# FINAL ENVIRONMENTAL ASSESSMENT:

# DOUBLE-CRESTED CORMORANT DAMAGE MANAGEMENT IN MICHIGAN

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**FISH AND WILDLIFE SERVICE**

**and the**

**UNITED STATES DEPARTMENT OF THE INTERIOR**
**NATIONAL PARK SERVICE**
**SLEEPING BEAR DUNES NATIONAL LAKESHORE**

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# 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 (MDNR); 3) implementing an adaptive management program proposed by the MDNR with a limit on annual DCCO take intermediate to the current program and the MDNR 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 |
| MDNR | 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) 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 (Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, New York, North Carolina, Ohio, Oklahoma, South Carolina, Tennessee, Texas, Vermont, West Virginia, and Wisconsin). 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 (MDNR), and tribes may work together to resolve conflicts with DCCOs in the State of Michigan. The EA is tiered to the 2003 FEIS on Double-crested Cormorant Management.

## 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 MDNR, 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 MDNR 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) and Environmental Assessment (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, availability of alternative prey, 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 (MDNR 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 damage 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 (MDNR 2005). Barrows (1912) reported migratory DCCOs in the State and suspected that some scattered breeding was occurring but had no evidence of breeding colonies (MDNR 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 (MDNR 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 1970s 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.

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 Naubinway 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.

**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. Blanks indicate times prior to conducting CDM when counts were not conducted.

| 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 |
| Naubinway 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.

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, sunfishes, largemouth bass, koi, walleye, perch and catfish (NASS 2006).

The State of Michigan operates six hatcheries and five permanent salmonine egg take stations (MDNR 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 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. The two Tribal hatcheries in Michigan (Kewanee Bay and Nunns Creek) contribute to Michigan fish populations through the production and release of walleye, lake trout and brook trout (GLIFWC 2009, USFWS 2009*a*). 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 perceived 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. Sticklebacks, scuplins, cyprinids, and yellow perch, and at some localities, burbot, freshwater drum, and lake 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*a*, 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, Ridgway and Fielder In Press). Study of the issue is further complicated by the fact that the decline in some fisheries 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 human use, 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 with concurrent monitoring of DCCOs and the impacted resource (see Section 1.5.3.1 and 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.

#### *1.5.3.1 Les Cheneaux Islands (LCI)*

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 catch between 200,000 and 400,000 yellow perch annually (Lucchesi 1988). Concurrent with this time period was the return of a breeding population of DCCOs. Counts of nests reached exceeded 4,500 in 2004 (Table 1-1). 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 annual 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 recruitment declines must explain the decline

in harvestable 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 that may have increased predation on yellow perch (USFWS 2003, Fielder 2008).

Fielder (2008) described the yellow perch population and fishery in the area since the 1995 Diana et al. (1997) study. The total annual mortality rate for yellow perch was as high 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 before they entered the harvestable portion of the fish population. In an effort to 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 magnitude of recruitment), 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 that 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 to the 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 MDNR monitored in the fish community through the use of the same gillnet survey that had been performed since 1969 and an annual creel survey to estimate sport fishery activity. Fielder (2010*a*) 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*a*). 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 pre-control 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 of DCCO predation. Consequently, abundance of fish in this age class could be attributable to recruitment (initial large year classes), 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*a*) 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.

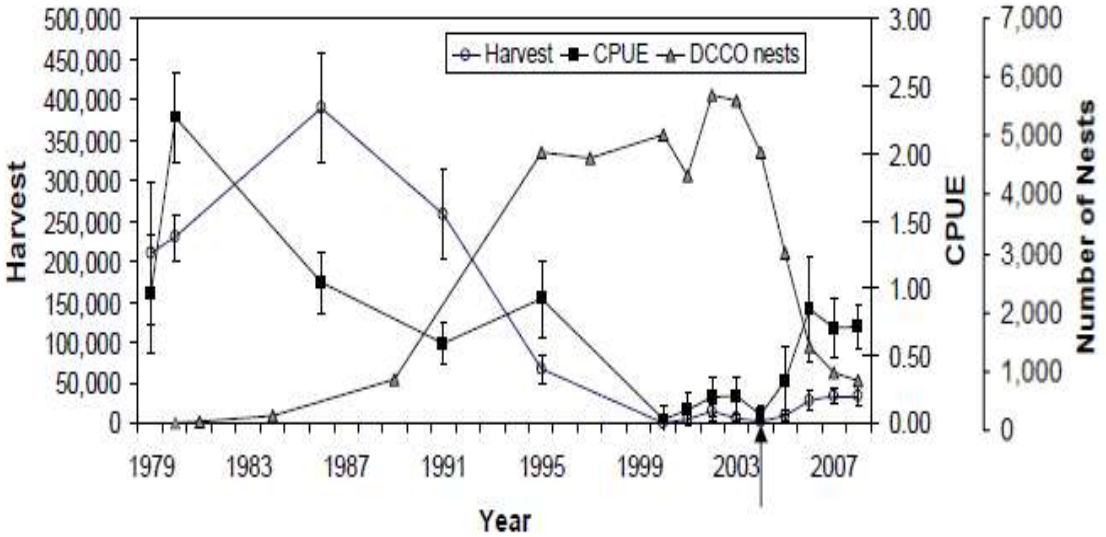


**Figure 1-1.** Trends in open water (April – October) yellow perch harvest and angler harvest rate (fish per hour of effort or CPUE), and Double-crested Cormorant (DCCO) nest numbers for the Les Cheneaux Islands, Lake Huron as determined by creel survey and nest inventory counts, 1979 – 2008. Cormorant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

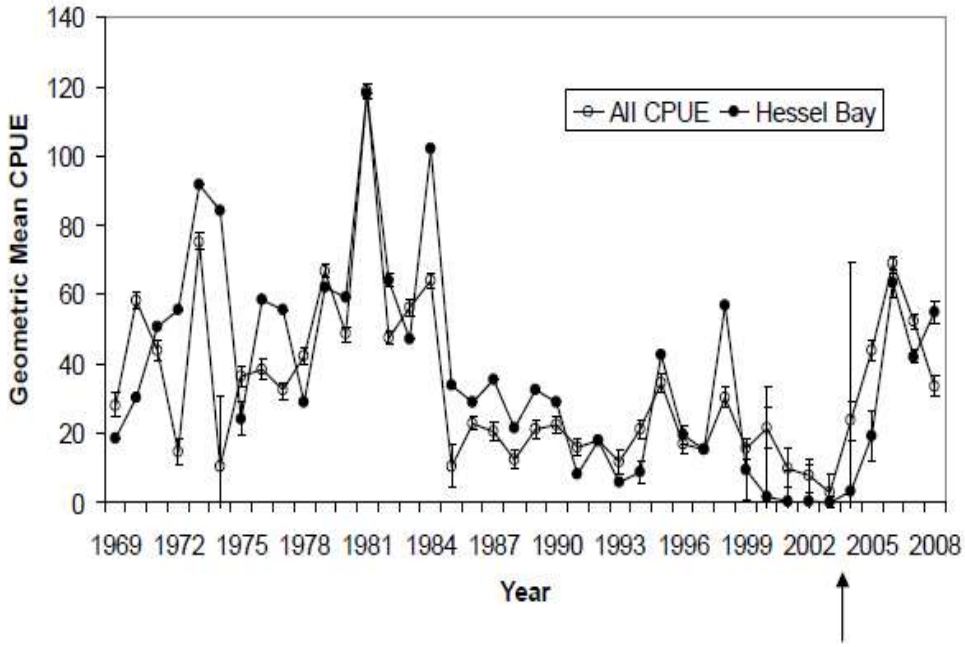


**Figure 1-2.** Geometric mean gillnet catch of yellow perch per 305 m of net (CPUE) for the all Les Cheneaux Islands sets combined and that for just Hessel Bay, 1969 – 2008. Error bars represent +/- 2 standard errors of the geometric mean. Cormorant control was implemented in 2004 as denoted by arrow.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

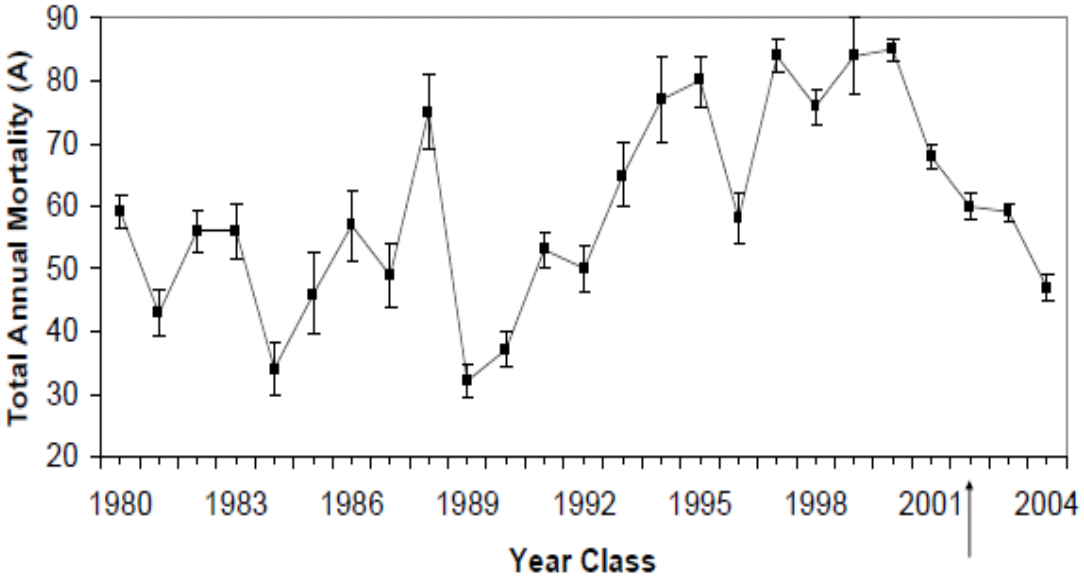


**Figure 1-3.** Total annual mortality rate (A) of yellow perch in the Les Cheneaux Islands as indicated by the cohort method, for year classes between 1980 – 2001. The 2004 cohort was the first year class produced fully within the control period since the proliferation of cormorants in the area. The 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*a*).

#### *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 MDNR has observed marked declines in young lake whitefish in survey trawl catches from Thunder Bay in recent years (J. Johnson, MDNR, 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 be only 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 MDNR 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.

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. This estimate is not a precise calculation of fish consumption and not all DCCO foraging occurs in Thunder Bay. However, these calculations do provide an indication of possibility of competition for prey-fish resources and potential impacts of DCCO foraging on local fishery resources.

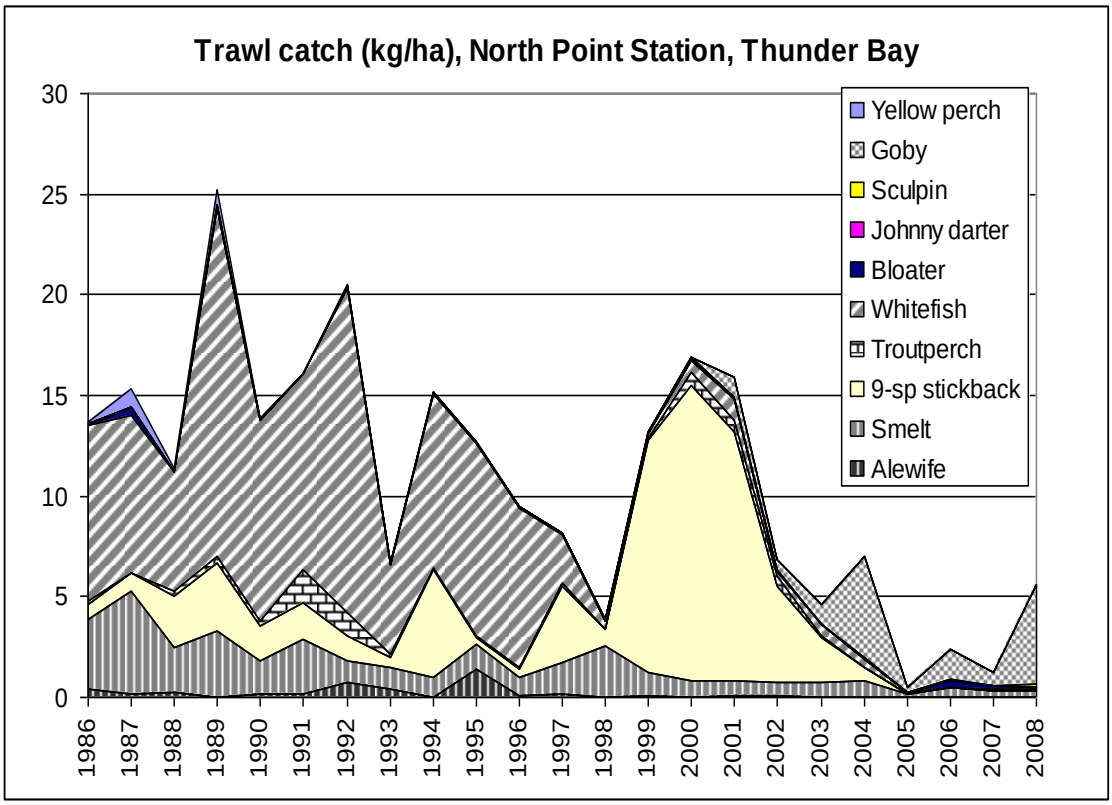


**Figure 1-4.** Trawl catch rates for fish in Thunder Bay, Lake Huron, MI.

The MDNR 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 Fish and Wildlife Conservation Office of the USFWS; two annual gillnet surveys; and ongoing monitoring of the commercial fish catch. The MDNR 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 MDNR 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 DCCO predation, would shed light on mechanisms causing the decline in fish population sizes 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]. The number of DCCOs killed in off-colony shooting was 1,845 in 2006, 1,447 in 2007, 1,279 in 2008 and 1,032 DCCOs in 2009. Although preliminary fishery 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 MDNR and members of the public are concerned about the sustainability of fish populations in this area in relation to potential predation impact by DCCO.

In 2006 the MDNR conducted a preliminary analysis to assess the amount of fish taken from Bays de Noc by DCCOs (D. Fielder, MDNR, personal comm.). 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).

[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.

The available foraging area was determined using the consumption area formula used by Ridgway et al. (2006*a*, *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. 2006*b*) 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 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 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 MDNR 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 MDNR 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 traps has increased slightly in the past 10 years (Kaemingk 2008), 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.

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 de Noc) was causing shifts in DCCO use of nesting colonies.

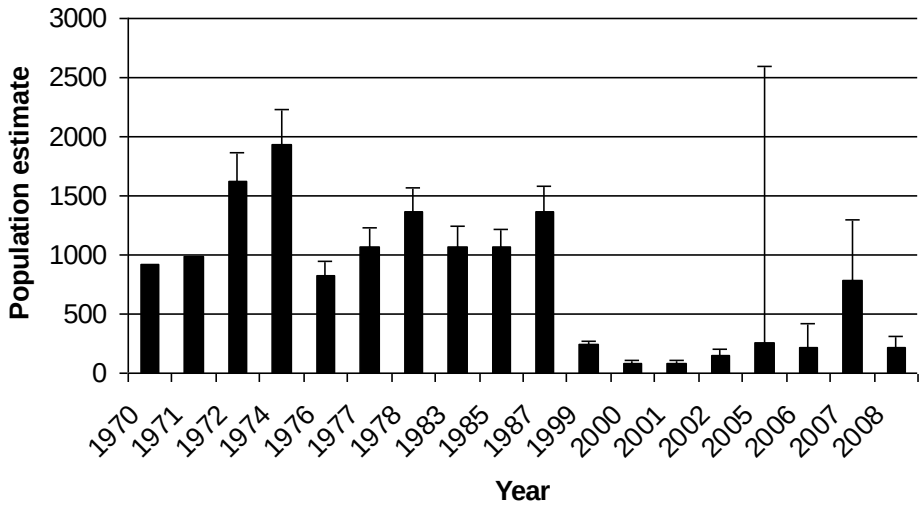


**Figure 1-5.** Schnabel smallmouth bass population estimates of Garden Harbor during 1972-1987 (H. Lenon, unpublished), 1999-2002 (M. Seider, unpublished), and 2005-2008 (M. Kaemingk).

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 size of the fish age groups 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 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).

Kaemingk (2008) 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 2008), 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 (2008) 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 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 MDNR 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 de 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 MDNR 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 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 in northern Lake Michigan, and impacts of DCCO predation on round whitefish (menominee) populations there.

#### *1.5.3.7 St. Marys 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. Marys 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. Marys River. Walleye and yellow perch have been observed in the stomachs of DCCOs from the upper St. Marys 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 comm.). In 2006, 486 nests were counted on the breakwater.

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.

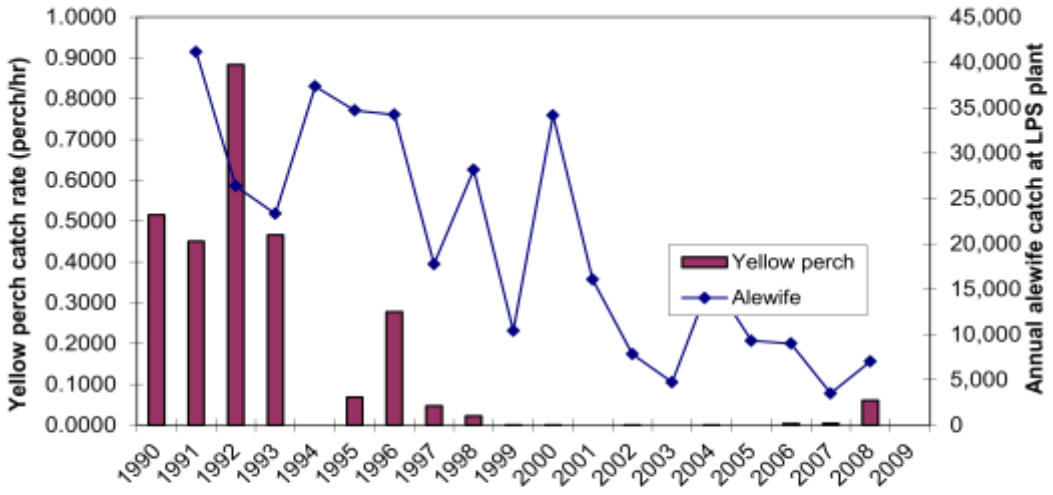


**Figure 1-6.** Catch rates for yellow perch for sport anglers on Lake Michigan out of Ludington, 1990-2009, excluding 1994; and total annual alewife gillnet catch just outside the Ludington pumped storage plant barrier net (data from HDR/LMS 2008).

