# The Double-Crested Cormorant

## Issues and Management

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# The Double-Crested Cormorant

## Issues and Management

# Preface

THIS BULLETIN is a comprehensive guide to the issues surrounding the double-crested cormorant (*Phalacrocorax auritus*), a species that has generated a tremendous amount of interest and controversy in recent years. The information presented is intended to help anglers, fish hatchery operators, fisheries and wildlife professionals, lake association members, nature center personnel, Cooperative Extension educators, secondary school teachers, and the interested public find the information needed to understand both the complexity of issues involved, and the management options available. Although conflicts with cormorants occur in other areas of the country, this bulletin focuses on populations of the interior United States and the northeastern Atlantic coast.

LEE KARNEY

The double-crested cormorant is an interesting yet controversial bird.

# Introduction

Even though breeding populations of the double-crested cormorant are present in many locations throughout North America, this bird is neither well known nor widely recognized by the public. Unlike other more popular, captivating water birds like the Canada goose (*Branta canadensis*) or common loon (*Gavia immer*), the double-crested cormorant is viewed by many as a relatively uncharismatic species. Maligned for centuries and persecuted for their fish-eating habits, the cormorant has recently become the center of controversy in regions where numbers have rapidly increased. Expanding populations have raised concerns about adverse impacts cormorants might have on other bird and fish species of special concern, declines in local fish populations, and destruction of vegetation at nesting areas. Specific socioeconomic concerns include economic losses from depredation at aquaculture facilities, potential impacts on fishing-related businesses, loss of fish in private lakes, and damage to trees on private property.

Although double-crested cormorants are widespread, some geographic areas have experienced significant population growth and conflict, while others have not. The breeding range of the cormorant is divided into five geographic areas—Alaska, the Pacific coast, the southern United States, the interior United States and Canada, and the northeast Atlantic coast. Populations have been growing and expanding since at least the 1980s in the interior United States and Canada, northeast Atlantic coast, and the southern United States. In this publication, we focus on the interior and Atlantic coast breeding populations, which breed and nest in the north, then migrate south to winter in coastal areas from Texas to North Carolina with significant concentrations in the Mississippi delta region.

Within the interior United States and Atlantic coast regions, the occurrence and severity of cormorant impacts varies. For example, in the Great Lakes region the number of cormorants increased an average of 29 percent per year from 1970 to 1991, after which population growth slowed. In some of these areas cormorant populations may be at an all-time high. However, recent population increases may alternatively represent recovery toward

pre-settlement numbers of cormorants in some regions, and a re-colonization in other regions after a long period of absence.

Recent population increases follow a dramatic decline that occurred between the 1950s and 1970s, caused by the effects of human persecution and chemical contamination from DDT. Cormorant numbers began to rebound in the mid-70s when DDT was banned, pollution control lowered the concentrations of toxic contaminants in the bird's food, food became more abundant throughout their winter and summer ranges, and cormorants were given protection by both Federal and State laws. These factors allowed populations of these adaptable birds to grow.

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Cormorant numbers have increased after a dramatic decline from the 1950s to the 1970s.

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# Biology and Natural History

## Description of the Cormorant

The double-crested cormorant is a long-lived, colonial-nesting water bird native to North America. One of 38 species of cormorants worldwide, and one of six species in North America, it is usually found in flocks, and sometimes confused with geese or loons when on the water (Table 1). Male and female cormorants look alike, having black plumage tinted with a greenish gloss on the head, neck and underside. In breeding plumage, tufts or crests of feathers appear for a

STAN TEKIELA

The double-crested cormorant perches on trees, rocks, buoys, and other objects that overhang or project from water.

**Table 1** **Characteristics useful for field identification of Double-Crested Cormorants versus Canada Geese or Common Loons**

| | *Canada Geese* | *Common Loons* | *Double-Crested Cormorants* |
|---|---|---|---|
| ***Color*** | Black, gray, buff and white, dark head and neck, lighter body | Black and white, black back evenly patterned with white in breeding season | Uniformly dark, or mottled brown and gray breast |
| ***Neck*** | C-shaped curve, long | Short, curved | Snake-like curve, long |
| ***Bill*** | Long, flattened at tip | Heavy with pointed tip | Slender, cylindrical, hooked tip |
| ***Tail*** | Shorter than cormorant | Very short | Much longer than geese or loons |
| ***Wing beat*** | Slower than cormorant or loon | Faster than geese or cormorant | Slower than loon, somewhat more rapid than geese |
| ***Neck in flight*** | Held horizontal | Held slightly lower than horizontal | Held slightly higher than horizontal |
| ***Perching position*** | Remains on ground | Ungainly on land | Upright posture with curving neck, tail used as brace, wings often spread; prefers trees, rocks, and buoys that overhang or project from water |
| ***Position on water*** | Swims with most of body above water | Swims low in water | Body often nearly submerged, neck, more erect than loons, bill pointed at upward angle |

WENDY VANDYK EVANS

Canada goose

LEE KARNEY

Common loon

STAN TEKIELA

Double-crested cormorant

short time on either side of the head of adult birds, giving them their name. Their black bills are slender and cylindrical with a hooked tip and sharp edges. They have black, webbed feet set well back on their body, a long curving neck, orange facial skin, and an orange throat pouch like their pelican relatives (family *Pelicanidae*). Some one- to two-year-old juvenile cormorants may have grey or tan plumage on their neck and breast.

