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Wintering Double-crested Cormorants in the Delta Region of Mississippi: Population Levels and their Impact on the Catfish Industry

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Abstract.—Historically, Double-crested Cormorant (*Phalacrocorax auritus*) populations wintering in the Delta region of Mississippi were low and probably restricted to an area along the Mississippi River. Coinciding with the tremendous growth of the Channel Catfish (*Ictalurus punctatus*) industry in this area, wintering populations have increased rapidly and may have expanded their wintering range to include areas of highest catfish density. More than half (57%) of the catfish growers in the region perceive cormorants to be a problem at their farms and many are dissatisfied with "fright" strategies they have used to reduce fish losses. Recent objective data appear to substantiate these complaints and to project cormorant losses to the catfish industry at $2 million annually. These same data also document temporal and spatial patterns of predation and suggest possible farm management practices that might help mitigate losses. Because the current distribution of cormorant winter roost-sites appears to be associated with significant catfish predation, dispersal of cormorants from these sites is also suggested as a possible means of alleviating losses.

Key words.—Catfish predation, Double-crested Cormorant, populations, *Ictalurus punctatus*, Mississippi, *Phalacrocorax auritus*.

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The Delta region of Mississippi is a 16,000 km^2 alluvial plain of the Mississippi and Yazoo rivers, commonly referred to as the Mississippi Delta. Owing to its flat topography and hot humid climate, it has traditionally been an intensively farmed region. Although much of the Delta has been drained, more than 10% of the original wetland, consisting of cypress swamps and bayous, remains. The flat topography and impervious subsoil layer has also lent itself to the development of aquaculture, primarily Channel Catfish (*Ictalurus punctatus*) production. Following the construction of the first catfish pond in 1965, the catfish industry grew rapidly during the 1970s and 1980s (Wellborn 1987) and presently exceeds 40,000 ha (Brunson 1991). This region currently has the highest fish production in the United States (USDA 1992). Each of two counties in the region (i.e., Humphreys, Sunflower) has more catfish production than any single state in the United States (Brunson 1991). Catfish farms in this region average approximately 100 ha of ponds with a typical rectangular pond size of 8 ha. Ponds are shallow, ranging from 1 to 2 m in depth, with fish densities ranging from 5,000 to 150,000 fish/ha. The concentration of these shallow fish ponds, stocked with high fish densities, has provided an attractive foraging area for piscivorous birds (Hodges 1989).

One potential piscivorous species in conflict with the Mississippi Catfish is the Double-crested Cormorant (*Phalacrocorax auritus*) that had previously been shown to affect inland fisheries (Craven and Lev 1987). As a result of the emerging conflict between aquaculture interests and piscivorous birds, the United States Congress appropriated funding to the U.S. Department of Agriculture (USDA) Denver Wildlife Research Center (DWRC) to conduct research to identify and help alleviate this conflict. These resources, in part, provided for the establishment of the DWRC, Mississippi Research Station at Mississippi State, Mississippi in August 1988. This paper reviews the available information and research conducted by the Mississippi Research Station on the nature and magnitude of the conflict between cormorants and the catfish industry in the Mississippi Delta.

POPULATION HISTORY

Historically, Double-crested Cormorant populations from the Great Lakes and Central Canadian Regions have migrated down the Mississippi River to winter along the shores of southern Mississippi and the Gulf of Mexico (Lewis 1929). Along the lower Mississippi River, wintering populations were reported to be very small (Lewis 1929). Coincidental with the growth of the Mississippi catfish industry, cormorant populations in the Great Lakes and Canada began to increase dramatically in the mid 1970s and 1980s, as a result of reduced persecution and pesticide levels (Ludwig 1984, Vermeer and Rankin 1984).

