

Changes in Summer Abundance and Distribution of Mute Swans along the Lower Great Lakes of Ontario, 1986 – 2011



Mute Swan Photo: Homer Caliwag

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Introduction

The Mute Swan (*Cygnus olor*) is one of three swan species that occur in North America, but is the only swan that is not native to the continent. Near the beginning of the 20th century, Mute Swans were transported into North America from Europe and Asia where they were released intentionally or escaped from captive or semi-captive collections leading to establishment of feral

populations along the mid-Atlantic coast of the U.S., portions of the Pacific coast and the Great Lakes region (Ciaranca *et al.* 1997). Breeding populations became established within coastal and inland marshes in portions of the Great Lakes region of the U.S. and Canada during the late 1950s through the 1970s (Petrie and Francis 2003). In Ontario, the first Mute Swan nest was documented in the

southwestern part of the province in 1958 and swans were first observed on the lower Great Lakes (LGL) (Lakes Ontario, Erie, St. Clair and their connecting rivers) during the 1960s (Peck 1966, Knapton 1993). Since that time, their abundance and distribution has increased substantially in Ontario, particularly along the shorelines, marshes and rivers associated with lakes St. Clair, Erie and Ontario (Petrie and Francis 2003, Badzinski 2007).

The LGL are an important spring and autumn staging area, providing feeding and resting habitat for millions of waterfowl and other waterbirds (Dennis *et al.* 1984, Schummer and Petrie 2011). Substantial and increasing numbers of Mute Swans have the potential to affect waterfowl (and other wetland-dependent and aquatic organisms) and their habitat in the LGL region in a variety of ways (Petrie and Francis 2003). As one of the larger-bodied waterfowl nesting in North America, Mute Swans aggressively defend nest sites, broods and foraging areas. Thus, they compete with other wildlife for critical habitat resources and can cause physical harm to humans (Ciaranca *et al.* 1997, Therres and Brinker 2004). Mute Swans also consume and uproot substantial quantities of aquatic vegetation during foraging which can reduce availability of food to native herbivores and alter abundance and composition of aquatic plants in aquatic ecosystems (Cobb and Harlan 1980, Allin and Husband 2003, Tatu *et al.* 2007). Thus, an increasing popu-

lation of Mute Swans is a conservation concern in the LGL region and elsewhere in North America.

Despite being an invasive, non-native species, Mute Swans are protected currently under the *Migratory Birds Convention Act*, 1994 in Canada. Mute Swans and other non-native species, however, are not federally protected in the U.S. since enactment of the *Migratory Bird Treaty Reform Act* in 2004 (United States Fish and Wildlife Service 2005). Petrie and Francis (2003) and Bailey *et al.* (2008) suggested removing Mute Swans from the list of federally protected species in Canada to facilitate control before populations attained levels that could affect health and function of the LGL coastal marsh ecosystem, components which are critical to sustaining populations of native fish and wildlife. Canada is currently reviewing the federal protection status of Mute Swans. In the meantime, accurately monitoring abundance and distribution of these swans over time is critical in the development of management strategies for Mute Swans and the habitats they negatively affect in Ontario and throughout Canada.

The population and range expansion of Mute Swans in the LGL region and throughout Ontario has been well documented using data from several different long-term, multi-species surveys. Petrie and Francis (2003) used data collected between 1980 and 2000 from the Breeding Bird Survey (BBS), Christmas Bird Count (CBC), the Midwinter