Double-crested cormorants have a body length of 29 to 36 inches, a wingspan of about 54 inches, and weigh four to six pounds. On average, double-crested cormorants live for six years but 19-year-old birds have been documented in the wild. When away from the roost, they are usually silent, but they may make hoarse, grunting alarm notes at roost sites.

They are expert divers, with webbed feet, streamlined bodies, and feathers that hold water and reduce buoyancy. They are typically believed to dive to depths of eight to 20 feet. After feeding, cormorants characteristically dry their feathers by perching with their wings outstretched.

LEE KARNEY

Cormorants dry their feathers by perching with their wings outspread.

## Habitat

During the breeding season double-crested cormorants inhabit lakes, ponds, slow-moving rivers, lagoons, estuaries and open coastlines. They need suitable nesting sites with feeding areas nearby. Cormorants may nest in trees or on the ground, on steep cliffs, or rocky or sandy islands. They may also use artificial sites such as bridges, wrecks, abandoned docks or towers. Nesting trees and structures are usually located in or near the water on islands, in swamps, or along tree-lined lakes. Cormorants choose live evergreen or deciduous trees for nesting, though the trees often die within three to ten years because of the significant accumulation of guano deposited on them. They prefer to nest in trees when available, rather than nesting on the ground.

Outside of the breeding season, cormorants use a variety of habitats including marine islands and coastal bays in addition to those habitats used during the breeding season. Cormorants need places with nighttime roosts and daytime resting or loafing areas during all seasons. They roost on sandbars, rocky shoals, cliffs and offshore rocks, utility poles, fishing piers, high-tension wires, channel markers, pilings, and trees near their fishing grounds.

## Breeding and Nesting Behavior

Cormorants are monogamous and breed in colonies ranging from several pairs to a few thousand pairs. Double-crested cormorants

JEREMY T. H. COLEMAN

Cormorants nest in colonies ranging from several pairs to thousands of pairs.

have some site fidelity, meaning they return to the same site to breed year after year. Young cormorants often return to colony sites where they hatched or to nearby areas to breed. Beginning in April, the pair begin construction of an elevated platform nest composed of twigs, branches, and other plant materials. These nests often reach a height of 12–20 inches and may be re-used in subsequent years.

Like other colonial-nesting birds such as great blue herons (*Ardea herodias*), cattle egrets (*Bubulcus ibis*), great egrets (*Ardea alba*), black-crowned night herons (*Nycticorax nycticorax*), gulls (*Larus* spp.), and terns (*Sterna* spp.), cormorants prefer islands with sparse vegetation. They usually breed beginning at age three, laying two to seven (typically three or four) light blue or bluish-white eggs in mid- to late April. Both adults begin incubating the eggs soon after the female lays the first one, and each

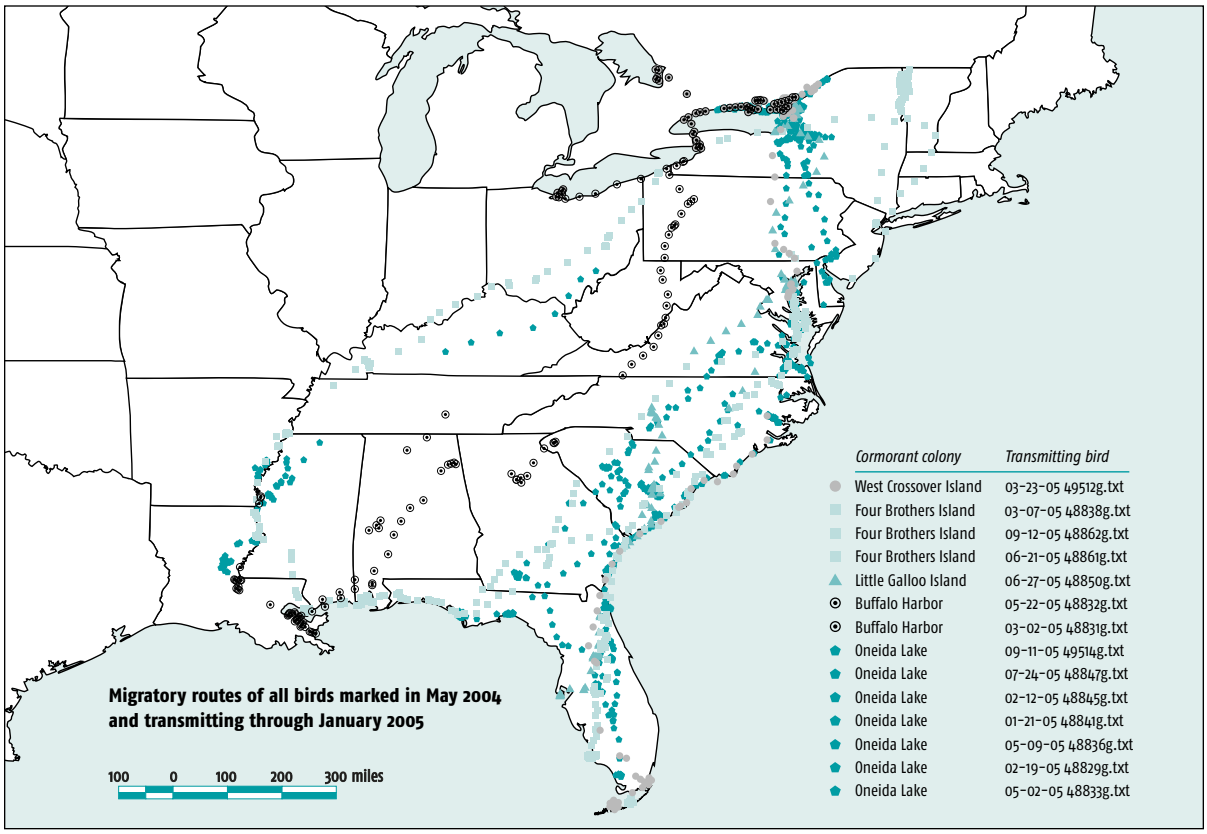
egg hatches after about 25 days. Because incubation begins right away, the first and last nestling may hatch a week or more apart. When this occurs, the youngest birds typically do not survive, as the begging activities of the older, larger more vocal nestlings receive more attention from the adult birds. On average, each nest produces two young. The chicks usually can fly by the time they are six weeks old. They accompany adults to feed at seven weeks and are independent when they are about ten weeks old.

