oak (*Quercus* spp.), in which loblolly pine comprises 20-79% and oak species account for 20% or more of the basal area; loblolly pine-mixed hardwood, in which loblolly pine comprises 20-79% and hardwoods other than oak comprise at least 20% of the basal area of the stand; and mixed hardwoods, in which various hardwood species account for at least 80% of the stand. The common hardwoods include sweet gum (*Liquidamber styraciflua*), swamp chestnut oak (*Q. michauxii*), willow oak (*Q. phellos*), and white oak (*Q. alba*). Besides these four forest types, Whiteman and Onken (1994) also delineated areas of blanket tree mortality generally associated with flooding and saltwater intrusion.

The upland agricultural and forested areas provide additional species diversity. Being dominated by non-wetland species and providing transition zones that are usually higher in diversity, they provide excellent pine tree nesting and perching sites for many bald eagles (*Haliaeetus leucocephalus*) that winter in the area. The hardwoods and pines also provide excellent habitat for the Delmarva fox squirrel (*Sciurus niger cinereus*) and many other species.

1.4.3.2 Wildlife - The program area provides habitat for a rich diversity of wildlife. More than 257 species of birds, 30 species of mammals, such as muskrat, river otter (*Lutra canadensis*), raccoon (*Procyon lotor)*, and red fox (*Vulpes vulpes*) and 40 species of reptiles and amphibians occur on the sites

for at least part of the year (Appendix E). An additional 25 species of birds have been sighted and an additional eight species of mammals also could occur based on range maps. The most conspicuous birds are waterfowl, particularly during migration. Peak numbers of geese occur in January and peak numbers of ducks can be seen in November. Nesting waterfowl include blue-winged teal (*Anas discors*), gadwalls (*A. strepera*), mallards (*A. platyrhynchos*), black ducks (*A. rubripes*), wood ducks (*Aix sponsa*), and Canada geese (*Branta canadensis*). Shorebirds, gulls, and terns also use the program area for foraging and nesting, and numerous raptors, of which the most predominant is the bald eagle. Largest of the mammal species are the two species of deer: the native white-tailed deer (*Odocoileus virginianus*) and the exotic sika deer (*Cervus nippon*), both of which maintain healthy populations. Commonly observed species of the secretive reptiles and amphibians include the eastern painted turtle *(Chrysemys p. picta)*, red-bellied turtle *(Chrysemys rubriventris)*, northern cricket frog *(Acris c. crepitans)*, southern leopard frog *(Rana sphenocephala)*, and occasionally, a northern copperhead *(Agkistrodon c. mokeson)*. The program area also hosts a wide array of fish species, and its marshes and estuaries are a spawning and nursery ground for commercial and sport fin and shellfish.

1.4.4 Socio-economic/Cultural Resources

1.4.4.1 Socio-economic Resources- Dorchester County had a 1990 population of 30,236 with Cambridge the largest city in the county. While the county's economy has historically been based on agriculture and water-related industries, manufacturing currently provides 36% of the county's employment. Service and retail trade industries primarily provide the balance of the county's employment. Timber is one of the county's leading agricultural industries with about 142,000 acres of commercial timber in the county. Average household income for the county is $35,368 (Dorchester County 1997). Waterfowl hunting is a major recreational activity and industry around the Chesapeake Bay area. State and federal waterfowl refuges, including BNWR and Fishing Bay WMA, are important in maintaining and protecting the waterfowl resource. During the 1996 waterfowl season, more than 140,000 ducks and 8,000 resident Canada geese were harvested by sportsmen.

Chesapeake Bay is a significant socio-economic factor in Dorchester County. Shellfish and fin-fish in the surrounding waters, and furbearers in the marshes have always provided a source of livelihood since the time of the earliest settlers. Fur trapping is a major source of supplemental income to many residents, particularly farmers and watermen. More than $9,400 was bid for 1997 trapping rights on the BNWR. Deer hunting is also permitted on BNWR and provided hunting opportunities for more than 1500 deer hunters in 1997. Sportsmen contribute substantially to the economy of the area through local purchases of gas, food, lodging, and supplies.

Fishing, boating, bird watching, nature photography, hiking, and environmental education are all attractions in Chesapeake Bay. The Chesapeake Bay area is within a day's drive of about 60% of the nation's population. In 1998, visits to the BNWR Visitor Center and Wildlife Drive exceeded 108,200. Total visitations to the BNWR's units exceeded 505,151. The Dorchester Tourism Council estimated that BNWR visitors contribute about $12 million annually to the Dorchester County economy.

1.4.4.2 Cultural Resources - The entire Chesapeake Bay area has a long history and prehistory of human use. Both Native American occupation and European settlement are well documented since colonial times. The Staplefort Cemetery at BNWR is considered historically significant. Prehistoric Indian sites existed on Barren Island. Brick foundation remnants of pre-BNWR home sites occur in various wooded locations.

1.5 Objectives of Nutria Damage Reduction and Marsh Recovery

The following objectives were established by the University of Maryland-Eastern Shore (UMES), USGS and the USFWS (Bounds and Carowan 2000). The relative degree to which each alternative allows meeting these objectives will be considered when deciding which alternative to implement.

The specific objectives are:

- 1.5.1 Establish an accurate estimate of nutria populations and densities in the three study areas.
- 1.5.2 Determine the most effective damage reduction strategies (maximize capture/effort indices) to optimize removal and achieve population reduction.
- 1.5.3 Evaluate the effects of population reduction on home range and movement patterns of nutria.
- 1.5.4 Determine how intense population reduction affects nutria reproductive behavior and performance.
- 1.5.5 Ascertain if the health of the nutria population is influenced by intense harvest.
- 1.5.6 Monitor the effects of intense nutria harvest on vegetative response of native species.
- 1.5.7 Develop management recommendations to eradicate nutria in Maryland and provide recommendations for action in other affected states.

1.6 Summary of Public Involvement Efforts

Public participation in the National Environmental Policy Act (NEPA) process for this EA was conducted in accordance with the USFWS's NEPA procedures. Issues related to the proposed action were identified during interagency meetings and through a public involvement process. The public involvement process included several avenues to reach as many interested public as possible. One thousand, nine hundred and nine letters were sent to public, private non-profit, state and local government agencies, and special interest groups (conservation groups, technical experts) to solicit input for the development of the EA from those organizations. In addition, notices inviting public participation were published in: The Baltimore Sun, Washington Post, The Daily Times, The Daily Banner, Dorchester Star, Star Democrat, Times-Record, Chesapeake Publishing. Public service announcements were also broadcast by: Maryland Public Television, WAAI/WTDK Radio Station, 100.9 FM & 107.1 FM, WCEM/AM-WCEM Radio Station, 106.1 FM & 1240 AM, WBOC-TV Channel 16, WMDT-TV Channel 47 News, WCEI Radio Station, Shore Good to Know - local newsletter by Connective Electric, Falcon Cable TV PSA, and Comcast Cable TV. Information was also solicited through media such as: the Dorchester Chamber of Commerce, Dorchester County Tourism Office, Dorchester County Library, Refuge Net, Refuges Website - sii.fws.gov, Refuges Special Events and the BNWR Website. A 30-day comment period was provided for initial public input. From the initial public involvement outreach, 36 letters and postcards were received from individuals and groups interested in providing input to the development of this EA. The letters received were considered in this analysis and substantive and relevant information was incorporated into the EA.

1.7 Relationship of this EA to other Environmental Documents

1.7.1 ADC Programmatic EIS. The Animal and Plant Health Inspection Service-Wildlife Services (APHIS-WS) has issued a Final Environmental Impact Statement (EIS) on the national APHIS-WS program (USDA 1997). Pertinent and current information available in the EIS has been incorporated by reference into this EA.

1.8 Authority and Compliance

The USFWS cooperates with land and wildlife management agencies to resolve wildlife management problems according to applicable federal, state and local laws. Based on agency relationships, missions, and legislative mandates, the USFWS is the *"lead agency"* and *"decision maker"* for this EA, and therefore responsible for the EA's scope and content. As cooperating agencies, the MDNR, UMES, APHIS-WS, and USGS provided input during the preparation of this EA and will provide advice and recommendations to the USFWS on when, where, and how nutria damage reduction could be conducted.

1.8.1 COMPLIANCE WITH FISH AND WILDLIFE SERVICE POLICY

The mission of the National Wildlife Refuge System is *"to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans"* as stated in the October 9, 1997 National Wildlife Refuge Improvement Act. BNWR was established under the authority of the Migratory Bird Conservation Act on January 23, 1933 to provide habitat for migrating and wintering birds. Additional lands have been added under the authorities of the Endangered Species Act (ESA) of 1973, North American Marshlands Conservation Act, the Refuge Administration Act, and the Refuge Recreation Act to add wetland habitats for migratory birds, and for the protection of the Southern bald eagle, the Delmarva fox squirrel, and other endangered species.

1.8.2 Authority of Federal and State Agencies in Wildlife Damage Management and Endangered Species Protection

1.8.2.1 USFWS - The USFWS is charged with implementation and enforcement of the ESA. The USFWS cooperates with the MDNR, UMES, and APHIS-WS by recommending measures to avoid or minimize take of threatened and endangered (T&E) species (R. Colona, MDNR 2000, unpubl. letter). The term *"take"* is defined by the ESA (section 3(19)) to mean *"to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."* The terms *"harass"* and *"harm"* have been further defined by USFWS regulations at 50 Code of Federal Regulations (CFR) section 17.3, as follows: 1) harass means an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering; 2) harm means an act which actually kills or injures wildlife. Such acts may include significant habitat modification or degradation when it actually kills or injures wildlife by significantly impairing essential behavioral patterns including breeding, feeding or sheltering.

1.8.2.2 APHIS-WS - The primary statutory authorities for the APHIS-WS program are the Animal Damage Control Act of 1931, and the Rural Development, Agriculture, and Related Agencies Appropriations Act of 1988 which authorize and direct APHIS-WS to reduce or minimize damage caused by wildlife in cooperation with other agencies. APHIS-WS is also subject to the ESA which requires federal agencies to use their authorities to conserve T&E species.

1.8.2.3 MDNR - Maryland statues provide for the conservation of the soil, water and related resources to preserve natural resources (Code of Maryland Regulations (COMAR), Agric.§§ 8-102 et seq.), including wildlife and wildlife habitat. Maryland also has many directives that consider wildlife and natural resources. For example, the MDNR is in charge of implementing the Governor's policy of

conserving biodiversity on state-owned lands containing forests. A state wildlands preservation system seeks to preserve wildland areas in their natural condition for future Maryland residents (COMAR, Nat. Res. §§5-1203). Maryland also has statutory provisions for cooperative management efforts. The state is part of the Interstate Environmental Compact, which authorizes cooperative efforts to protect the environment (COMAR, Nat. Res. §§3-501). The Chesapeake Bay Critical Area Protection Program was implemented on a cooperative basis between local and state government to protect Chesapeake Bay (COMAR, Nat. Res. §§8-1801 et seq.)

1.8.2.4 UMES - The University of Maryland Eastern Shore is the 1890 Land-Grant University in the state of Maryland. UMES in the only research and doctoral granting institution on the Eastern Shore of Maryland. The UMES's mandate as a land grant institution and its mission prescribe that it emphasize programs in the agricultural, resources, and natural sciences. UMES's participation in this project is consistent with its long range goals to serve the educational and research needs of government agencies, business and industry, at the local, regional, and national levels. This project addresses several UMES's priorities: 1) engaging our students in areas where they are under-represented, 2) providing our students with experiences that give them competitive advantages for employment, 3) helping the university to strengthen its collaborative programs and partnerships, and 4) providing opportunities for faculty development. The nutria problem on the Eastern Shore of Maryland is extreme, adversely affecting Maryland's economy and natural resources. The involvement of UMES students and faculty to seek solutions to problems such as this that effect Maryland's economy and natural resources is a role that UMES is expected to play as a Land-Grant institution.

1.8.2.5 USGS - The Maryland Cooperative Fish and Wildlife Research Unit of the Biological Resources Division of the USGS has the authority to conduct wildlife research under cooperative agreements.

1.8.3 Compliance with Federal and State Laws, and Executive Orders

The following federal laws are relevant to the actions considered in this EA and this program is in compliance with federal and state laws, and Executive Orders (EO).

1.8.3.1 National Environmental Policy Act (NEPA) - This EA has been prepared in compliance with NEPA (42 USC Section 4231, et seq.), the President's Council on Environmental quality (CEQ) Regulations, 40 CFR, Section 1500 - 1508, and Department of the Interior's Departmental Manual (DM) for NEPA compliance, USFWS (516 DM 6).

1.8.3.2 Public Law 105-322: Nutria Eradication and Control Pilot Program - PL 105-322 authorized the Secretary of the Interior to provide financial assistance to the State of Maryland for a pilot program to develop measures to eradicate or control nutria and recover marsh damaged by nutria. The Secretary of the Interior shall require that the pilot program consist of management, research, and public education activities carried out in accordance with the document entitled *"Marsh Restoration: Nutria Control in Maryland Pilot Program Proposal"* (Bounds et al. 2000).

1.8.3.3 Endangered Species Act (ESA) - It is federal policy, under the ESA, that federal agencies shall seek to conserve T&E species and shall utilize their authorities in furtherance of the purposes of the ESA (Sec. 2(c)).

The USFWS has completed ESA Section 7 Consultations on the effects of nutria damage reduction on

federally listed species in Maryland. Related compliance is discussed in Chapter 4, Environmental Consequences.

1.8.3.4 Migratory Bird Treaty Act - The Migratory Bird Treaty Act provides the USFWS regulatory authority to protect species of birds that migrate outside the United States. All cooperating agencies coordinate with the USFWS on migratory bird issues. Migratory birds would not be adversely affected by this proposal, but rather would benefit from recovery of marsh vegetation and a more natural environment. Any adverse impact on a migratory bird would be reported to the USFWS, Migratory Bird Management Office. See Chapter 4, Impacts on Non-target Species.

1.8.3.5 Animal Damage Control Act, and the Rural Development, Agriculture, and Related Agencies Appropriations Act - These Acts authorize and direct APHIS-WS to reduce or minimize damage caused by wildlife, in cooperation with other agencies. The proposed action is a cooperative effort with the USFWS, MDNR, APHIS-WS, UMES, and USGS and numerous other agencies and groups.

1.8.3.6 National Historical Preservation Act of 1966, as amended - The National Historic Preservation Act (NHPA) requires federal agencies to: 1) evaluate the effects of any federal undertaking on cultural resources, 2) consult with the State Historic Preservation Office regarding the value and management of specific cultural, archaeological and historic resources, and 3) consult with appropriate American Indian tribes to determine whether they have concerns for traditional cultural resources in areas of these federal undertakings. The program area has been surveyed in compliance with the NHPA and the proposed action would not have an adverse affect on those resources. If any unknown historical resources are found, the project would be stopped until the area could be surveyed and cleared for cultural or historical resources.

1.8.3.7 Prime and Unique Farmlands - In August 1980, the CEQ directed that federal agencies must assess the effects of their actions on farmland soils classified by the USDA's Natural Resource Conservation Service as prime or unique. Prime or unique farmland is defined as soil which particularly produces general crops such as common foods, forage, fiber, and oil seed; unique farmland produces specialty crops such as fruits, vegetables, and nuts. The program area is not classified as, nor does it have any known characteristics of prime or unique farmland. In addition, if lands were classified as prime or unique farmlands, the proposed action would not have an adverse affect on those lands.

1.8.3.8 Maryland State Laws (Center for Wildlife Law and Defenders of Wildlife 1996)

Maryland Endangered Species Act. Maryland has two laws that protect T&E species of plants and animals (COMAR, Nat. Res. §§10-2A-01 to 09; 4-2A-01 to 09.) Species are listed based on the best scientific and commercial data available and recognizes the Section 7 Consultations completed by the USFWS.

Maryland Environmental Policy Act - Maryland has a *"little NEPA"* requiring assessment of major proposed agency impacts on biological resources. The Maryland Environmental Policy Act (MEPA) requires state agencies to prepare environmental effects reports for each proposed state action that significantly affects the quality of the human environment (COMAR, Nat. Res. §§1-301 et seq.). In addition to MEPA, other statutes require mitigation or consideration of environmental harm. For example, a cumulative impact assessment is required periodically for the state's non-tidal marshes (COMAR, Nat. Res. §§5-908). The MDNR had input throughout the development of this EA, and

therefore, this EA satisfies Maryland's MEPA requirements.

Exotic Species Control - Maryland also has provisions designed to control the introduction and spread of exotic species. For example, a permit from the Forest, Park and Wildlife Service is required before any wildlife may be imported or possessed for release into the wild (COMAR §§08.03.09.04).

1.8.3.9 Executive Orders

Invasive Species EO 13112 - Authorized by President Clinton, EO 13112 establishes guidance to federal 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 (Appendix B). The EO, in part, states that each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law; 1) reduce invasion of exotic species and the associated damages, 2) monitor invasive species populations, provide for restoration of native species and habitats, 3) conduct research on invasive species and develop technologies to prevent introduction, and 4) provide for environmentally sound control, promote public education on invasive species.

The EO also established an Invasive Species Council (Council) whose members include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the EPA. The Council shall be Co-Chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council oversees: 1) the implementation of this order, 2) that federal agencies activities concerning invasive species are coordinated, complementary, cost-efficient, and effective, 3) the development of recommendations for international cooperation in addressing invasive species, 4) develop, in consultation with the CEQ, guidance to federal agencies, 5) facilitate development of a coordinated network among federal agencies to document, evaluate, and monitor impacts from invasive species on the economy, the environment, and human health, 6) facilitate establishment of a coordinated, up-to-date information-sharing system that utilizes, and 7) prepare and issue a national Invasive Species Management Plan.

