PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Least Bittern (*Ixobrychus exilis*) in Canada

Least Bittern

2011

Canada

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For copies of the recovery strategy, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

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PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years.

The Minister of the Environment and the Minister responsible for the Parks Canada Agency are the competent ministers for the recovery of the Least Bittern, a Threatened species listed in Schedule 1 of SARA, and have prepared this recovery strategy, as per section 37 of SARA. It has been prepared in cooperation with the Provinces of Manitoba, Ontario, New Brunswick, and Nova Scotia.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment Canada, the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Least Bittern and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada, the Parks Canada Agency, and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGMENTS

Andrew Horn (Dalhousie University) prepared the initial draft recovery strategy for the Least Bittern. Earlier drafts were reviewed by Members of the National Least Bittern Recovery Team [Vincent Carignan, Chair (Environment Canada, Canadian Wildlife Service – Québec region), Ron Bazin (Environment Canada, Canadian Wildlife Service – Prairie & Northern region), Samara Eaton (Environment Canada, Canadian Wildlife Service- Atlantic Region), Valerie Blazeski (Parks Canada Agency), Ken DeSmet (Manitoba Conservation), Laurie Maynard and Dave Moore (Environment Canada, Canadian Wildlife Service – Ontario region), Jon McCracken (Bird Studies Canada), and Eva Katic (National Capital Commission)], former members of the recovery team [Benoît Jobin (Environment Canada, Canadian Wildlife Service – Québec region), Mark McGarrigle (New Brunswick Department of Natural Resources), Todd Norris (Ontario Ministry of Natural Resources), Jennifer Stewart (Environment Canada, Canadian Wildlife Service – Atlantic region) and Gershon Rother].

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The following individuals provided information on Least Bittern population and habitat distribution, population trends, life history, survey methods, and conservation and management: Nickolas Bartok, Heidi Bogner, Robert Bowles, Courtney Conway, Glenn Desy, Pierre Fradette, Jonathon French, Christian Friis, Stacey Hay, Gary Huschle, Rudolf Koes, Claudie Latendresse, Soch Lor, Paul Messier, Shawn Meyer, Frank Nelson, Sarah Richer, Dave Roberts, Luc Robillard, Tracy Ruta-Fuchs, François Shaffer, Peter Taylor, Guillaume Tremblay, Breeding Bird Atlas and Marsh Monitoring Program volunteers, and birders in Manitoba, Ontario, Québec and the Maritimes.

EXECUTIVE SUMMARY

The Least Bittern (*Ixobrychus exilis*), North America's smallest heron, breeds in freshwater and brackish marshes with dense, tall persistent emerging plants, interspersed with open water and occasionally clumps of vegetation. It has been listed as Threatened under Schedule 1 of the *Species at Risk Act* (SARA) since 2003 because of apparent historical declines throughout its range.

Canada has 2-3% of the estimated 43,000 pairs distributed throughout southern Canada (Manitoba, Ontario, Québec, New Brunswick and Nova Scotia), the United States and in countries as far south as Argentina and Brazil. Because of the species' secretive habits and the difficulties of searching its habitat, population size and trend estimates are imprecise.

Wetland loss and degradation as well as impaired water quality are believed to be the primary threats to Least Bitterns throughout their range. Other threats include regulated water levels (except for conservation purposes), invasive species, collisions (with cars and anthropogenic structures), recreational activities, and climate change.

There are unknowns regarding the feasibility of recovery of the Least Bittern. Nevertheless, in keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA as would be done when recovery is determined to be feasible.

The population and distribution objectives for the Least Bittern are to maintain and, where possible, increase the current Canadian population size and area occupancy. Broad strategies and approaches to achieve these objectives are presented in the Strategic direction for recovery section.

Critical habitat is partially identified in this recovery strategy. It is contained within 98 breeding sites, 10 of which are located in Manitoba, 44 in Ontario, 42 in Québec and 2 in New Brunswick. A schedule of studies outlines key activities to identify additional critical habitat at breeding, foraging, post-breeding dispersal, moulting and migration stopover sites. One or more action plans will be posted on the Species at Risk Public Registry before 2016.

RECOVERY FEASIBILITY SUMMARY

In considering the criteria established by Government of Canada (2009), unknowns remain as to the recovery feasibility of the Least Bittern. Nevertheless, in keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA as would be done when recovery is determined to be feasible. This recovery strategy addresses the unknowns surrounding the feasibility of recovery.

1. **Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.**

   Yes. Breeding individuals are currently available and distributed throughout the Canadian range as well as in the United States.

2. **Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.**

   Yes. Sufficient wetland habitat is available to support the species at its current level. Unoccupied suitable habitat is also available and additional wetlands could become suitable after restoration efforts or wetland creation.

3. **The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.**

   Unknown. The main threats to the species and its breeding habitat, and methods to avoid or mitigate them are known. However, some of these methods need to be refined and tested in Canada. Furthermore, foraging, post-breeding dispersal, moulting and migration stopover sites have yet to be identified and the threats to those sites will need to be specified.

4. **Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.**

   Unknown. Habitat stewardship, wetland restoration techniques as well as wetland creation and management have proven to be effective for this species although specific management prescriptions need to be developed. Mitigating other threats, such as off-site effects on wetland habitat quality, however, will be a continuing challenge.

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1. COSEWIC[1] SPECIES ASSESSMENT INFORMATION

Date of Assessment: April 2009

Common Name (population): Least Bittern

Scientific Name: *Ixobrychus exilis*

COSEWIC 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.

Canadian Occurrence: Manitoba, Ontario, Québec, New Brunswick and Nova Scotia

COSEWIC 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 April 2009.

2. SPECIES STATUS INFORMATION

Canada has 2-3% of the estimated 43,000 pairs of Least Bitterns in North America (Delany and Scott, 2006). The species has been listed as Threatened under Schedule 1 of the *Species at Risk Act* (S.C. 2002, c. 29) since 2003. In Québec, it has been listed as Vulnerable under the *Act respecting threatened or vulnerable species* (R.S.Q., c. E-12.01) since 2009. In Ontario, it has been listed as Threatened on the *Species at risk in Ontario list* since 2004 and regulated under the *Endangered Species Act, 2007* (S.O. 2007, C. 6) since 2008. As of December 2011, the species had not been listed in Manitoba, New Brunswick or Nova Scotia.

The International Union for the Conservation of Nature ranks the global population of this species as “Least Concern” (BirdLife International, 2009). NatureServe (2010) conservation ranks for Canada and the United States vary widely as shown in Table 1.

[1] COSEWIC = Committee on the Status of Endangered Wildlife in Canada

Table 1. NatureServe (2010) conservation ranks for the Least Bittern.

Global Rank (G)	National Rank (N)	Sub-National Rank (S) [1,2]
G5 (secure)	N3B -Canada (vulnerable) N5B, N5N - United States (secure during breeding and nonbreeding)	Manitoba (S2S3B) ; New Brunswick (S2B) ; Nova Scotia (S1B); Ontario (S4B) ; Quebec (S2S3B) SH (Utah) ; S1 (California, Delaware, District of Columbia, Kentucky, Massachusetts, New Hampshire, Oregon, Pennsylvania, West Virginia) ; S2 (Arkansas, Colorado, Connecticut, Illinois, Kansas, Maine, Maryland, Michigan, Nevada, Ohio, Rhode Island, South Dakota, Tennessee, Vermont) ; S3 (Arizona, Indiana, Iowa, Mississippi, Missouri, New Jersey, New Mexico, New York, North Carolina, Virginia, Wisconsin)

1 1: Critically Imperiled; 2: Imperiled; 3: Vulnerable; 4: Apparently Secure; 5: Secure; H: possibly extirpated; B: Breeding.
2 In most states along the Gulf coast (e.g., Texas, Louisiana, Florida), where it is resident year-round, it is not listed, and has been recently removed from the federal list of "Species of Management Concern" (USFWS, 2002).

3. SPECIES INFORMATION

3.1. Species Description

Measuring about 30 cm and weighing 80 g, the Least Bittern is North America's smallest heron (Kushlan and Hancock, 2005). 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. When disturbed, the bird uses a rail-like "rick-rick-rick-rick" or an advertisement call that consists of repeated coos "coo-coo-coo" (Sibley, 2000). Further details are provided in the COSEWIC (2009) status report.

