

The Southern Expansion and Urbanization of The Merlin in Ontario

Nesting Merlins in Waterloo Region, 2008

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Figure 1. Merlin pair, female in flight, Victoria Park, Cambridge, 29 May 2008. The dead limbs of this Sugar Maple are in perch tree #6 (Table 4) where food exchange occurred between the pair during incubation and nestling stages.

Photo: John Millman

[The Merlin] breeds in the unsettled districts of the interior from Muskoka northward.... C.W. Nash 1905 annotated Ontario Checklist (Iron and Pittaway 2002).

THE MERLIN (*Falco columbarius*) has a Holarctic breeding range, from Alaska to Labrador and Newfoundland, and throughout northern Europe and Asia from Iceland, Scandinavia and Russia, to Kamchatka (Sodhi *et al.* 1993; Burton 1989). There are three subspecies in North America, with *Falco columbarius columbarius*, the Taiga Merlin (Figure 1) breeding in Ontario (Pittaway 1994).

This report outlines the historical distribution and southern expansion of the Merlin in Ontario in relation to the five breeding bird atlas regions: Hudson Bay Lowlands, Northern Shield, Southern Shield, Lake Simcoe-Rideau and Carolinian (Figure 2, from Cadman *et al.* 2007). Emphasis is placed on expansion south of the Southern Shield

region and, specifically, into urban centres. Seasonal expansion into these centres is described, particularly within the Grand River Watershed (GRW – Figure 2) where, in 2008, the first successful nesting of the Merlin was documented in Cambridge, Waterloo Region. Waterloo Region lies in the centre of the GRW at the interface of the Lake Simcoe-Rideau and Carolinian regions. This location is also within the periphery of the Hamilton Study Area (HSA – Curry 2006). The authors hope that the literature review and personal communications from birders, naturalists and researchers, about the Merlin’s southward expansion, will encourage further observations and study by OFO members of the changing dynamics of urban bird communities.

Early Years

The first records of the Merlin in Ontario were of birds collected and documented in the late 1700s by Hudson Bay Company fur traders along the Hudson and James Bay shorelines (Houston *et al.* 2003). More than mere shooters or collectors, these traders provided both specimens and accounts of birds to the Royal Society and the British Museum. Little documentation was provided about the Merlin in these early accounts, perhaps because it was a familiar species to Europeans, and thus did not garner the same interest as newly-discovered North American species (*ibid*). In cataloguing



Figure 2. The five breeding bird atlas regions of Ontario, from Cadman *et al.* 2007, also showing the Grand River Watershed and the City of Cambridge. With permission, *Atlas of the Breeding Birds of Ontario, 2001-2005*.

Canadian birds, Macoun and Macoun (1909) considered the Merlin abundant along the James Bay shoreline. Today, encountering Merlins in the Hudson Bay Lowlands region is considerably more likely than elsewhere in the province (Gahbauer 2007).

In the first treatise on the birds of Ontario, McLlwraith (1894) acknowledged the difficulty delineating the breeding range of this falcon. He would only state that it was a migratory visitor to Southern Ontario that “quite likely [bred] where there was plenty of room for it to do so without being observed”. Breeding range descriptions published in the early decades of the 1900s included

the Hudson Bay Lowlands, the Northern Shield and Southern Shield regions, south to Muskoka and Haliburton Districts (Macoun and Macoun 1909; Baillie and Harrington 1936). The only nest record in the Lake Simcoe-Rideau region during this time was a May-June 1936 nest in Ottawa (Lewis and Smith 1939). Snyder (1951) echoed earlier comments concerning its breeding range. He stated that the Merlin “builds its nest”, thus reinforcing the view that this species was seldom observed or studied in its nesting habitat, a view also held by some earlier naturalists (Houston and Schmidt 1981). Examining bird records from provinces and states throughout eastern North America, Duncan (1993) concluded that the Merlin was a common migrant during the late 1800s and early decades of the 1900s. Lack of substantive documentation for this conclusion in Ontario was attributed to few observers with lack of experience and knowledge of migratory concentration points, as well as the quality of field optics and field guides during this period.

During the mid-1900s, observing and learning about this falcon in its breeding habitat was seldom a case of “going birding.” In the 1960s, for example, Ontario birders could consult two comprehensive studies of breeding Merlins, undertaken in the 1940s in the Northern and Southern Shield regions respectively (Craighead and Craighead 1940, Lawrence 1949), or they could plan a northern birding trip. But to where? *A Naturalist's Guide to Ontario* (Judd and Speirs 1964),

based on information provided by naturalists and nature clubs throughout the province, made only one reference to the Merlin (a.k.a. pigeon hawk). That reference was specific to Whitefish Lake, 60 km southwest of present-day Thunder Bay, where the Craighead brothers had conducted their 1940 study and where nesting was known since 1929 (Baillie and Harrington 1936).

This example says more about the lack of information than the actual distribution of the Merlin. In fact, nests were also documented in Thunder Bay (formerly Port Arthur and Fort William), in the 1940s, as well as subsequently during 1962-1964 and 1984-86 to present day (Escott 1986, N. Escott pers. comm.). Speirs (1985) summarized records of confirmed nesting of the Merlin from 1924 to mid-1960s: seven reports from the Northern Shield and four from the Southern Shield regions. As early as 1966, Merlins regularly nested in Agawa Bay Campground, Lake Superior Provincial Park (Baxter 1985). Godfrey (1966) illustrated its breeding distribution south to at least Haliburton District in the Southern Shield region. By 1974, Merlins nested on Manitoulin Island (Speirs 1985).

Years of Decline

Throughout much of eastern North America, raptor populations declined during the 1950s and 1960s due to chlorinated hydrocarbon pesticides. For Merlins, levels were apparently high enough to cause egg-shell thinning (Temple 1972). With the banning of chlorinated

hydrocarbons in the 1970s, recovery began. In 1972, the Merlin was placed on the Blue List, the American Birds' early-warning list of bird populations under threat (Tate 1981). In assessing the Ontario population, Fyfe (1976) described the Merlin as declining or stable and considered its relative abundance rare-medium. Duncan (1993) compares and contrasts population changes in Merlins before and after "the DDT era" in eastern North America with particular reference to Ontario.

