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Forster's Terns Breeding in Ontario

Historical Trends and Recent Surveys of Eastern Lake St. Clair and Long Point, Lake Erie

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Forster's Tern nest, Cook's Bay, Lake Simcoe, late 1990s. *Photos: Glenn Barrett, Environment Canada.*

Introduction

The Forster's Tern (*Sterna forsteri)* has one of the most unusual histories of any bird species in Ontario. Its nesting at "St. Clair Flats", the north end (Canada and the U.S.) of Lake St. Clair, was well-known and documented in the late 1800s (Collins 1880, Morden and Saunders 1882, Langille 1884, McIlwraith 1894), a time of intense egg collecting. However, at that time, no estimate was made of the number of birds nesting or the extent of its nesting area on Lake St. Clair. Bent (1921) included Port Maitland (presumably the Dunnville Marshes, in Haldimand Co.) in a list of breeding areas, but no details were given and the record cannot be traced (McCracken 1987).

This period of activity in the late 19th century seems to have been followed by a hiatus of more than 90 years with no reported nesting of the species whatsoever (Baillie 1958). Presumably it still nested in the Ontario waters of Lake St. Clair but we have no confirmation. It did nest commonly on the U.S. side of Lake St. Clair during this period (Baillie 1958).

At Long Point, Lake Erie, breeding was first suggested as a possibility as early as 1950, when 9 birds were reported on 15 July (Baillie 1950). In 1975, A. Wormington observed 8 adults, 4 immatures, and 12 flying young-of-the-year (Goodwin 1975). It was not until 1976, however, that breeding was documented definitively, with the discovery of about 50 nesting pairs (Speirs 1985). By the mid 1980s, this number increased to an estimated 200+ pairs, but the colony collapsed thereafter due to high water levels (McCracken 1987, Weseloh 2007).

Forster's Tern was found nesting at Lake St. Clair and a few other locations during both the 1st and 2nd Ontario Breeding Bird Atlases (McNicholl 1987, Weseloh 2007). It was also found nesting annually in Cook's Bay, Lake Simcoe, during 1996-1999; the maximum number of nests there was 13 (DVCW, unpubl. data). Outside of a possible nest record on Lake of the Woods near Rainy River, all breeding of this species occurred in southern Ontario (Weseloh 2007).

The purpose of this article is to pull together as many of these records (post-1976) as possible with any quantitative data that may have been collected by the original observers. We also report on two recent surveys of Forster's Tern colonies by the authors on Lake St. Clair and at Long Point, Lake Erie.

Methods

We used several comprehensive, Ontario-wide surveys to provide information on the distribution and population size of Forster's Terns and how these have changed over time. First, were the three decadal colonial waterbird surveys, conducted by boat and at approximately 10-year intervals from 1977 to present by the Canadian Wildlife Service (CWS) and its partners. Included in this program were two surveys specifically designed to census Black Terns (*Chlidonias niger*) and Forster's Terns nesting in coastal Great Lakes wetlands, conducted by CWS in 1991 (Austen *et al.* 1996) and Bird Studies Canada (BSC) in 2001 (Graham *et al.* 2002). Second, were the first (Cadman *et al.* 1987) and second (Cadman *et al.* 2007) Ontario Breeding Bird Atlases (OBBA), providing complete coverage of the Forster's Terns' breeding range across the province. Nest records for years outside of the comprehensive survey periods were obtained from the Ontario Nest Records Scheme (ONRS) and from published sources.

We also report on two recent surveys of Forster's Tern colonies at Tic Tac Point, Lake St. Clair (2007) and Long Point, Lake Erie (2009). The Tic Tac

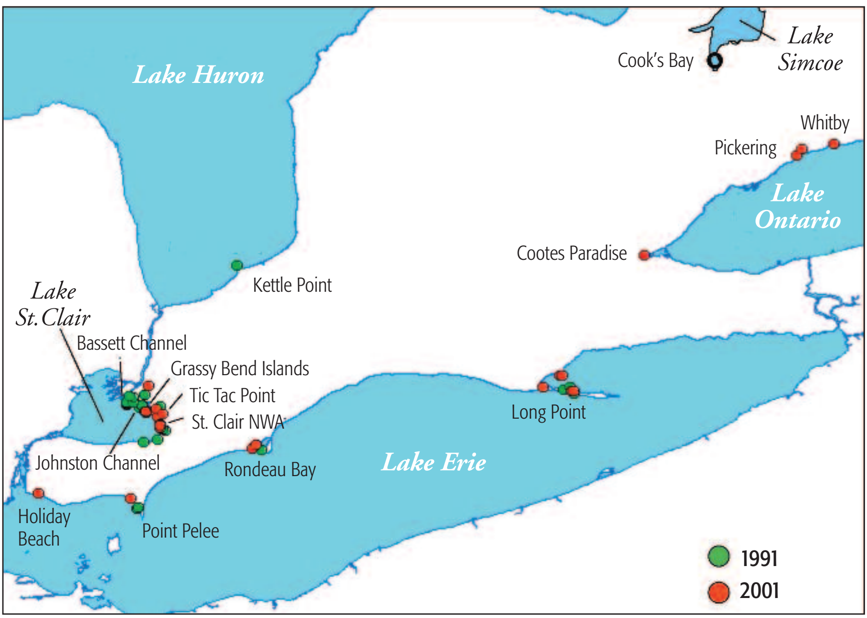

Figure 1. Nesting locations of Forster's Terns in Ontario during the 1991 (green circles) and 2001 (red circles) 'decadal' surveys. Nest records from Cook's Bay, Lake Simcoe (open circle) occurred between survey periods.

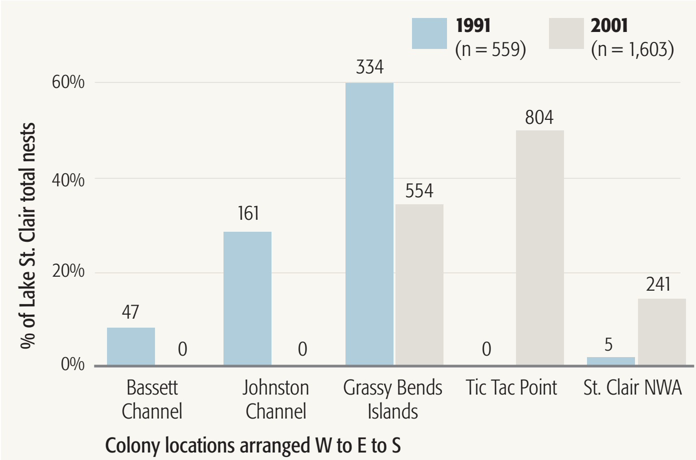

Figure 2. The proportion of nests at each of five colony locations in Lake St. Clair during the 1991 (blue bars) and 2001 (gray bars) 'decadal' surveys. Nest counts are shown above the bars.

Point islands were accessed by flat bottom boat using a "mud buddy" motor, launched from an access canal approximately 1 km to the SSE. We landed on any island from which Forster's Terns flushed. Usually two observers walked the perimeter and central portion of each such island; nests were marked with a small spot of spray paint to prevent double counting and the contents of all nests were recorded. The number of adults flying overhead was also noted. At several sites, an estimate of the number of nests was made from the boat due to the presence of large numbers of mobile chicks. The Long Point sites were surveyed by two people wading through the emergent vegetation to conduct nest counts; the number of adults present was assessed by counts from photographs.

Results

Population Trends and Distribution

Breeding has been restricted to a number of locations (Figure 1), some of which have been occupied consistently since the late 1970s; nesting at other sites has been much more intermittent. Within these general breeding locations, nest counts and colony sites have varied markedly among survey periods (Table 1). In both the 1991 and 2001 decadal surveys, 95% of all Ontario nests were found in Lake St. Clair (559 of 588 nests in 1991; 1603 of 1677 nests in 2001; Table 1). Major breeding sites in Lake St. Clair included: (i-iii) three main areas of the Bkejwonong Territory (Walpole Island First Nation) — Bassett Channel in the west and Johnston Channel and the Grassy Bend Islands in the east, (iv) Tic Tac Point and (v) St. Clair National Wildlife Area (St. Clair NWA).

There was a major shift in distribution between decadal survey periods, with the concentration of nests moving from the western part of Lake St. Clair to the eastern shoreline (Figure 2). Declines were observed at both Bassett Channel (47 nests in 1991 to 0 nests in 2001) and Johnston Channel (161 nests to 0 nests), with corresponding increases at Tic Tac

Table 1. Ontario nest records of Forster's Terns, 1976-2009. Columns in blue indicate nest counts from comprehensive, province-wide surveys: Decadal Waterbird Surveys in 1991 and 1992; OBBAs in 1981-85 and 2001-05. (see text for citations of various sources)

Water Body	Colony	1976-77	1979	1981	1982	1983	1984	1985
Lake of the Woods	Rainy River							
Lake Huron (main body)	Corsdu Reef							
	Kettle Point							
Lake St. Clair	Tremblay Beach							
	Jeanette's Creek							
	St. Clair NWA	14						
	Tic Tac Point	8						
	Mitchell's Bay - north							
	Walpole Island - Grassy Bend Islands							
	Walpole Island - Johnston Channel							
	Walpole Island - Snooks Lake							
	Walpole Island - Bassett Channel	8	2			3		
	Walpole Island - Squirrel Island	12						
	Walpole Island - unspecified	12						
	Walpole Island - Total	**32**	**2**			**3**		
Lake Erie	Holiday Beach							
	Point Pelee							
	Rondeau Bay	0		18	58	2	6	30
	Long Point	50		154	91			
Lake Ontario	Cootes Paradise							
	Rouge River Mouth							
	Frenchman's Bay							
	Whitby Harbour							
Lake Simcoe	Cook's Bay							
	TOTAL	**104**	**2**	**172**	**149**	**5**	**6**	**30**

N = nesting, prob =probable nesting, poss = possible nesting (see Cadman *et al.* 2007 for definitions).

1981-1985	1986	1990	1991-92	1996	1997	1998	1999	2001	2001-2005	2007	2009
poss									poss		
0			0					0	0		1-3 poss
N			3					0			
poss			4					0			
prob			0					0			
N			5					241	N		
N			0					804	N	640	
N			0					2	N		
N			334					554	N		
N			161					0	N		
N			8					0	N		
N	382		47					0	N		
N			0					0	N		
N			0				26	2	N		
N	**382**		**550**				**26**	**556**	**N**		
			0					2	N		5-7
poss			10					30	N		
N		200	3					12	N		
N	162		13					20	N		150
0			0					2	N		
0			0					1	N		
0			0					4	N		
0			0					3	N		
poss				13	10	2	6		N		
	544	**200**	**588**	**13**	**10**	**2**	**32**	**1677**		**640**	**156+**

Not included: possible nesting during 1981–85 (McNicholl 1987) at (a) two squares on St. Clair River, (b) one square on the Detroit River and (c) two blocks north of Lake of the Woods in southwest Ontario.

Point (possibly nesting in 1991 to 804 nests in 2001) and St. Clair NWA (5 nests to 241 nests); three colonies at Grassy Bend Islands accounted for substantial numbers of nests in both surveys (334 in 1991, 554 in 2001; Figure 2). All of these sites were occupied during the second OBBA (Weseloh 2007). More ephemeral nesting within Lake St. Clair occurred at other sites on the Bkejwonong Territory, Trembley Beach lagoons and Jeanette's Creek (Table 1).

Away from Lake St. Clair, most Forster's Tern nests occurred on Lake Erie, representing approximately 4% of nests found in both the 1991 and 2001 decadal surveys (26 of 588 nests and 64 of 1,677 nests, respectively; Table 1). The main breeding sites were: (1) Point Pelee National Park, near Leamington, Ontario (2) Rondeau Bay, near Erieau, Ontario and 3) Long Point, near Port Rowan, Ontario (Figure 1).

Forster's Terns have been reported breeding at Long Point since at least 1976 when there were an estimated 50 nests (McCracken *et al.* 1981), based on the observation of 100 adults (ONRS; 1976 record by A. Wormington) and the confirmation of at least 28 nests during late May-early June (by E. Dunn, M. Field and D. Hussell; Goodwin 1976). Since then, the number of nests at Long Point has fluctuated markedly. Forster's Terns did not nest there in 1977 (Blokpoel and McKeating 1978). JM found 154 nests at 8 separate colonies (range: 1-85 nests per colony) during an extensive survey made between 19 May and 12 June 1981 (McCracken 1981). The following year, he surveyed the same areas and found 91 nests at 9 locations (range: 1-44 nests per colony), and estimated that only 10-20% of these nests were successful (McCracken 1982). G. McKeating also reported "many nests washed out" in 1982 (ONRS). Long Point supported 162 nests in 1986 (M. McNicholl, pers. comm.). During the 1991 decadal survey, only 13 nests were found (10 confirmed, 3 probable), while the 2001 decadal survey yielded 20 nests. Up until 2009, all documented nestings at Long Point occurred in the large, broken expanses of cattail marsh several kilometres east of the Provincial Park (i.e. in the Thoroughfare Point Unit of the Long Point National Wildlife Area and in the Long Point Company marshes).

A pair of Forster's Terns was believed to have nested at Rondeau Bay in 1970 (Goodwin and Rosche 1971). However, it was not until the period of the first OBBA that nesting was actually documented at Rondeau (range = 2 – 58 nests and mean = 22.8±22.5 nests during 1981-85; Table 1; McNicholl 1987). Two hundred nests were recorded in 1990 (P.A. Woodliffe, ONRS); fewer during the 1991 (n=3 nests) and 2001 (n=12 nests) decadal surveys (Table 2). Overall nest abundance, and the degree to which it varied among years, was similar between Rondeau Bay (range = 2 to 200 nests) and Long Point (range = 13 to 162 nests; Table 1).

