Photo: Joe Crowley

Spiny Softshell

(Apalone spinifera) in Ontario

Ontario Recovery Strategy Series

Draft

2019

Ministry of the Environment, Conservation and Parks

Ontario

About the Ontario Recovery Strategy Series

This series presents the collection of recovery strategies that are prepared or adopted as advice to the Province of Ontario on the recommended approach to recover species at risk. The Province ensures the preparation of recovery strategies to meet its commitments to recover species at risk under the *Endangered Species Act 2007* (ESA) and the Accord for the Protection of Species at Risk in Canada.

What is recovery?

Recovery of species at risk is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed, and threats are removed or reduced to improve the likelihood of a species' persistence in the wild.

What is a recovery strategy?

Under the ESA a recovery strategy provides the best available scientific knowledge on what is required to achieve recovery of a species. A recovery strategy outlines the habitat needs and the threats to the survival and recovery of the species. It also makes recommendations on the objectives for protection and recovery, the approaches to achieve those objectives, and the area that should be considered in the development of a habitat regulation. Sections 11 to 15 of the ESA outline the required content and timelines for developing recovery strategies published in this series.

Recovery strategies are required to be prepared for endangered and threatened species within one or two years respectively of the species being added to the Species at Risk in Ontario list. Recovery strategies are required to be prepared for extirpated species only if reintroduction is considered feasible.

What's next?

Nine months after the completion of a recovery strategy a government response statement will be published which summarizes the actions that the Government of Ontario intends to take in response to the strategy. The implementation of recovery strategies depends on the continued cooperation and actions of government agencies, individuals, communities, land users, and conservationists.

For more information

To learn more about species at risk recovery in Ontario, please visit the Ministry of Environment, Conservation and Parks Species at Risk webpage at: **www.ontario.ca/speciesatrisk**

Recommended citation

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Cover illustration: Photo by Joe Crowley

ISBN [*MECP will insert prior to final publication.*]

Declaration

The recovery strategy for the Spiny Softshell (*Apalone spinifera*) was developed in accordance with the requirements of the *Endangered Species Act, 2007* (ESA). This recovery strategy has been prepared as advice to the Government of Ontario, other responsible jurisdictions and the many different constituencies that may be involved in recovering the species.

The recovery strategy does not necessarily represent the views of all individuals who provided advice or contributed to its preparation, or the official positions of the organizations with which the individuals are associated.

The recommended goals, objectives and recovery approaches identified in the strategy are based on the best available knowledge and are subject to revision as new information becomes available. Implementation of this strategy is subject to appropriations, priorities and budgetary constraints of the participating jurisdictions and organizations.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the advice set out in this strategy.

Responsible jurisdictions

Ministry of the Environment, Conservation and Parks
Environment and Climate Change Canada – Canadian Wildlife Service, Ontario
Parks Canada Agency

Executive summary

The *Endangered Species Act, 2007* (ESA) requires the Minister of the Environment, Conservation and Parks to ensure recovery strategies are prepared for all species listed as endangered or threatened on the Species at Risk in Ontario (SARO) List. Under the ESA, a recovery strategy may incorporate all or part of an existing plan that relates to the species.

The Spiny Softshell (*Apalone spinifera*) is listed as endangered on the SARO List. The species is listed as threatened under the federal *Species at Risk Act* (SARA). Environment and Climate Change Canada prepared the Recovery Strategy for the Spiny Softshell (*Apalone spinifera*) in Canada in 2018 to meet its requirements under the SARA. This recovery strategy is hereby adopted under the ESA. With the additions indicated below, the enclosed strategy meets all of the content requirements outlined in the ESA.

The Critical Habitat section of the federal recovery strategy provides an identification of critical habitat (as defined under the SARA). Identification of critical habitat is not a component of a recovery strategy prepared under the ESA. However, it is recommended that the approach used to identify critical habitat in the federal recovery strategy, along with any new scientific information pertaining to the Spiny Softshell and the areas it occupies, be considered when developing a habitat regulation under the ESA.

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1.0 Adoption of federal recovery strategy

The *Endangered Species Act, 2007* (ESA) requires the Minister of the Environment, Conservation and Parks to ensure recovery strategies are prepared for all species listed as endangered or threatened on the Species at Risk in Ontario (SARO) List. Under the ESA, a recovery strategy may incorporate all or part of an existing plan that relates to the species.

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1.1 Species assessment and classification

The following list is assessment and classification information for the Spiny Softshell (*Apalone spinifera*). Note: The glossary provides definitions for the abbreviations and technical terms in this document.

- SARO List Classification: Endangered
- SARO List History: Endangered (2017), Threatened (2004)
- COSEWIC Assessment History: Endangered (2016), Threatened (2002, 1991)
- SARA Schedule 1: Threatened (2005)
- Conservation Status Rankings: G-rank: G5; N-rank: N2; S-rank: S2

1.2 Area for consideration in developing a habitat regulation

Under the ESA, a recovery strategy must include a recommendation to the Minister of the Environment, Conservation and Parks on the area that should be considered in developing a habitat regulation. A habitat regulation is a legal instrument that prescribes an area that will be protected as the habitat of the species. The recommendation provided below will be one of many sources considered by the Minister, including information that may become newly available following completion of the recovery strategy, when developing the habitat regulation for this species.

The Critical Habitat section of the federal recovery strategy provides an identification of critical habitat (as defined under the SARA). Identification of critical habitat is not a component of a recovery strategy prepared under the ESA. However, it is recommended that the approach used to identify critical habitat in the federal recovery strategy, along with any new scientific information pertaining to the Spiny Softshell and

the areas it occupies, be considered when developing a habitat regulation under the ESA.

Glossary

Committee on the Status of Endangered Wildlife in Canada (COSEWIC): The committee established under section 14 of the Species at Risk Act that is responsible for assessing and classifying species at risk in Canada.

Committee on the Status of Species at Risk in Ontario (COSSARO): The committee established under section 3 of the *Endangered Species Act, 2007* that is responsible for assessing and classifying species at risk in Ontario.

Conservation status rank: A rank assigned to a species or ecological community that primarily conveys the degree of rarity of the species or community at the global (G), national (N) or subnational (S) level. These ranks, termed G-rank, N-rank and S-rank, are not legal designations. Ranks are determined by NatureServe and, in the case of Ontario's S-rank, by Ontario's Natural Heritage Information Centre. The conservation status of a species or ecosystem is designated by a number from 1 to 5, preceded by the letter G, N or S reflecting the appropriate geographic scale of the assessment. The numbers mean the following:

1 = critically imperilled
2 = imperilled
3 = vulnerable
4 = apparently secure
5 = secure
NR = not yet ranked

Endangered Species Act, 2007 (ESA): The provincial legislation that provides protection to species at risk in Ontario.

Species at Risk Act (SARA): The federal legislation that provides protection to species at risk in Canada. This Act establishes Schedule 1 as the legal list of wildlife species at risk. Schedules 2 and 3 contain lists of species that at the time the Act came into force needed to be reassessed. After species on Schedule 2 and 3 are reassessed and found to be at risk, they undergo the SARA listing process to be included in Schedule 1.

Species at Risk in Ontario (SARO) List: The regulation made under section 7 of the *Endangered Species Act, 2007* that provides the official status classification of species at risk in Ontario. This list was first published in 2004 as a policy and became a regulation in 2008.

List of abbreviations

COSEWIC: Committee on the Status of Endangered Wildlife in Canada
COSSARO: Committee on the Status of Species at Risk in Ontario
ESA: Ontario's *Endangered Species Act, 2007*

ISBN: International Standard Book Number
MECP: Ministry of the Environment, Conservation and Parks
MNRF: Ministry of Natural Resources and Forestry
SARA: Canada's *Species at Risk Act*
SARO List: Species at Risk in Ontario List

Appendix 1. Recovery strategy for the Spiny Softshell (*Apalone spinifera*) in Canada

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Spiny Softshell (*Apalone spinifera*) in Canada

Spiny Softshell

2018

Government of Canada
Gouvernement du Canada

Canada

Recommended citation:

Environment and Climate Change Canada. 2018. Recovery Strategy for the Spiny Softshell (*Apalone spinifera*) in Canada, *Species at Risk Act* Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. ix + 60 pp.

For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk (SAR) Public Registry[1].

Cover illustration: © Scott Gillingwater

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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 after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Spiny Softshell and has prepared this recovery strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the Province of Ontario (Ministry of Natural Resources and Forestry) and the Province of Quebec (Ministère des Forêts, de la Faune et des Parcs), as per section 39(1) of SARA.

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 and Climate Change 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 Spiny Softshell 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 and Climate Change 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.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area[3] be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that

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

[3] These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

Acknowledgments

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Numerous other individuals contributed to an earlier draft multi-turtle recovery strategy including Patrick Galois (Amphibia-Nature), Gabrielle Fortin (formerly Environment and Climate Change Canada, Canadian Wildlife Service – Quebec Region), David Seburn (Seburn Ecological Service), Scott Gillingwater (Upper Thames River Conservation Authority). Contributions from staff at the Ministry of Natural Resources and Forestry, Ministère des Forêts, de la Faune et des Parcs, Canadian Wildlife Service, and various universities and other organizations are also gratefully acknowledged. Further, recovery documents developed by the Équipe de rétablissement des tortues du Quebec and the Ontario Multi-Species Turtles at Risk Recovery Team formed the foundation for earlier drafts of this document and are gratefully acknowledged.

Acknowledgment and thanks are given to all other parties that provided advice and input used to help inform the development of this recovery strategy including various Indigenous organizations and individual citizens, and stakeholders who provided input and/or participated in consultation meetings.

Executive Summary

The Spiny Softshell (*Apalone spinifera*) is listed as Threatened on Schedule 1 of the *Species at Risk Act* (SARA). It is a medium to large-sized freshwater turtle which has a flat, leathery carapace[4] that is olive to tan in colour. Spiny Softshells are highly aquatic, and are typically associated with large water bodies such as rivers or lakes, although they can also inhabit streams, marshes, ponds, and oxbows[5]. The species moves onto land only to nest.

The species' range extends throughout the eastern half of North America, from the Great Lakes south to the Gulf of Mexico. In Canada, Spiny Softshells are found in southern Ontario and Quebec. It is estimated that roughly 1% of the global distribution of the species occurs in Canada.

The Canadian adult population of Spiny Softshell is estimated to be approximately 1,000 mature individuals in 35 local populations (14 extant, 7 historical, and 14 extirpated) [6]. Surveys of local populations in Ontario indicate that over the past 20 years there may have been population declines of up to 45% (COSEWIC 2016).

The main threats to the Canadian population of the Spiny Softshell are: shoreline and riverine habitat development/alteration; water level management; collisions with boats; illegal collection; human-subsidized predators[7]; exotic and invasive species; livestock farming and ranching; fishing by-catch; and disturbance from human activities. Other threats identified include contamination and nutrient loading and climate change. The Spiny Softshell is highly vulnerable to any increases in rates of mortality of adults or older juveniles since the species has delayed sexual maturity and a low reproductive rate.

There are unknowns regarding the feasibility of recovery of the Spiny Softshell. 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 long-term (i.e., 50 years) population and distribution objective is to maintain, and where necessary and feasible, increase the abundance of the Spiny Softshell to ensure the persistence of self-sustaining local populations where it occurs in Canada. The

[4] Carapace: The upper part of the turtle's shell (Harding 1997).
[5] Oxbow: a U-shaped bend in the course of a river; it might form a curved lake (oxbow lake) if the mainstream stops flowing around the loop of the bend.
[6] Local populations are equivalent to Element Occurrences (EOs) identified within NHIC 2012. Interpretations of local populations at the site level for permitted activities will need to be based on current knowledge, best available data and interpretations of project impacts on the precarious life cycle of Spiny Softshell Turtles. Permitted activities will follow the Population and Distribution objectives in Section 5 to maintain each extant local population in a self-sustaining state.
[7] Human-subsidized predators: Predators whose populations increase in response to low densities or absence of top predators and increased food and habitat availability from human sources (e.g., food handouts, garbage, crops, water sources or hiding cover).

medium term (i.e., around 10 to 15 years) sub-objective is to stabilize and, where necessary and biologically and technically feasible, increase population abundance at local populations through increasing suitable habitat and/or mitigating threats. The broad strategies to be taken to address the threats to the survival and recovery of the species are presented in the section on Strategic Direction for Recovery (section 6.2).

Critical habitat for the Spiny Softshell is identified for 14 local populations (12 in Ontario and 2 in Quebec) in Canada and includes habitat for all phases of the species life cycle using the following three criteria: 1. habitat occupancy; 2. habitat suitability; and 3. habitat connectivity. There are other locations that may still support Spiny Softshell, however, these locations have not been surveyed recently or adequately. For this reason, critical habitat for Spiny Softshell has only been partially identified in this recovery strategy. The Schedule of Studies (section 7.2) outlines the activities required to complete the identification of critical habitat in support of the population and distribution objectives. As additional information becomes available, critical habitat may be refined or more units meeting critical habitat criteria may be added.

One or more action plans will be completed for the Spiny Softshell and posted on the Species at Risk Public Registry by December 2023.

Recovery Feasibility Summary

Based on the following four criteria used by Environment and Climate Change Canada to assess the feasibility of recovery, there are unknowns regarding the feasibility of recovery of the Spiny Softshell. In keeping with the precautionary principle, a recovery strategy has been prepared as per section 41(1) of SARA for this species, 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. There are estimated to be approximately 1,000 mature individuals in the Canadian population of Spiny Softshell (COSEWIC 2016). In Ontario, the species occurs in the Great Lakes watershed in riverine and coastal wetland habitats of southwestern Ontario, with many observations being clustered in four areas (COSEWIC 2016). In Quebec, there is one known extant[8] local population in a river-lake system (consisting of < 100 mature individuals) and one local population that is considered extant but for which viability[9] has to be determined (Reference removed[10]; Reference removed; Reference removed; COSEWIC 2016). Although the species has low population densities within its Canadian range, the Spiny Softshell is considered globally secure. There are populations outside Canada, which may be able to sustain the Canadian population or improve its abundance.

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

   Yes. Although many of the habitats used by the Spiny Softshell have been lost, degraded, and/or fragmented as a result of industrial, urban and agricultural development, or construction and operation of water control structures, suitable habitat remains available within the Canadian range, and more could be made available through management and restoration to support this species. Management and restoration techniques could be used to increase the amount of suitable habitat, such as wetlands and nesting habitat, available for the species and to improve connectivity between local populations.

[8] Extant: the species has been confirmed present within the last 20 years.
[9] Viability: Likelihood to persist in the long-term
[10] Due to the vulnerability of some species to illegal collection, specific references providing sensitive information have been removed from this version of the recovery strategy. See *References* section for more information.

