ENVIRONMENTAL ASSESSMENT:

DOUBLE-CRESTED CORMORANT DAMAGE MANAGEMENT IN MICHIGAN

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In Cooperation with:

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

and the

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
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May 2010

SUMMARY

The United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (USDA, APHIS, WS), the United States Department of the Interior (USDI), Fish and Wildlife Service (USFWS), and the USDI National Park Service, Sleeping Bear Dunes National Lakeshore have prepared an Environmental Assessment (EA) on alternatives for the management of Double-crested Cormorant (*Phalacrocorax auritus*, DCCO) damage in Michigan. Increases in the North American DCCO population, and subsequent range expansion have resulted in complaints of DCCO damage to property, aquaculture, and public resources (e.g., co-nesting colonial waterbirds, sport and commercial fish populations, and vegetation), and risks to human health and safety (e.g., risk of DCCO collisions with aircraft). This EA analyzes the need for cormorant damage management (CDM) in Michigan and five alternatives for meeting the need for action including implementation of the Public Resource Depredation Order (PRDO) (50 CFR 21.48) as promulgated by the USFWS. Alternatives considered include: 1) continuing the current CDM program including implementation of the PRDO (No Action Alternative); 2) Implementing an adaptive management program proposed by the Michigan Department of Natural Resources and Environment (MDNRE); 3) implementing an adaptive management program proposed by the MDNRE with a limit on annual DCCO take intermediate to the current program and the MDNRE proposal; 4) Restricting Federal agency CDM to the use of nonlethal methods; and 5) Discontinuing CDM by Federal agencies.

Under the Proposed Action Alternative, an Integrated Wildlife Damage Management (IWDM) approach would be implemented to reduce cormorant damage and conflicts to aquaculture, property, and natural resources, and risks to human health and safety in localized situations when it is deemed necessary. Cormorant damage management would be conducted on public and private property in Michigan when the resource owner (property owner) or manager requests assistance and all necessary permits and authorizations have been obtained. Landowner/resource manager permission would be obtained prior to conducting CDM activities at any site. The IWDM strategy would involve the use of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, target and non-target species, and the environment. The agencies could provide technical assistance and direct operational damage management, including nonlethal and lethal management methods. When appropriate, physical exclusion, habitat modification, or harassment would be recommended and utilized to reduce damage. In other situations, birds would be humanely removed through use of shooting, egg oiling/destruction, nest destruction, or euthanasia following live capture. In determining the damage management strategy, preference would be given to practical and effective nonlethal methods. However, nonlethal methods may not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of nonlethal and lethal methods, or there could be instances where the application of lethal methods alone would be the most appropriate strategy. All management activities would comply with applicable Federal, State, tribal, and local laws. The USFWS would be responsible for ensuring compliance with the PRDO regulations at 50 CFR 21.48, so that the long-term sustainability of regional DCCO populations is not threatened by CDM activities.

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ACRONYMS

APHIS	Animal and Plant Health Inspection Service
AQDO	Aquaculture Depredation Order
AVMA	American Veterinary Medical Association
BBS	Breeding Bird Survey
BO	Biological Opinion
CCG	Cormorant Coordination Group
CDM	Cormorant Damage Management
CORA	Chippewa-Ottawa Resource Authority
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CPUE	Catch Per Unit Effort
DCCO	Double-crested Cormorant
EA	Environmental Assessment
EIS	Environmental Impact Statement
EJ	Environmental Justice
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FY	Fiscal Year
GLFWC	Great Lakes Indian Fish and Wildlife Commission
GTBB	Grand Traverse Bay Band of Odawa and Chippewa Indians
ICCG	Interagency Cormorant Coordination Group
IWDM	Integrated Wildlife Damage Management
LTBB	Little Traverse Bay Bands of Odawa Indians
MDNRE	Michigan Department of Natural Resources and Environment
MBP	Migratory Bird Permit
MBTA	Migratory Bird Treaty Act
MIS	Management Information System
MOU	Memorandum of Understanding
NASS	USDA, National Agricultural Statistics Service
NEPA	National Environmental Policy Act
NFH	National Fish Hatchery
NHPA	National Historic Preservation Act
NPS	USDI, National Park Service
NWR	USDI, National Wildlife Refuge
NWRC	National Wildlife Research Center
PRDO	Public Resource Depredation Order
ROD	Record of Decision
SOP	Standard Operating Procedure
SSMT	Saulte Ste Marie Tribe of Chippewa Indians
T&E	Threatened and Endangered
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Department of the Interior, Geological Survey
WDNR	Wisconsin Department of Natural Resources
WS	Wildlife Services

CHAPTER 1: PURPOSE AND NEED FOR ACTION

1.0 INTRODUCTION

Across the United States, wildlife habitat has been substantially changed as the human population expands and more land and water is used to meet human needs. These human uses often come into conflict with the needs of wildlife and increase the potential for negative human/wildlife interactions. Double-crested Cormorants (hereafter, DCCOs; see Appendix A for Latin names of all species mentioned in the text) are one of the wildlife species with resource needs and behaviors that conflict with human activities and resource uses. Conflicts include but are not limited to DCCO foraging on fish at aquaculture facilities, DCCO foraging on populations of sport, commercial and forage fish, damage to vegetation and habitat used by other wildlife species, damage to private property from DCCO feces, and risks of aircraft collisions with DCCOs at or near airports.

Wildlife damage management is the science of reducing damage or other problems associated with wildlife, and is recognized as an integral part of wildlife management (The Wildlife Society 1990). In 2003, the United States Department of the Interior (USDI),, Fish and Wildlife Service (USFWS), in cooperation with the United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services (WS), completed a Final Environmental Impact Statement (FEIS) on the management of DCCOs in the United States (USFWS 2003, 2009) in response to persistent conflicts and complaints relating to DCCOs. The selected management alternative included the establishment of a depredation order to address conflicts regarding DCCO impacts on public resources.

> **Public Resource Depredation Order (PRDO)**: This order was established to reduce the actual occurrence, and/or minimize the risk, of adverse impacts of DCCOs to public resources. Public resources, as defined by the PRDO, are natural resources managed and conserved by public agencies, as opposed to private individuals. Public resources include fish (both wild free-swimming fish and hatchery-reared fish at Federal, State, and tribal hatcheries that are intended for release in public waters), wildlife, plants, and their habitats. It authorizes WS, State fish and wildlife agencies, and federally-recognized Tribes (acting on tribal lands and the ceded territories) to control DCCOs without a Federal permit in 24 states (AL, AR, FL, GA, IL, IN, IA, KS, KY, LA, MI, MN, MS, MO, NY, NC, OH, OK, SC, TN, TX, VT, WV, and WI). It authorizes control on "all lands and freshwaters" including public and private lands. However, landowner/manager permission must be obtained before cormorant damage management (CDM) may be conducted at any site.

Michigan is one of several states experiencing DCCO damage including DCCO damage to public resources. This Environmental Assessment (EA) evaluates ways that WS, the

USFWS, the Michigan Department of Natural Resources and Environment (MDNRE), and tribes may work together to resolve conflicts with DCCOs in the State of Michigan.

1.1 PURPOSE

The purpose of this EA is to analyze the environmental effects of alternatives for use in addressing damage and conflicts involving DCCOs in Michigan. Options include implementation of the USFWS PRDO and use of Migratory Bird Depredation Permits (MBPs). Resources protected by such activities are private freshwater aquaculture stocks, public fishery resources, wildlife, plants, property, and human health and safety. This EA considers the potential environmental effects of conducting CDM throughout the State of Michigan. Once completed, this EA and associated Decision replaces a 2004 EA on cormorant damage management in Michigan and the 2006 supplement to the EA (USDA 2004, 2006*a*).

1.2 OBJECTIVES

The goal of this action is to reduce conflicts with DCCOs in the State of Michigan. In particular, the objectives are:

1. Coordinate agency efforts in reducing negative impacts of DCCOs on public resources in Michigan;

2. Reduce and prevent adverse impacts of DCCOs on vegetation and associated wildlife species by limiting DCCO numbers at existing sites and managing colonization of new nest sites.

3. Reduce adverse impacts of DCCOs on public fishery resources.

4. Minimize potential DCCO damage to private property and risks to human health and safety including damage to boats, buildings, vegetation, and fish (in private ponds and aquaculture facilities), and DCCO hazards at airports.

5. Conduct and support research and monitoring on the impacts of DCCOs on public resources and evaluate the effects of any CDM actions.

1.3 DECISION TO BE MADE

Wildlife Services is the lead agency in the preparation of this EA. The USFWS and USDI, Sleeping Bear Dunes National Lakeshore are cooperating agencies in the production of this EA. The EA was prepared in consultation with the MDNRE, and staff from the Chippewa-Ottawa Resource Authority (CORA), Little Traverse Bay Bands of Odawa Indians (LTBB), Grand Traverse Band of Odawa and Chippewa Indians (GTBB), the Bay Mills Indian Community, and the Sault Ste. Marie Tribe of Chippewa Indians.

The MDNRE provides for the control, management, restoration, conservation and regulation of birds, fish, game, forestry and all other wildlife resources in Michigan. As noted in the introduction, the USFWS has authority for the management of migratory birds through the Migratory Bird Treaty Act (MBTA) and the implementation of the PRDO. The USFWS is also charged with the management of the National Wildlife Refuges (NWRs) including Michigan Islands NWR that support DCCO colonies on Scarecrow Island in Thunder Bay; Little Charity Island in Saginaw Bay; and Gull, Pismire and Hat Islands in the Beaver Island Archipelago.

The cooperating and consulting agencies worked together to address the following questions in the EA:

- How can the lead and cooperating agencies best respond to the need to reduce conflicts with DCCOs covered under the USFWS' PRDO?

- How can the lead and cooperating agencies best respond to the need to address all other forms of DCCO damage not covered by the PRDO?

- What are the environmental impacts of alternatives for dealing with these types of DCCO damage?

- Will the proposed program have significant effects requiring preparation of an EIS?

Although the cooperating and consulting agencies have worked together to produce a joint document and intend to collaborate on CDM in Michigan, each agency will make its own decision on the alternative to be selected in accordance with the standard practices and legal requirements applicable to each agency's decision making process. The USFWS will be making two decisions based on this analysis: 1) the type and extent of CDM actions that may be permitted by the USFWS Migratory Bird Office; and 2) the type of CDM, if any, that will be conducted at USFWS NWRs in Michigan.

1.4 NEED FOR ACTION

As stated in the USFWS FEIS (USFWS 2003), the increase in the North American DCCO population and subsequent range expansion has been well-documented, along with concerns of the negative impacts associated with the expansion. The need to protect aquaculture, property, natural resources, and human health and safety from damage and conflicts associated with DCCOs is described in the USFWS FEIS (USFWS 2003) and is summarized in the following subsections.

1.4.1 Potential DCCO Impact on Aquaculture

DCCOs can feed heavily on fish raised for human consumption, and other purposes (USFWS 2003). When this occurs, there is a need to protect aquaculture facilities from DCCO feeding.

1.4.2 Potential DCCO Impact on Fishery Resources

DCCOs are opportunistic feeders that prey on a wide diversity of fish species (USFWS 2003). The relative impact of DCCO predation on fish in a given body of water is dependent on a number of variables. In select circumstances, DCCOs can have a negative impact on recreational or commercial fishing on a localized level (USFWS 2003) that results in a desire to reduce these negative impacts. Potentially, any species of fish that lives at depths accessible to DCCOs during the seasons when DCCOs are present could be negatively impacted by DCCO predation in Michigan, although vulnerability will depend on a number of factors including total density and numbers of fish and the depth distribution of the fish. Game fish of concern in Michigan are yellow perch, rainbow (steelhead) trout, brown trout, lake whitefish, and smallmouth bass. At some inland lakes, there may also be concerns about walleye. Newly stocked hatchery fish can be particularly susceptible to DCCO predation for periods ranging from days to more than a week while fish disperse from the release site. Newly released fish will be unfamiliar with their environment that may make them more vulnerable to predation. Michigan Department of Natural Resources and Environment Fisheries Biologists are also concerned about the total fish biomass removed from foraging areas around breeding colonies and the implications for local predator fish populations (MDNRE 2009). Excessive predation on forage fish could have adverse impacts on growth and survival of larger predatory game fish.

1.4.3 Potential DCCO Impact on Native Vegetation and Wildlife, Including T&E Species

DCCOs can have a negative impact on vegetation by both chemical (DCCO guano) and physical means (stripping leaves and breaking tree branches) that is a concern in the Great Lakes region, including Michigan (USFWS 2003). DCCOs can displace colonial species such as Black-crowned Night-Herons, Great Egrets, Great Blue Herons, gulls, Common Terns, and Caspian Terns through habitat degradation and nest site competition (USFWS 2003, USDA 2006*b*). When these situations occur, there may be a need to manage the local DCCO population to minimize negative impacts.

1.4.4 Potential DCCO Impact on Property

There is also a need to manage DCCO damage to property. In Michigan, property by DCCOs includes consumption of fish in privately-owned ponds; corrosion caused by the acid in DCCO droppings that damages boats, marinas, navigational aids, bridges and other properties; and damage to vegetation on privately-owned land (USFWS 2003). The mere presence of a DCCO on a navigational aid or other man-made structure is not necessarily a problem. In fact some of these sites are also used by threatened or endangered birds, and bird species of conservation concern (e.g., Osprey, Peregrine Falcons, and terns). It is generally only when

high densities of DCCOs use these sites or when DCCOs interfere with access to and performance of the equipment that there is a damage problem.

1.4.5 Potential DCCO Impact on Human Health and Safety

Collisions between aircraft and wildlife are a concern throughout the world because they threaten passenger safety (Thorpe 1996, Dolbeer et al. 2009), result in lost revenue and costly repairs to aircraft (Linnell et al. 1996, Robinson 1996), as well as erode public confidence in air travel (Conover et al. 1995). DCCOs are particularly hazardous to aircraft because of their large body size and mass, slow flight speeds, and tendency to fly in flocks (Dolbeer and Eschenfelder 2003). Where the potential for DCCO and aircraft collisions exists, there is a need to manage DCCO activity.

1.5 BACKGROUND

1.5.1 Double-crested Cormorants in Michigan

Double-crested cormorants are found in Michigan in spring, summer and fall during breeding and migration (Belyea et al. 1999, Wires et al. 2001*a*, USFWS 2003). The Michigan DCCO breeding population consists of birds from the Interior Region DCCO population (Tyson et al. 1999, USFWS 2003). Double-crested Cormorants are native to North America. The first documents mentioning cormorants in Michigan date to the 1800s and appear to primarily refer to migrating birds (MDNRE 2005). Barrows (1912) reported migratory DCCOs in the State and suspected that some scattered breeding was occurring but had no evidence of breeding colonies (MDNRE 2005). Multiple breeding colonies were documented in the 1930s on Isle Royale, Black River Islands, Bond Falls Flowage, St. Martin's Shoal, and Huron Island. Occasional nesting was also was reported in Thunder Bay and the Beaver Islands archipelago (MDNRE 2005). In the 1940s the Michigan DCCO population ranged from 200 – 500 nesting pairs (Diana et al. 1997).

Persecution by humans, changes in land use, and environmental contaminants led to sharp declines in the continental cormorant population, including the Great Lakes (Wires et al. 2001*a*). By the early 1970's approximately 125 breeding pairs remained in the U.S. portion of the Great Lakes (Weseloh et al. 1983). In 1976, DCCOs were included in Michigan's endangered species list as "probably extirpated". Protection provided by the Migratory Bird Treaty Act through an amendment to the Mexico Convention in 1972, a ban on the use of organochlorine pesticides (DDT) and PCBs, an increase in the southern aquaculture industry and abundant populations of non-native food fish in the Great Lakes contributed to subsequent cormorant population increases (USFWS 2003). By 1981 there were 318 nesting pairs divided among 7 DCCO colonies in Michigan. By 1985, there

were 1,100 nests on 15 islands and the species was removed from the State list of threatened and endangered species.

In 1989, there were approximately 5,000 breeding pairs of DCCOs in Michigan, and this number increased to 30,458 pairs in 1997 (Wires et al. 2001*a,* Weseloh et al. 2006). The estimate of DCCO breeding pairs declined to approximately 30,208 pairs in 2005 and 28,580 pairs in 2007 (Cuthbert 2009). Estimates of 0.6 to 4.0 non-breeding cormorants per breeding pair have been used to estimate the non-breeding portion of the population (Tyson et al. 1999). Using an estimate of 1 non-breeding bird per breeding pair, the 2007 spring/summer cormorant population in Michigan was conservatively estimated to be 85,740 birds. Although numerous factors can impact population size, at least some of the recent decline in the Michigan DCCO population may be attributable to CDM actions taken under the PRDO and/or to declines in alewife populations, especially in Lake Huron.

Table 1-1. Number of Double-crested Cormorant breeding pairs in areas of Michigan where cormorant damage management has been conducted. Nests are counted prior to conducting damage management activities at the sites.

Region	2004	2005	2006	2007	2008	2009
Les Cheneaux Islands, Lake Huron[1]	4,656	3,264	1,564	1,438	1,409	1,126
Bays de Noc, Lake Michigan[1]			9,854	7,633	4,696	8,077
Thunder Bay, Lake Huron[1]			3,364	2,193	1,428	1,060
Beaver Islands, Lake Michigan[1]				11,549	8,926	7,520
Ludington Pumped Storage Project, Lake Michigan[1]				532	518	313
Gem Island, Lake George[2]			435	415	324	349
Rock Island, Lake George[2]			143	208	202	100
Nubinway Island, Lake Michigan[3]			1,069	696	511	527
Paquin Island, Lake Michigan[3]			1,070	730	537	446
Isle aux Galets, Lake Michigan[3]				902	945	581
Bellow Island, Lake Michigan [3]				1,443	1,231	1,000

[1] Nests were counted prior to conducting cormorant damage management at the sites.
[2] Maximum nest count for the year – includes tree and ground nests.
[3] Maximum nest count for the year – only ground or low shrub nests at these sites.

In Michigan egg oiling and lethal removal of DCCOs under the PRDO began in 2004 in the Les Cheneaux Islands (LCI), Lake Huron (USDA 2004; Dorr et al. 2010*a*). The CDM program expanded to include the Bays de Noc (Lake Michigan) and Thunder Bay (Lake Huron) areas in 2006 (USDA 2006*a*). In 2006, the tribes initiated CDM on Gem Island and Rock Island in Lake George, and on Nubinway and Paquin Island on Lake Michigan (Ebener 2010). In 2007, CDM started in the Beaver Islands archipelago (Lake Michigan) and at Ludington Pumped Storage Project breakwall (Lake Michigan). In general, although there has been some variability, the number of breeding pairs in 2009 was lower than when CDM was initiated at each of the damage management sites (Table 1-1).

1.5.2 Potential DCCO Impact on Aquaculture

A 2005 census revealed that the U.S. domestic aquaculture industry represents slightly over 4,300 farms producing at least $1,000 or more in annual sales, with total sales reaching $1.09 billion (NASS 2006). The principal species propagated in the United States, listed in declining order of sales in 2005, were catfish, oysters, clams, trout, salmon, baitfish, tropical ornamental fish, hybrid striped bass, tilapia, crayfish and shrimp.

The impact of DCCOs on individual aquaculture facilities varies substantially. The frequency of occurrence of DCCOs at an aquaculture facility can be a function of many interacting factors, including: (1) size of the regional and local DCCO population; (2) the number, size, and distribution of ponds/raceways; (3) the size, distribution, density, health, and species composition of fish populations in the ponds/raceways; (4) the number, size, and distribution of natural wetlands in the immediate environs; (5) the size, distribution, density, health, and species composition of natural fish populations in the surrounding landscape; (6) the number, size, and distribution of suitable roosting habitat; and (7) the variety, intensity and distribution of local damage abatement activities. As a result, DCCOs rarely are distributed evenly over a given region, but rather tend to be highly clumped or localized. It is not uncommon for some aquaculture producers in a region to suffer little or no economic damage from DCCOs, while others experience exceptionally high losses (Glahn and Bruggers 1995; Glahn et al. 1999, 2000b, 2002). Some damage abatement activities (e.g., harassment) can shift bird activities from one area to another that does not eliminate DCCO damage but rather moves it to a new location (Aderman and Hill 1995, Mott et al. 1998, Reinhold and Sloan 1999, Tobin et al. 2002).

Price and Nickum (1995) concluded that the aquaculture industry has small profit margins so that even a small percentage reduction in the farm gate value due to predation is an economic concern. The magnitude of economic impacts that cormorants have on the aquaculture industry can vary dependent upon many

different variables including the value of the fish stock, number of depredating birds present, and the time of year the predation is taking place.

DCCO Impacts on Aquaculture in Michigan

In 2006, there were 34 aquaculture farms in Michigan with total annual sales of $2,398,000 (NASS 2006), compared to 47 farms with total sales of $2,028,000 in 1998 (NASS 2006). Fishes most commonly raised at commercial aquaculture facilities were trout, sunfish, largemouth bass, koi, walleye, perch and catfish (NASS 2006).

The State of Michigan operates six hatcheries and five permanent salmonine egg take stations (MDNRE 2003). Two hatcheries are in the Upper Peninsula (Marquette and Thompson State Fish Hatcheries), and four are on the west side of the Lower Peninsula (Platte River, Wolf Lake, Oden and Harrietta State Fish Hatcheries). These facilities raise brown, rainbow, brook and lake trout, splake, coho and Chinook salmon, lake sturgeon, walleye, northern pike, and northern muskellunge. In addition, Michigan has three national fish hatcheries (NFH) operated by the USFWS; Sullivan Creek NFH, Jordan River NFH, and Pendills Creek NFH, which raise lake trout for release into the Great Lakes. There are three hatcheries operated by Great Lakes Indian Fish and Wildlife Commission member Tribes. Tribal hatcheries contribute to Michigan fish populations through the production and release of walleye. In 2008, the Keweenaw Bay hatchery specializes in the production and rearing of Lake Trout and Brook Trout (GLIFWC 2009, USFWS 2009*b*). The fish at these hatcheries meet the PRDO definition of a public resource and management of DCCO damage may be conducted under the authority of the PRDO. Any private fish hatcheries contracted by the agencies to produce fish for release into public waters would also qualify as producing a public resource for purposes of the PRDO.

During Fiscal Years (October 1 – September 30) 2007-2009, WS received 14 requests for assistance with DCCO damage to aquaculture from 11 different Michigan aquaculture facilities. USFWS records indicate that for calendar years 2006-2008, the number of DCCOs killed for damage management at aquaculture facilities ranged from 103 – 267 birds per year.

1.5.3 Potential DCCO Impact on Fishery Resources

The rapid increase in DCCO populations over the last 25 years has led to an increase in conflicts between humans and DCCOs including complaints relating to DCCO impacts on commercial and sport fisheries (USFWS 2003). Cormorants opportunistically feed on a wide diversity of fish species dependent upon local availability (USFWS 2003). DCCO diet is reflective of the relative abundance and population dynamics of fish species in a specific water body (Bur et al. 1997, Belyea et al. 1999, Rudstam et al. 2004, Meadows 2007). In the Great Lakes, fish species such as the alewife and gizzard shad, appear to be important prey items.

Stickleback, sculpins, cyprinids, and yellow perch, and at some localities, burbot, freshwater drum, and lake/northern chub are also important prey fish species (Wires et al. 2001). DCCO foraging can have a negative impact on recreational fishing on a localized level (USFWS 2003). However, review of the literature indicates that the effects of DCCOs on game fish vary from lake to lake, from year to year and even from one time of the year to another in the same lake (Fielder 2010, Meadows 2007, Diana et al. 1997, Casselman and Marcogliese 2006, Belyea et al. 1999).

The impact of DCCO predation on fish and agency response to DCCO predation depends on a number of variables including the number of birds present, the time of year when predation occurs, fish community composition, abundance and distribution, and physical characteristics of the body of water such as depth or proximity to shore (which affect prey accessibility), and fishery management objectives. Environmental and human-induced factors also affect aquatic ecosystems and fish populations. These can be classified as biological (overfishing, exotic species, etc.), chemical (water quality, nutrient and contaminant loading, etc.) or physical (dredging, dam construction, hydropower operation, siltation, weather induced year-effects, global warming etc.). Such activities and factors may lead to changes in fish density, diversity, and/or species composition due to direct effects on year class strength, survival, recruitment to older age groups, spawning success, spawning or nursery habitat, and/or competition (USFWS 1995, 2003). The challenge is to try and isolate the effects of DCCOs and determine the magnitude and significance of DCCO impacts relative to other factors.

Determining the exact nature and magnitude of the impact of DCCOs on fish populations is difficult, especially in large complex systems found in the Great Lakes (Rudstam et al. 2004). Study of the issue is further complicated by the fact that the decline in the fishery occurred before the initiation of studies on local fish populations and the impacts of DCCO foraging (e.g., Thunder Bay and the Beaver Island Archipelago). In light of recent research, there is also a growing agreement among fisheries biologists that DCCO impacts need to be considered not just in terms of sport fish populations, but in terms of impacts on the overall fish community including species sought by the commercial fishery and non-game and forage species. DCCO fish consumption is beginning to be viewed more from an allocation perspective (Dobiesz et al. 2005). From an allocation perspective, high DCCO predation leaves less forage available for other predators or to human harvest without exceeding sustainability. Maintenance of a healthy ecosystem in the Great Lakes will require managers to address all forms of pressure on the forage base including humans, fish predation and predation by DCCOs. For example, state agencies manage stocking rates, including decreasing stocking of some species to keep population of predator species in balance with available forage (Section 1.5.3.5, WDNR 2008).

Although managers often do not have the benefit of long term data for every location where CDM is a concern, it is clear that high numbers of DCCOs have the potential to adversely impact local fisheries (Lantry et al. 1999; Rudstam et al. 2004; Fielder 2008). The existing and proposed programs to address concerns regarding DCCO impacts on fishery resources use an adaptive management approach to address this issue. The adaptive management approach involves establishing management objectives for impacted resources and assessing response to incremental changes in DCCO numbers in local areas coupled through concurrent monitoring of DCCO and fish populations (see Chapter 3 for details). Goals for managing local DCCO numbers are set and carefully monitored so that fisheries data can be evaluated in context of the DCCO population, and to ensure that the actions do not threaten the viability of the State DCCO population. Objectives are adjusted over time based on information obtained through monitoring of the fishery and DCCO populations. The adaptive management approach strives to allow for management benefits while simultaneously learning from experience, research and monitoring to better define the full scale and scope of the problem, management impacts and the extent of benefits to be expected from CDM.

1.5.3.1 Les Cheneaux Islands

The LCI region of northern Lake Huron has long been known for its yellow perch fishery. Between 1979 and 1995, the open water sport fishery was estimated to annual amount to between 200,000 and 400,000 yellow perch (Lucchesi 1988). Concurrent with this time period was the return of a breeding population of DCCOs. Counts of nests reached nearly 4,500. Concern regarding potential impacts of DCCO predation on the yellow perch population prompted a study in 1995 (Diana et al. 1997). That study reported that DCCOs removed only 2.3% of the available yellow perch biomass and accounted for less than 20% of the total annual mortality of perch during that year. Cormorants accounted for 0.8% of the mortality of legal-sized perch (7 inches), whereas summer sport fishing accounted for 2.5%. Total mortality for the perch population was estimated at 45% of the population. Diana et al. (1997) concluded that DCCOs had minimal impact on the local perch population because of the relatively high abundance of perch and because the impact of DCCO predation was buffered for much of the year by abundant alewives. The yellow perch fishery subsequently declined to a near total collapse in 2000 (Fielder 2004). Diana et al. (2006) speculated that yellow perch recruitment declines must explain the decline in yellow perch. Other factors that may have contributed to the decline included human harvest, declines in water levels, establishment of invasive species such as zebra and quagga mussels and implementation of a neighboring walleye stocking plan (USFWS 2003, Fielder 2008).

Fielder (2008) described the yellow perch population and fishery in the area since the Diana et al. (1997) work done in 1995. The total annual mortality rate for yellow perch was as great as 85% even after the fishery collapsed, which

suggested other mortality sources than human harvest were at work. Average age of yellow perch declined from 4.37 years in 1995 to just 1.48 years in 2004. Fielder (2008) believed that such a declining average age was consistent with predation losses and sustained recruitment. An index of yellow perch recruitment for the same period indicated continued reproduction and even some strong year classes of yellow perch (Fielder 2008). However, these strong year classes appeared to dissipate more than before they made to older age classes. In an effort to try and isolate forces shaping the yellow perch population and fishery in the LCI, Fielder (2008) linearly regressed several key yellow perch metrics from the population and fishery against several possible explanatory variables which included DCCO trends in abundance, yellow perch recruitment, water levels and temperatures (as possible forces driving recruitment variability), fishery harvest, and walleye abundance (as another predator). Of these, trends in DCCO abundance had the most significant and strongest correlation. Fielder (2008) concluded that the decline of yellow perch in the fishery and population was best explained by trends in cormorant abundance. However, strong correlations do not indicate the mechanism for the relationship and the possibility remains that a factor other than those considered may also have a substantial impact on perch populations in the Les Cheneaux.

Diana et al (1997) and Fielder (2008) used different methods when assessing impacts of DCCOs on the perch fishery which may explain some of the differences between the conclusions in the two studies. However, it seems likely that at least some of the difference may be attributable to differences in the availability of alewives and changes feeding ecology in the LCI. Alewives were abundant and an important food for DCCOs in 1995 (Diana et al. 1997) and may have buffered some of the impacts of DCCOs on yellow perch. However, increased fish predation and poor recruitment led to declines in the alewife population in Lake Huron after 1995 (Bence et al. 2004). It's possible that DCCO foraging pressure on perch increased as the availability of alewife decreased. Also DCCO nest numbers in the area continued to increase after the 1995 study to a high of 5,500 nests in (Fielder 2008).

In the LCI, cormorant damage management under the PRDO started in 2004, and has consisted of a combination of egg oiling and shooting adult birds (Dorr et al. 2010*a*). The objective was to reduce cormorant predation on the local fish populations and benefit the yellow perch fishery. Control efforts succeeded in bringing nesting numbers down to approximately 1,000 nests (Dorr et al. 2010*a*). During this period, the MDNRE monitored in the fish community through the use of the same gillnet survey that had been performed by the MDNRE since 1969 and an annual creel survey to estimate sport fishery activity. Fielder (2010) applied the same methods used to initially describe the yellow perch decline to examine the yellow perch population during the period of declining DCCO abundance. All yellow perch metrics improved from values detected prior to damage management including increases in yellow perch abundance, total harvest, and angler harvest rate (Figs. 1-1, 1-2; Fielder 2010). Total annual

mortality rate decreased to just 47% (from a high of 85% before control, Fig. 1-3). Average age of yellow perch increased to 3.66 from the precontrol low of 1.48, consistent with increased longevity of yellow perch year classes. Increased yellow perch recruitment (measured as abundance of age-2 fish) was also documented during this period which also likely contributed to the improvement in the fishery. It should be noted that because of the way recruitment was measured, it is difficult to determine if the improvement in recruitment was an actual improvement in recruitment or reflected the impacts of a reduction in DCCO predation. Recruitment was assessed by monitoring the abundance of age-2 perch. By the time the perch reach age-2, they have been subjected to two years DCCO predation. Consequently, abundance of fish in this age class could be attributable to recruitment, reduced predation or both. Regression analysis similar to that performed under Fielder (2008) also indicated strong statistical associations between trends in DCCO abundance and yellow perch population metrics (with the addition of the years during and post control). Fielder (2010) interpreted these results as further evidence of DCCOs being a formidable force that has shaped the yellow perch population and fishery in the LCI and that cormorant control had the desired outcome. Less clear from this analysis, however, has been what levels of DCCOs are sustainable in the LCI. Management objectives proposed under the preferred alternative are intended to help address this issue.

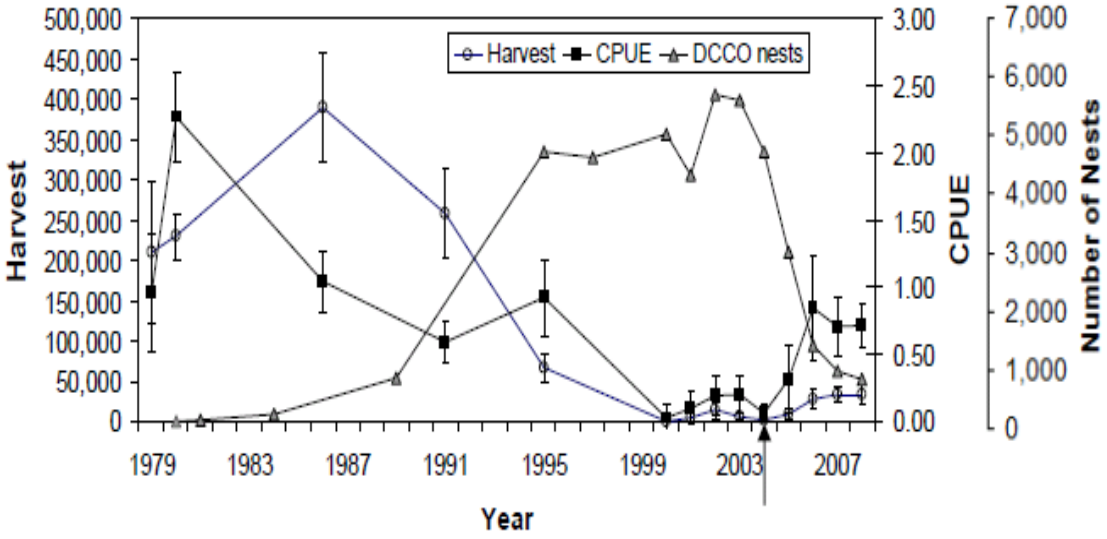

Figure 1-1. Trends in open water (April – October) yellow perch harvest and angler harvest rate (fish per hour of effort or CPUE), and Double-crested Cormorant (DCCO) nest numbers for the Les Cheneaux Islands, Lake Huron as determined by creel survey and nest inventory counts, 1979 – 2008. Cormorant control was implemented in 2004 as denoted by arrow. Figure from Fielder (2010).

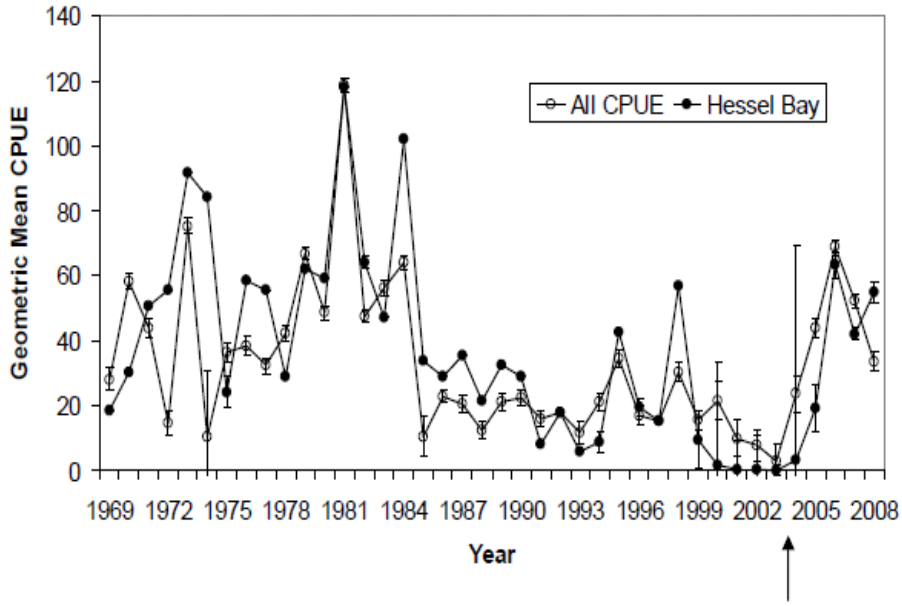

Figure 1-2. Geometric mean gillnet catch of yellow perch per 305 m of net (CPUE) for the all Les Cheneaux Islands sets combined and that for just Hessel Bay, 1969 – 2008. Error bars represent +/- 2 standard errors of the geometric mean. Cormorant control was implemented in 2004 as denoted by arrow. Figure from Fielder (2010).

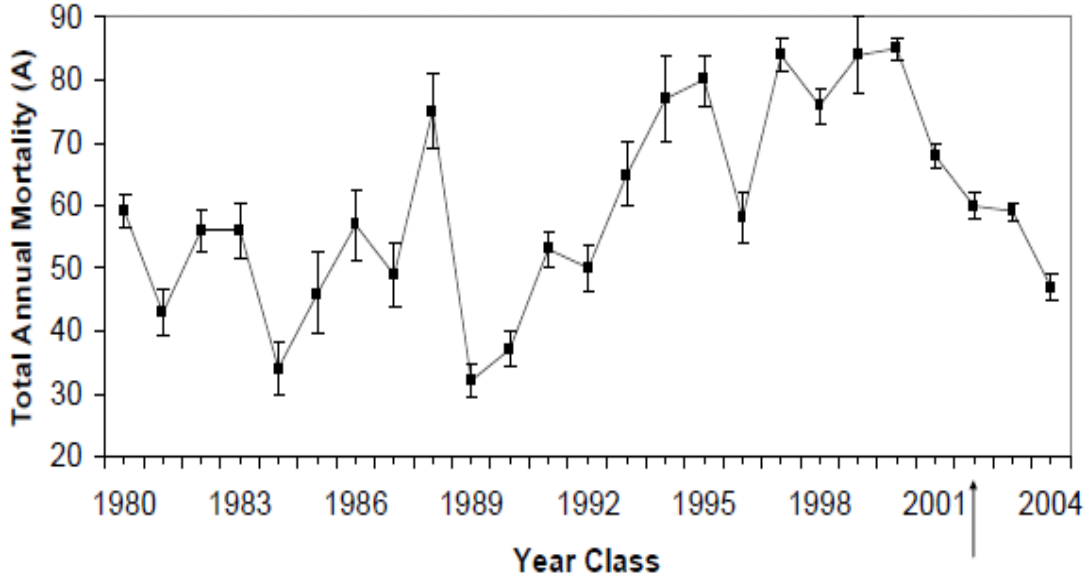

Figure 1-3. Total annual mortality rate (A) of yellow perch in the Les Cheneaux Islands as indicated by the cohort method, for year classes between 1980 – 2001. The 2004 cohort was the first year class produced fully within the control period since the proliferation of cormorants in the area. The 2002 and 2003 year classes also represents data collections limited to years since control began although those year classes originate before control was first implemented. Cohort based estimates of total annual mortality since control was implemented is denoted by the arrow. Figure from Fielder (2010).

1.5.3.2 Thunder Bay

Thunder Bay is recognized to be one of the leading spawning and nursery areas and most productive fishing grounds for lake whitefish in the Great Lakes (Ebener et al. 2004). Native American and State-licensed commercial fisheries harvest from 1.5 to 1.8 million pounds of lake whitefish annually offshore of the Thunder Bay area. Lake whitefish are vulnerable to DCCO foraging during the first two years of their life when juveniles spend time in shallow (< 30 m) water where they are accessible to foraging DCCOs. The MDNRE has observed marked declines in young lake whitefish in survey trawl catches from Thunder Bay in recent years (J. Johnson, MDNRE, pers. comm.). The trawl surveys also indicate declines in catch rates of all fish species caught in Thunder Bay (Figure 1-1). Estimated standing crop of bottom-oriented (vulnerable to a bottom trawl) fish in Thunder Bay was only 0.13 pounds per acre in 2005 (Fig. 1-4). A principal component of the trawl catch has been juvenile lake whitefish. Reasons for the sharp decline in the total trawl catch in recent years are unclear. However, similar trends have also been observed in USDI,U.S. Geological Survey trawl surveys from other near-shore areas of Lake Huron (Bence et al. 2008). Some of the declines may be from decreases in plankton and the benthic amphipod Diporeia, which are food for small fish including juvenile whitefish. Data indicate that plankton productivity may one third of normal levels The decline in plankton productivity has been attributed to the impacts of introduced zebra and quagga mussels that lock nutrients in the bottom of the lake where they are not available to zooplankton. Consequently, availability of prey fish for predatory fish and birds has declined. This may have increased competition among fish and avian predators for the diminishing supply of prey fish. Growth of Chinook salmon and lake trout has declined since the alewife population, the predominant food for both species, collapsed in 2003. Presumably DCCOs are similarly coping with reduced prey availability. Biologists from the MDNRE are concerned that the continued presence of high DCCO densities may lead to increased competition between DCCOs and predatory fish and adverse community-level effects on the fishery.