Environmental Justice Executive Order 12898 (Impacts on Minority and Low Income Persons or Populations) - Environmental Justice (EJ) promotes the fair treatment of people of all races, income and culture with respect to the development, implementation and enforcement of environmental laws, regulations and policies. Fair treatment implies that no person or group should endure a disproportionate share of the negative environmental impacts directly or indirectly from activities to execute domestic and foreign policies or programs. EO 12898 requires federal agencies to make EJ part of their mission, and to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies and activities on minority and low-income persons or populations. All agency activities are evaluated for their impact on the human environment and compliance with EO 12898 to ensure EJ.

The proposed activities are evaluated for their impact on the human environment and compliance with EO 12898. Agency personnel would use wildlife damage management methods as selectively and environmentally conscientiously as possible. All chemicals that would be used under the proposed action would be regulated by the EPA through the FIFRA, by the MDA[1], by Memorandum of Understanding

[1] Currently, zinc phosphide is not registered in Maryland, but will be before any use by a federal agency.

(MOU) with federal agencies, and by agency directives. Based on a thorough Risk Assessment, USDA (1997, Appendix P) concluded that when zinc phosphide is used following label directions, it is selective to target individuals or populations, and such use has negligible impacts on the environment. The proposed action, discussed in this document, would properly dispose of any excess solid or hazardous waste. It is not anticipated that the proposed action would result in any adverse or disproportionate environmental impacts to minority and low-income persons or populations.

CHAPTER 2: DESCRIPTION OF ALTERNATIVES

2.0 Introduction

This chapter consists of four parts: 1) an introduction, 2) description of alternatives considered and analyzed in detail including the Proposed Action (Alternative 1), 3) strategies and methodologies considered but deemed impractical or ineffective, and 4) a description of alternatives considered, but eliminated from detailed analysis. Alternatives were developed for consideration using Slate et al. (1992), *"Methods of Control*" (USDA 1997 Appendix J) and the *"Risk Assessment of Wildlife Damage Control Methods Used by the USDA Animal Damage Control Program"* (USDA 1997, Appendix P). Four alternatives were recognized, developed, and analyzed in detail by the Multi-agency Team (USFWS, MNDR, APHIS-WS, UMES, USGS); three alternatives were considered but not analyzed in detail with supporting rationale. The four alternatives analyzed in detail are:

Alternative 1 - Nutria Damage Reduction Research and Operational Program (Proposed Alternative)

Alternative 2 - No Nutria Damage Reduction (No Action Alternative)

Alternative 3 - Nutria Damage Reduction Research Only

Alternative 4 - Nutria Damage Reduction Operational Program Only

2.1 Description of the Alternatives

2.1.1 Alternative 1 - Nutria Damage Reduction Program (Proposed Alternative)

The proposed action would implement nutria research on three sites at BNWR, Fishing Bay WMA and Tudor Farms, and potentially a statewide operational nutria damage management program using research findings in other nutria infested marshes. The program would be implemented by the USFWS, MDNR APHIS-WS, UMES, and USGS to take immediate action to protect Maryland's Eastern Shore marshes (Bounds et al. 2000) and potentially other marshes damaged or destroyed by nutria.

Nutria damage reduction would be based on interagency relationships, which require close coordination and cooperation because of overlapping authorities and legal mandates. The agencies' goals for the proposed action include minimal removal of non-target wildlife and increased re-vegetation of damaged marsh. The nutria damage reduction program would be conducted in several phases. The phases are:

Outreach efforts enlisting public and governmental cooperation and support, crucial for a successful completion of the project.

A 3-year nutria research effort to help determine the natural history of Maryland's nutria to identify effective damage reduction strategies. Investigations that document age- and gender-specific home ranges, movement patterns, seasonal habitat use, population densities, and reproductive ecology would be conducted.

An operational nutria damage reduction effort would be implemented by federal and state agency personnel and consist primarily of trapping, snaring, shooting or chemical methodologies. The

operational personnel would evaluate and test damage management strategies based on research findings. Methods evaluation would allow identification and implementation of key combinations of selectivity, method efficacy and nutria eradication potential. The most promising eradication strategies would then be implemented in nutria infested marshes.

2.1.2 Alternative 2 - No Nutria Damage Reduction (No Action Alternative)

The No Action alternative is a procedural NEPA requirement (40 CFR 1502.14(d)) and serves as a baseline for comparison with the other alternatives. The No Action Alternative, as defined here, is consistent with CEQ (1981).

The No Action alternative would continue the on-going management/control of nutria in the Chesapeake Bay area using sport trappers and hunters; this alternative would not change the status quo, including no additional federal funding and support. Under the no action alternative, the lead and cooperating agencies would not initiate any additional actions to reduce nutria damage. State government officials and their contracted agents could take actions concerning nutria damage and private individuals could take actions toward reducing nutria damage under Maryland law.

2.1.3 Alternative 3 - Nutria Damage Reduction Research Only

This alternative would only allow for the proposed 3-year research program as described in Alternative 1 and by Bounds et al. (2000). The nutria research program would help determine the natural history of Maryland's nutria to develop more effective damage reduction measures. Investigations that document age- and gender-specific home ranges, movement patterns, seasonal habitat use, population densities, and reproductive ecology would be conducted. The number of animals removed under this alternative would be lower than Alternatives 1 or 4.

2.1.4 Alternative 4 - Nutria Damage Reduction Operational Program Only

This alternative would only allow for an operational nutria damage reduction program as described in Alternative 1. Operational nutria damage reduction/control activities would evaluate and test damage reduction equipment and strategies without the benefit of Maryland specific research findings. More animals would be removed under this Alternative than Alternative 3, but probably fewer as compared to Alternative 1.

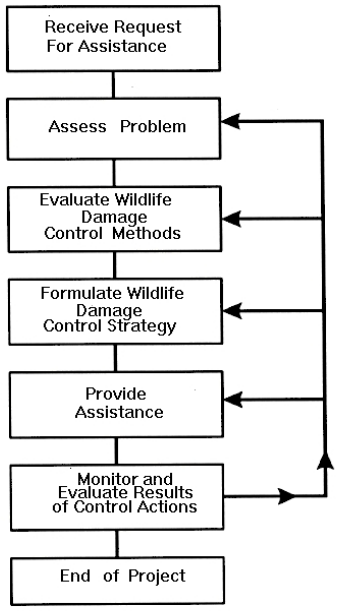
2.2 Nutria Damage Reduction Strategies and Methodologies

APHIS-WS, USGS and UMES would be the agencies that conduct nutria damage reduction efforts after consultation with the lead and other cooperating agencies. APHIS-WS, USGS and UMES, in part, would use the formalized decision model (Slate et al. 1992) (Figure 2-1), to determine the most appropriate implementation strategy to reduce nutria damage. This procedure would consider implementation of safe and practical methods for the prevention and reduction of damage caused by nutria, based on local problem analysis, environmental and social factors, and the informed judgement of trained personnel. In selecting management techniques for specific damage situations, consideration is given to:

natural history of nutria,
vulnerability to management strategies;
other land uses (such as recreational and commercial uses);

feasibility of implementing strategies;
status of non-target species (including T&E species);
local environmental conditions such as terrain, vegetation, and weather;
potential legal restrictions;
humaneness;
cost of reduction strategies[2].

Figure 2-1. WS Decision Model



2.2.1 Decision Making Procedure

The procedures used by agency personnel to determine damage reduction strategies can be found in Slate et al. (1992). The decision making process is a procedure for evaluating and responding to specific damage situations. Personnel assess the problem, evaluate methods for their availability (legal and administrative) and suitability based on biological, economic and social considerations. Following this evaluation, the methods deemed to be practical to reduce damage are formed into a strategy. After the management strategy has been implemented, monitoring and evaluation of the strategy would be conducted to assess its effectiveness. If the strategy is effective, the need for management is ended and adapted to other problem areas. In terms of the Decision Model, most damage reduction efforts consist of a continuous feedback loop between conducting the damage reduction activity and monitoring the results, with the damage reduction strategy reevaluated and, if necessary, revised.

An effective program requires that site specific consideration of the many variables be considered to allow the selection and implementation of the most appropriate strategy and technique to resolve each damage situation. Flexibility in the management approach is important because of the high variability found in the natural environment.

2.2.3 Integrated Wildlife Damage Management

Usually, the most effective approach to resolving wildlife damage problems is to integrate the use of several methods simultaneously or sequentially. Integrated Wildlife Damage Management (IWDM) is the implementation and application of safe and practical methods for the prevention and reduction of damage based on local problem analyses and the informed judgement of trained personnel. APHIS-WS, USGS and UMES would apply IWDM, commonly known as Integrated Pest Management, to reduce nutria damage through a decision model (Slate et al. 1992).

The philosophy behind IWDM is to implement effective management techniques in a cost-effective manner while minimizing the potentially harmful effects to humans, target and non-target species, and

[2] The cost of management in this proposal may be a secondary concern because of overriding environmental and legal considerations (i.e., E O 13112 and PL 105-322.)

the environment. IWDM draws from the largest possible array of options to create a combination of techniques for the specific situation. IWDM may incorporate cultural practices, habitat modification, animal behavior modification, removal of individual animals, local population reduction, or any combination of these, depending on the characteristics of the specific damage problem.

2.2.4 Nutria Damage Reduction Methods Authorized or Recommended for Use

The strategies and methodologies described below are common to Alternative 1 of this EA based on practical and legal strategies supported by Bounds et al. (2000) and the Decision Model (Slate et al. 1992). Alternative 2 would continue the current program of private trappers and hunters and not allow for direct agency involvement to reduce nutria damage. Under Alternative 3, agency personnel would only be allowed to conduct the 3-year research program (Bounds et al. 2000) without implementing research findings to reduce nutria damage. Alternative 4 would only allow for the implementation of an operational damage reduction program based on the current knowledge of nutria and Slate et al. (1992).

USDA (1997) describes methods used to reduce wildlife damage. Several of these were considered in this EA because of their potential use in reducing damage to natural and agricultural resources, sensitive plants and root mats, wildlife habitats and public health and safety. A more detailed description of the methods can be found in Appendix F of this EA and in USDA (1997, Appendix J).

2.2.4.1 Mechanical Nutria Damage Management Methods Proposed for Use

Live-traps (cage-type traps) are designed to live-capture animals and detain for handling or disposition.

Foot-hold traps can be effectively used to live-capture a variety of mammals, including nutria. Effective use of appropriate lures and trap placement by trained personnel increase the foot-hold trap's selectivity.

Snares are capture devices consisting of a cable loop and a locking device and are primarily placed in travel ways; most snares are also equipped with a swivel to minimize cable twisting and breaking. Snares can be used as a live capture device or set to kill the captured animal.

Shooting is selective for the target species and may involve the use of spotlights and either a shotgun or rifle.

Body-grip traps (Conibear-type traps) are kill-type traps designed to cause the quick death of the animal that activates the trap and are legally authorized for use in marshes in Maryland.

Colony Traps are multi-catch traps used to either live-capture, or capture and quickly drown the captured animal. There are various types of colony traps. One common type of colony trap consists of a cylindrical tube of wire mesh with a one-way door on each end (Novak 1987a). Colony traps are effective and relatively inexpensive to purchase, and easy to construct (Miller 1994).

Dogs, particularly trained and controlled retrievers, are often used by local hunters to locate and pursue nutria in thick vegetation. The use of dogs can greatly increase hunting success.

2.2.4.2 Chemical Nutria Damage Management Methods Proposed for Use

All chemicals used in Maryland are registered under the Federal Fungicide, Insecticide and Rodenticide Act (FIFRA) and administered by the EPA and the Maryland Department of Agriculture (MDA) or are

approved by the Food and Drug Administration (FDA). All agency personnel in Maryland who use chemical management methods would be certified as restricted-use pesticide applicators. No chemicals are used on public or private lands without authorization from the land management agency or property owner/manager. The chemical method currently authorized by EPA[3] for nutria damage management is:

Zinc phosphide - is registered to reduce nutria damage (EPA Reg. No. 56228-6), and is applied to bait (e.g., carrots, sweet potatoes, apples, pears) on rafts or the ground in marshes and canals. The maximum amount of bait [0.6% active ingredient (a.i.)] that can be place on large rafts (4 feet by 4 feet) spaced ¼ to ½ mile apart is 10 lbs. On small waterways, four pieces of bait can be placed on rafts that are at least 6 inches by 6 inches. Rafts must be anchored appropriately for the size of the raft and the body of water, considering factors such as size, depth, winds, current, and potential for flooding. Rafts can be located near burrows and runways used by nutria or near places where these animals are causing damage. Bait may also be placed on the ground beside burrows or runways used by nutria. However, only two to five pieces of bait can be placed on the ground at the location.

No zinc phosphide treated bait would be applied until untreated pre-bait is adequately accepted by the nutria.

2.3 Strategies and Methodologies Considered but Deemed Impractical or Ineffective at the Present Time

2.3.1 Harassment Activities

Harassment has generally proven ineffective in resolving aquatic rodent damage problems (Jackson and Decker 1993). Also, removal of food supplies to discourage nutria activity is generally not feasible nor ecologically desirable.

2.3.2 Repellents

No repellents are registered for nutria damage reduction at this time.

2.3.3 Use Contraceptives to Reduce Nutria Damage

A review of research evaluating chemically and surgically induced reproductive inhibition as a method for controlling nuisance aquatic rodents is contained in Novak (1987b). Although these methods were effective in reducing beaver reproduction by up to 50%, the methods were not practical or were too expensive for large-scale application.

Under this strategy, nutria would be surgically sterilized or contraceptives administered to limit their ability to produce offspring. However, at present, there are no chemical or biological contraceptive agents registered by the EPA, FDA or MDA for nutria and the use of immunocontraceptives is only in the realm of research. A nutria contraceptive, chemosterilant or immunocontraceptive, if delivered to enough individuals, could temporarily suppress local breeding populations by inhibiting reproduction. Reduction of local populations would result from natural mortality combined with reduced fecundity. No nutria would be killed directly with this method, however, treated and untreated nutria would continue to cause

[3] Currently, zinc phosphide is not registered in Maryland and will not be used by agency personnel until it is registered by the State.

damage. Populations of nutria outside of the treatment area would probably be unaffected.

Contraceptive measures for mammals can be grouped into four categories: surgical sterilization, oral contraception, hormone implantation, and immunocontraception (the use of contraceptive vaccines). These techniques would require that nutria receive either single, multiple, or possibly daily treatment to successfully prevent conception. The use of this method would be subject to approval by federal and state agencies. This strategy was not considered in detail because: (1) it would take many years of implementation before the nutria population would decline, and therefore, damage would continue at the present unacceptable levels for years; (2) surgical sterilization would have to be conducted by licensed veterinarians, would therefore be extremely expensive and labor-intensive; (3) it is difficult to effectively live trap or *chemically capture* the number of nutria that would need to be sterilized to effect an eventual decline in the population over large areas, and (4) no chemical or biological agents for sterilizing nutria have been approved for use by state and federal regulatory authorities.

2.3.4 Fumigants

Several fumigants are registered for controlling burrowing rodents but none are registered for use against nutria; in marsh habitat nutria generally do not burrow extensively. Some fumigants, such as aluminum phosphide and carbon monoxide, may have potential as nutria control agents but their efficacy has not been scientifically demonstrated. In addition, these methods are neither practical nor legal because they are not registered for this purpose.

2.4 Alternatives Considered but not Analyzed in Detail.

2.4.1 Bounties

Payment of funds for killing nutria (bounties) to reduce marsh damage or economic loss is not supported by the MDNR (R. Colona, MDNR, 2000, pers. comm.), USFWS nor the other cooperating agencies. Bounties are not considered because:

They are not generally effective in reducing damage and have not been found effective in reducing populations,
Circumstances surrounding take of animals are largely unregulated,
No process exists to prohibit taking of animals from outside the damage management area for compensation purposes,
The USFWS, APHIS-WS, USGS and UMES do not have the authority to establish a bounty program, and
Maryland state law prohibits the MDNR from paying bounties (COMAR §§10-107)

2.4.2 Nutria Damage Should be Managed by Hunters and Trappers

The jurisdiction for managing most resident wildlife rests with the MDNR who has the authority to request other agencies' assistance in achieving management objectives. The USFWS's authority to remove nutria on USFWS property falls under Executive Order 13112 or to assist the State of Maryland falls under PL 105-322. Currently, MDNR manages nutria as a furbearer but are legally defined as an un-protected species (COMAR §§10-101(s)). If deemed necessary, the MDNR has the option and authority to reduce restrictions on trapping, snaring or hunting to provide for more harvest opportunities for sportsmen and women. Although there is no closed season for nutria in Maryland, most private trappers and hunters are not able to provide year-round site-specific nutria damage reduction. That option,

however, remains open to entities experiencing damage or the threat of damage.

2.4.3 Nonlethal Damage Management and Relocation (rather than killing) of Nutria

Nonlethal damage management and relocation of native species may be appropriate in some situations with some species (i.e., if the problem species' population is at very low levels, there is a suitable relocation site and the additional funding required for relocation can be obtained.) However, nutria are non-native, invasive species that compete with native species. *Section. 2. Federal Agency Duties* of EO 13112 stipulates that: (a) Each federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law,

> *1) identify such actions;*
> *2) subject to the availability of appropriations, and within Administration budgetary 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;*
> *3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.*
> *4) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.*
>
> In addition, relocation would be illegal under Maryland statute (COMAR §§08.03.09.03). Any decisions on relocation of nutria would be coordinated with MDNR officials.