3.2. Population and Distribution

Least Bitterns breed from southern Canada to South America, including the Caribbean, and winter from California to Florida south to Mexico and Latin America, with resident populations in river valleys and coastal areas farther south to northern Argentina and southern Brazil (COSEWIC, 2009; Poole et al., 2009). Isolated migrant populations breed in Oregon, California, and New Mexico, and formerly in Utah (Figure 1).

The distribution of the species during the adult moulting phase needs further study but the timing of this phase (mid-September to mid-December) suggests it mostly takes place during migration (Poole et al., 2009). The migratory routes of Least Bitterns are unknown, but it is presumed that they migrate in a broad front that is locally funneled by north-south oriented peninsulas and coasts such as found in the closely related Little Bittern (*Ixobrychus minutus*) of Eurasia (Nankinov, 1999). The winter habitat of Least Bitterns is also poorly known, although the species is presumed to occupy brackish and saline swamps and marshes of the southern United States and Central America (Poole et al., 2009).

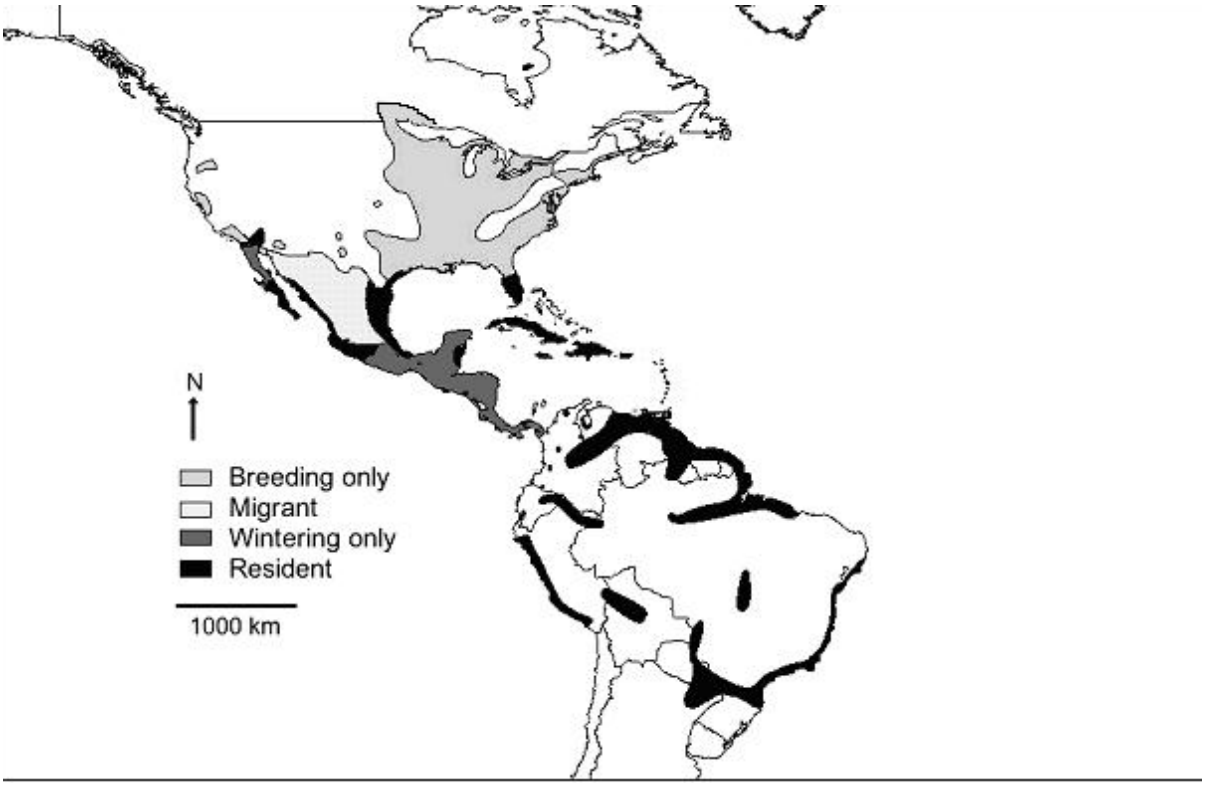

Figure 1. Least Bittern breeding and wintering ranges in North America (from COSEWIC, 2009).

In Canada, Least Bitterns breed in Manitoba, Ontario, Québec, New Brunswick (and possibly Nova Scotia) where they generally occur south of the Canadian Shield (COSEWIC, 2009; Figure 2). They have been reported as vagrants in other provinces. The Canadian Least Bittern breeding population is estimated at 1500 pairs (between 1000 and 2800; COSEWIC, 2009; Table 2). This figure comes from various sources including breeding bird atlases, targeted field work and citizen-driven monitoring programs (e.g. Marsh Monitoring Program) and it does not take into account immatures, sub-adults and non-breeding adults.

Table 2. Estimated numbers of Least Bittern pairs and atlas occurrences in Canada.

Province	**No. of breeding pairs (estimated) (COSEWIC, 2009)**	**No. of Atlas squares (100 km^2) in which the species was detected ; Reference**
Ontario	>500	210 (during the 2001-2005 period, 2nd atlas); Cadman et al. (2007)
Québec	200-300	18 (2010, first field season, 2nd atlas); B. Laliberté, pers. comm
Manitoba	~ 200	Unavailable
New Brunswick	unknown	7 (during the 2005-2010 period, 2nd atlas); Bird Studies Canada (2009, 2010)
Nova Scotia	unknown	0 (during the 2005-2010 period, 2nd atlas) ; Bird Studies Canada (2009, 2010)

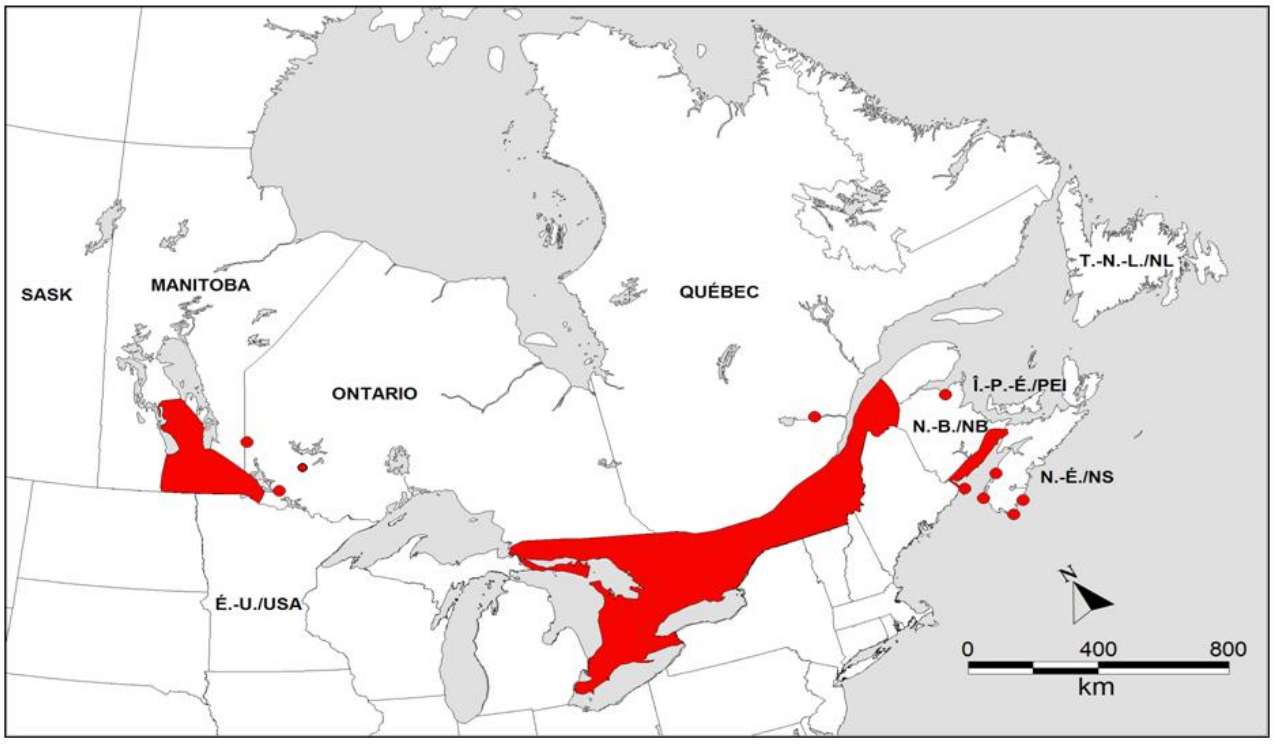

Figure 2. Breeding distribution of the Least Bittern in Canada as of 2010 (dots indicate locations isolated from the known breeding range, but where birds have been found during the breeding season; Canadian Wildlife Service, unpublished data).

