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Increased Abundance and First Breeding Record of the Neotropic Cormorant (*Phalacrocorax brasilianus*) on the Alluvial Plain of Mississippi

Katie C. Hanson[1,*], Travis L. DeVault[2], and Stephen J. Dinsmore[3]

Abstract - *Phalacrocorax brasilianus* (Neotropic Cormorant) has been observed with increasing frequency in the alluvial plain (Delta region) of Mississippi. In the past 6 years, 22 individuals have been observed in 20 separate sightings during spring and summer. These sightings have occurred at breeding colonies of other colonial waterbirds and commercial aquaculture facilities of *Ictalurus punctatus* (Channel Catfish). Two sexually mature Neotropic Cormorants have been collected at a colonial waterbird breeding colony near the Mississippi River in the western Delta region among flocks of *Phalacrocorax auritus* (Double-crested Cormorants). Twice during the summer of 2008, confirmed nesting of Neotropic Cormorants were documented in the Delta region of Mississippi. The increased abundance and range expansion of Neotropic Cormorants in the Delta region of Mississippi may be a result of the readily available food source of cultured Channel Catfish.

Introduction

The breeding range of *Phalacrocorax brasilianus* Gmelin (Neotropic Cormorant) extends from South and Central America northward into the southern United States, including southern Arizona, southern New Mexico, north-central Texas, southwestern Louisiana, southwestern Arkansas, and southeastern Oklahoma (Telfair and Morrison 2005). In the 1960s, Neotropic Cormorant populations declined drastically in Texas (Telfair and Morrison 2005), related perhaps to pesticide use (King 1989) and coastal development (Oberholser 1974). However, since the 1970s, the number and sizes of breeding colonies of Neotropic Cormorants have increased steadily, and new breeding colonies have been established both along the coast of the Gulf of Mexico and inland from southern Arizona to northwestern Louisiana, southwestern Arkansas, and southeastern Oklahoma (Coldren 1998, Green et al. 2006, Radamaker and Corman 2008, Telfair 2006). In Texas, the coastal and inland breeding populations increased from 1968 to 1992. However, while the coastal population declined from 1992 to 2004, the inland population continued to increase (Telfair and Morrison 2005).

The range of Neotropic Cormorants also appears to be expanding. In 2007, there were new breeding records in central Kansas (Grzybowski and

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Slicock 2008a; S. Seltman and R. Graham, Kansas Ornithological Society, Larned, KS, pers. comm.) and north-central Oklahoma (Grzybowski and Slicock 2008b). In addition to an overall increase in the number of wintering Neotropic Cormorants in Texas, a greater proportion of the wintering population is now found inland. National Audubon Society Christmas Bird Counts reveal that between 1957–58 to 1969–70, 99% of the population was coastal; however, between 1970–71 to 2005–06, only 83% was coastal (Telfair 2006).

A closely related and more thoroughly studied species, *Phalacrocorax auritus* Lesson (Double-crested Cormorant), also has increased in abundance, both in North America and in the southeastern US in recent years (Hatch and Weseloh 1999, Jackson and Jackson 1995, Wires et al. 2001). Double-crested Cormorants wintering in the alluvial plain (Delta region) of Mississippi increased by nearly 225% during the 1990s (Glahn et al. 2000b), and have continued to increase since (Dorr 2006). Although Double-crested Cormorants did not breed in the Delta region of Mississippi historically, nesting of this species has occurred there over the past decade (K. Hanson and B. Dorr, National Wildlife Research Center, Starkville, MS, unpubl. data; Reinhold et al. 1998; Sauer et al. 2007). The increase of Double-crested Cormorants in Mississippi has coincided with a dramatic increase in commercial production of *Ictalurus punctatus* Rafinesque (Channel Catfish) in Mississippi (Glahn and Stickley 1995, Glahn et al. 2000b, Mott and Brunson 1997). The Delta region of Mississippi comprises more than 29,000 ha of water surface area used for commercial catfish production (USDA 2008).