Also in 1976, a continental Merlin Working Group (MWG) was formed. A survey form was sent to more than 60 people known to have an interest in Merlins, with the intent to compare pre- and post-1950 breeding status across North America (Oliphant 1985). The *F. c. columbarius* populations had 2-3 young per successful pair whereas the prairie population of *F. c. richardsonii* had 3-4 young per successful pair. The MWG acknowledged the meagre information available about pre-1950 eastern *F. c. columbarius* populations.

Recovery and Expansion: An Overview

During the recovery period of the 1970s, nesting reports for Ontario reiterated a familiar refrain that "says more about the inaccessibility of the species' range than its true numbers" (Goodwin 1979). Peck and James (1983) mapped the distribution of 24 breeding records; all but three were located in the three northern regions from Muskoka and Haliburton

Districts north to the Hudson Bay coastline. In the mid-1980s, *Bird Finding in Canada* described locations along the Trans-Canada Highway through north central Ontario where Merlins, including nesting ones, could be observed (Bennett 1985a, 1985b, 1986).

The Ontario Breeding Bird Atlas, 1981-1985 (OBBA1) (Cadman *et al.* 1987), provided the most thorough coverage to date of the distribution of nesting birds, confirming that the Merlin had extended its breeding range into the Lake Simcoe-Rideau region, particularly northern Grey County, and was well-established on Manitoulin Island. Possible nesting during this period was reported on the Bruce Peninsula, Luther Marsh, the Sauble River and Rideau Lakes area (Weir 1987a). Reports submitted to the Royal Ontario Museum (ROM) show that qualified observers were acutely aware throughout these decades and into the 1990s of the unusual occurrence of Merlins in this region (ROM files: 1971, 1982, 1994).

In 1986, the Merlin was delisted from the Blue List and designated a Species of Special Concern (Tate 1986). Provincially, during the second half of the 1980s, increases in number were noted during both spring and fall migrations. For example, in 1990, the number observed south of the breeding range on fall migration was 2.5 times greater than the 1982-88 average (Weir 1990). Merlins nested in Sault Ste. Marie in the late 1980s (K. McIlwrick pers. comm.) and in Sudbury in 1987 (J. Lemon pers. comm.) Nest

records received by ROM for Timiskaming (1985), Haliburton (1994) and Renfrew (1997) brought the known total to 105 nests in 14 districts and counties in the province (Peck and James 1999).

The second Ontario atlas, 2001-2005, (OBBA2) (Cadman *et al.* 2007) revealed dramatic increases in Merlin numbers in every region of the province, particularly in the Southern Shield and Lake Simcoe-Rideau regions. In the latter, excluding Manitoulin Island, breeding evidence was documented in more than 160 atlas squares, with breeding confirmed in 68 squares, compared to 16 squares during the first atlas with only one confirmed breeding. Much of the increase was in natural areas: "open country... forest with scattered clearings or adjacent open habitat such as grasslands, wetlands, lakes or burns" (Gahbauer 2007). Five records were submitted for the Carolinian region, of which one was a confirmed nesting; in OBBA1, there were no breeding records for Merlins there. As well as expanding their breeding range south, Merlins were increasingly colonizing urban centres in the Lake Simcoe-Rideau region.

Seasonal changes in Merlin numbers within and south of the Southern Shield region, with particular reference to the Grand River Watershed (GRW)

Migrating

Migration along the lower Great Lakes offers the best opportunity to observe this falcon (Pittaway 1999; Stabb 2009).

Migration data from regional hawk watches are readily accessible online (HMANA.org). Duncan (1993) reviewed Merlin counts in both migration seasons at selected hawk watches, including Beamer CA and Hawk Cliff, that showed a steady increase during the 1980s. Although the occurrence of Merlins inland from the lakes is highly variable, throughout the 1980s both spring and fall counts showed continuous increases of migrants through Southern Ontario (Weir 1985, 1987b, 1990).

The GRW extends from the Dundalk Plateau to Lake Erie, a drainage area of 6806 km². About three-quarters of the GRW lies within Wellington County, Waterloo Region and the Hamilton Study Area, all of which have numerous bird records for much of the last one hundred years or more. Luther Marsh in the upper GRW is a well-known wetland complex and Important Bird Area (Cheskey and Wilson 2001).

Soper (1923) cites a 1905 autumn record of A. B. Klugh as the only record of the Merlin in Waterloo and Wellington Counties during the early decades of the 1900s. At Luther Marsh, Sandilands (1984) considered the Merlin an occasional migrant. Brewer (1977) noted ten records for Wellington County, describing its status only as migrant. Guelph Field Naturalists' bird records to 1991, show the Merlin as a rare migrant (R. Van Twest pers. comm.). Kitchener-Waterloo Field Naturalists' (KWFN) records, beginning in the early 1950s, show migrating Merlins as very rare until the 1980s.

In Waterloo Region, only one record, that of a spring migrant, was recorded between 1962 and 1981. Since the mid-1980s, Merlins were observed in small numbers throughout the spring and autumn months and, as expected, twice as frequently in autumn as in spring (KWFN records; records of W.G. Wilson). In the HSA, Curry (2006) cites McIlwraith (1894) who described the Merlin as a common migrant in the mid-1800s, and North (field notes) who considered it to occur regularly during the 1930s and 1940s. Curry (pers. comm.) saw only one Merlin between 1966 and 1976; today, he describes the species as an uncommon transient in the HSA.

Overwintering

Summarizing Christmas Bird Counts (CBC) 1968 to 1977, Speirs (1985) showed that no Merlins were recorded in the count areas of the Northern Shield region, except in Thunder Bay. During this time, it was recorded in very small numbers in the Lake Simcoe-Rideau region,

most notably Manitoulin Island, and at Long Point and around the western end of Lake Ontario in the Carolinian region. In the period 1982-1991, the winter average for southern Ontario was 11 individuals, so the 27 Merlins recorded in 1992

Table 1: Occurrence of Merlins on CBCs in selected urban centres in four atlas regions. (count week = cw)

