September 2003

THE ROLE OF RESEARCH IN EXPANDED REGIONAL MANAGEMENT OF DOUBLE-CRESTED CORMORANTS

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Abstract: The number of double-crested cormorants (*Phalacrocorax auritus*) breeding in the Great Lakes states and provinces has increased during recent decades. Their abundance and foraging habits have thrust this species into conflict with the aquaculture industry and fisheries interests. The U. S. Fish and Wildlife Service proposed a change in the management of double-crested cormorants recently to alleviate these conflicts, especially with aquaculture, natural resources, and federal fish hatcheries. Research activities should be an integral component of these expanded efforts to manage cormorants, including further investigations on cormorant impacts to the aquaculture industry and evaluations of the added benefits of proposed lethal control at winter roosts. Impacts to natural resources and commercial fisheries should also be addressed, given that management to protect these resources would be a significant departure from current management strategies. Use of lethal control at fish hatcheries may enhance opportunities for hatchery managers to reinforce non-lethal methods. However, research should evaluate the added benefits of lethal reinforcement and determine if it is economically justified. In view of the recognized potential for regional population management in the near future, scientists should continue to evaluate the effects of management actions on local and regional cormorant populations and collect the basic life-history data essential for population modeling efforts. The role science plays in wildlife damage management is well-established. In this symposium, we address the role of research activities in cormorant management actions conducted under the authority of the proposed rule change.

Key words: aquaculture, cormorant, double-crested cormorant, wildlife damage

Proceedings of the 10th Wildlife Damage Management Conference. (K.A. Fagerstone, G.W. Witmer, Eds). 2003

INTRODUCTION

In the mid-20th century, the Interior population of double-crested cormorants (*Phalacrocorax auritus*) suffered population declines throughout the Great Lakes region due to persecution and the effects of pesticides (Ludwig 1984, Weseloh et al. 1995). In response to pesticide bans and extensive conservation efforts, cormorant populations have shown remarkable increases (Ludwig 1984), especially those breeding in the Great Lakes States and Provinces. In fact, the Interior cormorant population numbered greater than 220,000 pairs in the mid-1990's (Hatch 1995). Their abundance and foraging habits have thrust this species into conflict with the aquaculture industry and fisheries interests over perceived and documented impacts to natural and commercial resources. Management of cormorant damage is complex, given that damage to aquaculture in the U.S. falls within the authority of the U.S. Department of Agriculture (Acord 1995, Glahn et al. 2000b), migratory bird management is by the U.S. Fish and Wildlife Service (Trapp et al. 1995), and the provincial governments of Canada (Keith 1995).

Recent reviews have addressed the need for research to determine the impacts of cormorants on these resources, the impacts of management actions on the cormorants, and the effectiveness of management activities on the resources being protected (Nisbet 1995). These and other publications have stressed the need for better information on cormorant ecology, including reproductive parameters, foraging ecology, and wintering ecology and movements (Erwin 1995, Weseloh and Lewis 1999). Conflicts involving cormorants include well-documented impacts to aquaculture in the southeastern U. S. (Glahn and Brugger 1995, Glahn and Stickley 1995, Glahn and Dorr 2002), but information needs still exist (Erwin 1995, Glahn et al. 2000b). Perceived cormorant impacts on recreational fisheries and other natural resources such as nesting birds also cause conflict and are a source of concern among recreationists, but true impacts are not well-documented (Trapp et al. 1999).

The U. S. Fish and Wildlife Service recently released a proposed rule for altering the management of double-crested cormorants in the U. S. to alleviate conflicts with this species through management actions to protect aquaculture, natural resources, and federal fish hatcheries (50 CFR Part 21, Federal Register Volume 68, March 17, 2003). The role science plays in wildlife damage management is well-established, even within the relatively narrow scope of cormorant impacts to aquaculture (Glahn et al. 2000b). In this symposium, we address the role of research activities in cormorant management actions conducted under the authority of the proposed rule change.