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

   Unknown. The primary threats to the species include: shoreline and riverine habitat development/alteration, water level management, collisions with boats, illegal collection, human-subsidized predators, exotic and invasive species, livestock farming and ranching, fishing by-catch, and disturbance from human activities. Large amounts of previously suitable habitat have now been altered to suit the needs of nearby urban environments (e.g., paved banks, walking trails). Although much habitat loss to urban environments is likely irreversible or difficult to reverse, it may be possible to restore some former habitats, and to mitigate or avoid further habitat destruction through public education, and conservation of current habitat. Public education and enforcement may also help to lessen human disturbance and illegal collection of the species. Targeted habitat protection through land acquisition, regulations, zoning, and landscape planning, along with stewardship techniques have been used successfully for certain local populations (Seburn and Seburn 2000). Some best management practices (BMPs) have been developed and implemented and it is likely that others could be developed and tested in a reasonable timeframe and implemented to help conserve vulnerable local populations from threats such as habitat degradation, indiscriminate water level management and accidental mortality. Public awareness/ educational materials have been developed and will continue to be an integral part of the recovery of this species. Techniques such as use of predator exclusion cages around nests, head-starting[11], and by-catch reduction devices to reduce mortality from fishing by-catch have been successfully implemented in some locations and could be used more broadly to mitigate threats to the species (Seburn and Seburn 2000; Reference Removed). To mitigate boating mortality, regulations could be implemented regarding motorized boat use in habitats with high turtle densities (Lester et al. 2013) and by educating boaters about impacts of boats to aquatic wildlife. Some techniques are available to control invasive species (such as invasive non-native Common Reed (*Phragmites australis*)) and to lessen the impacts of nest predation; however, it is unknown if these threats can be mitigated to the extent required to meet the population and distribution objectives for the Spiny Softshell in Canada.

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

Unknown. Illegal collection for the pet trade and human consumption is a serious threat to the species and it is unknown whether education/outreach, legislative protection and other recovery techniques will reduce this threat to a level where the species is no longer threatened with local extirpations. Systematic monitoring of the local population

[11] Head-starting: A conservation technique that consists of raising and releasing turtles back to the wild. Newborn animals or eggs are collected and raised until they grow to a size that reduces the chance of being eaten by predators once they have been returned to their natural habitat.

abundance is necessary because the species occurs in small, isolated local populations. Efforts to collect appropriate data across the Canadian population will be crucial to ensure local populations are not nearing levels where they are no longer self-sustaining. Some local populations may already be below a viable[12] population level and in order to ensure self-sustaining local populations within its Canadian range, recovery techniques such as reintroduction may be necessary to achieve the population and distribution objectives. As Spiny Softshells are slow to reach sexual maturity (around 12-15 years) and suffer high egg and juvenile mortality, population recovery may be slow. Therefore, it is unknown whether many of these recovery techniques will be successful in achieving the population and distribution objectives within a reasonable timeframe.

[12] Below a viable population level: Unlikely to persist in the long-term

Table of Contents

1. COSEWIC* Species Assessment Information

Date of Assessment: April 2016

Common Name: Spiny Softshell

Scientific Name: *Apalone spinifera*

COSEWIC Status: Endangered

Reason for Designation: The continuing decline of this species in Ontario and Québec is attributed to very low recruitment that has resulted from loss of nesting habitat. Suitable nesting and basking sites have been lost and/or degraded by development, altered water regimes (e.g., dams, floods, erosion of river banks), invasive plants, recreational use, and illegal harvest of individuals. Without nest protection, few eggs survive predation from an increased number of mammals.

Canadian Occurrence: Ontario and Quebec

COSEWIC Status History: Designated Threatened in April 1991. Status re-examined and confirmed in May 2002. Status re-examined and designated Endangered in April 2016.

* COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

2. Species Status Information

As recognised by COSEWIC (2016), there are six known subspecies of *Apalone spinifera*, and the Eastern Spiny Softshell (*Apalone spinifera spinifera*) is the only subspecies known to occur in Canada. In Canada, the Spiny Softshellis currently listed as Threatened[13] on Schedule 1 of the *Species at Risk Act* (SARA); however, the species was recently re-assessed as Endangered[14] by COSEWIC (2016). In Ontario, the species is listed as Endangered[15] under the *Endangered Species Act, 2007* (S.O. 2007, ch.6) (ESA) and receives general habitat protection under the ESA. It is also designated as a Specially Protected Reptile under the Ontario *Fish and Wildlife Conservation Act* (S.O. 1997, c.41). In Quebec, it has been listed as Threatened[16] under the *Act Respecting Threatened or Vulnerable Species* (RLRQ, ch.E-12.01) (ARTVS). The Spiny Softshell is also listed in Appendix III of the *Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES), which

[13] Threatened (SARA) – a species likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction.
[14] Endangered (SARA) - A wildlife species facing imminent extirpation or extinction.
[15] Endangered (ESA 2007) – a species that lives in the wild in Ontario but is facing imminent extinction or extirpation.
[16] Threatened in Quebec – a species which is in danger of disappearing.

controls the international trade of this species (CITES 2016). Appendix III allows trade of a listed species only if an export permit is granted.

The global rank for the Spiny Softshell[17] is Secure (G5) (NatureServe 2017). It is Nationally Imperiled (N2) in Canada and Nationally Secure (N5) in the United States (NatureServe 2017). The species is ranked as Critically Imperiled in Quebec (S1) and Imperiled (S2) in Ontario (Appendix A) (NatureServe 2017). The International Union for Conservation of Nature (IUCN) lists the Spiny Softshell as “Least Concern” (Van Dijk 2013).

Approximately 1% of the global distribution of the Spiny Softshell occurs in Canada (COSEWIC 2016).

3. Species Information

3.1 Species Description

The Spiny Softshell is a medium to large-sized aquatic turtle. The species has a flat, leathery carapace, through which the turtle’s spine and ribs can be felt (Reference removed). The carapace is olive to tan in colour and has small spiny projections at the front edge which produce a sandpaper-like feel. The plastron[18] is small, creamy white in colour, and offers only minimal protection (Reference removed). The head and limbs are olive to gray and patterned with dark spots and streaks (Ernst and Lovich 2009). This species has deeply webbed feet that are well adapted for swimming; a long neck; and an elongated pointed snout (COSEWIC 2016). The Spiny Softshell is able to move quickly on land and in the water, due to its streamlined, light weight shell (Reference removed).

The Spiny Softshell displays sexual dimorphism[19]. The carapace of male Spiny Softshells (and hatchlings) typically has ocelli[20], while the female carapace generally has dark and light blotches, with dark markings (COSEWIC 2016). Females are typically 1.6 times larger than males (Harding 1997), reaching a maximum adult carapace size of 54 cm while males reach a maximum size of 24 cm (Ernst and Lovich 2009; COSEWIC 2016).

The Spiny Softshell has an average life expectancy of several decades (Ernst and Lovich 2009), with a maximum life expectancy of over 50 years (COSEWIC 2016). Males reach sexual maturity at 9-10 cm plastron length (at approximately 7 years of

[17] NatureServe ranks are available for the Eastern Spiny Softshell (*A. spinifera spinifera*), but do not cover the full range of the species in Canada (i.e. Quebec), so the ranks for Spiny Softshell (*A. spinifera*) are presented here
[18] Plastron: the lower part of the turtle’s “shell” (Harding 1997).
[19] Sexual dimorphism: the condition in which the males and females in a species have different physical features (Carr 1952).
[20] Ocelli: Eye-shaped spots.

age), while females reach sexual maturity at 18-20 cm (at approximately 12-15 years of age) (Desroches and Rodrigue 2004; Ernst and Lovich 2009; COSEWIC 2016).

3.2 Species Population and Distribution

The Spiny Softshell's range (Figure 1) extends throughout the eastern half of North America. It can be found from the Great Lakes southward to the Gulf of Mexico and extends into central and western parts of the USA, but occurs mainly in the Mississippi River sub basins (Arkansas/Red, Mississippi, Missouri and Ohio Rivers) and is largely absent from the eastern seaboard (Ernst and Lovich 2009). The total abundance and complete distribution of the Spiny Softshell is currently unknown and information on local populations, in many cases, consists of presence/ absence data from occasional records and/or limited surveys.

Historically, the Spiny Softshell was more widely distributed in Canada, occurring throughout the lower Great Lakes/St. Lawrence River basin, from the upper St. Lawrence to lower Lake Huron. This included three major river systems and one lake in Quebec (Bonin 1997). Today, the Spiny Softshell local populations in Canada are severely fragmented, and occur in only a few isolated areas across its historical range (Figure 2) (COSEWIC 2016). Studies have reported a decline in the number of mature females in oviposition sites - including at three known large communal sites (References removed; Reference removed; Reference removed; COSEWIC 2016). In Ontario, the Spiny Softshell has been reported primarily in southwestern Ontario within coastal areas and major rivers/tributaries to Lake Erie, Lake St. Clair and Lake Huron. A large number of observations are clustered at four locations: two sites on Lake Erie and, sites in two major southwestern Ontario river systems. The species is considered extirpated[21] from Lake Ontario and the Ottawa River (COSEWIC 2016). In Quebec, there are only two known extant local populations of the species (COSEWIC 2016). Two other historical[22] local populations in two river systems (including Ottawa River which is considered as part of Ontario and Quebec) are considered extirpated in the province. Isolated individuals have been reported throughout the historical range in Quebec; however, these are not considered to be local populations (Reference removed; Rioux and Desroches 2007; Reference removed; AARQ 1988). Based on the 2016 COSEWIC status report, the Extent of Occurrence[23] is 51,070 km^2 and the Area of Occupancy[24] is 600 km^2 but these estimates currently omit two known occurrences from Quebec; their inclusion would slightly increase both calculations.

[21] Extirpated: the species is considered not present on site, as no positive record has been noted despite significant survey effort within the last 40 years.
[22] Historical: the species has been recorded within the local population within the last 20 – 40 years.
[23] Extent of occurrence: the area included in a polygon without concave angles that encompasses the geographic distribution of all known populations of a wildlife species (http://www.cosewic.gc.ca/eng/sct2/sct2_6_e.cfm).
[24] COSEWIC typically calculates area of occupancy (The area within "extent of occurrence" that is occupied by a taxon, excluding cases of vagrancy) using a grid with a cell size of 2 km X 2 km (Index of Area of Occupancy (COSEWIC 2009)).

Within Canada, there are 21 extant or historical local populations of Spiny Softshell, and a further 14 that are classified as extirpated[25]. This status assessment includes recent COSEWIC assessments of element occurrences[26],[27] where available. In Ontario 12 local populations are considered extirpated and 12 are considered extant. An additional 7 local populations are considered historical, as they have not been recently surveyed. In Quebec, 1 local population is extant, another 1 is considered extant but requires confirmation of viability and 2 others are presumed extirpated.

No precise data are available on local population sizes and trends, but preliminary data suggest local populations are declining throughout the Canadian range, and that the estimated number of mature individuals (capable of reproduction) in Canada is approximately 1,000 (about 900 in Ontario and less than 100 in Quebec) (COSEWIC 2016). Recent surveys indicate that over the last two decades the number of mature adults in some local populations in Ontario may have declined by as much as 45% (COSEWIC 2016). In Quebec, the number of individuals was estimated a decade ago to be in the low hundreds (Galois pers. comm. *in* COSEWIC 2002); today, there are believed to be fewer than 100 mature individuals (COSEWIC 2016). Available habitat (especially nesting habitat) continues to decline in quality and extent (COSEWIC 2016). Future increases to the population abundance may be dependent on increasing the amount of suitable habitat, which could be made available through habitat restoration and/or habitat enhancement techniques.

[25] A total of 35 local populations are known in Canada. Note that the Ottawa River, currently extirpated, is counted twice as it pertains to both Ontario and Quebec.

[26] Element Occurrence: Area of land and/or water where a species or natural community is, or was, present and has practical conservation value (NatureServe 2014). The term element occurrence is used in this recovery strategy to represent a local population and help to set population and distribution objectives. Element occurrences are not equal to observations as numerous observations can be associated with one element occurrence.

[27] The status of element occurrences from provincial data centres noted as historical but occurring in areas identified as extirpated in COSEWIC (2016) (i.e., local populations in Lake Ontario, Ottawa River - Ontario and Quebec, and St. Lawrence River) are considered extirpated in this Recovery Strategy.

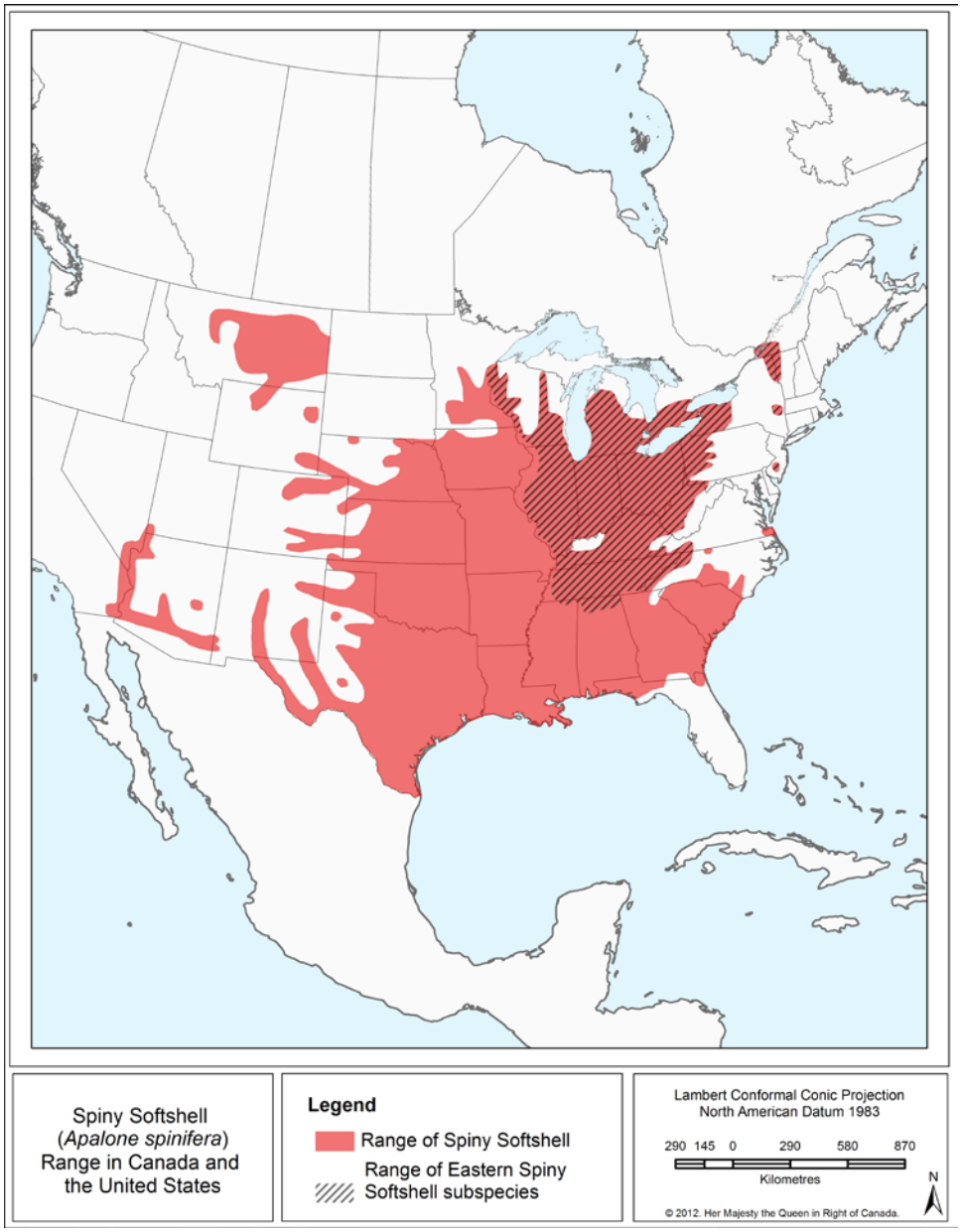

Figure 1. Spiny Softshell range in Canada and the United States (overall range from Ernst and Lovich (2009); Eastern Spiny Softshell subspecies range from Conant and Collins (1998)). This map represents the general range of the species (and subspecies), and does not depict detailed information on the presence and absence of observations within the range.