During the 1980s and early 1990s, Thunder Bay was one of Lake Huron's most important put-grow-take brown trout fisheries, and inspired the annual Alpena Brown Trout Festival. Brown trout numbers and harvest declined sharply during the 1990s and the fishery collapsed after 1995. Johnson and Rakoczy (2004) concluded that the combination of predatory fish consumption of stocked trout, rising avian (DCCO) predation, and the sharp decline of alewives may explain the post-1995 decline in the brown trout population in Thunder Bay. Walleye also forage on juvenile brown trout. However walleye numbers in the Bay stabilized before the brown trout collapse. Newly released brown trout remain in near-shore shallow water for weeks after release, making them particularly vulnerable to DCCO predation (Johnson and Rakoczy 2004). Other popular recreational fishes

in Thunder Bay include walleye, yellow perch and smallmouth bass. Yellow perch harvest has been near zero since the early 1990s. The status of the bay's smallmouth bass population is not well known.

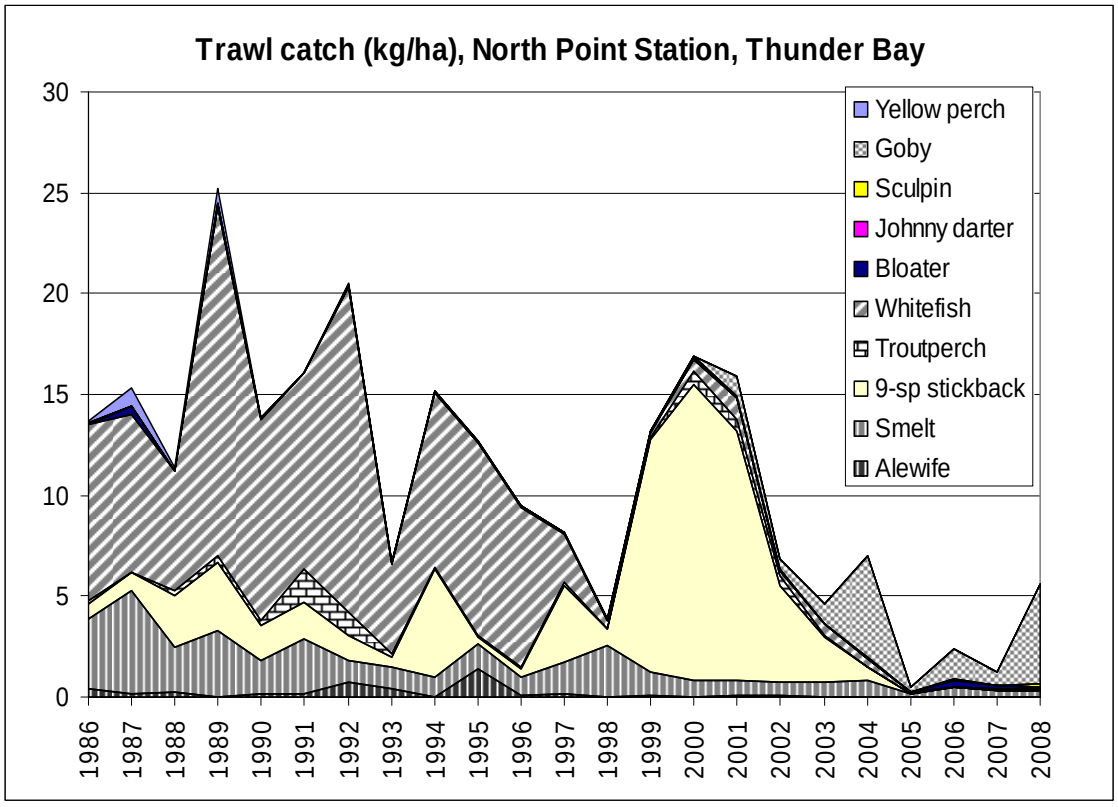

Figure 1-4. Trawl catch rates for fish in Thunder Bay, Lake Huron, MI.

The DCCO population in the Thunder Bay archipelago grew from approximately 452 to 3,702 nesting pairs (Gull, Scarecrow, Bird and Grass Islands) between 1989 and 2005. Assuming 1 non-breeding bird per nest (lower end of range from Wires et al. (2001*a*)), approximately 11,106 adult and non-breeding cormorants resided in Thunder Bay in 2005. At 1 pound of consumption per bird per day (Wires et al. 2001*a*), cormorants in Thunder Bay consumed approximately 1,110,400 pounds of fish in 2005. If all DCCO feeding was in Thunder Bay, consumption would have been at a rate of 34 pounds per acre, which far exceeds the trawl-based standing crop (instantaneous total fish biomass) of bottom oriented fish in Thunder Bay in recent years. Not all DCCO foraging occurs in Thunder Bay, but these calculations do provide an indication of possibility of competition for prey-fish resources and potential impacts of DCCO foraging on local fishery resources.

The MDNRE is intensively monitoring the fish community in Thunder Bay including an ongoing creel survey in the Thunder Bay area to directly assess impacts on anglers including an annual bottom-trawl survey, electrofishing survey

conducted with Alpena Field Office of the USFWS; two annual gillnet surveys; and ongoing monitoring of the commercial fish catch. The MDNRE has also been assessing impacts on the fish population by examining cormorant stomachs every few years, beginning in 2006 (Appendix F). Preliminary data is available for 2006. Cormorants were collected from April through September, although the number of DCCOs collected in April and September was limited (April – 17 birds; September – 7 birds) relative to May-August (69-169 birds per month). More than 16,900 fish were found in the stomachs of the 475 DCCOs examined. Round Goby were the primary fish consumed (91%). Notropis spp. (shiners – 3%), Yellow Perch (1.2%), and rainbow smelt (1.2%) were the next most common species identified in the DCCO stomachs. Species of commercial or sport fishing interest including walleye, round whitefish, brook trout, smallmouth bass, largemouth bass, unspecified salmonids, and lake whitefish were found in very limited numbers ($\leq$ 0.08%). Given that DCCOs are opportunistic foragers, if the species diversity and standing crop of the fish population recovers MDNRE anticipates seeing higher diversity of species (in addition to gobies) in the cormorant's stomachs. It is anticipated that the proposed adaptive management project (Section 1.5.8.2), involving intensive fish population monitoring in conjunction with manipulation of predator effects, would shed light on mechanisms causing the decline in fish populations and species diversity of Thunder Bay.

The colonies in this area under consideration for CDM, pending landowner approval, include: Gull Island, Grassy Island, and Bird Island, which are owned by the Michigan Nature Association. The Michigan Nature Association does not believe that current fishery data warrants CDM on their properties at this time. Scarecrow Island, which is part of Michigan Islands NWR, managed by the Shiawassee NWR, has hosted a substantial DCCO population in the past, and has previously been considered as a potential site for CDM (USDA 2006). However, based on a 2006 supplement to the 2004 EA on CDM in Michigan, the USFWS determined that CDM was not warranted on the island (USDA 2006). In 2008, DCCOs initially started their usual nesting at the site, but abandoned the island later in the summer. The abandonment is believed to have been caused by the presence of at least one raccoon and coyote on the island. A raccoon carcass and coyote tracks were found on the island in 2008. Some DCCOs (approximately 300 pairs) returned to the island in 2009. CDM is not currently proposed for this site, but could be considered in the future if large numbers of nesting DCCOs resume use of the island (Section 1.5.8.4). Because of the lack of access to the colony sites in Thunder Bay, all local cormorant population reduction has occurred through shooting birds which are away from the colony sites[1]. Take from off-colony shooting in Thunder Bay was 1,845 DCCOs in 2006, 1,447 in 2007, 1,279 in 2008 and 1,032 DCCOs in 2009. Although preliminary fishery

[1] If a landowner/ manager does not grant permission for access to a Great Lakes Island, DCCOs are not shot unless they are more than 500 yards from shore.

data appear encouraging, it is too early to make conclusions regarding the impact of CDM on fishery resources in the bay.

1.5.3.3 Bays de Noc

Big and Little Bays de Noc are located in Delta County. Nesting data compiled for the Big and Little Bays de Noc in 2009 from a combination of ground and aerial counts indicated a total of 8,077 nests in four colonies (Fisherman (aka Round), Snake, Little Gull and Gull Islands; WS and L. Wires, University of Minnesota unpublished data). In 2005, aerial surveys conducted by WS estimated at least 10,000 nests in five colonies. Peak numbers of birds were documented by these flights in late July 2005 after fledging with approximately 27,000 DCCOs (non-breeders and breeders combined) in the vicinity. The MDNRE and members of the public are concerned about the sustainability of fish populations in this area.

In 2006 the MDNRE conducted a preliminary analysis to assess the amount of fish taken from Bays de Noc by DCCOs (D. Fielder, MDNRE, personal communication. The exercise made use of the nest numbers identified above and utilized the consumption rates for different life stages and months reported by Seefelt (2005). The available foraging area was determined using the consumption area formula used by Ridgway et al. (2006a, b) which creates a circle or halo around colony sites based on nest numbers. The available foraging area was reduced within that halo by the area limited to a depth of 20 m or less (Ridgway et al. 2006b) that was determined by using bathymetry data in a geographic information system (GIS). Using this method, the 2005 consumption demand in the Bays de Noc area was estimated to be 15.48 Kg/ha. There are no standing biomass values for the Bays de Noc area so it's difficult to determine the magnitude of impact on the available forage. However, for purposes of comparison, a multi-year detailed analysis conducted in the North Channel region of Lake Huron estimated annual total standing biomass at 30 kg/ha and annual fish production at 12.5% of the total standing biomass. For DCCO consumption (15.48 kg/ha) to equate to the production of the system (12.5%, the standing total biomass) the standing biomass in Bays de Noc would have to be approximately 124 kg/ha. This level of biomass production is likely not achieved anywhere in the Great Lakes. It is likely that fish populations in the open bays are replenished by schools of fish in the main basin of Lake Michigan. The influx of fish from the larger system may allow the bays to support larger DCCO populations than could be sustained if the bays were an isolated system. The calculations used here are a generalized estimate which needs to be validated by research and a number of assumptions must be made to use this data. However, this calculation does provide an indication that the level of DCCO foraging in Bays de Noc is placing a considerable demand on fishery resources in the area. Without intervention, over time, DCCO numbers would eventually come into balance with available resources. However, the fish biomass remaining for other uses (e.g., predatory fish, human consumption) would likely be greatly reduced.

Diana et al. (1997) summarized diets of cormorants from northern Lake Michigan, which includes islands in and around Bays de Noc, Beaver Island, and the eastern Upper Peninsula shoreline. Stomach samples were collected coincident with banding operations during the chick-rearing season. Yellow perch made up a large portion of DCCO diets in early spring (47% by weight), were less commonly taken late spring/early summer (<2% by weight), and then made up an increased proportion of the late summer/fall diet (14% by weight). Meadows (2007) showed that yellow perch made up 17%, 9%, and 11% (by weight) in 2004, 2005 and 2006 respectively of cormorant diets in near a major perch nursery in southern Green Bay during the years from 2004-2006. White suckers made up an average of 38% and gizzard shad 17% of the diets of cormorants in that study.

In 2007, WS collected stomach samples from Snake Island in Big Bay de Noc and from Fisherman's Island near Little Bay de Noc. Of the 7,711 diet items identified, the following species were the most frequently consumed: round goby (84%); yellow perch (7%), crayfish species (3%), alewife (3%), pumpkinseed (1%), and approximately 50 other species (3%). Cormorants appear to be foraging opportunistically since round goby have constituted an average of 71% (by number) of MDNRE bottom trawl survey catch in the Bays de Noc during the last 5 years. A breakdown of cormorant diets by location and month shows that predation on yellow perch was only observed in Big Bay de Noc, and primarily occurred in April and May, coincident with the yellow perch spawning period. Sixty-nine percent of yellow perch observed in cormorant stomachs were less than 4" long. Numbers of yellow perch eaten by size group were as follows: <2" (77 fish); 2-3" (164 fish); 4-5" (60); 6-8" (43); and >8" (5).

In Bay de Noc, the concern is for the overall impacts on the fish community as opposed to any one fish species. Although species specific issues are not fully understood, the MDNRE is interested in seeing CDM applied in an effort to benefit the overall fish community by freeing forage fish for consumption by other predators (walleye and smallmouth bass, salmon, lake trout) as well as the local fisheries (walleye, yellow perch, smallmouth bass).

The colonies in this area that may receive CDM include Fisherman Island (also known as Round Island) and Snake Island, both of which are state-owned. Gull and Little Gull Islands, owned by the Michigan Nature Association, also support DCCO colonies, but CDM is not allowed at these sites. As with Thunder Bay, off-colony shooting has been used to reduce DCCO numbers in Bays de Noc (1,607 DCCOs in 2007, 640 DCCOs in 2008, and 1,124 DCCOs in 2009).

1.5.3.4 Beaver Islands Archipelago

The Beaver Islands are an archipelago in northern Lake Michigan. The islands sustained a popular smallmouth bass fishery for many years. Smallmouth bass

population estimates today are lower than calculated in the 1970s and 1980s (Figure 1-5). Although catch per unit effort (CPUE) in survey gillnets nets has increased slightly in the past 10 years (Kaemingk 2009), population estimates have remained low. Additionally, some year classes have been produced that recruited through the population and reached ages greater than six years. This suggests that some reproduction has continued during this period of low abundance.

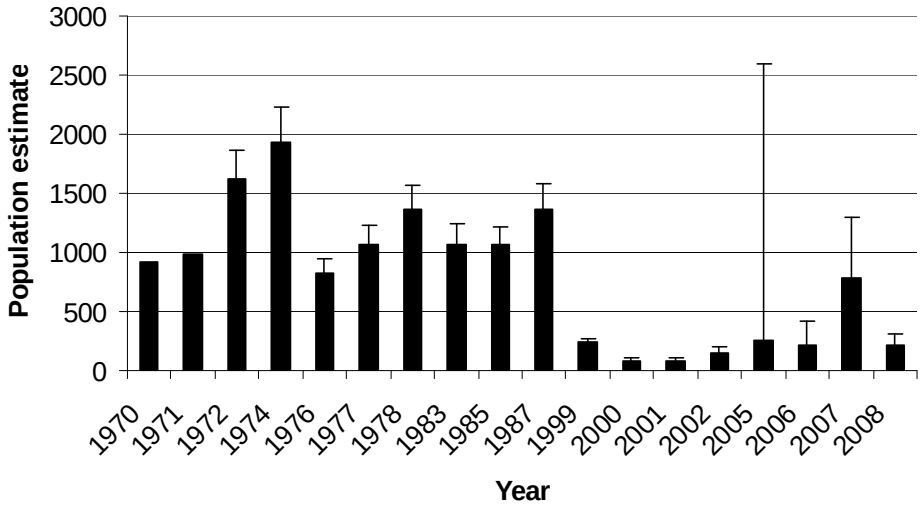

Figure 1-5. Schnabel smallmouth bass population estimates of Garden Harbor during 1972-1987 (H. Lenon, unpublished), 1999-2002 (M. Seider, unpublished), and 2005-2008 (M. Kaemingk).

Although it has been established that cormorants in the Great Lakes will eat smallmouth bass (Ludwig et al. 1989; Lantry et al. 1999; Schneider et al. 1999; Lantry et al. 2002), determining the impact of DCCOs on smallmouth bass in the Beaver Islands area has been challenging. Smallmouth bass are particularly vulnerable to DCCO predation because they spend their lives in shallow water habitats accessible to DCCOs, and because of the tendency of adults to guard their nests. DCCO foraging can impact bass directly by removing individuals (Lantry et al. 2002) and indirectly through removal or injury of breeding adults leading to reduced recruitment.

The DCCO population in the archipelago had increased substantially from 1989 (880 nests) to 1997 (11,709 nests; Wires et al 2001, Seider 2003). During 2000-2006, cormorant nest counts have varied considerably (6,407 pairs in 2004, 11,549 pairs in 2007 and 7,520 breeding pairs in 2009). A number of factors may contribute to the current variation including that, prior to CDM, the population may have been stabilizing, and that CDM conducted in the archipelago and

elsewhere in Lake Michigan (e.g., Bays du Noc) was causing shifts in DCCO use of nesting colonies,

Seider (2003) assessed the local bass population during 1999-2002. Based on concurrent declines in non-game fish, high survival rates for adult fish (fish age 6 and older) and the current low level of angler effort and harvest of smallmouth bass in the area, Seider concluded that angler harvest was not currently limiting the smallmouth bass population. Growth rates and condition of the fish were high indicating that food supplies were not limiting the population. There was evidence of unusually high mortality rates for smallmouth bass ages 3-5 (50-99%). Michigan angling regulations set a minimum total length limit of 14 inches for smallmouth bass in the area, a size obtained at age 6 or 7, so angling is unlikely to be the cause of the high mortality rate. Predation by other fish could have caused the unusually high juvenile mortality rates but few predatory fish (northern pike or bowfin) were captured during survey efforts.

The fish age classes with the high mortality rates were approximately 150-300 mm in total length, a size range readily taken by DCCOs (Craven and Lev 1987, Hobson et al. 1989, Campo et al. 1993, Modde et al. 1996, Neuman et al. 1997, Adams et al. 1999, Johnson et al. 2002). Based on the presence of crayfish in the diet of DCCOs from the area, Seider (2003) concluded that DCCOs are foraging in shallow-water habitats where smallmouth bass are found. However, in 2001 only 1 smallmouth bass was found in the stomachs of 50 DCCOs that were taken for a diet study. (J. Gillingham, Central Michigan University, pers. com. used in Seider (2003)). Seider (2003) noted that, because the small smallmouth bass population was extremely low (approximately 2,000 fish) and the DCCO population in the area was high (approximately 6,657 breeding pairs plus non-breeding birds in 2001; Seefelt 2005), even an extremely low occurrence of smallmouth bass in DCCO diets could have a detrimental impact on the bass population. Seider (2003) concluded that a mortality problem that was consistent with high predation by DCCOs was likely preventing or slowing the recovery of the smallmouth bass population. The author noted that additional research would be needed for a clear understanding of the role of cormorants in smallmouth bass population dynamics in the Beaver Islands (Seider 2003).

A graduate student conducting research in the area from Central Michigan University (Kaemingk 2009) observed that the apparent survival of smallmouth bass was very low during the summer months (June through August) and improved during the winter months (August through the next June). This pattern of loss is consistent with predation by cormorants, which inhabit the region for nesting during April through September. A competing hypothesis, however, is that these differences are related to fish emigrating from the study area (Kaemingk 2009), so additional research is required to determine the relative importance of both concepts. As with the study by Seider (2003), sport fishing does not appear to be a factor in the current mortality trends. The fishing season for smallmouth bass is open July 1 to December 31. Observed angling mortality

was relatively low during July and August decreasing the likelihood that anglers are responsible for losses of smallmouth bass during the summer months. Kaemingk (2009) also speculated that smallmouth bass left the archipelago and traveled large distances to occupy near shore waters throughout northern Lake Michigan thereby accounting for the high loss rate. However, the high recapture rate in the netting used for population estimation is inconsistent with this contention.

A study by Seefelt (2005) evaluated population size, diets and foraging behavior of DCCOs in the Beaver Archipelago from 2000-2004. Only 1 smallmouth bass was found in the 150 DCCO stomachs and 978 regurgitate samples examined. Alewife (55.5%), crayfish (18.8%), sucker (11.9%) and sculpin (5.5%) comprised the majority of biomass in DCCO diet samples in 2000. In 2001, alewife (77.1%), sucker (9.8%) and sculpin (6.1%) comprised the majority of biomass in DCCO diet samples. Seefelt (2005) used telemetry data from 10 DCCOs and observations of rafts of DCCOs to conclude that DCCOs from Pismire and the Southeast Garden colonies spent relatively little time in areas identified by Seider (2003) as having historically supported good smallmouth bass fisheries. However, her data do show some observations of rafts in and near St James Harbor on Beaver Island. Data from models indicated that DCCO predation contributed to the decline of smallmouth bass in the area, but the models also projected eventual recovery of bass in the absence of CDM providing the sport fishing mortality remained zero or very low. However the MDNRE has expressed concerns that the assumptions in the model regarding fish mortality rates may not accurately represent what may happen if the bass population starts to recover. DCCOs are opportunistic feeders and bass mortality from DCCO foraging may increase if the bass population increases and may not remain a constant portion of the population. Similarly fishing pressure may also increase as the population increases and need to be addressed through regulatory changes.

Aside from direct effects on smallmouth bass, the cormorant diet in the Beaver Islands includes a large proportion of alewives and other prey fish species. This consumption may reduce prey resources available to desired game fish species such as lake trout, Chinook salmon, smallmouth bass, yellow perch, and others. Based on nest numbers in 2005 and applying the consumption bioenergetics values of Seefelt (2005), it is estimated that the 11,071 cormorants in the Beaver Island archipelago consumed almost 7 ½ million pounds of fish biomass that year. At the same time, alewives were at some of their lowest levels in Lake Michigan since their original invasion. Chinook salmon stocking had also been reduced by 30% by the Michigan DNR over concerns of the declining prey base.

Cormorant damage management started in the Beaver Islands in 2007. Work has included egg oiling and shooting adults. Access to some islands was restricted because of concerns for nontarget species, so off-colony shooting similar to that conducted in Thunder Bay and Bays du Noc was also used to reduce DCCO

numbers (1,607 DCCOs in 2007, 1,360 DCCOs in 2008 and 2,500 DCCOs in 2009).

The Beaver Islands Archipelago includes Ile aux Galets. The LTBB has been conducting CDM on Iles aux Galets in conjunction with overall CDM efforts in the archipelago. The LTBB has treaty-protected fishing rights in the 1836 ceded waters of the Great Lakes and some tribal members rely on fishing for subsistence or income. Perch populations in the area have been at low levels since the 1990s due to low recruitment. The East Beaver Island Reef complex (Ile aux Galets/Dalia shoal/Hog Island shoal) area is a priority site for lake trout population recovery efforts and approximately 600,000 yearling lake trout are stocked in the area each spring. The tribe is concerned that DCCOs may be adversely impacting and/or threatening the recovery of yellow perch and lake trout.

1.5.3.5 Bellow Island

Bellow Island is located in Northwest Grand Traverse Bay and is owned by the Leelanau Conservancy. No cormorants were observed nesting at the site in the early 1980s, but by 2006, there were 1,571 breeding pairs on the island. Biologists with the GTBB are concerned that the amount of fish consumed by birds in the colony may be having an adverse impact on forage and game fish populations in the area. The GTBB has treaty-protected fishing rights in the 1836 ceded waters of the Great Lakes and some tribal members rely on fishing for subsistence or income. Additionally, the tribe is also concerned about DCCO impacts on newly stocked walleye. The GTBB, in conjunction with CORA, annually stocks 80,000 – 160,000 spring fingerling walleye into Grand Traverse Bay. The MDNRE also stocks Chinook salmon (230,000-235,000 yearlings), coho salmon (90,000-120,000 yearlings), brown trout (100,000-160,000 yearlings), and rainbow trout (20,000-30,000 yearlings) into the Grand Traverse Bay. As part of the lake trout restoration program, the USFWS also stocks approximately 250,000 yearling lake trout into the Bay. The Bellow Island DCCO colony is in close proximity to stocking sites and may be adversely affecting stocking programs.

In addition to impacts on fishery resources, the GTTB is concerned about the impact of high numbers of DCCOs on vegetation and other bird species using the island. The island is also a nesting site for Herring Gulls, Ring-billed Gulls and state-listed threatened Caspian Terns. Increases in the number of nesting DCCOs may limit the space available for other species. The few trees which had recently become established on the island have been killed by DCCO roosting activities and accumulation of feces. The GTBB assisted Dr. William Scharf with surveys of the Herring Gull colony on the island and Dr. Scharf assisted GTBB with development of methods to minimize impacts of the CDM program on the Caspian Tern colony located at the North end of the Island. The GTBB has also been working with the USDA, APHIS, WS National Wildlife Research Center

(NWRC) on an ongoing study to assess the impacts of CDM on nontarget species (Herring Gulls and Caspian Terns).

1.5.3.6 Paquin and Naubinway Islands

The SSMT and Bay Mills Indian Communities have been working in conjunction with the CORA to conduct CDM in on Paquin and Naubinway Islands in Mackinac County in Lake Michigan. The SSMT has treaty-protected fishing rights in the 1836 ceded waters of the Great Lakes. The tribes are concerned about survival of fingerling walleye stocked in Epoufette Bay, incidence of cormorant scarring on lake whitefish and round whitefish (menominee) in northern Lake Michigan, and impacts of DCCO predation on menominee populations in northern Lake Michigan.

1.5.3.7 St. Mary's River

The SSMT and Bay Mills Indian Community have been working in conjunction with the CORA to conduct CDM in on Gem and Rock Islands in the St. Mary's River. The Bay Mills Indian Community also conducts CDM on Round Island. The tribes have treaty-protected fishing rights in the 1836 ceded waters of the Great Lakes. The tribes are concerned about DCCO impacts on the survivorship of yellow perch and stocked fingerling walleye in the St. Mary's River. Walleye and yellow perch have been observed in the stomachs of DCCOs from the upper St. Mary's River and Waishkey Bay where walleye are annually stocked. In addition, Inter Tribal Fisheries and Assessment Program has reported that tags were recovered from DCCO nests colonies that ITFAP staff had originally attached to walleye and yellow perch released into Lake Huron.

1.5.3.8 Tahquamenon Island

Tahquamenon Island is located in Tahquamenon Bay in Eastern Lake Superior. The Bay Mills Indian Community has treaty-protected fishing rights in the 1836 ceded waters of the Great Lakes and some tribal members rely on fishing for subsistence or income. Tribal licensed commercial fishermen from the Bay Mills Indian Community have been reporting Lake whitefish and round whitefish in the 1836 ceded waters with DCCO slash marks down their sides and DCCOs harassing and causing the death of whitefish inside the trap nets.

1.5.3.9 Ludington Pumped Storage Project

A colony of cormorants has become established on a man-made breakwater at the Ludington Pumped Storage Project facility near Ludington, Michigan. The facility is co-owned by Consumers Energy and Detroit Edison, and was constructed in the late 1960s and early 1970s. The facility pumps water from Lake Michigan into a reservoir nearly 400 feet above the lake at night when demand for electricity is low. During periods of peak demand, water is released

from the reservoir to generate electricity. Operation of the facility helps to level the demands on coal-fired power plants in the power grid. The facility has an artificial breakwater associated with it that was placed parallel to the Lake Michigan shoreline to protect the infrastructure of the project from heavy Lake Michigan waves. The breakwater is roughly 550 yards in length, is constructed of large limestone slabs, and is not connected to the shore. Although it is unknown exactly when cormorants began nesting on the breakwater, it was likely in the late 1990s. By 2000, there was a "noticeable population of cormorants present there," (Dennis McKee, Consumers Energy, personal communication). In 2006, 486 nests were counted on the break water.

Sportfishing is critical to the economy of Ludington. The port of Ludington is one of the most heavily fished Great Lakes ports in Michigan. According to the Michigan Charter Boat Association website, 32 charter boats currently operate out of Ludington. In 2007, a total of 1,854 charter trips were taken out of Ludington, second in Michigan only to Grand Haven. Additionally, in 2007, a total of 198,920 non-charter angler-hours were generated out of Ludington, second in Michigan only to Manistee. This angling activity generated nearly $2.9 million dollars for the Ludington area.

The Pere Marquette River flows into Lake Michigan in Ludington, just north of the Pumped Storage Project. The Pere Marquette River supports naturally reproducing Chinook salmon, coho salmon, and rainbow trout. Steelhead are also stocked by Michigan DNR annually into the Big South Branch of the Pere Marquette River, and Chinook salmon are annually stocked from net pens in the Big Sable River in Ludington State Park. Due to their migratory nature, the wild and stocked salmonids from the Ludington area contribute to the entire Lake Michigan sportfishery, which is valued at valued at $495 million dollars annually (USFWS 2006). The Pere Marquette River is also a popular and productive sportfishing area. Much of the angling activity is based on migratory fish runs from Lake Michigan. The fishery provides positive economic impact for cities upriver, like Baldwin and Scottville, along with a number of smaller towns and villages.

Substantial changes in the species composition and abundance of Lake Michigan fish communities in the Ludington area have occurred during the last 25 years. These changes coincide with the increases in the abundance of cormorant populations and broader lake-wide changes that include the establishment of non-native invasive species including invertebrates (rusty crayfish, zebra mussels, quagga mussels) and fish (round goby). In recent years, large-scale changes have been noted in the Lake Michigan zooplankton community, and the alewife (another invasive non-native species) population has declined greatly.

Monitoring in 2008 showed that the number of 4- to 5-inch alewives in the area have declined to record lows in both absolute number and percent of the total alewife collection (HDR/LMS 2008). The annual local monitoring has illustrated

a clear and consistent decline in alewife from population levels measured prior to 2001. The 2008 total fish collection was among the smallest in 20 years of monitoring.

Creel survey data collected by the Michigan DNR also show substantial declines in the populations of game species in the Ludington area over the last ten years since the cormorant colony became established (Figs. 1-6 and 1-7). In particular, the harvest levels for brown trout, rainbow trout, and yellow perch have declined. While cormorants are unlikely to prey on adult salmonids, they have the ability to prey on juveniles. Behavior of juvenile salmonids may make them vulnerable to predation by cormorants. Smolting migrations often occur en masse and the concentration of juvenile salmonids may attract DCCOs for feeding events that would reduce the number of juvenile salmonids reaching Lake Michigan.

Brown trout may be particularly vulnerable to cormorant predation. Of all the salmonids in Lake Michigan, brown trout prefer the shallowest, warmest water. Even when other salmonids have vacated nearshore waters for deep water refuge, brown trout tend to stay shallow, often in the harbor areas where prey fish like alewives remain abundant. Most of the brown trout present in Lake Michigan are stocked, and brown trout are known to stay in the harbors for a month or more after being stocked. Cormorants frequently forage in and just off the Ludington Harbor in the same areas that the juvenile brown trout inhabit. Foraging by cormorants on stocked fish such as brown trout could easily reduce recruitment of stocked fish to adult size and reduce the availability of these fish for anglers.

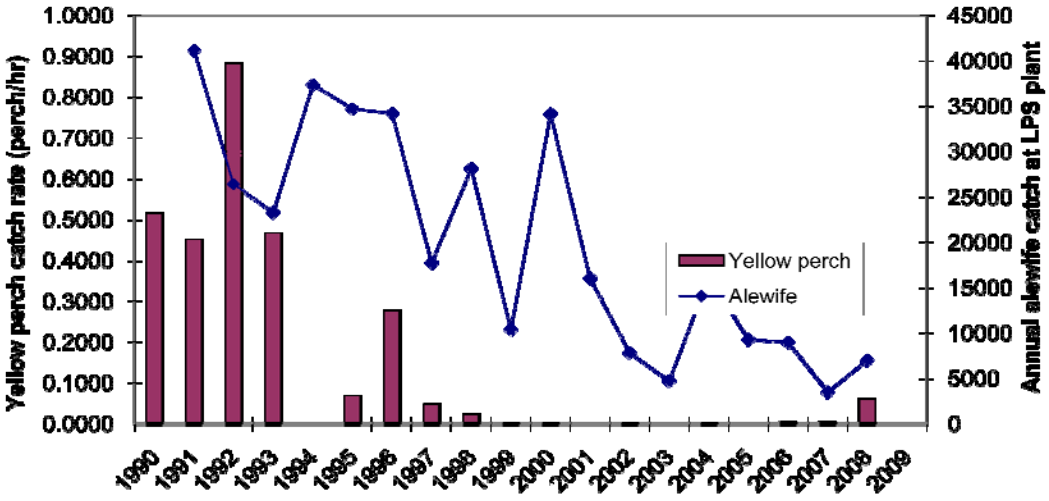

Figure 1-6. Catch rates for yellow perch for sport anglers on Lake Michigan out of Ludington, 1990-2009, excluding 1994; and total annual alewife gillnet catch just outside the Ludington pumped storage plant barrier net (data from HDR/LMS 2008).

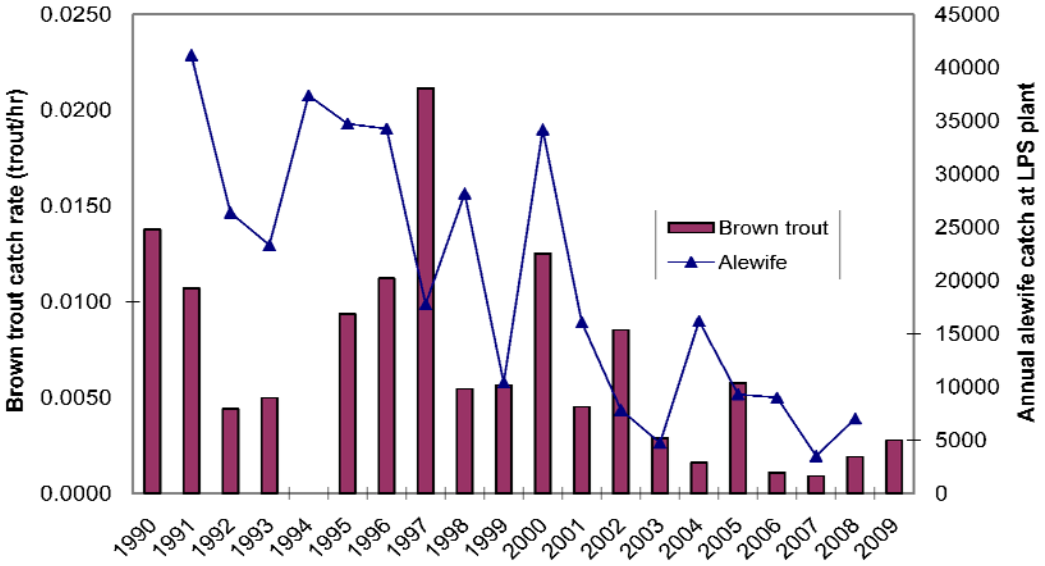

Figure 1-7. Catch rates for brown trout for sport anglers on Lake Michigan out of Ludington, 1990-2009, excluding 1994; and total annual alewife gillnet catch just outside the Ludington pumped storage plant barrier net (data from HDR/LMS 2008).

1.5.3.10 Fish Spawning Areas and Release Sites for Stocked Fish

There are two other general classes of DCCO impacts on public fishery resources in addition to conflicts associated with breeding colonies. The first occurs during spring migration when a large pulse of birds moves through the State. In some instances, DCCOs forage extensively in areas where smaller-sized fish such as yellow perch and sunfishes are spawning in shallow water and very vulnerable to DCCO predation. WS has developed a program that combines harassment with pyrotechnics and boats with limited lethal shooting to decrease the amount of DCCOs in areas where fish populations appear to be particularly vulnerable. These efforts are conducted during the migration peak in mid April and early May. Unfortunately, this CDM strategy can be very labor intensive because it requires the presence of humans to harass and shoot for extended periods of the day, especially in the morning. Wildlife Services has enlisted the help of private citizens (as designated agents of WS) to do the majority of the work in these situations. This approach has been used at Drummond Island, Brevoort Lake, Big Manistique Lake, South Manistique Lake, Indian Lake, Long Lake and Grand Lake and appears to be quite successful. A similar program is conducted by the Bay Mills Indian Community at Waishkey Bay. Dorr et al. (2010*b*) reported the program deterred an average of 90% of DCCO foraging attempts per year (2004-2007) at Drummond Island and an average of 89% of foraging attempts at Brevoort Lake (2005-2007). Average lethal DCCO take per year was 180 for Drummond Island and 429/year for Brevoort Lake. Average annual DCCO take was 1.1% of the estimated DCCOs present at Drummond Island and 5.4% of estimated DCCOs at Brevoort Lake. Walleye and yellow perch abundance

increased at Drummond Island and Brevoort Lake after CDM was initiated as did yellow perch abundance increased at Drummond Island. Fisheries response was consistent with the hypothesis that DCCO predation was a significant mortality factor. However, cormorants were only one of many possible factors which may affect these fisheries and additional monitoring will be needed to determine if continued improvement in the fisheries through DCCO management is sustainable (Dorr et al. 2010*b*). There are also concerns that harassed birds may cause problems at new locations.

DCCOs appear to be able to identify and take advantage of the concentrations of fish at release sites for hatchery fish. Research has documented that cormorants can adversely impact congregations of recently stocked salmonids (Modde et al. 1996, Ross and Johnston 1997). Measures for the protection of hatchery release sites in Michigan have been similar to the harassment with limited use of lethal take used to reduce conflicts with migrating birds. For example, the brown trout and cisco (lake herring) released by the MDNRE at Rockport and Alpena (Lake Huron) in June and early October are protected with a similar harassment/shooting effort. The brown trout remain close to shore where they are vulnerable to DCCO predation for up to several weeks after release (Johnson and Rakoczy 2004).

1.5.4 Potential DCCO Impact on Wildlife and Native Vegetation, Including T&E Species

DCCOs can have a negative effect on vegetation through both chemical (DCCO guano) and physical means (stripping leaves and breaking tree branches) and are of concern in the Great Lakes region (USFWS 2003, Hebert et al. 2005, USDA 2006*b*, USDA 2009). Accumulation of DCCO droppings (which contain uric acid), stripping leaves for nesting material, and the combined weight of the birds and their nests can break branches and kill many trees within 3 to 10 years (Bédard et al. 1995, Korfanty et al. 1999, Lemmon et al. 1994, Lewis 1929, Weseloh et al. 1995, Weseloh and Ewins 1994, Weseloh and Collier 1995, Hebert et al. 2005). Ammonium toxicity may be an important factor contributing to island forest decline (Hebert et al. 2005). Lewis (1929) considered the killing of trees by nesting DCCOs to be very local and limited, with most trees he observed to have no commercial timber value. However, tree damage may be perceived as a problem if these trees are rare species, or aesthetically valued (Bédard et al. 1999, Hatch and Weseloh 1999). For example, concerns about rare Carolinian vegetation communities and State-listed plant species as well as concerns about loss of habitat for tree and shrub-nesting colonial waterbirds prompted the Ohio Department of Natural Resources to initiate CDM activities at West Sister Island NWR and Green Island in Ohio (USDA 2006*b*).

DCCOs can displace colonial species such as Black-crowned Night-Herons, egrets, Great Blue Herons, gulls, Common Terns, and Caspian Terns through habitat degradation and nest site competition (USFWS 2003). DCCOs have been

known to take over heron nests. For example, of 81 nest acquisitions observed by Skagen et al. (2001), 57 were instances of DCCOs taking over Great Blue Heron nests. However, it should be noted that in the remaining 24 instances, Great Blue Herons took over DCCO nests. Cuthbert et al. (2002) examined potential impacts of DCCOs on Great Blue Herons and Black-crowned Night-Herons in the Great Lakes and found that DCCOs have not negatively influenced breeding distribution or productivity of either species at a regional scale, but did contribute to declines in heron presence and increases in site abandonment in certain site specific circumstances.

A study by Weseloh (2005) reviewed current and historical data on 43 breeding colonies of Black-crowned Night-Herons on Lakes Huron, Erie and Ontario and the Detroit, Niagara and St. Lawrence Rivers. Eleven of the sites also had nesting Great Egrets and eight also had nesting Great Blue Herons. Nesting Cattle Egrets and Snowy Egrets were present at two and one colonies, respectively. The study assessed trends in each species nesting relative to changes in co-nesting DCCO populations. Thirty-eight percent of Black-crowned Night-Heron colonies were not affected, 23% showed potential or probable conflict and 39% showed nest take-overs or colony decline/ abandonment. At least nine Black-crowned Night-Heron colonies appear to have been abandoned after nest take-overs by DCCOs. More than half of Great Egret and Great Blue Heron colonies showed probable (or higher) threat from cormorants. All Black-crowned Night-Heron colonies under threat were located between Lake Erie and the St. Lawrence River. Weseloh (2005) recommended that managers monitor DCCO nest placement when DCCOs nest with herons and assess if threats occur.

