U.S. FISH & WILDLIFE SERVICE

Environmental Assessment for Issuing Depredation Permits for Double-crested Cormorant Management

Division of Migratory Bird Management

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CHAPTER 1.0 PROPOSED ACTION

1.1 Introduction

Pursuant to the National Environmental Policy Act (NEPA)(42 U.S.C 4321 et seq.), the United States Fish and Wildlife Service (hereafter, USFWS) has prepared this Environmental Assessment (EA). As further described below, the purpose of this EA is to evaluate the reasonably foreseeable environmental impacts of making decisions on cormorant depredation permit applications for activities specified in this EA pursuant to 50 C.F.R. § 21.41 and to provide a foundation for site-specific evaluations of individual applications. While this EA considers the potential environmental impacts of permitting actions, the USFWS will evaluate each permit application individually and make future decisions based on the criteria set forth in 50 C.F.R. § 21.41. These future permitting decisions may require additional environmental review in the form of a site-specific environmental assessment or may be covered by a categorical exclusion, depending on the circumstances. We are considering two alternatives described below, the proposed action and a reduced take alternative (the preferred alternative).

1.2 Proposed Action

The USFWS proposes to make decisions on depredation permit applications (pursuant to 50 C.F.R. § 21.41) for take (i.e., lethal removal) of double-crested cormorants, *Phalcrocorax auritus* (hereafter, “cormorants”), across 37 central and eastern States and the District of Columbia (Fig 1-1). Annual take would be authorized based on the Potential Take Limit (PTL) model described below. This geographic scope encompasses five USFWS regions, including: Alabama, Arkansas, Connecticut, Delaware, the District of Columbia, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, West Virginia, and Wisconsin. This scope is associated with damage management of cormorants on their breeding grounds, winter grounds, and in areas where cormorants may come into conflict while migrating between these locations.

The scope of this proposal is limited to applications for depredation permits for managing cormorants at or near aquaculture facilities, alleviating human health and safety concerns, protecting threatened and endangered species (as listed under the Endangered Species Act of 1973, as amended; ESA), and reducing damage to property. The USFWS may also issue permits to take cormorants if there is convincing evidence that cormorants are adversely affecting species of high conservation concern (a regionally important bird population, for example) or rare and declining plant communities at a local scale.

This EA serves as a framework for USFWS and AHPIS/WS to make timely decisions on depredation permits pursuant to 50 C.F.R. § 21.41 for the lethal take of cormorants. FWS proposes to issue permits for cormorant depredation where they meet applicable legal and policy requirements and where the impacts fall within those assessed in this EA. USFWS staff will evaluate permit applications on an individual basis based on the scope and environmental consequences identified in this EA, conduct a tiered NEPA review, and produce a finding identifying whether any additional actions or assessments are needed.

As stated above, the cumulative authorized take of cormorants to reduce damage to aquaculture, human health and safety, federally listed threatened and endangered species, and property cannot exceed the lower limit of the PTL model (see chapter 5 and Appendix 1). This number is not a prescribed take level for cormorants, but the PTL is the maximum allowable annual take that corresponds to a biologically sustainable level of annual take based on knowledge of cormorant population dynamics, and under the current policy relative to the implementation of 50 C.F.R. § 21.41. Further, while the USFWS uses the PTL model to identify maximum allowable take, individual depredation permits themselves are not a means to manage cormorant populations. Rather, individual permits are meant to address site-specific elements within the scope of activities identified in this EA. Generally the take requested, individually or cumulatively, in submitted permit applications fall well under the lower limit of the PTL model, and would not impact the health of the cormorant population or generate significant localized population impacts. Thus, while issuing depredation permits to manage cormorant damage at the site-specific scale, the USFWS is also balancing the take of cormorants with maintaining cormorant populations.

In accordance with USFWS conditions of issuance and acceptance of permits (50 C.F.R. § 13.21(e)(1)), practicable and effective non-lethal methods are required as the initial approach before implementing lethal measures. If non-lethal measures are ineffective, lethal methods may be considered in combination with non-lethal methods as a means to reinforce non-lethal measures. The proposed action will comply with United States' treaty obligations of ensuring cormorant populations are maintained by authorizing take under the PTL model for activities within the scope of this proposed action. Other management objectives (e.g., increasing or decreasing cormorant populations) and potential future policies may result in different sustainable take levels, but are beyond the scope of this EA and are not considered here.

The USFWS tracks permit authorizations in the USFWS Permits Issuance and Tracking System (SPITS). Using SPITS, the USFWS can monitor permit authorizations for take of cormorants under the proposed action. Regular data queries allow the USFWS to determine if the maximum allowable take threshold is being approached within each managed subpopulation and coordinate among regions to ensure that authorized take does not exceed the threshold. Allocation of authorized take of cormorants will be implemented administratively across the USFWS regions within the geographic scope of this EA. To address PTL model uncertainty and ensure that authorized take is not having a significant individual or cumulative effect on cormorant populations and the quality of the human environment, the USFWS will assess cormorant survey data, SPITS data, and update the PTL at least every 10 years. During individual permit review including site-specific conditions, the USFWS may add conditions to the permit to minimize unintended impacts to cormorant populations (50 C.F.R. § 13.21 (e)(1)).

1.3 Reduced Take Alternative (Preferred Alternative)

CEQ regulations provide for the use of additional constraints on the proposed action as an alternative to the proposed action (40 C.F.R. § 1508.25(b)(3)); the same is true for our regulations at 43 C.F.R. § 46.130(a). As explained above, the proposed action relies on a PTL model to estimate the impact of issuing individual depredation permits on cormorant populations. PTL models are biologically based models that integrate scientific and policy elements of take management. While the PTL model provides a maximum allowable take to maintain cormorant populations within the scope of this EA, the USFWS would consider a more conservative approach by constraining allowable take to 51,571 cormorants per year, which is well below the lower limit of the PTL model. This limit is the expected annual take based on authorizations for cormorant take from 2010-2015. This temporal period is considered to be most reflective of estimated need for managing cormorants. Using an adaptive management approach, the USFWS may consider transitioning from the preferred alternative (reduced take alternative) to the less restrictive take authorized in the proposed action using the lower limit of the PTL, as better cormorant data is available. Based on the analysis contained in Chapter 5, limiting take to less than the lower limit of the PTL model maintains current cormorant populations. If the USFWS decides to use the reduced take alternative, the allowable take would be capped at the estimated take of each subpopulation (Atlantic (11,634 cormorants per year), Mississippi/Central (39,726 cormorants per year) and Florida (211 cormorants per year); See Table 5-2). This reduced level of take is a precautionary approach to the already conservative PTL model and thus further reduces the potential impacts to cormorant populations.

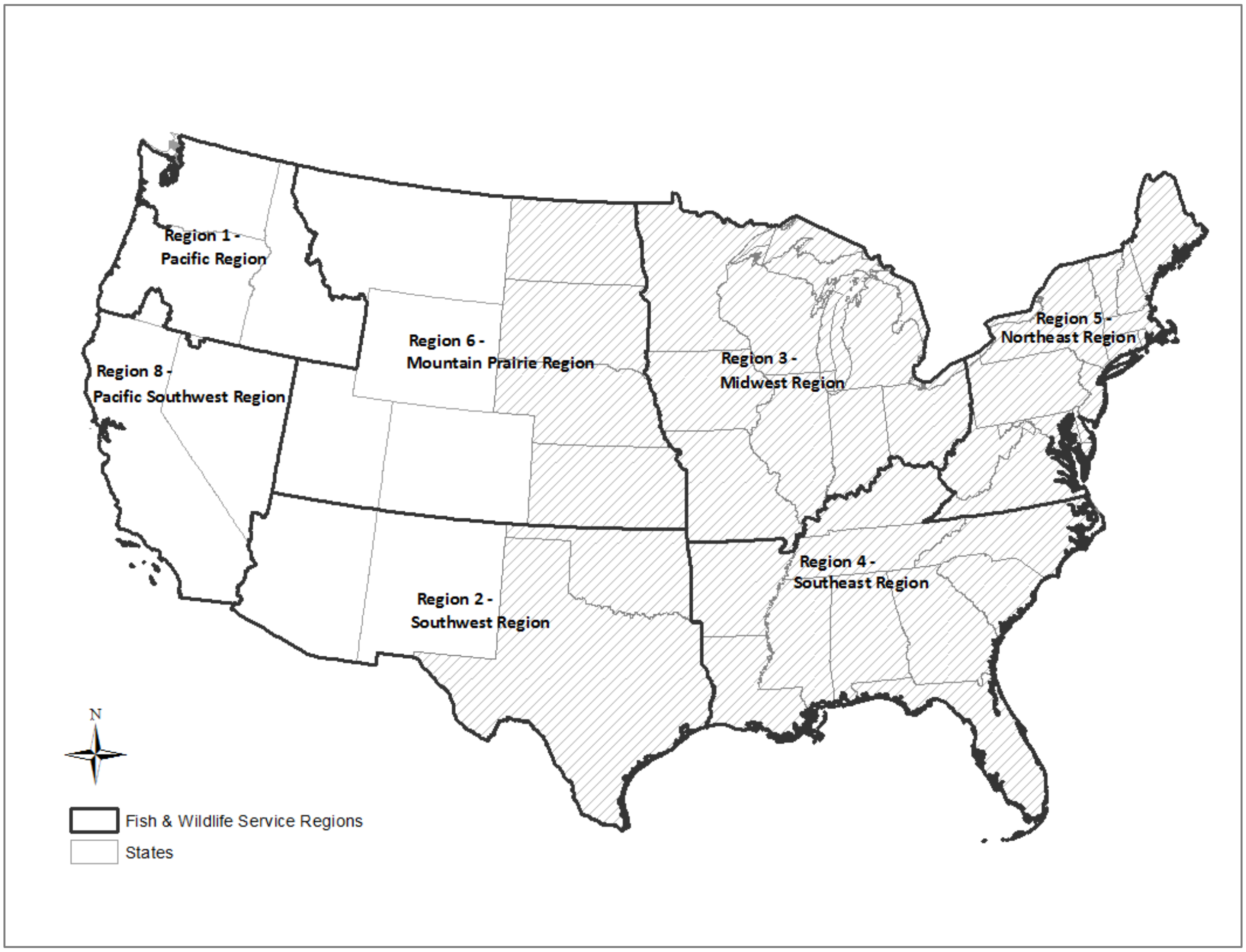

Figure 1-1. The spatial scale covered by this EA. Shaded states are those that are included in the proposed action.

CHAPTER 2.0 NEED FOR ACTION

2.1 Need for Action

The USFWS needs to make timely decisions on depredation permit applications for the take of cormorants at or near aquaculture facilities, in cases of human health and safety, for the protection of ESA listed species, and to alleviate damage to property while maintaining cormorant populations. This EA focuses on these actions because they are the reasons applicants generally identify in requesting individual depredation permits. Average authorized take for these purposes are described in detail in Section 4.4.

The Migratory Bird Treaty Act, as amended (MBTA) (16 U.S.C. §§ 703–712) is the implementing legislation for four international conventions (with Canada, Mexico, Japan, and Russia) for the protection of migratory birds. The MBTA prohibits the taking (i.e., killing, injuring, or possessing protected birds, their young, eggs, or nests) of migratory birds unless authorized (16 U.S.C. § 703). The MBTA allows for the authorization of take of migratory birds when it is compatible with the terms of the four international conventions (16 U.S.C. § 704(a)). The four international conventions require that the USFWS ensure the preservation of migratory birds.

Depredation permits are issued pursuant to 50 C.F.R. § 21.41, which authorizes the take of migratory birds that are injuring "crops or other interests." In issuing depredation permits, the USFWS has historically interpreted "other interests" to mean property damage, human health and safety, and threatened and endangered species. When a permit application is received, the USFWS is required to process the permit application as quickly as possible (50 C.F.R § 13.11(c)) and issue an appropriate permit to any properly executed application that meets all issuance criteria (50 C.F.R § 13.21).

Applicants for depredation permits are required to provide a description of: 1) the area where depredations are occurring; (2) the nature of the crops or other interests being injured; (3) the extent of such injury; and (4) the particular species of migratory birds committing the injury (50 C.F.R. § 21.41 (b)(1-4)). Applicants also provide a description of the non-lethal measures that they have used and would continue to use (and which would be considered under 43 C.F.R. § 46.130(b)). The Animal and Plant Health Inspection Service, Wildlife Services (hereafter, APHIS/WS) assists the USFWS with issuance of migratory bird depredation permits by conducting interviews and site visits with individuals experiencing damage. APHIS/WS collects information on the nature and extent of the damage, the species and number of migratory birds involved, non-lethal actions already taken to resolve the problem and the results of the non-lethal actions. As stated above, practicable and effective non-lethal methods are required as the initial approach before implementing lethal measures.

APHIS/WS supports efforts by USFWS to minimize take authorized through depredation permits by recommending the appropriate number of birds to be removed on the APHIS/WS Migratory Bird Damage Project Report (Form 37). Form 37 is completed to assist in alleviating damage caused by migratory birds, including implementation measures to avoid and minimize take of non-target species in association with depredation permits. Form 37 and a description of any long-term measures to eliminate or significantly reduce the continued need for managing cormorant damage must be included in the permit application. Once a permit application is received, the USFWS can: 1) deny the application for a depredation permit; 2) issue a depredation permit at the removal level requested; or 3) issue a depredation permit for a different level of cormorant take. In addition, USFWS may include appropriate conditions on each permit (50 C.F.R. § 13.21), such as measures to minimize disturbance to co-nesting species or prohibiting the take of cormorants at or near nesting colonies when dependent young are present. USFWS may also apply conditions requiring continued use of non-lethal methods.

Permittees must report actions taken under the permit (e.g., birds taken, number of nests where eggs were oiled, nests destroyed) at the end of the permit interval (50 C.F.R. § 13.21 (c)(4)). Other standard conditions included in depredation permits are provided in Appendix 2. Lethal take authorized on a depredation permit may only occur on or over the area described on the permit (50 C.F.R 21.41(c)(2)). Other non-lethal management actions may also be conducted on adjacent or other nearby properties (e.g., roost harassment).

2.2 Environmental Issues

Potential Impacts on Aquaculture

Cormorants can feed on fish raised for human consumption and on fish raised for other commercial purposes such as baitfish or ornamental fish (Glahn et al. 2000a, Dorr et al. 2012a, Dorr and Engle 2015). When economic loss occurs, there is a need to protect aquaculture facilities from feeding cormorants. This EA considers the need to address impacts on aquaculture facilities from cormorant damage.

Human Health and Safety

Collisions between aircraft and wildlife are a concern throughout the world because they threaten passenger safety (Thorpe 1996, Dolbeer et al. 2016). Cormorants are a particular hazard to aircraft because of their body size and mass, slow flight speeds, and their natural tendency to fly in flocks. Where the potential for cormorants and aircraft collisions exist, there is a need to manage cormorant activity in and around airfields. This EA considers the need to address impacts on human health and safety from cormorants.

Potential Impacts to Property

Cormorants may cause ecological and economic damage to property. Cormorants are known to nest and roost on artificial structures (e.g., bridges) and within the human environment (Wires 2014). Cormorants at nesting colonies and roost sites can have a negative impact on vegetation by both chemical (cormorant guano) and physical means (stripping leaves and breaking tree branches) (Boutin et al. 2011, Koh et al. 2012, McGrath and Murphy 2012, Ayers et al. 2015, Lafferty et al. 2016). Further, corrosion caused by fecal uric acid from nesting or roosting congregations of cormorants may damage vegetation, vehicles, and structures (Dorr et al. 2014). Accumulated bird droppings can reduce the functional life of some building roofs by 50% (Weber 1979). Where cormorants cause economic damage to property there may be a need to manage the damage to minimize negative impacts by cormorants. This EA considers the need to address impacts to property from cormorant damage.

Potential Impacts to Non-Target Species, Federally Listed Species, and Eagles from Cormorant Damage Management

Non-Target Migratory Birds

The MBTA implements the United States' commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for the protection of shared migratory bird resources. Each convention protects species of birds that are common to both the United States and the other country. When permitted cormorant damage management methods have the potential to impact migratory birds identified in those conventions, there is a need to analyze those impacts. Accordingly, this EA considers the impacts on non-target migratory birds of issuing depredation permits..

Eagles

The Bald and Golden Eagle Protection Act (Eagle Act) (16 U.S.C 668–668d) provides additional protection to bald (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) and prohibits anyone, without a permit issued by the Secretary of the Interior, from taking bald and golden eagles, including their parts, nests, or eggs. Take under the Eagle Act is defined as to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb (16 U.S.C. § 668(c)).

When cormorant damage management methods are likely to result in take of bald or golden eagles, there is a need for the Regional Migratory Bird Permit Office to provide information on the appropriate permit needed under the Eagle Act. In addition, the USFWS requires agencies and individuals conducting cormorant damage management (as part of depredation permit conditions) in the vicinity of bald eagle nests, roosts, or foraging areas to follow the recommendations found in the National Bald Eagle Management Guidelines (USFWS 2007) to reduce any potential liability for take or harassment of bald eagles.

Federally Listed Species

It is federal policy under the ESA (16 U.S.C. § 1531–1544) that all federal agencies shall seek to conserve endangered and threatened species and shall utilize their authorities in furtherance of the purposes of the ESA (§ 2(c)). Federal action agencies must consult with the USFWS under Section 7 of the ESA to ensure that "any action authorized, funded, or carried out by such an agency… is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of habitat of such species. Each agency shall use the best scientific and commercial data available" (§ 7(a)(2)).

When an individual depredation permit for cormorants has included any particular conditions or required changes to an action that may affect listed species or critical habitat, there is a need to for USFWS to consult under the ESA. If the USFWS's proposed permit conditions or requirements in an individual cormorant depredation permit may affect listed species or critical habitat *not* otherwise described in this EA, the Regional Permit Office will coordinate intra-USFWS Section 7 consultations at the permit stage.

2.3 Background

Prior to 1998, the sole method for authorizing lethal take of depredating cormorants was through the issuance of depredation permits under the existing federal regulations 50 C.F.R. § 21.41, which allow the take of migratory birds that are injuring "crops or other interests." In 1998, the USFWS issued a depredation order that authorized commercial freshwater aquaculture producers in 13 states to take cormorants without a federal permit when the birds were found committing or about to commit depredations on aquaculture stocks (50 C.F.R. § 21.47).

In response to ongoing damage at aquaculture facilities and other damage and conflicts associated with increasing cormorant populations, the USFWS published a Final Environmental Impact Statement (FEIS) and made changes to the regulations governing the take of cormorants in 2003. The 2003 FEIS considered direct, indirect, and cumulative effects of alternatives for cormorant management in the United States and discussed mitigating measures (USFWS 2003). Based on analysis in the FEIS and review of public and agency comments, the USFWS published a modified Aquaculture Depredation Order (AQDO) (50 C.F.R. § 21.47) in November 2003. The final rule also established a Public Resource Depredation Order (PRDO) (50 C.F.R. § 21.48).

The modified AQDO eliminated individual permit requirements for private individuals, corporations, state agencies, and federal agencies in 13 states taking cormorants at aquaculture facilities. It also allowed APHIS/WS employees to take cormorants at roost sites in the vicinity of aquaculture facilities during the months of October, November, December, January, February, March, and April. The PRDO enabled states, tribes, and APHIS/WS in 24 states to take cormorants found committing or about to commit, and to prevent, depredations on the public resources of fish (including hatchery stock at federal, state, and tribal facilities), wildlife, plants, and their habitats without individual depredation permits. To evaluate the potential effects on the cormorant population from the implementation of the two depredation orders, a mitigating measure required the USFWS to review and renew the two depredation orders every five years.

The two depredation orders were subsequently reviewed and renewed in 2009 and 2014. In May of 2016, the depredation orders were vacated by the United States District Court for the District of Columbia. The court concluded that the USFWS did not sufficiently consider the effects of the depredation orders on cormorant populations and other affected resources and failed to consider a reasonable range of alternatives in the review within the EA issued in 2014. The authority for authorizing lethal take of depredating cormorants reverted back to the issuance of individual depredation permits pursuant to 50 C.F.R. § 21.41.

The USFWS stopped issuing or renewing individual depredation permits for cormorant take in states previously covered by the depredation orders until we could complete a new NEPA analysis addressing cormorant take in the central and eastern states and the District of Columbia. This EA therefore addresses the need to consider effects of issuing individual depredation permits for lethal take of cormorants in 37 central and eastern states and the District of Columbia (see Figure 1-1) under specific circumstances.

CHAPTER 3.0 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

We considered several alternatives to the proposed action, but eliminated them from further analysis because they do not meet the underlying need of the proposed action (i.e., to make timely decisions on permit applications). They are: (1) reestablishment of the PRDO and AQDO; (2) the inclusion of the reduction of adverse impacts on free-swimming fish populations in the list of resources that may qualify for depredation permits; and (3) rescinding cormorant protections under the MBTA.

With respect to the considerations of a no action alternative, we have determined that there are no unresolved conflicts about the proposed action with respect to alternative uses of available resources. We have made this determination based on current cormorant population estimates and the PTL model analysis. These data and model results indicate that the allowable take in the proposed action would allow us to meet our Migratory Bird Treaty obligations. The reduced take alternative is a precautionary approach reducing take to considerably less than the level of take provided for in the proposed action, further ensuring the maintenance of cormorant populations. While the no action alternative (i.e., not processing permit applications) would also allow us to meet our treaty obligations, it does not meet the underlying need for the proposed action and leaves human cormorant conflicts unresolved. Accordingly, pursuant to 43 C.F.R. § 46.310, we have determined that there is no need to further analyze a no action alternative.

3.1 Reestablishment of the Public Resource and Aquaculture Depredation Orders

As explained above, on May 25, 2016, the United States District Court for the District of Columbia vacated the AQDO and the PRDO for cormorants until the USFWS could prepare an adequate EA or EIS in compliance with the requirements of NEPA. Therefore, to develop new regulations that either reinstate either of the two Depredation Orders or develop new depredation orders, it would be necessary to conduct an entirely new rulemaking and NEPA review process.

There is, however, an immediate need to respond to existing requests for assistance with cormorant damage to aquaculture, human health and safety, property, and threatened and endangered species. Therefore, this EA analyzes the effects of acting on depredation permit applications under the existing regulations (50 C.F.R. § 21.41) to allow for a timely response to the needs of agencies and the public. Once the ability to control ongoing damage caused by cormorants with depredation permits has been finalized through the current NEPA process, the agency may consider whether to pursue new rulemaking and associated NEPA review for cormorant management under new depredation orders.

3.2 Include reduction of adverse impacts on free-swimming fish populations in the list of resources that may qualify for depredation permits

Under the PRDO, several states conducted cormorant damage management actions to reduce presumed adverse impacts of cormorants on sport fish populations and there is interest in continuing these activities. The science to-date has limited examples demonstrating causality between the presence of cormorants as a sole or primary limiting factor for declines in free-swimming fish on a landscape level. Available information indicates that impacts are likely site-specific. We have limited information that would allow us to make determinations regarding whether cormorant depredation on free-swimming fish populations is compensatory or additive to other demographic processes among fish populations, such as recruitment, mortality from other sources, or distribution. In some systems, the issue is further complicated by the introduction of invasive species that can change relationships among species within a system (e.g., zebra mussels [*Dreissena polymorpha*], round goby [*Neogobius melanostomus*]). Acquiring additional information would allow us to determine if there may be significant impacts essential to a reasoned choice among alternatives (40 C.F.R. §1502.22). To comprehensively address all of these issues, include all stakeholders, and incorporate appropriate measures into permitting conditions, additional analyses beyond the scope of this EA would be required.