Forster's Terns have been reported breeding at Point Pelee less frequently. The first suggestion of nesting appears to be the report of an adult seen feeding a young bird on 12 July 1975 (Goodwin 1975). The only documented breeding records come from the two decadal survey periods (10 possible nests in 1991, 30 nests in 2001). More recently, breeding has been reported at the wetlands associated with Holiday Beach Conservation Authority (where Big Creek empties into Lake Erie), near Malden, Ontario: 2 nests in 2001 (Graham *et al.* 2002) and 5-7 nests in 2009 (D. Ware, pers. comm.).

Since 1991, small concentrations of Forster's Tern nests have also been found farther afield from lakes St. Clair and Erie. From 2-13 nests were found each year during 1996-99 at Cook's Bay, in southern Lake Simcoe (DVCW, unpubl. data; Table 1, Figure 1), and breeding evidence was also reported in the second OBBA (Weseloh 2007). There are two breeding records from the main body of Lake Huron; (Table 1). During the 1991 decadal census, three probable nests were recorded in the coastal marshes east of Kettle Point, Ontario; no terns were found there in 2001. On 17 June 2009, at least 3 (3-5) Forster's Terns were present, and possibly breeding, at a small Common Tern (*Sterna hirundo*) colony (n= 27 nests) on a shoal SSW of Corsdu Reef, off the western coast of the Bruce Peninsula near Oliphant, Ontario (DJM, unpubl. data).

Forster's Terns were first recorded breeding along the Lake Ontario shoreline during the 2001 decadal survey: (i) two nests at Cootes Paradise, at the western end of Hamilton Harbour, (ii) a single nest at the mouth of the Rouge River, near Pickering, Ontario, (iii) three nests at Whitby Harbour and (iv) four nests at Frenchman's Bay marsh, also near Pickering, Ontario (Graham *et al.* 2002; Table 1). Finally, Forster's terns were also recorded as possible breeders on Lake of the Woods near Rainy River during both the first and second OBBA (McNicholl 1987, Weseloh 2007). Possible nesting was also reported in two blocks north of Lake of the Woods during the first OBBA (McNicholl 1987).

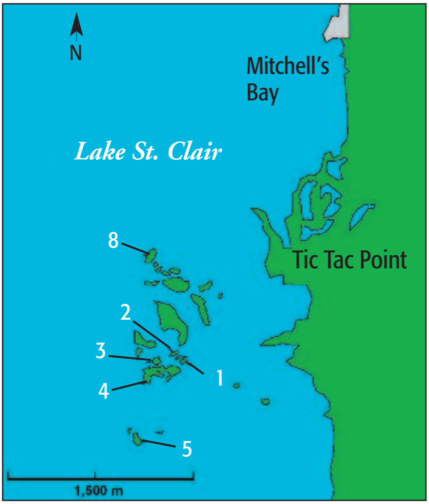

Figure 3. The locations of Forster's Tern colonies off of Tic Tac Point on Lake St. Clair in 2007. Colonies 6 and 7 are not shown, and were 3.5 km and 4.8 km south of the main cluster of colonies.

Recent Surveys

(1) Tic Tac Point

The Tic Tac Point islands (42.446, -82.430) are located south of Mitchell's Bay in eastern Lake St. Clair, approximately 0.5 km due west of Tic Tac Point (Figure 3). These 'islands' are essentially a series of sandbars, surrounded by shallow water (~60 cm deep), and covered to varying degrees with emergent vegetation (mainly *Typha* sp. cattails or *Phragmites* sp.). Open areas of these sandbars were usually covered with mats of dead vegetation, mainly cattail and *Phragmites* sp.

Table 2. Island characteristics, clutch size distribution and total number of nests and adults for Forster's Tern colonies surveyed near Tic Tac Point, Lake St. Clair in 2007.

	Latitude	Longitude	Size (ha)	Vegetation[1]
Tic Tac Point islands				
Island # 1	42.443517	- 82.429066	0.40	*Typha sp.*
Island # 2	42.443779	- 82.430414	0.16	*Typha sp.*
Island # 3	42.443416	- 82.431417	0.30	*Typha sp.*
Island # 4	42.442280	- 82.432687	0.08	*Phragmites sp.*
Island # 5	42.437846	- 82.433903	0.28	*Phragmites sp.*
				sub-total
				% of nests
Island # 6	42.411868	- 82.424935	0.37	not recorded
Island # 7	42.400398	- 82.421924	0.14	not recorded
Island # 8	42.451024	- 82.431852	0.48	*Typha sp.*
			0.28 ± 0.14[2]	

stalks, which had accumulated to a depth of up to 60 cm. It was on this 'rack' that the Forster's Terns constructed their nests.

During May 2007, CAF and Shawn Meyer (CWS) noted large concentrations of Forster's Terns while in the area conducting surveys of marsh-nesting birds. On 07 June 2007, DVCW, DJM, CAF and Gail Fraser visited the main cluster of the Tic Tac Islands to count nests and determine the breeding phenology of the colony.

In total, five sandbar islands were surveyed on the first day (Table 2, Figure 3). The small islands ranged in size from 0.08 ha to 0.40 ha (0.24±0.12 ha). The dominant emergent vegetation on three of the islands was cattail; the other two islands were covered with *Phragmites* sp. predominantly. A total of 470 nests was recorded: 20, 91, 94, 111 and 154 nests were found at the five colonies, respectively (Table 2). Most nests were constructed on more elevated areas of the island such as on sand ridges or mounded rack; even so, most nests were within 30 cm of the waterline. Forty-three percent of nests had three (or four) eggs, which is considered the average clutch size for this species (McNicholl *et al.* 2001); 31% had two eggs and 14% had a single egg or were empty. An additional 13% of nests had chicks (n=26, mean brood size = 1.3±0.5, range = 1-3 chicks) or were in the process of

[1] predominant vegetation cover; [2] mean± 1SD, * estimate based on 1:1 ratio of adults to nests (see text)

Nest Contents (e = eggs, c = chicks)								
0 e	1 e	2 e	3 e	4 e	e + c	c	Total Nests	Adults overhead
3	7	1	7	0	2	0	20	36
2	2	23	63	1	0	0	91	110
5	9	42	54	0	0	1	111	115
2	4	37	38	0	10	3	94	100
7	23	41	37	2	22	22	154	130
19	**45**	**144**	**199**	**3**	**34**	**26**	**470**	**491**
4.0%	**9.6%**	**30.6%**	**42.3%**	**0.6%**	**7.2%**	**5.5%**		
--	--	--	--	--	--	--	50*	50
--	--	--	--	--	--	--	80*	80
--	--	--	--	--	--	--	35*	40
							635*	661

hatching (n=34; mean = 1.4±0.5 eggs + 1.2±0.4 nestlings; Table 2). The oldest nestlings seen were 5-10 d old; most nestlings ranged from freshly hatched to 3 d old. There was some variation in nesting phenology among islands; interestingly, the two *Phragmites*-dominated islands were more advanced than the cattail islands (Table 2). There was roughly a 1:1 ratio between the number of adults present (n=491) and the number of nests (n=470).

In addition, to the Forster's Tern nests, we also found the nests of: Yellow-headed Blackbirds (*Xanthocephalus xanthocephalus*, n=3), Green Herons (*Butorides virescens*, n=2), Mute Swans (*Cygnus olor*, n=3), Mallards (*Anas platyrhynchos*, n=3) and Herring Gulls (*Larus argentatus*, n=1). One of the islands in the cluster, distinct from the Forster's Tern colonies, supported a Ring-billed Gull (*L. delawarensis*) colony of an estimated 300-400 nests.

During the next few weeks, additional islands to the north and south of the main cluster of sandbars off Tic Tac Point were surveyed by CAF and Shawn Meyer for the presence of nesting Forster's Terns. Two more sites were discovered to the south of the main colonies: one island (island #6), ~ 3.5 km to the south, had 50 adults flush on 14 June 2007; 80 adults flushed from a second island (island #7), ~ 4.8 km to the south, on 20 June 2007.

Some nests at these colonies had eggs, but a thorough census was not conducted due to the presence of large numbers of mobile chicks. Three pairs of Green Herons also flushed from island # 6. A final Forster's Tern colony was discovered on 20 June 2007, approximately 0.5 km to the north of the original main cluster of nesting sites (island #8). Thirty to forty adults flushed from this site; most nests seen at the water's edge contained 1-2 eggs but some nests had chicks. This colony was also not censused. Given the 1:1 ratio of adults to nests observed on 07 June 2007, we estimate 50, 80, and 35 nests, respectively, for islands #6, #7 and #8 (Table 2). Therefore the total number of Forster's Tern nests in the area of Tic Tac Point was estimated at 640 nests.

It is only recently that Forster's Terns have been recorded nesting at this location. Eight nests were recorded here during the first CWS decadal waterbird survey (1976-77; ONRS, 1977 record by George Peck) and were recorded as 'possibly nesting' during the second decadal survey (1991) although no nests were found (Austen *et al.* 1996). During the third decadal survey in 2001, however, 804 nests were counted, representing 48% of all nests found in Ontario (Graham *et al.* 2002). The number of nesting pairs for this location in 2007 was reduced slightly compared to the 804 nests counted in 2001, but it still represents an important, and perhaps the most significant, breeding area in Ontario.

(2) Long Point

Long Point is a 32-km long peninsula on the north shore of east central Lake Erie. Together with the adjoining wetlands at Turkey Point, it includes several thousand hectares of marshland. The most extensive amounts of suitable habitat for nesting Forster's Tern are closely associated with beds of cattail in the shallow waters of the Inner Bay. Farther to the west, the expansive marshes that are associated with the Big Creek delta are largely dominated by grasses and sedges and provide far less suitable nesting habitat for Forster's Terns.

During May through early June of 2009, there were regular sightings of large numbers of Forster's Terns to the east of the marina at the western terminus of Long Point, leading to the suspicion that the terns were nesting nearby (D. Hussell, S. Mackenzie and JM, pers. obs.). On 9 June 2009, Nick Bartok and his field crew were surveying the Long Point marshes for Least Bitterns (*Ixobrychus exilis*) and reported being mobbed by Forster's Terns when they conducted a point count at a small bed of cattails. The crew returned on 11 June 2009 and confirmed finding some nests with eggs, and estimated 75-100 adults flying around.

On 12 June 2009, JM and Stu Mackenzie (BSC) visited the site and discovered that there were actually two colonies in close proximity. Both colonies were in marshes owned by the Province of Ontario (part of what is called the "Crown Marsh" at Long Point). At the larger, more southerly colony (Colony A, Figure 4), at least 122 adults flushed (the number determined from counts taken from photographs). A partial count of the colony revealed 54 nests, many with 3-egg clutches; approximately 10 nests had

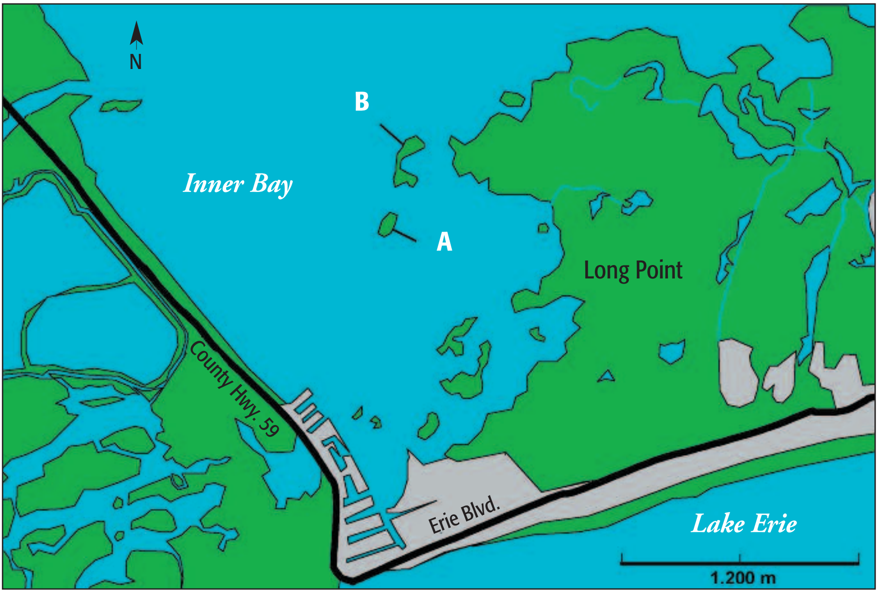

Figure 4. The locations of Forster's tern colonies (A and B, see text) at Long Point on Lake Erie in 2009.

recently hatched young and about a dozen nests were empty and the young were probably hiding nearby (no egg shells or signs of nest disturbance were observed). Based on the number of adults present and the density of nests in the area surveyed, the total size of Colony A was estimated at a minimum of 100 nests. Colony B (Figure 4) was estimated at 25-30 nests, based on the number of adults that flushed from this site. In total, both colonies were estimated to contain as many as 150 nests, representing the largest numbers of Forster's Terns nesting at Long Point since the mid-1980s.

Both colonies were located in small beds of emergent cattails. The cattail bed in Colony A was approximately 60 m x 100 m (~0.60 ha); the cattail stand at Colony B was about twice that size. Both areas were located in fairly deep water (120 cm+) and dominated either by *Typha angustifolia* or *T. a. x T. glauca*. There was a lot of muskrat activity at both colony sites and many of the nests were built on top of lodges (often three or more nests on a single lodge); others were constructed on floating mats of dead cattail. The bottom substrate at both sites was very loose silt/muck. The nesting substrate at Long Point was, therefore, considerably different from that observed at Tic Tac Point in 2007 (see above).

The Long Point colonies were located approximately 1 km from a local marina. A substantial amount of recreational boat traffic would have passed by both sites, which were each located about 0.25 km from the main boating channel from the marina to the Inner Bay. Hence, they were potentially exposed to considerable disturbance from the watercraft themselves and the wake they would have produced. The colonies were not visited later in the season to assess the degree to which this factor may have affected breeding success. However, as most nests were elevated on muskrat lodges or on floating mats of cattail, the potential negative effects of boat traffic may have been dampened to some degree.