JEREMY T. H. COLEMAN

Cormorants lay two to seven eggs in a nest built of twigs, branches, and other plant material.

JEREMY T. H. COLEMAN

Double-crested cormorant chicks wait in the nest for their next meal. These young will become independent when they are ten weeks old.




ADAPTED FROM MAP BY BRIAN S. DORR / USDA / WS / NATIONAL WILDLIFE RESEARCH CENTER

Routes chosen by double-crested cormorants equipped with satellite-transmitting radio collars while on nesting grounds in May, 2004

## Migration

Double-crested cormorants of the Atlantic coast and interior populations are seasonal migrants. They leave the northeast in September, migrating south along coastlines and river valleys. The two primary migration routes are down the Atlantic coast and through the Mississippi and Missouri Valleys to the Gulf Coast. Cormorants return to their breeding grounds in late March or April.

JEREMY T. H. COLEMAN

A cormorant affixed with a radio transmitter allows scientists to learn more about the migratory routes of these birds.

## Food Habits and Feeding

Double-crested cormorants feed almost exclusively on fish, primarily small bottom-dwelling or schooling "forage" fish. They are adaptable, opportunistic feeders that prey on many species of small fish (less than six inches), usually feeding on those that are most abundant and easiest to catch. This includes fish such as alewife (*Alosa pseudoharengus*), gizzard shad (*Dorosoma cepedianum*), yellow perch (*Perca flavescens*), sculpins (*Cottus* spp.) and sticklebacks (*Pungitius pungitius*). Because a cormorant's ability to catch a particular species of fish depends on a number of factors (distribution, relative abundance, behavior, habitat), the composition of a cormorant's diet can vary quite a bit from site to site and throughout the year, and can reflect the number and types of fish present in a given area at a given time.

CAL VORNBERGER WILDLIFE PHOTOGRAPHY

Cormorants feed on a variety of fish species.

Typically, cormorants feed during the day in shallow water (less than 25 feet) within a few miles of the shore and the breeding colony. To capture food cormorants dive below the surface and pursue prey underwater. Dives may last from 20–25 seconds or more and between dives the birds sometimes swim with their heads submerged, searching for prey. They grasp their prey in their bills and sometimes swallow fish underwater. Cormorants swallow large fish or those that are difficult to handle, such as eels or spiny fish, at the surface. At times, they may throw their prey into the air, catch it, and swallow it head first. Cormorants typically forage individually but may also gather into feeding flocks of tens to hundreds of birds, especially when preying on small schooling fish.

Adult cormorants feed regurgitated food to their nestlings. For very young chicks, an adult will arch its neck, take the head of the chick into its mouth, and regurgitate a semi-liquid food. Older nestlings will thrust their heads into the adult's throat and remove whole fish regurgitated into the neck pouch