3.3 Rescind Cormorant Protections under the Migratory Bird Treaty Act Protection

Several states and other parties have suggested removing cormorants from the list of species protected under the MBTA (50 C.F.R. § 10.13). This alternative would entail amending the MBTA and associated international conventions which are beyond the authority of the USFWS. Specifically, this action would require amending the treaty with Mexico to protect migratory birds, Convention for the Protection of Migratory Birds and Game Mammals (March 15, 1937). In addition, cormorants would still be protected under the laws of most states. This is not considered a viable near-term alternative.

CHAPTER 4.0 THE AFFECTED ENVIRONMENT

4.1 Introduction

The purpose of this chapter is to provide the existing conditions related to the environmental issues specified in this EA. The affected environment focuses on aspects of the human environment within the geographic scope of the proposed action that may be impacted by cormorants. This chapter also focuses on the environment that will be exposed to impacts from the authorization of take of cormorants through the issuance of depredation permits. The two cormorant depredation orders were in effect from 2003 until vacatur in 2016. During this time, depredation permits to address other types of cormorant damage were also issued under 50 C.F.R. § 21.41. We selected 2004 to 2015 as the time frame, while the orders were in place, as the basis for consideration of the affected environment because it best reflects the influences leading to current conditions and enables predictions regarding the nature of impacts from the proposed management alternatives. We did not include 2016 since the depredation orders were only in place for five months and would misrepresent the number of cormorants removed under the orders during that year.

4.2 Cormorant Populations

Overview of Cormorant Populations

Cormorants are native to North America and range widely across the continent. Habitats supporting breeding, roosting and wintering cormorants include ponds, swamps, freshwater and saline lakes, reservoirs, lagoons, artificial impoundments, rivers, estuaries, and open coastlines. Cormorants tend to locate breeding colonies on islands, and sometimes on cliffs, but may also use artificial structures such as bridges, navigational aids, and utility poles (Wires 2014). Cormorants may also be found on and around some human-modified environments including, but not limited to, airports and aquaculture facilities.

It is generally accepted that there are five different breeding populations, variously described by different authors as Alaska, Pacific Coast, Interior, Atlantic, and Southern populations. Tyson et al. (1999) estimated that 95% of the breeding cormorants in North America occurred in the Interior, Atlantic, and Southern breeding populations with 68% occurring in the Interior population. Dolbeer (1991) stated, "*There was little intermixing between cormorant populations east of the Rocky Mountains and populations on the Pacific coast of North America*". Recent population expansion, however, has blurred the boundaries for the Interior, Atlantic, and Southern populations (Hatch and Weseloh 1999, Wires et al. 2001, Dorr et al. 2014). There is high variation in the migratory tendencies of these different breeding populations. Birds that breed in Florida and elsewhere in the southeastern United States are essentially sedentary and those along the Pacific coast are only slightly migratory, while Atlantic and Interior birds show the greatest seasonal movements (Johnsgard 1993). The two primary migration routes appear to be down the Atlantic coast and through the Mississippi-Missouri River valleys to the Gulf coast (Palmer 1962) with increasing numbers of birds remaining in the Mississippi Delta (Jackson and Jackson 1995) (Figure 4-1).

The current cormorant population estimate in the central and eastern U.S. and Canada is 731,880 to 752,516 cormorants (see Table 4-1). Systematic censuses occurred in some regions (e.g., Great Lakes), but has not occurred in other regions with well-known breeding colonies (e.g., Manitoba, Ontario). While recent population data suggest the Great Lakes meta-population may be stable or declining (Guillaumet et al. 2014); increasing until the early 2000s and declining thereafter. This pattern coincides with the onset of widespread cormorant control measures in the Great Lakes by 2005, but the decline may have been precipitated by cormorant populations reaching carrying capacity in several areas in the Great Lakes (Wyman et al. 2016). It has been suggested that numbers in the Great Lakes may be affected by widespread management activities on the breeding and wintering grounds (Guillaumet 2014).

Table 4-1 Regional pre-breeding cormorant population estimates (breeders and non-breeders). Breeding pair estimates were extrapolated to include non-breeders (Appendix 1).

Subspecies	Population size	
Region	Low	High
P. a. auritus		
Atlantic Flyway		
Atl. Canada and Quebec	153,610	165,071
Atlantic United States[1]	98,832	103,116
Atlantic Subtotal	252,442	268,187
Mississippi/ Central Flyway		
Canada	225,458	235,176
United States	205,420	229,520
Miss. /Cent. Subtotal	460,878	464,969
P. a. floridanus		
Florida[2]	18,560	19,360
Total	731,880	752,516

[1]does not include Florida.

[2]allowable take in Florida based only on population size of *P.a. floridanus*.

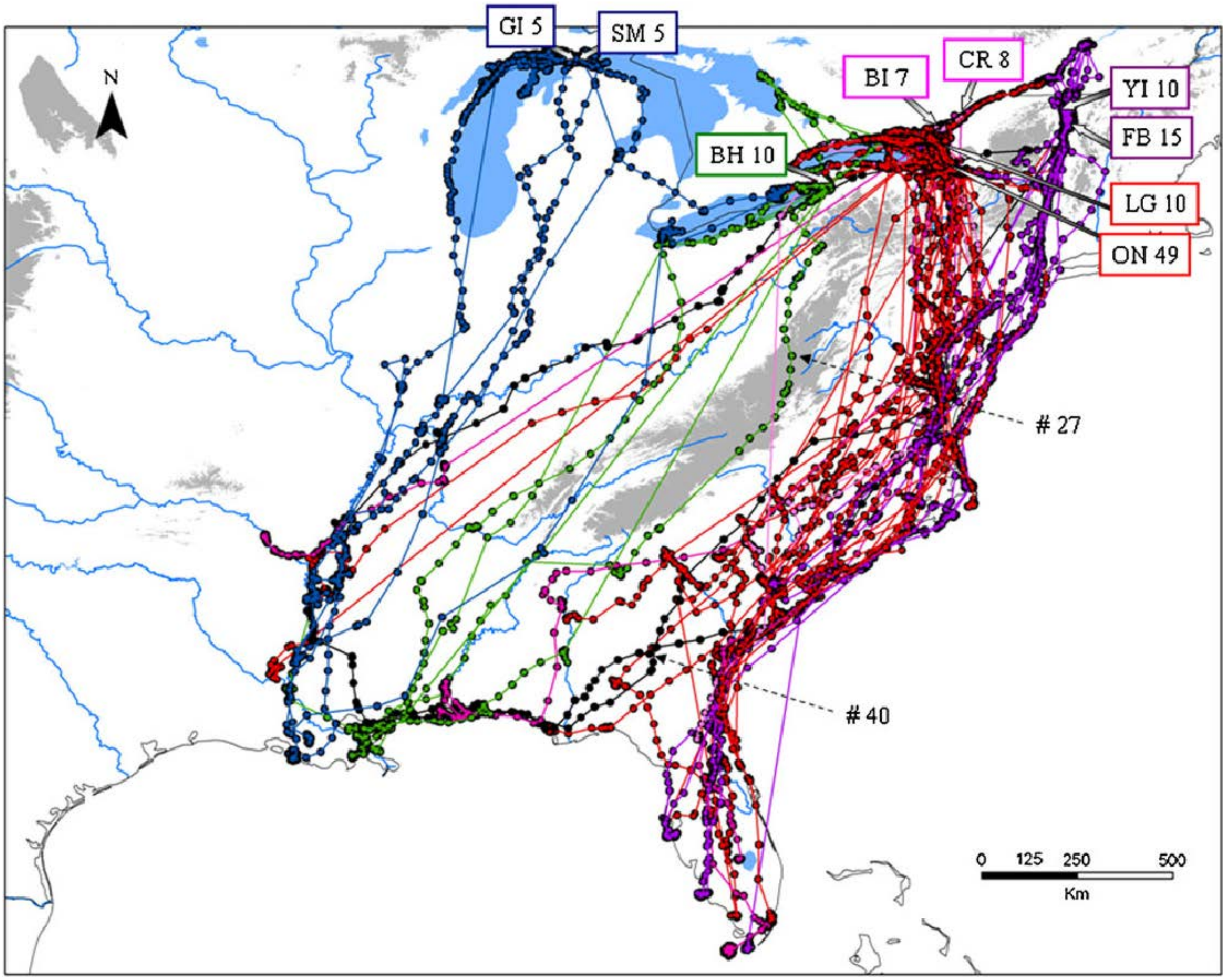

Figure 4-1 Telemetry tracks of 119 cormorants fitted with Global Positioning System transmitters in 2004–2007

Colonies from which birds were tagged include (number refers to sample size): Four Brothers (FB) and Young Island (YI) in Lake Champlain (purple, except # 40 from FB in black); Crossover (CR) and Blanket Island (BI) on the St. Lawrence River (pink); Oneida Lake (ON) and Little Galloo (LG) in Lake Ontario (red); North Breakwater at Buffalo Harbor (BH) in Lake Erie (green); St. Martin Shoal (SM) in Lake Huron and Green Island (GI) in Lake Michigan (blue). Bird # 40 (black) is an example of loop migration, with 2 fall migrations using the Atlantic Flyway and 1 spring migration along the Mississippi Flyway. From *Guillaumet et al. 2011. Determinants of local and migratory movements of Great Lakes Double-crested Cormorants. Behavioral Ecology*

22:1096-1103. Used with permission of Oxford University Press.

4.3 Effects of Cormorants on Aquaculture, Human Health and Safety, and Property

Aquaculture

Aquaculture producers often identify cormorants as causing the greatest predation threat to farm-raised aquaculture species (Stickley and Andrews 1989, Price and Nickum 1995, Dorr et al. 2012a, Craig et al. 2016). Traditionally, most inland breeding cormorants of North America migrated south after the breeding season to winter along the coastal areas of the United States and Mexico (Dorr et al. 2014). However, as aquaculture production increased in the southern United States, an increasing number of cormorants began wintering inland near aquaculture facilities (Glahn et al. 2000b, Dorr et al. 2012b, Dorr et al. 2014). The number of cormorants can increase rapidly wherever prey is readily accessible at aquaculture ponds (Hatch and Weseloh 1999, Wires et al. 2001, Dorr et al. 2012a, Wires 2014). The response of cormorants to the presence of aquaculture ponds may be a contributing factor to the increase in the wintering population of cormorants in the fish producing regions of the southern United States (Jackson and Jackson 1995, Glahn et al. 1999, Reinhold and Sloan 1999).

Damage to aquaculture resources occurs primarily from the economic losses associated with cormorants consuming fish and other commercially raised aquatic organisms. Damage can also result from the death of fish and other aquatic wildlife from injuries associated with predation as well as the threat of disease transmission from one impoundment to another or from one aquaculture facility to other facilities as cormorants move between sites.

The frequency of occurrence of cormorants at a given aquaculture facility can be a function of many interacting factors, including: (1) the size of the regional and local cormorant population; (2) the number, size, and distribution of ponds; (3) the size distribution, density, health, and species composition of fish populations in the ponds; (4) the number, size, and distribution of natural wetlands in the immediate environment; (5) the size distribution, density, health, and species composition of natural fish populations in the surrounding landscape; (6) the size, and distribution of suitable roosting habitat; and (7) the variety, intensity, and distribution of local damage abatement activities. As a result, cormorants rarely distribute evenly over a given region, but rather tend to be highly clumped or localized. Damage abatement activities can shift bird activities from one area to another thereby, reducing damage at one site while increasing it at another (Aderman and Hill 1995, Mott et al. 1998, Reinhold and Sloan 1999, Tobin et al. 2002). Thus, some aquaculture producers in a region suffer little or no economic damage from cormorants, while others experience exceptionally high losses.

Cormorants are generalists. Thus, there is a great deal of variation in prey composition, both geographically and seasonally. Most of the research on diet composition of wintering cormorants at aquaculture facilities has occurred near catfish farms in the southeastern United States where the average proportion of commercial catfish in the diet of cormorant ranges from 50% to 55% of the diet. The proportion of commercial catfish in the cormorant diet can vary seasonally from less than 30% in October and November to more than 80% in February, March, and April due to differences in prey availability (e.g., see Bivings et al. 1989, Conniff 1991, Glahn et al. 1995, Glahn and Brugger 1995, Glahn et al. 1999).

Cormorants are capable of taking catfish up to 42 cm (16 inches) in length (Campo et al. 1993). However, the majority of catfish caught by cormorants average about 10 to 15 cm (4 to 6 inches) (Schramm et al. 1984, Stickley 1991, Stickley et al. 1992, Glahn et al. 1995). This range is similar in size to prey eaten by cormorants in natural freshwater habitats, which average about 12 cm (5 inches) (Durham 1955, Hirsch 1986, Hobson et al. 1989, Campo et al. 1993, Glahn et al. 1998).

Aquaculture facilities are also concerned about the transmission of disease by cormorants between impoundments and from facility to facility. Given the confinement and high densities of aquatic organisms inside impoundments the introduction of a disease could result in substantial economic losses. Birds may also be capable of passing bacterial pathogens through fecal droppings and on their feet (Price and Nickum 1995). Taylor (1992) detected a bacterial fish pathogen (*Edwardsiella ictaluri*) in the intestines of cormorants, great blue herons (*Ardea herodis*), great egrets (*Ardea alba*) and snowy egrets (*Egretta thula*), in Mississippi. Taylor (1992) also found the bacterial pathogen for enteric septicemia of catfish within the intestines and rectal areas of cormorants collected from aquaculture facilities in Mississippi. However, since enteric septicemia of catfish is endemic in the region, Taylor (1992) did not consider birds as a primary vector of the disease. Birds can also pose as primary hosts to several cestodes, nematodes, trematodes, and other parasites that can infect fish. Birds can also act as intermediate hosts of parasites that can infect fish after completing a portion of their life cycle in crustaceans or mollusks (Price and Nickum 1995).

Human Health and Safety

The primary risk to human health and safety from cormorants is the risk of a cormorant collision with aircraft. Collisions between aircraft and wildlife are a concern throughout the world because they threaten passenger safety (Thorpe 1996), result in lost revenue and costly repairs to aircraft (Linnell et al. 1996, Robinson 1996), and erode public confidence in the air transport industry as a whole (Conover et al. 1995). The magnitude of the hazard depends on the physical, biological, and behavioral characteristics of each bird. Cormorants are a particular hazard to aircraft because of their body size (wingspan of 45-48 inches [114-123 cm]) and mass

(2.8-5.5 lbs. (1,200-2,500 g), slow flight speeds, and their natural tendency to fly in flocks (Cornell Lab of Ornithology 2010; Dolbeer and Eschenfelder 2003). Blockpoel (1976) states that birds with slow flight speeds can create increased hazards to aircraft because they spend relatively greater lengths of time in aircraft movement areas.

Cormorants were rated as the 8th most hazardous wildlife species to aircraft (DeVault et al. 2011). According to the Federal Aviation Administration's (FAA) Bird Strike database, there were 131 reported wildlife strikes involving cormorants to civil aircraft in the United States from 1990 to April 2016 (FAA National Wildlife Strike Database; https://wildlife.faa.gov/database.aspx). Forty-six of 77 strike reports, which provided information on damage, indicated that the aircraft had sustained minor to substantial damage. Twenty-one reports indicated that the aircraft had sustained substantial damage and one aircraft was destroyed. Thirty five of the 46 reported strikes with damage had a negative effect on the flight (e.g., need to abort takeoff or return to airport) and four reported cormorant strikes resulted in injuries to five people (Dolbeer et al. 2016). Twenty-one of the 46 strikes involved more than one bird, which poses hazards of concurrent damage to multiple portions of the aircraft/engine(s).

Another risk to human health from pathogens originating from cormorants, which is primarily associated with fecal contamination of water used for recreation (e.g., beaches) or community water supplies. Concentrations of colonial waterbirds can impact water quality through runoff of fecal material from areas where they congregate to roost, loaf or nest (Hatch 1996, Klett et al. 1998). Although this impact has not been documented specifically for cormorants, it has been documented in other colonial waterbirds, including great cormorants (Klimaszyk and Rzymski 2016, Han et al. 2017, Telesford-Checkley et al. 2017). Water contamination can include increased levels of fecal nitrogen and phosphorus as well as disease-causing organisms such as *Escherichia coli*. Risks to human health associated with fecal contamination of water are likely very low. There is a general perception among the public and a concern among resource management personnel that cormorants do have the ability to transmit diseases to humans, but a direct link is difficult to establish due to the expense of testing and the difficulty of tracing the disease back to cormorants. No such links have been identified in the United States.

While we acknowledge the possibility that such contamination may occur, given the paucity of data specific to cormorants in North America, the agency will only consider this a need for action when the health risk has been confirmed by an appropriate state, federal, or tribal health agency with expertise in such determinations.

Property

Property losses associated with cormorants include damage from fecal accumulation on infrastructure such as boats and marinas, bridges, buildings and other structures used by cormorants as breeding, loafing or roosting sites. In addition to the corrosive and nuisance problems associated with cormorant feces, accumulations of feces on walkways, ladders and equipment can lead to slippery surfaces and health and safety concerns. Vegetation damage and changes in soil characteristics associated with nesting or roosting cormorants can adversely impact vegetation on property. Loss of vegetation may also result in problems with erosion.

Over the period of fiscal years 2014-2016, APHIS/WS employees have taken actions involving cormorants to reduce risks of property damage to boat docks, marinas and watercraft (average of 24 work tasks per year), to buildings (73 work tasks per year), to roads and bridges (34 work tasks per year), general property damage (183 work tasks per year), damage at recreational areas (20 work tasks per year), vegetation damage (12 work tasks per year), and damage to utilities (32 requests per year). Damage is determined by information provided in APHIS/WS form 37 and is addressed through the issuance of depredation permits by the USFWS with technical input from APHIS/WS. Other types of damage that were relatively infrequent (5 or less work tasks per year) included predation on ornamental fish, dikes/dams/water impoundments, damage to equipment, and conflicts at landfills.

4.4 Authorized Take of Cormorants

Through 2016, the USFWS authorized the take of cormorants under the following regulations: 50 C.F.R. § 21.23 (scientific collecting permits), 21.41 (depredation permits, including those specifically for airports), 21.47 (AQDO), and 21.48 (PRDO). From 2004 to 2015, an average of 53,477 cormorants per year (range 34,067 to 78,793) were taken under all authorities.

Take of Cormorants under Depredation Permits

Depredation permits were the mechanism used to manage conflicts with cormorants before the depredation orders were enacted. Depredation permits have also been used in states for which the depredation orders did not apply or in instances where cormorants were causing damage for things that were not covered by the depredation orders, such as property damage and human health and safety concerns. Under depredation permits, an average of 7,099 cormorants per year were reported by APHIS/WS to have been taken in the central and eastern United States between 2004 and 2015 (range 3,708 to 9,918; Table 4-2).

In addition to standard depredation permits, the USFWS issues special depredation permits specifically to address human health and safety at airports. From 2004 to 2015, the USFWS issued an average of 34 special depredation permits per year in the central and eastern United States, resulting in an average take of 293 cormorants per year at airports.

Take of Cormorants under the Aquaculture Depredation Order

The now vacated AQDO authorized the take of cormorants at commercial, federal, and state facilities engaged in the production of freshwater aquaculture stock to alleviate depredation without the need for an individual depredation permit from the USFWS. The AQDO applied to freshwater aquaculture facilities in 13 states: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, and Tennessee in USFWS Region 4; Texas and Oklahoma in USFWS Region 2; and Minnesota in USFWS Region 3. In addition, the AQDO authorized APHIS/WS to take cormorants, with appropriate landowner permission, at roost sites in the vicinity of aquaculture facilities at any time during October, November, December, January, February, March, and April. Between 2004 and 2015, entities lethally removed an average of 19,871 cormorants per year (range 13,388 to 32,057) in those 13 states via the AQDO to alleviate cormorant depredation occurring at freshwater aquaculture facilities (Table 4-2). As shown in Table 4-3, between 2004 and 2015, the majority of cormorants lethally removed pursuant to the AQDO occurred in the Southeast.

In Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas, cormorants can occur throughout the year but are more abundant in those states during the winter and migration periods. Most take for aquaculture damage management in these states involved cormorants that migrated to the area from breeding grounds further north. Take under the vacated AQDO primarily occurred in association with efforts to disperse large congregations of cormorants from nighttime roost locations in order to reduce depredation on nearby aquaculture facilities. In Minnesota, cormorants are primarily present in the state during the breeding season (Dorr et al. 2014) and most take occurs at individual aquaculture facilities.

Take of Cormorants under the Public Resource Depredation Order

The take of cormorants for the protection of property under the PRDO is often associated with damage from cormorants resting, roosting or nesting on or over boats, docks, marina structures, bridges, navigational aids, utility poles, and damage to trees from roosting. This has also included take of cormorants for protection of fish in private stocked ponds and lakes. This category does not include take of birds for protection of property/human health and safety at airports. The PRDO was implemented predominantly to manage damage to sport fish, vegetation, and co-nesting birds. More than half of the 24 States authorized to operate under the PRDO have done so sporadically or not at all. From 2004 to 2015, the reported take of cormorants under the PRDO among the 24 States averaged 21,976 cormorants annually (range 2,395 to 35,735) (Table 4-2).

Table 4-2. Total number of cormorants taken under each authorization in the central and eastern United States, 2004-2015.

Authorization	Year												Annual Avg.
	2004	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	
Scientific Collecting (50 C.F.R. §21.23)	160	540	484	0	34	72	311	529	384	827	904	273	377
Depredation Permits (50 C.F.R. §21.41)	5,635	4,794	3,880	3,708	6,540	6,650	9,387	8,678	8,036	9,602	9,918	8,356	7,099
Aquaculture Depredation Order (50 C.F.R. §21.47)	25,582	21,513	32,057	17,926	18,055	16,338	14,958	13,388	14,817	19,732	21,559	22,532	19,871
Public Resources Depredation Order (50 C.F.R. §21.48)	2395	11,221	21,043	20,256	18,889	25,302	18,539	28,676	26,464	22,538	32,652	35,735	21,976
Total	33,772	38,608	57,464	41,890	43,518	48,362	43,195	51,271	49,701	52,699	65,033	66,896	53,477

[1] Depredation orders were vacated on May 25, 2016. No authorized take of cormorants occurred under the depredation orders after this date.

Table 4-3. Number of Double-crested cormorants taken under the Aquaculture Depredation Order, by State and year.

State	Number of Cormorants Taken Under the AQDO												
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Annual Average
Alabama	1,303	1,102	1,552	775	314	2,442	506	165	195	12	297	1,547	851
Arkansas	9,724	7,504	9,454	7,452	6,577	5,946	4,636	6,642	6,377	7,784	7,993	3,321	6,951
Florida	0	0	0	0	0	55	41	50	63	43	53	41	29
Georgia	32	63	55	75	75	236	44	60	48	148	38	180	88
Kentucky	14	4	24	7	12	12	0	0	7	22	25	17	12
Louisiana	993	732	234	111	0	0	0	24	26	29	22	37	184
Minnesota	2,553	1,857	1,865	1,246	1,676	1,725	1,667	1,748	1,540	951	1,166	1,206	1,600
Mississippi	9,116	10,057	18,111	7,191	8,424	4,432	6,876	4,010	3,910	9,083	9,754	13,825	8,732
North Carolina	0	165	695	1,035	774	719	588	512	1,259	1,596	1,262	2,137	895
Oklahoma	0	0	0	0	0	0	0	0	0	0	0	0	0
South Carolina	0	0	0	0	0	0	0	3	0	0	0	0	0
Tennessee	0	0	0	0	0	0	0	0	0	0	0	0	0
Texas	1,847	29	67	34	203	771	600	174	1,392	64	949	221	529
Total	25,582	21,513	32,057	17,926	18,055	16,338	14,958	13,388	14,817	19,732	21,559	22,532	19,871

[1]Query in USFWS Permits Issuance Tracking System on 5/17/17.

