The Effects of Egg Oiling on Fish Consumption by Double-Crested Cormorants On Little Galloo Island, Lake Ontario, in 2003

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As early as 1992 the expanding population of double-crested cormorants (Phalacrocorax auritus) on Little Galloo Island (LGI) in eastern Lake Ontario was thought to be impacting local native fish populations and stocked salmonids. Comprehensive diet studies on cormorants from this colony, initiated in 1992 and continued every year since, confirmed extensive predation on various fish species, including stocked salmonids. More recent studies provide clear evidence that LGI cormorants have a depressant affect on smallmouth bass (Lantry et al. 2002) and yellow perch (Burnett et al. 2002) populations surrounding the colony. This localized "halo" effect on fish populations is consistent with observations in the immediate vicinity of other large piscivorous waterbird colonies (Birt et al. 1987).

In 1999 the New York State Department of Environmental Conservation initiated an experimental program to reduce the reproductive success of double-crested cormorants nesting on LGI. The program consists of spraying cormorant eggs with vegetable oil early in the nesting season. The program have been successful in terms of reducing both cormorant reproductive success and fish consumption at the LGI colony (Johnson et al. 2000, 2001, 2002, 2003). We report on the effectiveness of the fifth year of control measures that were carried out in 2003.

Methods

NYSDEC staff began treating accessible double-crested cormorant nests on Little Galloo Island with pure food grade vegetable oil beginning on May 5, and ending July 25, 2003. The oiling process was conducted seven times with at least five complete treatments on each nest with eggs. Oil was applied from a backpack sprayer unit in sufficient volume to cover the exposed surface of each egg (approximately 6 ml/egg). The number of eggs treated per nest was recorded and each nest or group of nests were marked with spray paint to facilitate efficient movement throughout the colony as well as complete nest coverage. Also recorded were the number of nests not treated and the number of chicks present per visit.

The diet composition of double-crested cormorants on Little Galloo Island in 2003 was examined during the chick feeding (June 25 to July 25) and post-chick feeding (August 12 to October 14) periods. Diagnostic fish remains recovered in regurgitated pellets were used to quantify diet composition. Cormorants regurgitate about one pellet per day (Craven and Lev 1987, Orta 1992, Derby and Lovvorn 1997). Consequently, the contents of a pellet approximate mean daily fish consumption. Diagnostic material and eye lenses were removed from the pellets and identified under magnification. Eye lenses were not used in species

identification but were sometimes used to determine the number of fish eaten when lens numbers exceeded fish counts from otoliths and other diagnostic structures. Daily fish consumption was estimated as the mean number of fish per pellet multiplied by a fecal correction factor (1.042) (Johnson and Ross 1996). To estimate cormorant feeding days and fish consumption by chicks from the Little Galloo colony, we used the model developed by Weseloh and Casselman (unpublished report: Fish consumption by double-crested cormorants on Lake Ontario, Burlington, Ontario). The number of cormorant feeding days is largely based on active-nest counts and estimates of reproductive success (i.e., number of fledglings/nest). Model assumptions include (1) the population of mature birds is twice that of the active-nest counts, (2) the number of immature cormorants is approximately 10% of the adult population, and (3) residence time for breeding adults, immatures, and young-of-year (YOY) is approximately 158, 112, and 92 days, respectively. To estimate the biomass of fish consumed we assumed that cormorants consumed about 0.47 kg fish per day (Schramm et al. 1984, 1987; Weseloh and Casselman 1992). Since 0.47 kg is about 1 pound, a straight forward estimator of biomass consumed is the number of cormorant feeding days (i.e., 1 cormorant feeding day equals 1 pound of fish consumed). Because of seasonal variation in diet composition, to derive fish consumption estimates, we apportioned the 92 chick feeding days from the Weseloh and Casselman model into 42 days when adult cormorants were actively feeding chicks (chick feeding period) and 50 days post-chick feeding. In 2003, double-crested cormorant peak nest count on Little Galloo Island was 4,251. Fledgling productivity was estimated at 0.035 fledglings per nest on Little Galloo Island in 2003 based on counts during the field surveys. Fledgling productivity on nearby Snake Island in 2003 was estimated at 1.8 chicks per nest. We estimated fish consumption for each feeding period using the number of chick feeding days (either 42 or 50), the total number of chicks present, the period specific percent diet composition, and daily fish consumption estimates.

Results

In all 1,200 pellets were examined to describe the diet composition of double-crested cormorants on LGI during the chick and post-chick feeding periods in 2003 (Table 1). Alewife was the major prey species followed in contribution by yellow perch, rock bass, cyprinids, smallmouth bass, pumpkinseed, and slimy sculpin. The contribution of alewife in the diet declined from the chick (71.8%) to the post-chick (30.4%) feeding period, whereas most other important species increased. Mean daily fish consumption (i.e. number of fish per pellet) declined from 11.6 during the chick feeding period to 7.2 during the post-chick feeding period.