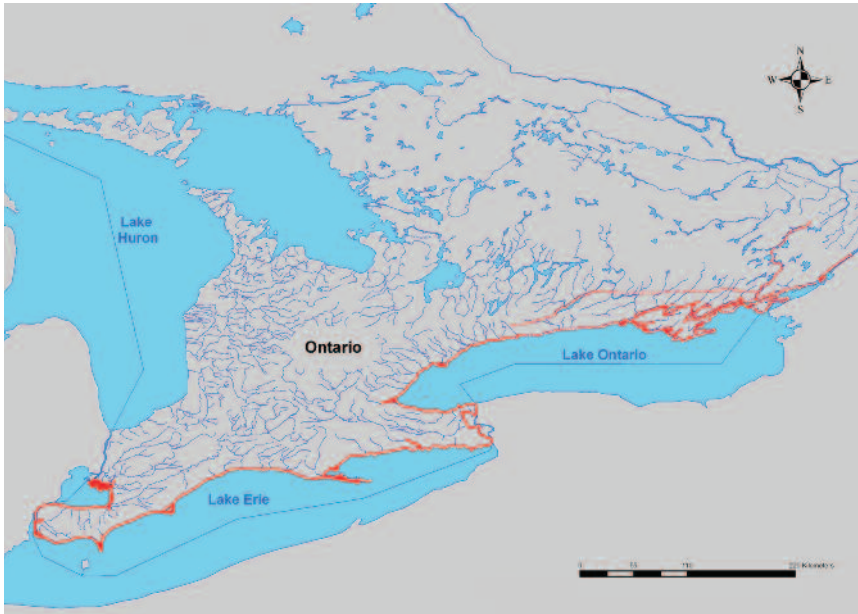


Figure 1. The lower Great Lakes shoreline, marsh complexes, rivers, and inland lakes surveyed during the Mid-Summer Mute Swan Survey in Ontario. The red line indicates the aircraft flight path recorded by an onboard Global Positioning System (GPS) during the 2011 survey. Produced by CWS-ON under licence with OMNR. Queen's Printer (c) 2011

Waterfowl Survey (MWS) and 1971 – 2000 aerial surveys of migrant waterfowl at Long Point – Lake Erie, Ontario, to document a rapid increase in Mute Swan abundance in the LGL region. It was estimated that the population of Mute Swans on the LGL increased by 10% to 18% per year between 1980 and 2000 and it was predicted that it could double by 2010 (Petrie and Francis 2003). The first and second Breeding Bird Atlases of Ontario showed that Mute Swans became more common and widely distributed along the LGL coastline, particularly around Lake Ontario and at inland locations in southern

Ontario from the 1980s through 2000s (Badzinski 2007). None of the above-mentioned surveys, however, were designed specifically to monitor the Mute Swan population in the province.

The Mid-Summer Mute Swan Survey (MSMSS) is a broad scale, coordinated, international monitoring initiative conducted throughout states and provinces in the Atlantic Flyway at three-year intervals since 1986 to determine abundance, productivity and distribution of Mute Swans in various jurisdictions and regions. Data collected during the survey are used to track and monitor population size and, in some

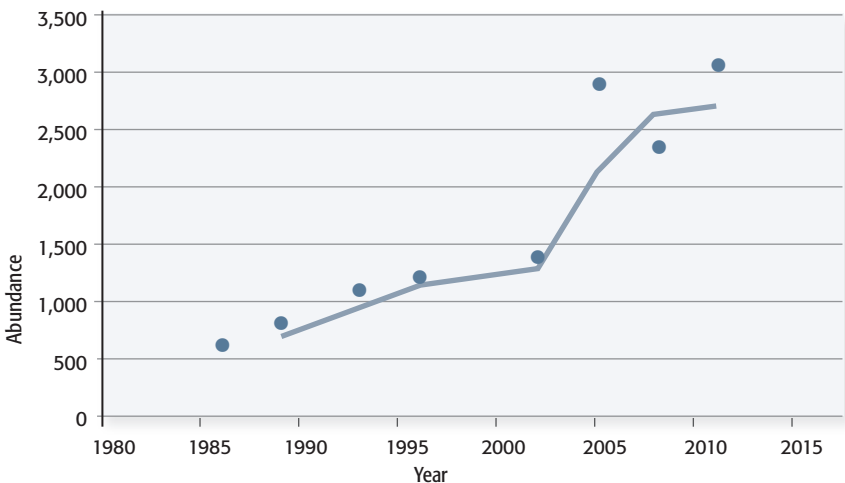
states, to set and evaluate population management goals for Mute Swans. In Ontario, the survey traditionally has covered the northern shoreline of the St. Lawrence River and the LGL, including the associated coastal marsh complexes. This survey provides the most current and detailed information on abundance and distribution of Mute Swans in the province. The purpose of this paper is to describe changes in Mute Swan abundance between 1986 and 2011 and distribution between 2002 and 2011 in the LGL region of Ontario.

