Herring Gull Nests on Bellow Island, 1974-2016

William C. Scharf
Lake Superior State University
650 West Easterday Avenue
Sault Ste. Marie, MI 49783

Current address:
6241 Summit Ct.
Traverse City, MI 49686
wcscharf@charter.net

Bellow Island (also called Gull Island) is located in Grand Traverse Bay 3 mi (4.8 km) southeast of Northport, Michigan (45^0 5' 59.99" N, 85^0 34' 1.93" W). It is a well-studied part of the regional ecosystem because of past and ongoing research on nesting Herring Gulls (*Larus argentatus*). Publications featuring Bellow Island include: reproductive effects of chlorinated hydrocarbon pesticides (Ludwig and Tomoff 1966), first census and mapping of colonial-nesting birds of the Great Lakes (Scharf 1978), vegetative habitat relating to Herring Gull nests on Bellow Island (Scharf et al. 1979), polygyny in Herring Gulls (Shugart 1980), second census of Great Lakes colonial-nesting birds (Scharf and Shugart 1998), environmental contaminants in eggs (Bowerman et al. 2011), and a Bellow Island Herring Gull found in Honduras (Scharf and Udvardy 2015).

The island is presently owned and managed by the Leelanau Conservancy (Scharf 1996). Historically, Herring Gulls were the island's sole colonial-nesting bird species. Wood (1951) mentions that Walter Hastings of the Michigan Conservation Department called it a large colony and F. E. and C. C. Ludwig banded Herring Gulls there from 1938 to 1941. Ludwig and Tomoff (1966) offered the opinion that Herring Gulls have probably nested on Bellow Island for hundreds of years and that this was the most successful gullery on Lake Michigan with an estimated 2500 nests historically.

Double-crested Cormorants (*Phalacrocorax auritus*) started nesting in trees on the island, with eight nests, in 1983. The high nitrogen content of cormorant feces subsequently killed the trees. Cormorant nesting populations built up to 1443 ground nests by 2007 (Cuthbert and Wires 2013). Cormorant nesting has since been controlled by egg oiling authorized by the U.S. Fish and Wildlife Service and coordinated by the Wildlife Services program

of the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS). The Grand Traverse Band of Ottawa and Chippewa Indians carry out the application of the oil. Cormorants have been reduced to fewer than 200 nests after ten years of control (E. Olsen, pers. comm.).

Ring-billed Gulls (*Larus delawarensis*) began nesting on Bellow Island in 1997, with about ten nests. They increased to approximately 3000 nests by 2016. Caspian Terns (*Hydroprogne caspia*) began nesting on gravel and rocky shorelines in 2005, and by 2016 numbered over 100 nests in two subcolonies.

Methods

Prior to 2007, nests were marked as they were counted. Marking started in the 1970s by placing wood chips in nests to distinguish nests that had already been counted. In 1989, tree-marking paint guns with non-toxic latex paint were used to mark counted nests (Scharf and Shugart 1998). The number from 1999 (Figure 1) represents nests counted on aerial photographs of Bellow Island (Cuthbert et al. 2001).

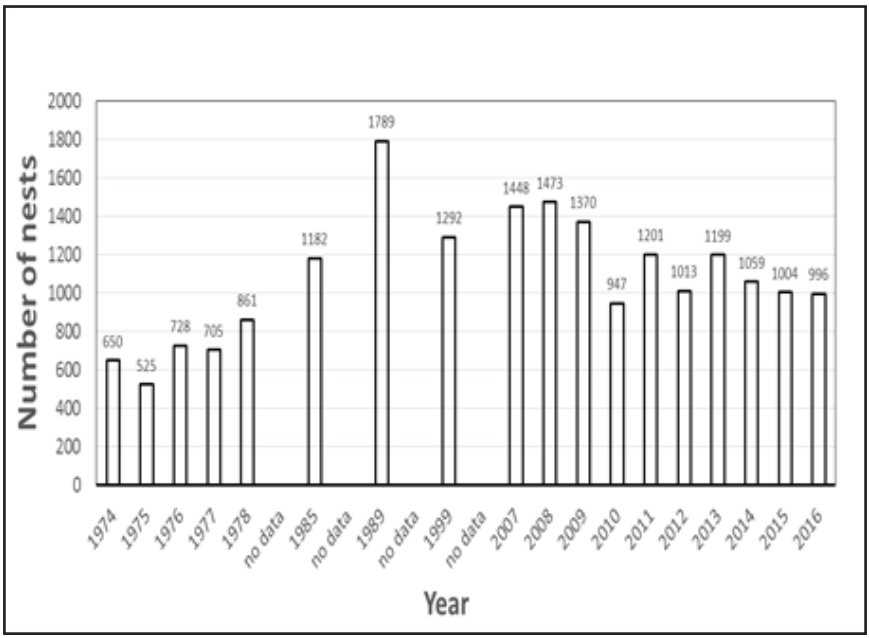

Figure 1. Number of Herring Gulls nests on Bellow Island over 43 year span.