Nest Management

In addition to the lethal removal of individual cormorants, nest management is used to reduce local breeding populations of cormorants and associated impacts on habitat and co-nesting species. Reducing the number of birds in a colony and the number of young to be fed also reduces the overall food requirements of the colony. Because cormorants are long-lived birds, actions to reduce reproductive success may take longer to reduce overall colony size than direct removal of birds. Nest management is typically authorized under depredation permits and the PRDO. Egg oiling, egg addling, and destruction of nests are management techniques used to minimize cormorant colonies and therefore local impacts. Cormorants are likely to continue to incubate oiled and addled eggs for a time after treatment which reduces the likelihood of re-nesting. Cormorants are more likely to re-nest at the project site or abandon the site for another location when nest destruction is used, so this method is used less often than egg oiling/addling.

APHIS/WS reports that the vast majority of nest management was done by oiling eggs, which has been done only primarily in the Great Lakes States of Michigan, New York, Vermont, Wisconsin and a trial year in Minnesota. Nest destruction is used less often, but consistently in the places where it is conducted, particularly New York and Wisconsin, and to a lesser extent in Arkansas, Michigan, Minnesota, and Vermont. Nest destruction is typically considered to be less effective at controlling cormorant populations as birds either readily rebuild nests, or abandon colonies to nest elsewhere. On average, 4,154 cormorants were taken via nest destruction each year in the central and eastern United States between 2004 and 2015.

Take of Cormorants under Scientific Collection Permits

Research information on cormorants, including both positive and negative impacts, is an integral part of adaptive management and regulatory decision-making. Research on cormorants in the United States is often conducted to better understand their ecology (i.e., movements and diet), impacts of damage management strategies, and impacts to public resources such as habitats and co-nesting migratory bird species, including at-risk species based on their population status. From 2004 to 2015, an average of 14 scientific collecting permits (50 C.F.R. § 21.23) have been issued in the central and eastern United States each year, resulting in the average take of 377 cormorants per year (Table 4-2). These types of permits are not included in the PTL assessed in this EA, however this level of authorized take is negligible and would not impact cormorant populations.

4.5 Cormorants and Non-Target Species

Co-nesting Migratory Birds

We incorporate in this section, by reference, the information in pages 35-38 of the 2003 FEIS concerning avian associates of cormorants. As noted, cormorants nest with several other bird species, including American white pelican (*Pelecanus erythrorhynchos*), great blue heron, great egret, black-crowned night-heron (*Nycticorax nycticorax*), and several species of gulls and terns (Laridae). The ability of cormorants 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 a sensitive species or where local management goals exist for that species.

In the eastern and central portions of the United States, several colonial waterbird species that commonly occur alongside nesting cormorant colonies have an elevated conservation concern status. Little blue heron (*Egretta caerulea*) and snowy egret, commonly found in the southern regions of the United States, are both considered of high conservation concern. Species such as American white pelican and black-crowned night-heron are considered of moderate conservation concern. While continent-wide populations of black-crowned night-herons are considered stable, this species has been state-listed as "endangered" in Indiana and Pennsylvania, "threatened" in Kentucky, Maine, Ohio, and New Jersey, and is designated as a "Species of Special Concern" in Michigan and Wisconsin (Hothem et al. 2010).

Anhinga (*Anhinga anhinga*), great cormorant (*Phalacrocorax carbo*), and neotropic cormorant (*Phalacrocorax brasilianus*) are also considered of moderate conservation concern. These species primarily occupy coastal areas, but will forage in freshwater as well as marine habitat. All three of these species are difficult to differentiate from cormorants, especially on the wing. Other colonial species that co-occur with cormorants such as Caspian (*Hydroprogne caspia*) and common terns (*Sterna hirundo*), great blue heron, great egret, great black-backed gull (*Larus marinus*), ring-billed (*Larus delawarensis*), and herring gull (*Larus argentatus*) are all considered of low conservation concern or species not at risk. However, inland populations of common tern have seen declines since the 1980's and as such they have a higher conservation status in some Great Lakes states.

In tree-nesting colonies, cormorant excrement has been shown to kill vegetation thereby destroying habitat for other species such as great blue heron, great egret, snowy egret, and black-crowned night-heron (Weseloh and Ewins 1994; Weseloh and Collier 1995; Wires et al. 2001), as well as cattle egrets (*Bubulcus ibis*), little blue herons, and anhingas in more southern latitudes (Lemmons 2007). Additionally, cormorant droppings into nests situated in lower trees can cause nest abandonment (Moore et al. 1995). Further, cormorant eggs have been found in other species' nests suggesting that some level of species displacement can occur (Somers et al. 2011).

Conflicts with nesting cormorants are not limited to tree-nesting species. In ground-nesting colonies, cormorants have been implicated in reducing available nesting space and nesting material. On Leech Lake in Minnesota, nesting cormorants reportedly displaced ring-billed gulls, which in turn competed for nesting space with common terns, a state listed species (Mortensen and Ringle 2007). This behavior has also been documented on Oneida Lake, New York (Mattison 2006).

Additionally, cormorants have been shown to engage in frequent antagonistic behavior with other co-nesting species such as great blue heron, herring gull and American white pelican (Wyman and Cuthbert 2015). Some researchers have found that these aggressive interactions can contribute to reduced reproductive success (Somers et al 2007; Somers et al. 2011), while others have found that these interactions have either no effect (Wyman and Cuthbert 2015) or, in the case of herring and ring-billed gulls, can even result in gull colony growth when cormorant are present (Wyman et al, personal communication).

Vegetation

The effect on vegetation from birds congregating within communities, such as cormorants, are direct and relatively easy to document. Through physical and chemical means, cormorants over time often kill shrubs and trees where they breed, nest, and loaf. While this is a natural occurrence in habitats for several bird species, colonies of cormorants can potentially create a localized problem for vegetation in protected areas such as parks, refuges, and islands. Thus, an important issue for consideration is the reduction of tree cover and plant diversity on the islands they colonize (Chapdelaine and Bédard 1995, Rippey et al. 2002).

Cormorant damage is particularly concerning when it occurs to vegetation or plant communities of special management importance. An example of how cormorants may affect vegetation communities is the Carolinian forest vegetation type, the northernmost geographic extension of the eastern deciduous forest ecosystem. In Canada, even though the Carolinian vegetation zone in the Lake Erie Region makes up only 1% of Canada's total land area, it boasts a greater number of species of flora and fauna, many of which are considered rare, than any other ecosystem in Canada (Kamstra et al. 1995, Boutin et al. 2011). Research conducted on Middle Island in Lake Erie, which encompasses a portion of the Carolinian vegetation type, found the vegetation greatly modified by cormorant habitation (Hebert et al. 2005). Cormorants affected not only the tree canopy, but also the understory vegetation decreasing species richness and increasing the abundance of exotic plant species (Boutin et al. 2011). The United States portion of Lake Erie area also contains Carolinian forest vegetation supporting rare species. Therefore, cormorant management was implemented at Green Island in Lake Erie to prevent destruction of habitat for six state-listed plant species, the state-threatened rock elm (*Ulmus thomasii*), being particularly sensitive to cormorant damage (Ohio Division of Wildlife et al. 2012).

Standard permit conditions to depredation permits are outlined in Appendix 2. After a case-by-case review of the site-specific conditions, the USFWS may add conditions to a depredation permit to minimize unintended impacts to vegetation where appropriate (50 C.F.R. § 13.21 (e)(1)).

Federally Listed Species

A common concern among members of the public and wildlife professionals, including USFWS and APHIS/WS personnel, is the impact of lethal cormorant damage management methods and activities on federally listed threatened and endangered species. Cormorant damage management methods are described in Appendix 3. Section 7 of the ESA, as amended (16 U.S.C. 1531-1543; 87 Stat. 884), provides that,

"The Secretary shall review other programs administered by him and utilize such programs in furtherance of the purposes of this Act'' (and) shall "ensure that any action authorized, funded or carried out ... is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of (critical) habitat.''

An Intra-USFWS ESA Section 7 consultation was conducted and a Biological Evaluation (ESA BE) was developed to assess if any proposed, threatened, or endangered species or associated critical habitat (Appendix 4), were affected by cormorant damage management. The USFWS determined that the permit conditions from the conservation recommendations in the 2003 FEIS, the National Bald Eagle Management Guidelines, and current practices for specific sensitive species, piping plover (*Charadrius melodus*), interior least tern (*Sterna antillarum*), bald eagle, and wood stork (*Mycteria americana*) would not adversely affect these species. Conservation measures were developed and added to both alternatives in order to protect these specific listed and sensitive species and will accompany any permit issued as appropriate. Other species of conservation concern included in the ESA BE do not require additional protective permit conditions at this time (Appendix 4).

A regional listing of endangered, threatened, proposed, and candidate species that share the broad geographic range and some habitats of cormorant populations is presented in Appendix 4. Management activities associated with cormorant population control have also been reviewed by APHIS/WS, in which they have conducted statewide Section 7 Consultations, in all states within the action area (*https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/programs/nepa/ct_nepa_regulations_assessments*) on the management of cormorants. Each of these consultations resulted in informal consultation and letters of concurrence from the USFWS that the proposed projects and management actions would have no effect on or are not likely to adversely affect listed species.

The issuance of depredation permits to lethally take cormorants would not authorize the take of any species protected by the ESA. Persons operating under depredation permit conditions must immediately report the take of species protected under the ESA to the USFWS. Standard permit conditions to depredation permits are outlined in Appendix 2. To protect piping plovers, interior least terns, and wood storks that nest or have colonies in or near areas where cormorant damage management could occur, the following conservation measures are implemented within any geographic area where ESA protection applies:

1) All control activities must 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.
2) Discharge or use of firearms (without noise suppression) to kill or harass cormorants or use of other harassment methods must 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.
3) Other control activities such as egg oiling, CO_2 asphyxiation, egg destruction, or nest destruction must 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; and
4) 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 Ecological Services Field Office staff to determine if the above measures are adequate.

Eagles

Another common concern among members of the public and wildlife professionals, including USFWS and APHIS/WS personnel, is the impact of lethal cormorant damage management methods and activities on bald eagles. Cormorant damage management methods are described in Appendix 3. A variety of human activities can potentially interfere with bald eagles, affecting their ability to forage, nest, roost, breed, or raise young. Therefore, the USFWS developed the National Bald Eagle Management Guidelines to advise landowners, land managers, and others who share lands with bald eagles when and under what circumstances the protective provisions of the Eagle Act may apply to their activities. The guidelines are intended to help people minimize such impacts to bald eagles, particularly where they may constitute "disturbance," which is prohibited by the Eagle Act. Adherence to these guidelines benefits individuals, agencies, organizations, and companies by helping them avoid violations of the law. However, these guidelines themselves are not law. Rather, they are recommendations based on several decades of behavioral observations, science, and conservation measures to avoid or minimize adverse impacts to bald eagles. The following guidelines to protect bald eagles are most applicable to cormorant damage management:

1) No buffer for damage activities is necessary around bald eagle nest sites outside the breeding season. During the breeding season, however, operators of off-road vehicles (including snowmobiles) are instructed not to operate within 330 feet of the nest. In open areas, where there is increased visibility and exposure to noise, this distance should be extended to 660 feet. Operators of motorized watercraft (including jet skis or personal watercraft), are also instructed not to operate within 330 feet of the nest, and, avoid concentrations of noisy vessels (e.g., commercial fishing boats and tour boats), except where eagles have demonstrated tolerance for such activity. Other motorized boat traffic passing within 330 feet of the nest should attempt to minimize trips and avoid stopping in the area where feasible, particularly where eagles are unaccustomed to boat traffic. Buffers for airboats should be larger than 330 feet due to the increased noise they generate, combined with their speed, maneuverability, and visibility.
2) Non-motorized recreation and human entry (e.g., hiking, camping, fishing, hunting, birdwatching, kayaking, canoeing) would also adhere to a 330-foot buffer if the activity will be visible or highly audible from the nest, particularly where eagles are unaccustomed to such activity.
3) During the bald eagle breeding season, discharge or use of firearms (without noise suppression) to kill or harass cormorants and blasting and other activities that produce extremely loud noises are to be avoided within 1/2 mile of active nests, unless greater tolerance to the activity (or similar activity) has been demonstrated by the eagles in the nesting area.
4) To avoid disturbance at foraging areas and communal roost areas, potentially disruptive activities and development in the eagles' direct flight path between their nest and roost sites and important foraging areas would be minimized. Additionally, boating near critical eagle foraging areas during peak feeding times would be minimized (usually early to mid-morning and late afternoon), except where eagles have demonstrated tolerance to such activity.

Use of Lead Ammunition

Lethal take of cormorants as a damage management measure has involved the use of lead ammunition. There are general concerns from the public with regard to risks to non-target species from the use of lead ammunition in rifles and pellet guns. There are also public concerns about the impact of deposits of lead ammunition on soil and water quality when firearms are used to lethally take cormorants. Due to these concerns, this section of the EA provides a general overview of existing use of lead ammunition and analyzes the associated risks of using lead in the lethal take of cormorants (Chapter 5 analyzes the effects of lead on cormorants and the environment based on the Proposed Action and the Preferred Action Alternative).

The USFWS conducted extensive review of the impact of lead shot used for waterfowl hunting (USFWS 1986) and concluded that the use of shot could have substantial impacts on waterfowl and predators/scavengers of waterfowl, primarily through the consumption of lead shot. Consistent with that determination, the USFWS Migratory Bird Permit Program has subsequently implemented the requirement to use non-toxic shot as defined under 50 C.F.R. 20.21(j) as part of the standard conditions of depredation permits issued pursuant to the MBTA for the lethal take of birds under 50 C.F.R. § 21.41. The USFWS also prohibits the use of lead ammunition in shotguns used to remove or disperse migratory birds for damage management, and lead shot is not used for cormorant damage management.

In many areas, shotguns are the primary or only firearm used to take cormorants for damage management. In some circumstances, use of shotguns is undesirable because of the need to minimize risks to nearby non-target species either through reduction of noise from firearms or through precise shot placement (i.e., when shooting in mixed species colonies), and for safety reasons when shooting must be conducted near structures or other areas used by people. In these cases, agencies (APHIS/WS, state and tribal wildlife management agencies) have been authorized to use rifles (0.22 caliber rimfire, 0.22-250 caliber centerfire) and 0.17, 0.20, and 0.22 caliber pellet rifles in some situations when precise shot placement or noise reduction are a priority. Rifles used by agency and tribal personnel may use lead ammunition.

Virtually all cormorant damage management conducted by the APHIS/WS program in Ohio and New York is for damage management in mixed species colonies and the programs report exclusive use of rifles and pellet rifles for cormorant removal. The APHIS/WS program in Florida primarily conducts cormorant damage management actions for the protection of human health and safety and property with a high proportion of birds taken through use of pellet rifles (approximately 80% of all cormorants taken). Using state estimates of the proportion of all cormorants taken using lead ammunition, and APHIS/WS annual program data reports for fiscal years 2011-2015 when the depredation orders were in place, APHIS/WS' take of cormorants with lead ammunition in rifles or pellet guns averaged approximately 4,500 cormorants per year. This is likely an overestimate, however, because when state directors provided a range for take with lead ammunition, the upper end of the range was used in the calculation.

Additionally, the types of actions described above involving use of lead ammunition in rifles are conducted by agency personnel who must meet high firearms proficiency standards. For example, APHIS/WS personnel are required to attend an approved National Rifle Association firearms safety and handling training program before using a firearm in an official capacity and to attend a refresher course annually (USDA 2016). While pass-through of the target may contribute to some environmental deposition of lead ammunition, the risk from missed shots is low.

4.6 Alternative Uses of Available Resources

Wildlife populations provide a range of social and economic benefits (Decker and Goff 1987). As indicated by comments received on past cormorant actions, members of the United States public often place high value on individual species of animals, especially people who enjoy coming in contact with or viewing wildlife within functioning ecosystems. Conversely, others may see the same species as a detriment to aesthetic values (e.g., droppings and damage to vegetation associated with large groups of cormorants). Preferences on wildlife conservation and the best ways to reduce conflicts/problems between humans and wildlife vary due to subjective values and lack of consensus about the best method to use for objective evaluation.

Recreational, non-consumptive use of cormorants for wildlife viewing is one part of their economic value and cultural importance. The large cormorant breeding colonies and associated colonial water birds such as gulls and American white pelicans can be a uniquely valued viewing opportunity for birding enthusiasts. The quality of the experience may be affected by shifts in the size of and location of colonies.

CHAPTER 5.0 EFFECTS OF THE PROPOSED ACTION AND THE PREFERED ALTERNATIVE

5.1 Introduction

This chapter describes the environmental consequences we predict from implementing the proposed action and the preferred alternative. These consequences are described as impacts or effects. This chapter is organized by resource category, with the discussion focused on the cumulative impacts resulting from all direct and reasonably foreseeable, indirect impacts. This chapter also identifies the existing mitigation measures associated with the proposed action.

Consistent with the CEQ regulations and Department of the Interior regulations implementing NEPA, we assessed the impacts of the proposed action based upon its significance, which considers context and intensity. The geographic scale includes 37 states and District of Columbia, and in part to the scale of each of three managed subpopulations (from the five populations identified above): the Atlantic Flyway, the Mississippi plus Central Flyways, and Florida. The temporal scope of the context for most resources is approximately 10 years, with the understanding that, given the changing nature of ecological and human systems, altered conditions and new information may persuade us to revisit the analysis, and perhaps modify decisions in the future.

5.2 Direct, Indirect, and Cumulative Effects of the Proposed Action on Cormorants

Maximum Allowable Take of Cormorants under the Proposed Action

USFWS developed PTL models to estimate the maximum allowable take of cormorants and the impact of various levels of lethal take on three cormorant subpopulations (Appendix 1). PTL models make use of population abundance and demographic information to estimate annual take levels that meet a management objective to ensure the long-term maintenance of a population. The minimum demographic information needed is an estimate of the maximum population growth potential. The cormorant population is maintained at current levels by limiting the annual harvest rate to less than one-half of the maximum population growth potential.

Three cormorant subpopulations were identified, from the five larger breeding populations, based on studies that used band recovery and satellite telemetry (Scherr et al. 2010, Guilliamet et al. 2011, Dorr et al. 2012b): the Atlantic Flyway, The Mississippi plus Central Flyways, and Florida (Table 4-1). PTL estimates were made for each of these subpopulations. Abundance estimates for each subpopulation were based on the most recent survey information (Table 5-1). The maximum population growth potential was estimated using a discrete logistic model and counts of nesting birds over 31 years from Lakes Erie, Huron, and Ontario (Appendix 1). Uncertainty in population size and growth were incorporated into the estimates of PTL for each subpopulation. In addition, the lower bound of the 60% confidence interval of the PTL estimate was used as the take limit. Take of an individual cormorant would count as 1 against the total allowable take, whereas oiling or destruction of a nest would count as 0.75 per adult against allowable take. The PTL models estimated that the annual maximum allowable take of 74,396 cormorants per year would maintain the cormorant populations considered in the proposed action. This is based on the combined Low PTL estimates of 26,226 cormorants in the Atlantic, 46,898 cormorants in the Mississippi/Central and 1,272 cormorants in Florida.

Table 5-1 PTL Low-High represents bounds of 60% confidence interval. The lower bound of PTL was used as the maximum allowable annual take level. The sum of the low PTL for the Atlantic and Miss./Central subtotals plus Florida equal the maximum allowable take.

Subspecies	PTL	
Region	Low	High
P. a. auritus		
Atlantic Flyway		
Atl. Canada and Quebec	16,152	26,824
Atlantic United States[1]	10,116	17,106
Atlantic Subtotal	26,226	43,846
Mississippi/ Central Flyway		
Canada	23,345	38,976
United States	21,962	36,789
Miss. /Cent. Subtotal	46,898	61,897
P. a. floridanus		
Florida[2]	1,272	3,211
Total	73,396	108,954

[1]does not include Florida.

[2]allowable take in Florida based only on population size of *P.a. floridanus*.

5.3 Direct, Indirect, and Cumulative Effects of the Anticipated Take on Cormorants for Aquaculture, Human Health and Safety, and Property

Aquaculture

Damage to aquaculture resources occurs primarily from the economic losses associated with cormorants consuming fish and other commercially raised aquatic organisms. Damage can also result from the death of fish and other aquatic wildlife from injuries associated with cormorant predation as well as the threat of disease transmission from one impoundment to another or from one aquaculture facility to other facilities as cormorants move between sites. Aquaculture producers currently have the ability to use non-lethal methods to exclude, harass, and disperse cormorants without the need for a permit from the USFWS when those methods would not result in the take of cormorants. Although non-lethal methods can be effective at dispersing or preventing cormorants from accessing aquaculture stock (Mott et al. 1998, Reinhold and Sloan 1999, Glahn et al. 2000b), cormorants can habituate to the repeated use of non-lethal harassment methods (e.g., showing no response or limited movements) (Mott and Boyd 1995, Littauer et al. 1997, Mott et al. 1998).

Littauer et al. (1997) suggested that the use of limited lethal removal of cormorants might be necessary to reinforce fear in the remaining birds when non-lethal scaring programs become ineffective. The lethal removal of cormorants can enhance the effectiveness of non-lethal methods (Mastrangelo et al. 1995). Hess (1994) found that aquaculture producers only lethally removed 290 cormorants in over 3,000 person-hours of shooting and attributed the low rate of removal to cormorants learning to avoid areas where people were present. Hess (1994) further found that fewer cormorants attempted to use aquaculture ponds where aquaculture producers employed shooting.

Under the proposed action, aquaculture producers and APHIS/WS can apply for a depredation permit, allowing lethal methods when non-lethal methods become less effective at excluding and/or dispersing cormorants. We expect to authorize the take of an average of 19,871 cormorants per year for aquaculture purposes based on the average authorizations from 2004 to 2015 (Table 4-2). This take will be distributed among the subpopulations not to exceed the Low PTL estimate in each of the subpopulations (Table 5-1). The expected authorized take for aquaculture is below the maximum allowable take threshold as determined by the PTL and thus authorized take for aquaculture will not have a significant adverse effect on cormorants and will benefit aquaculture. Removing cormorants at or near aquaculture facilities will benefit aquaculture by reducing fish loss and injury and reducing the number of cormorants presents at facilities. This has an indirect benefit of decreasing risk of disease transmission between ponds, sites, etc.

As explained below in Section 5.5, we expect non-significant indirect impacts to non-target species from cormorant aquaculture-related control activities. Issuance of depredation permits for lethal take of cormorants, along with measures described in Section 5.5 already implemented by APHIS/WS and any additional site-specific measures deemed necessary by USFWS to minimize impacts to non-target species, would not result in significant impacts to the populations of non-target species or the environment. Any non-target species taken are negligible and would not have population level effects to the non-target species. Thus, aquaculture control actions at the allowable take of 51,571 cormorants per year, as specified in the reduced take alternative, would not have significant cumulative effects to cormorants, nor significant cumulative effects to non-target species or the human environment.

Human Health and Safety

Depredation permits to address human health and safety have primarily been issued to airports, where there is a need to reduce the threat of bird-aircraft strikes to address human health and safety. A national ranking identified cormorants as the 8th most hazardous wildlife species to aircraft (DeVault et al. 2011), which is a direct threat to public safety. Additionally, when cormorants collide with aircrafts, significant damage to the airplane occurs. From 2004 to 2015, an average of 34 depredation permits per year for the take of cormorants at airports have been issued in the central and eastern United States, resulting in the average take of 293 cormorants per year.

The USFWS issues depredation permits to address water quality only when the control of cormorants are a direct source of water pollution (e.g., birds roosting over a water storage area). Annual take authorized for this application is less than that of at airports.

Similar to aquaculture facilities, non-lethal control methods to exclude, harass, and disperse cormorants can be employed to reduce the risk to human health and safety. When non-lethal methods are not completely effective for managing the risk to humans, depredation permits are authorized to manage cormorants for human health and safety under this proposed action. The low number of birds that are authorized annually for human health and safety concerns would not exceed the maximum allowable take threshold as determined by the PTL and allocated to each subpopulation. Therefore, we find that including the authorization of take for human health and safety reasons within the proposed action will have a benefit to reducing risk to human health and safety issues and will not have a significant adverse effect on cormorant populations covered by the proposed action, nor the human environment.