Although Christmas Bird Count (CBC) data do not record cormorants wintering prior to 1981, winter range maps suggest that they traditionally wintered along the Mississippi River as far north as the Mississippi Delta (Palmer 1962). Limited CBC data (American Birds, 1981-1988, Volumes 35-42) on wintering populations along the Mississippi in the Delta suggest drastic increases from 1981 to 1988 (Fig. 1). In the winters (November through March) of 1983-84 and 1984-85, weekly aerial surveys of catfish ponds in the Delta counties of highest catfish production (Christopher 1985) revealed no evidence of wintering cormorant populations. In 1988, cormorant populations recorded in the Washington County CBC peaked at 3,410, and Animal Damage Control (ADC) biologists estimated the total population in the Delta at approximately 50,000 birds (G. A. Littauer, *pers. comm.*).

Roosting sites identified in the survey included a number of sites along the Mississippi River, but also a number of sites situated around the area of highest catfish production, approximately 40 to 80 km east of the Mississippi River (Fig. 2; G. A. Littauer, *pers. comm.*). More recent counts of cormorants at winter roosts within the entire Delta region (Aderman and Hill 1995) suggested that cormorant populations varied among months during the wintering period (November through April), but peaked in March and April at approximately 30,000 birds during

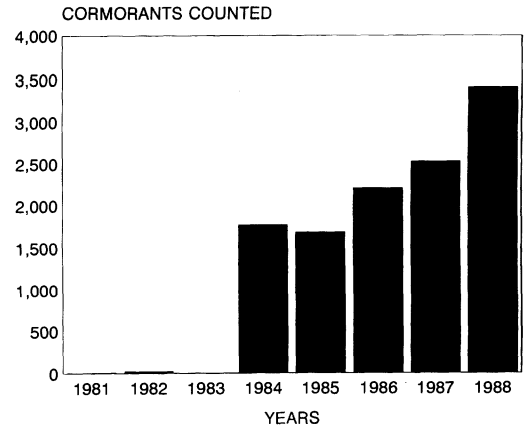

Figure 1. Double-crested Cormorants counted during the Christmas Bird Count in Washington County (South), Mississippi: 1981-88.

both the winters of 1989-90 and 1990-91. Additional censuses by ADC biologists in February of those winters and in 1991-92 yielded similar estimates of approximately 30,000 birds each year.

Currently 15 primary and 8 secondary roost sites have been identified in the Delta region. Usually only half of these sites are active at one time. Primary sites usually contain large concentrations of 1,000 to 10,000 birds, while secondary sites may contain a few to several hundred individuals.

In summary, cormorant populations in the Delta region appear to have increased drastically during the past decade, possibly shifting east towards the area of highest catfish production. However, since 1990, recorded cormorant populations have been slightly lower then the peak in 1988 and appear to have stabilized at approximately 30,000 birds.

CONFLICT WITH AQUACULTURE

Although some questions remain unaddressed, an intensive research effort initiated in 1988 involved several approaches to help identify the magnitude of the cormorant conflict with the catfish industry in the Delta. A questionnaire survey in 1988, reflected the views of 281 growers about cormorant damage and the costs of control measures used (Stickley and Andrews 1989). These results indicate that 57% of the Delta catfish growers considered cormorants to be

