U.S. Fish and Wildlife Service

DRAFT
ENVIRONMENTAL ASSESSMENT

EXTENDED MANAGEMENT OF DOUBLE-CRESTED CORMORANTS UNDER 50 CFR 21.47 and 21.48

DIVISION OF MIGRATORY BIRD MANAGEMENT

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SUMMARY

- In 2003, the U.S. Fish and Wildlife Service published a Final Environmental Impact Statement and made changes to the regulations governing the take of Double-crested Cormorants (*Phalacrocorax auritus*; DCCO). The final rule, published in the Federal Register in November 2003, established a Public Resource Depredation Order (PRDO; 50 CFR 21.48) and made changes to the 1998 Aquaculture Depredation Order (AQDO; 50 CFR 21.47). The final rule for the current depredation orders is available at http://www.fws.gov/migratorybirds/issues/cormorant/FinalRule/fed1regdccofinalrule.pdf. If not renewed, the PRDO and the AQDO will expire on April 30, 2009. The purpose of this EA is to determine whether the action of continuing the depredation orders is likely to have a significant effect on the environment.

- In this Draft EA, we consider the following three alternatives: Alternative A: No Action (allow the depredation orders to expire in 2009); Alternative B: Five-year Extension (extend the depredation orders to 2014), which is our preferred alternative; and Alternative C: No Expiration (eliminate the expiration dates on the depredation orders). We have analyzed effects of the three alternatives on: DCCOs, fish, other birds, vegetation, threatened and endangered species, the economic environment, and existence and aesthetic values. Extending the depredation orders for another five years would not harm populations of DCCOs or other birds that nest or roost with them; would not harm threatened and endangered species; would benefit resources that are negatively impacted by Double-crested Cormorants (fish, other birds, and vegetation); would minimize negative economic impacts on aquaculture businesses and recreational, fishing-dependent economies; would have no effect on existence values; and would have varying effects on aesthetic values.

- Given the limits on control, frequent population monitoring, and our review of annual reports and of proposed control activities we are confident that another five years of implementation of the depredation orders will not threaten the long-term conservation of DCCO populations.

PURPOSE AND NEED FOR THE PROPOSED ACTION

On August 11, 2003 we published a Final Environmental Impact Statement (FEIS) on Double-crested Cormorant (*Phalacrocorax auritus;* DCCO) management in the United States. You may view or download the FEIS online at http://www.fws.gov/ migratorybirds/issues/cormorant/finaleis/CormorantFEIS.pdf, or you can request a copy by writing the Division of Migratory Bird Management. The programmatic FEIS analyzed the anticipated effects of six alternatives on: DCCOs; other birds; fish; vegetation; Federally-listed threatened and endangered species; water quality and human health; aquaculture and recreational fishing economies; fish hatcheries; property losses; and existence and aesthetic values. The FEIS also considered direct, indirect, and cumulative effects and discussed mitigating measures. The proposed action or preferred alternative in the FEIS was Alternative D: Public Resource Depredation Order. This alternative entailed two regulation changes (described below): revision of the 1998 aquaculture depredation order and creation of a public resource depredation order.

On October 8, 2003 (68 FR 58022), USFWS published final regulations for an aquaculture depredation order (50 CFR 21.47) and a public resource depredation order (50 CFR 21.48) including all associated terms and conditions. The final rule also gave background information on the development of the regulations, presented our responses to significant comments received on the proposed rule, and, pursuant to the National Environmental Policy Act, presented our Record of Decision.

The aquaculture depredation order (AQDO) applies to 13 States (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Minnesota, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas) and, in those States, authorizes freshwater commercial aquaculture producers to take DCCOs committing or about to commit depredation of aquaculture stocks. It also authorizes USDA-APHIS-Wildlife Services (USDA-WS) employees to control DCCOs at roosts that are near aquaculture facilities. Numerous terms and conditions apply, including recordkeeping and reporting requirements.

The public resource depredation order (PRDO) applies to 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) and authorizes State fish and wildlife agencies, federally-recognized Tribes, and USDA-WS to take DCCOs to protect fish, wildlife, plants, and their habitats that are managed by public resource agencies for public benefit. Numerous terms and conditions apply, including annual notification and reporting requirements.

The purpose of the proposed action in the FEIS was to: (1) reduce resource conflicts associated with DCCOs in the contiguous United States, (2) enhance the flexibility of natural resource agencies in dealing with DCCO-related resource conflicts, and (3) ensure the long-term conservation of DCCO populations. The purpose of the preferred alternative (Alternative B) in this Environmental Assessment (EA) is to continue to meet the three objectives stated in the FEIS.

The conservation of DCCO populations is a fundamental responsibility of the USFWS; however, because of the problems associated with abundant DCCOs, that responsibility includes being responsive to damages caused by this species. Wildlife damage management, or control, is the alleviation of damage or other problems caused by or related to the presence (and often overabundance) of wildlife. It allows wildlife officials to balance the positive and negative impacts associated with wildlife in a world where humans and wildlife must coexist (Conover 2002) and it is an integral part of wildlife management (Leopold 1933, The Wildlife Society 1990, Berryman 1991). The Migratory Bird Treaty Act allows regulations to be written that authorize migratory birds to be taken to control depredation and other problems.

As DCCO populations expanded (numerically and, to some extent, geographically) during the 1970s to 1990s, fish and wildlife managers (and members of the public such as fish farmers, sport anglers, etc.) began to associate DCCOs with a host of resource conflicts. These included damage to trees and other vegetation, depredation on fishery and aquaculture stock, and competition with co-nesting species. Both scientific and anecdotal evidence support the premise that DCCOs can have significant localized impacts on resources. When USFWS issued the DCCO depredation orders in 2003, it did so in the understanding that DCCOs can cause real resource damages.

We anticipate a continuing need to manage DCCOs to protect public resources beyond the 30 April 2009 expiration dates of the PRDO and AQDO. Sometime after 2008, USFWS plans to prepare a Supplemental Environmental Impact Statement (SEIS) and reconsider strategies for DCCO management. Because there isn't enough time to complete an SEIS before expiration of the depredation orders, and because the proposed regulation change will not result in a change to current management strategies because no other changes than the expiration date would be made to the depredation orders, we have decided to complete an EA to make a significance determination and assist in the decision-making process.

AUTHORITY AND COMPLIANCE

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." USFWS manages the 93-million-acre National Wildlife Refuge System, which encompasses more than 520 national wildlife refuges, thousands of small wetlands, and other special management areas nationwide. It also operates 66 national fish hatcheries, 64 fishery resource offices and 78 ecological services field stations. The agency enforces Federal wildlife laws, administers the Endangered Species Act, manages migratory bird populations, restores nationally significant fisheries, conserves and restores wildlife habitat such as wetlands, and helps foreign governments with their conservation efforts. It also oversees the Wildlife and Sport Fish Restoration Program that distributes hundreds of millions of dollars in excise taxes on fishing and hunting equipment to state fish and wildlife agencies.

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703 et seq; 40 Stat. 755).

USFWS has the primary statutory authority to manage migratory bird populations in the U.S., authority which comes from the Migratory Bird Treaty Act (MBTA). The original treaty was signed by the U.S. and Great Britain (on behalf of Canada) in 1918 and imposed certain obligations on the U.S. for the conservation of migratory birds, including the responsibilities to: conserve and manage migratory birds internationally; sustain healthy migratory bird populations for consumptive and non-consumptive uses; and restore depleted populations of migratory birds. Conventions with Mexico, Japan, and Russia occurred after the original convention with Great Britain and these gave MBTA protection to additional migratory bird species. The cormorant taxonomic family, *Phalacrocoracidae*, and 31 other families were added to the List of Migratory Birds (that is, those bird species protected by the MBTA) in 1972 as a result of an amendment to the 1936 "Convention between the United States of America and the United Mexican States for the Protection of Migratory Birds and Game Mammals."

Endangered Species Act (16 U.S.C. 1531 et seq.).

Under the Endangered Species Act (ESA), all Federal agencies must conserve threatened and endangered species and utilize their authorities in furtherance of the purposes of the Act (Section 2(c)). In accordance with section 7 of the Act, the USFWS Migratory Bird program prepared a Biological Evaluation and conducted informal consultation with the USFWS Endangered Species program to evaluate Federally-listed species that may be affected by activities carried out under the depredation orders.

National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.). The National Environmental Policy Act (NEPA) is our national charter for protection of the environment. It requires Federal agencies to evaluate the potential environmental impacts when planning a major Federal action and ensures that environmental information is available to public officials and citizens before decisions are made and actions are taken. NEPA neither requires a particular outcome nor that the "environmentally-best" alternative is selected. It mandates a process for thoroughly considering what an action may do to the human environment and how any adverse impacts can be mitigated. This EA was prepared in compliance with NEPA.

COMPLIANCE WITH OTHER FEDERAL LAWS AND REGULATIONS

Environmental Justice and Executive Order 12898. Executive Order 12898, entitled "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," 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 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. This EA addresses environmental justice.

AFFECTED ENVIRONMENT

The purpose of this section is to establish a baseline for analysis of the alternatives. We incorporate by reference the material contained in Chapter 3 of the FEIS. Information pertinent to Pacific Coast and Alaska DCCO populations is excluded since this EA concerns only the 24 states to which the depredation orders apply. In addition to the information in the FEIS, we provide updates where applicable.

DOUBLE-CRESTED CORMORANT POPULATIONS

Although the Service has authorized increased levels of lethal take of DCCOs in recent years, the goal is not to dramatically reduce DCCO populations on a regional or continental scale but rather to manage DCCOs on a limited, localized basis to reduce or prevent resource damages. By reference, we incorporate here the information found in pages 22-31 of the FEIS concerning the basic biology and ecology of DCCOs. More information on the natural history of DCCOs can also be found at http://www.fws.gov/migratorybirds/issues/cormorant/status.pdf.

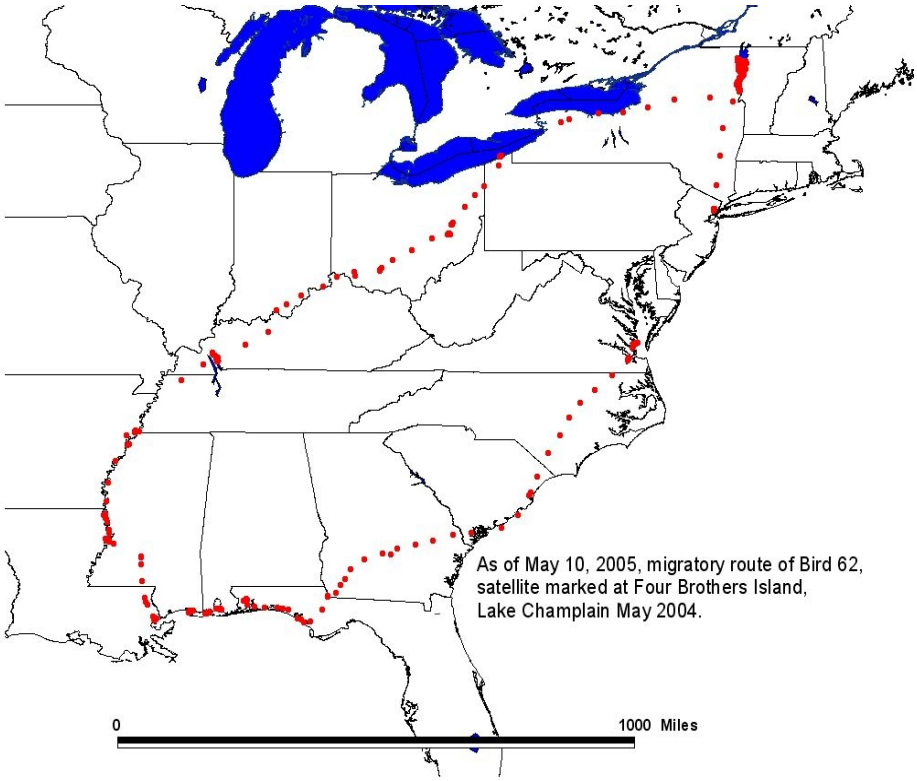
As noted in the FEIS, the continental (*i.e.*, North American) DCCO population is estimated to be at least two million birds (including breeding and non-breeding birds). DCCO populations are divided into four groups: Atlantic, Interior, Southern, and Pacific Coast-Alaska (as stated above, the latter is excluded from this analysis). Approximately 70% of DCCOs occur in the Interior population (Tyson *et al*. 1999), which includes Great Lakes DCCOs, and it is this population that is most intensively managed. Wires and Cuthbert (2006) described the Great Lakes region as "one of the most important areas in the human-cormorant conflict."

Analysis of impacts of management activities can occur at several different scales: continental, Atlantic/Interior/Southern population, regional (such as the Great Lakes), metapopulation (such as Lake Champlain-St. Lawrence River-Lac St. Pierre), or local (such as the Les Cheneaux Islands). Under the PRDO, managers work at the local scale. In this EA, we analyze the cumulative impacts of local management on regional populations wherever possible. Because DCCO populations have been well-studied in the Great Lakes and the bulk of public resource conflicts with DCCOs occur there, the Great Lakes population is an important population on which to focus.

