Species at Risk Act
Recovery Strategy Series

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

Least Bittern



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[1] http://sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1

Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996)[2] 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, Quebec, 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.

[2] http://registrelep-sararegistry.gc.ca/default.asp?lang=en&n=6B319869-1#2

Acknowledgments

This recovery strategy was prepared by Vincent Carignan and Benoit Jobin ((EC-CWS) - Quebec Region) based on an initial draft by Andrew Horn (Dalhousie University). Earlier drafts were reviewed by members of the National Least Bittern Recovery Team [Vincent Carignan, chair, Ron Bazin (EC-CWS – Prairie & Northern Region), Samara Eaton and Jen Rock (EC-CWS - Atlantic Region), Valerie Blazeski (Parks Canada Agency), Ken DeSmet (Manitoba Conservation), Kari Van Allen and Dave Moore (EC-CWS – Ontario Region), Jon McCracken (Bird Studies Canada), and Eva Katic (National Capital Commission)]; and former members of the recovery team [Laurie Maynard and Barbara Slezak (EC-CWS – Ontario Region), Mark McGarrigle (New Brunswick Department of Natural Resources), Todd Norris (Ontario Ministry of Natural Resources), Jennifer Stewart (formerly with EC-CWS – Atlantic Region) and Gershon Rother (formerly with the National Capital Commission)].

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Executive Summary

The Least Bittern (*Ixobrychus exilis*) is North America's smallest heron. It breeds in freshwater and brackish marshes with tall emergent plants interspersed with open water and occasional clumps of woody vegetation. The species was designated as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2001 and 2009, and has been listed with the same status under Schedule 1 of the *Species at Risk Act* (SARA) since 2003.

Around 2-3% of the estimated 43,000 North American pairs are found in Canada, where they are distributed throughout southern Manitoba, Ontario, Quebec, New Brunswick and possibly Nova Scotia. Because of the species' secretive habits and the difficulties of surveying its habitat, population size and trend estimates are imprecise.

Wetland loss and degradation as well as impaired water quality are the primary threats to the Least Bittern throughout its range. Other threats include regulated water levels, invasive species, collisions (with cars and man-made 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, a 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 population size and area of occupancy in Canada. Broad strategies and approaches to achieve these objectives are presented in the Strategic Direction for Recovery section.

Critical habitat is partially identified for the breeding habitat. It corresponds to the suitable habitat within 500 m of records of breeding activity since 2001. A total of 115 critical habitat units are identified, 10 of which are located in Manitoba, 54 in Ontario, 48 in Quebec and 3 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 follow this recovery strategy and will be posted on the Species at Risk Public Registry by 2019.

Recovery Feasibility Summary

In considering the criteria established by the 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 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 and apparently suitable habitat is also available and additional sites 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 as well as 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, along with wetland management, restoration and creation techniques 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[3] 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, Quebec, 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 in April 2009.

2. Species Status Information

Canada has 2-3% of the Least Bittern reproductive pairs in North America. The species has been listed as Threatened under Schedule 1 of the *Species at Risk Act* (SARA) (S.C. 2002, c. 29) since 2003. In Quebec, 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 August 2013, 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 the Least Bittern as “Least Concern” (BirdLife International, 2009). NatureServe (2010) conservation ranks for Canada and the United States vary widely as shown in Table 1.

[3] Committee on the Status of Endangered Wildlife in Canada

Table 1. NatureServe (2010) Conservation Ranks for the Least Bittern[1,2].

Global Rank (G)	National Rank (N)	Sub-National Rank (S)
G5 (Secure)	N4B - Canada (Apparently Secure) N5B, N5N - United States (Secure)	Manitoba (S2S3B) ; Ontario (S4B) ; Quebec (S2S3B); New Brunswick (S1S2B) ; Nova Scotia (SNRB) 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; NR: Not Ranked. B (following a number): Breeding; N (following a number): Non-breeding.
[2] In most states along the Gulf coast (e.g., Texas, Louisiana, Florida), where it is resident year-round, the species 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", otherwise its call consists of a repeated "coo-coo-coo" (Sibley, 2000). Further details are provided in the COSEWIC (2009) status report.

3.2. Population and Distribution

Global population and distribution

During the nesting season, the Least Bittern can be found from southern Canada to South America, including the Caribbean. There are year-round 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 also breed in Oregon, California, and New Mexico (Figure 1). There are an estimated 43,000 pairs of Least Bitterns in North America (Delany and Scott, 2006).

The migratory routes of the Least Bittern 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 distribution of the adults during the 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).

Least Bitterns winter from California to Florida south to Mexico and Latin America. The winter habitat is poorly known, although the species is presumed to occupy brackish and saline swamps and marshes (Poole *et al*., 2009).

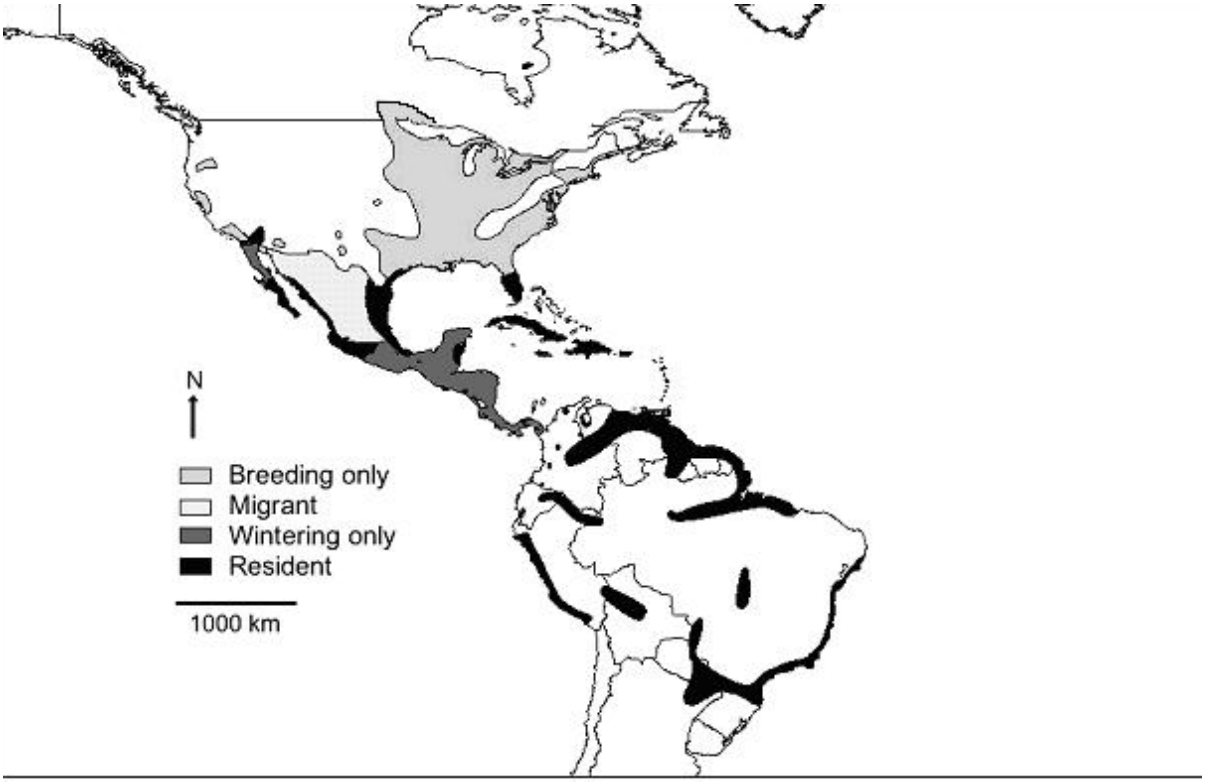


Figure 1. Global distribution of the Least Bittern (from COSEWIC, 2009).

