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RESEARCH AND MANAGEMENT OF BIRD DEPREDATIONS AT CATFISH FARMS

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ABSTRACT: Depredations by fish-eating birds are a major constraint on production at commercial catfish facilities in the southeastern United States. A recent survey of catfish farmers estimated total losses due to direct predation by birds and costs associated with employing preventive measures at $17 million, or 4% of national sales. In 1988, the U.S. Department of Agriculture's (USDA) National Wildlife Research Center (NWRC) established a research station in Mississippi to develop more effective methods for reducing the impact of birds on southeastern aquaculture farms. This paper describes the impact of double-crested cormorants (*Phalacrocorax auritus*, DCCO) on the catfish industry, describes control methods to reduce depredations by this species, and reviews some research currently being conducted at the NWRC Mississippi research station.

KEY WORDS: aquaculture, *Ardea herodias*, *Ictalurus punctatus*, *Phalacrocorax auritus*, *Pelecanus erythrorhynchos*, wildlife damage management

Proc. 18th Vertebr. Pest Conf. (R.O. Baker & A.C. Crabb, Eds.) Published at Univ. of Calif., Davis. 1998.

INTRODUCTION

Commercial aquaculture in the southeastern United States encompasses a variety of industries that sustain depredations from a broad diversity of piscivorous birds. Crawfish farmers in Louisiana, tropical fish farmers in Florida, bait fish farmers in Arkansas, and catfish farmers in Mississippi, Arkansas, Alabama, and Louisiana employ different techniques to raise their products, but all sustain serious losses due to birds (Martin 1985; Hoy et al. 1989; Ross 1994; Glahn and Brugger 1995; Glahn et al. 1995). In response to this problem, in 1988 the NWRC of the USDA established a research station in Mississippi to conduct research to develop more effective methods for reducing the impact of birds on southeastern aquaculture farms. This paper describes the impact of a major avian pest species on the largest U.S. aquaculture industry, describes control methods to reduce depredations, and reviews research currently being conducted with this species at the NWRC Mississippi research station.

CATFISH FARMING

Most research at the NWRC Mississippi field station has been directed towards catfish farming, by far the largest aquaculture industry in the U.S. Commercial catfish farms produced almost 450 million pounds of catfish in 1995, accounting for 73% of all aquaculture production in the United States (The Catfish Institute 1995, Figure 1). Four states, Mississippi, Arkansas, Alabama, and Louisiana, last year accounted for 94% of commercial catfish acreage and 97% of farm sales in the United States (The Catfish Institute 1995). Mississippi alone accounted for 54% of the acreage and 71% of farm sales of catfish in the U.S. (Table 1).

Most catfish farms in Mississippi are concentrated along the flood plain of the Mississippi River in the northwestern portion of the state, a region commonly referred to as the Mississippi delta. More than 40,000 ha (100,000 acres) in Mississippi are devoted to catfish production.

A typical Mississippi catfish farm contains a complex of ponds, each encompassing about 6.5 to 8 ha (16 to 20 ac) of water 1 to 2 m (3 to 6 ft) deep and supporting 5,000 to 150,000 fish per hectare. Such high concentrations of fish are an irresistible attraction to birds.

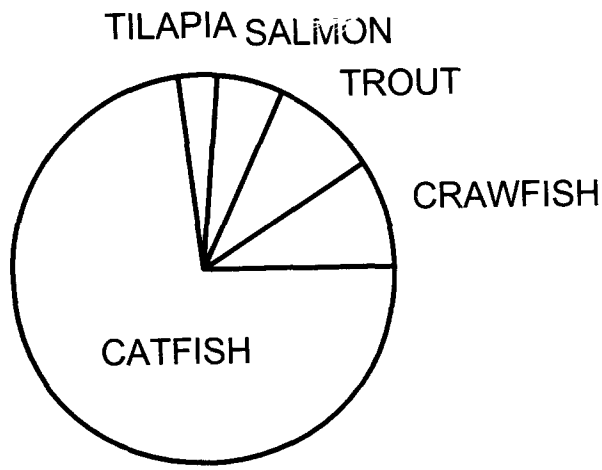

Figure 1. Percent sales of five major components of U.S. aquaculture in 1995. Total sales for all components was $552 million.