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*. In Review). In 2005, American and Canadian wildlife officials conducted a Great Lakes-wide DCCO survey and counted a total of 118,860 nests at 216 sites (Weseloh *et al*. In review). In 2007, the survey was repeated and 115,026 nests were counted. It is unclear whether the lower number in 2007 represents a true population decline or if disturbance from management efforts kept many birds from nesting even though they were still present in the population at large (D.V. Weseloh, personal communication). The total DCCO population (*i.e.*, 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). See Appendix 1 for

more information about population monitoring efforts. See Table 1 for an overview of DCCO populations in each State covered by the PRDO and AQDO. Figure 1 shows the migration route of a satellite marked DCCO and demonstrates the general linkage between DCCO breeding, migrating, and wintering grounds (J. Taylor and R. Chipman, USDA-WS, unpublished data).

Figure 1. Travels of a migrating DCCO



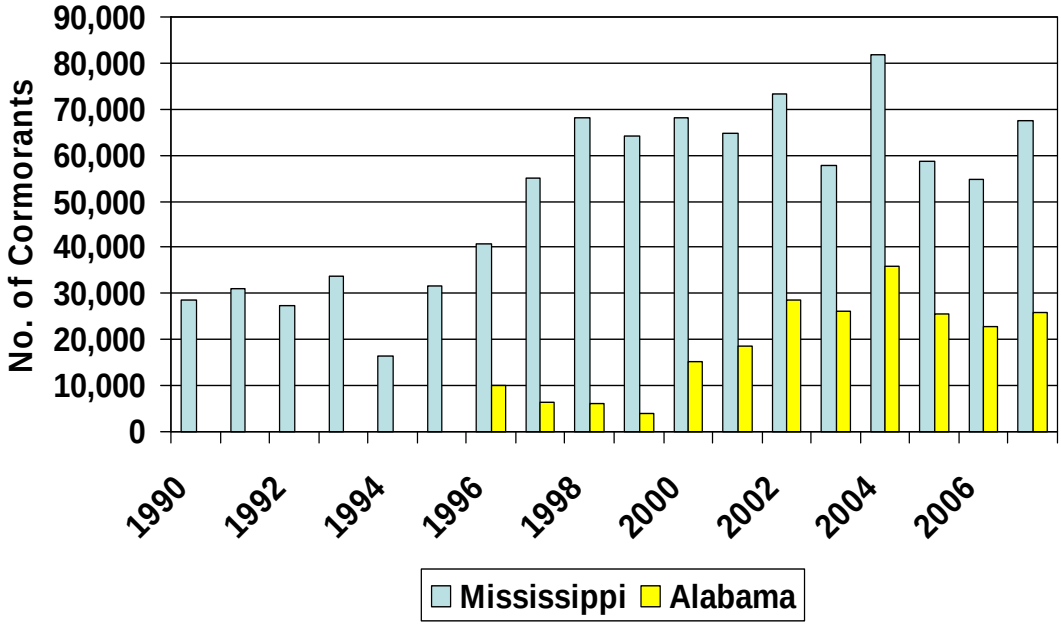
The Southern breeding population of DCCOs (which includes the states of Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas) has approximately 10,000 pairs, most of which occur in Florida (Wires *et al.* 2001, Hunter *et al.* 2006). Many more DCCOs (from the Interior and Atlantic populations) winter in the southeastern U.S. USDA-WS conducts bi-weekly roost surveys from October to April and an annual mid-winter roost survey in the Mississippi Delta region and parts of Arkansas and Alabama. Figure 2 shows recent mid-winter survey results for Mississippi and Alabama (USDA-WS, unpublished data).

Table 1. Number of breeding pairs of DCCOs in States included in the depredation orders.

State	Statewide Population of Breeding Pairs
Alabama*	486 (Lemmons 2007)
Arkansas*	21 (Lemmons 2007)
Florida*	6,745 (from a 1999 survey reported in Wires *et al.* 2001); Wires and Cuthbert (2006) noted that Florida is the only southeastern state in which breeding DCCOs are "abundant"
Georgia*	Unknown, but at least 7 colonies discovered since 1990 (Wires et al. 2001)
Illinois	At least 754 at 6 colonies, as of 1997 (Wires *et al.* 2001)
Indiana	226 (Weseloh *et al.* In review)
Iowa	At least 844 at 5 colonies, as of 1998 (Wires *et al.* 2001)
Kansas	Confirmed breeding at 3 sites; numbers small (Wires *et al.* 2001)
Kentucky*	Not known to breed in KY (Wires *et al.* 2001)
Louisiana*	2 breeding sites known as of 2001, but current numbers unknown (Wires *et al.* 2001)
Michigan	30,611 (Weseloh *et al.* In review)
Minnesota	16,000 (Wires *et al.* 2005)
Mississippi*	149 (Lemmons 2007)
Missouri	Not known to breed in Missouri (Wires *et al.* 2001)
New York	>10,000 (NYSDEC 2007 annual report)
North Carolina*	Known to breed at a few sites but #s unknown (Wires *et al.* 2001)
Ohio	5,164 (Ohio EA 2006)
Oklahoma*	One colony of ~30 pairs in 1996; otherwise unknown (Wires *et al.* 2003); USDA-WS personnel in OK checked several locations but did not find any colonies in 2007 (Lemmons 2007); winter estimate of 50,000 birds posted at OK Dept of Wildlife Conservation website (no information on distribution)
South Carolina*	725 counted in 1998, but this didn't include all colonies (Wires *et al.* 2001); Lemmons (2007) reported 104 nests in 3 colonies in 2007
Tennessee*	Very few colonies; numbers unknown (Wires *et al.* 2001)
Texas*	4 confirmed colonies in east Texas; overall breeding numbers are unclear (Texas Breeding Bird Atlas 2006; Wires *et al.* 2001); Lemmons (2007) reported a colony of 60 nests
Vermont	4,200 (VFWD/WS 2007 annual report)
West Virginia	Not known to breed in WV (Wires *et al.* 2001)
Wisconsin	13,337 (Weseloh *et al.* In review)

*The Southeast U.S. Waterbird Conservation Plan regional DCCO estimate, which includes colonies in these 12 States plus Virginia, is 10,600 breeding pairs (Hunter *et al.* 2006).

Figure 2. Numbers of DCCOs observed during bi-weekly roost surveys in Mississippi and Alabama.



The Southeast U.S. Waterbird Conservation Plan noted the following about DCCOs in that region (Figure 3).

> *[DCCOs] have undergone dramatic increases in the last 20 years coming into major economic conflicts with aquaculture and possibly other resources, mostly during the winter months. This is especially an issue at aquaculture facilities in Alabama and Arkansas, where it has been suggested that populations be reduced to 1980s levels. However, most Southeast U.S. breeding colonies are in locations and numbers of pairs that do not yet exceed our best understanding of pre-1900 populations (except potentially in the Mississippi Alluvial Valley). Perhaps existing breeding population levels should be maintained, even if efforts are to be undertaken to reduce overall wintering populations in the Southeast U.S. (especially in the Lower Mississippi Flyway States). In Mississippi, [DCCOs] have been increasing to the point that populations at some colonies are likely greater than the pre-1900 levels.*

FISH

We incorporate here, by reference, pages 31 through 35 of the FEIS, which discuss relationships between DCCOs and fish. The DCCO is a generalist, fish-eating bird (though occasionally other aquatic species are found in its diet). Over 250 species of fish have been reported in the DCCO diet, but the species of greatest concern for negative impacts caused by DCCO predation are sport fish such as walleye, yellow perch, smallmouth bass, and various salmonid species.

Figure 3. Area covered by the Southeast U.S. Waterbird Conservation Plan. Bird Conservation Regions (U.S. NABCI Committee 2000) numbered.

In recent years, researchers have begun to examine the issue from a systems perspective (*i.e.*, not focusing on a single species but the whole fish community, including forage fish). For example, researchers with the Ontario Ministry of Natural Resources conducted an intensive study of nearshore fish populations and DCCO populations in Georgian Bay and North Channel of Lake Huron from 2000-2005 (Ridgway *et al*. 2006*a, b*). Data from these studies indicated there were negative relationships between nearshore fish abundance and fish consumption by nesting DCCOs. In some study areas and years, particularly in Georgian Bay, estimates of annual fish consumption by DCCOs greatly exceeded annual nearshore fish production, and DCCOs were associated with "significantly altered and redistributed nearshore fish resources and [had] broad-scale impacts on prey-fish abundance" (Casselman and Marcogliese 2006).

The Wisconsin Department of Natural Resources explained why many fisheries managers are concerned about effects of DCCO predation (P. Peeters, WDNR, unpublished data).

> *During the most recent breeding survey in 2005, there were 12,882 double-crested cormorant nests in five colonies in the Wisconsin waters of northeast Wisconsin and there were another 7,676 nests just across the Michigan boundary in northern Green Bay. Collectively this represents one of the larger concentrations of cormorants in the Great Lakes Basin (18.3 percent of the 2005 breeding bird survey count). Multiplying the number of nests in this general area by two to account for the number of breeding birds (20,558 nests x 2 birds = 41,116 birds) and then multiplying the breeding birds by two to account for the sub adults and non breeding adults thought to be associated with a healthy and expanding cormorant population (41,116 breeders x 2 =*

82,232 birds), it can be estimated that in excess of 82,000 cormorants are foraging in a fairly limited area of Green Bay and the near shore Lake Michigan waters off the Door County peninsula.

Utilizing the generally accepted foraging rate of approximately one pound of fish consumed each day by each adult cormorant, for the typical six months of residency, and adding in a calculation to account for the young fledged each year, an impact on the fishery can be estimated at approximately 19 million pounds consumed by the cormorants in and around Green Bay [(82,232 birds x 1 lb. fish/day x 183 days) + (20,558 nests x 2 average chicks/nest x 183 days/ 2 because young chicks are not consuming 1 lb. fish/day) = 18,810,570 pounds of fish]. Regardless of the species of fish consumed, 19 million pounds of fish removed out of this limited area is a substantial amount of fish.

OTHER BIRDS

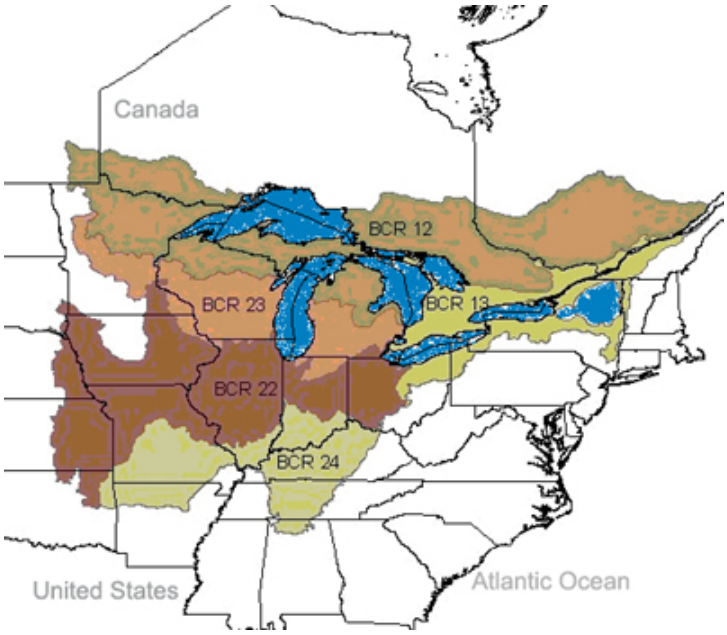
We incorporate here, by reference, the information in pages 35-38 of the FEIS concerning avian associates of DCCOs. As noted, DCCOs nest with several other bird species, including American White Pelicans (*Pelecanus erythrorhynchos*), Great Blue Herons (*Ardea herodias*), Great Egrets (*Casmerodius albus*), Black-crowned Night-herons (*Nycticorax nycticorax*), and several species of gulls and terns. The ability of DCCOs to have negative impacts on co-nesters, through habitat destruction, nest take-over, or reduction of available nesting space, is of particular concern in areas where an affected species is declining or where local management goals exist for that species. See Appendix 2 for more on the population status of species that nest in association with DCCOs.

The species that come into conflict with DCCOs most often in the Great Lakes region are the Great Blue Heron, Great Egret, and Black-crowned Night-heron, which are tree-nesting species). In the draft Upper Mississippi Valley/Great Lakes Waterbird Conservation Plan, the conservation concern status is listed as "moderate" for Black-crowned Night herons and "high" for Common Terns (*Sterna hirundo*) in the Boreal Hardwood Transition and Lower Great Lakes/St. Lawrence Plain Bird Conservation Region (BCRs 12 and 13, respectively, in Figure 4). In both BCRs, Great Blue Herons and Great Egrets are listed as "not at risk."

