COSEWIC
Assessment and Update Status Report

on the

Least Bittern
Ixobrychus exilis

in Canada

THREATENED
2009

COSEWIC
Committee on the Status
of Endangered Wildlife
in Canada

COSEPAC
Comité sur la situation
des espèces en péril
au Canada

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Previous reports:

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COSEWIC
Assessment Summary

Assessment Summary – April 2009

Common name
Least Bittern

Scientific name
Ixobrychus exilis

Status
Threatened

Reason for designation
This diminutive member of the heron family has a preference for nesting near pools of open water in relatively large marshes that are dominated by cattail and other robust emergent plants. Its breeding range extends from southeastern Canada through much of the eastern U.S. Information on the population size and exact distribution of this secretive species is somewhat limited. Nevertheless, the best available evidence indicates that the population is small (about 3000 individuals) and declining (> 30% in the last 10 years), largely owing to the loss and degradation of high-quality marsh habitats across its range.

Occurrence
Manitoba, Ontario, Quebec, New Brunswick, Nove Scotia

Status history
Designated Special Concern in April 1988. Status re-examined and confirmed in April 1999. Status re-examined and designated Threatened in November 2001 and in April 2009. Last assessment based on an update status report.

COSEWIC
Executive Summary

Least Bittern
Ixobrychus exilis

Species information

The Least Bittern, *Ixobrychus exilis*, is the smallest heron in the Western Hemisphere, seldom seen in its dense marsh habitat. In shape and secretive habits it resembles the more familiar American Bittern, *Botaurus lentiginosus*, but it is much smaller and somewhat more colourful. Its contrasting dark crown and back, and buff wing patches distinguish it from all other marsh birds. Even so, it is very secretive and most often detected only by its cuckoo-like call.

Distribution

The species nests from southern Canada to southern South America, with North American birds wintering mainly along the Gulf and Mexican coasts, south to Panama. In Canada, it breeds in southern Manitoba, Ontario, Quebec, New Brunswick, and probably Nova Scotia, with the majority of birds breeding in southern Ontario. The estimated extent of occurrence (EO) in Canada is 1,331,000 km^2. The area of occupancy (AO) is much smaller, but is currently difficult to estimate, given uncertainties in population size and distribution.

Habitat

Least Bitterns breed strictly in marshes of emergents (usually cattails, *Typha* spp.) that have relatively stable water levels and interspersed areas of open water. Such marshes have declined considerably across the birds' range since European settlement, although recently the rate of decline might be slowing, thanks to protection and stewardship programs for wetlands.

Biology

Adults arrive on Canadian breeding grounds starting in late April, with calling and nesting beginning by mid-May. They are only weakly territorial, sometimes nesting in small, loose colonies. As such, territory and home range size are highly variable. Nest success also varies considerably, as nests are subject to flooding, collapse, and depredation by a variety of predators. Some individuals can raise two broods in one season, but most other key facts about demography, such as age at first breeding and generation time are uncertain.

Population sizes and trends

About 1500 pairs (3000 mature individuals) are thought to nest in Canada, but the precision of this is uncertain. Numbers seem to be stable globally, but historically they have declined in Canada, and in the northern and central United States. The degree of recent declines is hard to assess, because the birds are hard to detect, but bird atlas projects and marsh bird monitoring programs suggest a decline in Ontario of >30% over the past decade. While trend information is currently lacking for other provincial jurisdictions, the majority of the Canadian population occurs in southern Ontario.

Limiting factors and threats

Habitat loss and degradation are by far the biggest threats to the species. Historically, they consisted of wholesale destruction of marshes, mainly for agriculture. More recently, habitat loss has slowed, but degradation continues in much of the range through such factors as fragmentation, reduced water quality, and invasive marsh plants. Other threats apply more locally, such as collisions with towers, fences, and cars, recreational activities, and perhaps toxins such as pesticides.

Special significance of the species

Least Bitterns are not used commercially, but are highly valued by naturalists, as mysterious, attractive birds representative of pristine expanses of marshland. They are considered useful indicators of the health of such habitats.

Existing protection or other status designations

The species is protected under the *Migratory Birds Convention Act* and by its current listing as Threatened under the *Species at Risk Act*. It is also provincially listed as Threatened in Ontario and Likely to be Designated as Threatened or Vulnerable in Quebec. It is not listed globally by the IUCN, nor federally in the United States, but 16 states have listed it under various designations of conservation concern.

COSEWIC HISTORY

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was created in 1977 as a result of a recommendation at the Federal-Provincial Wildlife Conference held in 1976. It arose from the need for a single, official, scientifically sound, national listing of wildlife species at risk. In 1978, COSEWIC designated its first species and produced its first list of Canadian species at risk. Species designated at meetings of the full committee are added to the list. On June 5, 2003, the *Species at Risk Act* (SARA) was proclaimed. SARA establishes COSEWIC as an advisory body ensuring that species will continue to be assessed under a rigorous and independent scientific process.

COSEWIC MANDATE

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species, subspecies, varieties, or other designatable units that are considered to be at risk in Canada. Designations are made on native species for the following taxonomic groups: mammals, birds, reptiles, amphibians, fishes, arthropods, molluscs, vascular plants, mosses, and lichens.

COSEWIC MEMBERSHIP

COSEWIC comprises members from each provincial and territorial government wildlife agency, four federal entities (Canadian Wildlife Service, Parks Canada Agency, Department of Fisheries and Oceans, and the Federal Biodiversity Information Partnership, chaired by the Canadian Museum of Nature), three non-government science members and the co-chairs of the species specialist subcommittees and the Aboriginal Traditional Knowledge subcommittee. The Committee meets to consider status reports on candidate species.

DEFINITIONS (2009)

Wildlife Species	A species, subspecies, variety, or geographically or genetically distinct population of animal, plant or other organism, other than a bacterium or virus, that is wild by nature and is either native to Canada or has extended its range into Canada without human intervention and has been present in Canada for at least 50 years.
Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)*	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)**	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)***	A category that applies when the available information is insufficient (a) to resolve a species' eligibility for assessment or (b) to permit an assessment of the species' risk of extinction.

* Formerly described as "Vulnerable" from 1990 to 1999, or "Rare" prior to 1990.

** Formerly described as "Not In Any Category", or "No Designation Required."

*** Formerly described as "Indeterminate" from 1994 to 1999 or "ISIBD" (insufficient scientific information on which to base a designation) prior to 1994. Definition of the (DD) category revised in 2006.

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Update
COSEWIC Status Report

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2009

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SPECIES INFORMATION

Name and classification

The Least Bittern (Petit Blongios; *Ixobrychus exilis*) is the smallest member of the heron family, Ardeidae (Order Ciconiiformes, Class Aves) in the Western Hemisphere. It is one of two species of the subfamily of bitterns (Botaurinae) that are found in North America, the other being the much larger, more common, and more familiar American Bittern (*Botaurus lentiginosus*). Some authorities consider the Least Bittern to form a superspecies with the Little Bittern, *I. minutus*, of Europe and Africa, the Yellow Bittern (*I. sinensis*) of Asia, and possibly the extinct Black-backed Bittern (*I. novaezelandiae*) of New Zealand, although these are all recognized as distinct species (AOU 1998; Kushlan and Hancock 2005).

Five subspecies of Least Bittern are distinguished, based on plumage and morphology. Only one, *I. e. exilis*, breeds in Canada. Four subspecies are year-round residents of Central and South America. North American populations were once divided into western and eastern subspecies (*I. e. hesperis* and *I. e. exilis*), but closer examination showed they overlapped in the characteristics used to distinguish them, so they are now all included in *I. e. exilis* (Gibbs *et al.* 1992; AOU 1998). Given this species' disjunct range, especially in the United States (see below), further molecular work might well show substantial *genetic* differentiation (Kushlan and Hancock 2005), albeit perhaps not among eastern birds, which are more continuously distributed. Rarely, individuals are seen with chestnut in place of the normally buff areas, a plumage variant once considered a different species, "Cory's Bittern", but no longer considered taxonomically significant (Gibbs *et al.* 1992).

Morphological description

The Least Bittern is tiny for a heron, only 30 cm in length and 80 g in weight, not much bigger than an American Robin (*Turdus migratorius*). Like the American Bittern, it hunches at rest and freezes when alarmed, with its bill stretched skyward. It is brown and buffy overall, with broad buff streaks on its white underside, and a contrasting back and crown that is glossy black in adult males but lighter in females and juveniles. Buff wing patches, which are especially obvious when the bird flushes, distinguish this species from all other marsh birds. It is most frequently detected by its calls, either a cuckoo-like, guttural "cu-cu-cu" used in mate attraction and territorial advertisement, a rail-like "rick-rick-rick-rick", or various alarm, flight, and contact calls delivered singly or in short series, and given various renderings such as "ank", "gak", and "kuk" (Sibley 2000; Kushlan and Hancock 2005).