CHAPTER 3 - ISSUES IMPORTANT TO THE IMPACT ANALYSIS and OUTSIDE SCOPE

3.0 Introduction

Chapter 3 contains a discussion of the issues that received detailed environmental impacts analysis in Chapter 4 (Environmental Consequences) and issues used to develop mitigation measures.

3.1 Issues Driving the Analysis

The USFWS and cooperating agencies have determined that the following issues should be considered in the decision-making process for this EA to help compare the impacts of the various damage reduction strategies:

3.1.1 Effectiveness

What is the relative effectiveness of the proposed strategies in reducing nutria damage to marsh vegetation? Do they meet the objectives of the proposal?

3.1.2 Impacts on Non-target Species

Would there be potential impacts on other species not targeted in a nutria damage reduction program?

3.1.3 Impacts on T&E Species

What would be the adverse or beneficial impacts on federally protected species?

3.1.4 Humaneness

How humane are the various alternative strategies? Since humaneness can be subject to perception, how is humaneness perceived by different interests?

3.1.5 Public or Pet Health and Safety

How might the action alternatives adversely affect public or pet health and safety?

3.1.6 Socio-economics

How might the action alternatives affect socio-economic values of the area?

3.2 Issues Not Analyzed in Detail with Rationale

3.2.1 Animal Welfare and Humaneness of Methods Proposed for Used

The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife, is an important but complex concept that can be interpreted many ways. Schmidt (1989) indicated that vertebrate pest damage management for societal benefits could be compatible with animal welfare concerns, if *" . . . the reduction of pain, suffering, and unnecessary death is incorporated in the decision making process."*

Suffering has been described as a *" . . . highly unpleasant emotional response usually associated with pain and distress*." However, suffering *" . . . can occur without pain . . .*," and *" . . . pain can occur without suffering . . . "* (American Veterinary Medical Association (AVMA) 1987). Because suffering carries the implication of a time frame, a case could be made for " *. . . little or no suffering where death comes immediately . . . "* (California Department of Fish and Game (CDFG) 1999), such as shooting.

Defining pain as a component of humaneness in relation to the proposed action appears to be a greater challenge than that of suffering. Pain obviously occurs in animals. Altered physiology and behavior can be indicators of pain, and identifying the causes that elicit pain responses in humans would " *. . . probably be causes for pain in other animals . . . "* (AVMA 1987). However, pain experienced by individual animals probably ranges from little or no pain to significant pain (CDFG 1999).

Pain and suffering as it relates to damage management methods has both a professional and lay point of arbitration. Wildlife managers and the public would be better served to recognize the complexity of defining suffering, since *" . . . neither medical or veterinary curricula explicitly address suffering or its relief"* (CDFG 1999).

Therefore, humaneness, in part, appears to be a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently. Thus, the decision-making process involves tradeoffs between the above aspects of pain and humaneness. The challenge in coping with this issue is how to achieve the least amount of suffering with the constraints imposed by current technology and funding.

Research and development have improved the selectivity and humaneness of management devices. The objectives of this project would also help to understand how to reduce nutria damage and recover marshes in as a humane manner as possible. Research would continue to bring new findings into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some damage management methods are used in situations where nonlethal damage management methods are not practical or effective.

This project (Animal Use Protocol 070199) has been reviewed by the UMES Institutional Animal Care and Use Committee (IACUC). The project was granted approval with modification. The Principal Investigator will make annual reports to the IACUC commencing 12 months after the initiation of the project. The report shall include verification of the following: a) training of field personnel in humane animal capture and handling techniques, b) training of field personnel in first aid, personal water safety, small boat handling, and land vehicle operation, c) immunization for tetanus and pre-exposure immunization for rabies, d) quality assurance that the experimental protocol has been followed by field personnel, e) report on number of animals captured, tagged, fitted with radio collars, injured and mortalities related to project activities.

3.2.2 Cultural and American Indian Concerns

The NHPA, as amended in 1992 (16 USC 470 *et seq.*) and NEPA require the consideration of impacts on cultural resources listed on or eligible for listing on the National Register of Historic Places. The Native American Graves Protection and Repatriation Act of 1990 (25 USC 3001) requires specific actions when Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony are excavated or discovered on federal lands.

The mission of the USFWS is *"to conserve, protect, and enhance fish and wildlife and their habitat for*

the continuing benefit of people." Little to no adverse effect on the cultural resources are anticipated from the proposed action or any of the alternatives. The effects of nutria damage reduction would be minimal as no ground disturbance would occur. Should a presently unknown site be found during implementation of any of the action alternatives, work would be discontinued and the site would be evaluated by qualified archaeologists.

While aesthetic/visual quality is not a criterion for historic significance, it is an important consideration for cultural reasons. For visitors who find natural-appearing conditions and native wildlife more visually pleasing than damaged marshes and mudflats or exotic species, the project would improve the visual cultural and aesthetic quality of the area.

3.2.3 Human Affectionate-Bonds with Individual Wildlife or Charismatic and Aesthetic Wildlife

The human attraction to animals has been well documented throughout history and may have instigated the domestication of animals. The American public is no exception and today many American households have pets. In addition, some people consider individual wild mammals and birds as "pets," or exhibit affection toward these animals, especially people who come in contact with wildlife such as homeowners and visitors to city/State parks, refuges, etc.

Public reaction to lethal damage reduction actions is variable because the public is comprised of different values toward wildlife. Some individuals that are negatively affected by wildlife support lethal removal or relocation. Other individuals affected by the same wildlife may oppose lethal removal or relocation. Individuals unaffected by the damage may be supportive, neutral, or opposed to the wildlife's removal based on personal views.

The public's ability to view nutria in the program areas would be more limited if the nutria are removed or relocated. However, the opportunity to view nutria would be available if an individual visits areas with adequate habitat outside the program area.

In addition, by reducing or eradicating nutria populations, natural marsh recovery would be more successful and natural habitats are more able to recover (Haramis 1996, 1997, 1999). Marsh recovery would be beneficial to native wildlife populations and provide more opportunities to people to view and enjoy native wildlife species.

3.2.4 The Public's Concern about the Use of Chemicals and Toxicants and that Toxicants/Chemicals Should be Banned

Much of the public's concern over the use of toxicants for wildlife damage management, in this case zinc phosphide, is based on an erroneous perception that the chemicals are nonselective and outdated chemical methodologies would be used. In reality, however, the chemicals and application methods proposed by agency personnel have a high degree of selectivity. Agency use of toxicants is regulated by the EPA through the FIFRA, by MOUs, the MDA[4] and by program directives. In addition, USDA (1997, Appendix P) conducted a thorough risk assessment and concluded that chemicals used according to label directions are selective for target individuals or populations, and therefore, have negligible impacts on the environment.

[4] Currently, zinc phosphide is not registered in Maryland and will not be used by agency personnel until it is registered by the State.

A decision to ban toxicants is outside the scope of agency or program authority. The agencies could elect not to use toxicants, but those registered are an integral part of IWDM and their selection for use follows criteria in Slate et al. (1992).

3.3 Evaluation of Significance

Each major issue will be evaluated under each alternative and the direct, indirect and cumulative impacts will be analyzed. NEPA describes the elements that determine whether or not an impact is *"significant*." Significance is dependent upon the context and intensity of the action. The following factors were used to evaluate the significance of impacts in this EA that relate to context and intensity (adapted from USDA 1997) for this proposal:

3.3.1 Magnitude of the Impact (size, number, or relative amount of impact) (intensity)

The *"magnitude"* analysis for this EA follows the process described in USDA (1997). Magnitude is defined in USDA (1997) as *". . . a measure of the number of animals killed in relation to their abundance."*

3.3.2 Duration and Frequency of the Impact (temporary, seasonal impact, year round or ongoing) (intensity) (Duration and frequency of an operational program, in part, would be determined from research findings).

3.3.3 Likelihood of the Impact (intensity)

3.3.4 Geographic Extent (the initial action is limited to the immediate project area, the BNWR, Fishing Bay WMA and Tudor Farms. However, implementation of effective strategies could occur in other areas in Maryland impacted by nutria) (context).

3.3.5 Legal Status of a species that may be removed, or conformance with regulations and policies that protect the resource in question (context).

Nutria are managed as furbearers with no closed season in Maryland, and have limited economic importance in some localities. In situations where nutria are causing damage, there is no legal protection and they can be taken anytime by any legal means. Consequently, citizens experiencing problems with nutria should be familiar with local wildlife laws and regulations. In addition, the signing of the Invasive Species EO 13112 on February 3, 1999 and PL 105-322 by President Clinton illustrates the national concern over the negative impact that non-native, invasive species (i.e., nutria) have on the nation's natural resources.

Nationally and locally, muskrats are one of the most important furbearers in terms of pelt production and total economic value. The MDNR has rules and regulations regarding the taking of muskrats. Agency personnel would make reasonable efforts to exclude muskrats from damage reduction methods by placing damage management equipment in places and at times to exclude muskrats as reasonably as possible. A small number of non-target muskrats are expected to be captured, but those capable of surviving would be released. In addition, nutria are direct competitors of muskrats and muskrat numbers are declining because of this interspecific competition with nutria (R. Colona, MDNR 2000 pers. comm.). If action is not taken, more muskrats could be adversely affected and displaced than if the proposed action is implemented. Long-term, muskrat populations are expected to benefit from reduced nutria populations and their populations are expected to increase.

The study sites were used as the preliminary program area because the proposed action and program is located within those sites. This analysis, however, is pertinent to other areas within Chesapeake Bay and the Eastern Shore of Maryland as well as other areas, and other programs in areas damaged by nutria, and the impacts would be the same. If no adverse impacts are detected in the study sites, the impact analysis would be similar in other areas.

3.4 Issues Outside the Scope of the EA

The following issues were raised by the public during the initial public involvement process but are outside the scope of analysis for this EA.

3.4.1 Research the nutria history and damage in Louisiana.
3.4.2 Build floodgates on the Blackwater River to stop sea level rise and salt water intrusion similar to Holland and wetland leaders should help landowners build dikes.
3.4.3 Inadequate funding for biological or genetic control and alternative marsh vegetation resistant to nutria.
3.4.4 Determine the real cause of the damage to the marsh; people are probably the cause and not nutria.
3.4.5 Conduct a research program (literature review, control methods, environmental studies, physiology, nutria diseases) and send a team of experts to South America to determine what has kept that population under control.
3.4.6 Navy bombing is destroying marsh on Bloodsworth Island more than nutria. Have Navy bomb Transquaking and Chicamacomico Rivers to eradicate nutria.
3.4.7 Human populations conflict with wildlife through urban sprawl.
3.4.8 Allow the use of .22 cal rifles in the marsh; shotgun shells are too expensive.
3.4.9 Send the pelts to Russia and deduct the money Mr. Clinton is always giving to them.

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

4.0 Introduction

Chapter 4 provides information needed for making informed decisions on the nutria damage reduction objectives identified in Chapter 1 (Section 1.5 of this EA) (Bounds and Carowan 2000). This chapter uses the issues identified in Chapter 3 as the evaluation criteria. Each of the major issues will be analyzed for its environmental consequences under each alternative.

Resource managers believe that without intervention Chesapeake Bay marshes which provide significant ecological, cultural, and economic benefit to the State of Maryland, the Atlantic Coast, and the Nation, may completely disappear within the next decade (Bounds et al. 2000). Tourists visit Dorchester County and other areas on the Eastern Shore to enjoy the native wildlife and natural marsh areas; however, the continued existence of these precious resources is currently threatened.

This section analyzes the environmental consequences using Alternative 2 (The Current Program) as the baseline for comparison. Table 1 summarizes the issues and impacts.

The following resources within the program area would not be adversely impacted by any of the alternatives analyzed; soils, geology, minerals, water quality/quantity, flood plains, wetlands, visual resources, cultural/historical resources, air quality, prime and unique farmlands, aquatic resources, timber, and range. These resources will not be analyzed further.

4.1 Additional Resources and Impact Analysis

4.1.1 Social and Recreational Concerns

Social and recreational concerns about the proposed action were identified during public involvement and are discussed within this EA and USDA (1997).

4.1.2 Cumulative and Unavoidable Impacts

Cumulative and unavoidable impacts to key wildlife species (nutria and muskrats) are discussed and analyzed in this chapter. Indirect impacts are discussed throughout the environmental consequences section where applicable.

Both vegetation and wildlife resources would be affected by the proposed action and the other alternatives. Under the proposed action, nutria populations would decrease or be eradicated, however, muskrat populations and other wildlife species in the area are expected to increase and the marsh vegetative mat should be more able to recover, thus benefitting the natural environment of the area. No T&E or non-target species would be adversely affected by the proposed or any of the other action alternatives analyzed in this EA.

Resource managers cannot control marsh degradation and loss factors such as sea level rise, global warming, land subsidence, and increased salinity. However, they can manage nutria populations to reduce and prevent further damage to marsh ecosystems by nutria. In addition to direct impacts, nutria also function as a catalyst that exacerbates and greatly accelerates marsh loss from these global factors.

Removal of nutria from Maryland's marshes will not stop losses due to these other factors, however it will slow losses to the gradual incremental rates experienced in areas not inhabited by nutria.

4.1.3 Target and Non-target Wildlife Species

Cumulative impacts to wildlife species are addressed in section 4.2. The population of most non-target species (red fox, otter, muskrat, raccoon, opossum, rice rats, migratory birds, waterfowl, etc.) that could be captured from implementation of the proposed action are healthy and stable to increasing (R.Colona, MDNR 2000 pers. comm., G. Carowan, USFWS 2000 pers. comm.). Some non-target animals are expected to be captured, however, the take is expected to be low and would not have adverse impacts on species populations. Section 7 Consultations (ESA) have been conducted with the USFWS to address adverse impacts and concerns from the proposed action to T&E species; no adverse impacts to T&E species are anticipated.

4.1.4 Irreversible and Irretrievable Commitments of Resources

Other than minor uses of fuels for motor vehicles and electrical energy for office maintenance, there are no irreversible or irretrievable commitments of resources to conduct these programs. Based on these estimates, the proposed action produces very negligible impacts on the supply of fossil fuels and electrical energy.

4.1.5 Adverse Impacts on Biodiversity

No wildlife damage management would be conducted to eradicate native or indigenous wildlife populations; only the non-native, invasive nutria under EO 13112 and PL 105-322 would be targeted. The impact on native species biodiversity from the proposed action would be beneficial because interspecific competition from nutria and marsh destruction caused by nutria would be reduced or eliminated. As the agents implementing this nutria damage reduction program, the UMES, USGS and APHIS-WS program impacts on biodiversity are not significant nationwide, statewide, or within the program area.

4.1.6 Aesthetics

The visual quality of the program area would not be degraded but rather enhanced to its more natural condition. Human manipulations of the natural environment would be considered by some to be a positive affect to the quality of the visual scene. Landscape integrity would be an important criterion for visitors and resource managers who find natural-appearing conditions more visually pleasing than damaged marsh to the point of numerous and expansive mudflats.

The removal of nutria would improve the natural visual quality of the area. Removing nutria is extremely important to local inhabitants, visitors, scientists, and agency personnel. The Chesapeake Bay marshes are recognized as some of the most important marshes in the United States (Tiner and Burke 1995). Loss of these critical marshes affects the health of the Chesapeake Bay ecosystem, impact state and local economies and decrease the fish and wildlife productivity. The natural resources of Chesapeake Bay make a significant contribution to the economic well-being of Maryland and to the quality of life of Maryland residents. Chesapeake Bay's well established marsh/riparian areas are frequently used by wildlife and have a very high aesthetic value.

4.2 Major Issues Analyzed in Detail

4.2.1 Alternative 1 - Nutria Damage Reduction Research and operational Program (Proposed Alternative)

Alternative 1 would allow for a coordinated research and operational program with other resource management agencies to develop an integrated nutria damage reduction program based on case-by-case needs. Other resource needs would be considered during the development of the program and integrated into it using the Decision Model (Slate et al. 1992). Ultimately, the proposed program would be based on the needs to reduce nutria damage to marsh vegetation, and the management objectives of the resource management agencies.

4.2.1.1 Effectiveness - The effectiveness of the proposed nutria damage reduction program is dependent upon numerous factors such as: 1) the skill of the field specialists, 2) cooperation of the affected agencies, and 3) the careful and skilled use of proven tools. The proposed management methods are foot-hold traps, kill traps, colony traps, cage traps, snares, shooting, dogs[5], and zinc phosphide[6] based on research findings and circumstances in the field. Some factors that may influence effectiveness cannot be predicted, such as weather, nutria behavior, and accessibility of the marsh. However, the most effective approach to resolving most wildlife damage is to integrate the use of several methods simultaneously or sequentially. Overall, the effectiveness of the proposed action alternative would be rated as the highest when compared with the other alternatives, because methods known to be effective would be used by skilled field specialists, with the cooperation of various agency experts.

The effectiveness (cost:benefit) of damage reduction strategies of the past that included the use of toxicants would likely show a higher benefit per unit cost than damage reduction programs today. Although toxicants are cheap and very effective at keeping damaging species numbers and losses low, there were valid concerns about some environmental impacts of their use. Our social value system has essentially established limits on how cost-effectively wildlife damage management can be conducted. As restrictions on the use of damage management methods increase, cost-effectiveness is reduced.

