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Predation on walleyes *Sander vitreus* by Double-crested Cormorants *Phalacrocorax auritus* at the West Sister Island colony in 2005

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Abstract

Double-crested Cormorants *Phalacrocorax auritus* (hereafter cormorants) first nested in Lake Erie in the mid 1900s and have established numerous successful nesting colonies. Concerns by commercial and recreational fishermen about potential negative effects of this piscivorous species on populations of fishes in Lake Erie, especially walleyes *Sander vitreus*, prompted us to conduct two pilot investigations of consumption of walleyes by cormorants. We examined stomach contents undigested regurgitant of cormorants from the West Sister Island colony, the largest colony in Ohio waters of the western basin of Lake Erie. Examination of stomach contents revealed no walleyes were consumed, but half of all regurgitants examined contained remains of walleyes of at least 2 different year classes. These pilot studies confirmed that cormorants at the West Sister colony consume walleyes. Our methods were qualitative and we examined only one colony; thus we cannot estimate total consumption of walleyes and we cannot estimate basin-wide effects of cormorant predation on the walleye population. A quantitative study involving all 3 colonies will be required to determine if walleyes are consumed by cormorants throughout the western basin and to quantify the potential effects of cormorants on the walleye population.

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Introduction

Double-crested Cormorants *Phalacrocorax auritus* (hereafter cormorants) are native to North America but not native to the Great Lakes. Their expansion into Lake Erie began in the mid 1900s (Scharf et al. 1978) owing to abundant food sources, reductions in environmental contaminants, and reduced poaching (Ludwig 1984, Fox and Weseloh 1987, Glahn et al. 1999). Cormorants sought and found suitable nesting habitat throughout the Great Lakes and established successful nesting colonies in their expanded range. Abundant fish populations provided ample food for these piscivores, and suitable nesting areas on the islands of the western basin permitted cormorants to establish large colonies. Cormorants are now an abundant water bird in the region and their populations have been expanding. Between 1970 and 1991, the population growth rate in Lake Erie was 29% (Weseloh et al. 1995). It decreased to 19% between 1990 and 1994 (Tyson *et al.* 1999), which permits a population to double in only 4 years.

Continued population growth of cormorants has threatened existing colonies of native shore birds, and has destroyed vegetation on some of Lake Erie's islands. Because of these destructive results, many agencies whose jurisdictions include Lake Erie have established control programs to limit cormorant population growth and expansion. Many agencies, including the U.S. Fish and Wildlife Service, conduct culls to reduce populations or slow population growth.

Fishing advocacy groups are also concerned that cormorants may negatively affect economically important fish populations in Lake Erie, which support thriving recreational and commercial fisheries. Of particular concern is the potential effect of cormorant predation on the walleye *Sander vitreus* fishery. The 2003 year class of walleyes was the largest since record keeping began; there is concern among recreational and commercial fishermen that large cormorant populations may negatively affect the walleye population. Research in Lake Ontario has shown that cormorants can reduce populations of yellow perch *Perca flavescens* (Burnett et al. 2002) and smallmouth bass *Micropterus dolomieu* (Lantry et al. 2002).

To address the concerns of commercial and recreational anglers, USGS conducted two pilot studies in 2005 on cormorants from the West Sister Island colony intended to assess if cormorants consume walleyes. This was a qualitative study to ascertain whether walleyes were consumed; it was not intended to quantify consumption or extrapolate the potential effect of basin-wide cormorant predation on walleyes. Our primary objectives were to determine if cormorants consume walleyes and to provide information to partner agencies for evaluating whether a more detailed diet study is warranted.

Methods

Study site

West Sister Island is approximately 72 hectares and is co-owned by the U.S. Coast Guard and the U.S. Fish and Wildlife Service. It is located in Ohio waters of the western basin of Lake Erie (Figure 1). It is managed as a wilderness area by the Ottawa National Wildlife Refuge. West Sister Island supports the largest colony of nesting native shorebirds in U.S. waters of Lake Erie.

Cull operation, 16 May 2005

US Fish and Wildlife Service biologists in cooperation with Ohio Department of Natural Resources (ODNR) biologists and technicians conducted a cull of Double-crested Cormorants for population reduction on 16 May 2005. Cormorants were killed using .22 caliber rifles. Culled birds were removed from the island and returned to the ODNR offices at Crane Creek for disposal. Prior to disposal, biologists and technicians selected 50 birds for examination of stomach contents.

