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American White Pelicans expand breeding range into western Lake Erie, 2016-2018

Y. Robert Tymstra, D.V. Chip Weseloh, David J. Moore, Doug Crump and James P. Ludwig

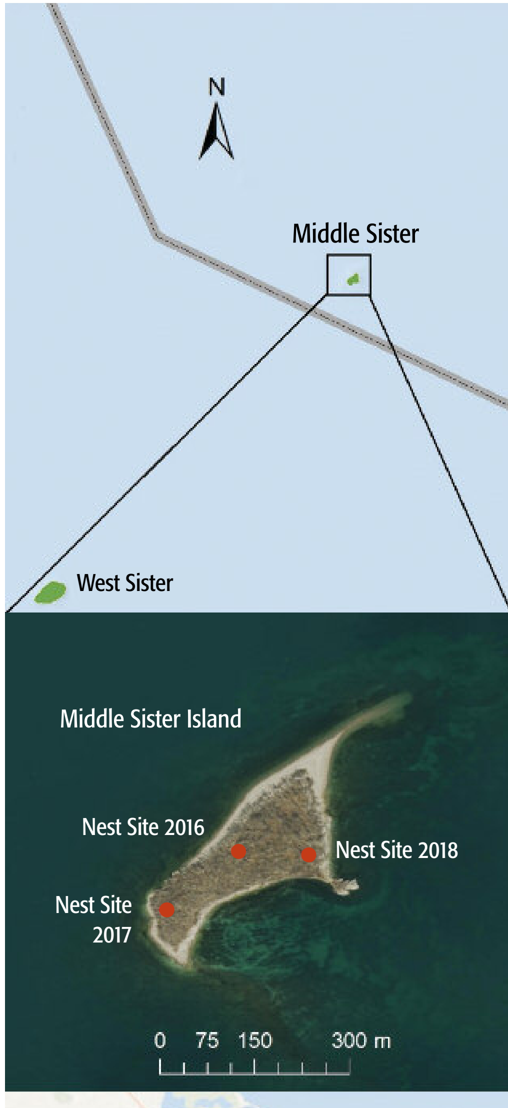
The historical breeding range of the American White Pelican (*Pelecanus erythrorhynchos*, henceforth pelican) is from northern Alberta through central Saskatchewan, central-eastern North and South Dakota, western Minnesota, southern Manitoba, to extreme northwestern Ontario. There are isolated nesting locations in several mid-western US states, northern California and central- southern British Columbia (Knopf and Evans 2004). Over the past 35 years, this species has expanded its range farther into (or immediately adjacent to) northern Ontario with breeding records from Lake Nipigon (Bryan 1991, Escott and Bryan 1993) and James Bay (Peck 2007) and into the Great Lakes in Lake Michigan (Matteson *et al.* 2014) and Lake Superior (Pekarik *et al.* 2009).

American White Pelicans on Big Chicken Island, 26 July 2016.
Photo: Dave Moore.

Prior to 2014, pelicans were a rare vagrant to western Lake Erie involving single or, at most, a few individuals (Natural History Information Centre, *in litt.*). In 2014, pelicans began appearing in western Lake Erie and sightings became more numerous with increased numbers of individuals per observation each subsequent year. For example, during daily surveys by the Pelee Island Bird Observatory (PIBO) on Pelee Island in western Lake Erie, a cumulative total of 22 pelicans was recorded in 2014, 27 in 2015 and 1,424 in 2016 (PIBO, unpubl. data). Therefore, it was no surprise when nesting was confirmed in 2016 with the discovery of nests and eggs on both Big Chicken Island and Middle Sister Island in the Canadian waters of western Lake Erie. The objective of this paper is to document this first nesting of the American White Pelican in Lake Erie and thus, in the lower Great Lakes, and to present additional pelican data from 2017 and 2018 for that area.

Methods

The information in this paper is based on independent fieldwork and observations from several sources. Information from Pelee Island, Lake Erie, was provided by PIBO from daily spring and autumn standardized 90-minute surveys conducted in Fish Point Provincial Park, at the southern tip of Pelee Island, Ontario (41.7333° N, 82.6726° W; Figure 1). PIBO survey periods, which began in 2003, extend from 1 April to 31 May and from 1 August to mid-November. All other islands mentioned herein were visited by boat. Only the trip on 19 July 2016 to Big Chicken Island was made specifically to confirm if pelicans were nesting there. All other encounters with pelicans occurred incidentally during fieldwork on contaminants and population studies on Herring Gulls (*Larus argentatus*) and/or Double-crested Cormorants (*Phalacrocorax auritus*, henceforth cormorants).



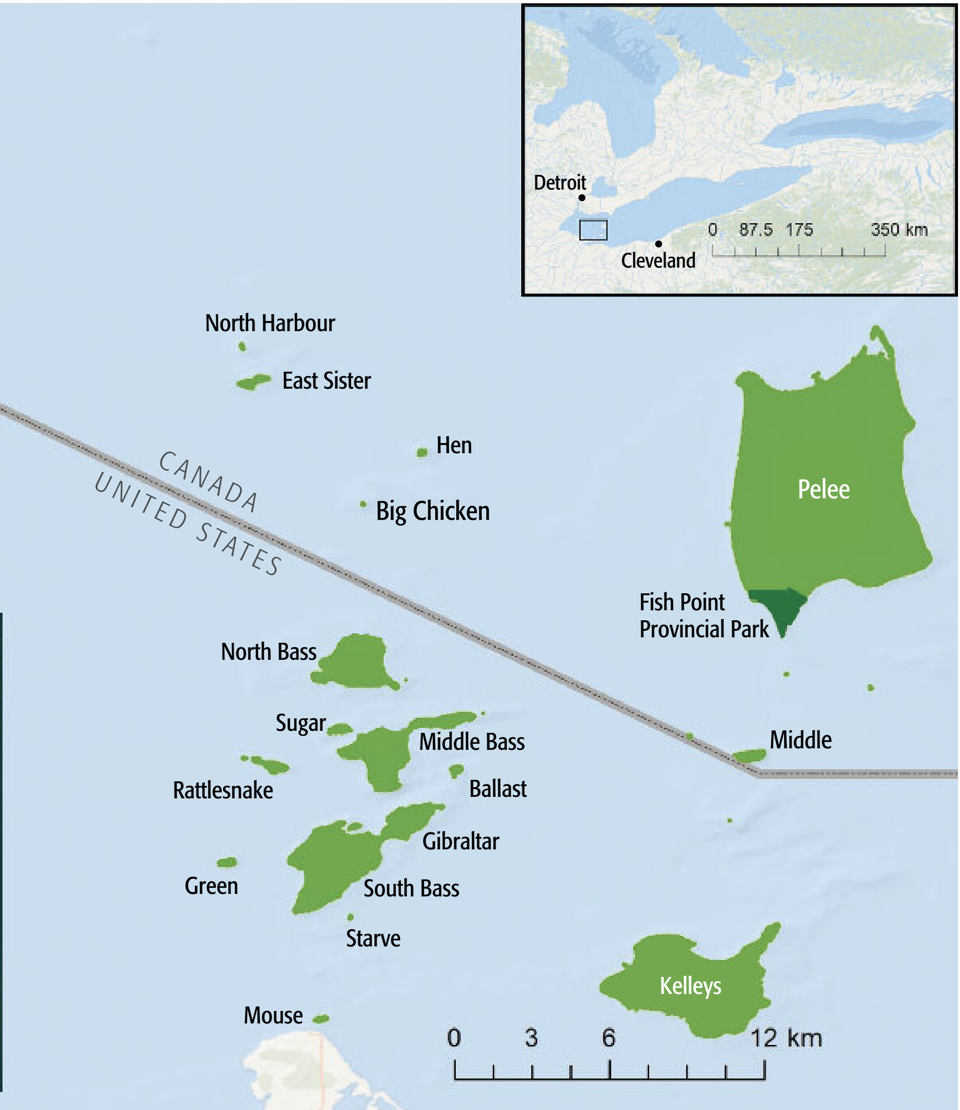


Figure 1. The Western Basin of Lake Erie. Please note the locations of Fish Point Provincial Park, Big Chicken Island and Middle Sister Island, the main sites discussed in this paper.
Map: Mike Burrell

Figure 2. The zodiac moored on Big Chicken Island, 19 July 2016.
Figure 3. An American White Pelican egg on Big Chicken Island with a small camera for scale, 19 July 2016.

Results

Pelee Island

PIBO did not record any pelicans on daily surveys between 2003 and 2013. In 2014, pelicans were recorded on three census days: two birds on 1 August, four on 3 August and 16 on 9 September. In 2015, pelicans were observed on four census days: 8-10 June and 8 September (one, five, 13 and eight birds, respectively). In 2016, pelicans were noted on 76 census days ranging from 2 May to 10 June and 2 August to 17 October. The highest count was 190 pelicans on 19 September (S. Onishi, PIBO, pers. comm.). With pelicans present in high numbers throughout the 2016 breeding season, it seemed likely they could be nesting on one of the small islands to the west of Pelee Island.

Big Chicken Island

Big Chicken Island (41.7704° N, 82.8177° W), located just south of Hen Island, is a small barren cobblestone island about 14 km west of Pelee Island. It seemed a likely location for pelicans to breed (DVCW, pers. obs.) given the current nesting of Herring Gulls and the hoisitorical nesting of cormorants (Blokpoel and McKeating 1978, Morris *et al.* 2003, Weseloh 2007a,b) (Figure 1). On 19 July 2016, YRT chartered a motorized zodiac from Pelee Island Charters to make a visit to Big Chicken Island.