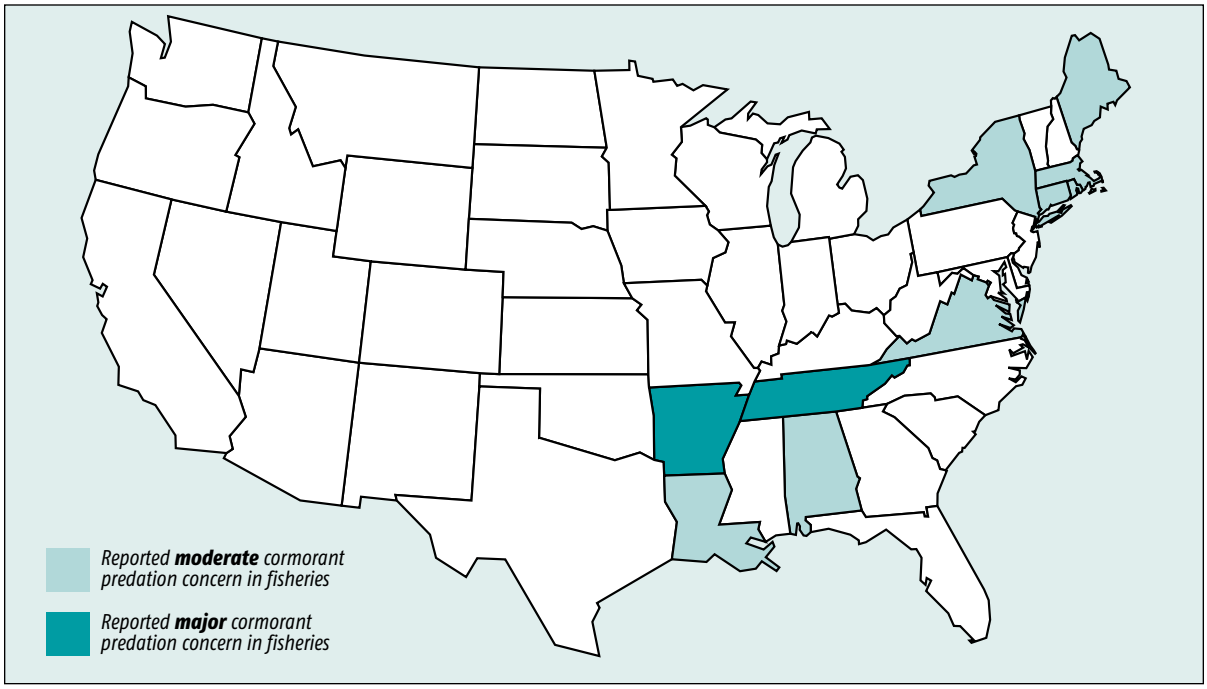
Overall, double-crested cormorants are not major consumers of commercial and sport fish species. However, exceptions have been documented at specific sites. Cormorants often congregate where there are high concentrations of fish such as stocking release sites, aquaculture ponds, dams and other areas. In these instances, as well as in some open water situations, they can have significant local impacts.

# Concerns About Cormorants

## Impacts on Recreational Fisheries

THERE IS A LONG HISTORY of conflict between human fishery interests and cormorants. As North American cormorant populations expanded following a low point in the 1960s and 1970s, concerns about fishery impacts also expanded. By the late 1990s, natural resource agencies in 27 states reported losses to free-ranging fish stocks. Agencies in ten states, ranging from the southwest to the northeast, considered cormorant predation to be of moderate to major fishery management concern.

In reviews of cormorant diet studies, scientists have concluded that fish species of recreational or commercial significance generally make up only a small percentage of the cor-

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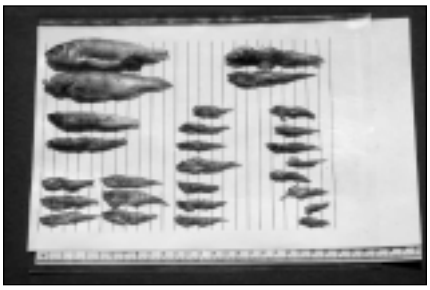
States reporting concerns regarding cormorant predation to sport and commercial fisheries

morant diet. Cormorants, however, are opportunistic predators whose diet varies considerably with local prey availability. For example, in one study trout comprised one percent of great cormorant (*Phalacocrorax carbo*) diet (by weight) in one English river, and 85 percent of the diet in another. In another study, investigators found that the percent of sport and commercially significant species in the diet of double-crested cormorants feeding at a Wyoming river varied from less than one percent to 93 percent. At Rice Island in the Columbia River, estuary salmonids, some of which are federally listed as threatened or endangered, are the most important prey of double-crested cormorants. However, diet studies by themselves say more about the importance of the fish to the cormorant than about the impact of the cormorant on the fish.

Reviewers considering the effect of cormorant predation on fisheries have often concluded that they have no clearly defined impact. Studies of fisheries impact are often inconclusive, because obtaining information can be difficult and expensive, particularly in large open systems. Fisheries operate under a wide variety of physical, biological and cultural conditions, so that even when comprehensive information is available it may be impossible to separate the effects of the various influences. Such conclusions, as can be made, are generally specific to the fishery in question.