DCCOs can have a negative impact on vegetation that provides nesting habitat for other birds (Jarvie et al. 1999, Shieldcastle and Martin 1999) and wildlife, including State and federally-listed threatened and endangered species (Korfanty et al. 1999). Cuthbert et al. (2002) did find that DCCOs have negative effects on normal plant growth and survival on a localized level in the Great Lakes region. Wires and Cuthbert (2001) identified vegetation die off as an important threat to 66% of the colonial waterbird colony sites identified as priority conservation sites in the U.S. Great Lakes. Of the 29 priority conservation sites reporting vegetation die off as a threat, Wires and Cuthbert (2001) reported DCCOs present at 23. Based on survey information provided by Wires et al. (2001), biologists in the Great Lakes region reported DCCOs as having an impact on herbaceous layers and trees. Damage to trees was mainly caused by guano deposition, and resulted in tree die off at breeding colonies and roost sites. Impacts to the herbaceous layer were also reported due to guano deposition, and often this layer was reduced or eliminated from the colony site. In addition, survey respondents reported that DCCO impacts to avian species were mainly through habitat degradation and competition for nest sites (Wires et al. 2001). Although loss of vegetation can have an adverse impact on many species, it should be noted that some colonial waterbirds such as pelicans, Common Terns, and potentially Caspian Terns prefer sparsely vegetated substrates.

Hebert et al (2005) conducted a study of the relationship between DCCO density and vegetation on East Sister Island and Middle Island in Lake Erie. In 2000, the year prior to their study, there were 5,485 DCCO nests on the 37.5-acre East Sister Island and 5,202 nests on the 45-acre Middle Island. In their study, the spatial use of nesting DCCOs was negatively correlated with forest cover. Whole island tree cover on East Sister Island decreased 15% in six years concurrent with trends in DCCO use of the island. The largest decline in tree cover occurred in one transect in Middle Island that was heavily used by DCCOs. Tree cover at the site declined from 92% in 1995 to 40% in 2001. Although the results of the study were correlational in nature and cannot prove that damage by DCCOs caused the decline in vegetation, review of other potential factors including pests, disease, human disturbance and weather did not provide any trends or data that would explain the observed declines. The authors also observed that DCCOs tended to prefer live trees for nesting and abandoned dead trees. There appeared to be a pattern of expanding habitat loss that developed as trees used by DCCOs died and DCCOs moved on to healthy, more stable nesting sites.

South Manitou Island

For years, DCCOs have nested on the shipwreck Morazan and the nearby USDI, National Park Service (NPS), Sleeping Bear Dunes National Lakeshore South Manitou Island (SMI) in Leelenau County. Fifty to 150 nesting pairs of DCCOs have used the island as a nest site in the recent past and SMI currently has 3 to 5 acres of vegetation that have died due to impacts associated with nesting DCCOs. On a small scale this is a natural phenomenon which also occurs at gull, Great-blue Heron, and other waterbird rookeries. However, if DCCO numbers continue to increase, they have the potential to impact and alter large areas of the island including the mature white cedars on the island. In addition to observed increases in DCCO populations reported here and in the EA, increased pressure on the SMI may result from DCCOs displaced by CDM programs conducted elsewhere in Michigan and the Great Lakes. The NPS considers the ancient cedars in the Valley of the Giants to be a distinctive and valuable plant community and has occasionally requested help in protecting the site. The white cedar trees on the southwest corner of the Island are among the oldest white cedars in North America. Cedar is also an important part of the ceremonies and culture of the Native American tribes in the area.

1.5.5 Potential DCCO Impact on Property

Birds can damage structures with fecal contamination. Corrosion damage to metal structures and painted finishes, including those on automobiles and boats, can occur because of uric acid from bird droppings. Accumulated bird droppings can reduce the functional life of some building roofs by 50% (Weber 1979).

Property losses in Michigan associated with DCCOs include impacts to fish in privately-owned ponds; damage to boats and marinas or other properties found near DCCO breeding or roosting sites; and damage to vegetation on privately-owned land (USFWS 2003).

1.5.6 Potential DCCO Impact on Human Health and Safety

Airport Safety

The primary risk to human health and safety from DCCOs in Michigan is the risk of a DCCO collision with an aircraft. Collisions between aircraft and wildlife are a concern throughout the world because they threaten passenger safety (Thorpe 1996), result in lost revenue and costly repairs to aircraft (Linnell et al. 1996, Robinson 1996), and erode public confidence in the air transport industry as a whole (Conover et al. 1995). All birds are potentially hazardous to aircraft and human safety. The magnitude of the hazard depends on the physical, biological, and behavioral characteristics of each bird.

DCCOs are a particular hazard to aircraft because of their body size and mass, slow flight speeds, and their natural tendency to fly in flocks. Blockpoel (1976) states that birds with slow flight speeds can create increased hazards to aircraft because they spend relatively greater lengths of time in aircraft movement areas. There is a very strong relationship between bird weight and the probability of plane damage (Anonymous 1992; Dolbeer 2000). For example, there is a 90% probability of plane damage when the bird weighs 70 or more ounces (4 1/3 pounds) versus a 50% probability of plane damage for a six ounce (1/3 pound) bird (Anonymous 1992). Adult DCCOs can weigh up to 96 ounces (six pounds; Terres 1980). The FAA Advisory Circular on hazardous wildlife attractants on or near airports provides a table ranking the relative risk of wildlife to aircraft based on strikes resulting in damage to aircraft (aircraft incurred at least some damage), strikes causing major damage to aircraft (aircraft incurred damage or structural failure which would normally require repair or replacement of the affected component or which rendered the aircraft unsalvageable), and strikes having a negative effect on flight (aborted takeoff, engine shutdown, precautionary landing, etc.; FAA 2007). Cormorants/pelicans ranked 4th after deer, vultures and geese, and had a higher risk rating than cranes, eagles, ducks, osprey, turkey/pheasants, herons. Each species was also assigned a relative risk score with deer, the most hazardous species, having a risk score of 100, and nighthawks, the least hazardous species evaluated, with a score of 1. Vultures had a score of 65, geese a score of 55 and cormorants/pelicans a score of 54. Scores for the other species groups in the top 10 were cranes – 47, eagles – 41, ducks – 39, Osprey – 39, turkey/pheasant – 39, and herons – 27.

According to the Federal Aviation Administration's (FAA) Bird Strike database there were 59 wildlife strikes involving DCCOs to civil aircraft in the U.S. from 1990 – October 2008 (Dolbeer et al. 2009). Reported cost of damage for the

strikes was $2,204,370. Fifteen of the 23 strike reports which indicated damage to aircraft indicated a negative impact on flight (e.g., precautionary landing, aborted takeoff). Examples of DCCO strikes include a May 2002 strike at Minneapolis-St.Paul International Airport (Twin Cities, MN), in which a DC-9-30 struck a flock of DCCOs during takeoff, immediately returned and landed, with minor damage to one wing (FAA National Wildlife Strike Database). In October 2002, at Logan International Airport (Boston, MA), a B-767 struck a flock of DCCOs, resulting in an engine shut down, precautionary landing, and damage to the engine and landing lights. The aircraft was out of service for 3 days, and repairs cost $1.7 million (Wright 2004). At Chicago O'Hare International Airport (Chicago, IL) in Aug. 2004, a B-737-800 ingested a DCCO in one engine when approximately 5 miles from the airport. A precautionary landing was made due to engine vibrations. Fluids were leaking from the engine and 6 fan blades had to be replaced. Cost of repairs was estimated at $61,000. Also at Chicago O'Hare International Airport, in September 2004 a MD-80 struck a flock of DCCOs. Several birds were ingested causing an engine failure and fire, with engine debris falling onto a suburban Chicago neighborhood. The aircraft made an emergency landing and repairs cost $186,000 (Wright 2004). It is estimated that only 20 - 25% of all bird strikes are reported (Conover et al. 1995; Dolbeer et al. 1995; Linnell et al. 1996; Linnell et al. 1999), and the number of strikes involving DCCOs is likely greater than Federal Aviation Administration records show.

Human Health Risks

Concerns about water quality and DCCOs exist on two levels: contaminants and pathogens (USFWS 2003). Waterbird excrement can contain coliform bacteria, streptococcus bacteria, Salmonella, toxic chemicals, and nutrients, and it is known to compromise water quality, depending on the number of birds, the amount of excrement, and the size of the water body. There are concerns regarding the impacts of elevated contaminant levels associated with breeding and/or roosting concentrations of DCCOs on groundwater supplies and human health. Although this effect has not been documented, the potential still exists. Beach closures in Michigan and elsewhere have been linked to large concentrations of gregarious bird species such as geese and gulls.

DCCO Impacts on Human Health and Safety in Michigan

WS recognizes that the risk to aircraft safety associated with DCCOs is low. To date, there have been no DCCO collisions with aircraft reported for Michigan. However, WS has received requests for this type of assistance. During calendar years 2006-2008, 33 DCCOs were shot at Michigan airports to reduce hazards to aircraft. Given that DCCO roosting and feeding sites are found in close proximity to some airports and military airbases in Michigan, it is possible that WS may receive requests for assistance in the future. WS may provide such assistance in Michigan if requested.

1.5.7 Michigan DCCO Coordination Group

In 2005, a Cormorant Coordination Group (CCG) with representatives from MDNRE and WS was convened to consult on and establish priorities for CDM initiated under the PRDO. The group was charged with reviewing the available information on DCCOs regarding their potential impact on natural resources in Michigan and recommending appropriate actions to respond to any impacts, including establishing annual management recommendations.

In 2006, the CCG supported initiation of harassment actions (including limited lethal take to reinforce harassment) to disrupt and disperse large flocks of DCCOs from shallow embayments during the spring migration period at Long and Grand Lakes in Alpena County, Potagannissing Bay on Drummond Island, Brevoort Lake, Manistique and South Manistique Lakes in Mackinac County, Indian Lake in Schoolcraft County, Waishkey Bay in Chippewa County, and Lake Huron off Rockport in Alpena County. The CCG also recommended reducing the number of breeding DCCOs (through egg oiling and lethal removal of adults) in the LCI (a continuation of a project started in 2004), Thunder Bay, and Bays de Noc. The CCG delayed a decision on potential CDM actions in the Beaver Island archipelago.

As interest in CDM to protect public resources in Michigan has increased, it has become increasingly important that all entities that have authority under the PRDO consult with one another and coordinate their activities. Consequently, a new Interagency Cormorant Coordination Group (ICCG) was formed which includes representatives from the USFWS, WS, MDNRE and affected Tribes. This informal group reviews available data and discusses and coordinates proposed CDM activities. The agencies comprising the working group will work cooperatively together on DCCO management issues in Michigan. However each agency will retain its own authority to make management decisions. The group will review DCCO population data, impacts of proposed CDM actions in Michigan individually and collectively, and information on regional and national CDM activities to ensure that CDM efforts in Michigan will not jeopardize the viability of State, regional or national DCCO populations. The USFWS, WS, and MDNRE have agreed that decisions on future PRDO CDM projects will be made only after consulting with the ICCG.

1.5.8 Proposed Initial DCCO Population Management Objectives for Breeding Colonies in Michigan

1.5.8.1 General Objectives

Two terms have been established to facilitate communication and implementation of the Public Resource depredation order. These terms are also used in the following description of the proposed action and in the impact analysis:

Breeding colony - defined according to professional discretion and may include a group of several close clusters of nests with eggs and/or chicks on a large island or peninsula, or the nests with eggs and/or chicks from several clustered small islands or sites; a breeding colony is a smaller unit than a "local breeding population"; the term "established breeding colony" refers to one that is known to have successfully fledged chicks in any prior year and has had adults attempt to nest in at least one of the previous 3 years.

Local breeding population – a group of birds from breeding colonies that interact on a regular basis (this unit is larger than a "breeding colony" but smaller than a regional population). Examples of local breeding populations in Michigan would be the colonies in the LCI, the colonies in Thunder Bay, the colonies in the Bays de Noc, and the colonies in the Beaver Islands archipelago.

To protect natural resources including co-nesting species, vegetation, and fishery resources in Michigan, the following general objectives have been proposed relative to implementation of the PRDO:

1) Maintain no less than 5,000 breeding pairs statewide. The Michigan DCCO breeding population was estimated at approximately 5,000 breeding pairs in 1989 and increased from that point to approximately 30,458 pairs in 1997. Given historic population increases, reducing the statewide DCCO population to 5,000 breeding pairs will not jeopardize the State DCCO population. This level is also over 4 times the level the state DCCO population was at when it was removed from the Michigan list of threatened and endangered species.

2) Preserve distribution of DCCOs throughout the state. At existing local breeding populations, CDM efforts will not reduce the number of breeding pairs below 100 pairs if there is only one breeding colony in the local breeding population. Local breeding populations with more than one colony will not reduced below 200 pairs. In instances where the local breeding population is comprised of one colony, lower management objectives may be implemented if DCCO presence jeopardizes vegetation of cultural or ecological value (e.g., threatened or endangered plants, vegetation used by threatened or endangered species or species of conservation concern, or vegetation with cultural significance to Native Americans). These instances would be rare and would only be implemented after consultation with the ICCG.

3) Discourage DCCO use of man-made structures. Where practical and effective alternatives are available, priority will be given to nonlethal site modification (e.g., exclusion) to eliminate DCCO use of the site.

4) Where existing data are adequate to indicate cause for concern, work to minimize adverse impacts of DCCOs on public fishery resources.

5) Manage colonization of new sites on a case-by-case basis. Cormorant damage management activities may result in movement of some DCCOs to existing, historic or new inland sites. It seems likely that opportunities exist for the establishment of new colonies which would allow for increased opportunities to view and enjoy DCCOs without necessarily having the adverse impacts that are currently being addressed at large colonies. New colonies will not be managed unless there is reasonable cause to believe that the DCCOs are causing or are about to cause damage.

6) Support research and monitoring on the impacts of DCCOs on public resources and evaluate the effects of CDM actions.

All CDM would be conducted using an adaptive management approach that would combine use of existing information on CDM from the literature and data on DCCOs and CDM from actions in Michigan to continually reevaluate the need for action, the effectiveness of CDM, methods used for CDM, and impacts of CDM on target and nontarget species. New information would be reviewed by the individual agencies and the Michigan ICCG. Management objectives and techniques would be adjusted as appropriate based on these reviews.

1.5.8.2 MDNRE Management Objectives

In addition to the general objectives, the MDNRE has proposed the following management objectives for cormorant colonies in the State based on concerns regarding DCCO impacts on fishery resources. Information in this section has been excerpted from the MDNRE unpublished report, "An Adaptive Management Framework for Managing Populations of Double-crested Cormorants in Michigan" (MDNRE 2009). Details on reasoning for conducting CDM for the protection of fishery resources at each of these sites are provided in Section 1.5.3 above.

<u>Les Cheneaux Islands</u>

Fielder (2010) concluded that CDM conducted in the LCI has had a beneficial impact on the perch population (Section 1.5.3.1). The MDNRE management objective for this area is to maintain the perch population at pre-collapse (pre-2000) levels. The hypotheses to be tested are as outlined by Fielder (2008). The null hypothesis is that DCCO predation has no impact on yellow perch mortality or abundance and that factors such as walleye abundance, recruitment of yellow perch, water level or water temperature have a greater influence on yellow perch populations in the Les Cheneaux. The alternative hypothesis is that the number of nesting DCCOs has a substantial impact on perch mortality and the abundance of yellow perch in the Les Cheneaux Islands. The MDNRE is currently monitoring, the yellow perch population through the use of gillnet surveys and creel surveys. Gillnet surveys are also used to monitor walleye populations. The MDNRE uses

data from the National Oceanic and Atmospheric Administration to monitor water temperature and water levels.

The proposal for the LCI is to maintain the number of breeding pairs at 500 breeding pairs for 5 years to determine if the yellow perch population and fishery proves stable and sustainable with this level of DCCO predation. Annual nest counts, fish community and environmental monitoring will continue as described in Fielder (2008 and 2010). If fish population metrics indicate declines are probably attributable to DCCOs, additional reductions may be considered.

Thunder Bay

The management goal for Thunder Bay is to improve survival of newly stocked brown trout, steelhead, and cisco, improve survival of juvenile lake whitefish, and reduce predation demand on the forage fish population in the bay. The null hypothesis for this site is that the current level of DCCO predation is not contributing substantially to observed declines in recreational and commercial fish species. Factors other than DCCOs (e.g., foodweb change, increasing round goby populations) are the primary force behind observed population dynamics of these fish species, and CDM will not be adequate to improve fish populations. The alternative is that although other factors are impacting the system, the impact of DCCOs is sufficiently great that reducing DCCO numbers results in increases in recreational and commercial fish populations. If the null hypothesis is false, then the agencies would expect to see the following changes as the local DCCO population declines:

1) Increased survival of juvenile lake whitefish, as measured in bottom trawl catch rates;
2) Increased survival of other species, such as forage fish, yellow perch and smallmouth bass, as measured by rising catch rates in surveys;
3) Improved brown trout angler harvest (total catch) and catch rates (CPUE); and
4) Increased prevalence of species such as yellow perch and smallmouth bass in DCCO diets as DCCO numbers decline and fish populations and species diversity increase.

The management proposal is to reduce the number of breeding DCCOs in the Thunder Bay area from the 2009 estimate of 1,060 pairs (control began in 2005, with a total of 3,994 breeding pairs) to approximately 450 pairs (Johnson et al. 2007), which was the number of nesting pairs that prevailed immediately prior to the measured declines in prey base, species diversity, and brown trout stocking success. Historically, post-stocking survival of brown trout was satisfactory, with approximately 5% of stocked fish surviving to be harvested by anglers, and lake whitefish juvenile (ages 0-3) densities, although variable, were generally high, averaging 10 kg/ha from 1986-1991, when DCCOs were present in the bay at this abundance. Both the foodweb change and DCCO hypothesis are likely to be

working in concert; therefore, recovery of the fish community to levels measured prior to dreissenid colonization is unlikely. A target goal for the brown trout fishery is that approximately 5% of fish stocked as fall yearlings be harvested by anglers. The goal for whitefish is a rise in recruitment levels from the present 0.34 kg/ha to one third that of the pre-dreissenid era, or 3.0 kg/ha of ages 0-3 whitefish in Thunder Bay, as measured in bottom trawls. Fish populations will be monitored through annual netting surveys, trawl surveys and creel surveys. DCCO nest counts will be conducted to monitor the DCCO population. Accomplishment of management objectives in this area is complicated by the fact that the landowners/managers of the areas where DCCOs nest have not granted access to these sites for egg oiling or other CDM actions. At present, management actions are limited to those activities which may be conducted off-shore (i.e., off-colony shooting).

Bays de Noc

The management objective for this area is to improve the yellow perch and walleye fisheries in the Bays de Noc and to reduce the foraging pressure on the prey base in the bays. The null hypothesis is that factors other than DCCOs (e.g., alewife, climate) are the primary force behind observed declines in survival of walleye and yellow perch dynamics of these fish species and that the proposed levels of CDM alone will not be adequate to improve fish populations. The alternative hypothesis is that DCCO predation is a key factor limiting the survival of yellow perch and walleye and contributes to a reduced overall biomass in the bays. The current management proposal is to reduce the number of breeding DCCOs in the bays 50% per year and assess fishery responses. Two of the islands are state owned and will be oiled while the other two island are privately owned and cannot be oiled at this time. Target fish species populations will be monitored through ongoing fish community surveys (e.g., gill net survey) and creels surveys. Response of prey fish populations will be monitored lake-wide and locally in surveys conducted by the USDI, Geological Survey, Great Lakes Science Center.

Fish populations will be monitored through an ongoing DNRE fish community survey that tracks potentially vulnerable gamefish, specifically yellow perch and young walleye, and forage species. Average values for these metrics from Bays de Noc fish community surveys during 2005-9 were as follows: age-1 and older yellow perch (77 fish per 1000 ft of net); age-0 and age-1 walleyes (16 and 5 fish per 1000 ft of net in Little Bay de Noc and Big Bay de Noc). If reductions in the number of nesting DCCOs has the anticipated effect, there may be a long-term increase (50% or higher) in these metrics. Year-to-year variation in these metrics is substantial, as individual values for each metric during the 5-year period ranged well beyond 50% of the mean value presented here. Thus, several years of data will be needed to assess whether there has been a detectable response of the fish community to CDM.

Beaver Islands Archipelago

The management objective for the Beaver Island Archipelago is to restore the smallmouth bass population and fishery and reduce overall foraging demand on the prey base of Lake Michigan. The null hypothesis is that factors other than DCCOs are the primary force behind observed declines in smallmouth bass survival and total fish biomass and the prey based in the Beaver Islands ecosystem. Alternatively, the impact of DCCO predation may a key factor limiting smallmouth bass survival and the fish biomass in the Beaver Islands and that reductions in DCCO numbers does result in improvements in these factors.

The management proposal for this area is to reduce the archipelago-wide DCCO breeding population 50% each year and monitor fish population and fishery responses. Shooting and egg oiling will be used to reduce DCCO numbers. Egg oiling and on-colony shooting may not be permitted on some islands and off-colony shooting may also be used. Monitoring and evaluation of the smallmouth bass population will be based on on-going studies conducted by Central Michigan University and supplemented by periodic creel surveys by the MDNRE. Prey fish impacts will be monitored by lake-wide and local prey fish surveys conducted by the USDI, Geological Survey (USGS), Great Lakes Science Center and the MDNRE Charlevoix Fisheries Research Station. The Great Lakes represent the lower thermal limit for smallmouth bass reproduction, and, on average, 7 or more year classes out of 10 will perish because of cold periods during their first summer. Monitoring will cover multiple years of spawning to be sure of covering a year with suitably warm water temperatures for reproduction. The MDNRE will monitor adult smallmouth bass abundance at historically-sampled locations, and percent of the population comprised of age 1 and younger smallmouth bass. Minimum target population levels of these parameters, based on "pre-DCCO" surveys (see Fig.1-5), are an average population size over a five year period of 600 adult smallmouth bass (Garden Harbor site), and 25% or more smallmouth bass age 1 and younger.

Ludington Pumped Storage Project

The management objectives for this area are: 1) improve abundance of yellow perch in the Ludington area to a level where sport angler creel rate equals or exceeds 0.3 CPUE; 2) improve survival of juvenile brown trout and rainbow trout to a level where sport angler creel rates equal or exceeds 0.01 CPUE for brown trout and 0.02 CPUE for rainbow trout; and 3) reduce foraging demands on fishery prey base of Lake Michigan. The null hypothesis is that factors other than DCCOs are not the primary factor limiting yellow perch and juvenile salmonids and that the proposed levels of CDM alone will not be adequate to improve fish populations. The alternative hypothesis is that predation by DCCOs is a key force behind observed population dynamics of these fish species in the Ludington area and is contributing to an overall reduction in fish biomass and prey base in the ecosystem.

The management proposal for this area, consistent with general objective 3 above, is to prevent all DCCO nesting at the Ludington site. Cormorant damage management efforts began at the site in 2007 when eggs were oiled and 10% of the breeding population was removed. In 2008, eggs were oiled and 50% of the breeding population was removed. The overall number of nesting pairs was reduced from 532 to 313 nesting pairs over the period of 2007 to 2009. Preliminary data are encouraging, but more time is needed before impacts of the program can be conclusively determined. The prevention of all DCCO nesting at Ludington will require continued removal of nesting pairs and oiling of eggs. Preliminary data are encouraging, but another three to five years may be required before impacts of the program can be conclusively determined.

1.5.8.3 Tribal CDM Projects

As noted in several tribes have Treaty-protected fishing rights in the Ceded waters of the Great Lakes. The tribes, MDNRE and WS work to coordinate CDM projects, and the tribes are included in the ICCG. This section includes a description of management objectives for each of the current tribal CDM projects.

Ile aux Galets

Cormorant damage management on Isle aux Galets is conducted by the LTBB. The management objective for the project is to reduce DCCO foraging pressure on perch and lake trout. The LTBB work is part of a coordinated CDM initiative for the Beaver Islands area. The LTBB is working to greatly reduce or eliminate DCCO reproduction on the island and DCCO need for fish. To date, efforts have been restricted to egg oiling, although lethal methods may be implemented at a future date as part of the Beaver Islands CDM effort discussed above.

Bellow Island

Cormorant damage management on Bellow Island is conducted by the GTBB. Management objectives for the GTBB are:

1) Protect tribally stocked walleye to improve the tribal fishery;
2) Reduce the potential for predation on stocked lack trout in Grand Traverse Bay and the Northern Lake Michigan Refuge
3) Reduce the number of nesting DCCOs to at the nesting colony to make more space available for other nesting bird species; and
4) Reduce vegetative damage caused by DCCO excrement and encourage long-term recovery of native plants.

The GTBB plans to continue to use a combination of egg oiling and shooting (<10% of breeding population) to reduce DCCO numbers and DCCO nesting success on the island. Success in meeting management objectives will be

evaluated by monitoring the number of DCCO nests and DCCO nest success, monitoring the number of nests or nesting area used by other bird species on the island, and Intertribal Fisheries and Assessment Program data. The GTBB also plans to analyze stomach contents of DCCOs taken for damage management, .

Paquin and Naubinway Islands

Cormorant damage management in this area is conducted by the SSMT and Bay Mills Indian Communities in conjunction with the CORA. The general management goal for the area is to reduce DCCO consumption of fish species important to tribal members in selected areas of the 1836 ceded waters of the Great Lakes. Specific objectives are to:

1) Protect fingerling walleye stocked in Epoufette Bay;
2) Reduce the incidence of cormorant scarring on lake whitefish; and
3) Reduce the incidence of cormorant scarring on menominee and protect menominee populations in northern Lake Michigan.

Success of the program will be measured primarily by reductions in cormorant marking of menominee and lake whitefish and, to a lesser extent, by increase abundance of menomiee. Measurable milestones of the program are to obtain a 25% reduction in marking of lake whitefish and menominee from levels observed in 2000-2005, and CPUE of menominee in Intertribal Fisheries and Assessment Program graded gillnet surveys in northern Lake Michigan should be at least 2.0 fish per 1,000 ft.

St. Mary's River

Cormorant damage management in this area is conducted by the SSMT and Bay Mills Indian Communities in conjunction with the CORA. The general management goal for the area is to reduce DCCO consumption of fish species important to tribal members in selected areas of the 1836 ceded waters of the Great Lakes. The specific objectives for the CDM in this area are to protect stocked fingerling walleye and naturally reproducing populations of yellow perch. The measurable milestone of the current program is to improve September CPUE of age 0 and age 1+ walleye to in excess of 6 fish per hour of electrofishing in the St. Mary's River.

Tahquamenon Island

The goal for this area is to decrease the populations and DCCO feeding pressure of DCCOs to reduce incidence of scarring on lake whitefish and round whitefish and reports of DCCOS harassing whitefish inside trap nets. The proposed program may also decrease damage by DCCo to nesting islands and surrounding aquatic systems. The Bay Mills Indian Community proposes to use a

combination of egg oiling and limited shooting of adults (up to 10% of the local breeding population) to reduce the number of DCCOs using the island.

1.5.8.4 National Wildlife Refuge Policy

Depending on the management alternative selected, CDM may be permitted on NWR islands in the Beaver Island archipelago (e.g., Hat, Pismire and Gull Islands) to assist the MDNRE in obtaining their management objectives for the area per the PRDO. Work proposals for each island would be evaluated on a case-by-case with priority given to the protection of sensitive nontarget species such as the state-listed threatened Caspian Terns on Hat Island. Any CDM on USFWS lands will be conducted by WS. As noted in Section1.5.3.2, DCCOs temporarily discontinued nesting at Scarecrow Island and CDM is not currently proposed for this site. However, CDM could be considered in the future if large numbers of nesting DCCOs resume use of the island. Criterion for permitting CDM on Scarecrow Island would be similar to those for NWR Islands in the Beaver Island archipelago.

1.5.8.5 Future PRDO Projects

The management objectives discussed above have been established to address current concerns regarding impacts of DCCOs on public resources. The presence and size of DCCO colonies in Michigan can and has changed over time. Future actions to reduce DCCO damage to public resources may be conducted at sites in addition to those listed above. As noted in Section 1.5.6, action agencies will consult with each other through the ICCG prior to initiating new CDM projects under the PRDO, and will comply with USFWS notification and review requirements for implementation of the PRDO.

This EA anticipates potential expansion in CDM activities and analyzes the impacts of such efforts as part of the program. Depending upon the alternative selected, additional PRDO efforts would be permitted under this EA so long as cumulative environmental impacts from the addition of the proposed action will not exceed parameters established in this EA. Future management plans must incorporate the general policies and protective measures stipulated in this EA. The impacts of CDM efforts, if any, conducted under the alternative selected in this EA will be monitored annually to determine if the analysis in the EA sufficiently addresses impacts of CDM efforts. If it is determined that an additional EIS is not needed, this EA would remain valid until WS, USFWS, NPS and MDNRE along with other appropriate agencies, determine that new needs for action, changed conditions, and/or new alternatives having different environmental effects must be analyzed. At that time, this analysis and associated decision would be supplemented pursuant to NEPA.

1.6 RELATIONSHIP TO OTHER ENVIRONMENTAL DOCUMENTS

ADC Programmatic Environmental Impact Statement. WS has issued a FEIS on the national APHIS/WS program (USDA 1997, Revised). Pertinent and current information available in the EIS has been incorporated by reference into this EA.

Final Environmental Impact Statement: Double-crested Cormorant Management in the United States. The USFWS has issued a Final EIS (FEIS) and Record of Decision (ROD) (68 Federal Register 58022) on the management of DCCOs (USFWS 2003). WS was a formal cooperating agency in the preparation of the FEIS and has adopted the EIS to support WS' program decisions for its involvement in the management of DCCO damage throughout the United States. WS completed a ROD on November 18, 2003 (68 Federal Register 68020). This EA is tiered to that FEIS. Pertinent and current information available in the EIS has been incorporated by reference into this EA. The FEIS, final ruling and PRDO may be obtained by contacting the Division of Migratory Bird Management, U.S. Fish and Wildlife Service, 4401 North Fairfax Drive, MBSP-4107, Arlington, Virginia 22203 or by downloading it from the USFWS website at http://fws.gov/migratorybirds/CurrentBirdIssues/Management/cormorant/cormorant.html. The WS ROD may be viewed at http://www.aphis.usda.gov/ws/pubs.html. The USFW renewed the depredation order in 2009 (USFWS 2009).

Environmental Assessment: Reducing Double-crested Cormorant Damage through an Integrated Wildlife Damage Management Program in the State of Michigan (USDA 2004) and Amendment (USDA 2006*b*). This EA analyzes alternatives, need for action, management objectives and potential impacts of CDM in Michigan. Implementation of the PRDO in Michigan was initiated based on analysis in the EA. Management actions and available information were updated and expanded in the 2006 supplement. Once completed, analysis and decisions in this (2010) EA supersede that in the 2004 EA and 2006 supplement.

1.7 SCOPE OF THIS ENVIRONMENTAL ASSESSMENT

1.7.1 Actions Analyzed

This EA evaluates the impacts of alternatives for CDM by WS and the cooperating agencies (USFWS and NPS) to protect aquaculture, property, natural resources, and human health and safety on private and public land or facilities within the State of Michigan wherever such management is requested or deemed necessary. As noted in USDA (2004), WS, the MDNRE and the Tribes can take action to manage DCCO damage under the Public Resource Depredation Order (PRDO; 50 CFR 21.48) and through depredation permits issued by the USFWS. WS can also assist others in obtaining depredation permits. WS and other entities

can also take DCCOs under scientific collecting permits issued by the USFWS. A MDNRE permit is also required for scientific collection and lethal take of DCCOS for damage management.

The proposed action could include areas in and around public and private facilities and properties where cormorants may roost, loaf, feed, nest or otherwise occur. Examples of areas where cormorant damage management activities could be conducted include, but are not necessarily limited to: aquaculture facilities; fish hatcheries; lakes; ponds; rivers; swamps; marshes; islands; communally-owned homeowner/property owner association properties; boat marinas; natural areas; wildlife refuges; wildlife management areas; and airports and surrounding areas. With permission of the landowner/manager, the proposed action may be conducted on properties held in private, local, State, Federal or tribal ownership. WS may, with landowner permission, conduct breeding bird control activities in any of the breeding sites in Michigan. This would include nesting locations identified by Wires and Cuthbert (2001) as high priority for the conservation of colonial waterbirds in the U.S. Great Lakes. The agencies and tribes will consult the USFWS before undertaking cormorant control activities at the high-priority sites.

1.7.2 Period for which this EA is Valid

If it is determined that an additional EIS is not needed, this EA would remain valid until WS, the USFWS, the NPS, and the MDNRE along with other appropriate agencies, determine that new needs for action, changed conditions, and/or new alternatives having different environmental effects must be analyzed. At that time, this analysis and associated decision would be supplemented pursuant to NEPA. Review of the EA would be conducted each year to ensure that the need for action, actions taken and environmental impacts are within parameters analyzed in the EA.

1.7.3 Native American Tribes and Land

The scope of this EA is limited to the CDM actions of WS and agencies working cooperatively with WS. Although the EA provides estimates of the anticipated activities of other entities (e.g., tribes) for the purpose of analyzing cumulative impacts, these estimates do not represent a commitment by these entities to work within the parameters analyzed by WS. WS and the USFWS will conduct annual monitoring of actions taken under the PRDO with assistance from cooperating agencies to determine if impacts are within parameters predicted and analyzed in the EA. The EA will be updated as needed pursuant to the NEPA.

Currently, Michigan WS does not have any MOUs with any American Indian tribe. If WS enters into an agreement with a tribe for CDM, this EA would be reviewed and supplemented if appropriate to insure compliance with NEPA.

MOUs, agreements and NEPA compliance would be conducted as appropriate before conducting CDM on tribal lands.

1.7.4 Site Specificity

The geographic scope of the proposed action includes areas in and around public and private facilities and properties and at other sites where DCCOs may roost, loaf, feed, nest or otherwise occur. Examples of areas where CDM activities could be conducted include, but are not necessarily limited to: aquaculture facilities; fish hatcheries; lakes; ponds; rivers; swamps; marshes; islands; communally-owned homeowner/property owner association properties; boat marinas; natural areas; wildlife refuges; wildlife management areas; and airports and surrounding areas. The proposed action may be conducted on properties held in private, local government, State, Federal, or tribal ownership once landowner permission has been obtained. The lead and cooperating agencies could conduct CDM at any of the areas where DCCOs cause damage or risks to health and safety in the State including any of the breeding sites currently identified throughout the State with landowner permission including, but not limited to properties identified in Section 1.5.3. Because many of these DCCO breeding sites are mixed species colonies where control measures have the potential to negatively impact other colonial nesting waterbirds, such as Great Egrets, Great Blue Herons and Black-crowned Night Herons, gulls, terns and American White Pelicans, mixed species colonies will be assessed very carefully before any control measures are recommended.

This EA analyzes potential effects of WS and cooperating agency (USFWS, NPS, MDNRE) CDM activities that will occur or could occur at private and public property sites or facilities within Michigan. Because the proposed action is to reduce damage and because the program's goals and directives are to provide services when requested and considered necessary, within the constraints of available funding and workforce, it is conceivable that additional CDM efforts could occur. This EA anticipates this potential expansion and analyzes the impacts of such efforts as part of the program (Chapter 4).

Planning for CDM must be viewed as being conceptually similar to Federal or other agency actions whose missions are to stop or prevent adverse consequences from anticipated future events for which the actual sites and locations where they will occur are unknown but could be anywhere in a defined geographic area. Although some of the sites where DCCO damage will occur can be predicted and are described in this EA, all specific locations or times where such damage will occur in any given year cannot be predicted. For the most part, the issues that pertain to the various types of DCCO damage and resulting management are the same wherever they occur, and are treated as such. The standard WS Decision Model (Slate et al. 1992) is the routine thought process that is the site-specific procedure for determining methods and strategies to use or recommend for individual actions conducted by the USFWS, WS and the cooperating agencies.

See USDA 1997 (Revised) and Chapter 3 for a more complete description of the WS Decision Model as well as examples of its application. All projects covered by this EA will be in accordance with any mitigation measures and standard operating procedures described herein and adopted or established as part of the final agency decisions.

The analyses in this EA are intended to apply to any action that may occur *in any locale* and at *any time* and by the lead and cooperating agencies and their authorized agents within Michigan. In this way, WS and USFWS believe they meet the intent of NEPA with regard to site-specific analysis and that this is the only practical way to comply with NEPA and still be able to accomplish its mission.

1.7.5 Summary of Public Involvement

Issues related to the proposed action were initially identified by natural resource staff within WS, USFWS, and MDNRE and from public comments received on the 2004 Michigan CDM EA and its 2006 Amendment (USDA 2004, 2006*b*). Issues identified at the meetings and in letters were incorporated into this analysis.

The USFWS DCCO FEIS (2003) was used to further define the issues and identify preliminary alternatives. As part of this process, and as required by the Council on Environmental Quality (CEQ), APHIS-NEPA, and USDI implementing regulations, this document and the subsequent Decision will be made available to the public through "Notices of Availability" published in local media, direct mailings of Notices of Availability to parties that have specifically requested to be notified, and through agency news releases and web sites. New issues or alternatives provided during public involvement periods will be used to determine whether the EA should be revised and the final decision regarding the alternative to be selected and its associated impacts.

1.8 AUTHORITY AND COMPLIANCE

Each of the cooperating agencies has specific roles and responsibilities relative to the management of DCCO damage in the State of Michigan. The degree and nature of each agency's involvement varies depending on the location and nature of the damage problem. The following table summarizes agency roles in addressing DCCO damage in Michigan and provides information on the ability of others to address DCCO damage.

Table 1-2. Roles and responsibilities for DCCO damage management in Michigan

Management Entity	Activities Covered by the PRDO	DCCO Take Not Covered by the Depredation Orders[1]
U.S. Fish and Wildlife Service –Regional Migratory Bird Permits Office	Provides limited technical assistance. Has authority to deny approval for projects proposing to take of more than 10% of local colony. Monitors impacts of local, regional and national DCCO damage management efforts. Provides oversight to ensure action agency compliance with the PRDO regulations. Monitors regional DCCO populations.	Provides limited technical assistance. Issues scientific collecting and depredation permits[1]. Monitors DCCO take under permits. Monitors regional DCCO populations.
U.S. Fish and Wildlife Service - Refuges	Approves/authorizes take of birds on USFWS property. Takes birds as agents of MDNRE or Wildlife Services. Aids in monitoring local DCCO population.	May take birds for research under scientific collecting permits. Provides limited technical assistance.
Michigan Department of Natural Resources and Environment	Provides technical assistance. Takes birds (less than 10% of local colony) after notifying USFWS. Takes birds (more than 10% of local colony) with approval of USFWS. Monitors State and local DCCO populations. Lead agency for monitoring and documenting impacts on fish populations.	Provides technical assistance. May take DCCOs under scientific collecting or depredation permits. Monitors statewide DCCO populations.

Management Entity	Activities Covered by the PRDO	DCCO Take Not Covered by the Depredation Orders[1]
Wildlife Services	Takes birds at request of landowners/ managers. Provides technical assistance. Takes birds (less than 10% of local colony) after notifying USFWS and MDNRE. Takes birds (more than 10% of local colony) with approval of USFWS and MDNRE. Aids in monitoring State/local DCCO populations.	Provides technical assistance. Consults with depredation permit applicants regarding nonlethal and lethal alternatives for damage management[1]. Provides Form 37 for USFWS consideration when issuing depredation permits. May take DCCOs under Federal scientific collecting and depredation permits.
Tribes	Provides technical assistance. May use lethal and nonlethal techniques to reduce DCCO damage to public resources on lands under tribal jurisdiction. Aids in monitoring local DCCO populations.	Provides technical assistance. As appropriate, may take DCCOs under scientific collecting permits and depredation permits.
USDI, National Park Service, Sleeping Dunes National Seashore	Approves/authorizes take of birds on NPS property. Takes birds as agents of MDNRE or Wildlife Services. Aids in monitoring local DCCO population.	May take birds for research under scientific collecting permits.
Others[2]	May act as agents for action agencies (WS, MDNRE, tribes) in certain CDM situations.	May take DCCOs under Federal scientific collecting permits. May use nonlethal techniques to reduce DCCO damage without a depredation permit. May take DCCOs causing damage under Federal depredation permits.

[1] Includes DCCOs taken under scientific collecting permits and DCCOs taken under Federal depredation permits for damage to property and management of risks to human health and safety.

[2] Airports, private citizens with property damage, disease surveillance, university researchers, etc.

