

United States
Department of
Agriculture

Animal and
Plant Health
Inspection
Service

FY 2006

Defining Economic Impacts and Developing Strategies for Reducing Avian Predation in Aquaculture Systems

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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 acceptable methods, tools, and techniques. 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 impacts of fish-eating birds on aquaculture stocks.

In the past 30 years, populations of fish-eating birds have increased dramatically and caused substantial economic impacts to aquaculture production. Aquaculture industry costs associated with bird damage and

damage prevention are estimated to exceed \$25 million annually for double-crested cormorants alone. The goal of NWRC's research is to determine the impact of fish-eating birds on aquaculture production and natural resources, and to develop methods to reduce depredation of southeastern catfish, baitfish, and crawfish industries. Current research is aimed at gaining information about the abundance, distribution, and foraging behavior of fish-eating birds, the economic impacts associated with their foraging activities, and the diseases they transmit at aquaculture facilities. This information will help to develop new techniques for reducing damage.

Applying Science and Expertise to Wildlife Challenges

Population Trends—NWRC scientists are studying population trends and movement patterns of double-crested cormorants and American white pelicans, by tracking large-scale movements through the use of telemetry and banding techniques. This research will provide a better understanding of population trends and bird movements and will be used to evaluate various alternatives for managing impacts of these birds on southeastern aquaculture and natural resources.

NWRC scientists recently evaluated the distribution and abundance of double-crested cormorants at catfish aquaculture



ponds in the Delta region of Mississippi. Results demonstrated that cormorants used these ponds extensively during January through April, with the greatest economic damage occurring in February and March. During this study, cormorants consumed an estimated 1,775 and 1,347 metric tons of catfish in the Delta region of Mississippi in 2000-2001 and 2003-2004 respectively. These losses translated into a cost of up to \$13.2 Million for 2001 alone. This study provides a biological basis for estimating economic losses caused by cormorants on a large scale.

Biology and Impact of Fish-Eating Birds on Aquaculture—An understanding of the biology of fish-eating birds and their economic impacts on aquaculture will enable the successful application of various management strategies. For example, given the feeding preferences of double-crested cormorants, American white pelicans, great blue herons, little blue herons, and great egrets, NWRC researchers are working to develop economic threshold predictions to determine their impacts on aquaculture production.

Major Research Accomplishments:

- WS documented the impact of cormorants on the catfish industry. This research was used to develop a Standing Depredation Order for the control of cormorants on farms in 1998, an Environmental Impact Statement, and 2 depredation orders for control of cormorants in winter roosts and breeding areas to protect aquaculture and natural resources in 2003.
- WS and their cooperators demonstrated that American white pelicans are a host of the *Bolbophorus trematode*, which can be devastating to the catfish aquaculture industry.
- WS demonstrated that low-powered lasers can disperse double-crested cormorants from night roosts adjacent to catfish farms.

Changes in the catfish aquaculture industry have resulted in changes in production systems and dominance of multiple-batch farming. This type of aquaculture involves growth of multiple size classes of fish simultaneously in the same pond and periodic harvest of market-ready fish. NWRC scientists have initiated research to address these production changes and characterize the impacts of foraging by captive double-crested cormorants on channel catfish in multiple-batch cropping systems. NWRC scientists will integrate the results of studies of cormorant habitat-use patterns with detailed studies of foraging impacts to investigate the potential for economic impacts from cormorant depredations and suggest management strategies to alleviate the damage.

Developing Methods for Reducing Damage to Aquaculture and Natural Resources

—As part of an integrated approach to reduce the impact of fish-eating birds on southeastern aquaculture, several tools have been developed. Field studies documented the effectiveness of low-powered lasers for dispersing double-crested cormorants from night roosts near aquacul-

Groups Affected by These Problems:

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

Major Cooperators:

- Catfish Farmers of America
- Cornell University
- Michigan Department of Natural Resources
- Mississippi State University, College of Veterinary Medicine
- Mississippi State University, Department of Wildlife and Fisheries
- Mississippi Agricultural and Forestry Experiment Station
- Delta Research and Extension Center, Thad Cochran National Warmwater Aquaculture Center
- New York Department of Environmental Conservation
- Southern Regional Aquaculture Center
- Vermont Fish and Game Department

ture facilities while minimizing disturbances to waterfowl and other non-target species. NWRC research on the economic impacts of cormorant foraging led to the issuance of two migratory bird depredation orders. These orders enable aquaculture producers and wildlife managers to manage local cormorant populations that are causing damage to aquaculture and natural resources.

NWRC biologists are working with WS operations personnel to determine the behavioral responses of cormorants to different management activities. In collaboration with the Michigan Department of Natural Resources, WS initiated a study in the Les Cheneaux region of Michigan in 2004 in response to localized depletions of harvest-sized yellow perch in the region. Information is being collected on perch populations, cormorant habitat use, and cormorant reproductive parameters in specific bodies of water where perch problems have persisted. It will be combined with investigations of cormorant diet patterns and cormorant behavioral response to specific management strategies including egg-oiling, nest destruction, and limited control of adult cormorants. Preliminary results show a near elimination of cormorant breeding success, a marked decline in cormorant numbers, and an increase in young age classes of yellow perch in the region. These studies will help determine the role of cormorants in perch depletion and whether cormorant management can effectively reverse these trends.

American White Pelican Disease Ecology

NWRC researchers, in collaboration with parasitologists at two state universities, the Thad Cochran Warmwater Aquaculture Center, and the Southern Regional Aquaculture Center, completed studies to determine the species of trematode infecting catfish in the southeastern United States and to determine whether fish-eating birds serve as hosts for this parasite. Biologists at the NWRC Mississippi field station artificially infected captive American white pelicans with larvae of *Bolbophorus* spp. trematodes. Results showed that American white pelicans can potentially transmit this

disease among catfish ponds. Double-crested cormorants, great blue herons, and great egrets did not appear to serve as hosts for these trematodes. Recent results indicate that a relatively low infection of trematodes in pelicans can result in large numbers of trematode eggs deposited into catfish ponds. This study underscores the importance of preventing pelican use of aquaculture facilities.

Selected Publications:

Fallon, J. A., R. L. Cochran, B. Dorr, and H. Klandorf. 2006. Interspecies comparison of Pentosidine accumulation in birds. *Auk* 123: 870-876.

Werner, S. J., and B. S. Dorr. 2006. Influence of fish stocking density on the foraging behavior of double-crested cormorants *Phalacrocorax auritus*. *Journal of the World Aquaculture Society* 37: 121-125.

Anderson, D. W., D. T. King, and John Coulson (Eds.). 2005. *The Biology and Conservation of the American White Pelican*. *Waterbirds* 28 (Special Publication 1): 112 pages.

Barras, S. C., and K. C. Godwin. 2005. Control of bird predation at aquaculture facilities: frightening techniques. Southern Regional Aquaculture Center Publication. Number 401:4 pp.

Werner, S. J., J. B. Harrel, and D. E. Wooten. 2005. Foraging behavior and monetary impact of wading birds at Arkansas baitfish farms. *Journal of the World Aquaculture Society* 36:354-362.

Dorr, B. S.; King, D. T.; Tobin, M. E.; Harrel, J. B.; Smith, P. L. 2004. Double-crested cormorant movements in relation to aquaculture in eastern Mississippi and western Alabama. *Waterbirds* 27:147-154.

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