Genetic description

The genetic structure of populations in this species has not been studied.

Designatable units

Only the nominate subspecies breeds in Canada; no significant disjunctions are believed to occur in its national distribution; and there is currently no evidence for genetic distinction in the Canadian population. Thus, this report deals with only one designatable unit.

DISTRIBUTION

Global range

Least Bitterns are restricted to the New World, and breed mainly in the eastern U.S. (see Figure 1). Their breeding range extends from southern Manitoba, Ontario, Quebec, New Brunswick, and, perhaps irregularly, Nova Scotia, south to the Caribbean and South America. Birds winter along the Atlantic coastal plain south of Maryland, but mainly winter in Florida, and along the Gulf Coast, especially Texas, Baja California, and in the coastal lowlands of Mexico and Central America (Gibbs *et al*. 1992). Elsewhere in the south, they are resident year-round. Their distribution and abundance in Mexico and Central America are poorly known (Howell and Webb 1995; Stotz *et al*. 1996), partly because wintering individuals are hard to distinguish from local residents (Gibbs *et al*. 1992). Previous COSEWIC reviews have implied that North American birds winter south to northern South America (e.g., James 1999), but in fact birds there, perhaps with rare exceptions, belong to more southerly subspecies (Restall *et al.* 2007). Disjunct breeding populations are scattered through the western U.S., in Oregon, California, Arizona, New Mexico, Wyoming, and, formerly, Utah. During migration, birds occur throughout the area between the breeding and wintering ranges. Specific migration routes are unknown (Gibbs *et al.* 1992), but the pattern of migration might be similar to that of the Little Bittern, which moves along a broad front (Nankinov 1999).

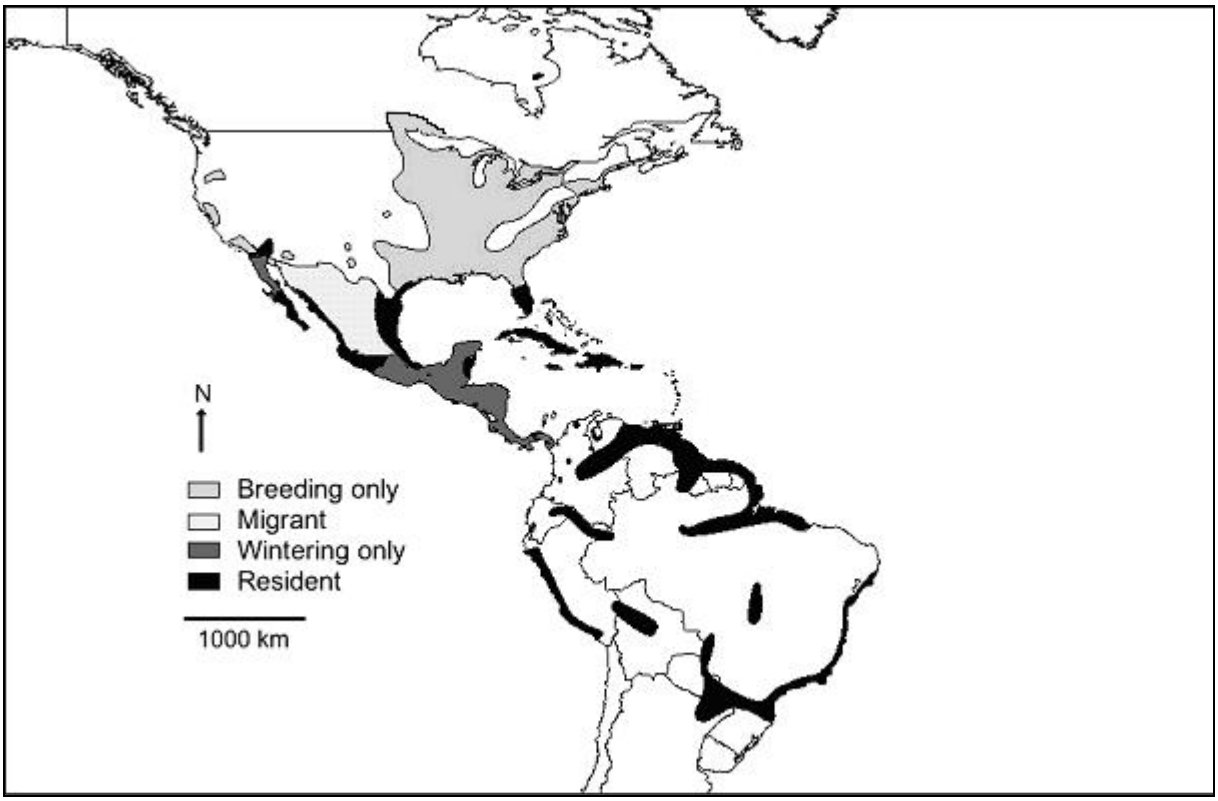

Figure 1. Global range of Least Bittern (modified from NatureServe 2008).

Canadian range

Least Bitterns are hard to detect, so information on their distribution, especially at the edges of their range, is based on relatively few detections, compared to bird species that are more conspicuous and live in more accessible habitat. Least Bitterns have occurred as vagrants in every province (James 1999; NHSPEI 2008), but occur regularly and breed only in Manitoba, Ontario, Quebec, New Brunswick and perhaps Nova Scotia. The range largely corresponds to the Temperate Wetland Region of Canada (as defined in National Wetlands Working Group 1997), although the eastern end of the Prairie Wetland Region in Manitoba and the southern edge of the Boreal Wetland Region in Manitoba, Ontario, and possibly Nova Scotia also hold breeding birds (Figure 2).

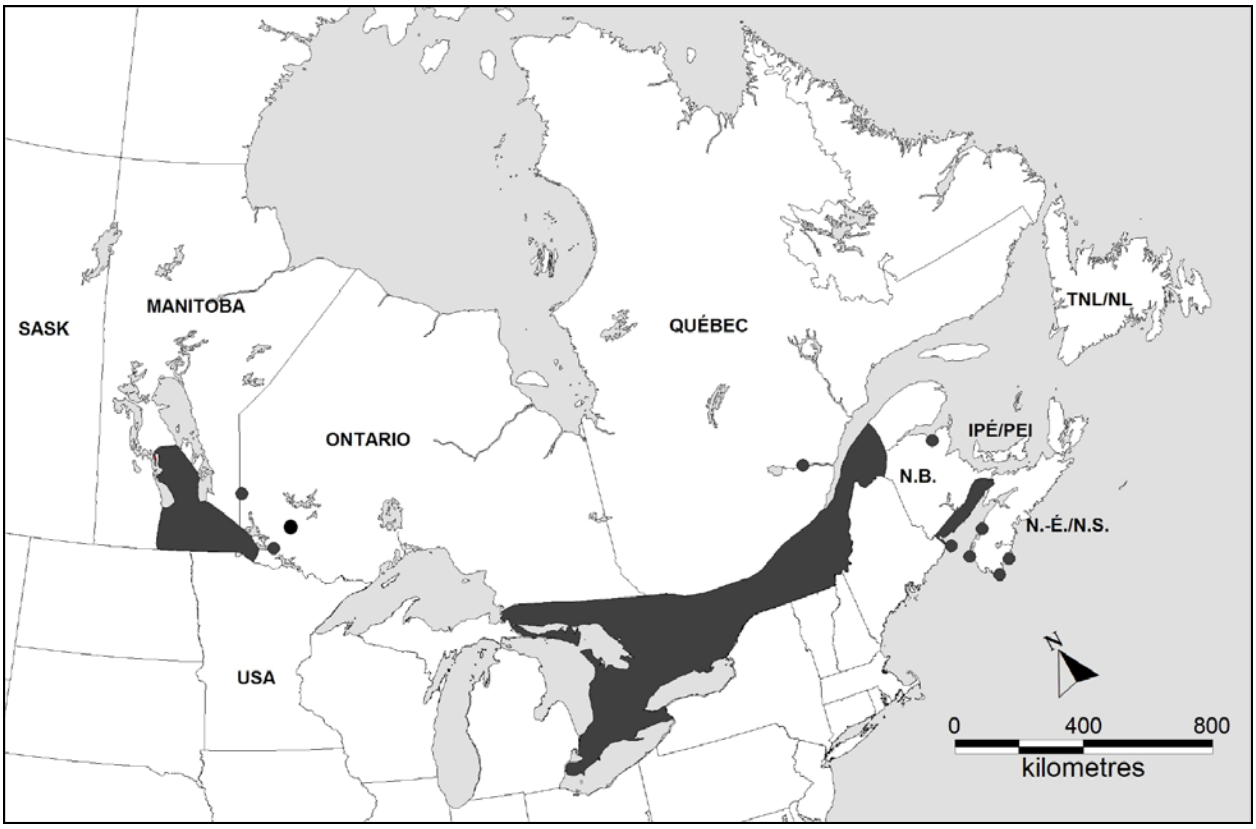

Figure 2. Canadian range of Least Bittern according to information assembled by the Canadian Least Bittern Recovery Team, 2007. Points indicate locations isolated from the known breeding range, but where birds have been found during the breeding season since 1997 (modified from B. Jobin pers. comm. 2008). Point locations in western Ontario are probably isolated because of low survey effort, and thus should be included within the main range extending from Manitoba. Note that the range as shown here obscures the discontinuous distribution of breeding sites; compare with Figure 3.

