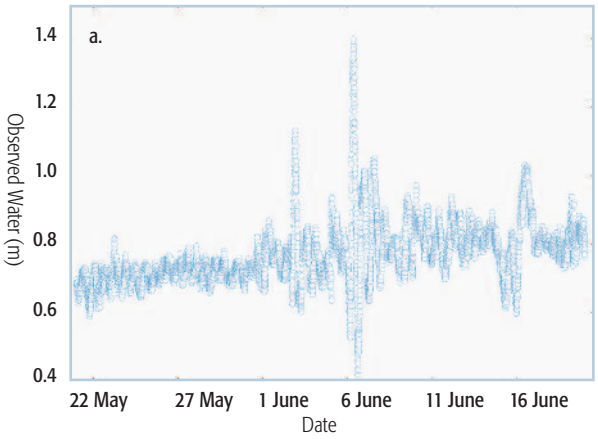
Successful renesting of Caspian Terns on Mohawk Island, Lake Erie, after complete colony failure

Laura E. King and Shane R. de Solla

The Caspian Tern (*Hydroprogne caspia*, formerly *Sterna caspia*) is the world's largest tern and nests globally in dense colonies in and around bodies of water. In Ontario, on the Great Lakes, they nest regularly on Lakes Huron, Ontario, and Erie, generally on islands, peninsulas, or protected beaches. Caspian Terns nest on sand, gravel, or limestone substrates with little or no vegetation (Ludwig 1965, Quinn and Sirdevan 1998). At Mohawk Island (also known as Gull Island), in eastern Lake Erie between the communities of Port Maitland and Lowbanks, a colony nests on a beach consisting almost exclusively of crushed Dreissenid (zebra and quagga) mussel shells. The earliest recorded colony on Mohawk was 80 pairs in 1996 (Morris 2010) and since then the colony has fluctuated between 165 and 441 nests from 2002 to 2009. Mohawk Island is a federally protected National Wildlife Area (NWA) and hosts important breeding colonies of Double-crested Cormorants (*Phalacrocorax auritus*), Herring Gulls (*Larus argentatus*), and Ring-billed Gulls (*Larus delawarensis*). The island previously provided breeding habitat for Common Terns (*Sterna hirundo)* but their last reported nesting was in 2004 (Morris 2010), although the species has been sighted in 2009 and 2010 flying near the island. Other waterbirds and passerines (various species of ducks, swallows, etc.) are sighted on and around the island regularly.

During the course of our research on Double-crested Cormorants, we visited Mohawk Island several times during the summers of 2009 and 2010. On 6 June 2010, a large seiche (a standing wave in a closed body of water such as a lake) caused a nearly one metre rise in water levels in eastern Lake Erie (Figure 1). Lake Erie is prone to large seiches because of its location, shape, and shallow western basin (NOAA 2003, Litchkoppler 2009). When storms blow in from the southwest, as is common, a seiche is set up on the lake, and the water from the southwestern end of the lake is pushed towards the northeastern end. This can temporarily cause very high water levels in the northeastern end, where Mohawk Island is located.



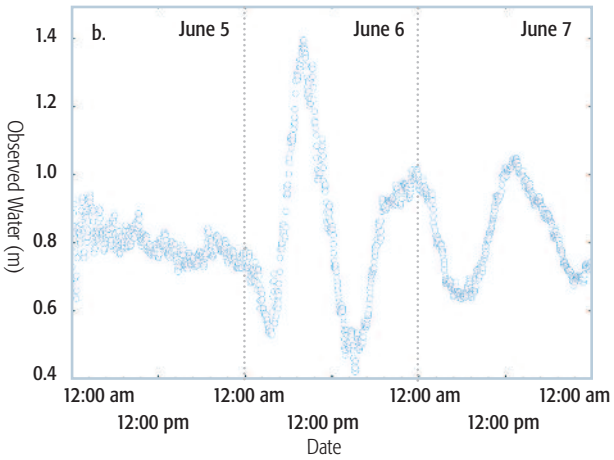


Figure 1. Water levels (relative to sea level) at Port Colborne, Ontario, east of Mohawk Island;
a) from 21 May to 20 June 2010;
b) from 5 June to 7 June 2010. Data from Port Colborne weather buoy (42.866667 N, 79.25 W). *Canadian Hydrographic Service, Fisheries and Oceans Canada.*

Seiches and often their associated storms are an important part of the ecology and structure of the Great Lakes (Trebitz 2006), moving nutrients to open waters (Bouchard 2007) and affecting multiple species including mussels (Bowers and de Szalay 2005) and fish (Roseman *et al.* 2001).