Annual midwinter censuses of Double-crested Cormorants have been conducted in the Delta region of Mississippi by USDA APHIS Mississippi Wildlife Services (MS-WS) since the winter of 1989–90 (Glahn and Stickley 1995), with no reports of Neotropic Cormorants to date. Surveys of likely and confirmed Double-crested Cormorant breeding colonies have been conducted by MS-WS in the Delta region since 1994, with the first documented Double-crested Cormorant nesting occurring in 1998 (Reinhold et al. 1998). Observations of Neotropic Cormorants have not been reported in Mississippi during the National Audubon Society Christmas Bird Count nor during the North American Breeding Bird Survey. Annual opportunistic surveys for waterbirds have been conducted by S.J. Dinsmore (unpubl. data) in spring and summer throughout the Delta region of Mississippi since 2001. According to the Mississippi Ornithological Society, a Neotropic Cormorant observed in the Delta region on 28 February 2003 represents the third published sighting for the state and the first record away from the Mississippi Gulf Coast (Knight and Knight 2003). The first and second records for the state were seen at Bellefontaine Beach in Jackson County in 1979 and 1980, respectively. An unconfirmed sighting was reported in 1990 at Waveland Lagoon in Hancock County.

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We describe the increased abundance of the Neotropic Cormorant, the presence of sexually mature adults, and first documented breeding attempt in Mississippi based on recent observations. We also suggest that these recent findings may be linked to the abundant food source provided by commercial Channel Catfish aquaculture in the Delta region of the state.

Methods

From 2003 to 2008, we completed a mixture of opportunistic surveys and targeted surveys of known and suspected colonial waterbird roosts, breeding colonies, and catfish pond complexes during the spring and summer months (late February through August) in the Delta region of Mississippi. Opportunistic surveys (2003–2007; S.J. Dinsmore, unpubl. data) consisted of systematic vehicular visits to catfish pond complexes and neighboring natural water bodies to count waterbirds with an emphasis on shorebirds and long-legged wading birds. Opportunistic surveys often visited >100 catfish ponds in a day and were not surveys for nests. Targeted surveys (2005–2008; K.C. Hanson, unpubl. data) were conducted on known colonial waterbird roosts and breeding colonies and included nest counts of Double-crested Cormorants, the presence of other species of nesting colonial waterbirds, and their proximity to nesting Double-crested cormorants.

Upon observation, Neotropic Cormorants were assigned to 1 of 3 age classes based on plumage characteristics described by Telfair and Morrison (2005). Individuals were classified as adults if they displayed adult breeding plumage, with glossy, nearly black feathers, a white-bordered gular pouch, and white filoplumes present on sides of the head. Individuals were classified as sub-adults if plumage was nearly black to fuscous in color, with a white-bordered gular pouch but lacking any filoplumes on the sides of the head. Individuals that lacked a white-bordered gular pouch and were fuscous in color were classified as juveniles (young-of-the-year).

Two Neotropic Cormorant specimens were recovered during management control operations of Double-crested Cormorants in the Delta region of Mississippi during 2007 and 2008. Morphometric measurements were collected and necropsies were performed on both specimens.

Results

Surveys completed from 2003 to 2008 yielded repeated sightings of adult, sub-adult, and juvenile Neotropic Cormorants at breeding colonies of other waterbirds, night roosts of Double-crested Cormorants, and commercial Channel Catfish aquaculture facilities (Table 1). The presence of both breeding adults and juveniles in the Delta region during the spring and summer months may be indicative of Neotropic Cormorants actively breeding in the area. All sightings of Neotropic Cormorants were observed in the presence of Double-crested Cormorants.

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All but one observation of Neotropic Cormorants were in Humphreys, Sunflower, and Washington counties, which are in the Delta region of Mississippi (Fig. 1). These three counties comprise more than 50% of the total water surface area (>20,000 ha) of Channel Catfish aquaculture in the state of Mississippi (USDA 2008). Neotropic Cormorants that we observed at aquaculture facilities often were loafing on pond levees with Double-crested Cormorants, presumably because Channel Catfish aquaculture ponds provide a readily available food source.

Neotropic Cormorants have been sighted multiple times at both Dutch Brake and Cold Lake, which are adjacent to commercial Channel Catfish aquaculture facilities and are Double-crested Cormorant roost sites. Neotropic Cormorants also were observed in Washington County at Deer Lake and Swan Lake at Yazoo National Wildlife Refuge, and at Swamp Roost. Both Swan Lake and Swamp Roost serve as Double-crested Cormorant winter roost sites and breeding colonies. Swamp Roost and Yazoo National Wildlife Refuge are less than 9 km apart, with the closest aquaculture facility within 17 km.