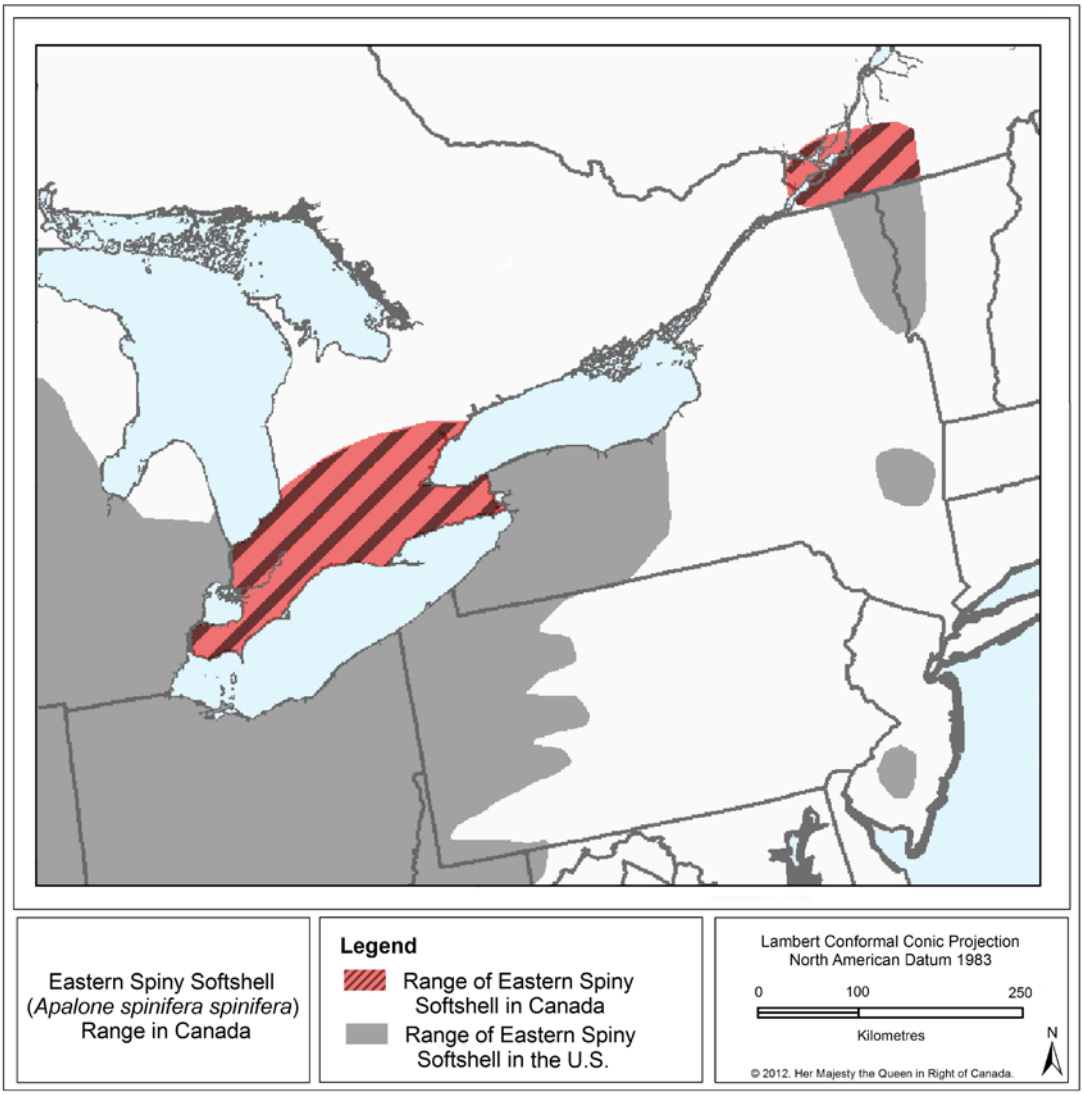

Figure 2. Spiny Softshell range in Canada (Eastern Spiny Softshell subspecies range from Conant and Collins (1998)). This map represents the general range of the species, and does not depict detailed information on the presence and absence of observations within the range.

3.3 Needs of the Spiny Softshell

General Habitat Needs

The Spiny Softshell relies primarily on aquatic habitat, and makes use of terrestrial habitat only for nesting and rare overland movements between adjacent water-bodies. In Canada, the Spiny Softshell is typically associated with large bodies of water such as rivers or lakes, although it can also occur seasonally in streams, marshes, ponds, and oxbows (Reference removed), and may use wetlands and ponds next to large bodies of water (Reference removed; Reference removed). Spiny Softshells may remain within a river (e.g., Reference removed) or move between rivers and a lake (e.g., Reference removed). They have been located in water depths of up to about 5 m, but typically stay

close to shore in water less than 3 m deep, except during overwintering (Reference removed). Spiny Softshells are also commonly found in association with features such as sandbars, mud flats, submerged logs and aquatic vegetation (Reference removed; Ernst and Lovich 2009).

Shallow areas with a soft substrate (mud or sand) and areas with sparse aquatic vegetation are commonly used by adults and juveniles for thermoregulation[28] and predator avoidance (Reference removed; Ernst and Lovich 2009). Shallow areas allow Spiny Softshells to extend their head above water and breathe while keeping the remainder of their body buried in the substrate (Ernst and Lovich 2009).

Nursery

In Ontario, juveniles have been noted to use specific nursery habitat similar to the study by Plummer (1976). Juveniles have been documented using shallow areas of rivers and lakes with mud, sand or other soft substrates (Gillingwater, unpublished data). The nursery habitat is typically outside the main flow of the watercourse and far from turbulent water or waves (Gillingwater, pers. comm. 2016). In Ontario, juveniles have been found exclusively in this habitat, however, it has been noted that adult male Spiny Softshells do use habitat similar or identical to nursery habitat for thermoregulation and foraging (Gillingwater, pers. comm. 2016). These habitats will also be used by adult females on occasion.

Overwintering

To protect themselves from freezing, Spiny Softshells overwinter in underwater hibernacula[29], usually under less than 5-10 cm of soft bottom substrate (e.g., sand or silt) (Ernst and Lovich 2009) from October to April or May. Females seem to overwinter earlier (mid-October) than males (end-November) (Dobbyn and Smith 2005).

Spiny Softshells often overwinter in the stream, river, or lake where they spend the majority of their time during the active season. In rivers, hibernacula have been observed in pools with a minimum depth of 1 m and up to approximately 5 m deep (Reference removed; Reference removed; COSEWIC 2016). In lake environments, hibernacula have been reported, typically near stream outlets, in areas with water depths from 2 to over 7 m (Reference removed; Reference removed; Reference removed). Spiny Softshells are intolerant of sustained periods of anoxia[30] and select overwintering sites that stay well-oxygenated during winter (e.g., where water flows all winter) (Fletcher 2002; Reference removed; Reese et al. 2003; Ultsch 2006). Spiny Softshells are known to have site fidelity to their overwintering sites (Reference removed; Vermont Fish and Wildlife 2009). They are also known to overwinter communally (Reference removed; Reference removed; Reference removed; Dobbyn and Smith 2005).

[28] Thermoregulation: To regulate body temperature.
[29] Hibernacula: plural form of hibernaculum; the place where an animal hibernates during the winter.
[30] Anoxia: abnormally low oxygen concentration in the body tissues caused by an environment with low concentrations of oxygen (Litzgus et al. 1999).

Mating
In Canada, Spiny Softshells mate in the spring (late April or May), when turtles emerge from overwintering (Ernst and Lovich 2009; Reference removed). Mating usually occurs in deeper offshore waters (Harding 1997; Ontario Nature 2012), though can occur in water adjacent to thermoregulation sites. Limited data are available about this behaviour or the depths at which it occurs.

Nesting
Female Spiny Softshells generally lay clutches of 12-18 eggs (Ernst et al. 1994) from late-May to mid-July (Fletcher 2002; COSEWIC 2016). In Ontario, females have been noted to lay a range of 3-43 eggs at one time (COSEWIC 2016; Gillingwater unpub. data). Nests are usually found in areas where the substrate is mainly composed of sand or a mix of sand and gravel and where the vegetation density and the slope are low (Reference removed; Reference removed; Reference removed). Common nesting areas include sand beaches, sand or gravel bars, or other terrestrial areas with sand, gravel, or clay banks (Reference removed; Reference removed; COSEWIC 2016). Sandy soil is preferred, but nesting may also occur in clay-loam soils (Ernst and Lovich 2009), although frequent nest failure has been found at sites with clay (Gillingwater pers. comm. 2016). They typically select nest sites in sunlit areas (with little cover) within sight of water (COSEWIC 2002; Reference removed). Females have been found to use the same general nesting area each year, although not necessarily the same beach or gravel bar (Reference removed), indicating fidelity to a general nesting area. Along a suitable portion of a river, Spiny Softshells may alternate nesting locations each year within a 2 km stretch. If nesting habitat is limited, several females may use the same nesting site (Ernst and Lovich 2009; Équipe de rétablissement des tortues du Quebec unpublished data). In Ontario and Quebec, it is clear that several threats, including shoreline alteration, flooding, human disturbance,invasive species, etc., is limiting the availability of nesting sites and contributing to nesting failures (Reference removed; Reference removed; COSEWIC 2016).

Distance between aquatic habitat and nesting sites vary greatly depending on site availability and local conditions. Nesting usually occurs close to water, with reported mean nest distances ranging from 3-38 m (Graham and Graham 1997; Steen et al. 2012). However, some females may move up to 100 m inland to nest (Ernst and Lovich 2009). In Ontario, nests are typically laid within 50 m of the shoreline (Reference removed; Reference removed; Gillingwater pers. comm. 2015), while in Quebec, nests are laid much closer to water, with all known nest sites occurring in the floodplain (i.e., areas which are periodically flooded). In a well-studied Quebec local population, reported distances between nest and the nearest watercourse from 2009-2011 ranged from 1.1-4.4 m (n = 22) (Galois et al. 2010, 2011, 2012), and all nests observed in Quebec since 2009 have been found within 10 m of a watercourse (n = 59) (Galois et al. 2010, 2011, 2012; Paré pers. comm. 2015). At this local population, it is likely that females do not move further from the water due to the topography and substrate of the nesting site. The banks of the waterways in the area are steep which preclude the turtles from seeing the water; an important factor in nesting habitat choice for this

species. As well, the nesting site substrate is composed of sand, gravel and cobble while the adjacent terrestrial habitat is composed of poor nesting substrate (e.g., clay soil) which would deter females from making the effort to move further from the water (Giguère pers. comm. 2015). A female Spiny Softshell in Quebec was reported to have moved 7 km upstream (in water) for nesting (Reference removed). Movements between overwintering and nesting sites of 18 km have been recorded in Ontario (Gillingwater pers. comm. 2016).

Hatchlings generally emerge in late summer after an incubation of 60-75 days (Fletcher 2002; COSEWIC 2016), though the incubation period can last as long as 100 days (Gillingwater pers. comm. 2016).

Thermoregulation

Turtles regulate their body temperature using the surrounding environment; they are able to modify or maintain their temperature by varying their exposure to sun (known as basking), shade and water (Bulté and Blouin-Demers 2010). Aquatic thermoregulation sites may include floating or protruding objects (e.g., rocks, logs, floating vegetation, or floating debris), and the species may sometimes thermoregulate while floating at the water surface (Reference removed; Ernst and Lovich 2009). In addition to using basking sites within the aquatic habitat, individuals may bask along riverbanks in open areas near the water, such as on mud or sandbanks (Reference removed; Ernst and Lovich 2009). Spiny Softshells have also been observed basking while buried in soft substrate (muddy/sandy) in shallow water (Gillingwater unpub. data; Dobbyn and Smith 2005; COSEWIC 2016).

Foraging

Spiny Softshells are primarily carnivorous (Ernst and Lovich 2009) feeding mainly on live or dead organisms, including: crayfish, insects, and fish but may also eat earthworms, snails, clams, isopods, cladocerans, amphibians and small snakes (Ernst and Lovich 2009). Important food items are available in lakes and in river reaches containing riffle[31] areas, adjoining creeks, inlets, muddy/sandy areas and bays, and within vegetative debris and aquatic plants (COSEWIC 2016). The species may forage in waters up to 2.5-3 m deep (example removed) (MNRF 2014a, unpublished data).

Movement Habitat (commuting and dispersal)[32]

Spiny Softshells regularly move between different aquatic habitat types to access recurrently or seasonally required resources (e.g., nesting sites, overwintering sites, food sources) (Reference removed). As a result, it is important that the different habitats they use are linked, or in reasonable proximity to one another so that individuals can move between them with ease to carry out life cycle processes. Spiny Softshells are

[31] Riffle: a part of a river where the current runs very swiftly.

[32] Movement habitat is the habitat that the species uses to move between habitats. Commuting here refers to short-distance movement within the home range in order to carry out different life processes (e.g., mating, foraging), while dispersal refers to long-distance movement related to emigration of individuals.

good swimmers, with adult females capable of frequent and long movements (Vermont Fish and Wildlife 2009; Gillingwater pers. comm. 2016).

Movements of more than 30 km have been observed along aquatic habitat in both Ontario and Quebec (Reference removed). The average linear home range[33] length observed for Spiny Softshells in Quebec is 10.8 km (Quebec Spiny Softshell Turtle Recovery team unpublished data). Some data suggest that there is a significant difference in Spiny Softshell mobility, and the chronology of movements, between the sexes; females seem to travel longer distances and are also more active than males (Reference removed). The mean annual home range area for Spiny Softshells in Quebec was 32.06 ± 30.70 km^2 for females (range of 1.77-110.28 km^2) and 2.75 ± 2.99 km^2 for males (range of 0.44-6.92 km^2) (Reference removed). Individuals have also been found to make extensive use of small areas of specific habitat types for such things as nesting and overwintering and used the rest of their home range mainly to move between these areas (Reference removed). It is thought that the large home ranges are due to the distance between suitable overwintering and nesting sites. Home range size for the Spiny Softshell in Ontario is unknown, although studies have shown movements of up to 30 km (References removed) for adult females, and less than 250 m over a season for males and juveniles (Galois pers. comm. in COSEWIC 2002; Gillingwater pers. comm. 2016). This is an important knowledge gap that needs to be addressed in order to refine recovery actions.

Plummer et al. (1997) studied home ranges of Spiny Softshells in a small stream (Gin Creek) in Arkansas, USA. They calculated an annual home range area of 0.88 ha for males and 0.7 ha for females and the slightly larger home range for males was not statistically significant. They observed daily movements of up to 1,920 m and stated that the movement pattern of Spiny Softshells in a small stream was characterized by brief but long distance movements out of their home ranges, followed by their immediate return. Comparing their results with results of other studies, the authors support the notion that home range size is influenced by the size of the waterbody and by the availability of habitat features to support their different life cycle activities, such as nesting and overwintering (Schubauer et al. 1990; MNRF 2014b).

3.4 Biological Limiting Factors

Most turtles, including Spiny Softshell, have certain common life history traits that can limit their ability to adapt to high levels of disturbance and that help explain their susceptibility to population declines (Congdon et al. 1993; Gibbons et al. 2000; Turtle Conservation Fund 2002). In particular, Spiny Softshells have a reproductive strategy that depends on high adult survival rates to counterbalance the low recruitment rates because of:

[33] Home range: The area needed by an animal to complete its normal activities (Burt 1943).