The northwestern corner of the Least Bittern's breeding range is southern Manitoba, where the species has been found in 18 wetlands: 12 in the Interlake region and six farther south, with most birds in two especially large wetlands: Rat River Swamp and Brokenhead Swamp (Hay 2006; R. Bazin pers. comm. 2008). Significant numbers also occur in the northern part of the Interlake region, within the Interlake Plain ecoregion, which is part of the Boreal Plains ecozone (R. Bazin pers. comm. 2008).

Most Least Bitterns in Canada are found in Ontario. During the 2001-2005 breeding bird atlas project, currently the best source for data on distribution in this province, they were found in 226 of the 4964 10-km^2 atlas squares surveyed (Woodliffe 2007). Apart from a few sites in western Ontario near Fort Frances, Dryden, and east of Sault Ste. Marie, most breeding sites were in southern Ontario. Breeding sites were particularly concentrated in the Mixedwoods Plains ecozone south of the Boreal Shield, specifically near Lake St. Clair, Long Point, and south of the shield between Peterborough and Kingston (Figure 3).

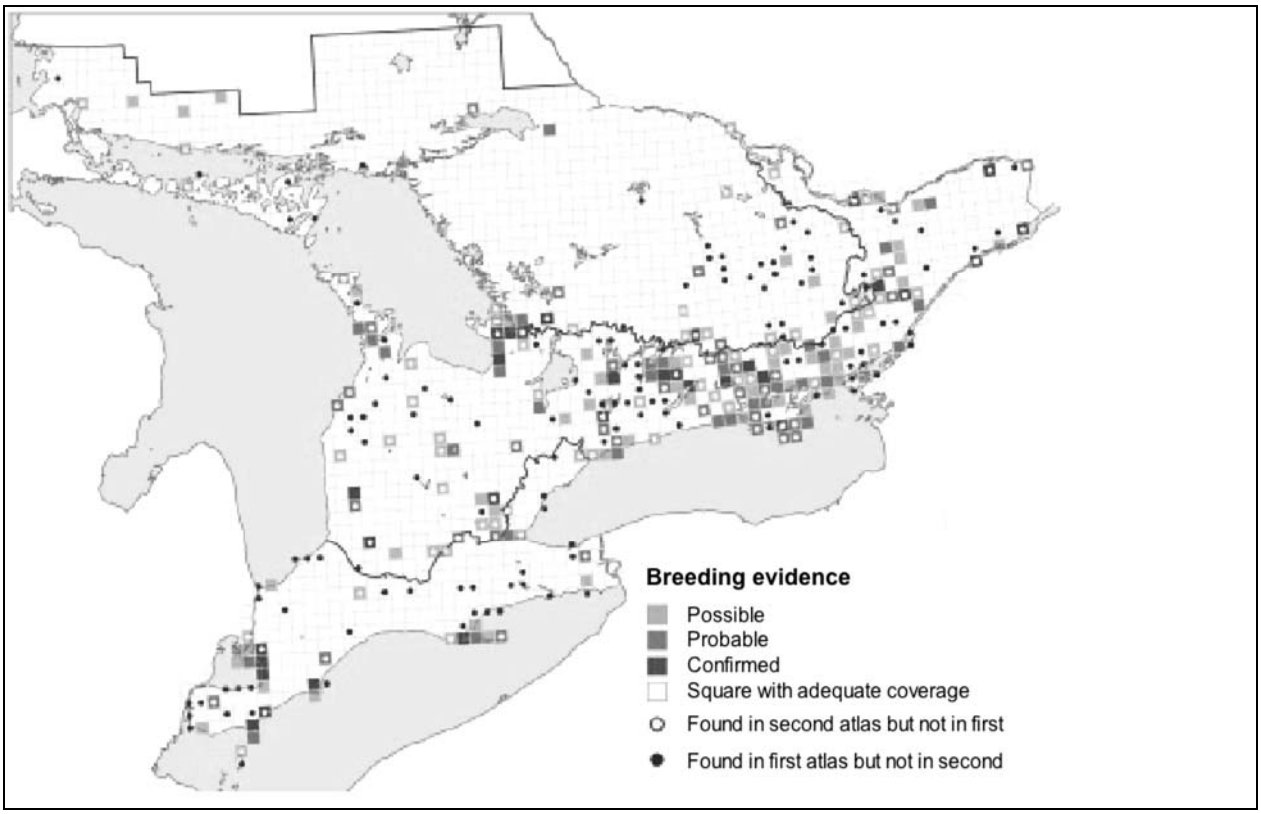

Figure 3. Breeding distribution of Least Bittern in southern Ontario, according to the latest Ontario breeding bird atlas project (from Woodliffe 2007). Note the discontinuous distribution within the main range as it is illustrated in Figure 2.

In Quebec, as of 2007, Least Bitterns have been found at 138 sites, 48 of which have been discovered since more intensive searches were started by the Canadian Wildlife Service in 2004 (B. Jobin pers. comm. 2008). Most sites are in southwestern Quebec, mainly in the Mixedwoods Plains ecozone, and especially along the St. Lawrence, Richelieu, and Ottawa Rivers (B. Jobin pers. comm. 2008).

No province-wide searches focused on this species have been conducted in the Maritimes. In New Brunswick, much apparently suitable habitat is infrequently visited by birders, particularly in the Valley Lowlands and Grand Lake Lowlands ecoregions, which contain many marshes and fens that are similar to those where the bird is found in neighbouring Maine (Gibbs *et al.* 1992; Hayden *et al*. 2005). Breeding or likely breeding records come from only five sites, mostly in the southeast of the province (Figure 2; Maritime Breeding Bird Atlas 2008). The only breeding record for Nova Scotia is from Amherst Point, where the species summers irregularly (Erskine 1992). Most other records from the province are from outside the breeding season, but birds have been found at four additional sites during the breeding season, and could perhaps represent breeding pairs (Figure 2).

With the possible exception of Ontario, where atlas results showed no appreciable change in geographic distribution between 1981-1985 and 2001-2005 (Woodliffe 2007), no province has enough data to offer reliable information on distribution trends. Indeed, as noted above, in Manitoba and Quebec, even a modest level of directed search effort for this species has already extended its known distribution. Nonetheless, the species' habitat needs (see below) likely restricted its distribution to the ecoregions where it is found today.

The extent of occurrence of Least Bitterns in Canada is 1,331,000 km^2 (measured as a minimum convex polygon). The area of occupancy is currently difficult to estimate, given uncertainties in population size and distribution. In addition, density and home range estimates vary considerably and home ranges often overlap (see "Habitat requirements," below).

HABITAT

Habitat requirements

Least Bitterns preferentially breed in marshes with tall emergent vegetation (usually cattails, *Typha* spp.), relatively stable water levels (less than 1 m, and usually 10-50 cm), and about 50% open water interspersed in small pockets throughout the vegetated areas ("hemi-marsh"; Gibbs *et al.* 1992; DesGranges *et al*. 2006; Budd 2007). Larger wetlands (> 5-10 ha) are said to be particularly important (Gibbs and Melvin 1992; Gibbs et al. 1992), with most detections among subsamples of marshes in Iowa, Maine, and Ontario occurring in marshes larger than 5 ha (Brown and Dinsmore 1986; Gibbs and Melvin 1992; Tozer 2002). Nonetheless, territorial birds have been found in marshes less than 0.5 ha in size (Gibbs *et al.* 1992), and such marshes are widespread and poorly searched. Breeding densities range from 0.04 to 5 calling birds per ha, or 1-5 nests per ha (Gibbs *et al.* 1992; Arnold 2005; Winstead and King 2006). Colonial nesting can occur locally, with pockets of over 15 nests per ha, perhaps because of food abundance or limited nesting sites (Kushlan 1973; Bowyer *et al*. 2002; Arnold 2005; Meyer and Friis 2008). Radiotracking studies show that mean home range varies widely, with a New York study reporting 9.7 ha (n=33; Bogner 2001; Bogner and Baldassarre 2002) and a Missouri study reporting 98 ha (n=18; Griffin *et al*. 2006). Such large variance in both breeding density and home range size compounds the difficulty of assessing how important marsh size is for breeding.

