

## Double-Crested Cormorant Predation on Smallmouth Bass and Other Fishes of the Eastern Basin of Lake Ontario

### Summary of 2000 Studies

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During the summer of 1998, the New York State Department of Environmental Conservation (NYSDEC) and the United States Geological Survey (USGS) conducted 11 studies designed to evaluate the impact of double-crested cormorant predation on smallmouth bass and other fish populations in the New York waters of the eastern basin of Lake Ontario. The results of the studies (Schneider et al. 1999) provided evidence that cormorant predation on smallmouth bass has been substantial and led to the conclusion that cormorant predation has resulted in a significant decline in the abundance of adult bass and in the quality of the sportfishery.

Based on these studies, the NYSDEC announced a five-year experimental plan for the management of double-crested cormorants and fish populations in eastern Lake Ontario. Complete details of the five-year plan were presented in a March 13, 1999 NYSDEC News Release (copy attached). Important activities conducted in 2000 included reducing the number of successful cormorant nests on Little Galloo Island by oiling eggs to prevent hatching, evaluating the impact of egg oiling on fish consumption by cormorants from the Little Galloo Island colony, and an evaluation of the diet composition and fish consumption by cormorants from colonies on Pigeon and Snake Islands, located in Canadian waters of eastern Lake Ontario. The potential impact of walleye predation on smallmouth bass was also re-evaluated.

In addition, two new studies were initiated in 2000 to determine the movements of cormorants nesting on Little Galloo, Pigeon and Snake Islands. In cooperation with the US Department of Agriculture's National Wildlife Research Center, a satellite telemetry study of cormorant movements associated with the Little Galloo Island nesting colony was undertaken. Satellite transmitters were attached to 26 nesting cormorants with the objectives of determining nest site fidelity, foraging behavior and migratory behavior. The second study involved placing radio transmitters on 25 nesting

cormorants on Pigeon Island and 25 on Snake Island to determine nest site fidelity, foraging behavior and movements between Lake Ontario, St. Lawrence River, Oneida Lake and other nearby waters. Both studies were designed to be conducted for two years with additional cormorants to be tagged in 2001.

The purpose of this report is to summarize the 2000 studies and provide additional information, where available, relating to studies conducted in 1998 and 1999.

### Overview of Attached Reports:

**Cormorant Management Activities in Lake Ontario's Eastern Basin:** Farquhar et al (2001) reported on activities conducted by the NYSDEC on four islands in the New York waters of eastern Lake Ontario. Since 1994, a variety of methods have been used to restrict cormorant nesting to Little Galloo Island. In 2000, cormorants attempted to nest on Gull and Bass Islands in Henderson Bay. A total of 574 nests on Gull Island and 794 on Bass Island were destroyed between May 15 and 28. No further nesting was attempted following May 28. Cormorants did not attempt to nest on Calf Island in 2000..

All cormorant eggs that could be reached from the ground on Little Galloo Island were treated with pure food grade vegetable oil beginning May 16. The oiling process was conducted 4 times, at two week intervals. Oil was applied from a backpack sprayer unit in sufficient volume to cover the exposed surface of each egg. The number of eggs oiled on each trip varied from 5,509 to 10,917. The peak nest count was 5,119, recorded on May 30.

Hatching success (number of chicks hatched per egg) for oiled eggs was less than 1%. This meets the objective set in the NYSDEC five-year management plan to reduce the number of successful nests on Little Galloo

Island by 90%. An estimated total of 300 chicks hatched on the island, mostly in untreated tree nests.

Egg oiling proved to be a very effective and relatively inexpensive method of limiting cormorant chick production on Little Galloo Island.

**Diet Composition and Fish Consumption of Double-Crested Cormorants from the Little Galloo Island Colony of Eastern Lake Ontario in 2000:**

Johnson et al. (2001a) provided diet information for the 2000 season. A total of 1,770 pellets collected between April 25 and September 26 were examined. Yellow perch (30%), alewife (23%), three-spine stickleback (13%), minnows (10%) and pumpkinseed (10%) composed over 86% of the diet. As observed in 1999, temporal differences in the consumption of several fish species were evident. Yellow perch and minnows both contributed more heavily to the diet during the pre- and post-chick feeding periods, while alewife were substantially more important during the chick feeding period. Smallmouth bass composed 5% of the diet, and increased from 1% during the pre-chick feeding period to 6% during the chick feeding period and to 10% during the post-chick feeding period.

