UNSOLICITED
COSEWIC Status Report

on

Chimney Swift
Chaetura pelagica

Prepared for the

COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA

By

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EXECUTIVE SUMMARY

Species information

Sometimes mistaken for a swallow, the Chimney Swift is readily distinguished by its cigar-shaped body, long, narrow, pointed wings, short spiny tail and quick, jerky flight. The folded wings project beyond the tail. The plumage is dark brownish except for the paler throat. All ages and sexes are similar in appearance.

Distribution

The breeding range of the Chimney Swift is limited to eastern North America. In Canada, it breeds in east central Saskatchewan, southern Manitoba, Ontario, Québec, New Brunswick, Nova Scotia and possibly Prince Edward Island and Newfoundland. Approximately one quarter of the species' breeding range is located in Canada. In the United States, the Chimney Swift is found westward to Montana, eastward to New England and southward to Texas and Florida. It winters in the upper Amazon River drainage basin in South America, mainly in Peru, as well as southern and northeastern Ecuador, northwestern Brazil and northern Chile.

Habitat

Chimney Swifts are aerial foragers, often concentrating near water where insects are abundant. Before the arrival of Europeans in North America, the Chimney Swift mainly used hollow trees for nesting sites; when hollow trees became rare as a result of logging, it quickly adopted chimneys. The Chimney Swift is now mainly associated with urban and rural areas where chimneys are available for nesting and roosting. In their northern breeding range, Chimney Swifts look for sites with a relatively constant ambient temperature. Winter habitat extends from river-edge forest and edge of tropical lowland evergreen forest to farmland and suburban and central city zones.

Biology

The Chimney Swift is monogamous and generally first breeds at two years of age. Pairs stay together for many years, returning every year to the same nesting site. Each pair occupies and defends its own nest site. The nest is a half-saucer made of small twigs attached together and to a vertical surface with the swifts' glutinous saliva. Mean clutch size is four eggs. Only one clutch is produced annually in Canada. Fledging success varies between 70 and 86% with a mean of 3 young fledged per nest. In the fall, large flocks of Chimney Swifts travel to the southern United States (Texas, Louisiana), where they cross the Gulf of Mexico and then fly down the Atlantic coast until they reach South America. They follow much the same route in reverse in the spring.

Population sizes and trends

The Chimney Swift population in Canada is estimated at 11820 individuals (Québec 2520; Ontario 7500; Maritimes 900; all other provinces 900). Chimney Swift populations are declining throughout its range. In the last 15 to 20 years, the area of occupancy in Ontario

and Québec decreased by 46% and 35% respectively. According to Breeding Bird Survey (BBS) data, the Canadian population has declined 7.8% per year from1968 to 2005, or an overall 95% reduction. There have been significant declines in all Canadian provinces where data are available. This decline has slowed to 2.37% per year over the last 15 years indicating a loss of about 28% during the last 3 generations (13.5 years). In North America, the species has declined 1.6% annually since 1966. In the United States, 58% of the states where data are available report a significant decline for the 1966-2005 period.

Limiting factors and threats

The most significant limiting factor to Chimney Swift populations is the dwindling number of breeding and roosting sites resulting from logging, the disappearance of old abandoned buildings, and most importantly the dramatic reduction in the number of suitable and accessible traditional chimneys, the species' main breeding habitat. The growing use of electric and gas heating, the renovation needs of old traditional chimneys, new fire prevention standards (adding a metal pipe inside brick chimneys, installation of spark arresters, chimney hats and protective fencing against nuisance animals) have reduced the number of traditional chimneys available for swifts. The rate at which chimneys are being converted is rising and hardly any suitable sites will remain in 30 years or so. In Québec, the number of nesting sites is now limited and it is estimated that only 60% of breeding adults actually reproduce; the situation is likely similar elsewhere in Canada.

Bad weather during the breeding season can cause mass mortality events. The frequency of such weather extremes may also increase as global warming continues. Other threats facing the species are chimney sweeping during the breeding period, pesticide spraying, and the intolerance of some building owners.

Special significance of the species

The Chimney Swift is the only swift found in eastern North America. The species has aroused a great deal of interest among the public and birdwatchers. Since Chimney Swifts are mostly found in cities and towns, they are relatively easy to spot and their spectacular entrances into their roosts never fail to fascinate people. A number of these sites are renowned and numerous visitors admire the spectacle of hundreds of birds entering their roosting chimneys at sunset. Individual Chimney Swifts are capable of eating more than 1,000 insects per day.

Existing protection

At present, the Chimney Swift does not have any special protection in Canada and the United States outside that provided by the Migratory Birds Convention Act. The species does not appear on any Canadian, US or World Conservation Union (IUCN) lists of threatened species. There is no known form of protection for the species in its winter range or during migration outside Canada and the United States.

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SPECIES INFORMATION

Name and classification

Scientific name: *Chaetura pelagica* (Linnaeus 1758); English name: Chimney Swift; French name: Martinet ramoneur; Spanish name: Vencejo de chimenea.

The Chimney Swift belongs to the genus *Chaetura*, which includes eight other species unique to the Americas (Chantler 1999). *Chaetura* swifts belong to the tribe Chaeturini, which in turn is part of the subfamily Apodinae, family Apodidae, order Apodiformes. The Chimney Swift is considered a monotypic species (Chantler 1999). There are three other species of swifts in Canada: Vaux's Swift (*Chaetura vauxi*), the only other *Chaetura* swift in North America; Black Swift (*Cypseloides niger*); and the White-throated Swift (*Aeronautes saxatalis*). All three are restricted to the western cordillera (Godfrey 1986).

Description

Often mistaken for a swallow, the Chimney Swift is readily distinguished by its cigar-shaped body, short tail, long, narrow, pointed wings, characteristic call and quick jerky flight. It is 12 to 14 cm long (Chantler 1999) with a wingspan of 29 to 31 cm (Snow and Perrins 1998) and weighs approximately 21 g (Chantler 1999). The shafts of the tail feathers extend 5 to 7 mm beyond the feather tips, giving the tail a spiny appearance, a diagnostic feature of the genus *Chaetura*. The wings are long and narrow, with the relatively long primaries and short secondaries typical of swifts. The folded wings extend well beyond the tail. Upperparts are dark sooty brown, palest on the rump, blackish on the wings; underparts are dark, paling to brownish grey and sometimes white on the throat (Godfrey 1986). The Chimney Swift does not exhibit any sexual dimorphism (Fischer 1958) and the juvenile plumage is similar to that of the adult. Smaller size and spiny tail distinguish it from the Black and White-throated Swifts. It is very similar to the Vaux's Swift, but is larger and darker and has lower-pitched calls.

DISTRIBUTION

Global range

The breeding range of the Chimney Swift (Figure 1) is essentially limited to eastern North America (Chantler and Driessens 2000; Chantler 1999), from southern Canada south to Texas and Florida (Gauthier and Aubry 1995; Chantler and Driessens 2000). It occasionally breeds in southern California and possibly Arizona (Sibley and Monroe 1990; Chantler and Driessens 2000). Approximately 26% of the species' breeding range is in Canada. Chimney Swifts winter in the upper Amazon basin of South America, mainly in Peru, northeastern Ecuador and northwestern Brazil (Pearson 1980, Snow and Perrins 1998, Chantler 1999). It is also found in southern Ecuador, western Peru and northern Chile (Bloch et al. 1991, Demetrio 1993, Chantler 1999).

Canadian range

In Canada the Chimney Swift breeds in east-central Saskatchewan, southern Manitoba, southern Ontario, southern Quebec, New Brunswick, Nova Scotia, probably Prince Edward Island and possibly south-western Newfoundland (Godfrey 1986). The Canadian extent of occurrence is about 1,302,000 km^2, while the area of occupancy is about 200,000 km^2. The latter figure is estimated from Ontario and Quebec breeding bird atlases (100 km^2 per occupied atlas square, 165,000 km^2) plus an estimated 35,000 km^2 in prairies and Atlantic Canada.

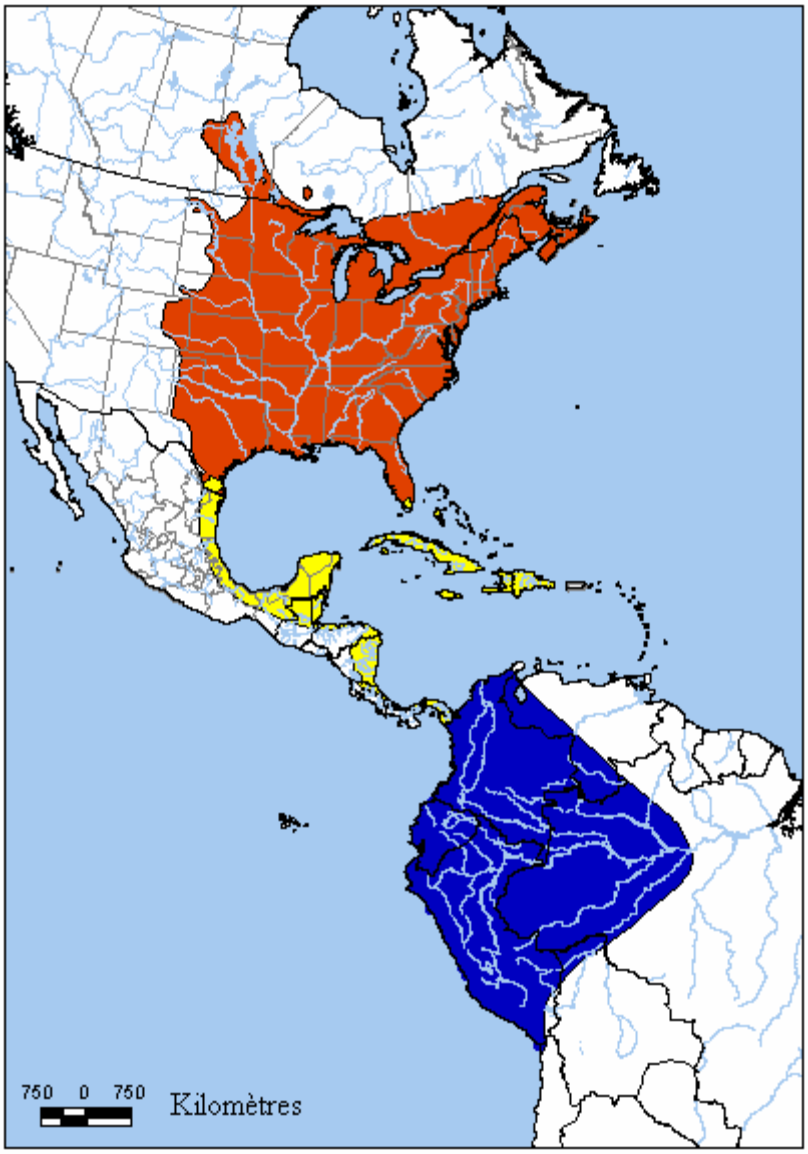

Figure 1. Chimney Swift range (*Chaetura pelagica*). Red: breeding; yellow: migration; blue: winter.

According to Smith (1996), the Chimney Swift is limited to the east central part of Saskatchewan. It is a confirmed breeder in Nipawin and individuals have been recorded in Raymore, Fort Qu'Appelle, Langenburg, Regina and Estevan (A. R. Smith, unpub. data). The Chimney Swift has been recorded breeding in southern Manitoba around Winnipeg, Dauphin, St. Laurent, Indian Bay, Steinbach, Portage la Prairie and Selkirk (Godfrey 1986; Cleveland *et al.* 1988; Manitoba Museum of Man and Nature 1998; Taylor *et al*. 2003).

In Ontario, the Chimney Swift breeds as far north as the 49th parallel (Peck and James 1983; Cadman *et al*. 1987), though most birds are concentrated along the southern edge of the province (Figure 2). The most northerly record is of birds in the vicinity of Pickle Lake (51.4° latitude north). (Helleiner 1987). Historical records suggest that it formerly occupied much the same range as it does today, at least in the southern half of the province (Helleiner 1987).