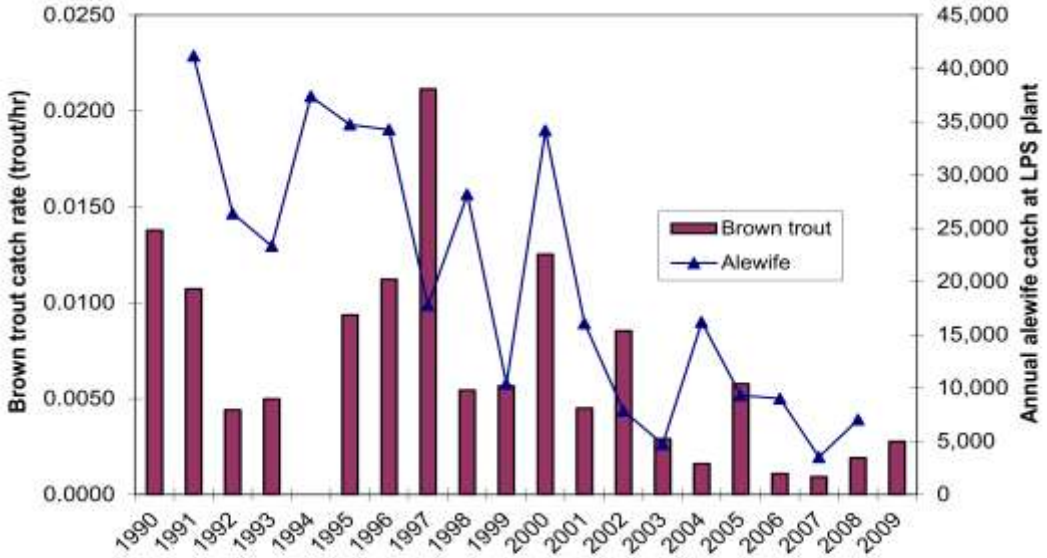


**Figure 1-7.** Catch rates for brown trout for sport anglers on Lake Michigan out of Ludington, 1990-2009, excluding 1994; and total annual alewife gillnet catch just outside the Ludington pumped storage plant barrier net (data from HDR/LMS 2008).

### *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 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 MDNR 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 4$^{th}$ after deer, vultures and geese, and had a higher risk rating than cranes, eagles, ducks, osprey, turkey/pheasants, and 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 MDNR 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, MDNR 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 MDNR 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 bereduced 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 Management Objectives

In addition to the general objectives, the following management objectives for cormorant colonies in the State based on concerns regarding DCCO impacts on fishery resources. Much of the information in this section has been excerpted from the MDNR unpublished report, "An Adaptive Management Framework for Managing Populations of Double-crested Cormorants in Michigan" (MDNR 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*a*) concluded that CDM conducted in the LCI has had a beneficial impact on the perch population (Section 1.5.3.1). The MDNR 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 MDNR 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 MDNR 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*a*). 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 population dynamics and declines in survival of walleye and yellow perch, 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 have eggs oiled while the other two island are privately owned and the owners will not permit egg oiling at this time. Target fish species populations will be monitored through ongoing fish community surveys (e.g., gill net survey) and creel 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 base 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 reductions in DCCO numbers do result in improvements in these factors.

The management proposal for this area is to reduce the archipelago-wide DCCO breeding population 50% each year until the population is reduced to 3,000 breeding pairs and then monitor fishery responses to the reduction. 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 MDNR. 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 MDNR 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 MDNR 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 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 Section 1.5.3 several tribes have Treaty-protected fishing rights in the Ceded waters of the Great Lakes. The tribes, MDNR 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 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 increased 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. Marys 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 tribes are also concerned about vegetation on islands including Gem and Advance Islands. 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. Marys River.

Tahquamenon Island

The goal for this area is to reduce incidence of scarring on lake whitefish and round whitefish and reports of DCCOs harassing whitefish inside trap nets by

decreasing the DCCO populations. The proposed program may also decrease DCCO damage 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 MDNR in obtaining their management objectives for the area per the PRDO. Work proposals for each island would be evaluated on a case-by-case basis 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 MDNR 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 USFWS renewed the depredation order in 2009 (USFWS 2009*b*).

**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. This analysis is tiered to the USFWS FEIS on Double-crested Cormorant Management (USFWS 2003). Wildlife Services, the MDNR 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 MDNR 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 MDNR 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, MDNR) 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 MDNR 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.<br>Has authority to deny approval for projects proposing to take of more than 10% of local colony.<br>Monitors impacts of local, regional and national DCCO damage management efforts.<br>Provides oversight to ensure action agency compliance with the PRDO regulations.<br>Monitors regional DCCO populations. | Provides limited technical assistance.<br>Issues scientific collecting and depredation permits[1].<br>Monitors DCCO take under permits.<br>Monitors regional DCCO populations. |
| U.S. Fish and Wildlife Service - Refuges | Approves/authorizes take of birds on USFWS property.<br>Takes birds as agents of MDNR or Wildlife Services.<br>Aids in monitoring local DCCO population. | May take birds for research under scientific collecting permits.<br>Provides limited technical assistance. |
| Michigan Department of Natural Resources and Environment | Provides technical assistance.<br>Takes birds (less than 10% of local colony) after notifying USFWS.<br>Takes birds (more than 10% of local colony) with approval of USFWS.<br>Monitors State and local DCCO populations.<br>Lead agency for monitoring and documenting impacts on fish populations. | Provides technical assistance.<br>May take DCCOs under scientific collecting or depredation permits.<br>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.<br>Provides technical assistance.<br>Takes birds (less than 10% of local colony) after notifying USFWS and MDNR.<br>Takes birds (more than 10% of local colony) with approval of USFWS and MDNR.<br>Aids in monitoring State/local DCCO populations. | Provides technical assistance.<br>Consults with depredation permit applicants regarding nonlethal and lethal alternatives for damage management[1].<br>Provides Form 37 for USFWS consideration when issuing depredation permits.<br>May take DCCOs under Federal scientific collecting and depredation permits. |
| Tribes | Provides technical assistance.<br>May use lethal and nonlethal techniques to reduce DCCO damage to public resources on lands under tribal jurisdiction.<br>Aids in monitoring local DCCO populations. | Provides technical assistance.<br>As appropriate, may take DCCOs under scientific collecting permits and depredation permits. |
| USDI, National Park Service, Sleeping Dunes National Lakeshore | Approves/authorizes take of birds on NPS property.<br>Takes birds as agents of MDNR or Wildlife Services.<br>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, MDNR, tribes) in certain CDM situations. | May take DCCOs under Federal scientific collecting permits.<br>May use nonlethal techniques to reduce DCCO damage without a depredation permit.<br>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, which is administered by Seney and Shiawassee NWRs. 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, Scarecrow Island and Thunder Bay 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 (MDNR)**. The MDNR 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.

MDNR currently has a Memorandum of Understanding with WS. The document establishes a cooperative relationship between WS and MDNR. 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 MDNR. The MDNR 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.

**<u>Impacts of Disease on Bird Populations</u>**

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, MDNR, Tribes) will consult with the USFWS and MDNR, 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 MDNR regarding potential impacts on State-listed T&E species from the alternatives proposed in this EA. All conservation measures recommended by the MDNR 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 MDNR 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 level 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 MDNR have also been conducting annual surveys of DCCO colonies at sites where CDM is conducted. WS, the USFWS, and MDNR 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 MDNR 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 MDNR 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 MDNR 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 MDNR stocks non-native fish species. Another reason that agencies like the MDNR 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 brought the invasive alewife 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*a*). 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 MDNR (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 MDNR 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 MDNR 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 MDNR 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 MDNR 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 MDNR 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 MDNR 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 MDNR 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 a 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 MDNR 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.

<u>Implementation of the PRDO</u>: 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 MDNR 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 applicable state, federal and local laws and regulations.

### 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 MDNR 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 MDNR 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 14,750 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. In addition to the birds which may be taken under the PRDO, 300 DCCOs per year may be taken under Scientific Collecting Permits and 450 DCCOs under Migratory Bird Depredation Permits.

### 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, MDNR, 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 MDNR 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.

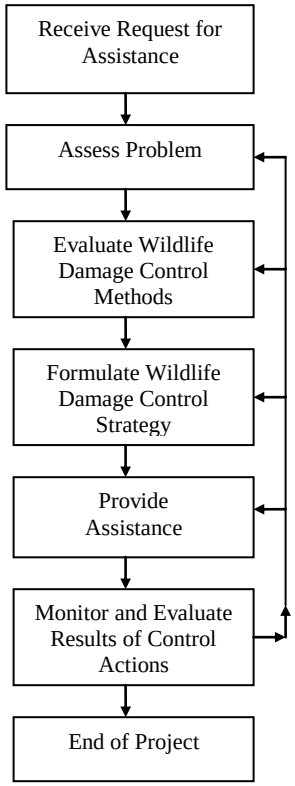


Figure 3-1. WS decision Model

### 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 MDNR 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 MDNR, 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 MDNR 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 MDNR 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*b*).

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*b*, 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 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 MDNR 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 MDNR 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 MDNR 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 | 160-245[2] |
| **Scientific Collecting Permits** | 0 | 350 | 0 | 246 | 0 | 0 |
| **TOTAL LETHAL TAKE OF BIRDS** | **2,007** | **3,218** | **5,908** | **8,774** | **8,345** | **9,845-10,030** |

[1] Sum of the maximum number of nests oiled per trip for each site where CDM was conducted.
[2] Two permittees had not provided reports at time of publication. One hundred and sixty birds were reported taken by other permittees. If the two permittees took the maximum number of birds allowed, total take under permits in 2009 would be 345 birds.

**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/MDNR** | 9,200 | 3,610 | Number of breeding DCCOs in excess of 5,000-12,5000 pairs | 14,000 | 3,610 |
| **PRDO - Tribes** | 500 | 600 | | 750 | 600 |
| **MBPs** | | | | | |
| Scientific collecting permits | 500 | | 500 | 300 | |
| Depredation Permits | 300 | | 500 | 450 | |
| **TOTAL** | **10,500** | **4,210** | **Variable** | **15,500** | **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 MDNR 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** | 24,973 | 14,723 | 39,696 |
| **2010** | 18,432 | NA | |

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, MDNR,

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 MDNR 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 MDNR 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 MDNR 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/MDNR 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 MDNR 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 MDNR 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 15,500 birds (maximum annual 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 15,500 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 MDNR 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 14,750 birds and cumulative take by all sources would be limited to 15,500 birds per year. Of the 14,750 birds per year that could be taken under the PRDO, up to 14,000 birds could be taken by WS and the MDNR 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 15,500 birds per year. Cumulative impacts of individual damage management actions resulting in annual take in excess of 15,500 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 15,500 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 MDNR 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 5,000 birds to the annual take under the PRDO for Alternative 1 to the annual cumulative take for all states under the PRDO for 2004-2010 would raise levels of take to 30,000, 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 37 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)**

**<u>Adverse Impacts on Non-target Species (Not Threatened or Endangered Species)</u>**

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, Caspian Tern and Lake Huron locust. Trampling associated with CDM activities intended to prevent DCCO colonization of new sites could also impact state-listed plants. Prior to any control action, the lead and cooperating agencies will consult with the MDNR to ensure that no actions taken under this plan will adversely affect Michigan's State-listed threatened and endangered species. All recommendations from the MDNR 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 species 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**

<u>Adverse Impacts on Non-target Species Including Threatened and Endangered Species.</u> 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 MDNR 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 as 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 allow Federal agencies to only use nonlethal techniques to protect public resources. The MDNR 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 MDNR and tribes would have limited access to lethal CDM techniques. However, it is likely to take longer for the MDNR 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 may 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 15,500 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 15,500 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 MDNR 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 MDNR 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 15,500 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 15,500 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 MDNR 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 MDNR 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 1 and 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 believe the knowledge that lethal CDM methods can be or have been used at a location would compromise their enjoyment of the 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 MDNR 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 – Adaptive Integrated Cormorant Damage Management**

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 MDNR 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 MDNR 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 MDNR 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 15,500 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 15,500 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 15,500 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 15,500 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 MDNR 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 Section 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 free-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 MDNR 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 Michigan.

| 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.<br>MDNR 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.<br>MDNR 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.<br>Specific measures to minimize impacts to T&E species.<br>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.<br>Specific measures to minimize impacts to T&E species.<br>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.<br>Specific measures to minimize impacts to T&E species.<br>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.<br>Specific measures to minimize impacts to T&E species.<br>Benefits to species adversely impacted by DCCOs similar to Alternative 3 but slower to achieve. | No effect by Federal agencies.<br>Low adverse effect by MDNR and tribes - methods used would be highly selective with very little risk to non-target species.<br>Specific measures to minimize impacts to T&E species.<br>Benefits to species adversely impacted by DCCOs dependent upon efficacy of nonlethal techniques and reduced use of lethal techniques at non-Federal sites.<br>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*<br>*Integrated CDM Program Including PRDO (No Action)* | *Alternative 2*<br>*Only Nonlethal CDM by Federal Agencies* | *Alternative 3*<br>*Adaptive Integrated CDM* | *Alternative 4*<br>*Adaptive Integrated CDM with Limited Take*<br>*(Proposed Action)* | *Alternative 5*<br>*No CDM by Federal Agencies* |
|---|---|---|---|---|---|
| **Effects on Human Health and Safety** | Negligible risk from methods used by agencies and tribes.<br>Good probability of reducing hazards associated with DCCOs. | Negligible risk from methods used by lead and cooperating agencies.<br>Risk from MDNR and tribal use of lethal techniques less than low levels anticipated for Alts. 1 and 5.<br>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.<br>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.<br>Probability of reducing hazards associated with DCCOs the same as Alternative 1. | No risk from actions of Federal agencies. No CDM on Federal land.<br>Risk from MDNR and tribal use of lethal techniques less than low levels anticipated for Alts. 1 and 4.<br>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<br>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 MDNR and tribal use of lethal CDM methods to protect public resources on non-Federal lands<br>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 MDNR and tribal programs. | Moderate effect at local levels due to intensity of DCCO removal. DCCO viewing opportunities would still be available.<br>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.<br>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.<br>Impact of non-Federal entities will depend on success of efforts to relocate problem DCCOs with nonlethal techniques and success of limited MDNR and tribal use of lethal CDM methods to protect public resources on non-Federal lands.<br>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 MDNR efforts.<br>No benefits to those who enjoy public resources adversely impacted by DCCOs on Federal land. |

| Issues | *Alternative 1*<br>*Integrated CDM Program Including PRDO (No Action)* | *Alternative 2*<br>*Only Nonlethal CDM by Federal Agencies* | *Alternative 3*<br>*Adaptive Integrated CDM* | *Alternative 4*<br>*Adaptive Integrated CDM with Limited Take*<br>*(Proposed Action)* | *Alternative 5*<br>*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 MDNR and Tribes.<br>Use of lethal methods by MDNR and tribes greatly reduced. | Moderate effect - methods viewed as inhumane (lethal CDM methods) by some people would be used by agencies and tribes.<br>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.<br>Annual lethal take intermediate to Alternatives 1 and 3. | No effect by Federal agencies. No CDM on Federal land.<br>No use of lethal take by any entity other than MDNR and tribes. Use of lethal methods by MDNR and tribes greatly reduced. |

# CHAPTER 5: LIST OF PREPARERS AND PERSONS CONSULTED

| | |
|---|---|
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# CHAPTER 6: RESPONSES TO COMMENTS

This appendix contains issues raised by the public during the comment period for this EA and the agencies' response to each of the issues. The agencies received 54 comment letters regarding the EA. Comments from the public are numbered and are written in bold text. The agencies' response follows each comment and is written in standard text.

The EA (Section 2.1.4) notes that the public reaction to wildlife damage management is variable and mixed because there are numerous philosophical, aesthetic, and personal attitudes and opinions about the aesthetic and utilitarian values of wildlife, and the best ways to reduce conflicts/problems between humans and wildlife. The diversity of opinions regarding wildlife and wildlife management was reflected in letters advocating for and against CDM and the proposed CDM program. Comments ranged from expressions of pleasure at the increase in DCCO numbers and the opinion that the increase was a sign of the improving health of the Great Lakes ecosystem to expressions of dismay at another adverse impact on the native ecosystem by a species perceived to be present in artificially high numbers because of the abundance of non-native fish for forage. Despite the diversity of values and opinions, the common theme in all the letters was the authors' passionate concern for the well-being and future of the state's natural resources, a concern shared by the lead, cooperating and consulting agencies.

**1. Why aren't clubs allowed to organize lethal eradication of DCCOS and why isn't there a hunting season for DCCOs?** The PRDO only authorizes States, Tribes, WS and their designated agents to conduct CDM. The EIS on cormorant management (USFWS 2003) did consider the use of hunting seasons, but chose to not to make hunting seasons available as a management option (EIS Response to comment 6, USFWS Final Rule Response 15).

**2. Can our club or organization help with conducting CDM under the PRDO?** Yes, but only as a designated agent of the MDNR, WS or the tribes. As discussed in EA Section 1.5.3.10, WS has developed a volunteer program that uses hazing and limited lethal removal to reduce DCCO foraging in areas where smaller-sized fish such as yellow perch and sunfishes are spawning in shallow water and very vulnerable to DCCO predation. The volunteers work as designated agents of WS and are required to go through a mandatory annual training program, and comply with project restrictions (e.g., emphasis is harassment with only occasional shooting to reinforce harassment) and reporting requirements to participate. These efforts are conducted during the migration peak in mid April and early May. 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.