Although Herring Gulls are not a species of conservation concern in the Great Lakes, Somers *et al*. (2007) observed that at a mixed colony in western Lake Ontario, Canada, DCCOs competed directly with Herring Gulls (*Larus argentatus*) for nest sites and materials, and contributed to reduced Herring Gull reproductive success.

In the southeastern U.S., DCCO management occurs at a Mississippi River oxbow lake containing mature cypress and ash woodlands in the Yazoo National Wildlife Refuge in Mississippi. Refuge biologists are concerned about habitat destruction caused by DCCOs negatively affecting wading birds such as Great Blue Herons, Great Egrets, and Snowy Egrets (*Egretta thula*). Lemmons (2007) reported that all known DCCO colonies in Alabama, Arkansas, and Mississippi contained other species. Anhingas and Great Blue Herons were the species most often associated with DCCOs. Black-crowned Night-herons, Cattle Egrets, Great Egrets,

Figure 4. Area covered by the Upper Mississippi Valley and Great Lakes Waterbird Conservation Plan. Relevant Bird Conservation Regions (U.S. NABCI Committee 2000) are indicated by numbers.



Snowy Egrets, and Little Blue Herons were also present. The most diverse rookeries were those in Mississippi (Lemmons 2007). In the Great Lakes, DCCO management has been conducted at West Sister Island in Lake Erie (part of the Ottawa National Wildlife Refuge) for the past two years to prevent further destruction of habitat for a regionally significant wading bird colony that includes Great Blue Herons, Great Egrets, Snowy Egrets, Black-crowned Night Herons, and perhaps Glossy Ibises (*Plegadis falcinellus*).

VEGETATION

By reference, we incorporate here the information on page 38 of the FEIS. The effects of DCCOs on vegetation are direct and relatively easy to document. Through physical and chemical means, DCCOs damage, and often kill, the vegetation (*e.g.*, shrubs and trees) where they nest and roost. Concerns surrounding such damage have to do with aesthetics, soil stability, or biodiversity (with regard to the plant community itself or, secondarily, with regard to habitat for other bird species).
In addition to the documentation found in the FEIS, Hebert *et al.* (2005) assessed the relationship between forest health and nesting DCCO distribution and found that forest cover was lower in areas with high numbers of breeding cormorants, and concluded that, "Cormorants appear to pose a threat to unique Lake Erie island plant communities." DCCO management to protect vegetation has occurred at both U.S. and Canadian sites over the past several years.

THREATENED AND ENDANGERED SPECIES

In the 2003 FEIS, USFWS concluded that DCCO management activities under the PRDO and AQDO had the potential to affect four species listed under the ESA: Bald Eagle (*Haliaeetus leucocephalus*, currently only listed in Arizona), interior Least Tern (*Sterna antillarum*), Wood Stork (*Mycteria americana*), and Piping Plover (*Charadrius melodus*). As a result, we completed an intra-Service biological evaluation and informal Section 7 consultation. The following conservation measures were incorporated into the depredation orders to help agencies avoid any take of ESA-protected species.

> *All control activities [under the aquaculture depredation order] are allowed if the activities occur more than 1500 feet from active wood stork nesting colonies, more than 1000 feet from active wood stork roost sites, and more than 750 feet from feeding wood storks, and if they occur more than 750 feet from active bald eagle nests.*
>
> *At their discretion, landowners, operators, and tenants may contact the Regional Migratory Bird Permit Office to request modification of the above measures. Such modification can occur only if, on the basis of coordination between the Regional Migratory Bird Permit Office and the Endangered Species Field Office, it is determined that wood storks and bald eagles will not be adversely affected. If adverse effects are anticipated from the control activities, either during the intra-Service coordination discussions described above or at any other time, the Regional Migratory Bird Permit Office will initiate consultation with the Endangered Species Field Offices.*
>
> *[Under the public resource depredation order,]:*
>
> *(i) discharge/use of firearms to kill or harass double-crested cormorants or use of other harassment methods are allowed if the control activities occur more than 1000 feet from active piping plover or interior least tern nests or colonies; occur more than 1500 feet from active wood stork nesting colonies, more than 1000 feet from active wood stork roost sites, and more than 750 feet from feeding wood storks; or occur more than 750 feet from active bald eagle nests;*
>
> *(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 or interior least tern nests or colonies; occur more than 1500 feet from active wood stork nesting colonies, more than 1000 feet from active wood stork roost sites, and more than 750 feet from feeding wood storks; or occur more than 750 feet from active bald eagle nests; and*
>
> *(iii) to ensure adequate protection of piping plovers, any Agency or their 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. The Regional Migratory Bird Permit Office will then coordinate with the Endangered Species Field Office staff to determine if the above measures are adequate.*
>
> *At their discretion, agencies or their agents may contact the Regional Migratory Bird Permit Office to request modification of the above measures. Such modification can occur only if, on the basis of coordination between the*

Regional Migratory Bird Permit Office and the Endangered Species Field Office, it is determined that no adverse effects to any of the four listed species will occur. If adverse effects are anticipated from the control activities, either during the intra-Service coordination discussions described above or at any other time, the Regional Migratory Bird Permit Office will initiate consultation with the Endangered Species Field Offices.

In June 2007, the Bald Eagle was delisted from the protection of the ESA and remains unlisted in all areas except Arizona, which is not an included State in either depredation order. Therefore the distance requirements for Bald Eagles noted above no longer apply. The species is still protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act, and USFWS encourages agencies and individuals conducting DCCO control in the vicinity of bald eagle nests, roosts, or foraging areas to follow the recommendations found in the National Bald Eagle Management Guidelines to reduce any potential liability for take or harassment of bald eagles. This document is available at: http://www.fws.gov/migratorybirds/issues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf.

EXISTENCE AND AESTHETIC VALUES

Existence value is the value a person associates with the knowledge that a resource (*e.g.*, the DCCO) exists, even if that person has no plans to directly use that resource. Individuals may hold this value for a number of reasons: 1) they wish to preserve the resource for future generations; 2) they wish to hold open the option to use the resource in some way in the future although they have no immediate plans to do so; or 3) they may simply feel that preservation of a resource is the right thing to do, and therefore attach a value to it (USFWS 2003). Existence value is independent of the size of the wildlife population (Conover 2002).

Aesthetic value refers to our sense of beauty and is, by nature, subjective and difficult to quantify. Because humans appreciate and are inspired by the beauty of wildlife, it has aesthetic value (Decker *et al*. 2001). An individual's perception of the beauty of a given animal can be affected by the extent to which members of that species have negatively impacted something of value to the individual.

ECONOMIC ENVIRONMENT

Economic analysis in this EA will focus on two issues: aquaculture and recreational fishing. No studies have been done since publication of the FEIS to quantify economic impacts of DCCO management, but we can draw general conclusions.

In 2005, there were 1,007 catfish farms in the 12 southeastern states included in the AQDO (all of which are also included in the PRDO), with 71% of those farms occurring in Alabama, Arkansas, and Mississippi alone. These farms had total sales of more than $450 million (USDA NASS 2005). Particularly in the winter months, DCCOs can cause extensive depredation at fish farms in the southeastern U.S. The economic issues associated with DCCO depredation at fish farms are presented on pages 40–42 in the FEIS.

Dorr *et al*. (2004) used VHF telemetry to document cormorant movements between night roosts and aquaculture producing areas in eastern Mississippi and western Alabama. They found that 64% of the 25 cormorants they marked had daytime locations within the primary aquaculture producing areas and 55% of all day locations within that area were on catfish ponds. The authors recommended that roost harassment efforts be focused on specific roost sites and that some roost sites from which cormorants are less likely to cause damage to aquaculture should not be harassed.

Another economic concern is the effect of cormorants on local businesses that gain significant economic benefits from recreational fishing. If DCCO predation depresses a fishery and it results in lower angler activity, negative economic consequences are likely to result for businesses dependent on fishing-related revenue. In 2006, nearly 30 million anglers 16 years and older in the U.S. (13% of the American population) engaged in fishing, and spent over $40 billion doing so. In 2006, 1.4 million anglers fished in the Great Lakes (USDI 2007); this figure represents a 44% decline from 1991. However, DCCOs are not solely, or even largely, responsible for declines in fishing participation around the Great Lakes. Other factors, such as rising gasoline prices and demographic changes, may also play an important role.

At Oneida Lake, New York, cormorants are managed "primarily to maintain the economic benefits to local communities from recreational fishing." In 2007, the USDA-WS National Wildlife Research Center began an economic analysis of cormorant impacts to natural resources in central New York and will continue that research in 2008 (USDA-WS NY DCCO Management Summary Report 2008). The results will help provide a benefit-cost analysis of cormorant management activities (T. DeVault, USDA-WS, personal communication).

ISSUES CONSIDERED BUT NOT IN DETAIL

We propose to eliminate evaluation of the depredation orders with respect to several issues that were discussed in the FEIS. In addition to the fact that, for the purpose of deciding whether to extend the depredation orders, the analyses of most relevance to the mission of the USFWS are those concerning impacts to DCCO populations, fish, other birds, vegetation, threatened and endangered species, economics, and existence and aesthetic concerns, we note below further reasoning for eliminating analysis of other topics.

Water Quality and Human Health

Though concerns about water quality around DCCO colonies and roosting sites exist, we are not aware of any studies since publication of the FEIS that have examined the relationship between DCCOs and water quality. It is widely known that high numbers of waterbirds concentrated in an area can be a source of nutrient and pathogenic pollution. For example, high numbers of resident Canada geese have been found to negatively affect water quality near beaches and in wetlands (USFWS 2005). However, since no formal studies of the effects of DCCO management on

water quality and human health have been conducted, it is our opinion that we cannot meaningfully evaluate the effects of the depredation orders on this issue.

Fish Hatcheries and Environmental Justice

USFWS has a responsibility to conserve, restore, enhance, and manage America's fishery resources and aquatic ecosystems for the benefit of future generations. The National Fish Hatchery System (NFHS) was established in 1871. The NFHS has a unique responsibility in providing fish to benefit Tribes. From 2004-2006, at least 13 state and federal hatcheries in the 24 States (specifically, in IA, KY, LA, MI, OH, and WI) took DCCOs to protect fish stock.

Executive Order 12898 ("Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations") 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. If excessive DCCO predation at a NFH that raises fish for Tribes impacts the hatchery's ability to meet Tribal needs, an environmental justice concern could be raised. However, given the ability of state and federal hatcheries in the 24 States to control depredating cormorants, this issue does not amount to "disproportionately high and adverse" effects on minority and low-income persons if the depredation orders remain in place.

Property Losses

Private property losses associated with DCCOs include impacts to fish in privately-owned lakes and ponds, damage to boats and marinas or other properties found near DCCO breeding or roosting sites, and damage to vegetation on privately-owned land. One measure of damage to property comes from the USDA-WS Management Information System (MIS) database which documents the number of requests for assistance received by USDA-WS officials to address wildlife damage (not including requests received by local, State or Federal agencies). For FY2004-2006 (*i.e.*, 10/1/03 to 9/30/06), USDA-WS MIS data showed there were 23 requests for assistance with property damage in the 24 PRDO states. Damage to private property is addressed through the issuance of depredation permits by USFWS with technical input from USDA-WS. Because the depredation orders do not deal directly with property losses, and we lack the degree of quantitative data to meaningfully assess this issue, we propose to eliminate it from the analysis.

ALTERNATIVES

ALTERNATIVE A (NO ACTION)

No change to regulation; allow depredation orders to expire.

Under this alternative, no revision to the regulations would occur and the AQDO and PRDO would expire on April 30, 2009, thus requiring that DCCO management activities be conducted under the authority of depredation permits, if at all. Non-lethal activities such as inactive nest destruction and harassment could continue and would not require approval from USFWS.

ALTERNATIVE B (FIVE-YEAR EXTENSION) – PREFERRED ALTERNATIVE

Amend regulation to extend expiration date of depredation orders.

Under this alternative, we would change the expiration dates found in 50 CFR 21.47(f) and in 50 CFR 21.48(f) from April 30, 2009 to April 30, 2014 (*i.e.*, a five-year extension). Management activities such as culling and egg oiling that have been conducted under the depredation orders could therefore continue in the States to which the orders apply and new activities could be implemented, as deemed necessary. All management activities would need to comply with the terms and conditions stated in the depredation orders.

ALTERNATIVE C (NO EXPIRATION)

Amend regulation to remove expiration date from depredation orders.

Under this alternative, we would eliminate the expiration dates found in 50 CFR 21.47(f) and in 50 CFR 21.48(f). Thus, management activities conducted under the depredation orders would continue indefinitely, or until the depredation orders were rescinded. All management activities would need to comply with the terms and conditions stated in the depredation orders.

ALTERNATIVES NOT CONSIDERED

We did not consider rescinding the depredation orders, because we think the evidence for continuing DCCO resource damages justifies extending the depredation orders. We did not consider any changes to the depredation orders in addition to the expiration dates because we want to allow at least five years of management (which will have occurred after 2008) under the present depredation orders to provide information to aid the evaluation of management activities and consideration of other options. We intends to prepare an SEIS within the next few years and that will provide an opportunity to examine additional DCCO management options and/or changes to the depredation orders.