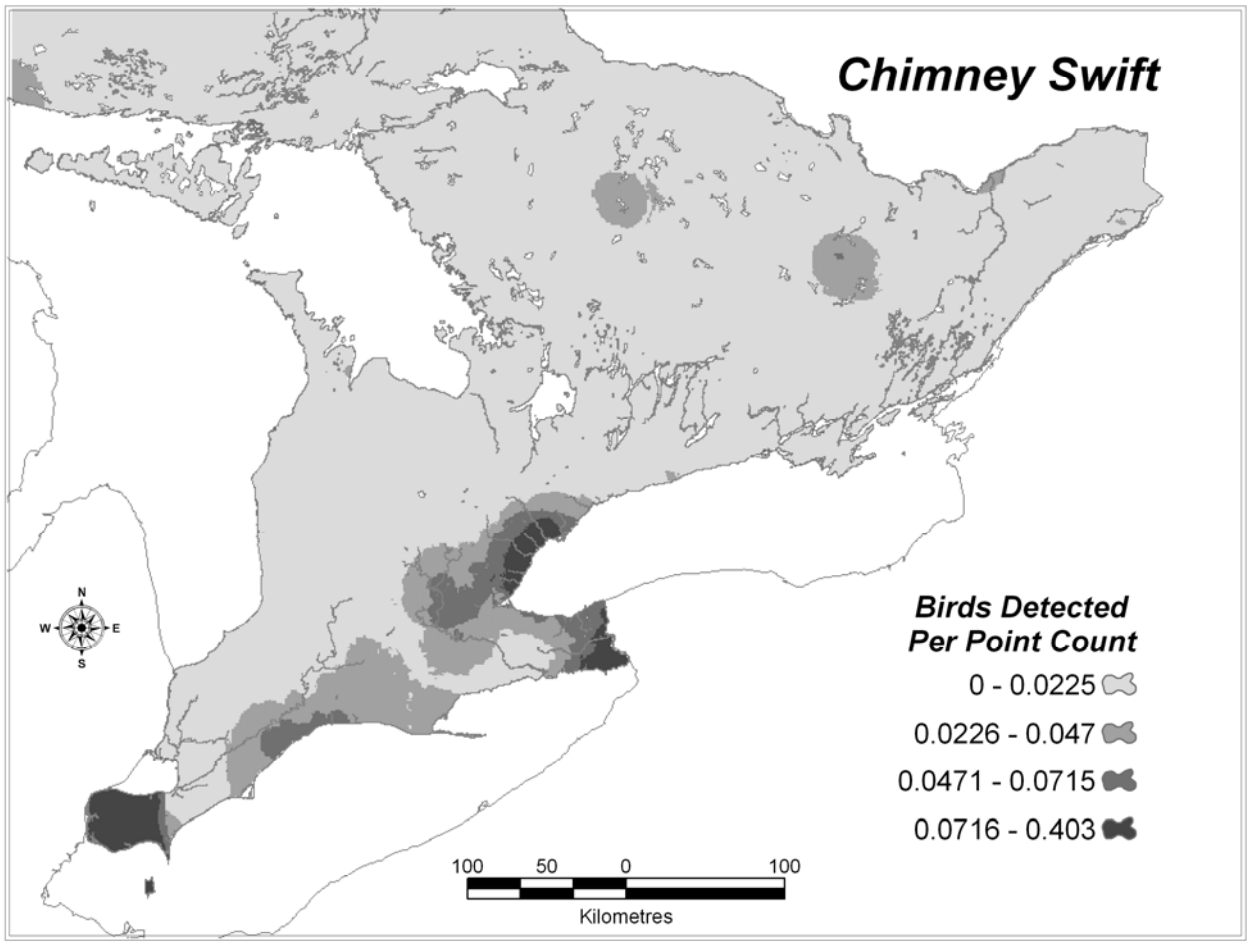

Figure 2. Relative population density of Chimney Swifts in Ontario, based on the first 4 years data from the second Breeding Bird Atlas Project (2001-2004; M. Cadman, unpubl. data).

In Québec it breeds in the southern half of the province, except Anticosti Island and the Magdalen Islands (where it is an accidental visitor), as far as Abitibi in the northwest and on the Upper North Shore in the northeast (Cyr and Larivée 1995; Lemieux and Robert 1995; David 1996). It was not reported breeding north of the 49th parallel in the Breeding Bird Atlas; the most northerly Atlas records are from St Maurice de Dalquier in Abitibi, the La Mothe Reservoir in the Saguenay–Lac St Jean region and Forestville on the Upper North Shore (Lemieux and Robert 1995). Swifts have been reported at Matamec and Harrington Harbour on the Middle and Lower North Shores, but there are no Atlas records (Lemieux and Robert 1995). The Chimney Swift also turns up as an accidental visitor in regions well north of its known breeding range. One was seen in Digges Sound, near the 60th parallel in the extreme

northwestern tip of Québec, in August 1980 (Gaston *et al.* 1985).

According to the Atlas of the Breeding Birds of the Maritime Provinces (Erskine 1992), the Chimney Swift breeds in most regions of New Brunswick and Nova Scotia, including Cape Breton Island. However, the species is scarce in regions adjoining the Northumberland Strait. Based on Godfrey (1986), Chantler and Driessens (2000) reported that the Chimney Swift breeds on Prince Edward Island. However, Erskine (1992) says that few individuals were observed there during the Maritime Provinces atlas project and describes breeding as probable but unconfirmed in that province. Montevecchi and Tuck (1987) list the Chimney Swift as a breeder in Newfoundland; there are numerous sight records at Codroy in southwestern Newfoundland, but there is no breeding evidence (Godfrey 1986).

HABITAT

Habitat requirements

General

The Chimney Swift spends most of the day foraging for insects on the wing. As a result, it is difficult to associate the species with a single type of habitat; its presence in a particular area largely depends on the availability of suitable nesting sites (DeGraaf and Rappole 1995) and the abundance of insects (Kaufman 1996). Before the arrival of European settlers, the Chimney Swift was associated with old growth forests where their main source of nesting and roosting sites--large hollow trees--were much more common than they are today. Today, the Chimney Swift is found over a large variety of habitats such as cities and towns, villages and rural or wooded areas, but it is most often associated with urban and suburban zones (Chantler 1999; Cink and Collins 2002).

The Chimney Swift is often seen near bodies of water because of the abundance of insects, its main food (Sibley 1988, Sibley and Monroe 1990; Chantler 1999; Cink and Collins 2002). Two studies revealed that three of the five main insect orders consumed were associated with wetlands (Fisher 1958; Fudge 1998). The proximity of nesting and roosting sites inventoried during the Québec Chimney Swift survey (1998-2002) revealed that 95% of them (140/147) were located less than 1 km from a body of water present on 1:50,000 topographical maps (CWS-QC unpublished data). Among those 140 sites, 90% (127/140) and 54% (76/140) were less than 600 and 300 m from a water source respectively.

Wintering Habitat

The Chimney Swift's wintering habitat in South America consists of river-edge forest, edge of tropical lowland evergreen forest and second-growth scrub (Rappole et al. 1983; Stotz et al. 1996). It also frequents irrigated farmland and suburban and city centre zones (Hughes 1988). On the Peruvian coast, it regularly occurs to 2,500 m and sometimes to 3,000 m (Hughes 1988). It roosts in chimneys, crevices, caves (Fjeldså and Krabbe 1990) and hollow trees that are plentiful in the Amazon forest (Whittemore 1981). However, the Chimney Swift's winter habitat preferences are still not very well known (Stotz et al. 1996; Cink and Collins 2002).

Nesting and roosting habitat

For nesting and roosting, the Chimney Swift looks for a dark, sheltered spot with vertical surfaces that it can grip onto and attach its nest (Fischer 1958). Prior to European settlement, it nested and roosted mainly inside hollow trees (living or dead) and occasionally on cave walls and in rocky crevices (Chamberlain 1891; Bent 1940; Tyler 1940; Coffey 1944; Lack 1956; Fisher 1958; Tufts 1961; Godfrey 1986; Erskine 1992). There is a lot of evidence that Chimney Swifts require large diameter trees (> 50 cm diameter at breast height or DBH). In 1985, a balsam poplar (*Populus balsamifera*) used by Chimney Swifts in the Rimouski area had a DBH of 60 cm (Bélanger 1985) and in 2001, another tree of the same size was also used by swifts in St-Pamphile (CWS-QC Unpublished data).The Vaux's Swift, a closely related species, also requires large hollow trees for nesting and roosting. Twenty-one trees containing Vaux's Swift nests in Oregon had a mean DBH of 67.5 cm (Bull and Collins 1993). The birds normally enter the tree through an opening in the top.

The Chimney Swift can also nest in cavities excavated by the Pileated Woodpecker (*Dryocopus pileatus*), although this is rare (Cameron 1949; Hofslund 1958; Cotrille 1956 *in* Dexter 1991). Flocks of Chimney Swifts have also been observed roosting on tree trunks. It is possible that birds choose this when there are no other appropriate sites available (Spendelow 1985) or when their usual sites suddenly become unavailable—e.g., when a fire is lit in a chimney (Campbell and Campbell 1944), or because of sudden poor weather conditions that force them to seek shelter (Arvin 1982).

With the arrival of Europeans in North America, forest clearing began and large trees became increasingly scarce (Leverett 1996; Drushka 2000). Faced with a decline in natural sites, Chimney Swifts rapidly adopted artificial structures (chimneys, barns, wells) for nesting and roosting (MacNamara 1918; Coffey 1936; Lack 1956; Fisher 1958; Johnsgard 1979; Bull 1985; Norse and Kibbe 1985; Sibley 1990; Peterjohn and Rice 1991; Sutcliffe 1994; Fleckenstein 1996; Snow and Perrins 1998; Cink and Collins 2002). Among these structures, chimneys are the most abundant and by far the most frequently used. Chimney Swifts appear to have adopted chimneys quite early on since they were first spotted in such structures in Maine in 1672 (Palmer 1949). Coffey (1944) mentioned that swifts began using chimneys in 1808. At the beginning of the 19th century, Audubon (1840) had already observed the widespread use of chimneys for nesting. He even commented that the species once nested in trees in western Kentucky, implying that the use of natural sites was already a phenomenon of the past by that time. In the same period, Wilson (1812) observed that nesting was already limited solely to chimneys in western Pennsylvania.

Chimney Swifts choose unused chimneys to roost or build their nests, but a moderate amount of heat does not appear to harm them in large chimneys (J. Gauthier, pers. obs.). Little is known about the factors that contribute to the swifts' decision to choose one chimney over another but temperature seems to play a role. During the Québec Chimney Swift Survey, the temperature inside a few chimneys occupied by swifts was measured. The data show that the inside temperature fluctuated very little in relation to the outdoor temperature (CWS-QC, unpublished data). Tyler (1940) reported that the chimneys most frequently occupied were unused, connected to the basements of their buildings and provided a flow of warm air. Bowman (1952) gives an example of such a chimney in Kingston, Ontario, adding that the flow of warm air made the chimney particularly attractive to swifts, particularly on cool April and May nights. In Lévis, QC, in spring 1998, during a cold day, swifts attracted by recorded

bird calls did choose a chimney connected to a house over the artificial chimney made out of wood, which did not retain heat (Garneau and Gauthier, CWS-QC Unpublished data). This experiment was repeated many times with similar results. In Québec, swifts look for sites where the ambient temperature will remain relatively constant and where some heat is present. Garneau and Gauthier (CWS-QC Unpublished data) were able to determine that the threshold temperature at which swifts abandon a chimney is 13ºC. It is likely that large hollow trees also offer this minimal temperature.

In addition to chimneys, Chimney Swifts can nest and roost in air shafts, silos, wells, inside barns, tobacco curing sheds, abandoned buildings and large concrete sewer pipes (Fischer 1958; Bull 1985; Dexter 1991, M. Robert, pers. comm.). Inside buildings, the birds generally build their nests above the floor in the darkest corners (Fischer 1958) where heat tends to accumulate.

Today, most authors agree that Chimney Swifts nest in chimneys and similar structures, rarely resorting to natural sites that are very scarce (MacNamara 1918; Coffey 1936; Lack 1956; Fisher 1958; Johnsgard 1979; Bull 1985; Norse and Kibbe 1985; Sibley 1990; Peterjohn and Rice 1991; Sutcliffe 1994; Fleckenstein 1996; Snow and Perrins 1998; Cink and Collins 2002). In Québec, the Chimney Swift roosting and nesting inventory (1998-2004) revealed that only 4 out of the 222 sites were not chimneys, although this ratio may be biased by searches directed towards chimneys.

As a result, the Chimney Swift is now highly dependent upon humans for nesting sites. In New York State, Sibley (1990) notes that almost all of the swift records during work on the Atlas of Breeding Birds in New York State were in cities or towns. In Ohio, Beissinger and Osborne (1984) observe that the Chimney Swift population density is five times higher in cities and towns than in forested areas. In Rhode Island and Tennessee, the highest densities of swifts are found in urban areas (Enser 1992; Nicholson 1997). However, some swifts probably continue to nest in hollow trees in isolated wooded areas (Fischer 1958; Helleiner 1987; Sutcliffe 1994), but reports of such behaviour are now rare (Norse and Kibbe 1985; Chantler 1999) and the number of Chimney Swifts breeding in forested areas probably represents a very small fraction of the population. Data from the Ontario Breeding Bird Atlas point counts (see Figure 2) show small populations of Chimney Swifts associated with areas of older forest (A. Dextrase, pers. comm.).