Despite recent advances in methods to detect the species (Meyer et al., 2006; Rehm and Baldassarre, 2007b; Tozer et al., 2007; Conway, 2009; Johnson et al. 2009, Jobin et al. 2010, 2011) which have led to increases in reported numbers of breeding individuals (Jobin, 2006, Latendresse and Jobin, 2007, Jobin et al. 2007, Meyer and Friis, 2008), there is a general consensus that the species has declined (Sandilands and Campbell, 1988; Austen et al., 1994; James, 1999; Environment Canada, 2007; Poole et al., 2009). In Canada, the species has shown declines in the heart of its Canadian range. For example, an average annual decline of 10.6% (95% CI = -6.9% to -14.3%) was noted in the Great Lakes Basin from 1995-2007 (Archer and Jones, 2009). An analysis of the data for Ontario yielded a similar trend (-10%/year, 95% CI = -5% to -16%, 1995-2006) and this takes into account that, overall, there was no significant change in the probability of observations between atlas projects (Cadman et al., 2007). Conversely, in the Lake Simcoe-Rideau zone, there was no significant change in the probability of observations (Cadman et al., 2007).

3.3. Needs of the Least Bittern

Current understanding of the ecological needs of Least Bitterns may be biased because selection of study sites and associated findings may be influenced by how easily the sites can be accessed and surveyed. Furthermore, the species' apparent habitat needs might be distorted by limitations in what habitat is available now compared to historically.

3.3.1. Habitat and Biological Needs

Least Bittern main breeding habitats consist of freshwater and brackish marshes with dense, tall, persistent emerging plants (mainly cattail *Typha spp*), interspersed with open water and occasionally clumps of shrubby vegetation (Parsons, 2002; Picard and Shaffer, 2003; Hay, 2006; Budd, 2007; Jobin et al., 2007; Yocum, 2007; Griffin et al., 2009). In Canada, these habitats are occupied from early May to early September (Fragnier, 1995). It appears that Least Bitterns may be relatively opportunistic in their habitat and nest site selection, provided that the available emerging vegetation can support and conceal their raised platform nest and that adequate foraging habitat is nearby (Nelson, 2003b; Arnold 2005). Least Bitterns are visual predators that forage for prey (e.g. small fish, tadpoles, insects) in clear shallow water near marsh edges, often from platforms that they construct out of bent vegetation (Poole et al., 2009). Moreover, marsh edges that border directly on deeper water are important for foraging, which probably explains why marshes interlaced with muskrat or other channels are preferred (Poole et al., 2009).

Naturally fluctuating water levels are an important habitat feature, at least during the breeding season, as high water levels would flood nests whereas low levels would reduce food availability and facilitate predators' access to nests (Arnold, 2005). Density of Least Bitterns may be affected by water depth, food abundance, vegetation type and cover availability more than marsh area or marsh area within the surrounding landscape (Arnold, 2005; Tozer et al. 2010).

Birds defending territories have been found in marshes as small as 0.4 ha (Gibbs and Melvin, 1990), but they usually nest in larger marshes (> 5 ha), especially those with a deeper open water zone (10-50 cm deep) and a roughly 50:50 ratio of vegetation to open water ("hemi-marsh" conditions; Rehm and Baldassarre, 2007a; Poole et al., 2009). The species can be semicolonial, particularly in highly productive habitats (Kushlan, 1973; Bogner, 2001; Meyer and Friis, 2008), where they can reach a density of up to five calling birds or nests per ha (Arnold, 2005; Poole et al., 2009). Although typically territorial, no definitive information exists on territory size and home range for Least Bitterns. Field data on Least Bittern movements, however, suggest that the average maximum distance travelled between two points by individual breeding birds is 393 m ± 36 SE (Bogner and Baldassarre, 2002a). A recent study by Griffin *et al.* (2009) even found a mean maximum distance of more than 2000 m in Missouri.

There is little information on habitat use during foraging, moulting, post-breeding dispersal, migration and on wintering areas although it is presumed that they possess similar properties to those of breeding habitats.

4. THREATS

4.1. Threat Assessment

Table 3. Threat Assessment Table.

Threat	Level of Concern [1]	Extent	Occurrence	Frequency	Severity [2]	Causal Certainty [3]
Habitat Loss or Degradation						
Wetland destruction	High	Widespread	Current	Recurrent	High	High
Impaired water quality	Medium-High	Widespread	Current	Continuous/ Recurrent [4]	Moderate	Medium
Regulated water levels	Medium	Local	Current/ Unknown	Recurrent/ Unknown	High/ Low	Medium
Exotic, Invasive or Introduced Species or Genome						
Invasive species	Medium	Local	Current	Continuous	High/ Moderate	Medium
Accidental Mortality						
Collisions with cars and anthropogenic structures	Low	Local	Current	Unknown	Unknown	Unknown
Disturbance or Harm						
Recreational activities	Low	Local	Current	Recurrent	Moderate	Medium
Climate and Natural Disasters						
Climate change	Low	Widespread	Anticipated	Unknown	Moderate/ Unknown	Medium/ Low
Natural Processes or Activities						
Diseases	Low	Widespread	Current	Unknown	High/ Low	Low

[1] *Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table.*
[2] *Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown).*
[3] *Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g. expert opinion; Low: the threat is assumed or plausible).*
[4] *Each threat is evaluated at the local level (each site) and at the rangewide level. When two items are present in a box, this means that the threat level is not the same for both scales (Local scale / Rangewide scale).*

4.2 Description of Threats

Threats are listed according to their level of concern. However, apart from wetland destruction and impaired water quality, the level of concern is speculative because the prevalence and impact of threats are poorly documented in Canada. Some threats may occur on wintering grounds and along migration routes with potentially important consequences on Least Bitterns that migrate to Canada for breeding. Some limiting factors such as the absence of muskrats (who open corridors in the marsh vegetation) and the reduction of natural disturbances (e.g. fires that prevent shrubs from invading the habitat) also have important effects.

Wetland destruction

Availability of suitable wetlands is the primary limiting factor for Least Bitterns because of their requirement for specific habitat characteristics which are limited across the range and as such may limit population size. Historic, anthropogenic loss of wetland habitat is thought to have severely reduced Least Bittern numbers across North America. The rate of large-scale wetland loss in southern Canada appears to have slowed in recent years, but wetlands continue to be drained for housing development and/or conversion to agricultural uses (Ducks Unlimited Canada 2010). In Québec, 80% of wetlands along the St. Lawrence River have been lost since European settlement (Painchaud and Villeneuve, 2003). Draining and filling of wetlands in southern Canada has slowed in recent years although habitat continues to be degraded through incremental encroachment and fragmentation (James, 1999). Development up to the edges of marshes, and fragmentation of marshes, for example by boat ramps, facilitates access to deeper portions of marshes by some mammalian predators[2], particularly raccoons (Jobin and Picman, 1997). Loss and degradation of wetlands is also an important factor in the United States (Dahl, 2006), affecting the migration and wintering habitats of the Canadian breeding population.

Impaired water quality

Run-off, siltation, acid rain and eutrophication can reduce prey abundance (Weller, 1999) and increase the likelihood of disease and toxicity. Any reduction in water clarity will likely reduce the foraging success of the Least Bittern, a visual feeder.

Single source pollution events such as toxic spills are particularly likely in marshes that border the busy shipping lanes of the St. Lawrence River and Great Lakes (Chapdelaine and Rail, 2004). The effects of such events on Least Bitterns have not been investigated but could be devastating since the species is known to bioaccumulate toxins in eggs and feathers (Causey and Graves, 1969).

[2] Such predators may also be more abundant that previously because of subsidized feeding opportunities around human settlements.