ENVIRONMENTAL IMPACTS

We analyzed the environmental consequences of each of the alternatives with respect to the issues identified in the Affected Environment section, and in comparison to the No Action alternative to determine if impacts would be greater, less, or the same.

ALTERNATIVE A (NO ACTION)

No change to regulations; allow depredation orders to expire. Under this alternative, the depredation orders would expire on April 30, 2009 and any resource or property damages caused by DCCOs would be addressed via depredation permits thereafter. Because of different standards for issuance of depredation permits, it's highly likely that fewer agencies would conduct DCCO control under this alternative. This alternative has a potential to increase adverse impacts on minority and low-income persons because DCCO control at fish hatcheries might be reduced, thereby curtailing the abilities of hatcheries to provide fish for members of Native American tribes or other low-income groups.

Impacts on DCCO Populations

Average annual take of DCCOs by all means (PRDO, AQDO, and permits) for all 24 States from 2004-2007 was 40,094 (Table 2). Most of this take occurred in seven states: Alabama, Mississippi, Texas, Minnesota, Michigan, Ohio, and New York. Take occurred on both breeding and wintering grounds and impacted, predominantly, the Interior DCCO population, though to a much lesser extent, the Southern population). More details and a summary of nest management are in Appendix 3.

Table 2. Number of DCCOs taken in 24 States covered by the depredation orders from 2004 through2007.

Year	PRDO	AQDO and Permits	Annual Total
2004	2,337	25,203	27,540
2005	11,771	22,005	33,776
2006	21,467	30,947	52,414
2007	20,592	26,052*	46,644
4-year total	56,167	104,207	*Annual average = 40,094*

* 2007 AQDO and permit take is an estimate based on an average of the previous 3 years' take.

For reasons noted earlier, our analysis will focus on the Great Lakes DCCO population. In this DEA, we use a figure of 345,078 (115,026, which is the number of nests counted in the Great Lakes in 2007, multiplied by 3 to account for breeding and non-breeding individuals) for the total Great Lakes regional DCCO population.

DCCO take can be put into perspective by calculating the percentage of the total regional population removed by management activities. The total 4-year take (2004-2007) under the PRDO in Great Lakes States was 30,353 birds, which amounts to an average annual take of 7,589 DCCOs or 2.2% of the total Great Lakes population.

The highest level of take in the Great Lakes so far occurred in 2006 (16,106, including birds killed in Canada); in that year, approximately 4.7% of the population was removed.

Nest surveys conducted across the Great Lakes in 2005 and 2007 indicate that the number of DCCO breeding pairs declined by approximately 3.2% (from 118,860 to 115,026) although it's difficult to determine if the decline is real – whether it is a result of culling and nest management rather than the result of year-to-year variability in detection rates.

Table 3. Percentage of the population culled in the Great Lakes in 2007.

Lake	Lakewide population estimate*	Number of cormorants killed in 2007	% of population culled
Superior	14,307	31	0.2%
Michigan	115,338	4,203	3.6%
Huron	73,377	2,277	3.1%
Erie	48,150	3,615	7.5%
Ontario	69,528	893	1.3%
Total	320,700	11,019	

* Derived from nest count x 3 (unpublished data); includes U.S. and Canadian sites.

Analysis of DCCO banding data (for birds banded in the Great Lakes from 1979-2006) by Seamans *et al*. (in review) indicated that the two depredation orders have likely had a negative effect on annual survival of "hatch year" age-class DCCOs in the Great Lakes. The effect of the depredation orders on survival of "second year" and "after second year" birds was unclear.

To gauge the effects of different management scenarios on DCCOs in the Great Lakes, we used equilibrium harvest dynamics and sustained yield methodologies (*e.g.*, Williams *et al.* 2002) to estimate population dynamics and sustainability of various harvest and egg oiling levels. The specific model and parameter estimates we used (and relevant assumptions) are discussed in Appendix 4.

We estimated the effect of various levels of harvest and egg oiling on the Great Lakes DCCO population by projecting abundance for 20 years under the following harvest and oiling scenarios.

Scenario 1 (the No Action Alternative): cease all harvest and egg oiling. DCCO management activities would be much more restricted if the depredation orders expire, though DCCO take could still be authorized under depredation permits.

Scenario 2: continue harvest and egg oiling at 2007 rates (h [harvest rate] = 0.06 and p [nest oiling rate] = 0.14).

Scenario 3: double annual harvest rate (h = 0.12) and keep egg oiling constant (p = 0.14).

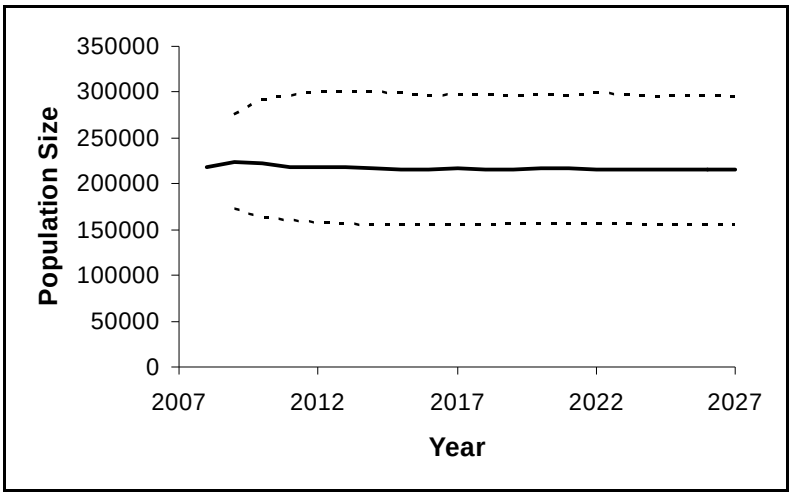
Scenario 4: double egg oiling rate (p = 0.28) and keep harvest constant (h = 0.06).

Scenario 5: double both harvest and egg oiling rates.

Scenario 1

If harvest and egg oiling cease, the population should remain near carrying capacity (Figure 5; it was assumed the population is currently at or near carrying capacity). The estimated population size of breeding individuals in 2014 would be 217,200 (80% confidence interval [indicated with dashed lines in the figures] = 155,600 to 300,200), and in 2027 the estimated size would be 215,600 (80% confidence interval = 155,100 to 295,700). These figures represent the number of breeding *individuals* and must be divided by two to obtain the number of breeding pairs/nests. (The most recent estimate of the Great Lakes breeding population is 230,052 [115,026 multiplied by 2]).

Figure 5. Estimated population trajectory of breeding DCCOs in the Great Lakes, assuming harvest and egg oiling are discontinued. The dashed lines represent 80% confidence intervals.



<u>Impacts to fish</u>

The intent of several of the management activities conducted under the PRDO has been to benefit recreational fisheries where there was evidence that DCCO predation was having negative impacts. A few examples are discussed here (Les Cheneaux Islands, Lake Huron, Michigan; Oneida Lake, New York, and eastern Lake Ontario, New York).

In the Les Cheneaux Islands region of northern Lake Huron, fisheries biologists with the Michigan Department of Natural Resources concluded that a likely cause of, or at least an important contributor to, the yellow perch fishery collapse there was excessive mortality caused by DCCO predation (Fielder 2004). Based on this information, MDNR and USDA-WS initiated DCCO control in 2004 with the objective of reducing DCCO foraging as a means of improving the perch fishery. MDNR fisheries biologists use five indicators to assess whether DCCO control has benefited the perch fishery (in parentheses are the observed results for each indicator): 1) a declining total annual mortality rate of yellow perch (declined from a high of 88% to 55% in 2007); 2) an increase in the sport fishery catch rate (returned to pre-collapse level, though overall

fishing effort remains depressed); 3) an increase in survey net catch rate of perch (abundance of yellow perch in annual gillnet surveys increased 18-fold in 2007 compared to the low during the collapse); 4) an increasing mean age of yellow perch (has increased for the last three years; consistent with higher perch survival); 5) a decline in the perch growth rate as density increases (declined for the first time in 8 years in 2006). The yellow perch recovery was aided by improved reproductive success starting in 2004 but the 74% reduction in local DCCO numbers due to control is credited with allowing the increased survival and longevity of yellow perch that was a significant part of the fishery recovery (USDA-WS [MI] 2007 annual report; D. Fielder, MDNR, personal communication).

Analysis by researchers at Oneida Lake in central New York suggested that DCCO predation on subadult yellow perch and walleye was a significant factor contributing to the decline in percid populations in the lake (Rudstam *et al*. 2004). USDA-WS implemented an expanded hazing program that significantly reduced the DCCO population, and consequently DCCO predation, on Oneida Lake in spring, summer, and fall. As a result of the intensive DCCO management program there, Cornell University researchers documented a 50% reduction in predation pressure (as compared to 1997 levels) on the fishery and have noted that increasing numbers of adult walleye are likely the result of DCCO management (J. Coleman, Cornell Univ., personal communication). Fisheries biologists now consider DCCO predation an insignificant influence on walleye and yellow perch populations (USDA-WS [NY] 2006 annual report).

In the eastern basin of Lake Ontario, New York, the New York State Department of Environmental Conservation and U.S. Geological Survey researchers documented a link between DCCO predation and smallmouth bass declines (Johnson *et al*. 2006). Reductions in DCCO populations are expected to prevent further fishery declines, and possibly allow for recovery of affected fish stocks. According to NYSDEC, efforts to measure a fishery response to DCCO control are underway but will require several years of study before conclusions can be drawn (NYSDEC 2007 annual report). Fish consumption on Lake Ontario is estimated to have declined to a level of .88 million cormorant feeding days, down from 3.0 million prior to implementation of management in 1998 (J. Farquhar, NYSDEC, unpublished data).

At Leech Lake, Minnesota, DCCO control has been conducted since 2005 because long-term fish population data indicated that yellow perch and walleye populations have been altered by the large number of DCCOs foraging there. In 2005 and 2006, walleye populations increased to twice the long-term average; however, managers at Leech Lake are still analyzing the cause(s) of the increase (LLBO 2007 annual report).

The likely impact of this alternative on fisheries would be likely declines in the populations of fish stocks of interest to commercial or sport fisheries.

Impacts to other birds

From 2004-2007, management was conducted under the PRDO in New York, Minnesota, Mississippi, Ohio, and Wisconsin for the purpose of reducing negative impacts to other birds. DCCO management can help protect habitat and alleviate competition between DCCOs and other birds. Although there are concerns that DCCO control, including non-lethal harassment activities, can negatively impact co-occurring bird species, past experiences indicate that carefully planned and implemented DCCO management can have a positive effect or no observed effect at all on species that nest with or near DCCOs.

Some of the precautions that have been taken by agencies to avoid affecting co-nesting species include using suppressed firearms to minimize noise disturbance, suspending harassment or control activities during critical nesting periods (*e.g.*, for common terns), ensuring that field personnel can distinguish different types of birds and their eggs, and moving slowly through nesting areas. In Ohio, shooters were paired with observers whose job it was to monitor co-nesting species and take note of disturbance behavior, if any. These observations were used to improve management operations so that disturbance to co-nesting species could be reduced (ODOW/USDA-WS/Ottawa NWR [OH] 2007 annual report).

In 2006, after several years of DCCO management on Young Island, Lake Champlain, Vermont, five Black-crowned Night-heron nests were confirmed (the first known nesting attempt since 1998) and at least four young fledged successfully from these nests (USDA-WS [VT] 2006 annual report). On Green Island in northern Lake Michigan (part of the Les Cheneaux archipelago), a Great Egret nest found in 2006, and noted as being the northernmost breeding record for this species in Michigan, was successful even with several visits to the island for DCCO management purposes (USDA-WS [MI] 2006 annual report). Also, in 2007, Caspian Terns nested on Little Pelican Island (site of DCCO culling efforts for three years) in Leech Lake, Minnesota, for the first time (LLBO [MN] 2007 annual report).

Researchers collected data on Black-crowned Night-heron and DCCO interactions at four locations in the Canadian Great Lakes and found that where the two species nested close to one another, heron nests were taken over or destroyed by DCCOs in some cases. They also found evidence that DCCOs displaced herons from preferred nesting sites within trees and noted, in summary, that "negative impacts of co-nesting with DCCOs… may explain recent declines in the number of heron colonies in the Great Lakes" (C. Weseloh and D. Moore, CWS, unpublished data).

The Lake Erie islands in Ohio provide important nesting habitat for Black-crowned Night-herons, Great Egrets, Snowy Egrets, Little Blue Herons, and Cattle Egrets (*Bubulcus ibis)*, in addition to DCCOs. West Sister Island, part of Ottawa National Wildlife Refuge, hosts one of the largest nesting colonies of herons and egrets in the U.S. portion of the Great Lakes, including Ohio's largest Black-crowned Night-heron breeding colonies. Biologists are concerned about the impact that further DCCO expansion will have on local numbers of these species. Following DCCO culling efforts in 2006, surveys on West Sister Island showed 36% and 29% increases in nesting pairs of Great Blue Herons and Great Egrets, respectively, compared to the previous year (ODOW/USDA-WS [OH] 2006 annual report).