Property

Cormorants use infrastructure and vegetation for breeding, roosting and loafing. The use of these structures can have negative effects through the degradation of the structure or through damage to the surrounding habitat. As with both aquaculture and human health and safety concerns, non-lethal management of cormorants may not completely resolve the issue. Under the proposed action, the USFWS can grant a depredation permit that allows lethal methods when non-lethal methods become less effective at excluding and/or dispersing cormorants. The proposed action would allow the authorization of cormorant take to protect property. Based on average annual take between 2004 and 2015 under the PRDO and individual cormorant depredation permits, excluding take of free-swimming fish, we expect to authorize the take of 21,993 cormorants per year to protect property. The expected authorized take is below the maximum allowable level, as allocated to each subpopulation, as established by the PTL and thus, we find that including the authorization of take to prevent damage to property will not have a significant negative impact to cormorant populations within the scope of the proposed action. The proposed action is a benefit for reducing damage to property by reducing the number of cormorants using the human-modified structures (i.e., roosting and nesting on infrastructure).

As explained below in Section 5.5, we expect non-significant indirect impacts to non-target species from cormorant property control activities. Issuance of depredation permits for lethal take of cormorants, along with measures described in Section 5.5 already implemented by APHIS/WS and any additional site-specific measures deemed necessary by USFWS to minimize impacts to non-target species, would not result in significant impacts to the populations of non-target species or the environment. Any non-target species taken are negligible and would not have population level effects to the non-target species. Thus, property control actions at the allowable take threshold of 51,571 cormorants per year, as specified in the reduced take threshold alternative, would not have significant cumulative effects to cormorants, nor significant cumulative effects to non-target species or the human environment.

Monitoring of Effects

Monitoring is essential to the management of any bird population. Standardized surveys provide important information required to assess population health, distribution, and trends. The proposed action allows for the authorization of take of cormorants up to a maximum allowable threshold resulting in overall maintained cormorant populations. Monitoring is essential to assess population status and trends upon the implementation of the proposed action. Coordinated monitoring in the United States portion of the Great Lakes occurs every few years, and along the Atlantic Coast about every 5 years. Monitoring in the remainder of the United States and in Canada is irregular. The PTL used a conservative approach to account for some of population data uncertainty. However in order to potentially use less conservative PTL parameters, increased survey coverage will be required to improve the accuracy of the PTL.

Tracking the authorized take under the proposed action and the preferred alternative is also required to ensure the authorized take does not exceed the maximum allowable threshold. The USFWS tracks permit authorizations in the USFWS Permits Information Tracking System (SPITS). Using SPITS, the USFWS can monitor permit authorizations for take of cormorants under the proposed action. Regular data queries allow the USFWS to determine if the maximum allowable take threshold is being approached and coordinate among regions to ensure that authorized take does not exceed the threshold. To address PTL model uncertainty and ensure that authorized take is not having a significant effect on cormorant populations, the USFWS will assess cormorant survey data and update the PTL at least every 10 years using data acquired from SPITS. After a case-by-case review of the site-specific conditions, the USFWS may add conditions to the permit to minimize unintended impacts to cormorant populations (50 C.F.R. § 13.21 (e)(1)).

5.4 Reduced Take Alternative (Preferred Alternative)

Per CEQ regulations (40 C.F.R. § 1508.25(b)(3)) and Department of Interior regulations at 43 C.F.R. § 46.130(b), the USFWS has discretion to limit the proposed action with additional constraints. This alternative limits take to that of the expected take, which is well below the take that would be authorized by the PTL model. The USFWS has an obligation to maintain cormorant populations, while managing cormorant damage to the activities covered under the scope of this EA. Taking a precautionary approach to cormorant management, the USFWS is considering the implementation of a lower allowable take that is even more conservative than the PTL model. Under this alternative, the USFWS would limit the maximum allowable take to 51,571 cormorants per year. This number is based on the estimated take of cormorants and reasonably foreseeable effects. Specifically, the expected take of cormorants (51,571) is based on the average annual take from 2010-2015 authorized in depredation permits (996), the AQDO (17,831), the PRDO (27,434) and nest equivalent (8,756 cormorants) minus the take reported for free-swimming fish (11,446). Under this alternative, the USFWS would restrict subpopulation take allowances to: Atlantic (11,634 cormorants per year), Mississippi/Central (39,726 cormorants per year) and Florida (211 cormorants per year) based on subpopulation estimates (Table 5-2).

As a result, the take associated with the various control activities—aquaculture and property protection, would likely be reduced, so cumulative impacts to cormorants would be reduced. Likewise, indirect and cumulative impacts to non-target species and the environment (e.g., lead deposition) would be reduced with this lower take threshold.

Conclusions

Issuance of permits to manage cormorant damage is a benefit to aquaculture, protects people, and alleviates damage to property. Based on the PTL analysis, managing take at the levels projected for the proposed action would maintain current cormorant populations. Managing take at or below the PTL results in subpopulations that can recover from adverse environmental conditions or accidental overharvest. The PTL was set to be conservative to guard against uncertainty in subpopulation dynamics and guard against overharvest. Localized impacts to cormorant populations are evaluated during the permit application evaluation process, if appropriate.

Between 2004 and 2015, the average authorized take was 53,477 cormorants per year. The USFWS does not foresee any additional take other than what is authorized under the proposed action and as described in the affected environment (i.e., take authorized under 50 C.F.R. § 21.23 and 21.41). We expect an additional 377 cormorants per year to be taken (from the two larger subpopulations) for the purposes of 50 C.F.R. § 21.23 permits, an amount that is *de minimis*. Although, these types of permits are not included in the PTL model assessed in this EA, this level of authorized take would not impact cormorant populations. Given that the PRDO and AQDO are no longer available as a method for authorizing take, we expect the average annual take authorization to decline by 1,906 cormorants per year. We expect authorized take to be 51,571 cormorants per year (Table 5-2), based on current populations and conditions (2010-2015). This level of take authorized by the preferred alternative is considerably lower than the PTL model's lowest allowable take estimate of 74,396 cormorants per year and thus would not impact cormorant populations. Therefore, we find that based on the current levels of take authorized (as described in chapter 4), all reasonable foreseeable effects, additional constraints (implementing a more conservative take threshold that aligns with estimated take), and the proposed action; the expected take under the proposed action and the reduced take alternative will not have a significant adverse effect on cormorant populations or the environment. Both the proposed action and the reduced take alternative would meet the need of the USFWS to make timely decisions on depredation permit applications for the take of cormorants at or near aquaculture facilities, in cases of human health and safety, for the protection of ESA listed species, and to alleviate damage to property while maintaining cormorant populations. The preferred alternative allows the USFWS to implement an even more conservative approach to managing overall take of cormorants through issuance of depredation permits. Using an adaptive management approach, the USFWS may consider transitioning from the preferred alternative to the proposed action using the lower PTL limit, as additional cormorant data becomes available. Based on the analysis contained in Chapter 5, reducing allowable take to below the lower PTL limit is considered safe and maintains current cormorant populations.

Table 5-2. Expected take (E[T]) of cormorants. Expected values based on average annual take 2010-2015. Minimum and maximum values are based on observed smallest and largest take among years.

	Estimated Take		
Subpopulation	E[T]	Min.	Max.
Atlantic	11,634	3,953	16,429
Miss./Cent.	39,726	36,394	43,454
Florida	211	64	368
Total	51,571		

5.5 Direct, Indirect, and Cumulative Effects of the Proposed Action and the Preferred Alternative on Non-target Species

Benefits to Non-target Species from Issuance of Depredation Permits for Cormorants

Cormorants can have negative impacts on co-nesting and non-target species through habitat destruction, nest take-over, reduction of available nesting space, and reduction of productivity via agonistic behavior. Cormorants also impact vegetation through physical and chemical means and, over time, often kill the shrubs and trees where they nest and roost. Issuance of depredation permits for lethal take of cormorants would therefore be beneficial to several non-target species and vegetation.

For example, following the implementation of cormorant damage management in New York, common terns returned to nest on an island on Oneida Lake, and by 2009 produced 324 nests

(Cranker and Cranker 2009). In addition, population declines of black-crowned night-herons on Lake Ontario were reversed and the great blue heron population at Canastota stabilized. After six years of cormorant control, great blue herons, great egrets, and black-crowned night-herons began nesting on Strawberry Island along the Niagara River (NYSDEC 2012).

In Minnesota, state and tribal agencies have implemented both lethal and non-lethal control measures to protect common tern habitat from nesting cormorants. These measures have been largely unsuccessful in encouraging common terns to continue nesting, however, in 2007 Caspian terns nested at Pelican Island in Leech Lake for the first time in recorded history, and have continued to increase since then (Mortensen 2012).

In Ohio, management agencies have managed each of the state's five known cormorant colonies since 2006 with the management goal of maintaining cormorant breeding pairs at a level that will allow the maintenance of habitat for other co-nesting species such as great blue herons, state-listed black-crowned night-herons, great egrets, and cattle egrets as well as rare plant communities. West Sister Island, a National Wildlife Refuge and Wilderness Area, is host to one of the largest wading bird nesting colonies (e.g., great blue herons, great egret, and black-crowned night heron) in the United States portion of the Great Lakes. While nest counts for these species have varied through time, in general nest numbers have increased or stabilized since 2006 when the most intensive cormorant control operations were conducted on this island. Great egrets and great blue herons have also shown a gradual increase in nest numbers on Green Island and Turning Point Island since cormorant management was implemented and black-crowned night herons have remained stable at these sites. While vegetation surveys conducted on West Sister have not shown a statistically significant difference in vegetation diversity of the understory pre- and post-cormorant management, picture documentation shows clear vegetation regeneration Island-wide following the implementation of cormorant management (USDA 2013).

Cumulatively, projected shifts in the distribution of most breeding and wintering bird species due to climate change, including cormorants, may also lead to redistribution of impacts to habitat. This Mixedwood Plains ecozone of Canada, in which the Carolinian vegetation zone lies, is expected to experience an increased threat from extreme weather (e.g., increased frequency and intensity of severe windstorms), and may see a slight increase in impacts from biotic disturbance (Johnston et al. 2010). This may interact synergistically to marginally increase the severity of cormorant impacts to habitat. The issuance of depredation permits for the lethal take of cormorants would likely benefit many non-target species of migratory birds and minimize the destruction of vegetation within the localized area authorized under the conditions of the permit.

Impacts to Non-target Species from Issuance of Depredation Permits for Cormorants

While the issuance of depredation permits for cormorants would likely benefit many non-target species and vegetation, there is also the potential for cormorant damage management actions under depredation permit conditions to directly impact some non-target species. For example, cormorant control measures can directly impact co-nesting and non-target species by a number of avenues, including, but not limited to, inadvertently treading on nests and take of non-target species. Cormorant damage management activities may also inadvertently cause disturbance of co-nesting colonial waterbirds; if adults are startled from the nest for too long or at the wrong time of day, there is the potential for increased mortality rates for eggs and chicks. Concerns have also been raised that a non-target bird could be unintentionally shot or injured in a live-capture device, or disturbed to the point it abandons its nest.

Take of Non-target Species

In mixed species flocks, there is also a risk that ammunition may pass through a cormorant and strike a nearby non-target bird or that shot may strike a non-target bird near a target cormorant. APHIS/WS records all take of target and non-target species in its Management Information System (MIS) database. Records show that there have been some instances of direct mortality of other bird species as a result of cormorant control activities. They include: two instances of Neotropic cormorants being taken during cormorant control activities in Mississippi in 2007 and 2008, one ring-billed gull injured and subsequently euthanized in Vermont in 2004, two ring-billed gulls shot in New York in 2006 and 2009 and one during 2010, and one American white pelican and one great egret accidentally shot in Wisconsin in 2009. Take of gulls, the pelican and the egret were associated with ammunition pass through and risks of shot to nearby birds, particularly in moving flocks of gulls and cormorants. Agencies continually work to train staff on safe, effective and selective use of firearms to reduce risks to non-target species from this type of take. These incidents are extremely low relative to the number of cormorants which are shot, and are not of sufficient magnitude or frequency to adversely impact non-target species populations.

There is also a concern that species with similar appearance to cormorants will be inadvertently taken during the implementation of the depredation permit conditions (e.g., Neotropic cormorant, great cormorant). Records from APHIS/WS MIS database indicate that for the 10-year period of fiscal years 2007-2016, only two Neotropic cormorants, and no great cormorants or anhingas were taken inadvertently. Populations of Neotropic and great cormorants in North America are also increasing (Telfair and Morrison 2005, Hatch et al. 2000). Due to the extremely low report of take of these species, and the relatively limited overlap between the areas used by these species and the areas where conflicts with cormorants are most likely (e.g., Great Lakes, inland aquaculture facilities in the south), the risks of mistakenly taking a Neotropic cormorant or a great cormorant are low, and impacts to the overall populations of these two species would not occur.

Disturbance to Non-target Species

Human activity at a cormorant colony during implementation of depredation permit conditions may result in adult waterbirds leaving their active nests. This may place eggs and young at risk when adults are away from the nests, especially early in the season when they are most in need of thermal protection. However, this human disturbance would likely be brief and waterbirds would likely return to their nests after a short period of time. Evidence of this can be shown by the Ohio Division of Wildlife, which conducted a study in which observers recorded disturbance behavior (or lack thereof) of co-nesting species during control efforts that were conducted in 2008 (Sherman 2008, unpublished report). Data from the observers showed that approximately 60% of the observed waterbirds tended to avoid leaving their nests during cormorant removal. When they did leave, however, they were only away for an average of 8 minutes.

When waterbirds do leave their nest during cormorant damage management activities, there is a concern that gulls may take the opportunity to prey upon non-target species' eggs and chicks within nests. Gulls, particularly ring-billed gulls, are known predators of eggs and chicks of other bird species. Human activity within a cormorant colony may therefore increase the vulnerability of eggs and chicks to gull predation (Ellison and Cleary 1978, Duerr et al. 2007, Dorr et al. 2014). Duerr et al. (2007) were able to greatly reduce egg predation by oiling eggs at night when gulls did not depredate nests, however, nighttime access to colonies may be precluded by logistical and safety concerns or concerns pertaining to impacts on co-nesting species.

Although population declines of black-crowned night-herons have been shown to improve after cormorant control (NYSDEC 2012), black-crowned night herons do show sensitivity to human activity during cormorant damage activities. Specifically, in locations in the Great Lakes, alleviation of cormorant impacts to black-crowned night-herons has been cited as a primary reason for cormorant management. However, as may occur with all migratory bird permits, after a case-by-case review of the site-specific conditions, the USFWS may add conditions to the permit to minimize unintended impacts to non-target species (50 C.F.R. § 13.21 (e)(1)). Special permit conditions that may be considered for protection of non-target species, as appropriate to the needs of the species and site-specific conditions would include but not be limited to conducting actions during an optimal time and/or frequency in the nesting season to reduce impacts to black-crowned night-herons.

Lead Ammunition

As stated in chapter 4, there are general indirect risks to non-target species from the use of lead ammunition in rifles and pellet guns. Bald and golden eagles and other scavenger species may consume carcasses of cormorants killed using lead ammunition. In addition, birds seeking grit for their crop may also consume pellets or bullet fragments that may be in soil. There are also public concerns about the impact of deposits of lead ammunition on soil and water quality when firearms are used to lethally take cormorants.

While non-lead ammunition is available in many calibers, their suitability and accuracy in all firearms is not universally equal to lead ammunition. Suitable ammunition is not always readily available, and its use is frequently prioritized in areas such as condor habitat, where it is specifically required. Because an integrated management approach needs to be able to adjust to changing circumstances on the ground (e.g., modification of state regulations, consultation under ESA, or new technologies), requirements for type of ammunition, when appropriate, are generally determined based upon site-specific conditions.

However, the use of lead ammunition in rifles is relatively low relative to all cormorant damage management, and carcasses of cormorants taken for depredation management would be collected and disposed of through burial (includes composting), incineration, donation for use in research, educational projects or for use by Native American Tribes so lead is not accessible to scavengers. Although the agencies are unable to recover all carcasses (e.g., some birds shot over water and some birds shot in tree nests or in heavy vegetation), the majority of all birds taken are recovered and the methods of disposal generally render the bird inaccessible to scavengers. When composting is used it must include provisions for preventing scavengers from accessing the carcasses (e.g., physical barriers for mammalian scavengers, burial in compost material to prevent detection by birds). Practices including deep burial and burial in landfills also help to ensure that recovered carcasses are not available to scavengers.

In most cases where burial is used for carcass disposal, birds are taken to a commercial landfill approved for animal disposal. These landfills are strictly regulated by the EPA and local authorities and environmental risks are mitigated by the landfill operator. Landfill operators are required to collect and treat leachate to protect groundwater, cover waste to protect air quality and reduce scavenging, and implement other measures to protect other environmental resources and minimize risks to public health. Environmental risks from carcass disposal in commercial landfills are likely to be very low.

Carcasses may also be buried on site or in a nearby location. Cultural resource laws (e.g., National Historic Preservation Act, Native American Graves and Repatriation Act), endangered species/critical habitat considerations, and uses, climate, soil type and depth, vegetation and proximity to ground and surface water must be considered when selecting burial sites. Compliance with applicable regulations pertaining to on-site burial is the responsibility of the permittee and is an existing standard requirement of depredation permits.

With regards to the risk of spent ammunition from rifles and lead accumulating in soil and water, the risk is substantially less than with shot. Deposit of lead into soil could occur if, during the use of a firearm, the projectile passes through a target, if misses occur, if the carcass was not retrieved, or if the carcass was buried outside of a landfill. Use of rifles is an exception to usual permit requirements and would generally only be used by agency and tribal personnel who must meet high firearms proficiency standards. Use of trained personnel reduces the likelihood of missed shots and associated deposits of spent ammunition in soil. Rifles are used when shooting in mixed species colonies and on land when needed for safety considerations.

In addition, rifles are also not used when shooting birds over water and risks of water contamination with spent ammunition from rifles is very low. Stansley et al. (1992) studied lead levels in water that was subjected directly to high concentrations of lead shot accumulation because of intensive target shooting at several shooting ranges. The study indicated that even when lead shot was highly accumulated in areas with permanent water bodies present, the lead did not necessarily cause elevated lead levels in water further downstream. Further, Craig et al. (1999) reported that lead levels in water draining away from a shooting range with high accumulations of lead bullets in the soil around bullet impact areas were far below the “action level” of 15 parts per billion as defined by the Environmental Protection Agency (EPA) (i.e., requiring action to treat the water to remove lead). The study found that the transport of lead from bullets or shot distributed across the landscape was reduced once the bullets and shot formed crusty lead oxide deposits on their surfaces, which served to reduce naturally the potential for ground or surface water contamination (Craig et al. 1999). Those studies suggest that, given the very low amount of lead being deposited and the concentrations that would occur from activities conducted by agencies and tribes to reduce cormorant damage using rifles would be minimal to nonexistent.

Federally-listed species and Eagles

An Intra-USFWS ESA Section 7 Biological Evaluation and Consultation was conducted to determine if the proposed action adversely affects any proposed, threatened, or endangered species or associated critical habitat (Appendix 4). The USFWS determined that the proposed action, which includes required special permit conditions for specific sensitive species, piping plover, interior least tern, bald eagle, golden eagle, and wood stork, will not adversely affect these species. Conservation measures were developed and added to the proposed action in order to protect these specific listed and sensitive species and will accompany any permit issued as appropriate. The specific permitting conditions for the federally listed species listed above are described chapter 4. These include measures and buffers around control activities such as discharge and use of firearms, egg oiling, CO_2 asphyxiation, egg destruction, or nest destruction, and considerations for control activities that may affect areas designated as piping plover critical habitat in the Great Lakes Region.

More specifically, cormorant control activities will be conducted greater than 500 feet from active piping plover, interior least tern, or wood stork nests or colonies. Given these permit conditions prevent the proposed action from adversely affecting these federally listed species, we find there would be no effect from the issuance of depredation permits for the lethal take of cormorants. All other sensitive species or associated critical habitat may be affected but not adversely affected due to dissimilarities in appearance (so will not be at risk of being taken by mistake), because a different habitat is utilized, or because the limited geographic range of sensitive species is not where cormorants will occur or be taken (Appendix 4).

Depredation permits issued to lethally take cormorants would also adhere to the National Bald Eagle Management Guidelines to ensure that cormorant damage management activities do not impact this species. As stated in chapter 4, protection measures specific to activities involving off-road vehicles, motorized watercraft use, recreation and human entry, discharge or use of firearms, and avoidance measures at foraging areas and communal roosts would help prevent the proposed action from impacting bald eagles.

Conclusions

APHIS/WS implements many standards in addition to the standard USFWS permit conditions to minimize risks to nesting waterbirds and non-target species. These include: “no entry” zones, maintaining a buffer distance around nesting colonies, shooting cormorants in some cases at sites away from a nesting island, oiling cormorant eggs, walking to and from blinds from which shooting will occur during night hours (where appropriate and safe), and ensuring that field personnel can distinguish different types of birds and their eggs.

The damage management standards that APHIS/WS implements also minimize indirect impacts to non-target species. Additional measures developed specifically to minimize indirect take include: using suppressed firearms to minimize noise disturbance, suspending harassment or control activities during critical nesting periods (e.g., for common terns), avoiding activities during severe temperature extremes and heavy precipitation, minimizing the number and duration of visits to cormorant colonies, removing cormorant carcasses in a manner that minimizes disturbance to co-nesters, wearing camouflage clothing, and moving slowly through nesting areas.

With regard to the use of lead ammunition, the risks of impacts from use of rifles for cormorant damage management actions would be relatively low. Non-toxic shot would continue to be used when shotguns are utilized. The majority of cormorants taken are collected and disposed of through burial (includes composting), incineration, donation for use in research, educational projects, or for use by Native American Tribes, preventing lead from being left in the environment and reducing the risks that bald or golden eagles or other scavenger species would access cormorants taken with lead ammunition. As stated above, after a case-by-case review of the site-specific conditions, the USFWS may add conditions to the permit to minimize unintended impacts to non-target species (50 C.F.R. § 13.21 (e)(1)). For activities using non-shotgun firearms for cormorant control, permit conditions may be considered for protection of non-target species such as eagles, as appropriate to the needs of the species and site-specific conditions.

Given that specific permit conditions for federally listed species would prevent the proposed action from adversely affecting these species, we find there would be no significant effect from the issuance of depredation permits for the lethal take of cormorants. In addition, depredation permits issued to lethally take cormorants would also adhere to the National Bald Eagle Management Guidelines to ensure that cormorant damage management activities do not impact this species.

Issuance of depredation permits for lethal take of cormorants, along with these measures already implemented by APHIS/WS and any additional site-specific measures deemed necessary by USFWS to minimize impacts to non-target species, would not result in significant impacts to the populations of non-target species. The additional constraint lowering the allowable take threshold to 51,571 cormorants per year would result in less authorized take of cormorants, and would therefore also not result in significant impacts to the populations of non-target species, either directly through accidental take or indirectly through lead ammunition deposition.

5.6 Alternative Uses of the Available Resource

The proposed action and preferred alternative would authorize the take of cormorants from the environment. While those applicants that are experiencing damage from cormorants and thus apply for a depredation permit would be in favor of take, there are people that oppose it. Among those who might be in opposition include birdwatchers who seek to enjoy birds within the natural environment and those that are generally opposed to the killing of animals.