Methods

The MSMSS is an internationally coordinated aerial survey that is conducted at three year intervals between 1 and 30 August in northeastern North America. In Ontario, this survey has been flown, traditionally, along the shorelines of the

St. Lawrence River, Lake Ontario (including East Lake, West Lake and Lake Consecon), Niagara River, Lake Erie, Detroit River, and Lake St. Clair, as well as over associated or nearby marsh complexes (Figure 1). During 2011, the survey area was expanded inland to include Rice Lake, Odessa Lake, and the Rideau Canal system between Kingston and Ottawa. The survey is conducted from a fixed-winged aircraft flying at an altitude of ~100 m, at a speed of ~150 kph and 250 m off of the shoreline. Survey routes over large wetland complexes and inland lakes are flown to maximize coverage of suitable habitat where swans may occur. The shoreline and inland survey area is divided into sectors, which are smaller geographic units based on landscape features and readily identifiable landmarks that enable determination of abundance and distribution of swans at finer scales.

Figure 2. Number of Mute Swans observed along the lower Great Lakes of Ontario during the Mid-Summer Mute Swan Survey 1986 – 2011. Trend line indicates 2-yr moving average.



Two observers, one on each side of the aircraft, use a tape or digital voice recorder to record abundance of adults (including sub-adults), cygnets and broods/family groups, as well as associated information on date, time, general location (*e.g.*, name of lake, river, bay), survey segment, general habitat type (*e.g.*, lake, impoundment, river, marsh), development zone (as of 2008: urban, suburban, rural), and latitude / longitude (as of 2011). Data are transcribed following surveys, entered into a standard electronic database and archived on a centralized server with Environment Canada. ArcGIS was used to create maps showing temporal and spatial patterns in abundance and distribution of Mute Swans in the LGL region of Ontario.

Results

Between 1986 and 2011, eight Mute Swan surveys were conducted on the LGL. Over this timeframe, the total abundance of Mute Swans increased from 615 to 3,062 in the traditional LGL survey area in Ontario; this represents an average increase of 15.9% per year (Table 1). Since 2005, the Mute Swan population in the LGL has increased at a slower rate (approximately 1.0% per year) (Figure 2 and Table 2). Abundance of adults and cygnets was not recorded separately until 2002, after which time the age classes increased by approximately 14.4% and 7.7% per year, respectively (Table 1). Since 2005, the number of broods has been counted in the traditional survey area. The surveys of 2005

and 2011 showed an increase from 85 to 126 broods, representing about an 8.0% per year increase (Table 1).

The local abundance of Mute Swans changed at several areas within the traditional LGL survey area between 2002 and 2011 (Figure 3). On Lake Ontario, the greatest rates of increase occurred at the east end in the vicinity of Prince Edward County (including East Lake, West Lake, Bay of Quinte, and Kingston area), whereas decreases occurred in central Lake Ontario just west of Prince Edward County and at Hamilton Harbour (Figure 3a). The greatest rate of increase was approximately 170% per year at West Lake – Prince Edward County, whereas the greatest decrease was approximately 18% per year along the shoreline between Presqu'île Bay and Bowmanville.

Table 2. Abundance and average percent change per year the Midwinter Survey - Lower Great Lakes (MWS-LGL) and

	1986	1989	1993	1996
Survey				
MSMSS Ontario	615	811	1,100	1,200
MWS-LGL Ontario	-	-	-	-
CBC - Ontario	63	100	227	202

* = not all survey sectors flown

Table 1. Number and average percent per year (% / Yr) of swans and broods observed during the Mid-Summer Mute Swan Survey in Ontario

	1986	1989	1993	1996	2002	2005	2008*	2011	% / Yr
Number of swans									
Adults	-	-	-	-	1,224	2,477	2,087	2,810	14.4 (since 2002)
Cygnets	-	-	-	-	149	417	270	252	7.7 (since 2002)
Total	615	811	1,100	1,200	1,373	2,894	2,357	3,062	15.9 (since 1986)
Total Number of Broods	-	-	-	-	-	85	79	126	8.0 (since 2005)
Average Number of Cygnets per Brood	-	-	-	-	-	4.91	3.42	2.00	

- = incomplete data * = not all survey sectors flown

(%/Yr) of Mute Swans observed in Ontario during the Mid-Summer Mute Swan Survey (MSMSS), the Christmas Bird Count (CBC) from 1986-2011.