Canadian population and distribution

In Canada, the Least Bittern generally breeds south of the Canadian Shield in Manitoba, Ontario, Quebec, New Brunswick and possibly Nova Scotia (COSEWIC, 2009; Figure 2). The species has been reported as a vagrant in other provinces. The Canadian breeding population is estimated at 1,500 pairs (between 1000 and 2800; COSEWIC, 2009; Table 2).

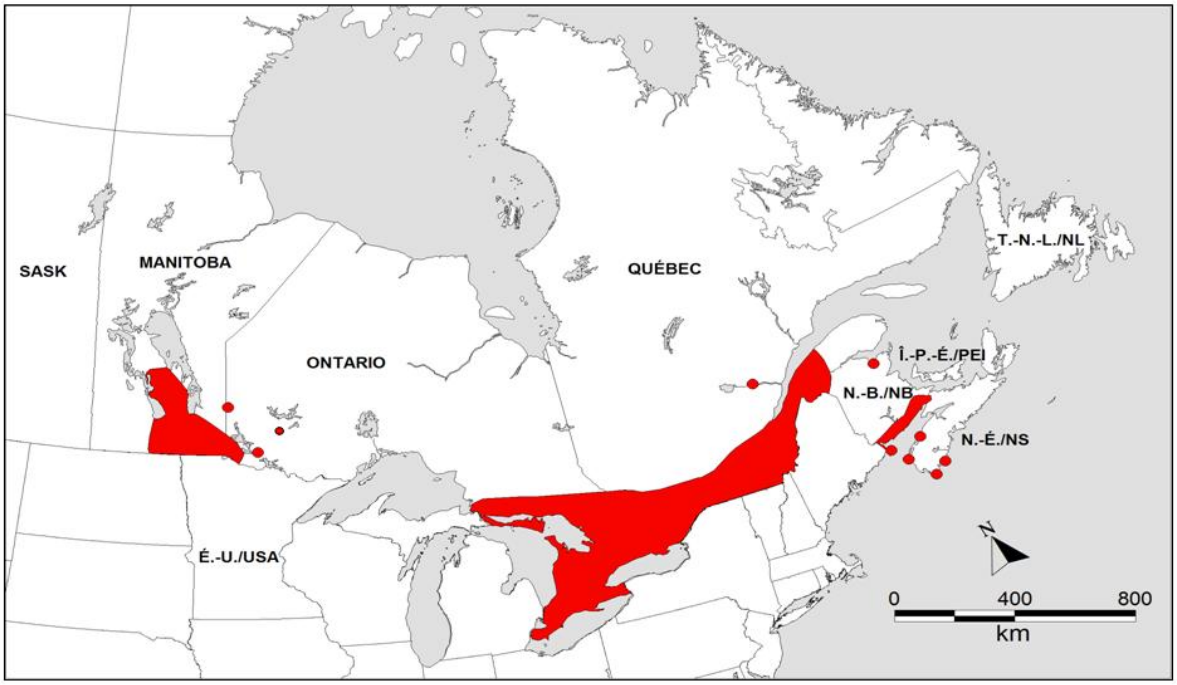


Figure 2. Breeding distribution of the Least Bittern in Canada as of 2012. Dots indicate locations isolated from the known breeding range, but where birds have been observed during the breeding season (Canadian Wildlife Service, unpublished data). This figure does not take into account immature individuals, sub-adults and non-breeding adults.

Table 2. Estimated Numbers of Least Bittern Pairs and Breeding Bird Atlas Occurrences in Canada.

Province	No. of breeding pairs (estimated) (COSEWIC, 2009)	No. of atlas blocks (100 km^2) in which the species was detected
Manitoba	~ 200	Unavailable
Ontario	>500	210 (during the 2001-2005 period, 2nd atlas); Cadman *et al*. (2007)
Quebec	200-300	38 (during the 2010-2012 period, 2nd atlas); Atlas des oiseaux nicheurs du Quebec (2012)
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)

Despite recent advances in methods to detect the species (Conway, 2009; Johnson *et al*. 2009, Jobin *et al*. 2013) which have led to increases in reported numbers of breeding individuals, 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, this tendency has been observed in the core of the species' range with an average annual decline of 10.6% (95% CI = -6.9% to -14.3%) in the Great Lakes Basin from 1995 to 2007 (Archer and Jones, 2009). An analysis of the data from the Ontario breeding bird atlases yielded a similar trend (-10%/year, 95% CI = -5% to -16%, 1995-2006; Cadman *et al*., 2007). Conversely, in the Lake Simcoe-Rideau region (Ontario), there were no significant changes in the probability of observation (Cadman *et al*., 2007).

3.3. Needs of the Least Bittern

Current understanding of the ecological needs of the Least Bittern 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

Breeding period

In Canada, breeding habitats are occupied from early May to early September (Fragnier, 1995). They consist of freshwater and brackish marshes with dense, tall, robust emergent plants (mainly cattail *Typha spp*), interspersed with relatively shallow (10-50 cm) open water and occasional clumps of shrubby vegetation (Parsons, 2002; Hay, 2006; Budd, 2007; Jobin *et al*., 2007; Yocum, 2007; Griffin *et al*., 2009). Rehm and Baldassarre (2007) refer to these conditions as hemi-marsh.

Water levels approximating those of a natural regime are an important breeding habitat feature as high water levels can flood nests that are constructed just above the water, whereas low levels reduce food availability and facilitate predators' access to nests (Arnold, 2005).

Densities of Least Bitterns appear to be mostly affected by local conditions such as water depth, food abundance, vegetation type and cover availability rather than marsh area or marsh area within the surrounding landscape (Arnold, 2005; Tozer *et al*. 2010). Indeed, although Least Bitterns usually nest in larger marshes (> 5 ha), territorial individuals have been found in marshes as small as 0.4 ha (Gibbs and Melvin, 1990). The species can also be semi-colonial, 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 hectare (Arnold, 2005; Poole *et al*., 2009). Although typically territorial, no definitive information exists on territory size and home range for the Least Bittern. Bogner and Baldassarre (2002a) found that breeding individuals moved an average maximum distance of 393 m ± 36 SE between two points while Griffin *et al.* (2009) found an average maximum distance of more than 2,000 m for breeding individuals in Missouri.