**3. Hazing programs don't work because, when the weather is bad, the crews don't go out and the DCCOs get all the fish.** We understand that hazing programs have their limitations. However, safety of volunteers and agency personnel must always be a priority and hazing cannot be conducted under unsafe conditions. Additionally, due to agency resource limitations, harassment programs are commonly conducted by volunteers who may be unable or unwilling to haze birds in inclement weather. However, despite these limitations, we believe the harassment

programs provide far more site-specific protection for fish than if DCCOs were allowed unlimited access to the fish. A study by Dorr et al. (2010) of the hazing program at Drummond Island and Brevoort Lake indicated that cormorant foraging at the sites decreased DCCO foraging attempts an average of 90%. Walleye and yellow perch abundance increased significantly at Drummond Island after the program was initiated. Similarly, the number of age 3 walleye at Brevoort Lake increased to record levels in 2008 after 3 years of DCCO harassment.

**4. Egg oiling as currently practiced is not having an adequate impact, especially in Bays de Noc. Agencies also need to shoot DCCOs.** Shooting has been used in combination with egg oiling and nest destruction in the Bays de Noc area since 2007 (EA Section 1.5.3.3). The number of adults killed each year under the current management alternative has been approximately 10% of the local breeding population. Increased levels of shooting are proposed for this area under Alternatives 3 and 4. The number of nesting DCCOs in Bays de Noc has decreased from approximately 9,850 pairs in 2006 to 6,390 in 2010.

**5. DCCOs should be eliminated or at least severely reduced. They are a non-native species and have no natural enemies to keep them in check. What good is a DCCO?** Double-crested Cormorants are native to North America and have been listed as a protected species under the Migratory Bird Treaty Act since 1972 (Section 1.5.1). DCCOs, as a predatory species, are an integral part of a diverse and healthy native ecosystem (USFWS 2003). They have the same predators as other colonial-nesting waterbirds. Islands tend to be preferred nesting sites to reduce risks from mammalian predators, but there is still predation risk on the islands. Gulls prey on eggs and chicks. Bald Eagles have also been observed preying on DCCOs.

Cormorants have inherent value regardless of their use to humans (USFWS 2003, EA Section 2.1.4). As the wildlife biologist Aldo Leopold famously said, "If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering." Given that cormorants are a species native to Michigan, it is reasonable to expect that they serve a role in Great Lakes ecosystems, whether that role is fully understood or appreciated or not. Further, the people of the United States of America, through treaties negotiated by their elected officials, have indicated that conservation of native migratory birds is a fundamental priority for its own sake, regardless of economic values. The importance of DCCOs in native ecosystems and to the people of Michigan was noted when DCCOs were protected under the state endangered species law from 1976 until 1985.

Cormorants also have aesthetic value for individuals who enjoy watching migrating birds and large waterbird colonies. According to the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, 3.2 million individuals annually participate in wildlife watching activities in Michigan, including 2 million individuals who reported engaging in bird watching. Wildlife watching generated approximately $1.6 billion annually for Michigan's economy (USFWS 2006). This is comparable to the $1.7 billion generated by angling. A number of bird watching resources identify sites where cormorants may be viewed in Michigan during the migration and breeding seasons, indicating that birdwatchers have an interest in visiting sites where cormorants may be seen. While not all wildlife watching dollars are generated by cormorant viewing, neither are all angling dollars at risk from current or potential impacts of

cormorant foraging.

Complete eradication of DCCOs is not an ecologically or sociologically acceptable solution to DCCO conflicts. Although the individual CDM actions proposed under alternatives 1, 3 and 4 would have the cumulative impact of reducing the state DCCO population, the EA contains sufficient protective measures to ensure the continued viability of the population (EA Section 1.5.8.1).

**6. Why is the federal government involved in CDM? DCCOs should be managed by the state, not the federal government. The federal government doesn't care what damage DCCOs do on a local level.** The USFWS has authority for managing DCCOs granted by Congress in the Migratory Bird Treaty Act. The possibility of removing DCCOs from the list of birds protected under the MBTA was considered but not analyzed in detail in the EIS (EIS response to comments 5 and 10). The USFWS understands the potential impacts DCCOs can have on property and natural resources. Concerns about the damage caused by DCCOs prompted the USFWS to prepare an EIS on methods to facilitate reducing local DCCO damage to property and natural resources. The EIS established the PRDO which granted states, WS and the tribes increased authority to manage cormorant damage. However, the USFWS cannot grant the state "full authority" without abdicating its responsibility under the MBTA. Wildlife Services does not have regulatory authority for wildlife management. WS provides assistance with wildlife damage management when a need exists and assistance is requested in accordance with applicable local, state and federal regulations. WS has been providing assistance with CDM in Michigan since 2004. The EA does consider an alternative under which WS would discontinue current efforts and not be involved in CDM in Michigan (Alternative 5).

**7. There should be places, like our national wildlife refuges, where native wildlife are protected. Permitting CDM on national wildlife refuges is in direct opposition to the purpose of these sites.** The mission of the USFWS is, "Working with others to conserve, protect, and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people". National Wildlife Refuges are established for various reasons and often cite specific species in enabling legislation. However, this does not diminish our responsibility to protect and provide for all native species of wildlife using these areas. Occasionally there are species population fluctuations (numbers and/or spatial) that negatively impact other species or their habitats. Any action on Refuge lands is closely monitored by Service and other agency's biologists and is conducted to conserve the diversity of native species and their habitats. Finally, CDM will never be allowed to the point of endangering the population of cormorants. (Response merged with another question/response).

**8. All CDM done under the PRDO should be carried out by trained biologists with their trained volunteers using humane methods, and with lethal methods used as a last resort.** The PRDO only allows states, tribes, WS and their designated agents to conduct CDM for the protection of public resources. All agency and tribal personnel are trained in the safe and effective use of CDM techniques. Volunteers who participate in the hazing programs must attend annual training on cormorant biology, bird identification, federal state and local regulations applicable to the cormorant hazing program and proper use of hazing methods.

The EA notes that preference is given to nonlethal methods where practical and effective. However, while nonlethal alternatives are desirable, there are relatively few nonlethal methods which may be used without adversely impacting nontarget bird species that nest near DCCOs. Methods such as physical exclusion or harassment cannot be used in most waterbird colonies because of the potential for adverse impacts on co-nesting species.

**9. The Interagency Cormorant Coordination Group is inadequate and biased because it has no representatives from groups that might have an opinion different from the cormorant suppression mindset of the agencies.** The purpose of the Interagency Cormorant Coordination Group is to coordinate the activities of the agencies authorized to act under the PRDO. There are multiple independent agencies in Michigan that may conduct CDM and actions conducted by one entity may impact actions conducted by others. Management actions must be coordinated to ensure that overall take does not exceed allowed levels. Non-government organizations and private individuals are not included on this group as they are not allowed to lethally take cormorants except, possibly, as agents of the designated action agencies (e.g., WS, the MDNR and the Tribes). The group provides a forum for exchange of information and discussion regarding proposed actions and ways to achieve program goals while minimizing risks of potential adverse impacts from CDM. Annual management recommendations by the MDNR are developed based on input from the public, collected fishery data and data analysis, collected data on cormorant colonies and migrating cormorant flocks, available management techniques, and available funding and staff. Any resident of the state of Michigan may contact the MDNR to provide feedback on resource management issues. The USFWS and WS are similarly open to public comment on management actions. Tribal agencies are similarly accountable to their members and tribal leaders. Although the agencies comprising the working group work cooperatively together on DCCO management issues in Michigan, each agency retains its own authority to make management decisions.

**10. Objectives wrongly omit any effort to increase public understanding of the role of DCCOs in the environment and increase tolerance for this species. Killing more birds with no substantial reason to do so just perpetuates the idea that the DCCO is a "bad" bird and the cycle of ignorance.** Based on analysis in the EA and responses to comments, the agencies do not agree that the proposed CDM actions are being conducted without substantial cause. EA Section 3.4.1 specifically addresses educational efforts as an integral part of CDM along with research, technical assistance (advice) and direct damage management. Open lines of communication are maintained between the action agencies and stakeholder groups which have strong feelings regarding cormorant management. Discussions have been held with many of these groups to better inform them of the current knowledge of the role of cormorants in Great Lakes food chains, ongoing management activities, and available management options. Wildlife Services includes information on the status of DCCOs as a native species and the fact that DCCOs are not responsible for all fishery declines in their presentations. The MDNR has developed informational publications, produced press releases, and communicated with journalists on the subject of cormorant management. Personnel from WS and the USFWS have similarly participated in public meetings and interviews with journalists, and developed fact sheets on DCCO management. The publications are available to all, and attempts are made to ensure that these products are unbiased to the extent possible.

**11. The MDNR and WS should reevaluate their attitude toward DCCO control. There are far more important issues at play in the Great Lakes that deserve attention. The amount of money spent controlling DCCOs should be put to other more deserving projects.** Michigan Department of Natural Resources and Environment priorities are driven by a number of factors including risks to public resources, available opportunities for conservation, values of the residents of Michigan, and the availability of resources to conduct projects. Decisions to conduct cormorant damage management activities are driven by a concern for the impacts of this species on other public resources (primarily fish, but concerns about vegetation and co-nesting species have also factored into management recommendations) and input from private citizens and their elected representatives at the local, county, state, and federal level regarding the values they place on cormorants, their prey, and their environment. Given these factors, it would be negligent for the MDNR not to examine the current status of cormorants in Michigan and make recommendations for their management to ensure the conservation, protection, management, accessible use and enjoyment of the State's natural resources for current and future generations. The WS program is a cooperatively funded, service-oriented program and does not have regulatory authority. Wildlife Services provides federal leadership and assistance in wildlife damage management when requested by the applicable landowner/manager or agency. Wildlife Services conducts CDM in Michigan in accordance with objectives established by the applicable landowner or resource manager/agency and the provisions of the PRDO.

**12. The EA fails to present a valid "no action" alternative as required by NEPA. The only thing that comes close is Alternative 5 which would still allow state agencies and the tribes to take DCCOs.** As stated in EA Section 1.6, this document is tiered to the USFWS EIS (USFWS 2003) which resulted in the establishment of the PRDO. The purpose of this EA is to review alternatives for implementing the decisions made in the USFWS FEIS and final rule and to provide more site-specific analysis of program impacts. As noted in Sections 3.3.2 and 3.3.5, state and tribal authority to take up to 10% of a local breeding population was granted in the PRDO. Although WS can choose to not participate in CDM in Michigan (Alternative 5), and the Service retains oversight authority, modification of the PRDO and authorities granted in the Order are outside the scope of this analysis. The "No Action" alternative analyzed in the EA (Alternative 1) is consistent with CEQ direction which states that the "No Action" alternative may be interpreted as the continuation of existing practices (CEQ 1981).

**13. There is no scientific justification for any of the alternatives. EA wrongly portrays natural functioning of ecosystem as "damage". Labeling these functions as "damage" creates a perception which is not universally accepted.** The agencies and tribes recognize the importance of resource management being science-based. In this analysis, the agencies and tribes relied on scientific studies as well as the best available biological knowledge and expert opinion to make their decisions. Additionally, social, political and economic factors contribute to agency and tribal decisions. What constitutes "sufficient" evidence to justify DCCO control is, to a certain extent, a question of values. Among stakeholders concerned with DCCO management we can safely say there is considerable disagreement over whether or not the proposed action is justified (with some even arguing that the proposed action does not go far enough). The USFWS and WS, as the lead and cooperating agencies on the EIS (USFWS 2003) and this EA jointly agree that there is sufficient evidence to justify the proposed action.

As noted in Response 5, the agencies agree that DCCOs are a native species and an important part of a healthy native ecosystem. Cormorant activities and use of resources coincide with those of people. Agencies such as the MDNR, USFWS and WS are charged with the responsibility of sustaining healthy ecosystems while also addressing the diverse and sometimes conflicting human expectations from the nation's natural resources. The agencies understand and acknowledge that DCCO actions which may be perceived by some members of the public as an adverse impact on their use or enjoyment of natural resources (damage), is perceived by others as part of the normal ebb and flow of a dynamic ecosystem. Plant and animal community composition, population numbers and distribution, are in a constant state of change. During pre-settlement times, these processes were self-regulating. However, today because of the vastly altered landscape, management actions must sometimes be taken to keep species in balance with the available habitat, or to mitigate unacceptable damage to other species that are in decline due to loss of habitat. The proposed action does not involve eliminating DCCOs or the important role they play in ecosystems, but rather is intended to use an adaptive management approach which will allow for continued support of DCCOs and other colonial waterbirds and their habitats.

**14. The EA provides no suggestion that humans should modify their attitudes to co-exist with DCCOs.** Coexistence with DCCOs is fundamental to all the alternatives under consideration. The agencies and tribes firmly believe that DCCOs are an essential component of a healthy ecosystem (Response 5 above) and that any CDM alternative considered must not jeopardize the viability of the state, regional or national DCCO population. The general goals established by the agencies and tribes (Section 1.5.8.1) establish a 5,000-pair minimum population for Michigan and also mandate preservation of the distribution of DCCOs throughout the state. Compliance with these objectives necessitates a degree of coexistence between humans and DCCOs. The alternatives under consideration vary in the degree to which CDM will be conducted in the state, the resulting impacts on local DCCO populations, and DCCO impacts on affected resources. In other words, the alternatives vary in the degree to which people who feel they are adversely being impacted by DCCOs are expected to coexist with local DCCO populations. Additionally, all alternatives under consideration include a public education component which includes information on the importance of DCCOs in ecosystems, the existence value of DCCOs and the value of DCCOs and bird-watching to non-consumptive users (Response 10 above).

In the EIS, the USFWS considered, but rejected for further analysis, an alternative in which no CDM would be conducted (EIS Section 2.5.1). In making the decision to eliminate this alternative from further study, the USFWS stated that, "to implement this alternative would be to ignore conflicts associated with cormorants that must be addressed if we are to fulfill our duties to manage America's migratory birds responsibly. Since there is real biological and socioeconomic evidence…justifying the need for DCCO management, we find this alternative to be unreasonable".

**15. DCCOs are having an adverse impact on the fishery in the Bays de Noc/Escanaba area. Fish populations of particular concern are brown trout, splake, perch, walleye, and smallmouth bass in shallow-water areas.** The stocking of splake was discontinued in 2008 due to long-running poor performance in Lake Michigan. Regarding the other species, the MDNR is

also concerned regarding the impact of DCCOs on these species in Bays de Noc. This issue and proposed management strategy are presented in EA sections 1.5.3.3 and 1.5.8.2.

**16. Stocked fish, including fish in Bays de Noc and Bear River in Petoskey, are not making it to harvest. Large numbers of DCCOs at stocking areas are taking all the fish.** The MDNR, tribes and WS are working with partner groups around the state to protect stocked fish at the time of stocking in specific areas. The MDNR has also established a reporting system where individuals can report concentrations of DCCOs at http://www.dnr.state.mi.us/cormorantobs/. Risks to fish at stocking sites and spawning areas are addressed in EA Sections 1.5.3.10. See Response 2 above.

**17. There appear to be declines in Chinook in the Ford River area.** Chinook salmon stocks in Lake Michigan are declining as expected based on recent management decisions to stock less fish in order to provide for a better balance between predators and prey.

**18. With all the major impacts on the Great Lakes Fishery, why are only DCCOs being targeted and not the other causes of fisheries problems? Agencies should address greater underlying issues impacting the fisheries such as the impacts of invasive fish and mussels.** There is no single factor that can be pinpointed to cause fish community fluctuations. It is typically a mix of abiotic and biotic factors, and we can make some fairly strong predictions regarding the impacts cormorants have on fish populations through their daily consumption. The agencies are aware that other factors such as invasive species (e.g., quagga and zebra mussels and round goby) are also having substantial impact on Great Lakes ecosystems, and the agencies are acting within the limits of available technology and resources to address these issues. For example, the MDNR is working with federal regulators to get improvements in the regulations governing ballast water and other vectors for invasive species. State fisheries management agencies have also decreased the number of predatory fish stocked in the Great Lakes in order to keep fish stocking in balance with the available forage base. The proposed CDM projects are another facet of this effort. Based on available data in the EA and review of the literature, the agencies have concluded that there is sufficient evidence to believe that DCCOs are contributing substantially to declines in fishery resources and that reducing DCCO predation will have a positive impact on the fishery. The proposed adaptive management approach will allow for positive impacts on the fishery while ensuring the program does not jeopardize the viability of state, regional and national DCCO or nontarget species populations.

**19. What about DCCO damage to fisheries in areas not specifically mentioned in the EA including the Menominee River and inland lakes such as Houghton Lake.** The management objectives and analysis presented in the EA include provisions for CDM to be conducted at sites in addition to those specifically addressed in the EA (Section 1.5.8.5, 1.7.4). New projects may be added so long as CDM is permitted under the selected alternative and individual and cumulative impacts remain within the parameters established and analyzed in the EA. Action agencies would consult with one another through the ICCG prior to initiating new CDM projects under the PRDO and would comply with the USFWS notification and review requirements for implementation of the PRDO.