Before our first trip to the island, we were told it had been submerged two days prior (M. Walker, pers. comm.). When we arrived, we found multiple piles of whole and broken eggs clustered together from 10 to 20 m from the eastern edge of the island (Figure 2). The tern colony was located on the east portion of the island, from about 20 m inland to within 20 cm from the water's edge (Figure 3). Given that the algae mats were washed throughout the centre of the island, it was apparent this seiche was high enough to destroy virtually all of the Caspian Tern nests on the island. We counted 271 whole or broken tern eggs, but many eggs may have been lost, so the number of eggs destroyed is likely higher. Any chicks that hatched by 6 June would also have been also lost. On 8 June, one lone Caspian Tern chick, newly mobile, ran across the beach at our approach. After that one day, it was not seen again. Most Ring-billed Gull nests and many Herring Gull nests were also destroyed, as the seiche covered much of the island (Figure 3). Double-crested Cormorants nest

Figure 2. Caspian Tern eggs destroyed by the 6 June 2010 seiche. 8 June 2010.
Photo: Shane de Solla

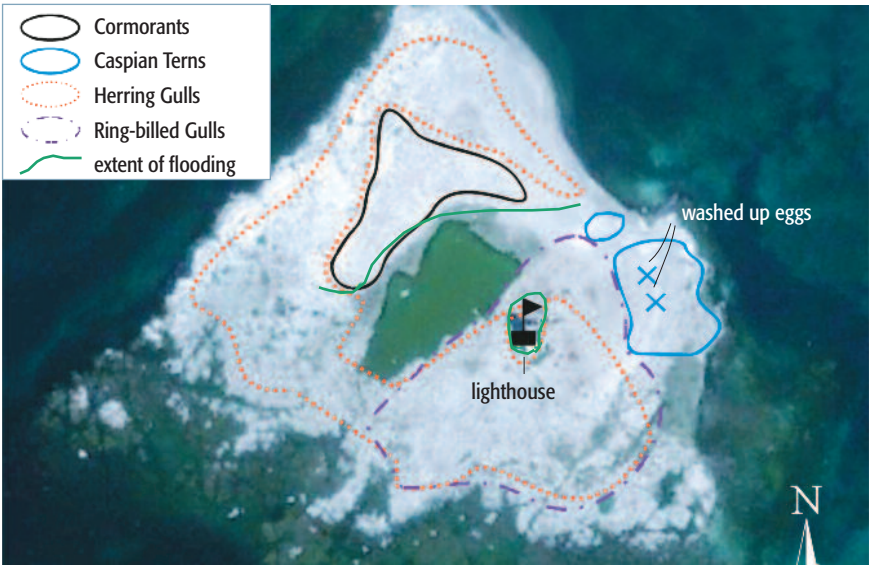


Figure 3. Approximate location of Caspian Tern (*Hydroprogne caspia*), Herring Gull (*Larus argentatus*), and Ring-billed Gull (*Larus delawarensis*) colonies, with estimated extent of flooding caused by a seiche, 6 June 2010. *Modified from Google Earth*

primarily at the highest elevation of the island, surrounded by some Herring Gull nests, and thus these were largely spared; however, some cormorant clutches of late nests at lower elevations may have been destroyed. During our visits in early June, the terns in the colony were loafing but not incubating, and actively foraging throughout the day. On 10 June, we observed several pairs of terns mating (Figure 4), and by 6 July, we noticed many terns sitting in nest depressions. That same day, we checked the colony and found that most nest depressions in one area contained either one or two eggs. We counted 361 nests on 8 July and by then several chicks had hatched, and by 15 July many days-old chicks were discovered in nest depressions (Figure 5). We observed a few new Ring-billed Gull nests, but no new Herring Gull nests, on the days following the seiche.