Regulated water levels

Since water-level management along the St. Lawrence River and Lake Ontario was established in the 1950's, the average maximum flow has decreased in summer and the average minimum flow has increased in winter (Morin and Leclerc, 1998). However, deviations from the regulation plan occur regularly and can impact Least Bittern during crucial periods (DesGranges et al., 2006). This situation may also be taking place in other important waterways such as the Ottawa River and even inland. Although Least Bitterns are able to adjust nest height somewhat in response to higher water levels (Nelson, 2003a), they seem to occupy sites where water levels are stable during the breeding season. Any dramatic change in water levels during the breeding season is liable to affect the species negatively, either directly by flooding nests (Guillemette and Messier, 2009), increasing the likelihood of depredation and impeding foraging or indirectly by degrading the habitat. The species reaction to decreasing water levels over the long term is more pronounced when sharp declines with few flooded areas are available than when the trend is declining but with a more cyclical presence of high water levels (Timmermans et al., 2008).

Prolonged periods of high water levels can reduce the extent of cattail marshes, both directly and by making conditions more favourable for other species such as Wild Rice (*Zizania palustris*) that are less suitable for nesting Least Bitterns (Sandilands and Campbell, 1988). Conversely, prolonged periods of relatively stable water levels may increase the density of cattail stands and eliminate open pools required by Least Bitterns. However, periodic draining of wetland cells for habitat management and restoration purposes which generally occur outside of bird breeding season is a measure which largely benefits waterbirds in the long-term (Parsons et al., 2002; Arnold, 2005). Jobin et al. (2009) showed that the abundance of a Least Bittern population was reduced rapidly following a strong decrease of water depth in impounded wetlands followed by a rapid increase in abundance when water depth later returned to previous levels.

Invasive species

Several species of invasive plants and animals are increasing in range and abundance in North American marshes, largely due to human actions. Purple Loosestrife (*Lythrum salicaria*), Reed Canary Grass (*Phalaris arundinacea*), European Common Reed (*Phragmites autralis spp. australis*) and Flowering Rush *(Butomus umbellatus*) have spread across North America, crowding out native emergent vegetation such as cattails (Lavoie et al., 2003; Hudon, 2004; Jobin, 2006; Jobin et al., 2007; Latendresse and Jobin, 2007). While Least Bitterns can breed in a variety of emergents, including stands of invasive species such as European Common Reed and Flowering Rush, they preferentially breed in cattails (Poole et al., 2009). Invasive species may provide suboptimal habitat, although actual use of these vegetation communities is unknown. Invasive plants, including those that do not compete directly with cattails (e.g., European Frog-bit [*Hydrocharis morsus-ranae*] and Water Chestnut [*Trapa natans*]), can also alter habitat structure or have a variety of more indirect effects on marsh habitat, particularly in accelerating marsh succession to drier conditions that are not optimal to breeding Least Bitterns (Blossey et al., 2001).

Populations of invasive fish and invertebrates, for example Carp (*Cyprinus carpio*), Round Goby (*Neogobius melanostomus*), Quagga and Zebra mussels (*Dreissena bugensis* and *D. polymorpha*), are also increasing in wetlands occupied by Least Bitterns, especially in southern Ontario and Québec. In addition to their numerous deleterious effects on ecosystem function, some of them may impact Least Bitterns more directly. For example, Carp can impact populations of smaller fish that Least Bitterns eat by eating their eggs at the same time as vegetation, and stir up sediment as they forage, reducing water clarity for visual feeders such as Least Bitterns (Wires et al., 2010).

Collisions with cars and anthropogenic structures

Least Bitterns fly at low levels and also migrate at night, characteristics which make them susceptible to collisions with vehicles, buildings, guy wires, power lines, barbed wire fences, and towers. These collisions may be frequent enough at some sites to threaten local populations (Poole et al., 2009). In one example, 12 Least Bitterns were killed in collisions with vehicles and four died after being impaled on a fence during one weekend on a road that passes through a refuge in Louisiana (Guillory, 1973). Least Bitterns have been found dead along the Long Point (Ontario) causeway on a few occasions (Ashley and Robinson, 1996; J. McCracken, unpubl. data). These incidents suggest that roadways or structures built adjacent to patches of suitable marsh habitat can cause mortality for birds moving between wetlands or during migration.

Recreational activities

Although Least Bitterns can tolerate a certain level of human activity near their breeding marshes, including the passage of boats near their foraging areas (Poole et al., 2009), they seem to prefer nesting outside urban areas (Smith-Cartwright and Chow-Fraser, unpublished results). Infrequent and unpredictable disturbance, however, may be as disruptive to Least Bitterns as it is for other species that are intolerant of human activity (Nisbet, 2000). Frequent use of call-broadcasts by recreational birders in wetlands where birding pressure is intense may also be disruptive to breeding Least Bitterns. As well, direct impacts such as waves from motorized watercraft could erode marsh edges and possibly flood or upset nests.

Climate change

Climate change has the potential of having unpredictable, widespread and severe effects on Least Bitterns and their habitat. Climate change could increase the frequency of events such as floods and storms that can destroy nests and habitat, and may also change the overall hydrological and temperature regimes that account for the Least Bittern's distribution in Canada. In the Great Lakes, for example, water temperature will likely rise, reducing seasonal mixing, increasing algal blooms, and lowering water levels, all with important effects on the ecosystem (AMEC Earth and Environmental, 2006). Reduction of water levels, in particular, will likely reduce the area of emergent marsh, reducing both prey and habitat for Least Bitterns (Mortsch et al., 2007; Wires et al., 2010). Modeling scenarios of changing hydrology of the St. Lawrence-Great Lakes hydrosystem forecast that water level fluctuations downstream may induce widespread nest destruction of breeding marsh birds, including the Least Bittern, along the St. Lawrence River

shorelines (DesGranges et al., 2006). On the other hand, a northward expansion by the species could favour the use of numerous wetlands in the boreal forest although the quality of these habitats for breeding purposes would need to be assessed.

Finally, increased penetration of water by ultraviolet radiation as a result of depletion of the ozone layer has negative impacts on the productivity of aquatic ecosystems (Persaud and Yan, 2005, and references cited therein), and hence could reduce food supplies of Least Bitterns.

Diseases

Although most nest losses have been attributed to abandonment, depredation, cannibalism and flooding (Nelson, 2003b; Griffin et al., 2009; Poole et al., 2009), various diseases and parasitism from nematodes, trematodes, lice and mites have been reported but have been poorly studied in Least Bittern. Presumably, the species is susceptible to diseases known to affect other wading birds, namely chlamydial infection, type C botulism, avian cholera, aspergillosis, sarcocystis (Friend, 1987; cited in Gibbs and Melvin, 1992), avian salmonellosis (Friend and Franson, 1999), *Eustrongilides*, a nematode particularly prevalent in the presence of nutrient and silt-laden run-off (P. Frederick, personal communication, cited in Gibbs and Melvin, 1992), and avian salmonella, outbreaks of which may be associated with sewage effluents (Wires et al., 2010). Furthermore, Least Bittern is one of 326 bird species in which West Nile Virus has been found (Center for Disease Control, 2009).

5. POPULATION AND DISTRIBUTION OBJECTIVES

The population and distribution objectives for the Least Bittern are to maintain and, where possible, increase the current Canadian population size and area of occupancy. An increase in population and area of occupancy is considered possible in many parts of the range where adequate, yet currently unoccupied, breeding, foraging, post-dispersal, moulting and migration stopover habitat is available or could be restored. These objectives can only be achieved over the long term (>10 years). The species' historical abundance and distribution are not well known, and specific habitat needs for different life stages and locations across its Canadian range are not understood well enough at present to set quantitative objectives. This may become possible in subsequent iterations of this recovery strategy as knowledge gaps are filled.

6. BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

6.1. Actions Already Completed or Underway

The following activities have been undertaken in Canada since 2000:

- Literature reviews of all available information on Least Bitterns (McConnell, 2004 ; Gray Owl Environmental Inc., 2009);
- National Least Bittern survey protocol for the breeding season (Jobin et al., 2010, 2011);
- National protocol for capturing, banding, radio-tagging and tissue sampling Least Bitterns in Canada (MacKenzie and McCracken, 2011);
- Surveys of potential and historical sites have been conducted in many portions of southern Manitoba (2003-2008; R. Bazin pers. comm.; Hay, 2006), Ontario (2001-2010;Bowles, 2002; Desy, 2007; Meyer and Friis, 2008) and Québec (2004-2010; Jobin, 2006; Jobin et al., 2007; Latendresse and Jobin, 2007; Guillemette and Messier, 2009; Jobin and Giguère, 2009);
- Second Breeding Bird Atlas published in Ontario (2001-2005; Cadman et al., 2007), fieldwork completed for the second Atlas in the Maritimes (2005-2010) and fieldwork started for the second Atlas in Quebec and Manitoba (2010);
- Directed surveys in National Wildlife Areas in Ontario and Québec;
- Masters and PhD theses completed on Least Bittern breeding habitat in Ontario (N. Bartok-University of Western Ontario; P. Quesnelle-Carleton University; D. Tozer – Trent University) and Manitoba (S. Hay-University of Manitoba);
- On-going monitoring programs: Great Lakes Coastal Wetland Monitoring Program (Canadian Wildlife Service-Ontario region; Meyer et al., 2006); Marsh Monitoring Program in Ontario since 1994 and in Québec since 2004; Monitoring of Least Bittern presence in several wetlands in southern Québec as part of the avian species at risk yearly breeding sites monitoring (SOS-POP); Prairies and Parkland pilot Marsh Monitoring Program since 2008.
- Upcoming creation of the Samuel-De Champlain projected biodiversity reserve (Natural heritage conservation Act of Québec; R.S.Q. c. C-61.01) which will protect 487 ha of wetlands on the shores of the Richelieu River near the Quebec/USA border. This will include two of the sites containing Least Bittern critical habitat (Baie McGillivray and Rivière Richelieu-Frontière).
- Broad efforts to protect, manage, and restore wetlands in Ontario are ongoing, for example, through the Eastern Habitat Joint Venture of the North American Waterfowl Management Plan, Great Lakes Sustainability Fund, and other programs.
- The Walpole Island First Nation is developing an ecosystem protection plan based on the community's Traditional Ecological Knowledge.

6.2 Strategic Direction for Recovery

Table 4. Recovery Planning Table for the Least Bittern.

Threats or limiting factor	Broad Strategy to Recovery	Priority	General Description of Research and Management Approaches
All	Encourage habitat management, conservation and stewardship	High	• Determine appropriate conservation strategies (e.g. stewardship, easement, covenant, acquisition) for critical habitat and surrounding area • Identify and mitigate the impact of threats on habitat occupancy and reproductive success
		Medium	• Collaborate with stakeholders, landowners, planning agencies, policy makers and First Nation communities to promote the management of important habitats (breeding, foraging, post-breeding dispersal, moulting, migration stopover) • Develop and deliver communication/ outreach products that encourage transfer of Traditional Ecological Knowledge relating to Least Bittern and associated wetland habitats.
Knowledge gaps relating to population dynamics	Survey and monitor populations in order to clarify the species' distribution, relative abundance and population trends	High	• Develop a national monitoring strategy that includes : 1. Least Bittern surveys at sites known to have been used in the past but where breeding status is not confirmed as well as in potentially suitable breeding habitats 2. Standardized techniques to calculate population density, size and trend estimates and specify these metrics for the Canadian Least Bittern population 3. Standardized techniques to study dispersal and migration routes (telemetry, banding, etc.)
Knowledge gaps relating to habitat selection	Research on habitat selection	High	• Determine key habitat attributes at several scales and how they vary spatially, temporally and seasonally • Characterize and survey foraging, moulting, post-breeding dispersal and migration stopover habitats

7. CRITICAL HABITAT

7.1. Identification of the Species' Critical Habitat

Critical habitat is partially identified for Least Bitterns in Canada. As there is limited information concerning most foraging, moulting, post-breeding dispersal and migration stopover habitats, critical habitat is only identified for the breeding habitat.

The identification of critical habitat for the Least Bittern is based on two aspects: habitat suitability and habitat occupancy.

7.1.1. Habitat suitability

Habitat suitability relates to the areas where individuals carry out various aspects of their breeding cycle (i.e., courtship, territory defense, feeding, nesting, and post-fledgling). Suitable breeding habitat for Least Bitterns consists of those areas within the high-water mark of permanent wetlands[3] (marshes and shrubby swamps) containing tall and robust emergent herbaceous and/or woody vegetation interspersed with areas of open water.

Based on field data on Least Bittern movements which suggest that the average maximum distance travelled between two points by individual breeding birds is 393 m ± 36 SE (Bogner and Baldassarre, 2002b), suitable habitat extends up to 500 m of documented breeding activity.

7.1.2. Habitat occupancy

Habitat occupancy relates to areas of suitable habitat that have documented breeding activity (probable or confirmed records; see Appendix A for definitions) and between-season fidelity (suitable habitat where Least Bitterns have returned to breed in multiple years). Since Least Bitterns may occupy marshes in a specific area for only one year and never be observed there again (i.e. some marshes are used sporadically but not necessarily for breeding), documented breeding activity in suitable habitat for at least two years is a stronger criteria to identify critical breeding habitat.

The use of the probable or confirmed evidence of breeding is consistent with criteria developed by species at risk experts to document Least Bittern observations within the Quebec conservation data centre database as it can be very difficult to confirm breeding in this species (e.g. secretive behaviour, pairs are very rarely seen and nests/fledglings are rarely found; Tozer et al., 2007). For example, out of 185 sites where Least Bitterns were detected in Canada between April and August (as of 2007), breeding had only been confirmed in 26 (14%).

[3] Permanent wetlands include naturally occurring wetlands as well as artificially created wetlands (i.e., impoundments) managed for the purpose of wetland habitat restoration and/or wildlife conservation where water depth may be managed to simulate natural water level fluctuations.

Given that wetland habitats are dynamic throughout the Canadian range, recent information may be more reliable for evaluating suitable wetland habitat and Least Bittern use. In light of this fact, the threshold year of 2001 has been identified as an appropriate time frame for including Least Bittern breeding records as this is the year when the second Ontario Breeding Bird Atlas data started to be gathered (Ontario has the core breeding population in Canada). Records older than 2001 would need to be validated to determine the continued presence of suitable habitat and current use by Least Bitterns.

7.1.3. Critical habitat identification for the Least Bittern

Critical habitat is identified in this recovery strategy as the area of suitable habitat with 500 m of documented breeding activity consisting of either :

- One or more records of confirmed breeding since 2001;

- A minimum of two records of probable breeding in any single year since 2001 **OR** at least one record of probable breeding evidence in each of 2 separate years within a floating 5-year window[4] since 2001,.

All the habitat (suitable or not) within 500 m of documented breeding activity is referred to as a site. A site can be a whole wetland or part of a wetland in the event that only portions of that wetland have records of breeding activity. Therefore, several critical habitat sites may occur within a large wetland but adjacent sites merge into larger sites in cases of overlap.

Using these criteria, Least Bittern critical habitat has been identified at 98 sites, including 10 in Manitoba, 44 in Ontario, 42 in Québec and 2 in New Brunswick (Appendix B). It is important to note that the data in Appendix B are presenting sites containing critical habitat, and not the critical habitat itself. The extent and boundaries of the critical habitat within each site are defined by the extent of suitable habitat as defined in Section 7.1.1.

7.1.4 Non-critical Habitats

Least Bitterns may occasionally nest in non-traditional sites (e.g. roadside ditches, sewage lagoons) that are anthropogenic in nature and do not provide sustained quality breeding habitat given that they may be the object of frequent interventions that could negatively affect breeding Least Bitterns. Correspondingly, these sites are not identified as critical habitat under SARA (even if breeding is confirmed), although the general prohibitions under SARA and the *Migratory Birds Convention Act,* 1994 (S.C., 1994, c. 22) protecting the birds and their residences (nests) from damage or destruction will remain in effect.

[4] This criterion is used to identify a probable breeder within the Quebec Conservation Data Center and was recommended by the National Least Bittern Recovery Team in 2009 as a selection criterion for the present recovery strategy.

7.2. Schedule of Studies to Identify Critical Habitat

Table 5. Schedule of Studies.

Description of Activity	Rationale	Timeline
Conduct surveys and habitat assessments at priority sites in which: - Least Bitterns have nested between 1990-2001[a] ; - Least Bitterns are present but for which breeding has not been categorized as probable or confirmed since 1990; - There is suitable habitat, but where no standardized surveys have taken place since 1990	Additional critical habitat identified, particularly in more remote areas	2011-2016
Identify sites containing foraging, post-breeding dispersal, moulting and migration stopover critical habitat in Canada	Needed to protect and ensure long-term survival in Canada	2011-2016

[a] The 1990 year has been selected based on the fact that Conservation Data Centers consider records older than 20 years to be historical.