CBC Location	First year observed including cw	No. of years observed to 2008 including cw	Max.No. Merlins observed (years) to 2008
Northern Shield region			
Thunder Bay	1942 ('43-'54=0)	35	4 ('87)
Southern Shield region			
North Bay	1998	2	1('05)
Sault Ste Marie	1990	9	4('02,'07)
Sudbury	1990	1	-
Lake Simcoe-Rideau region			
Barrie	1974 ('75-'97=0)	5	2 ('99,'07,'08)
Belleville	2003	3	3 ('08)
Guelph	1973 ('74-'86=0)	13	2 ('06)
Kingston	1972 ('80-'93=0)	14	3 ('00,'05)
Ottawa-Gatineau	1939 ('40-'59=0)	24	7 ('06)
Owen Sound	1983	4	1
Peterborough	1954 ('55-'80=0)	10	2 ('54,'03,'06,'08)
Port Hope-Cobourg	1989	11	2 ('98,'06)
Carolinian region			
Cambridge	1994	8	3 ('08)
Hamilton	1953 ('61-'79=0)	20	3 ('02, '05 -'07)
Ingersoll	1999	7	2 ('04,'05,'07)
Kitchener	1984	9	2 ('85)
London*	1981	10	4 ('07)
Niagara Falls	--	0	--
Peel-Halton	1987	9	4 ('08)
St Catharines	1993	4	2 ('94)
St Thomas	1978 ('79-'94 =0)	8	2 ('00)
Toronto	1954 ('55-'67=0)	19	3 ('05,'07,'08)

* In the 100-year history of the London CBC, which began in 1909, Merlin was not observed until 1981.

were a “record high, aided by feeding stations to host prey” (Weir 1992). CBC records show Merlin sightings increasingly occurring in urban areas during the 1980s and 1990s south of the Northern Shield and the Southern Shield in particular (Table 1).

In southern Wellington County, the Merlin is a rare but regular winter visitor particularly prior to freeze-up, with regular sightings in the last 5 years in downtown Guelph (R. Van Twest pers. comm.). In Waterloo Region, Merlins were observed in early January during four years between 1954 and 1961 and, as noted earlier, only once in the next 20 years. From 1984 to the present, Merlins have been observed each winter except in 1988 and 1990 (KWFN club records; records of M. Burrell, P.F.J. Eagles, B. Read and W.G. Wilson). Winter sightings in Hamilton and Brantford led Curry (2006) to suggest that overwintering birds made it impossible to determine extreme migration dates and that the Merlin was “almost overdue” as a breeding species in the HSA.

Summer

Speirs (1985) cites about a dozen records of summer sightings in the Lake Simcoe-Rideau and Carolinian regions between 1947 and 1980, none of which indicated nesting south of Muskoka. In 1989, a Merlin sighting in Whitby on 29 July was acknowledged as the only summer record that year south of the breeding range

(Weir 1989). A sighting on 5 August 2001 was a record-early fall migrant at Point Pelee (Bain 2001).

For Luther Marsh, Sandilands (1984) cites one record, 2 July 1983, which is also documented in OBBA1 as a possible breeder. In OBBA2, observations of Merlins at Luther Marsh during the breeding season documented it as a probable breeder (D. Lamble pers. comm.). In Guelph and vicinity no records exist for June and July; there is one record for May (R. Van Twest pers. comm.). KWFN records from 1954 to 1993, and those of Waterloo Region birders to 2007, have only two July records: 31 July 1985 (B. Read) and 29 July 1991 (C. A. Campbell). Until 2008, no sightings had been reported for Merlins in Waterloo Region between 14 May and 28 July, the nesting period at this latitude (Sodhi *et al.* 1993). Curry (2006) cites three July dates for Merlins in the HSA; on 5 July 2003, a likely failed breeder returned to Brantford and maintained its territory from that date and throughout the winter.

Landscape features of portions of Luther Marsh are suggestive of the northern habitat of breeding Merlins, and observations during both atlas periods gave cause to anticipate future nesting. It was a surprise, then, when the first report of nesting for GRW came from an older residential section of Fergus (R. Brown pers. comm.), but also another confirmation that certain urban environments are viable nesting habitat for this species.

Nesting Urban Merlins within and south of the Southern Shield region

With the exception of a nest in Ottawa in 1936 (Lewis and Smith 1939), Merlins began nesting in the late 1990s in the Lake Simcoe-Rideau region. In 1998, there was evidence of Merlins breeding in south Oshawa (Bain and Shanahan 1999). Beginning in 1999 and throughout the atlas period, at least nine locations in Ottawa had nesting Merlins (E. Ticknor pers. comm.); in 2000, there were at least five confirmed nests in Ottawa-Carleton (Bain and Shanahan 2000). During and following the second atlas, Merlins were also nesting in several urban centres within the Lake Simcoe-Rideau region, e.g. Owen Sound 2002 (ROM Files), Peterborough 2002 (Dextrase 2003), Kingston 2003 (R. Weir pers. comm.), Port Hope 2004 (ROM Files 2004, Weir 2008), Perth 2007 (J. Buehler pers. comm.) and Fergus 2007 (R. Brown and B. Wyatt pers. comm.). The Fergus nest, from which young successfully fledged (K. Barker pers. comm.), represents the first nesting in the GRW. In 2008, Merlins were found nesting in Cambridge by the authors, and in Waterloo (M. Geleynse pers. comm.). A nest located in London in 2008 (P. Read pers. comm.) was the first recorded urban nest for the Carolinian region.

Merlin Expansion South of the Lower Great Lakes

The southern expansion of the Merlin's breeding range extends to some of the northern states bordering the Lower Great Lakes. Merlin was considered rare and possibly breeding in New York State as early as the late 1800s, but not verified as a nesting species until 1992. During the first atlas, 1980-1985, it was not recorded (although later reported in the Adirondacks). In the second atlas, 2000-2005, Merlins were recorded in 131 atlas blocks (McGowan and Corwin 2008). No wonder the cover illustration of the recently published New York atlas is of the Merlin. An urban breeding pair was first discovered in 2003 in a cemetery in Binghamton. Since then nests have been found in Ithaca, Rochester, Buffalo and elsewhere.

A similar story exists in Pennsylvania. During the second Pennsylvania breeding bird atlas, 2004-2008, the first nest was found in a park in Bradford about 100km south of Buffalo. By 2007, Merlin nests were located in the Poconos and western Pennsylvania. A total of five nests was confirmed during the atlas. In the past decade in Ohio, Merlins have overwintered in several urban centres in cemeteries with large conifers. To date, no nests have been found (B. Whan pers. comm.). Historically, Merlins may have nested in Ashtabula County and northeast Ohio. Historical claims of breeding in the state are in doubt (*Ohio Breeding Birding Bird Atlas II, 2006-2010*). In the

remaining years of the atlas period, nesting Merlins are anticipated. In Michigan, Merlins breed in the Upper Peninsula and northern counties of the Lower Peninsula; there are no nesting records in the southern counties of the state (Natural Features Inventory; B. Petit pers. comm.).