In recent years, several large studies of fishery-cormorant interactions have been conducted. Not surprisingly the conclusions have varied. However, studies on eastern Lake Ontario, using a 20-plus year fishery database, concluded that cormorant predation was associated with an increase in mortality of young smallmouth bass (*Micropterus dolomieui*) that contributed to a major decline in bass abundance and in the quality of the bass fishery. Researchers at the Cornell University Biological Field Station have studied the walleye (*Sander vitreus*) population, recreational fishery, and cormorant diet at Oneida Lake, New York. They determined, based on over 40 years of fish population data, that cormorant predation was likely a significant source of subadult walleye mortality that negatively impacted the fishery.

Cormorant diets are highly variable depending on local prey availability. Impacts on fisheries are likely to be even more variable due to the complex set of conditions under which they operate. When considering the potential impact of cormorant predation on any given fishery, it is important to be aware that such impact is likely to be specific to that set of conditions. Information devel-



JEREMY T. H. COLEMAN

These fish were collected from the stomach of a double-crested cormorant. Cormorants are opportunistic and feed on a variety of fish species.

oped to date reveals that concerns about cormorant impacts on open water fisheries are widespread, but aquatic systems are extremely complex, and the impacts of any single predator species are difficult to demonstrate with a high degree of certainty.

## Impacts on Aquaculture

Cormorants have also come into conflict with the expanding aquaculture industry in the southeastern United States and elsewhere. Winter cormorant roosts in the southern United States near aquaculture ponds may range from hundreds of birds to tens of thousands. Depredation to catfish in particular has been economically significant. Estimated loss to the catfish industry ranges from 5–25 million dollars with estimates of $13 million in losses in Mississippi alone. Cormorants can affect hatchery operations throughout the United States. The mere presence of cormorants, as well as wounds caused by unsuccessful attacks, may stress hatchery fish. Stressed fish grow more slowly and are more susceptible to disease. Fish-eating birds like cormorants also may increase the spread of disease and parasites.

## Effects on Vegetation and Habitat

Like most colonial waterbirds, double-crested cormorants can have a significant effect on vegetation at breeding and roosting sites through normal nesting activities. Their guano is acidic and can change soil chemistry, killing ground vegetation and irreversibly damaging nest trees. Cormorants also destroy vegetation directly by stripping leaves and small branches from trees for nesting material. At times, the weight of the birds and their nests can even break branches. Loss of trees can lead to increased erosion, particularly on sand spits and barrier beaches.

In one example on Little Galloo Island in Lake Ontario, all of the trees have died over time from a combination of defoliation and guano. Damage to vegetation can occur relatively quickly after cormorants move into an area. For instance, in the St. Lawrence estuary cormorants on several islands caused irreversible damage to trees in less than three years.

JEREMY T. H. COLEMAN

Ground vegetation and trees usually die shortly after cormorants begin nesting in an area, as pictured here on Little Galloo Island in eastern Lake Ontario

Addition of cormorants as a nesting species in 1982 on Young Island in Lake Champlain resulted in the loss of all but one tree by 1996.

In some cases, cormorant colonies have significantly affected rare plants and plant communities. For example, the islands in western Lake Erie are home to rare Carolinian woodlands with stands of Kentucky coffeetree (*Gymnocladus dioicus*), and large cormorant colonies there could threaten their continued existence. The interactions between colonial water birds and vegetation are natural occurrences that have taken place throughout history. However, in human-altered ecosystems where alternative habitat is limited or unavailable, cormorants can affect the persistence of vegetation communities and other wildlife species that rely on habitat provided by these communities.

## Impacts on Other Bird Species

Cormorants tend to be attracted to nesting sites of other colonial water birds. Occupying similar habitat may affect other colonial water-bird species such as gulls, terns, egrets, herons, black-crowned night herons, as well as some waterfowl, by directly competing for nesting sites or by altering nesting habitat. For example, cormorant guano deposited under nest trees can kill understory vegetation important for nesting black-crowned night herons. At West Sister Island National Wildlife Refuge in Lake Erie, which supports the largest heron colonies in the Great Lakes, great blue heron numbers have declined annually since the double-crested cormorant arrived in 1992, presumably due to a combination of nest site competition, loss of nesting sites, and an increase in human activity.

GARY KRAMER

Cormorants may alter nesting habitat for other bird species, such as the black-crowned night heron.

On Oneida Lake, New York, double-crested cormorants, along with gulls, are thought to

compete for nesting space with common terns (*Sterna hirundo*), a species of special concern. Like gulls, cormorants return to their breeding grounds before common terns; this behavior renders portions of the limited nesting space on the lake unavailable to common terns.

## Newcastle Disease

Newcastle disease is a viral disease that can affect all bird species, and was first recognized in double-crested cormorants in the St. Lawrence River Estuary, Quebec in 1975. In 1992, double-crested cormorants in seven different states died from the disease. This widespread epidemic affected cormorants from the interior population, causing juvenile mortality rates ranging from ten to 90 percent. By the late 1990s, outbreaks had occurred in populations across North America.

Possible transmission of Newcastle disease from free-ranging wild birds to poultry is a concern, though there has only been one reported incident directly linking double-crested cormorants to an outbreak in domestic poultry. There has been no report of extensive mortality in other wild birds that share habitat with infected double-crested cormorants, however Newcastle disease identical to that found in cormorants has been isolated from American white pelicans (*Pelecanus erythrorhynchos*) and ring-billed gulls (*Larus delawarensis*).