As noted earlier, up until 2009, all previous nestings of Forster's Terns at Long Point have occurred in various sections of two favoured areas that are located from 2 to 4 km east of Long Point Provincial Park. The 2009 nestings, however, were located farther to the west, and much closer to the base of Long Point. Intensive surveys of the traditional locations by Stu Mackenzie, Nick Bartok, and JM in the summers of 2008 and 2009 failed to locate any Forster's Terns breeding at these sites, though foraging birds were occasionally seen.

Discussion

Forster's Terns nesting in Ontario occur at the extreme eastern edge of this species' main breeding distribution in the Great Basin Desert and Prairie Pothole Region areas of North America, with scattered local populations elsewhere (isolated nesting also occurs on the Atlantic coast; McNicholl *et al.* 2001). After a perceived absence of at least 90 years, Forster's Terns were again recorded nesting in Ontario in 1976 at Long Point. Since then, the number of nests in Ontario has increased dramatically to greater than 1,600 during the last complete census in 2001 (Graham *et al.* 2002). Many nesting sites have been occupied on a consistent basis over the past three decades (Table 1). However, the number of nests recorded at individual sites has varied markedly among years; for example, at Rondeau Bay and at Long Point during the period from 1976-91 (Table 1). It also appears that considerable variation in colony site location can occur over relatively short time scales. McCracken (1982) reported a complete shift in colony locations at Long Point between successive years (1981 and 1982), despite similar numbers of colonies, ranges of colony size and total nest numbers among years. These unusual population patterns raise a number of questions. First, why did Forster's Tern become extirpated from Ontario during the late 19th or early 20th centuries and remain absent for so long? Second, what prompted their return and subsequent population increase during the latter part of the 20th and early 21st centuries? And finally, why do nest numbers at traditional Ontario breeding sites fluctuate so much from year to year?

One reason for the long absence, followed by a resurgence, may be that the Forster's Terns breeding in Ontario represent a small sub-population of birds, at the edge of their main distribution, and isolated from the main concentration of breeders in the interior of North America (McNicholl *et al.* 2001). The very nature of this isolation would make this sub-population more subject to random factors and prone to abrupt increases or decreases in size. However, the long gap in Ontario nest records may not necessarily be in response to an overall decline or range contraction for this species. Although not well-suited to monitor waterbird species with clumped nesting distributions, the long-term Breeding Bird Survey data indicate that Forster's Tern numbers have been stable at a continental scale since the mid-1960s (a non-significant increase of 0.66 individuals/hr from point counts, 1966-2007; Sauer *et al.* 2008). Caution should be exercised, however, as no good historical trends exist; the ephemeral nature of nesting habitat makes it difficult to distinguish between changes in distribution and changes in population size (McNicholl *et al.* 2001).

An alternative explanation for the erratic fluctuations in the number of Forster's Tern nests in Ontario might simply be a function of incomplete survey coverage. Forster's Tern colonies can be difficult to find and nests can be difficult to count even once the colony has been discovered. At least some of the major nesting sites occur on private property and may not be readily detected during casual surveys. Even when permission is granted, access into many wetlands can be limited. Searching for nests presents a further challenge, especially in situations where floating nests are hidden within stands of emergent cattails. Access to most nests requires wading from the small boat used to reach the colony site. To illustrate, during the second OBBA, only 54 nests Forster's Tern nests were confirmed (i.e. nests located; Cadman *et al.* 2007) at a time when hundreds of observers were actively searching for breeding evidence and the total population for the province was likely in the order of 1,000 nests.

A more likely explanation for the sporadic nesting patterns observed for Forster's Terns is related to their somewhat unique nesting strategy. In Ontario, this species nests colonially in freshwater marshes, usually within stands of emergent vegetation and adjacent to open water. Nests are normally constructed on heaps of washed-up or floating vegetation, or atop muskrat lodges (McNicholl *et al.* 2001). Therefore, the availability of nesting habitat, nest distribution and breeding success are all sensitive to fluctuations in water levels. According to McNicholl (1975), change in colony sites is a common feature of Forster's Tern breeding ecology, and that a lack of site tenacity and the ephemeral nature of colonies was probably reflective of an adaptation to a nesting environment that was itself prone to change.

McNicholl (1987) attributed the presence of Forster's Terns in south-western Ontario to periods of high water levels; continuous, above-average water levels were recorded during the late 1800s and again starting in the late 1970s, periods when Forster's Terns were known to be nesting in the province. Water levels remained relatively high from the mid 1970s to the late 1990s on Lakes St. Clair and Erie (The Canadian Hydrographic Service; http:// www.waterlevels. gc.ca/ C&A/ net graphs- _e.html), which may explain the consistent nesting and increase in nest numbers since the perceived re-colonization of Ontario in the 1970s. However, water levels were only slightly lower on these water bodies during the mid 1940s to mid 1950s when no Forster's Tern breeding was detected, presumably because they were absent or present in very low numbers. Therefore, fluctuations in Great Lakes' water levels only provides a partial explanation for the long hiatus of breeding records by this species in Ontario.

Over shorter time scales, colony site selection does appear to be linked to the availability of suitable nesting substrate. McCracken (1982), observed an inter-year shift in colony locations at Long Point; terns nested at eight distinct sites in 1981, which were abandoned for nine new sites in 1982. The predominant nesting substrate in both years was rafts of dead cattail, floating within deep-water stands of emergent cattail. These rafts of vegetation were only present at the new colony sites and not at the sites occupied the previous year. It seems likely that both water level and wind action affect where these floating mats of cattails would accumulate or dissipate, thereby dictating where Forster's Tern colonies would develop (Graham *et al.* 2002).

While the fluctuations in water level and the associated affects on the availability of suitable breeding habitat are important factors influencing Forster's Tern population dynamics, local declines have also been attributed to competition for nesting space with other colonial-nesting species. Colonization of one island site by Ring-billed Gulls was suspected as the cause of a sharp decline in the number of Forster's Terns breeding in Rondeau Bay between 1990 and 1992 (Austen *et al.* 1996). Scharf and Shugart (1984) suggested that higher water levels favoured Forster's Terns, in part, because of the differentially adverse affect on Common Terns (*Sterna hirundo)*, thereby reducing competition for nesting space between these species. In addition, McCracken (1982) suggested that the proximities of suitable loafing and feeding areas were also important factors affecting colony site selection by Forster's Terns.

A comprehensive survey of marsh nesting terns by CWS is planned to begin during the 2010 breeding season. After it is completed, we will be in a better position to assess population trends and distributional changes for this species. As water levels have been stable but relatively low for the past decade (The Canadian Hydrographic Service; see link above), one might predict a decline in the number of Forster's Tern breeding pairs.

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Reproductive Success and Banding Returns of American Kestrels in Agroecosystems in the Southern Ontario Landscape

Kimberly O'Hare, Pamela Martin, Glenn Barrett*

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Figure 1. Recently hatched American kestrel chicks with adult female. *Photo: EC/Glenn Barrett*

Introduction

American Kestrels (*Falco sparverius*) are a common sight in southern Ontario, perched on wires and trees along roads in agricultural areas. About the size of a Blue Jay (*Cyanocitta cristata*), they prefer open habitats with scattered trees in cultivated and urban areas. Males establish a nesting territory and the female joins later, after moving among several territorial males before making a choice. They hunt small mammals, birds and invertebrates, with males delivering prey to the female during incubation and later, to the nestlings. Males also incubate the eggs while the female hunts. They nest almost exclusively in natural cavities in banks or cliffs or woodpecker holes in trees, and will readily compete with European Starlings (*Sturnus vulgaris*) for nest boxes (Smallwood and Bird 2002). Although their status is considered "very common", a long term decline of American Kestrel populations in southern Ontario is evident in the Canada Bird Trends Database of the North American Breeding Birds Survey (http://www. cws-scf.ec.gc.ca/mgbc/ trends). Being at the top of the food web, they are in a position to bioaccumlate persistent environmental contaminants and can be considered as bioindicators of environmental conditions. Their use of agricultural fields for foraging and their propensity to accumulate contaminants suggest they may be sensitive to agricultural impacts. Most persistent organochlorine pesticides including DDT, were banned from use in the 1970s and 1980s; nevertheless, the toxic breakdown product of DDT is still prevalent in the soil in many agricultural regions in Ontario (Crowe and Smith 2007, Bishop *et al.* 2000a, 2000b) and has been found in the eggs of American Kestrels and other agriculturally nesting birds (Hebert *et al.* 1994). In particular, areas of tobacco production and fruit orchards were heavily sprayed with DDT in the past and continue to receive high usage of the more modern pesticides.

We suggest that kestrels breeding in areas specializing in certain crop types (agroecosystems), are at greatest risk of exposure to both historically-applied persistent contaminants and current-use pesticides, which may impact their reproductive success. We investigated American Kestrel reproductive success from 2002 to 2005 in three different agroecosystems that we classified as having high, moderate and low pesticide use. American Kestrel adults and nestlings were banded from 2001-2008. Band recapture data may provide some insight on survival, nest re-occupancy and dispersal of kestrels in agricultural regions of Ontario.

Kestrel nest boxes were located along trails in the Great Lakes basin in southern Ontario. Nestbox trails were named for proximity to a primary town in the area. Two trails (Grimsby and Niagara-on-the-Lake) were on the Niagara Peninsula, where stone fruit orchards and vineyards predominated. Two other trails (Delhi and Tillsonburg) were located in areas in which tobacco was

Figure 2. Map of American Kestrel trails in southern Ontario

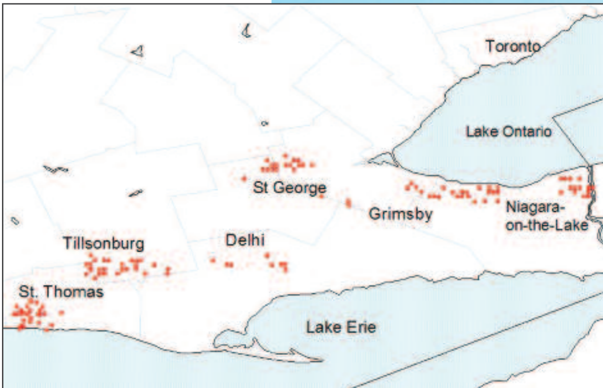

Figure 3. American Kestrel nest box located adjacent to an orchard (St. David's, Ontario)
EC/Glenn Barrett

common, although declining in occurrence in preference for corn and soy, as well as ginseng, winter rye and field vegetables. A fifth trail (St. George) was located north of Hamilton, where there is a larger proportion of woodlots, pastureland and hay crops, along with a diverse, less intensive landscape of dairy and beef farming, small apple orchards and mixed crops. Trails were also monitored for several years in Holland Marsh and St Thomas, however, only the banding data from these two sites are included in this paper.

Pesticides typically are sprayed based on the crop type, pest cycles, and recommendations made by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). The three agroecosystems in this study were ranked as high, moderate and low pesticide use based on both the crop type (for their unique pesticide regimes: McGee *et al.* 2004) and contaminant profiles from previous kestrel egg analysis (Hebert et al. 1994). The orchard and vineyards agroecosystem (Niagara-on-the-Lake and Grimsby) is ranked as having the highest pesticide use. Tobacco, corn and soy (Delhi and Tillsonburg) crops have moderate pesticide use and woodlots, pasture and mixed crops (St. George) were ranked as having the lowest use. The objective of our study was to determine if there were differences in productivity and egg contamination of American Kestrels nesting in areas of differing pesticide usage, based on agroecosystem type. In addition, we wanted to document nestbox usage and return rates of banded nestling and adult birds in southern Ontario.

Methods

Nest box trails were erected in 2001 with the exception of the St. George trail which was established in the 1980s. Trails had from 20 to 35 wooden boxes of a standard design placed on wooden utility poles at a height of at least 5 meters above the ground, spaced at least 1 km apart along secondary roads. Nest boxes were monitored during the breeding season from 2002 to 2005, beginning in early April of each year. A single egg was collected from each nest once 3 eggs had been laid and incubation had been initiated. Eggs were sent for analysis of organochlorine contaminants (including DDT) to Environment Canada's National Wildlife Research Centre in Ottawa. The hatch date of each nest was estimated by counting forward from the first date of incubation and was verified by visits around the estimated date. Chicks were banded at 16 days of age and sex was determined by wing feather colouration; a final visit was conducted at age 22 days. No further visits were conducted after this time to prevent forced early fledging. Three major parameters of reproductive success were determined. Clutch size was the total number of eggs laid, including those collected for chemical analysis. Hatch success was determined by the number of eggs hatched divided by the number laid minus any eggs that were collected for chemical analysis. Fledging success was considered to be the number of chicks alive at the final visit on day 22 divided by the total number of eggs hatched. Adult birds were often in nestboxes during incubation and we were occasionally able to catch the birds and band them, and check for any existing bands.

Results and Discussion

We assessed reproduction in 50 to 60 active kestrel nestboxes annually in southern Ontario in each of four years, 2002 through 2005, totaling 219 breeding attempts (Table 1). Clutch size for kestrels was consistently 4-5 eggs among all trails over all years. A very small number of pairs produced 3 or 6 eggs. Although hatch success appeared lower in some crop types in different years, differences were not statistically significant due to variability in the data and there were no consistent trends over the years. Fledging success of kestrels in all agroecosystems was over 90% in all years. Overall, reproductive success did not appear to be associated with agroecosystem type in our study and was similar to values found elsewhere (Smallwood and Bird 2002).