How far south might this falcon extend its breeding range? Oliphant (pers. comm.) sees no reason why it can't continue to extend its breeding range to the Mexican border for there is no competition from other bird-feeding specialists to that southern latitude.

First Nesting in Cambridge

On the afternoon of 23 April 2008, Read observed a pair of Merlins in Victoria Park, Galt-Cambridge. This urban park is approximately 15 hectares in size, with about 4 hectares of recreational open space and 11 hectares of woodlot. As well, the park lies within the old neighborhood of West Galt, whose streets and laneways are lined with mature trees, both coniferous and deciduous (Figure 3).

Beginning 5 May, observations by Read indicated that nesting might be taking place: incessant calling — *kee-kee-kee...*, accompanying Flutter Flying and

High Circling over the park's open space. (See Feldsine and Oliphant 1985 for illustrated descriptions of 14 courtship displays of the Merlin). On 6 May, Read with Bill and Heather Wilson, observed courtship activities, including male to female food transfer, in an area of the park where a nest was subsequently found; a nest previously been used by American Crows (*Corvus brachyrhynchos*). The nest (43°21'32"N; 80°19'32"W) was exposed atop an Eastern White Pine (*Pinus strobus*), about 24m tall, with dbh=83cm (Figure 4). The nest tree is one of a dozen, well-spaced (10-30m) mature trees surrounded by tennis courts, a ball diamond and a children's play area (Figure 5). The nest tree borders the south fence of the tennis courts. To the east of these facilities, and the nest tree, is a 1.3ha cricket pitch, and to the west a small parking lot and walking trail on the edge of the woodlot. Eight sets of flood lights atop 10m poles illuminate the nearby tennis courts and playground to 23:00h; the closest set is 16m from the nest tree.

The discovery of a Merlin nest in Victoria Park presented an opportunity to observe and monitor the nesting behaviour of these Merlins in an urban setting.

Figure 3. The view of Victoria Park, Cambridge looking south toward the cricket pitch and clubhouse, 2008. Note perch tree #1 (see Table 4). Photo: John Millman





Figure 4. An old crow's nest atop an Eastern White Pine in Victoria Park, Cambridge, 2008, became the first documented Merlin nest in Waterloo Region. *Photo: John Millman*

During the next four months, the authors and several local naturalists with experience in monitoring undertook a nest-watch that continued until the dispersal of young. During the 122-day period from first observation of the pair (23 April), to dispersal of the young (22 August), the nest site was visited on 96 days. Sixty-seven visits of 0.25h to 0.5h

were made to search the grounds about the nest site for feathers of prey species and moulted Merlin feathers, and to check on the welfare of the Merlins; 74 visits lasting 0.75h to 11 hours were made to monitor nest site activities (Table 2). On 30 of the monitoring visits, two or more monitors were present.

↓ Perch tree # 1



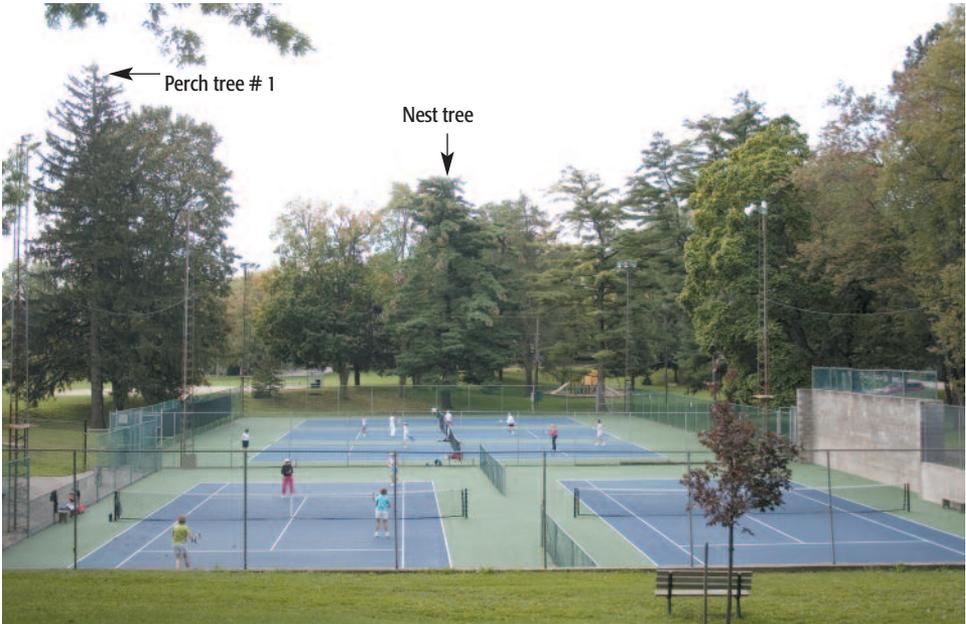


Figure 5. The nest tree was adjacent to the south end of the tennis courts, Victoria Park, Cambridge, 2008.
Photo: John Millman

Table 2: Feather searches and monitoring, Merlin nest site, 5 May to 22 August 2008, Victoria Park, Cambridge, ON

	Dawn to 10:00h	10:00h to 14:00h	14:00h to 18:00h	18:00h to Dusk
No. of Feather Searches	19	19	22	7
Total hours observation	7.75	6.25	13	2.75
Average (h)	0.4	0.3	0.6	0.4
Median (h)	0.5	0.3	0.5	0.3
Range (h)	0.3-0.5	0.3-0.5	0.3-0.5	0.3-0.5
No. of Monitoring Visits	16	17	25	16
Total hours observation	31.3	34.3	42.3	21
Average (h)	2	2	1.7	1.3
Median (h)	1.5	1.25	1.25	1.25
Range (h)	0.75-4	0.75-4	0.75-4	0.75-2.5

Observations were made with binoculars and telescopes. Communication between monitors was maintained by FRS radio. Field notes and times of activities were recorded. On 24 July, during the nestling stage, Marco DeBruin videotaped feeding behaviour at the nest. Monitors maintained 30+m distance from the nest tree; no attempt was made to climb the nest tree or adjacent trees. Since all observations were made from ground level, only the dates of fledging, 25 and 26 July, are certain. All other dates of nesting stages are extrapolated based on Sodhi *et al.* (1993) with incubation period of 30 days (Table 3).