The Least Bittern's habitat needs are largely dictated by its nesting and foraging habits. Nests are underlain by platforms on stiff vegetation-thus the need for dense robust stands of taller emergent species-and are almost always within 10 m of open water-thus the need for interspersed open water (Gibbs *et al.* 1992; Weller 1999; Rehm and Baldassarre 2007a). Open water is also needed for foraging, because Least Bitterns forage visually by ambushing their prey in shallow water near marsh edges, often from platforms that they construct out of bent vegetation (Gibbs *et al*. 1992). Access to clear water is essential for the birds to see their prey; siltation, turbidity, or excessive eutrophication makes foraging less efficient (Gibbs *et al.* 1992).

Although most known Canadian breeding sites are large marshes, some are other types of wetland, such as sloughs and bogs. Similarly, most breeding sites in Canada are dominated by cattails. Nevertheless, breeding also occurs in areas with other robust emergents, such as *Scirpus*, *Phragmites*, *Equisetum*, *Butomus*, *Sparganium*, and *Carex* (Sandilands and Campbell 1988; Gibbs *et al.* 1992; Jobin and Robillard 2005; Meyer and Friis 2008), and in shrubby swamps dominated by Buttonbush (*Cephalanthus occidentalis*), willow (*Salix* spp.) or alder (*Alnus* spp.; Jobin 2007; Latendresse and Jobin 2007; R. Bazin pers. comm. 2008). Elsewhere in the U.S. breeding range, breeding sites are dominated by other species that are physically similar to cattails, such as Sawgrass (*Cladium jamaicense*), Giant Cutgrass (*Zizaniopsis miliacea*), and Swamp Loosestrife (*Decodon verticillatus*; Gibbs *et al.* 1992; Winstead and King 2006). Thus, the structure of the vegetation-tall and dense, but not so impenetrable as to restrict movement-seems to be more important than the species (Nelson 2003; Arnold 2005).

The presence of some shrubby vegetation has been identified as a potentially important habitat variable in some regions, but not across its range. Specifically, the likelihood that particular marshes were occupied increased with shrubby vegetation in Manitoba (Hay 2006), decreased in the Great Lakes Basin (Kirk *et al.* 2001) and Tennessee (Winstead and King 2006), and was equivocal in Arkansas (Budd 2007). The most consistent correlate of occupancy at the landscape level is the presence of surrounding wetlands (Hay 2006; Budd 2007).

Water levels must be relatively stable throughout nesting. Adults can raise nests somewhat to deal with rising waters, but persistent or sudden increases will flood nests (Nelson 2003; Arnold 2005). Conversely, drops in water level during nesting can reduce foraging opportunities and enhance access for predators (Arnold 2005).

Nevertheless, when nests are not active, exposure to variation in water levels enhances Least Bittern habitat in the long term. Specifically, periodic drying enhances the growth of emergents, while periodic flooding arrests succession to shrubby vegetation (Arnold 2005). Artificial impoundments, when appropriately managed, can provide these needed conditions and be rapidly colonized by Least Bitterns (Jobin *et al*. 2009)

Needs for wintering habitat are less specific, and appear to be met by a wide variety of wetlands, not only emergent marshes like those used for breeding, but also brackish and saline swamps (Frederick *et al.* 1990; Gibbs *et al.* 1992). Habitat use during migration is poorly known, but presumably is similar to breeding and wintering habitat (Gibbs *et al*. 1992).

Habitat trends

There is little information on trends in the specific wetland types used by Least Bitterns, but information on wetlands more generally can at least serve as an index of likely trends in the species' habitat. On a historical scale, loss of wetlands in the Least Bittern's Canadian breeding range has been dramatic. Land use practices for agriculture caused 85% of these changes (Wiken *et al.* 2003). In southern Ontario, wetlands have declined by over 60% during the last two centuries (Petrie 1998), with over 80% of these losses occurring near urban centres (Wiken et al. 2003), and losses in the southwest (Essex County) estimated at 97% (Snell 1989). Similarly, in the species' Quebec range, along the St. Lawrence River, wetlands have declined by 80% since European settlement (Jean 2002). Estimated losses at the western and eastern ends of the species' Canadian range are only slightly lower, at 71% for the Prairies, 65% for Atlantic coastal salt marshes (Cox 1993), and 85% for the upper Bay of Fundy (Reed and Smith 1972). Similar trends, for similar reasons, occurred in the species' breeding range in the United States, which has lost half of its original wetlands (USEPA 2002).

Historical wetland loss in the Gulf States, where the birds winter, has been similarly dramatic. Coastal wetlands have declined by an estimated 52% in Texas since European settlement (Mizell 1998), and by up to 35% in Louisiana between 1932 and 1990 (Barras *et al*. 2003). Many of the remaining wetlands are significantly degraded by siltation (Barras *et al*. 2003), which, besides its harmful effects on the ecosystem as a whole, renders the habitat less suitable for foraging by visual foragers such as bitterns (Weller 1999). Wetlands in Central America have been exposed to similar threats, as well as chemical contamination, but their decline has not been quantified (Davidson and Gauthier 1993).

In Canada, more recent habitat trends (i.e., on the scale of the last few decades) are harder to assess. A wide variety of inventory schemes have been started, but they have yet to be integrated or to produce clear results (Chow-Fraser 2002; Milton and Hélie 2003; Ingram *et al*. 2007). Although wetlands were still in steep decline from the 1950s to the 1990s, these declines are probably starting to slow, thanks to recent initiatives for protection and stewardship targeted specifically at wetlands. These initiatives include federal and provincial wildlife policies and programs, programs related to the North American Waterfowl Management Plan (e.g., the Eastern Habitat Joint Venture), and numerous initiatives by non-governmental organizations such as Wildlife Habitat Canada, Ducks Unlimited Canada, the Nature Conservancy of Canada, and innumerable local conservation groups (Lynch-Stewart *et al*. 1999). Nonetheless, in Ontario, at least, local habitat loss and degradation continues at a smaller scale,

through removal of smaller marshes, fragmentation of larger ones, and various types of degradation such as contamination, siltation, and disturbance (Maynard and Wilcox 1997; EC and USEPA 2007; see also Threats, below). Declines in strongly wetland-dependent bird species throughout the Great Lakes Basin over the past 10 years, despite increases in some wetland edge and generalist species, also suggest recent deterioration in habitat conditions (Timmermans and Archer 2007).

In the United States, wetland loss has started to reverse, but mainly because of an increase in the abundance of freshwater ponds (Dahl 2006). Indeed, declines in freshwater emergent marshes (i.e., Least Bittern breeding habitat) continue, with a 1% decline from 1998 to 2004, albeit mainly involving marshes smaller than 2 ha (Dahl 2006), which are less likely to harbour this species (see "Habitat needs," above). As in Canada, incremental loss and degradation is much harder to quantify but is still occurring (Dahl 2006). Loss and degradation of wetlands continues on the wintering range in the Atlantic coastal plain, Gulf Coast, and Central America (Davidson and Gauthier 1993; Barras *et al*. 2003; Dahl 2006). For example, 15-32% of the area of coastal wetland existing in Louisiana in 1978 was gone by 2000 (Barras *et al*. 2003).

Habitat protection/ownership

Many breeding sites are protected federally under the *National Parks Act* or *Canada Wildlife Act*, or provincially in Ontario under Ontario's *Provincial Parks and Conservation Reserves Act*. Ontario's *Provincial Policy Statement* offers some protection to wetlands that are considered provincially significant, albeit only when development applications are made or site alteration bylaws apply. Similarly, the *Manitoba Water Strategy* calls for sustainable management of all wetlands, the *Quebec Water Policy* calls for some protection for aquatic ecosystems, and the *New Brunswick Wetlands Conservation Policy* commits to no loss of provincially significant wetlands and no net loss of wetland function (Rubec and Hanson 2008). Wetlands on Crown Land throughout Canada are protected by federal and provincial policies prohibiting activities that yield a net loss of function, and by the *Fisheries Act*, which prohibits destruction of fish habitat. Wetlands in general are somewhat protected by various other provincial and municipal planning regulations (reviewed in Rubec and Hanson 2008).

The amount of habitat that is protected can only be guessed, both because the species' pattern of occupancy is poorly known, and because the protective status of wetlands has not been fully inventoried. Wildlife Habitat Canada estimates that 9.2% of Canada's wetlands are under protected areas designations (IUCN standards I to VI), but this estimate includes only 1.7% of marshes in the Mixedwoods Plains ecozone, the heart of this species' distribution, and 0.2% of the Boreal Shield ecozone, the next most important ecozone for the species (Wiken *et al*. 2004).