About 150 cormorant chicks were fledged on LGI from 4,251 nests in 2003, a productivity of 0.035 chicks per nest. Chicks accounted for 13,800 cormorant feeding days from early June to mid October (Table 2). The total number of cormorant feeding days by the LGI colony in 2003 was estimated at 1.45 million (Table 2). We estimated the number of chicks that would have been produced on LGI from 4,251 nests in 2003 in the absence of reproductive suppression (i.e. egg oiling) by using a chick productivity estimate of 1.8 chicks per nest that was observed at nearby Snake Island in 2003. If reproductive suppression was not attempted we estimate that 7,652 cormorant chicks would have been produced on LGI in 2003, a reduction of 98 percent. The number of chick feeding days by the LGI colony was also reduced by 98 percent (703,984 to 13,800). For the entire LGI colony in 2003 reproductive suppression reduced the total number of cormorant feeding days from 2.14 million to 1.45 million (32.2%) and the number of fish consumed from 22.27 million to 15.91 million (28.6%) (Table 2). The relative magnitude of the reduction in fish consumption caused by reproductive suppression at LGI in 2003 was consistent with what was achieved in the previous three years (Figure 1).

We estimate that the 150 cormorant chicks produced on LGI in 2003 consumed about 127,000 fish (Table 3). If reproductive suppression was not carried out and 7,652 cormorant chicks were produced on LGI in 2003 we estimate that these chicks would have consumed 6.48 million fish (Table 3). Consequently, reproductive suppression reduced fish consumption by 6.35 million fish in 2003. Using diet composition information for the chick and post-chick feeding periods, the reduced fish consumption represented 3.45 million alewife, 1.19 million yellow perch, 0.68 million rock bass, 0.35 cyprinids, 0.34 million smallmouth bass, 0.11 million pumpkinseed, and 0.07 million slimy sculpin (Table 3).

Discussion

Results achieved by the double-crested cormorant reproductive suppression program on LGI since 1999 have been remarkably consistent. Chick productivity has been reduced from an average of about 2.00 chicks per nest (1992-1998) to 0.06 chicks per nest (1999-2003), a 97 percent reduction. Since initiated in 1999, egg oiling has resulted, on average, in a 96.0% (range 93.3% to 98.0%) reduction in cormorant chick production, a 28.0% (range 23.9% to 32.2%) reduction in cormorant feeding days, and a 24.3% (range 19.1% to 28.6%) reduction in total fish consumption (Johnson et al. 2000, 2001, 2002, 2003).

We estimate that the cormorant reproductive suppression program on LGI has reduced fish consumption by the colony by 29.4 million fish since it was initiated in 1999. Included in this estimate are approximately 12.51 million fewer yellow perch and 1.70 million fewer smallmouth bass that were not consumed by cormorants. These two species are especially important since declines in their abundance in the eastern basin of Lake Ontario have been associated with cormorant population increases (Burnett et al. 2002, Lantry et al. 2002).

Acknowledgments

We thank Brian Boyer, Nicole Bearup, Russ McCullough, Irene Mazzocchi, Jennifer Scofield and Brian Edmonds for their efforts in collecting and processing samples.

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Table 1: Percent diet composition of double-crested cormorants on Little Galloo Island during the chick (6/25/03 to 7/25/03) and post-chick (8/12/03 to 10/14/03) feeding periods in 2003.

	Chick	Post-chick
No. of pellets	450	750
Fish/pellet (adjusted)	11.6	7.2
Alewife	71.8	30.4
Yellow perch	10.1	30.5
Cyprinids	4.2	7.2
Rock bass	6.3	16.5
Smallmouth bass	2.9	8.5
Pumpkinseed	0.5	3.2
Slimy sculpin	0.7	1.5
Ictalurid	0.3	1.6
Three-spine stickleback	1.6	---
Catostomid	0.2	0.2
Esocid	<0.1	0.3
Other	1.4	0.1
Totals	100.0	100.0

Table 2. Estimated number of chicks produced, chick feeding days, total cormorant feeding days, and the number of fish eaten based on chick productivities of 0.035 (control = egg oiling) and 1.8 chicks per nest (no control) on Little Galloo Island in 2003.

Action	No. of chicks	No. of chick feeding days	Total cormorant feeding days	No. of fish eaten
No control	7,652	703,984	2.14 million	22.27 million
Control (egg oiling)	150	13,800	1.45 million	15.91 million
Difference	7,502	690,184	0.69 million	6.36 million

Table 3: Fish consumption estimates for double-crested cormorant chicks based on chick productivities of 0.035 (control = egg oiling) and 1.8 chicks per nest (no control) on Little Galloo Island in 2003.

	Number of fish consumed		
Species	Control	No control	Difference
Alewife	69,000	3,514,000	3,445,000
Yellow perch	24,000	1,217,000	1,193,000
Cyprinids	7,000	355,000	348,000
Rock bass	14,000	689,000	675,000
Smallmouth bass	7,000	343,000	336,000
Pumpkinseed	2,000	107,000	105,000
Slimy sculpin	1,000	67,000	66,000
Other	3,000	191,000	188,000
	127,000	6,483,000	6,356,000

Figure 1. Estimated numbers of fish consumed by double-crested cormorants and estimated number of fish "saved" by cormorant reproductive suppression since 1999 on Little Galloo Island.