**20. Cormorants are having an adverse economic impact and there is job loss associated with fishery declines caused by DCCOs.** The agencies understand that when DCCOs adversely impact fish populations there can be substantial adverse economic impacts on the community, including decreases in recreation and associated losses in business revenue and jobs. Shwiff et al. (2009) evaluated DCCO impacts on the Oneida Lake Region of New York. Studies have documented DCCO damage to recreational fishing in Oneida Lake (VanDeValk 2002, Rudstam et al. 2004.). Total estimated revenue lost to the Oneida Lake Region from 1990-2005 ranged from $100 million to $500 million (in 2008 dollars) and estimated job loss for the period ranged from 3,000-12,000. Costs and impacts of DCCOs and DCCO foraging on jobs in Michigan will depend on a number of variables including the extent to which DCCOs are contributing to observed fishery declines and impacts of individual fisheries on local economies. As noted by one commenter, reductions in fish populations can also have impacts not commonly considered in economic analyses including adverse effects on community events and fundraisers such as fish dinners and fish boils for charity. The challenge in complex systems like the Great Lakes which are impacted by many factors including invasive species and water quality concerns, is to determine the cause(s) of the decline and the extent to which DCCOs are contributing to the problem. (See also responses 18, 21, 27)

**21. There is no unequivocal evidence that DCCOs are the crux of the problems in the Beaver archipelago.** Given the highly complex and dynamic nature of the Lake Michigan ecosystem, time frames required for data collection and the constraints on agency resources, *unequivocal* evidence is unlikely to ever be available. When establishing the PRDO the USFWS specifically stated that they did not expect agencies to wait until impacts occur and are proven with absolute certainty before they are allowed to manage DCCOs (EIS Chapter 7, Issue 53). One of the benefits of the PRDO is that agencies in areas where the risks of adverse DCCO impacts are greatest are given more flexibility in taking action, including preventive action (EIS Chapter 7, Issue 53). Based on information provided in the EA and responses to comments, the agencies believe there is reasonable cause to believe that DCCOs may be having an adverse impact on fisheries in the Beaver Archipelago. (See Response 13).

**22. Removing DCCOs may have adverse unintended consequences, as argued in the EA for alewives. For example, at present, the primary diet item for DCCOs in the Beavers is the invasive round goby, which eats the eggs and fry of native sport fish. DCCOs are providing a benefit by eating invasive species. Because of their opportunistic feeding, DCCOs may play an important role in controlling Asian carp populations.** While the agencies agree that manipulation of predator prey systems should be undertaken with caution, the available evidence does not support the hypothesis that DCCOs can control the round goby population or prevent the establishment of Asian carp. Round goby populations were first documented in the Great Lakes (St. Clair River) in 1990 and, by 1995, gobies were found North of Chicago and in Duluth, Minnesota (USDA 2011, USGS 2000, INHS 1995). The productivity of the species is so high that populations have exploded to their present levels with current and higher numbers of DCCOs feeding in the Great Lakes and no CDM conducted for the protection of free-swimming fish populations until 2004 (EA Sections 1.5.7). Consequently, it seems unlikely that DCCOs have or can limit goby populations or reduce negative goby impacts on other resources. Goby and alewife population trends are likely controlled by factors other than DCCO. DCCOs are opportunistic feeders and cannot access all parts of most lakes, especially

deep lakes like the Great Lakes. Consequently, they are unlikely to take a substantial number of Asian carp until the species is well established in the ecosystem.

It should also be noted that invasive fish such as the round goby do not appear to be the predominant DCCO food item in all areas where CDM is conducted (M. Ebener, CORA, unpub. data). Biologists working with CORA identified 9,927 fish in regurgitant samples collected from Rock and Gem Islands in the St. Marys River during 2007-2008. Based on numbers of fish identified, unidentified shiners comprised the majority of fish collected at Rock Island (99%). Rainbow smelt (33% of fish counted), yellow perch (20%) and unknown shiners (20%) comprised the majority of fish collected at Gem Island. Alewife (2%) and round goby (0.7%) were only observed in regurgitant samples collected at Gem Island.

**23. Please provide more detail on the monitoring that would occur in the Beaver Island area. With the exception of the work being conducted by Michigan State University and the MDNR Charlevoix Fisheries station (which predated CDM), there has been very little monitoring for the desired effects of WS CDM.** Central Michigan University (CMU) has been conducting fish population assessments (focusing on smallmouth bass) since 1970. The MDNR Charlevoix Fisheries Research Station has regularly collaborated in this work. This monitoring will continue for the foreseeable future, including; smallmouth bass tagging studies (for estimates of adult abundance), assessments of smallmouth bass growth and condition, measurement of young smallmouth bass production, and evaluation of fish community composition (other than smallmouth bass). Expanded assessment work / monitoring will depend upon availability of additional staff and funding. Our goal is to develop appropriate monitoring programs within available budgets for determining the success of the program. The MDNR is working with the Quantitative Fisheries Center at Michigan State University to help define and refine current data collection procedures to best allocate resources to answer questions regarding the impacts of CDM on fishery resources.

**24. The EA relies too heavily on unsupported statements from the Seider (2003) thesis which has not been peer-reviewed or published. The methodologies and data analysis in the study were not sufficient to address the questions posed.** There is only a limited amount of information to work with regarding the specific question of cormorant impacts in the Beaver Islands. Seider (2003), Seefelt (2005) and Kaemingk (2008) are the only studies to specifically examine the question. Information from all three studies is included in the EA. To exclude or marginalize any of these analyses would be imprudent. As stated in EA Section 1.5.3.4, 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 thesis did not assert conclusively that DCCO predation was the only possible cause of the observed trends. 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). The EA does not draw conclusions based on Seider (2003) but does ask questions that adaptive management approaches are intended to help address. (See Response 25, 26).

**25. Studies used to justify CDM in the Beaver Archipelago are flawed (study does not include avian data, or address limitations of sampling gear). The Seider (2003) conclusion that mortality due to other predators is unsubstantiated is unsupported because the study**

**did not sample these predators directly or model impacts of these predators. Flaws in Seider (2003) are not given the same scrutiny as work such as that of Seefelt (2005), Seefelt and Gillingham (2008), and Kaemingk (2008) which advocate for a more cautious management approach.** Seider (2003) used avian data from other studies that were available to him in his calculations of the potential impact of DCCOs. No other substantive alterations to the fish community or the food web were observed at the time. Seider's conclusions were reasonable enough to raise the question for further consideration. Smallmouth bass samples in each year showed fish in all size categories from 110 mm to 510 mm suggesting that there were no missing age-classes in the datasets attributable to sampling gear. Kaemingk (2008) concluded, "as evident by very low apparent survival during the summer months, it appears that smallmouth bass are emigrating out of the Beaver Archipelago or suffering from post-spawn mortality". However, Kaemingk (2008) also concluded that, based on the low occurrence of bass in DCCO diets and data on DCCO foraging patterns (Seefelt 2005), DCCOs were not likely to be a limiting factor. Like Seider, Kaemingk (2008) did not directly sample predators or model predator impacts. It is noteworthy that Kaemingk (2008) also concluded that, based on movement between bays and islands, the smallmouth bass population within the archipelago appears to be one large population and that management decisions should incorporate the entire Beaver Archipelago. Limitations of all 3 studies are discussed in Section 1.5.3.4.

The EA works on the basis of science. There are not 'preferred' ideas. The agencies acknowledge that the available information is less than ideal, however we do believe that there is cause for concern regarding DCCO impacts on the smallmouth bass population. The adaptive management approach proposed by the MDNR would allow the MDNR to further explore this issue by manipulating the DCCO population while still ensuring that the action would not jeopardize the DCCO population or have other significant adverse environmental impacts. The proposed action is consistent with USFWS expectations in establishing the PRDO. The USFWS specifically stated that they did not expect agencies to wait until impacts occur and are proven with absolute certainty before they are allowed to manage DCCOs and that one of the benefits of the PRDO is that agencies in areas where the risks of adverse DCCO impacts are greatest are given more flexibility in taking action, including preventive action (EIS Chapter 7, Issue 53).

**26. Seider (2003) inappropriately uses a closed population model to estimate bass population. Studies including Kaemingk (2008) and Latta (1963) do not support idea that the smallmouth bass population is a closed population.** The population densities calculated using the different methods are similar, indicating movement or mortality is very low (Ricker. 1975), which is likely if the sampling is conducted within a narrow time frame. Most estimates were made from sampling conducted during a 2-3 week period (most often 2 weeks).

**27. Fish harvest from the tournament in Ludington area has declined substantially for 5-7 years prior to CDM and that for the last 2 years since the initiation of CDM, the fishery has improved. How can there be any doubt that the DCCOs were limiting the system?** We agree that yellow perch numbers have declined within the same time frame as cormorant numbers have increased. However, many factors impact perch populations. In order to separate what is really occurring with fish populations such as yellow perch we propose to use an adaptive management approach to determine whether cormorants are impacting fish populations in this area. Salmon harvest at tournaments has dropped at many locations around Lake

Michigan in recent years. This is attributable to a multi- agency agreed upon management action to decrease the number of large predators (salmon) in Lake Michigan (K. Smith, MDNR Fishery Division Chief, internal letter to MDNR December 6, 2006; Newcomb and Dexter 2006) to help maintain a reasonable balance with prey levels.

**28. Agencies need to address DCCO impacts on fishery in Saginaw Bay. There are virtually no perch and greatly reduced numbers of walleye in the Bay.** The walleye population in Saginaw Bay is currently at fairly high levels though there has been a slight decline recently. There is no evidence that DCCOs are having any current impact on either perch or walleye but we will continue to monitor those populations and the population level of DCCOs. We are aware that there is the potential for cormorants to impact the fish populations in the bay, but we do not currently feel that is the case.

**29. The EA inaccurately refers to changes in apparent survival as "pattern of loss". Apparent survival in the Beaver Islands is impacted by mortality and emigration. Data presented by Kaemingk (2008) angler reports and Central Michigan University's long-term data set support high temporary emigration rates of smallmouth bass.** Kaemingk (2008) provides evidence that emigration does occur in the system and can explain at least part of the lower apparent survival. Seider's explanation for this lower apparent survival was that DCCOs may be impacting the population at a low level. The point is taken. However the key observation is that smallmouth bass populations are much reduced compared to populations prior to the increase in DCCOs. In both studies population numbers have been relatively consistent and are clearly much below the abundances of smallmouth bass prior to the occurrence of DCCOs. The emigrations do not explain the major decline in smallmouth bass abundance and are not relevant to explaining the differences in population levels in the 1970s and the current time.

**30. The EA inaccurately states that the high recapture rate in netting used for population monitoring in the Beaver Islands is inconsistent with the hypothesis of high temporary emigration rates. Data for population monitoring is only from one sampling period instead of both sampling periods required to adequately address this issue and was used in Kaemingk (2008).** While emigration of bass and other fishes away from the Beaver Islands may be a competing hypothesis to cormorant predation it does not account for declines in the fishery. The fishery spans considerable spatial areas as well as seasons and years. It corroborates that bass are scarce. The differing theses underscore the management questions that the proposed adaptive management is intended to address.

**31. Seider (2003) concluded that there were particularly high mortality rates in particular age classes. However, fish in those age classes were present during subsequent sampling (Kaemingk 2008). Furthermore, smaller size classes not sampled by Seider (2003) were present in the 2005-2008 Fyke nets instead of the large trap nets. The Kaemingk (2008) study also documented multiple strong age classes over time dominated by fish spawned during the Seider (2003) study.** Seider's work and that of Kaemingk span different periods of time and are not necessarily directly comparable. Work on smallmouth bass and cormorant interactions in Lake Ontario has firmly established that cormorants can depress bass populations (Farquhar, et al. 2004). The proposed adaptive management approach is intended to help shed

light on the interactions occurring in the Beaver Islands. Both studies here clearly indicated that some recruitment occurred every year – no missing years of recruitment. Kaemingk's study indicated that 2002 and 2005 year classes were stronger than other years, but there are *no* strong year classes in this population.

**32. Data in Figure 1-5 refers to population estimates of smallmouth bass in Garden Harbor and not for the entire archipelago.** Noted, correction made

**33. Smallmouth bass are sampled in trap nets, not gill nets as stated on page 19.** Noted, correction made.

**34. Given the current level of data collection in the Beaver Islands and other locations where CDM is proposed under the PRDO, it will be impossible to determine if any future population changes are attributable to CDM or other factors in the system. The only way the current data collection would indicate impact of CDM is if there is a massive response in a large number of different fish species as a result of CDM, which is highly unlikely. Agencies need to either do a very thorough program which includes analysis of fish consumption by DCCOs, the changes in fish populations, and the ultimate gains in fishing, or do nothing further.** The agencies understand that just as negative changes in fish populations may not be attributable primarily to DCCOs, positive changes may also not be directly attributable to CDM. We recognize the statistical limits (and variation) of our monitoring techniques. It is for this very reason that it is necessary to take the rather large cormorant control numbers that we are seeking. The change in the cormorant numbers needs to be sufficiently large enough to detect a change in the fish population measures given their variance. We hope to be able to tease apart the various factors that contribute to population levels of smallmouth bass through our evaluations. In light of current challenges with the fisheries in areas discussed in the EA, and evidence to indicate there is reasonable cause to believe DCCOs may have a substantial impact on fishery resources, the MDNR does not feel that taking no action is a responsible strategy at this time. The MDNR is working with the Quantitative Fisheries Center at Michigan State University to identify ways to best address these questions within the limitations of available resources. The proposed adaptive management strategy would allow for management actions with the potential for positive impacts on public resources while still protecting the viability of the state DCCO population and nontarget species (See also Responses 49 and 52).

**35. Does the EA provide justification for the Age-0 and Age-1 population objectives in the Beaver Archipelago or proposals to achieve management objectives?** To evaluate potential impacts by cormorants on fishes, all ages should be evaluated, if possible. At this time, damage management proposals to address DCCO impacts on these age groups are the same as those proposed for the older age groups.

**36. Do data on DCCOs and perch in Green Bay show that DCCOs can adversely impact perch populations?** No, models using data from a DCCO food habits study conducted in lower Green Bay indicated that although high DCCO concentrations may have reduced the magnitude of the population increase that could result from strong perch year classes, there was no reason to believe that DCCOs were causing a decline in the perch population (USDA 2009).

**37. The EA has inaccurately revised the portrayal of alewife from invasive nuisance species to an important ecological factor as a food source for predatory fish. This argument seems to have been developed to defend CDM when DCCOs were eating alewives in the mid 2000s. It is an example of using data to defend actions contrary to restoring the Great Lakes Ecosystem.** While both alewife and round gobies are non-native species, both provide forage for important game species that are highly desired by anglers in Michigan. See EA Section 2.2.7 regarding the role of non-native sport fish in the Great Lakes. We recognize the negative impacts that non-native species can have on other native species and the proposed actions are not intended to preserve goby populations, *per se*. In some of the proposed project areas, management actions are intended to reduce foraging pressure on the overall prey base which, at the moment, also includes round goby and alewife.

**38. It is not appropriate to cite the situation with perch in the Les Cheneaux as justification that CDM should be conducted for smallmouth bass in the Beaver Archipelago. Each island off-shore ecosystem is unique.** We agree that each island system is unique and we have addressed them separately in the EA. However, the same basic mortality factors are acting on fish populations in each area. The systems may differ in the relative importance of each mortality factor. Work in the Les Cheneaux area establishes that, under certain conditions, DCCOs do seem to have an adverse impact on fishery populations and that CDM may be able to help improve fish populations. Data from other areas in the Great Lakes has also provided information indicating the DCCO predation can adversely impact fish populations. Ridgway and Fielder (In press) note that for predatory fish taken by anglers and DCCOs, a relatively small proportion of DCCO diets may represent a significant portion of juvenile cohorts also targeted by recreational fisheries. Data from Lake Ontario indicated that although smallmouth bass were only approximately 1-7% of DCCO diets, total consumption was sufficient to substantially impact survivorship in sub-adult smallmouth bass (Ridgway and Fielder, In press; Johnson et al. 2002, Lantry et al 2002). The agencies recognize the differences in the systems and are using an adaptive management approach to define management goals and indicators in each area.

**39. The EA should consider illegal fishing as a potential cause of observed problems with the smallmouth bass fishery in the Beavers. The archipelago is isolated, infrequently patrolled and easy to fish without law enforcement repercussions.** The MDNR considers all factors which could contribute to the decline in smallmouth bass numbers, including illegal harvest. Quantifying illegal take is always difficult, however, available information indicates that illegal harvest is not likely to be the limiting factor for the smallmouth bass population in the Beaver Islands. People generally take the older (adult) age classes of fish. However, data from Seider (2003) indicate that survival rates for adult bass are relatively high which would indicate that angler harvest (legal and illegal) is not limiting the population. Similarly, data from Kaemingk (2008) also indicated that adult smallmouth bass are not experiencing high mortality during the summer months when illegal harvest may be more likely.

**40. The importance of DCCOs to the overall fishery in the Great Lakes is overstated. DCCOs are only a small part of a complex food web. The tropic structure of the Great Lakes is resilient enough to absorb the predation pressure of a single native species.** We

understand the complexity of the Great Lakes ecosystems and understand that DCCOs are only a part of the food web (Ridgway and Fielder, In press). However, the trophic structure of the Great Lakes has repeatedly demonstrated its susceptibility to the impact of single species of predators or competitors (sea lamprey, alewife, rainbow smelt, zebra mussel, quagga mussel, bythotrephes; Bence and Mohr 2008, Clapp and Horns 2008). At no time have the agencies asserted that DCCOs are the only factor impacting the fishery. However, the analysis in the EA indicates that there is reasonable evidence to conclude that DCCOs are a significant component in the factors negatively impacting some fisheries and that CDM may be beneficial.

**41. Cannot justify killing off the DCCO population in the state because a small number of birds eat fish at aquaculture facilities or because of the rare incidences of damage to property.** The EA analyzes all types of CDM which may be conducted in the state to facilitate understanding of the cumulative impacts of CDM actions on DCCOs and other issues. Local population reduction is not proposed as a solution for depredation problems at aquaculture facilities or property damage. Problems at these sites are managed on a case by case basis and limited removal of individuals would only be authorized if practical and effective nonlethal methods are not available. These limited removals would not be expected to substantively impact the state DCCO population.