Several precautions were undertaken to enhance survival of the young, partic-



Figure 6. The male guarding the nest site from perch tree #2 (see Table 4), 26 May 2008, Victoria Park, Cambridge.

Photo: John Millman

ularly during the nestling stage. The City of Cambridge Environmental Planning Department and Parks Department were informed of the nest and

its status. On 17 July, a raccoon was observed about 200m from the nest tree in a Red Oak (*Quercus rubra*) at a height of 20m. Whitewash below a nest can alert raccoons to potential prey (M. Wernaart, M. Geleynse pers. comm.). The raccoon was live-trapped and relocated. As a further precaution, the nest tree was wrapped at shoulder height with aluminum siding.

Table 3: Time line for Merlins nesting, Victoria Park, Cambridge, ON, 2008.

Nesting Stages Observed by Monitors	Dates 2008	#of Days on Site/ Length of Nesting Stage (days)	Total hours of monitoring
Pair first observed	23 April		
Courtship*	5 May** -22 May	14/18	8.75
Egg-laying* + incubation*	23 May-26 June	33/35	24
Nestling*	27 June-25/26 July	25/29	49.25
Fledgling	25/26 July-21 August	23/27	48
Dispersal	22 August		

*extrapolated from date of fledging **start date of monitoring



Figure 7. Google Earth image showing locations of nest tree (N) and perch trees (1-7), Victoria Park, Cambridge. (see Table 4). Panoramic photo (see Figure 3) taken at D. Photo (see Figure 5) taken at T. 2009 Google™

Perch Trees

One of the most frequently observed behaviours of the Merlins throughout the nesting period was Prominent Perching. Both male and female, but predominantly the male, perched for prolonged periods of time surveying the surroundings (Figure 6), thus guarding the nest. Seven trees in and about the recreational open space of the park (Figure 7) were regularly and frequently occupied by the adults for specific activities (Table 4).

Observations made during monitoring are discussed for each stage of nesting. Discussions of prey species and hunting, and agonistic behaviour of the nesting Merlins, are presented separately.

Pair Formation

Pair formation begins one to two months prior to egg-laying (Sodhi *et al.* 1993). The most conspicuous behaviour during this stage was Flutter Flying, a mechanical toy-like flapping reminiscent of the flutter flight of the Eastern Kingbird (*Tyrannus tyrannus*), accompanied by rapid, intense calling *kee-kee-kee...* repeated multiple times, of varying lengths and given by both sexes. In time, the male's call could be distinguished from the female's, the former being higher pitched; however, we could not distinguish a difference in speed of the call notes between the sexes as suggested in Sodhi *et al.* (1993). The only other courtship display observed during this period

was Food Transfer, specifically perch-to-perch, from male to female. Copulation was observed on 16 and 26 May; copulation can occur 60 times per pair for a breeding season with increasing frequency during pre-laying and egg-laying periods (ibid).

During early to mid-May, the female was observed sitting on the nest for periods of time initially suggesting to us that she was incubating eggs, e.g. 90 minutes on 9 May. On 12 May, she was on and off the nest several times; the longest stay was 20 minutes. Oliphant (pers. comm.) points out that it is usual for the female to occupy the nest for periods of time prior to egg-laying.

Egg-laying and Incubation

During the last week of May, and the beginning of incubation, the local public school held a games event in the park. What a sight! The tennis courts were full, and over 400 children and adults were participating in various activities. Even though the route for most of the running events passed directly below the nest tree, the Merlins showed no overt displays of aggression or agitation to the ongoing activities.

The first egg (assuming four eggs) was probably laid on 23 May, with incubation starting on 28 May and hatching on 27 June. Eggs are laid at two-day intervals, with incubation starting one day

Table 4: Perch trees and activity in relation to Merlin nest (nest height = 24m), Victoria Park, Cambridge, ON, 2008.

Tree # & species	Height of perch above nest (m)	Distance from nest (m)	Merlin Activity
#1 Norway Spruce (<i>Picea abies</i>)	9	38	male guarding nest
#2 Eastern White Pine (<i>Pinus strobus</i>)	-6	15	male guarding nest during incubation
#3 Norway Spruce (<i>Picea abies</i>)	12	140	male guarding nest
#4 White Oak (<i>Quercus alba</i>)	11	92	male/female guarding nest
#5 Red Oak (<i>Quercus rubra</i>)	2	48	female in shade under canopy
#6 Sugar Maple (<i>Acer saccharum</i>)	-2 to -4	35	food transfer + plucking
#7 Norway Spruce (<i>Picea abies</i>)	4	75	male to fledgling food transfer

before the last egg is laid (Sodhi *et al.* 1993). During this time, the female remained on the nest for extended periods of time, with the male frequently perched atop either perch tree #1 or #2 (Table 4). Observed food exchange during incubation was perch-to-perch at perch tree #6, with the female plucking and consuming the prey item before returning to the nest.

Moult begins during the breeding season, starting in May and continues into September, with females moulting earlier than males (*ibid.*). In near-daily search, Read found ten moulted feathers on eight days, between 25 May and 25 June: nine primaries and secondaries, and one tail feather. The moulted wing feathers were from the female; at no time was the male observed without a full complement of primaries and secondaries although he was missing a tail feather, aiding in distinguishing sexes.

Nestling Stage

Hatch date was extrapolated to be 27 June. Extended periods of monitoring (three to 11 hours) took place over six days between 5 July, when the young were about one week old, and 25 July when the first two fledged. Visits and monitoring that lasted two hours or less, continued as well.