Table 1. U.S. catfish production, 1997.

State	Hectares	Sales (x1,000)
Mississippi	41,279	$275,559
Arkansas	11,534	52,214
Alabama	8,499	45,126
Louisiana	5,787	27,273
Other	4,678	17,606

BIRD DEPREDATIONS

In a recent survey (U.S. Dept. of Agric. 1997), catfish farmers identified wildlife as their second leading cause of losses. The vast majority of farmers indicated that birds, particularly cormorants and herons, were their biggest wildlife concern.

Wading birds such as great blue herons (*Ardea herodias*, GTBH) and great egrets (*Ardea alba*, GREG) are ubiquitous on catfish farms throughout most of the year. For the past two years, James Glahn, a wildlife research biologist at the NWRC Mississippi research station, has been conducting both field and pen studies to determine the foraging habits, diet, and impact of GTBH on catfish farms. The results will indicate when and where GTBH are likely to have the biggest impact on production and should help aquaculturists determine thresholds for applying damage control measures for these species.

American white pelicans (*Pelecanus erythrorhynchos*, AWPE) are an increasing concern to catfish farmers (King 1997). Flocks of 1,500 to 2,000 birds are common on catfish farms and adjacent flooded fields in the Mississippi delta. The large size and greater food requirements of this species, together with a propensity to forage at night, make pelicans a potentially large threat to catfish producers (Mott and Brunson 1997). Tommy King, another wildlife research biologist at the NWRC research station, has been monitoring pelican populations, movements, and daily activity budgets for the past several years in an attempt to clarify the impact of this species.

The most significant avian predator on catfish farms is the DCCO, a diving, fish-eating bird whose range extends across North America. DCCO populations have increased dramatically over much of North America during the past two decades, due mainly to a ban in 1972 on the use of DDT, reduced persecution on the breeding grounds, and possibly increased prey abundance on both their breeding and wintering grounds (Weseloh et al. 1995; Jackson and Jackson 1995). More than 350,000 pairs of DCCO currently breed in North America, with a total population probably between 1 and 2 million birds (Belant and Tyson 1997).

The biggest increases have come with interior populations that breed on the Great Lakes and in the Canadian prairie provinces and north-central U.S. (Belant and Tyson 1997). Every fall, several hundred thousand DCCO migrate south through the Mississippi Valley (Dolbeer 1991). In recent historical times, most of these birds spent the winter along the gulf coast. However, with the rise of the catfish industry, an increasing number of DCCO stop off farther north in Louisiana, Arkansas, and Mississippi.

DCCO populations increased dramatically during the 1980s along with the rapid rise of commercial catfish aquaculture in the Mississippi delta (Glahn and Stickley 1995). Since 1990, NWRC biologists and USDA Wildlife Services operations personnel have documented the continued increase in DCCO populations by monitoring active roost sites in the delta (Aderman and Hill 1995; Glahn et al. 1996). Numbers have increased from about 27,000 DCCO in 1990 to >68,000 birds in 1998 (Figure 2). Cormorant populations typically increase in the delta between November and January, reach a peak in February, and decline during the latter part of March as birds migrate north to breed (Glahn et al. 1996).

Jim Glahn and Kristin Brugger (1995) analyzed estimated DCCO population size, feeding rates, and prey size to construct a DCCO bioenergetics model. Their results indicated that DCCO in the Mississippi delta consume about $2 million worth of catfish, or about 4% of the potential harvest, annually.