**42. Data in Appendix F for Thunder Bay show that very few bass of any size are found in DCCO diets (0.04%) and only 1.22% of their diet was yellow perch. These levels of consumption are not enough to adversely impact populations of these species.** Cormorant damage management has not been proposed in Thunder Bay solely for the purpose of protecting yellow perch. Section 1.5.3.2 of the EA establishes lake whitefish, brown trout, overall fish biomass and sport fish populations as the issues of concern for this area. The impact of removing what seems like a relatively small number of fish on a fish population will depend on a number of factors including population size, productivity and the point in the life history of the fish where the predation occurs. At times, when frequency of a species in DCCO diets is low, impact may be a function of overall DCCO population size. Even a low rate of fish consumption per cormorant can add up to substantial impacts on a fish population if there are several hundred to thousands of breeding DCCOs consuming fish. Ridgway and Fielder (In press) also noted that for predatory fish which are also targeted by anglers, such as smallmouth bass, a relatively small proportion of DCCO diets may represent a significant component of the juvenile cohort of fish.

**43. DCCOs are not an issue for small privately owned ponds because DCCOs are only found on the coast of the Great Lakes where they can find the small islands they need to safely reproduce.** DCCOs are not restricted to the Great Lakes or to nesting on islands, although island sites do seem to be preferred. Additionally, problems with DCCO foraging are not limited to breeding birds. Large numbers of DCCOs migrate through the state, and these migrants can also be involved in depredation problems. The EA specifically discusses DCCO conflicts and management actions conducted at inland lakes (Section 1.5.3.10, See also Response 41 regarding conflicts at aquaculture facilities). Sault Tribe walleye rearing ponds located 10-15 miles from Lake Huron and the St. Marys River are regularly visited by flocks of cormorants that consume sizable number of the small walleye (M. Ebener, CORA, Sault Ste. Marie, MI, pers. comm.).

**44. Cormorant damage management proposed for the Beaver archipelago is excessive. Current efforts have not been implemented long enough to determine if they are having an impact. Agencies should just monitor impact of current program.** The agencies have reviewed comments and available data on the Beaver archipelago. The agencies still believe that there is reasonable cause to believe that DCCOs may be adversely impacting the fishery in the area but also acknowledge that the data is not unequivocal (Responses 21, 24-26). Consequently, the management objectives for the Beaver Archipelago have been modified from a proposal to reduce the population 50% each year (Section 1.5.8.2) to a proposal to reduce the population 50% per year to 3,000 breeding pair for the archipelago and monitor the response of the fishery to this reduction. This is an approximately 74% reduction from the 11,549 breeding pairs observed in 2007, and is likely to be of sufficient magnitude that an impact from the reduction in DCCO predation may be observed despite the numerous variables in the system. Observing the fishery response to a DCCO population maintained at a relatively constant level instead of a steadily decreasing DCCO population will also help to reduce the variability in the data analysis.

**45. EA needs to consider possibility that scarring of whitefish may be caused by other piscivorous birds such as eagles and mergansers which are also numerous in the area.** Cormorant marked whitefish began showing up in northern Lake Michigan just about the time that cormorant abundance peaked in the early 2000s. Reports of scarred whitefish were rare or nonexistent until this point in time even though there have been eagles, mergansers, and loons in the upper Great Lakes for decades. Eagles and mergansers do not dive 90 to 100 ft. and swim into trap nets to capture whitefish like cormorants do. Loons do, but they can't escape the nets like cormorants do. Increased problems with loons would be reflected in increased risk of loons captured in nets.

**46. EA needs to consider possibility that increasing populations of other piscivorous birds including gulls, mergansers and eagles are causing declines in the Beaver Archipelago.** Great Lakes Colonial Waterbird Survey data (Linda Wires, University of Minnesota, unpub. data; Cuthbert et al. 2002) indicate that the number of nesting Ring-billed Gulls in the Michigan portions of Lake Michigan increased from 32,256 breeding pairs in 1977 to 80,766 pairs in 1989-1991 and then decreased to 46,542 pairs in 1997-1999. Herring Gull populations followed a similar trend going from 7,307 breeding pairs to 11,691 pairs and 7,766 pairs during the same intervals. In the Beaver Islands, the Ring-billed Gull population increased from 7,292 pairs in 1976 to 24,289 pairs in 1989-1990, and then decreased to 3,001 pairs in 2007-2009 (MDNR unpublished data; L. Wires, University of Minnesota, unpub. data; Cuthbert et al. 2002). The number of Herring Gulls went from 2,592 pairs in 1976 to 3,534 pairs in 1989-1990 and then decreased to 2,969 pairs in 2007-2009. Gull populations appeared to be decreasing during the period when the DCCO population was increasing and smallmouth bass problems were documented. Mergansers are not counted during the Colonial Waterbird Survey. The data available for mergansers suggest that while the populations have oscillated over the years, and that the current population levels are very similar to thirty years ago (MDNR unpublished data).

**47. In order for there to be a cause and effect relationship between DCCOs and perch there should be a lag between increases in cormorant populations and perch decline. Instead, Figure 1-6 of the EA shows competitive exclusion of yellow perch by alewife. The**

**correlation between cormorant increase and perch decline is potentially spurious and should be omitted.** This is an inaccurate interpretation of the material presented. If alewife were competitively excluding perch then we would expect an increase in alewife concurrent with a decrease in perch. The graph demonstrates that both species are declining over the entire time period. We recognize that there are certainly other biotic and environmental factors that impact yellow perch and alewife abundance but suggest that cormorants may be a contributing factor.

**48. Fishermen only want large smallmouth bass (spawning size). Spawning size bass are too big for DCCO to consume so why are we worried about DCCO impacts on bass?** The concern regarding smallmouth bass is that DCCO predation, in addition to other mortality factors, is reducing the number of smallmouth bass that survive to become large enough to spawn or be of interest to anglers.

**49. The measurable goals and data collection are not specific enough to adequately assess the impacts of the program on the sport fishery and commercial harvest.** Section 1.5.8 provides the management objectives for each of the primary areas where CDM is proposed. We believe the objectives and data collection systems described in the EA are adequate, but we do recognize that they are not ideal. However state and federal funding is very limited at this time. The MDNR is working with the Quantitative Fisheries Center at Michigan State University to help define and refine current data collection procedures to best allocate resources to answer questions regarding the impacts of CDM on fishery resources. In establishing the PRDO the USFWS specifically noted that they did not expect agencies to have perfect information.

**50. DCCOs are now primarily eating round goby which has less nutritional value than alewife (N. Seefelt, unpub. data). Young fed a diet primarily of round gobies will not develop as fast as chicks fed alewife and adults will be unable to feed as many offspring as they did prior to the influx of gobies. Therefore, DCCO population in the Beaver Islands which is already declining because of actions of WS will most likely continue to decline with no further action by WS.** We agree that the number of nesting DCCOs in the Beaver Islands area has been generally decreasing (EA Table 1-1). It is too early to determine the impact of round gobies on DCCO survivorship or productivity. Although gobies are of lower nutritional value, available data indicate they are very abundant in some areas. DCCO populations increased during periods of alewife abundance and, even though round gobies have a lower nutritional value, there are insufficient data to indicate that the DCCO population, in the absence of CDM, would necessarily decline on a diet primarily of gobies. Lower rates of increase or a stable population are also possible options. The adaptive management program and annual monitoring of nesting DCCOs at sites where CDM is proposed would enable agencies to adjust CDM to allow for any changes in the DCCO population which may be associated with addition of round gobies to DCCO diets. Additionally, DCCOs are opportunistic when feeding and will take larger prey than gobies if they are available. The fact that DCCOs are eating a lower value food source doesn't guarantee a decrease in population. Alternatives could include a population increase at rates lower than those observed when DCCOs were feeding on alewife.

**51. Has the concept of sustainability in the EA been limited to only fish harvest?** No. The EA considers the impact of the proposed action on the sustainability of the DCCO population

and on nontarget species populations. The proposed action includes several measures intended to maintain the population viability and distribution of DCCOs in Michigan (Section 1.5.8.1).

**52. If the EA adequately implemented adaptive management, it would include clear resource objectives, analyze alternative causes for fishery declines and monitor effectiveness with adequate tools, and include diet analyses.** Objectives for primary areas where CDM is proposed are stated in Section 1.5.8.2. Funding availability is very limited at this time. We recognized that the goals and assessment provided in the EA may be challenging to document the effects of the control program. The DNRE is working with Michigan State University to review and modify our assessment monitoring methods as well as our overall target control levels to conform to the concept of Adaptive Management. The agencies also recognize that diet information would be valuable but even diet data are of limited utility unless there are adequate data on the standing fish biomass and fish production in the impacted area. The MDNR is particularly concerned about the level of fish production that is being consumed by cormorants. Cormorants are either consuming games species directly or consuming forage fish that game species feed on. Either way would influence game species production. This proposed action is not intended to perpetuate indefinitely if it is not successful. After a 5 to 10 year period, some of the control will likely be discontinued if fish communities are not benefitting from the control efforts. See also responses 18, 23, 34, 39 and 49.

**53. Calculations of consumption indicate consumption is near or in excess of biomass but in reality, round goby have increased and other fish populations have remained relatively constant.** The calculations are a generalized estimate which needs to be validated by research, and a number of assumptions must be made to use the estimates. However, the calculations do provide an indication that the level of DCCO foraging in Bays de Noc and Thunder Bay is placing a considerable demand on fishery resources. The agencies do not believe it is accurate to portray the situation in all areas as having increased or stable total fish biomass. In Thunder Bay, total trawl catch rates declined substantially starting in approximately 2000 (Fig. 1-4) and have remained at reduced levels even though the amount of round gobies in the catch has increased in recent years. Alternatively, DCCO foraging impacts are localized and are generally greatest in a radius around nesting colonies as has also been documented for other colonial waterbirds (e.g., Ashmoles halo; Ridgway and Fielder, In press). 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.

**54. EA fails to provide information on the disagreement between Diana (2010) and Fielder (2010*b*) regarding the impacts of DCCOs and CDM on the perch fishery in Les Cheneaux. Comments by Diana show flaws in work by Fielder.** The agencies have reviewed the comments from Diana and responses by Fielder in the published literature (Diana 2010, Fielder 2010*b*). While we agree that the data and conclusions presented in Fielder (2008), have limitations, after reviewing Diana (2010) and Fielder (2010*b*) we do not feel that these limitations compromise the utility of the work. Additionally, the EA also uses a more current publication (Fielder 2010*a*) which includes data on the yellow perch fishery in the Les Cheneaux before and after CDM. The additional data available after the initiation of CDM addresses some of the concerns raised in Diana (2010). Limitations to Fielder (2010*a*) are discussed in EA Section 1.5.3.1. See also Responses 34, 49 and 52.

**55. Changes in fish harvest shown in Figure 1-2 are nominal relative to the reduction in DCCO foraging pressure. Changes could just as readily resulted from changes in alewife, increase in round gobies, or substantial drop in Chinook salmon.** The agencies acknowledge that DCCOs are not the only factor impacting Great Lakes fish populations (Fielder 2010a, b). However, the agencies do believe that the pattern in the perch population before and after CDM and analysis of many of the factors which might influence the perch population do indicate that DCCO foraging has had a substantive impact on perch populations in the Les Cheneaux. The MDNR has not observed the favorable population responses in other yellow perch communities such as Saginaw Bay where similar changes in alewife, goby and salmon populations have also occurred.

**56. If CDM has helped to recover the yellow perch population in the Les Cheneaux, has it been cost effective?** Wildlife Services has been conducting most of the CDM under the PRDO in Michigan, spending approximately $125,000 per year on average as appropriated by Congress; additionally, the State of Michigan provided WS $150,000 in 2007 which was spent on CDM over three years. Only a portion of the Congressional funds have been spent on the Les Cheneaux Islands. By comparison, the annual economic loss due to the diminishment of the yellow perch fishery in that community is estimated at over $ 5 million dollars (Fielder 2010*a*).

**57. Data on CPUE in gillnets in Fig. 1-2 show an increase in CPUE between 2004 and 2006, but by 2008, CPUE decreased to levels seen in 2004. The data indicate that changes in CPUE occurred before the major change in DCCO numbers and that most likely some other factor is driving the system.** We do not agree. Angler harvest rates and angler harvest rate per unit effort continue to be above 2004 levels as is catch rate in Hessel Bay. Overall CPUE went back up and 2010 is the second highest level of the survey series since 1985 (D. Fielder, MDNR, unpub. data). Improvements in the fishery appear to be concurrent with marked decreases in the number of nesting DCCOs. A substantial (30%) drop in DCCO breeding pairs occurred the first year after initiation of CDM in the Les Cheneaux Islands, and the number of breeding pairs had dropped 66% by 2006 (Fig 1-1). Additionally, the decrease in breeding pairs does not include the decrease in foraging demand which resulted because of the reduction in reproduction associated with egg oiling.

**58. There should not be a substantial increase in the number of birds to be killed at LCI because data from LCI is not conclusive regarding the impacts of DCCOs and CDM on the perch population.** The proposal for the LCI is to maintain the number of breeding pairs in the LCI at approximately 500 pairs for 5 years and continue to monitor the response of the fishery to the reduced DCCO population. This is the management proposal implemented in the area since 2008 and is not a substantial increase in DCCO take.

**59. There are no peer-reviewed studies or any other data to justify CDM in Bays de Noc. Comparison to North Channel is inappropriate because they are two extremely different environments.** We agree that it is difficult to extrapolate information from one control location and apply it to other locations where species composition and population dynamics may be significantly different. It is for this very reason that we are attempting to explore the effects of cormorant control at multiple locations throughout Michigan. Through adaptive management,

control measures will be modified for the unique conditions at each site. While we do not have sufficient information to calculate relative productivity in northern Lake Michigan, we do think that the North Channel of Lake Huron is sufficiently similar to make some casual production estimates.

**60. There is no data to justify CDM at Ludington, Bellow, Paquin, Naubinway, Tahquamenon Islands or the St. Mary's River.** Information relevant to the need for action in these areas is presented in Sections 1.5.3.5 through 1.5.3.9. In 2004, stomach contents were examined from 40 DCCOs taken from lower Whitefish Bay and Upper St. Mary's River. Of the 16 birds with food in the stomach, 3 contained walleye (4 fish) and two contained yellow perch (5 fish). Although this was a small sample size, walleye and yellow perch constituted 7 and 9% respectively of the total number of food items found in the DCCO stomachs. The walleye and yellow perch accounted for 40% and 38% by weight of the food items found in the stomach contents. Regurgitant samples collected at Gem Islands in the St. Mary's River also indicate consumption of yellow perch. There has also been degradation of the approximately 90% of the tree canopy on Gem Island in the St. Mary's River (Figures 6-1). Commercial fishermen have been reporting cormorant-scarred whitefish in nets in northern Lake Michigan near Naubinway and Paquin Islands (M. Ebener, CORA, Sault Ste. Marie, MI, pers. comm.). The agencies and tribes believe this data is sufficient to warrant the CDM proposed for these sites. See also Response 13 regarding the availability of data and CDM and Response 22 regarding diet studies conducted in the St. Mary's River.

**Figure 6-1.** Gem Island, St. Mary's River, 2006.

**61. Only two smallmouth bass were observed in stomach samples collected in the Beaver Islands. If the fish population cannot withstand this level of natural predation then there are larger problems that should be addressed.** Diet data in question were collected after the decline in the smallmouth bass population had occurred. Given that DCCOs are opportunistic foragers, it is not surprising that only limited bass were found at the time of the study. The relative lack of smallmouth bass in DCCO diets after the majority of the decline only indicates that the reduced bass population is not a large portion of DCCO diets. It does not address the issue of whether or not DCCO foraging could have impacted the population in the past. Although

smallmouth bass may only comprise a very limited portion of DCCO diets, impact on the fishery is also a function of population size. There are a large number of DCCOs foraging in the Beaver Islands (approximately 7,520 breeding pairs in 2009).

**62. It is wrong to stock non-native fish, control native predators and allocate all fish resources for human use.** The appropriateness of managing DCCOs for the protection of sport fish is a value judgment that will vary depending on the values and perspectives of the individuals involved. Many of the predatory fish populations in the Great Lakes are non-native species that were introduced to control over-abundant alewives whose populations exploded after the native lake trout was eliminated from most of the Great Lakes by overfishing and sea lamprey predation. Salmonid management is also identified by Fish Community Objectives for each of the Great Lakes, which are supported by all the management agencies surrounding the Great Lakes. See also Response 14 regarding tolerance for DCCOs and DCCO use of fishery resources.

**63. Studies from Michigan and elsewhere continue to show that that DCCO diets contain 90% or more of non-native prey fish, primarily round goby and, historically, alewife. The level of predation on native fish is not sufficient to adversely impact native fish populations.** It is an over-simplification to say that DCCO diets in all locations are primarily comprised of round goby or other invasive fish. Diets vary considerably among locations and time of year depending upon the availability of different fish species (e.g., some fish species come into shallow water to spawn in spring). For example, very few round gobies or alewife were found in regurgitant samples collected at Rock and Gem Islands in the St. Mary's River in 2007 and 2008 (See Response 22). The high consumption of round gobies is only occurring in some locations where cormorant control is being proposed. We believe that significant consumption of game fish and important forage fish is still continuing at most locations. Additionally, when DCCO numbers are high, even a low proportion of game fish in DCCO diets can lead to a relatively high level of fish consumption, because of the number of birds taking fish. Impacts on fish populations also depend on the initial productivity and relative abundance of the species in question. Depending upon the species under consideration, the same rate of foraging pressure may have a greater impact on species stocked or present in relatively limited numbers than on a naturally producing fish population.

**64. If CDM increases, won't birds abandon sites and seek new locations? This could spread the damage problem. Would ground-nesting birds start nesting in trees (to get away from oiling) and causing more ecological damage than they were when nesting on the ground?** Available information on DCCO movement from one colony to another in response to CDM is provided in Section 4.1.2. There is some risk that birds will seek new sites. However, not all colonies automatically cause damage to the site where they are located and it is possible that multiple smaller colonies spread across the landscape may cause fewer conflicts than a limited number of large colonies. The agencies will continue to monitor for the presence of nesting DCCOs at new sites as part of the CDM program. Additionally, as local cormorant breeding populations are reduced and management goals are met, additional emphasis is placed on ancillary effects of management activities while developing management recommendations. These include the effects of disruption to co-nesting species during egg oiling and culling, and changes in cormorant behavior due to culling pressure or disturbance during egg oiling. In the

short term, overall reductions in cormorant numbers and associated acidification and nutrification are likely to provide a sufficient benefit to offset damage done by birds shifting from ground nesting to tree nesting.