Traps, snares and shooting are proven effective methods for removing nutria. Traps and snares would be checked daily and any live captured nutria would be euthanized in accordance with AVMA standards. Traps and snares would be placed either in nutria travel lanes or baited with a nutria's preferred food or lure to attract the animal. Effective trap and snare placement contributes to the selectivity for capturing target animals. Shooting is an effective and selective method when personnel are on site. Nutria could also be captured in cage traps and colony traps and if appropriate, these types of traps would be used, however, they may not be practical because of transporting traps through marsh areas.

Dogs (trained retrievers) could effectively be used in instances where nutria are flushed from thick marshy vegetation; dogs would be used to locate and pursue nutria. Training and maintaining suitable dogs requires considerable skill. Nutria control specialists, using their own dogs, may be employed that have the proper specialized experience, and who have first hand knowledge of the program/damage

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[5] Dogs would not be allowed or used on the BNWR

[6] Zinc phosphide would only be used after it is registered by the State of Maryland.

management area. This could be an effective *"tool"* that is available to reduce nutria damage in remote terrain, such as that found in some of the marsh areas.

Zinc phosphide is the only toxicant proposed for use. The use of zinc phosphide on various types of fruit, vegetable or cereal baits (apples, carrots, sweet potatoes, oats, barley) has been proven very effective at suppressing a local population (Evans 1970) and could be the only effective strategy in some situations (i.e., thick brushy and other inaccessible areas) but would not be used until registered in Maryland.

Removing nutria to reduce damage and protect marsh vegetation has been demonstrated to be beneficial to the marshes (Haramis 1997, 1999). Haramis (1999) noted that removing nutria has the potential to increase marsh vegetation and recover the marsh to more natural conditions, and that it would assist with management objectives for invasive species. Sport harvest, not part of the proposed action in this EA, would have removed nutria randomly from various designated locations. Because the proposed action in this EA would take nutria in a systematic manner to reduce or eradicate populations, it is reasonable to assume that this action would likely have a greater beneficial effect on recovering marshes, while minimizing the number of muskrats or other non-target species removed.

4.2.1.2 Impacts on Non-target Species - One non-target species that may be affected by the proposed alternative is the muskrat, however, raccoon, opossum *(Didelphis marsupialis*), or turtles may also be captured; all non-target animals but would be released if they are capable of surviving. Muskrats occupy the same habitat type and are found in areas occupied by nutria. Nutria out compete muskrats and decrease muskrat densities (R. Colona MDNR 2000 pers. comm.). In addition, nutria are damaging the marsh habitat of muskrats and muskrat populations will continue to decrease if nutria continue to expand their range and densities; muskrat populations are adversely impacted by interspecific competition from nutria (R. Colona MDNR 2000 pers. comm.). Under the proposed program, some non-target species may be captured and released unharmed or killed. The overall impact to the muskrat population is anticipated to be beneficial because interspecific competition from nutria would be reduced and marsh habitats could be recovered. In addition, by restoring marsh habitats, fisheries, native wildlife and vegetation would benefit from the proposed action. The USFWS also has a Trust Responsibility (i.e., migratory birds and T&E species, interjurisdictional fish, wetlands) to protect the land (i.e., NWR) for the purposes for which the area was established and this responsibility would benefit from removing negative effects of nutria on marsh habitats.

Damage reduction devices/techniques (traps, snares, baits, dogs, shooting, zinc phosphide) would be used in a manner to avoid capturing or harassing non-target species. Shooting is highly selective and does not pose a risk to T&E species or other non-target animals when conducted by professional field specialists trained in firearm use and trained to identify target and non-target species. The use of kill traps, snares and colony traps could capture and kill some muskrats, and zinc phosphide bait may kill some muskrats if they feed on the bait. The risks associated with zinc phosphide are mitigated through specific direction provided by the EPA label (EPA Reg. No. 56228-6). Furthermore, zinc phosphide would not present secondary poisoning risks to other animals that may scavenge on the carcass of an animal killed by zinc phosphide bait (USDA 1997, Appendix P; EPA 1998). Dogs (trained retrievers) used to flush nutria do not pose a threat to T&E species or other non-target species because they are trained and under the close supervision of dog handlers.

4.2.1.3 Impacts on T&E Species (Endangered Species Act Compliance) - Intra agency ESA Section 7 biological evaluations on the effects of nutria damage reduction on federally listed species found in Maryland were completed (Table 4-1). One consultation was completed for the BNWR (G. Carowan,

USFWS letter to P. Nickerson, USFWS 2001) and the other for Tudor Farms and Fishing Bay WMA (J. Wolfin, USFWS letter to P. Nickerson, USFWS 2001). The USFWS found through the intra agency consultations that the proposed action would have *"no effect"* or *"not likely to be adversely affected"* T&E species in Maryland (Tables 4-2a and 4-2b).

Table 4-1. Listed Species in Maryland

Species	Status[1]
Delmarva Peninsula fox squirrel (*Sciurus niger*	*E*
Bald eagle (*Haliaeetus leucocephalus*)	*T*
Piping plover, (*Charadrius melodus*)	*T*
Northeastern beach tiger beetle (*Cicindela dorsalis)*	*T*
Puritan tiger beetle *(Cicindela puritana)*	*T*
Dwarf wedge mussel *(Alasmidonta heterodon)*	*E*
Sensitive joint-vetch *(Aeschynomene virginica)*	*T*
Canby's dropwort *(Oxypolis canbyi)*	*E*
Swamp pink *(Helonias bullata)*	*T*

[1] *STATUS: E=endangered, T=threatened*

APHIS-WS, USGS and UMES would be the agencies implementing field level nutria damage reduction resulting from this EA. A 1992 biological opinion (BO) issued by the USFWS on the national APHIS-WS program (USDI 1992) and a 1993 BO issued by the USFWS to EPA on 16 chemical agents (USDI 1993) indicate various reasonable and prudent alternatives when using zinc phosphide to preclude jeopardy to T&E species. APHIS-WS, USGS and UMES have adopted all reasonable and prudent alternatives and measures, and terms and conditions that apply. All chemicals used by APHIS-WS, USGS and UMES are registered under FIFRA and administered by EPA and MDA[7]. Zinc phosphide is federally registered by APHIS-WS. Zinc phosphide presents minimal secondary hazards to predators and scavengers and no T&E species occurring in Maryland would be affected by use of this product (USDI 1993, EPA 1998).

4.2.1.4 Humaneness - The issue of humaneness, as it relates to the killing or capturing of wildlife, is an important and very complex concept that can be interpreted in a variety of ways. Humaneness is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently (USDA 1997). Some individuals and groups may oppose some proposed management techniques. Most animal welfare organizations do not oppose the concept of wildlife damage management, but they support more restrictions on those damage management methods perceived by them as inhumane, and support greater use of nonlethal methods (Schmidt 1989). Behavior modification (harassment) of nutria could be construed by some as stressful and therefore inhumane.

CDFG (1999) discussed issues related to humaneness and animal welfare in its Furbearing and Nongame Mammal Hunting and Trapping document. The document discussed welfare of individual animals, including the effects of various methods of *"take"* on pain and suffering, effects of an animal's death, the effects of wounding, and chase-related effects. The document concludes that wounding would be the greatest adverse humane effect on the species. The document did not include nutria, but these discussions apply as well to nutria.

[7] Currently, zinc phosphide is not registered in Maryland and would not be used by agency personnel until registered in the State.

The proposed action contains measures to minimize animal suffering as much as possible, and to eliminate unnecessary suffering (see Section 3.2.2). Consultations would be conducted with veterinarians to evaluate trapped animals to ensure that the methods can be reliably used for live capture with minimal impact on subsequent survival. APHIS-WS, USGS and UMES employs specialized, well trained and experienced personnel to conduct damage management. The skillful use of specific damage management methods when necessary to protect non-target species is considered the most humane approach by the cooperating agencies. APHIS-WS, USGS and UMES use AVMA[8] (1993) recommendations for humane animal treatment. Non-target species that are captured live would be released if they are deemed to be able to survive. If however, they are deemed wounded to the degree they cannot survive, they would be euthanized following methods recommended by the AVMA. Therefore, the magnitude of the impact is considered minor because wounding would be minimized, and selectivity would be maximized. In addition, research conducted under this alternative would continue to improve selectivity and humaneness of management devices.

Table 4.2a T&E Species Effect Determination for the BNWR.

Species/ Critical Habitat	Determination			Response
	NE	NA	AA	
Delmarva fox squirrel	X			Concurrence
Bald eagle		X		Concurrence
Piping plover	X			Concurrence
Northeastern beach tiger	X			Concurrence
Puritan tiger beetle	X			Concurrence
Dwarf wedge mussel	X			Concurrence
Swamp pink	X			Concurrence

NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested is optional but a "Concurrence" is recommended for a complete Administrative Record.

NA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response Requested is a"Concurrence".

AA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested for listed species is "Formal Consultation". Response requested for proposed and candidate species is "Conference".

4.2.1.5 Public and Pet Health and Safety - The proposed program would be an IWDM approach to reduce nutria damage and protect marsh vegetation while safe guarding public and pet health and safety, and guided by agency policies, directives, cooperative agreements, MOUs and federal and state laws. Only appropriate chemical and non-chemical methods to minimize nutria damage problems would be used and agency personnel would be aware of the risks to humans and pets. Agency use of toxicants is

[8] AVMA euthanasia methods were developed principally for companion animals, and not for free-ranging wildlife. However, wildlife physiological systems are very similar to companion animals and the humaneness of euthanizing methods for companion animals should be comparable for wildlife.

regulated by the EPA through the FIFRA, by state law and the MDA[9], and by agency directives and policies. Along with effectiveness, cost and social acceptability, risk is an important criterion for selection of an appropriate damage management strategy. Determination of risks to non-target animals, humans and pets, and agency personnel is thus an important prerequisite for successful application of strategies. Based on a thorough Risk Assessment (USDA 1997, Appendix P), APHIS concluded that the methods described and analyzed in this EA have negligible impacts on the environment and public and pet health and safety when used according to directives, policies, laws, and label directions. The greatest risks to public health and safety from the proposed use of mechanical and chemical methods are incurred by the agency personnel who apply the methods. For these reasons, the risks posed to the public and domestic pets from the proposed action are negligible.

Table 4-2b. Effect Determination for the Tudor Farms and Fishing Bay WMA

Species/ Critical Habitat	Determination			Response
	NE	NA	AA	
Delmarva fox squirrel		X		Concurrence
Bald eagle		X		Concurrence
Piping plover	X			Concurrence
Northeastern beach tiger	X			Concurrence
Puritan tiger beetle	X			Concurrence
Dwarf wedge mussel	X			Concurrence
Sensitive joint-vetch	X			Concurrence
Canby's dropwort	X			Concurrence
Swamp pink	X			Concurrence

NE = no effect. This determination is appropriate when the proposed action will not directly, indirectly, or cumulatively impact, either positively or negatively, any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested is optional but a "Concurrence" is recommended for a complete Administrative Record.

NA = not likely to adversely affect. This determination is appropriate when the proposed action is not likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat or there may be beneficial effects to these resources. Response Requested is a "Concurrence".

AA = likely to adversely affect. This determination is appropriate when the proposed action is likely to adversely impact any listed, proposed, candidate species or designated/proposed critical habitat. Response Requested for listed species is "Formal Consultation". Response requested for proposed and candidate species is "Conference".

4.2.1.6 Socio-economics - The natural resources of a healthy Chesapeake Bay are highly valued by the public and they make an important contribution to the economic well-being of Maryland and to the quality of life of Maryland residents. Maryland's marshes are used for multiple purposes including: fishing, hunting, trapping, bird watching, wildlife viewing/photography, berry and timber harvest, agriculture and livestock production.

Chesapeake Bay is a significant socio-economic factor in Dorchester County. Fur trapping is a major source of supplemental income to many residents, particularly farmers and watermen. The proposed action would have positive effects on the muskrat population, and thus, a positive effect on the income of Dorchester County fur trappers.

[9] Currently, zinc phosphide is not registered in Maryland and would not be used by agency personnel until registered in the State.

Although nutria were introduced to support the fur industry, private fur trappers and hunters have not kept pace with the animal's ability to reproduce. Fur markets and the profits from nutria pelts have been subject to fluctuations due to a variety of factors and the outlook for this trend is to continue. Therefore, a systematic and well organized nutria damage reduction and marsh recovery program is needed to curtail vital marsh loss and recover habitats and ecosystems vital to native wildlife populations.

4.2.2 - Alternative 2 - No Nutria Damage Reduction (No Action)

4.2.2.1 Effectiveness - Under this alternative, the resource management agencies would not take action to reduce nutria damage. Therefore, no nutria would be killed or harassed outside of the current sport harvest. The effectiveness of nutria damage reduction is dependent upon the use of the appropriate strategies and combinations of proven tools by sportsmen. It is anticipated that about the same numbers of nutria would be taken as in the past by private trappers or hunters. This strategy, the use of traps, snares and shooting, has been proven to be an effective method for removing nutria. However, this strategy of using private fur trappers and hunting is not keeping the nutria population at a level where marsh damage can be kept in check.

If no action is taken, marsh loss is expected to continue at a similar rate as today, leading to thousands of acres of marsh being lost over the next several decades. Nutria will continue to damage the marsh and the wetlands will continue to degrade.

All chemicals that could legally be used to reduce nutria damage must be registered under FIFRA and administered by EPA and MDA[10]. Zinc phosphide is federally registered by APHIS-WS and is the only toxicant registered for the control of nutria and the associated damage. Zinc phosphide can only be used by certified pesticide applicators and not the general public at large.

4.2.2.2 Impacts on Non-target Species - Under the no action alternative, no non-target species would be removed by agency personnel. Private fur trappers and hunters remove species other than nutria during the regulated furbearer harvest season, primarily muskrats. However, as nutria continue to proliferate in Maryland and elsewhere, it is likely that muskrat populations will further decline and be replaced by nutria (R. Colona, MDNR 2000 pers. comm.). Muskrats occupy the same habitat type and are found in areas occupied by nutria.

4.2.2.3 Impacts on T&E Species (Endangered Species Act Compliance) - No impact would occur to T&E species from agency personnel activities under this alternative. Under this alternative, the threat to T&E species would be from private trappers and hunters inadvertently capturing or killing a T&E species. The level to which T&E species may be affected by this alternative depends on the expertise and precautions to avoid T&E species that private trappers implement. A "No Action" alternative would continue the *status quo* where nutria would be trapped or hunted by private entities.

4.2.2.4 Humaneness - Under this alternative, agency personnel would not implement any field activities to remove or handle nutria and marsh recovery probably would not occur. The No Action Alternative could be considered more humane for the target species than the proposed action by some animal right groups. Nutria would not be captured and killed by agency personnel nor would they suffer

[10] Currently, zinc phosphide is not registered in Maryland and would not be used by agency personnel until registered in the State.

stress or injury from damage reduction tools applied by agency personnel.

However, the MDNR regulates trapping and hunting opportunities in Maryland, and the issue of humaneness would be dependent upon the skill of each trapper or hunter. Presumably, individual trappers and hunters would not be as skilled as professional damage control specialists. This alternative is also likely to be less selective in removing only nutria since professional wildlife specialists would only target nutria and are highly skilled in a variety of damage reduction methods to avoid non-target captures. As nutria populations and distribution increase, additional marshes would be adversely affected and continue interspecific competition between nutria and native species.

4.2.2.5 Public and Pet Health and Safety - Under this alternative, no agency personnel would be conducting nutria damage reduction research or operations. Therefore, no risk to the public or pets could occur from the use of nutria damage reduction strategies by agency personnel. The MDNR, USFWS or other governmental agencies would not have direct oversight of private trappers or hunters. The only regulations that private trappers or hunters would have to adhere to are USFWS and MDNR policies and trapping regulations.

4.2.2.6 Socio-economics - The natural resources of Chesapeake Bay are highly valued by the public and they make a significant contribution to the economic well-being of Maryland and to the quality of life of Maryland residents. However, under the No Action Alternative, nutria would continue to damage marsh vegetation, contributing to the marsh loss and its associated socio-economic implications.

Alternative 2 would also not allow coordination with other resource managers to meet the needs of the area and develop a nutria damage reduction or marsh recovery program. Other resource needs would not be considered during private trappers or hunters activities.

4.2.3 - Alternative 3 - Nutria Damage Reduction Research Only

4.2.3.1 Effectiveness - The effectiveness of this alternative is largely dependent upon the results of the nutria research proposed and the ability to implement research findings. Implementation of this alternative would provide Maryland-specific nutria research information for the development of effective nutria damage reduction strategies but would not allow for a direct operational nutria damage reduction effort. The damage reduction devices proposed for use under this alternative are cage and foot-hold traps so that nutria can be euthanized and biological samples taken to determine the most effective population reduction/eradication strategies. These samples would be used to determine nutria natural history in satisfaction and data collection for the objectives.

The most effective approach to resolving any wildlife damage is to integrate (i.e., IWDM) the use of several methods simultaneously or sequentially (USDA 1997). The philosophy behind IWDM is to implement effective management techniques, in a cost-effective manner while minimizing the potentially harmful effects to humans, target and non-target species and the environment. IWDM draws from the largest possible array of strategies to create a combination of techniques appropriate and most effective for the specific circumstances.