The Least Bittern is a visual predator that forages for prey (e.g., small fish, tadpoles, molluscs, insects) in clear, shallow water near openings in the marsh vegetation, often from platforms it constructs by bending emergent vegetation (Poole *et al*., 2009). This foraging method probably explains why they prefer marshes interlaced with channels, such as those created by muskrats (Poole *et al*., 2009).

Non-breeding period

There is little information on ecological needs of Least Bitterns and habitat characteristics in moulting, post-breeding dispersal, migration and wintering sites, although it is presumed that they are similar to those of breeding habitats.

4. Threats

4.1. Threat Assessment

Table 3. Threat Assessment.

Threat	Level of Concern [1]	Extent	Occurrence	Frequency	Severity [2]	Causal Certainty [3]
Habitat Loss or Degradation						
Wetland destruction and degradation	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 man-made 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 in order of decreasing level of concern. However, apart from wetland destruction and degradation and impaired water quality, the level of concern is speculative because the prevalence and impact of threats are poorly documented in Canada. Some threats that occur on wintering grounds and along migration routes may have consequences on Least Bitterns that migrate to Canada for breeding. 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) are also limiting factors for the species.

Wetland destruction and degradation

Loss of wetland habitat as a result of human activities 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 Quebec, 80% of wetlands along the St. Lawrence River have been lost since European settlement (James, 1999; Painchaud and Villeneuve, 2003). Development up to the edge of marshes as well as fragmentation facilitates access to deeper portions of marshes by some mammalian predators[4], 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 also likely reduce the foraging success of a visual feeder such as the Least Bittern.

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 important since the species is known to bio-accumulate toxins in its eggs and feathers (Causey and Graves, 1969).

[4] Such predators are probably more abundant than they were 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 1950s, 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 the Least Bittern during crucial periods of reproduction (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 mostly occupy sites where water levels are stable during the breeding season, any dramatic change in water levels during this period is liable to affect the species negatively.

Prolonged periods of high water levels can reduce the extent of cattail marshes, both directly through flooding and indirectly by making conditions more favorable for other species such as Wild Rice (*Zizania palustris*) that are less suitable for nesting Least Bitterns (Sandilands and Campbell, 1988; Timmermans *et al*., 2008). Conversely, prolonged periods of relatively stable water levels may increase the density of cattail stands and eliminate open pools required by the species. Jobin *et al*. (2009) showed that the abundance of a Least Bittern population was reduced rapidly following a pronounced decrease of water depth due to a breach in an impounded wetland during the reproductive season followed by a rapid increase in abundance the following year when water depth 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 interventions. Purple Loosestrife (*Lythrum salicaria*), Reed Canary Grass (*Phalaris arundinacea*), European Common Reed (*Phragmites autralis spp. australis*), Flowering Rush *(Butomus umbellatus*) as well as a hybrid cattail (*Typha* x *glauca*) in the Great Lakes region are crowding out native emergent plants (Lavoie *et al*., 2003; Hudon, 2004; Jobin, 2006; Jobin *et al*., 2007; Latendresse and Jobin, 2007; Wilcox *et al*., 2007). While the Least Bittern can breed in a variety of emergent plants, including stands of invasive species, they preferentially breed in cattails (Poole *et al*., 2009). Floating invasive plants (e.g., European Frog-bit [*Hydrocharis morsus-ranae*] and Water Chestnut [*Trapa natans*]), can also alter habitat structure namely by accelerating marsh succession to drier conditions that are suboptimal for feeding and breeding (Blossey *et al*., 2001).

Populations of invasive animals such as Common Carp (*Cyprinus carpio*) are increasing in wetlands occupied by the Least Bittern, especially in southern Ontario and Quebec. In addition to their deleterious effects on ecosystem function, they may impact the Least Bittern more directly when stirring up sediments as they forage thereby reducing water clarity (Wires *et al*., 2010).

Collisions with cars and man-made structures

Least Bitterns fly at low levels and migrate at night, two 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 case, 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 also been found dead along the Long Point (Ontario) causeway on a few occasions (Ashley and Robinson, 1996; J. McCracken personal communication). These incidents suggest that roads or structures built adjacent to suitable wetlands can cause mortality for birds moving between habitat patches or during migration.

Recreational activities

Although the Least Bittern can tolerate a certain level of human activity near wetlands used for breeding, including the occasional passage of small boats near their foraging areas (Poole *et al*., 2009), they seem to prefer nesting outside high density urban areas (Smith-Cartwright and Chow-Fraser, unpublished results). However, infrequent and unpredictable disturbance may be as disruptive to the Least Bittern 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 although the importance of this threat has not been evaluated. Finally, direct impacts such as waves from motorized watercrafts can erode wetland edges and possibly flood or upset nests.

Climate change

Climate change has the potential of having unpredictable, widespread and severe effects on the Least Bittern and its 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 Bitterns' distribution in Canada. For example, the reduction of water levels caused by elevated temperatures will likely reduce the area of wetlands, and lead to reduced prey abundance (Mortsch *et al*., 2007; Wires *et al*., 2010). Alternatively, a potential northward expansion by the species could favor the use of numerous wetlands in the boreal forest although the quality of these habitats for breeding purposes would have to be assessed.

Diseases

The impact of various diseases and parasitism have been poorly studied in Least Bittern populations. Presumably, individuals are susceptible to diseases known to affect other wading birds ((Friend and Franson, 1999; Wires *et al*., 2010). The Least Bittern is also 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 population size and area of occupancy in Canada. These objectives are considered possible in many parts of the range where adequate, yet currently unoccupied, breeding, foraging, post-breeding dispersal, moulting and migration stopover habitat is available or could be restored. Part of 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 or completed in Canada since 2000:

- Literature reviews of all available information on the Least Bittern (McConnell, 2004; Gray Owl Environmental Inc., 2009);
- National Least Bittern survey protocol for the breeding season (Jobin *et al*., 2011 a,b);
- 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 southern Manitoba (2003-2008; R. Bazin pers. comm.; Hay, 2006), in Ontario (2001-2012; Bowles, 2002; Desy, 2007; Meyer and Friis, 2008) and in Quebec (2004-2013; Jobin, 2006; Jobin *et al*., 2007; Latendresse and Jobin, 2007; Jobin and Giguère, 2009);
- Directed surveys in National Wildlife Areas in Ontario and Quebec;
- 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 Quebec since 2004; Monitoring of Least Bittern presence in several wetlands in southern Quebec as part of the avian species at risk annual breeding sites monitoring (SOS-POP); Prairies and Parkland pilot Marsh Monitoring Program since 2008;
- Creation of the Samuel-de-Champlain biodiversity reserve (*Natural heritage conservation Act of Quebec*; R.S.Q. c. C-61.01) which will preserve 487 ha of wetlands on the shores of the Richelieu River near the Quebec/USA border. This will

include two of the Least Bittern critical habitat units (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 and the Great Lakes Sustainability Fund;
- 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 for the Least Bittern.