In 1958, Fischer said that the number of reports of Chimney Swifts nesting in hollow trees had fallen considerably since the 1920s. Blodgett and Zammuto (1979) noted that barely 10 nests in hollow trees had been reported in the previous hundred years. Our literature review found only 22 reports of hollow tree nests in the United States between 1840 and 1991 (Audubon 1840; Ridgeway 1874; Daniel 1902; Stewart 1975; Blodgett and Zammuto 1979; Hall 1983; Bull 1985; Robbins 1991; Ferguson and Ferguson 1991; Nicholson 1997). In Canada, Peck and James (1983) report only one such nest in Ontario. In the Maritimes, there are no records of nesting in a hollow tree for New Brunswick, but there are 10 for Nova Scotia (A. J. Erskine, pers. comm.). However, most of these sightings are from one nest, observed during several consecutive years. In Québec there are six hollow tree nesting cases known (Québec Nest Record Card Program, Desgranges 1964, Bélanger 1985, Québec Chimney Swift Survey). Swifts were also observed flying over old forest habitats in Québec in 2000 (F. Morneau, pers. comm.), 2002 and in 2004 (CWS-QC Unpublished data). The observations made in 2002 and 2004 were part of old growth

Chimney Swift survey, where six forests were visited. It is important to note that nesting sites are difficult to locate because of the very secretive behaviour of the swifts as they approach the nest. Roosts are easier to identify because of the larger number of birds involved, but no roosts in hollow trees have been reported to us, probably because of the scarcity of large-diameter trees. The few birds seen in Saskatchewan have been in remote areas and are probably using hollow trees for nesting and roosting (A. R. Smith, unpub. data).

Like the Chimney Swift, the closely related Vaux's Swift also nests and roosts in chimneys. However this species is still found more frequently using large hollow trees (Bull and Collins 1993). A positive association was found between the Vaux's Swift and old growth forests (Manuwal and Huff 1987). Pough (1957) stated that the Vaux's Swift had just started to make the transition from hollow tree nesting to chimney nesting that the Chimney Swift made many years ago.

Trends

Many authors have mentioned without any real evidence that Chimney Swift populations increased dramatically with the arrival of European settlers and the multitude of nesting cavities provided by chimneys (Tyler 1940; Norse and Kibbe 1985; Dexter 1991; Kaufman 1996; Zucker 1996; Chantler and Driessens 2000; Cink and Collins 2002). Chimneys and other manmade structures were supposedly more abundant and available than hollow trees present before settlement, thus increasing the number of nesting and roosting sites. These new nesting sites were rapidly adopted by Chimney Swifts.

This hypothesis is likely incorrect. Graber and Graber (1963) are often cited to support the hypothesis that Chimney Swifts benefited from colonisation. They noted an increase in Chimney Swift density for Illinois between 1906-09 and 1956-59 and attributed these results to an increasing human population and development. However these results do not reflect the situation before and during colonisation but instead represent an urbanisation process; 10 of the 14 million acres of Illinois' forest had been cut during the 19th century and by 1900, 33 of Illinois' 36 million acres had already been modified (Graber and Graber 1963).

It seems more logical to suggest that European colonisation reduced the Chimney Swift population in North America, since surveys of remnant old growth forests suggest that the number of hollow trees removed was almost surely greater than the number of chimneys built after this event. McGee *et al*. (1999) found an average of 18 snags (at least 50 cm DBH) per hectare in old growth deciduous forest of New York state. Similarly, Goodburn and Lorimer (1998) found similar results for deciduous old growth forests in Wisconsin and Michigan State (20 snags/ha with a least 45 cm DBH). A rough estimate of 0.152 chimneys/ha in the eastern United States in 1900 can be calculated using United States Census Bureau (2004) data and assuming one house per four persons and two chimneys per house. This figure, though rough, is two orders of magnitude less than similar estimates of snag density before colonization.

In brief, chimneys were not constructed at the same rate as large hollow trees were felled. In Canada (Maritimes, Ontario and Québec), all available data suggest that the situation was quite similar. The number of households, and therefore chimneys, was less than in the United States, but logging activities and land clearing was of the same order (Historical Atlas of Canada 1990). In the Maritimes, few forests escaped the human influence after the

arrival of the Europeans (Loo and Ives 2003). In southern Ontario, almost all old growth was eliminated for agriculture and logging purposes (Suffling *et al*. 2003). The situation was much the same in Québec where logging activities went well beyond the inhabited areas of the St. Lawrence River (Dupont 1995).

The number and suitability of remaining chimneys continues to decline. The growing use of electric heating starting in the 1950s was the beginning of the end of this artificial habitat, a process continuing with conversion to heating by natural gas. Today, new buildings have either no chimneys or have metal flues unsuitable for Chimney Swifts. These flues are also often quite narrow (< 30 cm), which can turn them into fatal traps for birds that venture inside because they are unable to get out again. Insurance companies also encourage owners to have metal liners installed in their brick or stone chimneys during renovations as a fire prevention measure. In addition, if a chimney is no longer used to heat a building, the top is frequently capped or the chimney is demolished. In a number of municipalities, fire prevention bylaws oblige residents to install spark arresters in their chimneys. This widespread practice effectively blocks birds and other animals from using chimneys.

Apart from the efforts made in Québec, there are no quantitative data on the proportion of capped chimneys. However, it is sufficient to observe building roofs in the province to realize that a very large proportion of chimneys are metal or contain spark arresters. Savard (2000) mentions that, in some neighbourhoods in Chicoutimi where the Chimney Swift was recorded in the past, chimneys have been systematically capped or converted and the species seems to have deserted the city.

Suitable chimneys have a large enough diameter (> 28.5 cm), a rough inner surface (e.g., brick, cement, tile) and must offer protection against low temperatures. Chimneys that meet these criteria were generally built before 1960. After 1960, electricity became the prime energy source. Later, during the 1980's came the high performance combustion stoves. These stoves increased the amount of creosote accumulation, which when in contact with water, creates powerful acids, which in turn cause the chimney to crumble. To solve this problem, metal chimneys and metal lining inside traditional chimneys were installed. Terra Cota, the most important clay lining company in eastern North America, shut down in 2001 after more than 100 years in business. The company president and engineer, M. Gaillardetz said that this was a direct result of the change in technology. New technologies also brought smaller chimneys, unsuitable for swifts. Based on sales record of the Terra Cota Company during the 1990's, the small clay tiles used for the smaller chimneys, increased from 20% to 80%. At this rate, it is easy to conceive that most chimneys will no longer be suitable for swifts in 10 years at most, except for the few strong and more resistant chimneys on churches and religious buildings.

Abandoned chimneys often do not offer the appropriate protection for swifts against weather. Once a chimney reaches a certain point in deterioration, it no longer protects against the wind, thus lowering the internal temperature and causing the birds to leave the site if it fall beyond a certain point. Such chimneys also represent a safety hazard and are usually quickly destroyed, especially in the case of industrial, commercial, and government buildings.

Chimneys from residential buildings are for the most part already unsuitable for swifts. About 75% of residential chimneys either possess a metal tube inside or some sort or a cap at the top (fence, spark-arrester or hat) (personal communications from P. Allard of the

Giroux-Maçonenx brique et pavé Company, M. Gaillardetz of the Terra Cota Company, Fire Department of Montreal and the Professional Wood Heating Association). This high percentage of unavailable chimneys is easily confirmed by simple observations in cities and rural areas; of the 25% left, almost 60% have a diameter of 28.5 cm or less (M. Labrecque chimney sweeper and builder, pers. comm.), making them less preferred by swift, which have a mean wingspan of 30 cm. In such cases, swifts need to crawl out of the chimney.

Table 1. Proportion of church and presbytery chimneys unavailable for the Chimney Swift in Québec dioceses.

Dioceses	**Number of Parishes Selected**	**Number of Chimneys Sampled**	**Number of Chimneys Unavailable (%)**
Montreal	36	50	**27 (54%)**
St Jerome, Joliette	20	32	17 (53.1%)
Québec City	33	43	22 (51.1%)
Chicoutimi, Baie Comeau	22	40	15 (37.5%)
Nicolet, Trois Rivières	24	39	14 (35.9%)
Sherbrooke	13	20	7 (35%)
Valleyfield, St-Jean Longueuil, St Hyacinthe	37	53	14 (26.4%)
Amos, Rouyn–Noranda	13	18	4 (22.2%)
Gaspé, Rimouski and St Anne de la Pocatière	36	54	8 (14.8%)
Mont Laurier, Gatineau–Hull	15	21	3 (14.3%)
Total	**239**	**370**	**131 (35.4%)**

Table 2. Changes to church and presbytery chimneys in Québec that have rendered them unusable by Chimney Swifts.

Modifications	**Number of Chimneys (%)**
Presence of a spark arrester, hat or protective fencing	**66 (50.4%)**
Metallic flue inside the chimney	23 (17.5%)
Prefabricated chimney	17 (13%)
Chimney capped	16 (12.2%)
Chimney demolished	9 (6.9%)

Last but most importantly, are chimneys from churches, rectories and neighbouring schools built before 1960. Most are impressive structures made out of either bricks or stones, and are more resistant than residential chimneys. According to Dr. R. Pleau of the Architecture Department at Laval University, such chimneys with the newer cement have an average lifespan of 60 years. Although many are not used by the Chimney Swifts, they seem to be the most preferred sites. This may simply reflect the reality that these chimneys have

not yet been rebuilt; the high cost of such renovation, the high number of buildings and the decreasing popularity of religion make these chimneys a low priority for building owners. Religious building chimneys represent 57% of all known sites (nests and roosts) and 79% of all known roosts in Québec (Gauthier et al. in press).

In the course of the Québec Chimney Swift Survey since 1998, we have discovered swifts inside 40% church or rectory chimneys (Gauthier et al. CWS-QC, unpublished data). In light of this, we conducted a study to estimate the proportion of church and rectory chimneys that are still available in Québec parishes, looking at parishes founded prior to 1960. The results of this study appear in Table 1. Approximately 35.4% of chimneys (131/370) in the parishes selected are no longer available for swifts. The diocese with the highest rate of closure is Montreal, where 54% of church and rectory chimneys have been closed. The most common reason for the chimneys' unavailability was the installation of a spark arrester, a hat or protective fencing (Table 2). There is every reason to believe that the situation is similar in the rest of Canada and in the United States, although the rate of closure and conversion is probably different due to different weather conditions.

In Québec, there are 1,605 parishes that were founded prior to 1960 (Anonymous 2000). If we estimate that there are three chimneys per parish, one for the rectory, one for the church and one for the elementary school, which is very often located next to the church in old parishes, we obtain a total of 4,815 potential chimneys for the Chimney Swift. However, this number is probably lower because some churches do not have a chimney or the rectory is in the same building as the church. Some parish churches have more than two chimneys, but if the percentage of closure obtained with our sample (35.4%) is applied to all of the chimneys, we arrive at a total of 1,704 closed chimneys. This would leave 3,111 church and rectory chimneys potentially available in Québec parishes, from which many may not be suitable or even available to swifts. If the last chimneys were constructed in 1960 and the maximum lifespan of these chimneys made out of bricks and cement is 60 years, then by 2030 very few traditional chimneys will be left, and many of them will disappear in the next 5 to 10 years. At that point, the Chimney Swift will face severe shortage of nesting and roosting sites. Although chimneys on religious buildings are not the only breeding sites available for this birds, they probably represent the majority.

According to Simard (1998), Québec's religious heritage (architecture, landscape, furnishings and archives) is threatened and has become increasingly impoverished and degraded over the past few years. Accordingly, the Québec government has invested $101.5 million since 1995 for the restoration of this heritage, particularly church renovations (Government of Québec 2000). Under the program, 18 churches will undergo major restoration work in 2000 (Government of Québec 2000). In half of these cases, the roofs will be repaired and it is highly probable that the chimneys will be renovated at the same time. These renovations are not likely to benefit the Chimney Swift. As a result, the rate of closure of church and rectory chimneys could be quicker than expected.

The situation is thought to be similar in the rest of Canada and in the United States and there is every reason to believe that essentially all chimneys will one day be unsuitable to swifts. The rate of chimney conversion, destruction and closure is probably faster in the more northern latitudes because of climate, which could explain why Chimney Swifts are decreasing faster in Canada than those in United States.

To conclude, using data from Statistic Canada (Building and Labour census 1951), it is possible to estimate how many potentially suitable chimneys are left. Most of the suitable chimneys left are on churches and religious buildings and residential homes. Since the majority of chimneys in the 1950's were not suitable for swifts, as a result of being used by cooking stoves, we must refer to more affluent households which had two chimneys.. To this total we must also add households that converted to electricity with their chimney remaining potentially available for a certain period of time. Today, about 75% of these chimneys are not available to swifts. With a detailed analysis of Statistics Canada's figures, it would be possible to determine the potential of available chimney for swifts today. Based on our first estimates, this potential is low.

Protection/Ownership

The environment in which the Chimney Swift lives makes it difficult to link it with the concept of habitat protection, as it is usually defined. The vast majority of sites used by Chimney Swift are not protected, because they are chimneys on private buildings. There are only two known roosting sites in the Maritimes – one in Fredericton, NB and one in Wolfville, NS; both sites are well known and are under the protective care of local volunteers. In Ontario, there are no specific arrangements in place for the actual conservation of chimney roost sites, but some of the building owners are at least aware of the roost on their property. In Québec only nine urban sites are protected in some way and could be eligible for Environment Canada's stewardship program. They are six roosts located in Chantler, La Pocatière, Mont-Laurier, St Raymond de Portneuf, St Georges de Beauce and Joliette, as well as three nesting sites in Joliette, Lévis and Mont Mégantic. The owners of these nine sites are aware of the birds' presence and efforts are made to maintain the chimneys' availability.