Larger marshes, which appear to be preferred by Least Bitterns, are more likely to receive protection than smaller marshes. Indeed, most marshes in which Least Bitterns have been reported have some type of protected status. Specifically, of 74 Ontario marshes where the Marsh Monitoring Program detected them since 1995, one third

have federal or provincial designations (such as National Wildlife Areas, Wildlife Management Areas, or Parks), one third are protected as municipal Conservation Areas or under similar policies, and another third are privately managed, but virtually all have some kind of stewardship program in place. In Quebec, of the 130 sites that have been evaluated, 53 sites are entirely within protected areas (IUCN standards I to VI), four sites are partially protected, and 12 sites have protected status pending (B. Jobin pers. comm. 2008). In Manitoba, the protective status of likely breeding sites has not been tabulated, although most sites are on provincial crown land, including many that are within Wildlife Management Areas and are thus likely to receive some form of protection (R. Bazin pers. comm. 2008). In Nova Scotia and New Brunswick, at least three possible breeding sites are in Migratory Bird Sanctuaries or National Wildlife Areas (D. Amirault-Langlais pers. comm. 2008). Thus according to these tallies, up to two thirds of marshes where Least Bitterns nest in Canada are in protected areas.

These totals may be highly misleading, however. Protected area status is not always effective in providing protection. Habitat loss or degradation may still occur from on-site factors such as leaching from septic systems, habitat succession, and fire suppression. Moreover, many of these marshes are only partly protected, with large portions unprotected or bordering unprotected land. Indeed, areas protected under regional or municipal policies or park designations are included as protected areas, even if those measures are relatively weak (B. Jobin, pers. comm. 2008). Even National Wildlife Areas, which can offer particularly strong protection against habitat loss and degradation, are significantly threatened by construction and disturbance related to recreational use, by impacts originating off site, such as contamination and siltation, and by invasive species (A.M. Turner & Associates 2002). Most importantly, however, both formal survey programs and naturalists in general are more likely to search for Least Bitterns in larger, federally and provincially protected marshes, which of course might bias any estimation of the bird's protected habitat.

In short, data on the local distribution and abundance of Least Bitterns are so poor, and wetland inventories are still sufficiently incomplete, that while the protective status of the bird's habitat is likely improving, it remains unmeasured.

BIOLOGY

Since the previous status report, the number of substantive studies of the Least Bittern's breeding biology has dramatically increased. While the basic facts of the species' biology are now much better substantiated, the Least Bittern's secretive habits and relatively impenetrable habitat still make it one of North America's most poorly known birds.

Life cycle and reproduction

In Canada, Least Bitterns arrive on breeding grounds from late April to late May, and by mid-May males begin the brief (c. 6 week) calling period during which they are most easily detected by marsh bird surveys. They appear to be at least somewhat territorial, because calling males and nests are usually regularly spaced, and because the birds display a variety of territorial behaviours, for example, approaching and displaying to playback of their calls (Bogner 2001; Arnold 2005). Nonetheless, three lines of evidence suggest territoriality is weak or variable: responses to playback are weak compared to other marsh nesting species (Tozer *et al*. 2007), radiotracking studies show that home ranges often overlap (Bogner 2001; Griffin *et al*. 2006), and, as already noted, nests are sometimes clumped into loose "colonies" (Kushlan 1973; Arnold 2005; Meyer and Friis 2008).

First eggs are laid from mid-May to June, and incubated for 17 to 20 days (Gibbs *et al*. 1992). Young are fed in the nest for two weeks and near the nest for a further one to two weeks, gradually starting to forage for themselves (Gibbs *et al*. 1992). Nesting success is highly variable. Average clutch size is four to five eggs (range 2-7), and young are successfully raised to the point when they can leave the nest ("fledging success") in about 50% of nests (range 20-84%). Causes of nest failure include predation, nest collapse from wave action or wind, flooding, and abandonment (Gibbs *et al*. 1992; Arnold 2005; Lor and Malecki 2006; Pierluissi 2006; Yocum 2007). At one site in New York, 17% of pairs raised second broods in the same season (Bogner 2001). However, the degree to which double brooding is widespread is unknown, because many nests found late in the season are likely to be renesting attempts following failure of first nests (Sandilands and Campbell 1988; Meyer and Friis 2008).

Diet has not been studied in detail, but Least Bitterns are thought to prey mainly on small vertebrates (including fish, snakes, frogs, tadpoles, salamanders, and occasionally small mammals and songbird eggs or nestlings), large insects (especially Odonates and Orthopterans), leeches, slugs, crayfish, and some vegetation (Gibbs *et al*. 1992).

Little is known about Least Bittern behaviour or ecology during winter. Wintering populations presumably comprise both wintering birds that bred farther north as well as local residents, but there are no firm data on the relative proportion of wintering birds and residents at any given site (Gibbs *et al*. 1992; Howell and Webb 1995).

Most key demographic information is lacking. Lifespan and age at maturity are unknown, although the congeneric Little Bittern of Europe is thought to breed in its first year, with a few individuals staying on wintering grounds before breeding in their second year (Pezzo and Gosler 2005). The longevity record for Little Bitterns is six years, albeit based on a small sample of returns (Cramp 1977), and their generation time is unknown but estimated to be less than 3.3 years (BirdLife International 2007).

Predation

Predators on adults include snapping turtles and raptors, with eggs and chicks being taken by snakes, turtles, corvids, raptors (including owls), Raccoons (*Procyon lotor*), American Mink (*Neovison vison*), and other herons, including conspecifics. Eggs and chicks are also pecked by Marsh Wrens (*Cistothorus palustris*; Gibbs *et al*. 1992). Human settlement beside marshes has been proposed as a factor that might increase access by pets and Raccoons, and thus threaten local breeding populations (James 1999).

Physiology

Little is known of the physiology of Least Bitterns (Gibbs *et al*. 1992), although one factor relevant to their viability is a likely high exposure to toxins and disease (see below).

Dispersal/migration

Birds head south from Canadian breeding sites from late August to late September (Sandilands 2005). In the two months before then, juveniles probably disperse quite widely, as in most herons (Kushlan and Hancock 2005). They migrate at night, as indicated by nocturnal tower kills (Gibbs *et al*. 1992), and although details of their migratory habits are unknown, they can probably travel considerable distances with each flight, given the Little Bittern's ability to migrate non-stop across the Mediterranean Sea and the Sahara (Kushlan and Hancock 2005).

Interspecific interactions

Least Bitterns probably do not compete intensely with other species for food resources. Other species of heron (especially American Bitterns) and mink forage for similar prey along the same marsh edges, and at the same water depths (25-60 cm), as Least Bitterns, but they all probably take larger prey on average (Gibbs *et al*. 1992). At least in Canada, other sympatric wading birds, such as Virginia Rail (*Rallus limicola*) and Sora (*Porzana carolina*), forage in shallower water.

In some marshes, Muskrats (*Ondatra zibethicus*) cut channels through the vegetation, thus providing the interspersion of open water that the species requires for foraging and nesting (Weller 1999; see "Habitat requirements," above). In one wetland in Florida, Least Bitterns preferentially nested near the nests of Boat-tailed Grackles, *Quiscalus major*, perhaps thereby gaining some protection from predators (Post and Seals 1993). In another wetland, in Iowa, American Coots, *Fulica americana*, laid eggs in 2 of 13 nests, but given that coot eggs do not hatch within the incubation period of bitterns, this type of interspecific parasitism is probably biologically insignificant (Peer 2006).

Wading birds in general are particularly susceptible to oil poisoning (oil toxicosis) and diseases, including type C botulism, avian cholera, aspergillosis, sarcocystis, and avian salmonellosis (Friend 1987; Friend and Franson 1999). Two diseases of particular concern recently are H5N1 avian influenza, which has been found in four other heron species (National Wildlife Heath Center 2006) and West Nile Virus, which has been found in Least Bitterns (Centers for Disease Control 2005). Parasites have not been studied in detail, although trematodes, lice, and mites have been recorded (Gibbs *et al*. 1992).

Adaptability

Least Bitterns have specific habitat requirements, detailed in "Habitat requirements", above. As detailed there, they have a low tolerance for variation in water levels during nesting, and even low levels of siltation or eutrophication can reduce the quality of foraging habitat. Evidence of their tolerance of human disturbance is equivocal. Specifically, while they do nest in urbanized environments and seem to habituate to boat traffic where they forage, they also seem to prefer to nest in the more inaccessible parts of marshes (Gibbs *et al*. 1992; Weller 1999).