Threats or Limiting Factor	Broad Strategy to Recovery	Priority	General Description of Research and Management Approaches
All	Stewardship and management of the species and its suitable habitat	High	• Apply stewardship measures and management tools (including legal protection) within the suitable habitat as well as in adjacent habitats in order to reduce the impact of various threats • Maintain or implement management approaches aiming at stabilizing or increasing the population size and the area of occupancy
Knowledge gaps	Surveys and monitoring	High	• Develop a national monitoring strategy that includes : 1. Least Bittern surveys within critical habitat, in habitats with known occupancy but that are not yet identified as critical habitat, as well as in habitats that are potentially suitable for all life stages in Canada 2. Standardized techniques to determine population density, size and trend 3. Standardized techniques to study dispersal and migration routes 4. Monitoring wetland habitat characteristics as well as adjacent habitats
Wetland destruction; Impaired water quality; Regulated water levels; Knowledge gaps	Research	High	• Determine key habitat attributes for all life cycle stages in Canada and how they vary spatially and temporally
All	Communication and Partnerships	Medium	• Develop and implement a communication strategy with partner organizations, special interest groups, landowners and the general public

7. Critical Habitat

7.1. Identification of the Species' Critical Habitat

Critical habitat is partially identified for the Least Bittern in this recovery strategy. 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. A schedule of studies (section 7.2) is proposed to complete the identification of critical habitat.

The identification of critical habitat is based on two aspects: habitat suitability and habitat occupancy.

7.1.1. Habitat Suitability

Habitat suitability refers to the attributes of habitats in which individuals may carry out breeding activities (e.g., courtship, territory defense, nesting). The biophysical attributes of suitable Least Bittern breeding habitat include:

- permanent wetlands[5] (marshes and shrubby swamps within the boundaries of the high-water mark), **AND**
- tall and robust emergent herbaceous and/or woody vegetation interspersed with areas of open water (hemi-marsh conditions), **AND**
- Water level fluctuations close to those of a natural regime

Based on knowledge related to the average maximum movements during the breeding season (~400 m according to Bogner and Baldassarre, 2002b; 2,000 m according to Griffin *et al*., 2009), the suitable habitat within a 500 m radius was selected as representative of the area used by a Least Bittern individual or pair.

7.1.2. Habitat Occupancy

Habitat occupancy relates to areas of suitable habitat that have documented use for breeding purposes in one or multiple years. Confirmed breeding records (see Appendix A for definitions) constitute the highest indication of habitat occupancy and therefore of the presence of suitable habitat. However, since confirming breeding is difficult for this secretive species (Tozer *et al*., 2007), records of multiple probable breeders in a single year or probable breeders in multiple years can also be used as indicators of habitat suitability, in particular as a demonstration of fidelity to specific wetlands. The remaining records of breeding activities (e.g., possible breeders) were not considered as sufficient indicators of the suitability of the habitat for

[5] Permanent wetlands include naturally occurring wetlands as well as artificial wetlands managed for conservation purposes.

reproduction since the Least Bittern may use some wetlands sporadically (e.g., for movements) or for non-reproductive purposes.

Given that wetland habitats are dynamic throughout the Canadian range, recent information may be more reliable for evaluating suitable habitat and Least Bittern occupancy. In light of this, the selection of records dating back a maximum of 10 years from when the recovery strategy was being prepared (i.e. starting in 2001) has been identified as appropriate. Furthermore, 2001 was the first year of data collection for the second Ontario Breeding Bird Atlas, which enabled confirmation of the continued use of individual wetlands (fidelity) at the heart of the species' range in Canada. Records older than 2001 will need to be validated to determine the continued presence of suitable habitat and current occupancy by the Least Bittern (see section 7.2).

7.1.3. Critical Habitat Identification for the Least Bittern

Critical habitat is identified in this recovery strategy as the suitable habitat within 500 m of coordinates corresponding to the following minimum breeding activity:

- one record of confirmed breeding since 2001; **OR**
- two records of probable breeding in any single year since 2001; **OR**
- one record of probable breeding in each of two separate years within a 5-year floating window[6] since 2001

Depending on its area, structure and the nature of observed reproductive activities, a wetland can be identified as a single critical habitat unit or can include multiple units. Overlapping units are merged together to form a single larger unit.

Using these criteria, 115 critical habitat units containing up to 17 102 ha of Least Bittern critical habitat have been identified (see Appendix B), including 10 in Manitoba (1,856 ha), 54 in Ontario (10,740 ha), 48 in Quebec (4,615 ha) and 3 in New Brunswick (137 ha). Within a critical habitat unit, any man-made structure (e.g., roads, wharves, powerline poles) or areas (e.g., ploughed agricultural land, deep open water) that do not possess the biophysical attributes of suitable habitat are not identified as critical habitat.

7.1.4 Non-critical Habitats

The Least Bittern may occasionally nest in non-traditional habitats (e.g., roadside ditches, sewage lagoons) that are anthropogenic in nature and not managed for conservation purposes. These habitats do not provide sustained, high quality breeding conditions given that they may be the object of frequent interventions that could negatively affect breeding individuals. Consequently, they are not identified as critical habitat under SARA, even if breeding is confirmed. However, the general prohibitions

[6] This criterion is used by the Quebec Conservation Data Center (NatureServe network) and was recommended by the National Least Bittern Recovery Team in 2009 as the minimum requirement to indicate site fidelity.

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 remain in effect.

7.2. Schedule of Studies to Identify Critical Habitat

Table 5. Schedule of Studies.

Description of Activity	Rationale	Timeline
Conduct surveys in wetlands where: - Breeding has been confirmed between 1991-2000[a]; - Least Bitterns are present but the criteria to identify critical habitat have not been met since 1991; - There is suitable habitat, but no standardized surveys have been conducted since 1991.	Additional critical habitat units identified, particularly in more remote areas	2014-2019
Characterize foraging, post-breeding dispersal, moulting and migration stopover habitats in Canada and survey Least Bitterns within them in the appropriate periods of the year	Additional critical habitat units identified; Needed to conserve the species in throughout its life cycle in Canada	2014-2019

[a] The 1991 year has been selected based on the fact that Conservation Data Centres 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 (Government of Canada, 2009). 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. Examples of activities likely to result in the destruction of critical habitat for the Least Bittern are shown in Table 6.

Table 6. Examples of Activities Likely to Destroy Least Bittern Critical Habitat.