Cormorants from the Little Galloo colony consumed an estimated 20.24 million fish with a total weight of 1.75 million pounds during 2000. Forage fish (9.92 million) dominated the diet with the primary species being alewife, cyprinids, three-spine stickleback, slimy sculpin and trout perch. Cormorants consumed an estimated 9.40 million panfish, including 6.14 million yellow perch, 0.83 million rock bass, and 2.28 million pumpkinseed.

An estimated 900,000 smallmouth bass were eaten by cormorants in 2000..

The results were similar to studies conducted in prior years with alewife and yellow perch dominating the diet of cormorants from the Little Galloo Island colony. Although still relatively small, the contribution of gamefish in the diet in 2000 (4.9%) was the highest observed since diet studies began in 1992. Smallmouth bass comprised 4.7% of the cormorant diet in 2000, and represent the highest level recorded for this species.

**The Effects of Egg Oiling on Fish Consumption by Double-Crested Cormorants on Little Galloo Island,**

**Lake Ontario in 2000:** Johnson et al. (2001b) provides an estimate of the reduction of fish consumption by cormorants as a result of the egg oiling activities on Little Galloo Island. Utilizing the results of the first two studies discussed, it is estimated that 5,943 fewer cormorant chicks were produced on the island as a result of oiling. This reduced total fish consumption by the Little Galloo Island colony by an estimated 4.8 million fish. This represented a 24% reduction in pounds consumed and a 19% reduction in total fish consumed.

Because of the seasonal variation in the diet of cormorants from the Little Galloo colony, the oiling of eggs may provide the greatest protection for those fish species that are proportionally more abundant in the diet during the chick feeding and post-chick feeding periods. In this regard, alewife and smallmouth bass may benefit the most since their contribution to the diet is substantially greater during those periods. Consumption of smallmouth bass was reduced by an estimated 400,000 fish as a result of egg oiling.

While the experimental egg oiling program was effective in reducing fish consumption in eastern Lake Ontario, it is too early to determine what, if any, effect this will have on the fish community or individual species.

**Diet Composition and Fish Consumption of Double-Crested Cormorants from the Pigeon and Snake Island Colonies of Eastern Lake Ontario in 2000:**

Johnson et al. (2001c) present diet information from two islands located in the Canadian waters of eastern Lake Ontario. In 2000, there were 1,431 cormorant nests on Pigeon Island and 1,344 on Snake Island. Combined with the peak nest count of 5,119 on Little Galloo Island, cormorants nesting on the two islands represent 35% of the cormorant breeding population in eastern Lake Ontario. To evaluate the diet of cormorants nesting on the islands, pellets were collected once a month from May to October.

Analysis of the pellets indicated that total fish consumption by the two colonies was similar to that observed in 1999. Cormorants on Pigeon Island consumed an estimated 11.5 million fish weighing 0.64 million pounds, and those on Snake an estimated 9.0 million fish, with a weight of 0.60 million pounds. Cormorants on Pigeon Island consumed an estimated 250,000 smallmouth bass, and those on Snake 70,000.

**Diets of Walleye (*Stizostedion vitreum*) in the Eastern Basin of Lake Ontario, 1999 and 2000:**

Walleye are the only predator fish species that has increased in abundance in the eastern Lake Ontario fish community during the last two decades. Schneider et al (1999) reported on a study to determine if walleye could be a major predator on smallmouth bass and be associated with the decline in smallmouth bass abundance. He found no evidence that walleye were a significant predator on smallmouth bass.

Lantry (2001) further examined the question and reported on the results of a study that examined 169 walleye stomachs collected from eastern Lake Ontario anglers in 1999 and 2000. The majority of the samples (150) were collected in May 2000. No smallmouth bass were present in the samples.