POPULATION SIZES AND TRENDS

Search effort

Most of the wide-scale bird surveys that provide information for most other bird species, such as the North American Breeding Bird Survey and the Christmas Bird Count, detect Least Bitterns too rarely to be of any use for calculating trends (Downes and Collins 2007; Sauer *et al*. 2007). Nonetheless, because Breeding Bird Surveys have been used to estimate global and North American populations (Delany and Scott 2006), they are briefly described here. The survey is conducted by volunteers, who tally the number of birds of each species that they hear during three minutes, at each of 50 stations regularly spaced along a 40 km roadside route. Routes are randomly placed throughout North America, with over 2300 routes in the United States and over 350 in Canada. Most routes, however, do not adequately sample marsh habitats. Most routes are ideally done by the same volunteer for years, thus reducing variance due to observer abilities and search effort. Routes can be sampled any time between May 28 and July 7, so the peak calling periods of individual Least Bitterns, which can be asynchronous and each last only about 10 days (Bogner and Baldassarre 2001), can be easily missed.

Breeding bird atlas programs arguably provide better information on the presence of Least Bitterns than Breeding Bird Surveys do, because atlas programs employ sustained effort focused on each species likely to occur in a given area. They thus offer searchers the incentive and time needed to learn how to locate particular species and to search for it repeatedly in suitable habitat. In these programs, a province or state is divided into 10 x 10 km squares, within which volunteers seek out as much breeding

evidence for as many species as possible over a five-year period. The abundance of each species may be estimated subjectively or using point counts, although Least Bitterns are so hard to detect that, for this species, these estimates are unreliable. Nonetheless, the five-year window and species-by-species approach yield fairly good data about whether the species is present within each square. Also, because atlas programs are usually repeated every 20 years, they provide some information on trends in distribution and abundance.

Otherwise, assessment of populations must come from targeted surveys, which use a mixture of listening and playback of recorded calls, in suitable habitat during the time of year when males are calling the most. The only widespread, long-term program to do so is the Marsh Monitoring Program, which started in 1995 in Ontario, and 2004 in Quebec (Bird Studies Canada 2003). Here, volunteers visit up to eight widely spaced stations at large (> 1 ha) marshes twice between May 20 and July 5, play a taped sequence of several marsh species (including Least Bittern) for five minutes, and listen for five more minutes. The marshes and locations of stations surveyed are chosen by the volunteers. Thus, most sampling is in the more accessible portions of more accessible marshes, which creates a sampling bias. Also, Least Bittern detectability varies so much with the timing and frequency of surveys that modifications of these surveys have been proposed (Meyer *et al*. 2006; Rehm and Baldassarre 2007b; Tozer *et al*. 2007). Such a protocol that specifically targets Least Bitterns has been developed by Environment Canada and the recovery team. Application of its prototypes in Manitoba, Quebec, and Ontario since 2004 in many areas that were not previously surveyed has considerably improved our knowledge of the species' distribution in those provinces (Jobin 2006; Latendresse and Jobin 2007; Jobin *et al*. 2007; R. Bazin pers. comm. 2008; Meyer and Friis 2008).

Abundance

The most authoritative estimate of the global population uses Breeding Bird Survey abundance data, corrected for detectability and time of day (Rosenberg and Blancher 2005), and extrapolates them to the estimated area of occupancy (Delany and Scott 2006). This estimate yields 42,700 pairs, or 128,100 individuals of the subspecies *I. e. exilis* worldwide (Delany and Scott 2006; their ratio of three individuals to one pair accounts for immature birds, following Meininger *et al*. 1995). As noted above, however, the Breeding Bird Survey methodology is extremely poor at detecting this species, and the method of extrapolation is subject to many caveats (Thogmartin *et al*. 2006), so this estimate should be treated with considerable caution.

As for previous status reports, abundance in Canada is still unknown, although some new information leads to a slight change in the estimate of approximately 1000 pairs given in previous status reports (Sandilands and Campbell 1988; James 1999). An Ontario estimate of 555-2360 pairs was derived from the first Ontario atlas project and the Ontario Rare Bird Breeding Program (Austen *et al*. 1994). Since then, because standard methods detect this species so unreliably, the only new population estimates that have appeared come from targeted surveys by the Least Bittern Recovery Team

since 2004, which have increased the Manitoba estimate from fewer than 100 pairs to up to 200 pairs (R. Bazin, pers. comm. 2008), and have increased the Quebec total from 100 pairs to 200-300 pairs (B. Jobin, unpubl. data). These do not represent increases in population size, but reflect increased search efforts. Surveys using these protocols are just starting in Ontario, so there is no refined population estimate for the province. Thus, the best available information comes from the latest Ontario atlas project, which reported that sightings on standard point counts were too scarce to provide an abundance estimate, although the frequency of occurrence within atlas squares was similar to or only slightly lower than in the previous atlas project (Woodliffe 2007; see below). Numbers in the Maritimes are unknown. Given the small number of sites with confirmed or suspected breeding, there may be fewer than 20 pairs (J. Stewart, pers. comm. 2008), but the Maritimes Breeding Bird Atlas project, now underway, should provide a better estimate.

Taken together, these figures yield an estimated total population of about 1500 (between about 1000 and 2800) pairs in Canada. The certainty of this estimate is obviously poor, although it is somewhat corroborated by the global estimate quoted earlier (Delany and Scott 2006). Specifically, multiplying the global estimate (42,700 pairs) by Canada's proportion of the species range (2-3%) yields an estimated Canadian population of 850-1300 pairs.

Fluctuations and trends

Local annual fluctuations in abundance add to the difficulty of estimating long-term trends. For example, there was a 79% turnover of atlas squares reporting the species between the first and second Ontario breeding bird atlas projects (Woodliffe 2007). This variation is characteristic of this species and genus (Gibbs *et al*. 1992; Kushlan and Hancock 2005), and indeed of marsh birds more generally (Remsen and Parker 1990), which often shift breeding sites between years, depending on local conditions. Water levels, in particular, seem to explain annual variation in at least two Canadian studies: variation of 0.3-1.3 birds per survey route across six years in the Great Lakes Basin (Craigie *et al*. 2003) and of 18-38 pairs across three years at one Quebec site (Jobin *et al*. 2009).

Global trends are unknown (Delany and Scott 2006), but enough information exists to suggest that the population decline criterion of the IUCN Red List (> 30% in 10 years or three generations) has not been met (BirdLife International 2004). In North America, the consensus of all previous reviews is that Least Bitterns have declined historically across their breeding range except perhaps the Gulf States (Gibbs *et al*. 1992; James 1999; Kushlan and Hancock 2005). This conclusion is partly based on overall habitat declines (see "Habitat Trends," above), but also on historical (often anecdotal) reports of Least Bittern abundance in areas where they are now rare or absent. In Ontario, the heart of their Canadian range, they were considered abundant at the turn of the last century, uncommon by the 1930s, and rare by the 1980s (Sandilands 2005; Woodliffe 2007). Locally, there were fewer than two pairs by the 1980s at Hamilton Bay and Toronto, where they were common to abundant c. 1900; they appeared to decline

substantially in the 1990s at Long Point, where they were common as recently as the 1980s (Austen *et al*. 1994); and no nests have been reported from Point Pelee since 1981, where 25 nests were reported by a single observer as recently as the 1970s (Wormington 2006).

Recent trends are arguably best measured by breeding bird atlas programs, which use representative, region-wide sampling, and require observers to focus on each species likely to be found in their local area (see "Search effort," above). In Ontario, the Carolinian region showed a statistically significant decline in the probability of observation (after 20 hours of atlasing in a square) of 44% in the 20 years between the first and second atlas projects (1981-85 and 2001-2005). While sample sizes were too small for detecting statistical changes in other (more northerly) ecoregions outside the Least Bittern's core range in Ontario, there were also fewer occurrences in the north during the second atlas. Overall, the number of squares reporting the species decreased by 6%, from 223 to 210 (Woodliffe 2007). The change corrected for greater effort spent on the second atlas project, however, yields a statistically significant decline of 32% (Appendix 3 in Cadman *et al*. 2007). Border states with significant numbers of Least Bitterns reported small declines or stable numbers in recent atlas projects, with all figures uncorrected for the likely greater effort in recent years and thus probably conservative. Specifically, Ohio reported stable numbers since 1965, Michigan reported no appreciable change in 20 years (from 20 to 19 squares), and New York reported a 9% drop in the number of squares (Monfils 2003; Woodliffe 2007; McGowan and Corwin 2008). In Maine, revisits to 38 known breeding sites between 1989-90 and 2005 showed a 37% decline in occupancy (Hayden *et al*. 2005).

In comparison, Marsh Monitoring Program results for the Great Lakes Basin, from 1995 to 2006, show an average annual decline of 10% per year, with a 95% confidence interval of -13 to -8% (Figure 4; trend and confidence intervals based on Poisson regression, corrected for overdispersion). Analysis of all of the Ontario data (i.e., not just the Great Lakes Basin) yields virtually the same trend: an annual decline of 10%, with a confidence interval of -16 to -5% (T.L. Crewe pers. comm. 2008). Trend data for Canada are only available from Ontario, the only province to have started surveys early enough to provide trend estimates. These results should be viewed cautiously, however, because potential biases (see "Search effort," above) have not been fully explored.