There are probably few nesting sites in forest habitat since snags, hollow and sick trees are usually eliminated, regardless of the environment. In the Maritimes, only 1 to 5% of the forest cover is presently old growth (Mosseler *et al*. 2003). Nova Scotia aims at conserving 8% of its crown forest land toward achieving and maintaining old growth conditions (Nova Scotia Dept. of Natural Resources 2004). For New Brunswick, this figure reaches 19% of crown land (D. Beaudette, NB Dept. of Natural Resources, pers. comm.).

In southern Ontario, as of 1986, only 0.07% of the land south and east of the Canadian Shield was classified as greater than 120 years old (Larson et al. 1999). In central and northern Ontario, the percentage of the forest in old growth condition is considerably higher, averaging 23% in Crown forests, and 28% in parks and protected areas (OMNR, 2002). As in Québec, hollow, dead or dying trees are often removed during logging for safety reasons. However, current silvicultural guidelines within the range of the Chimney Swift in Ontario (Naylor et al 1996, OMNR 2000, 2001) include the maintenance of (usually 6) large, live cavity trees or potential cavity trees in every hectare of managed forest. However, cavity trees are defined as having a healthy crown (OMNR 2000) and may not be suitable for Chimney Swift. Large, dead trees used by roosting Pileated Woodpeckers, though rare, are to be retained in managed forest on crown land (Naylor 1996).

In Québec, seven of the 49 identified old-growth forests are classified ecological reserves and are thus protected: the Rivière du Moulin, Tantaré, Lake Malakisis, Tapani, Rolland Germain, Grands Ormes and Boisé des Muir ecological reserves. The old-growth

forests in these reserves represent 1,395 ha or 20.9% of the total area of the old-growth forests identified (Government of Québec 1996).

BIOLOGY

General

Chimney Swifts spend most of the day on the wing. They are extremely gregarious, feeding and roosting in large flocks (Chantler and Driessens 2000; Snow and Perrins 1998). During migration, they congregate in flocks of thousands at roosting sites along their migration route (Groskin 1945; Michael and Chao 1973). Roosts are also used in the summer, before and after nesting by breeding birds and during all of the summer by most of the nonbreeding birds and failed breeders.

Reproduction

The reproductive information in this section comes primarily from the work of Ralph Dexter (1944-83) at Kent State University in Ohio and by Richard B. Fischer (1939-53) in New York State.

The Chimney Swift is a solitary breeder and only one nest is built per nesting site (chimney, tree hollow, air shaft, etc.; Fischer 1958; Dexter 1969, 1974, 1991). Although several pairs may nest close together on the roof of a building with a number of chimneys (Dexter 1969), it is not a true colonial species (Fischer 1958). Chimney Swifts can form loose colonies in which each pair uses and defends a different site. Dexter (1969) even noted that swifts tended not to nest in air shafts that were adjacent to one already occupied by another pair. The only exception reported in the literature is of two nests inside the same barn (Fischer 1958). In that case, the building's large size in comparison to a chimney doubtless explains the presence of two pairs in one location. It is difficult to believe that there could be more than one nest in a given chimney given the aggressiveness that nesting pairs show to neighbouring swifts when nesting is advanced (C. Garneau, pers. comm.).

Chimney Swifts normally mate for life and are monogamous (Dexter 1992). Adults have a very strong tendency to return to the previous year's nesting site (Fischer 1958; Dexter 1992). Swifts retain the same mate as long as both return to the nesting site each year (Dexter 1971). However, if one of the birds does not appear, the remaining one will mate with another individual. Dexter (1992) recorded a mate fidelity rate of 84% (294 pairs) and 96% of these pairs occupied the same air shaft that they had used the previous year. Pairs typically build their nest in the same spot on the wall from one year to the next (Dexter 1969).

Chimney Swifts do not generally breed before their second year (Dexter 1981a), but some individuals can breed during their first summer (Dexter 1952a, 1981b, 1985; Fischer 1958; Kyle and Kyle Unpublished data). Courtship takes place primarily in the air and consists of chasing and flying by the pair, with the birds engaging in "V-ing" and gliding for short distances (Fischer 1958). It was long believed that swifts copulate while in flight but in fact they copulate on the vertical surface inside the nesting site (Dexter 1950; Fischer 1958) or in the nest (C. Garneau, pers. comm.). Chimney Swifts are generally single-brooded in northern latitudes (Baicich and Harrison 1997), although there have been reports of 2 broods per year for some pairs in Texas (Kyle and Kyle unpublished data).

The nest is made of small dead twigs glued to the vertical surface and to each other to form a half-saucer (MacNamara 1918; Shelley 1929; Fischer 1958; Zammuto and Franks 1981). Dexter (1969) observed that the average depth from the chimney top was 6.1 m in 400 nests studied in Ohio. Most of the time, they were attached to the chimney's south and west walls. Swifts do not normally reuse nests built the previous year as most fall down over the fall or winter (Dexter 1969), but some nests built in sheltered locations are in good enough condition to be renovated and reused (Amadon 1936; Fischer 1958; Dexter 1978, 1981a; Cink and Collins 2002; C. Garneau, pers. comm.).

Two to six (normally four or five) eggs are laid and the young hatch after 19 to 21 days of incubation (Fischer 1958), which is done by both parents. Hatching success is high; Fischer (1958) obtained a figure of 90.7%. These results are similar to those obtained from an artificial chimney in Lévis between 1998 and 2003 (Garneau and Gauthier, CWS-QC unpublished data) and in Texas between 1989 and 2002 (Kyle and Kyle unpublished data). Fledging success is also high (86%) and three to six young are produced (Fischer 1958). All existing data seems to show that reproductive potential is similar across the different regions and in time (Appendix 1), suggesting that when individuals reproduce, they perform well. The decline is therefore potentially caused by some other problem.

Based on numerous banding data collected across North America, between 1920 and 1950, the annual adult survival rate for Chimney Swift was about 63% (Henny 1972). This rate is similar to the 73 ± 7 % calculated from banding data from Paul and Georgean Kyle's Chimney Swift project in Texas between 1989 and 2002 (CWS-QC Unpublished data). Mortality is highest in the first year after hatching for most swift species studied (Chantler and Driessens 2000), but data from Kyle and Kyle permitted an estimation of the survival rate for juvenile Chimney Swifts (78.8 ± 21.9%), which was not significantly different from the adults. This is particularly high considering that the Chimney Swift makes long transcontinental migrations. With such a high survival rate, it is not surprising that swifts live to an old age for birds of such a small size. The record for known Chimney Swift longevity is 14 years (Dexter 1979); the average is 4.6 years (Dexter 1969).

Movements/Dispersal

Swifts arrive in southern Ontario at the end of April and in mid May in the more northern areas (Cink and Collins 2002). Most Chimney Swifts arrive in Québec in the last two weeks of May (David 1996). They leave Québec early, most of them by the end of August (David 1996). In New Brunswick, swifts have been reported from 22 April and 10 November, but most are gone by 18 September (Squires 1976, Tufts 1986).

The Chimney Swift migrates diurnally in flocks (Coffey 1936; Tyler 1940; Whittemore 1981; Chantler 1999). During the fall migration, the birds converge on the Mississippi Valley from the northern United States and Canada (Lowery 1943; Ganier 1944; Bowman 1952). The number of birds increases as they get farther south, reaching thousands of individuals in the Gulf States (Texas, Louisiana, Mississippi). Most of the swifts then cross directly over the Gulf of Mexico (Lowery 1943), passing over the Yucatan Peninsula and following the Atlantic coast of Central America (Howell and Webb 1995), reaching Peru in early November (Plenge et al. 1989). In spring, Chimney Swifts essentially repeat this route in reverse, arriving in the southern United States in mid-March.

Feeding habits

Chimney Swifts feed on insects and spiders, taken almost exclusively in the air (Chantler 1999). Main insects take are caddisflies (Trichoptera); mayflies (Ephemeroptera); crane flies (Diptera; Tipulidae); various other flies (Diptera); beetles (Coleoptera); wasps, ants, bees (Hymenoptera); and true bugs (Hemiptera) (Cink and Collins 2002). To drink, they skim close to the water, touching the surface lightly with their bills (Whittemore 1981; Godfrey 1986).

Physiology

Chimney Swifts can enter a torpid state when exposed to cold temperatures (Ramsey 1970). They do not exhibit any movement and their body temperature drops, rising quickly when the ambient temperature rises (Ramsey 1970).

Adaptability

Since the settlement of North America, the Chimney Swift has quickly adapted to new artificial habitats provided by man-made structures (chimneys, shafts, silos, etc). However, the species seems to be declining as the habitats for which it is adapted (hollow trees, chimneys) are rapidly disappearing. This situation will be addressed in the section on Limiting Factors and Threats.

POPULATION SIZE AND TRENDS

Abundance

Canada

Estimates of the Canadian population of Chimney Swifts can be made from Breeding Bird Survey (BBS) data. These surveys are designed for relative abundance measures, so total abundance estimates made from them are somewhat imprecise. Peter Blancher (in litt.) has provided an estimate for the Canadian population based on BBS data from 2000 to 2005. This calculation assumes that the survey sampled all the swifts within a 400-m detection distance. It also used a time-of-day correction of 1.12 to compensate for points sampled before swifts were active in the morning. Finally, a pair correction of 1.5 was used to compensate for adults that were on nests during the surveys, assuming that about a third of the adult population is nonbreeding. The result is a Canadian estimate of 17,250 breeding individuals for the years 2000-05; an estimate of 20,250 for the 1990s can be generated using the same methods.

More precise estimates can likely be made from provincial and regional population surveys.

Québec

The annual Chimney Swift Survey Program (Figure 8) in Québec has never counted more than 5,000 swifts: 1,572 in 1998; 3,508 in 1999; 3,687 in 2000; 2,095 in 2001; 3,496 in 2002; 3,850 in 2003; 3,131 in 2004 and 4700 in 2005. In 2006, effort was increased but only

2415 Chimney Swifts were counted, the decline possibly a result of high mortality in Hurricane Wilma the previous fall. Effort increased greatly from 2004 on, but few new sites, none of them with large numbers of swifts, have been found. With such a high level of coverage and effort, the probability of discovering new large roosts or many small ones is low.

Based on the monitoring of 26 roosts (where data are sufficient), it was determined that immatures constitute about 55% of the birds (Gauthier et al. in press). Although the coverage and survey effort in Québec were high, not all sites were surveyed every year—about 80% of the sites were monitored in 2005. To come up with a good population estimate, we added together the maximum number of swifts observed at each site in 2005 and the maximum number seen at between 1998 and 2004 for all known sites not monitored in 2005 and obtained an total of 5700 individuals. If we remove the number of immatures (55%), the total breeding population for the province of Québec then becomes 2520 adults or 1260 pairs for 2005 (Gauthier et al. in press).

Ontario

Population estimates for Ontario can be made in a variety of ways, but the strongest dataset for this is likely that from the second Ontario Breeding Bird Atlas. Abundance estimates collected for the first Ontario Breeding Bird Atlas (Cadman et al. 1987) allow an estimation of the Ontario population between 29,010 and 265,384 during the period 1981-1985. Using the same method of calculation as used in the Maritimes Atlas (which took order-of-magnitude estimates for each square and calculated an overall population estimate for the region; Erskine 1992), the 1985 Ontario population size would be about 35,000 individuals. The second Ontario Breeding Bird Atlas used point counts to more accurately estimate abundance of bird species across the province. This is a much stronger source of Chimney Swift data than the BBS, because point counts were more randomly dispersed across the landscape, included off-road counts, and were much more numerous than BBS stops. There were 47,901 point counts in 1,635 10x10km atlas squares in southern Ontario, where almost all squares were covered by atlassers, and where by far the majority of Chimney Swifts were detected.

Peter Blancher (in litt.) calculated a single point count average for each square that had at least 10 point counts, to avoid biasing results to squares most heavily surveyed by atlassers. He then stratified the square averages by provincial ecoregion, giving estimates for each Ontario ecoregion (the five most southern ecoregions had Chimney Swifts on point counts, with about half found in the Carolinian Forest ecoregion). To calculate area covered by an atlas point count, he used the same distance, time and pair corrections as above. For instance I assumed that all pairs within 400 m of the point count were detected in 5 minutes. Atlassers recorded 77% of Chimney Swifts within 100 m, 23% outside of 100 m, suggestive of a smaller radius of detection, but given the mobility of swifts during a 5-minute count, a 400 m distance seems reasonable. If the actual detection distance is smaller than 400 m, then the population estimate is conservative. The result is an Ontario estimate of 7500 breeding individuals for the years 2001-05.