On Hennepin Island, in Minnesota's Mille Lacs NWR, DCCO nests and eggs were destroyed in 2006 and 2007 to protect a population of Common Terns on the island from DCCO takeover (USDA-WS/USFWS [MN] 2006 and 2007 annual reports). Additionally, on islands in eastern Lake Ontario, New York, Black-crowned Night-heron declines observed prior to DCCO management were reversed (NYSDEC 2006 annual report).

As outlined in the terms and conditions of the PRDO, agencies are required to conduct DCCO control in such a way that negative impacts on co-nesting species are avoided.

At control sites in Ohio, shooters were paired with observers to make note of any disturbance behavior by co-nesting species, with the goal of using the observations to improve management operations to further reduce disturbance. ODOW and USDA-WS observed no adverse effects on non-target species during DCCO management activities. Observers at West Sister and Green Islands recorded the behavior of colonial waders at managed sites and found that birds that left the nest returned quickly following the departure of management personnel (ODOW/USDA-WS [OH] 2006 annual report).

Researchers in Canada examined the effects of DCCO culling on co-nesting species (Great Egrets and Great Blue Herons) at sites around Lake Ontario and found that, in 2005, nesting success did not differ between managed and control sites for either species. In 2006, nest failure rate was higher for both species at the managed site (D. Moore, CWS, unpublished data). Mattison (2006) measured different types of disturbance affecting the Common Tern colony on Oneida Lake, New York, and found that tern research activities caused the most disturbances while noting that further research is needed to quantify impacts of cormorant hazing activities on terns.

Under this alternative, the growth of DCCO populations after expiration of the depredation orders would likely be detrimental to colonial waterbirds and other co-nesting species.

Impacts to vegetation

Management to protect vegetation from DCCO damage has been carried out in Alabama, Michigan, Mississippi, New York, Ohio, Vermont, and Wisconsin. At all of these sites, DCCOs have caused damage by either physical or chemical means, or both. Because of the direct relationship between DCCO presence and vegetation health, it can be inferred that DCCO management will help alleviate vegetative damage (as long as damage is not irreversible or significantly affected by factors other than DCCOs). Some examples are listed below.

In Ohio, the concern is related to habitat destruction, and associated impacts on nesting species, as well as the presence of six State-listed plants on an island (Green Island in Lake Erie) where DCCOs have expanded rapidly. At this island, and the others where DCCOs are being controlled in Ohio, stopping or preventing vegetation damage is a management goal. Ohio Division of Wildlife and Ottawa National Wildlife Refuge staff have been measuring vegetation characteristics at West Sister Island and have plans to continue monitoring for several years to help determine if

management efforts are mitigating damage to vegetation (ODOW/USDA-WS 2006 annual report). In 2007, the PRDO annual report for Ohio control activities noted:

> *On Green Island several trees have been killed and areas on the southeast part of the island which once contained herbaceous ground cover are now bare rock. The cormorant first started nesting in this area, thus this area contains the most damage. The State-threatened rock elm is particularly susceptible to damage from the DCCOs since these trees were found along the south side of the island where the cormorant nests are concentrated.*

In Michigan, nesting DCCOs have been removed from South Manitou Island at Sleeping Bear Dunes National Lakeshore to protect old-growth northern white cedar. The National Park Service, which manages the site, will continue to monitor effects of DCCOs on the island vegetation (USDA-WS [MI] 2007 annual report).

DCCOs nesting on Young Island in Lake Champlain, Vermont, have killed all the trees and reduced what was once "a mosaic of tree, shrub, and herbaceous plant communities" into vegetation "dominated by stinging nettle, thistle, and lamb's quarters." The Vermont Fish and Wildlife Department's goal is to reduce the Young Island DCCO population enough that habitat can be restored and structural diversity increased to support more wildlife species (VFWD 2006 annual report). Active vegetation restoration was initiated in 2007 but the trees and plants did not do well because of the unhealthy soil condition (J. McConnell, USDA-WS, personal communication).

If the depredation orders are allowed to expire, there may be additional problems managing or restoring vegetation at some sites, though permits for control actions would be available.

Impacts to threatened and endangered species

Before we completed the FEIS and final regulations we completed a consultation under the Endangered Species Act with the Service's Division of Consultations, HCPs, Recovery and State Grants. Based on information from the DCCO proposed rule and an intra-Service Biological Evaluation, we determined that incorporating conservation measures (*i.e.*, safety zones inside of which control activities are prohibited) would avoid adverse effects on the Bald Eagle, interior Least Tern, Wood Stork, and Piping Plover. No reported take of ESA-listed species has occurred since implementation of the PRDO and AQDO and no negative impacts have been documented.

We foresee no impacts to threatened or endangered species under this alternative.

Existence and Aesthetic Values

Although management under the two depredation orders leads to localized killing and even population reduction in some cases, DCCOs are still present for people to assign existence value to them. USFWS, USDA-WS, and other agencies involved with DCCO control have no intention of eradicating DCCOs. As for impacts on aesthetic values, this varies depending on an individual's perspective on the beauty of DCCOs and the environments they inhabit and may affect. For example, many landowners and managers may prefer the aesthetic appeal of healthy trees over that of nesting

DCCOs and thus want to prevent DCCOs from killing trees. Regardless of individual perspectives, we foresee no significant change on these values if the depredation orders are allowed to expire.

Economic Environment

Since the 2003 AQDO revision to allow control at roost sites in the vicinity of aquaculture facilities, Mississippi aquaculture producers have reported reduced depredation on ponds in localized areas where roost control has occurred. DCCOs tend to remain thinned out for three to five days after roost control and historical roost sites seem to be used less often in areas where control efforts have been concentrated. DCCO roost sites have become more evenly distributed, as opposed to a few roost sites with large numbers (K. Godwin, USDA-WS, personal communication). We are not aware of any formal economic evaluations of the effects of the depredation orders on aquaculture production and have no way to gauge effectiveness in this area beyond this qualitative assessment. Allowing the AQDO to expire would require that aquaculture producers, hatchery managers, and USDA-WS officials wait to receive depredation permits before they could conduct control and in some cases this would affect their ability to respond quickly to depredation problems which would limit effectiveness.

With regard to economic impacts associated with recreational fishing the PRDO has allowed several management activities for the benefit of sport fisheries and to the extent that fisheries recover and angler participation increases accordingly, effects on local fishing-related businesses will benefit. In the Les Cheneaux Islands of Michigan, for example, the angler catch rate of yellow perch has returned to a level not seen since 1995 (USDA-WS [MI] 2007 annual report). We would expect such an improvement to eventually result in higher angler participation and for that to provide economic benefits to the local area.

ALTERNATIVE B (PREFERRED ALTERNATIVE)

Amend regulations to extend the expiration dates by five years. Under this alternative, DCCO management under the depredation orders would continue until 2014.

Impacts to DCCO populations

Total annual take (PRDO, AQDO, permits) under this alternative will likely be similar to levels seen in 2006 and 2007 (45-55,000 birds). Most of this take will continue to constitute birds from the Interior population (especially in the Great Lakes, where there are approximately 107,000 nesting pairs), both on their breeding and wintering grounds.

Annual DCCO take under the PRDO, though not specifically limited in the regulation itself, is limited by the numbers set forth in the FEIS and associated statewide EAs (USDA-WS EAs on DCCO management can be found at http://www.aphis.usda.gov/regulations/ws/ws_nepa_environmental_documents.shtml #EAs. Annual allowable take under the PRDO in the 24 states is 99,360 (see page 56 of the FEIS) or 4,140 birds per state. However, because fewer than half of the

eligible states have implemented the PRDO, and because DCCOs and conflicts are not evenly distributed among states, we have allowed Michigan and Ohio to take more than 4,140 DCCOs per year to reduce resource damages. With these limits, frequent population monitoring, and the Service's review of annual reports and of proposed control activities to take more than 10% of local breeding populations, we predict with confidence that continued cormorant control under the depredation orders will not threaten the long-term conservation of DCCO populations.

Scenario 2

If harvest and egg oiling remain at current rates, we estimate the population would decline approximately 20% by 2014 (Figure 6), or to approximately three times the size of the population in the early 1990s (estimated at 38,000 nests in 1991 by Weseloh *et al* [1995]). The estimated population size of breeding individuals in 2014 would be 172,400 (80% confidence interval: 123,600 to 237,000), and in 2027 the estimated population size would be 164,300 (117,200 to 228,400). This scenario is our prediction of what would occur under Alternatives B and C, with 2014 being the timeframe for Alternative B and 2027 the timeframe for Alternative C. Under this scenario, Alternative B would result in approximately 60,000-120000 breeding pairs in the Great Lakes population in 2014.

Scenario 3

If harvest rate is doubled and egg oiling remains at the current rate, we estimate the population would decline approximately 35% by 2014 (Figure 7). The estimated population size of breeding individuals in 2014 would be 140,600 (80% confidence interval: 98,900 to 196,900), and in 2027 the estimated size would be 121,700 (84,400 to 172,800). Under this scenario, Alternative B would result in about 42,000-86,000 breeding pairs in the Great Lakes population in 2014.

Scenario 4

If egg oiling is doubled and harvest remains at the current rate, we estimate the population would decline approximately 27% by 2014 (Figure 8). The estimated population size of breeding individuals in 2014 would be 158,500 (80% confidence interval: 112,800 to 217,900) and in 2027 the estimated size would be 139,900 (80% confidence interval = 97,800 to 196,500). Under this scenario, Alternative B would result in approximately 56,000 to 108,000 breeding pairs across the Great Lakes population in 2014.

Scenario 5.

If egg oiling and harvest are doubled from 2007 rates, we estimate the population would decline approximately 48% by 2014 (Figure 9). The estimated population size of breeding individuals in 2014 would be 113,300 (80% confidence interval = 78,700 to 160,300) and in 2027 the estimated size would be 80,000 (80% confidence interval = 51,100 to 121,100). Under this scenario, Alternative B (2014) would result in approximately 39-80,000 DCCO breeding pairs remaining across the Great Lakes population in 2014.

Figure 6. Estimated population trajectory for breeding DCCOs in the Great Lakes assuming harvest and egg oiling remain the same as rates in 2007 (h = 0.06, p = 0.14). The dashed lines indicate the 80% confidence interval on the estimate.

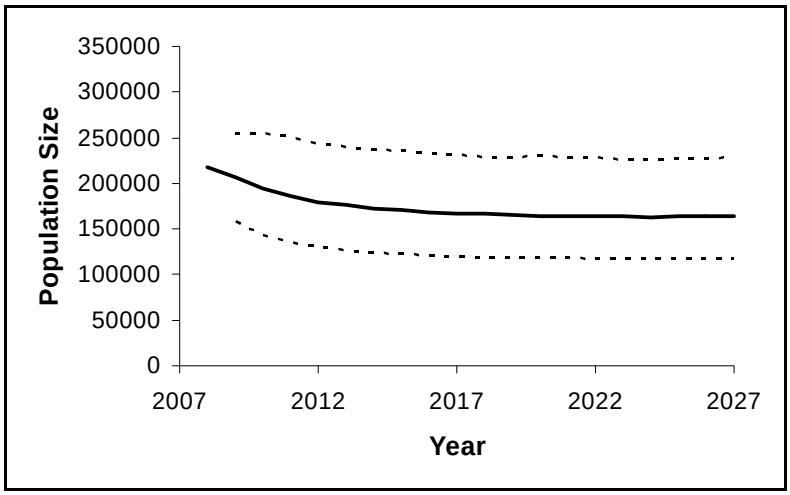


Figure 7. Estimated population trajectory of breeding DCCOs in the Great Lakes assuming harvest rate is twice the 2007 rate and egg oiling rate remains the same as 2007 (h = 0.12, p = 0.14). The dashed lines indicate the 80% confidence interval on the estimate.