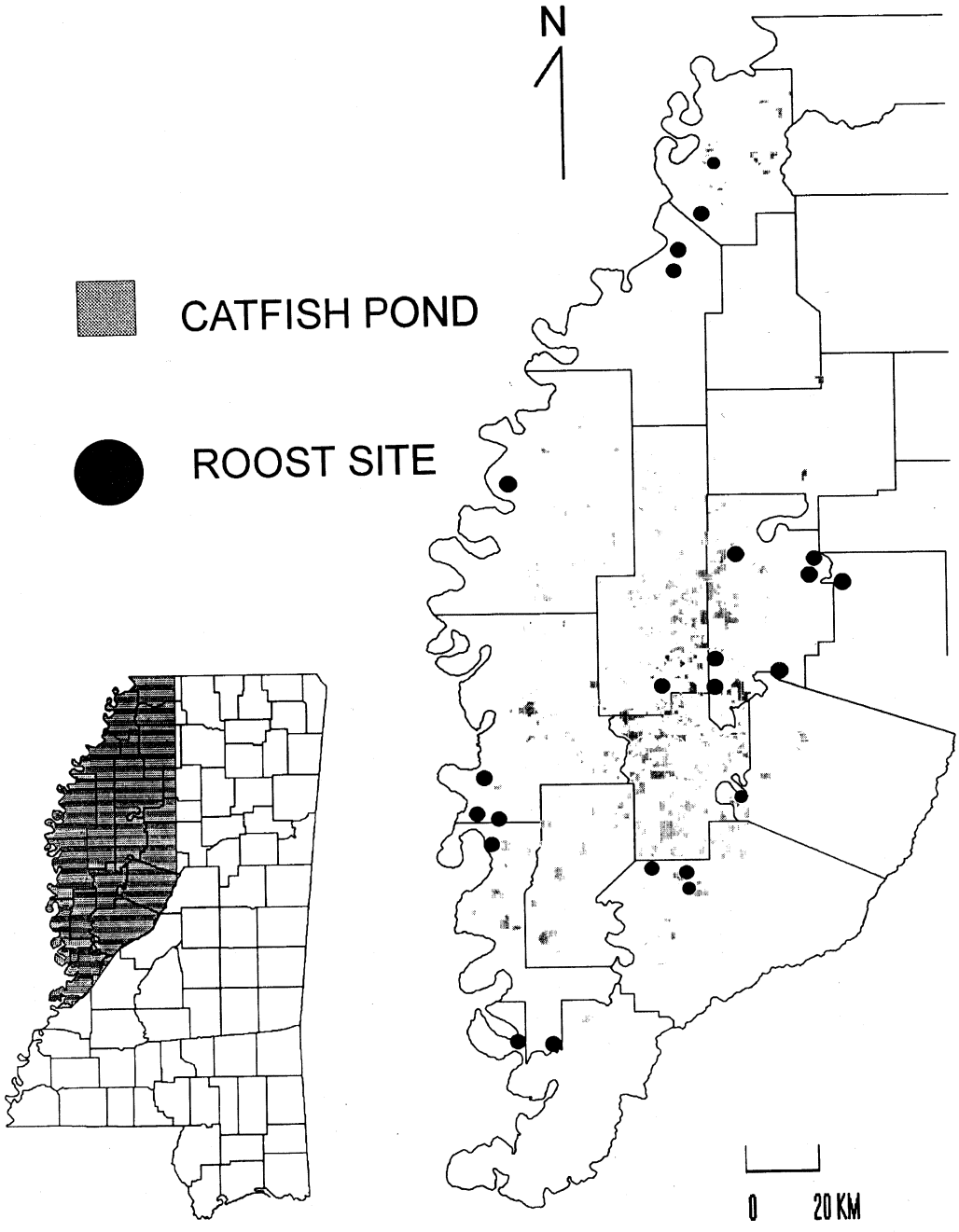

Figure 2. Distribution of catfish ponds and the nighttime roost sites of Double-crested Cormorants wintering in the Delta region of Mississippi during the winters of 1989-90 through 1991-92.

a problem at their farms. Although costs of damage were not determined from the survey, the average cost of bird harassment at farms using such procedures was estimated by growers at $7,400US per year. The most common harassment technique used by 147 (60%) of the growers involves driving around their ponds and shooting to frighten the birds off. Under special depredation permits, a small number of birds are sometimes

killed during these patrols. Despite the widespread use of harassment patrols, 40% of those using this technique did not consider it effective in reducing damage. Furthermore, this survey suggests that there was little consensus among growers on the long-term effectiveness of a variety of frightening methods used.

To document the possible financial losses to catfish producers from cormorant predation, Stickley *et al.* (1992) measured the foraging rates of cormorants on catfish fingerlings at 16 catfish ponds. The foraging rate of a typical flock of 30 cormorants averaged 5 catfish per cormorant-hour, but in an extreme case, a maximum of 28 fish per cormorant-hour was reported. At the average foraging rate, this rate would equate to a loss of $400US during a 9-hour foraging day for a flock of 100 birds. Based on these expected losses, harassing cormorants from ponds is economically viable.