On the sixth day after hatch the female continued to brood the young, and was observed periodically brooding them during the second week. Sodhi *et al.* (1993) states that brooding continues until the

seventh day and beyond during inclement weather. Located in the crown of the pine, this nest was neither concealed nor protected from the elements. During brooding, and earlier during incubation, the female was observed on the nest with her tail facing the sun. On one occasion, at mid-day, the female was observed sitting on the nest with her wings spread, as if to shield the young from the hot sun. On 11 July, despite a record rainfall of 10⁺cm overnight, the young did not appear to be negatively affected. Mortality of nestlings is common during heavy rainfall, high winds and cold weather (Oliphant pers. comm.).

During this stage, much of the observed activity was the feeding of the young. Monitors initially observed the female feeding two young (Figure 8), then three, and eventually four on 19 July. Food transfer from the male to the female took place at perch tree #6 (Table 4). The female plucked the prey there and then took it to the young. On 16 July, the female was observed on the nest with an intact, male House Finch, the only observation of an unplucked prey brought to the nest. Laing (1985) estimated an average of ten prey per day during a study in Denali National Park, Alaska. Calculated prey requirements determined from hand-raised birds for a pair and four young is about 800 House Sparrows for a 120-day nesting season (Oliphant and Tessaro 1985).

Sodhi *et al.* (1993) identifies peak hunting activity during breeding to be



Figure 8. Two of the four young, 18 July 2008, a week before fledging. During the final week before fledging, there is rapid replacement of down by contour feathers (Oliphant and Tessaro 1985). Photo: John Millman

early morning and late afternoon. At the Victoria Park nest, feeding of the young began as early as 05:45h and continued to as late as 20:16h. For example, on 8 July, six feedings occurred between 05:45h and 07:23h, but did not recommence that day until 15:00h when as many as four took place by 16:30h, for a total of 10. No monitoring took place that day after 16:30h. On 25 July, the day of first fledging, five mid-day feedings were recorded between 10:00h and 13:43h, followed by seven feedings between 16:10h and 19:31h.

Throughout this stage, the young exhibited no overt aggression towards each other even when prey was brought to the nest. Their passive demeanour caused monitors to comment on their “polite table manners”. Palmer (1988) notes little aggression among siblings. On one occasion, a few days before fledging, one nestling picked or preened down feathers from the head of a sibling.

The female was observed feeding in early morning and late afternoon; she consumed food both on the nest and while perched nearby. There was no direct

evidence that the female hunted during the nestling stage. During a two-decade study, Sodhi *et al.* (1992) observed only three occasions when females killed prey during this stage. The male was not observed feeding during this stage.

Fledging Stage and Dispersal

The first young fledged at 19:45h on 25 July and flew to a nearby tree; a second bird fledged five minutes later, crashing through nearby tree limbs and landing on the ground. Recently fledged Merlins that become grounded usually will climb or hop up on low-lying bushes and branches to get themselves off the ground. In this park all the lower branches are cut to allow the grass mowers around under the trees. Since this fledgling would be vulnerable to predation or mauling by dogs and cats if left on the ground, Read took the bird home for the night and arranged with a local falconer to care for the bird until it could be released safely. The next morning at 07:00h, he decided to check the nest area before delivering the first fledgling, and found another fledgling on the ground. Neither grounded bird made any attempt to resist handling, thus reinforcing the decision to remove them. At no time was Read or any of the other monitors attacked by either parent, nor was there any vocal agitation. Later that morning, the fourth bird successfully fledged at 09:03h, and flew more than 30m, exhibiting a strong flight. At 09:11h the male brought prey to this fledgling.

Falconer Jim Wilson of Glen Morris agreed to house the two fledglings in order to give them time to develop their primaries more fully and to practice flying. They were brought back to the park mid-morning on 28 July for banding and release. At no time during the handling and banding of the young was there any overt aggression displayed by the adults. The loud continuous vocalizations of the two young, however, attracted the attention of tennis players. Both fledglings were identified as females based on their size and weights, 202g and 211g. At Hawk Cliff in 2007 and 2008, banded Merlin females had an average weight of 204g (n=34); males weighed on average, 153g (n=24) (Don Fowler pers. comm.). Later, when all four fledglings were observed together, their similar size suggested they were all female.

The two fledglings that were released at the nest tree, hopped up branches and made short flights until they reached the top. Following the release, the fledglings remained near the nest site and the male brought food within the hour. Fledglings remain dependent on adults and stay near the nest site from one – four weeks after fledging (Sodhi *et al.* 1993). At the end of the first week, their flying skills had greatly improved and they were chasing each other and making longer flights. On 3 August, eight days after the young fledged, the nest site was monitored for 13 consecutive hours, beginning one hour after sunrise. Observations typified behaviour of fledglings during this stage of development. The male delivered prey



Figure 9. Hatch-year female with decapitated House Sparrow delivered by adult male, 1 August 2008, seven days after fledging. *Photo: John Millman*

to the young until 07:35h resuming again at 15:57h and continuing until 19:40h (Figure 9).

For much of the day the fledglings perched quietly, sometimes four together in the same tree with two on the same limb, or four within the same cluster of trees but in separate trees. One fledgling perched lengthwise on a branch and for more than half an hour; one perched on

the roof ridge of a nearby house. On one occasion, the two banded females perched together and exhibited bill-touching behaviour. The longest inactive period was from 12:05h to 13:20h. Training flights, of approximately 10 minutes each, on seven occasions, were intermittent throughout the day until 20:10h, at which time all fledglings went to roost (sunset at 20:39h).

The fledglings would chase one another, flying as many as three in tandem, or fly alone. These flights were low over the open space, as low as a half metre above ground, or over the street and house tops and neighbouring yards. As well as tail-chasing one another, the fledglings chased Monarch Butterfly (*Danaus plexippus*), dragonflies (*Odonata*), Blue Jay (*Cyanocitta cristata*) and Common Grackle (*Quiscalus quiscula*). By 6 August, the fledglings began flying consistently above canopy level, venturing a half kilometre from the park. On 15 August, training flights would end with the young vying for position on the same perches. Interestingly, no fledgling was observed to occupy the parental perches (Table 4). On 18 August, three fledglings were observed at more than twice the height of the neighbourhood trees. During one episode of tail-chasing, pursuit by one of the fledglings was broken off when an American Goldfinch (*Carduelis tristis*) was seen by the pursuit bird; it chased the goldfinch for approximately 50m but was unsuccessful in catching it.