Description of the Activity*	Description of the Effect (biophysical attributes or other)	Scale of Activity Likely to Destroy Critical Habitat**			Timing Considerations
		Site	Area	Landscape	
Infilling, excavation or draining of wetlands (e.g., infrastructure development and construction, superficial mineral extraction; underground mineral/hydrocarbon extraction, dredging and channelization)	- Direct loss of wetland habitats; - Changes to the hydrological regime (e.g., water levels); - Creation of unsuitable conditions for the growth of wetland vegetation; - Introduction of exotic or invasive species	X	X		Applicable at all times
Activities that generate soil run-off and increased water turbidity or nutrient influx (e.g., cultivating the land next to a wetland without proper vegetation buffers)	- Proliferation of vegetation associated with eutrophication (floating or emergent); - Habitat alteration (e.g., increased turbidity reduces foraging success)	X	X		Applicable at all times
Introduction of invasive vegetation, fish and invertebrate species	- Habitat alteration (e.g., increased turbidity or changes in prey availability reduces foraging success); - Changes to the conditions for nest building (e.g., structure and/or composition of the vegetation)	X			Applicable at all times
Repeated use of vehicles and motor boats within or close to wetlands	- Habitat degradation (via erosion) - Generation of waves that can flood nests (reduced suitable breeding habitat)	X			Applicable at all times in relation to erosion ; Applicable during the breeding period in relation to the flooding of nest component
Prescribed burns or other means of natural vegetation removal within wetland habitats	- Removal of elements that are used for nest construction or other activities (e.g., foraging)	X			Can be conducted when individuals have left the habitat (after the fall migration)

Description of the Activity*	Description of the Effect (biophysical attributes or other)	Scale of Activity Likely to Destroy Critical Habitat**			Timing Considerations
Deposition of deleterious substances (including snow), either directly (in water) or indirectly (upstream, soil)	- Reduced water quality (e.g., turbidity, pollution) decreases prey availability and foraging success; - Bioaccumulation of toxic substances in feathers and eggs	X	X		Applicable at all times
Construction of infrastructures (e.g., roads, houses, boat ramps) which increase the access to critical habitat	- Disturbance of breeding activities by an increased use of wetlands (reduced suitable breeding habitat); - Can increase predation by facilitating access to nests; - Increased occurrence of other threats (e.g., collisions)	X	X		Applicable at all times
Presence of livestock that removes or tramples the vegetation	- Destruction of emergent aquatic vegetation (directly and via erosion and soil compaction)	X			Applicable at all times

* Activities required to manage, inspect and maintain existing infrastructures that are not critical habitat but whose footprints may be within or adjacent to critical habitat units are not examples of activities likely to result in the destruction of critical habitat provided that they are carried out in a manner consistent with Least Bittern critical habitat conservation. Furthermore, management of wetlands for wildlife conservation purposes does not typically result in destruction of critical habitat if activities take place when the individuals are not present in the habitat (after migration). For additional information, communicate with Environment Canada – Canadian Wildlife Service at : enviroinfo@ec.gc.ca.

** Site : anticipated effect close to 1 x 1 km; Area : 10 x 10 km; Landscape : 100 x 100 km

8. Measuring progress

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives.

1) the population size of Least Bittern is maintained and, where possible, increased;
2) the area of occupancy is maintained and, where possible, increased.

9. Statement on action plans

One or more action plans associated with the recovery strategy will be elaborated in the coming years. They will be posted on the Species at Risk Public Registry by 2019.

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Appendix A: Standard Breeding Bird Atlas Codes

Atlas code*	Description
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. Atlas codes for possible breeding are not presented here.

Appendix B: Critical habitat for the Least Bittern in Canada

Table B-1. Description of the 10 x 10 km Standardized UTM Grid, Quarter Sections and Critical Habitat Units for the Least Bittern in Manitoba.

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates [2]		Quarter Sections[3] Containing Critical Habitat		Critical Habitat Unit Area (ha)[4]	Description	Land Tenure[5]
		Easting	Northing					
Brokenhead Swamp	14PA82	680000	5520000	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	111	Located in a freshwater wetland east of PR302, north of Hwy 1 and south of Hwy 15 near the town of Ross	Non federal
Buffalo Lake	14NB92	590000	5620000	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	241	Located in a freshwater wetland north of PR419, east of PR512 and north of Hwy 17 near the town of Chatfield	Non federal
Fish Lake	14PB12	610000	5620000	SW-30-20-02-E1 NW-30-20-02-E1	SE-25-20-01-E1 NE-25-20-01-E1	131	Located in a freshwater wetland east of Hwy 17 and west of Hwy 7 near the town of Meleb	Non federal
Little Birch Lake West	14NB66	560000	5660000	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	104	Located in a freshwater wetland south of PR325 and north of Sleeve Lake near the town of Ashern	Non federal
Little Birch Lake East	14NB66	560000	5660000	SE-12-25-05-W1 SW-12-25-05-W1	NE-01-25-05-W1 NW-01-25-05-W1	79	Located in a freshwater wetland south of PR325 and north of Sleeve Lake near the town of Ashern	Non federal
Rat River Swamp West	14PV65	660000	5450000	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	693	Located in a freshwater wetland east of Hwy 59, west of PR302 and north of the Vita Drain along the Rat River near the towns of Rosa and Zhoda	Non federal

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates [2]		Quarter Sections[3] Containing Critical Habitat		Critical Habitat Unit Area (ha)[4]	Description	Land Tenure[5]
		Easting	Northing					
Rat River Swamp Centre	14PV65	660000	5450000	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	125	Located in a freshwater wetland east of Hwy 59, west of PR302 and north of the Vita Drain along the Rat River near the towns of Rosa and Zhoda	Non federal
Rat River Swamp East	14PV75 14PV76	670000 670000	5450000 5460000	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	190	Located in a freshwater wetland east of Hwy 59, west of PR302 and north of the Vita Drain along the Rat River near the towns of Rosa and Zhoda	Non federal
Sleeve Lake	14NB66	560000	5660000	NW-19-24-04-W1 NE-19-24-04-W1	SE-30-24-04-W1 SW-30-24-04-W1	79	Located in a freshwater wetland south of PR325 and south of Little Birch Lake near the town of Ashern	Non federal
Unnamed Lake (locally called Little Sleeve Lake)	14NB66	560000	5660000	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	103	Located in a freshwater wetland south of PR325 between Little Birch Lake and Sleeve Lake near the town of Ashern	Non federal
					Total 1,856 in 10 critical habitat units			

[1] Grid ID is based on the standard Universal Transverse Mercator (UTM) Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098), where the first two digits represent the UTM Zone, the following two letters indicate the 100 x 100 km standardized UTM grid, followed by two digits to represent the 10 x 10 km standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See http://www.bsc-eoc.org/ for more information on breeding bird atlases).

[2] The listed coordinates represent the southwest corner of the 10 x 10 km standardized UTM grid containing all or a portion of the critical habitat unit. The coordinates may not fall within critical habitat and are provided as a general location only.

[3] 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 x 9.7 km (6 x 6 mi) and are further divided into thirty-six sections, each about 1.6 x 1.6 km (1 x 1 mi). In turn, each section is divided into four quarter sections: southeast, southwest, northwest and northeast, which are 0.8 x 0.8 km (0.5 x 0.5 mi). 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).

[4] The area presented is that of the critical habitat unit boundary (rounded up to the nearest 1 ha); an approximation based on a maximum extent that may contain critical habitat. The actual area of critical habitat may be much less depending on where the criteria for critical habitat are met. Refer to section 7.1 for a description of how critical habitat within these areas is defined. Field verification may be required to determine the precise area of critical habitat.