In a number of cases, however, cormorants using ponds appeared to be primarily feeding on, and appeared to prefer, Gizzard Shad (*Dorosoma cepedianum*) that proliferate in these ponds (Stickley *et al.* 1992). Data on food habits (Glahn *et al.* 1995) and observations during telemetry studies (T. King, *pers. comm.*) have also suggested the possible preference of cormorants for shad.

To estimate the overall damage of cormorants to the catfish industry in the Delta, concomitant studies supported by the Denver Wildlife Research Center were conducted on wintering roosting populations (Aderman and Hill 1995), food habits (Glahn *et al.* 1995), and activity budgets (King *et al.* 1995) of Double-crested Cormorants in the Delta region. Data from these studies as well as a laboratory study on energy assimilation during digestion (Brugger 1993) and other information from the literature were used to provide input into a bioenergetics model for cormorants wintering in the Delta region (Glahn and Brugger 1995). Outputs from this model for the winters of 1989-90 and 1990-91 were similar, with estimated annual losses of approximately 20 million fingerlings at a replacement cost of approximately $2 million (US$).

If the annual standing crop of fingerlings in the Delta region, grossly estimated at 500 million fish (USDA 1992), is indeed correct, losses to cormorants may approach 4%. More than half of these losses appear to occur in February and March when cormorant populations peak and their diet shifts towards more catfish (Glahn and Brugger 1995). Considering that cormorants roosting in the eastern part of the Delta are responsible for a disproportional amount of predation on catfish (Glahn *et al.* 1995), more than half of the losses may be restricted to that area of highest catfish production.

Although bioenergetic modelling provides relevant information about the overall impact of cormorants on the Delta catfish industry, it does not provide any information about potential losses at individual farms or ponds. Data from Stickley *et al.* (1992) suggest that cormorant predation, if left unabated over the damage season, can result in a 50% reduction in pond populations at a cost of approximately $18,000US per pond. These projected losses considered only replacement cost of fish removed by predation. Other production losses might include wounding, harassment, and disease vectoring of fish. Further research under controlled experimental conditions is necessary to refine the present data to allow predictions of production losses at individual ponds or farms.

MANAGEMENT IMPLICATIONS

All studies defining the conflict between cormorants and the Mississippi Delta catfish industry point to significant potential losses from cormorant predation. These studies help to define the nature of the conflict and provide insights towards its resolution. Clearly, catfish growers in the region perceive cormorants to be a threat to their livelihood and want better means of reducing this threat. Growers have used a variety of conventional frightening techniques with mixed and often short-term results up to now. However, novel frightening devices and strategies hold some promise for more consistent and long-term effects (Mott and Boyd 1995).

The typical 8 ha pond size and narrow-levee system, as well as the sheer magnitude of farms with respect to total water acreage appears to make conventional exclusion methods impractical (Mott and Boyd 1995). Recent research points to other possible cultural practices that might reduce cormorant predation. Food habits studies (Glahn *et al.* 1995) suggest that catfish within the size class of 10 to 20 cm are those most vulnerable to predation. Since a large number of these fish are stocked in March (USDA 1992), delaying the stocking of these fish until after the cormorants migrate in April could reduce the losses that occur during this period. If delayed stocking is not possible, introducing larger catfish (>20 cm) during the early spring and smaller fish later may also reduce the problem. Food habits and other observations strongly suggest the importance of Gizzard Shad as a possible "buffer prey" species in reducing predation on catfish. Considering the already ubiquitous nature of shad in this region, research is needed to examine the possible benefits and risks of localized shad stocking as a means of reducing catfish predation.

Because the current distribution of the cormorant wintering population appears to be associated with significant catfish production, efforts are needed to change this distribution in a socially acceptable manner. Mott *et al.* (1992) demonstrated that cormorants can be easily dispersed from their nighttime roost sites, resulting in a subsequent reduction of birds at nearby catfish ponds. Simultaneous harassment at all roost sites located near the counties of highest catfish production could have a similar benefit. In theory, this would reduce losses in these areas by relocating birds to their original wintering areas along the Mississippi River and the Gulf Coast. Whether this would be feasible and whether it would exacerbate problems elsewhere remain to be investigated.

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