2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	% / Yr
1,373	-	-	2,894	-	-	2,357*	-	-	3,062	-	15.9 (since 1986) 13.7 (since 2002) 1.0 (since 2005)
1,369	1,485	1,282*	2,928*	4,727	3,847*	374*	1,558*	2,371*	2,914*	2,787*	10.4 (since 2002) -0.7% (since 2005)
974	1,231	884	789	1,236	1,234	1,279	1,529	1,582	-	-	100.5 (since 1986)

CBC data accessed from the National Audubon Society website 23 January 2012.

Two pairs of swans each with four cygnets were observed on the Rideau Canal system and a single pair with four cygnets was observed on Odessa Lake (Figure 3a). Notable areas of increase further west in the LGL region, included Rondeau Bay and Holiday Beach – Lake Erie and the upper Detroit River and Lake St. Clair (Figure 3b). Decreases have occurred between 2002 and 2011 across a large part of southern Ontario from the Niagara River including the shoreline of Lake Erie between Fort Erie and Long Point, Point Pelee marsh and the lower Detroit River (Figure 3b).

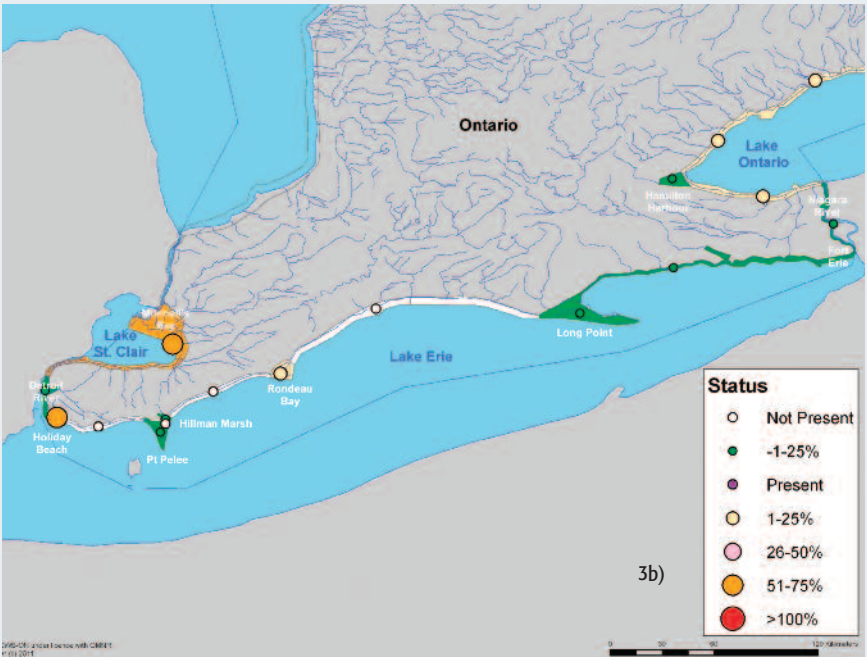
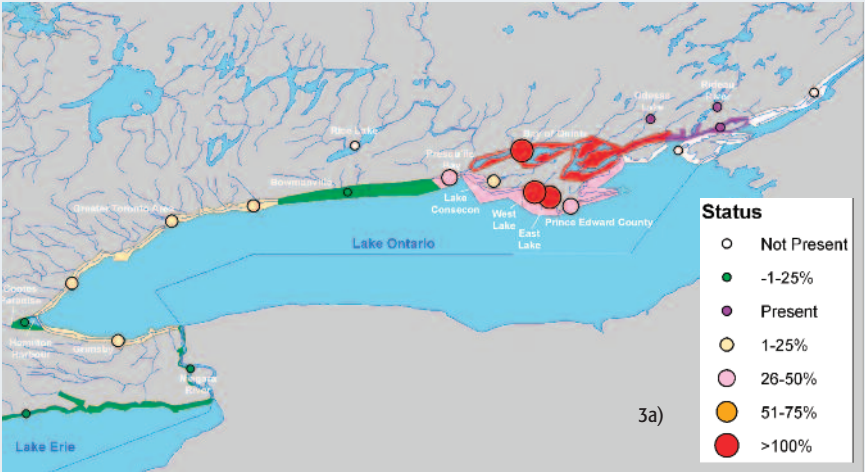
Discussion