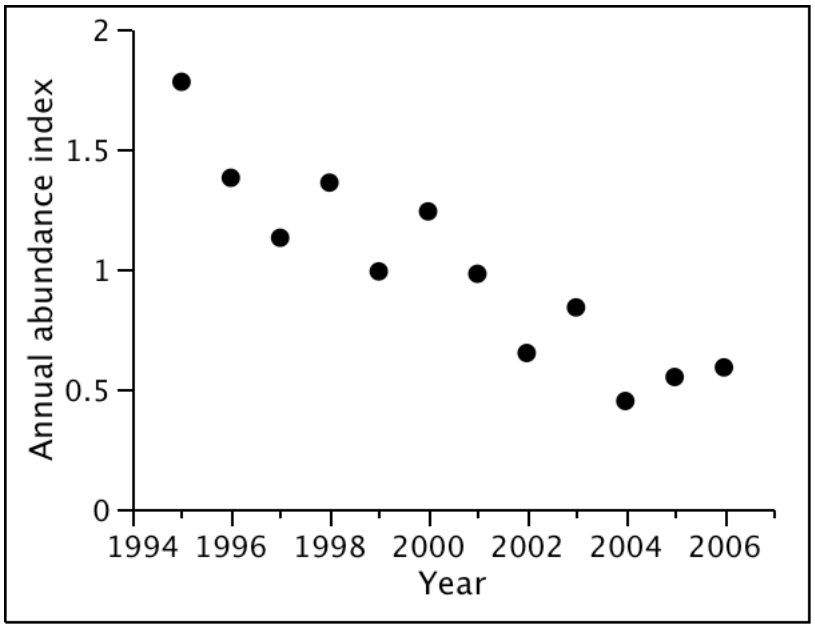

Figure 4. Annual abundance index of Least Bitterns detected by the Marsh Monitoring Program in the Great Lakes Basin (including both Canadian and U.S. data) from 1995 to 2006 (from Anonymous 2008). Index is Poisson mean birds per route (n = 51 routes), relative to 2006 mean (T.L. Crewe pers. comm. 2008).

In summary, historical population declines are poorly documented, but judging from rates of habitat loss (see “Habitat trends,” above), might have exceeded 80%. Trend estimates are variable according to survey program. The Ontario breeding bird atlas project suggests a decline of 32% in the number of 10x10 km squares occupied over the past 20 years, roughly equivalent to a decline of 16% in squares occupied over the past 10 years. Declines at the atlas square sampling unit are likely to underestimate the magnitude of change in abundance for Least Bittern, because some formerly occupied squares would have supported more than one pair. The Marsh Monitoring Program, which measures abundance more directly (subject to caveats given above) suggests a decline of 10% per year (confidence interval -16 to -5% per year) from 1996-2006, equivalent to a decadal decline of 65%, with a confidence interval of -83 to -40%. Thus, the best available information suggests a 10-year decline ranging between 16-65%, albeit with only limited certainty, and limited to Ontario, where the bulk of the Canadian population occurs.

Rescue effect

The Canadian range is continuous with the larger breeding range in the United States, and, like other herons, Least Bitterns are highly dispersive, with juveniles wandering widely at the end of the breeding season (see “Dispersal/Migration” above), and adults apparently shifting breeding locations across years (see “Fluctuations and trends” above). Nonetheless, given that adjacent populations in the northern United States are small and declining and frequently state-listed as threatened or endangered (see above and Table 1), the potential for a rescue effect is probably weak.

LIMITING FACTORS AND THREATS

Habitat loss and degradation, reviewed above under “Habitat trends”, is thought to be the most severe threat to Least Bitterns (Sandilands and Campbell 1988; Gibbs *et al*. 1992; James 1999), and can often be directly linked to local and regional declines in abundance and distribution (see “Population trends,” above). Most habitat loss and degradation has been anthropogenic. Historically, it consisted mainly of draining, filling, and dyking on a large scale, especially in Ontario and Quebec. More recently, even with protective measures in place for wetlands, it continues through impacts that are more local but still widespread, succinctly listed by Ingram *et al*. (2007) for the Great Lakes region, where they are the most severe, as: “filling, dredging and draining for conversion to other uses such as urban, agricultural, marina, and cottage development; shoreline modification; water level regulation; sediment and nutrient loading from watersheds; adjacent land use; invasive species, particularly non-native species; and climate variability and change.” Some of these impacts, notably channelization, water extraction, and erosion, can degrade Least Bittern breeding sites even when they occur well away from those sites, because they shift water levels or quality (through siltation or eutrophication) outside the narrow, stable range tolerated by Least Bitterns (Sandilands and Campbell 1988; Gibbs *et al*. 1992; James 1999; Weller 1999). Similar factors affect habitat on the wintering grounds, especially along the Gulf Coast and Central America (Davidson and Gauthier 1993).

Other threats are closely related to habitat loss and degradation, but may have sufficiently specific effects on Least Bitterns that they are worth singling out. These other threats include toxins, invasive species, disease, collisions, recreational activities, and climate change.

Wetlands are sinks for toxins from industrial and agricultural run-off, which predators such as Least Bitterns bioaccumulate (Eddleman *et al*. 1988). High dieldrin levels have been found in Least Bittern eggs in Louisiana (Causey and Graves 1969) and feathers in Ontario (Sandilands and Campbell 1988; Sandilands 2005). Herons are particularly susceptible to accumulating residues and eggshell thinning from DDE and dieldrin (Fleming *et al*. 1983), and Great Blue Herons (*Ardea herodias*) along the Great Lakes and St. Lawrence River have particularly high levels of mercury and PCBs (Champoux *et al*. 2006).

At sites across North America, including Ontario and Quebec, several invasive species are outcompeting the cattails in which most Least Bitterns breed. These species include Purple Loosestrife (*Lythrum salicaria*), Reed Canary Grass (*Phalaris arundinacea*), Common Reed (*Phragmites australis*), and, especially in Quebec, Flowering Rush (*Butomus umbellatus*; Lavoie *et al*. 2003; Hudon 2004; Jobin and Robillard 2005; Jobin 2006). All these species, as well as others that do not directly compete with cattails, such as European Frog-bit (*Hydrocharis morsus-ranae*), also encourage succession of marshes to drier habitat (Blossey *et al*. 2001).

Invasive animal species are a growing concern in the Great Lakes because of their disruptive effects on ecosystem function. Direct links to Least Bitterns are undocumented but likely. Specifically, Common Carp (*Cyprinus carpio*) forage in ways that remove vegetation and muddy the waters so the birds cannot see their prey.

Least Bitterns may be susceptible to devastating outbreaks of disease and parasites. An unknown disease likely wiped out the birds breeding at one Iowa marsh (Kent 1951). Outbreaks recorded for other wading birds have involved the nematode *Eustrongilides*, associated with nutrient and silt run-off, and avian salmonella, perhaps associated with sewage effluent (P. Frederick pers. comm. cited in Gibbs and Melvin 1992; Wires and Lewis 2005).

The few reports of Least Bitterns colliding with human-made structures are sufficiently dramatic to suggest the threat is locally serious. These include 16 birds killed by cars or colliding with fences in one weekend at one Louisiana refuge, regular collisions with a generator tower in Ontario that included eight on a single weekend, 18 strikes by airboats at one site in Florida, and nine road kills in one year along a 3.2 km section of highway in Florida (Sandilands and Campbell 1988; Gibbs *et al*. 1992; Smith and Dodd 2003).

Disturbance from recreational activities, notably boating, has been identified as a conservation concern for herons, because it can disrupt activities such as foraging and can cause nest abandonment (Kushlan and Hancock 2005). In Least Bitterns, nest abandonment has not been directly linked to human disturbance, and foraging birds reportedly habituate to frequent boat traffic (Gibbs *et al*. 1992). Nonetheless, this species' first response to approach may be to freeze (Frederick *et al*. 1990), so without targeted studies it is hard to determine whether boat traffic disrupts foraging. Motorized boating creates waves that could flood nests and erode the marsh edges where the species forages (McConnell 2004).

Climate change is projected to lower water levels in the Great Lakes and St. Lawrence River, reducing the size and distribution of their wetlands, without compensatory gain of new wetlands (Wires and Lewis 2005; Mortsch *et al*. 2006). Abundance of breeding Least Bitterns along the Great Lakes has been shown to be very tightly linked to changes in water levels (Craigie *et al*. 2003), so if these projections hold, their abundance in southern Canada will almost certainly decline (DesGranges *et al*. 2006).

