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

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

Overview of Attached Reports:

Cormorant Management Activities in Lake Ontario's Eastern Basin: Farquhar et al (2000) 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 1999, cormorants attempted to nest on Gull and Bass Islands in Henderson Bay. A total of 146 nests on Gull Island and 37 on Bass Island were destroyed between May 4 and 11. No further nesting was attempted following May 11. Cormorants did not attempt to nest on Calf Island in 1999.

All cormorant eggs that could be reached from the ground on Little Galloo Island were treated with pure food grade corn oil beginning May 6. The oiling process was conducted 5 times, at two week intervals. Oil was applied from a backpack sprayer unit in sulfficient volume to cover the exposed surface of each egg. Oil use for all visits totaled 78 gallons. The number of eggs oiled on each trip varied from 5,015 to 16,310. The peak nest count was 5,681, recorded on May 20.

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: 180 in untreated tree nests and 120 in treated 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 1999: Johnson et al. (2000a) provided diet information for the 1999 season. A total of 1,827 pellets collected between mid-April and early October were examined. Yellow perch (28%), alewife (27%) and cyprinids [minnow species] (18%) were the major prey items consumed by number. However, all three groups exhibited substantial seasonal variation in abundance in the diet. Yellow perch (36% versus 16%) and cyprinids (23% versus 5%) each contributed substantially more to the diet during the pre-chick feeding period than during the chick feeding period, when alewife (65%) dominated the diet. The contribution of smallmouth bass in the diet increased from 1% during the pre-chick feeding period, to 5% during the chick feeding period, and to 8% during the post-chick period.

Cormorants from the Little Galloo colony consumed an estimated 17.94 million fish with a total weight of 1.94 million pounds during 1999. Forage fish (9.87 million) dominated the diet with the primary species being alewife, cyprinids, three spine stickleback, slimy sculpin and trout perch. Cormorants consumed an estimated 7.32 million panfish, including 4.95 million yellow perch, 1.06 million rock bass, 1.02 million pumpkinseed, and 0.11 million ictalurids (bullheads and catfish).

An estimated 650,000 smallmouth bass and 80,000 esocids (pike family) were eaten by cormorants in 1999.

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 1999 (4%) was the highest observed since diet studies began in 1992. Smallmouth bass comprised 3.6% of the cormorant diet in 1999, 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: Johnson et al. (2000b) 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 8,300 fewer cormorant chicks were produced on the island as a result of oiling. This reduced total fish comsumption by the Little Galloo Island colony by an estimated 766,000 pounds and 5.66 million fish. This represented a 28% reduction in pounds consumed and a 24% 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 361,000 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 1999: Johnson et al. (2000c) present diet information from two islands located in the Canadian waters of eastern Lake Ontario. In 1999, there were 2,228 cormorant nests on Pigeon and 1,122 on Snake Islands. Combined with the peak nest count of 5,681 on Little Galloo Island, cormorants nesting on the two islands represent 38% 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 April to August.

Analysis of the pellets indicated that cormorant diets among the three eastern basin colonies were not significantly different, with the major components being yellow perch, alewife and cyprinids.

Cormorants on Pigeon Island consumed an estimated 15.3 million fish weighing 1.06 million pounds, and those on Snake an estimated 6.7 million fish, with a weight of 0.53 million pounds. Cormorants on Pigeon Island consumed an estimated 260,000 smallmouth bass, and those on Snake 50,000.

Presently, it is not known to what extent cormorants from Pigeon and Snake Islands feed in Canadian versus U.S. waters , and to what extent birds from Little Galloo Island feed in U.S. versus Canadian waters of eastern Lake Ontario. Based on the proximity of all three colonies to U.S. and Canadian waters, it is likely they feed in both.

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 1998 and 1999, the abundance of smallmouth bass remains low. Information on growth rates collected in 1999 indicates that growth of all age groups has increased in comparison to the 1970's and 80's. It is not clear if the increased growth rates are a result of low bass abundance resulting in reduced intraspecific competition or a shift in the lake's productivity to the benthic community. For further information see Eckert (2000a).

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 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.

Based on 1999 sampling, the overall abundance of fish remained low at approximately 24 fish per net gang. Smallmouth bass abundance remained at record low levels, with abundance in the last 5 years being the lowest recorded during the 24 year sampling period. Yellow perch abundance has also remained at record low levels during the past five years (Eckert 2000a).