The historically-used pesticide DDT, is the contaminant most likely to directly affect hatchability of eggs due to its ability to induce eggshell thinning, particularly in raptors (Lincer 1975). In Bald Eagles (*Haliaeetus leucocephalus*) and Peregrine Falcons (*Falco peregrinus*), concentrations of DDT in eggs of 10 to 20 ug per g wet weight were associated with significant levels of eggshell thinning and consequent reproductive impairment (Blus 1996). In our study, we found mean levels of DDT in kestrel eggs of over 5 ug per g in kestrel eggs in the Niagara-on-the-Lake trail (Table 2). Although these concentrations are significantly higher than those at most other sites, there with no evidence of an impact on reproductive success. In 1987 and 1988, kestrels nesting in the same fruit-growing areas of southern Ontario contained mean DDT concentrations of over 7 ug per g in their eggs (Hebert *et al.* 1994: see Table 2); in contrast to our study however, these birds experienced significant reductions in hatching success compared to those in other regions with lower egg concentrations of DDT. Nevertheless, their eggshells were not thinned to a degree to suggest this mechanism as the cause of failure (Hebert *et al.* 1994). In almost 15 years between these two studies, during which DDT would not have been sprayed at all, concentrations accumulated in eggs by kestrels declined very little, attesting to the persistence of this chemical in agricultural soil. Nevertheless, it is encouraging that exposure appears to have declined sufficiently to levels below the threshold of reproductive impacts in kestrels. Bishop *et al.* (2000b) found significant reductions in orchard-nesting Tree Swallow (*Tachycineta bicolor*) and American Bluebird (*Sialia sialis*) reproduction over a 7 year study, and reported that bluebird hatching success was

Table 1. Reproductive parameters of American Kestrels nesting in southern Ontario

		Mixed crop St. George trail			**Orchard/Vineyard** Niagara and Grimsby trails			**Tobacco** Delhi and Tillsonburg trails		
Year	Reproductive Parameters	N	mean	SE	N	mean	SE	N	mean	SE
2002	clutch size	8	4.88	0.23	27	4.89	0.11	20	4.95	0.11
	hatch success (%)	8	87	4	27	84	4	20	91	3
	fledging success (%)	8	97	31	26	98	3	20	98	1
2003	clutch size	6	5.00	0.26	27	4.56	0.13	20	4.80	0.09
	hatch success (%)	6	67	21	27	79	7	20	89	7
	fledging success (%)	4	94	6	24	94	4	18	99	1
2004	clutch size	6	4.00	0.37	25	4.48	0.13	25	4.24	0.19
	hatch success (%)	6	97	21	25	93	8	25	97	8
	fledging success (%)	5	100	0	22	100	0	23	96	3
2005	clutch size	5	4.60	0.24	27	4.48	0.20	23	4.13	0.22
	hatch success (%)	5	87	23	27	67	8	23	95	10
	fledging success (%)	4	100	0	22	91	5	19	95	5

N=sample size; SE=standard error

Table 2. Concentrations of the pesticide DDT (ug per g wet weight) and its metabolites in American Kestrel eggs in the current study, 2002-04, and previously measured by Hebert *et al*. (1994) in 1989

	Mixed crop			**Orchard/Vineyard**						**Tobacco**					
	St. George			Niagara-on-the-Lake			Grimsby			Tillsonburg			Delhi		
Year	N	mean	SE	N	mean	SE	N	mean	SE	N	mean	SE	N	mean	SE
		0.514						0.972			0.290			2.522	
2002–4	8	A	0.203	11	5.079 B	1.091	16	A	0.274	7	A	0.092	3	AB	1.738
1989	–	–	–	10	7.465	–	10	5.535	–	10	1.1718		10	1.386	–

N=sample size; SE=standard error

Note: Data from 1989 was a single pooled sample analysis; those from 2002-4 were means of individual sample analyses. Means followed by the differing uppercase letters are significantly different ($P < 0.05$; Analysis of Variance test) negatively correlated with egg DDE levels. The mechanisms responsible for reproductive decreases have not been elucidated but the eggshell thinning phenomenon is not typical in songbirds. Reproductive success of American Robins (*Turdus migratorius*), Tree Swallows; House Wrens (*Troglodytes aedon*) and bluebirds were not significantly reduced in orchards containing high levels of DDT compared to non-orchard areas in central British Columbia (Elliott *et al.* 1994).

From 2001 to 2008 over 1270 kestrels were banded along all the trails. Of these, 1161 were banded as nestlings and 109 were banded as adults, captured in the nestbox during incubation. Band returns from across North American were compiled from the Environment Canada Bird Banding Office database. In addition, the authors obtained recapture data during nest box checking by examining any incubating adults that could be captured; in this way we also captured breeders which were banded by other banders and we obtained information on banding location of these birds from the banding office. Between these two sources we obtained band return information on a total of 53 birds, or 4% of banded birds; of these, 36 were alive (Table 3). For birds that were banded or recaptured by the authors at a specific nestbox we were able to include exact nestbox location (e.g. TI-23); however, for birds that were banded or recaptured by other banders or found dead by other individuals we were only able to provide more general recapture location information as provided by the banding office.

Although our recapture sample is small, there is an obvious trend for birds to return to the geographic area in which they were originally banded, either as nestlings or as adults (Table 3). Two female kestrels were recaptured nesting in consecutive years. One female had been banded as a chick in 2002 (ID 1) on the Grimsby trail, then nested successfully in different boxes on the Niagara trail for 4 successive years. The other female, banded as an adult during incubation (ID 2) in 2005, returned to a nearby box in 2006 and back to her original box in 2007, fledging a total of 13 young in the 3 years. Three males, one in each of the Delhi, Tillsonburg and Niagara-on-the-Lake trails, (IDs 3,5 and 6) and one female from the Grimsby trail, (ID 4) were banded as chicks and returned to the same trails as successful breeders within the next two years. An additional five adult females banded during incubation, (IDs 7 to 11) were also recaptured in nestboxes on the same trail (ID 10 in same box) within two years of banding. An adult female banded during incubation in 2007 on the St. George trail (ID 13) abandoned her nest when it was destroyed, but moved to another St. George box and fledged three young during that same year. During nestbox checks, we recaptured nine adult birds that had been banded by other banders. Of these, four captured in Tillsonburg and St. Thomas nestboxes, had been banded near Sparta, a small town near Tillsonburg (IDs 16, 18, 23, 24); three had been banded southeast of Kitchener (IDs 17, 20, 21), near our St. George trail, two of which were captured in the

Table 3. Band returns from American Kestrels banded or recaptured in southern Ontario, 2001-2008.

Banding information					Recapture information			
ID	date	age	sex	location	recapture location	date	status	age at recapture
Returning breeders								
1	May-02	nestling	F	GR-21	NOL-22	Apr-03	Alive	1 YR
1	May-02	nestling	F	GR-21	NOL-22	May-04	Alive	2 YR
1	May-02	nestling	F	GR-21	NOL-13	May-05	Alive	3 YR
1	May-02	nestling	F	GR-21	NOL-17	Apr-06	Alive	4 YR
2	Apr-05	AHY	F	GR-11	GR-7	May-06	Alive	AHY
2	Apr-05	AHY	F	GR-11	GR-11	Apr-07	Alive	AHY
3	Jun-03	nestling	M	DE-22	DE-24	Apr-04	Alive	1YR
4	Jun-07	nestling	F	GR-5	GR-21	Apr-08	Alive	1YR
5	Jun-03	nestling	M	NOL-5	NOL-2	May-05	Alive	2YR
6	Jun-02	nestling	M	TI-22	TI-18	Mar-04	Alive	2YR
7	May-04	AHY	F	TI-35	TI-34	Jun-05	Alive	AHY
8	May-03	AHY	F	TI-19	TI-23	Apr-04	Alive	AHY
9	May-03	AHY	F	SG-24	SG-23	Apr-05	Alive	AHY
10	Apr-06	AHY	F	GR-2	GR-2	May-07	Alive	AHY
11	May-06	AHY	F	TI-5	TI-6	May-07	Alive	AHY
12	Mar-04	AHY	M	GR 11	GR-11	Apr-04	Alive	AHY
Breeder, recaptured same year								
13	Apr-07	AHY	F	SG-3	SG-15	May-07	Alive	AHY
14	May-07	AHY	F	SG-23	SG-23	Jun-07	Alive	AHY
15	May-07	AHY	F	TI-34	TI-34	Jun-07	Alive	AHY
Breeder, banded elsewhere								
16	Jun-03	nestling	F	near Sparta,ON	TI-27	May-04	Alive	1 YR
17	May-01	nestling	F	30 mi SE of Kitchener, ON	GR-25	Apr-04	Alive	3 YR
18	Sep-01	HY	M	near Sparta, ON	TI-23	May-06	Alive	5YR
19	Jul-96	nestling	F	near Hillman, MI	Ti-25	May-02	Alive	6YR
20	May-01	AHY	F	30 mi SE of Kitchener, ON	SG-10	Jun-02	Alive	AHY
21	May-01	AHY	F	30 mi SE of Kitchener,ON	SG-9	May-02	Alive	AHY
22	Mar-02	AHY	F	near Port Huron, MI	SG-26	Jun-02	Alive	AHY
23	Jun-03	AHY	F	near Sparta, ON	ST-12	May-05	Alive	AHY
24	Jun-03	AHY	F	near Sparta, ON	ST-25	May-05	Alive	AHY

Banding information					Recapture information			
ID	date	age	sex	location	recapture location	date	status	age at recapture
Banded nestling, recaptured during hatch year								
25	Jun-07	nestling	F	SG-15	N of Sudbury, ON	Dec-07	Alive	HY
26	Jun-01	nestling	F	TI-14	St. Thomas , ON(BT)	Sep-01	Alive	HY
27	Jun-01	nestling	M	NOL-12	St. Thomas, ON (BT)	Oct-01	Alive	HY
28	Jul-03	nestling	M	HM-18	Amherstburg, ON (BT)	Sep-03	Alive	HY
29	Jun-04	nestling	M	DE-7	St. Thomas, ON (BT)	Sep-04	Alive	HY
30	Jun-04	nestling	F	NOL-17	St. Thomas, ON (BT)	Aug-04	Alive	HY
31	Jun-02	nestling	F	NOL-6	Morgan, GA	Oct-02	Alive	HY
Banded nestling recaptured elsewhere after hatch year								
32	Jun-03	nestling	F	TI-8	Milverton,ON	Jul-04	Alive	1 YR
33	Jun-04	nestling	M	SG-3	Ancaster, ON	Jan-05	Alive	1 YR
34	Jun-04	nestling	M	TI-1	NE of Sudbury, ON (BT)	Mar-06	Alive	2 YR
35	Jun-03	nestling	F	DE-23	N of London, ON	May-06	Alive	3 YR
36	Jun-05	nestling	F	ST-12	W of Westminster, ON (BT)	Mar-08	Alive	3 YR
Banded nestlings found dead in hatch year								
37	Jun-06	nestling	F	TI-24	Tillsonburg, ON	Jun-06	Dead	HY
38	May-03	nestling	M	GR-15	Grimsby, ON	Jun-03	Dead	HY
39	Jun-07	nestling	F	TI-30	N of Ingersoll	Jun-07	Dead	HY
40	May-04	nestling	M	GR-5	Grimsby, ON	Jul-04	Dead	HY
41	May-03	nestling	F	GR-18	N of Peterborough, ON	Jul-03	Dead	HY
42	Jun-06	nestling	F	NOL-1	NOL-1	Jan-07	Dead in nestbox	HY
43	Jun-05	nestling	F	NOL-14	NOL-14	Dec-05	Dead in nestbox	HY
44	May-06	nestling	M	NOL-13	Niagara-on-the-Lake, ON	Nov-06	Dead	HY
Banded nestlings found dead after hatch year								
45	Jun-03	nestling	M	NOL-9	Port Colborne, ON	Jan-04	Dead	1 YR
46	Jun-03	nestling	M	TI-8	S of Tillsonburg, ON	Jan-04	Dead	1 YR
47	Jun-04	nestling	F	DE-17	Grimsby, ON	Mar-05	Dead	1 YR
48	Jun-05	nestling	unk	TI-26	Tillsonburg, ON	May-06	Dead	1 YR
49	Jun-07	nestling	M	GR-7	Stoney Creek, ON	Jun-08	Dead	1 YR
50	Jun-02	nestling	M	TI-27	Tillsonburg, ON	May-04	Dead	2 YR
51	Jun-07	nestling	M	SG-18	Bremen, GA	Feb-09	Dead	2 YR

Banding information					Recapture information			
ID	date	age	sex	location	recapture location	date	status	age at recapture
Banded breeders found dead								
52	Apr-04	AHY	M	TI-30	Tillsonburg, ON	Jan-05	Dead	1 YR
53	Apr-07	AHY	F	GR-29	GR-29	Apr-08	Dead in nestbox	AHY

HY =Hatching Year bird capable of sustained flight that has hatched during the calendar year; AHY=After hatch year is a bird in its first year or of unknown adult age. Band locations; GR-Grimsby, SG-St. George, TI-Tillsonburg, DE-Delhi, HM-Holland Marsh and NOL-Niagara-on-the-Lake, ST-St. Thomas, (BT)-Banding trap

St. George nestboxes. In contrast however, two were birds originally banded in Michigan, indicating that, while the general trend is for birds to return to the same geographic area to breed, some widerspread distribution also occurs. The two oldest birds recaptured in our study were a 6 year old female and a 5 year old male both, in the tobacco agroecosystem (bird ID#s 18 and 19).

Birds banded as nestlings in our trails and recaptured alive by others as adult birds were typically found in southern Ontario, with the exception of ID 34 which was captured in Sudbury in early spring. Similarly 6 of 7 birds banded as nestlings and found dead as adults in subsequent years were found extremely close to their natal areas, with the exception of bird ID 51 which was recovered in Georgia in the winter. Similarly, 2 of 2 birds banded as adults and later found dead were on the same trail as banded. One was found in April, dead in the box she had bred in the previous year.