1.8.1 Authority of Each Lead and Cooperating Agency in CDM in Michigan[2]

U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services Legislative Authority[2]. The USDA is authorized by law to protect American agriculture and other resources from damage associated with wildlife. The primary statutory authority for the Wildlife Services program is the Act of March 2, 1931 (46 Stat. 1468; 7 U.S.C. 426-426b) as amended, and the Act of December 22, 1987 (101 Stat. 1329-331, 7 U.S.C. 426c).

WS is a cooperatively funded, service-oriented program. Before any operational wildlife damage management is conducted, an *Agreement for Control* or similar document must be completed by WS and the landowner/administrator. WS cooperates with other Federal, State, Tribal, and local government entities, educational institutions, private property owners and managers, and with appropriate land and wildlife management agencies, as requested, with the goal of effectively and efficiently resolving wildlife damage problems in compliance with all applicable Federal, State, and local laws.

U.S. Department of the Interior, Fish and Wildlife Service (USFWS). The mission of the USFWS is: "Working with others to conserve, protect, and enhance fish, wildlife, plants and their habitats for the continuing benefits of the American people". While some of the USFWS's responsibilities are shared with other Federal, State, tribal, and local entities, the USFWS has special authorities in conserving migratory birds, endangered species, certain marine mammals, and nationally significant fisheries; managing the National Wildlife Refuge System; and enforcing Federal wildlife laws. The MBTA gives the USFWS primary statutory authority to manage migratory bird populations in the U.S. The USFWS is also charged with implementation and enforcement of the Endangered Species Act of 1973, as amended and with developing recovery plans for listed species.

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". One unit of the Refuge System in Michigan is Michigan Islands NWR. This refuge was established under Executive Order 9337 in 1943 as a refuge and breeding ground for migratory birds and other wildlife. The refuge is comprised of eight islands in Lakes Michigan and Huron, including Gull, Pismire, Hat and Shoe Islands in northern Lake Michigan, and Scarecrow Island in Thunder Bay, and Big and Little Charity Islands in Saginaw Bay. Scarecrow, Pismire, and Shoe islands were officially designated as Federal wilderness areas in 1970. Cormorants nest at Little Charity, Scarecrow, Gull, Pismire and Hat Islands.

[2]See Chapter 1 of USDA (1997 Revised) for a complete discussion of Federal laws pertaining to WS.

United States Department of the Interior, National Park Service (NPS). The NPS is responsible for management of Sleeping Bear Dunes National Lakeshore, including South Manitou Island and the North Manitou Island Shoals Coast Guard Lighthouse which host nesting DCCOs.

The Organic Act creating the NPS states the agency will "conserve the scenery and the natural and historic objects and the wildlife therein and… provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations" (16 U.S.C. 1).

The Management Policies 2001 for the NPS state in Section 4.4.2, Management of Native Plants and Animals, "Whenever possible, natural processes will be relied upon to maintain native plant and animal species, and to influence natural fluctuations in populations of these species. The NPS may intervene to manage individuals or populations of native species only when such intervention will not cause unacceptable impacts to the populations of the species and when at least one of the following conditions exists:

- A population occurs in an unnaturally high or low concentration as a result of human influences and it is not possible to mitigate the effects of the human influences;
- There is a need to protect rare, threatened, or endangered species; etc.

Michigan Department of Natural Resources and Environment (MDNRE). The MDNRE authority in wildlife management is given under Article I, Part 5, Regulation 324.503 of Michigan Public Act 451 of 1994. This section states in part;

The department shall protect and conserve the natural resources of this state; provide and develop facilities for outdoor recreation; prevent the destruction of timber and other forest growth by fire or otherwise promote the reforesting of forest lands belonging to the state; prevent and guard against the pollution of lakes and streams within the state and enforce all laws provided for that purpose with all authority granted by law; and foster and encourage the protecting and propagation of game and fish.

The Michigan Department of Natural Resources and Environment is committed to the conservation, protection, management, accessible use and enjoyment of the State's natural resources for current and future generations and to the protection and enhancement of Michigan's environment and public health.

MDNRE currently has a Memorandum of Understanding with WS. The document establishes a cooperative relationship between WS and MDNRE. Responsibilities include planning, coordinating, and implementing policies to address wildlife damage management and facilitating exchange of information.

1.8.2 Compliance with Other Laws, Executive Orders, Treaties, and Court Decisions.

A number of other Federal laws, treaties, and court decisions authorize, regulate, or otherwise affect WS wildlife damage management. The cooperating agencies comply with all applicable laws, and consult and cooperate with other agencies as appropriate.

National Environmental Policy Act (NEPA). All Federal actions are subject to NEPA (Public Law 91-190, 42 U.S.C. 4321 et seq.). NEPA sets forth the requirement that Federal actions with the potential to significantly affect the human environment be evaluated in terms of their impacts for the purpose of avoiding or, where possible, mitigating and minimizing adverse impacts. WS and the USFWS prepare analyses of the environmental effects of program activities to meet procedural requirements of this law. This EA meets the NEPA requirement for the proposed action in Michigan for WS, the NPS and the USFWS.

Ordinarily, individual actions on the types of sites encompassed by this analysis may be categorically excluded under the APHIS Implementing Regulations for compliance with the National Environmental Policy Act (NEPA) (7 CFR 372.5(c)). APHIS Implementing Regulations also provide that all technical assistance furnished by WS is categorically excluded (7 CFR 372.5(c)) (60 Federal Register 6,000, 6,003 (1995)). However, WS, the USFWS, and NPS have decided to prepare this EA to assist in planning CDM activities and to clearly communicate with the public the analysis of cumulative effects for a number of issues of concern in relation to alternative means of meeting needs for such management in the State, including the potential cumulative impacts on DCCOs and other wildlife species. With the exception for certain projects covered by the PRDO described in Sections 1.8.2 and 1.8.4, this analysis covers current and future CDM actions by the USFWS, WS and the cooperating agencies wherever they might be requested or needed within the State of Michigan.

Endangered Species Act (ESA). It is Federal policy, under the ESA, that all Federal agencies shall seek to conserve threatened and endangered (T&E) species and shall utilize their authorities in furtherance of the purposes of the Act (Sec.2(c)). WS conducts Section 7 consultations with the USFWS to use the expertise of the USFWS to ensure that "any action authorized, funded or carried out by such an agency . . . is not likely to jeopardize the continued existence of any endangered or threatened species . . . Each agency shall use the best scientific and commercial data available" (Sec.7 (a)(2)).

As part of the DCCO FEIS (USFWS 2003), the USFWS completed an intra-Service biological evaluation and informal Section 7 consultation on the management of DCCOs in the U.S. and this resulted in specific provisions for T&E species protection in the regulations implementing the PRDO at 50 CFR 21.48 (see section 4.1.2). An additional Section 7 consultation was completed

specifically on the risks to T&E species from the actions proposed in this EA.

Bald and Golden Eagle Protection Act (16 USC 668): Congress enacted the Eagle Protection Act (16 U.S.C. 668) in 1940, thereby making it a criminal offense for any person to "take" or possess any bald eagle or any part, egg, or nest. The Act contained several exceptions which permitted take under select circumstances. Since its original enactment, the Act has been amended several times to increase protections for eagles and/or provide exemptions for specific types of activities. For example, the amendment in 1962 was designed to give greater protection to immature bald eagles, and to include golden eagles. The 1962 amendment also created two exceptions to the Act: first, it allowed the taking and possession of eagles for the religious purposes of Indian tribes and second, it provided that the Secretary of the Interior, on request of the governor of any state, could authorize the taking of golden eagles to seasonally protect domesticated flocks and herds in that state.

While Bald Eagles were federally listed as a threatened species, the Endangered Species Act was the primary regulation governing the management of Bald Eagles in the lower 48 states. Now that Bald Eagles have been removed from the Federal list of threatened and endangered species, the Bald and Golden Eagle Protection Act is the primary regulation governing Bald Eagle management. For purposes of this Act, "take" is defined as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, or molest or disturb." If an APHIS action could potentially affect either bald or golden eagles in any of these ways, APHIS must consult with USFWS. If these species are found in a location where a proposed action will be carried out, APHIS must ensure that its actions do not impact eagles in a way that fits the definition of “take”. When there is the potential to affect eagles, it is advisable to coordinate with FWS to assure actions avoid “take.” WS has consulted with the USFWS regarding potential risks to Bald Eagles from the proposed actions and methods to reduce impacts on eagles.

Fish and Wildlife Coordination Act (16 U.S.C. 661-667e). The Fish and Wildlife Coordination Act obligates all Federal agencies to consult with state resource agencies on actions related to wildlife conservation, including but not limited to actions "minimizing damages from overabundant species".

Coastal Zone Management Act of 1972, as amended (16 USC 1451-1464, Chapter 33; P.L. 92-583, October 27, 1972; 86 Stat. 1280). This law established a voluntary national program within the Department of Commerce to encourage coastal states to develop and implement coastal zone management plans. Funds were authorized for cost-sharing grants to states to develop their programs. Subsequent to Federal approval of their plans, grants would be awarded for implementation purposes. In order to be eligible for Federal approval, each state's plan was required to define boundaries of the coastal zone, to identify uses of the area to be regulated by the state, the mechanism (criteria, standards or regulations) for controlling such uses, and broad guidelines for priorities of uses

within the coastal zone. In addition, this law established a system of criteria and standards for requiring that Federal actions be conducted in a manner consistent with the federally approved plan. The standard for determining consistency varied depending on whether the Federal action involved a permit, license, financial assistance, or a federally authorized activity.

All WS CDM actions conducted in the state require a permit from the MDNRE. The MDNRE participated as a consulting agency in the preparation of this EA and was instrumental in determining CDM objectives. Therefore, the lead and cooperating agencies have determined that the proposed action would be consistent with the State's Coastal Zone Management Program.

Migratory Bird Treaty Act of 1918 (16 U.S.C. 03-711; 40 Stat. 755), as Amended. The Migratory Bird Treaty Act provides the USFWS regulatory authority to protect families of birds that contain species which migrate outside the United States. The law prohibits any "*take*" of these species by any entities, except as permitted or authorized by the USFWS. The Migratory Bird Treaty Reform Act of 2004 clarifies the original purpose of the Migratory Bird Treaty Act as pertaining to the conservation and protection of migratory birds native to North America and directs the USFWS to establish a list of bird species found in the United States which are non-native, human-introduced species and therefore not federally protected under the MBTA.

The USFWS issues permits to requesters for reducing migratory bird damage in certain situations. WS provides on-site assessments for persons experiencing migratory bird damage to obtain information on which to base damage management recommendations. Damage management recommendations could be in the form of technical assistance or operational assistance. In severe cases of migratory bird damage, WS provides recommendations to the USFWS for the issuance of depredation permits to private entities or other agencies. The ultimate responsibility for issuing such permits rests with the USFWS.

Executive Order 13186 of January 10, 2001 "Responsibilities of Federal Agencies to Protect Migratory Birds." This Order states that each Federal agency, taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations, is directed to develop and implement a MOU with the USFWS that shall promote the conservation of migratory bird populations. WS has developed a draft MOU with the USFWS as required by this Order and is currently waiting for USFWS approval. WS will abide by the MOU once it is finalized and signed by both parties.

The Native American Graves and Repatriation Act of 1990. The Native American Graves Protection and Repatriation Act requires Federal agencies to notify the Secretary of the Department that manages the Federal lands upon the discovery of Native American cultural items on Federal or tribal lands. Federal

projects would discontinue work until a reasonable effort has been made to protect the items and the proper authority has been notified.

National Historic Preservation Act (NHPA) of 1966 as amended. The NHPA of 1966, and its implementing regulations (36 CFR 800), requires Federal agencies to: 1) determine whether activities they propose constitute "undertakings" that have the potential to cause effects on historic properties and, 2) if so, to evaluate the effects of such undertakings on such historic resources and consult with the Advisory Council on Historic Preservation (i.e. State Historic Preservation Office, Tribal Historic Preservation Officers), as appropriate. WS actions on tribal lands are only conducted at the tribe's request and under signed agreement; thus, the tribes have control over any potential conflict with cultural resources on tribal properties.

The CDM methods described in this EA that might be used operationally by WS do not cause major ground disturbance, do not cause any physical destruction or damage to property, do not cause any alterations of property, wildlife habitat, or landscapes, and do not involve the sale, lease, or transfer of ownership of any property. In general, such methods also do not have the potential to introduce visual, atmospheric, or audible elements to areas in which they are used that could result in effects on the character or use of historic properties. Therefore, the methods that would be used by WS under the proposed action are not generally the types of activities that would have the potential to affect historic properties. If an individual activity with the potential to affect historic resources is planned under an alternative selected as a result of a decision on this EA, then site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary.

There is potential for audible effects on the use and enjoyment of a historic property when methods such as propane exploders, pyrotechnics, firearms, or other noise-making methods are used at or in close proximity to such sites for purposes of hazing or removing birds. However, such methods would only be used at a historic site at the request of the owner or manager of the site to resolve a damage or nuisance problem, which means the activity would be beneficial to the historic property. A built-in mitigating factor for this issue is that virtually all of the methods involved would only have temporary effects on the audible nature of a site and can be ended at any time to restore the audible qualities of such sites to their original condition with no further adverse effects. Site-specific consultation as required by Section 106 of the NHPA would be conducted as necessary in those types of situations.

Environmental Justice and Executive Order 12898 - "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." Executive Order 12898, promotes the fair treatment of people of all races, income levels and cultures with respect to the development, implementation and enforcement of environmental laws, regulations and policies.

Environmental justice (EJ) is the pursuit of equal justice and protection under the law for all environmental statutes and regulations without discrimination based on race, ethnicity, or socioeconomic status. EJ is a priority within the USDA (WS) and USDI (USFWS). Executive Order 12898 requires Federal agencies to make environmental justice 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. APHIS implements Executive Order 12898 principally through its compliance with NEPA. All WS, NPS and USFWS activities are evaluated for their impact on the human environment and compliance with Executive Order 12898. The agencies' personnel use only legal, effective, and environmentally safe wildlife damage management methods. 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.

Protection of Children from Environmental Health and Safety Risks (Executive Order 13045). Children may suffer disproportionately from environmental health and safety risks for many reasons. CDM as proposed in this EA would only involve legally available and approved damage management methods in situations or under circumstances where it is highly unlikely that children would be adversely affected. Therefore, implementation of the proposed action would not increase environmental health or safety risks to children.

Protected and Unprotected Animals: Michigan Wildlife Conservation Order Section 9.1 (5). Double-crested Cormorants may only be taken as follows:

(a) Double–crested Cormorants may be harassed without a permit by nonlethal means to deter or prevent damage to private property or to public fishery resources using such devices as noise makers or scare devices and other recognized and recommended means of preventing damage which do not kill, harm, capture, trap, or collect animals.
(b) Double-crested Cormorants may be taken and their eggs destroyed or oiled by department employees and designated agents of department employees at times and by manners identified through a state breeding colony or local breeding population control action which has been submitted to the USFWS.

CHAPTER 2: ISSUES

2.0 INTRODUCTION

Chapter 2 contains a discussion of the issues relevant to the analysis, including issues that will receive detailed environmental impact analysis in Chapter 4 (Environmental Impacts), issues that have driven the development of mitigation measures and/or standard operating procedures, and issues that will not be considered in detail, with rationale.

2.1 SUMMARY OF ISSUES

The following issues have been identified as areas of concern requiring consideration in this EA. These will be analyzed in detail in Chapter 4:

- Effects on DCCO populations
- Effects on other wildlife (and plant) species, including T&E species
- Effects on human health and safety
- Effects on aesthetic values
- Humaneness and animal welfare concerns of the methods used

2.1.1 Effects on DCCO Populations

A common concern among members of the public is whether wildlife damage management actions, in particular the use of lethal control and techniques like egg oiling and nest/egg destruction that affect reproduction, will adversely affect the long-term sustainability of DCCO populations. The NEPA requires that Federal agencies consider the cumulative impacts of their proposed actions and other known impacts on the affected environment. Cumulative impacts on the regional DCCO population are addressed in the USFWS FEIS. Impacts on DCCO populations in Michigan will be addressed in Chapter 4 of this EA. One impact affecting DCCO populations common to all the alternatives is the impact of disease on DCCO populations.

Impacts of Disease on Bird Populations

West Nile Virus (WNV) has emerged in recent years in temperate regions of North America, with the first appearance of the virus in North America occurring in New York City in 1999 (MMWR 2002, Rappole et al. 2000). Since 1999 the virus has spread across the United States and was reported to occur in 44 states and the District of Columbia in 2002 (MMWR 2002). WNV is typically transmitted between birds and mosquitoes. The most serious manifestation of WNV is fatal encephalitis in humans, horses, and birds. WNV has been detected in dead birds of at least 138 species, including DCCOs (CDC 2003). Although birds infected with WNV can die or become ill, most infected birds do survive

and may subsequently develop immunity to the virus (CDC 2003, Cornell University 2003). In some bird species, particularly corvids (crows, blue jays, ravens, magpies), the virus causes disease (often fatal) in a large percentage of infected birds (Audubon 2003, CDC 2003, Cornell University 2003, MMWR 2002). At present, given current population trends for DCCOs in Michigan, there is no evidence indicating that the virus has had an adverse impact on the statewide DCCO population.

Newcastle Disease Virus (NDV) is a contagious and fatal viral disease affecting all species of birds, including domestic poultry and wild birds. Newcastle Disease Virus is spread primarily through direct contact between healthy birds and the bodily discharges of infected birds. The disease is transmitted through infected birds' droppings and secretions from the nose, mouth, and eyes. In DCCOs, neurological signs and mortality from NDV are generally only found in young of the year and older birds appear to be resistant to the disease (Glaser et al. 1999). In 1992, the first records of NDV causing mortality in wild birds in the U.S. were made when sick and dead juvenile DCCOs testing positive for NDV were reported in 7 states in the northern U.S. including North Dakota, South Dakota, Nebraska, Minnesota, Wisconsin, Michigan, and New York (Glaser et al. 1999). Estimated mortality of juvenile DCCOs in affected colonies in the Great Lakes during the 1992 outbreak ranged from 1 – 37%. Although the 1992 epizootic marked the first records from the U.S., the detection of DCCO eggs with positive antibody titers to NDV in 1991 prior to the 1992 epizootic and subsequent NDV outbreaks are an indication that NDV is likely maintained in DCCOs (Glaser et al. 1999). Although outbreaks of NDV can have substantial impacts on individual colonies, the impacts appear to be short-term. For example, an outbreak of NDV on Gull Island in the Apostle Islands in 1992 resulted in death of 262 cormorant young (Matteson et al. 1999). The colony increased from 520 nesting pairs in 1991 to 583 nesting pairs in 1993 despite the mortality in juvenile birds in 1992, illustrating the ability of DCCO populations to rebound from disease outbreaks such as NDV.

Avian botulism is a paralytic, disease resulting from ingestion of toxins produced by the bacterium *Clostridium botulinum*. Seven types of toxin have been identified (designated letters A – G). Type E toxin has been known to cause die-offs in fish and fish-eating birds (e.g., cormorants, common loons and gulls; Locke and Friend 1987, Campbell et al. 2005, Great Lakes Fishery Commission 2008, Domske 2009). The bacteria grow in decaying organic matter, especially carcasses. Fish carry type E toxin and can pass the disease to birds (Brand et al. 1983, 1988, Yule et al. 2006). Botulism spores may last in the environment for years, so once an area has had a botulism outbreak, there is increased likelihood of repeat outbreaks.

Naturally-occurring botulism type E was not reported in wild birds until 1963 and 1964, when it was associated with extensive deaths of Common Loons and gulls on the Indiana-Michigan shores of Lake Michigan (Brand et al. 1983). Since

1998, botulism type E outbreaks have occurred annually in at least one of the Great Lakes. In 2007, botulism type E was detected in a portion of the 6,982 birds collected on the shore of Lakes Ontario (1,753 carcasses), Erie (1,694), Huron (44), and Michigan (3,491). The top 5 affected species were Ring-billed Gull (2,362 carcasses), Common Loon (1,458), DCCOs (743), Long-tailed Duck (676) and Horned Grebe (354; USGS 2008). Total botulism type E mortalities for 2007 were estimated at 17,125 birds. The U.S. Department of the Interior, Geological Survey, National Wildlife Health Center reported that detected losses decreased substantially in 2009, but did not provide a complete estimate of mortalities for the Great Lakes (USGS 2009). As with NDV, although botulism type E can have substantial impacts on individual colonies, the impacts appear to be short-term and localized.

2.1.2 Effects on other Wildlife and Fish Species, Including Threatened and Endangered Species

A common concern among members of the public and wildlife professionals, including the lead and cooperating agencies, is the impact of CDM methods and activities on nontarget species, including T&E species. Of particular concern are the potential impacts on co-nesting colonial waterbirds (i.e. Great Egrets, Great Blue Herons, Black-crowned Night-Herons, American White Pelicans and Common Terns, Caspian Terns). Impacts of the proposed action on co-nesting colonial waterbirds may be positive because they reduce DCCO competition for nesting sites and DCCO damage to vegetation; or it is possible that actions taken to reduce DCCO activity at the site may adversely affect other species because of disturbance to nesting birds. The action agencies (WS, MDNRE, Tribes) will consult with the USFWS and MDNRE, and involved Tribes as appropriate before undertaking DCCO control activities at any of the sites in Michigan where DCCOs co-nest with other colonial waterbirds. Standard operating procedures (SOPs) for the EA (Chapter 3) include measures intended to mitigate or reduce the effects of CDM on nontarget species populations. To reduce the risks of adverse effects to nontarget species, the lead and cooperating agencies would select damage management methods that are as target-selective as practicable and apply CDM methods in ways to reduce the likelihood of capturing or killing nontarget species.

Of the Federally-listed animals in Michigan, only the Piping Plover could potentially occur at or near control sites and might be impacted by CDM activities. Bald Eagles were federally-listed as a threatened species at the time the DCCO FEIS was completed. Although Bald Eagles are no-longer a federally-listed species, they continue to receive the protections of the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. Federally-listed plants which might occur in the areas where the agencies may conduct CDM include Pitcher's thistle and dwarf lake iris. As part of the DCCO FEIS (USFWS 2003), the USFWS completed an Intra-Service Section 7 Biological Evaluation on the management of DCCOs in the U.S. WS has also consulted with the USFWS

regarding the specific impacts of the proposed alternatives on federally-listed species. All conservation measures recommended by the USFWS for the protection of T&E species will be implemented by the agencies as needed depending upon the alternative selected.

State-listed animal species in the area where CDM activities could be conducted and which may be impacted by CDM actions include the Piping Plover, Common Tern, Caspian Tern, Trumpeter Swan, Merlin and Common Loon. There are also multiple state-listed plants which may be in the areas where CDM may be conducted. Similar to the situation with federally-listed species, WS has initiated consultation with the MDNRE regarding potential impacts on State-listed T&E species from the alternatives proposed in this EA. All conservation measures recommended by the MDNRE for the protection of State-listed T&E will be incorporated in agency actions as needed depending upon the alternative selected.

2.1.3 Effects on Human Health and Safety

2.1.3.1 Effects on Human Health and Safety from CDM Methods

Some people may be concerned that agency use of CDM methods, such as firearms and pyrotechnic scaring devices, could cause injuries to people. Agency personnel occasionally use rifles and shotguns to remove or scare DCCOs that are causing damage. Shotguns may also be used on airports to scare or remove birds which pose a threat to aircraft or air passenger safety. Pyrotechnics are commonly used in noise harassment programs to disperse or move birds. There is some potential fire hazard to agricultural sites and private property from pyrotechnic use. To minimize fire hazards and potential risks to human safety, all WS personnel using pyrotechnics are specifically trained in the safe and effective use of this method (WS Directive 2.625). Volunteers working under WS supervision and staff from the other action agencies would be similarly trained.

Firearm use is a very sensitive issue and a concern because of issues relating to the safety and potential misuse of firearms. To ensure safe use and firearms awareness, WS employees who use firearms to conduct official duties are required to attend an approved firearms safety and use training program within three months of their appointment and a refresher course every two years afterwards. 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. Similar safety measures are used by the USFWS, and MDNRE for personnel authorized to use firearms.

2.1.3.2 Effects on Human Health and Safety from Not Conducting CDM

The concern stated here is that the absence of adequate CDM would result in adverse effects on human health and safety, because DCCO damage would not be curtailed or reduced to the minimum levels possible and practical. In the case of DCCO hazard management at airports, the potential impacts of not conducting such work could lead to increased risk of injuries or loss of human lives. These potential adverse effects are discussed in Section 1.5.5.

2.1.4 Effects on Aesthetic Values

Aesthetics is a philosophy dealing with the nature of beauty, or the appreciation of beauty. Therefore, aesthetics is subjective in nature and is dependent on what an observer regards as beautiful. The human attraction to animals has been well documented throughout history and started when humans began domesticating animals. The American public is no exception, and some people may consider individual wild animals and birds as "pets" or exhibit affection toward these animals, especially people who enjoy coming in contact with or viewing wildlife. Conversely, others may see the same species as a detriment to aesthetic values (e.g. droppings and damage to vegetation associated with large groups of DCCOs). Therefore, the public reaction to wildlife damage management is variable and mixed because there are numerous philosophical, aesthetic, and personal attitudes, values, and opinions about the aesthetic value of wildlife and the best ways to reduce conflicts/problems between humans and wildlife.

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). These include direct benefits related to consumptive and non-consumptive use (e.g., wildlife-related recreation, observation, harvest, sale), indirect benefits derived from vicarious wildlife related experiences (e.g., reading, television viewing), and the personal enjoyment of knowing wildlife exists and contributes to the natural ecosystems (e.g., ecological, existence, bequest values) (Bishop 1987). Direct benefits are derived from a user's personal relationship to animals and may take the form of direct consumptive use (using the animal or intending to) or non-consumptive use (viewing the animal in nature or in a zoo, photography) (Decker and Goff 1987). Indirect benefits or indirect exercised values arise without the user being in direct contact with the animal and come from experiences such as looking at photographs and films of wildlife, reading about wildlife, or benefiting from activities or contributions of animals such as their use in research (Decker and Goff 1987). Indirect benefits come in two forms: bequest and pure existence (Decker and Goff 1987). Bequest is providing for future generations and pure existence is merely knowledge that the animals exist (Decker and Goff 1987).

Just as fishing is an important source of revenue for Michigan, non-consumptive uses of wildlife such as wildlife watching and birding, also contribute

substantially to the State economy. In a 2006 survey, 3,227,000 individuals over the age of 16 participated in wildlife watching activities in Michigan (Leonard 2008). For purposes of the survey, wildlife watching activities were those activities which were conducted primarily for the purpose of observing, feeding and photographing wildlife but did not include visits to zoos, circuses, aquariums, museums and for scouting game, nor did it include activities for which wildlife watching was a secondary purpose of the trip/activity. Michigan was one of the top 10 states for economic output related to wildlife watching with an estimated economic output in 2006 of over $2.7 million and direct expenditures of $3.2 million. The large DCCO breeding colonies and associated colonial waterbirds such as gulls and American Pelicans can be a valuable viewing opportunity for birding enthusiasts.

There is likely to be concern that the proposed action or alternatives would result in the loss of aesthetic benefits to the public, resource owners, or neighboring residents. Potential impacts of the proposed action on aesthetic values include potential reductions in opportunities to view and enjoy DCCOs at specific sites where CDM is conducted, the potential that CDM might adversely affect co-nesting colonial waterbirds and opportunities to view and enjoy these species, the risk that if left unmanaged, expanding DCCO populations may result in the elimination of some co-nesting colonial waterbirds from certain sites and adversely affect bird and plant viewing opportunities, adverse impacts of large numbers of nesting DCCOs on vegetation at nest sites, complaints regarding noise and odor associated with large DCCO colonies, and potential adverse impacts of CDM activities on opportunities to enjoy certain fishery resources.

2.1.5 Humaneness and Animal Welfare Concerns of Methods Used by WS

DCCO control methods, especially lethal control, may raise issues about humaneness and animal welfare. The issue of humaneness and animal welfare, as it relates to the killing or capturing of wildlife is an important but very complex concept that can be interpreted in a variety of 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 is 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* . . .*"* (AVMA 1987). Because suffering carries with it the implication of a time frame, a case could be made for *"* . . . *little or no suffering where death comes immediately* . . .*"* (CDFG 1991), such as shooting so long as the shooting is conducted by a skilled professional.

Defining pain as a component in humaneness of WS methods 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 considerable pain (CDFG 1991).

Pain and suffering, as it relates to WS 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 nor veterinary curricula explicitly address suffering or its relief”* (CDFG 1991).

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. The challenge in coping with this issue is how to achieve the least amount of animal suffering within the constraints imposed by current technology and funding.

2.2 ISSUES CONSIDERED BUT NOT IN DETAIL WITH RATIONALE

2.2.1 Impacts on Biodiversity

The proposed program does not attempt to eradicate any native species of wildlife. The alternatives discussed in this EA include specific measures for the maintenance of a healthy viable DCCO population in Michigan. Any CDM actions would be conducted in accordance with applicable international, Federal, State, and tribal laws and regulations enacted to ensure species viability. Effects on target and nontarget species populations because of WS' lethal CDM activities are minor, as shown in Section 4.1.1 and 4.1.2, and therefore will not result in significant nationwide or statewide impacts on biodiversity (USDA 1997, Revised, USFWS 2003).

2.2.2 A “Threshold of Loss” Should Be Established Before Allowing Any Lethal CDM

The agencies are aware that some people feel Federal wildlife damage management should not be allowed until economic losses reach some arbitrary predetermined threshold level. Such policy, however, would be difficult or inappropriate to apply to human health and safety situations. Although some damage can be tolerated by most resource owners, resource owners and situations differ widely and a set wildlife damage threshold levels would be difficult to determine or justify. WS has the legal direction to respond to requests for assistance, and it is program policy to aid each requester to minimize losses. WS uses the Decision Model thought process discussed in Chapter 3 to determine appropriate strategies.

In a ruling for Southern Utah Wilderness Alliance, et al. vs. Hugh Thompson, Forest Supervisor for the Dixie National Forest, et al., the United States District Court of Utah denied plaintiffs' motion for preliminary injunction. In part the court found that a forest supervisor needs only show that damage from wildlife is threatened, to establish a need for wildlife damage management (Civil No. 92-C-0052A January 20, 1993). Thus, there is judicial precedence indicating that it is not necessary to establish a criterion such as percentage of loss of a particular resource to justify the need for wildlife damage management actions.

2.2.3 An ongoing monitoring program is needed to assess impacts on DCCO populations.

Impacts on DCCO populations from CDM are monitored through the bird counting and data reporting requirements of the PRDO. WS, the USFWS and MDNRE have also been conducting annual surveys of DCCO colonies at sites where CDM is conducted. WS, the USFWS, and MDNRE also participated in the 2005 Great Lakes DCCO survey, the 2007/2008 Great Lakes Colonial Waterbird Survey and the 2009 Great Lakes DCCO survey, and will participate in other regional population survey efforts.

2.2.4 Fisheries in the Great Lakes are already at risk from invasive species, nutrient loading, wetlands destruction and other threats.

This comment was made by opponents and supporters of CDM. The MDNRE already focuses much of its fisheries management effort in the Great Lakes to understanding, and reducing the impacts of, invasive species. The United States and Canada conduct extensive programs to reduce sea lamprey numbers. All states on the Great Lakes are striving to improve water quality and protect wetland habitat in and around the Great Lakes. Opponents of CDM argue that the impact DCCOs are having on the system is likely insignificant relative to the impact of introduced species, pollution, habitat alteration, etc., so we should be managing those factors instead of managing DCCOs. Advocates of CDM argue that it is beyond our current capabilities to manage many of the factors that are adversely impacting the Great Lakes but we can and should try managing DCCOs. The impact of DCCO predation may be greater in fish populations that are already under stress because of problems with depressed recruitment or declines in the availability of forage fish. Advocates of CDM contend that if it is possible to enhance fish populations without jeopardizing DCCO populations then we should do so.

The agencies acknowledge that determining the exact nature and magnitude of the impact of DCCOs on fish populations is difficult, especially in the complex systems in the Great Lakes. The agencies agree that factors like introduced species, nutrient loading and other threats also impact fish populations. Rarely are declines in fish populations in the Great Lakes attributable to only one source; rather, problems usually result from a suite of causal factors. The agencies can

only control some of these factors. The question becomes whether managing the factors which we can address will be sufficient to overcome the collective problems faced by the species we wish to protect/enhance (Section 3.1).

Analysis in this EA and the FEIS indicate that high numbers of DCCOs have the potential to adversely impact local fisheries. The proposed programs to address concerns regarding DCCO impacts on fishery resources use an adaptive management approach to address this issue. The adaptive management approach involves establishing management objectives for impacted resources and assessing response to incremental changes in DCCO numbers in local areas through concurrent monitoring of DCCO and fish populations (see Chapter 3 for details). Goals for managing local DCCO numbers are set and carefully monitored so that fisheries data can be evaluated in context of the DCCO population, and to ensure that the actions do not threaten the viability of the State DCCO population. Objectives are adjusted over time based on information obtained through monitoring of the fishery and DCCO populations. The adaptive management approach strives to allow for management benefits while simultaneously learning from experience, research and monitoring to better define the full scale and scope of the problem, management impacts and the extent of benefits to be expected from CDM.

2.2.5 The EA fails to provide adequate scientific data proving need for action. Only potential impacts are used as need for action. Need for action in many areas is based solely on speculation and correlational analysis and no hard data. More information is needed than the fact that there are a lot of DCCOs present and that they eat fish and that the MDNRE is concerned before CDM should be initiated. The EA needs to prove that the fish taken are economically important and that fish consumption is actually adversely impacting the population.

What constitutes "sufficient" evidence to justify CDM is, to a certain extent, a question of values. Among stakeholders concerned with DCCO management, there is considerable disagreement over whether or not the proposed action is justified, with some individuals arguing for more or less CDM than is proposed in the EA. In the FEIS, the USFWS stated that they "do not believe that agencies should have to wait until impacts occur and are proven with absolute certainty before they are allowed to manage DCCOs. One of the benefits of the PRDO is that agencies in areas where risks of significant DCCO impacts are greatest are given more flexibility in taking action including preventive action." (USFWS 2003).

The EA provides the data and science-based inference that were used to identify the sites where CDM may be conducted. The imminent threat of damage or loss of resources is often deemed sufficient for wildlife damage management actions to be initiated (U.S. District Court of Utah 1993). Resource management

agencies, organizations, associations, groups, and individuals have requested WS to conduct CDM damage management to protect fishery resources in the sites discussed in this EA. All CDM activities would be conducted in compliance with relevant laws, regulations, policies, orders and procedures, including those set by the USFWS when it established the PRDO.

The problem with CDM for the protection of fishery resources is, and will continue to be, that the data necessary to fully explore these issues don't exist in many locations and/or will be very costly and likely take time (years) to obtain. While the agencies agree that having highly detailed information on each site prior to initiating CDM would be optimal, they also recognize that there are consequences to inaction in places where CDM is warranted including adverse impacts on fish populations, local fishing opportunities and associated industries, commercial fisheries and ecosystems. The adaptive management approach presented here allows agencies to take action to reduce potential adverse impacts within an ongoing framework of hypothesis testing and data evaluation which will ultimately improve the management of DCCOs and fishery resources. The proposed adaptive management program includes limits on actions and protective measures which provide flexibility for management but also ensure that the actions will not have substantial cumulative adverse impacts on DCCOs or non-target species.

We do not concur that a DCCO prey species must be proven to have significant economic value for CDM to be warranted. Neither the PRDO nor the MBTA require that economic value be a determining factor in deciding when to engage in CDM.

2.2.6 If expanded control is permitted, it will be fueled by public pressure not real scientific need.

Science is a process for testing hypotheses. It forms one of the foundations for making management decisions but is not the only factor considered. Human values are and will always be an important factor in making natural resource management decisions. This comment assumes that there is only one management conclusion that is correct or science-based. In reality, decisions about when to manage (or not to manage) are largely value-driven which means that different people can look at the same data and come to different conclusions about the management implications. Furthermore, this comment assumes that listening to the public and heeding the science are mutually exclusive when, in fact, they are not.

2.2.7 Control of a native bird to protect a non-native fish species, even if that species provides recreational benefit to a small portion of the human population, is ethically questionable. This is especially true

given that biologists across the Great Lakes are identifying non-native species as one of the greatest threats to ecosystem health and integrity.

The impacts of non-native species are not universally detrimental or undesirable. The brown trout is a highly valued non-native species in the Great Lakes. The MDNRE works to establish a near shore fishery to increase the diversity of fishing opportunities in the State and to foster fishing opportunities during seasons when off-shore fishing is not accessible and for individuals who may not have the resources for off-shore fishing. Popularity with sport anglers is not the only reason MDNRE stocks non-native fish species. Another reason that agencies like the MDNRE had to turn to establishment of non-native species like rainbow trout and Chinook salmon was to adapt to the negative effects of water contamination, invasive species (forage fish like alewives) and other factors on Great Lakes fishery ecosystems, including populations of predatory fish. Introduction and management of these species is a part of what works to maintain a healthy fishery in the highly perturbed Great Lakes ecosystems. The intentional introduction of nonnative predatory fish species in the Great Lakes is often heralded as one the great natural resource management success stories of our time. It has brought invasive alewives population under predatory control that was previously lacking, and created a multi-million dollar sport fishery. Without alewife population control, attempts to reestablish self-sustaining populations of the native fish predator, lake trout, would be more difficult.

2.2.8 There is no proof that DCCO removal would protect/enhance target fish populations. Given the complexity of the factors impacting Great Lakes fish populations, how can the agencies be sure the proposed actions will alleviate conflicts?

We cannot be entirely sure that CDM activities will have the desired effect (although we are confident that they will) which is why the principles of adaptive management are being used as CDM is implemented. An evaluation of CDM conducted in the Les Cheneaux indicates that improvements in the yellow perch fishery were correlated with decreases in the number of nesting DCCOs (Section 1.5.3.1, Fielder 2010). The CDM activities proposed in this EA will be paired with monitoring of fish populations through methods such as ongoing Creel Surveys and Trawl Surveys. The cooperating agencies are also working with the NWRC, to determine if fatty acid analysis can be used to identify fish species consumed by DCCOs in the Great Lakes. The method has been used successfully in earlier studies to distinguish not only between farm-raised channel catfish and game fish in the diet of cormorants but the source of the farm-raised channel catfish in the diet (Stahl et al. 2006). The process looks for distinctive fatty acids in prey species and then checks samples from DCCOs to see if the DCCOs have been consuming fish with the fatty acids in question. The level of potential

increase will be dependent upon not only the reduction of DCCO predation on the resource, but also on environmental and human-induced factors that affect aquatic ecosystems and fish populations.

2.2.9 DCCOs on Gull, Hat, Pismire and other small islands in the Beaver archipelago are destroying habitat (vegetation) used by other birds.

Decisions to manage DCCOs to reduce damage to vegetation are made on a case by case basis. The occurrence of vegetation loss in areas with high densities of colonial birds is a normal process. Historically, when colonial waterbird breeding colonies reached sufficient density that damage to the vegetation occurred and the site was no longer attractive to some species, the birds could move to new locations. However, given changes in land use and habitat availability, this is not always possible. Management agencies become concerned about this process when the loss of vegetation is contrary to the management objectives of the site (e.g., a wildlife refuge established specifically for the protection of a wide diversity of bird species including species that are dependent upon the vegetation), affects State or federally listed threatened or endangered species or species of special concern, and/or alternative habitat is limited or it is unclear whether the displaced species would use the alternative habitat. Impacts of DCCOs on vegetation and co-nesting birds are addressed in the EA and in the FEIS (USFWS 2003).

2.2.10 Calculations involving DCCO consumption of fish biomass wrongly assume that only DCCOs matter in fish population dynamics. It is overly simplistic to assume DCCOs are having an adverse impact on the entire fish community.

DCCOs are opportunistic foragers and will consume most fish species in the right size range for DCCO consumption. The alternative to the strategy used in the EA is to use a species by species approach which would be at least as simplistic and also require a great many assumptions. The important factor in these calculations is that no matter what the other demands are on the biomass production in the area, the agencies have cause to be concerned that DCCOs are taking a high proportion of the annual production of the fish community.

