

in the Atlantic region (Tyson *et al.* 1999), which extends along the Atlantic coast from southern Newfoundland to New York City and Long Island (Wires *et al.* 2001). Atlantic DCCOs are migratory and occur with smaller numbers of great cormorants. From the early 1970s to the early 1990s, the Atlantic population increased from about 25,000 pairs to 96,000 pairs (Hatch 1995). While this population declined by 6.5 percent overall in the early to mid-1990s, some colonies were still increasing during this period. The most recent estimate of the Atlantic population is at least 85,510 breeding pairs (Tyson *et al.* 1999).

**Interior.** Nearly 70 percent of the DCCO breeding population is found in the Interior region (Tyson *et al.* 1999), which reaches across the prairie provinces of Canada, includes the Canadian and U.S. Great Lakes, and extends west of Minnesota to southwestern Idaho (Wires *et al.* 2001). Interior DCCOs are strongly migratory and, in the breeding months, are concentrated in the northern prairies, with the Canadian province of Manitoba hosting the largest number of breeding DCCOs in North America (Wires *et al.* 2001). Additionally, large numbers of Interior DCCOs nest on or around the Great Lakes (Hatch 1995, Wires *et al.* 2001). Since 1970, when 89 nests were counted during a severe pesticide-induced population decline (Weseloh *et al.* 1995), DCCO numbers have increased rapidly in the Great Lakes, with breeding surveys in 2000 estimating 115,000 nests there (Weseloh *et al.* 2002). From 1990 to 1997, the overall growth rate in the Interior region was estimated at 6 percent with the most dramatic increases occurring in Ontario, Michigan, and Wisconsin. The Interior population (including Canada) numbers is at least 256,212 breeding pairs (Tyson *et al.* 1999).

**Southern.** The Southern region includes Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, and Texas (Wires *et al.* 2001). Most DCCOs in this region are winter migrants from the Interior and Atlantic regions; the number of these wintering birds has increased dramatically in recent years (Dolbeer 1991, Glahn and Stickley 1995, Jackson and Jackson 1995, Glahn *et al.* 2000). Surveys conducted by APHIS/WS biologists suggest that winter numbers in the delta region of Mississippi have increased by nearly 225 percent since the early 1990s (over 73,000 DCCOs were counted in the 2001–2002 winter surveys; G. Ellis, unpubl. data). Breeding DCCOs in this region are also

on the rise, with some nesting occurrences representing first records and others recolonizations (Wires *et al.* 2001). Today, approximately 4 percent of the DCCO breeding population occurs in this region, numbering at least 13,604 breeding pairs (Tyson *et al.* 1999).

#### *Pacific Coast and Alaska.*

Approximately 5–7 percent of North America's DCCOs are found in this population, which has approximately 27,500 nesting pairs (including Mexico) according to Carter *et al.* (1995b) or at least 17,084 pairs (not including Mexico) according to Tyson *et al.* (1999). Carter *et al.* (1995) documented recent increases in California and Oregon, and declines in British Columbia, Washington, and Baja California. Tyson *et al.* (1999) did not consider Mexican populations and calculated a decline for the entire West Coast-Alaska region. In the past 20 years, the largest increases in the region have taken place in the Columbia River Estuary, where East Sand Island supports the largest active colony along the coast with 6,390 pairs in 2000 (Carter *et al.* 1995b, Collis *et al.* 2000, Wires *et al.* 2001). Increases at East Sand Island coincided with declines in British Columbia, Washington, and locations in interior Oregon, and the rapid increase undoubtedly reflected some immigration from these other areas (Carter *et al.* 1995).

#### **Impacts of Double-Crested Cormorants on Public Resources**

**Fish.** In order to fully understand fisheries impacts related to predation, DCCO diet must be evaluated in terms of the number of DCCOs in the area, the length of their residence in the area, and the size of the fish population of concern (Weseloh *et al.* 2002). While most, but not all, studies of cormorant diet have indicated that sport or other human-valued fish species do not make up high percentages of DCCO diet, conclusions about actual fisheries impacts cannot be based on diet studies alone. Nisbet (1995) referred to this as the “body-count” approach (*i.e.*, counting the numbers of prey taken rather than examining the effects on prey populations) and noted that it is necessary to also “consider functional relationships between predation and output parameters.”

Stapanian (2002) observed that “Rigorous, quantitative studies suggest that the effects of cormorants on specific fisheries appear to be due in part to scale and stocks of available prey.” Indeed, negative impacts are typically very site-specific and thus DCCO-fish conflicts are most likely to occur on a localized scale. Even early cormorant

researcher H.F. Lewis recognized that cormorants could be a local problem at some fishing areas (Milton *et al.* 1995). In sum, the following statements about DCCO feeding habits and fisheries impacts can be concluded with confidence from the available science: (1) DCCOs are generalist predators whose diet varies considerably between seasons and locations and tends to reflect fish species composition; (2) The present composition of cormorant diet appears to have been strongly influenced by human-induced changes in the natural balance of fish stocks; (3) “Impact” can occur at different scales, such that ecological effects on fish populations are not necessarily the same as effects on recreational or commercial catches, or vice versa; (4) Cormorant impact is generally most significant in artificial, highly managed situations; and (5) Because environmental and other conditions vary locally, the degree of conflicts with cormorants will vary locally.

Research in New York's Oneida Lake and eastern Lake Ontario has examined data on DCCO diets and fish populations (walleye and yellow perch in Oneida Lake and smallmouth bass in Lake Ontario) and concluded that cormorant predation is likely a significant source of fish mortality that is negatively impacting recreational catch (Adams 1999, Rudstam 2000, Lantry *et al.* 1999). Based on these studies, the Service will allow the authorized agencies and Tribes acting under the public resource depredation order to determine whether a similar situation exists in their location, and undertake appropriate control actions to mitigate negative effects, if applicable.

**Other Birds.** Weseloh *et al.* (2002) observed that nesting DCCOs could impact other colonial waterbirds in at least three ways: by DCCO presence limiting nest site availability, by DCCOs directly taking over nest sites, or by falling guano and nesting material from DCCO nests leading to the abandonment of nests below. Habitat destruction is another concern reported by biologists (USFWS 2001). The significance of DCCO-related effects on other birds varies with scale. While large-scale impacts on regional or continental bird populations have not been documented (Cuthbert *et al.* 2002), there is evidence that species such as black-crowned night herons, common terns, and great egrets can be negatively impacted by DCCOs at a site-specific level (Jarvie *et al.* 1999, Shieldcastle and Martin 1999, USFWS 2001, Weseloh *et al.* 2002). Biologists from several States and provinces have reported or expressed concern about impacts to other bird