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

Table B-2. Description of the 10 x 10 km Standardized UTM Grid and Critical Habitat Units for the Least Bittern in Ontario.

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates [2]		Critical Habitat Unit Area (ha)[3]	Description	Land Tenure[4]
		Easting	Northing			
Rainy Lake	15VP99	490000	5390000	104	Rainy Lake, District of Rainy River	Non federal
Lighthouse Point Provincial Nature Reserve	17LG63	360000	4630000	84	Lighthouse Point Provincial Park, Essex County	Non federal
Hillman Marsh Conservation Area	17LG75	370000	4650000	154	Hillman Marsh Conservation Area, Essex County	Non federal
Wheatley East Two Creeks	17LG85 17LG86	380000 380000	4650000 4660000	84	Wheatley Provincial Park, Municipality of Chatham-Kent	Non federal
St. Clair NWA Marsh Complex - St. Clair Unit	17LG89	380000	4690000	712	St. Clair NWA - St. Clair Unit, Municipality of Chatham-Kent	Federal and Non federal
St. Clair Marsh Complex	17LH80	380000	4700000	155	Middle section St. Clair Marsh, Municipality of Chatham-Kent	Non federal
Mitchell's Bay, Lake St. Clair	17LH80	380000	4700000	141	Mitchell's Bay, Lake St. Clair, Municipality of Chatham-Kent	Non federal
St. Clair NWA Marsh Complex - Bear Creek Unit	17LH80 17LH81	380000 380000	4700000 4710000	300	St. Clair NWA - Bear Creek Unit, Municipality of Chatham-Kent	Federal and Non federal
Rondeau Provincial Park 1	17MG28	420000	4680000	165	West side of Rondeau Provincial Park, Municipality of Chatham-Kent	Non federal
Rondeau Provincial Park 2	17MG28 17MG38	420000 430000	4680000 4680000	83	Rondeau Provincial Park, Municipality of Chatham-Kent	Non federal
Hullett Marsh Complex	17MJ63	460000	4830000	82	East of Clinton, Huron County	Non federal
Rankin River Wetland	17MK76 17MK86	470000 480000	4960000 4960000	92	South of Sky Lake Management Area, Bruce County	Non federal

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates [2]		Critical Habitat Unit Area (ha)[3]	Description	Land Tenure[4]
		Easting	Northing			
Big Creek NWA, Crown Marsh, Long Point Provincial Park	17NH41 17NH51	540000 550000	4710000 4710000	1281	West end of Long Point Sandspit, Norfolk County	Federal and Non federal
Unnamed Wetland - Haldimand-Norfolk County	17NH41	540000	4710000	83	Wetland east of Long Point Road, Norfolk County and portion of wetland in Big Creek NWA -Big Creek Unit	Federal and Non federal
Little Rice Bay Marsh - Thoroughfare Unit, Long Point NWA	17NH51	550000	4710000	141	Little Rice Bay Marsh area of Thoroughfare Unit, Norfolk County	Federal and Non federal
Big Rice Bay Marsh - Thoroughfare Unit, Long Point NWA	17NH51	550000	4710000	418	Big Rice Bay Marsh area of Thoroughfare Unit, Norfolk County	Federal and Non federal
Long Point Provincial Park	17NH51	550000	4710000	119	Wetland in Long Point Provincial Park, Norfolk County with portion extending into Long Point NWA-Thoroughfare Unit	Federal and Non federal
Indian Creek Wetland	17NH52	550000	4720000	1234	West of Turkey Point, Norfolk County	Non federal
Long Point Unit - Long Point NWA	17NH61 17NH71	560000 570000	4710000 4710000	1068	Along north shoreline of Long Point Unit, Norfolk County	Federal
Luther Marsh	17NJ46	540000	4860000	82	East part of Luther Marsh Conservation Area, Wellington County	Non federal
Arkell - Corwhin Wetland Complex	17NJ62 17NJ72	560000 570000	4820000 4820000	82	South of Eden Mills, Regional Municipality of Halton	Non federal
Tiny Marsh (Ti7)	17NK83	580000	4930000	310	Northeast of Allenwood, Simcoe County	Non federal
Wye Marsh (TA2)	17NK84 17NK85 17NK95	580000 580000 590000	4940000 4950000 4950000	323	Southwest section of Wye Marsh, Simcoe County	Non federal
Sturgeon Bay Marsh	17NK95 17PK05	590000 600000	4950000 4950000	104	Southwest end of the Trent Severn Waterway, Simcoe County	Federal and Non federal

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates [2]		Critical Habitat Unit Area (ha)[3]	Description	Land Tenure[4]
		Easting	Northing			
Cache Bay Wetland	17NM73	570000	5130000	123	Cache Bay Wetland, District Municipality of Nipissing	Non federal
Beaverton River Wetland Complex	17PJ59	650000	4890000	82	Beaverton River Wetland Complex, Regional Municipality of Durham	Non federal
Matchedash Bay Wetland (SE11)	17PK05	600000	4950000	115	North end of Matchedash Bay Wetland, Simcoe County	Non federal
Wenona Marsh	17PK26	620000	4960000	81	South of Gravenhurst, District Municipality of Muskoka	Non federal
Sturgeon Lake No. 26	17PK71 17PK72	670000 670000	4910000 4920000	190	North of Lindsay, City of Kawartha Lakes	Federal and Non federal
Miller Creek Wildlife Area	17QK11	710000	4910000	82	Miller Creek Wildlife Area, County of Peterborough	Non federal
Snelgrove Brook	17QK11 17QK12	710000 710000	4910000 4920000	82	East of Bridgenorth, County of Peterborough	Non federal
Woodview Swamp	17QK21	720000	4910000	82	West of Jermyn, County of Peterborough	Non federal
Birdsalls Creek	17QK30	730000	4900000	82	South of Westwood, County of Peterborough	Non federal
Presqu'ile Bay Marsh 1	18TP87	270000	4870000	329	Middle section of Presqu'ile Provincial Park, Northumberland County	Non federal
Presqu'ile Bay Marsh 2	18TP77 18TP87	270000 280000	4870000 4870000	138	North end of Presqu'ile Provincial Park, Northumberland County	Non federal
Presqu'ile Bay Marsh 3	18TP87	280000	4870000	189	Presqu'ile Bay Marshes, Northumberland County	Non federal
Unnamed Wetland - City of Quinte West	18TP99	290000	4890000	92	Northeast of Johnstown, City of Quinte West	Non federal
Hoards Creek	18TQ80	280000	4900000	82	South of Hoards, Northumberland County	Federal and Non federal