Ultimately, nutria damage reduction is dependent upon the careful and skilled use of the appropriate and proven tools. The effectiveness of this alternative to reduce nutria damage would depend on its applicability and implementation to an operational program. Overall, the effectiveness of this alternative

would be rated behind the proposed alternative because this alternative only allows for a 3-year research program and not the implementation of an operational IWDM program.

4.2.3.2 Impacts on Non-target Species - Under this alternative, some non-target species (i.e., muskrats, raccoon, opossum and turtles) may be captured but would be released if they are capable of surviving. Minor injuries may occur from the traps, but injuries should not be life threatening.

4.2.3.3 Impacts on T&E Species (Endangered Species Act Compliance) - Intra agency ESA Section 7 biological evaluations on the effects of nutria damage reduction on the listed species found in Maryland was conducted (G. Carowan, USFWS letter to P. Nickerson, USFWS 2001, J. Wolflin, USFWS letter to P. Nickerson, USFWS 2001). The USFWS found through the intra agency consultations that neither the proposed action nor any of the action alternatives would cause adverse affects to T&E species found in Maryland (Tables 4-2a and 4-2b).

Under this alternative, APHIS-WS, USGS and UMES would be the agencies implementing any field level nutria damage research programs resulting from this EA. A USFWS 1992 and 1993 BO (USDI 1992, 1993) indicated various reasonable and prudent alternatives to preclude jeopardy to T&E species. APHIS-WS, USGS and UMES have adopted all reasonable and prudent alternatives and measures, and terms and conditions that apply to avoid impacts to T&E species. Therefore, the impact to T&E species under this alternative are similar to those of Alternative 1.

4.2.3.4 Humaneness - Some people and groups consider any form of nonlethal damage reduction (cage traps) to be more desirable and humane than lethal strategies. Humaneness is a person's perception of harm or pain inflicted on an animal, and people may perceive the humaneness of an action differently (USDA 1997). The CDFG (1999) discussed issues related to humaneness and animal welfare in its Furbearing and Nongame Mammal Hunting and Trapping document. The document discussed welfare of individual animals, including the effects of various methods of *"take"* on pain and suffering and stated that cage traps are not perfect. Swanstrom (1962) and Swift (1966 as cited in CDFG 1999) stated that some animals captured in cage traps damage their teeth after being captured or when disturbed. The detailed discussion in CDFG (1999) is incorporated by reference.

4.2.3.5 Public and Pet Health and Safety - Under this alternative, the nutria damage reduction research program would be guided by agency policies, directives, cooperative agreements, MOUs and federal and state laws. The research program is expected to have positive effects on a more complete understanding of nutria natural history and marsh recovery with little to no adverse effect on public and pet health and safety.

Under this alternative, the entire program would consist of research on the natural history of nutria and recovery of marsh damage from nutria herbivory. Based on the risk assessment from USDA (1997), the environmental and public health and safety risks associated with trapping and research is low. The greatest risks to public health and safety from the use of mechanical and chemical methods are incurred by the agency personnel who apply the methods. For the reasons stated above, risks posed to the public and domestic pets from this alternative are low.

4.2.3.6 Socio-economics - Under this alternative, the socio-economic well-being of Dorchester County residents and residents of Maryland would not be adversely impacted. In contrast, implementation of research findings may in fact increase nutria natural history knowledge and lead to marsh recovery and

thus increased socio-economic well-being of Maryland residents.

4.2.4 Alternative 4 - Nutria Damage Reduction Operational Program Only

4.2.4.1 Effectiveness - The effectiveness of nutria damage reduction is dependent upon the careful and skilled use of the appropriate combinations of proven tools. The management methods and effectiveness under this alternative are similar to those of Alternative 1, however without the Maryland specific nutria natural history knowledge provided by research findings. Under this alternative, marsh recovery opportunities would remain unexplored.

4.2.4.2 Impacts on Non-target Species - Under this alternative, some non-target species may be captured and released unharmed or killed. Impacts on non-target species may be higher or the same as Alternative 1 because during the live capture phase, methods to capture nutria can be refined. The methods used under this alternative and species that could potentially be caught and killed or released unharmed are expected to be the same as Alternative 1. Therefore, the impact to non-target species under this alternative are similar to those of Alternative 1, however without the site specific nutria natural history knowledge provide by research findings.

4.2.4.3 Impacts on T&E Species (Endangered Species Act Compliance) - Intra agency ESA Section 7 biological evaluations on the effects of nutria damage reduction on the listed species found in Maryland was conducted (G.Carowan, USFWS letter to P. Nickerson, USFWS 2001, J. Wolflin, USFWS letter to P. Nickerson, USFWS 2001). The USFWS found through the intra agency consultations that neither the proposed action nor any of the action alternatives would cause adverse affects to T&E species found in Maryland (Tables 4-2a and 4-2b).

Under this alternative, APHIS-WS, USGS and UMES would be the agencies implementing any field level nutria damage operational programs resulting from this EA. A USFWS 1992 and 1993 BO (USDI 1992, 1993) indicated various reasonable and prudent alternatives to preclude jeopardy to T&E species. APHIS-WS, USGS and UMES have adopted all reasonable and prudent alternatives and measures, and terms and conditions that apply to avoid impacts to T&E species. Therefore, the impact to T&E species under this alternative are similar to those of Alternative 1.

4.2.4.4 Humaneness - Under this alternative, humaneness would be similar to the proposed alternative (Alternative 1). This alternative also contains measures to minimize animal suffering as much as possible, and to eliminate unnecessary suffering. Agency employees specialized, well trained and experienced to conduct damage management would improve the selectivity of management devices through other research and standardized field procedures. Research continues to improve selectivity and humaneness of management devices. Therefore, the issue of humaneness under this alternative is similar to those of Alternative 1.

4.2.4.5 Public and Pet Health and Safety - This nutria damage reduction program would also be guided by the same agency policies, directives, cooperative agreements, MOUs and federal and state laws as Alternative 1. For these reasons, the risks posed to the public and domestic pets from agency employed methods is low and the impacts the same as Alternative 1.

4.2.4.6 Socio-economics - The socio-economic considerations and results of this Alternative would be similar to Alternative 1. However, without Maryland specific nutria information, the benefits may not

be as high as those witnessed with Alternative 1.

4.3 Summary & Conclusions

Table 4-4 presents the major conclusions drawn from the analysis. All of the alternatives would result in no significant adverse impacts on the quality of the human environment.

The effectiveness of the alternatives, given no significant impact in any of the other evaluation criteria, is probably the most important evaluation criterion (issue) in this assessment because of the need to reduce nutria damage and recover damaged marshes. The effectiveness of any of the alternatives would determine the likelihood that the alternative would help to achieve the objectives of the proposal to prevent further decline of marsh habitat, while other measures are ongoing to reduce the invasive, non-native nutria populations.

Table 4-4. Summary of Impacts

Issue	Alt 1. Proposed Alternative	Alt 2. No Action Status quo	Alt 3. Research Only	Alt. 4. Operational Program Only
Effectiveness	Most likely to reduce nutria damage and protect marsh	Lowest	Low to moderate. This alternative would only allow for a 3-year research project	Moderate to high
Non-target Species	Low risks	None from agency personnel	Low risks	Low risks
T&E Species	No adverse effect.	No adverse effects from agency personnel	No adverse effect.	No adverse effect.
Humaneness	Some people opposed to capture and killing of any wildlife. Methods to minimize pain and suffering would be used.	Could be considered more humane for nutria because of no agency actions; only sport action. No program to protect native marsh habitats	Some people opposed to capture and killing of any wildlife. Methods to minimize pain and suffering would be used.	Some people opposed to capture and killing of any wildlife. Methods to minimize pain and suffering would be used.
Public and Pet Safety	Low risk	Low risks	Low risks	Low risks
Socio-economic	Highest Positive benefit to socio-economic considerations	Lowest positive benefit	Positive benefits, however this is only a 3-year research project	Positive benefits, however probably not as high as Alternative 1.
Cumulative Impacts	Low	None from agency personnel	Low	Low

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Appendix B
Invasive Species Executive Order 13112 and Public Law 105-322

EXECUTIVE ORDER 13112 - INVASIVE SPECIES

By the authority vested in me as President by the Constitution and the laws of the United States of America, including the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 et seq.), Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990, as amended (16 U.S.C. 4701 et seq.), Lacey Act, as amended (18 U.S.C. 42), Federal Plant Pest Act (7 U.S.C. 150aa et seq.), Federal Noxious Weed Act of 1974, as amended (7 U.S.C. 2801 et seq.), Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.), and other pertinent statutes, 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, it is ordered as follows:

Section 1. Definitions.

(a) "Alien species" means, with respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.

(b) "Control" means, as appropriate, eradicating, suppressing, reducing, or managing invasive species populations, preventing spread of invasive species from areas where they are present, and taking steps such as restoration of native species and habitats to reduce the effects of invasive species and to prevent further invasions.

(c) "Ecosystem" means the complex of a community of organisms and its environment.

(d) "Federal agency" means an executive department or agency, but does not include independent establishments as defined by 5 U.S.C. 104.

(e) "Introduction" means the intentional or unintentional escape, release, dissemination, or placement of a species into an ecosystem as a result of human activity.

(f) "Invasive species" means an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health.

(g) "Native species" means, with respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

(h) "Species" means a group of organisms all of which have a high degree of physical and genetic similarity, generally interbreed only among themselves, and show persistent differences from members of allied groups of organisms.

(i) "Stakeholders" means, but is not limited to, State, tribal, and local government agencies, academic institutions, the scientific community, nongovernmental entities including environmental, agricultural, and conservation organizations, trade groups, commercial interests, and private landowners.

(j) "United States" means the 50 States, the District of Columbia, Puerto Rico, Guam, and all possessions, territories, and the territorial sea of the United States.

Section 2. Federal Agency Duties.

(a) Each Federal agency whose actions may affect the status of invasive species shall, to the extent practicable and permitted by law,

(1) identify such actions;

(2) subject to the availability of appropriations, and within Administration budgetary 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; and

(3) not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere unless, pursuant to guidelines that it has prescribed, the agency has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions.

(4) Federal agencies shall pursue the duties set forth in this section in consultation with the Invasive Species Council, consistent with the Invasive Species Management Plan and in cooperation with stakeholders, as appropriate, and, as approved by the Department of State, when Federal agencies are working with international organizations and foreign nations.

Section 3. Invasive Species Council.

(a) An Invasive Species Council (Council) is hereby established whose members shall include the Secretary of State, the Secretary of the Treasury, the Secretary of Defense, the Secretary of the Interior, the Secretary of Agriculture, the Secretary of Commerce, the Secretary of Transportation, and the Administrator of the Environmental Protection Agency. The Council shall be Co-Chaired by the Secretary of the Interior, the Secretary of Agriculture, and the Secretary of Commerce. The Council may invite additional Federal agency representatives to be members, including representatives from subcabinet bureaus or offices with significant responsibilities concerning invasive species, and may prescribe special procedures for their participation. The Secretary of the Interior shall, with concurrence of the Co-Chairs, appoint an Executive Director of the Council and shall provide the staff and administrative support for the Council.

(b) The Secretary of the Interior shall establish an advisory committee under the Federal Advisory Committee Act, 5 U.S.C. App., to provide information and advice for consideration by the Council, and shall, after consultation with other members of the Council, appoint members of the advisory committee representing stakeholders. Among other things, the advisory committee shall recommend plans and actions at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order. The advisory committee shall act in cooperation with stakeholders and existing organizations addressing invasive species. The Department of the Interior shall provide the administrative and financial support for the advisory committee.

Section 4. Duties of the Invasive Species Council. The Invasive Species Council shall provide national leadership regarding invasive species, and shall:

(a) oversee the implementation of this order and see that the Federal agency activities concerning invasive species are coordinated, complementary, cost-efficient, and effective, relying to the extent feasible and appropriate on existing organizations addressing invasive species, such as the Aquatic Nuisance Species Task Force, the Federal Interagency Committee for the Management of Noxious and Exotic Weeds, and the Committee on Environment and Natural Resources;

(b) encourage planning and action at local, tribal, State, regional, and ecosystem-based levels to achieve the goals and objectives of the Management Plan in section 5 of this order, in cooperation with stakeholders and existing organizations addressing invasive species;

(c) develop recommendations for international cooperation in addressing invasive species;

(d) develop, in consultation with the Council on Environmental Quality, guidance to Federal agencies pursuant to the National Environmental Policy Act on prevention and control of invasive species, including the procurement, use, and maintenance of native species as they affect invasive species;

(e) facilitate development of a coordinated network among Federal agencies to document, evaluate, and monitor

impacts from invasive species on the economy, the environment, and human health;

(f) facilitate establishment of a coordinated, up-to-date information-sharing system that utilizes, to the greatest extent practicable, the Internet; this system shall facilitate access to and exchange of information concerning invasive species, including, but not limited to, information on distribution and abundance of invasive species; life histories of such species and invasive characteristics; economic, environmental, and human health impacts; management techniques, and laws and programs for management, research, and public education; and

(g) prepare and issue a national Invasive Species Management Plan as set forth in section 5 of this order.

Section 5. Invasive Species Management Plan.

(a) Within 18 months after issuance of this order, the Council shall prepare and issue the first edition of a National Invasive Species Management Plan (Management Plan), which shall detail and recommend performance-oriented goals and objectives and specific measures of success for Federal agency efforts concerning invasive species. The Management Plan shall recommend specific objectives and measures for carrying out each of the Federal agency duties established in section 2(a) of this order and shall set forth steps to be taken by the Council to carry out the duties assigned to it under section 4 of this order. The Management Plan shall be developed through a public process and in consultation with Federal agencies and stakeholders.

(b) The first edition of the Management Plan shall include a review of existing and prospective approaches and authorities for preventing the introduction and spread of invasive species, including those for identifying pathways by which invasive species are introduced and for minimizing the risk of introductions via those pathways, and shall identify research needs and recommend measures to minimize the risk that introductions will occur. Such recommended measures shall provide for a science-based process to evaluate risks associated with introduction and spread of invasive species and a coordinated and systematic risk-based process to identify, monitor, and interdict pathways that may be involved in the introduction of invasive species. If recommended measures are not authorized by current law, the Council shall develop and recommend to the President through its Co-Chairs legislative proposals for necessary changes in authority.

(c) The Council shall update the Management Plan biennially and shall concurrently evaluate and report on success in achieving the goals and objectives set forth in the Management Plan. The Management Plan shall identify the personnel, other resources, and additional levels of coordination needed to achieve the Management Plan's identified goals and objectives, and the Council shall provide each edition of the Management Plan and each report on it to the Office of Management and Budget. Within 18 months after measures have been recommended by the Council in any edition of the Management Plan, each Federal agency whose action is required to implement such measures shall either take the action recommended or shall provide the Council with an explanation of why the action is not feasible. The Council shall assess the effectiveness of this order no less than once each 5 years after the order is issued and shall report to the Office of Management and Budget on whether the order should be revised.

Section 6. Judicial Review and Administration.

(a) This order is intended only to improve the internal management of the executive branch and is not intended to create any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity by a party against the United States, its agencies, its officers, or any other person.

(b) Executive Order 11987 of May 24, 1977, is hereby revoked.

(c) The requirements of this order do not affect the obligations of Federal agencies under 16 U.S.C. 4713 with respect to ballast water programs.

(d) The requirements of section 2(a)(3) of this order shall not apply to any action of the Department of State or Department of Defense if the Secretary of State or the Secretary of Defense finds that exemption from such

requirements is necessary for foreign policy or national security reasons.

WILLIAM J. CLINTON
THE WHITE HOUSE,
February 3, 1999.

Appendix B
Invasive Species Executive Order 13112 and Public Law 105-322

Public Law 105-322 (105th Congress)

An Act

To authorize the Secretary of the Interior to provide financial assistance to the State of Maryland for a pilot program to develop measures to eradicate or control nutria and restore marshland damaged by nutria.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. NUTRIA ERADICATION AND CONTROL PILOT PROGRAM.

(a) Grant Authority.--The Secretary of the Interior (in this section referred to as the ``Secretary''), subject to the availability of appropriations, may provide financial assistance to the State of Maryland for a pilot program to develop measures to eradicate or control nutria and restore marshland damaged by nutria.

(b) Goals.--The pilot program shall develop methods to--
(1) eradicate nutria in Maryland;
(2) eradicate or control nutria in other States; and
(3) develop methods to restore marshland damaged by nutria.

(c) Activities.--The Secretary shall require that the pilot program consist of management, research, and public education activities carried out in accordance with the document entitled ``Marsh Restoration: Nutria Control in Maryland Pilot Program Proposal'', dated July 10, 1998.

(d) Cost Sharing.--
(1) Federal share.--The Federal share of the costs of the pilot program may not exceed 75 percent of the total costs of the pilot program.
(2) In-kind contributions.--The non-Federal share of the costs of the pilot program may be provided in the form of in-kind contributions of materials or services.

(e) Limitation on Administrative Expenses.--Not more than 10 percent of financial assistance provided by the Secretary under this section may be used for administrative expenses.

(f) Authorization of Appropriations.--For financial assistance under this section, there are authorized to be appropriated to the Secretary $2,900,000 for fiscal years 2000, 2001, and 2002.

Approved October 30, 1998.