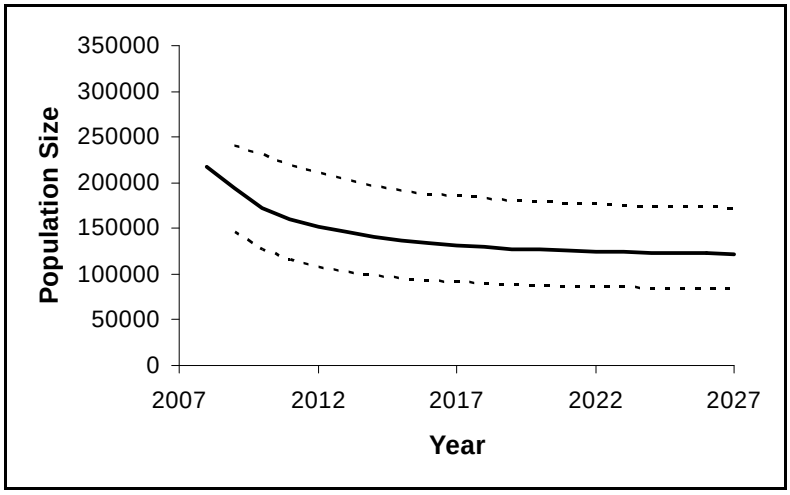
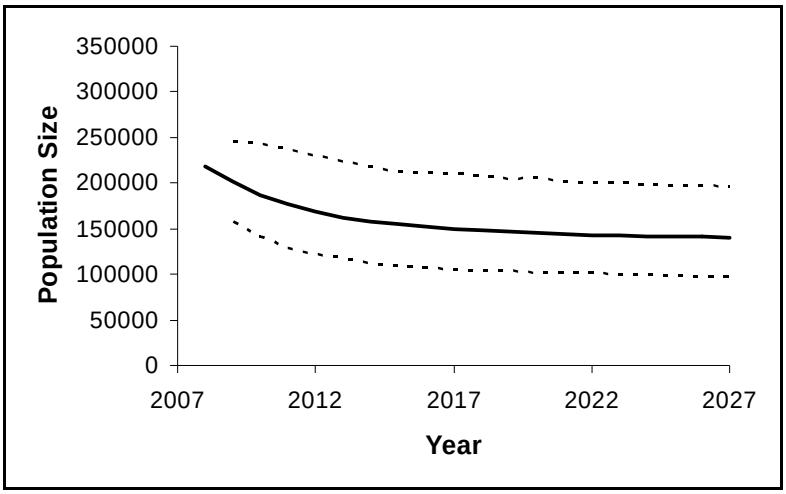


Figure 8. Estimated population trajectory of breeding DCCOs in the Great Lakes assuming harvest rate remains the same as 2007 and egg oiling rate is twice the 2007 rate (h = 0.06, p = 0.28). The dashed lines indicate the 80% confidence interval on the estimate.



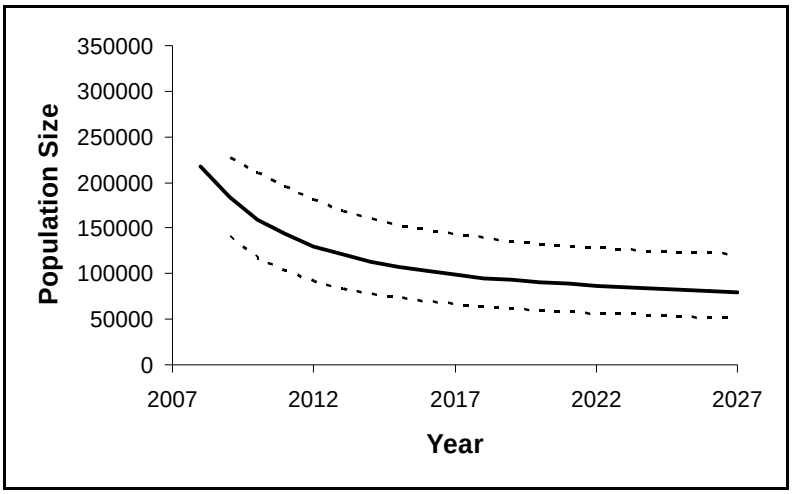
Essentially, these models indicate that, even under doubled harvest and egg oiling rates (which we do not expect to occur due to costs and other logistical factors), the Great Lakes DCCO population would be lower than current numbers but would remain at over 50% of its carrying capacity and significantly higher than populations in the early 1990s.

Fish

As discussed in 4.1.2 above, there is evidence in some areas that DCCO management has effectively reduced predation on fisheries of concern. We would expect to find the same results at other locations in the future as the PRDO continues to allow managers to address localized problem situations between DCCO and fisheries. Overall, this alternative would be more effective than the No Action alternative at resolving DCCO-fisheries conflicts.

One possibility at locations where DCCOs are managed to protect fisheries is that of DCCOs returning to pre-management numbers in a local area (if management is stopped) when multi-year DCCO population suppression has allowed a fishery to recover. This dilemma may require that management be continued indefinitely to protect a fishery, although not necessarily at the same levels as the first few years (*e.g.*, harassment and selected removal may suffice).

Figure 9. Estimated population trajectory of breeding DCCOs in the Great Lakes assuming harvest and egg oiling rates are both doubled from 2007 rates (h = 0.12, p = 0.28). The dashed lines indicate the 80% confidence interval on the estimate.



Other Birds

Continuing the PRDO for another 5 years will benefit species that have been negatively affected by DCCO abundance and habitat intrusion or destruction. Annual reports and discussions at DCCO management meetings indicate that agencies have followed the requirement in the PRDO to minimize disturbance to non-target species. As noted in 4.1.3 above, efforts to reduce the size of DCCO colonies under the PRDO have benefitted co-nesting species. No major unanticipated results or unintended consequences have been reported. Given the experiences of the past few years, it appears that DCCO management, when carefully planned and implemented, can benefit species of interest while avoiding negative impacts on non-target species and we would not expect this to change between now and 2014.

Vegetation

Alternative B would allow vegetation/habitat damage to continue to be addressed as agencies deem it necessary and would be more effective than the No Action Alternative.

Threatened and Endangered Species

DCCO management activities over the past few years have had no deleterious effects on ESA-listed species and we have no reason to anticipate that will change given continued observance of the conservation measures laid out in the depredation orders.

Existence and Aesthetic Values

This alternative will allow thousands of DCCOs to be killed, and their eggs to be oiled, until 2014. To some, this might be aesthetically offensive but to many others

who do not value high numbers of DCCOs and/or who dislike the damage caused by nesting DCCOs, continued management would provide aesthetic benefits. Take over the past few years has actually removed only a low percentage of the DCCO regional population and does not affect overall existence value.

Economic Environment

Under this alternative, aquaculture producers, hatchery managers, and USDA-WS professionals could respond quickly to localized DCCO depredation problems and this would allow for more effective management of such problems than if the depredation orders were allowed to expire.

ALTERNATIVE C

Amend regulations to remove the expiration dates. Under this alternative, the depredation orders would have no expiration date, although they could be rescinded at any point if deemed necessary. As indicated by the analyses of the different scenarios considered above, the biological effects of this alternative differ little from those under Alternative B over the course of the period modeled. This alternative would reduce the administrative work and expenses for the Fish and Wildlife Service.

Impacts to DCCO populations

Total annual take (PRDO, AQDO, permits) under this alternative will likely be similar to levels seen in 2006 and 2007 (45-55,000 birds). Most of this take will continue to fall on birds from the Interior population (especially Great Lakes birds), both on their breeding and wintering grounds. Given the oversight functions built into the PRDO and permitting system, the regular monitoring of DCCOs across the Great Lakes, and ongoing DCCO research (as well as the fact that the aim of agencies managing DCCO damages is not to eliminate or threaten population viability), the long-term conservation of DCCO populations would not be threatened if the depredation orders were put into effect indefinitely. Management under this alternative could result in a decreased Great Lakes DCCO population ranging from approximately 40,000 to 82,150 breeding pairs (see scenarios 2 and 5 in section 4.2.1 above).

Fish

As noted in 4.2.2 above, continued implementation of DCCO management under the PRDO would allow managers to address local situations where DCCO predation is having negative impacts on fisheries. It would, therefore, be more likely to benefit fisheries than the No Action Alternative.

Other Birds

Continuing the depredation orders indefinitely would allow managers to continue to address problem situations where DCCOs are having negative impacts on co-nesting birds or their habitat. We have no reason to believe that agencies would not continue to be highly conscientious in avoiding negative impacts to bird species

associated with DCCOs at management sites and therefore we conclude that overall this alternative would have beneficial or neutral effects on other birds.

Vegetation

This alternative would be more effective than the No Action Alternative at reducing damage to vegetation and habitat caused by nesting DCCOs since it would allow the PRDO to continue indefinitely, thereby maximizing management responsiveness at sites where DCCOs have caused or are beginning to cause vegetation destruction.

Threatened and Endangered Species

Similar to the discussion in 4.2.5, we have no reason to anticipate that ESA-protected species would be harmed if the depredation orders are extended indefinitely given the existing conservation measures.

Existence and Aesthetic Values

The discussion in 4.2.6 above also applies here.

Economic Environment

The discussion in 4.2.7 above also applies here.

SUMMARY

See Table 4 below. Scale is an important factor to consider when drawing conclusions about whether DCCO management activities have been effective. For example, the absence of a large regional population reduction after four years of DCCO control does not mean that management efforts were unsuccessful since the goal was not to attain such a population reduction. The goal of both depredation orders is to allow managers (and aquaculture producers in the case of the AQDO) to take actions to reduce or to prevent specific resource damages at the local scale (*e.g.*, reduce predation of yellow perch in the Les Cheneaux island region of northern Lake Huron or to stop habitat destruction on West Sister Island in Lake Erie). Therefore, the measure of success of specific actions taken under the depredation orders is whether those damages were lessened or eliminated, not whether management efforts caused large (over 25%) localized or regional population reductions.

CONSULTATION AND COORDINATION

PERSONS, GROUPS, AND AGENCIES CONSULTED

Much of the information used for the analysis in this EA came from agency PRDO annual reports. unpublished survey data for the Great Lakes came from Linda Wires (University of Minnesota), Dave Moore and Chip Weseloh (Canadian Wildlife Service), Jamie Stewart (Ontario Ministry of Natural Resources), Tony Aderman (USDA-WS), and Jim Dastyck (USFWS). Mark Seamans (USFWS) did the population modeling. The author conferred with biologists and managers from several of the action

Table 4. Comparison of alternatives.

Affected Entity	Alternative A No Action	Alternative B 5-year extension on expiration dates (PREFERRED)	Alternative C Removal of expiration dates
DCCO populations	No significant impact at regional scale; local populations would not be reduced after early 2009.	No significant impact (take and population status would continue to be monitored).	No significant impact (take and population status would continue to be monitored).
Fish	Beneficial in some situations; after early 2009 management to address fishery concerns would be much more limited.	Beneficial in some situations (more effective than No Action because of longer timeline).	Beneficial in some situations (more effective than No Action because of longer timeline).
Other birds	Some disturbance but beneficial or neutral overall with effectiveness declining after early 2009.	Some disturbance associated with control activities but beneficial when DCCO competition or habitat destruction are reduced (more effective than No Action because of longer timeline).	Some disturbance associated with control activities but beneficial when DCCO competition or habitat destruction are reduced (more effective than No Action because of longer timeline).
Vegetation	Beneficial where damage can be prevented or reversed; effectiveness would decline after early 2009.	Beneficial where damage can be prevented or reversed (more effective than No Action because of longer timeline).	Beneficial where damage can be prevented or reversed (more effective than No Action because of longer timeline).
T and E species	No effect as long as conservation measures are implemented.	No effect as long as conservation measures are implemented.	No effect as long as conservation measures are implemented.
Existence and aesthetic values	Generally neutral or positive, though effect differs with perspective.	Generally neutral or positive, though effect differs with perspective.	Generally neutral or positive, though effect differs with perspective.
Economic Environment	Presumably positive because depredation is reduced; effectiveness would decline after early 2009 when depredation orders expire.	Presumably positive because depredation would be reduced (more effective than No Action because of longer timeline).	Presumably positive because depredation would be reduced (more effective than No Action because of longer timeline).

The author conferred with biologists and managers from several of the action agencies and researchers from the USDA National Wildlife Research Center and those individuals are cited where appropriate.

SUMMARY OF PUBLIC PARTICIPATION

Issues related to the proposed action were originally identified during the NEPA process for completion of the 2003 FEIS. That process entailed the following (from page 116 of the FEIS).

> *On November 8, 1999, we published a Notice of Intent to prepare an Environmental Impact Statement and national management plan for the DCCO in the Federal Register (64 FR 60826). The notice solicited public participation in the scoping process. Scoping is the initial stage of the EIS process used to identify issues, alternatives, and impacts to be addressed in the NEPA analysis. A Notice of Meetings was subsequently published in the Federal Register (65 FR 20194) on April 14, 2000, to announce twelve public scoping meetings. Public comments were accepted from the date of publication of the Notice of Intent on November 8, 1999 until June 30, 2000. Over 900 people attended the public scoping meetings (of which 329 gave verbal testimony) and over 1,450 submitted written comments, either electronically or by mail. A notice of availability published on December 3, 2001 (66 FR 60218) announced completion of the DEIS and its availability for public comment. Ten public meetings were held in early 2002 and nearly 1,000 written comments were received. After publication of the proposed rule on March 17, 2003 (68 FR 12653), we received nearly 10,000 letters, emails, and faxes during a 60-day public comment period.*

Since the FEIS and original rulemaking, several interagency DCCO meetings have been held and, in the preparation of statewide EAs, there have been additional public comment opportunities. We do not think that the issues raised during these previous NEPA processes have changed considerably.