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates [2]		Critical Habitat Unit Area (ha)[3]	Description	Land Tenure[4]
		Easting	Northing			
Sawguin Creek Marsh	18UP18	310000	4880000	125	North of Ameliasburg, City of Prince Edward County	Non federal
Sandbanks Provincial Park	18UP26	320000	4860000	82	Southeast section of Sandbank Provincial Park, City of Prince Edward County	Non federal
Marysville Creek Wetland	18UP29	320000	4890000	131	East of Big Bay, Tyendinaga Mohawk Territory	Federal
Unnamed Wetland 1 - City of Prince Edward County	18UP35 18UP36	330000 330000	4850000 4860000	101	East of Point Petre Militaries Reserves Site, City of Prince Edward County	Non federal
Unnamed Wetland 2 - City of Prince Edward County	18UP39	330000	4890000	82	North of Solmesville, City of Prince Edward County	Non federal
Big Sand Bay	18UP46	340000	4860000	146	West of Prince Edward Point National Wildlife Area, City of Prince Edward County	Non federal
Ross Lake Wetland	18UQ01	300000	4910000	103	North of Madoc Junction, Hastings County	Non federal
Parks Creek	18UQ10	310000	4900000	82	South of Halston, Hastings County	Non federal
Thrashers Corners Wetland	18UQ10	310000	4900000	119	Northeast of Thurlow, City of Belleville	Non federal
Hutton Creek Wetland	18VQ15 18VQ16	410000 410000	4950000 4960000	81	West of Motts Mills, United Counties of Leeds and Grenville	Non federal
The Swale Wetland	18VQ17	410000	4970000	81	West of Smiths Falls, Lanark County	Federal and Non federal
Mud Creek	18VQ35	430000	4950000	138	West of North Augusta, United Counties of Stormont, Dundas and Glengarry	Non federal
Upper Canada Migratory Bird Sanctuary	18VQ97	490000	4970000	81	Upper Canada Migratory Bird Sanctuary, United Counties of Stormont, Dundas and Glengarry	Non federal

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates [2]		Critical Habitat Unit Area (ha)[3]	Description	Land Tenure[4]
		Easting	Northing			
Mississippi River Snye	18VR03	400000	5030000	81	South of Fitzroy Harbour, City of Ottawa	Non federal
Cooper Marsh	18WQ39	530000	4990000	81	West of South Lancaster, United Counties of Stormont, Dundas and Glengarry	Non federal
Loch Garry	18WR21	520000	5010000	81	South of Greenfield, United Counties of Stormont, Dundas and Glengarry	Non federal
			Total 10,745 ha in 54 critical habitat units			

[1] Grid ID is based on the standard Universal Transverse Mercator (UTM) Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098), where the first two digits represent the UTM Zone, the following two letters indicate the 100 x 100 km standardized UTM grid, followed by two digits to represent the 10 x 10 km standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See http://www.bsc-eoc.org/ for more information on breeding bird atlases).
[2] The listed coordinates represent the southwest corner of the 10 x 10 km standardized UTM grid containing all or a portion of the critical habitat unit. The coordinates may not fall within critical habitat and are provided as a general location only.
[3] The area presented is that of the critical habitat unit boundary (rounded up to the nearest 1 ha); an approximation based on a maximum extent that may contain critical habitat. The actual area of critical habitat may be much less depending on where the criteria for critical habitat are met. Refer to section 7.1 for a description of how critical habitat within these areas is defined. Field verification may be required to determine the precise area of critical habitat.
[4] Land Tenure is provided as an approximation of land ownership of the critical habitat unit and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land unit information.

Table B-3. Description of the 10 x 10 km Standardized UTM Grid and Critical Habitat Units for the Least Bittern in Quebec.

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates[2]		Critical Habitat Unit Area (ha)[3]	Description	Land Tenure[4]
		Easting	Northing			
Marais du Chemin du Lac Curley	18VR05	400000	5050000	79	North of the city of Gatineau; within Gatineau Park	Federal
Lac La Pêche	18VR05	400000	5050000	12	North of the city of Gatineau; within Gatineau Park	Federal
North Onslow (sud-ouest)	18VR05	400000	5050000	79	North of the city of Gatineau; within Gatineau Park	Federal
Marais du Lac Brown	18VR25	420000	5050000	79	West of Highway 5, near Wakefield; within Gatineau Park	Federal
Marais McLaurin Ouest	18VR53	450000	5030000	152	East of the city of Gatineau	Non federal
Marais McLaurin Est	18VR53	450000	5030000	220	East of the city of Gatineau	Non federal
Marais des Laîches	18VR53	450000	5030000	79	East of the city of Gatineau	Non federal
Marais aux Grenouillettes	18VR53 18VR63 18VR64	450000 460000 460000	5030000 5030000 5040000	40	Managed wetland East of the city of Gatineau	Non federal
Marais aux Massettes	18VR74	470000	5040000	99	Managed wetland East of the city of Gatineau	Non federal
Marais aux rubaniers	18VR94	490000	5040000	79	South of the city of Plaisance	Non federal
La Grande Baie (parc provincial d'Oka)	18WR73	570000	5030000	79	In Oka provincial Park	Non federal

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates[2]		Critical Habitat Unit Area (ha)[3]	Description	Land Tenure[4]
		Easting	Northing			
Parc-nature du Bois-de-l'île-Bizard	18WR84	580000	5040000	12	Regional park in Montreal	Non federal
Grand marais de Beauharnois	18WR81	580000	5010000	102	Managed wetland in Beauharnois	Non federal
Marais de Beauharnois N.-O. et S.-O. – Étang 1	18WR81	580000	5010000	79	Managed wetland in Beauharnois	Non federal
Marais de Beauharnois N.-O. et S.-O. – Étang 2	18WR81	580000	5010000	159	Managed wetland in Beauharnois	Non federal
Île Saint-Bernard	18WR92	590000	5020000	213	Managed wetland in Chateauguay	Non federal
Ruisseau Saint-Jean	18WR92	590000	5020000	23	West of Chateauguay	Non federal
Île des Sœurs	18XR13	610000	5030000	8	On Nun's island in the city of Montréal	Non federal
Marais du Bois 440	18XR05	600000	5050000	9	Wetland in the city of Laval	Non federal
Île aux Fermiers	18XR25	620000	5050000	133	On an island East of Montréal	Federal
Rivière aux Pins (La Frayère)	18XR25	620000	5050000	12	North of Boucherville	Non federal
Rue Alfred (Saint-Amable)	18XR25 18XR35	620000 630000	5050000 5050000	158	At the end of Alfred street in Saint-Amable	Non federal
Île Tourte Blanche	18XR15	610000	5050000	3	West of Parc national des Îles de Boucherville	Federal