LEGISLATIVE HISTORY--H.R. 4337:

CONGRESSIONAL RECORD, Vol. 144 (1998):
Sept. 28, considered and passed House.
Oct. 9, considered and passed Senate

Appendix C
Towards an Eradication Plan for Nutria in Maryland

Towards an eradication plan for nutria in Maryland

A report to the Maryland Department of Natural Resources

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Summary and recommendations

1. A field survey confirmed that nutria are the cause of extensive damage to the marshland ecosystem. It is recommended that exclosures are set up to measure the impact of nutria damage and to demonstrate the ability of the marshes to recover.

2. The trapping techniques proposed for the eradication scheme in Maryland are more efficient than the cage traps used in England. It is recommended that attention should be paid to making the traps target-specific and to increasing efficacy by developing raft trapping.

3. The inaccessibility of nutria in the centre of extensive marshland blocks is a potential barrier to eradication. Perimeter trapping will probably be sufficient in most cases but if some nutria have long term ranges within marshland blocks it will be necessary to gain access on foot or by marsh vehicles. It is recommended that a study of nutria ranging behaviour is set up using ear-tagging and radio-tracking at the earliest opportunity to investigate the extent of the problem.

4. Population fecundity is significantly lower in Maryland than in England, making the prospects of eradication more likely in this respect.

5. A practical demonstration of eradication would have great value for the development of techniques and for fund raising. It is recommended that a pilot eradication scheme using three trappers is initiated as soon as possible.

6. Currently it is not possible to estimate the number of trappers needed to achieve eradication within ten years. It is recommended that effective trapper areas are used as a basis for calculating the number of trappers required for eradication and that a scheme to measure the size of these areas in different areas is implemented as soon as possible.

7. In the eradication scheme, trapper numbers must be kept at high levels to the very end of the campaign, not reduced as nutria numbers fall.

8. It is recommended that a system for the strategic deployment of trapping effort is designed and implemented using past catch to trapping effort ratios.

9. Bounty schemes tend to promote high sustained yield rather than eradication. It is recommended that the such a scheme is regarded principally as a subsidy to local people rather than as a way of significantly reducing nutria numbers. The main benefit may be in securing local support for the efforts of the contracted trappers.

10. It is recommended that an incentive bonus scheme based on the principle that trappers should be rewarded for achieving eradication is devised and implemented. A possible scheme is outlined. Its implications must be made clear to all trappers appointed and it must form part of their contract of employment.

11. It is recommended that an independent monitoring team is set up to help detect nutria when they become rare and eventually to confirm eradication. The team could be based in the Department of Natural Resources and should have at least three full time field staff in the last few years of the campaign.

12. It is recommended that there should be a pro-active public relations campaign which includes advance negotiations with organisations and individuals who will need to give permission for access to their land.

Introduction

The following report is based on an evaluation of the nutria problem in the Maryland wetlands compared to the situation in England. Nutria were eradicated in England in a ten year trapping campaign which cost £2.6 million (Gosling, 1989). The factors that effect whether or not it is possible to eradicate nutria in Maryland are given particular attention..

Damage

Field assessment of damage

Large areas of fresh and salt water marshes were inspected during a low level helicopter flight and representative areas looked at in detail on foot.

Air inspection showed a pattern of damage to inner areas of marshland which is characteristic of nutria damage to fen habitats throughout the world. This sort of damage has been well documented in eastern Europe where nutria were once used to clear emergent vegetation to produce fish ponds. The damage in Maryland was most intense where there was evidence of the most dense nutria populations (clusters of above ground nests which are conspicuous from the air) and where preferred nutria food (particularly *Scirpus olnei* and *Typha angustifolia*) was most abundant. Inspection on foot of infested areas showed conclusively that the damage was caused by nutria feeding. Typical excavations of *T angustifolia* rhizomes were common: collectively these were the obvious cause of heavily damaged marsh.

In the areas damaged by nutria there was a continuum of change. The most heavily damaged areas were almost devoid of plant material and they were adjacent to areas of mud flat and then open water where the process of destruction appeared to be complete.

I was left in no doubt that the marshes were being seriously damaged and that an important, if not the most important factor, was damage by nutria. Other factors such as land subsidence are believed to be contributing to marsh loss but, even assuming that this is the case, nutria damage would critically reduce the ability of the marshland plant communities to withstand water action. At the very least, feeding by nutria is significantly accelerating the process of marshland destruction.

Exclosures to test the ability of marshland to recover from nutria damage.

A clear demonstration that nutria are responsible for marshland damage would be useful in helping gather support for an eradication scheme. Equally important it would be helpful to know if damaged marshland could recover if nutria were removed. These two points could be investigated using exclosures These should be of reasonable size perhaps with 10m sides (i.e. 100 square metres). About ten exclosures

would demonstrate the effect of feeding and powers of recovery in a range of the more important habitats with a limited number of replicates per habitat.

The exclosures should perhaps be placed in areas of intermediate damage where roots and rhizomes are still present. Areas of bare mud are presumably beyond recovery (although it might be interesting to check).

Exclosures could eventually be accompanied by explanatory displays for public relations purposes but this should be delayed until an exclosure effect becomes obvious. If the effect is dramatic it would be helpful to promote the result through the media.

Care would need to be taken in the interpretation over the potential role of muskrat and snow geese feeding. Recovery may be partly due to the exclusion of these species and it would be counterproductive to assign all damage to nutria if this is not the case. It would be possible to design exclosures which let some of these species in but exclude others. However, simple 'all-out' exclosures might be the best starting point.

Would it be possible to get a Masters student to investigate this problem using data from the exclosures?

It is recommended that exclosures are set up to measure the impact of nutria damage and to demonstrate the ability of the marshes to recover.

Control techniques

Trapping

All trapping in the eradication campaign in England was by cage-trapping. There are a number of advantages in this technique including the fact that is possible to release nearly all non-target captures unharmed. However there is no doubt that the efficiency of the campaign was reduced because cage traps are large and cumbersome and thus difficult to deploy in large numbers. The mean number of traps set per trapper per night was 48.

The use of conibear instant-kill traps and leg-hold traps would be a major advantage for the proposed Maryland campaign. One experienced trapper thinks that it would be possible to set about 100-250 traps even where there was a significant amount of walking involved when setting and checking traps. Where nutria have been reduced to low levels and traps can be inspected visually, for example from a moving boat, it might be possible to check 3-400 traps. In this respect, trapping could thus be 2 to 8 times more intensive per trapper than in England.

However, some development of the techniques to be used is needed. There could be large benefits from setting traps on rafts both in terms of increased efficiency and in reduced non-target captures. Both were major effects in England (Baker and Clarke, 1988), particularly in areas with tidal water level changes. Traps on rafts would also be very efficient to inspect from boats. The development of the rafts should take account of the need to create an attractive place for nutria to climb out and groom.

In addition there is the need to make trapping as target-specific as possible. Very large numbers of traps will be set and the potential damage to populations of non-target species is great. In the later years of the campaign these may form the majority of the animals caught. Apart from the conservation issue there is also an important public relations implications in taking all possible measures to reduce impact on native species.

The boat used to survey the Nanticoke River (12.4.94) would allow the transport of large numbers of traps over large distances. Strategic access using such boats could be critical for the campaign and their use needs to be costed when calculations of the number of trappers working on water have been completed (see below).

Shooting

Shooting at baits (piles of root crops or of corn) after prebaiting could be a useful supplementary technique particularly in winter. It could also be used by the monitoring team (see below) to confirm the presence of nutria.

Accessibility of key habitats

The areas of continuous marshland habitat are far greater in Maryland than in the England. In general it is not necessary to trap throughout continuous habitat because nutria have large ranges and also shift their ranges seasonally. Thus trapping at the periphery of a marshland block will often be sufficient. Having said this there must be limit to the size of the area that can be trapped only around the periphery (this will depend of nutria movements, see below) and it will often be necessary for trappers to penetrate marsh areas where logistically possible both to trap and to check whether or not peripheral trapping has been successful.

This issue will have a large effect on how quickly trappers can check their traplines and thus what areas they can trap at any one time. It will also effect the chances of trapping the last few nutria in an eradication campaign. Information on range size and seasonal movements of individual nutria are needed to resolve this problem. This information is not available from Maryland and since ranging behaviour depends heavily on habitat and climate it will be necessary to collect new information (see below).

The other habitats that may present problems of accessibility were briefly inspected and discussed. Wet woodland such as that in the middle reaches of the Nanticoke River should not maintain high densities of nutria and animals should not remain within it for long periods. In general it should be possible to eradicate nutria using peripheral trapping. This does not apply where there are patches of open marshland with extensive communities of preferred foods within the woodland and these would need to be trapped directly.

Saltwater marshes closer to Bay pose similar problems to those of extensive freshwater marsh but with the additional problem of access along strongly tidal creeks. Appropriate equipment including boat size, the development of floating trap sets and information about the ranging behaviour of nutria in these habitats may be critical.

Scattered nutria in agricultural areas can potentially absorb very large amounts of time spent in searching. There is no escape from this and this factor proved to be a major problem in the English campaign. Some help can be obtained through developing a system of contacts with professional organisation who have an interest in nutria eradication and with farmers.

Studies of ranging behavior to test the efficacy of perimeter trapping

Whether or not nutria can normally be caught by perimeter trapping large marshland blocks will depend on their ranges in these areas and whether they visit peripheral areas, including waterways accessible to boats.

This problem could be resolved by tagging animals(ear-tags) and by radio-tracking. Animals should be trapped \and tagged near the centres of a number of large marsh blocks and their movements studied. Short term results would be useful but the value of the work would be increased if year round movements could be followed (i.e. do nutria move into habitats where they could be more easily trapped at particular times of year and if so what proportion of the population?). Again, this would be an excellent subject for a Masters or Doctoral thesis.

It is recommended that a study of nutria ranging behaviour is set up using ear-tagging and radio-tracking at the earliest opportunity.

Population fecundity

Litter size is lower at 3-4 in Maryland than the 5-6 in England perhaps linked to the harsher winter climate and differences in wetland productivity. I am surprised by the high number of litters per female per year (2.05) estimated by Willner, Chapman and Pursley, 1979 and think this may be an overestimate. Juvenile mortality is linked to winter severity and is again likely to be poorer than in England.

Overall fecundity is probably significantly lower than in England and this factor thus favours the prospects for eradication.

Pilot eradication scheme

Whatever the theoretical background (or the strength of the case from the English exercise) there are strong merits in having a practical demonstration of eradication from a sub-area in the Maryland marshes. The area should be small enough to keep the exercise under close scientific control but large enough to be practically realistic.

It should be in an area of good nutria habitat which is at least moderately difficult to control so that it represents a real test of eradication.

In practice the pilot eradication scheme could employ three trappers (as in a similar scheme in England: Gosling, Baker and Clarke, 1988). The area trapped should be three times the area that one trapper can control using progressive trapping, while achieving near complete reduction of catch at each successive site and revisits to each site at not more than 3-6 mths interval. Preferably, the trapping should proceed in a measured way without special events (such as occasional influxes of sporadic hunting) so that the results of the pilot scheme can be applied more simply to other areas.

This regime should result in a rapid decline in the nutria catch. This can be expressed as nutria caught per unit of trapping effort. The decline should take the form of an exponential decay curve and this can be compared with the results obtained in England.

It is recommended that a pilot eradication scheme is initiated as soon as possible.

Trapper numbers

Numbers in the draft plan

The draft plan envisages a team of 14 trappers which falls in the last few years as nutria numbers decline.

With existing information I do not think it possible to arrive at a reasonably accurate figure for the number of trappers needed to achieve eradication and I outline below a practical scheme for estimating the number required. I would guess that 14 is too low, particularly when the need to eradicate nutria in dispersed peripheral locations is taken into account.

It is critically important not to reduce trapping intensity in the final stages of an eradication scheme. The effort needed to find and catch single animals or small colonies is as great or greater than that required to reduce numbers at the start. The capture of the last few individuals will determine whether the scheme will succeed and whether or not the major investment in an eradication scheme has been worthwhile.

It will be difficult to keep trapping intensity up to the last moment (no nutria will have been caught for months). The problems of trapper motivation need to be anticipated. Trappers must not be allowed to simply survey areas and then move on if no evidence is detected because nutria at low density are difficult to detect. Field supervisors must ensure that their team continues to trap at high intensity up to the end. Similarly difficulties with funding agencies must be anticipated and their likely response talked through before it happens. It will be difficult to secure funding for the last year or two unless the funds are committed for the entire campaign at an early stage.

Estimating the number of trappers needed for nutria eradication in Maryland

The approach adopted in England to determining the size of the trapper force needed to achieve eradication was to construct detailed simulation models and use these to explore population behaviour with various numbers of trappers (Gosling and Baker, 1987). This allowed us to simulate population reductions over various periods of time and to estimate the cost of each option.

We considered the number of trappers needed within a fixed area so that, in a sense, our aim was to determine the *density* of trappers. Because of differences in techniques and habitat structure the application or modification of our models for Maryland would be complex and of doubtful benefit. It would be possible to replicate the entire process of building the model, but, even with a number of shortcuts and simplifications that I could suggest, this would be a major exercise in applied population ecology.

Even with shortcuts the necessary research could take some years and, to avoid the inevitable delay (and loss of political momentum) I would suggest an alternative approach based on field determination of the areas that trappers can trap. This approach is based on the concept that the number of trappers is determined mainly by the area to be covered rather than the number of nutria present. Similarly, the number of traps deployed and time spent checking them depends principally on the area to be covered rather than the number of animals caught. This is particularly important in an eradication campaign when equal or greater effort should be devoted to catching single animals in the later stages of the campaign than the abundant colonies at the start.

The approach consists of employing a small number of trappers and, when adequate techniques are in place, start them operating in a practical fashion. This would involve setting the maximum number of traps that they could reasonably check during a working day. The number of traps would be about 150-400 and it would take a few days to survey and set out these traps. Accurate maps and records of captures including non-targets should be kept. If nutria trapping success is more than about 10-15% the number of traps should be increased locally. When the catch has declined to about zero for a few days the trapper should survey ahead and move the traps on to a new, adjacent location. This procedure (known as 'progressive trapping' should carry on over as large an area as possible but the trapper must return to the first site after an interval that does not exceed, say, five months. This constraint limits and defines the area that the trapper can cover.

This procedure will only define the area over which a trapper can work for a particular habitat. Replicates will be required within each habitat and separate estimates will be required for each of the major habitats involved.

An estimate of the number of trappers required for eradication is the total amount of habitat divided by the estimated area that a trapper can cover. In practice the estimate will be the sum of the separate estimates for each of the habitat types. The estimate is based on the assumption that populations subjected to this trapping regime must decline to extinction in the medium term. Data collected during this exercise (and from the pilot eradication scheme) over one or two should confirm the basic rate of decline although the process will not be complete.

In the eradication campaign itself trappers should be deployed more flexibly to respond to local variation in nutria density. The procedure recommended here is simply to estimate total trapping effort. However, the basic procedure should also form the basis for normal trapping practice.

It is recommended that effective trapper areas are used as a basis for calculating the number of trappers required for eradication and that a scheme to measure the size of these areas in different areas is implemented as soon as possible.

A trapper deployment strategy

The information needed to plan the spatial pattern of trapping through the campaign consists of records of nutria caught per unit area with comparable records of trapping effort. These data should be routinely collected by trappers and recorded by map grid squares. When sufficient data are in hand 'strategic regions' be defined. These should be reasonably few in number to avoid excessive complication and they should each contain approximately uniform habitat.

In England we assigned the available trapping effort to each region using one years past data on catch and effort and planned for a three month period in. the future (Gosling and Baker, 1987). Catch can be increased by a power function (not more than squared) to weight future effort into areas of highest nutria density. We weighted effort in this way for the first years of our campaign then gradually reduced the power function to progressively assign more effort to peripheral, low density areas (in absolute terms there was always more effort in the central areas of preferred habitat where the last nutria are most likely to be found).

These calculations are best when all data are unbiased. This will be difficult in Maryland until the contractual trapper team is in place. Bounty returns will help to some extent but bounty hunters will be most interested in trapping high density areas and so the data will be biased against the important low density peripheral regions. Informed guesswork should be a sufficient basis for the distribution of trapping effort up to the time when good distribution data become available.

It is recommended that a system for the strategic deployment of trapping effort is designed and implemented using past catch to trapping effort ratios.

Bounties, incentive schemes and monitoring eradication

Bounty scheme

The draft plan places some emphasis on the payment of bounties to achieve an early reduction in the nutria population. This may be partly because there is considerable local support for a bounty scheme and also an expectation that such a scheme will be put in place. It may be that a bounty scheme would serve a valuable purpose in

encouraging local people to support the eradication scheme and this may be a sufficient reason for using bounties for part of the scheme.

But would a bounty scheme contribute in a practical sense to achieving eradication? The problem is that bounty schemes give a value to the nutria and some people may then want to conserve or husband it as a source of revenue. They would also tend to work mainly in high density areas to maximise earnings and ignore low density areas which are critical to eradication. Bounty schemes did not work in England and while there are sociological differences (including a recognition by some trappers that nutria have a negative impact on muskrat populations) I would not recommend that such a scheme has a major place in the eradication scheme. This issue is discussed further in Gosling and Baker, 1989.

It has been argued that a bounty scheme could be useful in reducing numbers at and early stage. I do not find this argument compelling because a similar amount of effort would be required by the permanent trappers to catch small numbers of nutria as large numbers. This is because the trapping effort required to achieve eradication depends mainly on the area that must be covered rather than the number of animals there. If the trapping effort from this trapping force is sufficient to reduce low numbers to zero, it will also be able to reduce high numbers at the outset

A benefit from bounty scheme is that it will give some information about distribution of nutria which can be used to plan the trapping strategy. However this will be of limited value because bounty hunters will concentrate on high density areas. Only when the permanent trappers are in place will it be possible to get a comprehensive and unbiased picture of nutria distribution.