We removed stomachs by making an incision through the abdomen and exposing the alimentary canal from the esophagus through the intestines. Stomachs were removed from their juncture with the intestines to the base of the esophagus. When large fish extended into the esophagus, we removed as much of the esophagus as was necessary to remove the entire fish. Stomachs were then placed individually into a dissecting pan and examined. We recorded whether stomachs were empty or contained food, whether parasites were present, species of fish consumed if readily identifiable, and other noteworthy observations. We also examined contents for otoliths, which we retained for subsequent identification in the lab.

Examination of regurgitant, 6 July 2005

On 6 July, we examined cormorant regurgitant that contained undigested or only partially digested fish for evidence of walleyes. The regurgitant we examined differs from pellets or boli, which contain indigestible remains. This effort was conducted in

conjunction with a vegetation survey being conducted by State, Federal, and University researchers. We walked through the nesting area on the eastern side of the island listening and looking for regurgitation. When regurgitant was found, we identified fish remains to species. Walleyes were measured (total length) to determine year class.

Results

Cull operation

Eighteen of the 50 stomachs examined (36%) had no contents. Most of those with no contents had rigid stomachs indicating they had not eaten recently and had not recently regurgitated. Identifiable specimens of fish were recovered from 3 stomachs. Two white bass *Morone chrysops*, one white perch *Morone americana* and one gizzard shad *Dorosoma cepedianum* were identified. Otoliths were retrieved from 7 stomachs. Most otoliths were from white bass or white perch. Two pair of otoliths from freshwater drum *Aplodinotus grunniens* were also identified. There were no readily identifiable remains of walleyes in the stomachs we examined and no walleye otoliths.

Forty-eight (96%) cormorants were infected with a worm parasite. Parasites were sometimes moving freely among the stomach contents, but many were attached to the stomach wall. We did not attempt to identify the parasite nor did we collect a sample for identification. We did not quantify parasites and we did not have an established set of criteria for determining severity of infection. Most infected birds had a moderate number of parasites that were easily noticeable. A few cormorants had only small numbers of parasites. At least 2 cormorants had severe infections with several attached parasites lodged deeply within the lining of the stomach. One cormorant had a wound that completely penetrated the stomach and resembled wounds in other birds to which parasites were attached. That specimen also had a very large number of parasites. Cormorants were killed with a .22-calibre rifle; thus, we cannot rule out that the penetrating wound of the stomach was due to a bullet, although we noticed no other wound in the region of the penetrating stomach wound that would indicate it was shot in the abdomen (e.g., an exit wound for the bullet).

Examination of regurgitant

We examined regurgitant from 29 cormorants from the eastern end of West Sister Island, where the majority of nests are located, over a period of approximately 1.5 h. Nine (31%) regurgitants contained walleye from the 2003 year class, five (17.2%) contained walleye from the 2004 year class, and one contained walleye from an unknown year class. Overall, 15 of the 29 (52%) regurgitants examined contained walleye remains. Other species found in regurgitants included: white bass (4 regurgitants, 14%), white perch (2 regurgitants, 7%), pumpkinseed *Lepomis gibbosus* (1 regurgitant, 3%), and freshwater drum (1 regurgitant, 3%).

Discussion

Our pilot examinations of diets of cormorants confirm that nesting cormorants at the West Sister colony in Lake Erie consume walleyes. The examination of culled birds revealed no evidence of walleyes, but half of the regurgitant examined showed evidence of predation on walleyes of at least two different year classes. For the sample stomachs from culled birds, we did not exhaustively examine fish remains and we may have missed evidence of consumption of walleyes. Conversely, our examination of regurgitant was likely biased in favor of finding walleyes, as larger regurgitant was more easily located. Because we did not use a quantitative sampling design, we cannot estimate total consumption of walleyes by cormorants nor can we estimate effects on the walleye population.

Cormorants are mostly opportunistic feeders (Bur et al. 1999). Hence, it is not surprising that 2003 year class walleyes were consumed. The 2003 year class of walleyes was the strongest on record, and walleyes are very abundant in the western basin in early July. Young walleyes are also active in the water column making them susceptible to cormorant predation. Thus, consumption of 2003 year class walleyes is likely a result of their abundance rather than active selection by cormorants.