7.3 Activities Likely to Result in the Destruction of Critical Habitat

Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in time or from the cumulative effects of one or more activities over time (Governement of Canada, 2009). Examples of activities that are likely to result in destruction of critical habitat include, but are not limited to:

1) Activities causing permanent loss of wetlands identified as critical habitat such as infilling (e.g. infrastructure development and construction), draining, dredging and channelization (e.g. for agriculture), and resource extraction preventing the use of sites during the breeding, foraging, post-breeding-dispersal, moulting or migrating stages.

2) Activities that degrade critical habitat or alter their function to the point where it can no longer serve for the Least Bittern:

- Infilling, dredging, channelization that leads to the development of unsuitable vegetation within the marsh;
- Agricultural activities that generate soil run-off and increased water turbidity or nutrient influx which can lead to vegetation overgrowth and render the habitat inhospitable (e.g. reduced foraging success);
- Deliberate introduction of invasive vegetation, fish and invertebrate species that alter feeding activities and are unsuitable for nest building;
- Use of vehicles and motor boats within wetlands, causing water level and habitat changes;
- Prescribed burns or other means of natural vegetation removal within wetland habitats during the breeding season due to their effects on nesting activities;
- Deposition of deleterious substances, either directly (in water) or indirectly (upstream, soil), into wetlands that would affect water quality (e.g., chemicals, silt);

- Dumping of snow with salts or other abrasives in wetlands during snow removal operations as this may alter water quality and feeding success.
- Construction of infrastructures (e.g. roads, houses, boat ramps) which increase the access to critical habitat and can lead to disturbance of reproductive activities or increase other threats (e.g. collisions).
- Trampling by livestock that removes or tramples substantial amounts of standing emergent aquatic vegetation and erodes the banks.

Activities required to manage, inspect and maintain existing facilities and infrastructure which are not critical habitat but whose footprints may be within or adjacent to the identified critical habitat are not examples of activities likely to result in the destruction of critical habitat provided that they are carried out in a manner aimed at protecting the Least Bittern critical habitat. Therefore, management of wetlands for wildlife conservation purposes does not typically result in destruction of critical habitat.

8. MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. Every five years, the success of this recovery strategy will be measured against indicators outlined below.

1) the population size of Least Bittern is maintained and, where possible, increased;
2) the area of occupancy of sites with probable or confirmed records of Least Bittern breeding evidence is maintained and, where possible, increased.

9. STATEMENT ON ACTION PLANS

One or more action plans will be posted on the Species at Risk Public Registry for the Least Bittern before 2016.

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APPENDIX A: STANDARD BREEDING BIRD ATLAS CODES

Atlas code*	Description
Evidence of probable breeding	
P	Pair observed in their breeding season in suitable nesting habitat
T	Permanent territory presumed through registration of territorial behaviour (song, etc.), or the occurrence of an adult bird, on at least two days, a week or more apart, at the same place, in suitable nesting habitat during the breeding season
D	Courtship or display between a male and a female or two males including courtship, feeding or copulation
V	Visiting probable nest site
A	Agitated behaviour or anxiety calls of an adult indicating nest-site or young in the vicinity
B	Brood patch on adult female or cloacal protuberance on adult male
Confirmed breeding	
NB	Nest building or carrying nest materials
DD	Distraction display or injury feigning
NU	Used nest or egg shells found (occupied or laid within the period of the survey). Use only for unique and unmistakable nests or shells
FY	Recently fledged young or downy young
AE	Adults leaving or entering nest sites in circumstances indicating occupied nest (including nests which content cannot be seen)
FS	Adult carrying fecal sac
CF	Adult carrying food for young during its breeding season
NE	Nest containing eggs
NY	Nest containing young seen or heard

* Atlas codes and descriptions can vary slightly from one province to another but convey similar meanings.

APPENDIX B: LEAST BITTERN CRITICAL HABITAT

Table B-1. Sites containing critical habitat for the Least Bittern in Manitoba.

No.	Site name	NTS Map (1:50,000)[1]	Quarter section identification[2]		Latitude and longitude of site centroid	Area (ha)[3]	Description	Land tenure[4]
1	Brokenhead Swamp	62H16	NE-12-10-08-E1 NW-07-10-09-E1 NW-18-10-09-E1	SW-18-10-09-E1 SE-13-10-08-E1 NE-13-10-08-E1	49.830; -96.365	111	Freshwater wetland located east of PR302, north of Hwy 1 and south of Hwy 15 near the town of Ross, Manitoba	Non federal
2	Buffalo Lake	62I13	NW-10-21-02-W1 NE-10-21-02-W1 SE-15-21-02-W1 NE-15-21-02-W1	SW-15-21-02-W1 NW-14-21-02-W1 SW-14-21-02-W1 NW-11-21-02-W1	50.803; -97.654	241	Freshwater Lake located north of PR419, east of PR512 and north of Hwy 17 near the town of Chatfield, Manitoba	Non federal
3	Fish Lake	62I11 and 62I14	SW-30-20-02-E1 NW-30-20-02-E1	SE-25-20-01-E1 NE-25-20-01-E1	50.750; -97.323	131	Freshwater wetland located east of Hwy 17 and west of Hwy 7 near the town of Meleb, Manitoba	Non federal
4	Little Birch Lake West	62O01	SW-11-25-05-W1 SE-11-25-05-W1 NW-11-25-05-W1	NE-11-25-05-W1 SE-14-25-05-W1 SW-14-25-05-W1	51.150; -98.057	104	Freshwater wetland located south of PR325 and north of Sleeve Lake near the town of Ashern, Manitoba	Non federal
5	Little Birch Lake East	62O01	SE-12-25-05-W1 SW-12-25-05-W1	NE-01-25-05-W1 NW-01-25-05-W1	51.141; -98.037	79	Freshwater wetland located south of PR325 and north of Sleeve Lake near the town of Ashern, Manitoba	Non federal
6	Rat River Swamp West	62H02 and 62H07	NW-20-03-06-E1 SE-29-03-06-E1 NE-29-03-06-E1 NE-20-03-06-E1 SE-21-03-06-E1 SW-20-03-06-E1 NW-16-03-06-E1 SE-20-03-06-E1 NE-21-03-06-E1 NW-21-03-06-E1	NE-17-03-06-E1 NW-17-03-06-E1 SW-27-03-06-E1 SE-19-03-06-E1 NW-27-03-06-E1 SW-28-03-06-E1 NW-28-03-06-E1 SE-28-03-06-E1 NE-28-03-06-E1 NE-18-03-06-E1	49.232; -96.734	693	Freshwater wetland located east of Hwy 59, west of PR302 and north of the Vita Drain along the Rat River near the towns of Rosa and Zhoda, Manitoba	Non federal
7	Rat River Swamp Centre	62H02 and 62H07	NW-26-03-06-E1 NE-27-03-06-E1 NE-34-03-06-E1	SE-34-03-06-E1 NW-35-03-06-E1 SW-35-03-06-E1	49.253; -96.688	125	Freshwater wetland located east of Hwy 59, west of PR302 and north of the Vita Drain along the Rat River near the towns of Rosa and Zhoda, Manitoba	Non federal
8	Rat River Swamp East	62H02 and 62H07	NW-34-03-07-E1 NE-33-03-07-E1 NW-33-03-07-E1	SW-04-04-07-E1 SE-04-04-07-E1 SW-03-04-07-E1	49.266; -96.584	190	Freshwater wetland located east of Hwy 59, west of PR302 and north of the Vita Drain along the Rat River near the towns of Rosa and Zhoda, Manitoba	Non federal

9	Sleeve Lake	62O01	NW-19-24-04-W1 NE-19-24-04-W1	SE-30-24-04-W1 SW-30-24-04-W1	51.096; -98.010	79	Freshwater wetland located south of PR325 and south of Little Birch Lake near the town of Ashern, Manitoba	Non federal
10	Unnamed Lake (locally called Little Sleeve Lake)	62O01	NE-36-24-05-W1 SE-01-25-05-W1 SE-06-25-04-W1	NW-31-24-04-W1 SW-06-25-04-W1	51.127; -98.020	103	Freshwater wetland located south of PR325 between Little Birch Lake and Sleeve Lake near the town of Ashern, Manitoba	Non federal

[1] National Topographic System.