EXPANSION OF THE STANDING DEPREDATION ORDER FOR AQUACULTURE

Cormorant impacts on aquaculture in the southeastern United States are well-documented, and replacement costs were estimated at nearly $5 million annually to catfish production in Mississippi alone (Glahn et al. 2000a). Studies to determine patterns and mechanisms of impact to the industry have led to an understanding of catfish consumption rates by individual birds (Stickley et al. 1992, Glahn and Dorr 2002), catfish size preferences of cormorants (Glahn et al. 1995), and the effects of projected impacts on return at harvest (Glahn et al. 2003). Researchers must play an important role in the refinement of information to ensure that knowledge is relevant to cultural practices and bird behaviors. Information needs include the impact of realistic, multi-bird foraging assemblages on aquaculture production (Glahn and Dorr 2002) and the effects of compensatory fish growth following foraging activities and economic impacts at harvest (Glahn et al. 2003). Changes in the aquaculture industry driven by supply needs and income periodicity have resulted in dominance of multiple-batch farming (Edwin Robinson, Personal Communication), which is defined as growth of multiple size classes of fish simultaneously in the same pond (Tucker and Robinson 1990). Research efforts must address these changes and ensure that results from previously conducted studies (e.g., Glahn and Dorr 2002) adequately address impacts in new culture systems. For impact studies to serve their purpose, researchers must determine the ultimate effect of damage from cormorants on production costs and economic impacts at harvest (Erwin 1995, Nisbet 1995, Glahn et al. 2003).

Effective damage management on aquaculture facilities usually consists of an integrated program of both lethal and non-lethal techniques. Non-lethal scare devices including pyrotechnics and propane cannons have been used to disperse birds from southern aquaculture facilities (Stickley and King 1995, Littauer et al. 1997, Mott and Brunson 1997, Mott and Boyd 1995). Aquaculture producers also obtain individual permits for reducing the number of fish-eating birds on farms and reinforcing non-lethal methods (Mastrangelo et al. 1997). Localized shooting usually results in effective dispersal but few birds killed (Hess 1994), and has no significant impact on populations (Mastrangelo et al. 1997, Belant et al. 2000, Blackwell et al. 2000). In 1998, the U.S. Fish and Wildlife Service issued a standing depredation order for control of cormorants on aquaculture facilities in 13 southern states, thereby eliminating the need for growers to obtain individual permits to shoot this species. A recent survey of aquaculturalists conducting control activities under this depredation order indicated that although the number of cormorants killed increased under this new depredation order, there was no immediate negative impact on the population (Glahn et al. 2000a).

Non-lethal harassment has been effective for dispersing cormorants (Mott et al. 1992, 1998). Harassment of cormorants at night roosts reduces cormorant use of nearby aquaculture facilities (Mott et al. 1992, 1998), and use of harassed roosts decreases significantly following dispersal (Tobin et al. 2002). The proposed USFWS rule expands authority to shoot cormorants without a permit at night roosts. This change may help reduce the number of DCCO nesting near catfish farms and also reinforce harassment efforts. In a comparison of lethal and non-lethal approaches to roost harassment, Glahn (2000) found that the time required to disperse roosts and the duration of effectiveness did not differ when shooting was compared to hazing with pyrotechnics. He also found that few birds were killed using this technique. Research efforts should include evaluation of the added benefits of lethal reinforcement and continued evaluation of the effects of these actions on local and regional cormorant populations.

STANDING DEPREDATION ORDER FOR PROTECTING NATURAL RESOURCES

A primary source of conflict attributed to double-crested cormorants arises from perceived and/or real impacts from cormorant nesting and foraging on other natural resources. Cormorants have long been perceived as competitors for wild commercial and recreational fisheries, although such impacts have not been adequately documented (Trapp et al. 1999). Cormorants typically consume fish of a given species in proportion to its availability (Glahn et al. 1995, Glahn et al. 1998). Studies of cormorant diets have concluded that cormorant foraging activities in the Great Lakes (Craven and Lev 1987, Belyea et al. 1999, Bur et al. 1999) and the southeastern United States do not have a negative impact on sport fisheries (Glahn et al. 1998). Nonetheless, concern over the issue continues, and Weseloh and Lewis (1999) found that 2 of the top 4 information needs among biologists polled on cormorant impacts were related to impacts on fish populations.

Double-crested Cormorants are a colony nesting species, and the local effects of their droppings and activities can be detrimental to surrounding vegetation. Weseloh and Ewins (1994) described an example of the progression of nesting site selection beginning in the trees and then shifting to ground nesting sites. Nesting cormorants often defoliate the trees used for nesting and roosting (Lemmon et al. 1994, Shieldcastle and Martin 1999). Expanding cormorant nesting colonies may also displace other nesting birds, especially herons. Displacement may be indirect through destruction of vegetation (Lemmon et al. 1994, Shieldcastle and Martin 1999) or direct through usurpation of nest sites as proposed by Jarvie et al. (1999). In many cases, the population of the species that may be displaced is in a more sensitive condition due to loss of nesting habitat than that of the usurping cormorants, at least on a local scale, as with the case of black-crowned night herons (*Nycticorax nycticorax*, Shieldcastle and Martin 1999) and common terns (*Sterna hirundo*, Korfanty et al. 1999). Jarvie et al. (1999) used a Geographical Information System (GIS) approach to identify individual nest trees and document colony expansion and destruction of trees at a colony in Toronto, Canada. Research into the impacts of cormorants on native vegetation should include similar quantitative approaches to document changes in the diversity of ground flora and techniques for mitigating these losses.

