MASSIVE MORTALITY OF JUVENILE DOUBLE-CRESTED CORMORANTS ON LITTLE GALLOO ISLAND, JULY 1984

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INTRODUCTION

On 27 July 1984 we visited Little Galloo Island in eastern Lake Ontario as part of our annual monitoring of contaminant levels, population size and reproductive success of Herring Gulls *(Larus argentatus)* and Double-crested Cormorants *(Phalacrocorax auritus)* on the Great Lakes (Gilman *et al.* 1977, Weseloh *et al.* 1979, 1983, Mineau *et al.* 1984). We were startled on this visit to discover at least 624 dead cormorants on the island. This mortality represents about 42% of the potential cormorant productivity on Little Galloo Island in 1984. In this report we document the details of this event and contrast it with cormorant mortality on Pigeon Island, 14 miles (22 km) to the north.

METHODS

Since 1978, we have visited Little Galloo Island annually during the pre-nesting and/or nesting periods (March-August). We usually make an assessment of Herring and Great Black-backed Gull (*L. marinus*) numbers in mid-late May and of Cattle Egrets (*Bulbulcus ibis*) and cormorants in mid-late July (Blokpoel and Weseloh 1981, Weseloh 1984, CWS unpubl.). In assessing cormorants, our usual procedure is to walk around the entire island, locate and identify all cormorant nest trees on a map and record the number of nests in each tree. When ground nests are present, we record their locations and numbers as well. On this visit, the number of dead cormorants associated with each nest tree and/or each ground nesting area (*i.e.*, each sub-colony) was also recorded. We climbed only a few of the nest trees to determine contents not visible from the ground. Identical procedures were used on Pigeon Island on the following day (28 July).

RESULTS

On Little Galloo, we recorded 736 cormorant nests and 624 dead cormorants. We may have missed or overlooked (among nesting debris) up to 10% of the dead. All but one of the dead (an adult) were young of the year. Dead juveniles ranged in age from newly hatched to approximately 3-4 weeks old. All carcasses appeared to be at a similar state of decomposition. Most carcasses had dried out and "settled" into the substrate; only a few had maggots. We saw no fresh carcasses. We estimated that most of the young cormorants had died 2-3 weeks earlier.

The dead young were located around the perimeter of the island where the cormorants nested. We found dead cormorants at 42 of the

Table 1. Mortality Rate of Cormorants on Little Galloo Island As Observed On 27 July 1984 By (A) Nest Substrate and (B) Nest Location

A. Nest Substrate	Total No. Nests	Total No. Dead	Mortality Rate (No. Dead/Nest)
Tree	380	318	0.84
Ground	356	306	0.86
TOTAL	736	624	0.85
B. Nest Location (Portion of the Island)			
NW to E	336	385	1.15
SE and S	222	90	0.41
SW	123	135	1.10
W	55	14	0.25
TOTAL	736	624	0.85

57 sub-colonies we identified as we walked around the island. For example, the first nest tree we encountered had 9 nests and 16 dead cormorants, 12 of which were on the ground beneath the nests. Sub-colonies ranged in size from 1 to 46 nests.

The mortality rate was similar for tree and ground nests (0.84 *vs.* 0.86 dead cormorants/nest, respectively, see Table 1A) but varied considerably from one area of the island to another (Table 1B). In sub-colonies where mortality occurred, those on the north and southwest shores of the island had a higher range of mortality rates (1.10-1.15 dead per nest), than those on the west, south and southeast shores (0.25-0.40 dead per nest). This does not appear to be related to any features on the island as 11 trees and ground nests were equally exposed.

At ground nests, the dead cormorants were usually still in the nest. The large young appeared to have died while still active, *i.e.*, they were usually partly outside of the nest, either lying across the nest or their bodies were in the nest cup while their necks and heads were draped over the edge of the nest. There were few if any large young that appeared to have died passively, *i.e.*, died in their sleep or while being brooded.

At tree nests approximately 19% of the observable dead were still in their nests and 81% were beneath the trees on the ground. Nearly

Figure 1. Photo of cormorant nest on Little Galloo Island showing medium-sized rock in nest cup.

all tree nests were intact and we found no signs that nests had fallen or been intentionally dislodged from the nest trees. Most tree nests were well above eye level and in relatively tall trees, 20-30′ (7-10 m) high.

With only two exceptions (see below) we saw no indication of any unusual natural phenomenon, human disturbance or vandalism. We saw no fresh shotgun shells or rifle cartridges strewn about the island or dead cormorants with crushed skulls. This last feature, or any other skeletal damage, would have been difficult to detect and, due to the lack of necessary permits, we did not collect any of the carcasses.

We did find two ground nests, one on the west side of the island and one on the south side, containing large, 8″ (3.1 cm) diameter rocks in the nest cup (Figure 1). Beneath each rock were eggshell fragments and in one nest a dead featherless cormorant chick. The chick was in a state of decomposition similar to most of the other dead young and we concluded that it had died when the rest of the deaths had occurred.

On 28 July, on Pigeon Island, where earlier in the year we censused 410 cormorant nests, we found 40 nests still active and a total of 37

dead juvenile cormorants. Omitting the active nests, this results in a mortality rate of 0.10 dead/nest. In our experience this is a much more usual figure for observed mortality on a cormorant colony (as determined by our methods) than the 0.84-0.86 dead per nest observed on Little Galloo.