YRT arrived at the 'Chicken' shoals area at 19:45 hrs. As he approached Big Chicken Island, he counted about 30 pelicans, a few hundred cormorants and several dozen Herring Gulls. All birds flushed as the boat neared the island; the pelicans circled overhead briefly before departing the area. All of the pelicans observed appeared to be adults; some were in summer plumage with a black

Figure 4. Two active single egg nests of American White Pelican on Big Chicken Island, 19 July 2016.
Photos: Robert Tymstra

nape and at least one had the yellow-orange protuberance (horn) on its upper mandible, a sign of breeding condition (Knopf and Evans 2004).

YRT went ashore (Figure 2) and did a quick reconnaissance, not wanting to disturb whatever nesting was going on any more than necessary. He walked the length of the island (about 100 m) twice and returned to the boat about ten minutes later after finding five pelican nests with eggs (four with single eggs and one with two eggs). The eggs were chalky white with some staining. Several photographs were taken, using a second camera for scale, from which the eggs were estimated to be about 76 x 54 mm (Figure 3). The larger egg in the two-egg nest was estimated to be just over 79 mm. The incubation status of the eggs was not determined. Although the presence of eggs so late in the summer is somewhat unusual, it isnot unprecedented in new colonies (Knopf and Evans 2004). In addition to confirmed nests, there were at least a half dozen other suspected pelican nests nearby.

On 23 July 2016, Paul Pratt reported (*in litt.* to YRT) 70 pelicans on Big Chicken Island when he passed by the island in a boat. On 26 July 2016, DJM also made a brief (24 min) visit to the island. On approach, 105 pelicans flushed from the island and most circled and then landed on the water ≥100 m offshore. Ten nests were recorded during a complete search of the island: four nests with one egg and six empty nests (photos were taken of all nests). In addition to confirmed nests, an additional ten suspected nest scrapes were observed.

In 2016, pelican nests consisted of loose aggregations of sticks, vegetation and feathers placed on the bare cobble rock (Figure 4).They were concentrated in the central and highest part of the island, well away from the shore. One of the nests measured over 60 cm in

Figure 5. Part of the abandoned pelican colony on Middle Sister Island. Note the pelican eggs strewn about the ground, 26 July 2016. All pelican nests were numbered with red spray paint to avoid any double-counting or missing of nests. *Photo: Dave Moore*

diameter. It is possible that the empty nests had been abandoned, but they appeared to be under construction. No broken pelican eggshells were observed and there was no sign of any young.

Photos taken offshore from Big Chicken Island in 2017 confirmed nesting in that year. On 31 July 2017, Teddi Pertner and Zach Olsen took photos offshore of Big Chicken Island (far enough away that pelicans did not flush from the island) and confirmed nesting. Thirty-five pelicans were counted in the photos, which is likely an underestimate as coverage included only approximately half the island and the resolution was poor. However, some pelicans appeared to be incubating eggs or brooding young. On 13 August 2017, Dean Robillard took additional photos of the island, shot at ~50 m from shore, and estimated 20 adults remained on the island as he approached. Again, photos provided incomplete coverage of the whole island, but ten medium to large downy chicks, in at least six identifiable nests, were visible. Big Chicken Island was not surveyed in 2018.

Middle Sister Island

A week after the discovery on Big Chicken Island, on 26 July 2016, DJM and Jaimie Bortolotti conducted surveys for cormorants on Middle Sister Island (41.8487° N, 83.0009° W), approximately 40 km west of Pelee Island (Figure 1). While criss-crossing the heavily forested island (predominantly Hackberry *Celtis occidentalis*), counting cormorant tree-nests, they came across 24 abandoned pelican nests with cold eggs and/or eggshells (Figures 5 and 6). There were nine 0-egg nests, six 1-egg nests and nine

2-egg nests. Eggs were crushed or broken in seven of the nests. Two of the pelican eggs were collected and later deposited at the Royal Ontario Museum. The nests were located on the ground in small clearings among the trees (Figure 6), approximately 50 m in from the north shore of the island (Figure 1). The trees and understory were dense enough that adult pelicans would have had to walk in from the beach to access their nests in the forest. Finding this nesting cluster was a complete surprise, as no pelicans were seen near or on the island. Nests consisted of shallow scrapes made in the soil or litter (mostly wood chips and sticks at this site), with scattered sticks loosely built up around the perimeter (as seen on Big Chicken Island, Figures 4-6). Individual photos were taken of all nests (e.g., Figure 7) and the size of nests and eggs were estimated from these using the objects included for scale. Nests were 53 cm in diameter (±12 cm SD, range=39-86 cm, *n*=18). Eggs were 68±8 mm long (range=53-81 mm, *n*=13) and 44±5 mm wide (range=38-54 mm, *n*=12).

In 2017, while carrying out toxicological studies on Middle Sister Island, DC and Kim Williams estimated "about" 30 and 34 pelican nests, on 25 April and 3 May, respectively. The nests were located on the west side of the island (Figure 1). On both visits, they noted numerous nests with 0-egg, 1-egg and 2-egg pelican clutches. They visited the island a third time on 13 June and noted egg fragments and dead pelican chicks. They also saw

Figure 6. Two 0-egg nests and one 1-egg nest of American White Pelican on Middle Sister Island. Nest material had become scattered and nests were barely discernable; all nests were abandoned, 26 July 2016. Similar clumps of abandoned pelican nests were scattered over an area of approximately 30 x 30 m, which comprised the extent of the "colony". *Photo: Dave Moore*

Figure 7. An abandoned 2-egg nest of American White Pelican on Middle Sister Island with little or no structured nest, 26 July 2016. The fieldbook is included as a known size comparison.
Photo: Dave Moore

both a red fox (*Vulpes vulpes*) and a Bald Eagle (*Haliaeetus leucocephalus*) on the island. On a visit to Middle Sister Island on 22 June, for further toxicological work, JPL noted that all the ground nests of all species were obliterated there. He saw no adult pelicans around or near the island, so there appeared to be a complete failure of their nesting.

On 24 April 2018, DC estimated about 30 pelican nests on the east side of the island (Figure 1) but did not investigate any further to minimize disturbance. JPL visited the island on 6 July and noted four large flightless young pelicans (Figure 8) but did not search any further for the same reason. Therefore, it appears that there was pelican production in 2018.

Discussion

The islands and shoreline areas of western Lake Erie, on both the Canadian and the US sides of the lake (e.g., East and West Sister Islands, respectively), comprise one of the most important breeding areas for colonial waterbirds in the entire Great Lakes system (Blokpoel and McKeating 1978, Weseloh *et al.* 1988, Wires and Cuthbert 2001, Greenwood *et al.* 2007). There is a considerable variety of habitat for nesting by colonial waterbirds and they have responded positively. In the last 35 years, 11 species of colonial waterbirds (five species of herons, two species of gulls, three species of tern and one species of cormorant) have been recorded nesting on at least 38 different natural and man-made sites in the western basin of Lake Erie (Blokpoel and Tessier 1996, Scharf and Shugart 1998, Scharf 1998, Weseloh *et al.* 2002, Morris *et al.* 2003, Wires and Cuthbert 2013).

Figure 8. Large flightless young American White Pelicans, photographed on Lake Nipigon on 7 July 2001, similar to those that were seen on Middle Sister Island on 6 July 2018. *Photo: Glenn Barrett*

The American White Pelican is the 12th colonial waterbird species recorded nesting in western Lake Erie. Pelicans first nested in the Great Lakes on Cat Island in Green Bay, Wisconsin, Lake Michigan, with two nests in 1994 (Soulen 1995, Matteson *et al.* 2014); they have nested there every year since then. In 2018, there were 4,677 pelican nests on eight islands in Lake Michigan (F. Cuthbert, pers. comm.). Pelicans were first found nesting in the Canadian Great Lakes on Granite Island in northern Lake Superior, east of Thunder Bay, Ontario, in 2007 with 20 nests (Pekarik *et al.* 2009). Confirmed nesting was observed on Granite Island in seven of nine years between 2009 and 2017. No visits were conducted during the two years for which no breeding data were confirmed. In 2017, there were approximately 30 nests on the island (DC, pers. obs.).

There are no pelican nesting records yet from the Ohio waters of Lake Erie (M. Shieldcastle, *in litt.*). The two Canadian islands in western Lake Erie where nesting was observed are quite distinct in terms of habitat. Big Chicken Island is a small, low-lying cobblestone island with no vegetation and many nesting Herring Gulls and many loafing/roosting cormorants. It has clear 360° visibility and complete fly-in access to the pelican nests. Middle Sister Island is a much larger, heavily forested island with moderate ground cover throughout. Herring Gulls nest predominantly around the perimeter of the island but there are also nests in the interior. Most cormorants nest in trees but there are also numerous pairs nesting on the ground in the interior. Great Egrets (*Ardea alba*) and Black-crowned Night-Herons (*Nycticorax nycticorax*) also breed there (Rush *et al.* 2015). There was no clear visibility of the lake from the pelican nesting clusters in 2016-18. The difference between the islands could not be much greater: the small, barren, cobblestone island (the preferred habitat) (Koonz 2003) and the larger, forested island with areas of heavy ground vegetation. This latter situation, however, is a known nesting habitat for pelicans, especially in forested areas (Knopf and Evans 2005) and for new colonies (Koonz 2003).