[2] Quarter section descriptions are based on the Dominion Land Survey System, whereby most of western Canada is legally divided into townships based on longitudinal meridians and latitudinal base lines. Each township is given a township number and range number. Townships are approximately 9.7 km x 9.7 km (6 miles x 6 miles) and are further divided into thirty-six sections, each about 1.6 km x 1.6 km (1 mile x 1 mile). In turn, each section is divided into four quarter sections: southeast, southwest, northwest and northeast, which are 0.8 km x 0.8 km (0.5 mile x 0.5 mile). For example, the full legal description of quarter section NW-36-002-06-E is the Northwest Quarter of Section 36, Township 002, Range 06, east of the First Meridian (see McKercher and Wolf, 1986 for more information).

[3] Areas are approximate and represent the area of the site boundary and not necessarily the area of critical habitat.

[4] Land Tenure is provided as an approximation of land ownership and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

Table B-2. Sites containing critical habitat for the Least Bittern in Ontario.

No.	Site Name[1]	NTS Map (1: 50 000)[2]	Latitude and Longitude representing the Site[3]	Area (ha)[4]	Description	Land Tenure[5]
1	Arkell - Corwhin Wetland Complex	40P09	43.539; -80.134	79	South of Eden Mills	Non federal
2	Big Creek NWA, Crown Marsh, Long Point Provincial Park	40I09	42.586; -80.427	1216	West end of Long Point Sandspit	Federal (NWA), Non federal
3	Big Rice Bay Marsh - Thoroughfare Unit, Long Point NWA	40I09	42.586; -80.342	405	Big Rice Bay Marsh area of Thoroughfare Unit	Federal (NWA), Non federal
4	Big Sand Bay	30N15	43.922; -76.943	141	West of Prince Edward Point National Wildlife Area	Non federal
5	Birdsalls Creek	31D08	44.288; -78.08	79	South of Westwood	Non federal
6	Cooper Marsh	31G02	45.108; -74.53	79	West of South Lancaster	Non federal
7	Hoards Creek	31C05	44.276; -77.657	79	South of Hoards	Federal (PCA), Non federal
8	Hullett Marsh Complex	40P11	43.631; -81.471	137	East of Clinton	Non federal
9	Hutton Creek Wetland	31C16	44.789; -76.049	79	West of Motts Mills	Non federal
10	Indian Creek Wetland	40I09	42.658; -80.366	1132	West of Turkey Point	Non federal
11	Little Rice Bay Marsh - Thoroughfare Unit, Long Point NWA	40I09	42.586; -80.366	134	Little Rice Bay Marsh area of Thoroughfare Unit	Federal (NWA)
12	Loch Garry	31G07	45.27; -74.669	79	South of Greenfield	Non federal
13	Long Point Unit - Long Point NWA	40I09	42.557; -80.172	1036	Along north shoreline of Long Point Unit	Federal (NWA)
14	Luther Marsh	40P16	43.928; -80.427	79	East part of Luther Marsh Conservation Area	Non federal
15	Marysville Creek Wetland	31C03	44.178; -77.202	127	East of Big Bay	Federal (First Nations)
16	Matchedash Bay Wetland (SE11)	31D12	44.768; -79.686	111	North end of wetland	Federal (PCA), Non federal
17	Miller Creek Wildlife Area	31D08	44.385; -78.351	79	Miller Creek Wildlife Area	Non federal
18	Mississippi River Snye	31F08	45.462; -76.228	79	South of Fitzroy Harbour	Non federal
19	Mud Creek	31F11	44.737; -75.783	134	West of North Augusta	Non federal
20	Parks Creek	31C06	44.293; -77.294	79	South of Halston	Non federal
21	Presqu'ile Bay Marsh 1	31C04	43.996; -77.719	297	Middle section of Presqu'ile Provincial Park	Non federal

22	Presqu'ile Bay Marsh 2	31C04	44.013; -77.745	79	North end of Presqu'ile Provincial Park	Non federal
23	Rankin River Wetland	41A14	44.793; -81.253	89	South of Sky Lake Management Area	Non federal
24	Rondeau Provincial Park	40I05	42.278; -81.873	158	West side of Rondeau Provincial Park	Non federal
25	Ross Lake Wetland	31C06	44.317; -77.47	99	North of Madoc Junction	Non federal
26	Sandbanks Provincial Park	30N14	43.889; -77.228	79	Southeast section of Sandbank Provincial Park	Non federal
27	Snelgrove Brook	31D08	44.394; -78.363	79	East of Bridgenorth	Non federal
28	St. Clair Marsh Complex	40J08	42.453; -82.423	79	Middle section St. Clair Marsh	Non federal
29	St. Clair NWA Marsh Complex - Bear Creek Unit	40J09	42.534; -82.4	173	St. Clair NWA - Bear Creek Unit	Federal (NWA), Non federal
30	St. Clair NWA Marsh Complex - St. Clair Unit	40J08	42.363; -82.409	665	St. Clair NWA - St. Clair Unit	Federal (NWA), Non federal
31	Sturgeon Bay Marsh	31D12	44.733; -79.75	101	Southwest end of the Trent Severn Waterway	Federal (PCA), Non federal
32	Sturgeon Lake No. 26	31D07	44.403; -78.777	104	North of Lindsay	Federal (PCA), Non federal
33	The Swale Wetland	31C16	44.888; -76.038	79	West of Smiths Falls	Federal (PCA), Non federal
34	Thrashers Corners Wetland	31C16	44.274; -77.343	115	Northeast of Thurlow	Non federal
35	Tiny Marsh (Ti7)	31D12	44.59; -79.942	304	Northeast of Allenwood	Non federal
36	Unnamed Wetland - City of Quinte West	31C03	44.171; -77.539	88	Northeast of Johnstown	Non federal
37	Unnamed Wetland - Haldimand-Norfolk County	40I09	42.604; -80.464	79	East of Long Point Road	Non federal, Federal (NWA)
38	Unnamed Wetland 1 - City of Prince Edward County	30N14	43.874; -77.103	97	East of Point Petre Militaries Reserves Site	Non federal
39	Unnamed Wetland 2 - City of Prince Edward County	31C03	44.161; -77.126	79	North of Solmesville	Non federal
40	Upper Canada Migratory Bird Sanctuary	31B14	44.955; -75.038	79	Upper Canada Migratory Bird Sanctuary	Non federal
41	Wenona Marsh	31D14	44.791; -79.382	79	South of Gravenhurst	Non federal
42	Wheatley East Two Creeks	40J01	42.083; -82.451	79	Wheatley Provincial Park	Non federal
43	Woodview Swamp	31D08	44.327; -78.216	79	West of Jermyn	Non federal
44	Wye Marsh (TA2)	31D12	44.707; -79.876	316	Southwest section of Wye Marsh	Non federal

[1] Names are derived from Ontario Ministry of Natural Resources, Evaluated Wetland Boundaries (Land Information Ontario) and from the Great Lakes Coastal Wetland Consortium, Coastal Wetland Database (Great Lakes Commission) where available. Unevaluated or unnamed wetlands are identified by the township in which they reside. In many cases, only a portion of the wetland contains critical habitat.
[2] National Topographic System.
[3] The listed coordinates represent the southwest corner of the 1 km Universal Transverse Mercator (UTM) Military Grid Reference System square containing the critical habitat site centroid (see http://maps.nrcan.gc.ca/topo101/mil_ref_e.php for more information on the reference system). The coordinates may not fall within critical habitat and are provided as a general location only.
[4] Areas are approximate and represent the area of the critical habitat site boundary and not necessarily the area of critical habitat.
[5] Land Tenure is provided as an approximation of land ownership and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information. NWA = National Wildlife Area; DND = Department of National Defence; PCA : Parks Canada Agency.

Table B-3. Sites containing critical habitat for the Least Bittern in Québec.