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 1999 (Eckert 2000b). The results indicate that the quality of the smallmouth bass fishery improved in all areas of the lake during the 1999 fishing season, but the smallest increased occurred in the eastern basin. Comparisons of harvest and catch rates by location, show the Henderson area (eastern basin) remain below

respective average lakewide values. 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.

Predation of Smallmouth Bass by Walleye in the Eastern Basin of Lake Ontario

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. No smallmouth bass were identified in 167 walleye stomachs collected in 1998, 276 stomachs collected from 1992-97, or over 5,000 walleye stomachs from eastern Lake Ontario and the Bay of Quinte from 1958 to 1998. It was concluded that walleye are not a major predator on smallmouth bass in the eastern basin.

During 1999, NYSDEC staff from the Watertown Region 6 Office examined the stomachs of 40 walleye collected during the fall. Staff from the Cape Vincent Fisheries Station examined the stomachs of an additional 48 walleye collected during the summer. No smallmouth bass were identified. As in the previous study, the major prey item reported was alewife.

The Relationship Between the Abundance of Smallmouth Bass and Double-Crested Cormorants in the Eastern Basin of Lake Ontario

Lantry et al. (1999) used the ratio of catch per unit effort (CPUE) at age-3 to CPUE at age-6 for individual year classes of smallmouth bass as an index of relative mortality in younger fish. They found a significant difference in the relative mortality of smallmouth bass between ages 3 and 6 for two time periods: 1975-88 and 1989-96. Mortality increased substantially after 1989, near the end of a four-year period when double-crested cormorants on Little Galloo Island increased from 1,419 to 4,072 nesting pairs. Further, there was a highly significant negative relationship between age-3 to 6 mortality and numbers of nesting pairs of cormorants on Little Galloo Island.

Lantry et al (1999) also calculated that cormorants could potentially remove a major portion of each smallmouth bass year class. This led to the conclusion that smallmouth bass mortality between between ages 3 and 6 was the major cause of the decline in bass abundance. Further, based on diet studies, it was concluded that cormorants were able to consume large numbers of individual year classes, and negatively impact the numbers of adult bass in the eastern basin population.

The index of relative mortality for age-3 to 6 smallmouth bass in eastern Lake Ontario remained high (2.8) in 1999. This indicates that the 1993 smallmouth bass year class will not make a major contribution to the adult bass population and the sportfishery in future years.

Summary

Oiling double-crested cormorant eggs on Little Galloo Island proved to be a cost-effective method of limiting hatching success in 1999. Hatching success was less than 1% for eggs that were oiled. Total production was estimated to be 300 chicks: 180 in untreated tree nests and 120 in treated nests. This met the objecitve set in the NYSDEC five-year management plan to reduce the number of successful cormorant nests on Little Galloo Island by 90%.

In 1999, cormorants from Little Galloo Island consumed an estimated total of 17.94 million fish with a total weight of 1.94 million pounds. As in past years, yellow perch, alewife and cyprinids were the major prey items consumed. An estimated 650,000 smallmouth bass and 80,000 esocids were eaten by cormorants in 1999. Although still relatively small, the contribution of gamefish in the diet was 4% 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 24% (5,660,000 fish) and total weight by by an estimated 28% (766,000 pounds). It was also estimated that consumption of smallmouth bass was reduced by 361,000 as a result of egg oiling.

The first estimates of fish consumption for cormorant colonies on Pigeon and Snake Islands, located in Canadian waters of eastern Lake Ontario, were obtained in 1999. Cormorants nesting on these islands represented 38% of the cormorant breeding population in eastern Lake Ontario. Cormorant diets among the three eastern basin colonies were not significantly different, with the major components being yellow perch, alewife and cyprinids. Cormorants on Pigeon Island consumed an estimated 15.3 million fish (1.06 million pounds) and those on Snake 6.7 million fish (0.53 million pounds). An estimated 260,000 smallmouth bass were lost to predation from the Pigeon colony and 50,000 to the Snake Island colony.

Index gillnetting in the eastern basin during the summer of 1999 indicated that smallmouth bass and total fish stocks remain at 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. The high mortality rate of the 1993 year class of smallmouth bass between the ages of 3 and 6 indicates there will be a significant increase in the adult bass population and associated sportfishery in 2000.

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.

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