1. late sexual maturity (around 12-15 years for females from northern local populations, and a life span of over 50 years);
2. high rate of natural predation on eggs and juveniles under the age of two;
3. dependence on environmental conditions for the internal development of eggs, and
4. external incubation of eggs without parental care.

As a consequence of these life history traits, turtle populations including Spiny Softshells, cannot adjust to an increase in adult mortality rates. Long-term studies indicate that high survival rates of adults (particularly adult females) are critical to the maintenance of turtle populations such that even a 2-3% increase in the annual adult mortality rate over natural mortality rates could result in population declines (Congdon et al. 1993, 1994; Cunnington and Brooks 1996).

The Spiny Softshell is at the northeastern edge of its range in Canada (Figure 1). The climatic ranges within which the Spiny Softshell can survive limit its range in northern regions (Hutchinson et al. 1966; McKenney et al. 1998). Climate plays a vital role in recruitment, as Spiny Softshells rely on the external environment for incubation of eggs. Incubation time constitutes a major limitation for northern turtle populations (Brooks 2007), as the short northern summer typically makes it possible to produce only one clutch per year and reduces the likelihood that a nest will hatch in any given year. Although double clutching is known to occur in some years in Canada (COSEWIC 2016), recruitment rates can vary from one year to the next depending on weather conditions, particularly during the summer.

Another important limiting factor could also be the availability of suitable hibernation sites. The species is relatively intolerant of anoxic conditions during winter and ice cover lasts longer in the north (Ultsch and Cochran 1994).

3.5 Species Cultural Significance

Turtles play an important role in Indigenous spiritual beliefs and ceremonies. To the First Nations peoples, the turtle is a teacher, possessing a great wealth of knowledge. It plays an integral role in the Creation story, by allowing the Earth to be formed on its back. For this reason, most First Nations people traditionally call North America “Turtle Island” (Bell et al. 2010).

4. Threats

Threats to the Spiny Softshell may vary regionally and locally across its distribution within Canada. However, the information presented in Table 1 is an overall assessment of threats to the Spiny Softshell in Canada. Where information is known on the significance of threat at the local scale, additional information is provided in the threat description below Table 1.

4.1 Threat Assessment

Table 1: Threat Assessment Table

Threat	Level of Concern[a]	Extent[b]	Occurrence	Frequency	Severity[c]	Causal Certainty[d]
	Threat Information					
Habitat Loss, Degradation, or Fragmentation						
Shoreline and riverine habitat development/ alteration	High	Widespread	Historic and Current	Recurrent	High	High
Water level management	High	Widespread	Historic and Current	Recurrent	High	High
Livestock farming and ranching	Medium	Localized	Historic and Current	Seasonal	High	High
Accidental Mortality						
Collisions with boats	High	Widespread	Current	Seasonal	High	High
Fishing by-catch	Medium	Widespread	Current	Seasonal	Medium	Medium
Changes in Ecological Dynamics or Natural Processes						
Human-subsidized predators	High/ Medium	Widespread	Current	Seasonal	High	High
Biological Resource Use						
Illegal collection	High	Widespread	Current	Seasonal	Medium	High
Exotic, Invasive, or Introduced Species						
Exotic and invasive species	High/ Low	Widespread	Current and Anticipated	Continuous	High/ Low	Medium/ Low
Disturbance or Harm						
Disturbance from human activities	Medium	Widespread	Current	Seasonal	Medium	Medium
Pollution						
Contamination and nutrient loading	Medium/ Low	Localized	Current	Continuous/ Seasonal	Unknown	Medium/ Low
Climate and Natural Disasters						
Climate change	Low	Widespread	Anticipated	Continuous	Unknown	Low

[a] ***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.* ***Provincial Consideration****:* ***When two rankings are provided, this indicates a difference between provinces (ON/QC in order).***

[b] *Extent: reflects the spatial scale at which the threat is impacting the Canadian population (Localized: the threat is impacting small areas within the Canadian range; Widespread: The threat is impacting the majority of habitat within the Canadian range*

[c] ***Severity:*** *reflects the global population-level effect (High: very large population-level effect, Moderate, Low, Unknown).*

[d] ***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).*

4.2 Description of Threats

This section describes the threats outlined in Table 1 and emphasizes key points. Although threats are listed individually, an important concern is the long-term cumulative effect of a variety of threats posed on Spiny Softshell local populations. It should be noted that some of these threats apply only during the active season since they lead to direct mortality, removal, mutilation, or illegal collection of individuals. Among mechanisms through which threats can impact Spiny Softshell local populations, isolation through habitat loss and fragmentation is of particular concern, as it reduces or eliminates dispersal, therefore limiting the possibility of rescue effect[34] in areas where this is possible.

Habitat Loss, Degradation, or Fragmentation
Shoreline and riverine habitat development/ alteration
Habitat loss and degradation are threats of high concern to Spiny Softshell local populations. Their riparian[35] and aquatic habitats have been and are being degraded by shoreline alteration; construction and maintenance of roads, bridges and dams; urbanization; intensive agricultural activity; amongst others (COSEWIC 2016). Illegal development such as stream diversion, pond excavation and boat dock installation, are also of concern, especially when at or near nesting or thermoregulation habitats.

Shoreline habitat degradation reduces the availability of suitable nesting and basking sites (Reference removed). Such habitat degradation can also reduce the number of overwintering sites and increase the number of predators (e.g., Ernst and Lovich 2009). In many areas, shorelines are reinforced to prevent erosion, often using metal or concrete walls or rip rap[36] (Reference removed, Reference removed). This hardening of the shoreline prevents the Spiny Softshell from carrying out critical life functions (such as nesting, foraging, and basking) along large stretches of formerly available habitat, which will ultimately lead to a decline in local population abundance (Reference removed). For example, natural shorelines possess more emergent and aquatic vegetation than developed shorelines (Radomski and Goeman 2001), and these habitat configurations are crucial to Spiny Softshell throughout the active season (Reference removed). Construction activities associated with this type of development can also lead to direct turtle mortality.

Dredging may affect turtles directly or indirectly. Individuals may be extracted from overwintering sites and/or killed by heavy equipment during dredging. Overwintering sites might also be destroyed by dredging. Alterations in water quality (due to sediment loading in rivers) and changes in river morphology could potentially alter prey composition and availability (Bodie 2001).

[34] Rescue effect: Immigration of individuals that have a high probability of reproducing successfully, such that extirpation or decline of a wildlife species can be mitigated.
[35] Riparian: Close to the bank of a river or other waterbody.
[36] Rip-rap: Rock or other material used to protect shorelines.

The loss of habitat to development and agriculture is significant to the Spiny Softshell (COSEWIC 2016) and some of it is irreversible, meaning that restoration is no longer a viable approach. Infilling or draining of wetlands for such purposes effectively eliminates turtle habitat such as basking and foraging sites (Reference removed).

Some techniques commonly used for the management of streams and riparian zones, such as reduction of snags/log jams, riparian draining, channelization, reduction of sandbars and beaches, and impoundment, may cause negative effects on turtles (Bodie 2001). Spiny Softshells are particularly affected by reduction of sandbars and beaches, which reduce the availability of suitable nesting sites, alter water flow and changing sediment dispersal (COSEWIC 2016).

Water level management

Water control structures (e.g. power dams, locks) can impede the movement of turtles in aquatic environments, thereby increasing habitat fragmentation and preventing access to suitable habitats (Bennett et al. 2010). This is of particular concern for highly aquatic turtle species, such as the Spiny Softshell, which frequently use aquatic habitat for movement between habitats and dispersal, and for which water control structure construction potentially contributes to isolation of local populations (Edmonds 2002; Bennett et al. 2010). Isolation of local populations has the potential to compromise rescue effect in the medium term, which would lead to a higher likelihood of elimination of local populations (Stockwell et al. 2003; Marchand and Litvaitis 2004). In the long-term, a reduced ability for successful dispersal of individuals can result in loss of genetic variation (Gray 1995). Loss of genetic variation in small, isolated local populations can in turn cause loss of population fitness and adaptability, and increase the risk of extinction in the wake of a catastrophic or epidemic[37] event (Frankham 1995; Reed and Frankham 2003). Conversely, a small number of Spiny Softshell individuals have been found to scale rip rap surrounding a dam structure, suffering injuries in the process, as well as ending up on a road (Gillingwater pers. comm. 2016). Since impoundments upstream of dams are not appropriate habitat, Spiny Softshells will likely return to the other side (Gillingwater pers. comm. 2012). This suggests that these structures are a hazard to Spiny Softshells even where it does not form a barrier to movement.

Some water control operations also impact turtle habitat by altering upstream and downstream water levels, thereby impacting depth of overwintering sites and availability of nesting, basking and foraging habitats. For example, the use of dams for flood control may negatively impact the species by reducing the scouring effects of peak flows on the shoreline (removal of vegetation on shorelines), and thus the amount of exposed soil that is suitable for nesting (Seburn 2007). Water control can also affect the downstream flow regime that alters sediment transport, thermal properties, water levels, and oxygen concentrations, all of which can affect the habitat suitability, especially during hibernation.

[37] Epidemic: A rapid spread of disease.

Fluctuation in water levels caused by water control structures can cause direct mortality the following ways: increased water levels during the spring and summer may drown nests (killing embryos), since nests are usually laid close to water, and decreased water levels during the winter may lead to freezing (and death) of overwintering turtles (Ewert 1979). Flooding events aggravated by flood control structures along two major river systems have been increasingly implicated in complete loss of clutches laid in a season (Équipe de rétablissement de la tortue- molle à épines au Québec 2014; COSEWIC 2016). From 2008-2011, storm events resulted in all nest sites (except one, which was trampled by cattle) to remain submerged during embryo development, drowning all embryos (Ewert 1979; COSEWIC 2016).

Small water control structures for the purpose of wetland restoration may benefit Spiny Softshell, but they also have the potential to damage or destroy the habitat if the structure is not designed with the habitat needs of Spiny Softshell in mind. If the water control structure for the purpose of wetland restoration maintains the suitable habitat for all turtles present, the structure is not considered a threat to the species.

Livestock farming and ranching

Livestock farming and ranching are a concern in some locations where Spiny Softshells are known to occur. The presence of the livestock on or near the shoreline degrades nesting habitat through soil compaction and shoreline erosion; also, trampling might crush nests and individuals. According to COSEWIC (2016), primary Spiny Softshell nesting sites on two major river systems are affected by this threat.

Accidental Mortality

Collisions with boats

While in the water, turtles are at risk of being injured or killed by collisions with boats and/or propellers (Burger and Garber 1995; Smith et al. 2006; Reference removed; Bulté et al. 2010; Bennett et al. 2014). Turtle deaths due to impact with motorboats, even in water bodies with low to moderate (versus high) boat traffic, may lead to a decline in the local freshwater turtle population (Bulté et al. 2010). While research evaluating injury and mortality rates from motorboat strikes is not available for the Spiny Softshell in Ontario, research has been done on this threat for other aquatic turtles in Ontario. A study of the impact of recreational motor boating on populations of Northern Map Turtle in two Ontario locations found that 8.3% and 3.8% of individuals at the two locations had propeller injuries; if over 10% of these collisions result in turtle death, rapid population extirpation is possible (Bulté et al. 2010). Given the fact that Spiny Softshell and Northern Map Turtles share similar aquatic habits, this suggests that propeller strikes are likely a threat to Spiny Softshells in their Canadian range. In one Quebec location, mortality due to recreation-related accidents such as boat-propeller injuries is a concern for a local population of Spiny Softshells, when added to habitat alteration and other threats (Reference removed).

Given that many nesting female Spiny Softshells in Canada live in large waterbodies with heavy motorized boat traffic, this threat to the species is increasing, with many of the local populations being affected by recreational boating (COSEWIC 2016). Also,

Spiny Softshells are more vulnerable to this threat because they regularly bask just offshore by floating at the surface of the water and are at very high risk of being struck by boats, compared to turtles that rarely or infrequently bask this way (e.g. Blanding's Turtles).

Fishing by-catch

By-catch in commercial and recreational freshwater fishing is an under-appreciated but real threat to turtles (Raby et al. 2011). Turtles can be accidentally hooked on recreational fishing lures or caught in commercial or scientific fish traps or nets and drown. Because nets are often not checked for several days, the rate of drowning among turtles is high. Mortality rates are sufficient to cause extirpation of local turtle populations (Midwood et al. 2014). Those turtles that survive without drowning in nets can show signs of harm that puts them at risk of later mortality (Stoot et al. 2013).

Studies conducted in eastern Ontario and on the Mississippi River (U.S.) found that passive fishing techniques (e.g., Fyke nets) can result in significant by-catch of turtles (e.g.,: Reference removed; Carrière 2007; Larocque et al. 2012a). For example, Larocque et al. (2012b) found that at least 93% of non-fish by-catch, consisted of four species of turtle. Severe mortality (33%) of turtles has also been documented in nets set in a lake in Ontario (Reference Removed). It is often recommended that a portion of nets are maintained above water to reduce turtle mortality. However, even if this guidance is followed, turtles tend to travel to the last compartment of the net, which is anchored to the bottom and therefore may be completely submerged (Thompson, pers. comm. in Seburn 2007) and risk drowning.

In addition to the risk of by-catch in commercial fisheries' nets, turtles also risk injury and mortality from ingestion of recreational anglers' hooks. Turtles that get caught in fishing lines are often released by cutting the line, leaving the hook in the turtle (Reference removed; Reference removed). The hook and nylon line can lead to serious lacerations in the digestive tract and lead weights can cause poisoning (Borkowski 1997). In 2005 alone, three Spiny Softshells were found with fishing line in their throats in southern Ontario (Gillingwater 2008) and at least one per year since have been recorded (Gillingwater pers. comm. 2016). Spiny Softshells are either found dead, or alive with the hook embedded (Gillingwater pers. comm. 2016). Even dissolving hooks can cause life threatening injury to the turtle before the hook dissolves (Gillingwater pers. comm. 2016). A study in Tennessee found that 4% of male and 6% of female Spiny Softshells had ingested fishing hooks (Steen et al. 2014).

Changes in Ecological Dynamics or Natural Processes

Human-subsidized predators

In many areas, the low density or absence of top predators and increased food and habitat availability from human sources (e.g., food handouts, garbage, crops, water sources, hiding cover) have led to a greater abundance of turtle predators than natural conditions would have historically supported (Mitchell and Klemens 2000). The main predators of the Spiny Softshell include Raccoon (*Procyon lotor*), Coyote (*Canis latrans*), Striped Skunk (*Mephitis mephitis*), American Mink (*Neovison vison*) and

Red Fox (*Vulpes vulpes*) (COSEWIC 2016; Reference removed). Adult females are more likely to escape predation than males due to their larger size and speed (Reference removed). Eggs and juvenile turtles are the most susceptible to predation and have many different predators including mammals, birds, other reptiles, amphibians, and fish (Reference removed). Spiny Softshell nests are often predated by Raccoons, Coyotes, Striped Skunk and Red Fox (Ernst and Lovich 2009; Reference removed).

The abnormally high level of many predator populations can lead to unsustainable rates of predation on turtles (eggs, juveniles, adults). For instance, 100% predation rates on unprotected Spiny Softshell nests have been recorded in an Ontario Provincial Park (Reference removed; Reference removed) and along the largest communal nesting site known in Canada (Gillingwater pers. comm. 2016). At three sites in Ontario (within a Provincial Park), the rate of egg survivorship to hatching was 85.4%, 70.8% and 30.9% for protected nests and 61% and 47.3% for natural nests at the two first locations, respectively (De Solla et al. 2003).