**Intercolony and Regional Movements of Double-crested Cormorants Breeding in Eastern Lake Ontario - Research Report for Calendar Year 2000:**

Werner et al. (2001) reported on the preliminary results of a two year satellite telemetry study of the movements of cormorants in eastern Lake Ontario. Study objectives to evaluate cormorant emigration, reproductive success, nest-site fidelity, and foraging movements following control activities at Little Galloo Island. Satellite transmitters were attached to 26 nesting cormorants during May 2000. The transmitters have an expected life of approximately one year, and cormorant movements will be monitored during that period.

Preliminary results indicate that the tagged cormorants remained near the nesting colony from May to September 2000. Two groups did, however, emigrate from the Island to in July and were observed near Montreal, Quebec and Oneida Lake. These individuals may have emigrated as a result of disturbances associated with the previously discussed egg oiling activities. Daily activity patterns indicated that Little Galloo Island cormorants foraged in the New York and Canadian waters of eastern Lake Ontario. Most of the cormorants migrated east of the Appalachian Mountains toward their wintering range beginning in October. One cormorant migrated west of the Appalachian Mountains to its wintering area in the central portion of the Gulf of Mexico coast. The winter distribution (to 2/1/2001) extends from southeastern LA, along the coast of the Gulf of Mexico, and the southern portion of the Atlantic coast.

Movements of cormorants tagged in 2000 will be monitored through the spring of 2001 and provide additional information on wintering areas, northerly migration routes, and nest site fidelity to Little Galloo Island. An additional 25 radio transmitters will be attached to nesting cormorants on Little Galloo Island during May 2001 to provide another year's data on their behavior. The final study results will provide considerable information on the behavior of cormorants in eastern Lake Ontario and be useful in developing effective population management strategies.

**Double-crested Cormorants and VHF Telemetry on Lake Ontario, 2000:**

Mazzoichi (2001) reported on the preliminary results of a two year radio telemetry study of the movements of cormorants nesting on Pigeon and Snake Islands in the Canadian waters of eastern Lake Ontario. Study objectives were to determine the foraging locations of cormorants nesting on the two islands, nest site fidelity during the breeding season, and movements between Lake Ontario, St.Lawrence River, Oneida Lake and other nearby waters. VHF radio transmitters were attached to 25 cormorants on each island during May and their movements were monitored through fall migration.

Preliminary results indicate that cormorants nesting on Pigeon and Snake Islands forage in the New York and Canadian waters of eastern Lake Ontario. They were also found in the upper St.Lawrence River, suggesting that they were also foraging there. There was nest site fidelity at the two colonies and no marked birds were located on Little Galloo Island during the study period. During the fall migration period, some of the marked cormorants were located on Oneida Lake and nearby Onondaga Lake. This suggests that the large influx of migrating cormorants observed on Oneida Lake each fall is likely from birds nesting on eastern Lake Ontario.

During May 2001, 75 nesting cormorants (25 on each island) will be marked with VHF radio transmitters on Little Galloo, Pigeon and Snake Islands to collect additional information on movements and foraging behavior for the three colonies. This information will be useful in determining if management strategies for the Little Galloo Island cormorant colony will be effective in rehabilitating smallmouth bass stocks in the New York waters of eastern Lake Ontario.

## Update of 1998 Reports

### Population Trends Among Smallmouth Bass in the Eastern Basin

Chrisman and Eckert (1999) reported the abundance, age, growth and mortality of smallmouth bass from the eastern basin from 1976 to 1997. Their study documented a significant decline in the relative abundance of bass beginning in 1991, and an increased growth rate for ages 6 to 10 over the course of the study period. Based on gillnet collections during the summer of 1999 and 2000, the abundance of smallmouth bass remains low. The catch per unit effort of smallmouth bass in gillnets declined from 10.68 in 1999 to 5.01 in 2000. The level observed in 2000 is comparable to the record low abundance in 1995. Recruitment of adult bass from the projected strong 1993 year class was not evident in the gillnet collections. For further information see Eckert (2001a).

### Summary of 1999 Warm Water Fish Stock Assessment

Since 1976, NYSDEC has conducted a warm water fish stock assessment program in the eastern basin of Lake Ontario. In a review of the information collected from 1976 to 1998, Eckert (1999a) described a pattern of overall decline in the warm water fish community from 200-250 fish in 1976-79 to approximately 20 fish per net gang in 1997-98. The abundance of smallmouth bass declined to record low levels during the period from 1995-98.