This draft EA will be made available for public comment for 30 days. We will post it on the USFWS Division of Migratory Bird Management website (http://www.fws.gov/migratorybirds/issues/cormorant/cormorant.html) and we will publish a Federal Register notice announcing that it is available for public comment. We will consider all comments we receive, and then will finalize the EA and publish a Record of Decision.

TRANS-BOUNDARY EFFECTS OF THE ALTERNATIVES

To the best of our knowledge, the preferred alternative will not have a significant negative impact on DCCOs outside the borders of the United States. As noted in the FEIS (USFWS 2003), DCCOs "that breed in Florida and elsewhere in the Southeastern U.S. are essentially sedentary, those along the Pacific coast are only slightly migratory, while Atlantic and Interior birds show the greatest seasonal movements (Johnsgard 1993)." Thus, there is little potential for actions under the depredation orders to have effects outside the U.S. borders.

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Ms. Hanisch, the primary author, was a wildlife biologist with the Division of Migratory Bird Management. She is now a Ph.D. student.

Dr. Allen is a Branch Chief in the Division of Migratory Bird Management.

APPENDIX 1

POPULATION MONITORING

Since implementation of the PRDO in 2004, DCCOs have been surveyed across the Great Lakes in 2005 and 2007. These surveys were the result of a cooperative effort involving several State, Federal, Tribal, and Canadian agencies and the University of Minnesota. Chip Weseloh of the Canadian Wildlife Service an others have prepared a summary report of this effort, and their paper is under review for publication. The estimated breeding population of the Great Lakes in 2005 was 118,860 pairs and, in 2007, it was 115,026 pairs. The census area for these figures includes all five Great Lakes and their connecting channels, as well as the St. Lawrence River and large nearby inland lakes (*i.e.*, Oneida Lake and Lake Champlain).

The decadal Great Lakes Colonial Waterbird Survey began in 2007 and covered Lakes Superior, Michigan, and Erie (and the Detroit and Niagara Rivers). Remaining waterbodies will be surveyed in 2008.

The Canadian Wildlife Service, in cooperation with Provincial and State agencies, has monitored DCCO nest counts in the Lower Great Lakes (Lakes Erie and Ontario, Niagara River, and St. Lawrence River) each year since 1979. The table below summarizes these counts from 1999 to 2005 (D.V. Weseloh, CWS, unpublished data).

Water Body	Year						
	1999	2000	2001	2002	2003	2004	2005
Lake Erie	9,109	13,271	13,530	15,015	12,103	18,956	17,420
Niagara River	0	9	47	84	257	393	340
Lake Ontario	20,053	24,344	25,353	28,180	24,273	26,381	23,530
St. Lawrence River	476	1,620	1,220	1,021	2,494	2,511	2,997
TOTAL	29,638	39,244	40,150	44,300	39,127	48,241	44,287

In the southeastern U.S., USDA-WS conducts bi-weekly roost surveys (from October to April) and an annual mid-winter roost survey in the Mississippi Delta region and parts of Arkansas and Alabama. Bi-weekly roost surveys are used to direct coordinated roost dispersal activities. Mid-winter surveys are complete simultaneous counts of all known night roosts in the aquaculture producing areas of Alabama, Arkansas, and Mississippi. Also in 2006 and 2007, nest counts were conducted in several southeastern states to better quantify the Southern breeding population and a report titled "Status of Double-crested Cormorants breeding in the Southeastern United States" was prepared. In 2007, 876 DCCO nests were counted at sites in Alabama, Arkansas, Maryland, Mississippi, and South Carolina, although that does not include all DCCO breeding efforts in the region.

APPENDIX 2

STATUS OF CO-NESTING SPECIES

Breeding Bird Survey (BBS) trends were acquired at http://www.mbr-pwrc.usgs.gov/bbs/trend/tf06.html on 18 April 2008 (Sauer *et al.* 2007)
Significant trends (with a P value < 0.1) are italicized.

American White Pelican

BBS trend, 2000-2006
- Mississippi (MS) Flyway: 21.70 (*P* value = 0.15696)
- Region 3 (excluding Missouri and Iowa, including Ontario): 18.05 (P value = 0.14126)

Upper Mississippi Valley and Great Lakes (UMVGL) Draft Waterbird Conservation Plan: Increasing in region, mostly due to population recovery and re-colonization.

Special listings - Special Concern in MN, WI

Anhinga

BBS trend, 2000-2006
- USFWS Region 4: Trend estimate = 6.14 (*P* value = 0.42501)
- *Texas: Trend estimate = 61.25 (P value = 0.04717)*

Southeast Regional Waterbird Conservation Plan: "Although their status is likely stable, little information is known about the migration, movements, or demography of this species. Additional monitoring is needed to understand the status, trends and threats for this species in the Southeast U.S. region."

Black-crowned Night-heron

BBS trend, 2000-2006
- USFWS Region 3 (excluding Missouri and Iowa, including Ontario): -1.05 (*P* value = 0.76968)
- MS Flyway: -0.46 (*P* value = 0.89339)
- USFWS Region 4: 11.26 (*P* value = 0.23868)

UMVGL Draft Waterbird Conservation Plan: Trend over last 10-30 years varies depending on region; notes that "in Great Lakes site-specific management of cormorants may be necessary to preserve habitat for this species"

Special listings - Special Concern (MI, WI); Threatened (OH, KY); Endangered (IL, IN)

Common Tern

No trend data available at BBS website.

UMVGL Draft Waterbird Conservation Plan: Overall high conservation ranking; conservation recommendations = "site enrichment, protective structures, predator control, interspecific competitor removal, and restrictions on human access at sites with high potential for long-term use and high productivity."

Special listings - Threatened (MN, MI, NY); Endangered (WI, OH, VT)

Great Blue Heron

BBS trend, 2000-2006

- MS Flyway: -0.83 (*P* value = 0.57942)
- *USFWS Region 3 (excluding Missouri and Iowa, including Ontario): -2.68 (P value = 0.05843)*
- USFWS Region 4: 1.24 (*P* value = 0.51986)

UMVGL Draft Waterbird Conservation Plan: Decline in BCRs 12 and 23; increase in BCRs 13 and 22.

Special listings - Special Concern (WI)

Great Egret

BBS trend, 2000-2006

- MS Flyway: -2.14 (*P* value = 0.59584)
- USFWS Region 3 (excluding Missouri and Iowa, including Ontario): -3.44 (P value = 0.38715)
- USFWS Region 4: -1.95 (*P* value = 0.52225)

UMVGL Draft Waterbird Conservation Plan: Increasing trend across region, however declining in WI.

Special listings - Threatened (WI); Special Concern (IN, OH)

Herring Gull

BBS trend, 2000-2006

- Michigan: 0.74 (*P* value = 0.89377)
- *New York: 14.20 (P value = 0.09309)*
- USFWS Region 3 (excluding Missouri and Iowa, including Ontario): 7.68 (P value = 0.45415)
- MS Flyway: -1.71 (P value = 0.41473)

UMVGL Draft Waterbird Conservation Plan: Low concern

Neotropic Cormorant

BBS trend not available.

Southeast Regional Waterbird Conservation Plan: "Neotropic Cormorant appears to be expanding from Texas and Louisiana northward .... Although Neotropic Cormorants are not nearly as common in economic conflicts as [the DCCO], this species is widespread and abundant … and keeping populations stable as opposed to encouraging increases seems the best course of action."

Ring-billed Gull

BBS trend, 2000-2006

USFWS Region 3 (excluding Missouri and Iowa, including Ontario): -0.81 (*P* value = 0.71793)

MS Flyway: 1.67 (*P* value = 0.63127)

UMVGL Draft Waterbird Conservation Plan: Not at risk

Snowy Egret

BBS trend, 2000-2006

MS Flyway: -10.42 (P value = 0.04788)

USFWS Region 3 (excluding Missouri and Iowa, including Ontario): not available

USFWS Region 4: -12.34 (P value = 0.00198)

UMVGL Draft Waterbird Conservation Plan: Unknown trend where species is peripheral, however thought to be declining overall.

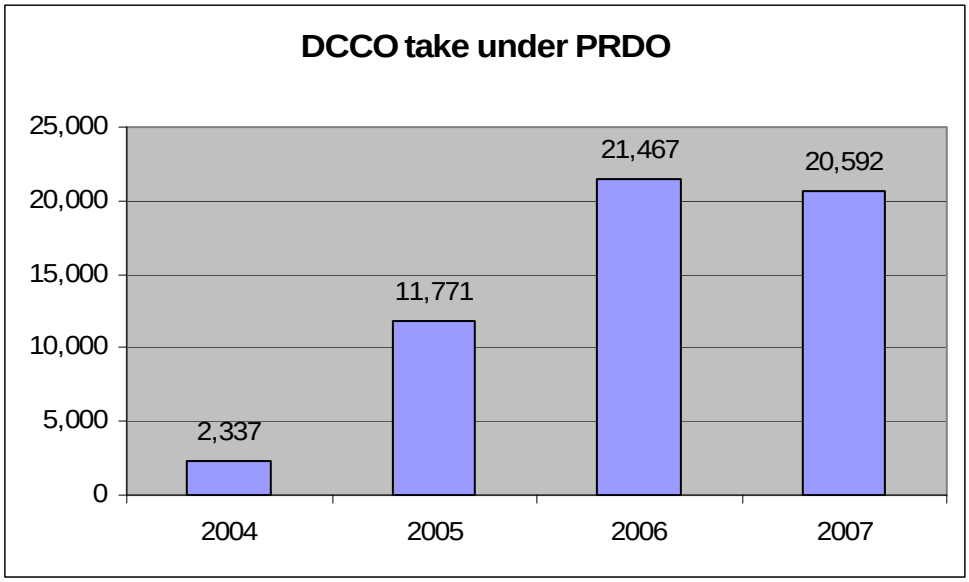
Special listings - Endangered (OH, MO, IL, WI)

APPENDIX 3

CORMORANT MANAGEMENT ACTIVITIES, 2004-2007

Take under the PRDO, 2004-2007

For 2004-2007 (4 years), average annual take of DCCOs under the PRDO was 14,042 birds. The following graph shows annual take of DCCOs under the PRDO from 2004-2007.



Action	2004	2005	2006	2007	4-year total
Birds killed	2,337	11,771	21,467	20,592	56,167
Nests oiled/destroyed (total, not peak)	18,935	17,307	31,843	43,348	111,073

Overview of 2007 Activities (this covers the period from 10/1/06 to 9/30/07)

States in which control activities were carried out in 2007: Alabama, Arkansas, Iowa, Michigan, Minnesota, Mississippi, New York, Ohio, Texas, Vermont, and Wisconsin. The following table shows PRDO take and resources protected in 2007.

State	Take	Resource Issue
Alabama	861 birds	Reduce island vegetation damage
Arkansas	26 birds; 15 nests	Protect fisheries and cypress trees
Iowa	50 birds	Protect hatchery fish
Michigan (tribes)	407 birds; 11,915 nests	Protect tribal fisheries
Michigan (WS)	7,360 birds; 9,935 nests	Reduce foraging pressure on various fish spp.; protect vegetation
Minnesota	2,761birds; 13 nests	Reduce predation on fisheries and to reduce impacts on other birds
Mississippi	697 birds	Protect vegetation and other birds

State	Take	Resource Issue
New York (WS)	203 birds; 35 nests	Protect fisheries, vegetation, and other birds
New York (State)	1,466 birds; 12,353 nests	Protect fisheries, vegetation, and other birds
Ohio	3,725 birds	Protect habitat and other birds
Texas	2,636 birds	Protect fisheries
Vermont	397 birds; 1,415 nests	Protect vegetation/habitat and promote wildlife diversity
Wisconsin	3 birds; 7,667 nests	Protect fisheries

Overview of 2006 Activities (covers the period from 10/1/05 to 9/30/06)

States in which control activities were carried out in 2006: Alabama, Arkansas, Michigan, Minnesota, Mississippi, New York, Ohio, Texas, Vermont, and Wisconsin. The following table shows PRDO take and resources protected in 2006.

State	Take	Resource Issue
Alabama	1,362 birds	Island vegetation damage
Arkansas (USDA-WS)	145 birds; 37 nests	Protect fisheries and cypress trees
Arkansas (State)	93 birds	Protect fisheries
Michigan (Tribes)	180 birds; 2,919 nests	Protect tribal fisheries
Michigan (USDA-WS)	5,447 birds; 9,205 nests	Reduce foraging pressure on various fish spp.
Minnesota	3,303 birds; 44 nests	Reduce predation on fisheries and to reduce impacts on other birds
Mississippi	633 birds	Protect vegetation and other birds
New York (USDA-WS)	109 birds; 137 nests	Protect fisheries, vegetation, and other bird species
New York (State)	1,815 birds; 14,044 nests	Protect fisheries, vegetation, and other bird species
Ohio	5,873 birds	Protect habitat and other birds
Texas	2,272 birds	Protect fisheries throughout the state
Vermont	328 birds; 747 nests	Protect vegetation/habitat and promote wildlife diversity

Overview of 2005 Activities (covers the period from 10/1/04 to 9/30/05)

States in which control activities were carried out in 2005: Alabama, Arkansas, Michigan, Minnesota, New York, Texas, and Vermont. The following table shows PRDO take and resources protected in 2005.