Newcastle disease is transmitted through bird guano, or by humans who have been in contact with infected birds. Therefore, people working with double-crested cormorants should take measures to prevent infecting other birds, wild or domestic. After handling cormorants, disinfect hands, footwear and equipment, and wash all clothing. People can also contract Newcastle disease. Symptoms, including conjunctivitis, mild fever, headache and malaise, are usually mild and last three to four days.

## Recreation, Property Values and Tourism

Cormorants may cause damage to private property by feeding on stocked fish in privately owned lakes and ponds, damaging boats, marinas and other structures near breeding or roost sites, or damaging vegetation on privately owned land. The strong odor of droppings near roosts and nesting areas along with the loss of vegetation may reduce nearby property values. Tourists attracted to the natural beauty of waterfront areas may view the areas as unattractive once cormorants take up residence. On a local scale, decreasing property values and reduced tourism and recreation, may cause economic losses for area residents and businesses that rely on income from tourism.

# Non-Lethal Management Options

## Harassment

HARASSMENT, or scare tactics applied in an integrated and consistent fashion, can discourage cormorants from using specific sites. Birds can be hazed at fish hatcheries and aquaculture facilities, as well as roosting and nesting sites on larger ponds, lakes and the marine environment. Devices that make noise including pyrotechnics such as shell crackers, screamers, whistling or exploding projectiles, bird bangers, propane cannons, and live ammunition have been tried, with varying success. Live ammunition is often the least expensive and most readily available form of pyrotechnics, however other methods may be more effective and extra precaution should be taken to avoid injuring or killing cormorants and other protected species. Hand-held lasers have been used successfully to disperse roosting cormorants and are most effective in low light conditions, such as at night roosts. In addition, lasers are silent and can be used to move cormorants without disturbing other non-target species.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Propane canons and other noise-making devices are used to discourage cormorants from using specific areas.

The regular presence of humans may frighten cormorants from smaller aquaculture or hatchery facilities as well as from roosting sites and potential colonies. Encouraging

RICHARD CHIPMAN

Using a variety of methods in combination, such as mylar tape (*above*), propane canons (*opposite*), human effigies, and scare eye balloons can increase the effectiveness of harassment efforts.

visitors and frequent human activity near valuable stocks at hatcheries and aquaculture facilities also may help to reduce depredation on fish stocks.

Visual harassment techniques like scarecrows, human effigies, and balloons have also been tried with varying degrees of success. However, stringing mylar tape between stakes near roosting and loafing sites has proven effective in reducing cormorant use of these areas on Oneida Lake in New York. In addition, chasing cormorants with boats has been used successfully to disperse roosts and flocks from ponds and larger bodies of water. Cormorants learn quickly and these methods often do not deter the birds for long. For harassment to be effective, a variety of techniques should be used in combination, and the location and combination of devices should be changed frequently for best results.

## Habitat Modification

Netting and grid wires can prevent or deter cormorants from preying on fish in hatchery or aquaculture ponds. Nets provide a physical barrier and are effective as long as the edges of the nets extend to the ground surrounding the pond. If nets do not extend to the ground, cormorants may learn to walk into the water and around the netting. Although netting can be effective, the cost may be prohibitive for large ponds. In some instances, the levies between ponds are too narrow to hold net support structures, and netting may interfere with machinery needed for daily operations.

Overhead wire systems work by making it difficult for cormorants to land on, and take off from, ponds. Although these systems are effective at preventing large flocks from landing, individual birds often learn to fly between the lines, or land on levies and walk into the pond despite the wires. However, grid wires may reduce access to people as well, and present hazards to non-target species like osprey (*Pandion haliaetus*) or swallows (*Hirundinidae*), as well as bald eagles (*Haliaeetus leucocephalus*). Floating ropes, sometimes called bird balls, are a less expensive and less labor-intensive alternative to wire systems. Floating ropes can be strung parallel to each other and 50–55 feet apart. The success of both wire systems and floating ropes depends on the availability of alternative foraging areas nearby. Birds that are able to find other food sources easily are more likely to be deterred.

Wire grid systems can also protect nesting colonies of other waterbirds. Along with gulls, cormorants can out-compete common terns for favored nesting islands. Grid wires suspended above tern nesting colonies can enhance tern nesting success and productivity by discouraging larger birds from nesting. This method effectively reserves nesting space for common terns until they are able to establish and defend a colony.

## Fisheries Management

Site-specific impacts on fisheries often occur when large concentrations of easily accessible fish are present. Fish are particularly vulnerable when large numbers of hatchery-raised lake fish are released at once, or when natural movements, like salmon smolt runs, or fish spawning behavior may concentrate fish in small areas. Fish harvest methods that congregate fish in enclosed areas that cormorants can access also leave fish vulnerable. Releasing fish at night so they have time to disperse before cormorants begin feeding in the morning can reduce predation. In lakes, releasing fish in deep water rather than from the shore can reduce predation. In streams, fish can be stocked early in the season before cormorants return from their wintering grounds. Harassment conducted in coordination with stocking may also relieve pressure on recently stocked fish.