All four young were last seen in the park on 14 August. After that, only three young were observed and they remained together until 21 August. One may have been killed, or that fledgling may have made a kill on its own and became independent. Oliphant (pers. comm.) said that Saskatoon fledglings were independent at three weeks of age. Sometimes, the young roosted at night in a cluster of conifers in a neighbouring yard adjacent to the cricket pitch, about 150m from the

nest tree; in time, they would roost in the park's woodlot. Mid-morning on 22 August, the three young were seen about a kilometre from the nest site in a group of Red Pine (*Pinus resinosa*) bordering a townhouse complex across from a shopping plaza. The young did not return to their roost on the evening of 22 August, nor were they seen on any subsequent visits to the park. On 28 August, a female juvenile or adult Merlin was seen actively hunting near the park. On 14 September, the Merlin pair was seen in Victoria Park. On 22 September, a male Merlin was observed in perch tree #1, the last sighting in Victoria Park.

Prey Species and Hunting Success

Merlin prey were identified from carcasses on the ground, plucked feathers, wings and tails collected about the nest site, particularly beneath plucking perches, as well as observations of Merlins with intact carcasses. After hatch, and as the young became older, food exchanges occurred with prey items already plucked and decapitated, making identification difficult.

Of 39 prey items recovered about the nest site, ten bird species were identified with House Sparrow (*Passer domesticus*) accounting for 41% (Table 5). Sodhi *et al.* (1993) cites three comprehensive studies of nesting Merlins in urban habitats in Alberta and Saskatchewan where the House Sparrow was the principal prey species, 64 to 76%. Three probable Cliff Swallows (*Petrochelidon pyrrhonota*) prey

may have come from a colony of over 100 pairs located under a bridge in downtown Galt about 700m from the nest. Two species, Swainson's Thrush (*Catharus ustulatus*) and Bay-breasted Warbler (*Dendroica castanea*), are migrants; the remaining prey species are common-to-abundant breeders in the area. Merlins are opportunists and very successful hunters; if a bird of songbird size presents itself, a Merlin will likely chase it and often catch it.

Once brooding was discontinued the female would frequent perch tree #5, a shaded location (Table 4). She was not observed hunting. According to Oliphant (pers. comm.), the female does not need to hunt and will stay close to the nest if the male is able to catch enough

prey. Despite all the prey delivered by the male, a kill was only observed on one occasion: on 5 July, from a 10m high perch about 90m from the nest. The male quickly dove, captured a House Sparrow and returned within seconds to the same perch. That this kill was opportunistic was reinforced by the caching of the prey on a bough of perch tree #1. Prey was taken 25m to 4800m from nests in the Saskatoon studies (Sodhi 1992).

There appears to have been a high prey availability about this nest. Four observed activities support this conclusion. Aggression of young towards adults or other young was never observed when prey was brought to the nest. When the female was feeding one young, other young did not attempt to intervene. On

occasion, when the female was observed bringing food to the nest, no response came from the well-fed young. Other times, the male was observed calling in the nest area with a food item and this did not elicit a response from the female.

In the nestling stage, during three feeding periods on two different days, the male delivered 18 prey. These feeding periods lasted 2h 18min, 2h 48min and 3h 21min. On average, prey was delivered in intervals of 22 minutes (median=23 minutes; range 5 – 40 minutes).

Table 5: Prey Species of Nesting Merlins, Victoria Park, Cambridge, ON, 2008.

Species	# Identified
House Sparrow (<i>Passer domesticus</i>)	16
American Goldfinch (<i>Carduelis tristis</i>)	6
House Finch (<i>Carpodacus mexicanus</i>)	3
Probable Cliff Swallow (<i>Petrochelidon pyrrhonota</i>)	3
Indigo Bunting (<i>Passerina cyanea</i>)	3
Cedar Waxwing (<i>Bombycilla cedrorum</i>)	3
Swainson's Thrush (<i>Catharus ustulatus</i>)	1
Barn Swallow (<i>Hirundo rustica</i>)	1
Brown-headed Cowbird (<i>Molothrus ater</i>)	1
Bay breasted Warbler (<i>Dendroica castanea</i>)	1
Dragonfly sp.	1

During a 3-minute period on 24 July, the day before fledging, there were three prey delivered between 15:13h and 15:16h with interval times of one and two minutes respectively. The time intervals suggest cache retrieval, extreme opportunism and/or that both parents were involved.

Prey was observed being cached on at least four occasions, suggesting young and parents were at times satiated. During feather searches, four intact prey were found directly beneath known perch trees. These included a Swainson's Thrush, an American Goldfinch and two House Sparrows. Merlins will cache prey "well within 50m" of the nest (Palmer 1988).

Agonistic Behaviour of Nesting Merlin

Aggression towards other species changed during the nesting cycle. During courtship, egg laying and incubation, the male aggressively chased Blue Jays out of the immediate nest area. On 26 May, the male chased a Grey Squirrel (*Sciurus carolinensis*) that attempted to climb the nest tree. Common Grackles were attacked by the adults throughout the nesting stages; during the incubation stage, the male attacked a Common Grackle, knocking out three of its tail feathers. The female pursued a Common Grackle during the nestling stage and on three occasions during the fledgling stage. During the latter stage, both parents attacked a Northern

Flicker (*Colaptes auratus*) which had landed on a tree occupied by fledglings.

American Crows were observed in small number on the grounds of the park and as fly-bys; they were never observed in the nest tree. On occasion, the male chased a group of five or six crows from the open space, but for the most part crows were ignored. Sodhi *et al.* (1992) annually observed frequent attacks on crows, particularly by the male, when they approached within 100m of the nest. Four of five Ospreys (*Pandion haliaetus*) that flew over the nest area were attacked by the male who dive bombed them from above. On two occasions, a Turkey Vulture (*Cathartes aura*) was observed in the vicinity of the nest; one was vigorously attacked.

Raptors breeding in Cambridge that are predators of Merlin include Great Horned Owl (*Bubo virginianus*), Red-tailed Hawk (*Buteo jamaicensis*) and Cooper's Hawk (*Accipiter cooperii*). Great Horned Owl was absent in Victoria Park woodlot, with the closest known nest 2.5km away. Cooper's Hawk nests about 3km from the nest site, but none was seen in Victoria Park until after dispersal of the young. Two pairs of Red-tailed Hawks nested within a kilometre (B. Read, W. G. Wilson pers. obs.). Of 26 physical interactions observed between Merlin and other species, nine were aerial pursuits of Red-tailed Hawks. The male undertook these aerial pursuits throughout the nesting period, and by mid-July was sometimes joined by the female.