The proposed USFWS depredation order allows egg oiling, nest/egg destruction, and take of adult cormorants by Federal, state, and tribal entities, and their agents. Data on the effectiveness of managing of breeding cormorants is limited to experimental programs of limited scope (DesGranges and Reed 1981, Bedard et al. 1999) and evaluation of the effects of illegal destruction on reproductive success of a colony (Ewins and Weseloh 1994). The results of these experiences suggest that control efforts aimed at nests and eggs must be massive and diligent to be effective (DesGranges and Reed 1981, Ewins and Weseloh 1994), and that there will be a time lag between implementation of control measures and population decline (Bedard et al. 1999). Mortality of adult birds appears to be more effective for control of reproductive output in a colony than nest treatments (Ewins and Weseloh 1994, Blackwell et al. 2002). The role of research in these types of management activities has been discussed in numerous symposium summaries (Erwin 1995, Nisbet 1995), as essential for predicting, monitoring, and evaluating the effect of management actions on the protected resource, while documenting the effects of these techniques on local and regional populations. Bedard et al. (1999) conducted the most extensive colony control program to date and also concluded that these management activities must be conducted under scientific supervision.

LETHAL CONTROL AT FISH HATCHERIES

Prior to its prohibition, lethal control of fish-eating birds was common at state and Federal hatcheries, and was considered an effective tool by some hatchery managers (Lagler 1939, Parkhurst et al. 1987). However, in the same survey, wading birds such as herons and egrets were more commonly associated with damage, and few respondents from state and Federal hatcheries experienced problems with cormorants (Parkhurst et al. 1987). In fact, cormorants were not observed catching fish in some studies (Parkhurst et al. 1992, Pitt and Conover 1996). Netting and other types of exclusion are commonly recommended for preventing depredations in raceway settings and facilities with small ponds such as most hatcheries (Salmon and Conte 1981, Gorenzel et al. 1994, Littauer et al. 1997). However, addition of lethal control may enhance opportunities for hatchery managers to reinforce non-lethal methods and provide an additional tool for larger facilities where exclusion may be more difficult. Research efforts would help determine any added benefits of lethal reinforcement, as well as whether the use of lethal measures at these facilities is economically justified.

RESEARCH AND POPULATION MANAGEMENT.

The proposed rule for management of double-crested cormorants cited the future need for a regional cormorant management plan (50 CFR Part 21, Federal Register Volume 68, March 17, 2003). Goal-oriented management of a migratory bird population is a tremendous undertaking that requires coordination at international, national, regional and local scales (e.g., North American Waterfowl Management Plan, Environment Canada and USDI 1986). Flyway-wide management requires extensive monitoring of populations at different scales and the response of these populations to management actions and environmental factors. In waterfowl management, research has provided the ecological information on which management decisions are made and population goals are set. Several reviews indicate that similar critical data on the life history of double-crested cormorants are lacking. Nisbet (1995) commented that the breeding biology and population ecology of cormorants are not well understood. Erwin (1995) recommended large-scale banding and re-sighting efforts to better estimate recruitment rates, age-specific survival and productivity, and other key reproductive parameters. Professionals participating in a symposium on cormorant ecology also considered collecting these productivity data a top priority (Weseloh and Lewis 1999).

Management decisions and actions must sometimes be initiated even when reliable data are non-existent (Dolbeer 1998). Double-crested cormorants are already managed aggressively on some breeding (Bedard et al. 1999), post-breeding and migratory (Chipman et al. 2000), and wintering (Glahn et al. 2000a) areas to alleviate damage. An important role for researchers therefore is to identify, prioritize, and collect data for understanding how cormorant populations grow and respond to management. Basic and applied research can provide information on cormorant ecology, which is a prerequisite for science-based management decisions. Glahn et al. (2000b) provided an excellent review of the research needs for population management. Without the basic knowledge identified in previous reviews (Nisbet 1995, Erwin 1995, Weseloh and Lewis 1999), we cannot accurately predict the effects of management on cormorant populations nor attribute observed changes in reproductive success and population size to management actions. However, given reliable and appropriate input data, simulation models can be used to evaluate and predict the effectiveness of proposed management scenarios (Bedard et al. 1999, Blackwell et al. 2002). Ultimately, research must remain an active component of the management process.

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