Recaptures of live hatch year juveniles occurred primarily early in the fall, where 5 of 7 were trapped at migration banding stations on the north shore of Lake Erie; Hawk Cliff (Port Stanley) and Holiday Beach (Amherstburg). Interestingly, another was found in December north of Sudbury (ID 25) and another in October in Georgia (ID 31).

Retrievals of dead hatch year juveniles were typically very close to the breeding area, either in the summer or fall after fledging. One exception was a bird found near Peterborough (ID 41). In a couple of cases, banded juveniles were found dead in their natal nestboxes late the following winter during nestbox cleaning (Bird ID 42 and 43).

The strong site fidelity seen in southern Ontario kestrels appears to be similar to other populations in North America. Steenhof and Peterson (2009) report that 20% of over 900 adults banded in nest boxes in Iowa were recaptured in the area in at least one subsequent year. Our numbers are much lower, with only 8% of 109 banded adults being recaptured in our nestboxes or found dead in the area; most were exclusively within the same trail. Our lower recapture rates are probably a function of the lower intensity of our study — our goal was to obtain eggs for contaminants and reproductive parameter, not to band adults, whereas Steenhof and Peterson were specifically interested in site fidelity. The propensity of nestlings to return to their natal region (philopatry) also appears to be strong in our Ontario kestrels, which bears out findings of other North American researchers. Miller and Smallwood (1997) reported that 34 colour-marked nestling kestrels in Florida dispersed an average of approximately 8 km from their natal nestbox to the site of first breeding, the farthest being 34 km. While we don't have exact distances available for our recaptured birds, most birds returned to their natal trail.

Conclusion

American Kestrels breeding in man-made nestboxes in agricultural landscapes in southern Ontario appear to be successfully reproducing and maintaining occupancy of the nestbox trails over several years. There do not appear to be impacts of agricultural exposure to pesticides on productivity despite the fact that concentrations of DDT in eggs have declined little in the past 15 years. Site fidelity of this population of birds appears to be consistent with that in other parts of the continent. Continuing to monitor kestrel reproduction, site fidelity and pesticide levels in their habitats may provide necessary information to help reverse the continent wide decline of this species.

Acknowledgements

The authors would like to thank Cyril Crocker for allowing us to utilize his St. Thomas kestrel nestbox trail. We would also like to thank Bill Read and many others who, over the years, have helped the authors establish, maintain and monitor the other kestrel nestboxes described in this paper.

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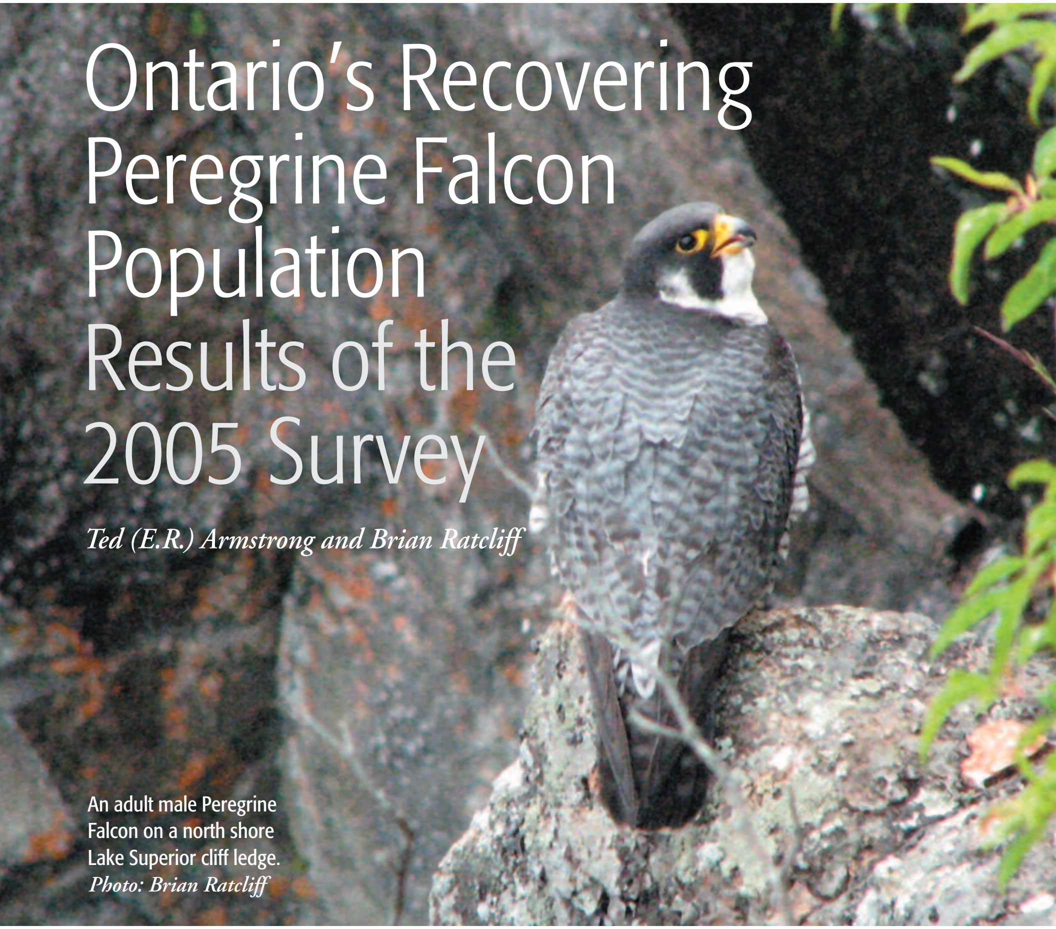

Ontario's Recovering Peregrine Falcon Population

Results of the 2005 Survey

Ted (E.R.) Armstrong and Brian Ratcliff

An adult male Peregrine Falcon on a north shore Lake Superior cliff ledge. *Photo: Brian Ratcliff*

Introduction

The Peregrine Falcon (*Falco peregrinus*) disappeared as a breeding species in Ontario in the early 1960s, primarily as a result of DDT contamination. The *anatum* subspecies of the Peregrine Falcon was designated as endangered in Ontario in 1977, and nationally in 1978. Identified priorities of the resulting National Recovery Plan (Erickson *et al.* 1988) were population monitoring, addressing low productivity as a result of pesticides, and preserving the gene pool (Erickson *et al.* 1988). Other recovery efforts included prohibitions on the use of DDT in Canada, and the release of captive-reared young across Canada. A total of 592 young Peregrine Falcons was released into the wild between 1977-2005 (OMNR data). Since recovery efforts were initiated, Peregrine Falcon numbers have dramatically increased both nationally and in Ontario (Holroyd and Banasch 2003, Armstrong 2007).

Population monitoring is addressed as part of the National Recovery Strategy primarily through coordinated national surveys conducted every five years (Cade and Fyfe 1970, Fyfe *et al.* 1976, Murphy 1990, White *et al.* 1990, Holroyd and Banasch 1996, Rowell *et al.* 2003, Banasch and Holroyd 2004). Since 1970, Ontario has participated in these nation-wide surveys to determine site occupancy, productivity, and population trends. Additionally, several local monitoring programs continue annually between these 5-year surveys. We are reporting here on the results of the 2005 survey, prior to initiation of the upcoming 2010 survey.

Survey Methods

The 2005 survey was designed using the same format as the 2000 Ontario Peregrine Falcon survey (Ratcliff and Armstrong 2002) and consistent with the national survey protocol. A combination of volunteers, naturalist organizations, Parks Canada and Ontario Ministry of Natural Resources (OMNR) staff coordinated surveys of historic and currently active nest sites, as well as areas with high potential as nesting habitat. A number of communication measures were undertaken to raise public awareness of the survey and to solicit reports of Peregrine Falcon breeding activity. The 2005 survey also coincided with and benefited from the final year of the most recent Ontario Breeding Bird Atlas (Cadman *et al.* 2007).

Field surveys were timed to regional breeding chronology. Nesting chronology of Peregrine Falcons is generally earlier in southern Ontario than in northern Ontario (Figure 1). In northern Ontario, Peregrine Falcons return to nest sites in late March and begin egg laying in late April. In southern Ontario, many urban nesting birds no longer migrate and maintain territories throughout the year. Egg laying is often initiated in mid-March, about one month earlier than the earliest date noted for historical southern Ontario cliff nests of April 23 (Peck and James 1983). Northern Ontario was defined for this survey as all of the province north of the French and Mattawa River systems; southern Ontario includes that portion of the province south of these rivers.

Cliff Monitoring

All active cliff breeding sites identified in previous surveys were re-surveyed. Efforts were also made to check additional cliff sites with high potential, as well as all known historic nesting sites. Helicopter surveys have proven to be an effective and efficient method for surveying Peregrine Falcon nesting activity along remote cliffs with limited access and abundant, high quality habitat. These areas include Algonquin Park, the Bruce Peninsula, the Ottawa River, the north shore of Lake Huron, Lake Nipigon, and the Lake Superior Basin. Helicopter survey windows were identified

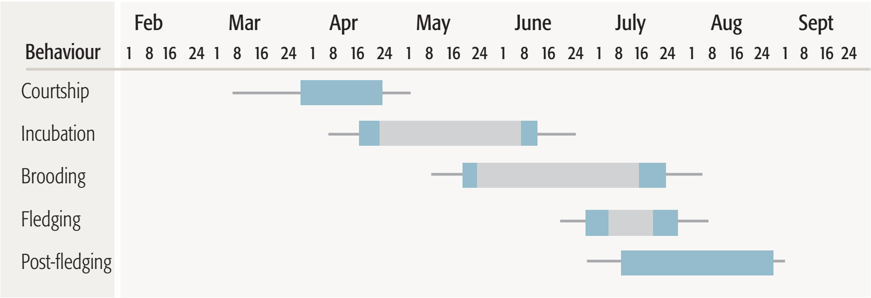

Figure 1a. Approximate nesting chronology for Northern Ontario Peregrine Falcons obtained from the recorded observations in the Peregrine Falcon nesting status reports from 2000 – 2004. This figure pertains to 112 nests and 212 young over the five year duration. The lines indicate the observed range for each behaviour while the solid bars indicate when the majority of each behaviour occured. The grey area signifies the range when approximately 80% of the behaviour occurred. It was assumed that the incubation and brooding periods have a duration of 33 days and 40 days respectively.

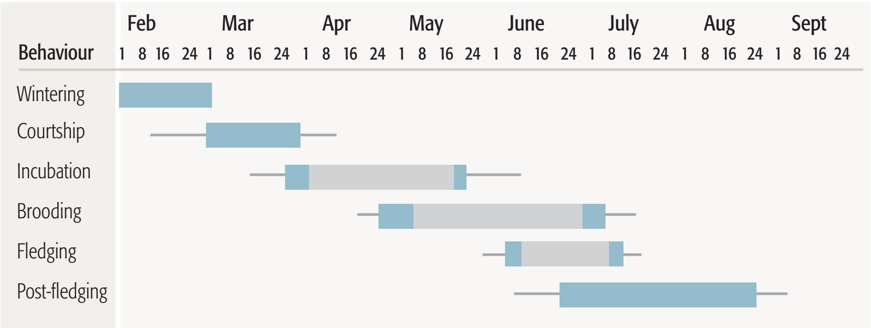

Figure 1b. Approximate nesting chronology for Southern Ontario Peregrine Falcons obtained from the recorded observations in the Peregrine Falcon nesting status reports from 2000 – 2004. This figure pertains to 41 nests and 59 young observed over the five year duration. The lines indicate the observed range for each behaviour while the solid bars indicate when the majority of each behaviour occured. The grey area signifies the range when approximately 80% of the behaviour occurred. It was assumed that the incubation and brooding periods have a duration of 33 days and 40 days respectively. Out of the 13 nesting sites in the 2004 nesting season, it was observed that 62% of the mature falcons overwintered at the nest site while 15% returned in the spring. There was no data for the remaining 23%.

as the best survey dates both to confirm nesting activity and to count the number of young at each nest site for productivity estimates. Surveys were conducted in late May in southern Ontario, and during the second week of June in northern Ontario. Some cliff sites were also monitored from the ground or by water.

Urban Areas Monitoring

Most urban nesting sites are known, and many are monitored annually by local monitoring programs. Data on urban nesting Peregrine Falcons were obtained from existing nest monitoring programs, and additional reports of new nesting sites that were received.

Evidence of Breeding and Productivity

Progressive levels of breeding activity were recorded as follows:

- **Occupied Territory** — a single adult Peregrine Falcon observed in suitable habitat throughout part or all of the breeding season;
- **Territorial Pair** — confirmation of a pair on territory during the breeding season; and
- **Confirmed Nesting Attempt** — the highest level of breeding activity, indicated by an adult sitting on a scrape, the presence of eggs, nestlings or recently fledged young.

Banding of young Peregrine Falcons at nest sites was undertaken in northwestern and southern Ontario where it could be feasibly and efficiently coordinated with monitoring activities. Banding studies provided additional productivity information. The presence of young of banding age (approximately three weeks or older) was used as an estimate of the number of young fledged. While this is likely an overestimate of productivity, this provides annual reference data at a point in the nesting cycle where nestling mortality declines significantly.