On one occasion, they pursued and dive-bombed a juvenile that was about 400m from the nest. American Crows were also observed joining in these attacks. After the Merlin young fledged, the adult female was observed on two occasions 300m north of Victoria Park in a cemetery frequented by two fledgling Red-tailed Hawks. She was very vocal and made repeated dives at them.

Factors Limiting Merlin Nesting in Urban Centres

The primary factors limiting nesting of the Merlin in urban centres are the availability of suitable nest sites and the availability of suitable prey species (Oliphant pers. comm.). Merlins do not build a nest but rather use old but intact corvid or hawk nests that may be modified to some degree (Sodhi *et al.* 1993). Oliphant (pers. comm.) states that of hundreds of Merlin nests of which he's aware, all but one were located in coniferous trees. In southern Ontario, crows are in abundance in much of the Carolinian and virtually all the Lake Simcoe-Rideau regions, with approximately half their nests reported to be in conifers (Sandilands 2007). In many towns and cities of southern Ontario, Eastern White Pine, Red Pine, Norway Spruce and White Spruce are common plantings in parks, cemeteries and residential yards. Merlins require a continuing supply of crow nests since they rarely use the same nest in two consecutive years (Sodhi *et al.* 1993).

During 2008, the nest in Victoria Park was reduced in size by half due to its use by the Merlins and the effects of weather. Merlins may reuse the same nest the following year if it is still intact (Oliphant pers. comm.).

An analysis of Merlin nest-site habitat by Sieg and Becker (1990) demonstrated that nest trees were surrounded by well-spaced taller trees and were located on landscapes providing both easy access to the nest tree and good visibility of the surroundings. The Victoria Park nest site exhibited these characteristics. In non-urban habitat, Merlins nest along forest edges or forest openings adjacent to lakes, rivers, bogs or prairie parkland, probably to facilitate hunting (Sodhi *et al.* 1993). This may explain the proximity of open space, such as a cricket pitch, within its urban habitat. The Waterloo nest discovered in 2008 was located in a cluster of Red Pines in a residential front yard across a busy street from playing fields.

In general, the primary prey of Merlins are the most abundant song birds in a region, 20-40g in weight, that frequently leave cover where they become vulnerable to predation (Sodhi and Oliphant 1993). Seven of the prey species of the Victoria Park Merlin are both ubiquitous and abundant-to-common in the region, with House Sparrow and American Goldfinch the most numerous. In Peterborough, the principle prey was Cedar Waxwing (Dextrase 2003). These three species are some of the most abundant song birds in the Carolinian and

Lake Simcoe-Rideau regions: House Sparrow, 2.1 million; American Goldfinch, 3.3 million; and Cedar Waxwing, 1.1 million (Cadman *et al.* 2007). With this apparent abundant supply of prey and suitable nest sites, Merlins will likely continue to nest in and expand into urban centres in these regions. The urban centres of the Carolinian region that lie within the Greater Toronto and Hamilton areas, the Niagara Peninsula and the counties of southwestern Ontario are locations with relatively abundant populations of House Sparrows (Lang 2007). Nevertheless, the population trend of the House Sparrow is one of decline in North America (Curry 2006; Lang 2007; Peach *et al.* 2008).

Will Merlins return to nest in an urban centre like Cambridge? Oliphant and Haug (1985) believe that urban Merlins are, for the most part, birds fledged from urban nests. Peregrine Falcons (*Falco peregrinus*) raised in urban environments will themselves select that environment in which to nest (B. Ratcliff pers. comm.).

How many pairs of Merlins would be able to nest in an urban centre such as Cambridge? Observations of earlier expansion and nesting in other Ontario centres may offer clues. In the Lake Simcoe-Rideau region, Merlin began nesting in the Kingston Region in 2003 where it has nested annually; five years later, the number of nesting pairs is $10^{\pm 3}$ (Weir 2008). In Port Hope, Merlins first nested in 2004; two pairs have nested annually since 2005 (R. Frost pers. comm.).

In the Southern Shield region, Merlins have nested in two major urban centres for about 20 years. In 1931, one nest near Sault Ste. Marie was noteworthy (Speirs, 1985). Beginning in the late 1980s, Merlin numbers increased to as many as 20 to 25 nesting pairs within the city (K. McIlwrick pers. comm.). As many as half a dozen Merlins overwinter and when migrants return, McIlwrick describes spring in the city as “alive with calling Merlins”. Recently, Merlin numbers in the city appear to have decreased. Decline in principle prey species may be a factor. House Sparrow, for example, is “almost extirpated in the Sault”; House Finch has also decreased in number. A decline in bird feeders a few years ago resulting from a city-wide ban on feeding Rock Pigeon (*Columba livia*) complicates an explanation.

In 1987, the Merlin nested for the first time in Sudbury, and since then one to three pairs have nested most years, and exclusively in spruce. (J. Lemon pers. comm.). Lemon observed Merlins hunting in pairs, an infrequent behaviour for hunting wintering waxwings in urban centres (Sodhi *et al.* 1993). Chipping Sparrow (*Spizella passerina*) and finches are the primary prey; there are no House Finches, and House Sparrows were last recorded on the 2000 CBC when 12 were observed (J. Lemon pers. comm., D. Schoenefeld pers. comm.). The only counts of House Sparrow undertaken in Cambridge have been during annual CBCs. The twenty-year average, 1977 to

1996, is 1447, with a five-year average, 2004 to 2008, of 637.

The changes in the infrastructure, the landscape of human communities, the complexities of predator-prey relationships and their implications for urban Merlins, have been examined by Bailey (2002). In considering four decades of nesting Merlins in Saskatoon, and several decades in other Saskatchewan urban centres, Bailey offers insight into the dynamic nature of urban bird communities in which native and introduced songbird species interact with recovering populations of raptors. Birders throughout the urban centres of Ontario have the opportunity to observe, document and respond to the current and coming changes in bird communities in their own urban landscapes. Couple these interactions with the potential impact on bird populations of projected future climate change in southern Ontario (Price 2004) and the relevance of such field study is readily apparent. The flux of nature is forever with us.

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