In Quebec, available information suggests that this threat may be of lesser concern to some local populations. For example, no predators were detected during the monitoring of an important communal nesting site in the spring of 2014 (S. Giguère, pers. comm. 2015).

Methods to counteract elevated predation rates (such as predator exclusion cages around laid nests) have been developed and used with varying degrees of success (Seburn 2007; Riley and Litzgus 2013). However, in many cases, it would be difficult and costly to implement these methods, such as predator exclusion devices over turtle nests, at the scale required to protect local populations from this threat.

Biological Resource Use

Illegal collection

Worldwide, many turtle species are impacted by individual and large-scale systematic illegal collection for use as pets, food and traditional remedies (Thorbjarnarson et al. 2000; Bodie 2001; Reference removed; Moll and Moll 2004). The rate of export of freshwater turtles, for both pet and food trades is high in the U.S. (Mali et al. 2014). For example, between 1999 and 2014, around 700,000 individuals of Spiny Softshell were legally exported for commercial purposes, of which 13% were wild caught (U.S. Fish and Wildlife Service 2014). The Spiny Softshell was one of the common species in the United States export trade during 1989-1997 (Moll and Moll 2004). Large numbers of adults (mainly females) have been exported from the U.S. to specific markets since the late 1990s, as well as large quantities of hatchlings (Van Dijk 2013). Kopecký et al. (2013) analyzed the freshwater turtle pet-trade in the European Union: out of the 15 most marketed[38] turtle species, the Spiny Softshell is ranked 8th, with an estimated 27,035 individuals imported from the United States during 2008-2012. The rate of illegal trade can be expected to also be high in Canada given the lucrative trade

[38] Marketed: Species with a sum of more than 500 imported individuals (Kopecký et al. 2013).

demand. Reptile species are more likely to be involved in the international pet trade if they are categorized as at risk than if they are not considered at risk (Bush et al. 2014), which is consistent with a general demand for rare wildlife (Courchamp et al. 2006).

In Canada, the collection, trade, and possession of Spiny Softshells is illegal under federal and provincial legislation, nevertheless, there are reports of poachers harvesting adult Spiny Softshells and their eggs for food in Ontario (Reference removed). In March 2013, a Toronto newspaper reported a single restaurant had 31 Spiny Softshells in its freezers (The Star 2013). This type of activity may indicate a high demand for the species in the food trade.

Illegal collection of the Spiny Softshell removes individuals from the population which, given the species' reproductive strategy (extreme longevity, low recruitment rates), may greatly reduce recruitment (COSEWIC 2016). The annual removal of even just a few adults from a local population can have a significant impact. The extent of illegal organized turtle harvest is poorly documented in Canada for the Spiny Softshell.

Exotic, Invasive, or Introduced Species

Exotic and invasive species

The introduction of invasive, exotic plants can alter the availability and quality of the Spiny Softshell habitats. In some areas, particularly around Lake Erie, Lake Huron, and Lake St. Clair, and along some major rivers, non-native Common Reed (*Phragmites australis*) has invaded shorelines, forming a monoculture[39] that has altered conditions of foraging habitat and nesting habitat, forcing female Spiny Softshells to use other egg laying sites (Reference removed; Gillingwater pers. comm. 2012). Invasive plants tend to form dense encroaching stands that progressively reduce the available area of nesting sites each year (COSEWIC 2016). The expansion of road networks also facilitates the spread of invasive plant species, especially in southern Ontario (Gelbard and Belnap 2003).

Turtles nest in open, unshaded areas receiving adequate solar heat. In a study conducted along Lake Erie, Ontario, it was found that non-native Common Reed had reduced the amount of suitable nesting habitat for many turtle species because growth of the plant increased the amount of shade, altering the microenvironment (particularly the thermal microenvironment) of turtle nests during the incubation period (Reference removed). The loss of suitable nesting habitat for turtle species due to invasive plants including non-native Common Reed, Japanese Hops (*Humulus japonicus*), and Purple Loosestrife (*Lythrum salicaria*) has also been observed at many other shorelines throughout southern Ontario (Gillingwater pers. comm. 2012). Common Reed and Japanese Hops continue to result in loss of significant portions of Spiny Softshell nesting habitat in Southwestern Ontario (Gillingwater pers. comm. 2016). Reed Mannagrass (*Glyceria maxima*) might also have an impact on Spiny Softshell.

[39] Monoculture: An area that is dominated by a single plant species.

Invasive species are considered to be a high level threat across the Canadian range of Spiny Softshell (COSEWIC 2016). However, the extant local populations in Quebec are not impacted by invasive species to the same degree as other local populations, likely due to increased isolation and lower levels of commercial traffic currently occurring at the extant Quebec local populations (Reference removed). To reflect this, the severity and level of concern for invasive species is ranked as High-Low (Table 1).

Disturbance or Harm

Disturbance from human activities

Human activity can affect Spiny Softshells in many ways. Because this species is wary of humans, simply approaching basking turtles can cause them to leave their basking sites and return to the water. Should the disturbance be repetitive, the resulting heat loss can delay the development of eggs in females, and affect other life cycle activities in both sexes and in all age classes (e.g., food metabolism, spring emergence) (Bulté and Blouin-Demers 2010). Moreover, the presence of humans and/or boats can delay or interrupt nesting; and females may abandon their nest, making them more subject to predation (Horne et al. 2003; Moore and Seigel 2006; References removed). Repeated disturbance at nesting sites may also force females to use lower quality nesting sites (Moore and Seigel 2006), which in turn can slow incubation and reduce the hatching rate of the eggs (Horne et al. 2003). In Ontario, a paved trail was developed adjacent to a known thermoregulation and nesting site, and although suitable habitat remains, Spiny Softshells have abandoned the site in recent years likely due to the increased presence of humans (Gillingwater pers. comm. 2016). Species that spend much of their time in larger water bodies, particularly Spiny Softshells, may be more susceptible to disturbance or harm because recreational boating, jet skis and other water sports often occur in the Spiny Softshell's Canadian range. Recreation on nesting beaches (e.g., use of off-road vehicles) can also lead to females avoiding laying eggs (Reference removed) as well as risk trampling of nests or hatchlings (Reference removed). Translocation of turtles (e.g., individuals collecting turtles to look at and returning them to the wild in a location other than where the individuals were captured) from one water body to another by humans may lead to increased stress and/or threats (e.g., road networks) when the turtle attempts to return to its area of origin or find habitats to meet its life cycle activities (e.g., for foraging or overwintering) (Gillingwater pers. comm. 2012).

The Spiny Softshell may be subject to deliberate harassment and persecution by humans. This includes, but is not limited to, throwing rocks at turtles, shooting them with firearms, and intentionally driving over them (e.g.,: Horne et al. 2003; Ashley et al. 2007; Reference removed). Observers have also witnessed the deliberate destruction of eggs (Horne et al. 2003; Gillingwater 2008).

Pollution

Contamination and nutrient loading

Aquatic habitat of the Spiny Softshell can be impacted by the degradation of water quality caused by the runoff of contaminated water from agriculture (e.g., nutrients and pesticides), industry (e.g., industrial waste), roads (e.g., de-icing salt), and urban areas (e.g., heavy metals) (Mitchell and Klemens 2000; Bishop et al. 2010). Spiny Softshells

could be vulnerable to contaminant accumulation, although the long-term impact is poorly understood. Individuals absorb contaminants in the environment through various physiological processes such as feeding, breathing, absorption through tissues or membranes such as eggshells (Bishop et al. 1998). Spiny Softshells are more likely to be affected by contaminants than other turtle species because of their diet and range (St. Lawrence and Great Lakes drainage basins).

Recent studies indicate that the benthic food chain has little effect on mercury accumulation in Painted and Musk Turtles (Reference removed) and that concentration of mercury in blood and scutes[40] does not affect parasitism level in Painted Turtles (Slevan-Tremblay 2013). However, mercury exposure could be detrimental to the immune system by reducing the number of lymphocytes[41]. Two studies undertaken in the Great Lakes basin detected several industrial-based contaminants in Snapping Turtle eggs. It was also noted that abnormal embryo development increased with exposure to polychlorinated aromatic hydrocarbons (Bishop et al. 1998; Van Meter et al. 2006). Although these studies focused on other species, the potential for similar effects on the Spiny Softshell exists as they share similar habitats and behaviours.

Inputs of sediments and organic matter through erosion and runoff (e.g., from farm fields) can also alter water quality and habitat structure and threaten local populations of the Spiny Softshell (Reference removed). Declines and/or extirpation of turtle populations have been attributed to siltation (the continual deposit of silt) in several studies (Bodie 2001), such as the decline and possible extirpation of Smooth Softshell (*Apalone mutica*) and Illinois Mud Turtles (*Kinosternon flavescens* ssp. *spooneri*) in Illinois (Moll 1980), declines of Map Turtles (*Graptemys geographica*) and softshells (*Apalone* sp.) in Missouri (Johnson 1992) as well as in Kansas (Plummer 1976). Inputs of organic matter and nutrients can increase water turbidity and reduce dissolved oxygen content, which could affect respiration in winter. To what extent such conditions could affect the Spiny Softshell is not known.

The augmentation of nutrient loads associated with human activity can lead to blue-green algal blooms in waters frequented by turtles (Carpenter et al. 1998), and this can threaten turtles through ingestion of toxins from the algae. In addition, nutrient loading can lead to increased oxygen consumption by bacteria, which, in turn, can result in periods of low dissolved oxygen levels (hypoxia) or even a total absence of oxygen (anoxia) during winter. Spiny Softshells are anoxia-intolerant (Reese et al. 2003); therefore, if they hibernate in areas where oxygen levels are decreased, they could be at risk of dying during hibernation due to hypoxia or anoxia.

Groundwater contamination related to discharge at overwintering sites is also of concern. Studies to determine the extent of the effects of nutrient loading on Spiny Softshells are needed to help identify the level of risk to local populations.

[40] Scutes: Thick horny plate located on the shell.
[41] Lymphocyte: a subtype of white blood cell that assists the immune system fight off infection or disease.

Climate Change and Natural Disasters

Climate change

Climate is the main limiting factor of the distribution of turtles in the northern part of their range. Given the effect of climate on recruitment rates, it seems likely that global climate change will have an impact on turtle populations, although the overall nature and extent of the impact is unclear. An increase in the annual average temperature in Ontario of 2.5-3.7ºC by 2050 (compared to 1961-1990) is expected, along with changes in seasonal precipitation patterns (Expert Panel on Climate Change Adaptation 2009).

Changes in patterns of precipitation due to climate change may cause lower water levels during summer (Lemmen et al. 2008), and these lower levels could in turn increase the availability of nesting sites. However, in the absence of increased precipitation, higher temperatures and increased evaporation could lead to low water runoff (Expert Panel on Climate Change Adaptation 2009) and dry out wetlands that were once permanent. Decreasing water levels in the Great Lakes may result in significant loss of coastal wetland habitats utilized by the Spiny Softshell. As well, lower water depth in Great Lakes wetlands containing overwintering sites may result in increased mortality of hibernating turtles.

Changes in patterns of precipitation due to climate change may also cause an increase of extreme rainfall events, which would cause more flooding of eggs on the shoreline. One nesting site monitored regularly in Quebec is already regularly flooded. If the frequency and intensity of extreme rainfall events increase in the future as predicted (Expert Panel on Climate Change Adaptation 2009), there is a risk that the nesting site will be flooded even more often. That would further reduce hatching success and impact the recruitment in the local population (Équipe de rétablissement de la tortue-molle à épines au Québec 2014). Further studies are needed to determine the impacts that climate change will have on the species.

5. Population and Distribution Objectives

The long-term (i.e., 50 years) population and distribution objective is:

- Maintain, and where necessary and feasible, increase the abundance of the Spiny Softshell to ensure self-sustaining[42] local populations where it occurs in Canada.

To work towards achieving the long term population and distribution objective, the following medium term (i.e., 10 to 15 years) sub-objective has been identified:

[42] Self-sustaining local populations show stable or increasing population trends and show resilience, i.e. the population size is large enough that there is sufficient genetic diversity and ability to rebound from disturbance and avoid demographic collapse (GoC 2017)

- Stabilize and, where necessary and biologically and technically feasible, increase population abundance at local populations, through increasing suitable habitat and/or mitigating threats.

The Spiny Softshell is listed under SARA due to low total population size (~1000 mature individuals) and continuing decline in the number of mature individuals (COSEWIC 2016). There is uncertainty around the exact population estimate of Spiny Softshell in Canada, but population declines have been observed in multiple local populations throughout the Canadian range (COSEWIC 2016). These declines have led to the recent status re-assessment by COSEWIC[43] (COSEWIC 2016) which is based on an estimated reduction in the number of mature individuals of more than 50% over the last three generations (105 years); and a projected reduction in the number of mature individuals of more than 50% within the next three generations (COSEWIC 2016).

To ensure the recovery of the Spiny Softshell in Canada, it is necessary that local population declines be reversed by eliminating or mitigating threats to the species, in order to increase the abundance of local populations or the amount of suitable habitat available to them where it is feasible to do so. Local populations contribute to the resilience[44] and redundancy[45] of the Canadian population, and help maintain the species range. Therefore, in the medium-term, stabilizing population abundance at local populations is a first step to maintaining a self-sustaining Canadian population. Some examples of local populations where it may be necessary to work towards an increase in the abundance include: those that have data showing a clear population decline, where suitable habitat is being lost/degraded, and/or where threats are documented to be high and negatively affecting local populations. Examples of local Spiny Softshell populations where it may be feasible to increase abundance in Canada may include local populations where recruitment is extremely low, and proven recovery techniques can mitigate the threats. In addition, maintaining connectivity within and among local populations free of permanent barriers will increase stability of local populations, as immigration from outside sources may play a role in the persistence of the species in areas where recruitment is low. In the long-term, maintaining self-sustaining local populations throughout the Canadian range will maintain the Canadian distribution of Spiny Softshell, and ensure the survival and recovery of this species in Canada. As part of maintaining self-sustaining local population in the long-term, increasing available and accessible suitable habitat up and downstream of extant local populations will allow Spiny Softshell local populations to expand and potentially increase connectivity within local populations.

[43] COSEWIC re-assessed the status of Spiny Softshell in Canada as Endangered in 2016. This information is currently under consideration for up-listing the status under the *Species at Risk Act*

[44] Population size(s) is large enough that there is sufficient genetic diversity and ability to rebound from disturbance and avoid demographic collapse (GoC 2017).

[45] Distribution is widespread and/or there are multiple (sub) populations or locations such that catastrophic loss (e.g., from a local event) is unlikely (GoC 2017).

This long-lived species has specific ecological requirements, complex life cycle needs, and a limited ability to compensate for the loss of individuals through reproduction or through recruitment from adjacent local populations. As a result, broad strategies and general approaches undertaken on several fronts and over large regions will be required to achieve this population and distribution objective. These approaches and strategies include legislative and administrative tools, reduction in individual mortality, protection, management and restoration of habitat, improved recruitment, communication, outreach and stewardship, surveys and monitoring, and research.