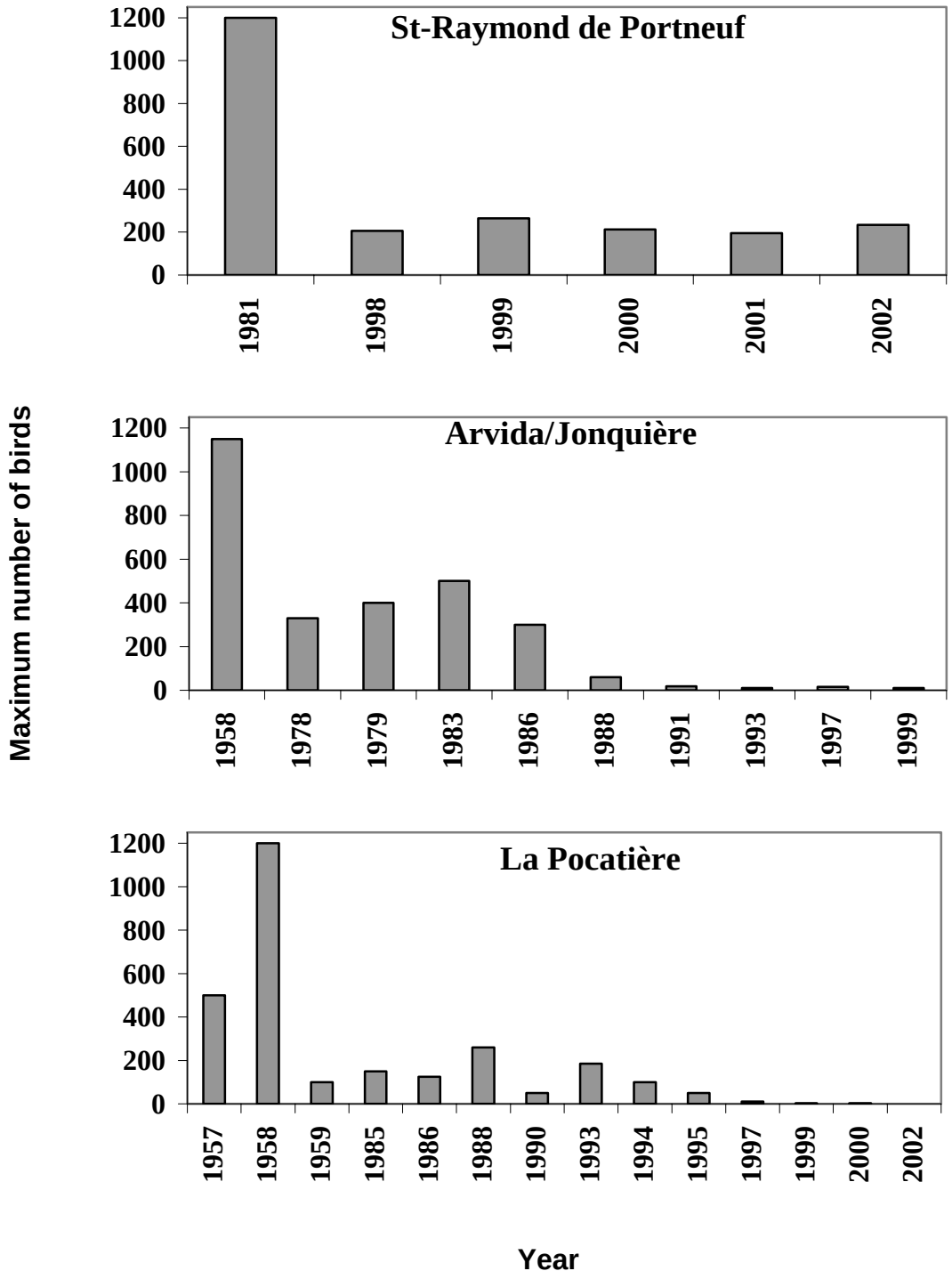

Figure 3. Maximum number of Chimney Swift in time at three historical roosting sites in Québec.

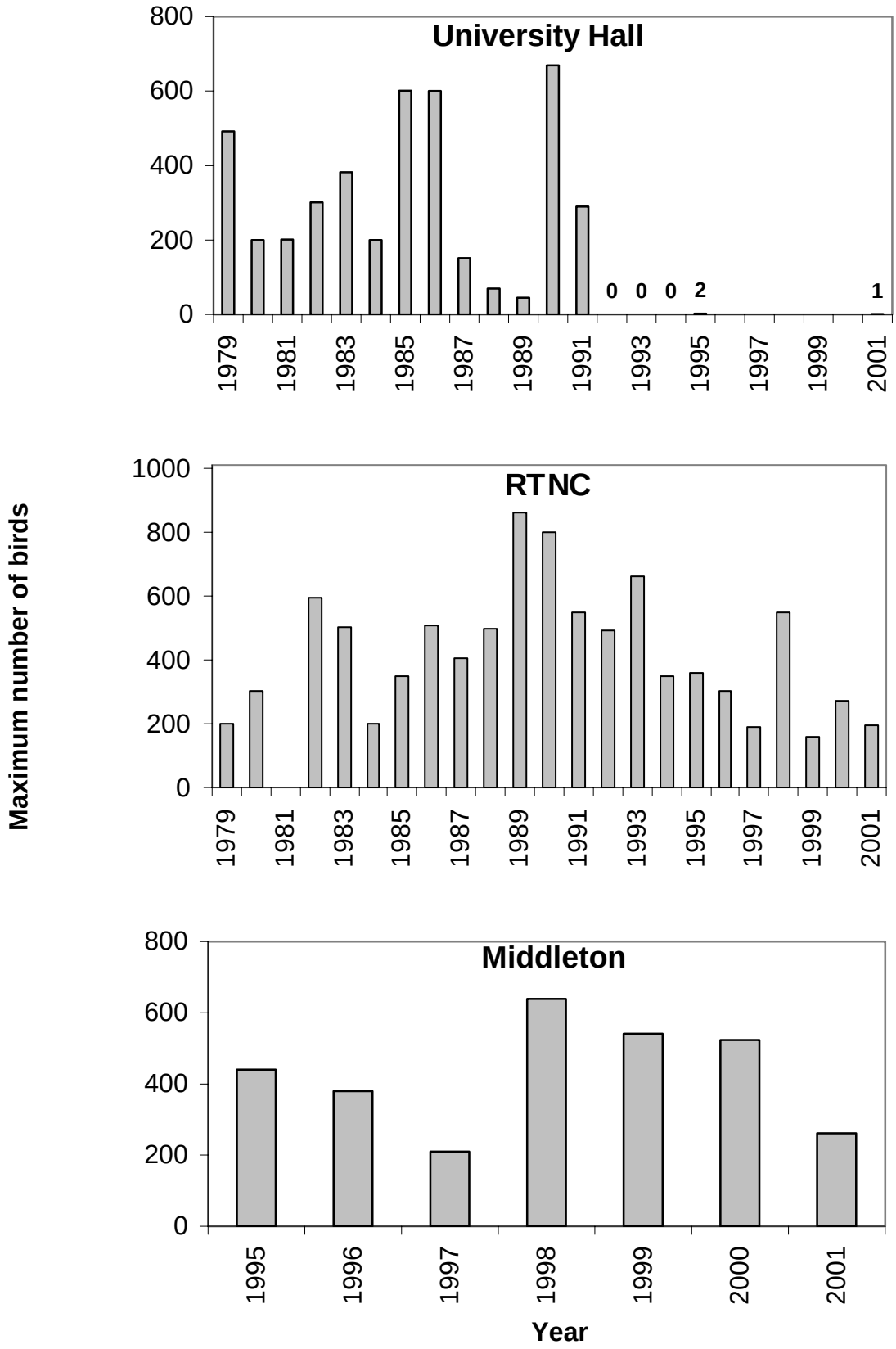

Figure 4. Maximum number of Chimney Swifts at three historical roosting sites in Nova Scotia.

Table 3. Total number of Chimney Swifts observed at sites identified during the Québec Chimney Swift Survey between 1998 and 2003.

Administrative Region	Number of Chimney Swifts
Lower St Lawrence	406
Saguenay-Lac St Jean	35
Québec City	553
Mauricie–Bois Francs	147
Eastern Townships	309
Montreal	353
Outaouais	574
Abitibi–Témiscamingue	0
North Shore	0
Northern Québec	0
Gaspé-Magdalen Islands	28
Chaudière–Appalaches	1134
Laval	2
Lanaudière	208
Laurentians	2296
Montérégie	698
Total	**6743**

A second method of estimating numbers of Chimney Swifts in Ontario would be to use the chimney method based on an extrapolation from figures obtained in Québec, which are based on systematic surveys of roosting and nesting sites since 1998. Because buildings in Ontario are similar to those in Québec (structure and chimneys), the number of chimneys and therefore, the number of swifts will be proportionate to the number of people. Based on this method, there should be about 2988 breeding individuals in Ontario. Figures from the Atlas point-count method (7500 individuals) are those that we retain for this report.

Atlantic Canada and Prairies

In the Atlas of Breeding Birds in the Maritimes, Erskine (1992) converted orders-of-magnitude population estimates from each atlas square into an overall estimate for each of the Maritime provinces. The outcome of this exercise was an estimate of approximately 20,000 ± 3,000 pairs in the Maritimes as a whole (New Brunswick: 12,000 ± 2,300, Nova Scotia: 8,500 ± 1,900, Prince Edward Island: 15?). These numbers seem overestimated and are perhaps characteristic of the method used. After applying the BBS trend (Table 4) to these figures we get a swift density about ten times higher than the one for Québec. The Chimney Swift population estimate from Québec is based on a systematic inventory and is therefore more reliable. Also, the habitat trend (degradation of traditional chimneys) is similar in both areas. Using an extrapolation of the number of swifts per potential building a total of about 345 pairs is obtained; it is likely that this is low so we estimate a population of about 450 breeding pairs (Gauthier et al. in prep).

There are no population estimates for Chimney Swifts in Newfoundland (Montevecchi and Tuck 1987). No quantitative data exist for the province of Saskatchewan and Chimney Swifts are not common (Smith 1996). In Manitoba, Chimney Swifts seem fairly common in urban areas but only sporadic counts exist (Taylor et al. 2003); some 200 swifts were

observed in Winnipeg in 1980. In light of this information, a total of about 450 breeding pairs is estimated for Newfoundland and the Prairies.

Gauthier et al. (in press) present evidence that the Canadian population could be as low as 8000 breeding individuals, but it is likely that the total is higher than that. Using the regional calculations above, a total of 11820 individuals is estimated for all of Canada (Québec 2520; Ontario 7500; Maritimes 900; all other provinces 900).

Trends

Breeding Bird Survey (BBS) routes cover the Chimney Swift's entire breeding range and provide more than three decades of data. According to the BBS, the Canadian Chimney Swift population declined 7.8% annually between 1968 and 2005 (Downes *et al*. 2005) (Table 4), resulting in a cumulative decline of 95% over that 37-year period. The decline accelerated until 1998; the trends for the last 25 years, 10 years and 5 years of the 1968-1998 analysis are -7.4%, -11.4% and -15.2% respectively (Dunn *et al*. 2000). The decline seems to have moderated in recent years with a non-significant annual decline of 3.4% in the 1995-2005 period (Downes et al. 2005). In the last 3 generations (13.5 years) the decline has been 2.37% per year (Sauer et al. 2005), resulting in a total decline of about 28%. All these BBS trends are calculated by comparing numbers on the same routes with the same observers.

The annual population index, calculated using BBS data, has declined steadily since 1970 (Downes *et al*. 2005) (Figure 5). This decline can be observed in all provinces where BBS data is available (Figure 6).

Table 4. Chimney Swift population trends (% change/year) in Canada based on Breeding Bird Survey data (Downes et al. 2005[1], Sauer et al. 2005[2]). N: number of routes used in analysis; *: P < 0.05

	1968-2005[1]			1968-1985[1]			1985-2005[1]			1991-2005[2]			1995-2005[1]		
Region	Trend	P	N	Trend	P	N	Trend	P	N	Trend	P	N	Trend	P	N
Canada	-7.8	*	207	-8.0	*	138	-6.8	*	159	-2.37		-	-3.4		117
Ontario	-8.4	*	82	-6.4	*	49	-10.2	*	65	-11.3	*	-	-9.0	*	47
Quebec	-4.9	*	60	-9.3	*	37	-3.1		46	+0.88		-	+6.8		38
New Brunswick	-4.9		30	-2.7		27	-8.6		21						
Nova Scotia	-8.5	*	29	-10.8	*	23	-5.6		21				-17.3		16

This decline is occurring throughout the breeding range of the Chimney Swift (DeGraaf and Rappole 1995). The BBS data show a significant downward trend in the entire Chimney Swift population of 1.6% annually between 1966 and 2005 (Table 5). The decline has accelerated, reaching -2.5% annually for the period 1980-2005. In the United States, although

Chimney Swifts are considered common in almost all the states where they breed, the population has also declined by 1.5% per year since 1966 (Table 5). Of the 38 US states for which data are available, 22 (58%) show a significant downward trend for the 1966-2005 period (Sauer *et al.* 2005). Within states showing a significant decrease for the longer period (1966-2005), 16 out of 22 (73%) saw the decline accelerate in the last 25 years (1980-2005; Table 5). Sauer *et al*. (2005) caution that the trend data from Illinois, Indiana, Kentucky, Michigan, Rhode Island, Tennessee and West Virginia are deficient (e.g. small number of birds per route and fewer than five routes sampled).