From 2007-2016, a team of three to six nest counters walked in unison on parallel transects spaced at intervals of 10 m (11 yds), counting nests to their right or left depending on the direction of travel. Each counter counted the nests between their foot and the foot of the next counter. A corresponding protocol was followed on subsequent transects. Counters used click-type tally meters that aid the accuracy of counting. Counts were timed for the peak of incubation. In recent years, factors such as ice, predators (e.g., Coyotes, *Canis latrans*; Great Horned Owls, *Bubo virginianus*; a Snowy Owl. *B. scandiaicus* found dead on the island in spring 2015), or other unknown agents caused indistinct or bimodal peaks in incubation, indicating an asynchrony of reproductive timing.

It is important to recognize that synchronous egg laying, incubation, and hatching are natural selective adaptations of individuals in colonial nesting and contribute to fitness through predator swamping, information transfer, or both. Swamping includes egg and chick cannabilism, which is common in Herring Gulls. Lack of synchrony could result from a suite of factors caused by depredation or disturbance-related disruptions at the onset of egg laying. Interruption of the normal progression can lead to failure of the initial nest and cause re-nesting, leading to multiple peaks of incubation (Shugart and Scharf 1977). Return visits were made to gauge the timing of incubation, and subsequent counts were made in several but not all years.

Results and Discussion

Assumed lower numbers of Herring Gull nests in the 1970s were thought to be the result of excess egg and chick mortality due to thin eggshells caused by chlorinated hydrocarbon pollutants (Ludwig and Tomoff 1966). The highest breeding population reported in this study was 1789 nests in 1989 (Fig. 1). It was a period after recovery from toxic pollutants and before Double-crested Cormorants and Ring-billed Gulls began encroaching on former Herring Gull territories on Bellow Island.

Following a high count of 1473 nests in 2008 (Figure 1), Herring Gull nests on Bellow Island decreased 35% to 996 nests in 2016. There was also a 31 % decrease from 1370 in 2009 nests to 947 in 2010 that may have resulted from the disturbances of other researchers placement and servicing of several observation cameras in 2009. These declines are a matter of concern, but two causes are apparent: (1) changes in the trophic structure of the aquatic ecosystem, and (2) competition for nesting space from cormorants and Ring-billed Gull (see below).

Changes in the aquatic ecosystem of northern Lake Huron, specifically the decline of forage fish, were documented to have caused decline of the Herring Gull population (Hebert et al. 2009). The Lake Huron study showed a decline in Herring Gull egg volume and a degradation of protein content and quality of the yolk. Introductions of predatory game fish species are thought to have reduced forage fish availability. The effects of invasive Zebra and Quagga mussels (*Dreissena polymorpha* and *bugensis*) have also led to declines in lake productivity by their filtration of nutrients from the water.

Both Ring-bills and cormorants kill vegetation with their feet and phytotoxic feces. The lost vegetative cover was important to Herring Gulls and had provided optimal, preferred habitat. Several successive low water years destroyed much vegetation when the island's water table was lowered with that of the surrounding lake level. Summer rainfall was sparse and inadequate. It drained through the xeric, porous, sandy soil. This resulted in the island's vegetation being made susceptible to the droughty conditions produced by the lower lake level. Several successive years of low water levels and low summer rainfall have eliminated much of the former lush assemblage of shrubs and herbs and given the Ring-bills a favorable habitat to start their colonization. The extent of the former vegetation, including trees, shrubs, and a diverse herbaceous component, was documented in Scharf et al. (1979).

Ring-billed Gulls compete with the larger and more aggressive Herring Gulls by acquiring their nesting space in three ways: (1) they have a more densely packed, impenetrable nest territory than the Herring Gulls; (2) they destroy the remaining vegetation with their feet and feces; and (3) they are hyperactive, causing a cacophony day and night that seems to repel the Herring Gulls, who seek a less crowded, and preferably vegetation-screened territory. Ring-bills have an advantage over Herring Gulls because they are generalist feeders, eating everything from earthworms to garbage. They are not dependent on food from the aquatic ecosystem as Herring Gulls are.

Control of the steadily rising Ring-billed Gullnesting population on Bellow Island might allow reoccupation of former Herring Gull nesting territories, and a very rainy summer could rejuvenate the vegetation. However, an adequate prey-fish base would be an essential component for ensuring Herring Gull population recovery. Provision of forage fish for the dietary needs of Herring Gulls would require an unlikely reversal of State, Federal,

and tribal programs to introduce more salmonids (*Salmo* sp.), Lake Trout (*Salvelinus namaycush*), and Walley (*Sander vitreus*) that compete for forage fish with Herring Gulls.

Acknowledgments

An anonymous reviewer greatly improved the manuscript.

The Leelanau Conservancy, owners of Bellow Island since 1993, encouraged and authorized the work. The Grand Traverse Band of Ottawa and Chippewa Indians, through Erik Olsen, provided boat transportation for the past eleven years as part of their cormorant monitoring and control effort. Research funding from the Michigan DEQ to William L. Bowerman at the University of Maryland facilitated this work as an adjunct to egg collection for toxic contaminant analysis by WCS. James P. Ludwig, Erik Olsen, and Gary Shugart read and commented on the manuscript. I thank counters Nathan Barton, Hank Bailey, Mary Hindelang, Michael Jorae Gerald Luskey, Erik Olsen, Andrew Rockwood Jenee Rowe, Erik . Scharf, Karl . Scharf, Gary W. Shugart, and Nate Winkler and several generations of my students.

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