Between 1986 and 2011, the abundance of Mute Swans along the Ontario side of the LGL during the MSMSS has increased from 615 to an all-time high of 3,062 swans, which represents an average increase of nearly 16% per year over that time. Although our observations suggest that the LGL population of Mute Swans has increased more than predicted by Petrie and Francis (2003) since 1986, the rate of increase has slowed since 2005 in the traditional survey area. Petrie and Francis (2003) calculated that with a conservative growth-rate estimate of 10% per year, the population of Mute Swans on the LGL would double every 7-8 years (*i.e.*, 2010). Results from the 2011 MSMSS show that the population in 2010 was likely around 2,700 swans, approximately double the 2002 estimate. Al-

though counts of Mute Swans in Ontario from the MWS generally correlate closely with data from the MSMSS, CBC data show an increase of approximately 100% per year since 1986 – likely due to the fact that very few swans were detected in CBC circles in the mid-1980s (Table 2). The slower growth rate, or potential declining rate of Mute Swans in the LGL (see Table 2 – MWS), in recent years suggests that these highly territorial swans may either be reaching a level that is restricting future population growth (*i.e.*, carrying capacity) in the LGL, at least in their core use areas that are traditionally surveyed, or that annual control initiatives on the U.S. side of the Huron-Erie Corridor may be limiting population growth. At inland wetlands and lakes, however, the population appears to be rapidly increasing as the range of the Mute Swan expands beyond the shorelines of the Great Lakes towards interior portions of Ontario. The continued increase in the population and range of Mute Swans in Ontario is a concern because it could reach a level where local ecosystem degradation is possible and management options could not effectively curtail population growth.

Since 2002, MSMSS data have shown localized population changes in several areas along the LGL shoreline. The greatest rate of increase in Mute Swans has occurred around and within Prince Edward County in eastern Lake Ontario.

Figure 3. Change (percent per year) in Mute Swan (*Cygnus olor*) abundance between the 2002 and 2011 Mid-Summer Mute Swan Surveys within shoreline sectors and marsh complexes at: **3a)** St. Lawrence River and Lake Ontario (including the Rideau River system – Kingston to Ottawa, Odessa Lake, and Rice Lake – 2010 only) and **3b)** Niagara River, Lake Erie, Detroit River and Lake St. Clair.



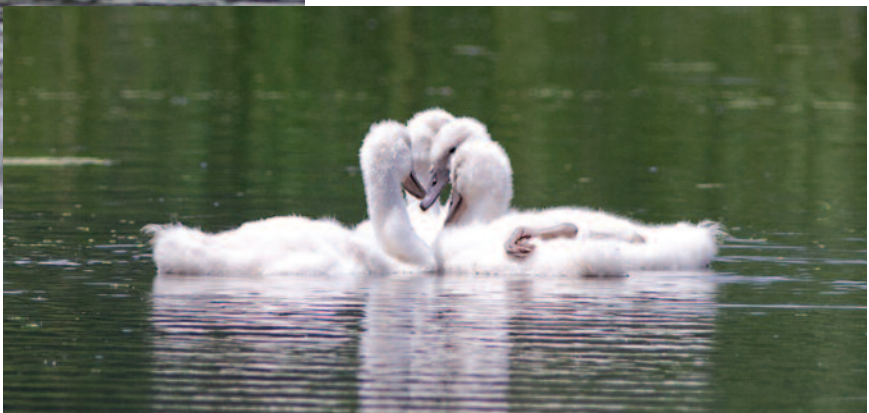


The greatest rate of increase in Mute Swans has occurred around and within Prince Edward County in eastern Lake Ontario.