Rodriguez (2002) re-analysed the 1966-1993 BBS data to study changes in the range size of significantly declining birds. During this period, Chimney Swift populations declined by 21% while its range contracted by 32.2%. Rodriguez noted that Chimney Swifts decreased more rapidly at the edge of its distribution than in the centre, where numbers are higher.

Breeding Bird Atlas projects have also reported declines: Palmer-Ball (1996) in Kentucky, Hess (2000) in Delaware and Mulvihill (1992) in Pennsylvania. In Connecticut, Zeranski and Baptist (1990) note that the species began to decline in the 1960s and 1970s. The Driftwood Wildlife Association (2000), a Texas organization conducting a research on the Chimney Swift, reports a population decline since the mid-1980s. Some authors cite the decrease in available chimneys used for nesting sites as the reason for the decline (Zeranski and Baptist 1990; Hess 2000). Sibley (1988) also reports a significant decline in the number of swifts in New York State, particularly in New York City and area. In Ohio, Peterjohn and Rice (1991) reported that the Chimney Swift was widespread, but that the population decline had become obvious in many parts of the state in the 1980s. In Colorado, Kingery (1998) observes that the species has been less and less evident in recent years. The population drop in New Hampshire and Maryland has led the authors to declare that the species should be monitored in the next few years and that a follow-up should be carried out (Sutcliffe 1994; Zucker 1996).

Table 5. Chimney Swift population trends (% change/year) in the United States based on Breeding Bird Survey Data (Sauer et al. 2005). *: P < 0.10; **: P <0.05; ***: P < 0.01

Regions	1966-2005	1980-2005
North America	-1.6 ***	-2.5 ***
United States	-1.6 ***	-2.5 ***
Alabama	-1.5 *	-2.8 ***
Delaware	-2.0 *	-1.2
Georgia	-1.1	-2.0 ***
Illinois	-2.5 ***	-3.6 ***
Indiana	-2.8 ***	-3.8 ***
Iowa	-1.9	-3.1 ***
Kentucky	-2.4***	-4.9 ***
Maine	-2.5 **	-2.6
Maryland	-1.6 **	-0.7
Missouri	-1.5	-2.2
New Hampshire	-1.9 *	-2.9 ***
New Jersey	-3.0 **	-2.1 **
New York	-1.7 ***	-1.0
North Carolina	-0.5	-1.0
Ohio	-0.7	-1.6 ***
Oklahoma	-3.1 ***	-3.3 **
Rhode Island	-11.2 **	-12.6 **
Tennessee	-2.0 ***	-3.2 ***
Texas	-2.4 ***	-3.4 ***
Vermont	-2.4 *	-0.3
Virginia	-1.3 ***	-1.4 ***
West Virginia	-1.6 **	-2.5 ***

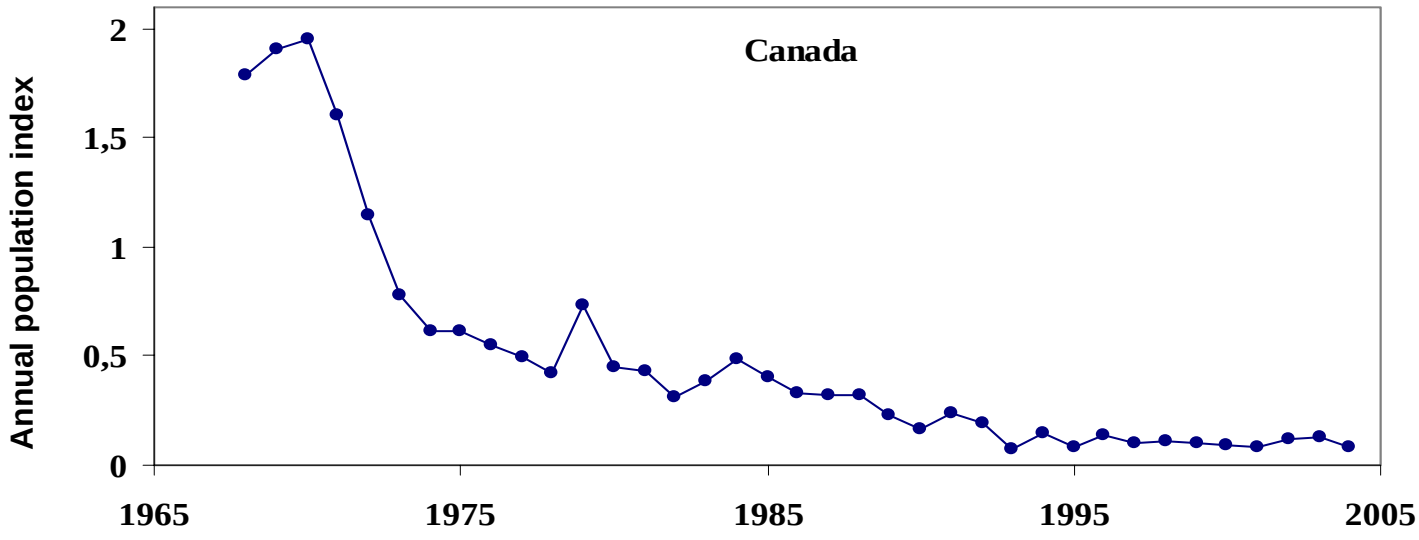

Figure 5. Annual population indices for the Chimney Swift in Canada based on Breeding Bird Survey data (Downes et al. 2005).

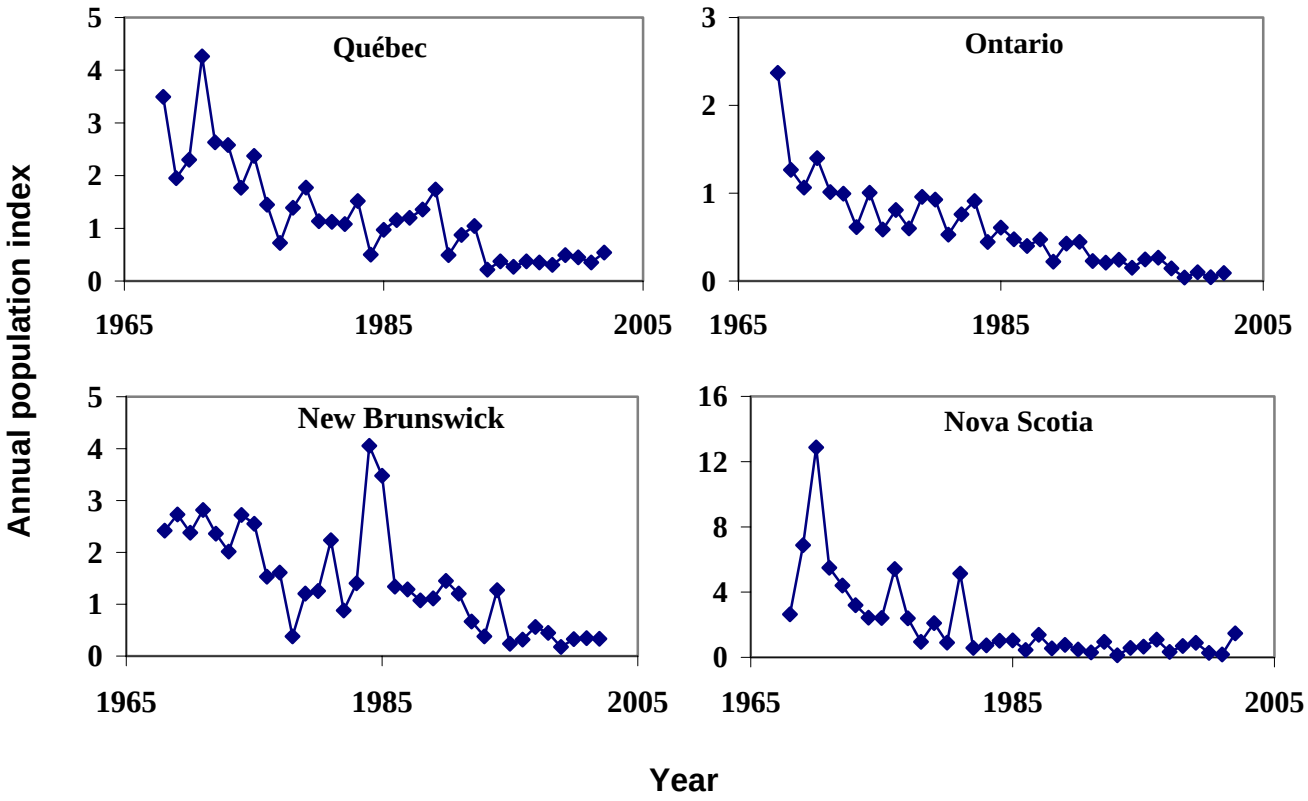

Figure 6. Chimney Swift annual population indices in four Canadian provinces based on Breeding Bird Survey data (Downes et al. 2003).

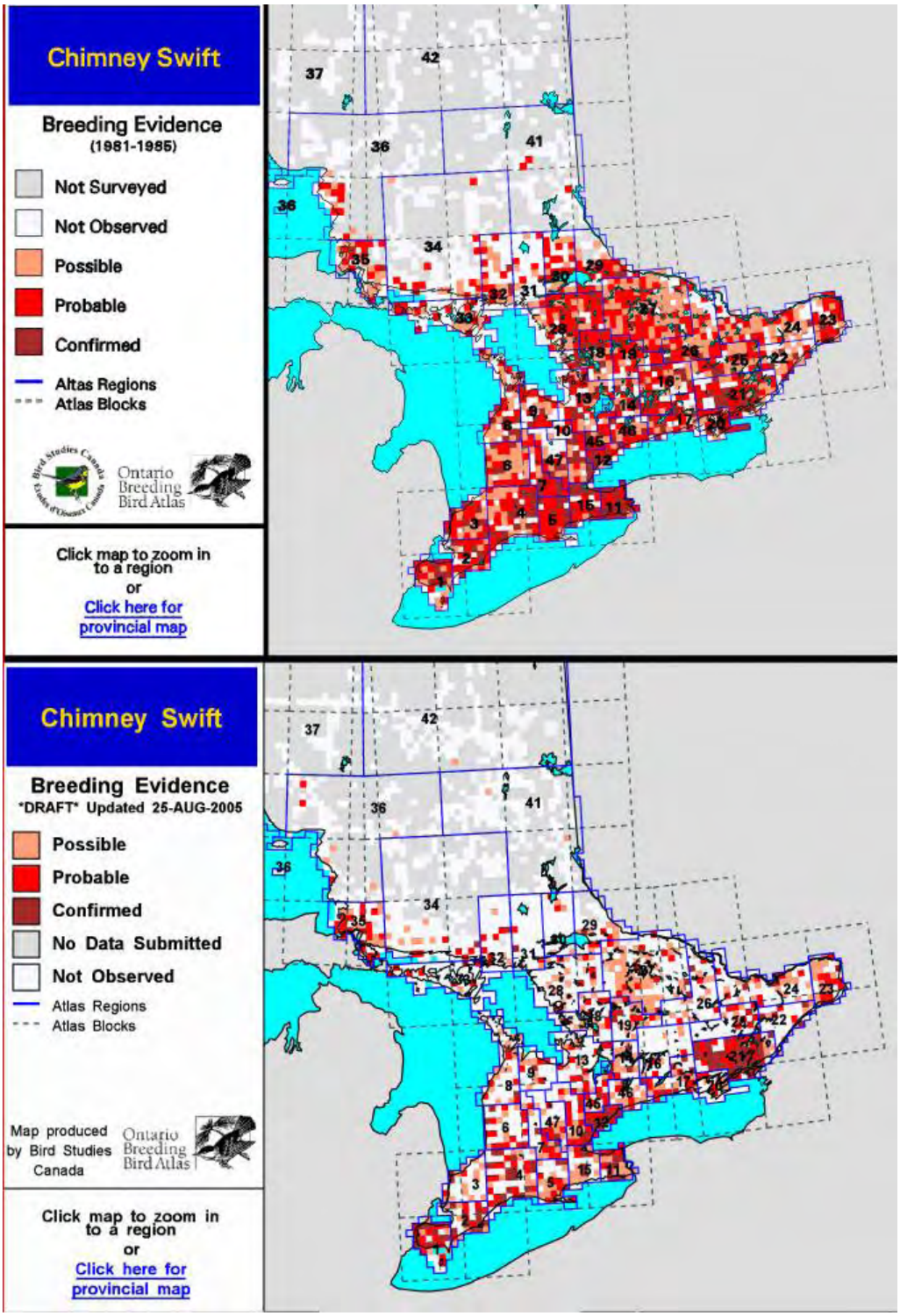

Figure 7. Chimney Swift breeding distribution in southern Ontario in 1981-1985 (top) and 2001-2005 (bottom) (Ontario Breeding Bird Atlas).