One adult male Neotropic Cormorant was shot unintentionally on 15 June 2007 by USDA APHIS Mississippi Wildlife Services personnel during Double-crested Cormorant control operations at Swamp Roost, with birds being salvaged as part of a Double-crested Cormorant reproductive status

Table 1. Recent observations of Neotropic Cormorants on the alluvial plain of Mississippi. A = adult, S = subadult, and J = juvenile.

Date	A	S	J	County	Location
28 Feb 2003	1			Humphreys	Double-crested Cormorant roost at Cold Lake
01 Mar 2003	1[A]			Humphreys	Double-crested Cormorant roost at Cold Lake
03 May 2003		1		Humphreys	Catfish aquaculture pond SE of Cold Lake
07 May 2003		1		Humphreys	Catfish aquaculture pond SE of Cold Lake
09 Aug 2003	1		1	Adams	St. Catherine Creek NWR[C]
30 Aug 2003		1		Humphreys	Catfish aquaculture pond W of Isola, MS
21 Jul 2004		1		Washington	Swan Lake, Yazoo NWR
07 Aug 2004		1		Sunflower	Dutch Brake
13 Aug 2004			1	Washington	Catfish aquaculture pond SE of Hollandale, MS
17 Jul 2005	1			Washington	Deer Lake, Yazoo NWR
17 Jul 2005		1		Humphreys	Catfish aquaculture pond E of Belzoni, MS
02 Jul 2006		1		Sunflower	Dutch Brake
02 Jul 2006	1			Humphreys	Catfish aquaculture pond S of Isola, MS
03 Aug 2006		1		Humphreys	catfish aquaculture pond S of Isola, MS
03 Aug 2006		1		Sunflower	Dutch Brake
15 Jun 2007	1			Washington	Swamp Roost
15 Jul 2007	2		1	Sunflower	Dutch Brake
07 May 2008	1[B]			Yazoo	Stuart Brake Ridge
03 Jun 2008	1[B]			Yazoo	Stuart Brake Ridge
09 Jun 2008	1			Washington	Swamp Roost

[A]Repeat sighting of the bird observed the previous day.
[B]Bird observed on nest.
[C]St. Catherine Creek is located south of the Delta region of Mississippi.

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research project. Swamp Roost is an established mixed breeding colony of Double-crested Cormorants, *Anhinga anhinga* L. (Anhingas), *Ardea albus* L. (Great Egrets), *Ardea herodias* L. (Great Blue Herons), and *Nycticorax nycticorax* L. (Black-crowned Night-Herons). The male Neotropic Cormorant collected was in adult breeding plumage with white nuptial plumes on the head and neck. Morphometric measurements taken included body mass (1.12 kg), culmen length (52.8 mm), tarsus length (52.8 mm), and wing chord length (258 mm). Upon necropsy, enlarged testes were observed (left