Mute Swan and cygnets *Photo: Ann Brokelman*



The expansion of Mute Swans into this area probably is due to emigration from nearby high density nesting areas, such as Presqu'île Bay; a predicted response when optimal breeding habitat is filled with territorial breeding pairs and nesting habitat becomes limiting. Data from the Ontario Breeding Bird Atlas also suggest that birds from the Presqu'île Bay area have begun to breed in adjacent atlas squares thereby contributing to the eastward range expansion that has occurred since the early 1980s (Badzinski 2007). The area contains a considerable amount of shallow, productive emergent marshes with substantial submerged aquatic vegetation available to swans and relatively disturbance-free habitat, which are attractive habitats to breeding and moulting swans. For example, the number of broods increased from 0 to 12 between 2005 and 2011 at the Bay of Quinte. Similarly, the abundance of adults has increased over the same period at the Bay of Quinte, Smith Bay, Point Petre, and Lake Consecon. Mute Swans typically reach sexual maturity after 2 or 3 years (Ciaranca *et al.* 1997), so many of these non-breeding swans likely will have established territories and begun to breed in these wetlands by the time of the next MSMSS in 2014.



With improvements in aquatic vegetation, the abundance of Mute Swans breeding and using Cootes Paradise has increased considerably to the extent that now Mute Swan management is being implemented.

The decline in the abundance of Mute Swans between Presqu'ile Bay in the east and Bowmanville in the west (-18% per year) may be due to limited breeding and molting habitat. There are only a few harbours, such as Cobourg and Port Hope, and small isolated wetlands in this area, so few areas exist for swans to nest or seek refuge from the wind and waves on Lake Ontario (Environment Canada and Ontario Ministry of Natural Resources 2003). Movement of Mute Swans from these areas into suitable marsh habitats, such as Weller's Bay, East Lake, West Lake, Lake Consequon, Oshawa Second Marsh, Cranberry Marsh, Frenchman's Bay and the Rouge River may partly account for the decrease in this area but also for the increases in Prince Edward County and the area west of Bowmanville to the Niagara River (excluding Hamilton Harbour). Unlike Prince Edward County, marshes of central and western Lake Ontario are relatively small in size, have limited emergent vegetation (nesting habitat) and some have sparse submerged aquatic vegetation communities (brood rearing habitat) (Environment Canada and Central Lake Ontario Conservation Authority 2010), which may affect territory size, abundance and distribution of Mute Swan breeding pairs

(Ciaranca *et al.* 1997). Notably, between 2002 and 2011, there was a trend of low and stable abundance of broods in central and western Lake Ontario, particularly the Greater Toronto area where 4, 7, 9 and 8 broods were counted during the four MSMSS conducted over that period. Habitat limitations, in conjunction with ongoing egg control initiatives in this region, likely has reduced recruitment so growth in the area between Bowmanville and Niagara River is mainly due to an increase in subadults moving from other locations.

The slight decline (-2.5% per year) in the abundance of Mute Swans in Hamilton Harbour may be due to the redistribution of swans from Hamilton Harbour into Cootes Paradise (adjacent marsh approximately 250 hectares in size that is not included in the MSMSS) or other inland locations. In the 1990s, the restoration of Cootes Paradise began in order to improve the quantity and quality of aquatic vegetation; since then water quality and marsh/aquatic habitats have improved greatly with the implementation of Project Paradise (Royal Botanical Gardens 1998, Environment Canada 2002). With improvements in aquatic vegetation, however, the abundance of Mute Swans breeding and using Cootes Paradise has increased

considerably to the extent that now Mute Swan management is being implemented. For example, between 2000 and 2003 there was an average of approximately four pairs of Mute Swans nesting in Cootes Paradise while this number increased to approximately seven pairs between 2008 and 2011. In addition, there are typically 25 – 50 Mute Swans using the marsh during mid-summer (T. Theysmeyer, pers. comm.). Although Trumpeter Swans were re-introduced into Cootes Paradise in 1982 with the hopes that they would displace and exclude Mute Swans, to date, this has not happened. Instead, Mute Swans appear to be outcompeting Trumpeter Swans for nesting sites.