# Lethal Management Options

## Nest Destruction

A VARIETY OF METHODS can be used to reduce or stabilize cormorant populations, or to deter them from taking up residence in new areas. Any technique that involves egg or nest destruction or removal of cormorants will require federal and in many areas state permits may also be required. Nests or nesting trees can be removed or physically broken up with the hope that adult birds will either leave the area, or fail to rebuild and re-nest successfully that season. This method may be useful for discouraging cormorants from nesting in new areas, especially if nests are destroyed early on. It requires more effort in already established colonies. Nest destruction is relatively labor intensive, although can be practical on smaller colony sites. In order to be effective, control must be repeated throughout the nesting season and likely on an annual basis. Nest removal may shift cormorants to other locations where they may cause other conflicts.

Egg oiling can be used to prevent or reduce population growth and may be useful for eliminating colonies at specific location, especially if combined with other harassment or population reduction methods. Spraying eggs with food-grade corn oil prevents the exchange of gasses through the shell, causing asphyxiation. The benefit of egg oiling over destroying eggs is that cormorants will continue to incubate the eggs

JEREMY T. H. COLEMAN

Managers discourage nesting and encourage cormorants to leave Wantry Island in Oneida Lake, New York by removing their nests. Nest removal is a labor-intensive management activity.

and are less likely to attempt to re-nest. Management strategies that include egg oiling are best suited to situations where cormorant presence can be tolerated, and rapid population reduction is not the goal. Because cormorants often re-nest, some reproduction may still occur if persistent effort is not applied. In some states, a pesticide applicators license may be required for oiling eggs.

## Shooting

When a rapid reduction in cormorant numbers is required, shooting adult cormorants is an approach that is more effective for the immediate reduction of populations than destroying eggs or nests. Shooting can be most effective on breeding colonies, although open water shooting and removal at roosts can also be used to protect specific sites. Shooting adults also helps to reduce cormorant populations through harassment of the remaining birds. Special care is necessary to prevent killing of non-target species. Shooting can be combined with pyrotechnics to enhance the effectiveness of non-lethal control options.

KRISTI L. SULLIVAN

A back-pack sprayer can be used to spray eggs with food grade corn oil, preventing them from hatching.

# Regulation and Management Authority for Cormorants

## The United States Fish and Wildlife Service

The United States Fish and Wildlife Service (USFWS) has the primary responsibility and authority for managing migratory bird populations in the United States. This authority was established by the Migratory Bird Treaty Act of 1918, a treaty between the United States and Great Britain (on behalf of Canada) established to:

1. ensure the conservation and management of migratory birds internationally;
2. sustain healthy migratory bird populations for consumptive and non-consumptive uses; and
3. restore declining populations of migratory birds.

In 1972, the U.S. Convention with Mexico was amended and the double-crested cormorant was added to the list of Migratory Birds and given protection in the United States under the Migratory Bird Treaty Act. Under this protection, cormorants cannot be captured or shot, and their nests and eggs cannot be disturbed unless a permit is first obtained from USFWS. Depredation permits to take cormorants have been issued by USFWS since 1986 and may allow for the taking of eggs, adults and young, or active nests.

## USDA APHIS Wildlife Services

Although the USFWS has primary responsibility for managing cormorants, the USFWS does not conduct on-the-ground management activities when cormorants cause damage. The United States Department of Agriculture Animal and Plant Health Inspection Service Wildlife Services (USDA APHIS WS) is one of the agencies involved with on-the-ground management. Their job is to help states, organizations, and individuals resolve conflicts between people and wildlife on public and private lands by collecting information, documenting damage, and recommending or implementing wildlife damage management options.

In March 1998, USFWS issued an Aquaculture Depredation Order, allowing people engaged in commercial aquaculture to shoot cormorants without a federal permit at freshwater aquaculture facilities or state-operated hatcheries in Minnesota and 12 southeastern

states. The Depredation Order allowed shooting of cormorants during daylight hours when necessary to protect aquaculture/hatchery stock, if these actions were taken in conjunction with a non-lethal harassment program approved by USDA APHIS WS.

## State Wildlife Management Agencies

Although USFWS has the primary responsibility for managing cormorants, state wildlife management agencies are also actively involved in management of double-crested cormorants. In many states, double-crested cormorants are protected by state migratory bird legislation in addition to the Migratory Bird Treaty Act. Cormorant control programs are being implemented in states where cormorants are affecting fish populations, vegetation and other colonial water birds. In New York and Vermont, for instance, programs are underway to prevent the spread of cormorants to other nesting islands in Lake Ontario, Oneida Lake, and Lake Champlain. Until recently, a federal permit issued by the USFWS was required before any state agency could implement a control program. As populations of cormorants in many states increased, the existing permit requirements left little flexibility for states to efficiently deal with conflicts on a local level.

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The double-crested cormorant is protected by the Migratory Bird Treaty Act of 1918.