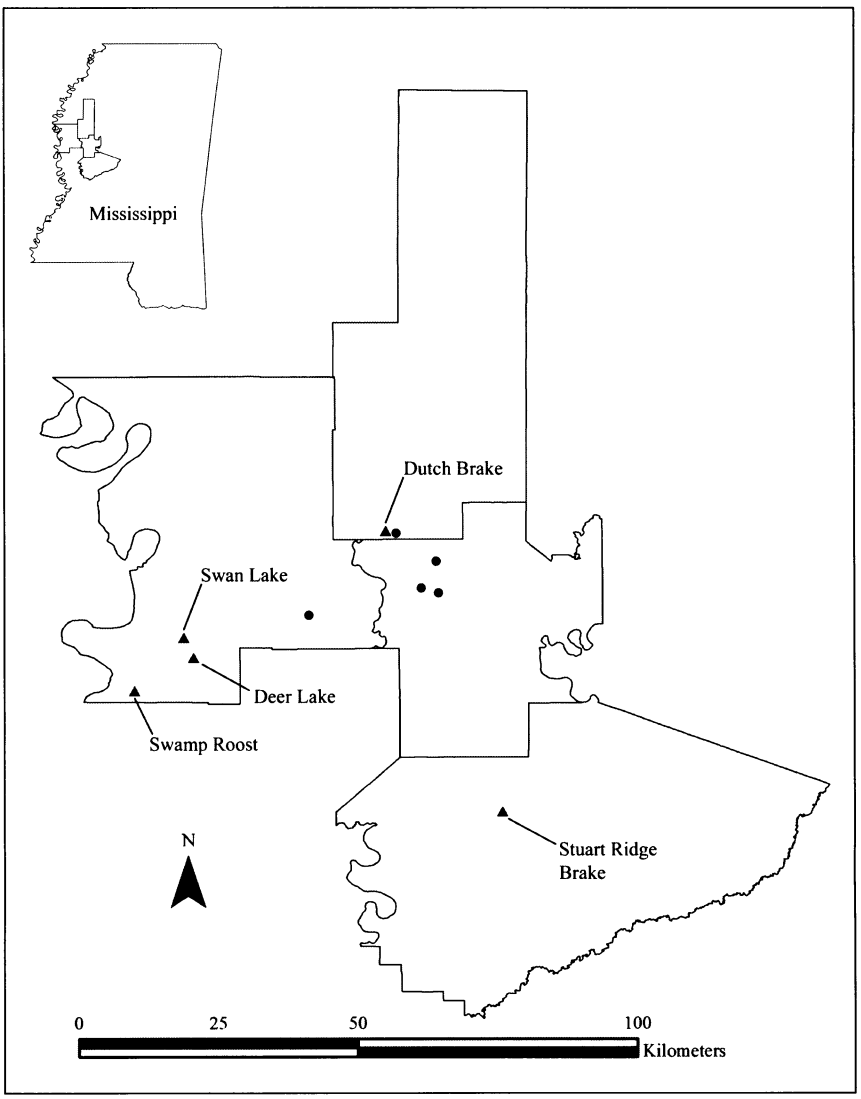

Figure 1. Locations within the Mississippi alluvial plain (Delta region) where Neotropic Cormorants have been observed (2003–2008). Triangles represent colonial waterbird breeding colonies. Circles represent Channel Catfish aquaculture pond.

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testis length = 18.8 mm, width = 7.4 mm, mass = 0.403 g), indicating that the bird was in active breeding status.

On 9 June 2008, an adult female Neotropic Cormorant was shot unintentionally by USDA APHIS WS National Wildlife Research Center personnel during Double-crested Cormorant control operations at Swamp Roost, with birds being salvaged as part of a Double-crested Cormorant food-habits research project. Morphometric measurements taken of the adult female bird included body mass (1.13 kg), culmen length (49.2 mm), tarsus length (53.3 mm), and wing chord length (252 mm). Upon necropsy and examination of the reproductive tract, the presence of a striated and convoluted oviduct and one pre-ovulatory follicle indicated the bird was sexually mature and was in active breeding status. No post-ovulatory follicles were observed, suggesting the bird had not laid eggs within the previous few weeks. This finding was consistent with the later stage of nesting (lack of post-ovulatory follicles in sexually mature females, and presence of chicks and fledglings) observed in Double-crested Cormorants within the breeding colony.

In the afternoon of 7 May 2008, an adult Neotropic Cormorant was sighted in Stuart Ridge Brake perched in a *Nyssa aquatica* L. (Water Tupelo) next to a nest. Shortly thereafter, the same bird was observed and photographed climbing into the nest and remained there until dark. Twenty-seven days later, on 3 June 2008, an adult Neotropic Cormorant was sighted in the afternoon, at the same tree and nest. The bird remained on the nest until dark. The presence of eggs or chicks in the nest was undetermined. Stuart Ridge Brake is an established Double-crested Cormorant breeding colony, located adjacent to a commercial Channel Catfish aquaculture facility in Yazoo County. It also contains breeding Anhingas, Great Egrets, Great Blue Herons, Black-crowned Night-Herons, and *Eudocimus albus* L. (White Ibis).