Obtaining more baseline data on abundance and trend information in local populations is needed to assess where local populations are threatened or declining and to develop more quantitative targets for recovery. In light of recent information (status re-assessment by COSEWIC in 2016), the importance of the recovery measures increases, including research to address knowledge gaps. Where there are data uncertainties, conservation planning and protection decisions that may impact this species should be precautionary and evidence-based.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

At the national scale, the Canadian Herpetological Society (CHS) is the main non-profit organization devoted to the conservation of amphibians and reptiles, including turtles, and conducts the following activities: scientific investigations, public education programs and community projects, compilation and analysis of historical data and the undertaking of projects that support conservation or habitat restoration.

Environment and Climate Change Canada has been funding projects related to turtle conservation throughout Quebec and Ontario through the Habitat Stewardship Program (HSP) and Aboriginal Fund for Species at Risk (AFSAR) since 2001 and the Interdepartmental Recovery Fund (IRF) since 2004. Projects have included activities such as: undertaking targeted surveys for the species; identifying important habitat of local populations; studying the severity of and/or mitigating threats; soliciting observations/ encouraging public reporting of sightings; and educating landowners and/or the public on species identification, threats, and stewardship options. Federal funding has contributed to several of the initiatives described below.

Ontario
An Ontario Multi-Species Turtles at Risk Recovery Team was established in the early 2000s by a group of people interested in turtle recovery. This group focused on six turtle species at risk: Blanding's Turtle (*Emydoidea blandingii*); Eastern Musk Turtle (*Sternotherus odoratus*); Northern Map Turtle (*Graptemys geographica*), Spiny Softshell; Spotted Turtle (*Clemmys guttata*); and Wood Turtle (*Glyptemys insculpta*). This group has coordinated and initiated a number of recovery efforts including

conducting educational and outreach programs on reptiles and various management initiatives such as nest protection projects and nest site rehabilitation projects (Seburn 2007).

The Ontario Ministry of Natural Resources and Forestry (MNRF) has funded numerous turtle conservation and stewardship projects across Ontario through the Ontario Species at Risk Stewardship Fund and other provincial funding programs.

Since 2009, Ontario Nature has been coordinating the development of a new Ontario Reptile and Amphibian Atlas (www.ontarionature.org/atlas) and is working with the Natural Heritage Information Centre (NHIC) (provincial Conservation Data Centre (CDC) in Ontario) and other organizations. By soliciting occurrence records from the public, researchers, government and non-government organizations, this project is improving our knowledge of the distribution and status of reptiles and amphibians, including the Spiny Softshell, in Ontario (Ontario Nature 2012; Crowley pers. comm. 2012).

There have been several large-scale inventory, survey, or monitoring programs targeting turtles, including Spiny Softshell, in Ontario (e.g., Ontario Turtle Tally (Toronto Zoo), Kawartha Turtle Watch (Trent University), survey or monitoring initiatives from Nature Conservancy of Canada) as well as some local survey and monitoring programs for Spiny Softshell (e.g., by the Upper Thames River Conservation Authority). In addition, research has been conducted on Spiny Softshell in Ontario to fill knowledge gaps, including studies on home ranges, local population sizes, predation, demographics, habitat use, and ecology of nesting have been conducted in various parts of Ontario (e.g., Reference removed; De Solla et al. 2003; Reference removed; Reference removed; Reference removed; Reference removed; Galois et al. 2010, 2011, 2012; Reference removed; Reference removed; Reference removed; Reference removed; Rioux and Desroches 2007).

There are many organizations and agencies that offer outreach/educational programs about turtle species at risk to school groups, First Nations, and the general public (e.g., Scales Nature Park, Reptiles at Risk on the Road Project, Georgian Bay Biosphere Reserve (and previously the Georgian Bay Reptile Awareness Program), Ontario Nature, MNRF, Ontario Parks, Upper Thames River Conservation Authority). In addition, the National Parks and Historic Canals provide opportunities to their visitors to learn about the Spiny Softshell and other at risk turtles across Ontario. The Toronto Zoo Adopt-a-Pond Wetland Conservation Programme (www.torontozoo.com/adoptapond) is one of several projects that have developed turtle conservation curricula for schools, while the Toronto Zoo Turtle Island Conservation program (www.torontozoo.com/conservation/tic.asp) promotes turtle conservation and awareness among First Nation and non-indigenous groups. Turtle SHELL (Safety, Habitat, Education and Long Life) has prepared booklets and installed turtle crossing signs. In 2004, the Upper Thames River Conservation Authority produced the *Stewardship of the Spiny Softshell Turtle*, a guide targeting landowners with property next to turtle habitat.

Various habitat restoration, threat mitigation, and other conservation initiatives have been undertaken in Ontario to benefit the Spiny Softshell. For example, the Upper Thames River Conservation Authority has carried out extensive recovery and stewardship work for the Spiny Softshell, including locating and protecting nests. The Ontario Turtle Trauma Centre (OTTC) in Peterborough rehabilitates wild turtles that were injured in the hopes of recovering and releasing them (https://ontarioturtle.ca/).

Many projects are being carried out as a requirement under the Ontario *Endangered Species Act, 2007* that are directly benefitting turtle populations. For example, turtle fencing and ecopassages are now incorporated into the design of most new highways whenever they bisect at-risk turtle habitat (Ontario Road Ecology Group 2010; OMNR 2013).

Quebec

Turtle recovery teams were established by the Province of Quebec as early as 1996 (Équipe de rétablissement de la tortue-molle à épines [Spiny Softshell Recovery Team]) and have evolved in scope from single to five species (Équipe de rétablissement de cinq espèces de tortues du Québec [Recovery Team for Five Turtle Species in Quebec]). An implementation team is also in place to work on implementing recovery actions set forth in a recovery plan for this species (Groupe de mise en oeuvre pour le rétablissement de la tortue-molle à épines [Implementation team for the recovery of the Spiny Softshell]).

An amphibian and reptile database (Atlas des Amphibiens et des Reptiles du Québec) exists and is managed by the Société d'Histoire Naturelle de la Vallée du Saint-Laurent (SHNVSL). The Atlas des Amphibiens et des Reptiles du Québec is a source database of the Centre de données sur le patrimoine naturel du Québec (CDPNQ), which is held by MFFP for the data on threatened or vulnerable faunal species, including the Spiny Softshell. CDPNQ is currently mapping the element occurrences for the Spiny Softshell in Quebec.

Since 1996, inventories across the historical distribution (e.g., Reference removed, Reference removed, Reference removed, Reference removed, Reference removed), research on the ecology (Reference removed, Reference removed), habitat use and movements (Reference removed, Reference removed, Reference removed, Reference removed, Reference removed), genetics (Reference removed), threats such as boat mortality and injuries (Reference removed), and potential alteration of overwintering habitat (References removed) have been conducted in the province.

The Implementation Team for the Recovery of Spiny Softshell also produced protection plans for the main habitats used by the species in Quebec. In association with these plans, several land acquisition projects have been implemented to protect habitats used by the Spiny Softshell in Quebec. Over 270 ha of habitat have been protected by partners such as the Nature Conservancy Canada (Reference removed). Also, several stewardship and communication initiatives have been put forward to protect Spiny Softshells and their habitat (signs and navigational buoys indicating the presence of

protection zones, distribution of brochures and pamphlets to the public, presentations in schools, television and newspaper reports, and development of a web page). A nest monitoring and protection program has also been ongoing since 2008. Through annual nesting surveys, a total of 59 nests have been located to date, which have been protected through relocation and predation mitigation measures (e.g., fencing) (Galois et al. 2010, 2011, 2012). To increase the nesting success in Quebec, a project of artificial egg incubation, followed by the release of hatchlings, has been implemented by the Implementation Team for the Recovery of Spiny Softshell in 2009 (Reference removed). Moreover, a communication strategy is also currently in development to promote the Spiny Softshell as a regional animal emblem for the protection of biodiversity and environment. All these actions have been conducted by government organizations, zoological institutions, conservation organizations and watershed organizations. One of the main nesting sites used by Spiny Softshells in Quebec has been closely monitored since 2003 by volunteers.

6.2 Strategic Direction for Recovery

To work towards achieving the population and distribution objectives, seven broad strategies for recovery have been established. The broad strategies are:

1. Use legislative and administrative tools to conserve Spiny Softshell individuals and habitat
2. Reduce individual mortality, injury, and illegal collection across the Canadian range of the Spiny Softshell
3. Protect, manage, and restore habitat across the Canadian range of the Spiny Softshell
4. Improve recruitment in locations where local Spiny Softshell populations are in decline or viability is deemed compromised
5. Conduct communication, outreach, and stewardship activities
6. Survey and monitor local Spiny Softshell populations, habitat, and threats
7. Conduct research on population demographics, habitat characterization and use, and threats/threat mitigation to fill knowledge gaps

Research and management approaches are recommended for each strategy (Table 2). Threats/limitations in the first column are numbered as follows for concise presentation (in no particular order of severity):

1. Shoreline and riverine habitat development
2. Collisions with boats
3. Human-subsidized predators
4. Illegal collection
5. Exotic and invasive species
6. Water level management
7. Livestock farming and ranching
8. Fishing by-catch
9. Disturbance from human activities
10. Contamination and nutrient loading; and
11. Climate change

Table 2. Recovery Planning Table

Threat or Limitation	Broad Strategy for Recovery	Priority[a]	General Description of Research and Management Approaches
1,4,6,7	Legislative and administrative tools to conserve Spiny Softshell individuals and habitat	High	• Continue to improve and enforce existing federal and provincial laws, regulations, policies, prohibitions and other regulatory and non-regulatory tools to protect Spiny Softshell individuals and their habitat. • Continue to develop and implement mitigation techniques (e.g., best management practices) and evaluate their effectiveness to address threats to individuals and habitat.
2,3,4,7,8,9	Reduce individual mortality, injury, and illegal collection	High	• Continue to develop and implement mitigation techniques (e.g., BMPs and alternatives to traditional development) to reduce Spiny Softshell adult mortality and injury. Examples of priority mitigation measures include: o Implement and evaluate stewardship activities to reduce disturbance of occupied nesting habitat and individuals (e.g., signposting, monitoring of off-road vehicle use on beaches), especially in habitat near urban areas. o Implement and evaluate techniques to control predator populations or restrain access to nesting habitats through direct and indirect measures (e.g., garbage removal, predator management, and fencing). • Promote the implementation of approved BMPs, development alternatives, and mitigation techniques to the general public, First Nations, landowners, land managers, governments and industry, which address priority threats through stewardship, funding and other techniques. • Develop a federal/provincial strategy to focus on countering illegal collection for pet trade and consumption.
1,3,5,6,7, 9,10	Protect, Manage or Restore Habitat	High	• Protect areas large enough to maintain viable local populations and increase connectivity through stewardship, development of BMPs, and/or land conservation. • Assess habitat restoration needs at locations where habitat loss, degradation, and fragmentation are threatening local Spiny Softshell populations.Identify, develop, implement and evaluate exotic and invasive species management at impacted sites used by Spotted Turtle • Identify, develop, implement and evaluate restoration techniques at priority sites and monitor use by Spiny Softshell. • Determine disturbance threshold levels for activities that are likely to destroy critical habitat. • Continue to encourage stewardship activities, including financial support through available funding programs.

1-10	Improve recruitment in locations where Spiny Softshell is declining or viability is deemed compromised	High	This strategy must be implemented concurrently with two aforementioned broad strategies: "Reduce Individual Mortality, Injury, and Illegal Collection" and "Protect, Manage or Restore Habitat" • Assess the status and abundance of individuals at locations where Spiny Softshell is declining or viability is deemed compromised to inform recruitment needs. • Implement, evaluate, adapt and improve recruitment techniques in accordance with results obtained and Spiny Softshell ecology. An example of a priority recruitment technique is: o Developing a cost effective head-starting protocol/program (including nest monitoring, artificial incubation of eggs, and release of juveniles).
All Threats	Survey and Monitoring	High	• Prioritize sites with suitable habitat and historical or potential local populations and conduct targeted inventories • Develop and promote the appropriate use of standardized protocols for survey, monitoring, and databases (e.g., data collection, handling, marking). • Develop and implement monitoring plans in Ontario and Quebec. Encourage the submission of records for the Spiny Softshell to provincial herpetological atlases as well as the provincial Conservation Data Centre (CDC);
All Threats	Communication, Outreach and Stewardship	Medium	• Develop and implement a communication and outreach strategy or continue to implement existing communication and outreach tools to help address threats to the Spiny Softshell. • Develop outreach/education material, with an emphasis on turtle harvest and trade, for groups most often associated with the use of this species. Produce and distribute these materials in the language of the target audience. • Encourage the transfer, use and archiving of information and tools, including Indigenous Knowledge (IK). • Improve and maintain cooperation among stakeholders (e.g., engage partners and promote collaborative work with multiple jurisdictions). • Promote and engage partners (e.g., academics, government, non-government organizations, First Nations) in research initiatives necessary to fill knowledge gaps.
All Threats	Research on population, habitat, and threats to fill knowledge gaps	Medium	• Determine the minimum habitat and population criteria for a viable local population (e.g., suitable habitat area, number of mature individuals) at the appropriate recovery scale. • Increase knowledge of the habitat requirements of the species to further characterize and define the habitats (e.g., nesting, feeding, and overwintering sites) used while carrying out various life cycle activities • Conduct research to evaluate the severity of known threats to local populations and document frequency, extent, and causal certainty of threats. • Conduct intensive demographic and genetic studies in selected sites across the range to expand knowledge of local population discreteness, size, age composition, and sex ratios.

[a] "Priority" reflects the degree to which the broad strategy contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species.

6.3 Narrative to Support the Recovery Planning Table

Considering the Spiny Softshell's reproductive strategy (see section 3.4), maintaining the highest possible adult survival rate, especially for females, remains the primary need of the species to achieve recovery. Unfortunately, some biological traits of the Spiny Softshell (i.e., aquatic habits, basking by floating on the surface of the water, nesting in beaches) make it very sensitive to many human activities (e.g., mortality from boating, as well as illegal collection, recreational activities at beaches) so it will be important that a proactive, integrated approach be taken to limit threats on adult Spiny Softshells.

Such approaches should focus primarily on where and when most of the adult mortality occurs. Habitat protection, management, and restoration are also key to recovery since such approaches contribute to maintaining, improving or creating suitable habitat, and also contributing to reducing adult mortality (i.e., reducing threat severity). Habitat protection and restoration should focus primarily on the aquatic zone and shorelines identified as critical habitat (see section 7) where most of the adults are found. These approaches must be implemented via an integrated approach engaging various groups (e.g., land owners, land users, land planners, First Nations, non-government organizations, and governments). In order to inform these groups, as well as begin to mitigate specific threats (e.g., boating mortality, and fishing by-catch), specific communication and outreach approaches need to be undertaken.

Population surveys and monitoring are also necessary to help gather information on the species in order to help inform further conservation efforts. It is recognized that in some locations, mortality of eggs and juveniles may be of higher concern than adult mortality. It is important to identify primary threats at each location and conduct the appropriate threat mitigation techniques, as some threat levels may not be uniform across Canada. It is also necessary to fill the knowledge gaps which surround this species through a wide range of specific studies to help meet the population and distribution objectives. Along with approaches highlighted in Table 2 some knowledge gaps will also be filled via the Schedule of studies to identify critical habitat (Table 4).

7. Critical Habitat

Under SARA, critical habitat is defined as "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species". Section 41 (1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat to the extent possible, as well as examples of activities that are likely to result in its destruction. This federal recovery strategy identifies critical habitat to the extent possible, based on the best available occupancy information for the Spiny Softshell as of December 2013. Following the publication of this strategy additional critical habitat may be identified if new information supports the inclusion of areas beyond those currently identified. In some of the areas identified as critical habitat, the quality of the habitat will need to be improved for recovery to be achieved.

