

**A New Colony Location for Double-crested Cormorants  
(*Phalacrocorax auritus*) and other Waterbirds in the Beaver  
Archipelago, Northern Lake Michigan**

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Over the past several decades, the Double-crested Cormorant (*Phalacrocorax auritus*) has shown a resurgence in population levels within the Great Lakes Basin (Ludwig 1984, Scharf 1978, Ludwig et al. 1989, Ludwig and Summer 1997, Scharf and Shugart 1998). As a reflection of this change in population size, the number of breeding birds at specific colony sites has fluctuated across the Great Lakes (Cuthbert et al. 1997, Wires et al., 2001) and, more specifically, in Lake Michigan (Seefelt and Gillingham, in press) (Table 1). In the past, such colony dynamics have been attributed to changes in suitable habitat, often due to species interactions, predation and/or human disturbance (Kury and Gochfeld 1975, Ellison and Cleary 1978, Verbeek 1982, Gotmark 1992, Cairns et al. 1998, Skagen et al. 2001). In other studies, changes in water level have had an impact on the breeding success of a variety of birds, including Piping Plovers (*Charadrius melodus*) (North 1986) and pelicans (Pyrovesti 1997). In addition, the number of Herring Gull (*Larus argentatus*) nests present in each of the Great Lakes has been shown to be a function of the length of the shoreline, including islands (Morris et al. 2003).

Lake Michigan, as well as lakes Huron and Superior, was, in 2003, at its lowest level since 1926 and 1964 (NOAA 2003). Lowering of lake level has been the trend in the Lake Michigan-Huron basin over the past several years, with the highest rate in lake level reduction occurring between 1998 and 2000. The decrease in lake level is due in part to above average air temperatures and

decreased precipitation. In addition, in the winters of 1998-2002, ice coverage over the lakes was below average therefore allowing for increased evaporation. Although the winter ending in 2003 was colder than previous years and allowed for greater ice formation, below normal precipitation the preceding fall contributed to low lake levels (NOAA 2003). Such changes in lake level affect the shape and size of shoreline habitat.

The Beaver Archipelago (Charlevoix County) of northern Lake Michigan, consists of about ten permanent islands (Figure 1). However, low water levels have recently exposed several smaller islands. Other changes in the archipelago due to low water level have included the growth in area of existing low rock and cobble islands and the formation of land bridges between small islands and larger islands. An example of the latter includes the formation of Grape Spit, which is now a portion of Hog Island, but at high water level forms two small islands, Grape Islands East and West, both separated from Hog Island.

In the past, Grape Spit, or Grape Islands East and West (lat 45° 46.1'N, long 85° 25.0') has been an important colony site for both cormorants (Table 1) and Ring-billed Gulls (*Larus delawarensis*) (Scharf and Shugart 1998). In 2002, water levels had dropped sufficiently so that Grape Spit was completely connected to the main island by a substantial land bridge. This allowed mammalian predators, including coyotes and raccoons (as recorded by nocturnal video observation of individual animals and their tracks), to traverse to the colony site from Hog Island. This, combined with cold air and water temperatures in May and June 2002, probably caused reproductive failure of both cormorants and gulls at this site. All but two cormorant nests, which were located in trees, were lost at Grape Spit in 2002. Other cormorant colonies in the archipelago, including those that were not accessible by mammalian predators, showed



Figure 1: The ten major named islands of the Beaver Archipelago of northern Lake Michigan. Cormorant colonies have been documented on Gull, Whiskey, Pismire and Hat Islands, as well as on Grape and Tims, which are currently connected to Hog Island.

decreased reproduction or complete reproductive failure in 2002 (Table 1). This was probably due in part to both unfavorable weather conditions and decreased food availability. Adverse weather conditions, including cold temperatures, have been shown to influence nesting success in other systems (Skagen et al. 2001). In addition, cold water temperatures may have restricted the movement of prey fish into shallow waters and off-shore areas, therefore making some food sources unavailable to the birds. Reproductive failure was also observed in Herring Gulls and Caspian Terns (*Sterna caspia*) in the archipelago.

In 2003, when lake levels had further declined, neither cormorants nor gulls attempted to colonize Grape Spit. Number of breeding cormorants increased at other colonies, including Pismire Island (lat 45° 45.8' N, long 85° 26.6' W) and Hat Island (lat 45° 50.0' N, long 85° 18' W) (Table 1). In addition, a new colony (lat 45 45.8' N, long 85 27.0' W) became established on a small, unnamed island off the southeastern portion of Garden Island (Figure 2), hereafter referred to as the Southeast (SE) Garden Colony. Pismire Island and the SE Garden Colony site are relatively close (1.25 miles and 2 miles, or 2 km and 2.7 km, respectively) to Grape Spit (Figure 1). In July 1993, when the SE Garden Colony island was almost completely underwater, three cormorant nests were observed in willows in the center of the island (E. Leuck, pers. comm.). However, since this observation, there have been no other records of waterbird colonies at this site. Moreover, the nests that have been documented in both 2002 (when all were unsuccessful) and in 2003 (when some were successful) were ground nests. Most of these were located on the elevated portion on the southern half of the island near shrubs and herbaceous vegetation. In addition, in 2003, a substantial Ring-billed Gull colony (estimated to be at least 5000 pairs) was established on the southern periphery of SE Garden Colony, closer to the water's edge.