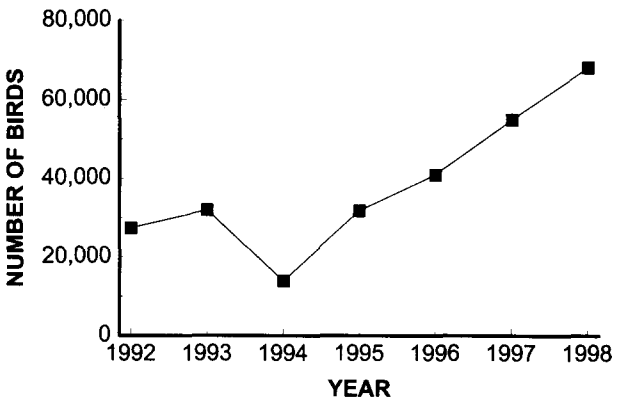

Figure 2. Number of double-crested cormorants censused at night roosts in the delta region of Mississippi during one night in January of each year. U.S. Department of Agriculture, Wildlife Services biologists identified all active roosts in the delta, and counted the number of cormorants flying into each roost in the evening or flying out the next morning.

DAMAGE CONTROL MEASURES

Eighty-seven percent of 281 Mississippi catfish farmers who responded to a survey in 1988 felt that fish-eating birds were enough of problem to warrant applying some control measures (Stickley and Andrews 1989). These growers spent an average of $7,400 to control bird depredations on their farms, amounting to estimated delta-wide expenditures of about $2 million. In spite of these efforts, growers still may have lost >$3 million because of birds.

A more recent survey (Wywialowsky 1998) estimated that in 1996 catfish producers lost $11.5 million due to bird predation. Estimated total losses due to direct predation and costs associated with employing preventive measures amounted to $17 million, or 4% of national catfish sales.

Management of DCCO depredations on catfish farms consists of trying to repel birds from farms, reducing local populations, and dispersing birds from night roosts near catfish farms (Mott and Boyd 1995). NWRC biologists have evaluated several techniques for repelling DCCO from catfish ponds, including floating ropes to interfere with DCCO landing and taking off from ponds (Mott et al. 1995) and a human effigy called "scary man" that inflates and makes loud noises (Stickley and King 1995; Stickley et al. 1995). Both techniques deterred birds for a limited time, but eventually birds habituated to them. The expense of employing these measures would probably limit their use.

For most farmers, scaring birds consists of patrolling levees and shooting pyrotechnics or shotgun shells. Of course shooting a shotgun can be both a scaring and a lethal technique. Aquaculture farmers in the Southeast can apply for depredation permits to shoot birds on their farms. In 1995, farmers reported taking 7,756 DCCO, 2,798 GTBH, 1,975 GREG, and 1,448 birds of other species under 904 permits issued by the U.S. Fish and Wildlife Service (USFWS) (Belant et al. 1998). The vast majority of these birds were taken in the states of Arkansas, Mississippi, and to a lesser extent, Louisiana.

Interestingly, actual numbers of birds reported taken under aquaculture depredation permits was only 62% of that authorized (Belant et al. 1998). Birds quickly become wary and increasingly difficult to shoot, and patrollers often cannot get within shooting range of birds. The main value of shooting probably is not so much to reduce regional populations, but to reinforce scaring efforts. Belant et al. (1998) recently concluded that birds taken under depredation permits between 1987 and 1995 had no effect either on regional winter populations or on continental breeding populations.

The USFWS recently issued a standing depredation order (63 FR 10550) that allows aquaculture farmers in 13 states, mostly in the Southeast, to shoot DCCO without a permit if the birds are causing or are about to cause damage on their farms. The USFWS does not anticipate any significant increase in take, but the new regulations will eliminate much paperwork both for farmers and the USFWS.

The third component of DCCO management consists of dispersing birds from night roosts near aquaculture farms (Mott et al. 1992, in press). DCCO typically roost in emergent bald cypress/tupelo gum trees in congregations of from several hundred to 10,000 or more birds. More than 60 DCCO roost sites have been identified in the Mississippi delta of which 10 to 15 typically are used during any given night. Many roosts are concentrated in the southeastern portion of the delta, near the main concentration of catfish farms.