Collections in 2000 indicate that the overall abundance of fish declined to 19.9 fish per net gang, the lowest levels observed to date. Smallmouth bass abundance remained at record low levels, with abundance in the last 5 years being the lowest recorded during the 25 year sampling period. Yellow perch abundance has also remained at record low levels during the past five years (Eckert 2001a).

### Trends in Lake Ontario Smallmouth Bass and Sport Fisheries

Eckert (1999b) examined trends in the smallmouth bass fishery of Lake Ontario since 1985 to determine if ecosystem changes may have reduced the angling

quality of the lakewide smallmouth bass fisheries. He reported a significant decline in the harvest rate ratio at the Henderson site (Eastern Basin) beginning in the early 1990's in comparison to other areas of lake Ontario. He was unable to demonstrate any significant lakewide trend in smallmouth bass harvest rates at other locations despite significant reductions in nutrients, alewife abundance, and increased dreissenid densities.

A comparable lakewide angler survey was conducted in 2000 (Eckert 20001). The results indicate that the quality of the smallmouth bass fishery in the Henderson area (Eastern Basin) remained below that observed in other area of Lake Ontario where cormorants are not present.. This is in contrast to the six year period from 1985-90 when the Henderson area was consistently at or above the average lake-wide harvest and catch rates.

### Summary

Oiling double-crested cormorant eggs on Little Galloo Island proved to be a cost-effective method of limiting hatching success again in 2000. Hatching success was less than 1% for eggs that were oiled. Total production was estimated to be 300 chicks, mostly from untreated tree nests. This met the objective set in the NYSDEC five-year management plan to reduce the number of successful cormorant nests on Little Galloo Island by 90%.

In 2000, cormorants from Little Galloo Island consumed an estimated total of 20.24 million fish with a total weight of 1.75 million pounds. As in past years, yellow perch, alewife and cyprinids were the major prey items consumed. An estimated 900,000 smallmouth bass were eaten by cormorants in 1999. Although still relatively small, the contribution of gamefish in the diet was 4.9% in 1999, the highest observed since diet studies began in 1992.

The reduction in cormorant chick production did result in a decrease in the numbers of fish consumed by the Little Galloo Island colony. The total number of fish consumed was reduced by an estimated 19% (1.8 million fish) and total weight by an estimated 24%. It was also estimated that consumption of smallmouth bass was reduced by 400,000 as a result of egg oiling.

Estimates of fish consumption for cormorant colonies on Pigeon and Snake Islands, located in Canadian waters of

eastern Lake Ontario, were obtained in 2000. Cormorants nesting on these islands represented 35% of the cormorant breeding population in eastern Lake Ontario. Cormorants on Pigeon Island consumed an estimated 11.5 million fish (0.64 million pounds) and those on Snake Island, 9.0 million fish (0.60 million pounds). An estimated 250,000 smallmouth bass were lost to predation from the Pigeon colony and 70,000 to the Snake Island colony.

Index gillnetting in the eastern basin during the summer of 2000 indicated that smallmouth bass and total fish stocks remain at record low levels in comparison to prior years. The Lake Ontario lake-wide angler survey also showed that angler catch and harvest rates in the eastern basin were below those observed in other areas of Lake Ontario, where nesting cormorants are not present. It is projected that there will not be a significant increase in the adult bass population and associated sportfishery in 2001.

The success of egg oiling as a management tool in limiting Little Galloo Island cormorant reproduction and reducing fish consumption is encouraging. However, it is too early to speculate what effect it will have on smallmouth bass or the fish community as a whole. This is particularly true when the fish consumption estimates for Pigeon and Snake Islands, both in Canadian waters of the eastern basin, are considered.

The preliminary results of the satellite and radio telemetry studies of cormorant movements and feeding behavior indicate that cormorants on the three island colonies show nest site fidelity during the breeding season, forage in both New York and Ontario waters of eastern Lake Ontario, and provided information on migration routes. Completion of the second year of these studies will provide valuable information for the development of effective management strategies for the eastern Lake Ontario ecosystem.

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