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates[2]		Critical Habitat Unit Area (ha)[3]	Description	Land Tenure[4]
		Easting	Northing			
Pointe à la Meule	18XR30 18XR31	630000 630000	5000000 5010000	118	Along the Richelieu river; south of Saint-Jean-sur-Richelieu	Non federal
Baie McGillivray	18XR30	630000	5000000	102	Along the Richelieu river; East of l'Île aux noix	Non federal
Rivière du Sud - A	18XQ39	630000	4990000	328	East of the Richelieu River near the Quebec/USA border; Downstream portion of the river	Non federal
Rivière du Sud - B	18XQ49	640000	4990000	130	East of the Richelieu River near the Quebec/USA border; Upstream portion of the river	Non federal
Anse à l'Esturgeon	18XQ39	630000	4990000	118	Along the Richelieu river; south of l'Île aux noix	Non federal
Rivière Richelieu (frontière)	18XQ28 18XQ38	620000 630000	4980000 4980000	94	Along the Richelieu river at the Quebec/USA border	Non federal
Baie Missisquoi (rivière aux Brochets)	18XQ49 18XQ59	640000 650000	4990000 4990000	170	North of Lake Champlain	Non federal
Ruisseau Black (La Swamp)	18XQ49	640000	4990000	122	North of Lake Champlain	Non federal
Étang Streit (Refuge d'oiseaux migrateurs de Phillipsburg)	18XQ58	650000	4980000	79	Philipsburg Migratory Bird Sanctuary, east of Lake Champlain	Non federal
Farnham (base militaire 7B)	18XR51 18XR52	650000 650000	5010000 5020000	10	North of Farnham	Federal
Farnham (base militaire 6B)	18XR51	650000	5010000	17	North of Farnham	Federal

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates[2]		Critical Habitat Unit Area (ha)[3]	Description	Land Tenure[4]
		Easting	Northing			
Marais de l'Estriade	18XR82 18XR83	680000 680000	5020000 5030000	79	East of Granby	Non federal
Marais de la rivière aux cerises	18YR21	720000	5010000	140	In Magog	Non federal
Marais Réal-D. Carbonneau	19BL73	270000	5030000	11	Managed wetland in Sherbrooke	Non federal
Île du Moine	18XS50	650000	5100000	122	Managed wetland on an island East Sorel-Tracy	Federal / Non federal
Baie Lavallière	18XS50	650000	5100000	91	Northern portion of the wetland East of Sorel-Tracy	Non federal
Île des Barques	18XS50	650000	5100000	51	Managed wetland on an island East of Sorel-Tracy	Federal
Baie Saint-François	18XS50 18XS60	650000 660000	5100000 5100000	367	East of Sorel-Tracy	Non federal
Rivière Saint-Joseph	18XR39	630000	5090000	143	Southwest of Berthierville	Non federal
Saint-Barthélémy (bassin Ouest)	18XS51	650000	5110000	18	Managed wetland south of Saint-Barthélémy	Non federal
Saint-Barthélémy (bassin Est)	18XS51	650000	5110000	27	Managed wetland south of Saint-Barthélémy	Non federal
Marais de la Commune	18XS71	670000	5110000	31	Managed wetland East of Sorel-Tracy	Non federal
Marais aménagés du refuge d'oiseaux migrateurs de	18XS71	670000	5110000	317	Managed wetlands West of Nicolet within Nicolet Migratory Bird Sanctuary	Federal / Non federal

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	UTM Grid Coordinates[2]		Critical Habitat Unit Area (ha)[3]	Description	Land Tenure[4]
		Easting	Northing			
Nicolet						
Marais Provencher	19CM07	300000	5170000	19	Managed wetland in Neuville	Non federal
Étang de la Grande Ferme (Réserve nationale de faune du cap Tourmente)	19CN61	360000	5210000	3	Managed wetland in Cap Tourmente National Wildlife Area	Federal
		Total of 4,615 ha in 48 critical habitat units				

[1] Grid ID is based on the standard Universal Transverse Mercator (UTM) Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098), where the first two digits represent the UTM Zone, the following two letters indicate the 100 x 100 km standardized UTM grid, followed by two digits to represent the 10 x 10 km standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See http://www.bsc-eoc.org/ for more information on breeding bird atlases).

[2] The listed coordinates represent the southwest corner of the 10 x 10 km standardized UTM grid containing all or a portion of the critical habitat unit. The coordinates may not fall within critical habitat and are provided as a general location only.

[3] The area presented is that of the critical habitat unit boundary (rounded up to the nearest 1 ha); an approximation based on a maximum extent that may contain critical habitat. The actual area of critical habitat may be much less depending on where the criteria for critical habitat are met. Refer to section 7.1 for a description of how critical habitat within these areas is defined. Field verification may be required to determine the precise area of critical habitat.

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

Table B-4. Description of the 10 x 10 km Standardized UTM Grid, Atlas Blocks and Critical Habitat Units for the Least Bittern in New Brunswick.

Name of the Critical Habitat Unit	10 x 10 km UTM Grid ID[1]	New Brunswick Atlas Block Reference[2]	UTM Grid Coordinates[3]		Critical Habitat Unit Area (ha)[4]	Description	Land Tenure[5]
			Easting	Northing			
St. George's Marsh	19FL70 19FK79	NB Atlas p. 90 square B3	670000 670000	5000000 4990000	38	The St. George marsh is located in St. George and borders the Trans Canada highway	Non federal
Germantown Marsh (Shepody National Wildlife Area)	20LR66	NB Atlas p. 82 square C1	360000	5060000	20	The two northern most controlled water level impoundments (A and A-1) east of the Shepody River within the north east corner of the Germantown Marsh unit (NB Atlas p. 82, Square C1) within the Shepody National Wildlife Area	Federal
Bell Marsh	20LS50	NB Atlas p. 65 squares B4, B5	350000	5100000	79	The Bell Marsh borders the north shore of the Petitcodiac river and is situated south of Marsh Junction near Moncton	Non federal
			Total of 137 ha in 3 critical habitat units				

[1] Grid ID is based on the standard Universal Transverse Mercator (UTM) Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098), where the first two digits represent the UTM Zone, the following two letters indicate the 100 x 100 km standardized UTM grid, followed by two digits to represent the 10 x 10 km standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See http://www.bsc-eoc.org/ for more information on breeding bird atlases).

[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] The listed coordinates represent the southwest corner of the 10 x 10 km standardized UTM grid containing all or a portion of the critical habitat unit. The coordinates may not fall within critical habitat and are provided as a general location only.

[4] The area presented is that of the critical habitat unit boundary (rounded up to the nearest 1 ha); an approximation based on a maximum extent that may contain critical habitat. The actual area of critical habitat may be much less depending on where the criteria for critical habitat are met. Refer to section 7.1 for a description of how critical habitat within these areas is defined. Field verification may be required to determine the precise area of critical habitat.

[5] Land Tenure is provided as an approximation of land ownership of the critical habitat unit and should be used for guidance purposes only. Accurate land tenure will require cross referencing critical habitat boundaries with surveyed land unit 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*[7]. 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 shallow 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 marshbirds habitat (Post and Seals, 2000: Tori *et al*., 2002; Rehm and Baldassarre, 2007).

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 (*Erimyzon sucetta*), Spotted Gar (*Lepisosteus oculatus*), Pugnose Shiner (*Notropis anogenus*)], turtles [Blanding's Turtle (*Emydoidea blandingii*), Spotted Turtle (*Clemmys guttata*)] and snakes (Eastern Foxsnake (*Pantherophis gloydi*)] 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.

[7] http://www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1