Data collected for the second Ontario Breeding Bird Atlas (2001-2005) indicate that the species has been reported in only 48% as many 10-km squares as it was during the first atlas (1981-1985), even though at least 85% as much effort has been expended on field surveys. When corrected for effort, the data indicate a decline of 46% in the Area of Occupancy over the last 20 years; that decline has occurred throughout the species range in Ontario (http://www.birdsontario.org/publpr/download/OBBA_Change_Tables.pdf).

On the basis of the data gathered for the Québec Breeding Bird Atlas in the 1980s (1984 to 1989), Lemieux and Robert (1995) describe the Chimney Swift as a fairly common species in Québec. However, they also note that the population is showing a downward trend. According to 1966-1998 BBS data (Table 4), the Québec Chimney Swift population is falling 6.3% annually. Since 1993 the downward trend seems to have reversed, but this recent trend is not statistically significant (Table 4). This positive trend could be the result of a few good years, giving a short term increase. It could also be a consequence of a limited number of routes in the province or the biased estimation due to short time intervals discussed earlier and it is therefore best to consider trends that cover the longest time periods.

Breeding Bird Survey data are not alone in showing a negative trend in Québec. For the 1969-1989 period, ÉPOQ (*Étude des populations d'oiseaux du Québec*) file data show a significant annual decline of 1.44 percent ($p < 0.01$) (Cyr and Larivée 1995). After learning about the sharp decline in the range of distribution in Ontario, a subsample (n=200) of the 1995 census squares from the Atlas of breeding birds in Québec (n=790; Gauthier et Aubry 1995) was made in 2004 to see if a reduction in the Chimney Swift's range of distribution also occurred in this province. Results showed that the range of distribution significantly declined by 33% between 1989 and 2004 ($p<0.001$; CWS-QC Unpublished data).

Since 1998, the Canadian Wildlife Service has been surveying Chimney Swift roosting and nesting sites in Québec. The purpose of the survey is to estimate swift population sizes, monitor population changes, locate and characterize the sites used, evaluate how many of these sites have been abandoned or closed over the years and develop conservation measures for the species. The results of the survey are presented in Table 5; 258 confirmed sites were identified between 1998 and 2005. These sites are spread out over most of Québec's regions, with the exception of Northern Québec and the North Shore, Laval and Abitibi-Témiscamingue. All of the sites are shown on Figure 8. The largest roosts in the province are located in St Georges de Beauce and Mont-Laurier, where at least 1,000 birds have been counted. The region where most of the sites have been found to date is Chaudière-Appalaches. There are few sites south of Montreal and in the Eastern Townships, but the network is still being formed. More than a third of the sites identified are roosts and the swifts use church or rectory chimneys in 40% of cases. This survey was made possible thanks to a network of volunteers and 93 observers have participated since 1998.

In the case of three roosts, located at least 200 km apart, in St Raymond de Portneuf, Jonquière and La Pocatière, we have historical data on the presence of Chimney Swifts. At all three sites the downward population trend observed confirms other existing Canadian data (Figure 6). In St Raymond de Portneuf, located 50 km west of Québec City, swifts are occupying the chimney of a former convent that has been converted into a senior citizens' residence. The chimney is still being used by the birds. In 1981, approximately 1,200 swifts were counted, while in 2002 the maximum number was 234 (Figure 3). Their numbers have thus fallen 81% in 21 years, or 3.8% per year.

Figure 3 also presents the changes in the number of Chimney Swifts in Arvida (town merged with Jonquière in 1975) from 1958 to 1999. Observations between 1958 and 1986 are related to a roost in a supermarket chimney in Carré Davis, the downtown shopping district. In the case of the 1988-1997 observations, the exact location is not specified, but there is every reason to believe that it is the same chimney since Chimney Swifts exhibit

strong site fidelity. The number of swifts frequenting this area of town has fallen significantly in the last 40 years. There were approximately 1,000 birds in the late 1950s (Browne 1967), a few hundred in the early 1980s, a few dozen at the end of the 1980s and only about 15 since 1991. The population has dropped 99% in 42 years (2.4%/year). The supermarket chimney, the location of the large roost in 1958, was capped in fall 1998. The chimney was still available as a roost before that date, but that did not prevent the number of swifts from declining. A follow-up visit in summer 1999 confirmed this decline; no more than 11 birds were observed entering the chimney of a school in the same area. Since a roost usually draws birds from a large area, this number is indicative of the population in this area of the town since the observers searched it systematically over one entire summer.

The third roost is located at the François Pilote Museum in La Pocatière in the Lower St. Lawrence region. The chimney is as old as the structure, which was built in 1925, but is no longer used for heating. The roost has been used by Chimney Swifts since 1940 and has been protected since then (Tanguay 1964-65). Although the chimney is still available, the number of birds using it has declined significantly since the late 1950s (Figure 6). Only two were seen entering the chimney in 1999, down from the 1,200 birds observed in 1958, a drop of over 99.8% in 42 years (2.4%/year). It is highly possible that the number of swifts present in 1957 was over 500 because the observer was only able to witness the start of flocking (R McNeil, pers. comm.). Twenty years ago in the Rimouski region, 100 or so swifts were regularly seen in flight; today just over 20 can be observed after much effort (J. Larivée, pers. comm.).

Including historical data, the species was reported in at least 40 different locations in the Saguenay-Lac St Jean region between 1971 and 1997 (Savard 1999) and in six or seven municipalities annually in the 1980s (Savard 2000). However, in the summer of 1999, swifts were spotted in only three municipalities (Jonquière, La Baie and Roberval) (Savard 2000). The species seems to have completely deserted Chicoutimi, where it had been present in the past (Savard 2000). In short, all the available sources of information in Québec show a dramatic and continuing decline in the Chimney Swift population.

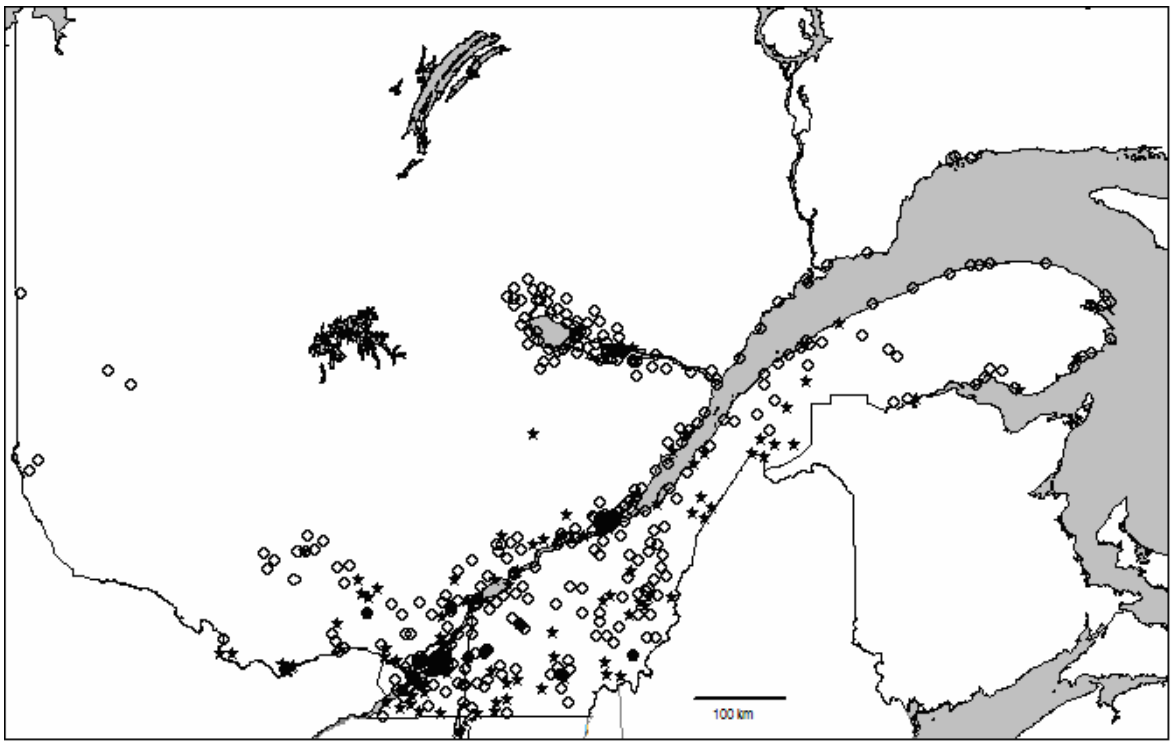

Figure 8. Distribution of parishes surveyed during the Quebec Chimney Swift Survey Program between 1998 and 2005 and during the chimney survey of religious buildings in 2000. Empty circles represent parishes where no swifts were detected, while full stars indicate parishes with a known Chimney Swift site (nest or roost), active, abandoned or closed.

According to Erskine (1992), the Chimney Swift population in the Maritime Provinces has declined markedly in the last 30 years. They are less numerous in Prince Edward Island and New Brunswick than in the past. A. Erskine (pers. comm.) also mentioned the species has been less frequently observed and even disappeared from certain areas since the publication of the Atlas of Breeding birds of the Maritimes in 1992. Figure 4 presents maximum numbers counted at three historical roosts in the Maritimes. Chimney Swifts have almost completely disappeared at the University Hall roost (Acadia University), while numbers of birds in the two other sites showed considerable variation over the years with no clear trend. Chimney Swift numbers at the RTNC chimney in Wolfville peaked in 1989 but then declined following a severe cold spell in 1990 (Wolford 1996).

In the Atlas of Saskatchewan Birds, Smith (1996) classifies the Chimney Swift as uncommon in Saskatchewan and notes that historical data suggest that the species was once more widespread in the province than it is today. In Manitoba, swifts were also more abundant historically (Taylor *et al*. 2003). There are no data on population trends in Newfoundland.

Population trends in the Chimney Swift's winter range are unknown (Cink and Collins 2002). Logging in the Amazon forest could cause problems for the species in the future. This aspect will be addressed in greater detail in Limiting factors and Threats.

Extinction probability

Gauthier et al. (in press) have undertaken population viability analyses for the Canadian Chimney Swift population. Results of these analyses suggest that if only swifts of at least two years of age reproduce, between 40 and 60% of these birds must breed in order to maintain a viable population over the next century. These results not only suggest how a decrease in the availability of nesting sites (or successful reproduction) would influence the viability of the population but also the possible effects of habitat enhancement measures on this species (e.g., building artificial chimneys).

The analyses indicate that if only 30% of birds two years of age and older breed, the chance of extinction over the next 100 years would be higher than 10% regardless of how many first year birds breed. If we use the maximum mean number of fledged young per year, the threshold extinction of 10% in the next 100 years is exceeded only when no first year birds breed. In Québec, the number of breeding sites now seems insufficient to the point where there are probably very few first year old birds that breed.

LIMITING FACTORS AND THREATS

Habitat loss

The main cause of the decline in the North American Chimney Swift population seems to be the reduction in the number of nesting and roosting sites: large-diameter hollow trees, old abandoned buildings and suitable chimneys (Kyle and Kyle 1996; Driftwood Wildlife Association 2000; Cink and Collins 2002). This decline in suitable sites is projected to continue over the next few decades, with very few sites remaining 30 years from now.

Chimney sweeping during the breeding period

The few chimneys still suitable for swifts are often swept in the summer, coinciding with the swift's breeding period. In Texas, the Driftwood Wildlife Association has partnered up with the National Chimney Sweep Guild in order to educate professional chimney sweepers about the Chimney Swift's plight and promote chimney maintenance outside of the breeding period (Kyle and Kyle 1999).

Public misconceptions about the species

Public misconceptions about the species have resulted in building owners' intolerance for swifts nesting in their chimneys. They often cite fire risks as the reason for preventing Chimney Swifts from using their chimneys, even though such risks are nonexistent. Roosting swifts cling to the chimney walls at night and leave in the morning. Nesting swifts build only one nest per site, and it is minuscule (approximately 10 cm long and 5 X 7.5 cm wide (Fischer 1958)). It is made of small twigs and often falls to the bottom of the chimney at the end of the season. As a result, there is no possibility of the nest blocking the chimney and causing a fire. Poor chimney maintenance is a much greater danger. However, it must be recognised that

the rearing of Chimneys Swift can be quite noisy, forcing homeowners to intervene. Also, some people confuse swifts with more problematic bird species such as the European Starling, which prompts them to remove the nests.