Perceptions of the ethics of a wildlife damage management can vary widely among individuals depending on their individual values and relationships with cormorants and the resources impacted by cormorants. Advocates of an animal rights philosophy and individuals with a more biocentric perspective that considers hardship to any living creature as something to be avoided would consider the proposed action unethical because it involves the use of lethal methods (Haider and Jax 2007). There may be public concern relative to the humaneness of the take of cormorants. Shooting and egg oiling, often a public concern relative to the humaneness, will be the primary lethal methods used to address damage by cormorants. The AVMA states "... euthanasia is the act of inducing humane death in an animal" and "...that if an animal's life is to be taken, it is done with the highest degree of respect, and with an emphasis on making the death as painless and distress free as possible" (AVMA 2013). Additionally, euthanasia methods "should minimize any stress and anxiety experienced by the animal prior to unconsciousness." As noted in chapter 4, when working under field conditions, shooting, as conducted by trained personnel, can be the most humane method available when an animal is taken. Many individuals see egg oiling as being more humane than shooting.

Some individuals primarily concerned about animal welfare may consider the proposed action and the reduced take alternative to be acceptable because of the overall reduction in take of cormorants (compared to previous years) and because of the greater scrutiny given to each proposed use of lethal methods through the permitting process. Overall, we find that some segments of the public may oppose the proposed action. Using a maximum allowable take limitation and implementing the most humane methods for taking cormorants, we believe that neither the proposed action nor the reduced take alternative will significantly affect individuals who seek alternative uses of the resource; however, opposition to the authorization of take is unavoidable.

Conclusions

Neither the proposed action nor the reduced take alternative have a significant effect on individuals who wish to watch cormorants in the natural environment because the proposed action ensures that cormorant populations will be maintained. The proposed action will have no effect on the distribution of cormorants and thus cormorants will be available within the natural environment across the landscape for birdwatchers and others seeking to enjoy them. Moreover, the additional constraint of the reduced take alternative lowers the allowable take to 51,571 cormorants per year would result in less authorized take of cormorants. Thus cormorants also will be available within the natural environment across the landscape under the preferred alternative.

CHAPTER 6 LIST OF PERSONS CONSULTED, EARLY COLLABORATION, AND STAKEHOLDER ENGAGEMENT

During the development of this EA, the USFWS met and discussed cormorant management with a number of government and non-government stakeholders. The USDA Animal, Plant Health and Inspection Service, Wildlife Services (APHIS/WS) was a consulting agency and provided invaluable assistance on the development of this EA. APHIS/WS is the agency responsible for handling human/wildlife conflicts and provided information regarding methods for taking cormorants and the potential impacts to both cormorants and non-target species.

USFWS frequently met with Congress (both the House and Senate), especially those from states that fall within the scope of this EA. During national Flyway Council meetings, USFWS met and discussed cormorant management with representatives from the four Flyway Councils, and State representatives. During these meetings, USFWS gathered information and explained the approach outlined in this EA.

At the annual Association of Fish and Wildlife Agencies, USFWS leadership met with the Bird Conservation Committee, Human Wildlife Conflict Working Group, Partners in Flight/Shorebird/Waterbird Working Group, and the Fisheries and Water Resources Policy group. Representatives from State, Federal, and Non-government agency conservation groups attend these committees and provide insights and opinions on how the USFWS manages bird populations.

In addition to government and conservation stakeholders, the USFWS has met on multiple occasions with industry groups such as Catfish Farmers of America Association and individual fish producers. These groups expressed both concern over cormorant damage to their industry and the need for the USFWS to resume the timely processing of depredation permits for cormorants.

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Appendix 1: Assessment of Double-crested Cormorant Take.

Potential biological removal (PBR) models were used to estimate the impact of take on the double-crested cormorant population. Wade (1998) developed PBR models to determine the effect of various levels of take had on marine mammals. Runge et al. (2004) extended the work of Wade (1998), explicitly tying the models to harvest theory, describing them as potential take level (PTL) models. The simplest form of the model is:

$$PTL = N_{min} \frac{r_{max}}{2} F_O,$$

where N_{min} is the minimum known population size, r_{max} is the maximum population growth rate, and F_0 is the management or recovery factor. Estimation of PTL should account for uncertainty in population size and population growth rate, if known. The PTL framework has been used as a tool to manage take of cormorants in the past (USFWS 2009), in addition to other nongame species (Runge et al. 2009, Johnson et al. 2012). The following paragraphs detail the data and assumptions used to estimate PTL for cormorants.

N_{min}. For this analysis, USFWS Regions 3, 4, and 5 are the area of primary concern for managing cormorants in this analysis. The western states that border this area in Regions 2 and 6 were also considered because they have breeding cormorants that are considered part of the population of interest or are likely to have depredation permit requests that need to be considered (Texas, Oklahoma, Kansas, Missouri, Iowa, Nebraska, South Dakota, and North Dakota). Two subspecies of double-crested cormorant occur in this area: *P. a. floridanus* which is resident in Florida and the Caribbean; and *P. a. auritus*, which occurs over the remaining area and into Canada (Dorr et al. 2014). Because it is a different subspecies and occurs only in a small part of the overall range of concern, the PTL was estimated separately for the Florida subspecies.

We subdivided *P.a. auritus* into two subpopulations for assessment: Atlantic Flyway (CT, DC, DE, GA, MA, MD, ME, NC, NH, NJ, NY, PA, RI, SC, VA, VT, WV) and Mississippi plus Central Flyway (AL, AR, IA, IL, IN, KS, KY, LA, MI, MN, MO, MS, NE, ND, OH, OK, SD, TN, TX, WI). A number of studies using satellite telemetry and band-recovery indicate cormorants generally follow migratory pathways that conform to the Flyways (Dolbeer 1991, Scherr et al. 2010, Guilliamet et al. 2011, Dorr et al. 2012, Chastant et al. 2014). For the two *P.a. auritus* subpopulations a minimum population size was estimated for each for use in PTL calculations (Table 5-1). The range of N_{min} estimates represents high and low observations over a number of years from individual states and provinces (Table A-1), or uncertainty in point estimates provided by surveyors. The *P. a. floridanus* subspecies breeds in Florida and the Caribbean and is considered non-migratory (Dorr et al. 2014). The breeding population size of this subspecies in Florida is much smaller than that of *P.a. auritus* (Table 5-1). However, in Florida the two subspecies intermix during winter and are indistinguishable. Therefore, a separate PTL analysis was done for the entire state of Florida. Individuals killed during the breeding season in Florida should be considered the *floridanus* subspecies, and birds killed during winter would be of unknown subspecies. A conservative approach to the PTL analysis was used for *floridanus* (the lower F_0 of 0.50 to account for potential winter take, see below discussion on F_0): the size of *P.a. floridanus* breeding population was used as $N_{\min}$.

The PTL assessment requires $N_{\min}$ to be expressed as the number of individuals, yet nearly all counts of cormorants in the literature are expressed as number of nests. Cormorant census data comes from nest counts conducted in the United States and Canada. The numeric range in counts represents high-low years, or best guess by state and provincial biologists. Counts are likely an underestimate of breeding population because of nest failure and re-nesting not captured by surveyors, missed colonies, and nest detection <1 at surveyed colonies. Nest counts do not survey non-breeding birds, i.e., young of year, 2 year olds, and some proportion of adults. It is thought that the proportion of adults that do attempt to breed is high (Dorr et al. 2014).

Dorr et al. (2016) collected data on reproductive condition in a single year in Michigan, Minnesota, and Vermont (n=358 females); 22.1% of birds in feeding flocks were estimated to be non-reproductive. Given a count of nests (C) the pre-breeding multiplier (PBM) is estimated as:

$$PBM = {}^{C}\!/_{(C \times 2 + C \times 2 \times 0.221)} = 2.442$$

It is important to keep in mind that the resultant estimate of population size (N) is a pre-breeding estimate: $N=PBM*C$.

An alternative method to estimate the expansion factor for estimating the total population is by using a projection matrix approach, estimating a stable age distribution in the population given demographic parameters, then calculating the proportion of pre-adult birds. This approach assumes that all adult cormorants breed and no pre-adult cormorants breed. This approach can be used to estimate a pre- or post-breeding number of cormorants. For a post-breeding census we can parameterize the Leslie matrix:

$$\begin{bmatrix} N_{HY}(t+1) \\ N_{SY}(t+1) \\ N_{ASY}(t+1) \end{bmatrix} = \begin{bmatrix} 0 & 0 & S_{ASY}b \\ S_{HY} & 0 & 0 \\ 0 & S_{SY} & ASY \end{bmatrix} \times \begin{bmatrix} N_{HY}(t) \\ N_{SY}(t) \\ N_{ASY}(t) \end{bmatrix}$$

where *b* is annual fecundity, and *S* is annual survival by age-class (HY = Hatch Year, SY = Second Year, and ASY = After Second Year). A pre-breeding Leslie matrix could be:

$$\begin{bmatrix} N_{SY}(t+1) \\ N_{ASY}(t+1) \end{bmatrix} = \begin{bmatrix} 0 & S_{HY}b \\ S_{SY} & S_{ASY} \end{bmatrix} \times \begin{bmatrix} N_{SY}(t) \\ N_{ASY}(t) \end{bmatrix}$$

Seamans et al. (2012) estimated age-specific survival for the Great Lakes population of cormorants using capture-recovery data from 1979 to 2006 (S_{HY}=0.45, S_{SY}=0.84, and S_{ASY}=0.88). Seamans (unpublished data) estimated fecundity of cormorants at 0.36. Solving the stable age iteratively resulted in an age-class distribution for HY (0.217), SY (0.25) and ASY (0.685) for the post-breeding approach and *PBM*=2.92. Using the pre-breeding approach resulted in a stable age distribution of 0.138 and 0.862 for SY and ASY cormorants, respectively and *PBM*=2.32.

Neither the Dorr approach nor the matrix approach directly account for non-breeding adults. Dorr et al. did not identify the age (SY vs. ASY) of birds killed in feeding flocks. The matrix approach explicitly assumes that all ASY cormorants breed each year, which is not likely. Interestingly though, the two approaches resulted in a *PBM* estimates that were similar.

r_{max}. From 1979-2009, annual counts of breeding cormorants were available for three Great Lakes: Erie, Huron, and Ontario. Annual harvest data was also available during this time period. This subset of data was used to estimate r_{max}. Starting around 1979, the Great Lakes cormorant population experienced rapid growth, going from near zero breeding birds to over 200,000 (fig. A1-1). A discrete-time logistic population growth model was fit to the data to estimate r_{max}. The form of the logistic growth model was:

$$N_{t+1} = N_t + r_{max} N_t \left[1 - \frac{N_t}{K}\right] - H_t,$$

where N_t was number of breeding birds in year *t*, *K* was carrying capacity (estimated from the model), and H_t was total harvest in year *t*. The estimate of r_{max} and its uncertainty (r_{max}=0.3577, SE=0.0933, 95% CI 0.1666 to 0.5487) was used in PTL analyses for all subpopulations of cormorants.

F_0. The value to use for F_0 is dependent on management goals and is set between 0 and 2. If the goal is to have the largest population of cormorants possible then F_0 is set at or near 0, thus resulting in a population at or near its carrying capacity. As an example, an F_0 = 0.1 was recommended for whales which have special protections (Wade 1998). For many game species, F_0 is set at or near 1, which theoretically results in the maximum sustained annual harvest over time. If actual take occurs as prescribed when F_0 is 1, then the resultant population size should be at half of carrying capacity. An F_0 >1 might be chosen for abundant species if the goal is to reduce the population size.

Double-crested cormorants are not considered a sensitive species thus an F_0 ~ 0.1 is not required. Conversely, take should probably not be allowed to approach that of a game species because that would be (although unintended) managing for maximum yield over time, and would likely require increased annual monitoring to ensure over-harvest is not occurring. Thus, an F_0 = 0.75 was chosen for the *P.a. auritus* subpopulations (which accounts for cormorant take outside of the U.S., and tracks the trend for theses subpopulations). For *P.a. floridanus* an F_0 = 0.50 was chosen because the population is much smaller, more isolated, and fewer monitoring programs are in place to assess the effect of take on the subspecies.

Simulating PTL. A simulation approach was used to estimate PTL and its uncertainty. Uncertainty in PTL estimates came from sampling uncertainty distributions for key parameters. When a range of values was available to represent uncertainty in population size, we sampled from a uniform distribution bounded by the lower and upper ends of the range. This process accounted for uncertainty related to the pre-breeding multiplier, incomplete counts, counts completed in different years, etc. We also allowed for uncertainty related to the count or observation process; we included a multiplicative, random observation error, $\theta \sim Normal(0, \sigma_{obs}^2)$, with σ_{obs}^2 drawn from a uniform distribution between 0.1 and 0.2 (i.e., observation error produced a CV = 10 – 20%).

The magnitude of uncertainty was based on the observed CV in annual nest counts from Lakes Erie, Huron, and Ontario 1995 – 2009 (i.e., CV=16%). Population growth rate was sampled from a normal distribution with mean and SD based on results the estimation of r_{max} (above). The final model to assess allowable take of cormorants while accounting for uncertainty in population size, survey sampling error, observation error, and uncertainty related to population growth rate was:

$$N = Cexp(\theta)$$
$$C \sim Uniform(C_{low}, C_{high})$$
$$\theta \sim Normal(0, \sigma_{obs}^2)$$
$$\sigma_{obs} \sim Uniform(0.20, 0.40)$$
$$r_{max} \sim Normal(\mu_{r_{max}}, \sigma_{r_{max}}^2)$$

A simulation with 10,000 iterations from the model above was used to estimate PTL for each population. Package 'fitdistrplus' in Program R (R Core Team 2012) was used to execute the simulations.

Expected Take and Population Size. A discrete logistic growth model was used to project the impact the proposed action would have on the size of each cormorant subpopulation (*see* description of the logistic growth model under 'r_{max}' above). These impacts were then compared to the PTL and, for comparison, to cormorant population size and take during the period of the depredation orders from 2004-2015.

A number of parameter estimates had to be assumed or derived in order to use the discrete logistic model. The maximum population growth potential (r_{max}) estimated using data from Lakes Erie, Huron and Ontario (r_{max}=0.3577) was used in the discrete logistic growth model for each subpopulation. It was assumed that cormorant subpopulation sizes (Table 5-1) were at equilibrium with the average annual take over the last 5 years (2011-2015) when the depredation orders were in effect. The annual harvest rate (h) at the observed equilibrium could then be estimated as the average annual take in each subpopulation over the past 5 years divided by the average population size of each subpopulation; h=0.112 for the Atlantic; 0.092 for the Mississippi plus Central; and 0.018 for Florida. The discrete logistic equation was reconfigured to estimate equilibrium population size (N_{eq}) at various harvest rates i: $N_{eq,i} = K * (r_{max}-h_i)/r_{max}$). Assuming the population sizes in Table 5-1 are at equilibrium ($N_{eq,observed}$) with the harvest rates calculated above ($h_{observed}$), carrying capacity (K) can be estimated for each subpopulation as: $K = N_{eq,observed} / (r_{max}-h_{observed})/r_{max}$): K = 378,809 for the Atlantic; 623,028 for the Mississippi plus Central; and 19,565 for Florida. Carrying capacity and equilibrium population size at various harvest levels are depicted in yield curves in Figure A1-2. Expected equilibrium population sizes under the proposed action (based on average annual take 2004-2015) with uncertainty (due to uncertainty in r_{max} estimate) were:

Equilibrium *N* projection, 95% CI based on simulation for Proposed Action.

		N
Atlantic	median	362,281
	95% Lower CI	301,996
	95% Upper CI	422,388

Central & Mississippi	median	475,245
	95% Lower CI	354,743
	95% Upper CI	575,238
Florida	median	19,227
	95% Lower CI	16,085
	95% Upper CI	22,395

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Table A-1. Number of breeding pairs of cormorants in 37 states, the District of Columbia, and 8 Canadian provinces. Estimates are from the Flyway cormorant management plans (Atlantic and Mississippi Flyway Council 2010 and Central Flyway Council 2013), unless otherwise noted. Numbers for Saskatchewan were not used for estimating N_{min}.

State/Province	Estimate	Source
United States		
Alabama	550	
Arkansas	150	
Connecticut	858	Mid-Atlantic/New England Maritime Colonial Waterbird Survey, 2013.
Delaware	36	
District of Columbia	0	
Florida	8,000	
Georgia	10-100	(Keyes pers. comm)
Illinois	754	(Wires et al 2001)
Indiana	1,800	
Iowa	1,100 – 1,600	
Kansas	3	(Busby and Zimmerman 2001)
Kentucky	800	
Louisiana	150	
Maine	19,408	Mid-Atlantic/New England Maritime Colonial Waterbird Survey, 2013.

Maryland	2,900	Mid-Atlantic/New England Maritime Colonial Waterbird Survey, 2013.
Massachusetts	6,883	Mid-Atlantic/New England Maritime Colonial Waterbird Survey, 2013.
Michigan	25,000-30,000	
Minnesota	15,421	(Hamilton and Cuthbert. 2016)
Mississippi	200-500	
Missouri	300-500	
Nebraska	50-300	(Jorgenson pers. comm.)
New Hampshire	20	(Wires et al 2001)
New Jersey	60-70	(Gochfeld 2012, New Jersey Birds)
New York	6,333	(New York State Department of Environmental Conservation 2016)
North Carolina	250	
North Dakota Ohio	14,179 3,500	(Drilling 2015)
Oklahoma	50-100	
Pennsylvania	122	
Rhode Island	2,400	Mid-Atlantic/New England Maritime Colonial Waterbird Survey, 2013.
South Carolina	200	
South Dakota	12,633	(Drilling 2013)
Tennessee	500	

Texas	60	(Lemmons 2007)
Vermont	2,000	(Vermont Fish and Wildlife Department, 2015)
Virginia	2,876	(Watts and Paxton 2014)
West Virginia	No Data	
Wisconsin	11,424	(USDA 2016)
Canada		
Manitoba	36,180	(Wires et al. 2001)
Newfoundland and Labrador	2,000	(Thomas et al. 2007)
New Brunswick	10,808	Mid-Atlantic/New England Maritime Colonial Waterbird Survey, 2013.
Nova Scotia	12,000 – 14,000	
Ontario	61,000	(Wires et al. 2001)
Prince Edward Island	7,695	(Wires et al. 2001)
Quebec	33,708	Jean-Francois Rail pers. comm. (Environment Canada)
Saskatchewan	34,057	(Somers et al. 2010)

Figure A1-1. Counts of cormorants in Lakes Erie, Huron, and Ontario 1979-2009 (observed), and estimated number of breeders based on discrete logistic growth model fitted to data and using 1979 abundance as a starting value.

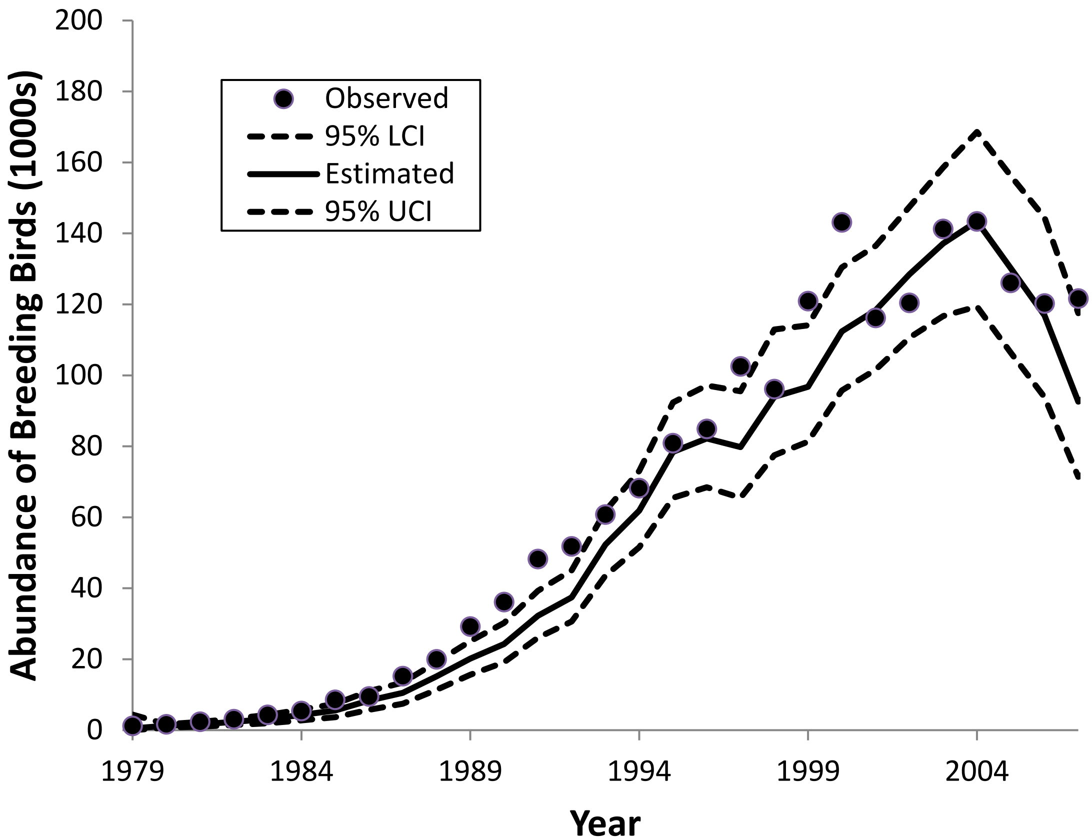
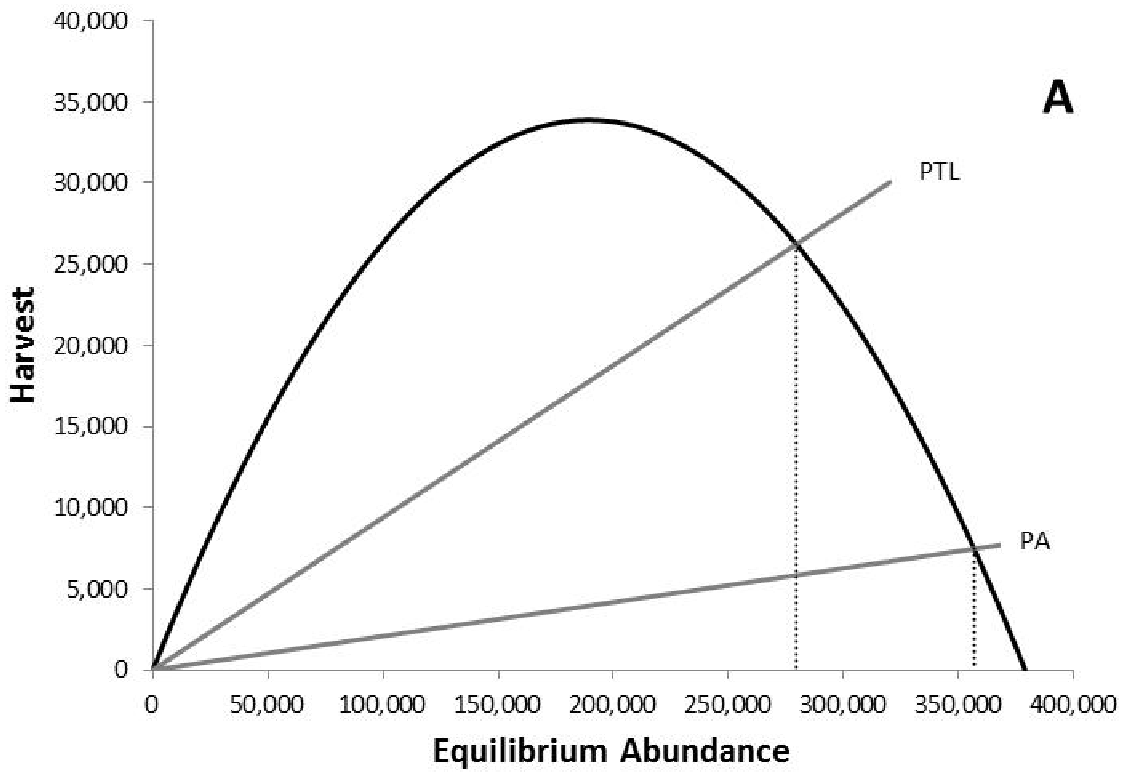
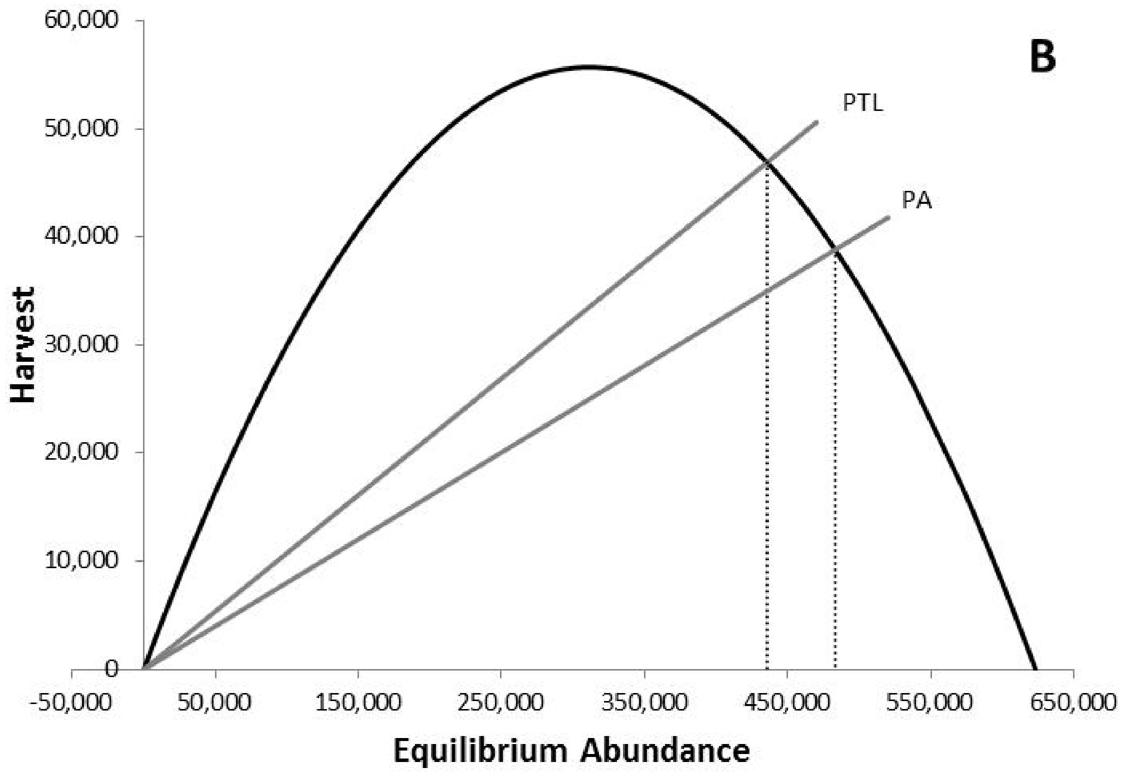


Figure A1-2. Yield curves based on discrete logistic growth model for cormorants in the Atlantic (A), Mississippi plus Central (B), and Florida (C) subpopulations. Figures depict expected equilibrium population sizes for expected take under the proposed action (PA), and at Potential Take Level (PTL) (i.e., maximum allowable annual take).