Discussion

The Mississippi Breeding Bird Atlas lists several criteria based on the recommendations for North American Breeding Bird Atlas projects (Laughlin et al. 1990) for confirmation of a breeding species. These criteria include carrying nesting material, nest building, and observations of an occupied nest. Based on these criteria, our observations qualify as a first breeding record for the Neotropic Cormorant, and suggest that the species may be expanding its range in inland Mississippi. Continued reports of inland breeding colonies in eastern Texas, northwestern and central Louisiana, southwestern Arkansas, southeastern and north-central Oklahoma, and central Kansas further support the likelihood of additional breeding colonies of Neotropic Cormorants becoming established in Mississippi (Coldren 1998, Green et al. 2006, Grzybowski and Slicock 2008a, Radamaker and Corman 2008, Telfair 2006, Telfair and Morrison 2005).

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Like Double-crested Cormorants, Neotropic Cormorants are opportunistic foragers, typically foraging on fish that are most abundant (Telfair and Morrison 2005). Telfair and Morrison (2005) note that the overall growth pattern of the North American Neotropic Cormorant population is consistent with expanding growth rates of other species of cormorants (van Eerden and Gregersen 1995, Hatch and Weseloh 1999, Jackson and Jackson 1995). Neotropic Cormorant populations have increased in the Greater Antilles and Cuba in recent years, possibly as a result of fish-farming (Lee and Mackin 2009, Norton 1990, Telfair and Morrison 2005). Radamaker and Corman (2008) also have noted that range expansion and increases in Arizona populations of Neotropic Cormorants are likely due to an increase in availability of prey. Highly prolific species of exotic tropical fish (*Tilapia* spp.) have been introduced into Arizona and are frequent prey items of both Neotropic and Double-crested Cormorants.

We observed Neotropic Cormorants at or nearby Channel Catfish aquaculture facilities, often among Double-crested Cormorants. Glahn et al. (2000a) documented improved overwinter body condition of Double-crested Cormorants in the Delta region of Mississippi due to exploitation of commercially raised Channel Catfish and hypothesized that the consumption of Channel Catfish has increased Double-crested Cormorant survival and contributed to a rapid increase in their population. Double-crested Cormorants forage extensively at aquaculture facilities (Glahn et al. 1995), and Neotropic Cormorants probably utilize this food source as well. The increased abundance of Neotropic Cormorants in the Delta region may be due, in part, to the overall regional expansion of their range. However, the readily available cultured Channel Catfish in particular may facilitate their expansion into the Delta region.

From May through September, Double-crested Cormorant control operations can be conducted under the authority of a Public Resource Depredation Order (PRDO), which allows state fish and wildlife agencies, tribes, and USDA Wildlife Services to lethally take Double-crested Cormorants to protect natural resources (USFWS 2003). Mississippi is one of the 24 states covered by the PRDO. The presence and unintentional collection of Neotropic Cormorants during control activities was unexpected. Until recently, the presence of Neotropic Cormorants was unknown in any of the managed Double-crested Cormorant breeding colonies. No other incidental take of Neotropic Cormorants have been reported while operating under the PRDO (Terry Doyle, US Fish and Wildlife Service, Arlington, VA, pers. comm.).

In addition to the PRDO, Double-crested cormorant control activities may be conducted under the authority of an Aquaculture Depredation Order (AQDO). This depredation order authorizes the take of Double-crested Cormorants from aquaculture facilities in 13 states when they are committing or about to commit depredations to aquaculture stocks. It also authorizes USDA APHIS Wildlife Services to perform control activities at roost sites

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in the vicinity of aquaculture facilities during the months of October through the following April. Persons operating under either depredation order are required to report the take of any migratory bird species other than Double-crested Cormorants to their Regional Migratory Bird Permit Office. To date, no Neotropic Cormorants have been reported as incidental take under the AQDO (Terry Doyle, US Fish and Wildlife Service, Arlington, VA, pers. comm.). However, if numbers continue to increase in the region, potential for incidental take under this order may also increase.

In conclusion, observations of Neotropic Cormorants at sites used by Double-crested Cormorants (e.g., breeding colonies and catfish farms) in the Delta region have increased. Information provided herein on the expansion of Neotropic Cormorants in the Delta region should minimize inadvertent take of Neotropic Cormorants during management control of the Double-crested Cormorant under both these orders.

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