Origin of Territorial Birds

At each territory, efforts were undertaken to identify the origin of adult birds by the presence or absence and colour of legs bands as follows:

- unbanded — a wild-reared bird from either Canada or the U.S.;
- black colour band — a Canadian wild-reared bird;

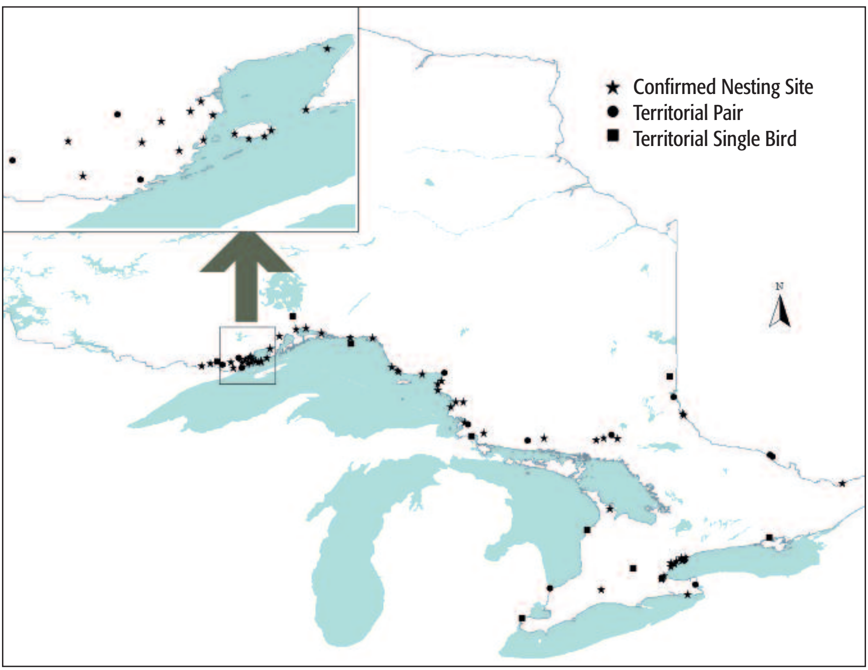

Figure 2. Location of confirmed Peregrine Falcon territories in Ontario, 2005

- red colour band — a Canadian released bird;
- bicoloured band (black over green or black over red), or purple-anodized U.S.F. & W.S. band — a U.S. wild-reared bird;
- gold-anodized U.S.F. & W.S. band — a U.S. released bird; and
- plain silver U.S.F & W.S. band — a Canadian wild-reared bird, or a bird banded at a banding station while on migration.

Results

Confirmed Peregrine Falcon breeding activity was recorded at 78 active sites, comprising 54 confirmed nesting attempts, 13 territorial pairs and 11 single birds occupying territories (Figure 2, Table 1). Four of these territorial pairs nested in Quebec, Michigan or New York, with significant parts of their territory in Ontario. Of the 78 territories, 53 (68%) were located in northern Ontario, while 25 (32%) were from southern Ontario. The highest number of territories (43, or 55%) occurred within the Lake Superior Basin.

Seventeen new territories were located that had not been documented previously — 9 in the north and 8 in the south. Eleven territories that were active in 2000 were not occupied in 2005. The trend in the number of territories recorded in Ontario between 1980-2005 is shown in Figure 3.

Cliffs made up the majority of Peregrine Falcon territories in Ontario — 53 (68%) were associated with cliffs (Figure 4), while 17 (22%) were associated with buildings (Table 2). Smaller numbers of territories were associated with bridges (4), open pit mines (3) and smokestacks (1). Of the confirmed nesting attempts, 39 were on cliffs, 12 on buildings, 2 in open pit mines, and 1 on a bridge.

Forty-six (85%) of the 54 nest attempts were considered successful in fledging at least 1 young (Table 3). Estimated productivity was:

- Average number of chicks fledged/ pair (N= 63) -2.0
- Average number of chicks fledged/ nest attempt (N= 54) -2.3
- Average number of chicks fledged /successful nest (N= 46) -2.7

Figure 3. Trend in the number of Peregrine Falcon territories in Ontario based on 5-year surveys, 1970-2005.
This trend closely fits a 2-factor polynomial curve with high significance (y = 4.3 x 2 – 14.7x + 10.5; y = number of territories; x = number of 5-year periods starting in 1980; R2 = 0.9766).

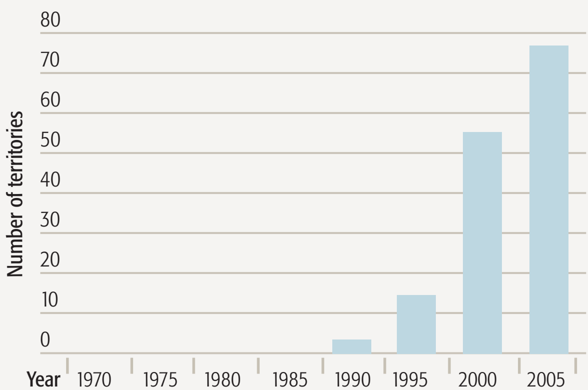

Table 1. Overall summary results of the 2005 Ontario Peregrine Falcon survey.

Breeding Status	Northern Ontario	Southern Ontario	Number
Confirmed nesting attempts	40	14	**54**
Territorial pairs	7	6	**13**
Occupied territories	6	5	**11**
Total	53	25	**78**

Four of the territorial pairs were recorded as territorial pairs in Ontario but were successfully nesting in New York, Michigan and Quebec. All pairs utilize significant portions of Ontario as their hunting and perching territories. These birds are included in the total number of territories, but are not included in numbers of nesting attempts, successful nests or number of young fledged.

Table 2. Peregrine Falcon territory type identified during the 2005 survey.

Territory Type	Northern Ontario	Southern Ontario	Total (%)
Cliff	49	4	**53 (68.0)**
Building	0	17	**17 (21.8)**
Open Pit Mine	3	0	**3 (3.8)**
Bridge	1	3	**4 (5.1)**
Stack	0	1	**1 (1.3)**
Total	**53**	**25**	78 (100.0)

Table 3. Estimated productivity of Peregrine Falcons by nest site type, 2005.

Nest Site Type	Confirmed nesting attempts	Successful nests (no. fledged young)	No. Fledged young	No. Fledged young/nesting attempt	No. Fledged young /successful nesting attempt
Cliff	39	34	89	2.28	2.62
Building	12	10	32	2.66	3.20
Mine	2	2	5	2.50	2.50
Bridge	1	0	0	0.00	0.00
Totals	**54**	**46**	**126**	**2.33**	**2.74**

Table 4. Origin of known territorial adult Peregrine Falcons identified during 2005 and 2000 surveys.

Origin	2005 Survey (%)	2000 Survey (%)
United States release program	0 (0.0)	4 (11.5)
Canadian release program	1 (2.3)	5 (14.0)
Unbanded birds (wild origin)	18 (40.9)	12 (34.0)
Canadian wild banded	10 (22.7)	3 (9.0)
United States wild banded	8 (18.2)	4 (11.5)
United States banded unknown origin	4 (9.1)	0 (0.0)
Birds banded but not identified	3 (6.8)	7 (20.0)
Total	**44** (100)	**35** (100)

Figure 4. Lake Nipigon island cliff site, surveyed and inactive in 2005, with nesting activity first recorded in 2006. *Photo: Rob Swainson*

Productivity was highest at southern Ontario urban sites (Figure 5), averaging 3.2 fledged young per successful nest, compared with 2.6 for northern cliff sites.

Forty-four adults were identified on territory by banding status — 1 from a captive release program, 36 were wild-reared, and 7 were banded but of unknown origin (Table 4).

Discussion

Falcon population continues to increase. In 2005, there was an increase of 25 territories (47%) over the last provincial survey. The 78 occupied territories documented during the 2005 survey represented the highest number of territories ever recorded in Ontario. Since the last province-wide survey in 2000, additional territories have been documented annually, with 52 new territories documented between 2001 and 2005 (OMNR data), and seventeen new territories in 2005 alone. Not all territories are occupied annually.

The rate of population increase is remarkable, given that the first confirmed nesting record after the population collapse only occurred in 1986. Ontario Breeding Bird Atlas records suggest a similar rate of population recovery, increasing from only 3 squares with breeding evidence in the first atlas in the early 1980s (none of which were confirmed nesting) to 96 squares in the second atlas in the early 2000s (Armstrong 2007). Projections suggest that Ontario's Peregrine Falcon population will continue to increase, perhaps until the available nesting habitat becomes saturated. There is no reliable estimate of the provincial population prior to the DDT-induced population collapse in the mid-20th century. During historical times, much of the highest quality cliff habitat across the north was inaccessible, and there were few observers and even fewer who recorded their observations (many of those who did document early nest records collected eggs or nestlings for museum or private collections). While historical records are sparse and spotty, there are 48 documented historical nesting sites (confirmed or suspected) from 1848-1963 (OMNR data). The actual size of the historical nesting population would have been much higher.

Ontario's Peregrine Falcon population continues to be partitioned into distinct northern and southern populations. Territories in northern Ontario were distributed mainly on cliff sites, from the Lake Superior Basin to Lake Timiskaming, while in southern Ontario territories were primarily associated with buildings in urban centres. There is little mixing of

Figure 5. An adut Peregrine Falcon near an urban nesting site, Greater Toronto area.
Photo: Mark Heaton / www.peregrinefoundation.ca

birds reared in either rural or urban environments (Holroyd and Banasch 1990), an observation also found from Ontario banding returns. The greatest proportion of territories (55%) occurred in the Lake Superior Basin. As the infilling of territories and the expansion of range continues in both northern cliffs and southern urban sites, Peregrine Falcons are still not re-occupying the majority of the historically documented cliff-nesting sites in south-central and eastern Ontario. If the pattern of distinct urban and cliff populations continues, reoccupancy of this area may rely on gradual infilling from more northern cliff-nesting birds rather than expansion from the geographically closer urban population. There was essentially no increase in cliff-nesting in southern Ontario since the 2000 survey, with only one cliff nest site located on the Bruce Peninsula. However, a portion of the territory occupied by the Niagara Falls pair was in Ontario, while the pair nested on a cliff ledge in the New York side of the gorge.

Surveying northern cliffs is challenging due to the remoteness and the large amount of potential habitat. In the western Lake Superior Basin, where there are many cliffs, most of the highest quality cliff sites are now occupied, and Peregrine Falcons are beginning to use some of the lower quality sites (i.e. lower cliff heights, shorter linear extents of cliff face). Some lower quality cliffs were not surveyed, and thus some active territories in both northern and southern Ontario may have been missed. Similarly, Peregrine Falcons traditionally have been using buildings of more than 18 stories, but in 2005, a Scarborough nest site was on a 5-story building (M. Heaton pers. comm.). It is probable that more marginal cliff sites and smaller buildings will be used in future years as the population continues to expand.

The trend towards increasing Peregrine Falcon numbers in Ontario parallels that in adjacent jurisdictions. Similar population trends have been observed across southern Canada, except that Ontario's population recovery appears to have started later and been more rapid (Rowell *et al.* 2003). Each year since 1987 there has been a year-to-year increase in the number of Peregrine Falcon territorial pairs recorded in the Midwest U.S., and northwestern Ontario (Tordoff *et al.* 2005). The number of territorial pairs increased from 2000 to 2005 in the adjacent jurisdictions of Michigan, Minnesota, New York and Wisconsin (Tordoff *et al.* 2005, Loucks 2008). The opportunity for recruitment from these adjacent populations into the Ontario population is very high, and Ontario birds are similarly contributing to the U.S. breeding population. Although 2005 data are not available, in 2004, 7 Ontario banded birds were confirmed breeding in the Midwest U.S., including Minnesota (2), Michigan (2), Ohio (2) and Wisconsin (1) (Tordoff *et al.* 2004). Both Minnesota birds were cliff nesters from Ontario cliffs, while the other 5 were urban nesting birds from southern Ontario urban nests.

Naturally-reared birds now make up almost the entire breeding population, another sign of population recovery. Only 2% of the identified banded adults originated from Canadian or U.S. release programs, a significant decrease from the 24% identified during the 2000 survey (Ratcliff and Armstrong 2002). This can be attributed to the ending of major release programs nation-wide and the continued expansion of the wild-reared population. More than twice the number of young were fledged naturally in 2005 as were released during the peak of the release program in Ontario (i.e. 126 vs. 54). Canadian wild-banded adults increased from 9% in 2000 to 23% in 2005, while unbanded birds, reflecting wild-reared birds from Canada and/or the U.S., increased from 34% to 41%.

The productivity of Ontario's Peregrine Falcon population remains high. The number of successful breeding pairs located in 2005 was the highest ever recorded in Ontario, and the record number of chicks that were assumed to have fledged was almost double the productivity of 2000 (126 vs. 68 respectively). The estimated productivity of 2.72 chicks/successful nest is comparable to the 2.62 young/successful nest recorded in 2000 (Ratcliff and Armstrong 2002) and the 2.8 young/successful nest average noted in the Midwest U.S. (Tordoff *et al.* 2004).

The original goal of the Peregrine Falcon recovery program, initiated in the 1970s, was to re-establish the Peregrine

Falcon as a breeding species in Ontario. The current Ontario population exceeds the objectives established for the original Recovery Plan (Erickson *et al.* 1988), although this alone cannot be a sign of full recovery — those recovery objectives were developed at a time when there was no breeding Peregrine Falcon population in Ontario, and the prospects for success were far less clear. Reflecting this improvement, and based largely on the positive population trends evidenced over the past several provincial and national surveys, the status of the Peregrine Falcon was downlisted recently from Endangered to Threatened in Ontario (Ontario Ministry of the Environment 2006), and recommended for a status of Special Concern nationally (COSEWIC 2007). The prospects for continued recovery of the Peregrine Falcon population in Ontario continue to look very promising. The 2010 national Peregrine Falcon survey will provide the next opportunity to check on the status of the recovery this species in Ontario.