This effort demonstrated that cormorants do in fact consume walleyes, but it did not establish the magnitude of consumption or whether cormorants were selectively feeding on walleyes. Furthermore, it focused on just one of the 3 major nesting colonies of cormorants in Lake Erie. Previous research has shown that cormorants feed within a limited area around their nesting colony (Stapanian et al. 2002). Thus, a more thorough diet study of all three nesting colonies will be required to determine both if cormorants in other colonies feed on walleyes and the magnitude of walleye consumption by cormorants in the western basin of Lake Erie.

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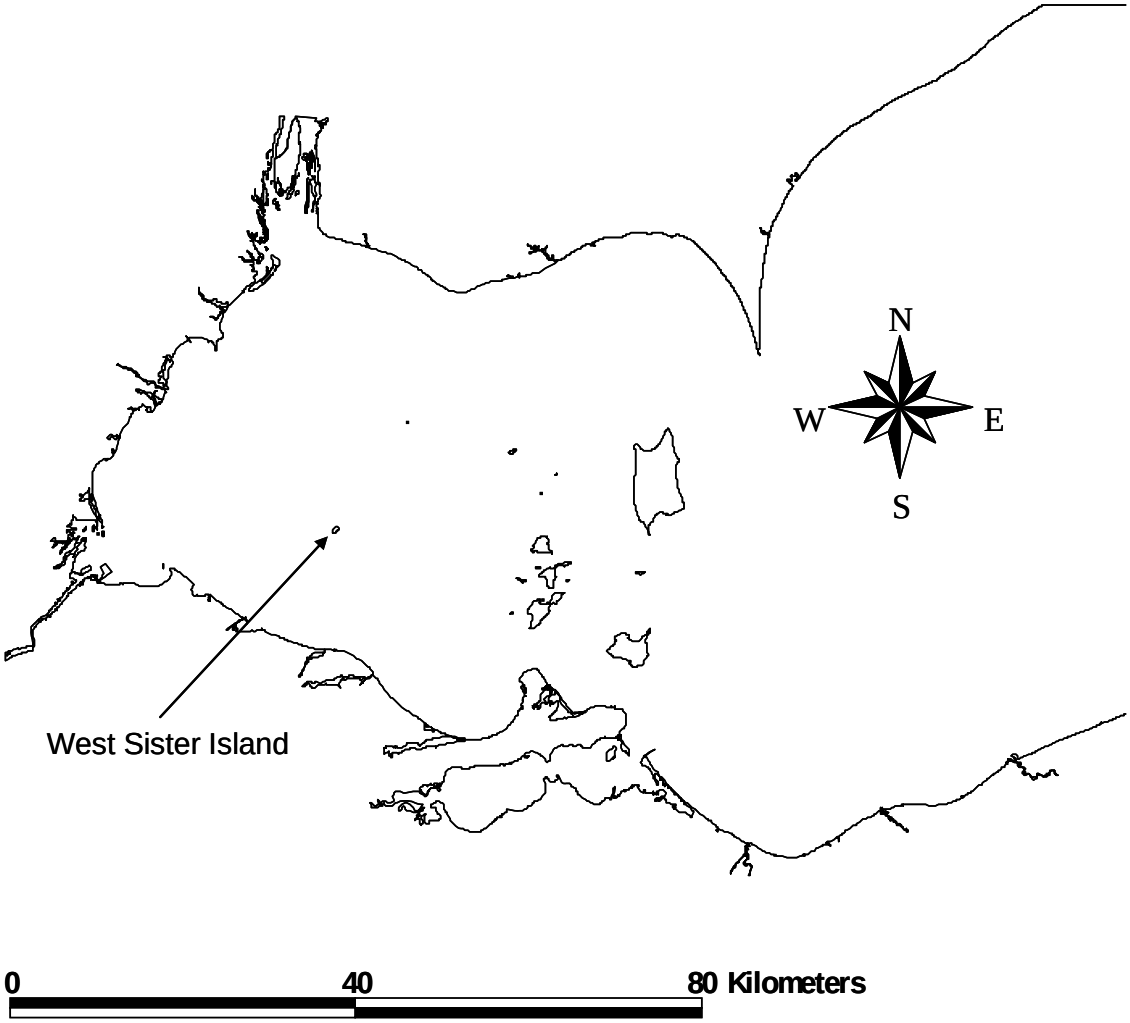

Figure 1. Location of West Sister Island in the western basin of Lake Erie.