**65. Agencies should not leave bird carcasses out to rot.** The MBTA and PRDO require proper disposal of birds killed for damage management, including donation for scientific or educational use, incineration or burial. Agencies conducting CDM make all reasonable effort to comply with these requirements, however, some birds cannot be recovered, usually because the site is inaccessible (e.g., high in a tree).

**66. The 3 paragraphs on aesthetic values in Section 2.1.4 are not adequate treatment of the issue.** Aesthetic values are addressed in detail for each alternative in Chapter 4.

**67. Issues of vegetation damage, DCCO colony encroachment on T&E species, damage to property, threats to aircraft seem unlikely in the Beaver Islands. Most of the vegetation on the islands where DCCOs nest is invasive species. The DCCO colonies in the Beaver archipelago are on islands which are closed to public access and so any complaints about aesthetic impacts are not justification for CDM.** The EA provides a cumulative analysis of all types of cormorant damage management that may be conducted in Michigan. Not all types of conflicts may be applicable to every situation. As noted in Section 1.5.8.2, 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.

**68. Vegetation on Pismire and Gull Islands is recovering and is proof that CDM is not needed to protect vegetation at these sites. Nutrients from DCCO guano is enabling more plants to grow and plant species richness is greater that before DCCOs although vegetation communities will not be the same as before DCCOs.** These observations confirm that efforts to reduce cormorant nesting on an island may be highly beneficial to restoring plant communities where existing vegetation had been destroyed by nesting cormorants. They are also consistent with preliminary research findings from areas where high concentrations of DCCOs have resulted in vegetation loss which indicate that seed banks survive for several years after vegetation has died. The determination of whether additional cormorant management is needed on these islands will depend on the desired condition of the avian and plant communities on the islands as well as whether or not cormorants reinitiate nesting on the islands. It is expected that any management of this long lived, gregarious species will need to be long-term in scope, involve ongoing monitoring and assessments, and be responsive to changing conditions both in the environment and the population dynamics of the species.

**69. DCCOs have nested in colonies with other birds throughout the Great Lakes Region and other areas for hundreds of years. No evidence has been produced to demonstrate that DCCOs on the Great Lakes are having significant enough impacts on co-nesting colonial waterbirds to warrant CDM or to demonstrate that reducing DCCO numbers will increase numbers of other species.** Reasons for managing DCCOs at individual breeding colonies vary from location to location. While no colonies are being managed at this time to reduce impacts to co-nesting waterbird species, adverse impacts on co-nesting species which need trees or shrubs for nesting habitat has been an issue in other states. For example, the Black-crowned Night-

Heron is listed by the Michigan Natural Features Inventory as a Special Concern species in Michigan; where dangers to the continued existence of any established Black-crowned Night-Heron colony are identified, reductions in nesting cormorants may be considered to protect night-heron nesting habitat. Addressing this type of damage in the EA facilitates federal agency response to this type of damage if there is reason to believe it is occurring in Michigan. Information on situations where DCCOs have been documented to have adverse impacts on co-nesting species or their habitat is provided in Section 1.5.4.

**70. If the agencies are concerned about co-nesting colonial waterbirds they should refrain from entering colonies with these birds present, develop a monitoring program for species of concern, and preserve high quality habitat.** Concern for co-nesting species factors into the annual development of agency management recommendations and the selection of management practices at specific breeding colonies. Procedures for reducing impacts on co-nesting species are also provided in the Standard Operating Procedures listed in Chapter 3 of the EA. At sites where there are concerns for the impacts of access by individuals to oil eggs or cull adults, portions of islands have been avoided to minimize impacts, or the number of site visits has been reduced to minimize impacts. Statewide monitoring and habitat management of species other than cormorants is outside the scope of this EA and is addressed by other conservation programs at the state and federal level.

**71. Why are the agencies proposing to control DCCO population to reduce aircraft hazards when there have been no documented collisions between DCCOs and aircraft in MI or the Great Lakes? There cannot be any hazards to aircraft on the Beaver Islands because DCCOs don't fly inland.** The assertion that DCCOs do not fly inland is not correct. DCCOs migrate overland from the Great Lakes to the Southern U.S. each year and DCCO foraging on fish has been documented at inland lakes in Michigan. The multiple inland DCCO colonies in Minnesota are also testimony to DCCO use of inland habitat (USDA 2005). The EA analyzes all types of CDM which may be conducted in the state to facilitate understanding of the cumulative impacts of CDM. Local population reduction is not proposed to reduce risks to aircraft from DCCOs. Problems at these sites are managed on a case by case basis and limited removal of individuals would only be authorized if practical and effective nonlethal methods are not available. These limited removals would not be expected to substantively impact the state DCCO population. In the EA, we note that risks to aircraft safety from DCCOs in Michigan are low. However, it is not correct to state that there have been no strikes in Great Lakes States. In addition to the examples of DCCO strikes and damage to aircraft in Minnesota and Illinois noted in Section 1.5.6, for the period of 2000-2010, there has also been an additional DCCO strike in Illinois, 2 additional strikes in Minnesota and one strike in Wisconsin. Strike rates are likely an underestimate of risk because many airports have wildlife hazard management programs in place specifically to reduce strikes from birds like DCCOs. As noted in the EA, over the period of 2006-2008, 33 DCCOs were killed to reduce hazards to aircraft and additional birds were hazed from airport property using nonlethal methods. For more information on wildlife hazard management at airports we recommend the following web site: http://wildlife-mitigation.tc.faa.gov/wildlife/.

**72. Is fecal contamination from the DCCO colony at Ludington, MI responsible for the nearby closure of beaches because of Coliform bacteria?** The agencies consulted with M.

Hill from the Michigan Department of Health District 10 regarding the spikes in bacteria and data presented by commenters. Large concentrations of birds (cormorants, gulls, geese) can impact E. coli levels, but the DCCOs in the Ludington colony may not be the source of the changes in the E. coli levels presented by commenter. A sewage spill in Ludington may have contributed to some of the spikes reported. Another site with elevated E. coli levels reported by commenter had a defective sewage pipeline nearby which could also have impacted E. coli levels. Heavy storms may also wash contaminants into the water. Specific testing would be required to determine the source of the E. coli before a conclusive determination could be made.

**73. Why does the EA discuss DCCO impacts on water quality when there is no substantiated evidence of DCCOs having such impacts?** From the Final EIS on Double-crested Cormorant Management in the United States (USFWS 2003) to which this document is tiered, "…it is true that there is currently no evidence that they are responsible for widespread contamination or are a significant threat to human health. But, since impacts to water quality were a significant concern raised during scoping, we felt that it was appropriate to include the issue in the DEIS [Draft Environmental Impact Statement] analysis." Although there are not currently any situations where there is evidence of DCCOs having an adverse impact on water quality in Michigan, the issue of DCCO impacts on water quality was also raised in comments on this EA.

**74. Are current concentrations of DCCOs unnatural?** Double-crested cormorants have a well documented presence in the United States and are a native species. In ornithological checklists for Michigan dating back to the 1800s, cormorants are noted as present in the state. High numbers were seldom observed, but breeding sites on Great Lakes islands were likely seldom visited and poorly surveyed, if at all, at this time. There is no reason to believe that cormorants are not native to the Great Lakes though the current population is probably higher than the presettlement level (Weseloh et al. 1995).

**75. EA provides no data on actual opinions of the general public, nor are there any plans to obtain such data. Public opinions of a vocal minority are used to represent the public in general.** The MDNR and USFWS regularly communicate with stakeholders regarding cormorant management both through participation in organized meetings and as a result of unsolicited comments from members of the public. This input from private citizens as well as their elected representatives at the local, county, state, and federal level regarding the values they place on cormorants, their prey, and their environment is used when assessing the desires of the residents of Michigan.

**76. EA wrongly persecutes groups which provide sanctuaries for DCCOs and disregards their wishes to provide sites free of DCCO control by conducting CDM as close as 500 yards from the sanctuaries.** The EA does not persecute any landowner. Analyses of impacts of the proposed action note that DCCOs may move from areas subject to CDM to areas which are not subject to CDM and that restricted access to some colonies may limit the ability of the MDNR to achieve DCCO management objectives in some areas. The authority of any landowner in the state of Michigan does not extend beyond the boundary of their property. In the case of Great Lakes island landowners, this authority does not extend over the open waters of the Great Lakes. The Great Lakes bottomlands in Michigan are owned by the State of Michigan

and administered by the MDNR. As such, the MDNR is the land manager for the open waters of the Great Lakes around privately owned islands and has the authority to manage resources in these areas as necessary. As a compromise, when requested by the landowner, WS does not shoot of adult birds within 500 yards of these islands to minimize noise disturbance to nesting birds. T

**77. What impact do public comments have on agency decisions?** Public comments are a valuable means of ensuring that all relevant issues, data and alternatives are addressed in this chapter of the EA. Agencies consider these issues in detail before making management decisions. Modifications to the proposed action have been made based on public comment and are described in the Decision and Finding of No Significant Impact.

**78. EA's statement that DCCO populations in the Great Lakes have been increasing is inaccurate and has been inaccurate for the last 10 years.** This statement was erroneously made in Section 1.4. and has been corrected. Correct information on the State DCCO population trends and regional trends is provided in Section 1.5.1 and in the population impact analyses in Chapter 4. In addition to the material presented in the EA, the 2009 Great Lakes Colonial Waterbird survey indicated there were approximately 18,220 breeding DCCO pairs in Michigan, down from 29,383 nests counted in 2007 (Cuthbert 2009). There were also decreases in many colonies where CDM was conducted in 2010 (WS, unpublished data). Language in Section 1.4 has been corrected to read, " Increases in the North American DCCO population and associated concerns of the negative impacts associated with the DCCO population expansion led the USFWS to establish the PRDO and expand the AQDO (USFWS 2003). Although cormorant populations have decreased in many areas where the PRDO and AQDO have been implemented, the need to protect aquaculture, property, natural resources, and human health and safety from damage and conflicts associated with DCCOs described in the USFWS FEIS remain (USFWS 2003). The need for action described in the FEIS is summarized in the following subsections…"

**79. Isn't the goal of maintaining the Michigan cormorant population at approximately 5,000 breeding pairs futile because birds from other areas will fill in the spaces?** The objective of the proposed action is to manage cormorant damage in Michigan, <u>not</u> to reduce the population to 5,000 breeding pairs. The EA established a minimum state population of 5,000 pairs and the goal of maintaining DCCO distribution throughout its current range in the state to protect the viability of the state DCCO population (Section 1.5.8.1). Damage management actions will be monitored and adjusted to ensure that they do not reduce the state DCCO population below 5,000 breeding pairs. Evidence from the program in the Les Cheneaux Islands area indicates that, depending upon the management objectives for the site, some sort of long-term management may be needed to achieve management goals. However, over time, the number of birds taken per year decreases and in some areas, it may be possible to maintain populations at or near management objectives primarily with methods such as egg oiling.

**80. Commenter states that personal conversations with authorized agents of WS indicate agents are not acting responsibly and are only participating so they can shoot DCCOs.** All volunteers working as agents of WS are required to take an annual training course before they can participate in the program. Only a few agents at each site are authorized to take DCCOS. Most individuals working as agents of WS are only authorized to use harassment. The course

includes information on the historical and legal status of DCCOs in Michigan as well as the requirements for safe, legal and effective implementation of the harassment program. Agents violating the terms and conditions of the harassment program are removed from the project.

**81. There is no reason to believe that there would be a risk to public safety if disgruntled individuals took matters into their own hands.** Unauthorized take of DCCOs is a violation of the MBTA, state wildlife laws and the provisions of the PRDO. Safe use of firearms, pyrotechnics and other equipment used for CDM requires training for safe and effective implementation. Wildlife Services, MDNR and tribal staff who conduct CDM are specifically trained in the safe and effective use of CDM methods. Volunteers who use pyrotechnics and firearms as designated agents of WS also receive safety training. Without this kind of training, there is increased risk to public safety and to the safety of the individuals implementing the CDM.

**82. EA cannot conclude that there will be no significant impact on the human environment.** We recognize that the proposed removal of DCCOs will result in a substantial reduction in the DCCO population in Michigan. However, this reduction was analyzed and authorized in the USFWS FEIS on DCCO management in North America. Analysis in the EA indicates that there will be no other substantial impacts on the human environment from the proposed action.

# 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
## LITERATURE CITED


Adams, C. M., C. P. Schneider, and J. H. Johnson. 1999. Predicting the size and age of smallmouth bass consumed by double-crested cormorants in the eastern basin of Lake Ontario 1993-1994. Pages 1-8 In Final report to assess the impact of double-crested cormorant predation on smallmouth bass and other fishes of the eastern basin of Lake Ontario. New York State Department of Environmental Conservation Special Report, February 1, 1999, Albany.

Aderman, A.R., and E.P. Hill. 1995. Locations and numbers of double-crested cormorants using winter roosts in the Delta region of Mississippi. Colonial Waterbirds 18 (Spec. Pub. 1):143-151.

Anonymous. 1992. Airports - breeding grounds for bird strikes. Flight Safety Foundation. Airport Operations Vol. 18., No. 4. Arlington, VA. 4p.

Audubon. 2003. West Nile Virus – Effects on Wildlife. www.audubon.org/bird/wnv/

AVMA (American Veterinary Medical Association). 1987. Journal of the American Veterinary Medical Association. Panel Report on the Colloquium on Recognition and Alleviation of Animal Pain and Distress. 191: 1186-1189.

Barrows, W. B. 1912. Michigan bird life. Special Publication. Michigan Agricultural College, East Lansing, MI. 822 pp.

Beaver, B.V., W. Reed, S. Leary, B. McKiernan, F. Bain, R. Schultz, B.T. Bennett, P. Pascoe, E. Shull, L. C. Cork, R. Franis-Floyd, K.D. Amass, R. Johnson, R.H. Schmidt, W. Underwood, G.W. Thorton, and B. Kohn. 2001. 2000 Report of the AVMA Panel on Euthanasia. Journal of American Vet. Medical Association 218: 669-696.

Bédard, J., A. Nadeau, and M. Lepage. 1999. Double-crested cormorant culling in the St. Lawerence River Estuary: Results of a 5 year program. Pages 147-154 *In* Symposium on Double-crested Cormorants: Population Status and Management Issues in the Midwest (M.E. Tobin, ed.). USDA Tech. Bull. No. 1879. 164pp.

Bédard, J., A. Nadeau, and M. Lepage. 1995. Double-crested cormorant culling in the St. Lawrence River Estuary. Colonial Waterbirds 18 (Spec. Pub. 1): 78-85.

Belyea, G.Y., S.L. Maruca, J.S. Diana, P.J. Schneeberger, S.J. Scott, R.D. Clark, Jr., J.P. Ludwig, and C.L. Summer. 1999. Impact of double-crested cormorant predation on the yellow perch population of the Les Cheneaux Islands of Michigan. Pages 47-59 *In* Symposium on Double-crested Cormorants: Population Status and Management Issues in the Midwest (M.E. Tobin, ed.). USDA Tech. Bull. No. 1879. 164pp.

Bence, J. R., J. E. Johnson, J. He, J. S. Schaeffer, S. Riley, R. J. Young, M. Ebener, D. Reid, L. C. Mohr, D. Gonder, A. Cottrill, A. Woldt, T. Morse, G. C. Christie, and M. Ridgeway.. 2004. Offshore Predators and Their Fish Community. Pages 11-36 *in* The state of Lake Huron in 2004. J.R. Bence and L.C. Mohr (eds.). Great Lakes Fishery Commission Special Publication 08-01, Ann Arbor, Michigan.

Bence, J.R., and Mohr L.C. (Eds.). 2008. The state of Lake Huron in 2004. Great Lakes Fish. Comm. Spec. Pub. 08-01.

Bishop, R. C. 1987. Economic values defined. Pages 24 -33 in D. J. Decker and G. R. Goff, eds. Valuing wildlife: economic and social perspectives. Westview Press, Boulder, CO. 424 p.

Blackwell, B.F., G.E. Bernhardt, R.A. Dolbeer. 2002. Lasers as non-lethal avian repellents. J. Wildl. Manage. 66: 250-258.

Blokpoel, H. 1976. Bird hazards to aircraft. Books Canada Inc. Buffalo, NY 236pp.

Bur, M.T., S.L. Tinnirello, C.D. Lovell, and J.T. Tyson. 1997. Diet of the double-crested cormorant in western Lake Erie. Pages 73-85 *In* Symposium on Double-crested Cormorants: Population Status and Management Issues in the Midwest (M.E. Tobin, ed.). USDA Tech. Bull. No. 1879. 164pp.

Campo, J. J., B. C. Thompson, J. C. Barron, R. C. Telfair II, P. Durocher, and S. Gutreuter. 1993. Diet of double-crested cormorants wintering in Texas. Journal of Field Ornithology 64:135-144.

Casselman, J. M. and L. A. Marcogliese. 2006. Fish consumption by nesting double-crested cormorants and nearshore fish abundance and production in Lake Huron. (Abstract) presented at the Submitted as part of the symposium entitled; Cormorants; Research, Management & Policy. 2006 Midwest Fish and Wildlife Conference, Traverse City, MI.

CDC (Center for Disease Control and Prevention). 2003. West Nile Virus. www.cdc.gov.ncidod/dvbid/westnile/birds&mammals.htm.

CDFG (California Department of Fish and Game). 1991. California Department of Fish and Game. Final Environmental Document - bear hunting. Sections 265, 365, 367, 367.5. Title 14 Calif. Code of Regs. Calif. Dept. of Fish and Game, State of California, April 25, 1991. 13pp.

CEQ. 1981. Forty most asked questions concerning CEQ's NEPA regulations. 40 CFR 1500-1508 and Fed. Reg. 55:18026-18038.

Clapp, D.F., and W. Horns (Eds.). 2008. The state of Lake Michigan in 2005. Great Lakes Fish. Comm. Spec. Pub. 08-02.