B
PTL
PA
Harvest
Equilibrium Abundance
60,000
50,000
40,000
30,000
20,000
10,000
0
-50,000
50,000
150,000
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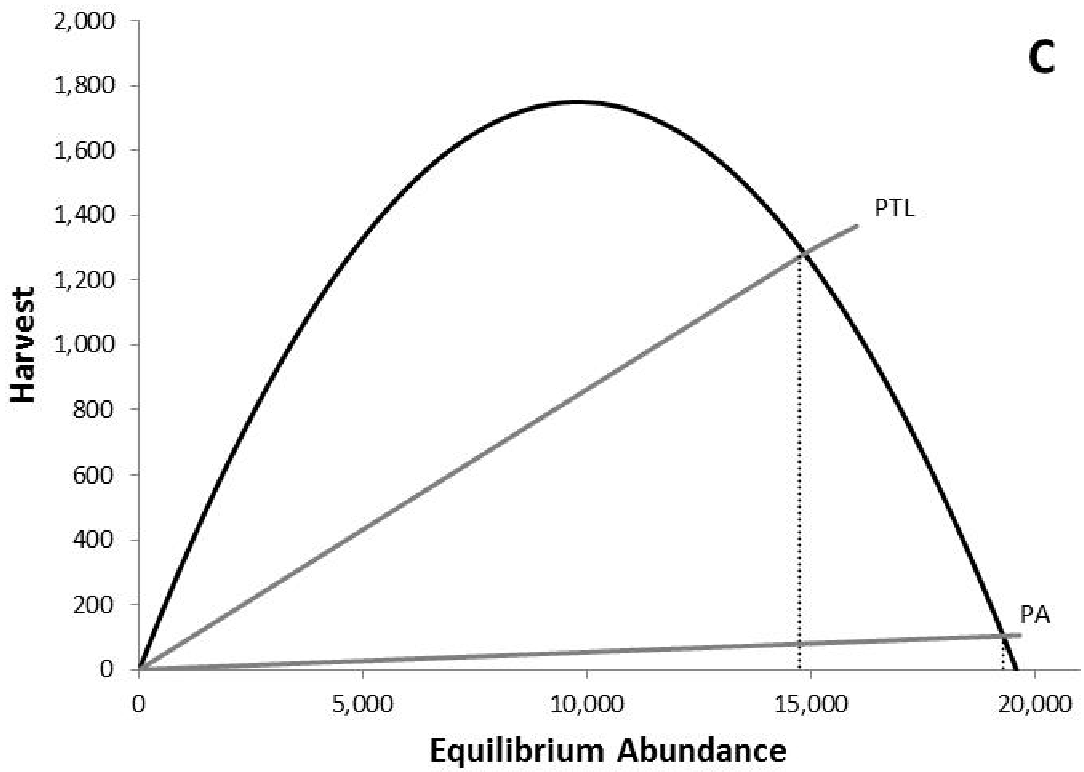
350,000
450,000
550,000
650,000


C
Harvest
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
PTL
PA
0
5,000
10,000
15,000
20,000
Equilibrium Abundance

Appendix 2: Standard conditions for Migratory Bird Depredation Permits (50 C.F.R. 21.41).

All of the provisions and conditions of the governing regulations at 50 C.F.R. part 13 and 50 C.F.R. part 21.41 are conditions of your permit. Failure to comply with the conditions of your permit could be cause for suspension of the permit. The standard conditions below are a continuation of your permit conditions and must remain with your permit. If you have questions regarding these conditions, refer to the regulations or, if necessary, contact your migratory bird permit issuing office. For copies of the regulations and forms, or to obtain contact information for your issuing office, visit: http: //www.fws.gov/migratorybirds/mbpermits.html.

1) To minimize the lethal take of migratory birds, you are required to continually apply non-lethal methods of harassment in conjunction with lethal control.
   [Note: Explosive Pest Control Devices (EPC Ds) are regulated by the Bureau of Alcohol, Tobacco, Firearms, and Explosives (ATF). If you plan to use EPC Ds, you require a federal explosives permit, unless you are exempt under 27 C.F.R. 555. I 4 I. Information and contacts may be found at www.atf gov/ex plosives /how- tolbecome-an- fel.ht m.]
2) Shotguns used to take migratory birds can be no larger than I0-gauge and must be fired from the shoulder. You must use nontoxic shot listed in 50 C.F.R. 20.134).
3) You may not use blinds, pits, or other means of concealment, decoys, duck calls, or other devices to lure or entice migratory birds into gun range.
4) You are not authorized to take, capture, harass, or disturb bald eagles or golden eagles , or species listed as threatened or endangered under the ESA found in 50 C.F.R. 17 , without additional authorization.

For a list of threatened and endangered species in your state, visit the USFWS's Threatened and Endangered Species System (TESS) at: http://www.fws.gov/endangered.

1) If you encounter a migratory bird with a federal band issued by the United States Geological Survey Bird Banding Laboratory, Laurel, MD, report the band number to 1-800-327-BAND (2263) or http://www.repo rtband.gov.
2) This permit does not authorize take or release of any migratory birds, nests, or eggs on federal lands without additional prior written authorization from the applicable federal agency, or on State lands or other public or private property without prior written permission or permits from the landowner or custodian.

3) Unless otherwise specified on the face of the permit, migratory birds, nests , or eggs taken under this permit must be:
    a. turned over to the U.S . Department of Agriculture for official purposes, or
    b. donated to a public educational or scientific institution as defined by 50 C.F.R. I0 , or
    c. completely destroyed by burial or incineration , or
    d. with prior approval from the permit issuing office, donated to persons authorized by permit or regulation to possess them.
4) A sub-permittee is an individual to whom you have provided written authorization to conduct some or all of the permitted activities in your absence. Sub-permittees must be at least 18 years of age. As the permittee, you are legally responsible for ensuring that *your* sub-permittees are adequately trained and adhere to the terms of *your* permit. You are responsible for maintaining current records of who you have designated as a sub-permittee, including copies of designation letters you have provided.
5) You and any sub-permittees must carry a legible copy of this perm it, *including these Standard Conditions,* and display it upon request whenever you are exercising its authority.
6) You must maintain records as required in 50 C.F.R. 13.46 and 50 C.F.R. 21.41. All records relating to the permitted activities must be kept at the location indicated in writing by you to the migratory *bird* permit issuing office.
7) Acceptance of this permit authorizes the United States Fish and Wildlife Service to inspect any wildlife held, and to audit or copy any permits, books, or records required to be kept by the permit and governing regulations.
8) You may not conduct the activities authorized by this permit if doing so would violate the laws of the applicable State, county, municipal or tribal government or any other applicable law.

Appendix 3: Cormorant damage management techniques employed by APHIS/WS and other Federal, Tribal, and State agencies throughout the eastern and central United States.

Wildlife damage control activities generally fall into one of three broad categories: 1) resource management, 2) physical exclusion, and 3) wildlife management.

1. Resource Management

Cultural methods may include facility location, facility design, and fish management (Gorenzel et al. 1994) and are carried out by land owners/managers. The physical location, design, and construction of an aquaculture facility influence the susceptibility of fish to bird predation, while facility design influences success in protecting fish stocks from predation. Fish management may include locating the most susceptible fish species and size close to the center of human activity and near buildings that might be incorporated in a bird exclusion system, and altering fish stocking dates so that vulnerable fish are not stocked when substantial bird numbers are present (Mott and Boyd 1995).

In New Brunswick, Canada, modifications to the design and use of oyster cultivation gear reduced coastal bird, including cormorant, roosting on gear and associated need to reduce contaminants in and on the oysters by transferring suspended stocks onto the bottom prior to harvest (Comeau et al. 2008). The procedure increases both labor and time needed to complete the production cycle. Birds preferred roosting on floating cages over floating bags used for oyster production, and altering the depth at which production bags are suspended helped to reduce cormorant roosting on the equipment.

Environmental/habitat modification can be an integral part of wildlife damage management. Since the presence of wildlife is directly related to the type, quality, and quantity of suitable habitat, habitat itself can be managed to reduce or eliminate the production or attraction of certain bird species. In most cases, the land owner/manager is responsible for implementing habitat modifications. Habitat management is most often a primary component of wildlife damage management strategies at or near airports (i.e., to reduce bird aircraft strike problems by eliminating bird nesting, roosting, loafing, or feeding sites). Generally, many bird problems on airport properties can be minimized through management of vegetation and water from areas adjacent to aircraft runways (Godin 1994).

Nest/tree removal is the removal of nesting materials during the construction phase of the nesting cycle or the removal of trees used for nesting/roosting. Nests can be removed or destroyed manually or by use of high pressure water to dislodge nests from trees (Chipman et al. 1997). Nest/tree removal has been used to manage cormorants locally (to eradicate colonies) and regionally (to reduce populations).

Tree nests present a greater challenge during the physical breakup of nest structures. Entire trees have been removed, both in private (Anderson and Hamerstrom 1967) and official control efforts (USFWS 1999a,b). Nest removal, even when successful at preventing colonization attempts, cannot be considered permanent; control must be repeated each time cormorants attempt to nest in areas of concern. It may also eliminate nest substrates for other species. Where cormorants have already made trees unsuitable for nesting by other species, this may not be an issue; however, removing nest trees may shift cormorant nesting and move them into conflict with other species (Wires et al. 2001). Additionally, because cormorants frequently nest on the ground, tree removal may only be effective where the substrate is inappropriate for nesting or the threat of mammalian predation is high (Wires et al. 2001).

2. Physical Exclusion

Bird proof barriers can be effective but are often cost-prohibitive, particularly because of the aerial mobility of birds which requires overhead barriers as well as peripheral fencing or netting. Exclusion adequate to stop bird movements can also restrict movements of people, including fish maintenance and harvesting operations, and are susceptible to ice and wind damage (Mott and Boyd 1995, Littauer et al. 1997). Exclusion devices have been used to reduce coastal bird (including cormorant) roosting on oyster production gear and associated fecal contamination (Comeau et al. 2008). Barrier systems using wire, line, and string in parallel and grid patterns and polyethylene rope with foam floats have been used for deterring cormorants (Mott et al. 1995; Littauer et al. 1997). The concept is meant to take advantage of the relatively long take-off distance (approximately 30 feet) that cormorants generally require (Curtis et al. 1996). Parallel wires should be positioned perpendicular to the prevailing wind as cormorants generally take off and land into the wind. Colored streamers have been used to increase visibility of the wires and strings. However, cormorants have been known to adapt readily to parallel wires so grid patterns are inherently more effective (Littauer et al. 1997).

Net and wire systems pose a risk of unintentional mortality in birds from collisions with the systems and entanglement in netting. Nemetzov and Olsvig-Whittaker (2003) evaluated netting systems in Israel and determined that risks associated with netting were related to the visibility of the netting with lower incidence of bird mortality in ponds with thick, dark netting and small mesh sizes. Net systems that were relatively loose horizontally instead of taut also had lower mortality rates that may have been related to visibility as nets moved in the wind or the ability of the birds to free themselves from the netting. Risks were greatest when monofilament netting was used and Nemetzov and Olsvig-Whittaker (2003) recommended prohibition of the use of thin monofilament nets. Maintenance of systems was the primary factor affecting the number of live birds under nets, particularly maintenance of perimeter netting. One of the highest rates of live birds detected under netting was for nets with good but not complete perimeter netting. Nemetzov and Olsvig-Whittaker (2003) recommended that to reduce risks of trapping birds, perimeter netting either be complete and well-maintained or omitted altogether.

3. Wildlife Management

A. Non-lethal techniques

Harassment or animal behavior modification. This refers to tactics that alter the behavior of wildlife to reduce damage. Animal behavior modification may involve use of scare tactics to deter or repel animals that cause loss or damage (Gorenzel et al. 1994; Littauer 1990; Reinhold and Sloan 1999). Numerous techniques and devices can be used to frighten cormorants. Wires et al. (2001) reviewed these non-lethal techniques by dividing them into three categories: 1) direct human harassment, in which humans attempt to frighten, but not kill, cormorants, 2) simulated human harassment, in which static or animated devices frighten cormorants by simulating human threats, and 3) other harassment, in which the negative stimulus is not necessarily connected to human activity. Some but not all methods that are included in this category are:

- Lasers
- Propane exploders
- Pyrotechnics
- Distress calls and sound producing devices
- Air horns
- Scare crows
- Mylar tape
- Eye spot balloons
- Vehicle horn and chase
- Live ammunition

These techniques are generally only practical for small areas. Scaring devices such as distress calls, helium-filled eye spot balloons, scare crows, effigies and silhouettes, mirrors, and moving disks can be effective but usually for only a short time before birds become accustomed and learn to ignore them (Mason and Clark 1997; Mastrangelo et al. 1997, Stickley, et al. 1995; Stickley and King 1995; Mott et al. 1995; Reinhold and Sloan 1999). Littauer et al. (1997) noted that a scaring program must be consistent and aggressive to be successful. Timing is also critical (Mott and Boyd 1995) and therefore harassment must begin as soon as it can be economically justified and continued until all undesirable birds vacate the area (Reinhold and Sloan 1999).

Human harassment. As discussed in Wires et al. (2001), the most common form of direct human harassment is ground patrol with pyrotechnics. Patrols may occur on foot or in vehicles and may utilize a variety of pyrotechnics to frighten cormorants (and, of course, other birds). Pyrotechnics include various shellcrackers, screamers, whistling projectiles, exploding projectiles, bird bangers, flash/detonation cartridges and live ammunition (Moerbeek et al. 1987; Hanebrink and Byrd 1989; Stickley and Andrews 1989; Littauer 1990; Brugger 1995; Mott and Boyd 1995; Pitt and Conover 1996; Spencer 1996; Littauer et al. 1997; Reinhold and Sloan 1999). Live ammunition is often used because it is cheaper and more readily available than pyrotechnics (Littauer 1990; Mott and Boyd 1995; Littauer et al. 1997). Cormorants are often frightened from aquaculture ponds simply because of the presence of humans (Hanebrink and Byrd 1989; Spencer 1996; and Reinhold and Sloan 1999). Hodges (1989) concluded, for example, that the presence of humans at aquaculture facilities during critical periods may be the most effective means of keeping cormorants off ponds.

Simulated Human Harassment. To reduce labor costs for harassment patrols, various devices, both static and animated, have been developed to simulate the threat of human activity near areas of concern, usually aquaculture ponds. These devices range from simple wood cutout scarecrows to elaborate contraptions that create startling movements, emit numerous noises, and flash lights (Wires et al. 2001).

Human effigies/scarecrows have long been used against avian predators at many different types of agriculture fields, despite their general lack of success at preventing depredations (Inglis 1980). Increasing both realism and level of animation in scarecrows may improve their ability to scare birds, and combining scarecrows with automated sound devices may enhance the frightening effect (Littauer 1990; Littauer et al. 1997). Stickley et al. (1995) and Stickley and King (1995) tested an inflatable effigy called Scarey Man® on catfish farms in Mississippi, as described in Wires et al. (2001). For relatively short lengths of time (10-19 days), the device significantly reduced the number of cormorants on the ponds (71-99% reduction in number of cormorants flushed from ponds during ground patrols). Compared to replacement cost of catfish consumed (based on mean cormorant consumption rate in Stickley et al. 1992), Scarey Man® devices were considered to be economically efficient (Stickley et al. 1995). However, evidence of habituation was reported, especially when day roosts were in view of the Scarey

Man® devices. Stickley and King (1995) suggested that the device be used where cormorant depredations are “serious.”

Another animated scarecrow was described by Conniff (1991). This device was described as a jack-in-the-box scarecrow with inflatable plastic arms, revolving strobe lights, and amplified sounds (130 dB) of horns honking, people shouting, shotguns firing, and birds screaming. The device was declared “ineffectual,” indicating that “a cormorant can get used to almost anything.”

Other harassment. As described in Wires et al. (2001), other means to startle birds into flight have been developed, and many have been used against cormorants. These include amplified cormorant distress calls; sirens and other electronically generated noises; tin plates, mylar balloons, reflecting tape and other reflectors; lasers; and eyespot balloons and raptor silhouettes (Barlow and Bock 1984; Moerbeek et al. 1987; Parkhurst et al. 1987; Stickley and Andrews 1989; Littauer 1990; Brugger 1995; Mott and Boyd 1995; Price and Nickum 1995; Spencer 1996; Littauer et al. 1997; Reinhold and Sloan 1999, Glahn et al. 2000).

Auditory scaring devices such as propane exploders, pyrotechnics, air horns, and audio distress/predator vocalizations are effective in many situations for dispersing damage-causing bird species. However, birds often habituate to such devices, rendering them ineffective. Using a combination of harassment devices prolongs habituation and provides the greatest amount of protection. Frequently changing and moving devices further enhances protection (Gorenzel et al. 1994; Reinhold and Sloan 1999).

Visual scaring techniques such as use of mylar tape (highly reflective surface produces flashes of light that startles birds), eye-spot balloons (the large eyes supposedly give birds a visual cue that a large predator is present), flags, and lasers, sometimes are effective in reducing bird damage (Gorenzel et al. 1994; Littauer et al. 1997; Stickley et al. 1995; Stickley and King 1995).

Reviewers have generally found distress calls ineffective against cormorants for long periods of time (Wires et al. 2001). Hanebrink and Byrd (1989) mention that, while APHIS-WS recommended using amplified distress calls, the calls merely moved birds to different ponds. Littauer (1990) listed distress calls among other electronically generated noises whose effectiveness was “uncertain,” but did note observations of cormorants apparently being attracted to distress calls. Effectiveness of audio and visual scare tactics (specifically distress calls, electronically generated noises, tin plates, mylar ribbon, flash tape, flagging, helium balloons, inflatable eyespot balloons and hawk silhouette kites) have generally been found to be low when deployed by themselves or over long periods of time (Littauer 1990; Spencer 1996; Reinhold and Sloan 1999).

Various noisemakers to scare cormorants have been developed, including the rope firecracker, which sets off explosions as the rope burns (Littauer 1990) and propane/butane/acetylene cannons, some of which can be programmed to go off at varying intervals and variable numbers of times. The effectiveness of cannons is itself variable (Wires et al. 2001). Stickley and Andrews (1989) reported that 40% of respondents used propane cannons. Of these, 60% found them to be either somewhat or very effective against cormorants. Brugger (1995) reported initial success with cannons, but with relatively quick habituation. Conniff (1991) reported that butane cannons eventually became perches for cormorants. Individuals using propane cannons in Oklahoma and Georgia reported them to be ineffective (Spencer 1996; Simmonds et al. 1995) and Moerbeek et al. (1987) found gas cannons generally ineffective against Great Cormorants in the Netherlands.

Given the general lack of success with harassment techniques used separately (largely due to habituation), many investigators have concluded that, to be effective, 1) a variety of techniques must be used, 2) techniques should be applied vigorously, 3) location of static and automatic devices should be changed frequently, and 4) the combination of techniques should be altered frequently (Moerbeek et al. 1987; Littauer 1990; Mott and Boyd 1995; Mott and Brunson 1997; Reinhold and Sloan 1999). The recommendation by Littauer (1990) that use of gas cannons be stopped once habituation begins to occur (to prevent a decrease in their utility at a later date) could probably be applied to all forms of non-lethal harassment (Wires et al. 2001).

Non-lethal Dispersal at Night Roosts. Night roost dispersal is used to harass cormorants from their roosting sites in an effort to re-locate birds away from a particular area or region (Mott et al. 1998; Reinhold and Sloan 1999, Glahn 2000, Glahn et al. 2000). The goal of this approach is to keep cormorants from roosting in the area at night and subsequently to decrease the number of depredating birds within the harassment area during the day. Most discussion of this technique has focused on the Mississippi Delta region where it has been practiced since 1992 (Mott et al. 1998, Dorr et al. 2004, Glahn 2000). Dorr et al. (2004) used VHF telemetry to document cormorant movements between night roosts and aquaculture producing areas in eastern Mississippi and western Alabama. Dorr et al. (2004) 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. Dorr et al. (2004) recommended that roost harassment efforts should focus on specific roost sites and that some roost sites where cormorants were less likely to cause damage to aquaculture should not be harassed. In Mississippi, APHIS/WS harasses cormorants as they arrive at roost locations to disperse those cormorants toward roost locations closer to the Mississippi River. Glahn et al. (1995) found that commercially raised fish from aquaculture facilities comprised a much lower percentage of the diet of cormorants roosting closer to the Mississippi River, likely due to the higher availability of natural forage from the oxbow lakes along the Mississippi River. Glahn et al. (2000) found that a higher percentage of cormorants used roosts along the Mississippi River following the implementation of dispersal activities at roost locations further from the river.