In conclusion, the adoption of a bounty scheme should be mainly for sociological and political reasons (essentially a subsidy to the local community) rather than for practical reasons.

It is recommended that the bonus scheme is regarded principally as a subsidy to local people rather than as a way of significantly reducing nutria numbers. The main benefit may be in securing local support for the efforts of the contracted trappers.

Incentive bonus scheme

A bonus incentive scheme was used in the eradication scheme in England to overcome the obstacle that if trappers succeeded in eradicating nutria they would lose their jobs Gosling and Baker, 1987). Essentially the aim was to reward trappers for succeeding in eradicating nutria.

The scheme adopted was as follows. Trappers were promised a sum equivalent to three times their annual wage if they eradicated nutria within six years (of a ten year eradication period). They were also told that no money for nutria control would be available after the ten year period. The date of eradication was defined as the last day on which evidence of nutria was determined by the independent monitoring team (see below). As evidence and numbers of nutria declined, all such evidence was collected

and carefully documented. When a year had elapsed from the latest piece of evidence of this kind, the process of final validation was considered to have started. The process then entered a six month period. If nutria were detected in that period, trapping continued for that period and for a further three month period. If nutria were not detected in the six month period the campaign would end in that period. After the six month period there was potentially an indefinite series of three month periods. If no nutria were detected in any one, the campaign ended at the end of that period. If they were detected during any period the campaign was extended into the next period.

Trapping was maintained at the same high level right up to the end of the campaign. When single animals were detected towards the end of the campaign they attracted massive tactical concentrations of trapping effort because the success of the entire financial investment depended on successful removal of the animals involved.

It is recommended that an incentive bonus scheme based on the principles outlined is devised and implemented. Its implications must be made clear to all trappers appointed and it must form part of their contract of employment.

Monitoring progress towards eradication

The trapper force cannot be put in the position of confirming whether or not nutria have been eradicated because they stand to gain though the incentive bonus scheme. It is thus necessary to establish a separate monitoring team who can provide independent evidence about eradication. The monitoring team should not be included in the incentive bonus scheme. Instead they should have permanent employment contracts (perhaps within the Department of Natural Resources or be guaranteed equivalent alternative employment at the end of the eradication scheme).

An additional very important benefit of such a team is that its existence is an incentive to the trapper team to actually remove all nutria (as opposed to any temptation to falsify records). A certain tension will develop between the trapper team and the monitoring team but this has positive results and negative effects can be controlled by careful management.

Towards the end of the campaign when the detection of nutria becomes vital to the chances of success of the campaign, and increasingly difficult, the monitoring team should help the trapping organisation by providing information about the location of animals whenever possible.

Independent monitoring was an essential element of the eradication scheme in England (Gosling and Baker, 1987) and it is recommended that a team to carry out this function is established in Maryland. The team could be based in the Department of Natural Resources and should have at least three full time field staff in the last few years of the campaign.

Public relations

Effective public relations are more important during an eradication campaign than during a control operation. This is because the trapping team must have access to all land which might harbour nutria and because information from the public about the location of individuals or small colonies is critical to the success of the scheme. particularly when nutria become rare.

The public relations effort should focus on the aim to conserve endangered wetlands. Damage caused by nutria and the benefits of their removal in conservation and economic terms should be emphasised. The threat to a way of life for local people should also receive attention. In discussing the control operation it can be stressed that humaneness (for example all traps inspected at least once every day) and avoiding no-target deaths are given high priority. It also needs to be stressed that nutria are an introduced species and that they are not endangered in their native range.

It is recommended that there should be a pro-active public relations campaign which includes advance negotiations with organisations and individuals who will need to give permission for access to their land.

An outline eradication plan

Important elements of an eradication plan cannot be decided without answers to some of the questions posed above. Important elements include an estimate of the number of trappers needed to achieve eradication and key tactical issues such as the efficacy of perimeter trapping under local conditions and development of optimum trapping techniques. The following plan is thus a draft which will need to be changed as further information is collected.

Year 1:-

• Develop trapping techniques

• Initiate exclosure studies of nutria impact and marshland recovery.

• Initiate radio-tracking study to determine ranging behavior and thus the efficacy of perimeter trapping.

• Initiate pilot eradication scheme using three trappers.

• Initiate trapping study to determine effective trapper areas and thus the trapper force needed for eradication.

• Design trapping and monitoring organisation, draft contracts of employment. Design incentive bonus scheme.

• If politically essential, run bounty scheme and use data to design preliminary trapper deployment plan.

Year 2:-

• Complete studies initiated in first year.

• Take decision about whether or not to proceed to full eradication scheme.

• Set up trapping organisation.

Years 3-10:-

• Eradication scheme.

Is it possible to eradicate nutria in Maryland?

Experience in England has shown that it is possible to eradicate a substantial nutria population over a large area of wetland habitat (Gosling, 1989). This is consistent with detailed information about the biology of this slow-breeding rodent and the levels of mortality that can be inflicted in a trapping campaign.

A number of factors make the prospects of eradication in Maryland even more likely than they were at a comparable stage in England. These include a more efficient trapping technique, better mobility over water and lower population fecundity.

However some further information is needed before it will be possible to predict with reasonable certainty that eradication will be achieved. These include an accurate estimate of the trapper force required and information about nutria ranges to help plan trapping tactics in extensive marshland areas.

Other elements of the plan need careful thought and implementation. These include a well structured trapping organisation, a strategic trapping plan based on past data on catch and effort and an incentive bonus scheme. The incentive bonus scheme and an independent monitoring team are essential elements of the plan.

Given the successful resolution of these issues there is no impediment to eradication. On balance the factors favouring eradication outweigh potential obstacles and it could be possible to complete the task more quickly than in England.

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Appendix D

TIMELINE FOR NUTRIA DAMAGE REDUCTION PROGRAM

YEAR 1	YEAR 2	YEAR 3
Public Education		
Hold briefings for legislators, interest groups, landowners, and key audiences	continues	provide recommendations
Develop educational tool kits	increase distribution	provide recommendations
Develop press kits/hold press events	continues	provide recommendations
Hold public information meetings	continues	provide recommendations
Host informative tours at study sites	continues	continues
Establish Internet sites	updates	provide recommendations
Issue Public Service Announcements	updates	provide recommendation
Establish nutria display at Blackwater NWR	updates	include recommendations
Produce video	increase distribution	revise/include recommendations
Outdoors Maryland segment	updates	new segment-progress/next step
Management and Research		
Continue nutria exclosure study	continues	analyze results/recommendations
Capture and mark/radio-collar nutria		
Initiate intensive trapping	continues	analyze results/recommendations
Research home range and behavior	continues	analyze results/recommendations
Develop population estimates using		
Mark/recapture data	continues	analyze results/recommendations
Compare different trapping techniques	continues	analyze results/recommendations
Compare reproductive response of nutria in exploited/unexploited areas	continues	analyze results/recommendations
Wetland Demonstration Project	continues	analyze results/recommendations

Appendix E
Wildlife Found in the Analysis Area

Mammals

Opossum (*Didelphis virginiana)*
Masked Shrew (*Sorex cinereus)*
Least Shrew (*Cryptotis parva)*
Shorttail Shrew (*Blarina brevicauda)*
Starnose Mole (*Condylura cristata)*
Eastern Mole (*Scalopus aquaticus)*
Little Brown Bat (*Myotis lucifugus)*
Red Bat (*Lasiurus borealis)*
Eastern Cottontail Rabbit (*Sylvilagus floridanus)*
Gray Squirrel (*Sciurus carolinensis)*
Delmarva Fox Squirrel (*Sciurus niger cinereus)*
Southern Flying Squirrel (*Glaucomys volans)*
Rice Rat (*Oryzomys palustris)*
White-footed Mouse (*Peromyscus leucopus)*
Meadow Vole (*Microtus pennsylvanicus)*
Pine Vole (*Pitymys pinetorum)*
Muskrat (*Ondatra zebethicus)*
Nutria (*Myocaster coypus)*
Black Rat (*Rattus rattus)*
Norway Rat (*Rattus norvegicus)*
House Mouse (*Mus musculus)*
Red Fox (*Vulpes vulpes)*
Gray Fox (*Urocyan cinereoargenteus)*
Raccoon (*Procyon lotor)*
Longtail Weasel (*Mustela frenata)*
Mink (*Mustela vison)*
Striped Skunk (*Mephitis mephitis)*
River Otter (*Lutra canadensis)*
Sika Deer (*Cervus nippon)*
White-tailed Deer (*Odocoileus virginianus)*

Potentially Occurring Mammals

Keen's Bat (*Myotis keenii)*
Silver-haired Bat (*Lasionycteris noctivagans)*
Eastern Pipistrell (*Pipistrellus subflavus)*
Big Brown Bat (*Eptesicus fuscus)*
Hoary Bat (*Lasiurus cinereus)*
Evening Bat (*Nycticeius humeralis)*
Southern Bog Lemming (*Synaptomys cooperi)*
Meadow Jumping Mouse (*Zapus hudsonius)*

Birds

Red-throated Loon (*Gavia stellata)*
Common Loon *(Gavia immer)*
Pied-billed Grebe (*Podilymbus podiceps)*
Horned Grebe *(Podiceps auritus)*
Northern Gannet *(Sula bassanus)*
Brown Pelican *(Pelecanus occidentalis)*
Great Cormorant *(Phalacrocorax carbo)*
Double-crested Cormorant *(Phalacrocorax auritus)*
American Bittern *(Botaurus lentiginosus)*
Least Bittern *(Ixobrychus exilis)*
Great Blue Heron *(Ardea herodias)*
Great Egret *(Casmerodius albus)*
Snowy Egret *(Egretta thula)*
Little Blue Heron *(Egretta caerulea)*
Tricolored Heron *(Egretta tricolor)*
Cattle Egret *(Bubulcus ibis)*
Green Heron *(Butorides striatus)*
Black-crowned Night Heron *(Nycticorax nycticorax)*
Yellow-crowned Night Heron *(Nycticorax violaceus)*
Glossy Ibis *(Plegadis falcinellus)*
Red-breasted Merganser *(Mergus serrator)*
Ruddy Duck *(Oxyura jamaicensis)*
Black Vulture *(Coragyps atratus)*
Turkey Vulture*(Cathartes aura)*
Osprey *(Pandion haliaetus)*
Bald Eagle *(Haliaeetus leucocephalus)*
Northern Harrier *(Circus cyaneus)*
Sharp-shinned Hawk *(Accipiter striatus)*
Cooper's Hawk *(Accipiter cooperii)*
Northern Goshawk *(Accipiter gentilis)*
Red-shouldered Hawk *(Buteo lineatus)*
Broad-winged Hawk *(Buteo platypterus)*
Red-tailed Hawk *(Buteo jamaicensis)*
Rough-legged Hawk *(Buteo lagopus)*
Golden Eagle (*Aquila chrysaetos)*
American Kestrel *(Falco sparverius)*
Merlin *(Falco columbarius)*
Peregrine Falcon *(Falco peregrinus)*
Wild Turkey *(Meleagris gallopavo)*
Ring-necked Pheasant *(Phasianus colchicus)*

Appendix E
Wildlife Found in the Analysis Area

Tundra Swan *(Cygnus columbianus)*
Mute Swan *(Cygnus olor)*
Greater White-fronted Goose *(Anser albifrons)*
Snow Goose *(Chen caerulescens)*
Ross' Goose *(Chen rossii)*
Brant *(Branta bernicla)*
Canada Goose *(Branta canadensis)*
Wood Duck *(Aix sponsa)*
Green-winged Teal *(Anas crecca)*
American Black Duck *(Anas rubripes)*
Mallard *(Anas platyrhynchos)*
Northern Pintail *(Anas acuta)*
Blue-winged Teal *(Anas discors)*
Northern Shoveler *(Anas clypeata)*
Gadwall *(Anas strepera)*
Eurasian Wigeon *(Anas penelope)*
American Wigeon *(Anas americana)*
Canvasback *(Aythya valisineria)*
Redhead *(Aythya americana)*
Ring-necked Duck *(Aythya collaris)*
Greater Scaup *(Aythya marila)*
Lesser Scaup *(Aythya affinis)*
Oldsquaw *(Clangula hyemalis)*
Black Scoter *(Melanitta nigra)*
Surf Scoter *(Melanitta perspicillata)*
White-winged Scoter *(Melanitta fusca)*
Common Goldeneye *(Bucephala clangula)*
Bufflehead *(Bucephala albeola)*
Hooded Merganser *(Lophodytes cucullatus)*
Common Merganser *(Mergus merganser)*
Baird's Sandpiper *(Calidris bairdii)*
Pectoral Sandpiper *(Calidris melanotos)*
Dunlin *(Calidris alpina)*
Stilt Sandpiper *(Calidris himantopus)*
Buff-breasted Sandpiper *(Tryngites subrufisollis)*
Ruff *(Philomachus pugnax)*
Short-billed Dowitcher *(Limnodromus griseus)*
Long-billed Dowitcher *(Limnodromus scolopaceus)*
Common Snipe *(Gallinago gallinago)*
American Woodcock *(Scolopax minor)*
Wilson's Phalarope *(Phalaropus tricolor)*
Red-necked Phalarope *(Phalaropus fullicaria)*
Laughing Gull *(Larus atricilla)*
Bonaparte's Gull *(Larus philadelphia)*
Ring-billed Gull *(Larus delawarensis)*
Herring Gull *(Larus argentatus)*
Lesser Black-backed Gull *(Larus fuscus)*
Great Black-backed Bull *(Larus marinus)*
Northern Bobwhite *(Colinus virginianus)*
Black Rail *(Laterallus jamaicensis)*
Clapper Rail *(Rallus longirostris)*
King Rail *(Rallus elegans)*
Virginia Rail *(Rallus limicola)*
Sora *(Porzana carolina)*
Common Moorhen *(Gallinula chlorapus)*
American Coot *(Fulica americana)*
Black-bellied Plover *(Pluvialis squatarola)*
American Golden-Plover *(Pluvialis dominica)*
Semipalmated Plover *(Charadrius semipalmatus)*
Killdeer *(Charadrius vociferus)*
American Oystercatcher *(Haematopus bachmani)*
Black-necked Stilt *(Himantopus mexicanus)*
American Avocet *(Recurvirostra americana)*
Greater Yellowlegs *(Tringa melanoleuca)*
Lesser Yellowlegs *(Tringa flavipes)*
Solitary Sandpiper *(Tringa solitaris)*
Willet *(Catoptrophorus semipalmatus)*
Spotted Sandpiper *(Actitis hypoleucos)*
Upland Sandpiper *(Bartramia longicauda)*
Whimbrel *(Numenius phaeopus)*
Hudsonian Godwit *(Limosa haemastica)*
Ruddy Turnstone *(Arenaria interpres)*
Red Knot *(Calidris canutus)*
Sanderling *(Calidris alba)*
Semipalmated Sandpiper *(Calidris pusilla)*
Western Sandpiper *(Calidris mauri)*
Least Sandpiper *(Calidris minutilla)*
White-rumped Sandpiper *(Calidris fuscicollis)*
Yellow-bellied Flycatcher *(Empidonax flaviventris)*
Acadian Flycatcher *(Empidonax virescens)*
Willow Flycatcher *(Empidonax traillii)*
Least Flycatcher *(Empidonax minimus)*
Eastern Phoebe *(Sayornis phoebe)*
Great Crested Flycatcher *(Myiarchus crinitus)*
Western Kingbird *(Tyrannus verticalis)*
Eastern Kingbird *(Tyrannus tyrannus)*
Horned Lark *(Eremophila alpestris)*
Purple Martin *(Progne subis)*
Tree Swallow *(Tachycineta bicolor)*
Rough-winged Swallow *(Stelgidopteryx ruficollis)*
Bank Swallow *(Riparia riparia)*
Cliff Swallow *(Hirundo pyrrhonota)*
Barn Swallow *(Hirundo rustica)*
Blue Jay *(Cyanocitta cristata)*
American Crow *(Corvus brachyrhynchos)*
Fish Crow *(Corvus ossigragus)*

