**Wildlife Services**

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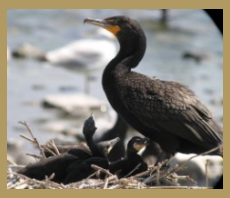
National Wildlife Research Center

FY 2017

# Reducing Predation, Habitat Damage and Disease Potential of Fish-eating Birds in Aquaculture Systems

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**Groups Affected:**

- Aquaculture producers, distributors and retailers
- Catfish Farmers
- Consumers
- Sportfish guides and outfitters
- Wildlife managers

**Major Cooperators:**

- Canadian Wildlife Service
- Catfish Farmers of America
- Cornell University
- Delta Research and Extension Center, Thad Cochran National Warmwater Aquaculture Center
- Idaho Department of Fish and Game
- Michigan Department of Natural Resources
- Mississippi Agricultural and Forestry Experiment Station
- Mississippi State University, College of Veterinary Medicine
- Mississippi State University, Department of Wildlife, Fisheries, and Aquaculture
- Ontario Ministry of Natural Resources
- Ontario Parks
- Southern Regional Aquaculture Center
- U.S. Environmental Protection Agency-Great Lakes Restoration Initiative
- Vermont Fish and Game Department
- Wildlife Services Operations
- Wisconsin Department of Natural Resources

## National Wildlife Research Center Scientists Address Aquaculture Losses

Wildlife Services' (WS) National Wildlife Research Center (NWRC) is the only Federal research facility devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective and socially responsible methods, tools, and techniques. The NWRC's field station in Starkville, MS, is located in the heart of the primary aquaculture producing area of the southeastern United States and was established to develop methods to reduce the economic impacts of fish-eating birds, such as double-crested cormorants, pelicans, egrets, and herons, on aquaculture stocks.

In the past several decades, populations of fish-eating birds have increased dramatically and caused substantial economic impacts on aquaculture production. For the catfish aquaculture industry alone, costs associated with bird damage and damage prevention are estimated at approximately $25 million annually. NWRC's research goal is to determine the economic impact of fish-eating birds on aquaculture production and natural resources and to develop methods to reduce depredation impacts on southeastern catfish, baitfish, and crawfish industries. Current research aims to gain information about the abundance, distribution, and foraging behavior of fish-eating birds; economic impacts associated with their foraging activities; and diseases they transmit at aquaculture facilities. Information gathered as a consequence of this research provides a basis for developing new strategies, techniques, and tools for reducing damage.

## Applying Science and Expertise to Wildlife Challenges

**Isotopes Used to Track Cormorant Diets. —** Hidden in the feathers of birds are clues to their diet and migratory behavior. That's because, over time, isotopes that make up the food animals eat remain in their feathers and other tissues. To learn more about double-crested cormorant diet and behavior, NWRC and Cornell University researchers looked for differences in the ratios of carbon, nitrogen and sulfur atoms in the feathers of cormorants from eastern North America. Researchers discovered that the feathers from birds feeding on Mississippi farm-raised catfish showed a unique isotope signature, compared to the feathers of birds feeding on natural or marine resources. Birds that ate farm-raised catfish showed relatively low levels of sulfur and nitrogen in their feathers. They also showed carbon 13 values that were in between those found for birds feeding in natural marine and freshwater habitats. This isotope approach confirmed what researchers suspected about cormorant migratory patterns and winter habitat use. All sampled cormorant colonies use aquaculture habitats during the winter and were from colonies in Lakes Huron and Erie. However, more male cormorants feed at aquaculture habitats, while marine habitats were used more by females. Researchers note targeting birds at wintering grounds in the Southeast, may be more effective at reducing damage.

**Environmental Impacts of Cormorants to Forested Islands. —** Within the last 10-15 years, double-crested cormorants have begun nesting on islands in Alabama causing concern among managers and recreationalists regarding their impacts on the fisheries, vegetation, soil, and water quality. To better assess these environmental impacts, NWRC and Mississippi State University researchers compared water quality, soil chemistry and tree health of six forested islands with and without nesting cormorants. Results showed that water quality and chemistry did not differ between islands with and without cormorant colonies. However, soil from islands with nesting cormorants was more acidic and had greater concentrations of phosphorous than soils from islands without nesting cormorants. In addition, researchers found evidence that cormorants were negatively affecting tree health and vigor. Although nesting cormorants are impacting forested islands, researchers note this is a natural process and recommend that management efforts to reduce damage should be considered within a framework that allows for natural ecological processes, including changes in soil chemistry and vegetation.

**Competition between Pelicans and Anglers. —** The Idaho Department of Fish and Game (IDFG) annually stocks about 1.8 million hatchery catchable trout state-wide at a cost of about $2.5 million. Because of increasing concerns over pelican predation and potential competition with anglers for recently released hatchery trout, NWRC and IDFG researchers internally PIT-tagged and externally

anchor-tagged stocked rainbow trout at 12 areas in Idaho. After juvenile birds fledged and left their nesting grounds, researchers recovered PIT tags from fish that were deposited by the birds. Pelican predation on hatchery trout averaged 18 percent and ranged from 0 to 48 percent. Angler catch averaged 21 percent and ranged from 0 to 82 percent. Results also showed that the mean angler catch was nearly 4 times higher when pelican predation was less than 25 percent. Findings suggest that predation by American white pelicans on catchable-sized hatchery rainbow trout stocked in southern Idaho waters often exceeds the total catch of those fish by anglers who compete directly with avian predators for use of stocked trout.