DISCUSSION

The 623 dead juvenile cormorants on Little Galloo Island represent a significant portion of the potential productivity of the adult cormorant population. Since 1979 Double-crested Cormorants on established colonies on the Great Lakes have been producing (to fledging) approximately 2.0 young per nest (*i.e.*, per nesting pair of adults) (CWS unpubl.). Thus the 736 nests (nesting pairs) of cormorants which we recorded on Little Galloo Island should have yielded approximately 1500 young. The 623 dead juveniles represent approximately 42% of the potential productivity from Little Galloo Island. We did see several hundred fledged and/or nearly fledged young cormorants along the shore of the island. These birds presumably had fledged before or otherwise escaped the catastrophe(s).

From observations we made at the time of our visit to Little Galloo Island and from information that has since come to us (see below) there appear to be two causes for the large number of dead cormorants on Little Galloo Island. First, vandalism, as evidenced by the presence of medium-sized rocks in two nests, was a definite factor but one of unknown extent. We feel that whoever dropped the rocks into the two nests probably was responsible for at least some of the remaining cormorant mortality (at least at ground nests). It seems unlikely that any vandals would have dropped rocks into two nests and stopped there.

If our estimate is correct on how long the young cormorants had been dead, the vandalism could have occurred on or about the 4th of July weekend. We suspect one or more persons came to Little Galloo Island and at the very least dropped rocks into two nests. The same or different individuals may have gone around to some or all of the other ground nests and shot (perhaps with a pellet gun) and/or clubbed the young cormorants to death. This hypothesis is consistent with the positions in which we found many of the large dead young at ground nests. When approached by humans, large young cormorants extend their necks and lunge. If they were killed at this point, their heads and necks would drape over the edge of the nest. We cannot envision a form of passive death where the head and neck would be draped *over* the edge of the nest, and hence must conclude that these young were deliberately killed.

We do not believe the dead young in and below the tree nests were the result of vandalism. However, it is difficult to explain the large number of dead on the ground below nest trees. Usually only cormorants nearly ready to fledge will leap out of their nest when humans walk beneath the nest tree (pers. obs.). Few, if any, of the dead cormorants we found below nest trees were of this age. If the young had been shot while in the nest by someone standing to the side of the nest (out from under the nest tree where visibility would be the best), they would have collapsed in the nest. Also it is unlikely that wounded birds would crawl to the edge of the nest so as to fall to the ground. Finally, only if the nest and cormorant were shot at from directly below (and by something more powerful than a pellet gun) might the force of impact from a bullet be enough to throw the young out of the nest so that they would fall to the ground. This seems unlikely.

The second apparent cause of juvenile cormorant mortality on Little Galloo Island was a brief but intense rain and hailstorm which struck the island on Sunday, 15 July (B. Miller, G. Spaziani, New York Dept. of Environmental Conservation, pers. comm.). The storm came from the southwest, lasted approximately a half an hour (1600-1630 hours) and had 60 mph (100 kmh) winds and driving rain with intermittent ½" (1.3 cm) diameter hail. A storm of that intensity would be severe enough to blow young cormorants from their tree nests. They would die either from the fall or from exposure.

We suspect that the vandalism occurred prior to the storm (4 *vs.* 15 July) and was directed at ground nests. The storm would have affected both ground and tree nests but the arboreal exposure of the latter would have put them at greater risk. Also depending upon how extensive the vandalism had been (at ground nests), there may have been only a few live cormorants still at their nests when the storm struck.

We do not feel that our original estimate of the time(s) of death (2-3 weeks prior to our visit) is inconsistent with our theory of two causes of death. We may not have been able to differentiate between carcasses dead for three weeks (vandals) and those dead only two weeks (storm). Furthermore, birds killed during the storm and pelted with hail and rain may have appeared to have been dead longer than they actually had.

If the storm moved northeast from Little Galloo Island, it would have missed Pigeon Island which lies directly north. It would also appear that the vandals who visited Little Galloo did not go to Pigeon Island.

We have no reason to suspect that other causes of death (*e.g.*, toxic chemical poisoning) played any major role in the mortality on Little Galloo Island. From our previous surveys of toxic chemicals in eggs of Herring Gulls and cormorants from monitor colonies in Lake Ontario,

we know that levels of the most predominant organochlorines (OCs) have decreased sharply and nearly continuously over the last 10 years (Weseloh *et al.* 1979, IJC 1983, Mineau *et al.* 1984, CWS unpubl.). Also, the levels of several OCs in eggs from Little Galloo Island in 1981 and 1982 were comparable to or lower than those in eggs from other Lake Ontario colonies (CWS unpubl.).

Although dead cormorants were very obvious on the island, we did not notice an abnormally large number of carcasses of any of the other colonial waterbirds which abundantly nest on Little Galloo Island, *i.e.*, Black-crowned Night-Herons (*Nycticorax nycticorax*) and Herring and Ring-billed Gulls (*Larus delawarensis*). Young of these species are more mobile and prone to flee than young cormorants and would have been able to take refuge in nearby vegetation when the vandals and storm struck.

Finally, with respect to deaths caused by vandals and to the lack of an abnormally large number of carcasses of other colonial waterbird species, we would be naive to discount the possibility that young cormorants had been singled out for attack. Cormorant numbers have been increasing sharply in recent years (Scharf and Shugart 1981, Price and Weseloh, MS) and cormorants are now more numerous on Lake Ontario (and the Great Lakes) than at any time in their recorded history (Weseloh *et al.* unpubl.). Fishermen have been known to vandalize cormorant colonies when cormorant numbers are high and they fear the birds are competing with them for fish (Omand 1947, Quilliam 1972). We are not suggesting that fishermen were responsible for the current vandalism on Little Galloo Island, but is is a possibility.

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