2.2.11 Material in the EA wrongly flies in the face of evidence that only one smallmouth bass was found in 50 DCCO stomachs to assert that DCCOs are a threat to smallmouth bass in the Beaver archipelago. Seefelt (2005) concluded that DCCO foraging areas are spatially separate from areas where smallmouth bass occur so the probability that DCCOs adversely impact these fish is low. Seefelt (2005) also concluded that the smallmouth bass fishery would recover in the absence of CDM.

The findings of the research conducted in the Beaver Islands archipelago by Seefelt (2005) are discussed in Section 1.5.3.4. The EA also discusses the findings of a Beaver Islands smallmouth bass study by Seider (2003) which concluded that a mortality problem consistent with high predation by DCCOs was likely preventing/slowing the recovery of the smallmouth bass population. We are also aware that there are some questions regarding whether the methodology for collecting DCCO behavioral data presented by Seefelt (2005) truly represents the full range of foraging habitats used by DCCOs. For example, the food habits study presented by Seefelt (2005) indicates that crayfish were found in approximately 19% of the DCCO stomachs observed in the study. Crayfish are also commonly eaten by smallmouth bass (Scott and Crossman 1973) which has raised some questions as to whether there might be more concurrent use of bass habitat by DCCOs than observed in the Seefelt (2005) study. The EA also discusses questions regarding the assumptions in the model used by Seefelt (2005) to predict recovery of the bass population.

CHAPTER 3: ALTERNATIVES

3.0 INTRODUCTION

This chapter contains a description of each of the alternatives and a discussion of how the selection of each alternative by one agency affects the management actions of the other agencies. Management alternatives were developed for consideration using the WS Decision Model (Slate et al. 1992); Appendix J ("*Methods of Control*"), Appendix N ("*Examples of WS Decision Model*"), and Appendix P ("*Risk Assessment of Wildlife Damage Control Methods Used by USDA, Wildlife Services Program*") of the WS FEIS (USDA 1997, Revised); and Appendix 4 ("*Management Techniques*") of the USFWS DCCO FEIS (USFWS 2003).

Agency Decisions

These alternatives describe the management techniques available to WS (involvement in CDM), the USFWS Migratory Bird Office (issuing permits and oversight of the PRDO), the USFWS National Wildlife Refuges (NWRs; oversight of CDM activities on refuge lands), Tribes (involvement in CDM), and the MDNRE (involvement in CDM). Although the agencies and tribes have worked together to produce a joint document and intend to collaborate on CDM in Michigan, each of the agencies and tribes will be making its own decision on the alternative to be selected in accordance with the standard practices and legal requirements pertaining to each agency's/tribal decision making process.

Although the agencies and tribes make independent decisions, the decisions made by one agency can restrict the actions taken by the other agencies. For example, if the WS and the MDNRE select an alternative that allowed for nonlethal and lethal CDM techniques to implement the management objectives discussed in Section 1.5.8, but the USFWS Migratory Bird Offices chooses the alternative which keeps lethal DCCO take to current levels, then the WS and MDNRE will not be able to implement the management objectives in Section 1.5.8 at all locations in the same year.

Alternatively, if the USFWS Migratory Bird Office and NWRs chose an alternative that allowed for nonlethal and lethal CDM techniques, but WS selected a nonlethal-only alternative, then WS could help with nonlethal CDM, but lethal CDM under the PRDO could only be conducted on NPS and NWR lands with the assistance of the MDNRE or tribes[3]. Selection of a nonlethal only alternative by WS would also prevent WS from conducting the consultations and completing the forms required by the USFWS before issuing a MBP. Therefore it would not be possible to obtain a MBP for CDM until the USFWS established an alternative mechanism for issuing permits. Details on the relationships among agency decisions are provided in Appendix E.

[3] Tribes could only provide assistance at these sites if they were within the ceded territory.

For simplicity and clarity of analysis, each of the alternatives below is described and its impacts are analyzed as if the lead agencies had selected the same alternative.

3.1 THE MICHIGAN DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENT ADAPTIVE MANAGEMENT STRATEGY

The MDNRE has proposed the use of an adaptive management strategy to address cormorant impacts on fish populations in the Great Lakes. Adaptive management is the process by which agency management actions are designed and monitored in order to test hypotheses and provide information to improve future management decisions. The adaptive management process is particularly well suited to addressing management situations where an agency does not have complete information on all facets of a system, as is often the case with DCCO impacts on public resources in the Great Lakes.

The MDNRE approach would involve implementing CDM at sites described in Section 1.5.3 to test hypotheses presented in Section 1.5.8. Fishery systems in Michigan are highly variable and the methods used to monitor fish populations have margins of errors that can be 20% or higher. Under these circumstances, it can be difficult to detect impacts of any management action on a fishery. Consequently, the MDNRE has proposed levels of local DCCO population reduction that it believes will be sufficient to cause a detectable change in the fishery if, in fact, DCCOs are a major factor limiting the fishery. Specifically, in the Bays de Noc and Beaver Islands, the MDNRE has proposed up to 50% annual reductions in the number of breeding pairs in local breeding colonies until management objectives are reached. The local DCCO breeding colony in the Les Cheneaux area has already been reduced to the management objective and the goal in this area, and any other area where the management objective has been reached, is to maintain the local breeding colony at current levels and monitor impacts on fish. DCCO population reductions would be compared to fishery data obtained through creel surveys, trawl surveys, annual netting surveys, and DCCO diet studies as appropriate. New CDM sites may be added if DCCOs are found committing or about to commit, and to prevent, depredations on the public resources of fish (including hatchery stock at Federal, State, and Tribal facilities), wildlife, plants, and their habitats. Management efforts at a site will be discontinued if, after a period of time, there is no evidence that the CDM was resulting in an improvement in the fishery. Given the number of variables which can impact fish populations on the Great Lakes, including irregularly occurring year-classes of some fish species, it may take a period of several years to determine if CDM is having an impact on fish populations.

The agencies also understand the importance and value of maintaining a viable DCCO population in the State. The MDNR has established population minimum population threshold of 5,000 breeding pairs. If the DCCO population drops below this level all lethal CDM (including egg oiling) and nest destruction for the protection of public resources would be discontinued. This is over 4 times the level the population was at when DCCOs were removed from the State list of threatened and endangered species. In

1989, approximately 5,000 breeding pairs of DCCOs were counted in Michigan, and by 1997 the population had increased to 30,458 pairs (Wires et al. 2001*a*, Weseloh et al. 2006). Based on this level of population increase, reducing the number of breeding pairs to as low as 5,000 pairs would not jeopardize the viability of the State DCCO population.

Some colonies have been identified as, "priority sites for waterbird conservation" (Wires and Cuthbert 2001*b*). All action agencies agree to consult with the USFWS on ways to minimize impacts on nontarget species prior to conducting CDM at these sites.[4]

3.2 ALTERNATIVES ANALYZED IN DETAIL

This section contains a description of each of the alternatives and a discussion of how the selection of each alternative by one agency affects the management actions of the other agencies. Alternatives analyzed in detail are:

- Alternative 1 - Integrated CDM Program, including implementation of the PRDO (No Action). This is the "No Action" alternative as defined by the Council on Environmental Quality.
- Alternative 2 – Only Nonlethal CDM by Federal Agencies.
- Alternative 3 – Adaptive Integrated Cormorant Damage Management.
- Alternative 4 – Adaptive Integrated Cormorant Damage Management with Limited Annual Take (Proposed Action).
- Alternative 5 – No Federal CDM

3.3 DESCRIPTION OF THE ALTERNATIVES

3.3.1 Alternative 1. Integrated CDM Including Implementation of the PRDO (No Action Alternative)

As defined by the CEQ, the no action alternative can be interpreted as the continuation of current CDM practices. This alternative would continue current CDM activities in Michigan that have included working under the PRDO and MBPs. An integrated wildlife damage management (IWDM) approach would be implemented to reduce DCCO damage to and conflicts with public resources, aquaculture, property, and human health and safety. The IWDM strategy would encompass the use and recommendation of practical and effective methods of preventing or reducing damage while minimizing harmful effects of damage management measures on humans, target and non-target species, and the environment.

[4] The agencies recognize that this list is may be replaced with a more current evaluation. The action agencies will apply these same protective measures to a revised list approved by the USFWS and its cooperators if and when available.

Under this alternative, the lead and cooperating agencies could provide technical assistance and direct operational damage management, including nonlethal and lethal management methods by applying the WS Decision Model (Slate et al. 1992). When appropriate, physical exclusion, habitat modification, nest destruction, or harassment would be recommended and utilized to reduce damage. In other situations, birds would be removed through use of shooting, egg oiling/addling/destruction, or euthanasia following live capture. In determining the damage management strategy, preference would be given to practical and effective nonlethal methods. However, nonlethal methods may not always be applied as a first response to each damage problem. The most appropriate response could often be a combination of nonlethal and lethal methods, or there could be instances where the application of lethal methods alone would be the most appropriate strategy.

The primary strength of this alternative and the IWDM approach is that it allows for access to the full range of CDM techniques when developing site specific management plans. However, under this alternative, an agency could decide to only use a subset of the possible CDM methods for the management of DCCO damage at a specific site. It would be possible to use only nonlethal techniques at specific sites. Selection of this alternative also does not obligate any agency to work to implement the MDNRE management objectives (Section 1.5.8) at all sites under their jurisdiction. For example, refuge staff could choose to restrict their actions under this alternative to responding to and discouraging DCCO activity at vegetated NWR islands but not conduct CDM at other large colony sites.

Cormorant conflict management activities would be conducted in the State, when requested and funded, on private, public or tribal property, after receiving permission from the landowner/land manager. All management activities would comply with appropriate Federal, State, and local laws. The USFWS would be responsible for ensuring compliance with the PRDO and MBPs and that the long-term sustainability of regional DCCO populations is not threatened. Except as noted above for land management agencies, selection of this alternative by any of the agencies would not restrict the management options available to the other agencies. However, it should be noted that if a landowner/ manager does not grant permission for access to a Great Lakes Island, DCCOs may still be shot if they are more than 500 yards from shore.

Implementation of the PRDO: If this alternative is selected, the agencies could work to meet the management objectives set in Section 1.5.8 under the authorities established in the PRDO. However, the maximum lethal DCCO take allowed under the PRDO for this alternative, 9,700 DCCOs per year, will not allow for simultaneous implementation of the MDNRE adaptive management strategy (e.g., 50% annual reductions in the number of breeding pairs at Bays de Noc and Beaver Islands) at all sites described in Section 1.5.8.

This alternative would include regular monitoring of the results and impacts of CDM efforts in Michigan and review of new information from the literature. Management methods and objectives will be adjusted as needed based on available information. This process would include review of the EA to determine if the analysis adequately addresses current conditions and plans. The EA will be supplemented or replaced as needed in accordance with APHIS, USFWS and NPS NEPA implementation procedures.

Carcasses of DCCOs killed during CDM would be disposed of in accordance with applicable Federal, State and local regulations and applicable permits. Disposal methods could include burial at landfills, incineration, composting or donation for research projects. Composting would be conducted in accordance with

3.3.2 Alternative 2. Only Nonlethal CDM by Federal Agencies

Under this alternative, the Federal agencies would only use, recommend and permit nonlethal techniques for CDM. WS would not assist with the site evaluations and completion of WS Form 37 required by the USFWS for a MBP. The USFWS would not issue MBPs for lethal techniques to resolve conflicts with DCCOs or research involving lethal CDM methods. The NPS and NWRs would not use or permit the use of lethal CDM on their lands. Permits are not required from the USFWS for nonlethal CDM techniques so access to these methods would not change.

The USFWS FEIS on DCCO management permits PRDO actions that will result in the take of less than 10% of a DCCO colony (USFWS 2003). Decisions made by the USFWS in this EA cannot affect this type of CDM action on non-Federal land. The MDNRE and tribes could still act as action agencies under the PRDO and could use lethal methods to take up to 10% of the birds in a colony in combination with nonlethal methods to try to meet management objectives (Section 1.5.8) on non-Federal lands. Lethal methods used by the MDNRE and tribes would be subject to the same use restrictions described for Alternative 1 (e.g., requirements for landowner permission, minimum population thresholds, provisions for protecting nontarget species, etc.). Egg oiling involves killing the developing fetus and, as such, is a lethal CDM method. As with other lethal techniques, egg oiling could be used by the State and tribes, but would not be used by the Federal agencies, nor would it be used on Federal lands. Overall management objectives for the CDM in Michigan would be as described for Alternative 1.

3.3.3 Alternative 3. Adaptive Integrated Cormorant Damage Management

Under this Alternative, an integrated damage management approach would be used to reduce damage by and conflicts with DCCOs in Michigan. The adaptive management program described in sections 1.5.8 and 3.1 would be implemented. Up to 50% of the local breeding population could be removed per year in sites

targeted for CDM under the PRDO for the protection of public resources until the management objectives for the site have been reached. There would be no maximum limit on the number of DCCOs that could be taken per year so long as the number of breeding pairs in the State was not reduced below 5,000 pairs. Local breeding populations consisting of only 1 breeding colony would not be reduced below 100 breeding pairs. Local breeding populations consisting of more than one colony would not be reduced below 200 pairs. In instances where the local breeding population is comprised of one colony, lower management objectives may be implemented if DCCO presence jeopardizes vegetation of cultural or ecological value (e.g., threatened or endangered plants, vegetation used by threatened or endangered species or species of conservation concern, or vegetation with cultural significance to Native Americans). These instances would be rare and would only be implemented after consultation with the ICCG. Additionally all action agencies agree to consult with the USFWS prior to conducting CDM at "priority sites for water bird conservation" as identified in Wires and Cuthbert (2001*b*).

Methods that could be used for CDM, restrictions on their use, and the use of the WS Decision Model would be as described for Alternative 1. The number of birds that could be taken under Scientific Collecting Permits (500) would be the same as for Alternatives 1 and 4. Based on increasing complaints from landowners, the number of birds that might be taken under depredation permits has been increased to 500 birds per year. Carcass disposal would also be handled as described for Alternative 1.

3.3.4 Alternative 4 – Adaptive Integrated Cormorant Damage Management with Limited Annual Take (Proposed Alternative)

Cormorant damage management actions under this alternative would be identical to Alternative 3 except that the maximum number of DCCOs that could be taken under the PRDO would be limited to 19,000 birds per year. This cap on take was estimated based on DCCO nest numbers in Table 1-1, management objectives stated in proposed in Section 1.5.8, limits on access to some DCCO colonies, and an understanding of the resource limitations of the action agencies. The number of birds that could be taken under Scientific Collecting Permits (500) and MBPs (500) would be the same as for Alternative 4.

3.3.5 Alternative 5. No Federal CDM

Under this alternative, the Federal agencies would not participate in CDM. WS would not conduct the consultations or complete the forms required by the USFWS to issue MBPs and the USFWS would not issue MBPs. Nonlethal CDM techniques could still be used without a permit. Information on CDM methods would still be available through other sources such as USDA Agricultural Extension Service offices, USFWS, MDNRE, universities, or pest control organizations.

As with Alternative 2, the USFWS would not grant approval for actions conducted under the PRDO that propose the take of more than 10% of the local DCCO population. Decisions made by the USFWS in this EA cannot affect this type of CDM action on non-Federal land. The MDNRE and tribes could still act as action agencies under the PRDO and could use lethal methods to take up to 10% of local DCCO colonies in combination with nonlethal methods to try to meet management objectives (Section 1.5.8) on non-Federal lands. No CDM would be conducted on NPS or NWR lands because Federal agency approval would be needed for any activities at those locations.

3.4 CDM STRATEGIES AND METHODOLOGIES

3.4.1 Integrated Wildlife Damage Management (IWDM)

The most effective approach to resolving wildlife damage is to integrate the use of several methods simultaneously or sequentially. The philosophy behind IWDM is to implement the best combination of effective management methods in a cost-effective[5] manner while minimizing the potentially harmful effects on DCCO populations, humans, nontarget species, and the environment. IWDM may incorporate cultural practices (e.g., fish husbandry), habitat modification (e.g., exclusion, vegetation management), animal behavior modification (e.g., scaring, roost dispersal), removal of individual offending animals (e.g., shooting, live capture and relocation), local population reduction (e.g., shooting, nest and egg destruction), or any combination of these.

The IWDM approach proposed by the lead and cooperating agencies involves the use of four general strategies for addressing DCCO damage:

> **Technical Assistance Recommendations** "Technical assistance" as used herein is information, demonstrations, and advice on available and appropriate wildlife damage management methods. The implementation of damage management actions is the responsibility of the requester. In some cases, WS provides supplies or materials that are of limited availability for non-WS entities to use. Technical assistance may be provided through a personal or telephone consultation, or during an on-site visit with the requester. Generally, several management strategies are described to the requester for short and long-term solutions to damage problems; these strategies are based on the level of risk, need, and the practicality of their application.
>
> Under APHIS NEPA implementing regulations and specific guidance for the WS program, WS technical assistance is categorically excluded from

[5]The cost of management may sometimes be secondary because of overriding environmental, legal, human health and safety, animal welfare, or other concerns.

the need to prepare an EA or EIS. However, it is discussed in this EA because it is an important component of the IWDM approach to resolving DCCO damage problems.

Direct Damage Management Assistance This is the implementation or supervision of CDM activities. Direct damage management assistance may be initiated when the problem cannot effectively be resolved through technical assistance alone. When conducted by WS direct damage management assistance is not conducted until *Agreements for Control* or other comparable documents are completed which detail the type of CDM assistance to be provided and the methods to be used. The initial investigation defines the nature, history, extent of the problem, species responsible for the damage, and methods that would be available to resolve the problem. Professional skills of trained damage management personnel are often required to effectively resolve problems, especially if restricted use chemicals are necessary, or if the problems are complex.

Educational Efforts Education is an important element of CDM because wildlife damage management is about finding balance and coexistence between the needs of people and needs of wildlife. This is extremely challenging as nature has no balance, but rather, is in continual flux. In addition to the routine dissemination of recommendations and information to individuals or organizations with DCCO damage, lectures, courses, and demonstrations are provided to aquaculture producers, homeowners, State and county agents, colleges and universities, and other interested groups. The lead and cooperating agencies frequently work together in education and public information efforts. Additionally, technical papers are presented at professional meetings and conferences so that wildlife professionals and the public are updated on recent developments in damage management technology, programs, laws and regulations, and agency policies.

Research and Development The lead and cooperating agencies are all involved in research efforts relating to DCCO biology, the impact of DCCOs on fisheries, wildlife and other natural resources, and CDM techniques. The lead and cooperating agencies also cooperate and exchange information with universities and other agencies and entities conducting DCCO research. Research findings are used to clarify the need for action, refine management objectives and improve the methods used to address DCCO damage. The Michigan ICCG will serve a critical role in the exchange and dissemination of findings from current research and the incorporation of that research in management decisions. Decisions on future PRDO CDM projects will be made only after the working group examines the results of current DCCO research and damage management activities.

3.4.2 Decision Making

WS personnel use a thought process for evaluating and responding to damage complaints that is depicted by the WS Decision Model described by Slate et al. (1992) (Figure 3-1). The Decision Model is not a written documented process, but a mental problem-solving process similar to that used by all wildlife management professionals including those in the lead and cooperating agencies when addressing a wildlife damage problem. WS personnel assess the problem and evaluate the appropriateness and availability (legal and administrative) of damage management strategies and methods based on biological, economic and social considerations. Following this evaluation, methods deemed to be practical for the situation are incorporated into a management strategy. After this strategy has been implemented, monitoring is conducted and evaluation continues to assess the effectiveness of the strategy. If the strategy is effective, the need for further management is ended. In terms of the WS Decision Model (Slate et al. 1992), most damage management efforts consist of continuous feedback between receiving the request and monitoring the results of the damage management strategy.

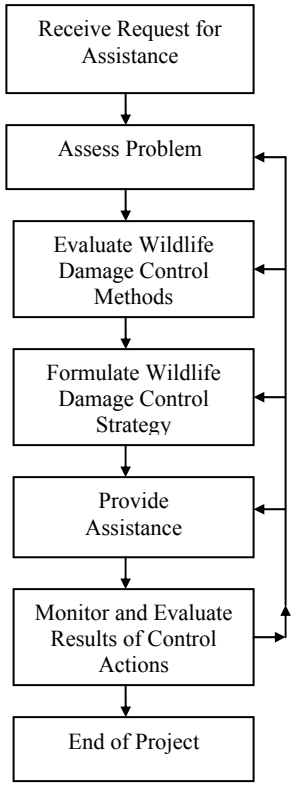

Figure 3-1. WS decision Model

3.4.3 Cormorant Damage Management Methods Available for Use (*see* Appendix 4 of USFWS FEIS (USFWS 2003) for detailed description of methods)

3.4.3.1 Nonlethal Methods

Agricultural producer and property owner practices consist primarily of nonlethal preventative methods such as **cultural methods**[6] and **habitat modification**. Examples of habitat modification include the removal of nesting trees or nesting materials.

Animal behavior modification refers to tactics that alter the behavior of birds or disperse birds to reduce damages. Some, but not all, of these tactics include the following:

[6]Generally involves modifications to the management of protected resources to reduce their vulnerability to wildlife.

- Exclusion methods such as netting and overhead wires,
- Propane exploders (to scare birds),
- Pyrotechnics (to scare birds),
- Distress calls and sound producing devices (to scare birds),
- Visual repellents and scaring tactics (to scare birds),
- Lasers (to scare birds), and
- Scarecrows.

Dispersal of DCCOs from day/night roosts or from breeding/nesting sites utilizing propane exploders, pyrotechnics, distress calls/sound producing devices, visual repellants or scarecrows may help to limit or reduce DCCO activity in the area where damage is occurring.

Lasers are a nonlethal technique recently evaluated by NWRC (Blackwell et al. 2002, Glahn et al. 2000*a*). The low-powered laser has proven to be effective in dispersing a variety of bird species in a number of different environments. The low-powered laser is most effective before dawn or after dusk when the red beam of the laser is clearly visible. Bright sunlight will "wash out" the laser light rendering it ineffective. Although researchers are not sure if birds see the same red spot as people, it is clear that certain bird species elicit an avoidance response in reaction to the laser. The birds appear to view the light as a physical object or predator coming toward them and generally fly away to escape. Research, however, has shown that the effectiveness of low-powered lasers varies depending on the bird species and the context of the application. Lasers have been used to startle DCCOs under low-light conditions (Wires et al 2001 *a*, Hatch and Weseloh 1999, and McKay et al. 1999).

Nest destruction involves tearing down, scattering or otherwise removing the nests of target species.

3.4.3.2 Lethal Methods

Egg addling/destruction is the practice of destroying the embryo in the egg prior to hatching; physically breaking eggs; or directly removing eggs from a nest and destroying them.

Egg oiling is a method for suppressing reproduction of birds by spraying a small quantity of food grade vegetable/corn oil on eggs in nests.

Live traps/nets are various types of traps designed to capture birds alive. Cormorants captured in traps, nets, or by hand would be humanely euthanized.

Shooting is effective as a dispersal technique and a way to reduce bird numbers. Shooting with rifles or shotguns is sometimes used to manage DCCO damage problems when lethal methods are determined to be appropriate. At many

locations, the use of a .22 caliber rifle equipped with a noise suppressor is the only practical method of removing DCCOs without spooking them or having a negative effect on other birds that are protected under Federal law. CDM programs in other parts of the U.S. and Canada have been experimenting with other types of firearms and ammunition as alternatives for minimizing impacts on nontarget species near DCCOs. As data become available, new shooting strategies will be incorporated as practical and appropriate (e.g., legal for use in Michigan). The birds are killed as quickly and humanely as possible. Shooting can be helpful in some situations to supplement and reinforce other dispersal techniques. It almost never results in the direct mortality of nontarget species and may be used in conjunction with the use of spotlights and decoys.

Cervical dislocation is an American Veterinary Medical Association (AVMA) approved euthanasia method (Beaver et al. 2001) which is sometimes used to euthanize birds which are captured by hand or in live traps/nets. The bird is stretched and the neck is hyper-extended and dorsally twisted to separate the first cervical vertebrae from the skull. The AVMA approves this technique as a humane method of euthanasia and states that cervical dislocation when properly executed is a humane technique for euthanasia of poultry and other small birds (Beaver et al. 2001). Cervical dislocation is a technique that may induce rapid unconsciousness, does not chemically contaminate tissue, and can be quickly accomplished (Beaver et al. 2001).

Carbon dioxide (CO_2) gas is an AVMA approved euthanasia method (Beaver et al. 2001) which is sometimes used to euthanize birds which are captured in live traps/nets or by hand. Live birds are placed in a container or chamber into which CO_2 gas is released. The birds quickly expire after inhaling the gas. CO_2 gas is a byproduct of animal respiration, is common in the atmosphere, and is required by plants for photosynthesis. It is used to carbonate beverages for human consumption and is also the gas released by dry ice. The use of CO_2 by WS for euthanasia purposes is exceedingly minor and inconsequential to the amounts used for other purposes by society.

3.4.3.3 Disposal of Carcasses

DCCO carcasses may be disposed of via burial (e.g., in a landfill), composting or incineration. Composting of DCCO carcasses would be conducted in accordance with guidance provided by the MDNRE and the Michigan Department of Agriculture. Compost sites will be situated in well-drained locations a minimum of 200 ft from any well, non-farm residence, and waters of the state. Compost piles will not be situated in locations where construction of the pile would result in damage to state or federally-listed plants or adverse impacts on other state or federally listed threatened or endangered species.

3.5 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN DETAIL WITH RATIONALE

3.5.1 Lethal CDM Only

Agencies selecting this alternative would not use nonlethal techniques for CDM. This alternative was eliminated from further analysis because some DCCO damage problems can be resolved effectively through nonlethal means and at times lethal methods may not be available for use due to safety concerns or local ordinances prohibiting the use of some lethal methods, such as the discharge of firearms.

3.5.2 Compensation for DCCO Damage Losses

The compensation alternative would require the establishment of a system to reimburse persons impacted by DCCO damage. This alternative was eliminated from further analysis because no Federal or State laws currently exist to authorize such action. Under such an alternative, WS would not provide any direct control or technical assistance. Aside from lack of legal authority, analysis of this alternative in the WS FEIS indicated that the concept has many drawbacks (USDA 1997, Revised):

- It would require larger expenditures of money and labor to investigate and validate all damage claims, and to determine and administer appropriate compensation. A compensation program would likely cost several times as much as the current program.
- Compensation would most likely be below full market value. It is difficult to make timely responses to all requests to assess and confirm damage, and certain types of damage could not be conclusively verified.
- Compensation would give little incentive to resource owners to limit damage through improved cultural, husbandry, or other practices and management strategies.
- Not all resource owners would rely completely on a compensation program and lethal control would most likely continue as permitted by Federal and State law.
- Compensation would not be practical for reducing threats to human health and safety or damage to public resources.

3.5.3 Increase DCCO Population Reduction and/or Eliminate DCCOs

As indicated in Section 1.5.1, DCCOs are a native species in Michigan and are an important and integral part of the Michigan ecosystem. Individuals expressing a desire to eradicate or radically control DCCOs cite vegetation loss and consumption of sport or commercially valuable fish as the need for action. While the agencies agree that DCCOs can cause adverse impacts on public resources, it

should also be noted that DCCOs also consume undesirable non-native fish such as round goby. In moderation, the habitat changes that occur as a consequence of the establishment of large DCCO colonies are part of a natural process which creates nesting opportunities for other bird species. While the agencies recognize that there are some individuals whose aesthetic enjoyment of a site is diminished by the loss of vegetation, and individuals who are concerned about DCCO impacts on fishing opportunities, they also recognize that there are many people who enjoy viewing large flocks of DCCOs and for whom the knowledge and sight of a healthy DCCO population in Michigan has aesthetic value. The importance of DCCOs to Michigan citizens was demonstrated when the struggling DCCO population was placed on the State list of threatened and endangered species in 1976, and public resources were committed to the recovery of the DCCO population.

It is the responsibility of the MDNRE, USFWS, WS and the tribes to maintain healthy and viable native wildlife populations while also working with one another, landowners and resource managers to address conflicts with native wildlife species that may occur. The management objectives in Section 1.5.8 were established to obtain a balance between the desire for a healthy DCCO population and the need to manage adverse impacts of DCCOs on vegetation and co-nesting species and fishery resources.

3.5.4 Nonlethal Methods Implemented Before Lethal Methods

This alternative is similar to Alternative 1 except that WS personnel would be required to always recommend or use nonlethal methods prior to recommending or using lethal methods to reduce DCCO damage. Both technical assistance and direct damage management would be provided in the context of a modified IWDM approach. The Proposed Action recognizes nonlethal methods as an important dimension of IWDM, gives them first consideration in the formulation of each management strategy, and recommends or uses them when practical before recommending or using lethal methods. However, the important distinction between the Nonlethal Methods First Alternative and the Proposed Alternative is that the former alternative would require that all nonlethal methods be used before any lethal methods are recommended or used.

While the humaneness of the nonlethal management methods under this alternative would be comparable to the Proposed Program Alternative, the extra harassment caused by the required use of methods that may be ineffective could be considered less humane and may unduly disturb co-nesting species. As local bird populations increase, the number of areas negatively affected by birds would likely increase and greater numbers of birds would be expected to congregate at sites where nonlethal management efforts were not effective. This may ultimately result in a greater number of birds being killed to reduce damage than if lethal management were immediately implemented at problem locations (Manuwal 1989). Once lethal measures were implemented, DCCO damage would be

expected to drop relative to the reduction in localized populations of birds causing damage.

In many situations this alternative would result in the death of greater numbers of DCCOs, increased cost to the requester, and a delay in reducing damage in comparison to the Proposed Alternative. Consequently, the Nonlethal Methods Implemented Before Lethal Methods Alternative is removed from further discussion in this document.

3.6 STANDARD OPERATING PROCEDURES FOR CDM IN MICHIGAN

Mitigation measures are any features of an action that serve to prevent, reduce, or compensate for effects that otherwise might result from that action. The current WS program, nationwide and in Michigan, uses many such mitigation measures and these are discussed in detail in Chapter 5 of the ADC FEIS (USDA 1997, Revised) and Chapter 4 of the DCCO FEIS (USFWS 2003).

3.6.1 Standard Operating Procedures - General

Some key measures pertinent to the proposed action and the other alternatives that will be incorporated into Standard Operating Procedures, depending upon the alternative selected, include:

- A Decision Model thought process like the WS Decision model (USDA 1997, Revised) will be used to identify effective wildlife damage management strategies and their effects (Section 3.4.2).
- Reasonable and prudent measures or alternatives are identified through consultation with the USFWS and are implemented to avoid effects to T&E species.
- Research is being conducted to improve CDM methods and strategies so as to increase selectivity for target species, to develop effective nonlethal control methods, and to evaluate nontarget hazards and environmental effects.
- When used in accordance with WS procedures and policies, the risk of adverse impacts on public safety and hazard to the environment from the proposed CDM methods have been determined to be low according to a formal risk assessment (USDA 1997 Revised, Appendix P). Where such activities are conducted on private lands or other lands of restricted public access, the risk of hazards to the public is even further reduced.
- Agents acting under the authority of the lead and cooperating agencies (50 CFR 21.48(c)(2)) will be informed and trained in the safe and proper use of CDM methods including applicable laws and regulations authorizing use of these methods.

3.6.2 Additional Mitigation Specific to the Issues

The following is a summary of additional mitigation measures that are specific to the issues listed in Chapter 2 of this document.

Effects on Target Species Populations

- CDM activities are directed to resolving DCCO damage problems by taking action against individual problem birds, or local populations or groups, not by attempting to eradicate populations in the entire state or region.
- DCCO take is monitored by comparing numbers of birds killed with overall populations or trends in populations to assure the magnitude of take is maintained below the level that would threaten the long-term sustainability of regional DCCO populations (See Chapter 4).
- To avoid adverse impacts on DCCO populations, the lead and cooperating agencies will abide by the terms and conditions of the PRDO (50 CFR 21.48) and USFWS migratory bird permits issued for the management and control of DCCO damage and conflicts, including, but not limited to, reporting on an annual basis the number of nests in which eggs were oiled or destroyed and the number of DCCOs killed.
- In certain circumstances when conducting control activities in DCCO breeding colonies, WS is required to notify the USFWS prior to conducting control activities with the approximate number of DCCOs that may be killed under the proposed project (50 CFR 21.48(d)(9)). The USFWS will review this advanced notification to determine if the proposed project would threaten the long-term sustainability of regional DCCO populations.
- When shooting nesting DCCOs, WS will attempt to remove both breeding adults from a specific nest to prevent the possibility of renesting.
- If determined practical and effective, egg oiling and shooting of DCCOs will target different nests or areas of a colony to maximize effectiveness and minimize the potential of renesting.
- As applicable, the action agencies will review the USFWS Final Report (Wires and Cuthbert 2001) – "Prioritization of waterbird colony sites for conservation in the U.S. Great Lakes region" prior to conducting control activities at DCCO breeding colonies. If the action agencies conduct control activities at any of the sites identified in this report as "priority sites for waterbird conservation", the agencies will consult with the USFWS for advice on how to proceed with management actions. [7]

[7] The agencies recognize that this list is may be replaced with a more current evaluation. The action agencies will apply these same protective measures to a revised list approved by the USFWS and its cooperators if and when available.

Effects on Nontarget Species Populations Including T&E Species

- WS personnel are trained and experienced in selecting the most appropriate method for taking problem animals and excluding nontargets.
- Observations of birds in areas that are associated with DCCO concentrations are made to determine if nontarget or T&E species (Federal, Tribal, or State Listed) would be at risk from CDM activities.
- As appropriate, management actions taken in mixed-species waterbird colonies would be conducted in such a manner to avoid or minimize impacts to non-target species (i.e. visiting sites during early morning and late afternoon hours to avoid thermal stress to eggs/nestlings, conducting actions as early as possible in the nesting season to reduce nestling abandonment, limiting the number of visits, leaving perimeter of untreated DCCO nests around nontarget species where practical, etc.).
- Egg oiling will only be used for ground and shrub nesting DCCOs to minimize disturbances to co-nesting colonial waterbird species.
- Where appropriate, egg oiling activities will take place during night hours to minimize potential impacts to co-nesting colonial waterbird species. Night egg oiling will not be used in areas with Common Terns because terns will not return to their nest until morning if disturbed during the night. Also, the action agencies will not conduct such activities during night hours if it is determined unsafe to do so.
- When possible, when shooting DCCOs from blinds set up in breeding colonies, moving to and from the blinds and blind preparation will be conducted during periods of darkness to minimize impacts to co-nesting colonial waterbird species. However, the action agencies will not conduct such activities during night hours if species sensitive to night disturbance (Common Terns) are present or it is determined unsafe to do so.
- When shooting DCCOs in breeding colonies, the action agencies will utilize the smallest caliber firearm that is effective and will utilize noise-suppressed firearms (silencers) as deemed appropriate to minimize repeated disturbances to co-nesting colonial waterbird species.
- The removal of DCCO carcasses will be completed at such intervals and times of day that will cause the least amount of disturbances to co-nesting colonial waterbird species.
- The action agencies have consulted with the USFWS regarding potential effects of control methods on T&E species, and will abide by reasonable and prudent alternatives and/or reasonable and prudent measures established as a result of that consultation (see Section 4.1.2).
- The action agencies will abide by the conservation measures specified in the USFWS FEIS (USFWS 2003) and at 50 CFR 21.48(d)(8) to avoid adverse effects on listed species.

- Prior to any control action, the action agencies will consult with the MDNRE to ensure that no actions taken under this plan will adversely affect State-listed threatened and endangered species.
- Non-toxic shot will be used when using shotguns to harass or kill DCCOs.
- As applicable, the action agencies will review the USFWS Final Report (Wires and Cuthbert 2001) – "Prioritization of waterbird colony sites for conservation in the U.S. Great Lakes region" prior to conducting control activities at DCCO breeding colonies. If the action agencies conduct control activities at any of the sites identified in this report as "priority sites for waterbird conservation", the agencies will consult with the USFWS for advice on how to proceed with management actions.
- To avoid adverse impacts on nontarget species, the action agencies will abide by the terms and conditions of the PRDO (50 CFR 21.48) and USFWS migratory bird permits issued for the management and control of DCCO damage and conflicts.
- As specified in the PRDO (50 CFR 21.48(d)(10)), on an annual basis, the action agencies are required to provide the USFWS with a statement of efforts being made to minimize incidental take of nontarget species and also to report the number and species of migratory bird involved in such take, if any. The USFWS will review this information to ensure control activities taken under the PRDO will not adversely impact nontarget migratory bird species.
- In certain circumstances when conducting control activities in DCCO breeding colonies, the action agencies are required to notify the USFWS prior to conducting control activities which species of other (non-target) bird species are present (50 CFR 21.48(d)(9)). The USFWS will review this advanced notification to determine if the proposed project may threaten the long-term sustainability of nontarget migratory bird species.
- Before going into a new site to conduct work to prevent colonization by nesting DCCOs, the agencies will consult with the USFWS and MDNRE regarding the occurrence of State and federally-listed plant species. When possible, areas supporting these species will be avoided. Agency staff will be trained in the identification of these species and will be made aware of the occurrence of these species at the site in order to avoid negative impacts.

CHAPTER 4: ENVIRONMENTAL IMPACTS

4.0 INTRODUCTION

Chapter 4 provides information needed to make informed decisions when selecting among the alternatives for meeting the purpose and need for action. This chapter analyzes the environmental consequences of each alternative in relation to the issues identified for detailed analysis in Chapter 2. Each alternative is analyzed in comparison with the No Action Alternative (Alternative 1) to determine if the real or potential effects would be greater, lesser, or the same. Although each agency has the authority to make its own decision regarding the alternative to be selected, impacts are analyzed for each alternative as if all of the lead and cooperating agencies had selected the same alternative. This allows for analysis of the full range of potential impacts from the proposed alternatives while maintaining clarity and avoiding undue repetition. Impacts of the lead and cooperating agencies selecting differing alternatives will be intermediate to those presented in this chapter (Appendix E).

The following resource values within the State are not expected to be significantly impacted by any of the alternatives analyzed: soils, geology, minerals, flood plains, wetlands, visual resources, air quality, prime and unique farmlands, timber, and range. These resources will not be analyzed further.

Cumulative Effects: Cumulative effects are discussed in relationship to each of the alternatives analyzed, with emphasis on potential cumulative effects from methods employed, and including summary analyses of potential cumulative impacts to target and nontarget species, including T&E species.

Irreversible and Irretrievable Commitments of Resources: Other than minor uses of fuels for motor vehicles and other materials, there are no irreversible or irretrievable commitments of resources.

Effects on sites or resources protected under the National Historic Preservation Act: The actions of the lead and cooperating agencies are not undertakings that could adversely affect historic resources (See Section 1.9.2).

4.1 ENVIRONMENTAL IMPACTS OF ALTERNATIVES ANALYZED IN DETAIL

4.1.1 Effects on DCCO Populations

The analysis for magnitude of impact generally follows the process described in Chapter 4 of USDA (1997, Revised). Magnitude is described in USDA (1997, Revised) as *". . . a measure of the number of animals killed in relation to their abundance."* Magnitude may be determined either quantitatively or qualitatively. Quantitative determinations are based on population estimates, allowable harvest levels, and actual harvest data. Qualitative determinations are based on population trends and harvest data when

available. Standard Operating Procedures to avoid adverse impacts on DCCO populations are described in Chapter 3.

Alternative 1 – Integrated CDM Program, Including Implementation of the PRDO (No Action Alternative)

DCCOs range throughout North America, from the Atlantic coast to the Pacific coast (USFWS 2003). By 1997, the DCCO population had expanded to an estimated 372,000 nesting pairs; with the U.S. population (breeding and non-breeding birds) conservatively estimated to be greater than 1 million birds (Tyson et al. 1999). In the EIS on DCCO management, the USFWS estimated the continental population at approximately 2 million birds (USFWS 2003). Tyson et al. (1999) found that the DCCO population increased approximately 2.6% annually during the early 1990s. The greatest increase was in the Interior region with a 22% annual increase in the number of DCCOs in Ontario and the U.S. States bordering the Great Lakes (Tyson et al. 1999).