Pesticides

Since the Chimney Swift depends mainly on insects for its subsistence, it is vulnerable to any reduction in the availability of its prey caused by pesticides. Most of the studies conducted on the impacts of pesticides in various environments report pesticide-induced changes in birdlife food resources (Avian Effects Dialogue Group 1994). Insectivorous birds are particularly vulnerable to agricultural and forest pesticides, which can significantly reduce insect prey populations. The reduced abundance of insects has been related to reduced survival, growth and reproduction among birds, as well as to changes in diet composition and quality (Avian Effects Dialogue Group 1994).

In Canada, the arrival of the West Nile Virus generated pesticide-based eradication programs in specific areas. In North America, the practice of spraying pesticides to control other insects in cities and towns is also becoming increasingly popular. It is known that pesticides can be transported over long distances in the air (Poissant 1999). A number of them are relatively volatile, so they evaporate quickly after being applied and disperse in the atmosphere (Poissant and Koprivnjak 1996). Chimney Swifts could be indirectly affected by these products, which cause an impoverishment of the aerial plankton by reducing populations of flying insects. Erskine (1992) expressed concern about aerial spraying against spruce budworm (*Choristoneura fumiferana*), which has taken place in New Brunswick since 1952 and which could reduce flying insect populations below the level needed to support swift numbers recorded historically in the province.

In addition, insects that survive these pesticide applications become contaminated and are then eaten by swifts, which become contaminated in turn. There are some indications that Chimney Swifts, like birds of prey, can accumulate dangerous levels of pesticides. Chantler (1999) reports that high concentrations of DDE, a degradation product of DDT, have been found in the Guam Swiftlet (*Aerodramus bartschi*), another member of the swift family. Chantler (1999) also points out that, considering the position of swifts in the food chain and their extended longevity, it stands to reason that pesticides pose a risk to this family. Sick (1993) states that in Brazil various species of swifts are in decline, as are swallows and nightjars, all of them victims of the unrestricted use of pesticides. In Ontario, similar trends were observed in other aerial foragers such as swallows and nighthawks, which suggest that something may be happening to their food supply, namely insects (M. Cadman pers. comm.).

The recent fecundity and survival rates calculated for swifts in Québec (Garneau and Gauthier, CWS-QC unpublished data) and Texas (Kyle and Kyle unpublished data) are comparable to those between 1930 and 1950 (see appendix 1), suggesting that DDT and its degradation products have not significantly reduced fecundity in Chimney Swifts as they did for other species.

Competition

There is intra- and interspecific competition among swift species, which can be significant in species nesting in cavities (Lack and Collins 1985). Disputes over the occupation

of nesting sites have been reported between Common Swifts (*Apus apus*) and European Starlings (*Sturnus vulgaris*). In the case of the Chimney Swift, competition between adults could take on greater importance as suitable nesting sites becomes increasingly scarce. Intense competition could exclude birds from breeding due to a lack of available sites, but it could also affect the breeding success of the few lucky pairs, given the extra time required to defend and maintain their territory.

Winter range

Since the Chimney Swift makes use of hollow trees in its South American winter range, the species is threatened by intensive logging and fires in the Amazon forest. The discovery of their wintering grounds in 1944 proves that the species uses hollow trees as roosting sites in South America (Brackbill 1950). In addition, after forests are cleared to create farmland, large quantities of pesticides are often used to control insects that are harmful to farm crops and humans. In some countries, very harmful pesticides that are banned in North America, such as DDT, are still being used. These products may be having a significant impact on the Chimney Swift, but no data are available.

Accidents

Swifts roosting in a chimney do on occasion die from asphyxiation or are burned when the heat is turned on in cold weather (Deane 1908). This situation can cause the death of a large number of birds in a single roost. Musselman (1931) reported that 3,000 to 5,000 swifts died in October in a chimney in Illinois. At Lake Springfield, Illinois, Bohlen (1989) found 100 dead swifts killed by cars on a cold, rainy spring day when the birds were flying very low to catch insects.

Predation

Since Chimney Swifts spend most of their time in the air, coming down to nest and roost in fairly inaccessible locations such as chimneys or hollow trees, predation is likely a minimal threat to populations. However, Merlins have invaded Canadian urban centres in recent years and increasing attacks on swifts have been noted in Québec. One Merlin preyed on swifts at a roost on the St Jovite church in 1999 (M. Renaud, pers. comm.); during the period when the bird of prey was present, the swifts almost completely abandoned the roost.

Weather conditions

According to Walker (1944), the Chimney Swift's greatest single enemy is the weather. Cold can be very damaging for this insectivore. For instance, 109 birds were found dead on the hearth of the François Pilote Museum chimney in La Pocatière on May 23, 1990; apparently killed by low temperatures and snow (Aubry *et al.* 1990). Between 1999 and 2003, a video camera was used at an artificial nesting site in the Québec urban area (Lévis). During many consecutive days of cold and rain, Garneau and Gauthier (CWS-QC unpublished data) observed that swifts never went out to forage. In addition, each time the temperature inside the chimney went below a threshold, swifts would leave the chimney, perhaps looking for a better site even though conditions remained unfavourable.

Precipitation can also kill birds indirectly. A steady drenching rain for two or three days

may clear the air of insects and with the food supply gone, the birds are subject to starvation (Walker 1944). Cold, rainy weather in northern Europe is known to cause considerable mortality in swift and swallow populations (Elkins 1988). These unfavourable weather conditions, which reduce the number of airborne insects, indirectly cause the birds' death. In addition to affecting the number of insects available, Chantler (1999) says that temperature and precipitation also have a major impact on swifts' breeding success.

Heavy rain also detaches nests from chimney walls on occasion, which often destroys the eggs and nestlings (Dexter 1952b; 1960; 1981a). However, the young do sometimes survive and climb back up the wall, where the parents continue to feed them (Dexter 1952b; 1960; 1985).

Climate change will undoubtedly have consequences for birdlife. In a study on the evaluation of Québec breeding birds' vulnerability to climate change, Morneau *et al.* (1998) observed that of the 13 most climate-sensitive species, most of them were insectivorous neotropical migrants. The Chimney Swift was one of the 71 vulnerable species identified. Species that forage for insects on the wing are more sensitive to temperature variations as this variable directly affects insect abundance. Tropical insect species could expand their range northward. However, climate change could also be very damaging for some species by affecting the abundance and distribution of insects (Chantler 1999). Some data also suggest that climate warming will result in greater climate fluctuations. Temperature extremes, such as very cold springs or summers, could be catastrophic for aerial foragers such as the Chimney Swift. These extremes could also accelerate the degradation of the last remaining traditional chimneys. Warm weather and rain during the winter followed by extreme cold temperature can cause considerable damage to stone or brick structures. Water that infiltrates into the cement and bricks can cause erosion to the structure once it refreezes.

Climate change could also have an impact on the frequency, intensity and trajectories of hurricanes, which are particularly damaging to swift populations. They tend to occur during the fall migration period, and some, like Hurricane Wilma in October 2005 pushed more than 2000 Chimney Swifts north from staging areas further south. At least 700 Chimney Swifts were found dead in the Maritimes after Hurricane Wilma (D. Busby, unpub. data). According to the National Oceanic and Atmospheric Administration (NOAA 2005), the mean number of storms since 1995 is higher compared to the previous period (1970-1994).

West Nile Virus

The Chimney Swift appears on the list of birds which have been found dead and tested positive for the West Nile Virus in the United States (Center for Disease Control and Prevention, Division of Vector-Born Infectious Diseases 2003). There have been no cases of infection in Canada and the species is not on the list of birds retained for testing. The increase of insecticide spraying in response to this disease could also adversely affect insectivorous birds including the Chimney Swift (see *Pesticides* above).

SPECIAL SIGNIFICANCE OF THE SPECIES

The Chimney Swift is the only swift found in eastern North America. The species has

aroused a great deal of interest among the public; their spectacular entrances into their roosts never fails to fascinate people. A number of these sites (Fredericton, NB; Wolfville, NS; St Georges de Beauce, QC) attract many visitors to the spectacle of hundreds of birds entering their chimneys at sunset. Some Québec birdwatching clubs have even organized visits to the St Georges de Beauce site. The Chimney Swift survey conducted by the Canadian Wildlife Service in Québec is also helping to create public awareness of the species' plight and every year new observers are joining the group of volunteers. Some individuals (C Garneau, Lévis, QC) and organizations (Ecomuseum, St Anne de Bellevue, QC; Le Nichoir, Hudson, QC) have become actively involved in the project by building artificial chimneys for swifts.

Individual Chimney Swifts are capable of eating more than 1,000 insects per day (Kyle and Kyle 2004). Large populations of swifts could act as biological control for insects that carry harmful diseases (e.g., West Nile Virus).

PROTECTION

In the United States and Canada, the Chimney Swift is protected by the Migratory Birds Convention Act, 1994, which prohibits the hunting, possession and/or sale of migratory birds and their disturbance during the breeding period. The Chimney Swift is not considered threatened or endangered as it does not appear on the World Conservation Union's list (IUCN 1996), the Canadian endangered species list (Government of Canada 2004), the US Endangered Species Act List (US Fish and Wildlife Service 2000) or any provincial lists. The Chimney Swift is considered a Moderate Priority Species on the Partners in Flight Watchlist, as one of 90 species ranked in the highest tiers of conservation concern (Carter *et al*. 1996).

The Chimney Swift does not receive any known form of protection in its winger range. Stotz *et al*. (1996) believe that the conservation priority for this species is low in the Neotropics. However these authors acknowledge the fact that their wintering range and habitat preference are poorly known which is why the Chimney Swift is also classified at a medium level of research priority.

TECHNICAL SUMMARY

Chaetura pelagica

Chimney Swift Martinet ramoneur

Extent and Area Information	
Extent of occurrence (EO)(km²)	1,302,000 km²
Specify trend in EO	Decline?
Are there extreme fluctuations in EO?	No
Area of occupancy (AO) (km²) 165,000 km^2 from Ontario and Quebec breeding bird atlases (100 km^2 per occupied atlas square) plus an estimated 35,000 km^2 in prairies and Atlantic Canada.	ca. 200,000 km^2
Specify trend in AO (Breeding Bird Atlases) -46% over 20 years(1985-2004) Ontario -35% over 15 years (1989-2004) in Québec	Ca. 33% decline over 13.5 years (3 generations; average of ON and QU data)
Are there extreme fluctuations in AO?	No
Number of known or inferred current locations	Not applicable
Specify trend in #	Not applicable
Are there extreme fluctuations in number of locations?	Not applicable
Specify trend in area, extent or quality of habitat	Decreasing

Population Information	
Generation time (average age of parents in the population)	4.5 years
Number of mature individuals	Ca. 11820
Total population trend:	Decline
% decline over the last/next 10 years or 3 generations. Data from Breeding Bird Survey, annual decline of 2.4% over last 15 years	ca. 28% decline over last 3 generations (13.5 years); >95% decline since 1968
Are there extreme fluctuations in number of mature individuals?	No
Is the total population severely fragmented?	No
Specify trend in number of populations	Not applicable
Are there extreme fluctuations in number of populations?	Not applicable
List populations with number of mature individuals in each:	Not applicable

Threats (actual or imminent threats to populations or habitats)
• Loss of nest and roost sites—initially through logging of old-growth forests, more recently through loss of chimneys suitable for nests and roosts.

Rescue Effect (immigration from an outside source)	
Status of outside population(s)?	Declining
Is immigration known or possible?	Yes

Would immigrants be adapted to survive in Canada?	yes
Is there sufficient habitat for immigrants in Canada?	No
Is rescue from outside populations likely?	Unlikely

Quantitative Analysis	A 10% chance of extinction within 100 years is predicted if only 30% of birds 2 years of age and older breed

Current Status COSEWIC: No status

Recommended Status and Reasons for Designation

Recommended Status: Threatened	**Alpha-numeric code: A2c**
<u>Applicability of Criteria</u> **Criterion A** (Declining Total Population): Meets Threatened A2c because of decline in Area of Occupancy (33% over 3 generations). Actual population decline estimates over 3 generations (28%) do not meet this criterion, though declines were much steeper just prior to the 3-generation time period (95% population decline over 34 years). Criterion B **(Small Distribution, and Decline or Fluctuation):** Not applicable; range too large **Criterion C** (Small Total Population Size and Decline): Estimated population (11820) slightly too large, although decline criterion is met for Threatened (28%) **Criterion D** (Very Small Population or Restricted Distribution): not applicable **Criterion E** (Quantitative Analysis): a 10% chance of extinction over 100 years is predicted if all one-year-old birds are prevented from breeding because of lack of nest sites.	
Reasons for Designation: The Canadian population of this aerial insectivore has declined by 28% over the last three generations and its Area of Occupancy has been reduced by a third over the same time period. The estimated population is 11820 individuals. The most plausible cause of this decline is the decline in number of suitable chimneys that the swifts use for nesting and roosting. This decline in available nesting sites is projected to continue; very few natural sites (large hollow trees) exist.	

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