This type of dispersal program is labor intensive and requires a great deal of organization and coordination to be effective (Reinhold and Sloan 1999; Tobin 1998). Electronic noise generators, amplified recordings, propane exploders, pyrotechnics, and firecrackers can be used to disperse birds. Laser guns can also be used to startle cormorants in low-light conditions (Wires et al. 2001, Dorr et al. 2014). McKay et al. (1999) reported that laser guns have been used effectively against Great Cormorants in England, Wales, France, and Italy. This technique effectively reduced numbers of birds at night roosts as well as numbers feeding in nearby ponds in England and Wales.

Discussions of the effectiveness of the Mississippi Delta program suggest that the program may be numerically and economically effective (Wires et al. 2001). Surveys within harassment areas during the winter of 1993-94 counted 70% fewer birds than the previous winter (1992-93) when there was no harassment; surveys from 1994-95 showed a 71% decrease from number of birds detected in 1992-93 (Mott et al. 1998). Survey data from aquaculturists in 1994 revealed that 62% within the harassment zone reported fewer problems with cormorants than in previous years, whereas 38% outside the zone had the same sentiments; data from 1995 revealed little change, with 74% of aquaculturists within the harassment zone reporting fewer problems and 38% outside reporting the same (Mott et al. 1998). These perceptions are reflected in the amount of money spent on harassment at individual aquaculture facilities: within the harassment zone, aquaculturists reported an average $1,406 decrease in expenses for harassment at their facilities in 1994, and $3,217 in 1995. Cost of the program was $16,757 in 1994 and $32,302 in 1995. If these costs were divided equally among participating aquaculturists, each would have paid $419 in 1994 and $557 in 1995. Based on a comparison between cost of the night roost harassment program and reductions in harassment expenditures at individual aquaculture facilities, the control program was considered economically effective. However, Reinhold and Sloan (1999) point out that "ever-increasing numbers" of night roosts can limit the success of dispersal programs.

Despite coordinated efforts to disperse cormorants from roosts and aquaculture facilities using non-lethal methods, cormorants can continue to attempt to roost near aquaculture facilities and continue to cause damage at aquaculture facilities. Cormorants can habituate (e.g., showing no response or limited movements) to the use of non-lethal harassment methods (Mott and Boyd 1995, Mott et al. 1998). To reinforce the use of non-lethal methods, entities sometimes lethally removed a limited number of cormorants from roost locations and aquaculture facilities using firearms.

Prevention of colony establishment. Another important means of limiting the damages caused by cormorants is to prevent birds from establishing colonies in areas of concern. Bregnballe et al. (1997) predicted that potential breeders prevented from founding a new colony could be expected to either delay breeding to a later year or to join existing colonies. This would likely have two effects: (1) the population would stabilize sooner and (2) the population would stabilize at a lower absolute population size because the resources available at breeding would be reduced. Without persistent, frequent attempts to harass birds away from potential breeding sites, however, or if individuals attempt to nest at sites that have been previously used for roosting, it is likely that they would be less willing to abandon nesting attempts. Bregnballe et al. (1997) suggested that it might therefore be necessary to shoot some of these individuals to prevent colonization.

B. Lethal techniques

Egg and nest destruction. Cormorant eggs and nestlings have been destroyed in attempts to reduce recruitment into populations and to eliminate colonies at specific locations (in conjunction with other forms of harassment). Bregnballe et al. (1997) predicted that the effect of increased egg mortality on autumn population size would be buffered by increased density-dependent chick survival. However, if repeated egg oiling efforts led to near total clutch failure at ground-nesting colonies, the local colony would be expected to stabilize at lower sizes and the proportion of the foraging area being exploited during breeding would decline.

In general, egg and nest destruction are not expected to eliminate reproduction for individual cormorants during a nesting season because of their tendency to re-nest after disturbance. As reported in Wires et al. (2001), in some instances (Lake Winnipegosis, Manitoba; Lake of the Woods, Minnesota and Ontario; St. Lawrence River Estuary, Quebec) local cormorant populations continued to rise despite egg and nest destruction efforts (Hobson et al. 1989; Baillie 1939, 1947; DesGranges and Reed 1981). In contrast, some investigators have suggested that egg and nest destruction (often in conjunction with killing adults) may have slowed the growth of local populations (Weseloh and Collier 1995), stabilized local populations, or contributed to declines (Ewins and Weseloh 1994; Sheppard 1994/5; USFWS 1999b). McLeod and Bondar (1954) concluded that consistent destruction of eggs and young appeared to reduce the local breeding population on Lake Winnipegosis in the 1940s and 1950s.

In some cases, nest and egg destruction may cause colony abandonment. Egg oiling is a method of suppressing reproduction of nuisance birds by spraying a small quantity of food grade vegetable oil or mineral oil on eggs in nests. The oil prevents exchange of gases and causes asphyxiation of developing embryos. The method has an advantage over nest or egg destruction in that the incubating birds generally continue incubation and do not re-nest. The EPA has ruled that use of corn oil for this purpose is exempt from registration requirements under the Federal Insecticide, Fungicide, and Rodenticide Act. To be most effective, the oil should be applied anytime between the fifth day after the laying of the last egg in a nest and at least five days before anticipated hatching. This method is extremely target specific and is less labor intensive than egg addling. Egg oiling has essentially the same result as that of killing eggs and nestlings, but cormorants are less likely to abandon nests and lay replacement clutches, making the technique more effective as an annual treatment (Wires et al. 2001). Bédard et al. (1995) report, “None of the eggs in 427 experimentally treated nests hatched in 1987 and nearly half were still tended by adults 49 to 59 days after laying (the remainder having been abandoned and scavenged).” Shonk (1998) reports, “Of the eggs treated with oil, 49% were incubated past the expected hatching date. The remainder of the eggs were lost during the incubation.” Human disturbance during oiling increases predation by gulls (Shonk 1998), which may cause some cormorants to re-nest.

Egg/embryo mortality rates approach 100% when the oil/solution is applied correctly (DesGranges and Reed 1981; Blokpoel and Hamilton 1989; Christens and Blokpoel 1991; Shonk 1998; Bédard et al. 1999). Although laboratory tests found oiling ineffective when applied only to part of an egg (Blokpoel and Hamilton 1989), field tests in which only the tops of eggs were sprayed were highly successful, indicating that careful application to the entire egg surface may not be necessary (Christens and Blokpoel 1991; Bédard et al. 1999). Egg-rolling activities by parents may assist in covering the entire surface (Christens and Blokpoel 1991).

Because cormorant egg laying is not synchronous, only one spraying per summer may not treat enough of the eggs laid that nesting season to have a significant impact on the local colony, and multiple oiling efforts to overcome this problem may increase the cost of control beyond acceptable levels. Both problems were cited as reasons for the failure of egg oiling efforts in Maine by Dow (1953). If carried out with appropriate intensity, egg oiling can reduce local colonies, although the results are more slowly seen than with culling or a combination of the two techniques.

Killing adults. Shooting adults has been a commonly used technique for reducing damage caused by cormorants (Matteson 1983; Hobson et al. 1989; Ewins and Weseloh 1994; Sheppard 1994/5; Carter et al. 1995; Jackson and Jackson 1995; Ludwig and Summer 1995; Weseloh and Collier 1995; USFWS 1999b). Shooting cormorants is believed to reinforce non-lethal harassment (EIFAC 1988, Hess 1994, Littauer 1990, Mastrangelo et al. 1997, Rodgers 1988 and 1994, Tucker and Robinson 1990, cited in Glahn et al. 2000) and is highly selective for target species. Shooting is typically conducted with shotguns or rifles and can be relatively expensive because of the staff hours sometimes required.

Cormorants can be wary and difficult to shoot (Wires et al. 2001). In cases where large numbers of birds are present, shooting may be more effective as a dispersal technique than as a way to reduce bird densities and associated damage. A study by Glahn (2000) indicated that shooting cormorants in roosts was as effective as frightening them with pyrotechnics for dispersing them, and may not result in habituation.

Killing nesting cormorants is most likely to be successful at reducing damage when two conditions are met: (1) scale of control is large enough to overcome the effects of immigration and (2) the control effort is well coordinated, long-term, and sufficiently rigorous to overcome density-dependent compensation mechanisms. The age and sex of the individuals being removed also influences the success of shooting cormorants to address damage (Bédard et al. 1999, Ludwig and Summer 1995, Wires et al. 2001). Shooting is more likely to reduce local colony size than destroying eggs, nestlings, or fledglings, because first-year birds frequently have low survival rates and many would not have survived to breed anyway (Wires et al. 2001).

Shooting adults at colonies may have impacts beyond killing individual breeders because of harassment effects on survivors. Cairns et al. (1998) observed that the abandonment of a large cormorant colony in waters of Prince Edward Island, Canada, seemed to have been caused by shooting and harassment at the colony that had taken place when cormorants first returned to the area in the spring. The birds from the abandoned Ram Island colony apparently shifted to nearby Little Courtin Island. However, since cormorants usually exhibit strong philopatry and site-fidelity, the displacement was judged to be highly "anomalous." Ewins and Weseloh (1994) reported that the shooting of > 50 adults on Pigeon Island, Lake Ontario, in 1993 (when the colony had 818 pairs) reduced reproductive output for that year: fledging rates were 0.3 vs. 1.6 young/nest on a nearby island that was not subject to shooting. Long-term impacts on the colony were not reported (Wires et al. 2001).

Limited data are available on the effectiveness of killing adults on reducing cormorant damage from local populations/colonies (Wires et al. 2001). Matteson (1983) noted that shooting cormorants at pound nets by fishermen did not prevent the nearby Mink Island, Lake Ontario population from increasing from 40 nests in 1945 to 50 nests in 1956. Ludwig and Summer (1995) analyzed leg band recovery data for cormorant colonies in the Les Cheneaux region of Lake Huron and concluded that, based on the level of immigration into this region, lethal control of adults would have to be Great Lakes-wide to reduce damage from local populations (see also Korfanty et al. 1999). Despite predictions by Ludwig and Summer (1995) cormorant damage management conducted in the Les Cheneaux Islands using a combination of shooting and egg oiling resulted in reduced cormorant colony size.

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Appendix 4: Intra-USFWS Section 7 Biological Evaluation Form

I. Region: 2-6

II. USFWS Activity:

Migratory Birds and State Programs Section 7 Consultation on the 2017 Environmental Assessment for Double-crested Cormorant Management.

III. Pertinent Species and Habitat: (organized by Region)

A. Listed species and/or critical habitat within the action area:

* Denotes species with critical habitat designations

Region 2 (OK and TX)

Attwater's greater prairie chicken	(*Tympanuchus cupido attwateri*) [E]
Mexican spotted owl	*(Strix occidentalis lucida)* [T]
Red-cockaded woodpecker	(*Picoides borealis*) [E]
Least tern	(*Sterna antillarum*) [E]
Northern aplomado falcon	(*Falco femoralis septentrionalis*) [E]
Brown pelican	(*Pelicanus occidentalis*) [E]
Southwestern willow flycatcher	(*Empidonax traillii extimus*) [E]
Black-capped vireo	(*Vireo atricapillus*) [E]
Golden-cheeked warbler	(*Setophaga chrysoparia*) [E]
Whooping crane*	(*Grus americana*) [E]
Piping plover*	(*Charadrius melodus*) [T]
Yellow-billed cuckoo	(*Coccyzus americanus*) [T]
Yuma Ridgway's rail	*(Rallus obsoletus yumanensis)* [E]

Eskimo curlew	(*Numenius borealis*) [E]
Concho water snake*	(*Nerodia paucimaculata*) [T]

Region 3 (IL, IN, IA, MI, MN, MO, OH, WI)

Piping plover*	(*Charadrius melodus*) [T]
Least tern	(*Sterna antillarum*) (Interior population) [E]
Whooping crane*	(*Grus americana*) [E]
Kirtland's warbler	(*Setophaga kirtlandii*) [E]
Red Knot	(*Calidris canutus rufa*) [T]
Lake Erie water snake	(*Nerodia sipedon*) [T]
Houghton's goldenrod	(*Solidago houghtonii*) [T]
Dwarf lake iris	(*Iris lacustris*) [T]
Pitcher's thistle	(*Cirsium pitcheri*) [T]

Region 4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)

Ivory-billed woodpecker	(*Campephilus principalis*) [Extinct?]
Red-cockaded woodpecker	(*Picoides borealis*) [E]
Mississippi sandhill crane*	(*Grus canadensis pulla*) [E]
Piping plover*	(*Charadrius melodus*) [E]
Least tern	(*Sterna antillarum*) (Interior population) [E]
Everglade snail kite*	(*Rostrhamus sociabilis plumbeus*) [E]
Wood stork	(*Mycteria americana*) [E]
Black-capped vireo	(*Vireo atricapillus*) [E]
Cape Sable seaside sparrow*	(*Ammodramus maritimus mirabilis*) [E]

Florida grasshopper sparrow (*Ammodramus savanarum floridanus*) [E]

Roseate tern (*Sterna douglalli*) [T]

Audubon's crested caracara (*Polyborus plancus audubonii*) [T]

Florida scrub jay (*Aphelocoma coerulescens*) [T]

Whooping crane* (*Grus americana*) [NEP]

Bachman's warbler (*Vermivora bachmanii*) [Extinct?]

Red Knot (*Calidris canutus rufa*) [T]

Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*) [E]

Ringed map turtle (*Graptemys oculifera*) [T]

Yellow-blotched map turtle (*Graptemys flavimaculata*) [T]

Atlantic salt marsh snake (*Nerodia clarkii taeniata*) [T]

Region 5 (NY, VT, WV, CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VA, VT, WV, and DC)

Piping plover* (*Charadrius melodus*) [T]

Roseate tern (*Sterna douglalli*) [E]

Red-cockaded woodpecker (*Picoides borealis*) [E]

Red Knot (*Calidris canutus rufa*) [T]

Atlantic salmon (*Salmo salar*)[E]

Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) [E]

Region 6 (KS, ND, SD, and NE)

Least tern (*Sterna antillarum*) (Interior population) [E]

Northern Great Plains Piping plover*(*Charadrius melodus*) [T]

Whooping crane* (*Grus americana*) [E]

Eskimo curlew	(*Numenius borealis*) [E]
Black-capped vireo	(*Vireo atricapillus*) [E]
Mexican spotted owl*	(*Strix occidentalis lucida*) [T]
Southwestern Willow Flycatcher*	(*Empidonax traillii extimus*) [E]

B. Proposed species and/or proposed critical habitat within the action area

Louisiana Pine snake	(*Pituaphis ruthveni*) [PT]
Mountain plover	(Charadrius montanus) [P]

C. Candidate species within the action area:

Lesser prairie chicken	(*Tympanuchus pallidicinctus*) [C]

IV. Geographic area and action: Regions 2-6, The scope of the analysis within this EA includes cormorants that occur within five USFWS regions, covering 37 states and the District of Columbia: Alabama, Arkansas, Connecticut, Delaware, the District of Columbia (DC), Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Vermont, Virginia, West Virginia, and Wisconsin. This analysis includes actions for depredation permits for managing cormorants at aquaculture facilities, for the purposes of human health and safety, the protection federally listed species under ESA, and the alleviation of damage to property. The USFWS may also issue permits to take cormorants if there is convincing evidence that cormorants are adversely affecting species of high conservation concern (a regionally important bird population, for example) or rare and declining plant communities at a local scale. Under the proposed action, the USFWS would timely process a permit that meets the criteria within 50 C.F.R. § 13.21 and 21.41 (with appropriate conditions under 50 C.F.R. § 13.21(e)(1)).

V. Location: Cormorants affected by this analysis are associated with damage management of cormorants on their breeding grounds, winter grounds, and in areas where cormorants may come into conflicts while migrating between these locations. See Table 1 below.

Table 1. State seasonal status of cormorants in relation to proposed action.

States	**Seasonal status of cormorants in State** (based on Wires et al. 2001, and expert opinion)	**Non-lethal cormorant Management**	**Depredation Permits Issued**
Region 1			
all States excluded	N/A	N/A	N/A
Region 2			
Oklahoma	breeding/migrating/wintering	yes	yes
Texas	breeding/migrating/wintering	yes	yes
Region 3			
Illinois	breeding/migrating	yes	yes
Indiana	breeding/migrating	yes	yes
Iowa	breeding/migrating	yes	yes
Michigan	breeding/migrating	yes	yes
Minnesota	breeding/migrating	yes	yes
Missouri	breeding/ migrating	yes	yes
Ohio	breeding/migrating	yes	yes
Wisconsin	breeding/migrating	yes	yes
Region 4			
Alabama	breeding/migrating/wintering	yes	yes
Arkansas	breeding/migrating/wintering	yes	yes
Florida	breeding/migrating/wintering	yes	yes
Georgia	breeding/migrating/wintering	yes	yes
Kentucky	breeding/ migrating	yes	yes
Louisiana	breeding/migrating/wintering	yes	yes
Mississippi	breeding/migrating/wintering	yes	yes

North Carolina	breeding/migrating/wintering	yes	yes
South Carolina	breeding/migrating/wintering	yes	yes
Tennessee	breeding/migrating	yes	yes
Region 5			
Connecticut	breeding/migrating	yes	yes
Delaware	breeding/migrating	yes	yes
Maine	breeding/migrating	yes	yes
Maryland	breeding/migrating	yes	yes
Massachusetts	breeding/migrating	yes	yes
New Hampshire	breeding/migrating	yes	yes
New Jersey	breeding/migrating	yes	yes
New York	breeding/migrating	yes	yes
Pennsylvania	breeding/migrating	yes	yes
Rhode Island	breeding/migrating	yes	yes
Virginia	breeding/migrating/wintering	yes	yes
Vermont	breeding/migrating	yes	yes
West Virginia	migrating	yes	yes
DC	migrating	yes	yes
Region 6			
Kansas	breeding/migrating	yes	yes
Nebraska	breeding/migrating	yes	yes
North Dakota	breeding/migrating	yes	yes
South Dakota	breeding/migrating	yes	yes
Region 7			
Alaska excluded	N/A	N/A	N/A

<u>Breeding habitat</u> (March - July): Ponds and lakes (natural and artificial), slow-moving rivers, lagoons, estuaries, and open coastlines. Small rocky or sandy islands if available. Nests built in trees, on structures, or on the ground. Also nests on emergent vegetation in marshes. Nesting trees and structures usually standing in or near water, on islands, in swamps, or on tree-lined

lakes. Roosts and resting places often on exposed sites such as rocks or sandbars, pilings, wrecks, high-tension wires, or trees near favored fishing sites.

Wintering habitat (November - February): Ponds and lakes (natural and artificial), rivers, lagoons, estuaries, coastal bays, marine islands, and open coastlines for feeding, loafing, and roosting sites. On the coast, sandbars, shoals, coastal cliffs, offshore rocks, channel markers, and pilings are used for roosting. Roosts on perching sites such as trees, utility poles, or fishing piers. Birds wintering along the lower Mississippi River often roost in isolated cypress swamps.

Migrating habitat: During migration, cormorants can be found in any of the areas listed above.

VI. Description of Proposed Action:

The proposed action would allow for: 1) non-lethal methods that do not require authorization from the USFWS to be used to protect property, human health and safety, aquaculture, and natural resources; and/or 2) issuance of depredation permits pursuant to 50 C.F.R § 21.41 for the use of lethal methods of cormorant control to remove cormorants for the protection of crops or other interests being injured (i.e., property, aquaculture, human health and safety, sensitive bird species and their habitats, rare or sensitive plant communities).

Under the proposed action, existing wildlife management policies and practices would continue with the standard ones required of all depredation permits. As may occur with all migratory bird permits, after a case-by-case review of the site-specific conditions, the USFWS may add conditions to the permit to minimize unintended adverse impacts to cormorant populations and to non-target species (50 C.F.R. § 13.21 (e)(1)). Special permit conditions that may be considered for cormorants would include but not be limited to prohibitions on the take of adult cormorants at nesting colonies during periods when dependent young are present. Special permit conditions that may be considered for protection of non-target species, as appropriate to the needs of the species and site-specific conditions would include but not be limited to conducting actions during an optimal time in the nesting season to reduce negative impacts to co-nesting species.

Table 2. Lethal methods of cormorant take under the proposed action by Region of the US Fish and Wildlife Service.

States	**Breeding Actions**	**Wintering Actions**	**Migrating Actions**
Region 2 Oklahoma	For both OK and TX:	For both OK and TX: Shooting (including at	For both OK and TX: Shooting, CO_2

Texas	Shooting, egg oiling, nest destruction, CO_2 asphyxiation	roosts near aquaculture facilities), CO_2 asphyxiation	asphyxiation
Region 3 Illinois Indiana Iowa Michigan Minnesota Missouri Ohio Wisconsin	For all Region 3 States : Shooting, egg oiling, nest destruction, CO_2 asphyxiation	N/A	For all Region 3 States: Shooting, CO_2 asphyxiation
Region 4 Alabama Arkansas Florida Georgia Kentucky Louisiana Mississippi North Carolina South Carolina Tennessee	For all Region 4 States: Shooting, egg oiling, nest destruction, CO_2 asphyxiation	For all Region 4 States: Shooting, CO_2 asphyxiation	For all Region 4 States: Shooting, CO_2 asphyxiation
Region 5 Connecticut Delaware Maine Maryland Massachusetts New Hampshire New Jersey	For all Region 5 States except West Virginia: Shooting, egg oiling, nest destruction, CO_2 asphyxiation	For VA: Shooting (including at roosts near aquaculture facilities), CO_2 asphyxiation	For all Region 5 States: Shooting, CO_2 asphyxiation

New York Pennsylvania Rhode Island Virginia Vermont West Virginia DC			
Region 6 Kansas Nebraska North Dakota South Dakota	For KS, NE, ND, SD: Shooting, egg oiling, nest destruction, CO_2 asphyxiation	N/A	For KS, NE, ND, SD: Shooting, CO_2 asphyxiation

***Shooting:* Shooting cormorants is a highly target specific technique that is believed to reinforce non-lethal harassment. In the case of cormorants, shooting is always conducted with shotguns or rifles. When used by trained personnel, the risk of shooting directly taking non-target species is minimal. Shooting can be conducted from a distance and while this quality minimizes the likelihood of direct human disturbance to species co-occurring with cormorants, the noise associated with gunfire could cause indirect disturbance.

Egg oiling and destruction: Cormorant eggs have been destroyed in attempts to reduce recruitment into populations and to eliminate colonies at specific locations. Egg oiling is a method of suppressing reproduction of nuisance birds by spraying a small quantity of food grade vegetable oil on eggs in nests. The oil prevents exchange of gases and causes asphyxiation of developing embryos. The EPA has ruled that use of corn oil for this purpose is exempt from registration requirements under the Federal Insecticide, Fungicide, and Rodenticide Act (the public resource depredation order authorizes only the use of corn oil). This method is extremely target specific. However, it requires direct physical contact with cormorants, their eggs, or their nests which necessitates immediate human presence at nest and roost sites. Such control efforts are typically conducted on foot by a small number of personnel in order to minimize incidental disturbance of other species, especially at nest colonies.

Nest destruction: Nest removal is the removal of nesting materials during the construction phase of the nesting cycle. Nest destruction on the ground simply involves the physical breakup of nest structures. Tree nests present a greater challenge. Nests can be destroyed manually or by use of high pressure water to dislodge nests from trees.

CO2 asphyxiation: CO2 is sometimes used to euthanize birds which are captured by hand or in live traps and when relocation is not a feasible option. Live birds are placed in a container such as a plastic 5-gallon bucket or chamber and sealed shut. CO_2 gas is released into the bucket or chamber and birds quickly die after inhaling the gas. This method is approved as a euthanizing agent by the American Veterinary Medical Association. In the case of cormorants, this is a secondary technique that will generally be used only when appropriate damage control personnel (APHIS/WS) are already on site using other methods such as egg oiling.