7.1 Identification of the Species' Critical Habitat

Critical habitat for the Spiny Softshell in Canada is identified for 14 local populations (12 in Ontario and 2 in Quebec). Seven historical local populations were not included in the critical habitat identification, as these did not meet at least one criterion (e.g. multiple-occupancy). It is recognized that the critical habitat identified may be insufficient to achieve the population and distribution objectives for the species. A schedule of studies has been included to outline the activities necessary to complete the identification of critical habitat (see section 7.2).

Critical habitat for the Spiny Softshell is based on three general criteria: habitat occupancy, habitat suitability, and habitat connectivity (between occupied areas), which are described below.

7.1.1 Habitat Occupancy

This criterion refers to areas where there is a reasonable degree of certainty of the presence and current use of a habitat by the species.

Habitat is considered occupied when:

- a minimum of two Spiny Softshell individuals have been observed in any single year in the past 40 years[46] (an indicator of habitat quality) OR
- a single Spiny Softshell individual has been observed in two or more years in the last 40 years (an indicator of site fidelity).

A 40-year period has been chosen for the habitat occupancy criteria. It is appropriate given the long generation time[47] of the species (approximately 35 years) (COSEWIC 2016). This longevity trait makes the entire life span of the species difficult to study, by complicating the acquisition of an adequate amount of accurate life history data. The species is not well surveyed across its range. Application of a 40 year timeframe allows for the inclusion of local populations that likely persist but for which Spiny Softshell individuals may not have been detected in recent years. Habitat quality is targeted by the habitat occupancy criteria to increase confidence that the habitat will contribute to the maintenance of a local Spiny Softshell population. Site fidelity is considered because Spiny Softshells are shown to exhibit fidelity to their overwintering and nesting sites (see section 3.3).

Habitat occupancy is based on professional surveys and telemetry studies, nest site observations (e.g., presence of egg shell fragments) and overwintering site observations, observations of dead individuals, and incidental sightings of the Spiny Softshell. These observational data must be spatially precise (≤ 150 m) or provide enough detail to be associated to a specific suitable water feature (e.g., a river, lake or

[46] A period from 1974-2013 was used to identify critical habitat in this Recovery Strategy.
[47] Generation time: Average age of parents in a population.

wetland) to be considered adequate to identify critical habitat. Spiny Softshell terrestrial movements are limited and they remain close to water (Graham and Graham 1997; Steen et al. 2012) therefore, it is usually possible to associate the observation with a corresponding suitable aquatic habitat feature. Critical habitat is not identified for locations where sufficient survey efforts using appropriate survey protocols and following appropriate timing and methods have been carried out over multiple years but have failed to confirm Spiny Softshell persistence or habitat use and local extinction is presumed (e.g., Lake Ontario, Ottawa River).

To meet the multiple occupancy criteria, the two observations must be within a 30 km linear distance from one another, to account for species dispersal (see section 7.1.3). This conservative approach is appropriate because most locations have not been adequately surveyed and there is a higher probability that more Spiny Softshells reside within proximity to known observations.

7.1.2 Habitat Suitability

Habitat suitability refers to areas possessing a specific set of biophysical attributes that allow individuals to carry out essential life cycle activities (i.e., overwintering, mating, thermoregulation, nursery, nesting, foraging) as well as their movements. It is important that all required habitat areas are linked aquatically or semi-aquatically, and are in reasonable proximity to one another so that turtles can move between them with ease. Suitable habitat for the Spiny Softshell can therefore be described as a mosaic of aquatic and terrestrial habitats, in which specific biophysical attributes can be associated with essential life cycle activities. Within the area of suitable habitat, the biophysical attributes required by the Spiny Softshell will vary over space and time with the dynamic nature of ecosystems. In addition, particular biophysical attributes will be of greater importance to turtles at different points in time (e.g., during different life processes or at various times over the year). The biophysical attributes of suitable habitat for the Spiny Softshell are detailed in Table 3.

Given the lack of information on the amount of habitat that is required for the Spiny Softshell to complete its life cycle activities within a home range, the following approach has been used to identify an extent of suitable habitat for the Spiny Softshell. The description of suitable habitat reflects the fact that certain biophysical attributes do not need to be immediately adjacent to each other, as long as they remain connected so that the individuals can move between them easily to meet all their biological needs and respond to or avoid disturbance. The distances determining the extent of suitable habitat are specific to the Spiny Softshell and based on the species' biological and behavioural requirements (see section 3.3).

Suitable habitat for the Spiny Softshell consists of overwintering, mating, thermoregulation, nursery, nesting, and foraging habitat, and habitat for movement (commuting and dispersal) between these areas and is defined as:

- An occupied suitable watercourse or waterbody (up to the high water mark) including in-stream wetlands OR suitable portion of the watercourse or waterbody (i.e., littoral[48] zone, as measured from the high water mark to a maximum depth of 7 m) AND extending a linear distance of 10 km parallel to the shoreline in both directions from a valid record[49] of Spiny Softshell (resulting in a total minimum site length of 20 km); OR
- An occupied suitable wetland (or wetland complex[50]) not recognized as a watercourse nor a waterbody AND extending a radial distance of up to 10 km from a valid record of Spiny Softshell; AND
- The adjacent aquatic and terrestrial suitable habitat extending up to a province-specific distance (50 m in Ontario; 10 m in Quebec) on either side of the occupied watercourse, waterbody or wetlands (measured landward from the boundary of the watercourse, waterbody or wetlands).

In addition, suitable habitat includes confirmed nesting sites wherever they occur (regardless of the distance to the nearest suitable aquatic feature), as defined by:

- An area extending a radial distance of 50 m from a valid nesting record of Spiny Softshell.

Spiny Softshells are highly aquatic, rarely leave the water, and most home ranges are associated to a permanent waterbody, watercourse, or wetland, although they may move to adjacent or connected streams, ponds and wetlands. Spiny Softshells have large home ranges and can make extensive movements in river habitats over the course of a year. The 10 km distance is selected based on the average linear home range length observed for Spiny Softshells in Quebec (10.8 km; Quebec Spiny Softshell Turtle Recovery team, unpublished data). This distance creates a 20 km site length, capturing the typical upstream and downstream movement distances observed for Spiny Softshell (females) in Canada (Reference removed; Fletcher 1996). The terrestrial distance captured along watercourses, waterbodies, and wetlands represents the maximum documented nesting distance in Ontario and Quebec (see section 3.3), and is set by province. It is probable, given the climatic and other differences between the Ontario and Quebec local populations, that the turtles have, or will develop, different adaptations in the two areas (COSEWIC 2016). The terrestrial distance of 50 m in Ontario captures the maximum distance from a nest site to water at the majority of studied sites (References removed; Gillingwater pers. comm. 2015). In Quebec, the 10 m distance includes all nest sites reported to date (Galois et al. 2010, 2011, 2012; Paré pers. comm. 2015). Thus, these distances will capture the vast majority of potential nesting habitat, which is important considering few precise locations are known. These distances may also capture some adjacent or connected streams, ponds and wetland containing suitable habitat for Spiny Softshells as well as the habitat suitable for movement to access them.

[48] Littoral zone: part of the water body that is close to the shore.
[49] The watercourse or waterbody closest to the location of a valid record for Spiny Softshell.
[50] A wetland complex includes adjacent wetlands hydrologically linked via surface water.

Nest site availability and selection are likely to be especially important for local population persistence given the nature of known factors limiting the Spiny Softshell (e.g., long-term reproductive success strategy, climatic conditions - see section 3.4). Due to the rarity of these habitats, confirmed nesting sites are also identified as critical habitat wherever they occur, including the suitable terrestrial and aquatic habitat for Spiny Softshell within a 50 m radial distance around valid nesting observations. This area allows for nesting and staging and may also provide for a protective movement corridor for females and hatchlings to migrate from and to suitable aquatic habitat.

Table 3: Detailed biophysical attributes of suitable habitat for specific life cycle activities of the Spiny Softshell in Canada.

Suitable Aquatic Habitat Biophysical Attributes			
Habitat Feature(s)	*Characteristics*	*Life Cycle Activities*	*Reference*
Watercourses (e.g., rivers, streams), waterbodies (e.g., lakes, oxbows ponds), or wetlands (e.g., marsh)	• adequate water depth (1-7 m); AND • well-oxygenated; AND • does not freeze to the bottom; AND • soft substrates (e.g., sand, mud) or gravel bottom	Overwintering/ Mating	Reference removed; Fletcher (2002); References removed; Ernst and Lovich (2009)
	• aquatic habitats with water up to 7 m in depth; AND • soft substrate such as sand or organic mud or gravel bottom; AND • aquatic vegetation and/or vegetative debris; OR • floating/ emergent logs and/or rocks	Foraging/ Thermoregulation/ Nursery	Reference removed; Reference removed; Reference removed; Ernst and Lovich (2009); Vermont Fish and Wildlife (2009); Gillingwater, unpublished data
	• aquatic habitats with water up to 7 m in depth; AND • permeable to Spiny Softshell (no barriers to movement)[a]	Commuting and dispersal movements	Reference removed; Reference removed; Ernst and Lovich (2009); Vermont Fish and Wildlife (2009)
Suitable Terrestrial Habitat Biophysical Attributes			
Habitat Feature(s)	*Characteristics*	*Life Cycle Activities*	*Reference*
Mostly unvegetated areas and/ or shoreline areas (e.g., sand bars, beaches, mud flats, rocky outcrops, islands).	• sand, gravel, mud or clay substrate, receiving sunlight for large portions of the day	Nesting/ Thermoregulation	COSEWIC (2002); Reference removed; Ernst and Lovich (2009); Vermont Fish and Wildlife (2009)
Shoreline and terrestrial habitat (e.g., river banks, beaches)	• permeable to Spiny Softshell (no barriers to movement)[b]	Commuting/ Dispersal movement	Ernst and Lovich 2009

[a] Barriers to Spiny Softshell movement in aquatic habitat include large human-made structures, such as dams and locks, which prevent or heavily restrict water movement.

[b] Barriers to Spiny Softshell movement in terrestrial habitat include highways, untraversable topography and urbanized areas.

7.1.3 Habitat Connectivity

Maintaining the natural linkages between habitat types required by the Spiny Softshell is necessary for the persistence of local populations. Connectivity between local populations is required for immigration and emigration (movement into and out of local populations, respectively) which increases gene flow (maintaining genetic diversity within and between local populations), allows for rescue effect which will help support the local populations, and allows the species to react to environmental stressors (e.g., water level changes, pollution, anoxic environments) by moving to another location. In Canada, habitat loss and fragmentation is a threat to local Spiny Softshell populations (see 4.2; COSEWIC 2016). This threat can result in the loss of dispersal corridors, isolating local populations, and causing reductions in genetic diversity.

To allow short-distance movements needed to carry out Spiny Softshell life cycle activities (commuting habitat), connectivity is provided within the defined areas of suitable habitat (seasonal movements between habitats as required to complete an annual life cycle) (section 7.1.2, see also Table 3, Figure 3). To allow long-distance movements such as immigration or emigration (dispersal movement – see section 3.3), the habitat connectivity criterion connects local populations by their hydrological corridors based on the documented tendencies of the Spiny Softshell to undertake aquatic movements for dispersal (Reference removed; Reference removed; Reference removed).

The habitat connectivity criterion is defined as:

- the hydrological corridor consisting of surface water features (watercourses, waterbodies, or wetlands) (up to the high water mark), OR portions of the feature (extending from the high water mark to a maximum water depth of 7 m) intervening between two valid records of Spiny Softshell that are separated by a maximum linear distance of 30 km.

The 30 km distance is three times the average linear home-range length (10 km) and is based on the maximum separation distance between element occurrences recommended by NatureServe (2017) to maintain connectivity and reduce the probability of genetic isolation. The distance is also consistent with documented movements by the Spiny Softshell in one river in Ontario (30 km; Reference removed; Reference removed).

7.1.4 Application of the Criteria to Identify Critical Habitat for Spiny Softshell

Critical habitat for the Spiny Softshell is identified as the extent of suitable habitat (section 7.1.2), where the habitat occupancy criterion (section 7.1.1) is met. At the present time, suitable habitat boundaries of permanent watercourses, waterbodies and wetlands are available for most local populations in Ontario and Quebec and can be used to define the area within which critical habitat is found, herein referred to as the critical habitat unit. Where the habitat connectivity criterion is applied (in cases where

two valid observation records are within a network of continuous surface water features and are separated by a maximum distance of 30 km) the critical habitat unit is extended to identify a larger aquatic habitat complex for the Spiny Softshell (see Figure 3). Thus, the critical habitat unit represents the maximum extent of critical habitat at a given location. Human-made structures (e.g., road surfaces, road shoulders, pavement) do not possess the biophysical attributes of suitable habitat for the Spiny Softshell (Section 7.1.2) and are therefore not identified as critical habitat. Where appropriate, human-made features that do possess the biophysical attributes of suitable habitat for Spiny Softshell (e.g., control structure-dependent waterbodies), are identified as critical habitat.

Application of the critical habitat criteria to available data identifies 12 units that contain critical habitat for 14 of the 21 extant or historical local populations of Spiny Softshell in Canada: 12 in Ontario (including nine extant and three historical local populations) and two in Quebec (1 extant and 1 considered extant, but viability needs to be assessed). This is considered a partial identification of critical habitat as there are seven local populations in Ontario that have not been surveyed recently or adequately and/or where there is a lack of certainty in the data needed to identify critical habitat or where data sharing agreements are required. A schedule of studies (section 7.2) has been developed to provide the information necessary to complete the identification of critical habitat that will be sufficient to meet the population and distribution objectives. The 14 extirpated local populations were excluded from the identification of critical habitat and are not considered under the schedule of studies.