Conover, M.R., W.C. Pitt, K.K. Kessler, T.J. Dubow, and W.A. Sanborn. 1995. Review of human injuries, illnesses and economic-based losses caused by wildlife in the United States. Wildlife Society Bulletin 23:407-414.

Cornell University. 2003. West Nile Virus: Transmission, Infection, & Symptoms. Environmental Risk Analysis Program, Cornell University – Department of Communication & Center for the Environment. http://environmentalrisk.cornell.edu/WNV/Summary2.cfm

Craven, S.R. and E. Lev. 1987. Double-crested cormorants in the Apostle Islands, Wisconsin, USA: population trends, food habits, and fishery depredations. Colonial Waterbirds 10:64-71.

Crowder, L. B. 1980. Alewife, rainbow smelt and native fishes in Lake Michigan: competition or predation? Environ. Biol. Fish. 5:225-233.

Custer, T. W. amd C. Bunck. 1992. Feeding flights of breeding Double-crested Cormorants at two Wisconsin colonies. Journal of Field Ornithology 63:203-211.

Cuthbert, F. J. 2009. Double-crested Cormorants in the U.S. Great Lakes 1997-2008. Presentation to the Great Lakes Double-crested Cormorant Management Working Group. March 4-5, East Lansing, MI.

Cuthbert, F.J., Wires, L.R., McKearnan, J.E. 2002. Potential impacts of nesting double-crested cormorants on great blue herons and black-crowned night herons in the U.S. Great Lakes Region. Journal of Great Lakes Research 28: 145-154.

Davidson, W. R. and V. F. Nettles. 1997. Field manual of wildlife diseases in the Southeastern United States. Southeastern Cooperative Wildlife Disease Study, Athens, Georgia.

Decker, D. J. and G. R. Goff. 1987. Valuing Wildlife: Economic and Social Perspectives. Westview Press. Boulder, Colorado, 424 p.

Diana, J. S. 2010. Should cormorants be controlled to enhance yellow perch in Les Cheneaux Islands? A comment on Fielder (2008). Journal of Great Lakes Research 36:190-194.

Diana, J. S., G. Y. Belyea, and R. D. Clark, Jr. 1997. History, status and trends in population of yellow perch and Double-crested Cormorants in Les Cheneaux Islands, Michigan. Michigan Department of Natural Resources and the Environment, Fisheries Division Special Report No. 17.

Diana, J.S., C.A. Jones, D.O. Lucchesi, and J.C. Schneider. 1987. Evaluation of the yellow perch fishery and its importance to the local economy of the Les Cheneaux Islands area. Final Report Grant LRP-8C-7, Coastal Zone Management Program, Mich. Dep. Nat. Resour. Ann Arbor.

Diana, J.S. and S.L. Maruca. 1997. General introduction. Pages 1-2 *in* J.S. Diana, G.Y. Belyea, and R.D. Clark, Jr., eds. History, status, and trends in populations of yellow perch and double-crested cormorants in Les Cheneaux Islands, Michigan. Mich. Dep. Nat. Resour. Fish. Div. Spec. Rep. 16. Ann Arbor.

Diana, J. S., S. Maruca, and B. Lowe. 2006. Do increasing cormorant populations threaten sport fishes in the Great Lakes? A case study in Lake Huron. J. of Great Lakes Res., 32:306-320.

Dobiesz, N. E., D. A. McLeish, R. L> Eshenroder, J. R. Bence, L. C. Mohr, M. P. Ebener, T. F. Nalepa, A. P. Woldt, J. E. Johnson, R. L. Argyle and J. C. Makarewicz. 2005. Ecology of the Lake Huron fish community, 1970-1999. Canadian Journal of Fisheries and Aquatic Sciences 62:1432-1451.

Dolbeer, R.A. 2000. Birds and aircraft: fighting for airspace in crowded skies. Proceedings of the Vertebrate Pest Conference 19: 37-43.

Dolbeer, R. A., and P. Eschenfelder. 2003. Amplified bird-strike risks related to population increases of large birds in North America. Pages 49-67 *in* Proceedings of the 26th International Bird Strike Committee Meeting (Volume 2), Warsaw, Poland.

Dolbeer, R.A., S. E. Wright, and E. C. Cleary. 1995. Bird and other wildlife strikes to civilian aircraft in the U. S., 1994. Interim report DTFA01_91_Z_02004. USDA for FAA, FAA Technical Center, Atlantic City, New Jersey. 8p.

Dolbeer, R. A., S. E. Wright. J. Weller, and M. J. Begier. 2009. Wildlife strikes to civil aircraft in the United States 1990-2008. Federal Aviation Administration National Wildlife Strike Serial Report Number 15. http://wildlife-mitigation.tc.faa.gov/wildlife/downloads/BASH90-08.pdf.

Dorr. B. S., T. Aderman, P. H. Butchko, and S. C. Barras. 2010*a*. Evaluation of a management program to reduce double-crested cormorant (*Phalacrocorax auritus*) impacts to fisheries in the Les Cheneaux Islands, of Lake Huron, Michigan. Journal of Great Lakes Research 36:224-231.

Dorr, B.S., A. Moerke, M. Bur, C. Bassett, T. Aderman, R. D. Singleton, P. H. Butchko, and J. T. Taylor, II. 2010*b*. Evaluation of harassment of migrating Double-crested Cormorants to limit depredation on select sport fisheries in Michigan. Journal of Great Lakes Research. 36:215-223.

Duerr, A. E., T. M. Donovan and D. E. Capen. 2007. Management-induced reproductive failure and breeding dispersal in Double-crested Cormorants on Lake Champlain. Journal of Wildlife Management 71:2565-2574.

Ebener, M. P. 2010. Sault Ste. Marie Tribe of Chippewa Indians and Bay Mills Indian Community Cormorant Control Activities in 2009. Annual Report to the USFWS. Chippewa Ottawa Resource Authority, Sault Sainte Marie, Michigan. 8pp.

Ebener, M. P., L. C. Mohr, A. P. Wolde, and J. E. Johnson. 2004. Lake Huron whitefish distribution study. Great Lakes Fishery Commission proposal for project funding, Ann Arbor.

FAA (U.S. Department of Transportation, Federal Aviation Administration). 2007. Advisory Circular: Hazardous wildlife attractants on or near airports. AC No. 150/5200-33B.

Farquhar, JF, IM Mazzocchi, RD McCullough, and JH Johnson. 2004. Management of Double-Crested Cormorants in the Eastern Basin of Lake Ontario, 1999-2993: A Summary and Recommendations. NYSDEC Special Report – April 1, 2004.

Fielder, D. G. 2010*a*. Response of the yellow perch in the Les Cheneaux Islands, Lake Huron to declining numbers of double-crested cormorants stemming from control activities. Journal of Great Lakes Research. 36:207-214.

Fielder, D. G. 2010b. Response to Diana commentary. Journal of Great Lakes Research 36:195-198.

Fielder, D. G. 2008. Examination of factors contributing to the decline of the yellow perch population and fishery in Les Cheneaux Islands, Lake Huron, with emphasis on the role of Double-crested Cormorants. Journal of Great Lakes Research 34:506-523.

Fielder, D. G. 2004. Collapse of the yellow perch fishery in Les Cheneaux Islands, Lake Huron and possible causes. In Proceeding of Percis III: The Third International Percid Fish Symposium (Barry, T. P., and J. A. Malison, Eds.), pp 129-130. University of Wisconsin Sea Grant Institute, Madison, WI.

Glahn, J.F., and K.E. Bruggers. 1995. The impact of double-crested cormorants on the Mississippi delta catfish industry: a bioenergetic model. Colonial Waterbirds 18 (Spec. Publ. 1):137-142.

Glahn, J.F., G. Ellis, P. Fioranelli and B.S. Dorr. 2000a. Evaluation of moderate and low-powered lasers for dispersing double-crested cormorants from their night roosts. Proceedings of the 9th Wildlife Damage Management Conference (M.C. Brittingham, J. Kays, and R. McPeake, eds.).

Glahn, J.F., D.S. Reinhold, and C.A. Sloan. 2000b. Recent population trends of double-crested cormorants wintering in the Delta region of Mississippi: Responses to roost dispersal and removal under a recent depredation order. Waterbirds 23(1): 38-44, 2000.

Glahn, J.F., M.E. Tobin, and J.B. Harrel. 1999. Possible effects of catfish exploitation on overwinter body condition of double-crested cormorants. Pg 107-113 *in* (M.E. Tobin, Tech. Coord.) Symposium on double-crested cormorants: Population status and management issues in the Midwest. 9 December 1997., Milwaukee, WI. Tech. Bull. 1879. Washington, D.C.: U.S. Department of Agriculture, Animal and Plant Health Inspection Service.

Glahn, J.F., S.J. Werner, T. Hanson, and C.R. Engle. 2002. Cormorant depredation losses and their prevention at catfish farms: Economic considerations. *in* (L. Clark, Tech. Ed.) Proceedings of the 3rd NWRC Special Symposium, "Human conflicts with wildlife: Economic considerations." August 1-3, 2000. Fort Collins, CO.

Glaser, L. C., I. K. Barker, D. V. C. Weseloh, C. Ludwig, R. M. Windingstad, D. W. Key and T. K. Bollinger. 1999. The 1992 epizootic of Newcastle Disease in Double-crested Cormorants in North America. Journal of Wildlife Diseases 35:319-330.

GLIFWC (Great Lakes Indian Fish and Wildlife Commission). 2009. 2008 Tribal Fish Hatchery Production.

Hatch, J.J. and D.V. Weseloh. 1999. Double-crested cormorant: (*Phalacrocorax auritus*). In The Birds of North America, No. 441 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

HDR/LMS. 2008. Report of the Ludington Barrier Net Effectiveness Monitoring Program.

Hebert, C. E., J. Duffe, D. V. C. Weseloh, E. M. T. Senese, G. D. Haffner. 2005. Unique island habitats may be threatened by double-crested cormorants. Journal of Wildlife Management 69:57-65.

Hobson, K. A., R. W. Knapton, and W. Lysack. 1989. Population, diet, and reproductive success of double-crested cormorants breeding on Lake Winipegosis, Manitoba, in 1987. Colonial Waterbirds 12:191-197.

INHS (Illinois Natural History Survey). 1995. The round goby invades Lake Michigan. Illinois Natural History Survey Reports November-December 1995. http://www.inhs.uiuc.edu/inhsreports/nov-dec95/gobies.html.

Jarvie, S. H. Blokpoel, and T. Chipperfield. 1999. A geographic information system to monitor nest distributions of double-crested cormorants and black-crowned night herons at shared colony sites near Toronto, Canada. Pg 121-129 *in* (M.E. Tobin, Tech. Coord.). Symposium on double-crested cormorants: Population status and management issues in the Midwest. 9 December 1997., Milwaukee, WI. Tech. Bull. 1879. Washington, D.C.:U.S. Department of Agriculture, Animal and Plant Health Inspection Service.

Johnson, J. E., D. Borgeson, B. S. Dorr, P. H. Butchko, J. McClain, and A. Moerke. 2007. Thunder Bay Cormorant Partnership Fisheries Evaluation Plan. Michigan Department of Natural Resources and Environment, Ann Arbor.

Johnson, J. E., and G. P. Rakoczy. 2004. Investigations into recent declines in survival of brown trout stocked in Lake Charlevoix and Thunder Bay, Lake Huron. Michigan Department of Natural Resources and Environment, Fisheries Division Report No. 2075.

Johnson, J. H., R. M. Ross, and R. D. McCullough. 2002. Little Galloo Island, Lake Ontario: a review of nine years of double-crested cormorant diet and fish consumption information. Journal of Great Lakes Research 28:182-192.

Kaemingk, M. 2008. Population dynamics and movement of smallmouth bass (*Micropterus dolomieu*) within the Beaver Archipelago, northern Lake Michigan. Masters thesis, Department of Biology, Central Michigan University, Mount Pleasant, MI.

Korfanty, C., W.G. Miyasaki, and J.L. Harcus. 1999. Review of the population status and management of double-crested cormorants in Ontario. Pg 131-145 *in* (M.E. Tobin, Tech. Coord.) Symposium on double-crested cormorants: Population status and management issues in the Midwest. 9 December 1997., Milwaukee, WI. Tech. Bull. 1879. Washington, D.C.: U.S. Department of Agriculture, Animal and Plant Health Inspection Service.

Lantry, B. F., T. H. Eckert, C. P. Schneider and J. R. Chrisman. 2002. The relationship between the abundance of smallmouth bass and double-crested cormorants in the Eastern Basin of Lake Ontario. Journal of Great Lakes Research 28:193-201.

Lantry, B. F., T. H. Eckert, C. P. Schneider, and J. R. Chrisman. 1999. The relationship between the abundance of smallmouth bass and double-crested cormorants in the eastern basin of Lake Ontario. Journal of Great Lakes Research. 28(2):193-201.

Lemmon, C.R., G. Burgbee, and G.R. Stephens. 1994. Tree damage by nesting double-crested cormorants in Connecticut. Connecticut Warbler 14:27-30.

Leonard, J. 2008. Wildlife watching in the U.S.: Impacts on national and state economies. United States Department of the Interior, Fish and Wildlife Service, Arlington, VA. Report 2006-1. 12pp.

Lewis, H.F. 1929. The natural history of the double-crested cormorant (*Phalacrocorax auritus*). Ru-Mi-Lou Books, Ottawa, Ontario.

Linnell, M. A., M. R. Conover, T. J. Ohashi. 1999. Biases in bird strike statistics based on pilot reports. J. Wildl. Manage. 63:997-1003.

Linnell, M.A., M.R. Conover, and T.J. Ohashi. 1996. Analysis of bird strikes at a tropical airport. Journal of Wildlife Management 60: 935-945.

LLBO (Leech Lake Band of Ojibwe). 2007. Double-crested Cormorant conflict management and research on Leech Lake – 2007 Annual Report. Fish Wildlife and Plant Resources Program, Division of Resources Management, Leech Lake Band of Ojibwe.

Locke, L. N. and M. Friend. 1987. Avian Botulism. Pages 83-93 *in* Field Guide to Wildlife Diseases. M. Friend, (ed.). United States Department of the Interior, Fish and Wildlife Service Resource Publication 167. Washington, D.C.

Lucchesi, D.O. 1988. A biological analysis of the yellow perch population in the Les Cheneaux Islands, Lake Huron. Mich. Dep. Nat. Resour. Fish. Res. Rep. 1958. Ann Arbor.

Ludwig, J.P., C.N. Hull, M.E. Ludwig, and H.J. Auman. 1989. Food habits and feeding ecology of nesting double-crested cormorants in the upper Great Lakes, 1986-1989. Jack-Pine Warbler 67:117-129.

Manuwal, D. 1989. Nuisance waterfowl at public waterfront parks in Seattle metropolitan area. Final Rpt. To Interlocal Waterfowl Manage. Comm. College of Forest Resour., Univ. WA Seattle, WA. Page 48. 48pp.

Mattison, P. M. 2006. Quantifying disturbance factors and effects in Common Terns (Sterna hiundo) using visual, audio, and reproductive data. M.S. Thesis Cornell University, Ithica, NY.

Matteson, S. W., P. W. Rasmussen, K. L. Stromborg, T. I. Meier, J. Van Stappen, and E. C. Nelson. 1999. Changes in the status, distribution, and management of double-crested cormorants in Wisconsin. Pg 27-45 *in* (M.E. Tobin, Tech. Coord.) Symposium on double-crested cormorants: Population status and management issues in the Midwest. 9 December 1997., Milwaukee, WI. Tech. Bull. 1879. Washington, D.C.: U.S. Department of Agriculture, Animal and Plant Health Inspection Service.

McKay, H., R. Furness, I. Russell, D. Parrott, M. Rehfisch, G. Watola, J. Packer, M. Armitage, E. Gill and P. Robertson. 1999. The assessment of the effectiveness of management measures to control damage by fish-eating birds to inland fisheries in England and Wales. Report to the Ministry of Agriculture, Fisheries and Food. MAFF Project VC0107.

MDNR (Michigan Department of Natural Resources). 2009. An adaptive management framework for managing populations of Double-crested Cormorants in Michigan. Michigan Department of Natural Resources, Wildlife Division, Lansing, MI.

MDNR (Michigan Department of Natural Resources). 2005. Double-crested cormorants in Michigan: a review of history, status and issues related to their increased population. Michigan Department of Natural Resources Report No. 2, August 2005.19pp.

MDNR (Michigan Department of Natural Resources). 2003. Overview of Michigan's fish hatchery system. www.michigan.gov/dnr.

Meadows, S. A. 2007 food habits of Double-crested Cormorants in southern Green Bay with emphasis on impacts on the yellow perch fishery - final summary report. Report preparted for the Wisconsin Department of Natural Resources by the University of Wisconsin, Madison, Department of

MMWR (Morbidity and Mortality Weekly Report). 2002. Provisional Surveillance Summary of the West Nile Virus Epidemic – United States, January-November 2002. Center for Disease and Surveillance; December 20, 2002. Vol. 51; No. 50.

Modde, T., A. F. Wasowicz, and D. K. Hepworth. 1996. Cormorant and grebe predation on rainbow trout stocked in a Southern Utah reservoir. North American Journal of Fisheries Management. 16:388-394.

Moore, D., D. V. C. Weseloh, P Careless, and D. Tyerman. 2005. Effects of culling cormorants on sympatrically nesting herons and egrets on Lake Ontario. Waterbird Society Meeting Abstracts, Jekyll Island GA, October 2005

Mott, D.F., J.F. Glahn, P.L. Smith, D.S. Reinhold, K.J. Bruce, and C.A. Sloan. 1998. An evaluation of winter roost harassment for dispersing double-crested cormorants away from catfish production areas in Mississippi. Wildlife Society Bulletin 26 (3): 584-591.