The Great Lakes region consists of all five Great Lakes and their connecting channels, Lake Champlain, Oneida Lake in New York, and the St. Lawrence River up to and including Lac St. Pierre (Weseloh et al. 2006). The majority of CDM conducted under the PRDO occurs in the Great Lakes. In 2005, 115,000 DCCO nests were counted at 216 sites by American and Canadian wildlife officials and volunteers during a Great Lakes-wide DCCO survey (Weseloh et al. 2006). The survey of cormorants was repeated during the 2007 Great Lakes Colonial Waterbird survey (110,400 nests) and in the 2009 Great Lakes DCCO survey (102,500 nests; F. Cuthbert, University of Minnesota, Unpublished Data). Decreases may be attributable, in part, to CDM actions conducted in the Great Lakes, but other factors, especially the decline in alewife populations, may also contribute to the decline. The survey only estimates the number of breeding DCCO pairs and does not provide an estimate of juvenile and non-breeding birds. Estimates of 0.6 to 4.0 non-breeding cormorants per breeding pair have been used for several populations (Tyson et al. 1999). Given the survey numbers, the total DCCO population (breeders and non-breeders) for the Great Lakes region can be conservatively estimated at 345,078 birds (3 times the 115,026 nests, conservatively calculated by multiplying each nest by two adults and one young; USFWS 2009*a*).

The Michigan population of breeding DCCOs is composed of birds from the Interior population (USFWS 2003, Tyson et al. 1999). There were approximately 30,611 breeding pairs of DCCOs in 2005. The number decreased slightly in 2007 to 28,580 pairs and decreased further to 18,220 pairs in 2009 (Weseloh et al. 2006, USFWS 2009*a*, F. Cuthbert, University of Minnesota, unpublished data). Using an estimate of 1 non-breeding bird per breeding pair yields a population estimate of 54,660 DCCOs in Michigan in 2009. During migration, there are additional DCCOs moving through the State.

Seamans et al. (2008) used bird band recovery models to estimate temporal trends in hatch year (HY), second year (SY) and after second year (ASY) survival of Double-crested Cormorants banded in the Great Lakes from 1979-2006. This time period

included the period of rapid DCCO population increase in the Great Lakes, the USFWS issuance of the 1998 Aquaculture Depredation Order and the 2003 PRDO and changes in the Aquaculture Depredation Order. Survival in hatch-year birds decreased throughout the study period and was negatively correlated with abundance estimates for DCCOs in the Great Lakes area. This decline may have been related to density-dependent factors. However, there was also evidence that the depredation orders were contributing to the decreasing survival in hatch-year birds. There was no clear evidence of impact of the depredation orders on second-year or after-second-year DCCOs even though lethal removal of DCCOs in the Great Lakes increased more than 6-fold after the implementation of the depredation order. After-hatch-year survival did decrease from 2004-2006 but was still within the range of previous years. Additional time may be required before the models detect any changes in mortality rates resulting from the 2003 depredation orders. This may be especially true given that it wasn't until the 2007 Great Lakes Colonial Waterbird Survey, after the completion of Seamans et al.'s (2008) study, that the first reduction (3.2%) in the Great Lakes area DCCO population was recorded since the initiation of their study (Weseloh et al. 2008).

Estimated DCCO Take – Scientific Collecting Permits

During 2004-2008, 0-350 DCCOs per year were taken by under scientific collecting permits (Table 4-1). Some DCCOs taken under the PRDO for damage management were also used for research purposes. Take for DCCO research is not anticipated to occur every year, and it is not anticipated to exceed 500 birds per year in the years when it does occur. Agencies will continue using DCCOs taken for CDM whenever possible to reduce the need for additional mortality under scientific collecting permits (Table 4-1).

Estimated DCCO Take – Damage to Property, Health and Safety Risks

Total annual take of DCCOs under MBPs for the period of 2004-2008 has ranged from, 122-586 birds per year. To date, MBPs for CDM in Michigan have primarily involved the reduction of damage to fish at aquaculture facilities and property damage (e.g., fish stocked in privately owned lakes). For purposes of the PRDO, damage to vegetation on private property and fish in private lakes is considered damage to property and not damage to a public resource. A MBP is required to conduct CDM at these locations. Damage management actions conducted at these sites can only be classified as the protection of public resources under the PRDO if a State or Federal wildlife management agency has identified a species or plant community on the site as being a public resource needing special protection, or if the management of DCCOs on private property is warranted for the protection of public resources in another location (e.g., fishery resources). Total annual take under MBPs is not anticipated to exceed 300 birds per year.

Estimated DCCO Take – Management of Damage to Public Resources (PRDO)

Under this alternative, total annual DCCO take under the PRDO would remain similar to that which occurred from 2006-2009 and would not exceed 9,700 birds per year (Table 4-2). Of the 9,700 birds per year that could be taken, up to 9,200 birds could be taken by WS and the MDNRE and the remainder would be available to tribal entities. The USFWS would review annual work proposals to ensure that proposed annual take would

not exceed levels set for this alternative. Annual take would also be monitored to ensure that the State DCCO population was not reduced below 5,000 breeding pairs. Annual allocation of take among action agencies could be adjusted if the affected parties mutually agree on the change (e.g., through the ICCG) so long as total annual take under the PRDO does not exceed 9,700 birds per year. For example, tribal entities could ask WS to take DCCOs for tribal CDM projects under the PRDO, in which case the take would be included in the WS/State total. Alternately, taking more than 500 DCCOs from tribal areas could be beneficial to public resources and some of the take allowance for WS and the MDNRE could be shifted to the tribes. Similarly, the annual DCCO take allotted to each category of take (MBPs, Scientific Collecting Permits, PRDO) could be increased or decreased based on management needs, but could not exceed 10,500 birds per year. Selection of this alternative would limit the extent to which the MDNRE could implement its proposed adaptive management strategy described in Sections 1.5.8 and 3.1 because the total level of take allowed would not be sufficient to achieve the proposed reductions in local breeding populations at all sites.

Table 4-1. Summary of cumulative Double-crested Cormorant take and egg oiling in Michigan. Numbers are for adult birds and do not include eggs oiled. Data on 2009 take under per Depredation and Scientific Collecting Permits was not available at the time the EA was prepared.

Source of Take	2004	2005	2006	2007	2008	2009
EGG OILING						
Maximum number of nest oiled per trip[1]	3,114	2,991	8,479	12,179	8,035	7,049
LETHAL TAKE OF BIRDS						
WS-PRDO	1,199	2,251	5,447	8,005	7,953	9,522
State/Tribes - PRDO	222	178	180	296	270	163
Depredation Permits	586	439	281	227	122	NA
Scientific Collecting Permits	0	350	0	246	0	NA
TOTAL LETHAL TAKE OF BIRDS	**2,007**	**3,218**	**5,908**	**8,774**	**8,345**	**NA**

[1] Sum of the maximum number of nests oiled per trip for each site where CDM was conducted.

Table 4-2. Number of DCCOs that could be lethally removed under each of the proposed management alternatives.

Authorization for Take	Alternative #1	Alternative #2*	Alternative #3	Alternative #4	Alternative #5*
PRDO – WS/MDNRE	9,200	3,610	Number of breeding DCCOs in excess of 5,000-12,5000 pairs	18,000	3,610
PRDO - Tribes	500	600		1,000	600
MBPs					
Scientific collecting permits	500		500	500	
Depredation Permits	300		500	500	
TOTAL	**10,500**	**4,210**	**Variable**	**20,000**	**4,210**

* Maximum allowed lethal take under the PRDO that would be permitted under this alternative is 10% of the local breeding population. The maximum take levels presented for this alternative are based on data from Table1-1 and tribal take from 2007-2008 and may vary depending upon changes in the DCCO population and the number of areas where CDM is proposed.

Egg Oiling/Addling and Nest Destruction

In 2004 and 2005 3,114 and 2,991 nests, respectively, were oiled during cumulative CDM efforts by all entities in Michigan. In 2006, WS CDM efforts in Michigan increased (USDA 2006) and the number of nests oiled increased to 7,049 to 12,179 nests per year for 2006-2009. The EIS stated that since DCCOs are relatively long-lived birds, egg oiling would have to be conducted repeatedly over a period of years before any impact on adult populations would be evident. The EIS also determined that without extensive regional coordination of efforts the overall impact of egg oiling on the continental and regional DCCO populations would likely be minimal. On a local level, oiling a high proportion of nests in a colony can reduce the number of DCCOs in a colony over time (USDA 2003, Stromberg et al. 2008). Collectively, the individual CDM egg oiling projects would result in a reduction in the State DCCO population. WS, the USFWS and the MDNRE will monitor the cumulative impacts of CDM on DCCO populations in the State. Sites where CDM is conducted have nests counts each year. Egg oiling and all other CDM efforts will be adjusted as needed to keep the Michigan DCCO population from dropping below 5,000 breeding pairs and to maintain the minimum size for local breeding populations discussed in Section 1.5.8.1.

In the short term, the proposed annual cumulative take of DCCOs by all sources (10,500 DCCOs) would be 12.2% of the estimated 54,660 birds in the State in 2009. Over a period of years, the cumulative impacts of individual CDM projects at specific sites may result in reductions in the total number of DCCOs in the State. Cumulative impacts of individual management programs would be managed so that the State DCCO population

is not reduced to less than 5,000 pairs and local breeding populations will not be reduced below minimums discussed in Section 1.5.8.1. Maximum cumulative impacts would likely result in a statewide population ranging from 5,000 – 12,500 breeding pairs. Monitoring of breeding colony numbers will be done annually at the sites where CDM is conducted. The agencies will also continue to participate in Great Lakes cormorant and colonial waterbird surveys.

Table 4-3. Double-crested Cormorant take in the 24 states included in the Public Resource Depredation Order (PRDO).

Year	PRDO Take	Aquaculture Depredation Order and Other Permits	Total Take
2004	2,334	28,651	30,985
2005	11,221	25,009	36,230
2006	21,428	33,393	54,821
2007	19,960	19,405	39,365
2008	18,745	21,868	40,613
2009			

In 1989, approximately 5,000 breeding pairs of DCCOs were counted in Michigan. In 1997, 30,458 pairs were counted (Wires et al. 2001*a,* Weseloh et al. 2006). Because the population increased when it was at approximately 5,000 birds, it is reasonable to conclude that this population level is viable and, at a minimum, capable of sustaining itself. The proposed minimum population limit is over 4 times the level the State DCCO population was at when it was removed from the Michigan list of threatened and endangered species. Consequently, if cumulative impacts of CDM actions reduce the number of breeding pairs to 5,000 pairs; it would not jeopardize the viability of the State DCCO population.

Nationwide, the FEIS predicted that the implementation of the Aquaculture Depredation Order (AQDO, 50 CFR 21.47), PRDO, and issuance of migratory bird permits would affect approximately 8% of the continental DCCO population on an annual basis or 159,635 DCCOs (USFWS 2003). Maximum annual take under the PRDO analyzed in the FEIS was 99,360. The FEIS concluded that the proposed level of take would be sustainable at the State, regional and national level (USFWS 2003). Table 4-3 summarizes cumulative DCCO take since the implementation of the PRDO. Cumulative take has been well below the level analyzed in the FEIS.

DCCOs are protected by the USFWS under the MBTA. Therefore, nationwide, DCCOs are taken in accordance with applicable Federal laws and regulations authorizing take of migratory birds and their eggs or young, including the AQDO (not applicable in Michigan), PRDO, and the USFWS permitting processes. The USFWS, as the agency with migratory bird management responsibility, will impose restrictions on DCCO management at the State, regional, and national levels as needed to assure cumulative take does not adversely affect the long-term sustainability of populations. WS, MDNRE, and the Tribes will report and coordinate their CDM activities and the USFWS will

ensure that cumulative take does not exceed that which can be sustained by the population.

Based upon the above information, the lead and cooperating agencies have determined that the impacts to the Michigan DCCO population from this alternative will not jeopardize the long-term sustainability of DCCO populations at a local, State, regional, or national level.

Alternative 2 – Only Nonlethal CDM by Federal Agencies

Under this alternative, the Federal agencies would not kill any DCCOs or destroy/oil eggs, but they could use nonlethal CDM methods. WS would not complete the WS Form 37 consultations needed before USFWS could issue depredation permits, and the USFWS would not issue MBPs. No lethal CDM would be conducted on NPS or USFWS lands. Local governments, landowners and their designated agents (e.g., private damage management businesses) could only use nonlethal CDM techniques.

Under the PRDO, the MDNRE and tribes have the authority to take up to 10% of local breeding populations of DCCOs per year on non-Federal lands, with the consent of the land owner/manager, in order to protect public resources (USFWS 2003). The MDNRE and tribes have indicated that they would use this authority. Lethal CDM techniques could not be used on Federal lands, but nonlethal methods could be used to try to meet management objectives. The MDNRE or tribes could also shoot offshore of Federal lands to reduce the local breeding population in an area so long as take occurred more than 500 yards from the shore of the Federal property. To estimate lethal take that might occur under this alternative, we assumed that the maximum annual WS/MDNRE lethal take of birds would be 10% of the local breeding DCCO population at local breeding populations in the Les Cheneaux Islands, Thunder Bay, Bays de Noc, Beaver Islands, and Ludington Pumped Storage Project (Table 1-1) or approximately 4,210 birds based on pre-CDM nest counts conducted in 2009. Lethal take of DCCOs by the tribes was at or below the 10% threshold for 2007 and 2008, so we used data from these years to estimate that tribal take under this alternative would be approximately 300 birds. These numbers are estimates used to improve understanding of the impacts of this alternative. Actual annual maximum take would be 10% of the local breeding population based on pre-CDM DCCO nest counts. The PRDO regulations set no limits on the use of egg oiling and addling which may be conducted without additional review by the USFWS. State and tribal egg oiling and addling is likely to be identical to that which would be conducted under the preferred alternative. Take that would occur under this alternative is far lower than would occur under Alternative 1. Selection of this alternative would limit the extent to which the MDNRE could implement its proposed adaptive management strategy described in Sections 1.5.8 and 3.1 because the total level of take allowed may not be sufficient to achieve the proposed reductions in local breeding populations at all sites. If the MDNRE management objectives can be achieved under this alternative, it would take several years longer to do so than for Alternatives 1, 3 and 4.

For reasons noted for Alternatives 1, the lead and cooperating agencies conclude that this alternative would not jeopardize the long-term sustainability of DCCO populations at the State, regional, or national level.

Alternative 3 – Adaptive Integrated Cormorant Damage Management

Management objectives and methods used to implement this alternative would be as described for Alternative 1. However, there would be no fixed limit to the number of birds that may be taken per year under the PRDO. This alternative would provide the greatest flexibility to increase or decrease annual take in accordance with management objectives developed through the adaptive management process. Maximum take per year would be determined based on the adaptive management objectives described in sections 1.5.8 and 3.1. For example, 50% per year reductions in the local breeding population in Thunder Bay could be implemented until management objectives are reached for the site (initial goal for Thunder Bay = 450 breeding pairs). However, take at individual project areas like Thunder Bay would be limited if the proposed level of cumulative take would reduce the State breeding population to or below 5,000 breeding pairs. Proposed take would also not be allowed to reduce the number of DCCO breeding pairs at local breeding colonies below the thresholds discusses in section 1.5.8.1. The USFWS would work collaboratively with the action agencies through the ICCG to ensure that cumulative take would not reduce the state DCCO population below 5,000 pars. Because of the level of CDM which may occur under this alternative, it may be necessary to survey DCCO colonies at sites where CDM does not occur in order to make sure that annual take will not reduce the number of breeding DCCOs in the State below 5,000 pairs.

Cumulative impacts of individual damage management actions resulting in annual take in excess of 20,000 birds (maximum take for Alternative 4) per year are expected to result in reductions in the State DCCO population. In time, the population would be reduced to the point where the limit on cumulative take from all sources imposed to maintain no less than 5,000 breeding pairs results in maximum allowed annual take of 20,000 birds or less. At that time, impacts of this alternative on the DCCO population would be identical to Alternative 4.

Additional limits on take would be based on cumulative take which may occur for all states under the PRDO. Nationwide, the FEIS predicted that the implementation of the PRDO would affect approximately 99,360 DCCOs (USFWS 2003). Maximum cumulative annual impact on the DCCO population from all sources including the Aquaculture Depredation Order, the PRDO and permits was estimated to be 159,635 DCCOs or approximately 8% of the continental DCCO population. The FEIS concluded that the proposed level of take would be sustainable at the State, regional and national level (USFWS 2003). Table 4-3 summarizes cumulative DCCO take since the implementation of the PRDO. Maximum actual take under the PRDO and cumulative take from all sources has been well below the levels analyzed in the FEIS. All proposals for action under the PRDO are presented to the USFWS prior to the start of the CDM season. The USFWS is responsible for ensuring that total proposed annual take under the

PRDO, including take proposed for this alternative, does not exceed levels analyzed in the FEIS or jeopardize the State, regional or national DCCO population.

The cumulative impact of the individual management actions which may be conducted under this alternative would likely reduce the State DCCO population. The potential level of annual DCCO removal and the rate of population reduction would be greatest under this alternative, at least for the first few years of the program. Given the current MDNRE adaptive management objectives and strategy (Sections 1.5.8, 3.1), and measures for the protection of the DCCO population, cumulative impacts on the State DCCO population are likely to eventually result in a population ranging from 5,000 to 12,500 breeding pairs. Based on analysis presented for Alternative 1 and the discussion above, this level of take will not jeopardize the viability of the State, regional or national DCCO population.

Alternative 4 – Adaptive Integrated Cormorant Damage Management with Limited Annual Take (Proposed Action)

This alternative would be the same as Alternative 3 except that annual take of DCCOs under the PRDO would be limited to 19,000 birds and cumulative take by all sources would be limited to 20,000 birds per year. Of the 19,000 birds per year that could be taken, up to 18,000 birds could be taken by WS and the MDNRE and the remainder would be available to tribal entities. As with Alternative 1, allocation of PRDO take among the action agencies could be adjusted if the affected parties mutually agree on the change (e.g., through the Michigan Cormorant Coordination Group). Similarly, the annual DCCO take allotted to each category of take (Migratory Bird Permits, Scientific Collecting Permits, PRDO) could be increased or decreased based on management needs, but could not exceed 20,000 birds per year. Cumulative impacts of individual damage management actions resulting in annual take in excess of 20,000 birds per year allowed under Alternative 3 are expected to result in reductions in the State DCCO population. Under Alternative 3, individual damage management actions would eventually reduce the State DCCO population to the point where the limit on take imposed to maintain no less than 5,000 breeding pairs resulted in maximum allowed annual take of 20,000 birds or less. At that time, impacts of Alternatives 3 and 4 on the DCCO population would be identical.

Depending upon the annual management proposals and resources available to the action agencies, limiting annual take under the PRDO would allow for a slightly more gradual impact on local breeding populations. The MDNRE would likely be able to achieve management objectives established in Sections 1.5.8 and 3.1, but it may take slightly longer to achieve the objectives than under Alternative 3. The minimum State DCCO population (5,000 breeding pairs) would remain as for all other alternatives as would the minimum number of breeding DCCOs per local breeding population (Section 1.5.8.1). Adding approximately 10,000 birds to the annual take under the PRDO for Alternative 1 to the annual cumulative take for all states under the PRDO for 2004-2008 does raise current levels of take over 33,000, still well below the 99,360 DCCOs per year analyzed in the FEIS. Given the proposed level of take and measures for the protection of the

DCCO population, cumulative impacts on the State DCCO population are likely to result in a population ranging from 5,000 to 12,500 breeding pairs. Based on analysis presented for Alternative 1 and the discussion above, this level of take will not jeopardize the viability of the State, regional or national DCCO population.

Alternative 5 - No Federal CDM

Under this alternative, the Federal agencies would have no impact on DCCO populations in the State. As discussed in Section 3.1, WS would not complete the WS Form 37s consultations needed before USFWS could issue depredation permits, and the USFWS would not issue MBPs. No CDM would be conducted on Federal lands. However, similar to Alternative 2, under the PRDO the State and tribes do have the authority to take up to 10% of local breeding population of DCCOs on non-Federal lands, with the consent of the land owner/manager, in order to protect public resources (USFWS 2003).

The lack of any CDM on Federal lands could result in increases in DCCO populations at these locations through reproduction in the birds already using the site and birds which may move from treatment areas. The risk of this type of impact is greater for this alternative than for Alternative 2 where at least nonlethal methods could be used to manage DCCO populations on Federal lands.

Maximum annual take of DCCOs under the PRDO would be the same as for Alternative 2, and would not jeopardize the long-term sustainability of DCCO populations at the State, regional, or national level.

4.1.2 Effects on Other Fish and Wildlife Species, Including Threatened and Endangered Species

Alternative 1 - Integrated CDM Program, Including Implementation of the PRDO (No Action Alternative)

Adverse Impacts on Non-target Species (Not Threatened or Endangered Species)

Direct impacts on non-target species occur when program personnel inadvertently kill, injure, or harass animals that are not target species, including eggs or young of nesting adults that are disturbed by CDM activities. It is extremely unlikely that a non-target species would be shot. No non-target birds or mammals have been killed by WS during CDM operations in Michigan. Live traps and nets are rarely used, and non-target species caught in live-traps and nets could be released. While every precaution is taken to safeguard against taking non-target birds, at times changes in local flight patterns and other unanticipated events can result in the incidental take of unintended individuals. These occurrences are rare and should not affect the overall populations of any species under the proposed program. Mitigation measures to reduce potential impacts to non-target species, especially nesting birds, are listed in Chapter 3.

The most likely negative effect on non-target species from CDM activities in Michigan is disturbance of co-nesting colonial waterbirds. If adults are startled from the nest for too long or at the wrong time of day, there is the potential for increased mortality rates for eggs and chicks. However, in most instances, migratory birds and other affected non-target wildlife may temporarily leave the immediate vicinity of scaring, but usually return after conclusion of the action. Moore et al. (2005) evaluated the impact of DCCO removal on co-nesting Great Blue Herons and Great Egrets on Lake Ontario. For both species, there was no impact on the proportion of time spent in nest attendance between control and treatment sites for the interval prior to DCCO removal, the intervals between DCCO removal efforts and the period after DCCO removal was completed. Nest attendance declined for both species during the DCCO removal periods (35±20 min). Herons disturbed during the DCCO removal returned to the nest in 11 - 14 min (longest unattended=50±30 min) and all egrets returned to nests before the cormorant removal had ended (longest unattended=6±4 min). However, there was no difference in the nest success of herons or egrets between treated and untreated sites. These findings are similar to those of CDM monitoring conducted on West Sister Island, Green Island, and Turning Point Island in Ohio in 2006 and 2007.

On both West Sister and Green Island, observers recorded the response of other colonial waders to the presence and actions of management personnel. During DCCO management activities, 59 -60% of observed waders remained on their nests. Of the waders that did flush from the nest 80% did so when the teams were ≤ 30 meters from the nest. Over 65% of the waders returned when the teams were ≤ 20 meters from the nest. Time away from the nest was 10 ± 1.5 minutes in 2006 and 7.4 + 0.7 minutes in 2007 (Ohio Division of Wildlife, unpublished data). At West Sister Island, Great Blue Heron and Great Egret population estimates increased by 37 and 29%, respectively from 2005 (prior to CDM) to 2006 (1st year of CDM). On Green Island, Great Blue Heron population estimates decreased by 32%, but since the nest surveys were conducted 2 weeks later than the previous year, nests may have been missed due to increased foliage density and lowered visibility (Dave Sherman, ODW, personal communication). Annual West Sister Island nesting survey results from 2007 showed that Great Blue Heron, Great Egret, and DCCO nest numbers decreased approximately 25% from 2007 while Black-crowned Night-Heron nests decreased 4%. Site observations indicate that a severe thunderstorm with high winds was mainly responsible for the 2007 decreases in the Great Blue Herons, egrets, and possibly DCCOs. The Black-crowned Night-Heron nests were not as severely affected likely because they nest later in the year and had greater opportunity for renesting. Despite the decreases, the number of Great Egret and Great Blue Heron nests counted in 2007 was within 10% of the mean nest estimates for the previous 5 years. Great Egret nests remained stable at Turning Point Island. Black-crowned Night-Heron nest numbers at Turning Point Island increased by 50% in 2006 and decreased by 40% in 2007, perhaps demonstrating the variability of Night-Heron nest numbers at that location. Great Blue Heron numbers at Green Island decreased 30% in 2006, but the 2007 survey showed a 50% increase for this species on Green Island.

A study on Common Tern response to CDM and research disturbance conducted at Lake Oneida, NY (Mattison 2006), documented that the greatest levels of disturbance in the

colony were from human activity within the colony, including researchers monitoring tern reproduction and banding birds and a WS crew that visited the island to install mylar tape on one end of the island to deter nesting DCCOs. However, the tape itself did not appear to be particularly alarming to the terns. Noise disturbance from other locations on the lake including that from the use of pyrotechnics ("screamers" and "bangers") was less disruptive than visits to the colony, and birds appeared to quickly acclimate to the use of the devices. The exploding type "bangers" were less disruptive to the terns than the "screamers". Terns did not leave nests during the 13 instances of "banger" use within observable distance of the colony, but did lift off nests in three of the seven instances when "screamers" were used from similar distances.

At colonies which support a high number of co-nesting gulls, predation by gulls has become an increasing concern for CDM projects. Human activities including research, population surveys and CDM actions which result in adult birds leaving their nests create opportunities for gulls to prey on eggs and chicks of other gulls and co-nesting species. Efforts to reduce gull predation include working at the colonies at night to reduce likelihood that adults will move off nests, minimizing the number of site visits, conducting CDM later in the season when gulls have eggs and chicks and are less likely to leave their own young in order to prey on other nests, and maintaining a sufficient distance from non-target birds to prevent or reduce incidence of adults flushing from nests. While this type of disturbance does result in the loss of eggs and chicks, many of the species including gulls and DCCOs may renest and can successfully fledge young (LLBO 2007).

Movement of DCCOs from treatment sites to untreated locations or new locations where they may also cause problems is a potential adverse impact of CDM programs. A CDM program involving egg oiling that was conducted at Young Island in Lake Champlain appeared to result in an increase in the number of DCCOs at a nearby untreated colony (Four Brothers Colony). There also appeared to be an increase in DCCO attempts to colonize new sites. Duerr et al. (2007) evaluated factors impacting DCCO emigration rates at these sites. DCCO emigration from the treated island was greatest in the year when gulls preyed on eggs that were left unprotected by adults during egg oiling, and was lowest and relatively minimal during the year when eggs were oiled at night to prevent problems with gull predation. The authors hypothesized that difference may have been attributable to the scale of the impact of the different types of disturbance and the way DCCOs obtain information on future nesting sites. Gull predation had a colony wide effect on treated and untreated sites because adults were flushed from the nests in both locations as part of the study protocol. Predation problems may indicate that the DCCOs had selected a poor quality colony and that the appropriate response would be to leave the colony. Egg oiling with low gull predation had a more localized impact. DCCOs may use information from nearby untreated locations to indicate that they had selected a poor site within the colony or made a poor selection of a mate. Neither perception would be anticipated to be as likely to result in emigration from the island as colony-wide predation problems. Based on the study findings, the authors concluded that an egg-oiling program which managed gull predation and left at least a portion of the birds to successfully nest (as a cue to DCCOs that the site could be successful) would likely still be an effective

means of reducing local DCCO problems with minimal impacts on nearby colonies and uncolonized sites from DCCO emigration. Additional research is still needed to further test this hypothesis and to determine the proportion of nests that must be left in order to minimize issues with DCCO relocation to new sites.

While the study by Duerr et al. (2007) provides valuable information on factors influencing DCCO emigration rates, care must be taken when applying this information to sites in Michigan. Factors other than CDM may also influence DCCO emigration rates. Even if no CDM is conducted at existing colonies, bird banding data indicate that at least some movement of DCCOs among colonies is likely. Observations by Stromberg et al. (2008 unpub. report) at Spider Island, Wisconsin, in 2003 indicate that an intensive research program conducted early in the year may have caused some birds to abandon the site. Cameras set to monitor colonies on islands in Michigan indicate that colonies may also be disturbed by curious people visiting the islands despite the fact that many colony locations are officially closed to public access. Impact of these informal visits is unclear, but could be substantial because untrained individuals would not be likely to take the same precautions to minimize disturbance as trained biologists. Even the choice to not manage DCCOs in a colony has consequences which may cause DCCOs to move to new sites. DCCOs may shift from older unmanaged colonies to newer sites if resources (e.g., food, nesting material, and space for nesting) are more readily available at the new location. Public frustration with perceived lack of agency action has occasionally resulted in illegal remedies for DCCO conflicts including introduction of raccoons and hogs on colony islands. These remedies do not resolve the problem because all the DCCOs abandon the site and move to new locations where they may cause new problems or make existing conflicts worse. Consequently, the extent to which CDM efforts would contribute to existing disturbance and DCCO emigration rates is likely variable. Risks of emigration and colonization of new sites may be reduced if efforts are made to minimize impacts of gull predation and to time CDM efforts so that they coincide with research and monitoring projects.

One strategy which may be used to remove DCCOs while minimizing impacts on co-nesting waterbirds is to shoot DCCOs from boats or other nearby off-colony locations within the major approach and departure paths for birds using the colony. This method has also been used to reduce the number of birds foraging in areas where local colonies may not be accessed for CDM. In situations where access to a Great Lakes island colony site is not permitted, shooting will not be conducted within 500 yards of the shore.

Successful, professional CDM programs require a continual evaluation of impacts on nontarget species and modification to meet the specific needs and concerns for each site. For example, conducting CDM activities at night is one means of reducing difficulties with gull predation, but this method cannot be used at sites with nesting Common Terns because the terns will leave their nests and may not return for hours, which increases the risks to tern eggs and chicks (USDA 2005). The agencies work together and with agencies conducting CDM in other States to exchange information on the environmental impacts of CDM and ways of minimizing CDM impacts on nontarget species.

Given the data available, the SOPs established for the protection of non-target species, and the fact that the agencies will continue to evaluate impacts on non-target species and adjust management techniques accordingly, the use of frightening devices proposed in this alternative will have a low magnitude of impact on non-target species.

Beneficial Impacts on Non-target Species (Not Threatened or Endangered Species)

The PRDO was established to allow for CDM activities specifically designed to benefit nontarget species including co-nesting birds (e.g., Black-crowned Night-Heron, which are a species of special concern in USFWS Region 3), vegetation and fisheries. CDM programs can benefit wildlife species that are adversely impacted by DCCO predation, competition with DCCOs for habitat, and/or the impact of large DCCO colonies on vegetation. Experience by the lead and cooperating agencies indicates that an integrated CDM program as would be permitted under this alternative would have the greatest potential to successfully reduce adverse DCCO impacts on other plant, wildlife and fish species.

Threatened and Endangered Species

Special efforts are made to avoid jeopardizing T&E species through biological evaluations of the potential risks and the establishment of special restrictions or mitigation measures to minimize or negate any risks. Standard Operating Procedures to avoid adverse T&E effects are described in Chapter 3.

Federally-listed Species. A summary of Federally-listed T&E species in Michigan is provided in Appendix C. The USFWS completed an Intra-Service Section 7 Biological Evaluation on the management of DCCOs in the U.S. for the FEIS (USFWS 2003). The only species in the national consultation that could potentially be impacted by CDM actions in Michigan are Piping Plovers and Bald Eagles (USFWS 2003). Bald eagles have subsequently been removed from the Federal list of threatened and endangered species and are currently protected under the Bald and Golden Eagle Protection Act and the MBTA. To facilitate compliance with the Eagle Protection Act, the agencies would continue to implement the eagle protections specified in the FEIS and the PRDO regulations.

There are three federally-listed plant species in Michigan which were not addressed in the EIS that may be found in some areas where the agencies are working to prevent establishment of new DCCO colonies: Pitcher's thistle, Houghton's goldenrod and dwarf lake iris. An additional Intra-Service Section 7 consultation is being completed specific to CDM actions in Michigan. All recommendations from the Section 7 consultation will be incorporated into the CDM activities conducted by the agencies. The following is a list of conservation measures to reduce risks of adverse impacts on federally-listed species applicable to CDM in Michigan:

(i) All personnel conducting CDM will be trained in the identification of Piping Plovers and will check treatment areas prior to and during treatment for the presence of Piping Plovers.

(ii) Discharge/use of firearms to kill or harass DCCOs or use of other harassment methods are allowed if the control activities will occur more than 1,000 feet from active Piping Plover nests or colonies and migrating plovers.

(ii) Other control activities such as egg oiling, cervical dislocation, CO_2 asphyxiation, egg destruction, or nest destruction are allowed if these activities occur more than 500 feet from active Piping Plover nests or colonies and migrating plovers.

(iii) To ensure adequate protection of Piping Plovers, any agency or its agents who plan to implement control activities that may affect areas designated as Piping Plover critical habitat in the Great Lakes Region are to make contact with the appropriate Regional Migratory Bird Permit Office prior to implementing control activities.

(iv) Before going into a new site to conduct work to prevent colonization by nesting DCCOs, the agencies will consult with the USFWS regarding the occurrence of dwarf lake iris Houghton's goldenrod, and Pitcher's thistle at the site. When possible, areas supporting these species will be avoided. Agency staff will be trained in the identification of these species and will be made aware of the occurrence of these species at the site in order to avoid accidental damage by trampling.

As documented in Section 1.5.4, colonization by DCCOs can result in substantial shifts in the vegetative community. Efforts to manage DCCO colonization of sites where federally-listed plant and animal species occur may have beneficial impacts on these species. Given these protective measures, the lead and cooperating agencies have determined that Alternative 1 may affect but will not adversely affect any Federally-listed T&E species or critical habitat in Michigan.

State-listed Species. The State list of endangered and threatened species is provided in Appendix D. The lead and cooperating agencies have determined that CDM has the potential to affect the Piping Plover, Trumpeter Swan, Common Loon, Common Tern, Forster's Tern, and Caspian Tern and Lake Huron locust. Trampling associated with CDM activities intended to prevent DCCO colonization of new sites could also state-listed plants. Prior to any control action, the lead and cooperating agencies will consult with the MDNRE to ensure that no actions taken under this plan will adversely affect Michigan's State-listed threatened and endangered species. All recommendations from the MDNRE for the protection of State-listed species will be incorporated in the program activities. When possible, areas supporting these species will be avoided. Agency staff will be trained in the identification of State-listed plant species and will be made aware of the occurrence of these species at the site in order to avoid accidental damage by trampling. Actions to minimize risks to State-listed are described above for species that are also federally-listed and in the section on SOPs in Chapter 3

Removal or substantial reductions in the size of a DCCO colony may result in the transition of vegetation on the site to later seral stages of vegetational succession (e.g., increased trees and shrubs). While these changes may be beneficial to some species they would not be beneficial to species which require sparse vegetation or open areas for nesting (Caspian and Common Terns). The impact of DCCO removal on vegetation will vary from site to site. Some areas did not have trees or shrubs prior to their use by DCCOs and DCCO removal is not likely to impact habitat available for species such as terns. Similarly, some areas have high numbers of other colonial waterbirds (e.g., gulls, and the fecal accumulations from other species on the site are likely to continue to suppress vegetation in the absence of DCCOs. Wildlife Services and the Tribes will work with the MDNR to ensure that CDM actions do not have an adverse impact on nesting terns.

CDM actions intended to protect vegetation are likely to have a beneficial impact on State-listed plants and may also benefit State-listed bird species by virtue of protecting their habitat. The lead and cooperating agencies conclude that with the mitigation measures described here and in Chapter 3, this alternative will not adversely impact State-listed species.

Alternative 2 – Only Nonlethal CDM by Federal Agencies

Adverse Impacts on Non-target Species Including Threatened and Endangered Species. Under this alternative, the Federal agencies would be restricted to the use of nonlethal CDM techniques. Consequently, there would be no risks from Federal use of lethal CDM techniques. Lethal CDM techniques would not be permitted on Federal lands. The USFWS would also not issue MBPs for DCCO management. However, under the PRDO the State and tribes have the authority to take up to 10% of local breeding population of DCCOs, with the consent of the land owner/manager, in order to protect public resources on non-Federal lands (USFWS 2003). The MDNRE and tribes have indicated that they would use this authority. All provisions for the protection of State and federally-listed T&E species would remain the same as for Alternative 1.

The primary risk to non-target species from the use of nonlethal techniques is the risk of disturbing co-nesting species during harassment, nest destruction and other nonlethal CDM activities as described for Alternative 1. On Federal lands, the limitations on methods which may be used will likely require more hours of nonlethal CDM to achieve the same management objectives than Alternatives 1, 3 and 4. However, any impacts associated with egg oiling and shooting will be eliminated. Given the tendency of most bird species to habituate to frightening devices, it may not be possible to achieve the same level of CDM as with Alternatives 1, 3 and 4.

On non-Federal lands, impacts of egg oiling and shooting will be similar to Alternative 1, but lower in magnitude because lethal removal of birds will be limited to 10% of the local breeding population. The PRDO does not establish any thresholds for the use of egg oiling. Consequently, use of egg oiling by non-Federal entities under the PRDO will not change under this alternative. The increase in time and labor required per year to achieve

management objectives may increase the risk of disturbing co-nesting species over that expected for Alternatives 1, 3 and 4.

The lead and cooperating agencies will continue to utilize SOPs for CDM activities as discussed in Chapter 3 and for Alternative 1 in order to reduce potential impacts on listed (Federal and State) and non-listed species. Therefore, risks associated with use of lethal CDM alternatives under this alternative would be similar to Alternative 1, but overall impact would be lower than Alternative 1 because less lethal CDM would be conducted.

Beneficial Impacts on Non-target Species Including Threatened and Endangered Species. This alternative would only allow Federal agencies to use nonlethal techniques to protect public resources. The MDNRE and tribes would have limited access to lethal methods for implementation of the PRDO on non-Federal lands. Management objectives would remain the same for this alternative as for Alternative 1. However, as discussed above, the agencies may not be able to achieve CDM objectives under the restrictions of this alternative. For example, use of lethal methods such as egg destruction to prevent the colonization of new sites would not be available on Federal lands under this alternative. If so, potential beneficial impacts on nontarget species will be reduced. Lack of access to this method could be a serious impediment to efforts to protect vegetation and colonial nesting species at the NWRs. Success in protecting public resources may be more likely on non-Federal lands where the MDNRE and tribes would have limited access to lethal CDM techniques. However, it is likely to take longer for the MDNRE and tribes to achieve management objectives than under Alternatives 1, 3 and 4.

Alternative 3 – Adaptive Integrated Cormorant Damage Management

Adverse Impacts on Non-target Species Including Threatened and Endangered Species from CDM. This alternative differs from Alternative 1 only in the intensity and magnitude of the work to be conducted. Methods to be used and their risks to nontarget species are the same as for Alternative 1. All provisions for the protection of State and federally-listed T&E species would also remain the same as for Alternative 1.

Under this alternative, more CDM will be conducted and more DCCOs will be lethally removed than for Alternative 1. The increase in the intensity of CDM may result in more instances of DCCOs changing nest sites in response to CDM. Specifically, there may be more incidents of DCCOs attempting to colonize new sites and an increase in DCCO numbers at sites where CDM is not conducted. This movement could lead to new or increased damage at existing sites or threats to vegetation and wildlife at new locations. However, movements of DCCOs are not always problematical. Smaller DCCO colonies over a wider area may cause fewer problems than the original colony which was treated. Similarly, the size of some existing colonies may be able to increase, at least to a limited extent, without a substantial increase in damage or conflicts. The agencies and tribes would monitor the DCCO population and DCCO impacts and adjust to any changes in the damage management situation.

The increased level of CDM also has the potential for greater adverse impacts on nontarget species from disturbance of nesting birds than Alternative 1. Methods for addressing this issue are as described for Alternative 1. Increasing use of off-shore shooting may also be a means of minimizing disruption of nesting nontarget species while increasing DCCO removal.

Cumulative impacts of individual damage management actions resulting in annual DCCO take in excess of 20,000 birds (maximum take for Alternative 4) per year should result in reductions in the State DCCO population. In time, the population would be reduced to the point where limits on take imposed to maintain no less than 5,000 breeding pairs resulted in maximum allowed annual take of 20,000 birds or less. At that time, impacts of this alternative on nontarget species would be identical to Alternative 4.