A Follow-up Note Regarding the 2010 Peregrine Falcon Survey

Ontario is once again participating in the national Peregrine Falcon survey in the spring and summer of 2010. Ontario birders and ornithologists are encouraged to be on the lookout for observations of Peregrine Falcons during their breeding season, and to report their observations through a local monitoring program, your local Ontario Ministry of Natural Resources district office, or to jenn.chikoski@ontario.ca

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The Great Egret Roost at Muddy Creek, Essex County

Autumn 2006

D.V. Chip Weseloh, Alan Wormington and David J. Moore

The Great Egret (*Ardea alba*, henceforth egret) is a large, all white-plumaged heron which is an uncommon summer resident in southern Ontario. Currently (2009) it nests at several sites in southern Ontario: East Sister, Middle Sister and Middle islands in western Lake Erie, Toronto Harbour and High Bluff Island on Lake Ontario and Chantry and Nottawasaga islands, Cedar Point and Chimney Reefs in Lake Huron (Blokpoel and Tessier 1998, CWS unpubl. data). Some of these sites have been active for several years (Peck 1987, 2007). In the 2000s, egrets are known to have abandoned previous nesting sites on the Humber River in Toronto, Barrier Island in Georgian Bay and Bergin Island in the St. Lawrence River (G. Coady, S. Elliott, DVCW, respectively, unpubl. data). It has previously nested on/near Walpole Island in Lake St. Clair (DVCW, A. Woodliffe, unpubl. data) but its current status there is uncertain. Close to Ontario's borders, it also nests on West Sister, Green and Sandusky Turning Point islands on the Ohio side of Lake Erie (Shieldcastle and Martin 1999, M. Shieldcastle, pers. comm.), on Motor and Strawberry islands on the New York side of the Niagara River (Watson 2001, C. Adams, pers. comm.) and at Stony Island and Point Mouillee in the Detroit River and western Lake Erie waters of Michigan, respectively (Cuthbert, in press). Hence, in 2007-2009, there were at least 16 active Great Egret colonies in and close to southern Ontario.

After the breeding season, herons and egrets are known to leave their breeding colonies and wander widely (especially northward) prior to their southward autumn migration (Townsend 1931, Coffey 1943, McCrimmon *et al.* 2001). In the evenings, during this

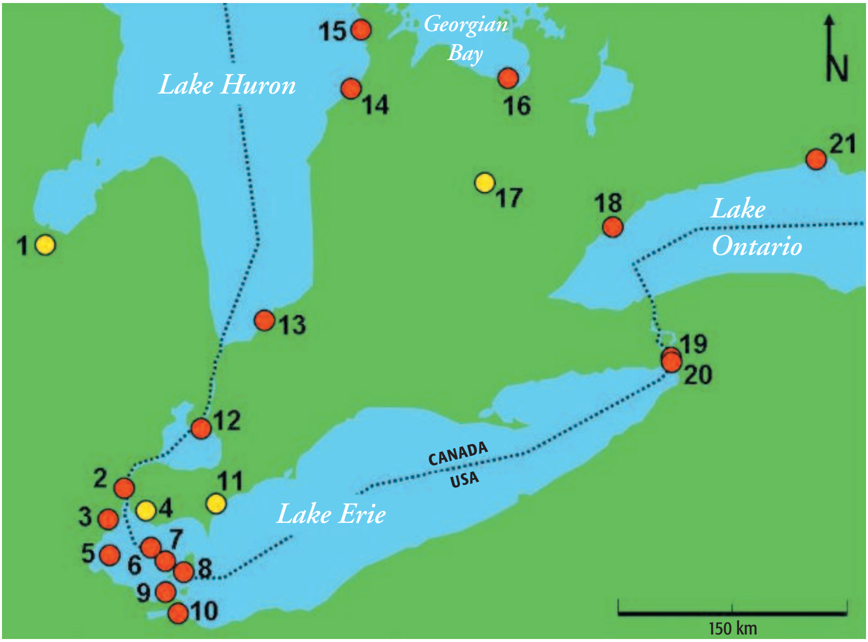

Figure 1. The active breeding sites (red dots) and the solely roosting sites (yellow dots) mentioned in the text for Great Egrets.

1. Shiawassee National Wildlife Refuge
2. Stoney Island
3. Pointe Mouillier
4. Big Creek Marsh
5. West Sister Island
6. Middle Sister Island
7. East Sister Island
8. Middle Island
9. Green Island
10. Sandusky Turning Point Island
11. Muddy Creek
12. Walpole Island
13. Cedar Point
14. Chantry Island
15. Chimney Reefs
16. Nottawasaga Island
17. Luther Marsh
18. Tommy Thompson Park
19. Motor (Pirate) Island
20. Strawberry Island
21. High Bluff Island

post-breeding period, they continue their habit of roosting communally, i.e. they gather together at dusk (Seibert 1951, Sigfried 1971) usually in trees or shrubs in or near standing water, where they spend the night. Early in the morning (usually prior to sunrise), they disperse out from these roosts to nearby feeding and foraging areas.

Socially, communal roosts are probably the second most important gathering place for colonially-nesting waterbirds, after their breeding colony. Communal roosts are the places many bird species return to each evening and from which they disperse each morning. In the post-breeding season, the communal roost becomes their centre of activity. It stands to reason that if there is not a safe local area where these birds can roost, then local populations of those species will be small. Thus, roosting areas should be identified and efforts should be made to characterize their periods of use and the size of the (temporary) populations that use them.

Even though the Great Egret is a very conspicuous bird and is eagerly sought out by birders and other naturalists, historically there has been very little reporting of its roosting sites in Ontario. This is perhaps understandable because "going to roost", i.e. leaving a foraging area and flying to where the birds will sleep, is an activity associated with sunset; a time when the majority of naturalists are often not active.

There is a well-known roosting site for herons and egrets at Muddy Creek, in extreme southwestern Ontario on the north side of Wheatley Harbour, Essex County. Exactly when these herons and egrets were first attracted to this area as a roost is probably not known, but they have been roosting there, at least intermittently, for more than 35 years (DVCW, AW, pers. obs.). The known presence of this roost and the increasing numbers of Great Egrets breeding in Ontario (Peck 1987, 2007, Blokpoel and Tessier 1998) prompted the current study; its objective was to document the number of egrets using the roost and their direction of arrival at the roost during the post-breeding late summer and autumn period. Since that study was completed, other information concerning egret numbers and roosting in Essex County/southern Ontario has come forward, or been collected, and some of that has been incorporated into this paper.

Methods

A reconnaissance visit, to search for foraging areas and roosting sites, was made to southern Essex County during the afternoon and evening of 11 August 2006 (by DJM). Subsequently, an observation post was established on the south side of Muddy Creek at the north end of Wheatley Harbour (Figure 1). The post was just west of County Road 37, which eventually goes south to Hillman Marsh. The time, direction and number of egrets arriving at Muddy Creek were recorded during the following six evenings in 2006: 13, 15 and 17 August and 13, 17 and 26 September. The observer (AW) arrived at the site, on average, 77 minutes (range = 40-93 minutes) before official sunset, as calculated for Wheatley, and stayed until, on average, 28 minutes (range = 23-35 minutes) after sunset. The average observation period was, thus, 105 minutes in duration (range = 75-122 minutes). In addition to these counts, a second set of counts of Great Egrets roosting in the trees at Muddy Creek in the early morning (pre-sunrise) was made approximately every 3rd day on 13 mornings between 29 September and 01 November 2006 (also by AW). The primary purpose of these secondary counts was to detect when egrets abandoned the roost for the season, i.e. when did they cease using the roost.

Results

Muddy Creek – 2006

The number and direction of arriving egrets at the Muddy Creek roost are shown in Table 1, as is the number of egrets at the roost at 2210 hrs on 11 August. There were two main directions of arrival in August: from east-northeast (15.8% of total) and south-southwest (83%) bearings. These were also the

Table 1. Numbers and direction of arrival of Great Egrets at the Muddy Creek roost, Aug.- Sept. 2006.

Date	Arriving From ENE	SSW	WSW	W	Already at Roost	Total
11 - Aug.	–	–	–	–	76	76
13 – Aug.	14	44	1		2	61
15 – Aug.	7	49		1	1	58
17 – Aug.	6	49			1	56
Subtotal	**27**	**142**	**1**	**1**	**80**	**251**
Percent	**15.8%**	**83%**	**0.6%**	**0.6%**		**100%**
13 – Sept.	4	15			1	20
17 – Sept.	13	11			1	25
26 – Sept.	8	9		5	4	26
Subtotal	**25**	**35**	**0**	**5**	**6**	**71**
Per Cent	**38.5%**	**53.8%**	**0.0%**	**7.7%**		**100%**

* Based only on arriving birds.

main arrival directions observed in September but with a greater proportion arriving from the ENE (38.5%) versus SSW (53.8%). The peak number of egrets at the roost and flying to the roost, 76 and 61, respectively, occurred during the first two days of observation; the number of egrets counted at the roost in the evening declined over the course of the study. Numbers were reasonably consistent during each of the two survey periods, but between survey periods (from mid-August to mid-September) the average number of egrets coming to the roost at the Muddy Creek site declined by approximately 59.5%.

Most egrets (66.7% in August and 81.6% in September) arrived at the roost singly. On two of the three evenings in August, more egrets arrived before official sunset than after. In September, more egrets arrived after sunset on two of the three evenings. Overall, more egrets arrived before sunset than after during both periods (52.1% and 59.4%, respectively).

Table 2. Number of Great Egrets at the Muddy Creek roost, pre-sunrise, Sept. –Oct. 2006

Date	Number	Date	Number
29 Sept. 06	24	15 Oct. 06	2
2 Oct. 06	24	18 Oct. 06	0
5 Oct. 06	19	21 Oct. 06	3
7 Oct. 06	10	25 Oct. 06	0
10 Oct. 06	10	29 Oct. 06	0
13 Oct. 06	0	1 Nov. 10	0
14 Oct. 06	1		

Early morning counts, well before sunrise when it was still dark, at the Muddy Creek roost from late September to early November 2006, showed a continuous decline in the number of egrets using the roost (Table 2). The last egrets vacated the roost for the season between 21-25 October 2006.

Discussion

The identification of roosts of communal birds in Ontario has received minimal and usually negative attention. The best known communal roosts seem to be those of crows, starlings and blackbirds, and these are often "notorious" roosts because they are often located in or close to cities (Reaume 1986) and the masses of birds using the roosts, often in the thousands, are considered pests. Roosts of egrets, night-herons, terns and some of the other waterbirds (e.g. gulls) are not as well known, nor are they as large (Schreiber 1968, Cooke and Ross 1972). The egret roost at Muddy Creek is very easy to observe and hence lends itself well to intensive observation and monitoring.

Immediate Origin and Numbers of Egrets at Muddy Creek

The immediate origin of the egrets which arrived at the Muddy Creek roost during this study is open to conjecture. Hillman Marsh, a noted foraging area for egrets, is only 2.8 km away to the SSW, the main direction of arrival of egrets in August. To the NNE, only 1.8 km away, is Holiday Harbour and Wheatley Provincial Park with its aquatic complexes of both West Two Creeks and East Two Creeks. It is generally accepted that egrets roosting at Muddy Creek feed and forage in these nearby wetland areas during the day. For example, during the summer and autumn at Hillman Marsh, Great Egrets at sunset are routinely seen departing that area and flying off in the direction of Muddy Creek (AW, pers. obs.). Furthermore, other than Hillman Marsh, there are no other areas southwest of Muddy Creek, within the Pelee Peninsula, where Great Egret numbers are present with any regularity.

Since the present study was completed (in 2006), several other observations have come forth that may shed light on movements of egrets associated with Muddy Creek. These observations may or may not have had a bearing on movements in 2006, but they give us insight into subsequent ones since this roost is still active.

It would be easy to assume that all egrets seen at either Hillman Marsh or the area of Holiday Harbour roost at Muddy Creek in the autumn, but this is not always the case. From 29 July to 4 September 2008, intermittent observations were made in the evening/early morning at the Muddy Creek roost, and there were never more than six egrets present (Table 3). Yet during the day on 3 September 2008, 40+ egrets were observed in the NW corner of Hillman Marsh (AW, pers. obs.). A few of these birds undoubtedly went to roost at Muddy Creek, but obviously many did not. This suggests that there must have been another roost at which the rest of these birds, foraging at Hillman Marsh, spent the night. Also, no egrets are known to use Hillman Marsh proper as a night-time roosting site (AW, pers. obs.).

The fact that the number of egrets roosting at Muddy Creek declined with each successive day of observation in

Table 3. Observations of Great Egrets in the Muddy Creek Roost (MC)-Hillman Marsh area (HM), autumn 2008.

Date	Observations	Observer
29 Jul 2008	9:00 PM: 5 GREGs at MC	D.V. Chip Weseloh
18 Aug 2008	8:38 PM: 5 GREGs at MC	D.V. Chip Weseloh
03 Sep 2008	40+ GREGs at HM	Alan Wormington
04 Sep 2008	5:11 AM: 6 GREGs, 2 GBHEs at MC	Bruce Patterson
04 Sep 2008	8:30 PM: 4 GREGS, 2 GBHEs at MC	Bruce Patterson
10-12 Sep 2008	AM: 75+ GREGs, 20 GBHEs at HM	Bruce Patterson
16 Sep 2008	6:30 AM: 39 GREGs, 3 GBHE, 2 BCNH at MC	Bruce Patterson
28 Sep 2008	9:30 PM: 47 GREGs, 7 GBHEs at MC	Bruce Patterson
29 Sep 2008	<8:00 PM: 35 GREGs at MC	Bea Patterson

August, and had declined substantially by September, suggests that the date of peak roosting numbers there was missed and probably occurred before 11 August (but see 28 & 29 September 2008, in Table 3). In 2006, the maximum number of egrets observed at the Muddy Creek roost was 76. Additional autumn counts of significance that have been recorded there include 56-61 birds on 13-17 August 2006 (DJM, unpubl. data), 78 birds on 8 September 2007; 63 on 8 October 2007; and 60 on 29 August 2009 (AW, unpubl. data). The sizes of other egrets roosts in southern Ontario and adjacent New York and Michigan include the following high counts (Figure 1): 304 – Luther Marsh, Ontario (21 August 2009, DVCW, pers. obs.); 440 – Shiawassee National Wildlife Refuge, Michigan (24 September 2009, S. Kahl, in litt); 75 – Motor Island, Niagara River, NY (4 August 2009, B. Watson, in litt.); 26 Strawberry Island, Niagara River, NY (18 August 2009, B. Watson, in litt.); 35 – Wildlife Management Area, Tonawanda, New York (21 October 2009, B. Watson, in litt.); 70 – Montezuma National Wildlife Refuge, New York (27 September 2008, L. Ziemba, in litt.); 51 – Cornwall, Ontario (2 September 2009, DVCW, pers. obs.); 145 – Winthrop, New York (24 August 2009, B. Watson from J. Collins, in litt). Thus, in the southeastern Great Lakes basin, the Muddy Creek egret roost probably qualifies as a small- to medium-sized roost in comparison. However, it may rank as one of the oldest, most traditional.