In order to minimize disturbance at these new colonies, we did not monitor nesting success. However, there are two observations that warrant further comment. First, the average measurements of eggs from Lake Erie (69 mm x 46 mm) were about 20% less than the average size reported for pelican eggs (90 mm x 56.5 mm), and the largest (81 mm) was shorter than the overall length range (81.5-103 mm) (Knopf and Evans 2004). Eggs were measured predominantly (13 of 15) at Middle Sister Island, and only during the first year this site was colonized. Reduced egg size may have been an anomaly in that year, or perhaps, related to age of the breeding birds and/or lateness of nesting (Haymes and Blokpoel 1980, Nisbet *et al.* 1984, Kraupa *et al.* 2004, Tsuboi and Ashizawa 2011, Clark and DiMatteo 2018) or female body condition (Gladbach *et al.* 2010); clutch initiation is often delayed when nesting at a new site (DVCW and DJM, unpubl. data). Egg length and breadth were not measured directly, but rather estimated from photographs. It is possible that this method, in which photographs were not collected in a standardized way, resulted in a systematic underestimate of actual egg size. Second, it seems clear that no chicks were fledged during three of the five known breeding attempts (combining the two sites over three years). In 2016, clutches on Big Chicken Island were initiated in mid- to late-July, which was likely too late in the season to result in any fledged chicks. On Middle Sister Island, the colony was abandoned during incubation in 2016 and, even though some chicks hatched in 2017, there was no productivity in that year, likely due to predation or associated disturbance. In 2017 on Big Chicken Island and in 2018 on Middle Sister Island, young pelicans may have fledged.

The American White Pelican is undergoing a dramatic expansion of its breeding range in North America (Knopf and Evans 2004, Anderson *et al.* 2005). It appears that this expansion has not been accompanied by an increase in its numbers but rather by an abandonment of previously established colonies. For example, in 2004, 28,000 pelicans abandoned the large nesting colony at Chase Lake, North Dakota (Anderson and King 2005). Three additional nesting sites have been reported in Ontario recently. A site in Lac Seul has been active annually from 2009-2015 with up to 75 nests and successful reproduction (Natural History Inventory Centre, unpubl. data). Two sites on the Welcome Islands in Thunder Bay, Lake Superior, had 11 nests in 2009 (DJM, pers. obs.) and "about 25 nests" in 2015 (DC, pers. obs.). The outcomes of nesting at these sites are not known.

The nesting on Lake Erie, so far from the colony sites in Lake Michigan and Lake Superior seems unusual; why such a large dispersal from the nearest established breeding colony (550 km away)? As various authors and studies have shown, pelicans range and forage very widely from their nesting colonies, e.g., over 300 km to find food for their young (Johnson and Sloan 1978, Yates 1999, Madden and Restani 2005, Murphy 2005). Western Lake Erie has been identified as a predictable location for pelicans during pre- and post-breeding migratory periods (eBird data 2004-2016; Fink *et al.* 2018). Presumably, birds could have prospected this area as they migrated to and from more northerly breeding colonies.

In summary, in Ontario, American White Pelicans are now known to nest in at least five major lakes: Lake of the Woods (Baillie 1938, Peck and James 1983, 2007), Lake Nipigon (Bryan 1991, Escott and Bryan 1993), Lake Superior (Pekarik *et al.* 2009), Lac Seul (see above) and Lake Erie (this paper). They now nest on three of the Great Lakes (Lake Michigan, Lake Superior and Lake Erie). This eastward expansion of the pelican into Ontario and the Great Lakes is very similar to that of another colonial waterbird from 80-90 years ago: the Double-crested Cormorant. In the modern era, cormorants also first nested in the Great Lakes in Lake Superior (1913) and moved eastward. It appeared in Lake Huron in 1932 and in Lake Ontario and Lake Erie in 1938 and 1939, respectively (Weseloh *et al.* 1995). While pelicans have not yet started to nest in Lake Huron or Lake Ontario, it is perhaps only a matter of time. Both of those lakes have seemingly very suitable habitat, i.e., remote small rocky islands with other colonial waterbirds. The Watcher and Limestone Islands in Georgian Bay, Lake Huron, and Scotch Bonnet and Pigeon Islands in Lake Ontario may be the most likely future nesting locations. Time will tell if they become breeding birds Great Lakes-wide.

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Y. Robert Tymstra
1011 East West Road
Pelee Island, Ontario N0R 1M0

D.V. Chip Weseloh
Canadian Wildlife Service
Environment and Climate Change Canada
1409 Dufferin Street
Toronto, Ontario M3H 5T4

David J. Moore
Canadian Wildlife Service
Environment and Climate Change Canada
Canada Centre for Inland Waters
867 Lakeshore Road
Burlington, Ontario L7S 1A1

Doug Crump
Science and Technology Branch
Environment and Climate Change Canada
Carleton University
Ottawa, Ontario K1A 0H7

James P. Ludwig
19835 Duart Rd.
Duart, Ontario N0L 1H0

Greater Yellowlegs opportunistically forage on vulnerable mating darners

Alexandra Anderson and Gill Holmes

Introduction

The Greater Yellowlegs (*Tringa melanoleuca*) is a medium-sized shorebird that breeds in muskeg swamps in the boreal region of Canada and Alaska (Elphick and Tibbitts 1998). In Ontario, these birds are known to breed in the Hudson Bay Lowlands (Harris 2007) and pass through southern Ontario during migration. Although they migrate to wintering areas in a broad front across North America, Greater Yellowlegs are rarely observed in large numbers at a single location during their annual cycle (Elphick and Tibbitts 1998). This, combined with the remote location of their breeding sites, has resulted in a lack of knowledge of the biology of Greater Yellowlegs compared to other shorebird species. During southbound migration, Greater Yellowlegs are commonly observed along the southwestern coast of James Bay, Ontario, an important stopover site for many shorebird species. Shorebirds are surveyed and monitored there by the James Bay Shorebird Project each fall, and daily counts of Greater Yellowlegs can exceed one hundred individuals per day on these surveys (Friis 2018). This congregation of Greater Yellowlegs provides an opportunity to learn more about the ecology of this under-studied shorebird.

Predation Behaviour

We noticed an unusual foraging behaviour of Greater Yellowlegs during a high-tide shorebird survey at North Bluff Point (51.4839°N, 80.4517°W) on 20 August 2017. We walked 3.5 km of coast to record shorebird abundance, diversity and behaviour as part of the James Bay Shorebird Project. On this day, many darner dragonflies (*Aeshna* spp.) (Figure 1) were flying across exposed intertidal mud flats and mating. This may have been triggered by warmer temperatures that day (20°C at 11:00 compared to temperatures less than 16°C on preceding mornings). Mating darners were attached in tandem (Figure 2),

Figure 1. An up-close view of a Subarctic Darner.
Photo: Alexandra Anderson

Figure 2. Subarctic Darners in tandem mating.
Photo: Gill Holmes

flying together and landing on the mudflats or small exposed rocks. We observed mating darners 800 m from shore over the mudflats as the tide was rising. We did not identify all of the species of darners mating on this day, but several species, including Canada Darner (*Aeshna canadensis*), Lake Darner (*Aeshna eremita*), Variable Darner (*Aeshna interrupta*), Sedge Darner (*Aeshna juncea*), Zigzag Darner (*Aeshna sitchensis*), Subarctic Darner (*Aeshna subarctica*) and Shadow Darner (*Aeshna umbrosa*) have been observed in the Hudson Bay Lowlands (Sutherland *et al.* 2005).

Greater Yellowlegs were foraging at the waterline on the incoming tide during this survey (Figure 3). We observed 62 adult Greater Yellowlegs, six juveniles and an additional 12 un-aged Greater Yellowlegs. Most of the yellowlegs were loafing, but 13 adults and one juvenile were feeding. Of the 13 foraging adults,

Figure 3. Greater Yellowlegs on intertidal flats, southwest James Bay. *Photo: Jean Iron*

we observed four birds preying upon mating darners. The yellowlegs grabbed vulnerable darners while pairs were attached in tandem. They then dunked the darner pairs under water repeatedly until the darners detached or appeared stunned. The yellowlegs swallowed the darners one at a time in only a few gulps and then continued foraging. The whole process, capture to consumption, occurred in approximately 30 seconds. This was the first and only instance that we noticed yellowlegs depredating darners during the daily shorebird surveys which occurred over two months. We did not notice darners mating over the intertidal area in large numbers any other day during the season. Most prey items consumed by foraging shorebirds in this area are not identifiable by observation with a spotting scope; however, it is easier to identify large prey items, for example, we have observed Greater Yellowlegs eating stickleback fish (*Gasterosteus* sp.) at this site.

Importance

Knowledge of the diet of Greater Yellowlegs is limited to stomach contents from fewer than 20 individuals (Elphick and Tibbitts 1998) and personal observations. Greater Yellowlegs have been known to eat dragonfly naiads (Bent 1927, Brooks 1967a, b) and occasionally adult dragonflies (Elphick and Tibbitts 1998). The predation by Greater Yellowlegs of darners in tandem is an observation that, to our knowledge, has not been documented in the literature. The consumption of adult darners is not surprising given their shared habitat; however dragonflies are agile flyers (Bomphrey *et al.* 2016, Paulson 2019) and may frequently escape predation by yellowlegs. Our observation indicates that Greater Yellowlegs are opportunistic foragers and can prey on vulnerable darners, such as when they are flying in tandem and their flight maneuverability is limited.