Appendix E
Wildlife Found in the Analysis Area

Gull-billed Tern *(Sterna nilotica)*
Caspian Tern *(Sterna caspia)*
Royal Tern *(Sterna maxima)*
Sandwich Tern *(Sterna nilotica)*
Common Tern *(Sterna hirundo)*
Forster's Tern *(Sterna forsteri)*
Least Tern *(Sterna antillarum)*
Black Tern *(Chlidonias niger)*
Black Skimmer *(Rynchops niger)*
Rock Dove *(Columba livia)*
Mourning Dove *(Zenaida macroura)*
Black-billed Cuckoo *(Coccyzus erthropthalmus)*
Yellow-billed Cuckoo (*Coccyzus americanus)*
Barn Owl *(Tyto alba)*
Eastern Screech Owl *(Otus asio)*
Great Horned Owl *(Bubo virginianus)*
Barred Owl *(Strix varia)*
Long-eared Owl *(Asio otus)*
Short-eared Owl *(Asio flammeus)*
Northern Saw-whet Owl *(Aegolius acadicus)*
Common Nighthawk *(Chordeilis minor)*
Chuck-will's widow *(Caprimulgus carolinensis)*
Whip-poor-will *(Caprimulgus vociferus)*
Chimney Swift *(Chaetura pelagica)*
Ruby-throated Hummingbird *(Archilochus colubris)*
Belted Kingfisher *(Ceryle alcyon)*
Red-headed Woodpecker *(Melanerpes erthrocephalus)*
Red-bellied Woodpecker *(Melanerpes carolinus)*
Yellow-bellied Sapsucker *(Sphyrapicus varius)*
Downy Woodpecker *(Picoides pubescens)*
Hairy Woodpecker *(Picoides villosus)*
Common Flicker *(Colaptes auratus)*
Pileated Woodpecker *(Dryocopus pileatus)*
Eastern Wood Pewee *(Contopus sordidulus)*
Blue-winged Warbler *(Vermivora pinus)*
Golden-winged Warbler *(Vermivora chrysoptera)*
Tennessee Warbler *(Vermivora peregrina)*
Orange-crowned Warbler *(Vermivora celata)*
Nashville Warbler *(Vermivora ruvicapilla)*
Northern Parula *(Parula americana)*
Yellow Warbler *(Dendroica petechia)*
Chestnut-sided Warbler *(Dendroica pensylvanica)*
Magnolia Warbler *(Dendroica magnolia)*
Cape May Warbler *(Dendroica tigrina)*
Black-throated Blue Warbler *(Dendroica caerulescens)*
Yellow-rumped Warbler *(Dendroica coronata)*
Black-throated Green Warbler *(Dendroica virens)*
Blackburnian Warbler *(Dendroica fusca)*
Carolina Chickadee *(Parus carolinensis)*
Tufted Titmouse *(Parus bicolor)*
Red-breasted Nuthatch *(Sitta canadensis)*
White-breasted Nuthatch *(Sitta carolinensis)*
Brown-headed Nuthatch *(Sitta pusilla)*
Brown Creeper *(Certhia americana)*
Carolina Wren *(Thryotharus ludovicianus)*
House Wren *(Troglodytes aedon)*
Winter Wren *(Troglodytes troglodytes)*
Sedge Wren *(Cistothorus platensis)*
Marsh Wren *(Cistothorus palustris)*
Golden-crowned Kinglet *(Regulus satrapa)*
Ruby-crowned Kinglet *(Regulus calendula)*
Blue-gray Gnatchatcher *(Polioptila caerulea)*
Eastern Bluebird *(Sialia sialis)*
Veery *(Catharus fuscescens)*
Gray-cheeked Thrush *(Catharus minimus)*
Swainson's Thrush *(Catharus ustulatus)*
Hermit Thrush *(Catharus guttatus)*
Wood Thrush *(Hylocichla mustelina)*
American Robin *(Turdus migratorius)*
Gray Catbird *(Dumetella carolinensis)*
Northern Mockingbird *(Mimus polyglottos)*
Brown Thrasher *(Toxostoma rufum)*
Water Pipit *(Anthus spinoletta)*
Cedar Waxwing *(Bombycilla cedrorum)*
Loggerhead Shrike *(Lanius ludovicianus)*
European Starling *(Sturnus vulgaris)*
White-eyed Vireo *(Vireo griseus)*
Solitary Vireo *(Vireo solitarius)*
Yellow-throated Vireo *(Vireo flavifrons)*
Warbling Vireo *(Vireo gilvus)*
Philadelphia Vireo *(Vireo philadelphicus)*
Red-eyed Vireo *(Vireo olivaceus)*
Blue Grosbeak *(Guiraca caerulea)*
Indigo Bunting *(Passerina cyanea)*
Rufous -sided Towhee *(Pipilo erythrophthalmus)*
American Tree Sparrow *(Spizella arborea)*
Chipping Sparrow *(Spizella passerina)*
Field Sparrow *(Spizella pusilla)*
Vesper Sparrow *(Pooecetes gramineus)*
Savannah Sparrow *(Passerculus sandwichensis)*
Grasshopper Sparrow *(Ammodramus savannarum)*
Henslow's Sparrow *(Ammodramus henslowii)*
Sharp-tailed Sparrow *(Ammodramus caudacutus)*
Seaside Sparrow *(Ammodramus maritimus)*
Fox Sparrow *(Passerella iliaca)*
Song Sparrow *(Melospiza melodia)*

Appendix E
Wildlife Found in the Analysis Area

Yellow-throated Warbler *(Dendroica dominica)*
Pine Warbler *(Dendroica pinus)*
Prairie Warbler *(Dendroica discolor)*
Palm Warbler *(Dendroica palmarum)*
Bay-breasted Warbler *(Dendroica castanea)*
Blackpoll Warbler *(Dendroica striata)*
Cerulean Warbler *(Dendroica cerulea)*
Black-and-white Warbler *(Mniotilta varia)*
American Redstart *(Setophaga ruticilla)*
Prothonotary Warbler *(Protonotaria citrea)*

Worm-eating Warbler *(Helmitheros vermivorus)*
Ovenbird *(Seiurus aurocapillus)*
Northern Waterthrush *(Seiurus noveboracensis)*
Louisiana Waterthrush *(Seiurus motacilla)*
Kentucky Warbler *(Oporornis formosus)*
Connecticut Warbler *(Oporornis agilis)*
Mourning Warbler *(Oporornis philadelphia)*
Common Yellowthroat *(Geothlypis trichas)*
Hooded Warbler *(Wilsonia citrina)*
Wilson's Warbler *(Wilsonia pusilla)*
Canada Warbler *(Wilsonia canadensis)*
Yellow-breasted Chat *(Icteria virens)*
Summer Tanager *(Piranga rubra)*
Scarlet Tanager *(Piranga olivacea)*
Northern Cardinal *(Cardinalis cardinalis)*
Rose-breasted Grosbeak *(Pheuticus ludovicianus)*

Lincoln's Sparrow *(Melospiza lincolnii)*
Swamp Sparrow *(Melospiza georgiana)*
White-throated Sparrow *(Zonotrichia albicollis)*
White-crowned Sparrow *(Zonotrichia leucophrys)*
Dark-eyed Junco *(Junco hyemalis)*
Snow Bunting *(Plectrophenax nivalis)*
Bobolink *(Dolichonyz oryzivorus)*
Red-winged Blackbird *(Agelaius phoeniceus)*
Eastern Meadowlark *(Sturnella magna)*
Yellow-headed Blackbird *(Xanthacephalus xanthocephalus)*
Rusty Blackbird *(Euphagus carolinus)*
Brewer's Blackbird *(Euphagus cyanocephalus)*
Boat-tailed Grackle *(Quiscalus major)*
Common Grackle *(Quiscalus quiscula)*
Brown-headed Cowbird *(Molothrus ater)*
Orchard Oriole *(Icterus spurius)*
Northern Oriole *(Icterus galbula)*
Purple Finch *(Carpodacus purpureus)*
House Finch *(Carpodacus mexicanus)*
Red Crossbill *(Loxia curvirostra)*
White-winged Crossbill *(Loxia leucoptera)*
Common Redpoll *(Carduelis flammea)*
Pine Siskin *(Carduelis pinus)*
American Goldfinch *(Carduelis tristis)*
Evening Grosbeak *(Coccothraustes vespertinus)*
House Sparrow *(Passer domesticus)*

Accidentals

Western Grebe *(Acchmophorus occidentalis)*
American White Pelican *(Pelecanus erythrorhynchos)*
White Ibis *(Eudocimus albus)*
Barnacle Goose *(Branta leucopsis)*
Fulvous Whistling Duck *(Dendrocygna bicolor)*
Swallow-tailed Kite *(Elanoides forficatus)*
Gyrfalcon *(Falco rusticolus)*

Marbled Godwit *(Limosa fedoa)*
Roseate Tern *(Sterna dougallii)*
Snowy Owl *(Nyctea scandiaca)*
Ash-throated Flycatcher *(Myiarchus cinerascens)*
Northern Shrike *(Lanius excubator)*
Bachman's Sparrow *(Aimophila aestivalis)*

Reptiles and Amphibians

Snapping Turtle *(Chelydra serpentina)*
Stinkpot *(Sternotherus odoratus)*
Eastern Mud Turtle *(Kinosternon s. subrubrum)*
Spotted Turtle *(Clummys guttata)*
Eastern Box Turtle *(Terrapene c. carolina)*
Northern Diamondback Terrapin *(Maclaclemys t. terrapin)*
Red-bellied Turtle*(Chrysemys rubriventris)*

Corn Snake *(Elaphe g. guttata)*
Black Rat Snake *(Elaphe o. obsoleta)*
Eastern Kingsnake *(Lampropeltis g. getulus)*
Eastern Milk Snake *(Lampropeltis t. triangulum)*
Northern Copperhead *(Agkistrodon c. mokeson)*
Marbled Salamander *(Ambystoma opacum)*
Spotted Salamander *(Ambystoma t. tigrinum)*

Appendix E
Wildlife Found in the Analysis Area

Eastern Painted Turtle *(Chrysemys p. picta)*
Northern Fence Lizard *(Sceloporus u. hyacinthinus)*
Ground Skink *(Scincella lateralis)*

Five-lined Skink *(Eumeces fasciatus)*
Broad-headed Skink *(Eumeces laticeps)*
Red-bellied Water Snake *(Nerodia e. erythrogaster)*
Northern Water Snake *(Nerodia s. sipedon)*
Eastern Garter Snake *(Thamnophis s. sauritus)*
Rough Earth Snake *(Virginia striatula)*
Eastern Hognose Snake *(Heterodon platyrhinos)*
Southern Ringneck Snake *(Diadophis p. punctatus)*
Eastern Worm Snake *(Carphophis a. amoenus)*
Northern Black Racer *(Coluber c. constrictor)*
Rough Green Snake *(Opheodrys aestivus)*

Red-spotted Newt *(Notophthalmus v. viridescens)*
Red-backed Salamander *(Plethodon c. cinereus)*
Eastern Mud Salamander *(Pseudotriton m. montanus)*
Eastern Spadefoot Toad *(Scaphiopus h. holbrooki)*
American Toad *(Bufo americanus)*
Fowler's Toad *(Bufo woodhousei fowleri)*
Northern Cricket Frog *(Acris c. crepitans)*
Northern Spring Peeper *(Hyla c. crucifer)*
Green Treefrog *(Hyla cinerea)*
Gray Treefrog *(Hyla versicolor)*
Narrow-mouthed Toad *(Gastrophryne carolinensis)*
Bullfrog *(Rana catesbeiana)*
Green Frog *(Rana clamitans melanota)*
Southern Leopard Frog *(Rana sphenocephala)*
Pickerel Frog *(Rana palustris)*

Appendix F
Methods Proposed for Use

Resource owners and government agencies have used a variety of techniques to control nutria and reduce their damage. However, all lethal and nonlethal methods developed to date have limitations based on costs, logistics, or effectiveness. Below is a discussion of nutria damage reduction methods available to the action alternatives, including the proposed alternative.

MECHANICAL MANAGEMENT METHODS

Some mechanical methods that can be used for non-lethal or lethal removal include foot-hold, cage-type or colony traps, and snares. These techniques are usually implemented by agency personnel because of the technical training required to use such devices. A more detailed description and formal risk assessment of all mechanical devices can be found in USDA (1997, Appendix P).

Live Trapping. Cage traps, snares, and foot-hold traps can be used to capture nutria alive. These methods are rarely, if ever, used to solve problems caused by nutria, or other overabundant or invasive species.

Cage Traps are designed to live-capture animals, and for the proposed action would be used to capture nutria for tagging and release or later disposition. The traps are generally constructed of a metal frame and covered with welded wire or are constructed of plastic. The trap's appearance is similar to a large rectangular box. When set, the trap is opened to allow an animal to enter the door, when tripped the door closes behind the animal. One advantage of using cage traps is the ease of release of nutria or non-target animals. Disadvantages are that the traps are heavy and are relatively bulky to carry and maneuver.

Foot-hold traps can be effectively used to live-capture a variety of mammals. Despite the numerous damage management methods developed, trapping remains the most effective method of removing beaver and other aquatic rodents (Hill 1976, Hill et al. 1977, Wigley 1981, Weaver et al. 1985).

Foot-hold traps are either placed in travel ways, or beside trails used by the target species and the traps sets are baited. Placement of traps is contingent upon the habits of the respective target species, habitat conditions, and presence of non-target animals. Effective trap placement and use of appropriate lures contributes to the foot-hold trap's selectivity. An additional advantage is that foot-hold traps can allow for the on-site release or the relocation of animals. The use of foot-hold traps requires more workforce than some methods, but they are indispensable in resolving many damage problems. Also, it is easier to deploy more foot-hold traps than cage traps and foot-hold traps are easier to conceal than cage traps.

Snares are capture devices comprised of a cable formed in a loop with a locking device and placed in travel ways. Most snares are also equipped with a swivel to minimize cable twisting and breakage. Snares are easier than foot-hold traps to keep operational during periods of inclement weather and snares set to catch an animal around the body or foot are a live-capture method.

Shooting is selective for target species and may involve the use of spotlights and either a shotgun or rifle. Shooting is an effective method to remove small numbers of individuals in damage situations, especially where trapping is not feasible. Shooting is utilized as a lethal damage management option because it offers more selectively than some other methods. Shooting may sometimes be one of the only damage management options available if other factors preclude setting of damage management equipment.

APHIS-WS personnel receive firearms safety training to use firearms while performing their duties. Firearm use is very sensitive and a public concern because of safety issues relating to the public and misuse. To ensure safe use and awareness, APHIS-WS employees who use firearms to conduct official duties are required to attend an

approved firearms safety and use training program within 3 months of their appointment and a refresher course every 3 years (WS Directive 2.615). APHIS-WS employees who carry firearms, as a condition of employment, are required to sign a form certifying that they meet the criteria as stated in the *Lautenberg Amendment* which prohibits firearm possession by anyone who has been convicted of a misdemeanor crime of domestic violence.

Conibear-type traps are designed to cause the quick death of the animal that activates the trap. Conibear-type traps are used exclusively in aquatic habitats, with placement depths varying from a few inches to several feet below the water surface. Placement is in travel ways created or used by the target species with the animal captured as it travels through the trap and activates the triggering mechanism. Safety hazards and risks to humans are usually related to setting, placing, checking, or removing the traps. Conibear traps present a minor risk to most non-target animals because of the placement in aquatic habitats and below the water surface.

Colony Traps or underwater box traps can be very effective in ponds and marshes (Novak 1987a). This type of trap requires more time and effort to set, but can be very effective if the correct size is used. The trap is cheap, simple, and easy to make. The trap is cumbersome to carry and must be staked down for proper use. The traps can be easily made from stovepipe, but some of the most effective versions are variations to this. The doors are hinged at the top or there are funnel entrances to allow easy entry from either end, but no escape out of the box. Death from drowning occurs in a short time. The trap design also allows for multiple catches. Such a trap can be made in most farm shops in a few minutes.

Dogs are trained to pursue and "flush" nutria from dense vegetation to allow trappers and hunters the ability to shoot and harvest. Specially trained dogs, particularly retrievers, are often used by local hunters and are under the direct control of the trainer so as not to pursue non-target species. The use of dogs can greatly increase hunting success.

CHEMICAL MANAGEMENT METHODS:

All chemicals used in Maryland are registered under Federal Fungicide, Insecticide and Rodenticide Act (FIFRA) and administered by the EPA and the MDA or are approved by the FDA. All agency personnel in Maryland who use chemical management methods would be certified as restricted-use pesticide applicators. No chemicals are used on public or private lands without authorization from the land management agency or property owner/manager. The only chemical method currently authorized for nutria damage management is:

Zinc Phosphide - The use of zinc phosphide on various types of fruit, vegetable or cereal baits has proven to be effective at suppressing local populations of nutria (Evans 1970). Zinc phosphide is registered to reduce nutria damage (EPA Reg. No. 56228-6), and is applied to bait (e.g., carrots, sweet potatoes, apples, pears) on rafts or the ground in marshes and canals. The maximum amount of bait (0.6% active ingredient (a.i.)) that can be place on large rafts (4 feet by 4 feet) spaced ¼ to ½ mile apart is 10 lbs. On small waterways, four pieces of bait can be placed on rafts that are at least 6 inches by 6 inches. Rafts must be anchored appropriately for the size of the raft and the body of water, considering factors such as size, depth, winds, current, and potential for flooding. Rafts can be located near burrows and runways used by nutria or near places where these animals are causing damage. Bait may also be placed on the ground beside burrows or runways used by nutria. However, only two to five pieces of bait can be placed on the ground at the location

Zinc phosphide is federally registered by APHIS-WS (EPA Reg. No. 56288-6). Zinc phosphide presents minimal secondary hazard to predators and scavengers as zinc phosphide is an emetic, so meat-eating animals such as mink, dogs, cats and raptors. Any animal, capable of regurgitating, would regurgitate any zinc phosphide tainted meat with little or no effect. No T&E species occurring in Maryland would be affected by use of this formulated

product (G. Carowan, USFWS letter to P. Nickerson, USFWS 2001, J. Wolfin, USFWS letter to P. Nickerson, USFWS 2001), and therefore, no mitigation is necessary to protect listed species because none are likely to be affected by use of this formulated product. APHIS-WS personnel that would use chemical methods are certified as pesticide applicators by MDA and would adhere to all certification requirements set forth in FIFRA and Maryland pesticide control laws and regulations. A quantitative risk assessment evaluating potential impacts of APHIS-WS' use of chemical methods, when used according to the label, concluded that no adverse effects are expected from the above use (USDA 1997, Appendix P).