NASS. 2006. 2005 Census of aquaculture. United States Department of Agriculture, National Agricultural Statistics Service. http://www.agcensus.usda.gov/Publications/2002/ Aquaculture/index.asp

Neuman, J., D. L. Pearl, P. J. Ewins, R. Black, D. V. Weseloh, M. Pike, and K. Karwowski. 1997. Spatial and temporal variation in the diet of double-crested cormorants (Phalacrocorax auritus) breeding in the lower Great Lakes in the early 1990s. Canadian Cournal of Fisheries and Aquatic Science 54:1569-1584.

Newcomb, T and J. Dexter. 2006. Chinook salmon reductions key to balance in managing the Great Lakes. Unpublished information summary report, Michigan Department of Natural Resources. 9pp.

Price, I.M. and J.G. Nikum. 1995. Aquaculture and birds: the context for controversy. Colonial Waterbirds 18 (Spec. Pub. 1): 33-45.

Rappole, J.H., S.R. Derrickson, and Z. Hubalek. 2000. Migratory birds and the spread of West Nile virus in the Western Hemisphere. Emerging Infectious Diseases 6(4):319-328.

Reinhold, D.S. and C.A. Sloan. 1999. Strategies to reduce double-crested cormorant depredation at aquaculture facilities in Mississippi. Pg 99-105 *in* (M.E. Tobin, Tech. Coord.) Symposium on double-crested cormorants: Population status and management issues in the Midwest. 9 December 1997., Milwaukee, WI. Tech. Bull. 1879. Washington, D.C.: U.S. Department of Agriculture, Animal and Plant Health Inspection Service.

Ridgway, M.S., and D. Fielder. 2011. Double-crested cormorants in the Laurentian Great Lakes: issues and ecosystems. Pages X – Y in W. Taylor, A. Lynch, and N. Leonard, editors. Great Lakes Fisheries Policy and Management: A binational perspective, Second Edition. Michigan State University Press, East Lansing, Michigan. (In Press)

Ridgway, M. S., S. W. Milne, T. Middel, J. Casselman (2006*a*). Double-Crested Cormorant and coastal fish monitoring and assessment in the North Channel and Georgian Bay, Lake Huron: Field methods, site descriptions and analysis information. Ontario Ministry of Natural Resources. 67pp

Ridgway, M. S., J. B. Pollard, and D. V. C. Weseloh (2006*b*). Density Dependent growth of Double-crested cormorant colonies in coastal regions of Lake Huron. Ontario Ministry of Natural Resources. Canadian Journal of Zoology 84:1409-1420.

Ricker, W. E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations. Bulletin of the Fisheries Research Board of Canada 191.

Robinson, M. 1996. The potential for significant financial loss resulting from bird strikes in or around an airport. Proceedings of the Bird Strike Committee Europe 22: 353-367.

Ross, R. M., and J. H. Johnson. 1997. Fish losses to Double-crested Cormorant predation in Eastern Lake Ontario, 1992-1997. Symposium on Double-crested Cormorants: Population status and management issues in the Midwest. United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, Fort Collins, CO.

Rudstam, L. G., A. J. VanDeValk, C. M. Adams, J. T. H. Coleman, J. L. Forney, and M. E. Richmond. 2004.

Cormorant predation and the population dynamics of walleye and yellow perch in Oneida Lake. Ecological Applications, 14(1) 149-163.

Shaeffer, J. S., T. P. O'Brien, D. M. Warner and E. F. Roseman. 2006 Status and Trends of Pelagic Prey Fish in Lake Huron. U.S. Geological Survey, Great Lakes Science Center, 1451 Green Rd., Ann Arbor, MI 48105

Schmidt, R. 1989. Wildlife management and animal welfare. Trans. N.Amer. Wildl. And Nat. Res. Conf. 54:468-475.

Schneider, C. P., A. Schiavone, Jr, T. H. Eckert, R. D. McCullough, B. F. Lantry, D. W. Einhouse, J. R. Chrisman, and C. M. Adams. 1999. Double-crested cormorant predation on smallmouth bass and other fishes of the Eastern basin of Lake Ontario: overview and summary. New York Department of Environment and Conservation. Special Report.

Seamans, M. E., J. P. Ludwig, K. Stromborg, F. E. Ludwig II, and F. E. Ludwig. 2008. Annual survival of Double-crested Cormorants from the Great Lakes, 1979-2006. Unpublished Report.

Seefelt, N. E. 2005. Foraging ecology, bioenergetics and predatory impact of breeding double-crested cormorants (*Phalacrocorax auritus*) in the Beaver archipelago, northern Lake Michigan. PhD Dissertation, Department of Zoology, Michigan State University.

Seefelt, N. E. and J. C. Gillingham. 2008. Bioenergetics and prey consumption of breeding double-crested cormorants in the Beaver Archipelago, Northern Lake Michigan. Journal of Great Lakes Research 34:122-133.

Seider, M.J. 2003. Population dynamics of smallmouth bass in the Beaver Archipelago, northern Lake Michigan, 1999-2002. MS Thesis, University of Georgia.

Shieldcastle, M.C. And L. Martin. 1999. Colonial waterbird nesting on west sister island national wildlife refuge and the arrival of double-crested cormorants. Pg 115-119 *in* (M.E. Tobin, Tech. Coord.) Symposium on double-crested cormorants: Population status and management issues in the Midwest. 9 December 1997., Milwaukee, WI. Tech. Bull. 1879. Washington, D.C.: U.S. Department of Agriculture, Animal and Plant Health Inspection Service.

Shroyer, S. M., and T. S. McComish. 2000. Relationship between alewife abundance and yellow perch recruitment in southern Lake Michigan. North American Journal of Fisheries Management 20:220-225.

Shwiff, S. K. Kirkpatrick, and T. DeVault. 2009. The economic impact of Double-Crested Cormorants to Central New York. U.S. Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center Economics Project Report, Fort Collins, CO.

Skagen, S. K., C. P. Melcher, and E. Muths. 2001. The interplay of habitat change, human disturbance and species interactions in a waterbird colony. American Midland Naturalist. 145:18-28.

Slate, D.A., R. Owens, G. Connolly, and G. Simmons. 1992. Decision making for wildlife damage management. Transactions of the North American Wildlife Natural Resource Conference 57: 51-62.

Smith, S. H. 1070. Species interactions of the alewife in the Great Lakes. Transactions of the North American Fisheries Society 4:754-765.

Stahl, R. S., B. S. Dorr, S. C. Barras, and J. J. Johnston. 2006. Use of fatty-acid profiles to distinguish between selected game fish and farm-raised channel catfish. Procedings of the Vertebrate Pest Conference 22:389-392.

Stromborg, K. L., J. K. Netto, J. S. Ivan, and C. R. Courtney. 2008. Survivorship and mortality patterns of cormorants at Spider Island, Wisconsin, 1988-2006. In press. Procedings of the 2007 IA Great Lakes

Research.

Terres, J.K. 1980. The Audubon Society Encyclopedia of North American Birds. Wings Bros. New York, New York.

Thorpe, J. 1996. Fatalities and destroyed civil aircraft due to bird strikes, 1912-1995. Proceedings of the International Bird Strike Conference 23: 17-31.

Tobin, M.E., D.T. King, B.S. Dorr, and D.S. Reinhold. 2002. The effect of roost harassment on cormorant movements and roosting in the Delta region of Mississippi. Waterbirds 25(1):44-51.

Tyson, L.A., J.L. Belant, F J. Cuthbert and D.V. Weseloh. 1999. Nesting populations of double-crested cormorants in the United States and Canada. Pp. 17-25. Symposium on Double-crested Cormorants: Population Status and Management Issues in the Midwest, December 9, 1997, (M. E. Tobin, ed.). USDA Technical Bulletin No. 1879. 164pp.

USDA (U.S. Department of Agriculture). 2011. Round Goby. USDA, Animal and Plant Health Inspection Service, National Invasive Species Information Center, Species Profiles. http://www.invasivespeciesinfo.gov/aquatics/goby.shtml.

USDA. 2009. Environmental Assessment: Double-crested Cormorant damage management in Wisconsin. USDA, APHIS, WS, 732 Lois Dr., Sun Prairie, WI 53901. http://www.aphis.usda.gove/regulations/ws/ws_nepa_environmental_documents.shtml.

USDA. 2006*a*. Amendment to the environmental assessment: reducing Double-crested Cormorant damage through an integrated wildlife damage management program in the state of Michigan. USDA, APHIS, WS, 2803 Jolly Road, Suite 100, Okemos, MI 48864. http://www.aphis.usda.gove/regulations/ws/ws_nepa_environmental_documents.shtml.

USDA. 2006*b*. Environmental Assessment: Reducing Double-crested Cormorant damage in Ohio. USDA, APHIS, WS,6929 American Parkway, Reynoldsburg, OH. http://www.aphis.usda.gov/regulations/ws/ws_nepa_environmental_documents.shtml

USDA. 2005. Environmental Assessment: Reducing Double-crested Cormorant damage in Minnesota. USDA, APHIS, WS, St. Paul Downtown Airport, 644 Bayfield St., Suite 215, St. Paul, Minnesota, http://www.aphis.usda.gov/regulations/ws/ws_nepa_environmental_documents.shtml.

USDA. 2004. Environmental Assessment: Reducing Double-crested Cormorant damage through and integrated wildlife damage management program in the state of Michigan. USDA, APHIS, WS, , 2803 Jolly Road, Suite 100, Okemos, MI 48864. http://www.aphis.usda.gove/regulations/ws/ws_nepa_environmental_documents.shtml.

USDA. 1997 Revised. Final Environmental Impact Statement. USDA, APHIS, WS Operational Support Staff, 4700 River Road, Unit 87, Riverdale, MD 20737.

USDI (U.S. Department of the Interior). 2001. Waterbird Conservation for the Americas. USDI, Geological Survey, Patuxent Wildlife Research Center; Laurel, MD. http://www.mp2- pwrc.usgs.gov/cwb/.

USFWS (U.S. Fish and Wildlife Service). 2009*a*. Tribal fish hatchery programs of the Northern Great Lakes Region. http:www.fws.gov/Midwest/Ashland/TribalIndex.html.

USFWS (U.S. Fish and Wildlife Service). 2009*b*. Final Environmental Assessment: Extended management of Double-crested Cormorants under CFR 50 CFR 21.47 and 21.48. U.S. Department of the Interior, Fish and Wildlife Service, Arlington Virginia.

USFWS (U.S. Fish and Wildlife Service). 2006. National Survey of Fishing, Hunting, and Wildlife- Associated Recreation. ), Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau.

USFWS (United States Department of the Interior, Fish and Wildlife Service). 2003. Final Environmental Impact Statement: Double-crested Cormorant Management. U.S. Dept. of the Interior, USFWS, Div. of Migratory Bird Management, 4401 N. Fairfax Drive MS 634, Arlington, VA 22203. http://migratorybirds.fws.gov/issues/cormorant/cormorant.html .

USFWS (U.S. Fish and Wildlife Service). 1995. Report to Congress: Great Lakes Fishery Resources Restoration Study.

USGS (U.S. Department of the Interior, Geological Survey). 2000. Round Goby: An exotic fish in the Great Lakes. GLSC Fact Sheet 2000-1. http://www.glsc.usgs.ogv/_files/factsheets/2000-1%20Round%20Goby.pdf.

VanDeValk, A.J., C. M. Adams, L. G. Rudstam, J. L. Forney, T. E. Brooking, M. A. Gerken, B. P. Young, And J. T. Jacob. 2002. Comparison of angler and cormorant harvest of walleye and yellow perch in Oneida Lake, New York. Transactions of the American Fisheries Society 131:27-39.

WDNR (Wisconsin Department of Natural Resources). 2008. Lake Michigan Management Report. Lake Michigan Fisheries Team, Wisconsin Department of Natural Resources, Madison, WI. http://dnr.wi.gov/fish/lakemich/GLFC_Report_2008.pdf

Weber, W.J. 1979. Health Hazards from Pigeons, European starlings, and English sparrows. Thompson Publ. Fresno, Calif. 138pp.

Weseloh, D. V. C., 2005. The threat to Black-crowned Night-Heron colonies form nesting double-crested cormorants on the great lakes: a protocol and an assessment. Waterbird Society Meeting Abstracts, Jekyll Island GA, October 2005

Weseloh, D.V. and B. Collier. 1995. The rise of the double-crested cormorant on the Great Lakes: winning the war against contaminants. Great Lakes Fact sheet. Canadian Wildlife Service, Environment Canada and Long Point Observatory.

Weseloh, D. V., F. J. Cuthbert, and S. L. Hanisch. 2008. Results of the 2007 Census of Double-crested Cormorant Nests in the Great Lakes Area. Presentation to the Great Lakes Double-crested Cormorant Management Working Group. March 27-28, East Lansing, MI.

Weseloh, D.V., and P.J. Ewins. 1994. Characteristics of a rapidly increasing colony of double-crested cormorants (Phalacrocorax auritus) in Lake Ontario: population size, reproductive parameters andband recoveries. J. Great Lakes Res. 20(2):443-456.

Weseloh, D.V., P. J. Ewins, J. Struger, P. Mineau, C. A. Bishop, et al. 1995. Double-crested Cormorants of the Great Lakes: Changes in population size, breeding distribution and reproductive output between 1913 and 1991. Colon. Waterbirds 18 (Spec. Publ.1):48-59.

Weseloh, D.V., C, T. Havelka, F. J. Cuthbert and S. Hanisch. 2006. The 2005 Great Lakes-wide census of nesting double-crested cormorants. Unpublished report. Canadian Wildlife Service, 4905 Dufferin ST. Downsview, ON M3H 5T4

Weseloh, D.V., C. Pekarik, T. Havelka, G. Barrett, and J. Reid. 2002. Population trends and colony locations of double-crested cormorants in the Canadian Great Lakes and immediately adjacent areas, 1990-2000: a manager's guide. J. Great Lakes Res. 28 (20):125-144.

Weseloh, D. V., S. M. Teeple, and M. Gilbertson. 1983. Double-crested Cormorants of the Great Lakes: egg-laying parameters, reproductive failure, and contaminant residues in eggs, Lake Huron 1972-1973. Canadian Journal of Zoology 61:427-436.

Wildlife Society, The. 1990. Conservation policies of the Wildlife Society. The Wildlife Society. Wash., D.C. 20 pp.

Wires, L.R. and Cuthbert, F.J. 2001. Prioritization of waterbird colony sites for conservation in the U.S. Great Lakes. Final Report to USFWS. Available at: http://www.waterbirds.umn.edu/F2-CWBPrior.pdf .

Wires, L.R., F.J. Cuthbert, D.R. Trexel, and A.R. Joshi. 2001. Status of the Double-crested Cormorant (*Phalacrocorax auritus*): Eastern and Central North America. USFWS Report.

Wright, S. 2004. Some significant wildlife strikes to civil aircraft in the United States, 1990 - December 2003. Unpublished report, USDA APHIS WS National Wildlife Research Center, Sandusky, OH.

# 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 (MDNR)** | **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 MDNR 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 MDNR. 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.<br><br>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 (MDNR)** | **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 MDNR or the tribes. | ___ | No impact on alternatives available to MDNR. 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 MDNR 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.<br><br>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 (MDNR)** | **Tribes** | **USDI Sleeping Bear Dunes National Lakeshore (SBDNL) and Others** |
| **Michigan Department of Natural Resources (MDNR)** | No impact on alternatives available to MBO or NWRs. However, a MDNR 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 MDNR. | No impact on alternatives available to WS. However, A MDNR 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 MDNR. | ___ | 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 MDNR. | No impact on alternatives available to SBDNL. However, a MDNR 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 MDNR.<br><br>Cumulative lethal DCCO take for CDM and research by other entities would be limited to level allowed under the alternative selected by the MDNR. |

| 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 (MDNR)** | **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 MDNR. | 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 MDNR. 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 MDNR 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 MDNR.<br><br>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 MDNR. 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 (MDNR)** | **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 MDNR 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.<br><br>A permit is not required for non-lethal CDM. | MDNR 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.<br><br>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.<br><br>Non-lethal CDM does not require a permit from the MBO. | WS, the MDNR 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.<br><br>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 (MDNR)** | **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 MDNR or tribes for assistance with lethal take under the PRDO.<br><br>WS would only assist with research and CDM using non-lethal methods | ___ | No impact on decisions available to state under the PRDO.<br><br>WS would not assist with consultation and Form 37 required for a depredation permit from the USFWS. MDNR would not be able to obtain a depredation permit.<br><br>WS would only assist the MDNR with CDM and research using non-lethal methods. | No impact on decisions available to tribes under the PRDO.<br><br>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.<br><br>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.<br><br>These entities would be able to obtain research permits.<br><br>WS would only assist with CDM and research using non-lethal methods. |
| **Michigan Department of Natural Resources (MDNR)** | MBO and NWRs could select any alternative. However, a permit from the MDNR 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 MDNR 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 MDNR is required to conduct CDM in Michigan so CDM would be limited to nonlethal methods.<br><br>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 (MDNR)** | **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 MDNR. | ___ | No impact on actions by SBDNL.<br><br>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.<br><br>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 MDNR. 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.<br><br>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 (MDNR)** | **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 MDNR 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.<br><br>Non-lethal CDM does not require a permit from the MBO. | MDNR 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.<br><br>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.<br><br>Non-lethal CDM does not require a permit from the MBO. | WS, the MDNR 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.<br><br>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.<br><br>WS would not conduct CDM on NWRs. | No impact on decisions available to state. MDNR 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 (MDNR)** | **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 MDNR or tribes for assistance with lethal take under the PRDO.<br><br>WS would not assist with CDM or research. | ___ | No impact on decisions available to state under the PRDO.<br><br>WS would not assist with consultation and form 37 required for a depredation permit from the USFWS. The MDNR would not be able to obtain a depredation permit. State would be able to obtain research permits.<br><br>WS would not assist state with CDM or research. | No impact on decisions available to tribes under the PRDO.<br><br>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.<br><br>WS would not assist state with CDM or research. | Landowners/managers would need to go to MDNR or tribes for implementation of projects involving the PRDO.<br><br>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.<br><br>These entities would be able to obtain research permits.<br><br>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 MDNR. 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.