State	Take	Resource Issue
Alabama	1,143 birds	Island vegetation damage
Arkansas (USDA-WS)	134 birds; 47 nests	Protect fisheries and cypress trees
Arkansas (State)	41 birds	Protect fisheries
Michigan (tribes)	178 birds	Protect fisheries
Michigan (USDA-WS)	2,601birds; 2,991 nests	Reduce foraging pressure on various fish spp.
Minnesota	2,993 birds; 20 nests	Reduce predation on fisheries and to reduce impacts on other birds
New York (USDA-WS)	47 birds; 131 nests	Protect fisheries, vegetation, and other

State	Take	Resource Issue
		bird species
New York (State)	1,618 birds; 12,960 nests	Protect fisheries, vegetation, and other bird species
Texas	2,599 birds (via "cormorant control permit" issued to citizens)	Protect fisheries throughout the state
Vermont	458 birds; 1,172 nests	Protect vegetation/habitat and promote wildlife diversity

2004 Activities (from the creation of the PRDO in December 2003 to 9/30/04)

States in which control activities were carried out in 2004: Arkansas, Georgia, Michigan, New York, and Vermont. The following table shows PRDO take and resources protected in 2004.

State	Take	Resource Issue
Arkansas	193 birds; 95 nests	Protect sport fish and cypress trees
Georgia	30 birds	Protect stock at state fish hatchery
Michigan (USDA-WS)	1,202 birds; 3,114 nests	Reduce foraging pressure on yellow perch
Michigan (Tribe)	222 birds	Protect walleye at stocking sites
New York (USDA-WS)	105 birds; 520 nests	Protect sportfish, vegetation, and other bird species
New York (State)	377 birds; 13,748 nests	Protect sportfish, vegetation, and other bird species
Vermont	208 birds; 1,458 nests	Protect vegetation/habitat and promote wildlife diversity

Local population control efforts under the Public Resource Depredation Order

In some States where the PRDO has been implemented, goals have been set to reduce the local DCCO population as a means of mitigating, or in some cases preventing, resource damage. The table below summarizes these efforts.

State	Location	Objective
Ohio	West Sister Island, Lake Erie	48-61% reduction in number of breeding birds (target population for the island is 1,500-2,000 pairs)
Minnesota	Leech Lake	Population goal is 500 pairs
Michigan	Les Cheneaux Islands, Lake Huron; Thunder Bay, Lake Huron; South Manitou Island, Lake Michigan	50% reduction; 33% reduction; 10% reduction
New York	Little Galloo Island, Lake Ontario; Oneida Lake	Population goal is 1,500 pairs; population goal is 40-100 birds
Vermont	Young Island, Lake Champlain	20% removal each year, plus 100% egg oiling
Alabama	Lake Guntersville	50-75% reduction by culling

Ohio: To reduce the number of DCCOs degrading arboreal habitat on Lake Erie islands, DCCOs were removed from three colonies. At West Sister Island, part of Ottawa National Wildlife Refuge, DCCO nests decreased from 3,813 in 2005 to

1,967 in 2007. On Green Island, DCCO nests declined from 857 in 2005 to 686 in 2007. However, on Turning Point Island, DCCO nests increased from 409 in 2005 to 934 in 2007 (ODOW/USDA-WS/Ottawa NWR 2007 annual report).

Minnesota: The 500-nest goal on Little Pelican Island was reached in 2006; however, tribal biologists noted that large numbers of non-breeding DCCOs continue to use the lake. The total estimated cormorant population in 2007 was ~3,800 before culling and ~2,500 after culling)(LLBO 2007 annual report).

Michigan: In the Les Cheneaux Islands of northern Lake Huron, the number of DCCO nests has declined from 5,500 in 2003 to 1,438 in 2007; the target population is 1,000 pairs. At colonies in the Thunder Bay, Lake Huron, area a 33% reduction (by culling, not egg oiling) of the population was conducted (USDA-WS [MI] 2007 annual report).

New York: At Little Galloo Island in Lake Ontario, DCCO nest numbers have declined from 8,410 in 1996 to 2,702 in 2007 as a result of egg oiling and culling efforts. Nest management reinforced with lethal shooting helped reduce DCCO nesting activity by 33% from 2005 to 2006 on Long Island in Oneida Lake (Cranker *et al*. 2006).

Vermont: Egg oiling since 1999 and culling since 2004 have helped reduce the number of DCCOs nesting on Young Island to the lowest point since 1994. Research to improve understanding of movement responses by managed DCCOs suggested that "within a particular year management can effectively limit recruitment of DCCO at a nesting colony without changing the large-scale nesting and colonization patterns observed in the Lake Champlain Basin" (Strickland *et al*. 2006). Pioneer nesting attempts are also managed at sites throughout the lake (VDFW/USDA-WS [VT] 2007 annual report).

Nest management

Egg oiling and destruction of nests are two other management techniques used to minimize DCCO impacts. The total nests affected were 18,935, 17,307, and 31,483 in 2004, 2005, and 2006, respectively. In 2007, 43,348 nests were affected (total, not peak, numbers). The vast majority of nest management was done by oiling eggs, which has been done only in Great Lakes states. The table below gives the peak number of nests in which eggs were oiled under the PRDO in 2006. The peak number factors out multiple oilings of a single nest and is the best indication of the actual number of nests impacted (repeatedly oiling the same nests on separate visits maximizes effectiveness and is part of the methodology of egg oiling).

Duerr *et al*. (2007) studied breeding dispersal of DCCOs at colonies in Lake Champlain and observed that although oiling eggs did slightly increase breeding dispersal (movement to other nesting sites), such dispersal did not significantly influence effectiveness of management when egg oiling was carried out in a way that avoided predation of DCCO eggs by co-nesting species such as gulls.

2007 PRDO egg oiling activities

State	Location(s)	Peak number of nests in which eggs were oiled
Wisconsin – WDNR and USDA-WS	Cat, Hat, Hog, Lone Tree, and Jack Islands, Lake Michigan	8,811
Michigan – Sault Ste Marie Tribe of Chippewa Indians and Bay Mills Indian Community	Ile Aux Galets, Naubinway, Paquin, and Bellow Islands, Lake Michigan; Gem and Rock Islands, St. Mary's River; Tahquamenon and Round Islands, Lake Superior	4,024
Michigan – USDA-WS	Les Cheneaux Islands, Lake Huron and Michigan; Ludington Pump breakwall, Snake, Gull, and Pismire Islands, Lake Michigan	5,280
New York – NYSDEC	Little Galloo Island, Lake Ontario; Reef Lighthouse, Lake Erie; Buckhorn Weir, Niagara River	2,817
New York – USDA-WS	Long Island, Oneida Lake	15
Vermont – VDFW and USDA-WS	Young Island, Lake Champlain	529

Non-lethal hazing activities

Because of stakeholder concerns regarding the effects of cormorants on the recreational fisheries of Oneida Lake, New York, a non-lethal hazing program has been in effect there since 1998. The New York USDA-WS program uses pyrotechnics, boat chases, and other fear-provoking stimuli during spring, summer, and fall to manage DCCOs in this area. Regular population monitoring and analysis of cormorant movements via VHF and satellite telemetry indicate that the hazing activities have reduced the mean number of DCCOs using Oneida Lake by 92% compared to previous, unmanaged years (T. DeVault, unpublished data).

At several sites in Michigan, non-lethal harassment combined with lethal reinforcement (*i.e.*, occasional shooting of birds) has been used during DCCO spring migration and is considered to be effective at reducing the time birds spend on the water and, consequently, the time spent foraging. For example, efforts at the mouth of the Potagannissing River on Drummond Island had deterrence rates of 98%, 82%, and 59% in 2004, 2005, and 2006, respectively (USDA-WS [MI] 2006 annual report).

The Vermont Department of Fish and Wildlife and USDA-WS utilize pyrotechnics, other harassment techniques, and nest destruction to prevent pioneering attempts by DCCOs on Lake Champlain (VDFW/USDA-WS [VT] 2007 annual report).

Take under the Aquaculture Depredation Order and Permits

In 13 states, commercial aquaculture producers can take depredating DCCOs at their fish farms under the Aquaculture Depredation Order (50 CFR 21.47; AQDO). Employees of USDA-WS can also take DCCOs at roosts located in the vicinity of fish farms. In addition to the AQDO, DCCOs may be taken under the authority of migratory bird permits issued for scientific collecting and depredation control

purposes. The table below gives the number of DCCOs taken under the AQDO and permits in 2004-2007. (As noted, the number for 2007 is an approximation based on the average of the three previous years since, at the time of writing, we did not yet have summary data for 2007).

Year	DCCOs taken under AQDO and permits
2004	25,203
2005	22,005
2006	30,947
2007	26,052*

*This figure is an average of the previous 3 years' take

All of the states included in the AQDO are in the southern U.S. except for Minnesota. The numbers in the table above include Minnesota but the breakdown for that state is: 1,246 DCCOs reported killed in 2007; 1,865 DCCOs reported killed in 2006; 1,857 DCCOs reported killed in 2005; and 2,553 DCCOs reported killed in 2004. The other states are Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas. Most DCCOs killed under the AQDO are taken at fish farms in Alabama, Arkansas, and Mississippi.

APPENDIX 4

POPULATION MODEL DATA AND ASSUMPTIONS

Data available for modeling population dynamics were: annual counts of nests from Lakes Erie and Ontario 1979-2007; annual harvest of individuals from each lake in the Great Lakes 2003-2007; the number of nests oiled in each lake 2005 to 2007; and the number of nesting individuals in each lake 2005 and 2007. Banding and band-recovery data, 1979-2006, were available and were analyzed separately (Seamans *et al*. in review).

We used the following model to assess the effect of harvest and egg oiling on the population:

$$N_{t+1} = sN_t[1 + (1 - p_t)(a + bN_t)] - h_t \times N_t$$

where N_t is the abundance in year t, h_t is the harvest rate in year t, and p_t is the annual proportion of nests oiled in year t. Annual survival of nesting individuals (s; individuals $\geq$2 years old) was taken from Seamans *et al*. (In Press; s = 0.884, SE = 0.020). An age ratio (a) and density dependent term (b) were estimated using the above equation and data from Lakes Erie and Ontario; N_t = 2x number of nests each year, p = proportion of nests oiled each year; and h = number of individuals harvest each divided by N_t. Parameter estimates were: a = 0.5476 (SE = 0.1875); and b = -0.00000489 (SE = 0.00000148).

Uncertainty in parameter estimates, and harvest and egg oiling rates, was incorporated into projections using a simulation approach. Ten thousand simulations were executed for each harvest/oiling scenario. Parameter values for a, b, and s were randomly drawn from a normal distribution for each year in each simulation. Normal distributions for each parameter were based on estimated standard errors. Harvest and egg oiling rates were randomly drawn from a uniform distribution for each year in each simulation, with the distribution encompassing values 20% above and below target rates. Eighty percent confidence intervals were reported for scenario and projected values were rounded to the nearest 100.

We assumed that multiplying nest counts by 2 accurately represented the population of breeding individuals. Unless double-counting nests is a serious problem, nest counts probably underrepresent the breeding population, because not all birds are likely to breed each year. Therefore, there likely are more birds than the counts suggest.

For projecting the population, we assumed that the abundance of breeding individuals in the Great Lakes was at or very near carrying capacity. Models of population dynamics suggested that the population in Lakes Erie and Ontario was at carrying capacity (estimation of carrying capacity using logistic regression is not shown in our results). Further, Ridgway *et al*. (2006b) also estimated that the DCCO population in the northern portion of Lake Huron reached carrying capacity around 2003. Regardless of whether the Great Lakes population is slightly under or over

carrying capacity, harvesting and egg oiling at constant rates will result in equilibrium populations similar to those represented in the text and figures.

In the simulations, harvest and egg oiling rates were allowed to vary each year ±20%. However, it was not clear if the harvest reported for the Great Lakes accurately reflected the harvest of individuals from these population for two reasons. First, harvest of Great Lakes double-crested cormorants wintering in the southeastern U.S. also occurs but was not included during estimation of model parameters. It was not clear how many or at what rate individuals that breed in the Great Lakes are harvested in the Southeast.

Second, harvest reported from the Great Lakes likely includes non-breeders. This was also not accounted for; instead the total harvest was used for estimation of model parameters. Thus, it was not clear if harvest of breeding individuals should be adjusted upwards or downwards. However, because maximum population growth occurred before implementation of the 1999 and 2003 depredation orders, the estimate of carrying capacity (accounted for by the density dependent term in the population model) for the population is likely confounded by implementation of the depredation orders. In other words, it may be the carrying capacity is slightly higher than that estimated. If this is the case then the estimated population trajectories are conservative. If the carrying capacity is lower, then the equilibrium population sizes suggested by the trajectories will overestimate population size.

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