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Alexandra Anderson
Environmental and Life Sciences
Graduate Program
1600 West Bank Drive
Trent University
Peterborough, Ontario K9J 0G2
E-mail: aande763@gmail.ca

Gill Holmes
Environmental and Life Sciences
Graduate Program
1600 West Bank Drive
Trent University
Peterborough, Ontario K9J 0G2

Bald Eagles team up to kill Double-crested Cormorant near Blind River, Ontario

Steven Elliott

On 20 November 2018, I was sitting drinking coffee and looking out my living room window overlooking the North Channel of Lake Huron, just east of Blind River, Ontario, and watching 18 Herring Gulls (*Larus argentatus*). They were resting on thin ice that had formed near shore from the previous night's -16°C temperature. It was a sunny day with a bit of blue sky breaking through the light grey clouds. I noticed the shadow of a Bald Eagle (*Haliaeetus leucocephalus*) following the shoreline. The gulls saw the eagle and rose in unison, flying towards the open water. Their concern was short-lived because the eagle disappeared around a point and they settled back down on the ice. I remember how rare it was to see an eagle or find an eagle's nest when I first moved to Blind River, Ontario, in 1985. It is now common to see both mature and immature eagles flying along the North Channel of Lake Huron but I still watch and follow every one until it is out of sight.

Seeing the eagle that morning reminded me of another sunny day, 11 April 2015, when my friend, Mark Galsworthy, and I walked out onto the frozen North Channel from Algoma Mills, Ontario. We had to step over a large crack and pressure ridge to get onto the ice, which was starting to thaw and pull away from shore. It had felt good to be going out for a day fishing for herring near the mouth of Lauzon Creek. We drilled a dozen holes through the ice approximately 100 m out from shore. I was walking from hole to hole, jigging a small silver spoon intent on catching a fish for supper when Mark shouted, "Here comes one of your buddies!" I looked up and saw a Double-crested Cormorant (*Phalacrocorax auritus*) flying about 8 m above the ice, 50 m or so away. The cormorant was heading toward the open water at the mouth of the creek and flying right behind it were two adult Bald Eagles about 10 m apart. The eagles were gaining on the cormorant and the three birds overshot the patch of open water and continued on for approximately 700 m. I could make out that all three birds had landed on the ice but it was too far to see what happened next and I wished I had brought binoculars. A brisk cold wind had started and we decided to head back to shore.

Mid-morning the next day found us back at the same location quietly sitting on our pails fishing. I looked toward Magazine Rock (46.180766° N, 82.779245° W), a cormorant nesting site I had visited many times, and saw three birds flying towards us. As they came closer, I was surprised to once again see an adult cormorant flanked by two adult eagles. This time the eagles were much closer to, and slightly above, the cormorant. As the eagles were closing in on it, the cormorant slid down onto the ice and made a dash up into the rocks on shore. Both eagles landed with it and the larger eagle quickly over-took the cormorant and sat on it. After a few minutes, the eagle dragged the cormorant back out onto the ice and started to feed on it, with the second eagle waiting approximately 20 m away. When the larger bird finished feeding and flew off, the second eagle flew over and fed on what was left of the dead cormorant. After feeding, it flew off and I decided to walk over and see what was left of the cormorant. As I started to walk towards it, an immature Bald Eagle flew to the remains and immediately started to feed. I had not noticed it before and when it saw me, it half carried, half dragged the remains 100 m further away. I stopped and waited until it flew off before walking over to inspect the remains. Only an hour had passed but most of the muscle had been stripped from the carcass, leaving only the wings, legs and head. I had seen Bald Eagles feeding on cormorant chicks several times before but this was the first time I had actually seen an adult cormorant being killed by an eagle. I believe the two adult eagles were a pair who, working together, had a successful hunting strategy for catching early returning adult cormorants when ice still covered the North Channel.

Todd *et al.* (1982) mention seeing "… occasional cooperation between two hunting eagles." They also reported finding remains of Double-crested Cormorants at 2-8% of Bald Eagle nests

Bald Eagles. *Photos: Eleanor Kee Wellman©*

and perch sites they searched in Maine. Beyond that report, it is well known that Bald Eagles will harass cormorants as well as kill and feed on cormorant eggs, young and adults; documentation comes from Manitoba (Hobson *et al.* 1989, Hunt *et al.* 1992), British Columbia (Giebrecht 2001, Van Damme and Colonel 2007) and Minnesota (Wendels *et al.* 2016). The current record may be the first documentation from Ontario.

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Steven Elliott
8 Kennedy Road
Box 1824
Blind River, Ontario P0R 1B0
E-mail: upsalabound@gmail.com

Red-necked Grebe: First confirmed nesting for Durham Region, Ontario

A. Geoffrey Carpentier

Figure 1. Adult Red-necked Grebe approaching nest on 15 May 2018. *Photo: A. Geoffrey Carpentier*

Introduction and Observations

The Red-necked Grebe (*Podiceps grisegena*) is an uncommon nesting species in much of Ontario, with a widespread but discontinuous distribution. Historically, it has bred on Big Trout Lake, Lake of the Woods, Sioux Lookout, Mildred and Sandy Lakes and lakes in Thunder Bay District in northwestern Ontario, in Cochrane District, on Manitoulin Island and in Luther Marsh, Halton Region, Burlington and Port Credit (Speirs 1985, Godfrey 1986, Armstrong 1987, James 1991). Up to 1983, 71 nests had been recorded for Ontario, primarily in the western part of the province from Thunder Bay to Favourable Lake (northwestern Ontario) and in Cochrane District, with a few scattered nesting attempts

Table 1. Spring and summer occurrences of Red-necked Grebe in Durham Region, Ontario.

Date	Location	Observer	Details	Source
04 June 1960	Lynde Shores	Naomi S. Le Vay	1 bird	eBird 2018
12 June 1969	Cranberry Marsh	Naomi S. Le Vay	1 bird	Tozer and Richards 1974
20 June 1978	Frenchmen's Bay	David D. Calvert	1 bird	eBird 2018
07 June 1979	Lynde Shores	Margaret J.C. Bain	2 birds	eBird 2018
Unspecified date, summer 1979	Pickering	J. Murray Speirs	4 birds	Speirs 1985
20 June 1981	Lynde Shores	John and Naomi S. Le Vay	2 birds	eBird 2018
11 June 1983	Lynde Shores	Naomi S. Le Vay	1 bird	eBird 2018
21 July 1984	Lynde Shores	John and Naomi S. Le Vay	1 bird	eBird 2018
17 June 1990	Lynde Shores	Margaret J.C. Bain	1 bird	eBird 2018
17 June 2013	Cranberry Marsh	Jay van der Gaast	1 bird	eBird 2018
21 June 2013	Lynde Shores	Paul Frost	1 bird	eBird 2018
19 June 2016	Oshawa Second Marsh	Glenn Coady	1 bird	G. Coady, pers. comm.
04 July 2016	Frenchman's Bay	John Brett	1 bird	eBird 2018
05 July 2016	Frenchman's Bay	Toronto and Region Conservation Authority field staff	1 bird	eBird 2018
28 June 2017	Darlington Provincial Park	Michael Ferguson	1 bird	eBird 2018
27 April to 16 July 2018	Nonquon Sewage Lagoon	David B. Worthington, Connor Hawey, A. Geoffrey Carpentier and many other observers	This note	eBird 2018
8 July 2018	Cranberry Marsh	Theresa Dobko and Ella Y Fu	2 birds	eBird 2018

in unspecified locations in southern Ontario (Peck and James 1983). During the second atlas of breeding birds in Ontario (2001-2005), evidence of new breeding locations was reported from Sudbury, Manitoulin Island and the western end of Lake Ontario (Harris 2007). Since the second atlas, successful nesting has occurred at three discrete sites in the Etobicoke area of Toronto and one nesting attempt was made in the Lakeview area of Mississauga, Peel R.M. (G. Coady, pers. comm.). The Regional Municipality of Durham is located east/northeast of Toronto and encompasses an area of approximately 2500 km^2. Scugog Township, where the Nonquon Sewage Lagoons are located, is located in the north

Figure 2. Location of the Nonquon Sewage Lagoons in Port Perry, Durham Region, Ontario. The white star shows the approximate location of the nest.
Imagery © 2018 First Base Solutions, Map Data © Google Canada

half of the Region. Other than the pair that is the subject of this article, I could find only 16 summer records of the Red-necked Grebe in Durham Region (Table 1) and until 2018, no nesting had been reported. The objective of this note is to document the first known nesting attempt and first successful nesting of the Red-necked Grebe in Durham Region.

On 27 April 2018, I found a single adult Red-necked Grebe at the Nonquon Sewage Lagoons in Port Perry, Durham Region, Ontario (Figures 1 and 2). On 5 May 2018, Connor Hawey reported that two adults were observed courting at the Nonquon site (eBird 2018). Subsequently, the species was not reported there again until 17 May 2018, when Dave Worthington reported finding a nest with two eggs along the shore of one of the lagoons (eBird 2018).