Teams of farmers harass birds by shooting guns, bird bombs, screamers, and other non-lethal noise-making devices as birds fly into roosts for the night. Birds usually abandon the site after 1 to 3 nights of such harassment.

The development of the DCCO roost dispersal program in the Mississippi delta has been a cooperative effort among the NWRC Mississippi research station, the USDA/WS operational program, and the catfish farmers themselves. Don Mott and his coworkers (Mott et al. 1992, in press) demonstrated that 1 to 3 nights of widespread, consistent, and coordinated harassment could cause birds to abandon roost sites near catfish farms in the eastern part of the Delta and move to roosts along the Mississippi River. Furthermore, they documented that such efforts resulted in reduced DCCO populations at nearby catfish farms. The program subsequently was taken over by catfish farmers themselves, with significant logistic and technical assistance from WS operations personnel. The latter monitored roost sites and mobilized manpower to disperse birds when and where necessary. Coordinating such an effort over the entire delta logistically is a monumental task.

Biologists from the NWRC Mississippi research station continue to monitor the effectiveness of the roost dispersal program. Last winter 50 DCCO were captured and outfitted with transmitters to determine the effect of roost harassment on roosting and foraging behavior. To monitor roosting locations, two people rode in separate vehicles along two transects at night and used scanning receivers to detect any radio-tagged birds at major potential roosting locations. Seventy-eight percent, 59%, 53%, and 32%, respectively, of cormorants identified at any particular roost returned to that same roost 1 night, 2 nights, 3 to 5 nights, or >6 nights later, indicating that DCCO tend to return to the same night roost site on succeeding nights. The above results are for all birds, regardless of whether they were harassed. Roost fidelity would have been even stronger if movements of harassed and non-harassed birds had been analyzed.

Roost fidelity of birds from harassed versus and non-harassed roosts were compared with regard to whether they returned to the same site within 48 hours. Eighty-one percent of birds returned to the same site when not harassed, compared to only 11% for harassed birds. When they did change night roosts, harassed birds also traveled farther (median distance = 26 km) than non-harassed birds (median distance = 0 km). Clearly birds tended to change roost locations more often and travel farther when they were harassed.

A main objective of the roost dispersal study program is to move birds to roosts along the Mississippi River and away from the major concentration of catfish farms. Glahn et al. (1995) identified stomach contents of DCCO collected in the MS delta and found that catfish made up about 75% of the diet of birds collected in the interior delta, but only about 14% of the diet of birds collected along the Mississippi River. One of the major things to be determined by the study is whether birds that roosted along the river are likely to return to the eastern delta the next day to feed. Foraging activity was monitored by flying over the delta during the day to locate telemetered birds. Only 7% of telemetered DCCO that roosted along the river foraged in the eastern delta the next day, compared to 100% of birds that roosted in the interior delta.

SUMMARY

Depredations by GTBH, AWPE, and DCCO are a major concern of aquaculturists in the southeastern U.S. Management of bird depredations on catfish farms entails repelling birds from farms, reducing local populations, and dispersing birds from night roosts in major catfish-growing areas. Farmers patrol their facilities regularly throughout the winter and use both frightening devices and lethal means to reduce depredations on their farms. Lethal control is important not only for reducing local populations on particular farms, but also for reinforcing non-lethal scaring techniques. Relocating cormorant roosts away from areas of concentrated aquaculture production is an important non-lethal component of an integrated program to reduce the very real and substantial impact that DCCO have on the catfish industry in Mississippi. Clearly, relocating roosting DCCO from the interior delta to the Mississippi River is an effective strategy for reducing depredations at catfish farms.

ACKNOWLEDGMENTS

J. G. Glahn and S. C. Smith reviewed an earlier draft of this manuscript.

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