Other Autumn Roosting areas in Essex County

Several years ago, there was good documentation of another egret roosting area in Essex County. During the period of 4 June to 27 September 2001, Elizabeth M. Learmouth (in litt.), assisted at various times by Dean J. Ware, Paul D. Pratt

Table 4. Observations of Great Egrets foraging in the Big Creek Marsh (BCM) area. All observations were by Elizabeth M. Learmouth unless otherwise indicated.

Date	Observations
02 Jul 2001	131 GREGs in BCM (P.D. Pratt)
16 Jul 2001	184+ GREGs at BCM (K.R. Konze) and, in the evening, 93 GREGs in their roost tree on Hunt Club Property. Both GBHEs and GREGs roost in trees on barrier beach between beach and LE; visible from observation tower of Conservation Authority.
17 Jul 2001	144 GREGs in BCM as seen from the observation Tower. Also, 189 visible from BCM Bridge, 333 in all.
22 Jul 2001	At dusk at the Hunt Club, "many" egrets were seen in their tree roosts.
23 Aug 2001	At 2:15 PM, 200 egrets in the marsh
3 Sep 2001	59 GREGs counted at BCM
11 Sep 2001	12 GREGs counted at BCM
25 Sep 2001	6 GREGs counted at BCM

Figure 2. An enlargement of the Big Creek Marsh area showing the location of the commonly used viewing area at the bridge on County Road 20 and the Observation Tower at the Holiday Beach Conservation Area. The roost was located just to the left (west) of the Observation Tower along the shoreline.

and Karl R. Konze, recorded large numbers of Great Egrets foraging near Amherstburg in Big Creek Marsh (hereafter BCM), and roosting on the adjacent property of the Big Creek Hunt Club (Table 4, Figure 2).

Paul D. Pratt later commented (in litt.) that, "There was a large heron/egret roost in the tall cottonwoods along the beach that summer." On 11 August 2006, 16 egrets were observed foraging in BCM from the small bridge that goes over the marsh on County Road 20 (between 2030 and 2115 hrs). As the evening progressed, all 16 flew south, following the marsh, headed for the observation tower at the Holiday Beach Conservation Authority (Figure 2, DJM, pers. obs). Whether they alighted in the trees near the tower, to roost for the evening, or continued out over the water to roost on the islands out in Lake Erie could not be determined. However, the roosting flight was present and there must have been a roost somewhere in SW Essex County.

Big Creek Marsh is approximately 50 km west of Hillman Marsh; it is very unlikely that egrets would fly that far between a roost and a feeding area; a maximum foraging flight distance of 40 km is cited by McCrimmon *et al.* (2001). In September 2008, Robert C. Pettit (in litt.) commented that he did not know of any egret roost tree visible from the tower. Thus, this roost site may now be inactive.

Ultimate Origin of Egrets Using the Muddy Creek Roost

While the immediate origin of egrets using the Muddy Creek roost is probably very local, i.e. many feeding studies show most initial daily foraging flights are less than 10 km (McCrimmon *et al.* 2001), the ultimate origin of those egrets could be any of several more distant breeding colonies. For example, a flightless young egret (#42U) was banded on Nottawasaga Island on 7 July 2008 and re-observed 6 weeks later at the Muddy Creek roost on 18 August. We also know that colour-banded egrets from Chantry Island (92 km due west of Nottawasaga Island) come to and use the Luther Marsh roost in the autumn (DVCW unpubl. data). Logic would tell us that birds from Chantry Island, nearly 300 km to the NNE, probably also then stop off at Muddy Creek. In addition to those two breeding colonies, 50 km to the north, is the egret colony on Walpole Island. More locally, the islands in western Lake Erie would also have to be considered a highly probable source of egrets for Muddy Creek given the numbers which occur there. In 2006, there were approximately 1200 pairs of egrets breeding on the six island colonies in western Lake Erie, with more than 1100 of them on West Sister Island (M. Shieldcastle, DVCW unpubl. data). Twelve hundred pairs of nesting egrets will fledge approximately 2,400 young egrets for a total of approximately 4,800 egrets that would be leaving those islands in July-August. It would probably be safe to say that most of the egrets at the Muddy Creek roost, perhaps those using the roost in late summer, might have come from the colonies in western Lake Erie, 48-59 km away. Another potential source of egrets to the Muddy Creek roost is from a large autumn roost at the Shiawassee National Wildlife Refuge in Saginaw Bay (Lake Huron), Michigan. Since 2001, there has been an annual maximum of over 400 egrets that roost there in the August-September period; in 2006 there were 226 on 16 September (S. Kahl, in litt.). The refuge is approximately 225 km NNW of Muddy Creek. A final "locale" source of egrets for this roost might be the Motor Island breeding colony at the east end of Lake Erie in the Niagara River.

Final Departure from the Roost and Autumn Migration

The date of the final roost departure at Muddy Creek in 2006 (22-25 October) is interesting when compared to that at another well-studied roosting site for Great Egrets in southern Ontario, namely Luther Marsh. During the last two years, 2008 and 2009, the last egrets have left the Luther Marsh roost site on 23 and 30 September, respectively (DVCW and L. McLaren, unpubl data). It is also known that many (colour-banded) egrets from the breeding colony on Nottawasaga Island, near Collingwood, Ontario, move to the Luther Marsh roost after the breeding season (DVCW unpubl data). With Luther Marsh located approximately 270 km NE of Muddy Creek, it could be predicted that, in the autumn, egrets would desert the more northerly roost site before they would desert the more southerly one. Egrets displaying evening migration departures from Luther Marsh leave their roost in a southwesterly direction, towards Essex County. So, some egrets from the Luther Marsh roost might be headed towards Hillman Marsh and the Muddy Creek roost when they leave Luther Marsh. Egret # 42U (above) might easily have spent a few days at Luther Marsh on its way from its natal colony at Nottawasaga Island to Muddy Creek., Thus, it is easy to visualize egrets from Nottawasaga Island departing that site at the end of the breeding season in late July, moving 60 km to Luther Marsh where they take up temporary residence and use the roost there. As autumn progresses, some of them depart the Luther Marsh area to the southwest…going to Hillman Marsh and the Muddy Creek roost…or to an as of yet unknown roost in the Essex County area. From here it is not known where they go exactly …but one can again visualize Ontario egrets moving to their eventual wintering areas through a series of 200-300 km southward flights to new feeding areas and the associated roosting sites every several days as the season progresses. This kind of movement is complete speculation on our part as nothing is published on the process of migration in Great Egrets (McCrimmon *et al.* 2001). However, this conjecture seems to fit with what we have seen in the field. It is known that most of the winter recoveries and sightings of (our) colour-banded egrets come from the Carolinas, Florida and the Caribbean Islands.

Additional Observations of Egrets at the Muddy Creek Roost

Although not quantitatively documented, opportunistic observations at Muddy Creek confirm that small numbers of egrets roost at the site during the spring and early summer (AW, pers. obs.). Presumably these are one-year old, non-breeding birds, as Great Egrets are not thought to breed until they are two years of age (McCrimmon *et al.* 2001). Also, the number of egrets using the roost begins to rise dramatically in late summer (AW, per. obs.) which coincides with the departure of adults and juveniles from various breeding colonies. For comparison, at the Luther Marsh roost, seasonal occupation in 2009 did not begin until the last week of June. Numbers there built up slowly over the next month but increased sharply in August, and then reached their peak during the 3rd week of that month (DVCW and L. McLaren, unpubl. data).

Summary

The trees along the north side of Muddy Creek have been used as an autumn roosting site by Great Egrets for at least the last 35 years; in 2006 at least 76 egrets roosted there in mid-August. Their numbers declined through the autumn of 2006 and all egrets had vacated the site by 30 October. At dusk, egrets arrived at the roost from the SSW and ENE, the directions of Hillman Marsh and Wheatley Provincial Park, respectively. On 3 September 2008, more egrets foraged in the nearby Hillman Marsh area than roosted at Muddy Creek, suggesting that perhaps another roost site(s) must have existed in the area. A major roost site was known during 2001 (and perhaps 2006 as well) at the mouth of the Big Creek Marsh at Lake Erie, near Amherstburg, which is 50 km west of Hillman Marsh. However, it is highly unlikely that egrets feeding at Hillman Marsh would fly as far as Big Creek Marsh to roost, and there are no known observations to suggest that they do. Compared to other egret roosts in and or close to southern Ontario, the one at Muddy Creek is considered small to medium in size, even though it is still significant in a local context. Ontario observers are urged to be on the lookout for egret roosts, especially during the August-September time period, in hopes of better understanding the roosting habits of egrets in Essex County and elsewhere in southern Ontario. Please report sightings to DVCW.

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How a Snowy Owl hunts Bonaparte's Gulls on the wing

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Dietary preference and predatory behaviour of the Snowy Owl *(Bubo scandiaca)* have been fairly well documented across their range which spans arctic and subarctic landscapes of North America and Asia (Parmalee 1992). On the breeding grounds they rely heavily on cyclic populations of lemmings (*Dicrostonyx, Lemmus* sp.) (Parmalee 1992, Gilg *et al.*) Predatory behaviours are as diverse as their prey. The faithful 'sit and wait' routine, common among many raptors, appears to be the preferred method for taking small mammals (Boxall and Lein 1982). Taking advantage of opportunity however, often requires creativity. Some of the earliest descriptions of the owls predatory behaviour describe an individual snatching fish out of water holes (Audubon 1840). They are also very capable at catching prey in flight; whether it be chasing down ptarmigan and other birds on the tundra (Parmalee 1992), ducks and grebes along the coasts (Campbell and MacColl 1978, Robertson and Gilchrist 2003), or murrelets and alcids on the Aleutian Islands (Williams and Frank 1979). It is therefore likely that gulls may make up a large proportion of the diet of those owls that winter in the Great Lakes region and other areas where gulls are abundant (other coastal regions and landfills).

There were a large number of Snowy Owls in the mid-latitudes of North America in the winter of 2009 (Ontbirds and other list-serves), with many birds lingering well into April. When the Long Point Bird Observatory staff and volunteers arrived at the eastern Tip of Long Point on 2 April, an adult Snowy Owl was present at the Tip, remaining until the 14th. For those 12 days nary a gull would share space at the Tip with the owl. On our first wander around the Tip we noticed a suspiciously high number of carcasses and remains of Bonaparte's Gulls (*Chroicocephalus philadelphia*) scattered along the beaches. I suspected that the owl probably had something to do with it, and my suspicions were confirmed on the morning of 6 April when it was observed feeding on fresh remains. In total, the remains of at least 12 different individuals were identified during its residence. It's easy to imagine how the owl could have grabbed sick, injured or sleeping birds off the water or beach, but there is a big difference between opportunistic and lazy. I've not yet met a raptor that was the latter, and this bird did not disappoint.

The owl spent the vast majority of its time sitting at the extreme eastern end of the Tip, perfectly content to be barraged by wind and blowing sand. It appeared to barely sleep, always having an eye fixed on the horizon, its admirers, or passing passerines and gulls. On most evenings its birding became more deliberate, particularly paying attention to the movements made by flocks of Bonaparte's Gulls. Shortly after sunset on the evening of 8 April the owl took flight, circling over the Tip before slowly descending to the water with purpose. As it approached the surface of the lake, its flight became difficult to discern at times from the white being scalped off the waves by the westerly winds. It quickly became apparent that this evening flight was a well choreographed, practiced routine — the hunt was on.

Within a minute the owl had reached a small roosting flock of about 100 Bonaparte's Gulls, which immediately took flight and proceeded to mob and pursue the owl as it approached. The owl was steadfast and continued west into the wind. Once the chase was initiated the owl stayed just ahead of the mob. Within about 500 meters it reached another roosting flock, this one of more than 500 birds, which also began a relentless chase. Yet again, in a disciplined fashion, the owl continued west, remaining slightly ahead of the mob. The majority of the gulls followed close behind as a circulating group of up to 50 took turns mobbing the owl. Unfazed, the owl continued until all of a sudden it opened its long wings, which caught the wind like a parachute, slowing the owl to a near stop as it rode the wind into a position up to 6 metres above the now somewhat disarrayed flock. From this position the owl quickly dove into the mob easily challenging as many of the aerial acrobats as it felt was feasible. The owl rarely missed a beat, although of 5 observed 'attacks' (3 on 8 April, 2 on 9 April) only one was successful. When the owl missed, it would immediately re-initiate the chase and wait for the gulls to catch up and drop their guard. A few hundred metres along it would parachute above them again and take its pick of the flock. After a run at the flocks the owl would return to a favourite perch along the beach. Presumably this may have also been a clever way to learn where the gulls were roosting, in order to be able to pick one off under the cover of night.

This is yet another example of the opportunistic use of abundant regional and seasonal prey species by Snowy Owls, and speaks to their extraordinary abilities to track and hunt prey of all shapes, sizes, and niches. It used to be hard to imagine how an already deep respect for these owls could have grown, but as is usually the case, the more you know, the more you know you don't know.

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