On 18 May 2018, I confirmed the nesting, seeing the two adults and three eggs in the nest (Figures 3 and 4). On 15 June 2018, I observed the female incubating eggs on the nest and, on 19 June 2018, I saw the adults with two very small young.

To determine the egg laying dates and incubation period for this nest, I used the first known observation date of two eggs in the nest (17 May), the published

Figure 3. Nest seen through spotting scope, showing three eggs and the nest construction details on 15 May 2018.

Figure 4. Close up of Red-necked Grebe nest showing egg detail on 15 May 2018.

Figure 5. Adult Red-necked Grebe with one young on 11 July 2018. *Photos: A. Geoffrey Carpentier*

laying interval and a date midway between the last known date before the young hatched and the first date young were reported (17 June). Red-necked Grebes lay eggs at intervals of 1-2 days (Stout and Nuechterlein 1999) that are pale bluish-white when first laid, but become stained and splotched with mud and debris as they are incubated. The pale and relatively clean eggs observed on 17 and 18 May (Figure 4) and the addition of an egg on 18 May suggests laying started no earlier than 14 May (based on alternate day laying) and no later than 16 May (based on one egg/day being laid). Red-necked Grebes begin incubating after the first egg is laid and incubation lasts between 22 and 35 days with averages based on a large sample ranging from 25-27 days (Stout and Nuechterlein 1999). This suggests that the incubation period for this nest was between 32 and 34 days, falling within the published extremes for this species.

The nest was situated on the north shore of the third lagoon counting from the eastern most lagoon (Figure 2). The nest was on a floating mat of sparse fresh green vegetation, interwoven with dead, partially decayed vegetation (mostly cattails, *Typha* sp.), some algae and some mud (Figures 3 and 4). Individual stalks of live cattails were woven into the nest platform as anchors. The nest itself was a shallow depression in which the eggs were set and sat barely above the surface of the water about 3 m offshore along the edge of a cattail mat. The details of this nest are consistent with the features described by Stout and Nuechterlein (1999).

The nest was observed by several other birders, but there were never more than three eggs observed. The eggs were ovate and quite pale (almost white) with very small indeterminate darker flecks on them, when freshly laid (Figure 4). Once there were young, the nest was obscured by the vegetation surrounding it and it could not be determined whether the third egg was still in the nest, had fallen out or was depredated. Stout and Nuechterlein (1999) reported that the last laid eggs are often abandoned.

Both parents fed the two young following hatching until at least 22 June. On 9 July, only one young could be found (Figure 5). It was still downy but about half the size of the adults. On 16 July, no young could be found, but the adults were still there. No observations of adults or young after 16 July indicate that the adults had abandoned the site. Since parents usually stay with young until they are able to fly at 7-9 weeks of age, this nesting attempt did not result in new recruits to the Red-necked Grebe population.

Conclusion

This appearance of the young represents the first successful nesting of Red-necked Grebe on its first reported nesting attempt for Durham Region.

Acknowledgements

Early observations and timely reporting by Connor Hawey and David Worthington led to the discovery of this nesting. With the assistance of the editors of *Ontario Birds* and valuable insights by Glenn Coady and Tyler Hoar, this first nesting for Durham Region has been documented.

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A. Geoffrey Carpentier
11 Strattonville Crescent
Port Perry, Ontario L9L 1W7
E-mail: geoff.carpentier@gmail.com

How do recent changes in Lake Erie affect birds? Part two: Zebra Mussels and Quagga Mussels

Doug Tozer and Gregor Beck

Figure 1. The non-native invasive Zebra Mussel (shown here) often has a distinctive zig-zag pattern on its shell, which is flattened on one side. By contrast, the non-native invasive Quagga Mussel (not shown) typically lacks the zig-zag pattern and has an all-rounded shell. *Photo: Bird Studies Canada.*

Over the past few decades, Lake Erie has been described as an environmental disaster, as well as a great conservation success. The health of the lake reached a low point in the 1960s and 1970s, but improved greatly by the 1980s (Makarewicz and Bertram 1991). Now, by contrast, we are hearing about harmful algal blooms, botulism, invasive species, climate change and other issues threatening Lake Erie water quality. The health of the lake is now, once again, at a low point. What's happening? Why does the health of the lake keep flip-flopping back-and-forth? What does it all mean for birds? This review article is part two of a series of three articles that will appear in *Ontario Birds.* The articles provide an overview of some of the current environmental and ecological issues for Lake Erie, with emphasis on the implications for the numerous bird species that depend on the lake for nesting and migration. There are dozens of worthy issues to profile. We chose to begin, in part one, with invasive *Phragmites* (Tozer and Beck 2018). In part two, we tackle the invasive Zebra Mussel and Quagga Mussel (*Dreissena polymorpha* and *D. rostriformis bugensis*, respectively). In addition to a review of each issue, the articles will also present new analysis of relevant citizen science data and suggest actions that we, as birders, can take to help alleviate the issues.

The Zebra Mussel and Quagga Mussel are invertebrate bivalve mollusks that live in freshwater (Figure 1). Individuals of both species filter feed with remarkable efficiency, each moving up to 1 L of water per day through their relatively tiny shells (1 mm to 3 cm in length) to their digestive tracts. Food, which is trapped by layers of mucous, consists of phytoplankton and zooplankton that drift through the water. Both species, once mature, anchor themselves with root-like byssal threads to diverse substrates, which for Zebra Mussels usually consist of hard surfaces, such as rock, wood, plastic and fibreglass, and for Quagga Mussels just about any surface (Snyder *et al.* 1990). Less commonly, both species are found on soft substrates, including mud, sand, and aquatic plants, and because of this they are capable of transforming entire substrates from soft to hard bottom (Berkman *et al.* 1998, Petrie and Knapton 1999).

The two species of mussels are native to the Black Sea and Caspian Sea and adjacent regions of the Middle East. They were first detected in North America in Lake Erie during the mid-to-late-1980s (Carlton 2008). Both species probably arrived here in ship ballast water dumped by ocean-going freighters (Griffiths *et al.* 1991). They have since spread throughout much of the Great Lakes, including Lake Erie, where they cover thousands of square kilometres of substrate to depths of several centimetres above the bottom surface (Berkman *et al.* 1998). With the help of free-swimming planktonic larvae and unintended transport by humans, they have spread well beyond the Great Lakes and now occupy 34 US states and three provinces (check out the animated online maps showing the spread across North America over the years provided by Benson *et al.* 2019a,b). The Zebra Mussel has spread farther and faster than the Quagga Mussel (Karatayev *et al.* 2011a), perhaps because its flat side and stronger and faster-growing byssal threads allow it to adhere better to hard substrates, such as recreational boats, that can be transported to new locations by people (Peyer *et al.* 2008). Relatively faster growth of the Zebra Mussel may also contribute to its capacity for rapid population establishment and range expansion (Karatayev *et al.* 2011b). It likely was for those reasons that the Zebra Mussel initially was more common in Lake Erie, reaching peak population density as early as 1989, but since then the Quagga Mussel has become the dominant species, reaching peak density between 1998 and 2002. For example, on a lake-wide basis between 2009 and 2012, Quagga Mussels comprised 87% by density (individuals per m^2) and 98% by biomass (g of tissue and shell per m^2) of Zebra and Quagga mussels combined (Karatayev *et al.* 2014). The increasing dominance of the Quagga Mussel is probably partly due to its higher tolerance of a broader range of conditions (e.g., water depth, temperature) and its slower metabolism which allows for better survival during food shortages as compared to the Zebra Mussel (Karatayev *et al.* 2015).

Both of these species can wreak havoc just about anywhere populations become established. They clog water intake pipes at electrical power generation stations and drinking water treatment facilities and coat docks, boats and buoys (Connelly *et al.* 2007). Their efficient filter feeding improves water clarity and increases light penetration, which allows for more abundant algae and plant growth. Subsequently, this can lead to large amounts of dead algae washing up on beaches, causing a nuisance for swimmers and other beachgoers (Aur *et al.* 2010). Further, the dense mats of sharp mussel shells found along shorelines and beaches are another reason swimmers detest them. The two mussels are so efficient in their collective filter feeding that they reduce populations of some native invertebrates through competition for the same food. For example, the once abundant bottom-dwelling amphipod *Diporeia* is now likely extirpated from Lake Erie, which has been partially attributed to the mussels (Barbiero *et al.* 2011, Watkins *et al.* 2012). The apparent extirpation of *Diporeia*, in turn, appears to have negatively affected some populations of fish, which depend directly or indirectly on *Diporeia* for food, such as the commercially valuable lake whitefish (*Coregonus clupeaformis*) (Nalepa *et al.* 2005). The high nutrients, warmer temperatures and low oxygen in the water within Zebra Mussel and Quagga Mussel beds stimulate bacteria to produce type-E botulism toxin (Getchell and Bowser 2006) which has been transferred by multiple pathways up the food chain. The botulism toxin can cause large die-offs of mussel-eating and fish-eating birds (Pérez-Fuentetaja *et al.* 2011). There will be more information about this topic in our third and final article in this review series. Zebra Mussels and to a lesser extent Quagga Mussels, attach to and cover the surface of some native mussels to the point of smothering them, effectively cutting off their source of food and ultimately causing their local extinction (Ricciardi *et al.* 1998b). Remarkably, densities of the two non-native mussels combined sometimes reach hundreds of thousands of individuals per m^2 in Lake Erie (Leach 1993) and over 14,000 individual Zebra Mussels have been found attached to the shell of a single native mussel (Schloesser and Nalepa 1994). Indeed, 16 of the 41 (39%) mussel species native to Ontario are currently listed as special concern, threatened, or endangered, and in nearly every case, at least partially due to Zebra Mussels (Ministry of the Environment, Conservation and Parks 2019).