VII. Determination of effects:

A. Explanation of effects of the action on species and critical habitats in items III. A, B, C:

* Denotes species with critical habitat designations

Region 2

Whooping crane (*Grus americana*) [E]*: Whooping cranes feed and roost in freshwater marshes, wet prairies, and upland grain fields. The wild population of whooping cranes is migratory, breeding in Canada (Northwest Territories) and wintering in and around the Aransas National Wildlife Refuge along the coast of Texas. In Region 2, whooping cranes and cormorants do not overlap in range during the breeding season. During the winter, when cormorants can be found near the Gulf coast, their ranges do overlap. During migration, they could overlap in Oklahoma and other parts of Texas. However, habitat selection of the two species is slightly different with whooping cranes being more of a wetland and upland field bird and cormorants preferring deeper lakes, reservoirs, and streams. In the winter, most cormorants in Texas can be found at inland lakes and reservoirs rather than at coastal sites where whooping cranes might be found. It is not likely that whooping cranes will be adversely affected by the proposed action.

Attwater's greater prairie chicken (*Tympanuchus cupido attwateri*) [E]: Unlike cormorants, this prairie chicken inhabits Texas coastal prairies. Incidental take associated with cormorant control actions is very unlikely because of these differences in habitat preferences. Furthermore, because of the critical endangered status of the Attwater's greater prairie chicken they are carefully monitored and it is therefore unlikely that cormorant control would be conducted in an area where it would harm this species. It is not likely to be adversely affected by the proposed action.

Red-cockaded woodpecker (*Picoides borealis*) [E]: The mature pine forest preferred by these woodpeckers is very different from the preferred habitat of cormorants. The proposed action is not likely to result in adverse effects to this species.

Least tern (*Sterna antillarum*) (Interior population) [E]: In Region 2, least terns and cormorants overlap during the breeding season. Because of their different flight profile and pattern, it is unlikely that least terns could be confused with cormorants and taken directly. Since least terns are more likely to be found on beaches and sandbars than lakes and reservoirs where cormorants are more common the probability of indirect take is low. However, control activities will not occur more than 1000 feet from active interior least tern nests or colonies of least terns, avoiding any incidental take (i.e. harassment) of these species.

Northern aplomado falcon (*Falco femoralis septentrionalis*) [E]: The Northern aplomado falcon inhabits savanna/rangeland/grassland areas, making it unlikely to co-occur with cormorants. The proposed action is not likely to result in adverse effects to this species.

Southwestern willow flycatcher (*Empidonax traillii extimus*) [E]*: The southwestern willow flycatcher is found in dense riparian associations of willow, cottonwood, button bush, and other deciduous trees and shrubs. The fact that this species is rarely found in Texas and does not occur in Oklahoma, combined with its preference for streams and marshes rather than lakes and reservoirs, make it not likely that the proposed action will adversely affect it.

Mexican spotted owl (*Strix occidentalis lucida*) [T]: Within the action area, this owl is only found in west Texas. Its habitat preference is mixed-conifer forest, often in steep canyons, which is very different from cormorant preferred habitat. It is not likely to be adversely impacted by the proposed action.

Black-capped vireo (*Vireo atricapillus*) [E]: This vireo breeds only in Texas and Oklahoma. Preferred habitat is dense low thickets and oak scrub, which is very different from the preferred habitat of cormorants. This species is not likely to be adversely affected by the management techniques covered by the proposed action.

Golden-cheeked warbler (*Setophaga chrysoparia*) [E]: This warbler inhabits oak-juniper woodlands in Texas only. It is not likely to be adversely affected by the proposed action.

Piping plover (*Charadrius melodus*) [T]*: The preferred habitat of piping plovers is sandy beaches, sandflats, dredge islands, and drained floodplains. In Region 2, the winter range of cormorants and this species may overlap along the Gulf coast. Since piping plovers are more likely to be found on beaches and sandbars than lakes and reservoirs where cormorants are more common indirect take or harassment is low. However, control activities will not occur more than 500 feet (1000 feet for discharge or use of firearms (without noise suppression)) from active piping plover nests or colonies, avoiding any incidental take (i.e. harassment) of these species. The proposed action is not likely to adversely affect piping plovers in Region 2.

Mountain plover (*Charadrius montanus*) [P]: This species has been proposed for listing as a threatened species and can be found in very small numbers in grasslands, meadow complexes, agricultural fields, or alkali flats. This species is unlikely to occur in areas inhabited by cormorants and thus not likely to be adversely affected by the proposed action.

Eskimo curlew (*Numenius borealis*) [E]: This species may be extinct. Preferred habitat on its wintering grounds is grasslands, pastures, plowed fields and, less frequently, marshes and mudflats. It is not likely to be adversely affected by the proposed action.

Lesser prairie chicken (*Tympanuchus pallidicinctus*) [C]: The prairie chicken is an upland species found in short-, mid-, and tall-grass prairies and shrub steppes. The proposed action is not likely to adversely affect this species.

Yellow-billed cuckoo (*Coccyzus americanus*) [C]: This species can be found throughout Texas and Oklahoma in woodlands, thickets, orchards, and streamside groves. Because of differences in preferred habitat to that of cormorants, it is not likely to be adversely affected by the proposed action.

Concho water snake (*Nerodia paucimaculata*) [T]*: This species inhabits fast-flowing rocky streams and takes cover under rocks in water or in vegetation along the shore of the Concho River in Texas. Due to its limited distribution and the difference in its preferred habitat and that of cormorants, it is not likely to be adversely affected by the proposed action.

Louisiana pine snake (*Pituaphis ruthveni*) [P]: This snake is found in Region 2 only in extreme east-central Texas in longleaf pine savannah. The management techniques associated with the proposed action are not likely to adversely affect this species.

Region 3

Piping plover (*Charadrius melodus*) [E]*: The piping plover is listed as endangered in Great Lakes watersheds of six Region 3 States within the action area (IL, IN, MI, MN, OH, and WI). Great Lakes piping plovers nest on sandy beaches, sandflats, dredge islands, and drained floodplains. They are generally solitary nesters but may nest with terns. While the preferred nesting habitat of cormorants and piping plovers is different, they may be found in close enough proximity but since control activities will not occur more than 500 feet (1000 feet for discharge or use of firearms (without noise suppression)) from active piping plover nests or colonies, the proposed action is not likely to adversely affect this species.

Least tern (*Sterna antillarum*) (Interior population) [E]: This species usually forms colonies on bare or sparsely vegetated sand or dried mudflats along coasts or rivers. In Illinois and Iowa, cormorants may nest in proximity to least tern colonies along the Mississippi River. The species' preferred nesting habitats are different and direct take is unlikely due to dissimilarity of appearance and since control activities will not occur more than 500 feet (1000 feet for discharge or use of firearms (without noise suppression)) from active piping plover or interior least tern nests or colonies, the proposed action is not likely to adversely affect this species.

Whooping crane (*Grus americana*) [XN]*: Whooping cranes found within Region 3 belong to a recently introduced population in Wisconsin. This population is classified as a nonessential experimental population, and for section 7 purposes, whooping cranes are considered threatened on National Wildlife Refuge and National Park Service lands and proposed on all other lands. Habitat selection of the two species is slightly different with whooping cranes being more of a wetland and upland field bird and cormorants preferring deeper lakes, reservoirs, and streams. The proposed action is not likely to adversely affect this species.

Kirtland's warbler (*Setophaga kirtlandii*) [E]: This warbler is found only in Michigan in stands of dense scrubby jack pine. Its range does not overlap with that of cormorants and thus it is not likely to be adversely affected by the proposed action.

Red Knot (*Calidris canutus rufa*) [T]: Red knots are coastal long distance migrants between its breeding grounds in the Canadian Arctic and several wintering regions, including the Southeast United States (Southeast), the Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America. Dissimilarity of appearance and differences in habitats make it not likely the proposed action will adversely affect this species.

Lake Erie water snake (*Nerodia sipedon*) [T]: Lake Erie water snakes live on a group of limestone islands in western Lake Erie that are located more than one mile from the Ohio and Canada mainlands. Lake Erie water snakes found on those islands will not be adversely affected by the proposed action. To the contrary, biologists have speculated that abundant cormorant populations may be having a negative impact on this species and thus it could benefit from the proposed action.

Houghton's goldenrod (*Solidago houghtonii*) [T]: This plant is mostly limited to shoreline habitats on the northern shores of Lakes Michigan and Huron. It is found in sparsely vegetated, moist, sandy, interdunal depressions; rocky and cobbly shores; beach flats and calcareous beach sands; and seasonably wet alvar, occasionally in association with Pitcher's thistle and dwarf lake iris. Cormorants may be having negative effects upon the distribution of this species; thus the proposed action could benefit it.

Dwarf lake iris (*Iris lacustris*) [T]: This plant is found almost exclusively on the northern shores of

Lakes Michigan, Huron and Superior, most often in young, well-drained soils ranging from sands to gravels to sandy clay loam and organic-enriched sands. Cormorants may be having negative effects upon the distribution of this species; thus the proposed action could benefit it.

Pitcher's thistle (*Cirsium pitcheri*) [T]: This plant is found in a narrow band along the margins of Lakes Michigan, Huron, and Superior with 90 % of sites occurring in Michigan and some sites occurring in Indiana and Wisconsin. The species is a regional endemic restricted to dune habitats in the western Great Lakes region and appears to establish itself only in very open, sandy soil. Cormorants may be having negative effects upon the distribution of this species; thus the proposed action could benefit it.

Region 4

Ivory-billed woodpecker (*Campephilus principalis*) [Extinct?]: Since this species is presumed extinct and found in different habitat then cormorants, it is not likely that the proposed action will adversely affect it.

Red-cockaded woodpecker (*Picoides borealis*) [E]: The mature pine forest preferred by these woodpeckers is very different from the preferred habitat of cormorants. Thus, the proposed action is not likely to result in adverse effects to this species.

Mississippi sandhill crane (*Grus canadensis pulla*) [E]*: These cranes are confined to a fairly small section of Jackson County, Mississippi. Savannas are the preferred habitat of this crane and are inhabited year round. Because of differences in preferred habitat and the limited geographic range of this species, it is not likely that the proposed action would adversely affect it.

Piping plover (*Charadrius melodus*) [T]*: In Region 4, the Northern Great Plains population of piping plovers winters along the Gulf Coast states and the Atlantic Coast population winters along the Atlantic coast from Virginia south to North Carolina. Preferred winter habitat of this species is primarily sandy ocean beachesbut since control activities will not occur more than 500 feet (1000 feet for discharge or use of firearms (without noise suppression)) from active piping plover nests or colonies, the proposed action is not likely to adversely affect this species.

Least tern (*Sterna antillarum*) (Interior population) [E]: The interior population of the least tern breeds in isolated areas along the Missouri, Mississippi, Ohio, Red, and Rio Grande river systems, which include several States in Region 4. Since control activities will not occur more than 500 feet (1000 feet for discharge or use of firearms (without noise suppression)) from active least tern nests or colonies, the proposed action is not likely to adversely affect this species.

Everglade snail kite (*Rostrhamus sociabilis plumbeus*) [E]*: The Everglade snail kite can be found in a small portion of Florida. Their preferred habitat is large, shallow, inland freshwater marshes which support populations of apple snails. Cormorants prefer deeper waters than this species. It is not likely that the Everglade snail kite would be adversely affected by the proposed action.

Wood stork (*Mycteria americana*) [E]: Wood storks are listed as Endangered in Alabama, Florida, Georgia, and South Carolina. They are birds of freshwater and brackish wetlands, primarily nesting in cypress or mangrove swamps. Habitat types and distributions in some areas overlap between cormorant and wood storks All control activities must 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. Therefore, these provisions and differences in their physical appearance make it unlikely that they would be directly taken.

Cape Sable sparrow (*Ammodramus maritimus mirabilis*) [E]*: The Cape Sable sparrow inhabits brushless, subtropical marshes of interior southern Florida, habitat that is different than the preferred habitat of cormorants. It is not likely that the proposed action would result in adverse effects to this species.

Florida grasshopper sparrow (*Ammodramus savanarum floridanus*) [E]: The Florida grasshopper sparrow occurs in the prairie region of south central Florida, inhabiting the stunted growth of saw palmetto, dwarf oaks, bluestems, and wiregrass. It is not likely to be adversely affected by the proposed action.

Black-capped vireo (*Vireo atricapillus*) [E]: In Region 4, this vireo breeds only in Louisiana. Preferred habitat is dense low thickets and oak scrub, which is very different from the preferred habitat of cormorants. This species is not likely to be adversely affected by the management techniques covered by the proposed action.

Roseate tern (*Sterna douglalli*) [T]: In Region 4, roseate terns are restricted to Florida. They breed primarily on small offshore islands. Their preferred habitat is coastal and dissimilarity of appearance makes it unlikely that they will be adversely affected by the proposed action.

Audubon's crested caracara (*Polyborus plancus audubonii*) [T]: Audubon’s crested caracara is found in open grassland, prairie, pastures, or desert habitats. It is listed as threatened only in Florida. It is not likely to co-occur in habitat with cormorants and thus is not likely to be adversely affected by the proposed action.

Florida scrub jay (*Aphelocoma coerulescens*) [T]: The Florida scrub jay is found only in Florida, inhabiting oak scrub on white, drained sand, in open areas without a dense canopy. Its upland habitat preferences make it not likely to be adversely affected by the proposed action.

Whooping crane (*Grus americana*) [XN]*: A non-migratory, introduced population of the whooping crane is found in a portion of Osceola County, Florida. Because of the critical status of this species and its limited geographic range, it is very unlikely that any cormorant management would be conducted near enough to cause incidental take. The proposed action is not likely to adversely affect whooping cranes.

Bachman's warbler (*Vermivora bachmanii*) [Extinct?]: This species not only has (had?) different preferred habitat than cormorants, but is believed to be extinct. The proposed action is not likely to adversely affect this species.

Red Knot (*Calidris canutus rufa*) [T]: Red knots are coastal long distance migrants between its breeding grounds in the Canadian Arctic and several wintering regions, including the Southeast United States (Southeast), the Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America. . Dissimilarity of appearance and differences in habitats make it not likely the proposed action will adversely affect this species.

Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*) [E]: The Florida salt marsh vole inhabits periodically flooded salt marshes within Waccasassa Bay in Levy County, Florida. Its very small population size and preference for herbaceous wetlands make it not likely to be adversely affected by the proposed action.

Atlantic salt marsh snake (*Nerodia clarkii taeniata*) [T]: This species inhabits coastal salt marshes and mangrove swamps in Florida. It may co-occur with cormorants, but it is not likely to be adversely affected by management activities.

Yellow-blotched map turtle (*Graptemys flavimaculata*) [T]: This species is restricted to the Pascagoula River drainage in Mississippi. Its preferred habitat is typically riverine with a moderate current and numerous basking logs. Because of its limited geographic range and differences in preferred habitat, it is not likely to be adversely affected by the proposed action.

Ringed map turtle (*Graptemys oculifera*) [T]: This species occurs in the main channel of the Pearl River in Mississippi and Louisiana. Its preferred habitat is typically riverine with a moderate current and numerous basking logs. Because of its limited geographic range and differences in preferred habitat, it is not likely to be adversely affected by the proposed action.

Region 5:

Piping plover (*Charadrius melodus*) [T/E]*: The State of New York contains piping plovers from both the Great Lakes population (endangered) and the Atlantic population (threatened). Piping plovers in the rest of Region 5 belong to the Atlantic population. This species nests on sandy beaches, sandflats, dredge islands and drained floodplains. While the preferred nesting habitat of cormorants and piping plovers is different, they may be found in close enough proximity but since control activities will not occur more than 500 feet (1000 feet for discharge or use of firearms (without noise suppression)) from active piping plover nests or colonies, the proposed action is not likely to adversely affect this species.

Roseate tern (*Sterna douglalli*) [E]: Roseate terns breed locally along the Atlantic coast. They breed primarily on small offshore islands different from cormorants along with dissimilarity of appearance, thus making it not likely that they will be adversely affected by the proposed action.

Red Knot (*Calidris canutus rufa*) [T]: Red knots are coastal long distance migrants between its breeding grounds in the Canadian Arctic and several wintering regions, including the Southeast United States (Southeast), the Northeast Gulf of Mexico, northern Brazil, and Tierra del Fuego at the southern tip of South America. Dissimilarity of appearance and differences in habitats make it not likely the proposed action will adversely affect this species.

Red-cockaded woodpecker (*Picoides borealis*) [E]: The mature pine forest preferred by these woodpeckers is very different from the preferred habitat of cormorants. Thus, the proposed action is not likely to result in adverse effects to this species.

Atlantic salmon (*Salmo salar*) [E]: This species will not be affected by the proposed action since control efforts will not take place under water.

Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) [E]: This species will not be affected by the proposed action since control efforts will not take place under water.

Region 6:

Least tern (*Sterna antillarum*) (Interior population) [E]: While cormorants and least terns may co-occur in these riverine habitats, control activities will not occur more than 500 feet (1000 feet for discharge or use of firearms (without noise suppression)) from active least tern nests or colonies, the proposed action is not likely to adversely affect this species.

Piping plover (*Charadrius melodus*) [T]*: Piping plovers of the Northern Great Plains population occur in Region 6 but since control activities will not occur more than 500 feet (1000 feet for discharge or use of firearms (without noise suppression)) from active piping plover nests or colonies, the proposed action is not likely to adversely affect this species.

Whooping crane (*Grus americana*) [E]*: Whooping cranes migrate through Region 6 but are not likely to be adversely affected by the proposed action because of differences in preferred habitat between cormorants and whooping cranes.

Black-capped vireo (*Vireo atricapillus*) [E]: In Region 6, preferred habitat is dense low thickets and oak scrub, which is very different from the preferred habitat of cormorants. This species is not likely to be adversely affected by the management techniques covered by the proposed action.

Eskimo curlew (*Numenius borealis*) [E]: This species may be extinct. Preferred habitat on its wintering grounds is grasslands, pastures, plowed fields and, less frequently, marshes and mudflats. It is not likely to be adversely affected by the proposed action.

Mexican spotted owl* *(Strix occidentalis lucida)* [T]: This owl is only found in mixed-conifer forest, often in steep canyons, which is very different from cormorant preferred habitat. It is not likely to be adversely impacted by the proposed action.

B. Explanation of actions to be implemented to reduce adverse effects:
[Under the proposed action]:

i. All control activities must 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.
ii. 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;
iii. other control activities such as egg oiling, 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; and
iv. 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 Ecological Services 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 Ecological Services 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-USFWS coordination discussions described above or at any other time, the Regional Migratory Bird Permit Office will initiate consultation with the Ecological Services Field Offices.

VIII. Effect determination and response requested:

A. Listed species/designated critical habitat:

<u>Determination</u>

- no affect/no adverse modifications _____ Concurrence

Regions 2-6

All species not otherwise listed in VIII. B, C

- may affect, but is not likely to adversely affect species/adversely modify critical habitat (see below) _____ Concurrence

Region 2 (OK and TX)

Attwater's greater prairie chicken	(*Tympanuchus cupido attwateri*) [E]
Mexican spotted owl	*(Strix occidentalis lucida)* [T]
Red-cockaded woodpecker	(*Picoides borealis*) [E]
Least tern	(*Sterna antillarum*) [E]
Northern aplomado falcon	(*Falco femoralis septentrionalis*) [E]
Southwestern willow flycatcher	(*Empidonax traillii extimus*) [E]
Black-capped vireo	(*Vireo atricapillus*) [E]
Golden-cheeked warbler	(*Dendroica chrysoparia*) [E]
Whooping crane*	(*Grus americana*) [E]
Piping plover*	(*Charadrius melodus*) [T]
Yellow-billed cuckoo	(*Coccyzus americanus*) [T]
Yuma clapper rail	*(Rallus longirostris yumanensis)* [E]
Eskimo curlew	(*Numenius borealis*) [E]

Concho water snake*	(*Nerodia paucimaculata*) [T]

Region 3 (IL, IN, IA, MI, MN, MO, OH, WI)

Piping plover*	(*Charadrius melodus*) [T]
Least tern	(*Sterna antillarum*) (Interior population) [E]
Whooping crane*	(*Grus americana*) [E]
Kirtland’s warbler	(*Dendroica kirtlandii*) [E]
Red Knot	(Calidris canutus rufa) [T]
Lake Erie water snake	(*Nerodia sipedon*) [T]
Houghton’s goldenrod	(*Solidago houghtonii*) [T]
Dwarf lake iris	(*Iris lacustris*) [T]
Pitcher’s thistle	(*Cirsium pitcheri*) [T]

Region 4 (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN)

Ivory-billed woodpecker	(*Campephilus principalis*) [Extinct?]
Red-cockaded woodpecker	(*Picoides borealis*) [E]
Mississippi sandhill crane*	(*Grus canadensis pulla*) [E]
Piping plover*	(*Charadrius melodus*) [E]
Least tern	(*Sterna antillarum*) (Interior population) [E]
Everglade snail kite*	(*Rostrhamus sociabilis plumbeus*) [E]
Wood stork	(*Mycteria americana*) [E]
Black-capped vireo	(*Vireo atricapillus*) [E]
Cape Sable seaside sparrow*	(*Ammodramus maritimus mirabilis*) [E]
Florida grasshopper sparrow	(*Ammodramus savanarum floridanus*) [E]
Roseate tern	(*Sterna douglalli*) [T]
Audubon's crested caracara	(*Polyborus plancus audubonii*) [T]
Florida scrub jay	(*Aphelocoma coerulescens*) [T]
Whooping crane*	(*Grus americana*) [NEP]
Bachman’s warbler	(*Vermivora bachmanii*) [Extinct?]
Red Knot	(*Calidris canutus rufa*) [T]
Florida salt marsh vole	(*Microtus pennsylvanicus dukecampbelli*) [E]
Ringed map turtle	(*Graptemys oculifera*) [T]
Yellow-blotched map turtle	(*Graptemys flavimaculata*) [T]

Atlantic salt marsh snake (*Nerodia clarkii taeniata*) [T]

Region 5 (NY, VT, WV, CT, DE, ME, MD, MA, NH, NJ, NY, PA, RI, VA, VT, WV, and DC)

Piping plover*	(*Charadrius melodus*) [T]
Roseate tern	(*Sterna douglalli*) [E]
Red-cockaded woodpecker	*(Picoides borealis)* [E]
Red Knot	(*Calidris canutus rufa*) [T]
Atlantic salmon	(*Salmo salar*)[E]
Atlantic sturgeon	(*Acipenser oxyrinchus oxyrinchus*) [E]

Region 6 (KS, ND, SD, and NE)

Least tern	(*Sterna antillarum*) (Interior population) [E]
Northern Great Plains Piping plover*	(*Charadrius melodus*) [T]
Whooping crane*	(*Grus americana*) [E]
Eskimo curlew	(*Numenius borealis*) [E]
Black-capped vireo	(*Vireo atricapillus*) [E]
Mexican spotted owl*	*(Strix occidentalis lucida)* [T]
Southwestern Willow Flycatcher*	*(Empidonax traillii extimus)* [E]

may affect, and is likely to adversely affect species/adversely modify critical habitat (see below)

NONE JEF Concurrence

B. Proposed species/designated critical habitat:

<u>Determination</u>

- no effect on proposed action/no adverse modifications of proposed critical habitat (see below)

NONE JEF Concurrence

- may affect, but is not likely to adversely affect species/adversely modify critical habitat (see below) JEF Concurrence

Louisiana Pine snake (*Pituaphis ruthveni*) [PT]
Mountain plover (*Charadrius montanus)* [P]

- is likely to jeopardize proposed species/ adversely modify proposed critical habitat

NONE JEF Concurrence

C. Candidate species:

<u>Determination</u>

- no effect (see below) JEF Concurrence

Lesser prairie chicken (*Tympanuchus pallidicinctus*) [C]

- is likely to jeopardize candidate species

NONE JEF Concurrence

Jerome Ford 10/18/2017

Signature Date