# New Strategies for Managing Cormorant Damage

In 1999, the USFWS with USDA APHIS WS as a cooperator, recognizing the need to respond to new challenges facing resource managers, began developing an Environmental Impact Statement (EIS) on double-crested cormorant management "to address impacts caused by population and range expansion of the double-crested cormorant in the . . . United States." This document, approved in 2003, was developed to address growing concerns from the public and natural resource management professionals about the effects of double-crested cormorants on local fish populations, other bird populations (including threatened and endangered species), vegetation and habitat, private property, and economic opportunities. The goal of the EIS was to develop management options to reduce conflicts with double-crested cormorants and enhance the flexibility of land management agencies to deal with problems on a more local level, while ensuring the long-term sustainability of cormorant populations.

## Increased Local Control

The formal rule change includes several provisions for managing cormorant conflicts on a local scale. The plan includes a new Public Resource Depredation Order, which allows state fish and wildlife agencies, federally-recognized tribes, and USDA APHIS WS to use lethal control to manage double-crested cormorants to address conflicts in 24 states. The states include Alabama, Arkansas, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Michigan, Minnesota, Mississippi, Missouri, New York, North Carolina, Ohio, Oklahoma, South Carolina, Tennessee, Texas, Vermont, West Virginia, and Wisconsin.

According to the new Depredation Order, lethal control, including shooting, egg oiling or destruction, and nest destruction, can be carried out to protect public resources including fish, wildlife, plants and other wild species on public lands and waters. With appropriate landowner permission, control activities can also take place on private lands where double-crested cormorants that are causing harm to public resources occur.

Agencies are still encouraged to use non-lethal techniques when appropriate, and responsible agencies must conduct a baseline survey of colonial waterbird populations in the area, followed by monitoring the effectiveness of the management program each year control measures are implemented.

## Control around Aquaculture Facilities

The EIS also allowed for increased control of conflicts at aquaculture facilities. Under the new rule, private and state aquaculture facilities in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Minnesota, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee and Texas can shoot cormorants without a federal permit as they have been able to since 1998. However, the Aquaculture Depredation Order has been expanded to also allow lethal control of cormorants at winter roost sites (October to April) in those 13 states. In all other states USDA APHIS WS may still recommend that permits be issued and the USFWS may issue permits to take birds, eggs or active nests.

## Other Management Options

In addition to these new features, federal regulations still allows permits to be issued by USFWS to private landowners if there is significant economic damage to privately stocked fish on a privately owned water body that maximizes fishing opportunities for patrons, either for a fee or for recreation. As before, the USFWS can issue permits if cormorants are causing significant property damage to physical structures or vegetation on either public or private land or water, or if there is significant human health and safety risk (e.g., airports, water quality).

## Adaptive Management

The goals of the current management rules and depredation order are to reduce conflicts with double-crested cormorants through localized damage management while maintaining viable populations of double-crested cormorants. To ensure that these goals are being met, the USFWS is encouraging agencies to use adaptive management to evaluate the effects of control measures on cormorant populations and the extent to which control measures are alleviating damage. As new information is gained, future management activities can be modified, or adapted, as necessary.

# Summary

Double-crested cormorant management occurs in a complex biological, ecological, and socio-economic environment. Although cormorants can cause a variety of resource damages, the actual occurrence, and relative significance, of impacts should be determined on a localized basis and science-based management strategies planned and implemented accordingly. Continued evaluation of the impacts of management actions on both cormorant populations and the resources being protected will contribute to our understanding of how best to manage and conserve this remarkably adaptable and abundant bird.

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Cormorants use a variety of roost sites including channel markers, sandbars, rocky shoals, cliffs and offshore rocks, utility poles, fishing piers, high-tension wires, pilings, and trees.

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As new information about cormorants is gained, management activities can be adapted as necessary.

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STAN TEKIELA

Unlike other water birds, the double-crested cormorant is neither well-known nor widely recognized by the public.

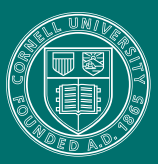
# The Double-Crested Cormorant

## Issues and Management

In the Eastern United States, the double-crested cormorant has generated a tremendous amount of interest and controversy in recent years. Cormorant populations have increased dramatically since the 1970s, and conflicts with commercial and sport fisheries, competition with other waterbirds for nesting space, and damage to property occur in several states.

The information presented in this guide is intended to help anglers, fish hatchery operators, fisheries and wildlife professionals, lake association members, and other interested stakeholders find the information needed to understand both the complexity of issues involved, and the management options available for reducing cormorant problems. Although conflicts with cormorants occur in other areas of the country, this bulletin focuses on populations of the interior United States and the eastern Atlantic coast.

This publication is the result of collaboration by Cornell University Cooperative Extension, the U.S. Fish and Wildlife Service, the USDA APHIS Wildlife Services, the USGS New York Cooperative Wildlife Research Unit, and the New York State Department of Environmental Conservation. Copies of this booklet are available from the Department of Natural Resources, Fernow Hall, Cornell University, Ithaca, New York 14853.

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