There is, perhaps, a bit of a bright side to some of this. Species richness, density and biomass of native invertebrates like aquatic insects, snails and crustaceans are often many times greater within large, extensive beds of Zebra Mussels and Quagga Mussels compared to adjacent unoccupied lake bottom (Burlakova *et al.* 2012). This is likely because the shells of the mussels provide more abundant and complex substrates for shelter, plus the mussels collect nutrients from the extensive water column and pump them back out in concentrated form in their feces, all of which increases available resources locally for native invertebrates living on the substrate (Ricciardi *et al.* 1998a). The elevated populations of native invertebrates, in turn, appear to benefit certain fish, such as the yellow perch (*Perca flav-escens*), which are sought after by anglers (Cobb and Watzin 2002). The beneficial influence on invertebrates and other wildlife occurs only in relatively shallow water (<20 m); however, in deeper water, the mussels tend to cause declines in populations of invertebrates, like *Diporeia* discussed earlier (Burlakova *et al.* 2018). As noted above, the Quagga Mussel is becoming relatively more common over time in Lake Erie, whereas the Zebra Mussel has been declining. These trends bode well for native mussels because Quagga Mussels are less likely to attach to other mussels, and therefore, are less likely to depress or eliminate populations of native mussels (Burlakova *et al.* 2014b). Indeed, surveys show that as Quagga Mussels increase and Zebra Mussels become less abundant, the number of native mussels with attached Zebra Mussels and Quagga Mussels declines to a third, and the number of non-native invasive mussels attached to native mussels decreases by tenfold (Burlakova *et al.* 2014b). Overall, however, Zebra Mussels and Quagga Mussels have completely altered the entire ecology of the Lake Erie ecosystem, with many negative consequences and relatively few positive ones (Burlakova *et al.* 2014a).

What about birds? Might there be a bright side in this story for them? Early in the invasion and for some time thereafter, some waterfowl species, including scaup (*Aythya* spp.), Bufflehead (*Bucephala albeola*), Common Goldeneye (*Bucephala clangula*), scoters (*Melanitta* spp.) and Long-tailed Duck (*Clangula hyemalis*) switched to eating Zebra Mussels and Quagga Mussels, in some cases almost entirely (Figure 2). Prior to the invasion of non-native mussels, Lesser Scaup (*Aythya affinis*) staging in autumn and spring in 1986 in Lake Ontario consumed 86% (aggregate dry mass) native plant-eating snails (Ross *et al.* 2005). The proportion of native snails declined to 16% in 1999 and 2000, well after the arrival of Zebra Mussels and Quagga Mussels, which by then made up 67% of the scaup's diet (Badzinski and Petrie 2006). Similarly, in Lake Erie, the diet of staging scaup consisted of 39-99% Zebra and Quagga Mussels between 1992 and 2000, depending on the location (Custer and Custer 1996, Petrie and Knapton 1999, Badzinski and Petrie 2006). The ducks feed so heavily on the mussels in some places that they significantly reduce the number of mussels by several fold, although it is unlikely that they will reduce the mussel population across all of Lake Erie (Petrie and Knapton 1999, Mitchel *et al.* 2000). It is not surprising that the ducks switch to eating the mussels because the mussels are extremely plentiful, typically occur in dense concentrations and are high in protein. Further, the ducks' gizzards seem to be able to handle processing the hard shells easily enough (Snyder *et al.* 1990). The increased populations of invertebrates

Figure 2. The Common Goldeneye is just one of several species of waterfowl that may have benefited from eating non-native Zebra Mussels and Quagga Mussels since they invaded Lake Erie and the rest of the Great Lakes. The mussels also indirectly benefit these ducks because various invertebrates that the birds are fond of eating are found at higher population levels amongst the mussels' shells. On the negative side, the mussels are a source of contaminants for the ducks, and sometimes a source of the lethal type-E botulism toxin. *Photo: Tim Arthur*

around the mussel beds also benefit diving ducks, like Common Goldeneye (Figure 2), Long-tailed Duck, and especially Bufflehead, because they are particularly fond of eating the elevated numbers of shrimp-like crustaceans and midge fly larvae found amongst the mussel shells (Schummer *et al.* 2008a).

The potential problem with the switch in diet is that the super-efficient filter feeding by the mussels accumulates various contaminants in the mussels at very high levels, including polychlorinated biphenyls (PCBs) and heavy metals (Mazak *et al.* 1997). By contrast, the comparatively less contaminated native plant-eating snails are presumably much healthier for the ducks (Ross *et al.* 2005). Indeed, high levels of contaminants, especially selenium, are found in both the mussels and the ducks (Custer and Custer 2000, Petrie *et al.* 2007, Schummer *et al.* 2010, Ware *et al.* 2011). Selenium is a naturally-occurring element and is required in trace amounts for everyday cell function in animals, but when acquired in large enough doses it causes physiological problems (US Department of Health and Human Services 2003). For instance, elevated body burdens of selenium in birds can cause reduced hatchability of eggs and deformities in

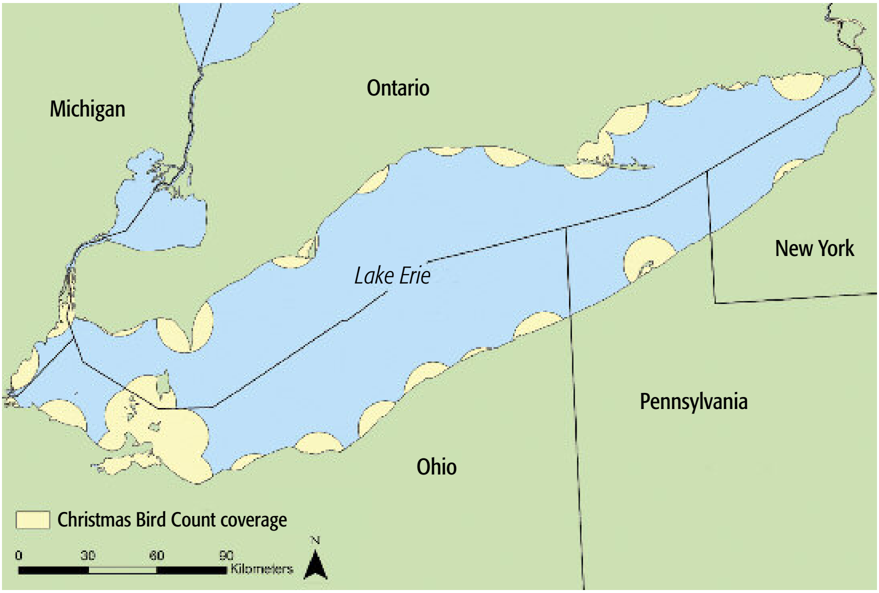


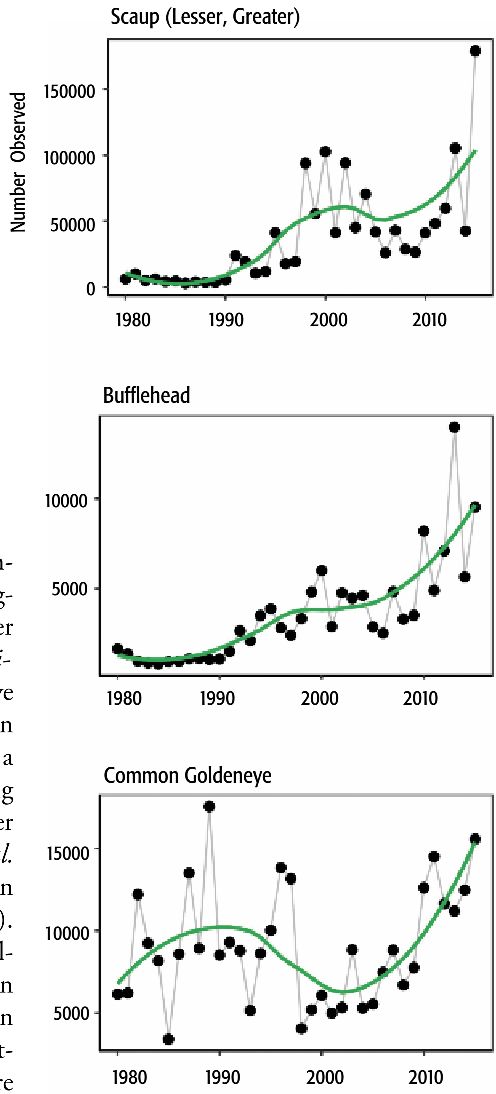
Figure 3. Areas surveyed by the Christmas Bird Count on Lake Erie.
Data source: Bird Studies Canada and Audubon.

in embryos, and oxidative stress can inhibit enzyme and protein function, all of which can lead to reductions in reproductive success and survival (Spallholz and Hoffman 2002). The main source of selenium in the water of the lower Great Lakes is likely various industrial activities, such as coal-fired power generation and fossil fuel combustion, which are known to produce selenium as a by-product, although other sources such as agricultural runoff are possible. The selenium then makes its way to air, then water, and is subsequently taken up by the mussels (Lemly 2004). Reflective of this pattern is the observation that selenium levels in ducks staging on the lower Great Lakes are higher closer to heavy industrial areas compared to farther away (Schummer *et al.* 2010). This leads to the question of whether the elevated contaminant levels in the ducks are high enough to significantly affect the ducks' reproduction and survival?