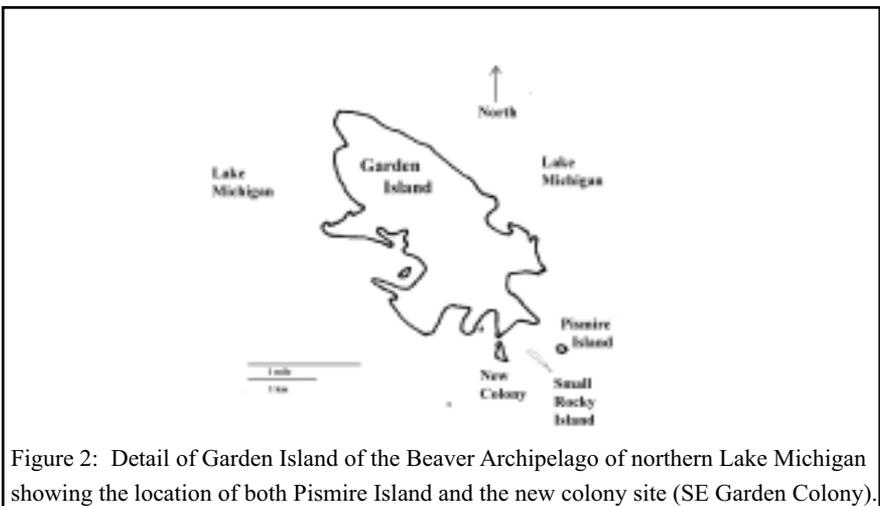


Figure 2: Detail of Garden Island of the Beaver Archipelago of northern Lake Michigan showing the location of both Pismire Island and the new colony site (SE Garden Colony).

Numbers of cormorant nest have been shown to vary over the breeding season in the Great Lakes (Ewins et al. 1995) and other systems (Johnson and Krohn 2001). Because of this, in 2003 nests were counted at the SE Garden Colony and on Pismire Island early in the breeding season (04 June 2003) and late in the season (29 July 2003). These dates roughly correspond to time periods when reproductive attempts are at their seasonal high, with egg-laying and incubation being the predominant activities (early June), and when chicks are beginning to fledge and remaining active nests are those that are successful (late July). Nests were considered active if they were well maintained and were occupied by large chicks (or large chicks were in close proximity to the nests). At the SE Garden Colony, a total of 614 nests were counted in early June. The final nest count in late July was 335, indicating 55% of the nests had remained active (Table 1). At Pismire Island, a total of 1164 nests were counted in early June. The final nest count in July was 807, indicating 69% of the nests had remained active (Table 1).

Cormorant populations may be regulated by both density dependent and independent factors (Cairns 1992, Hatch and Weseloh 1999). It has been suggested that seabird populations may be regulated by the number of nest sites available, social interactions, and food shortages (Croxall 1987). Cormorant populations in the Great Lakes may not be limited by available nest sites, but may be limited by the quality of the nest sites and competition for these sites, as

Table 1. Nest count data from 1984, 1989, 1997 and 2000-2003 for four colonies (Pismire, Grape, Hat and the SE Garden Colony) in the Beaver Archipelago. Not all active colonies in the archipelago have been included in this table. All researchers followed the same counting procedures (see Cuthbert et al., 1997), with count numbers from 2000 to 2003 reflecting the highest number of nests as counted early in the breeding season. Numbers in parentheses for 2002 and 2003 reflect successful nesting attempts. Successful nesting was determined by the presence of large chicks in the proximity of well maintained nests in late July of count years. Total number of successful nesting attempts are not known for Hat Island, which, due to its remoteness, was counted only once in both 2002 and 2003.

	<b>Pismire</b>	<b>Grape</b>	<b>Hat</b>	<b>SE Garden</b>	<b>Total</b>
1984 <sup>a</sup>	57	0	54	0	250
1989 <sup>b</sup>	35	291	294	0	880
1997 <sup>c</sup>	383	3509	4617	0	11,709
2000 <sup>d</sup>	987	2431	4917	0	10,125
2001 <sup>d</sup>	1035	2146	4511	0	9705
2002 <sup>e</sup>	615 (0)	1339 (2)	365	987 (0)	5700 (3661)
2003 <sup>e</sup>	1164(807)	0	7341	614 (335)	9119 (8483)

<sup>a</sup> Nest count data from Ludwig, 1984.

<sup>b</sup> Nest count data from Scharf and Shugart, 1998.

<sup>c</sup> Nest count data from Cuthbert et al., 1997.

<sup>d</sup> Nest count data from Seefelt and Gillingham, in press.

<sup>e</sup> Nest count data from Seefelt and Gillingham, unpublished data.

well as the proximity of nest sites to food resources (Hatch and Weseloh 1999). Changes in colony location and size in the Beaver Archipelago are a response to changes in availability of desirable nesting locations and a fluctuating food supply, both of which may have been influenced by changing water levels.

Seabird ecology is an important aspect of the Great Lakes ecosystem (Hebert and Sprules 2002). One important component of this is population dynamics and the plasticity of breeding colonies. Overall, factors that influence colony size and formation are not well studied in Double-crested Cormorants (Hatch and Weseloh 1999). However, changing lake levels can change the availability of nesting habitat for cormorants and other waterbirds, and therefore may be an important factor in determining population sizes and breeding success.

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