The ability of a female to lay a new clutch of eggs after the original is destroyed is termed renesting. Renesting is common to ground nesters, including ducks, coots, turkeys, terns, and gulls, who typically face a variety of challenges such as predation and/or nest destruction through changing environments. Terns generally lay one clutch per season, but if clutches and/or chicks are destroyed, renesting can occur. Renesting has been documented previously in all species of terns, including but not limited to Caspian Terns (Cuthbert 1985, 1988), Least Terns (*Sterna antillarum*) (Massey and Fancher 1989), Black Terns (*Chlidonias niger*) (Eichhorst and Reed 1985), and Common Terns (Wendelin *et al.* 2000).

Figure 4. Caspian Tern colony (with Ring-billed Gull colony and Herring Gull in foreground) on Mohawk Island, Lake Erie. The majority of the Caspian Terns are standing, but a few in the foreground can be seen sitting on nests. On the right side of the photo, in the background, a copulating tern pair can be seen. 10 June 2010. *Photo: Laura Elizabeth King*

Caspian Terns on the Great Lakes often begin to lay eggs around 5 May, with young by 1 June (Ludwig 1965). Peak laying period on the Great Lakes typically is 7 May–1 June (Cuthbert and Wires 1999). Juveniles then fledge from colonies in July and August; however, laying can continue up to the beginning of August if renesting is occurring. Our observed colony lost hundreds of eggs, and presumably many chicks, on June 6; if previous research applies to the Mohawk Island colony, it would seem that the peak laying period was already over by the time they lost their nests.

When a large number of pairs lose nests at once due to flooding, the colony can move to a slightly different site within the general area (Cuthbert 1988), which we partially observed in that a portion of the colony moved a short distance (approximately 20 metres). Suitable Caspian Tern nesting habitat on Mohawk Island is limited to the eastern-most portion of the island, and only on crushed mussel shells. Furthermore, the majority of the surrounding territory was occupied by Herring or Ring-billed Gulls. If more habitat had been available, it is probable that the Caspian Tern colony would have moved farther away from the original site of nest destruction.