Beneficial Impacts on Non-target Species Including Threatened and Endangered Species. The PRDO was established to allow for CDM activities specifically designed to benefit nontarget species including co-nesting birds (e.g., Black-crowned Night-Heron, which are a species of special concern in USFWS Region 3), vegetation and fisheries. CDM programs can benefit wildlife species that are adversely impacted by DCCO predation, competition with DCCOs for habitat, and/or the impact of large DCCO colonies on vegetation. As with Alternative 1, use of an integrated management strategy which includes the use of the full range of legally available CDM methods best enables managers to develop site-specific programs to reduce damage while minimizing risk of adverse impacts on the human environment.

This alternative would allow for full implementation of the MDNRE DCCO adaptive management objectives described in 1.5.8 and 1.3. The level of DCCO take permitted is sufficient for the management objectives to be fully implemented at all sites simultaneously. The objectives were set by the MDNRE primarily for the enhancement of fishery resources. Implementation of this alternative would have the greatest likelihood of benefitting fishery resources in those situations where DCCO predation is a primary factor limiting the population while still preserving the viability of the State DCCO population. The proposed monitoring would enable fisheries biologists to determine if the CDM is having the desired effect on the fishery in the target areas and improve existing knowledge regarding the impacts of DCCOs on Great Lakes fisheries.

Alternative 4 - Adaptive Integrated Cormorant Damage Management with Limited Annual Take (Proposed Action)

Adverse Impacts on Non-target Species Including Threatened and Endangered Species from CDM.

This alternative differs from Alternatives1 and 3 only in the intensity and magnitude of the work to be conducted. The total number of DCCOs which may be taken for CDM under this alternative is intermediate to Alternatives 1 and 3. Methods to be used and their risks to nontarget species are the same as for Alternatives 1 and 3. Risks of adverse impacts on nontarget species would be lower than for Alternative 3 in the initial years of

project implementation. However, cumulative impacts of individual damage management actions resulting in annual DCCO take in excess of 20,000 birds per year for Alternative 3 is expected to result in reductions in the State DCCO population. In time, the population would be reduced to the point where limits on take imposed to maintain no less than 5,000 breeding pairs resulted in maximum allowed annual take of 20,000 birds or less. At that time, impacts of Alternatives 3 and 4 on nontarget species would be identical.

Beneficial Impacts on Non-target Species Including Threatened and Endangered Species.

Beneficial impacts under this alternative are similar to Alternatives 1 and 3. Total take under this alternative would allow for the effective implementation of the adaptive management program proposed by the MDNRE for the enhancement of local fisheries (Sections 1.5.8 and 3.1). However, depending upon resource and take allocation, it may take longer to achieve desired local DCCO population levels and associated fishery impacts than under Alternative 3.

Alternative 5 - No Federal CDM

Adverse Impacts on Non-target Species Including Threatened and Endangered Species. Under this alternative, the Federal agencies would not participate in CDM and there would be no CDM on Federal lands. The USFWS would not issue MBPs and would not grant approval for PRDO projects proposing to take more than 10% of a local DCCO population.

The lack of any CDM on Federal lands could result in increases in DCCO populations at these locations through reproduction of the birds already using the site and birds which may move from treatment areas. The risk of this type of impact is greater for this alternative than for Alternative 2 where at least nonlethal methods could be used to manage DCCO populations on Federal lands. The increase in DCCO numbers may aggravate existing damage problems or result in the risk of adverse impacts on plants and animals at new colony sites.

As with Alternative 2, under the PRDO the State and tribes do have the authority to take up to 10% of a local breeding population of DCCOs on non-Federal lands, with the consent of the land owner/manager, in order to protect public resources (USFWS 2003). The MDNRE and tribes have indicated that they would use this authority. The State, tribes, local governments, landowners and their designated agents (e.g., private damage management businesses) could use nonlethal CDM techniques on non-Federal lands.

The amount of CDM that could be conducted would be much lower than for Alternative 1. Therefore, this alternative is likely to have a reduced level of risk to non-target species than the low level discussed for Alternative 1.

Beneficial Impacts on Non-target Species Including Threatened and Endangered Species. Management objectives for activities to protect wildlife and vegetation on non-Federal lands would be the same as all the other alternatives. The ability to achieve the management objectives will be limited by the restrictions on the number of DCCOs that can be taken using lethal methods, lack of assistance from WS, and further complicated by the lack of CDM on Federal lands. Cormorant damage management activities on non-Federal lands and the lack of CDM on the Federal lands is likely to exacerbate any adverse impacts of DCCOs on vegetation and other species of wildlife using the NWRs and National Park . Overall benefits to non-target species are lowest for this alternative.

4.1.3 Effects on Human Health and Safety

4.1.3.1 Effects on Human Health and Safety from CDM Methods

Alternative 1 - Integrated CDM Program, Including Implementation of the PRDO (No Action Alternative)

CDM methods that might raise safety concerns include shooting with firearms and harassment with pyrotechnics. Firearms and pyrotechnics would only be used by agency personnel, the tribes, and their designated agents who are trained and experienced in the safe and legal use of firearms. WS personnel regularly receive refresher safety training to keep them aware of safety concerns, and the other agencies and tribes have similar training requirements. There have been no accidents involving the use of firearms or pyrotechnics in which a member of the public was harmed by the lead or cooperating agencies. A formal risk assessment of WS' operational management methods found that when used in accordance with applicable laws, and WS regulations, policies and directives, risks to human safety were low (USDA 1997, Revised, Appendix P). Therefore, no adverse effects on human safety from use of these methods are expected. Agents acting under the authority of the lead and cooperating agencies will be informed and trained in the safe and proper use of CDM methods including the use of firearms.

Alternative 2 – Only Nonlethal CDM by Federal Agencies

Under this alternative, the CDM method that might raise safety concerns is harassment with pyrotechnics. Risks associated with these methods are identical to those for Alternative 1. However, there will likely be greater use of harassment techniques than for Alternative 1. However, given the training and experience of lead and cooperating agency personnel conducting CDM, risks to human health and safety are still anticipated to be very low.

Alternative 3 – Adaptive Integrated Cormorant Damage Management

This alternative differs from Alternatives 1 and 4 only in the extent of the CDM which may be conducted. Methods to be used and the areas where CDM may be conducted are identical to Alternative 1. Risks to human health and safety from the use of CDM will be slightly higher than Alternative1, but still very low.

Alternative 4 - Adaptive Integrated Cormorant Damage Management with Limited Annual Take (Proposed Action)

This alternative differs from Alternative 1and 3 only in the extent of the CDM which may be conducted. Methods to be used and the areas where CDM may be conducted are identical to Alternative 1. Risks to human health and safety from the use of CDM will be slightly higher than Alternative 1, but still very low.

Alternative 5 - No Federal CDM

Under Alternative 4, the Federal agencies would not be involved in CDM activities in Michigan so there would be no risks from their use of firearms or pyrotechnics. The State, tribes, local governments, landowners and their designated agents (e.g., private damage management businesses) could still use pyrotechnics or firearms in CDM programs, and this activity would likely occur to a greater extent in the absence of assistance from the lead and cooperating agencies. Hazards to humans and property would vary depending upon the training and experience of the individuals conducting CDM. Risks could be greater under this alternative if personnel conducting CDM activities have less training and experience than personnel with the Federal agencies. The Federal agencies would not be able to provide advice and information on the safe and proper use of these methods so risks may be greater than Alternative 1. However, advice and training would still be available from the State. Overall risks to human health and safety are still likely to be low, but may be higher than with Alternative 1.

The CDM methods to be used are identical to Alternative 1, but there would be slightly less CDM under this Alternative than under Alternative 1. This is not anticipated to result in a substantial change in the extremely low risk to human health and safety anticipated for Alternative 1.

4.1.3.2 Effects on Human Health and Safety from Not Conducting CDM

Alternative 1 - Integrated CDM Program, Including Implementation of the PRDO (Proposed Action/ No Action Alternative)

People are concerned with potential injury, and loss of human life resulting from DCCO strikes with aircraft (Sections 1.5.6). An Integrated CDM strategy combining lethal and nonlethal methods has the greatest potential to successfully reduce risks to aviation and human safety. In some situations, the implementation of nonlethal controls such as harassment could actually increase the risk of human safety problems at other sites by causing the birds to move to sites not previously affected. In such cases, lethal removal of the birds may actually be the best alternative from the standpoint of overall human safety concerns. If the lead and cooperating agencies are providing direct operational assistance in relocating DCCOs, coordination with local authorities will be conducted to assure they do not reestablish in other undesirable locations.

Alternative 2 – Only Nonlethal CDM by Federal Agencies

Under this alternative, the lead and cooperating agencies would be restricted to implementing and recommending only nonlethal CDM methods. As discussed in Chapter 3, the USFWS would not be able to issue MBPs for the use of lethal techniques to address risks to human safety from DCCOs. This alternative is unlikely to be as effective in reducing DCCO risks to human safety because there are some situations at airports where nonlethal techniques may not provide a sufficiently rapid or controlled response from the target bird(s) or where nonlethal techniques are not effective because the target animal has habituated to the frightening stimulus. Overall risks to human safety would be slightly greater under this alternative than Alternative 1.

Alternative 3 – Adaptive Integrated Cormorant Damage Management

Activities conducted to reduce risks of DCCO strikes to aircraft will not differ between this Alternative and Alternative 1. Impacts on human safety would not differ between the two alternatives.

Alternative 4 - Adaptive Integrated Cormorant Damage Management with Limited Annual Take (Proposed Action)

Activities conducted to reduce risks of DCCO strikes to aircraft will not differ between this Alternative and Alternative 1. Impacts on human safety would not differ between the two alternatives.

Alternative 5 - No Federal CDM

Under this alternative, the lead and cooperating agencies would not participate in CDM. The USFWS would not be able to issue MBPs for the use of lethal techniques to address risks to human safety from DCCOs. Cormorant damage management by entities other than the lead and cooperating agencies would be limited to nonlethal techniques. Resource owners and managers would be responsible for developing and implementing their own CDM program. Efforts by these individuals to reduce or prevent conflicts could result in less experienced persons implementing control methods, therefore leading to a greater potential to not reduce DCCO hazards, than under the proposed action. As discussed for Alternative 2, there may be some situations where nonlethal techniques are not adequate to reduce the safety risk. In other situations the implementation of nonlethal controls such as harassment could actually increase the risk of problems at other sites by causing the birds to move to sites not previously affected. Under this alternative, problems could increase if affected individuals were unable to find and implement effective means of controlling DCCOs that cause damage. Overall risks to human safety would be greatest under this alternative.

4.1.4 Effects on Aesthetic Values

Alternative 1 - Integrated CDM Program, Including Implementation of the PRDO (Proposed Action/ No Action Alternative)

Some people who routinely view individual birds or flocks of DCCOs would likely be disturbed by removal of such birds. Some individuals are morally or philosophically opposed to the killing of any birds and may feel distress at the knowledge that lethal CDM methods can be or have been used at a location will compromise their enjoyment of that site. The lead and cooperating agencies are aware of such concerns and take this into consideration when planning CDM activities. Preference is given to nonlethal methods where practical and effective.

Lethal control actions would generally be restricted to specific colonies associated with damage problems and will not target the statewide DCCO population. Although a minimum population threshold of 100 breeding pairs has been established for local breeding populations, in most instances, actual numbers are likely to be much higher. The minimum population numbers do not include young of the year, or non-reproductive birds so the total number of birds at the sites will be higher than indicated by the number of nests. The opportunity to view large DCCO colonies would still be available. In most cases, CDM activities will reduce but not eliminate individual DCCO colonies. Lethal removal of DCCOs from airports should not affect the public's enjoyment of the aesthetics of the environment since airport properties are closed to public access and are managed to minimize most wildlife attractants.

In some instances, large roosting or nesting populations of DCCOs can destroy habitat and displace other nesting birds, reducing the aesthetic value for some people. This alternative would reduce negative impacts caused by DCCOs on wildlife species and their habitats including colonial waterbirds co-nesting with DCCOs. The enjoyment of recreational fishing and the opportunity to consume the fish caught are positive aesthetic values for some people. This alternative would enable agencies to reduce negative impacts caused by DCCOs to fish and wildlife species and their habitats.

Alternative 2 – Only Nonlethal CDM by Federal Agencies

Under this alternative the Federal agencies would only use and authorize nonlethal CDM techniques. The only lethal CDM that could be conducted under this alternative would be by the State and tribes under the PRDO and would only involve take of up to 10% of the local breeding population. People who oppose lethal control of wildlife by government but are tolerant of government involvement in nonlethal wildlife damage management would favor this alternative. Persons who are concerned about the fate of individual wild birds would be less affected by the death of individual birds under this alternative than under Alternatives 1 and 5 because fewer birds would be taken. However, these individuals may still oppose dispersal of certain birds. The ability of individuals to enjoy viewing DCCOs would not differ from Alternative 1 in that the objectives for the reduction in the number of birds nesting at sites would be the same. However, the fate of some of the birds would be different since there would be much less use of lethal CDM techniques.

This alternative would allow the Federal agencies to conduct work under the PRDO. This alternative would reduce the negative aesthetic impacts of DCCOs on birds, vegetation and fisheries resources if nonlethal methods are effective in reducing such damage to acceptable levels. However, as stated in Section 4.1.2, nonlethal methods are not always as effective as strategies which use lethal and nonlethal methods. However, under the PRDO the State and tribes have the authority to take up to 10% of local breeding population of DCCOs, with the consent of the land owner/manager, in order to protect public resources on non-Federal lands (USFWS 2003). The MDNRE and tribes have indicated that they would use this authority. Limited access to lethal methods may improve the overall efficacy of CDM at non-Federal sites and help to reduce negative impacts of DCCOs on birds, vegetation and fishery resources. In general, this alternative is not anticipated to be as effective in reducing negative impacts of DCCOs on non-target species as Alternative 1.

Alternative 3 – Only Technical Assistance from Federal Agencies

The rate of reduction in local breeding populations targeted for CDM would be greatest under this alternative. The cumulative impact of individual actions under this alternative would likely result in a substantial reduction in the State DCCO population. Individuals who enjoy viewing large DCCO colonies may be dismayed by the magnitude of the reduction. However, it is likely that some colonies on Federal and/or private lands may remain closed to CDM. Although shooting offshore may result in some reduction in the local colony, arrival of new birds from surrounding areas would be expected to counteract some of the loss. Opportunities to view large DCCO colonies are likely to remain at these locations.

The reductions in local breeding populations are likely to have the cumulative impact of reducing the State DCCO population to 5,000 – 12,500 breeding pairs during the breeding season. Assuming one juvenile or non-breeding bird per breeding pair, the population would range from 15,000 to 37,500 birds and would be higher when migrant birds are moving through the State. Further, DCCO colonies are likely to remain in most treatment areas except those groups on man-made structures. Consequently, DCCO viewing opportunities would continue to be available at most colony sites in the State.

In situations where DCCOs are having a negative impact on fish, vegetation or co-nesting birds, this alternative would provide the fastest mechanism for reducing local breeding populations. Individuals who feel their aesthetic enjoyment of an area has been negatively impacted by DCCOs would likely favor this alternative.

Alternative 4 - Adaptive Integrated Cormorant Damage Management with Limited Annual Take (Proposed Action)

The rate of reduction in local breeding populations targeted for CDM would be more gradual than under Alternative 3, and faster than might occur under Alternative 1. The cumulative impact of individual actions under this alternative would likely result

in a substantial reduction in the State DCCO population similar to that described for Alternative 3. Individuals who enjoy viewing large DCCO colonies would likely be unhappy with the magnitude and rate of the reduction. As with Alternative 3, it is likely that some colonies on Federal and/or private lands may remain closed to CDM, and opportunities to view large DCCO colonies will remain at these locations. As noted for alternative 3, the DCCO population is likely to range between 37,500 and 15,000 birds during the breeding season with more birds available for viewing during the spring and fall migration.

In situations where DCCOs are having a negative impact on fish, vegetation or co-nesting birds, this alternative would provide the fastest mechanism for reducing local breeding populations. Individuals who feel their aesthetic enjoyment of an area has been negatively impacted by DCCOs would likely prefer this alternative to alternatives 1, 2 and 5 but would not consider it as desirable as Alternative 3.

Alternative 5 - No Federal CDM

Under this alternative, the Federal agencies would not conduct or permit any CDM in Michigan. No CDM would be conducted on Federal lands. People opposed to government involvement in CDM and the use of CDM on Federal lands would favor this alternative. People concerned about the welfare of individual birds or the use of lethal CDM would prefer this alternative over Alternatives 1 and 5 because the lethal removal of DCCOs would be lower. However, lethal take under the PRDO could still be implemented by the MDNRE and tribes, so long as lethal take does not exceed 10% of the local breeding DCCO population. Non-Federal entities could still use nonlethal techniques and some individuals might oppose dispersal of certain birds.

Under this alternative, the lack of Federal operational assistance in reducing negative DCCO impacts on vegetation, birds, fish and property could result in an increase in adverse affects on aesthetic values. The PRDO would only be implemented by MDNRE and tribes, and their actions would be limited to take of up to 10% of the local DCCO population on non-Federal lands. There would be no CDM conducted on the NWRs so any adverse impacts on aesthetic values associated with birds using the NWRs would not be addressed. Beneficial impacts of this alternative on the opportunity to enjoy vegetation, birds, or fisheries resources that are negatively affected will be much lower than Alternative 1.

4.1.5 Humaneness and Animal Welfare Concerns of the Methods Used

Alternative 1 - Integrated CDM Program, Including Implementation of the PRDO (Proposed Action/ No Action Alternative)

Under this alternative, lethal methods viewed by some persons as inhumane would be used in CDM. Shooting, when performed by experienced professionals, usually results in a quick death for target birds. Occasionally, however, some birds are initially wounded and must be shot a second time or must be caught by hand and then

dispatched or euthanized. Some persons would view shooting as inhumane. Some people may also consider killing embryos via egg oiling, egg addling, or egg destruction as inhumane but this technique is generally viewed as preferable to killing juvenile (hatched) or adult birds.

Occasionally, DCCOs captured alive would be euthanized. The most common method of euthanasia would be by decapitation, cervical dislocation or CO_2 gas. These methods are described and approved by AVMA as acceptable euthanasia methods (Beaver et al. 2001).

This alternative includes shooting birds during the breeding season. There has been some concern regarding the impacts of shooting birds off-colony on offspring which may be left at the nest. It is difficult to ascertain whether birds shot off colony are nesting or are non-reproductive individuals, or to know if both members of a pair have been removed. In areas where egg oiling has been used to treat all or almost all of the eggs in a colony, the risk of orphaning young is very low. However, given the distances DCCOs travel to forage, the origin of birds shot off colony is difficult to determine. The agencies and tribes strive to conduct DCCO removal before most eggs hatch and after most young have left the nest (fledge). Wildlife Services is experimenting with a 6-week moratorium on shooting timed to correspond to the period of peak hatching to minimize potential risks to juvenile birds. The moratorium may not be implemented in areas where the birds shot are highly likely to be from colonies where egg oiling has been conducted. In these colonies, almost none of the eggs hatch and risks to young are minimal. The agencies are currently interested in investigating and developing additional strategies for minimizing potential impacts on chicks.

WS has improved the selectivity and humaneness of management techniques through research and development. Research is continuing to bring new findings and products into practical use. Until new findings and products are found practical, a certain amount of animal suffering could occur when some CDM methods are used in situations where nonlethal damage management methods are not practical or effective.

Personnel with the lead and cooperating agencies are trained, experienced and professional in their use of management methods so that they are as humane as possible under the constraints of current technology, workforce and funding. Mitigation measures/SOPs used to maximize humaneness are listed in Chapter 3.

Alternative 2 – Only Nonlethal CDM by Federal Agencies

Under this alternative, lethal methods viewed as inhumane by some persons would not be used or permitted by the Federal agencies. WS would not conduct the site evaluations and complete the WS form 37s necessary for USFWS issuance of MBPs. No lethal CDM could be conducted on Federal land.

The MDNRE and tribes would be able to use lethal methods under the PRDO so long as lethal take did not exceed 10% of the local breeding population. The number of DCCOs to be lethally removed would be lower, so it might be possible to do all removals prior to or after the majority of eggs hatch. Confining lethal removal of birds to the period before most chicks have hatched and after most young have left the nest (fledged) would minimize risk of possible adverse impacts on chicks.

In general, individuals who consider the use of lethal CDM methods inhumane would find this alternative preferable to Alternative 1. However, there would still be some objections because the use of lethal methods would not be eliminated.

Alternative 3 – Adaptive Integrated Cormorant Damage Management

The methods used for CDM under this alternative are identical to those that would be used under Alternative 1. Humaneness issues for this alternative are similar to those for Alternative 1. The primary difference is that the magnitude of the lethal DCCO removal permitted under this alternative would be substantially greater than would occur under Alternative 1. The cumulative impact of the individual management actions resulting in annual take in excess of 20,000 birds per year would be expected to reduce the State DCCO population. Individual damage management actions would eventually reduce the State DCCO population to the point where the limit on take imposed to maintain no less than 5,000 breeding pairs would result in maximum allowed annual take of 20,000 birds or less. At that time, impacts of Alternatives 3 and 4 on the DCCO population would be identical.

Resource availability (e.g., equipment, staff) is sufficiently limited that not all work proposed under this alternative may be done during periods when risks to dependent young are low. Pressure to shoot during the 6-week moratorium or to develop alternate strategies for minimizing impacts on chicks would be greatest for this alternative.

Individuals concerned about the welfare of individual DCCOs and opposed to use of lethal methods for wildlife damage management would be most strongly opposed to this alternative.

Alternative 4 - Adaptive Integrated Cormorant Damage Management with Limited Annual Take (Proposed Action)

The methods used for CDM under this alternative are identical to those that would be used under Alternative 1. Humaneness issues for this alternative are similar to those for Alternative 1. The primary difference is that the magnitude of the lethal DCCO removal permitted under this alternative would be intermediate to that proposed for Alternatives 1 and 3, at least for the early years of program implementation. Cumulative take in excess of 20,000 birds per year which could occur under Alternative 3 would be expected to reduce the State DCCO population. The State DCCO population would eventually be reduced to the point where the limit on take

imposed to maintain no less than 5,000 breeding pairs resulted in maximum allowed annual take of 20,000 birds or less. At that time, impacts of Alternatives 3 and 4 would be identical.

Given current resources, it would be difficult for agencies and tribes to achieve the proposed level of CDM without shooting during the 6-week moratorium described for Alternative 1. Pressure to shoot during the 6-week moratorium and to develop alternate strategies for minimizing impacts on chicks would be greater than under Alternative 1 but less than Alternative 3.

Individuals concerned about the welfare of individual DCCOs and opposed to use of lethal methods for wildlife damage management will be more opposed to this alternative than Alternative 1, but may find it less objectionable than Alternative 3.

Alternative 5 - No Federal CDM

Under this alternative, the Federal agencies would not be involved in CDM. WS would not conduct the site evaluations and complete the WS form 37s necessary for USFWS issuance of MBPs. The USFWS would not issue MBPs or approve projects that propose the take of more than 10% of the local breeding DCCO population. No CDM would be conducted on Federal lands. Similar to Alternative 2, the MDNRE and tribes would be able to use nonlethal and lethal methods under the PRDO so long as lethal take does not exceed 10% of the local breeding DCCO colony. Individuals who believe lethal CDM techniques are inhumane are likely to perceive this alternative as being similar to Alternative 2 and more humane than Alternatives 1, 3 and 4.

4.2 CUMULATIVE IMPACTS

Cumulative impacts, as defined by CEQ (40 CFR 1508.7), are impacts to the environment that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts may result from individually minor, but collectively significant, actions taking place over time.

Under the alternatives presented, the agencies and tribes would address damage associated with DCCOs in a number of situations throughout the State. The agencies and tribes would coordinate their efforts and information on the impacts of their activities and the activities of other entities reporting to the USFWS to monitor the cumulative impacts of their actions. The potential cumulative impacts analyzed below could occur either as a result of agency and tribal CDM program activities over time, or as a result of the aggregate effects of those activities combined with the activities of other agencies and individuals.

Cumulative Impacts on Wildlife Populations: As analyzed in Sections 4.1.1 the CDM proposed by the agencies and tribes will not jeopardize the State, regional, or national DCCO populations, although there will be reductions in local breeding populations and a cumulative

reduction in the State DCCO population. Population monitoring and the State minimum population threshold should help to insure that a viable DCCO population is maintained in the State. Cormorant damage management methods used or recommended by the lead and cooperating agencies together with impacts by other entities, will likely have no cumulative adverse effects on non-target wildlife populations although, depending on the alternative selected, unintentional (indirect) mortality of some individuals is possible. The intent and expected result of this program is to prevent the adverse impacts of high DCCO numbers on co-nesting colonial waterbirds and their habitat, fishery resources, property, and aircraft safety. The potential for beneficial impacts on vegetation, sensitive wildlife populations and populations of fee-swimming fish is greatest for Alternative 3 and then decreasingly less under Alternative 4, 1, 2, and 5.

Cumulative Impact Potential from CDM Methods: CDM methods used or recommended by the lead and cooperating agencies may include exclusion through use of various barriers, habitat modification of structures or vegetation, live trapping and euthanasia of birds, harassment of birds or bird flocks, nest and egg destruction, and shooting. Shotguns would only use shot that does not contain lead to prevent adverse impacts associated with lead in the environment. No cumulative adverse environmental effects are anticipated from implementation of these CDM methods.

4.3 SUMMARY

Under the Proposed Action, the lethal removal of DCCOs by the agencies and tribes would not have an adverse impact on the long-term sustainability of DCCO populations in Michigan, the Region or the United States, but some local and statewide reductions would occur. Given the SOPs for the protection of nontarget species in Chapter 3 and the lead and cooperating agencies' commitment to adhere to all USFWS and MDNRE recommendations and requirements for the protection of State and Federally-listed threatened and endangered species, the Proposed Action will not adversely impact nontarget species populations. No risk to public safety is expected when the State and tribes conduct or recommend CDM because trained and experienced wildlife biologists/specialists would be conducting the work and providing guidance (technical assistance) to others conducting CDM. Potential risks to public safety are slightly higher from persons who reject assistance and recommendations in Alternatives 1, 2, 3 and 4 and conduct their own CDM activities, and when no assistance is provided in Alternative 5. However, overall risks to public safety from the actions of entities other than the lead and cooperating agencies are anticipated to be very low.

Although some persons will likely be opposed to the lead and cooperating agencies conducting CDM activities on public and private lands within the State of Michigan, the analysis in this EA indicates that an Integrated CDM program will not result in cumulative adverse impacts on the quality of the human environment. Table 4-3 summarizes the expected impact of each of the alternatives on each of the issues.

Table 4-3. Summary of impacts of each of the alternatives on each of the issues related to CDM in Ohio.

Issues	*Alternative 1* *Integrated CDM Program Including PRDO (No Action)*	*Alternative 2* *Only Nonlethal CDM by Federal Agencies*	*Alternative 3* *Adaptive Integrated CDM*	*Alternative 4 Adaptive Integrated CDM with Limited Take (Proposed Action)*	*Alternative 5* *No CDM by Federal Agencies*
Effects on DCCO Populations	Low effect - reductions in local DCCO numbers would not significantly affect long-term sustainability of State, regional, and national populations.	Limited effect by Federal agencies. Nonlethal CDM on Federal lands. MDNRE and tribal removal of DCCOs for the protection of public resources would be lower than Alts. 1, 3 and 5. No other lethal CDM would be permitted.	Moderate effect – highest annual level of lethal removal of all alternatives. Reductions in local DCCO numbers would not significantly impact the long-term sustainability of State, regional and national populations.	Moderate effect – Annual level of lethal removal intermediate to Alternatives 1 and 3. Reductions in local DCCO numbers would not significantly impact the long-term sustainability of State, regional and national populations.	No effect by Federal agencies. No CDM on Federal Lands. MDNRE and tribal removal of DCCOs for the protection of public resources would be lower than Alts 1, 3 and 4 and equal to Alt. 2. No other lethal CDM would be permitted.
Effects on Other Wildlife Species, Including T&E Species	Low adverse effect - methods used by agencies and tribes would be highly selective with very little risk to non-target species. Specific measures to minimize impacts to T&E species. Benefits to species adversely impacted by DCCOs.	Low adverse effect - methods used by agencies and tribes would be highly selective with very little risk to non-target species. Specific measures to minimize impacts to T&E species. Benefits to species adversely impacted by DCCOs dependent upon efficacy of exclusive use of nonlethal methods on Federal lands and reduced use of lethal techniques at non-Federal sites.	Low adverse effect - methods used by agencies and tribes would be highly selective with very little risk to non-target species. Sight increase in impacts over Alternative 1 because of increased intensity of CDM. Specific measures to minimize impacts to T&E species. Greatest and most rapid benefits to species adversely impacted by DCCOs.	Low adverse effect - methods used by agencies and tribes would be highly selective with very little risk to non-target species. Impacts intermediate to Alternatives 1 and 3 because of increased CDM. Specific measures to minimize impacts to T&E species. Benefits to species adversely impacted by DCCOs similar to Alternative 3 but slower to achieve.	No effect by Federal agencies. Low adverse effect by MDNRE and tribes - methods used would be highly selective with very little risk to non-target species. Specific measures to minimize impacts to T&E species. Benefits to species adversely impacted by DCCOs dependent upon efficacy of nonlethal techniques and reduced use of lethal techniques at non-Federal sites. No benefit to species adversely impacted by DCCOs on Federal land. Problems on Federal land may be worse if DCCOs move to Federal lands with no CDM.

Issues	*Alternative 1* ***Integrated CDM Program Including PRDO (No Action)***	*Alternative 2* ***Only Nonlethal CDM by Federal Agencies***	*Alternative 3* ***Adaptive Integrated CDM***	*Alternative 4* ***Adaptive Integrated CDM with Limited Take (Proposed Action)***	*Alternative 5* ***No CDM by Federal Agencies***
Effects on Human Health and Safety	Negligible risk from methods used by agencies and tribes. Good probability of reducing hazards associated with DCCOs.	Negligible risk from methods used by lead and cooperating agencies. Risk from MDNRE and tribal use of lethal techniques less than low levels anticipated for Alts. 1 and 5. Less likely to reduce hazards associated with DCCOs than Alternatives 1, 3, and 5.	Negligible risk from methods used by agencies and tribes. Risks slightly higher than with Alternative 1 because of increased use of CDM but still very low. Probability of reducing hazards associated with DCCOs the same as Alternative 1.	Negligible risk from methods used by agencies and tribes. Risks slightly higher than with Alternative 1 because of increased use of CDM but still very low. Probability of reducing hazards associated with DCCOs the same as Alternative 1.	No risk from actions of Federal agencies. No CDM on Federal land. Risk from MDNRE and tribal use of lethal techniques less than low levels anticipated for Alts. 1 and 4. Less likely to reduce hazards associated with DCCOs than Alternatives 1 and 3 and 4.
Aesthetic Impacts	Low to moderate effect at local levels; Some local populations may be reduced. DCCO viewing opportunities would still be available Potential for localized benefits to those who enjoy public resources and private property that may be adversely impacted by DCCOs.	Low to moderate effect. Impact will depend on success of efforts to resolve DCCO problems with nonlethal techniques and success of limited MDNRE and tribal use of lethal CDM methods to protect public resources on non-Federal lands Localized benefits to those who enjoy public resources and private property that may be adversely impacted by DCCOs variable depending on efficacy of nonlethal techniques and MDNRE and tribal programs.	Moderate effect at local levels due to intensity of DCCO removal. DCCO viewing opportunities would still be available. Greatest and quickest benefits to those who enjoy public resources and private property that may be adversely impacted by DCCOs.	Moderate effect at local levels due to intensity of DCCO removal. Effects slower to occur but eventually of same magnitude as Alternative 3. DCCO viewing opportunities would still be available. Benefits to those who enjoy public resources and private property that may be adversely impacted by DCCOs slower to occur but eventually of same magnitude as Alternative 3.	No effect by Federal agencies. No CDM on Federal land. Impact of non-Federal entities will depend on success of efforts to relocate problem DCCOs with nonlethal techniques and success of limited MDNRE and tribal use of lethal CDM methods to protect public resources on non-Federal lands. Localized benefits to those who enjoy public resources and private property that may be adversely impacted by DCCOs on non Federal lands variable depending on efficacy of MDNRE efforts. No benefits to those who enjoy public resources adversely impacted by DCCOs on Federal land.

Issues	*Alternative 1* *Integrated CDM Program Including PRDO (No Action)*	*Alternative 2* *Only Nonlethal CDM by Federal Agencies*	*Alternative 3* *Adaptive Integrated CDM*	*Alternative 4 Adaptive Integrated CDM with Limited Take (Proposed Action)*	*Alternative 5* *No CDM by Federal Agencies*
Humaneness and Animal Welfare Concerns of Methods Used	Low to moderate effect - methods viewed as inhumane (lethal CDM methods) by some people would be used by lead and cooperating agencies.	Lower effect than Alt. 1 because only nonlethal methods would be used by entities other than MDNRE and Tribes. Use of lethal methods by MDNRE and tribes greatly reduced.	Moderate effect - methods viewed as inhumane (lethal CDM methods) by some people would be used by agencies and tribes. Highest lethal take of all Alternatives.	Moderate effect - methods viewed as inhumane (lethal CDM methods) by some people would be used by agencies and tribes. Annual lethal take intermediate to Alternatives 1 and 3.	No effect by Federal agencies. No CDM on Federal land. No use of lethal take by any entity other than MDNRE and tribes. Use of lethal methods by MDNRE and tribes greatly reduced.

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APPENDIX A

LIST OF SCIENTIFIC NAMES OF SPECIES MENTIONED IN TEXT

(Scientific names for state and federally-listed threatened and endangered species are provided in Appendices C& D)

BIRDS AND MAMMALS
American White Pelican (*Pelecanus erythrorhynchos*)
Bald Eagle (*Haliaeetus leucocephalus*)
Black-crowned Night-Heron (*Nycticorax nycticorax*)
Blue Jay (*Cyanocitta cristata*)
Caspian Tern (*Sterna caspia*)
Cattle Egret (*Bubulcus ibis*)
Common Loon (*Gavia immer*)
Common Tern (*Sterna hirundo*)
Crows (*Corvus* spp.)
Deer (*Odocoileus* spp.)
Double-crested Cormorant (*Phalacrocorax auritus*)
Forster's Tern (*Sterna forsteri)*
Golden Eagle (*Aquila chrysaetos*)
Great Black-backed Gull (*Larus marinus)*
Great Blue Heron (*Ardea herodias*)
Great Egret (*Ardea alba*)
Great Horned Owl ((*Bubo virginianus)*
Green Heron (*Butorides virescens)*
Herring Gull (*Larus argentatus*)
Magpie (*Pica* spp)
Mallard (*Anas platyrhynchos*)
Nighthawk (*Chordeiles* spp.)
Osprey (*Pandion haliaetus*)
Peregrine Falcon (*Falco peregrinus*)
Piping Plover (*Charadrius melodus*)
Ravens (*Corvus* spp.)
Red-breasted Merganser (*Mergus serrator*)
Ring-billed Gull (*Larus delawarensis)*
Ring-necked Pheasant (*Phasianus colchicus*)
Snowy Egret (*Egretta thula*)
Trumpter Swan (*Cygnus buccinators)*
Yellow-crowned Night-Heron (*Nyctanassa violacea)*
Wild Turkey (*Meleagris gallopavo*)

FISH , MUSSELS AND CRAYFISH
Alewife (*Alosa pseudoharengus*)
Bowfin (*Amia calva*)
Brook trout (*Salvelinus frontinalis*)
Brown trout (*Salmo trutta*)
Burbot (*Lota lota*)
Channel catfish (*Ictalurus punctatus*)
Chinook salmon (*Oncorhynchus tshawytscha*)
Cisco (*Coregonus artedi*)
Coho salmon (*Oncorhynchus kisutch*)

Freshwater Drum (*Aplodinotus grunniens*)
Gizzard shad (*Dorosoma cepedianum*)
Koi (*Cyprinus carpio*)
Lake Chub (*Couesius plumbeus*)
Lake sturgeon (*Acipenser fulvescens*)
Lake trout (*Salvelinus namaycush*)
Lake whitefish (*Coregonus clupeaformis*)
Largemouth bass (*Micropterus salmoides salmoides*)
Muskellunge (*Esox masquinongy*)
Northern pike (*Esox lucius*)
Pumpkinseed (*Lepomis gibosis*)
Quagga Mussel (*Dreissena rostriformis bugensis*)
Rainbow smelt (*Osmerus mordax*)
Rainbow trout (*Oncorhynchus mykiss)*
Round goby (*Dorosoma cepedianum*)
Round whitefish (menominee, *Prosopium cylindraceum*)
Rusty Crayfish (*Orconectes rusticus*)
Smallmouth bass (*Micropterus dolomieu*)
Splake (*Salvelinus namaycush X Salvelinus fontinalis*)
Striped bass (*Morone saxatilis x M. chrysops*)
Sucker (Family Catostomidae)
Sunfish (Family Centrarchidae)
Talapia (*Oreochromis* spp.)
Walleye (*Sander vitreus*)
White suckers (*Catostomus commersoni*)
Yellow perch (*Perca flavescens*)
Zebra Mussel (*Dreissena polymorpha*)

PLANTS
Dune thistle (*Cirsium pitcheri*)
Dwarf lake iris (*Iris lacustris*)
White cedar (*Thuja occidentalis*)

APPENDIX B
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APPENDIX C

FEDERAL LIST OF THREATENED AND ENDANGERED SPECIES IN MICHIGAN

MAMMALS
Canada lynx (*Lynx canadensis*) - Threatened
Gray wolf (*Canis lupus*) - Endangered
Indiana bat (*Myotis sodalis)* - Endangered

BIRDS
Kirtland's warbler (*Dendroica kirtlandii*) - Endangered
Piping plover (*Charadrius melodus)* - Endangered
Whooping crane (*Grus americanus*) - nonessential experimental population

REPTILES
Copperbelly water snake (*Nerodia erythrogaster neglecta*) - Threatened
Eastern massasauga (*Sistrurus catenatus*) - Candidate

CLAMS (Freshwater Mussels, Unionids)
Clubshell (*Pleurobema clava*) - Endangered
Northern riffleshell (*Epioblasma torulosa rangiana*) - Endangered
Rayed bean (*Villosa fabalis*) - Candidate

INSECTS
American burying beetle (*Nicrophorus americanus*) - Endangered
Hine's emerald dragonfly (*Somatochlora hineana*) - Endangered
Hungerford's crawling water beetle (*Brychius hungerfordi*) - Endangered
Karner blue butterfly (*Lycaeides melissa samuelis*) - Endangered
Mitchell's satyr (*Neonympha mitchellii mitchellii*) - Endangered

PLANTS
American hart's-tongue fern (*Asplenium scolopendrium* var. *americanum*) - Threatened
Dwarf lake iris (*Iris lacustris*) - Threatened
Eastern prairie fringed orchid (*Platanthera leucophaea*) - Threatened
Houghton's goldenrod (*Solidago houghtonii*) - Threatened
Lakeside daisy (*Hymenoxys herbacea*) - Threatened
Michigan monkey-flower (*Mimulus glabratus* var. *michiganensis*) - Endangered
Pitcher's thistle (*Cirsium pitcheri*) - Threatened
Small whorled pogonia (*Isotria medeoloides*) – Threatened

APPENDIX D

STATE LIST OF THREATENED AND ENDANGERED SPECIES IN MICHIGAN

MOLLUSKS

Endangered Species:
Catinella protracta - A land snail (no common name)
Epioblasma obliquata perobliqua - White catspaw
Epioblasma torulosa rangiana - Northern riffleshell
Epioblasma triquetra - Snuffbox
Gastrocopta holzingeri - Lamda snaggletooth
Guppya sterkii - Sterki's granule
Ligumia nasuta - Eastern pondmussel
Ligumia recta - Black sandshell
Obliquaria reflexa - Threehorn wartyback
Obovaria olivaria - Hickorynut
Obovaria subrotunda - Round hickorynut
Planorbella multivolvis - Acorn ramshorn
Planorbella smithi - An aquatic snail (no common name)
Pleurobema clava - Clubshell
Simpsonaias ambigua - Salamander mussel
Stagnicola contracta - Deepwater pondsnail
Stagnicola petoskeyensis - Petoskey pondsnail
Toxolasma lividus - Purple lilliput
Toxolasma parvus - Lilliput
Vallonia gracilicosta albula - A land snail (no common name)
Vertigo hubrichti - Hubricht's vertigo
Vertigo modesta modesta - A land snail (no common name)
Vertigo modesta parietalis - A land snail (no common name)
Vertigo morsei - A land snail (no common name)
Vertigo nylanderi - Deep-throat vertigo
Villosa fabalis - Rayed bean