**Pelican and Cormorant Parasitology and Disease Epidemiology. —** NWRC researchers conducted several studies with pelicans, cormorants, and other fish-eating birds to determine their role in spreading *Bolobophorus damnificus* trematodes and the virulent strain of *Aeromonas hydrophilia* (VAh) on aquaculture farms. The *B. damnificus* trematode costs the Mississippi catfish industry approximately $27 million in damages each year. Study results indicated that adult *B. damnificus* trematodes were found only in American white pelicans, the parasite's definitive host. In other studies, researchers found that cormorants, wood storks, great egrets, and pelicans could shed viable VAh after consuming infected fish and can shed bacteria that caused a VAh disease outbreak in naive catfish ponds--implicating them as a disease reservoir and a vector capable of spreading the pathogen to uninfected areas. These studies stress the need to reduce predatory feeding and scavenging on commercial catfish operations.

**Cormorant Predation on Multiple-Batch Production of Channel Catfish. —** Double-crested cormorants are the primary bird predator on commercially produced channel catfish. To learn more about cormorants' economic impacts on catfish farms, NWRC researchers simulated different levels of cormorant predation on channel catfish in a multiple-batch cropping system. A multiple-batch cropping system contains ponds that include fish of varying sizes. This method allows faster growing fish to be selectively harvested while fingerlings are added to replace the harvested fish. The process continues for years without draining the pond. Results of varying predation levels on 40, 0.05-hectare catfish ponds showed that production costs for catfish farming increase as cormorant predation increases. The maximum increase in production cost is $0.143 per kilogram. However, researchers note that losses due to cormorant predation are partially offset by increases in individual fish growth due to lower catfish densities.

**Selected Publications:**


Craig, E.C., B.S. Dorr, K.C. Hanson-Dorr, J.P. Sparks, and P.D. Curtis. 2015. Isotopic discrimination in the Double-crested cormorant *(Phalacrocorax auritus).* PloS One 10(10):e0140946. doi: 10.1371/journal.pone.0140946.

Craig, E.C., D.T. King, J.D. Sparks, and P.D. Curtis. 2016. Aquaculture depredation by Double-Crested Cormorants breeding in eastern North America. Journal of Wildlife Management 80:57-62; doi: 10.1002/jwmg.989.

Dorr, B.S. and C.R. Engle. 2015. Influence of simulated double-crested cormorant, Phalacrocorax auritus, predation on multiple-batch production of channel catfish, *Ictalurus punctatus*. Journal of the World Aquaculture Society 46(3): 319-327. doi:10.1111/jwas.12187.

Jubirt, M.M., L.A. Hanson, K.C. Hanson-Dorr, L. Ford, S. Lemmons, P. Fioranelli, and F.L. Cunningham. 2015. Potential for Great Egrets *(Ardea alba)* to transmit a virulent strain of Aeromonas hydrophila among channel catfish *(Ictalurus punctatus)* culture ponds. Journal of Wildlife Diseases 51(3):634-639. doi: 10.7589/2014-06-156.

Lafferty, D.J.R., K.C. Hanson-Dorr, A.M. Prisock, and B.S. Dorr. 2016. Biotic and abiotic impacts of Double-crested cormorant breeding colonies on forested islands in the southeastern United States. Forest Ecology and Management 369:10-19. doi: 10.1016/j.foreco.2016.03.026.

Meyer, K.A., C.L. Sullivan, P. Kennedy, D.J. Schill, D.M. Teuscher, A.F. Brimmer, and D.T. King. 2016. Predation by American white pelicans and double-crested cormorants on catchable-sized hatchery Rainbow trout in select Idaho lentic waters. North American Journal of Fisheries Management 36(2):294-308. doi: 10.1080/02755947.2015.1120835.


**Major Research Accomplishments:**

- WS and Cornell University researchers discovered that the feathers from double-crested cormorants feeding on Mississippi farm-raised catfish showed a unique isotope signature, compared to the feathers of birds feeding on natural or marine resources.

- WS and Mississippi State University researchers compared water quality, soil chemistry and tree health of six forested islands with and without nesting cormorants. Results showed that water quality and chemistry did not differ between islands with and without cormorant colonies. However, soil from islands with nesting cormorants was more acidic and had greater concentrations of phosphorous than soils from islands without nesting cormorants.

- WS research suggests that predation by American white pelicans on catchable-sized hatchery rainbow trout stocked in southern Idaho waters often exceeds the total catch of those fish by anglers who compete directly with avian predators for use of stocked trout.

- WS disease studies indicated that adult *B. damnificus* trematodes were found in American white pelicans. Furthermore, cormorants, wood storks, great egrets, and pelicans could shed the virulent strain of *Aeromonas hydrophilia* after consuming infected fish--implicating them as a disease reservoir and a vector capable of spreading the pathogen to uninfected areas.

- WS research found that production costs for catfish farming increase as cormorant predation increases. The maximum increase in production cost is $0.143 per kilogram. However, researchers note that losses due to cormorant predation are partially offset by increases in individual fish growth due to lower catfish densities.