The stakes associated with the question are high. Much larger numbers of some waterfowl species now stage or overwinter on Lake Erie since Zebra Mussels and Quagga Mussels have become common (Petrie and Badzinski 2007). This of course means that much larger numbers of ducks are also now exposed to the potentially negative effects of selenium and other contaminants picked up from eating the mussels. To illustrate these stakes, we used data from the Christmas Bird Count (coordinated in Canada by Bird Studies Canada, and in the US by the National Audubon Society) to plot numbers of waterfowl

Figure 4. Number of individuals of some mussel-eating ducks observed during Christmas Bird Counts on Lake Erie between 1980 and 2015. See Figure 3 for survey locations. Dots are grand totals of all individuals observed on all counts in a particular year; lines of best fit are superimposed on observed counts to show overall trajectory. All species show major or moderate increases in the most recent years, with scaup and Bufflehead relatively scarce before the mussel invasion (~late-1980s) and dramatically more common afterwards.

Raw sums of observed individuals are shown because adjustments for differences among years in effort and area surveyed (e.g., birds per party hour per ha of lake surveyed) yielded nearly identical patterns.



observed over the years in late autumn-early winter throughout Lake Erie (Figure 3). Our analysis shows that Lesser Scaup and Greater Scaup (*Aythya marila*), Bufflehead and Common Goldeneye all show major or moderate increases in the most recent years, probably due to a variety of factors, including decreasing coverage and duration of ice cover over the years (Wang *et al.* 2012, Mason *et al.* 2016), as well as increasing reliance on invasive mussels for food (Figure 4). Notably, scaup and Bufflehead were relatively scarce before the mussel invasion and became substantially more common afterwards (Figure 4). Some of these patterns have been noted by others before and after the mussel invasion at Long Point and Point Pelee on Lake Erie (Wormington and Leach 1992, Petrie and Knapton 1999). The degree to which certain duck species consume mussels varies depending on time and location, particularly for Bufflehead and Common Goldeneye (i.e., sometimes in some places they eat lots of the two mussels, and sometimes they do not) (Petrie and Knapton 1999, Schummer *et al.* 2008b). It seems likely, however, that the patterns we observed in our analysis for Lesser Scaup and Greater Scaup especially, and Bufflehead, were caused, at least in part, by a switch to eating mainly Zebra Mussels and Quagga Mussels (Petrie and Knapton 1999). Our analysis shows that hundreds of thousands of individuals of mussel-eating ducks are likely exposed to contaminants while staging or overwintering on Lake Erie.

The problem is potentially quite big, but is it actually negatively affecting the reproduction and survival of the ducks? On the reproduction side of things, studies have measured selenium and other contaminants in female scaup when they arrive on their boreal breeding grounds and found levels low enough to be of little or no concern (Fox *et al.* 2005, Matz and Rocque 2007, DeVink *et al.* 2008a, Badzinski *et al.* 2009). This may occur because as the ducks head north, and get farther away from the Great Lakes, they no longer take on contaminants because they are no longer eating contaminated mussels, and the more the ducks' livers and kidneys are able to eliminate the high amounts of selenium from their bodies (Petrie and Badzinski 2007). Thus, they are able to reproduce without jeopardizing the hatchability of their eggs or the health of their embryos. What about survival? To get at this one, researchers got quite ambitious. It seemed clear that selenium was at high levels in the ducks because they were eating tainted Zebra Mussels and Quagga Mussels, but how to know if the ducks' health and survival was being negatively affected because of it? The clincher: experimentally feed captive scaup with low, medium, and high doses of selenium over the range found in the wild and directly measure their health and survival, including measures of oxidative stress and immune function. This huge undertaking was accomplished with 54 captive scaup housed in outdoor pens at a facility near Aylmer, Ontario (Brady *et al.* 2013), plus another 46 captive birds kept in similar cages in Laurel, Maryland (DeVink *et al.* 2008b). Surprisingly, no differences were found among the treatment groups. The survival and health of the high-dose birds was no different than the low-dose birds (DeVink *et al.* 2008b, Brady *et al.* 2013). The researchers also found no relationship between high levels of selenium and various health measures in wild, free-living scaup wintering in Hamilton Harbour on Lake Ontario (Ware *et al.* 2012). Conclusion: the ducks take on lots of selenium from the mussels, but it is not enough to negatively affect their health and survival. All the available evidence to date suggests that mussel-eating ducks on Lake Erie and the rest of the lower Great Lakes are not at risk from the high levels of selenium they acquire as a result of eating Zebra and Quagga Mussels. Indeed, numbers of breeding scaup and other duck species that often consume the two species of mussels, such as Bufflehead, have increased by several fold throughout their ranges over the past decade or so (Canadian Wildlife Service Waterfowl Committee 2017, US Fish and Wildlife Service 2018).

Figure 5. The number of staging and overwintering scaup (shown here) and other species of mussel-eating ducks has increased dramatically to hundreds of thousands of birds on Lake Erie since the invasion by non-native invasive Zebra Mussels and Quagga Mussels.

It is sobering to consider "what could have been" if the high levels of selenium that these birds ingest when eating the mussels were to seriously negatively affect their reproduction and survival.

Photos: Jeremy Bensette

So what does this all mean? Probably the most important and sobering message for waterfowl is "what could have been." Just imagine if the reproduction and survival of the hundreds of thousands of scaup and other species of waterfowl that eat contaminated Zebra Mussels and Quagga Mussels on Lake Erie and the rest of the lower Great Lakes (Figure 5) had been seriously negatively affected. Those species might be experiencing population declines large enough for them to be listed as species at risk. Therefore, as with invasive *Phragmites*, the take-home message is that we need to be extremely careful when it comes to invasive species and take preventative measures to avoid their establishment and spread (Tozer and Beck 2018). In the case of Zebra Mussels and Quagga Mussels, we may have gotten off somewhat easy, at least with respect to the ducks and selenium issue, but that is only part of the story since these invasive mussels have had broader environmental and social impact. We recommend collectively taking the time to learn more about invasive species issues and ways to prevent them. Some good ways to start include reviewing actions that can be taken while birding or pursuing other recreation in or near lakes to prevent the spread of invasive species, such as cleaning gear and boats before moving between locations (see summary at Ministry of Natural Resources and Forestry 2019). Also, learning more about government policies and recommended policy changes to deal with invasive species in Ontario (read Environmental Commissioner of Ontario 2019) would be a good idea. Spreading the message about ways to limit the spread of invasives around the Great Lakes is an important task for all of us. Currently, at least, Zebra Mussels and Quagga Mussels do not appear to be an issue for mussel-eating ducks, as far as selenium in their diet is concerned; in fact, the mussels are likely a dietary benefit to them, as long as they are not tainted with botulism toxin. By contrast, the very negative effects of these two invasive species on native mussels especially, and the Lake Erie ecosystem as a whole, is something that is too easily forgotten in the larger scheme of things.

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Doug Tozer
Long Point Waterfowl and Wetlands Research Program
Bird Studies Canada
P.O. Box 160
Port Rowan, Ontario N0E 1M0
E-mail: dtozer@birdscanada.org

Gregor Beck
Bird Studies Canada
P.O. Box 160
Port Rowan, Ontario N0E 1M0

Purple Martin death by entrapment in a House Sparrow nest

Justin Peter

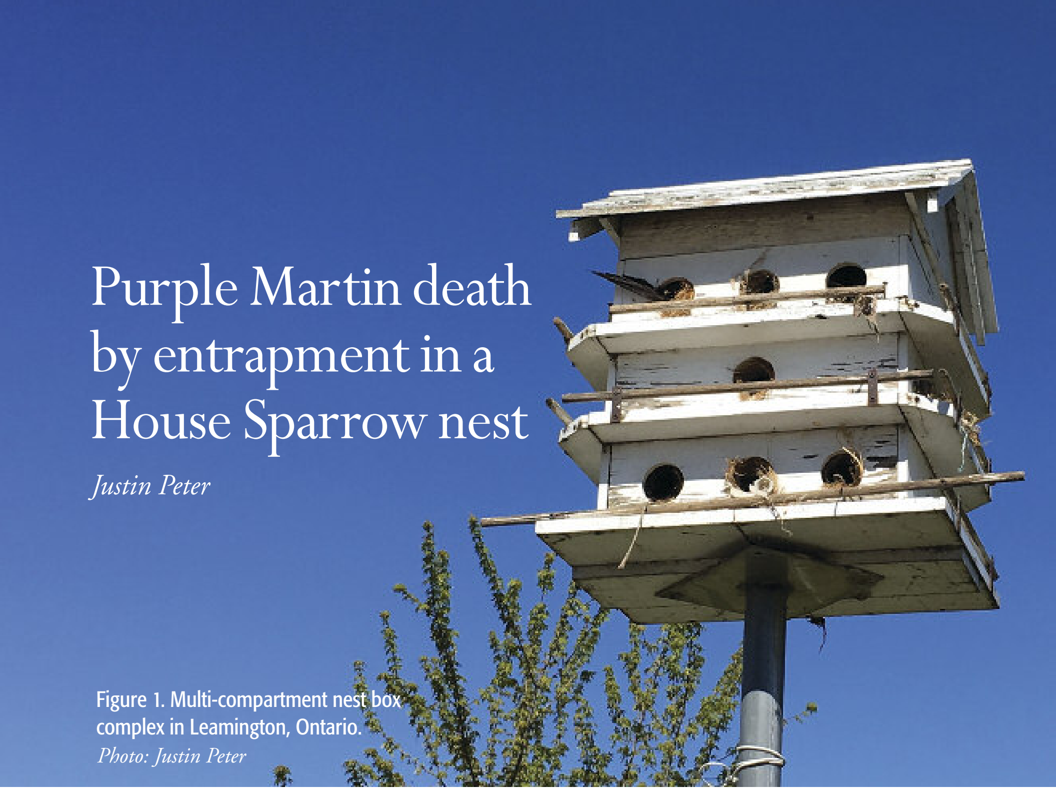

Figure 1. Multi-compartment nest box complex in Leamington, Ontario. *Photo: Justin Peter*