Threatened Species:
Alasmidonta viridis - Slippershell
Catinella exile - Pleistocene catinella
Catinella gelida - A land snail (no common name)
Cyclonaias tuberculata - Purple wartyback
Euchemotrema hubrichti - Carinate pillsnail
Euconulus alderi - A land snail (no common name)
Fossaria cyclostoma - Bugle fossaria
Hendersonia occulta - Cherrystone drop
Lampsilis fasciola - Wavyrayed lampmussel
Mesodon elevatus - Proud globe
Pallifera fosteri - Foster mantleslug
Physella parkeri - Broadshoulder physa
Potamilus ohiensis - Pink papershell
Pyganodon subgibbosa - Lake floater
Truncilla donaciformis - Fawnsfoot
Vertigo bollesiana - Delicate vertigo

INSECTS

Endangered Species:
Brychius hungerfordi - Hungerford's crawling water beetle
Catocala amestris - Three-staff underwing
Neonympha mitchellii mitchellii - Mitchell's satyr
Schinia indiana - Phlox moth
Schinia lucens - Leadplant moth
Somatochlora hineana - Hine's emerald dragonfly
Speyeria idalia - Regal fritillary

Threatened Species:
Dryobius sexnotatus - Six-banded longhorn beetle
Erynnis persius persius - Persius dusky wing
Euphyes dukesi - Dukes' skipper
Flexamia huroni - Huron River leafhopper
Hesperia ottoe - Ottoe skipper
Incisalia henrici - Henry's elfin
Incisalia irus - Frosted elfin
Lycaeides idas nabokovi - Northern blue
Lycaeides melissa samuelis - Karner blue
Oarisma powesheik - Powesheik skipperling
Ophiogomphus howei - Pygmy snaketail
Papaipema silphii - Silphium borer moth
Tachopteryx thoreyi - Grey petaltail
Trimerotropis huroniana - Lake Huron locust

FISHES

Endangered Species:
Clinostomus elongatus - Redside dace
Erimyzon claviformis - Western creek chubsucker
Notropis anogenus - Pugnose shiner
Notropis photogenis - Silver shiner
Noturus stigmosus - Northern madtom
Opsopoeodus emiliae - Pugnose minnow
Percina copelandi - Channel darter
Percina shumardi - River darter
Phoxinus erythrogaster - Southern redbelly dace
Threatened Species:
Acipenser fulvescens - Lake sturgeon
Ammocrypta pellucida - Eastern sand darter
Coregonus artedii - Cisco
Coregonus bartletti - Siskiwit lake cisco
Coregonus hubbsi - Ives lake cisco
Coregonus zenithicus - Shortjaw cisco
Hiodon tergisus - Mooneye
Moxostoma carinatum - River redhorse
Sander canadensis - Sauger

AMPHIBIANS

Endangered Species:
Ambystoma opacum - Marbled salamander
Ambystoma texanum - Smallmouth salamander

Threatened Species:
Acris crepitans blanchardi - Blanchard's cricket frog

REPTILES

Endangered Species:
Clonophis kirtlandii - Kirtland's snake
Nerodia erythrogaster neglecta - Copperbelly water snake

Threatened Species:
Aspidoscelis sexlineata - Six-lined racerunner
Clemmys guttata - Spotted turtle
Pantherophis gloydi - Eastern fox snake

BIRDS

Endangered Species:
Ammodramus henslowii - Henslow's sparrow
Asio flammeus - Short-eared owl
Charadrius melodus - Piping plover
Dendroica discolor - Prairie warbler
Dendroica kirtlandii - Kirtland's warbler
Falco peregrinus - Peregrine falcon
Lanius ludovicianus migrans - Migrant loggerhead shrike
Rallus elegans - Audubon King rail
Tyto alba - Barn owl

Threatened Species:
Asio otis - Long-eared owl
Buteo lineatus - Red-shouldered hawk
Corturnicops noveboracensis - Yellow rail
Cygnus buccinator - Trumpeter swan
Dendroica cerulea - Cerulean warbler
Dendroica dominica - Yellow-throated warbler
Falco columbarius - Merlin
Gallinula chloropus - Common moorhen
Gavia immer - Common loon
Ixobrychus exilis - Least bittern
Seiurus motacilla - Louisiana waterthrush
Sterna caspia - Caspian tern
Sterna forsteri - Forster's tern
Sterna hirundo - Common tern

MAMMALS

Endangered Species:
Felis concolor - Cougar
Lynx canadensis - Lynx
Microtus ochrogaster - Prairie vole
Myotis sodalis - Indiana bat

Threatened Species:
Cryptotis parva - Least shrew
Nycticeius humeralis - Evening bat
Sorex fumeus - Smoky shrew

PLANTS

Agalinas gattingeri - Gattinger's gerardia
Agalinas skinneriana - Britton Skinner's gerardia
Amerorchis rotundifolia - Hultén Small round-leaved orchis
Androsace occidentalis - Rock-jasmine
Antennaria rosea - Rosy pussytoes
Aristida tuberculosa - Beach three-awned grass
Arnica cordifolia - Heart-leaved arnica
Arnica lonchophylla - Longleaf arnica
Asclepias ovalifolia - Dwarf milkweed
Asplenium ruta-muraria - Wall-rue
Asplenium scolopendrium var. *americana* - Hart's-tongue fern
Baptisia leucophaea - Cream wild indigo
Besseya bullii - Kitten-tails
Botrychium acuminatum - Moonwort
Bouteloua curtipendula - Torrey Side-oats grama grass
Carex crus-corvi - Raven's-foot sedge
Carex heleonastes - Hudson Bay sedge
Carex nigra - Reichard Black sedge
Carex platyphylla - Broad-leaved sedge
Carex straminea - Straw sedge
Castanea dentata - Borkh. American chestnut
Chamaerhodos nuttallii - Rock-rose
Chasmanthium latifolium - Wild oats
Chelone obliqua - Purple turtlehead
Dasistoma macrophylla - Mullein-foxglove
Dichanthelium polyanthes - Round-seed panic-grass
Dodecatheon meadia - Shooting star
Draba glabella - Smooth whitlow grass
Eleocharis atropurpurea - Purple spike rush
Eleocharis microcarpa - Small-fruited spike-rush
Eleocharis nitida - Slender spike rush
Eleocharis parvula - Dwarf spike-rush
Echinodorus tenellus - Dwarf burhead
Galium kamtschaticum - Schultes Bedstraw
Gentiana flavida - White gentian
Gentiana puberulenta - Downy gentian
Gillenia trifoliata - Bowman's root
Gymnocarpium jessoense - Northern oak fern
Hedysarum alpinum - Alpine sainfoin
Hymenoxys herbacea - Lakeside daisy
Hypericum sphaerocarpum - Round-fruited St. John's-wort
Isoetes engelmannii - Engelmann's quillwort
Lygodium palmatum - Climbing fern
Mertensia virginica - Virginia bluebells
Mimulus michiganensis - Michigan monkey flower
Nuphar pumila - Small yellow pond lily
Nymphaea leibergii - Pygmy water lily
Ophioglossum vulgatum - Southeastern adder's-tongue
Opuntia fragilis - Fragile prickly pear
Penstemon gracilis - Slender beard tongue
Phlox ovata - Wideflower phlox
Plantago cordata - Heart-leaved plantain
Platanthera ciliaris - Orange- or yellow-fringed orchid

Platanthera leucophaea - Prairie white-fringed orchid
Poa canbyi - Piper Canbyi's bluegrass
Populus heterophylla - Swamp or Black cottonwood
Potamogeton pulcher - Spotted pondweed
Prosartes hookeri - Fairy bells
Proserpinaca pectinata - Mermaid-weed
Rhynchospora (Psilocarya) nitens - Short-beak beak-rush
Rhynchospora recognita - Globe beak-rush
Rubus acaulis - Dwarf raspberry
Ruellia strepens - Smooth ruellia
Rumex occidentalis - Western dock
Sanguisorba canadensis - Canadian burnet
Schoenoplectus americanus - Three-square bulrush
Scleria pauciflora - Few-flowered nut rush
Scutellaria nervosa - Skullcap
Silene virginica - Fire pink
Solidago bicolor - White goldenrod
Sporobolus clandestinus - Dropseed
Stellaria crassifolia - Fleshy stitchwort
Subularia aquatica - Awlwort
Tipularia discolor - Cranefly orchid
Trillium undulatum - Painted trillium
Utricularia inflata - Floating bladderwort
Vaccinium vitis-idaea - Mountain cranberry
Viola epipsila - Northern marsh violet
Woodsia alpina - Northern woodsia

Threatened Species:
Agoseris glauca - Prairie or pale agoseris
Agrimonia rostellata - Beaked agrimony
Allium schoenoprasum - (native variety) Chives
Arabis perstellata - Rock cress
Aristida longespica - Three-awned grass
Aristolochia serpentaria - Virginia snakeroot
Armoracia lacustris - Lake cress
Artemisia ludoviciana - Western mugwort
Asclepias hirtella - Woodson Tall green milkweed
Asclepias purpurascens - Purple milkweed
Asclepias sullivantii - Sullivant's milkweed
Asplenium rhizophyllum - Walking fern
Aster drummondii - Drummond's aster
Aster furcatus - Forked aster
Aster modestus - Great northern aster
Aster sericeus - Western silvery aster
Astragalus canadensis - Canadian milk vetch
Bartonia paniculata - Muhl. Panicled screwstem
Beckmannia syzigachne - Slough grass
Berula erecta - Cut-leaved water parsnip
Botrychium campestre - Prairie Moonwort or Dunewort
Botrychium hesperium - Western moonwort
Botrychium mormo - Goblin moonwort
Botrychium spathulatum - Spatulate moonwort
Braya humilis - Low northern rock cress
Bromus pumpellianus - Pumpelly's bromegrass
Calamagrostis lacustris - Northern reedgrass
Calamagrostis stricta - Narrow-leaved reedgrass

Callitriche heterophylla - Large water starwort
Caltha natans - Floating marsh marigold
Calypso bulbosa - Calypso or fairy-slipper
Camassia scilloides - Wild hyacinth
Carex albolutescens - Sedge
Carex assiniboinensis - Assiniboia sedge
Carex atratiformis - Sedge
Carex conjuncta - Sedge
Carex lupuliformis - False hop sedge
Carex media - Sedge
Carex novae-angliae - New England sedge
Carex oligocarpa - Eastern few-fruited sedge
Carex rossii - Ross's sedge
Carex scirpoidea - Bulrush sedge
Carex seorsa - Sedge
Carex tincta - Sedge
Carex typhina - Cattail sedge
Castilleja septentrionalis - Pale Indian paintbrush
Ceanothus sanguineus - Wild lilac
Cerastium brachypodum - Shortstalk chickweed
Cirsium pitcheri - Pitcher's thistle
Collinsia parviflora - Small blue-eyed Mary
Coreopsis palmate - Prairie coreopsis
Corydalis flavula - Yellow fumewort
Cryptogramma acrostichoides - American rock-brake
Cypripedium candidum - White lady slipper
Cystopteris tennesseensis - Tennessee bladder fern
Dalibarda repens - False violet
Dennstaedtia punctilobula - Hay-scented fern
Dentaria maxima - Large toothwort
Diarrhena obovata - Brandenburg Beak grass
Dichanthelium leibergii - Leiberg's panic grass
Draba cana - Ashy whitlow grass
Draba incana - Twisted whitlow grass
Draba reptans - Creeping whitlow grass
Dryopteris celsa - Small log fern
Eleocharis compressa - Flattened spike rush
Eleocharis tricostata - Three-ribbed spike rush
Empetrum nigrum - Black crowberry
Erigeron acris - Fleabane
Erigeron hyssopifolius - Hyssop-leaved fleabane
Eryngium yuccifolium - Rattlesnake-master or button snakeroot
Eupatorium fistulosum - Hollow-stemmed Joe-pye weed
Eupatorium sessilifolium - Upland boneset
Euphorbia commutata - Tinted spurge
Euphrasia hudsoniana - Eyebright
Euphrasia nemorosa - Eyebright
Festuca scabrella - Rough fescue
Filipendula rubra - Queen-of-the-prairie
Fraxinus profunda - Pumpkin ash
Fuirena pumila - Umbrella-grass
Galearis spectabilis - Showy orchis
Gentiana linearis - Narrow-leaved gentian
Gentianella quinquefolia - Small Stiff gentian
Geum triflorum - Prairie smoke
Glyceria melicaria - Slender manna grass

Gnaphalium sylvaticum - Woodland everlasting
Gratiola aurea - Hedge-hyssop
Gratiola virginiana - Annual hedge hyssop
Gymnocarpium robertianum - Newman Limestone oak fern
Helianthus mollis - Downy sunflower
Hieracium paniculatum - Panicled hawkweed
Hydrastis canadensis - Goldenseal
Hypericum adpressum - Creeping St. John's-wort
Ipomoea pandurata - Wild potato vine or man-of-the-earth
Iris lacustris - Dwarf lake iris
Isotria verticillata - Whorled pogonia
Juncus brachycarpus - Short-fruited rush
Juncus militaris - Bayonet rush
Juncus scirpoides - Scirpus-like rush
Juncus stygius - Moor rush
Juncus vaseyi - Vasey's rush
Justicia americana - Water willow
Lactuca floridana - Woodland lettuce
Lechea pulchella - Leggett's pinweed
Linum virginianum - Virginia flax
Lonicera involucrata - Banks Black twinberry
Ludwigia sphaerocarpa - Globe-fruited seedbox
Luzula parviflora - Small-flowered wood rush
Lycopodiella margaritae - Clubmoss
Lycopus virginicus - Virginia water-horehound
Moehringia macrophylla - Big-leaf sandwort
Morus rubra - Red mulberry
Muhlenbergia richardsonis - Mat muhly
Myrica pensylvanica - Northern bayberry
Myriophyllum farwellii - Farwell's water milfoil
Nelumbo lutea - American lotus
Oplopanax horridus - Devil's club
Orobanche fasciculata - Broomrape
Oryzopsis canadensis - Torrey Canada rice grass
Osmorhiza depauperata - Sweet Cicely
Panax quinquefolius - Ginseng
Panicum longifolium Torrey Panic grass
Panicum philadelphicum Bernh. Ex Trin. Philadelphia panic-grass
Panicum verrucosum Muhl. Warty panic grass
Parnassia palustris L. Marsh grass-of-parnassus
Pellaea atropurpurea (L.) Link. Purple cliff brake
Penstemon calycosus Small Beard tongue
Petasites sagittatus (Pursh) A. Gray Sweet coltsfoot
Phacelia franklinii (R. Br.) A. Gray Franklin's phacelia
Phlox maculata L. Wild sweet William
Poa alpina L. Alpine bluegrass
Poa paludigena Fern. & Wieg. Bog bluegrass
Polemonium reptans L. Jacob's ladder
Polygonum careyi Olney Carey's smartweed
Polygonum viviparum L. Alpine bistort
Polymnia uvedalia L. Yellow-flowered leafcup
Potamogeton bicupulatus Fern. [*Potamogeton capillaceus* Poiret] Waterthread pondweed
Potamogeton hillii Morong Hill's pondweed
Potamogeton vaseyi Robins Vasey's pondweed
Potentilla paradoxa Nutt. Sand cinquefoil
Potentilla pensylvanica L. Prairie cinquefoil

Prenanthes crepidinea Michx. Nodding rattlesnake-root
Prosartes trachycarpa S. Watson Northern fairy bells
Pterospora andromedea Nutt. Pine-drops
Pycnanthemum muticum (Michx.) Pers. Mountain mint
Pycnanthemum pilosum Nutt. Hairy mountain mint
Ranunculus ambigens Watson Spearwort
Ranunculus cymbalaria Pursh Seaside crowfoot
Ranunculus lapponicus L. Lapland buttercup
Ranunculus macounii Britton Macoun's buttercup
Ranunculus rhomboideus Goldie Prairie buttercup
Rhexia mariana L. Maryland meadow beauty
Rhynchospora scirpoides (Torr.) A. Gray Bald-rush
Ruellia humilis Nutt. Hairy wild petunia
Ruppia maritima L. Widgeon grass
Sabatia angularis (L.) Pursh Rosepink
Sagina nodosa (L.) Fenzl Pearlwort
Sagittaria montevidensis Cham. & Schlecht. Arrowhead
Salix planifolia Pursh Tea-leaved willow
Sarracenia purpurea f. *heterophylla* (Eaton) Fern. Yellow pitcher plant
Saxifraga paniculata Miller [S. aizoön Jacq.] Encrusted saxifrage
Saxifraga tricuspidata Rottb. Prickly saxifrage
Schoenoplectus hallii (A. Gray) S.G. Sm. Hall's bulrush
Scleria reticularis Michaux Netted nut rush
Scutellaria ovata Hill Forest skullcap
Scutellaria parvula Michaux [sensu lato] Small skullcap
Senecio indecorus Greene Northern ragwort
Silene nivea (Nutt.) Muhl. ex Otth Evening campion
Silene stellata (L.) Aiton f. Starry campion
Silphium integrifolium Michaux Rosinweed
Silphium laciniatum L. Compass plant
Silphium perfoliatum L. Cup plant
Sisyrinchium atlanticum Bickn. Atlantic blue-eyed-grass
Solidago houghtonii A. Gray Houghton's goldenrod
Solidago missouriensis Nutt. Missouri goldenrod
Spiranthes ovalis Lindley Lesser ladies'-tresses
Tanacetum huronense Nutt. Lake Huron tansy
Tofieldia pusilla (Michaux) Pers. False asphodel
Trichostema brachiatum L. [*Isanthus brachiatus* (L.) BSP.] False pennyroyal
Trichostema dichotomum L. Bastard pennyroyal
Trillium nivale Riddell Snow trillium
Trillium recurvatum Beck Prairie trillium
Trillium sessile L. Toadshade
Triphora trianthophora (Sw.) Rydb. Nodding pogonia or three birds orchid
Utricularia subulata L. Bladderwort
Vaccinium cespitosum Michaux Dwarf bilberry
Vaccinium uliginosum L. Alpine blueberry
Valeriana edulis var. *ciliata* (T. & G.) Cronquest Edible valerian
Valerianella chenopodiifolia (Pursh) DC. Goosefoot corn salad
Valerianella umbilicata (Sull.) A. W. Wood Corn salad
Viburnum edule (Michx.) Raf. Squashberry or mooseberry
Viola novae-angliae House New England violet
Viola pedatifida G. Don Prairie birdfoot violet
Vitis vulpina L. Frost grape
Wisteria frutescens (L.) Poiret Wisteria
Wolffia papulifera Thompson [*W. brasiliensis* Weddell] Watermeal
Woodsia obtusa (Sprengel) Torrey Blunt-lobed woodsia

Zizania aquatica var. *aquatica* L. Wild rice
Zizia aptera (A. Gray) Fern. Prairie golden alexanders

APPENDIX E
INTERACTION AMONG AGENCY DECISIONS

This appendix provides details on how the decisions made by one of the agencies or tribes would impact the actions and decisions available to the other agencies, tribes, and other individuals that may need CDM or wish to conduct CDM research. Information on the selection of Alternative 3 is not provided because selection of this alternative by any of the agencies or tribes would not restrict alternatives and actions available to any other entity. Alternatives 1, 3 and 4 are identical except for the amount of annual take allowed, so the analysis has been combined for these alternatives (Table 1).

Table 1. Impacts of agency selection of Alternative 1 - Integrated CDM Including Implementation of the PRDO (No Action Alternative) and 4 – Adaptive Integrated Cormorant Damage Management with Limited Annual Take (Proposed Action).

Agency Choosing Alternatives 1, 3 or 4	Choices Available to Other DCCO Management Entities				
	USFWS Migratory Bird Office (MBO) and National Wildlife Refuges (NWRs)	**Wildlife Services (WS)**	**Michigan Department of Natural Resources and Environment (MDNRE)**	**Tribes**	**USDI Sleeping Bear Dunes National Lakeshore (SBDNL) and Others**
USFWS Migratory Bird Office (MBO)	The NWRs can choose the same alternative as the MBO or they can choose to be more, but not less restrictive than the alternative selected by the MBO.	WS could select any other alternative. Total annual cumulative lethal DCCO take permitted will depend on limits set by USFWS for the alternative selected.	The MDNRE could select any other alternative. Total annual cumulative lethal DCCO take permitted will depend on limits set by USFWS for the alternative selected.	The tribes could select any other alternative. Total annual cumulative lethal DCCO take permitted will depend on limits set by USFWS for the alternative selected.	MBPs would be available for CDM and research. Total DCCO take permitted will depend on limits set by USFWS for the alternative selected.
USFWS National Wildlife Refuges (NWRs)	No impact on alternatives available to the MBO.	No impact on alternatives available to WS. Lethal CDM would only be conducted on NWRs with the consent of the NWR and if proposed action did not result in statewide cumulative annual lethal DCCO take in excess of alternative selected by the NWR.	No impact on alternatives available to MDNRE. Lethal CDM would only be conducted on NWRs with the consent of the NWR and if proposed action did not result in statewide cumulative annual lethal DCCO take in excess of alternative selected by the NWR.	No impact on alternatives available to WS. Lethal CDM would only be conducted on NWRs with the consent of the NWR and if proposed action did not result in statewide cumulative annual lethal DCCO take in excess of alternative selected by the NWR.	No impact on actions at sites other than NWRs. Research on NWRs using lethal methods permitted only if statewide cumulative annual lethal DCCO take is not in excess of alternative selected by the NWR.

Agency Choosing Alternatives 1, 3 or 4	Choices Available to Other DCCO Management Entities				
	USFWS Migratory Bird Office (MBO) and National Wildlife Refuges (NWRs)	**Wildlife Services (WS)**	**Michigan Department of Natural Resources and Environment (MDNRE)**	**Tribes**	**USDI Sleeping Bear Dunes National Lakeshore (SBDNL) and Others**
Wildlife Services (WS)	No impact on alternatives available to MBO or NWRs. NWRs wishing lethal CDM under the PRDO which would result in statewide cumulative lethal DCCO take in excess of that allowed in the alternative selected by WS would have to obtain assistance from the MDNRE or the tribes.	___	No impact on alternatives available to MDNRE. WS would not assist with lethal CDM under the PRDO if statewide cumulative lethal DCCO take would be in excess of that allowed in the alternative selected by WS.	No impact on alternatives available to tribes. WS would not assist with lethal CDM under the PRDO if statewide cumulative lethal DCCO take would be in excess of that allowed in the alternative selected by WS.	No impact on alternatives available to SBDNL. SBDNL would have to obtain assistance from MDNRE or tribes for CDM under the PRDO which would result in statewide cumulative lethal DCCO take in excess of that allowed in the alternative selected by WS. MBPs would be available for CDM and research. WS would not assist with lethal CDM or research if statewide cumulative lethal DCCO take would be in excess of that allowed in the alternative selected by WS

Agency Choosing Alternatives 1, 3 or 4	Choices Available to Other DCCO Management Entities				
	USFWS Migratory Bird Office (MBO) and National Wildlife Refuges (NWRs)	**Wildlife Services (WS)**	**Michigan Department of Natural Resources and Environment (MDNRE)**	**Tribes**	**USDI Sleeping Bear Dunes National Lakeshore (SBDNL) and Others**
Michigan Department of Natural Resources (MDNRE)	No impact on alternatives available to MBO or NWRs. However, a MDNRE permit is also required to conduct CDM in Michigan, so cumulative lethal DCCO take in the state would be limited to that allowed under the alternative selected by the MDNRE.	No impact on alternatives available to WS. However, A MDNRE permit is required to conduct CDM in Michigan, so cumulative lethal DCCO take in the state would be limited to that allowed under the alternative selected by the MDNRE.	___	No impact on alternatives available to tribes. CDM would only be conducted on non-tribal lands if statewide cumulative lethal DCCO take did not exceed level permitted in alternative selected by the MDNRE.	No impact on alternatives available to SBDNL. However, a MDNRE permit is required to conduct CDM in Michigan so cumulative lethal DCCO take would be limited to that allowed under the alternative selected by the MDNRE. Cumulative lethal DCCO take for CDM and research by other entities would be limited to level allowed under the alternative selected by the MDNRE.

Agency Choosing Alternatives 1, 3 or 4	Choices Available to Other DCCO Management Entities				
	USFWS Migratory Bird Office (MBO) and National Wildlife Refuges (NWRs)	**Wildlife Services (WS)**	**Michigan Department of Natural Resources and Environment (MDNRE)**	**Tribes**	**USDI Sleeping Bear Dunes National Lakeshore (SBDNL) and Others**
Tribes	No impact on alternatives available to MBO or NWRs. NWRs wishing lethal CDM under the PRDO which would result in statewide cumulative lethal take in excess of that allowed in the alternative selected by the tribes would have to obtain assistance from WS or the MDNRE.	No impact on alternatives available to WS. CDM would only be conducted on tribal lands if statewide cumulative lethal DCCO take did not exceed level permitted in alternative selected by the tribe.	No impact on alternatives available to MDNRE. CDM would only be conducted on tribal lands if statewide cumulative lethal DCCO take did not exceed level permitted in alternative selected by the tribes.	___	No impact on alternatives available to SBDNL or on CDM and research activities that do not involve tribal lands. SBDNL would have to obtain assistance from WS or MDNRE for lethal CDM under the PRDO which would result in statewide cumulative lethal DCCO take in excess of that allowed in the alternative selected by the MDNRE. Research involving the use of lethal methods would only be allowed on tribal lands if statewide cumulative lethal DCCO take did not exceed level permitted in alternative selected by the tribe.
USDI, Sleeping Bear Dunes National Lakeshore (SBDNL)	No impact on alternatives available to MBO or NWRs.	No impact on alternatives available to WS. CDM would only be conducted at SBDNL if statewide cumulative lethal DCCO take did not exceed level permitted in alternative selected by SBDNL.	No impact on alternatives available to MDNRE. CDM would only be conducted at SBDNL if statewide cumulative lethal DCCO take did not exceed level permitted in alternative selected by SBDNL.	No impact on alternatives available to tribes. CDM would only be conducted at SBDNL if statewide cumulative lethal DCCO take did not exceed level permitted in alternative selected by SBDNL.	No impact on research or CDM conducted on lands other than SBDNL. Research and lethal CDM would only be allowed at SBDNL lands if statewide cumulative lethal DCCO take did not exceed level permitted in alternative selected by the SBDNL.

Table 2. Impacts of agency selection of Alternative 2 – Only Non-lethal CDM by Federal Agencies

Agency Choosing Alternative 2 – Only Non-lethal CDM by Federal Agencies	Choices Available to Other DCCO Management Entities				
	USFWS Migratory Bird Office (MBO) and National Wildlife Refuges (NWRs)	**Wildlife Services (WS)**	**Michigan Department of Natural Resources and Environment (MDNRE)**	**Tribes**	**USDI, Sleeping Bear Dunes National Lakeshore (SBDNL) and Others**
USFWS Migratory Bird Office (MBO)	The NWRs can choose the same alternative as the MBO or they can choose to be more, but not less restrictive than the alternative selected by the MBO. Therefore, if the MBO selects Alternative 2, the NWRs may select Alternatives 2 or 4.	WS could select any other alternative. However, only the MDNRE and Tribes could receive WS assistance with lethal CDM because the only type of lethal CDM that could be conducted would be take of less than 10% of a local DCCO population under the PRDO. There could be no other types of lethal DCCO removal because it would require permits/consent from the MBO. A permit is not required for non-lethal CDM.	MDNRE could use lethal methods to take less than 10% of a local DCCO population under the PRDO because this action does not require approval or a permit from the MBO. Non-lethal CDM does not require a permit from the MBO.	The Tribes could use lethal methods to take less than 10% of a local DCCO population under the PRDO because this action does not require approval or a permit from the MBO. Non-lethal CDM does not require a permit from the MBO.	WS, the MDNRE and tribes would be able to take up to 10% of a local DCCO population under the PRDO with landowner/manager consent because this action does not require approval or a permit from the MBO. No lethal take would be permitted for other CDM or research. Non-lethal CDM does not require a permit from the MBO.
USFWS National Wildlife Refuges (NWRs)	No impact on decisions made by the MBO	No impact on decisions available to WS. Lethal CDM would not be authorized on NWRs.	No impact on decisions available to state. Lethal CDM would not be authorized on NWRs.	No impact on decisions available to tribes. Lethal CDM would not be authorized on NWRs.	Decision by NWRs has no impact on availability of CDM alternatives or research at any other location. Research involving use of lethal methods would not be permitted at NWRs.

Agency Choosing Alternative 2 – Only Non-lethal CDM by Federal Agencies	Choices Available to Other DCCO Management Entities				
	USFWS Migratory Bird Office (MBO) and National Wildlife Refuges (NWRs)	**Wildlife Services (WS)**	**Michigan Department of Natural Resources and Environment (MDNRE)**	**Tribes**	**USDI, Sleeping Bear Dunes National Lakeshore (SBDNL) and Others**
Wildlife Services (WS)	No Impact on MBO or on alternatives available to NWRs. However, NWRs would have to go to MDNRE or tribes for assistance with lethal take under the PRDO. WS would only assist with research and CDM using non-lethal methods	___	No impact on decisions available to state under the PRDO. WS would not assist with consultation and Form 37 required for a depredation permit from the USFWS. MDNRE would not be able to obtain a depredation permit. WS would only assist the MDNRE with CDM and research using non-lethal methods.	No impact on decisions available to tribes under the PRDO. WS would not assist with consultation and Form 37 required for a depredation permit from the USFWS. The tribes would not be able to obtain depredation permits. WS would only assist the tribes with CDM and research using non-lethal methods.	WS would not assist with consultation and form 37 required for a depredation permit from the USFWS. These entities would not be able to obtain a depredation permit. These entities would be able to obtain research permits. WS would only assist with CDM and research using non-lethal methods.
Michigan Department of Natural Resources (MDNRE)	MBO and NWRs could select any alternative. However, a permit from the MDNRE is required to conduct CDM in Michigan so CDM would be limited to nonlethal methods.	WS could select any alternative. However, a permit from the MDNRE is required to conduct CDM in Michigan so CDM would be limited to nonlethal methods.	___	No impact on decisions available to the tribes or on CDM conducted on tribal lands. However , lethal CDM could not be conducted by the tribes on state lands within the ceded territories.	SBDNL could select any alternative. However, a permit from the MDNRE is required to conduct CDM in Michigan so CDM would be limited to nonlethal methods. All CDM and research by other entities would be limited to nonlethal methods.

Agency Choosing Alternative 2 – Only Non-lethal CDM by Federal Agencies	Choices Available to Other DCCO Management Entities				
	USFWS Migratory Bird Office (MBO) and National Wildlife Refuges (NWRs)	**Wildlife Services (WS)**	**Michigan Department of Natural Resources and Environment (MDNRE)**	**Tribes**	**USDI, Sleeping Bear Dunes National Lakeshore (SBDNL) and Others**
Tribes	No impact on decisions made by the MBO or alternatives available to the NWRs.	WS could select any alternative. However, WS would only be able to assist the tribes with non-lethal CDM and research.	No impact on decisions available to the MDNRE.	___	No impact on actions by SBDNL. Other entities requesting permission to conduct research or CDM on lands owned or managed by the tribes would not be able to use lethal methods. Decision by tribes has no impact on availability of CDM alternatives at any other location.
USDI, Sleeping Bear Dunes National Lakeshore (SBDNL)	No impact on Alternatives available to the NWRs or MBO.	No impact on alternatives available to WS. WS would only be able to assist with nonlethal CDM at SBDNL.	No impact on alternatives available to MDNRE. No lethal CDM would be conducted at SBDNL.	No impact on alternatives available to tribes. No lethal CDM would be conducted at SBDNL.	Decision of SBDNL has no impact on availability of CDM on lands other than SBDNL. Other entities requesting permission to conduct research or CDM on lands owned or managed by the SBDNL would not be able to use lethal methods.

Table 3. Impacts of agency selection of Alternative 5 – No Federal CDM.

Agency Choosing Alternative 5 – No Federal CDM	Choices Available to Other DCCO Management Entities				
	USFWS Migratory Bird Office (MBO) and National Wildlife Refuges (NWRs)	**Wildlife Services (WS)**	**Michigan Department of Natural Resources and Environment (MDNRE)**	**Tribes**	**USDI, Sleeping Bear Dunes National Lakeshore (SBDNL) and Others**
USFWS Migratory Bird Office (MBO)	NWRs cannot select an alternative that is less restrictive than that selected by the MBO. Therefore, there would be no CDM on NWRs.	WS could select any other alternative. However, only the MDNRE and tribes could receive WS assistance with lethal CDM because the only type of lethal CDM that could be conducted would be take of less than 10% of a local DCCO population under the PRDO. There could be no other types of lethal DCCO removal because it would require permits from the MBO. Non-lethal CDM does not require a permit from the MBO.	MDNRE could take less than10% of local DCCO populations on non-Federal lands under the PRDO because this action does not require approval or a permit from the MBO. Non-lethal CDM does not require a permit from the MBO.	Tribes could take less than 10% of local DCCO populations on non-Federal lands under the PRDO because this action does not require approval or a permit from the MBO. Non-lethal CDM does not require a permit from the MBO.	WS, the MDNRE and tribes would be able to take up to 10% of a local DCCO population under the PRDO with landowner/manager consent because this action does not require approval or a permit from the MBO. No lethal take would be permitted for other CDM or research. Non-lethal CDM does not require a permit from the MBO.
USFWS National Wildlife Refuges (NWRs)	No impact on decisions made by the MBO	WS could select any alternative. WS would not conduct CDM on NWRs.	No impact on decisions available to state. MDNRE would not be allowed to conduct CDM on NWRs.	No impact on decisions available to tribes. Tribes would not be allowed to conduct CDM on NWRs.	Decision by NWRs has no impact on availability of CDM alternatives or research at any other location.

Agency Choosing Alternative 5 – No Federal CDM	Choices Available to Other DCCO Management Entities				
	USFWS Migratory Bird Office (MBO) and National Wildlife Refuges (NWRs)	**Wildlife Services (WS)**	**Michigan Department of Natural Resources and Environment (MDNRE)**	**Tribes**	**USDI, Sleeping Bear Dunes National Lakeshore (SBDNL) and Others**
Wildlife Services (WS)	No impact on alternatives available to MBO or NWRs. However, NWRs would have to go to MDNRE or tribes for assistance with lethal take under the PRDO. WS would not assist with CDM or research.	___	No impact on decisions available to state under the PRDO. WS would not assist with consultation and form 37 required for a depredation permit from the USFWS. The MDNRE would not be able to obtain a depredation permit. State would be able to obtain research permits. WS would not assist state with CDM or research.	No impact on decisions available to tribes under the PRDO. WS would not assist with consultation and form 37 required for a depredation permit from the USFWS. The tribes would not be able to obtain a depredation permit. Tribes would be able to obtain research permits. WS would not assist state with CDM or research.	Landowners/managers would need to go to MDNRE or tribes for implementation of projects involving the PRDO. WS would not assist with consultation and Form 37 required for a depredation permit from the USFWS. These entities would not be able to obtain a depredation permit. These entities would be able to obtain research permits. WS would not assist with research.
USDI, Sleeping Bear Dunes National Lakeshore (SBDNL)	No impact on Alternatives available to the NWRs or MBO.	No impact on alternatives available to WS. WS would not assist with any CDM at SBDNL.	No impact on alternatives available to MDNRE. No CDM would be conducted at SBDNL.	No impact on alternatives available to tribes. No CDM would be conducted at SBDNL.	Decision of SBDNL has no impact on availability of CDM on lands other than SBDNL.

APPENDIX F
COMORANT STOMACH CONTENTS DATA – THUNDER BAY

The following table contains preliminary data from a study of the stomach contents of Double-Crested Cormorants foraging in Thunder Bay, Michigan in 2006. Numbers presented are the proportion of all fish

	Collection Period						
	April (17 Birds)	**May (169 Birds)**	**June (103 Birds)**	**July (110 Birds)**	**August (69 Birds)**	**September (7 Birds)**	**Total (475 Birds)**
Cormorants with Empty Stomachs	**3**	**0**	**2**	**0**	**1**	**0**	**6**
Total Fish	**120**	**5,737**	**3,897**	**3,881**	**3,056**	**232**	**16923**
Round Goby	45.00	93.88	94.66	84.38	91.92	75.43	90.90
Total Notropis spp. (shiners)[1]	10	2.61	0.51	5.64	1.90	5.17	3.08
Emerald Shiner	3.33	0.91	0.18	5.44	1.54	5.17	1.97
Yellow Perch	27.50	0.59	0.59	2.04	1.24	0	1.22
Rainbow Smelt	0	0.44	0.51	3.69	0.36	0	1.18
Total Catostomids (suckers)[2]	0.83	0.17	0.82	1.29	0.26	0	0.60
Crayfish	0.83	0.35	0.62	0.49	0.26	1.29	0.44
Mottled Sculpin	0	0.54	0.44	0.41	0.29	0	0.43
Spottail Shiner	5.83	0.47	0.03	0	0	0	0.21
Trout Perch	0	0.10	0.10	0.21	0.03	0	0.11
Sand Shiner	0.83	0.02	0.23	0.13	0.03	0	0.10
Walleye	0	0.03	0.10	0.21	0	0	0.08
Johnny Darter	0	0.09	0.10	0.03	0.03	0	0.07
Ninespine Stickleback	0	0.03	0.03	0.23	0	0	0.07
Round Whitefish	0	0.07	0.03	0.05	0	0	0.07
Alewife	0	0	0.03	0.08	0.13	0	0.05

	Collection Period						
	April (17 Birds)	**May (169 Birds)**	**June (103 Birds)**	**July (110 Birds)**	**August (69 Birds)**	**September (7 Birds)**	**Total (475 Birds)**
Cormorants with Empty Stomachs	**3**	**0**	**2**	**0**	**1**	**0**	**6**
Total Fish	**120**	**5,737**	**3,897**	**3,881**	**3,056**	**232**	**16923**
Common White Sucker	0	0.07	0.10	0.10	0.03	0	0.05
Log Perch	4.17	0.03	0	0.03	0	0	0.05
Pumpkinseed	0.83	0.16	0	0	0.03	0	0.05
Brook Trout	0	0	0.15	0	0	0	0.04
Creek Chub	0	0	7	0	0	0	0.04
Mimic Shiner	0	0.03	0.03	0.03	0.07	0	0.04
Sculpin spp.	0	0.02	0.10	0.03	0	0.43	0.04
Smallmouth Bass	0	0.03	0.03	0.03	0.10	0	0.04
Sea Lamprey	0	0.07	0.03	0	0	0	0.03
Blacknose Dace	0	0	0.08	0.03	0	0	0.02
Common Shiner	0.83		0	0.05	0	0	0.02
Gizzard Shad	2.50	0	0	0	0	0	0.02
Largemouth Bass	1.67	0.02	0	0	0	0	0.02
Longnose Dace	0	0	0.05	0.05	0	0	0.02
Rock Bass	0	0	0	0	4	0	0.02
Salmonid	0.83	0	0.08	0	0	0	0.02
Slimy Sculpin	0	0.02	0.05	0	0.03	0	0.02
Atlantic Salmon	0	0.02	0	0	0	0	0.01
Bowfin	0	0	0	0	0.03	0	0.01
Burbot	0	0.02	0.03	0.10	0.10	0	0.01
Lake Whitefish	0	0.02	0	0	0	0	0.01
Longnose Sucker	0	0	0	0.03	0	0	0.01
White Bass	0.83	0	0	0	0	0	0.01

	Collection Period						
	April (17 Birds)	**May (169 Birds)**	**June (103 Birds)**	**July (110 Birds)**	**August (69 Birds)**	**September (7 Birds)**	**Total (475 Birds)**
Cormorants with Empty Stomachs	**3**	**0**	**2**	**0**	**1**	**0**	**6**
Total Fish	**120**	**5,737**	**3,897**	**3,881**	**3,056**	**232**	**16923**
Unknown	4.17	0.68	0.69	0.95	1.51	17.67	1.15

1 Includes Emerald Shiner, Spottail Shiner, Sand Shiner and Mimic Shiner, and any unspecified *Notropis* spp.

2 Includes Common White Sucker, Longnose Sucker and any unspecified Catostomids.