The abundance of Mute Swans at the Niagara River has declined by approximately 11% per year since the 2002 MSMSS. This area has very little, if any, breeding habitat and limited foraging habitat due to the high river flow rate, depth and linearity. This likely explains the sporadic and infrequent use by relatively few adults (only five adults were observed during the MSMSS in 2002) and why no broods have been reported since 2002. Data from the Ontario Breeding Bird Atlas also confirm the lack of breeding in the Niagara River, but reports possible breeding evidence near the mouth at Lake Ontario during the 2001 – 2005 survey (Badzinski 2007).

The area west of the upper Niagara River at Fort Erie to Long Point on Lake Erie experienced a decline of 7-10% per year in the abundance of Mute Swans

between 2002 and 2011. Much of the highest quality emergent marsh habitat and shallow productive bays in this area are located at the Long Point coastal marsh complex, where annual permits were issued to property owners and wetland managers to facilitate localized control of Mute Swans during that period. Moreover, between 2001 and 2004, Mute Swans were collected at Long Point – Lake Erie and the Canadian side of the Detroit River and Lake St. Clair by Long Point Waterfowl as part of Mute Swan diet study (Bailey *et al.* 2008). These activities may explain the decrease in the number of adults from 67 to 15 individuals in this area between 2002 and 2011, which effectively reduced the local breeding population and recruitment in the area. Similarly, localized population control programs on the U.S. side of the Detroit River and Lake St. Clair area have resulted in fewer swans in these areas in recent years. For example, 1,237 Mute Swans were removed from the Detroit River and Lake St. Clair area between 2009 and 2011 (D. Marks, pers. comm.); this may explain part of the large decline from 898 to 264 birds between 2008 and 2011 surveys.

Further west of Long Point, the abundance of Mute Swans has increased at considerable rates at Rondeau Bay and Holiday Beach – Lake Erie near the lower Detroit River and Lake St. Clair, each of which contain optimal breeding and foraging habitats. For example, the largest wetland complex in the Great

Lakes, nearly 6,900 ha on Walpole Island First Nation, occurs at the north end of Lake St. Clair (United States Army Corps of Engineers 2004). Immediately south of this delta, Mitchell's Bay and St. Luke's Bay are shallow embayments that contain large quantities of submerged aquatic vegetation available to swans. As a result, the north end of Lake St. Clair consistently is where the majority of Mute Swans occur in western Ontario and throughout the entire LGL region of Canada. Movement of swans due to disturbance from egg control and culling activities in nearby private wetlands and the Detroit River may also partly account for the nearly 10 fold increase in Mute Swans between 2008 and 2011 at Lake St. Clair.

Although some localized culls and egg control programs have reduced the number of pairs, non-breeding adults, and cygnets in some areas, such as Long Point – Lake Erie and the lower Detroit River, the population of Mute Swans using the LGL continues to slowly increase (Table 1) and expand its range within Ontario (Badzinski 2007). This increase and expansion is a concern for biologists and wetland managers in the LGL region and elsewhere for several reasons. First, the LGL population of Mute Swans provides a source of swans for continued colonization of suitable marsh habitats associated with the LGL and suitable inland habitats. Range expansion within Ontario (north and east) is already occur-

ring as well as in adjacent States such as Michigan. If predicted warmer winters and reduced lake ice occur in the LGL region in the future (Mortsch *et al.* 2006), range expansion is likely to occur rapidly and perhaps even further north. Second, more breeding pairs of Mute Swans over time will result in more conflicts with native wildlife and humans because of their aggressive behaviour. Third, large and increasing numbers of Mute Swans may cause localized wetland degradation due to their significant food requirements and foraging activities (Therres and Brinker 2004, Tatu *et al.* 2007). Consequently, reduced quality and quantity of food resulting from local wetland degradation or indirect competition with Mute Swans may negatively affect a multitude of native waterfowl, waterbirds and fish that depend on LGL coastal wetlands during portions of their annual life cycle. Thus, monitoring the growth and expansion of the population of Mute Swans in Ontario (and elsewhere) is paramount for ensuring that appropriate management actions can be prescribed and undertaken quickly enough to minimize ecosystem-related and human conflicts caused by this non-native species.



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