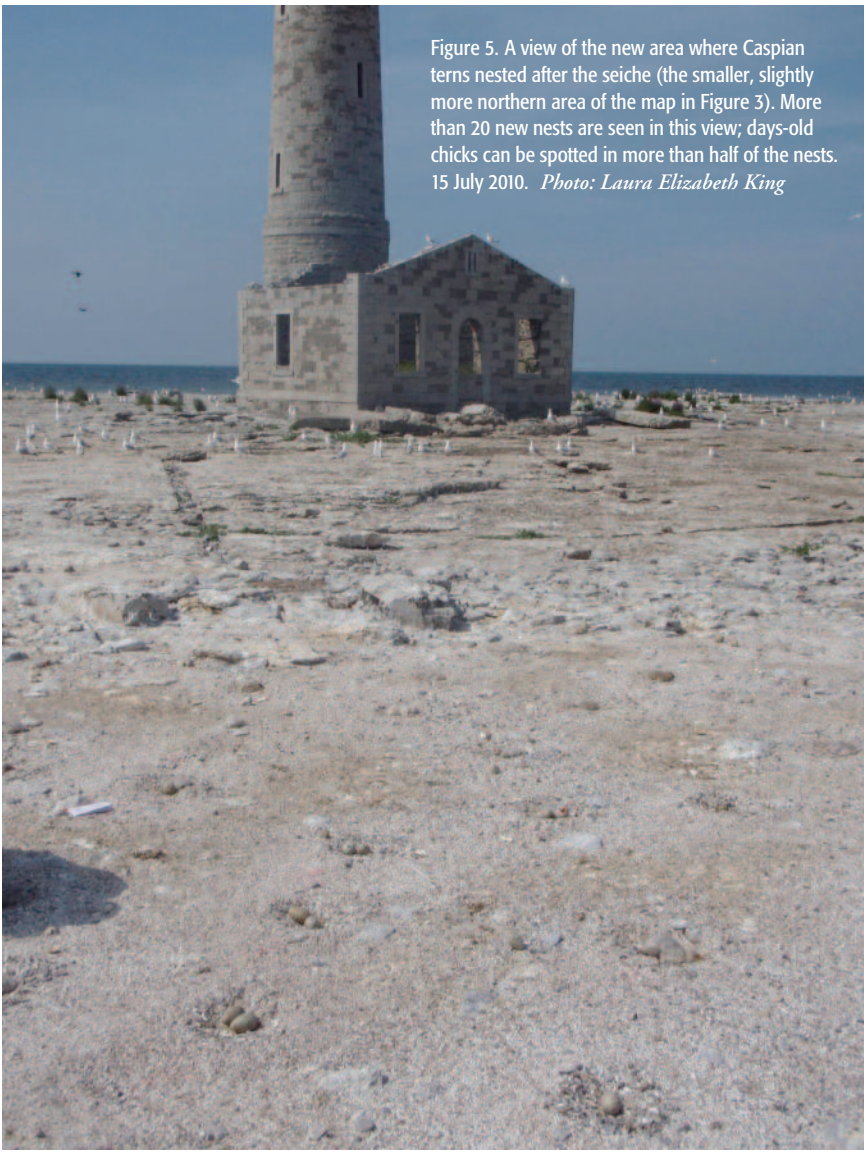


Figure 5. A view of the new area where Caspian terns nested after the seiche (the smaller, slightly more northern area of the map in Figure 3). More than 20 new nests are seen in this view; days-old chicks can be spotted in more than half of the nests. 15 July 2010. *Photo: Laura Elizabeth King*

Many factors affect renesting, depending upon the individual and the species. Renesting has been connected with female age, nesting experience, body condition, investment in previous clutch(es), available food, or date (Arnold *et al.* 2010). In American Coots (*Fulica americana*), renesting may be more affected by time and habitat quality than by the amount of food available to the female.

Water levels may also be an important renesting cue (Arnold 1993). In Mallards (*Anas platyrhynchos*), renesting is dependent on variables such as nesting season length, stage of incubation, and date of nest loss. There is some evidence that older females and those in better condition are more likely to renest, but overall the best predictor of renesting was date of nest initiation (Arnold *et al.* 2010). Replacement clutches tend to have fewer and smaller eggs than the initial clutch (Brown and Morris 1996). Furthermore, the egg mass of renests tend to be lower the later the initial egg loss occurred (Wendelin *et al.* 2000). The seiche on Mohawk Island occurred soon (approximately three weeks) after the Caspian Terns first started nesting, whereas both species of gulls, being earlier nesters, would have had less opportunity or incentive to renest.

In terns, it is likely that predictable environmental cues, especially water levels, allow pairs to time and place nests to avoid flooding and thus renesting (Reinert 2006); however, unpredictable seiches can still cause colony washout, especially when available habitat is constrained by island size, proximity to competing colonial waterbirds, and availability of suitable nesting substrate. Tern renesting in the few studies to date has been variable — Shugart *et al.* (1979) calculated up to 66% of pairs renested; Cuthbert (1988) reported 46% of pairs who had nests wash out renested within two to three weeks; Penland (1976, 1981) found that as little as 7% of the pairs renested. Specific experiments to determine factors affecting renesting in Caspian Terns have not been performed, but this would be an interesting area for future studies.

Given that weather is often unpredictable in the island nesting areas of Caspian Terns, an adaptation to be able to renest quickly following nest loss is highly advantageous. At this colony on Mohawk Island, Lake Erie, the majority of pairs seemed to be able to lay two eggs again within the breeding season and successfully raise their clutch, despite sporadic human disturbances and the inherent habitat limitations of a small and crowded island.

Acknowledgements

We would like to thank our very capable field assistants Kyna Intini and Kimberley Palonen. Funding was provided by the Chemical Management Plan, Environment Canada, and by an NSERC award to LEK. Many thanks to Jim Quinn, David Moore, and Chip Weseloh for tern expertise, and to Mike Walker of Mohawk Marina for field support and excellent observations.

Literature Cited

Arnold, T.W., **Devries, J.H.**, and **D.W. Howerter**. 2010. Factors that affect renesting in Mallards (*Anas platyrhynchos*). Auk 127:212-221.