No.	Site name	NTS Map (1:50,000) [1]	Latitude and longitude of site centroid	Area (ha)[2]	Description	Land tenure[3]
1	Lac La Pêche	31F09	45.635; -76.190	12	North of the city of Gatineau; within Gatineau Park	Federal (NCC)
2	Baie McLaurin Ouest	31G05	45.485; -75.590	152	East of the city of Gatineau	Non federal
3	Marais McLaurin Est	31G05 and 31G12	45.493; -75.565	212	East of the city of Gatineau	Non federal
4	Marais aux Massettes	31G11	45.577; -75.276	99	Managed wetland Eats of the city of Gatineau	Non federal
5	Marais aux Grenouillettes	31G12	45.510; -75.510	40	Managed wetland Est of the city of Gatineau	Non federal
6	Marais des Laîches	31G12 and 31H05	45.503; -75.536	79	East of the city of Gatineau	Non federal
7	La Grande Baie (Oka provincial park)	31G08 and 31H05	45.485; -74.008	79	In Oka provincial Park	Non federal
8	Grand marais de Beauharnois	31H05	45.266; -73.932	102	Managed wetland in Beauharnois	Non federal
9	Marais de Beauharnois N-O et S-O – Étang 1	31H05	45.268; -73.965	79	Managed wetland in Beauharnois	Non federal
10	Marais de Beauharnois N-O et S-O – Étang 2	31H05	45.279; - 73.952	159	Managed wetland in Beauharnois	Non federal
11	Île Saint-Bernard	31H05	45.389; -73.756	213	Managed wetland in Chateauguay	Non federal
12	Île des Soeurs	31H05	45.454; -73.555	8	On Nun's island in the city of Montréal	Non federal
13	Ruisseau Saint-Jean	31H05	45.368; -73.775	23	West of Chateauguay	Non federal
14	Parc-nature du Bois-de-l'île-Bizard	31H12	45.513; -73.887	12	Regional park in Montreal	Non federal
15	Marais du Bois 440	31H12	45.657; -73.626	9	Wetland in the city of Laval	Non federal
16	Île aux Fermiers	31H11	45.666; -73.456	133	On an island East of Montréal	Federal (other)
17	Rivière aux Pins (La Frayère)	31H11	45.642; - 73.443	12	North of Boucherville	Non federal
18	Île Tourte Blanche	31H11 and 31H12	45.600; -73.491	3	Part of a provincial parc on the Îles de Boucherville	Federal (other)
19	Pointe à la Meule	31H03	45.227; - 73.243	118	Along the Richelieu river; south of Saint-Jean-sur-Richelieu	Non federal
20	Baie McGillivray	31H03	45.143; -73.250	102	Along the Richelieu river; East of l'Île aux noix	Non federal

21	Rivière du Sud -A	31H03	45.102; -73.233	328	East of the Richelieu River near the Quebec/USA border; Downstream portion of the river	Non federal
22	Rivière du Sud - B	31H03	45.092; -73.207	130	East of the Richelieu River near the Quebec/USA border; Upstream portion of the river	Non federal
23	Anse à l'Esturgeon	31 H03	45.113; -73.282	118	Along the Richelieu river; south of l'Île aux noix	Non federal
24	Rivière Richelieu (frontière)	31H03	45.015; -73.355	94	Along the Richelieu river at the Quebec/USA border	Non federal
25	Baie Missisquoi (rivière aux Brochets)	31H03	45.079; -73.098	170	North of Lake Champlain	Non federal
26	Ruisseau Black (La Swamp)	31H03	45.092; -73,136	122	North of Lake Champlain	Non federal
27	Farnham (base militaire 7B)	31H06	45.310; -73.022	10	North of Farnham	Federal (DND)
28	Farnham (base militaire 6B)	31H06	45.318; -73.018	17	North of Farnham	Federal (DND)
29	Marais de l'Estriade	31H07	45.400; -72.680	79	East of Granby	Non federal
30	Marais de la rivière aux cerises	31H08	45.279; - 72.166	140	In Magog	Non federal
31	Marais Réal-D. Carbonneau	21E05	45.419; - 71.901	11	Managed wetland in Sherbrooke	Non federal
32	Île du Moine	31I02	46.094; -72.964	122	Managed wetland on an island East Sorel-Tracy	Federal (other)/ Non federal
33	Île des Barques	31I02 and 31I03	46.078; - 73.004	51	Managed wetland on an island East of Sorel-Tracy	Federal
34	Marais de la Commune	31I02	46.138; -72.786	31	Managed wetland East of Sorel-Tracy	Non federal
35	Rivière St-Joseph	31I03	46.027; -73.266	143	West of Sorel-Tracy	Non federal
36	St-Barthélémy (bassin Ouest)	31I03	46.177; -73.051	18	Managed wetland south of Saint-Barthélémy	Non federal
37	St-Barthélemy (bassin Est)	31I03	46.179; -73.043	27	Managed wetland south of Saint-Barthélémy	Non federal
38	Baie Saint-François	31I02	46.092; - 72.930	297	East of Sorel-Tracy	Non federal
39	Étangs aménagés de Baie-du-Febvre	31I02	46.153; - 72.732	317	Managed wetland West of Nicolet	Federal (DND)
40	Baie Lavallière	31I02	46.081; -72.954	91	Northern portion of the wetland East of Sorel-Tracy	Non federal
41	Marais Provencher	21L12	46.720; -71.536	19	Managed wetland in Neuville	Non federal
42	Grande Ferme / Cap Tourmente	21M02	47.051; -70.816	3	Managed wetland in Cap Tourmente NWA	Federal (NWA)

[1] National Topographic System.
[2] Areas are approximate and represent the area of the site boundary and not necessarily the area of critical habitat.
[3] Land Tenure is provided as an approximation of land ownership and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information. NWA = National Wildlife Area; DND = Department of National Defense; NCC: National Capital Commission.

Table B-4. Sites containing critical habitat for the Least Bittern in New Brunswick.

No.	Site name	NTS Map (1:50,000) [1]	New Brunswick Breeding Bird Atlas block reference [2]	Latitude and longitude of site centroid	Area (ha)[3]	Description	Land tenure[4]
1	Bell Marsh	21I02	NB Atlas p. 65 Squares B4, B5	46.057727; -64.84347	79	The Bell Marsh borders the north shore of the Petitcodiac river and is situated south of Marsh Junction near Moncton.	Non federal
2	St. George's Marsh	21G02	NB Atlas p. 90 Square B3	45.131885; -66.827757	79	The St. George marsh is located in St. George and borders the Trans Canada highway.	Non federal

[1] National Topographic System.
[2] Reference number consists of the page number and block(s) where the critical habitat is located as identified in the 2002 edition of the New Brunswick Atlas (Province of New Brunswick, 2002).
[3] Areas are approximate and represent the area of the site boundary and not necessarily the area of critical habitat. The area is the same for each site as there is only one observation per site for the New Brunswick data.
[4] Land Tenure is provided as an approximation of land ownership and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land parcel information.

APPENDIX C: EFFECTS ON THE ENVIRONMENT AND OTHER SPECIES

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that recovery strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the recovery strategy itself, but are also summarized below in this statement.

The Least Bittern's preference for a combination of dense emergent vegetation interspersed with areas of relatively deep open water, often in remote portions of extensive marshes means that protection of its habitat is largely synonymous with general wetland protection, which would benefit several wetland species (e.g., waterfowl, marsh birds, shorebirds) that use these wetlands for foraging, breeding, staging, resting and/or moulting at certain periods of their annual cycle. Maintenance of the hemi-marsh conditions that Least Bitterns prefer is generally consistent with approaches to enhancing waterfowl and marsh bird habitat (Post and Seals, 2000: Tori et al., 2002; Rehm and Baldassarre, 2007a).

It should be recognized, however, that several other species at risk including birds (King Rail (*Rallus elegans*), Yellow Rail (*Coturnicops noveboracensis*) and Prothonotary Warbler (*Protonotaria citrea)*), fishes (Lake Chubsucker (*Erinyzon sucetta*), Spotted Gar (*Lepisosteus oculatus*), Pugnose Shiner (*Notropis anogenus*)), turtles (Blanding's Turtle (*Emydoidea blandingii*), Spotted Turtle (*Clemmys guttata*)) and snakes (Eastern Foxsnake (*Clemmys guttata*)) may prefer other types of wetland conditions than Least Bitterns. Management actions should take these competing needs into account, while also recognizing the potential for synergistic recovery actions. Wherever possible, natural ecosystem processes should be maintained and allowed to evolve without human interference as these are the processes that marsh inhabitants are naturally adapted to.

The possibility that the present recovery strategy inadvertently generates negative effects on the environment and on other species was considered. The majority of recommended actions are non-intrusive in nature, including surveys and outreach. We conclude that the present recovery strategy is unlikely to produce significant negative effects.