SPECIAL SIGNIFICANCE OF THE SPECIES

The Least Bittern is not a game species and has no direct economical use or special cultural significance. Nonetheless, it has the distinction of being the smallest member of the heron family, an especially charismatic and well known taxon. Its secretive habits and attractive plumage have made it a special favourite of birdwatchers, challenging to find and emblematic of large, impenetrable wetlands. Its sensitivity to hydrology, water quality, and vegetation make it a particularly useful indicator of the health of marsh habitat in Canada (DesGranges *et al*. 2006).

EXISTING PROTECTION OR OTHER STATUS DESIGNATIONS

Least Bitterns and their nests are protected under the *Migratory Birds Convention Act*. In Canada, the species' listing as Threatened under Schedule 1 of the *Species at Risk Act* protects individuals, their residences (in this case, nest sites), and ultimately critical habitat from harm or destruction. The species is also provincially listed in Ontario as Threatened, which protects individuals, and will eventually protect their habitat, under Ontario's *Endangered Species Act, 2007*. In Quebec, the species is provincially listed as Likely to be Designated as Threatened or Vulnerable, where designation as Threatened or Vulnerable offers some protection of individuals through the *Act Respecting Threatened or Vulnerable Species*.

The Least Bittern's General Status Rank in Manitoba, Ontario, and New Brunswick is At Risk, and in Quebec is May Be at Risk (Canadian Endangered Species Conservation Council 2006). In Quebec, it is presently considered "Likely to be designated as threatened or vulnerable" under the *Loi sur les espèces menaces ou vulnérables du Québec* (Quebec's Act Respecting Threatened or Vulnerable Species, Quebec Department of Natural Resources and Wildlife 2008). The remaining provinces that have a General Status Rank for the species rank it as Accidental (British Columbia, Saskatchewan, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador).

In the United States, the species is not federally listed, but is state listed in 16 states, most of which are in the northeast and north central regions bordering Canada (Table 1). Globally, the IUCN lists Least Bitterns as Least Concern (i.e., a species that does not meet any risk category), and is thus classed together with taxa that are widespread and abundant (NatureServe 2008).

NatureServe rankings vary regionally (NatureServe 2008; Table 1). In Canada, it is ranked as N3B nationally, with provincial ranks as S2S3B in Manitoba, S3B in Ontario, S3 in Quebec, S1S2B in New Brunswick, and S1B in Nova Scotia. In the United States, it is ranked N5B, N5N, and four Gulf States give it a ranking of S4 (Florida, Georgia, and Texas) or S5 (Louisiana). Otherwise, rankings vary from S1 to S3, with no clear regional pattern (Table 1). Specifically, it is ranked as low as S1 in nine states, S2 in 18, S3 in seven, and undetermined in four.

Table 1. Conservation status of Least Bittern in the United States. Status from NatureServe 2008, listings from a web search of state wildlife departments, May 2008.

State	Status	State listing
Alabama	S2N,S4B	
Arizona	S3	
Arkansas	S2B,S2N	
California	S1	Species of special concern
Colorado	S2B	
Connecticut	S2B	Threatened
Delaware	S1B	
District of Columbia	S1B,S2N	
Florida	S4	
Georgia	S4	
Illinois	S2	Endangered
Indiana	S3B	Endangered
Iowa	S3B,S2N	Endangered
Kansas	S2B	
Kentucky	S1S2B	
Louisiana	S5B	
Maine	S2B	Threatened
Maryland	S2S3B	In need of conservation
Massachusetts	S1S2B	Endangered
Michigan	S2	Threatened
Minnesota	SNRB	
Mississippi	S3B	
Missouri	S3	
Nebraska	S2	
Nevada	S2B	Special concern
New Hampshire	S1	
New Jersey	S3B	
New Mexico	S3B,S3N	
New York	S3B,S1N	Threatened
North Carolina	S3B	
North Dakota	SNRB	
Ohio	S2	Threatened
Oklahoma	SNR	
Oregon	S1B	
Pennsylvania	S1B	Endangered
Rhode Island	S2B,S2N	Special concern
South Carolina	SNRB,SNRN	
South Dakota	S2B	
Tennessee	S2B	Deemed in need of management
Texas	S4B	
Utah	SHB	
Vermont	S2B,S2N	Special concern
Virginia	S3B,S3N	
West Virginia	S1B	
Wisconsin	S3B	

TECHNICAL SUMMARY

Ixobrychus exilis
Least Bittern Petit Blongios
Range of Occurrence in Canada: MB, ON, QC, NB, and NS

Demographic Information

Generation time (average age of parents in the population)	< 3 yrs
Estimated percent reduction in total number of mature individuals over the last 10 years or 3 generations. Based on 65% population decline estimated from Marsh Monitoring Program around Great Lakes (biased because this is the region where the strongest declines have likely occurred) and 16% decline in occurrence estimated from Ontario Breeding Bird Atlas (biased under-estimate of population decline). No trend information is currently available outside Ontario, but the majority of the Canadian population occurs in southern Ontario.	>30%
Suspected percent reduction in total number of mature individuals over the next 10 years or 3 generations.	Unknown but likely >10%
Estimated percent reduction in total number of mature individuals over any 10 years or 3 generations period, over a time period including both the past and the future.	Unknown
Are the causes of the decline clearly reversible?	No
Are the causes of the decline understood?	Not fully
Have the causes of the decline ceased?	No
[Observed, inferred, or projected] trend in number of populations	Not applicable
Are there extreme fluctuations in number of mature individuals?	No
Are there extreme fluctuations in number of populations?	Not applicable

Extent and Area Information

Estimated extent of occurrence Measured as a minimum convex polygon	1,331,000 km²
Observed trend in extent of occurrence	Stable
Are there extreme fluctuations in extent of occurrence?	No
Index of area of occupancy (IOA) IAO cannot be calculated at this time because of large uncertainties in distribution and abundance	Unknown km²
Inferred trend in area of occupancy	Unknown
Are there extreme fluctuations in area of occupancy?	No
Is the total population severely fragmented?	No
Number of current locations	Unknown
Trend in number of locations	Unknown
Are there extreme fluctuations in number of locations?	Unknown
Trend in area and quality of habitat	Decline

Number of mature individuals in each population

Population	**N Mature Individuals**
Total (based on Ontario Breeding Bird Atlas and surveys outside Ontario)	Ca. 3000 individuals
Number of populations (locations)	1 population

Quantitative Analysis

	Not done

Threats (actual or imminent, to populations or habitats)

Loss and degradation of wetland habitats, toxins, invasive species, disease, collisions, and climate change.

Rescue Effect (immigration from an outside source)

Status of outside population(s)? USA: small and declining in northeastern and northcentral states bordering Canada; stable elsewhere	
Is immigration known?	Unknown, but possible
Would immigrants be adapted to survive in Canada?	Yes
Is there sufficient habitat for immigrants in Canada?	Declining
Is rescue from outside populations likely?	Not likely

Current Status

COSEWIC: Threatened (2009, 2001) Ontario: Threatened Quebec: Likely to be Designated as Threatened or Vulnerable

Additional Sources of Information: Not applicable.

Status and Reasons for Designation

Status:	**Alpha-numeric code:**
Threatened	A2b; C1
Reasons for designation: This diminutive member of the heron family has a preference for nesting near pools of open water in relatively large marshes that are dominated by cattail and other robust emergent plants. Its breeding range extends from southeastern Canada through much of the eastern U.S. Information on the population size and exact distribution of this secretive species is somewhat limited. Nevertheless, the best available evidence indicates that the population is small (about 3000 individuals) and declining (>30% in the last 10 years), largely owing to the loss and degradation of high-quality marsh habitats across its range.	

Applicability of Criteria

Criterion A (Decline in Total Number of Mature Individuals): Meets Threatened A2b, with a reduction in population size of >30% in the last three generations, based upon appropriate indices of abundance.
Criterion B (Small Distribution Range and Decline or Fluctuation): Not applicable.
Criterion C (Small and Declining Number of Mature Individuals): Meets Threatened C1, with estimated population of <10,000 individuals and continuing decline estimated at >10% over three generations.
Criterion D (Very Small Population or Restricted Distribution): Not applicable
Criterion E (Quantitative Analysis): Not done.

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Andrew Gregg Horn grew up in Cambridge, Massachusetts, earned his B.Sc. at Cornell University in 1981, and did his Ph.D. in Zoology at University of Toronto on song complexity in Western Meadowlarks *Sturnella neglecta*. During post-doctoral work at the University of Cambridge, Queen's University, and Agriculture Canada, he studied various aspects of parent-offspring interactions and acoustic communication in birds, work he continues as a Research Adjunct at Dalhousie University. He has also conducted various projects in avian monitoring and assessment, drafting several status reports and recovery plans, which include the first draft of the Canadian Least Bittern Recovery Strategy.