Arnold, T.W. 1993. Factors affecting renesting in American Coots. Condor 95: 273-281.

Bouchard, V. 2007. Export of organic matter from a coastal freshwater wetland to Lake Erie: an extension of the outwelling hypothesis. Aquatic Ecology 41:1-7.

Bowers, R. and **F.A. de Szalay**. 2005. Effects of water level fluctuations on zebra mussel distribution in a Lake Erie coastal wetland. Journal of Freshwater Ecology 20:85–92.

Brown, K.M., and **R.D. Morris**. 1996. From tragedy to triumph: renesting in Ring-billed Gulls. Auk 113:23-31.

Cuthbert, F.J. 1985. Intraseasonal movement between colony sites by Caspian Terns in the Great Lakes. Wilson Bulletin 97:502-510.

Cuthbert, F.J. 1988. Reproductive success and colony-site tenacity in Caspian Terns. Auk 105:339-344.

Cuthbert, F.J. and **L.R. Wires.** 1999. Caspian Tern (*Sterna caspia*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology.

Eichhorst, B.A., and **J.R. Reed**. 1985. Renesting of a Black Tern. North American Bird-Bander 10:8.

Great Lakes Storm Surges. 2003. National Oceanic and Atmospheric Administration (NOAA). Retrieved from http://www.glerl.noaa.gov/seagrant/glwlphotos/Seiche/1113Storm/November2003.html

Litchkoppler, F. 2009. Quoted in "High winds cause Lake Erie seiche...". Retrieved from http://blog.cleveland.com/metro/2009/09/high_winds_cause_lake_erie.html

Ludwig, J.P. 1965. Biology and structure of the Caspian Tern (*Hydoprogne caspia*) population of the Great Lakes: 1896-1964. Bird Banding 36:217-233.

Massey B.W., and **J.M. Fancher**. 1989. Renesting by California Least Terns. Journal of Field Ornithology 60:350-357.

Morris, R.D. 2010. Colonial nesting waterbirds in the Niagara Region. Pp. 181-198. *In* J.E. Black and K.J. Roy (eds.). Niagara birds: a compendium of articles and species accounts of birds of the Niagara Region in Ontario. Brock University Printing and Digital Services, St. Catharines, Ontario. 703 *Pp.*

Penland, S. 1976. The natural history and current status of the Caspian Tern in Washington State. MS thesis, Department of Biology, University of Puget Sound, Tacoma, WA.

Penland, S. 1981. Natural History of the Caspian Tern in Grays Harbor, Washington. Murrelet 62:66-72.

Quinn, J.S. and **J. Sirdevan**. 1998. Experimental measurement of nesting substrate preference in Caspian terns, *Sterna caspia*, and the successful colonisation of human constructed islands. Biological Conservation 85:63-68.

Reinert, S.E. 2006. Avian nesting response to tidal-marsh flooding: Literature review and a case for adaptation in the Red-winged Blackbird. Studies in Avian Biology 32:77-95.

Roseman, E.F., **W.W. Taylor**, **D.B. Hayes**, **R.L. Knight**, and **R.C. Haas**. 2001. Removal of walleye eggs from reefs in western Lake Erie by a catastrophic storm. Transactions of the American Fisheries Society 130:341-346.

Shugart G.W., **Scharf W.C.**, and **F.J. Cuthbert.** 1979. Status and Reproductive Success of the Caspian Tern (*Sterna caspia*) in the U.S. Great Lakes. Proceedings of the Colonial Waterbird Group 1978:146-156.

Trebitz, A.S. 2006. Characterizing seiche and tide-driven daily water level fluctuations affecting coastal ecosystems of the Great Lakes. Journal of Great Lakes Research 32:102-116.

Wendelin, H., **Becker, P.H.**, and **J. González-Solís**. 2000. Parental care of replacement clutches in Common Terns (*Sterna hirundo*). Behavioral Ecology and Sociobiology 47: 382-392.

Laura E. King
Department of Biology, McMaster University
Hamilton, Ontario L8S 4L8

Shane R. de Solla
Environment Canada
Canada Centre for Inland Waters
Box 5050
Burlington, Ontario L7R 4A6