Introduction

In the late afternoon of 12 May 2017, I was observing a multi-compartment nest box complex in Leamington, Ontario (Figure 1). This artificial structure was occupied by multiple breeding pairs of both Purple Martin (*Progne subis*) and House Sparrow (*Passer domesticus*). While studying the activities of these birds at the house, I noticed that a bird's right wing was protruding from one of the entrance holes; the wing was stationary and its entire length from the carpal joint to the tips of the primaries was visible (Figures 1, 2). Owing to its suspended appearance and angle within the entrance, it appeared to be attached to a body. Most of the hole's right half was occluded by nest material consisting of dried grass stalks, which emanated from the hole (Figures 1, 2); it was not possible to see any more of a presumed bird inside. Based on the appearance of the wing and the fine nesting material as well as the current occupancy of the housing complex, I deduced that the wing must belong to a Purple Martin and that the nest inside had been constructed by House Sparrows. Purple Martin nests generally contain coarser dried vegetation that is deposited neatly within the cavity; if it projects from the cavity, it does so at the bottom of the hole, not along the sides, and is mixed with mud (pers. obs.) (Figure 3). The wing was not present when I observed the nest box complex approximately 24 hours prior, on 11 May 2017. I requested and received permission from the property owner to conduct a hands-on investigation.

Figure 2. Purple Martin wing protruding from nest compartment entrance, attached to a body entangled in the grass of a House Sparrow nest. *Photo: Justin Peter*

On 15 May 2017, the wing was still present and I used a ladder to gain access to the exterior of the compartment. I attempted to flex and extend the wing of the bird and I palpated just inside the compartment entrance to the base of the wing, determining that the wing was indeed attached to a body. The body's right side was positioned lengthwise along the compartment's front inside wall with the head lower than the bird's rear. The grass stalks in the entrance hole obscured the bird's head, which was wedged within them. I extracted the bird from the cavity (Figure 4). The bird was a dead adult (after second-year) female Purple Martin (Hill 2002). Its head was cocked to the left and its tail feathers were bent towards the bird's right side. In addition, its vent feathers were soiled by feces (Figure 5). It had dabs of feces on its central breast feathers as well and had two poultry feathers adhering to its underside. Its right leg was extended with toes partly flexed, and the left foot was in a perching position with the toes extended. The bird did not have any obvious signs of external trauma. Based on the position of the right leg, it appears that the bird was attempting to thrust itself forward. Is it possible that this martin died due to its inability to exit the cavity?

Figure 3. Nest compartment in multi-cavity complex with a typical Purple Martin nest, showing coarse materials mixed with mud spilling out of the compartment.

Figure 4. Female Purple Martin extracted from the nest compartment. Grasses extruding from the entrance hole had obscured the bird's head, which was wedged within them.

Photos: Justin Peter

Figure 5. Female Purple Martin extracted from nest compartment with its head cocked to the bird's left and tail feathers bent towards its right side. Note vent feathers soiled by feces. *Photo: Justin Peter*

The House and Nest Compartments

The house contained 18 compartments. The complex's compartment entrance holes were approximately 5 cm in diameter. Based on this dimension, I estimated a cavity's interior dimensions to be approximately 15 cm x 15 cm x 15 cm. I was curious about the configuration of the nest within the compartment in question. By probing through the cavity entrance, I determined that the bottom of the nest compartment was padded with grass stalks. There were a couple of large poultry-like feathers embedded in the stalks just inside the entrance, and the grassy materials reduced the apparent diameter of the entrance by approximately 50%. Just inside the entrance, materials were arranged in such a way that formed a tunnel that veered towards the left, obscuring the rear wall of the cavity. Presumably, the tunnel met the compartment's left wall and led to a rear chamber where a nest cup would be situated. The copious use of grass stalks dressed over the walls and roof in a way that could form a tunnel-like structure was consistent with construction by House Sparrows (Harrison 1975, Indykiewicz 1991, Lowther and Cink 2013). Based on this, it appeared that the Purple Martin had entered a House Sparrow nest, which may or may not have been active. The orientation of the materials within the compartment would have prevented the martin from moving straight towards the rear wall after entering, and would also have prevented her from exiting the compartment by directly facing the entrance hole.

I observed the activity of birds at the house for approximately 15 minutes following the removal of the dead bird. Four compartments were being attended by after-second year (i.e., in definitive basic plumage) Purple Martin males and contained nests typical for this species. Six units were attended by House Sparrows and contained nest material with copious grass stalks typical of that species. Additional compartments appeared unoccupied but all contained House Sparrow-type nests, including the compartment that is the subject of this note. It is unknown whether the ensnared female Purple Martin had been investigating the nest cavity with designs on appropriating it.

Discussion

There is a paucity of records of bird death due to entrapment in nests; however, there are instances of death at nest sites that appear related to competition or predation. An Eastern Bluebird (*Sialia sialis*) died after being stuck to the pine resin oozing around the nest cavity hole of a Red-cockaded Woodpecker (*Picoides borealis*), presumably as the bluebird was investigating the cavity as a potential nest site (Dennis 1971). A Steller's Jay (*Cyanocitta stelleri*) was ensnared by fishing line that had been incorporated into the nest of a Bullock's Oriole (*Icterus bullockii*) possibly as the jay was investigating the nest for potential prey in the form of eggs or nestlings (Iron and Pittaway 1995).

The Purple Martin is a secondary-cavity nester and its eastern population breeds almost exclusively in artificial multi-compartment nest box complexes close to humans, effectively forming colonies in such places (Brown and Tarof 2013). Both males and females may defend multiple cavities against conspecifics of the same sex, at least early in the breeding season. In unmanaged colonies, Purple Martins may compete with introduced House Sparrows, which — while not obligate cavity nesters — take readily to artificial cavities and may also breed in loose aggregations in such places (Jackson and Tate 1974, pers. obs.). A House Sparrow nest built within an enclosed space may be a mere cup of vegetation at the bottom of the compartment or may be built up so that nest material covers sides as well as top of nest box chamber (Indykiewicz 1991), expanding to fill the available volume (Lowther and Cink 2013). Without human intervention and management of martin nest box complexes, sparrows may cause the local extirpation of martins by appropriating nest cavities and making them permanently unsuitable for martin use (Brown and Tarof 2013); this may be due to the obstructive nature of the nest itself. However, Purple Martins sometimes appropriate a compartment that contains a partly built House Sparrow nest, using grass placed by sparrows as base for their nest; these nests may contain feathers brought in by sparrows, which martins do not try to discard (Brown and Tarof 2013).

A Purple Martin's total length is 20 cm whereas a House Sparrow's length is 16 cm (Dunn and Alderfer 2017). Given the compartment's actual dimensions and the reduction in effective accessible space due to the presence of the House Sparrow nest as well as the orientation of the materials, the Purple Martin's maneuverability within the compartment would have been compromised. Furthermore, the position of the victim's head, buried as it was in the grass stalks that partly blocked the entrance hole, suggests that the reduction in the hole diameter was also a factor in the martin's death. Whereas a sparrow's nest, filling a compartment as it may, might ordinarily outright repel a Purple Martin or other larger birds, the victim in this instance made a fatal mistake by entering but not being able to exit the compartment. The soiled vent in addition to the position of the martin's legs and bent tail feathers suggest that the bird became stuck in attempting to exit the compartment but was unable to progress, and that the style of House Sparrow nest presented an obstacle to her movement. This is the first known record of a Purple Martin death by entrapment in a House Sparrow nest.

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Justin Peter
491 King Street East
Toronto, Ontario M5A 4l1
E-mail: jbpetr@yahoo.ca

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Editors:
Chip Weseloh, 1391 Mount Pleasant Road,
Toronto, Ontario M4N 2T7

Ken Abraham, 434 Manorhill Avenue,
Peterborough, Ontario K9J 6H8

Chris Risley, 510 Gilmour Street,
Peterborough, Ontario K9H 2J9

Ornithological Consultants: Glenn Coady, Michel Gosselin, Ross James and Mark Peck

Cover Art: Barry Kent MacKay

Advertising: Mark Cranford
advertising@ofo.ca

Design/Production: Judie Shore

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