Given the vulnerability of Spiny Softshell to illegal collection, critical habitat is presented using 50 x 50 km Universal Transverse Mercator (UTM) grid squares (Table 4, see also Figure 4) to avoid disclosure of this sensitive information. The UTM grid squares are part of a standardized grid system that indicates the general geographic areas containing critical habitat, for land use planning and/or environmental assessment purposes. Critical habitat within each grid square occurs where the description of habitat occupancy (section 7.1.1), habitat suitability (section 7.1.2) and habitat connectivity (section 7.1.3) are met. More detailed information on the location of critical habitat, to support protection of the species and its habitat may be requested on a need-to-know basis by contacting Environment and Climate Change Canada – Canadian Wildlife Service at ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

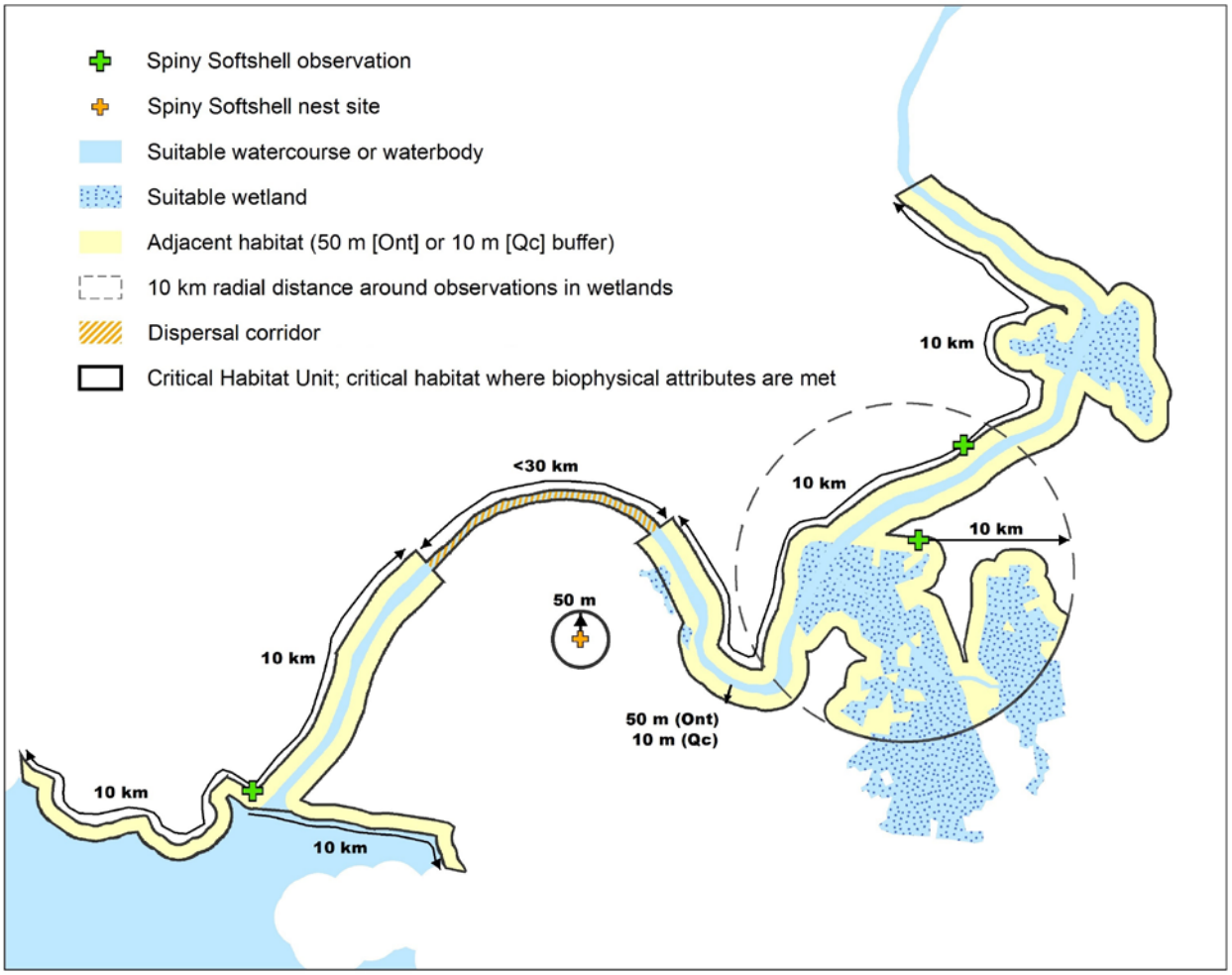

Figure 3. Schematic of Critical Habitat Criteria for the Spiny Softshell. A critical habitat unit is identified where the habitat occupancy criterion applies. Within the critical habitat unit, critical habitat is identified as the areas that contain the detailed biophysical attributes (described in Table 3) that are required for a specific life cycle activity. The maximum extent of biophysical attributes is determined by ecological and behavioural knowledge specific to the Spiny Softshell (i.e., the watercourse or waterbody extending to a maximum of 10 km parallel to the shoreline in both directions from an observation and the adjacent suitable habitat[s] within a province specified distance (50 m in Ontario, 10 m in Quebec) of the watercourse or waterbody; OR the wetland up to a maximum radial distance of 10 km from the valid observation and the adjacent suitable habitat[s] within a province specified distance (50 m in Ontario, 10 m in Quebec) of the wetlands; OR a known nesting site comprising an area extending a radial distance of 50 m from a valid nesting observation). The critical habitat unit is extended to include dispersal corridors where two valid observations occur within a continuous hydrological network and are separated by a maximum distance of 30 km (Habitat Connectivity Criterion).

Table 4: Critical Habitat for the Spiny Softshell in Canada occurs within these 50 x 50 km UTM grid squares where the description of habitat occupancy (section 7.1.1), habitat suitability (section 7.1.2) and habitat connectivity (section 7.1.3) are met.

50 x 50 km Standardized UTM grid square ID[a]	Province/Territory	UTM Grid Square Coordinates[b]	
17TLBB	Ontario	300000	4650000
17TLGC		350000	4600000
17TLGD		350000	4650000
17TLHC		350000	4700000
17TLHD		350000	4750000
17TMGB		400000	4650000
17TMHA		400000	4700000
17TMHB		400000	4750000
17TMHC		450000	4700000
17TMHD		450000	4750000
17TNHA		500000	4700000
17TNHB		500000	4750000
17TNHC		550000	4700000
17TNHD		550000	4750000
18TXQB	Quebec	600000	4950000
18TXQD		650000	4950000
18TXRA		600000	5000000
18TXRC		650000	5000000

[a] Based on the standard UTM Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography/topographic-information/maps/9789), where the first 2 digits represent the UTM Zone, the following letter represents the UTM Row, the next 2 letters indicate the 100 x 100 km Standardized UTM grid, followed by 1 letter to represent the 50 x 50 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 www.bsc-eoc.org for more information on breeding bird atlases).

[b] The listed coordinates are a cartographic representation of where critical habitat can be found, presented as the southwest corner of the 50 x 50 km Standardized UTM grid square 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.

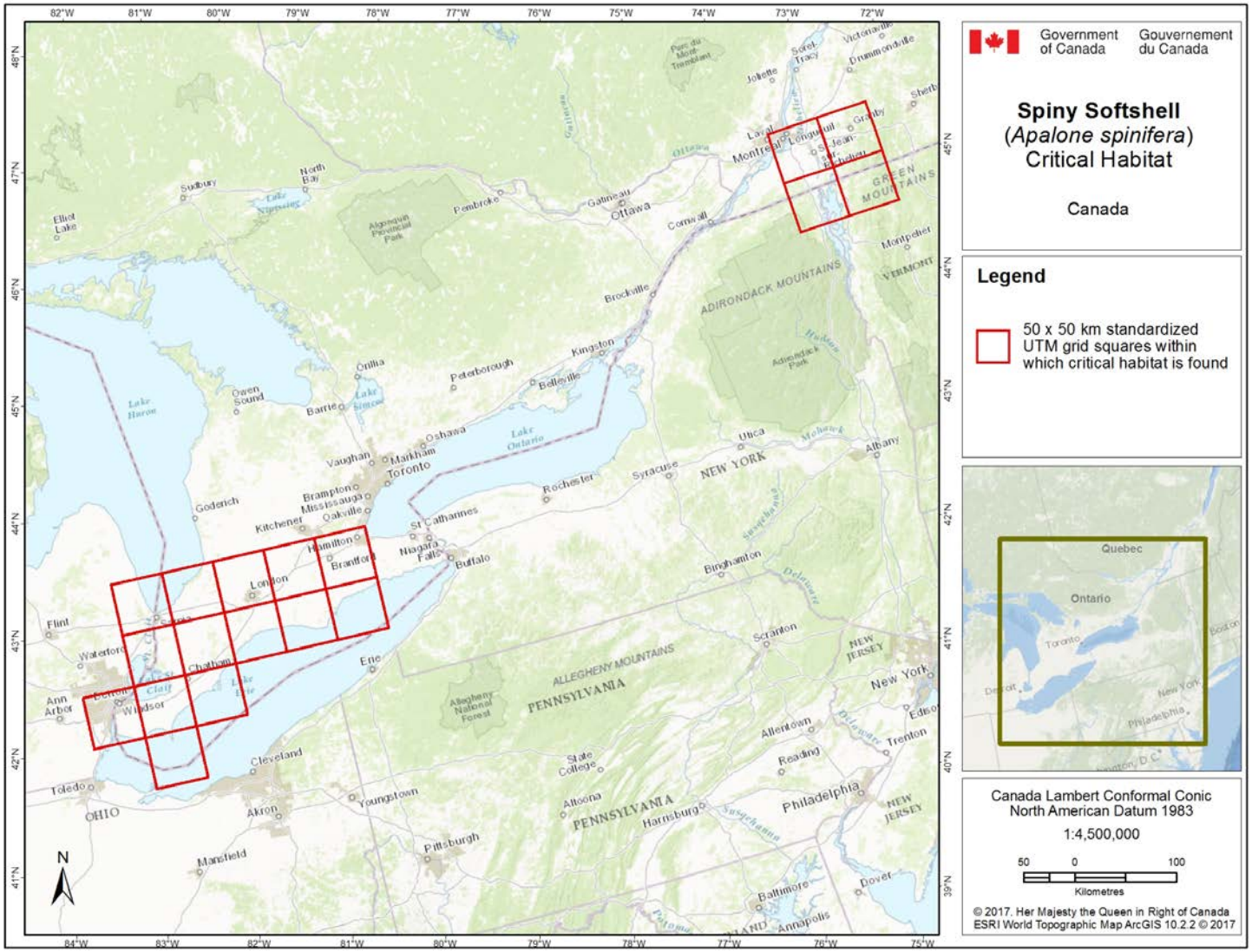

Figure 4: Grid squares that contain critical habitat for the Spiny Softshell in Canada. Critical habitat for the Spiny Softshell occurs within these 50 x 50 km UTM grid squares where the description of habitat occupancy (section 7.1.1), habitat suitability (section 7.1.2) and habitat connectivity (section 7.1.3) are met.

7.2 Schedule of Studies to Identify Critical Habitat

Critical habitat for the Spiny Softshell is partially identified in this recovery strategy as it may be insufficient to meet the population and distribution objectives (section 5) for the species. There are some locations (e.g., extant or historical element occurrences) that may still support Spiny Softshells but have either not been surveyed recently or adequately, or where data sharing agreements are required, and/or where there is a lack of certainty in the data needed to identify critical habitat. Studies are required to confirm whether these areas contribute to the overall local population viability.

Table 5. Schedule of Studies to Identify Critical Habitat

Description of Activity	Rationale	Timeline
Confirm habitat occupancy in locations where only a single observation of Spiny Softshell is available, where the validity of a record is in question (e.g., records possibly corresponding to released individuals), where data sharing agreements are required or where records are spatially imprecise or cannot be associated to specific locations.	This activity is needed to complete critical habitat identification.	2018 – 2028
Conduct local population surveys and habitat assessments at historical sites to confirm species' presence in areas that have received insufficient survey effort.	Information on the recent presence (including nesting) is required to support the identification of critical habitat (i.e., determination of habitat occupancy).	2018 – 2028

7.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management 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 or multiple activities at one point in time or from the cumulative effects of one or more activities over time.

Destruction of critical habitat for the Spiny Softshell can happen at a variety of scales and in both aquatic and terrestrial habitats. It may occur from an activity taking place either within or outside of the critical habitat boundary, and may occur in any season of the year. Within the critical habitat boundary, activities may affect habitats that provide suitable conditions for mating, nesting, foraging, thermoregulation, or overwintering. Certain activities may also affect dispersal and commuting corridors that connect these habitats. Within these corridors it is most important to maintain habitat permeability (movement through connective habitat to access adjacent suitable habitats) and, as a result, certain activities that are likely to cause destruction in habitats suitable for mating, foraging, overwintering, nesting and thermoregulation may not cause destruction in corridors as long as sufficient habitat permeability is maintained. In

general, some activities taking place outside of the critical habitat boundary may be less likely to cause destruction of critical habitat than those taking place within the critical habitat boundary.

Activities described in Table 6 are examples of those likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed.

Table 6: Examples of activities likely to result in the destruction of critical habitat

Description of Activity	Description of Effect	Location of the Activity Likely to Destroy Critical Habitat		
		Within Critical habitat		Outside Critical Habitat
		Nesting, foraging, mating, overwintering , nursery or thermoregulation habitat	Commuting and/or dispersal habitat	
Activities that result in the alteration of hydrology (such as drainage) or filling of wetlands; dredging	Complete or partial draining or filling of wetlands at any time of the year is likely to cause permanent or temporary loss of mating, thermoregulation, overwintering, nursery, movement and foraging habitat(s). Dams and large retention ponds can also contribute to the fragmentation of suitable habitat and hinder the movement and dispersal of turtles. Raising the water level may result in temporary or permanent saturation of the nesting substrates and may prevent turtles from successfully using the nesting site. Conversely, a repeated decline in water levels can promote vegetation growth at nest sites and prevent their use for nesting. Water supplies and controlled releases can reduce natural erosion processes that contribute to the creation or maintenance of nesting sites. Changes in hydrology (e.g., from drainage or dredging) may also alter the depth of water and flow sufficient to prevent the species from successfully overwintering (e.g., exposure of overwintering turtles to frost caused by an abnormal drop in the water level). Water level stabilization can permanently reduce the availability of floodplain habitat (e.g., wetlands) used by the Spiny Softshell for its thermoregulation and feeding. When conducted outside the boundaries of critical habitat, such activities may result in the destruction of this habitat if the water level and flow that contribute to the maintenance of critical habitat are altered. The likelihood of such activities leading to destruction of critical habitat increases during periods of overwintering and nesting. The precise timing of peak flows is critical to nest success. Similarly, the timing of flow rates and water depths has a critical effect on overwintering success. Habitat may be destroyed if these activities change these parameters to the extent that the overwintering and nesting	X	X	X

Description of Activity	Description of Effect	Location of the Activity Likely to Destroy Critical Habitat		
		Within Critical habitat		Outside Critical Habitat
		Nesting, foraging, mating, overwintering , nursery or thermoregulation habitat	Commuting and/or dispersal habitat	
	needs of the species are not met. Even activities conducted outside of the critical habitat boundary may indirectly drain wetlands that form part of the critical habitat. If these activities were to occur outside the bounds of critical habitat, it could result in destruction of critical habitat if the wetland characteristics that contribute to critical habitat suitability are not maintained (e.g., hydrology of critical habitat). A single event could cause critical habitat destruction.			
Activities such as residential and/or industrial development; habitat conversion for agriculture	Complete or partial conversion of shoreline habitats or terrestrial habitats for other uses (e.g., development, agriculture) at any time of year may cause permanent loss or degradation of thermoregulation, nesting, nursery, and/or foraging habitat(s). Such conversion may also remove or degrade commuting or dispersal habitat, thus potentially reducing access to key areas (e.g., nesting sites) as well as isolating local populations. A single event could cause critical habitat destruction. If these activities were to occur outside the bounds of critical habitat, it could indirectly result in destruction of critical habitat if the characteristics that contribute to critical habitat suitability are not maintained (e.g., hydrology of critical habitat). All such activities within critical habitat are likely to result in destruction of critical habitat.	X	X	X

Description of Activity	Description of Effect	Location of the Activity Likely to Destroy Critical Habitat		
		Within Critical habitat		Outside Critical Habitat
		Nesting, foraging, mating, overwintering or thermoregulation habitat	Commuting and/or dispersal habitat	
Activities that alter water flow and/or fragment aquatic habitat, such as the creation and operation of water control structures	Alteration/ disruption of water flow, such as through the creation and operation of dams or other water control structures, may lead to temporary or permanent degradation or elimination of nesting, overwintering, nursery, foraging, and thermoregulation habitat(s). Stabilization of water levels may permanently diminish flood plain habitat availability (e.g., wetlands, open shoreline areas) upon which the Spiny Softshell relies for nesting, foraging and/or thermoregulation. High water levels can saturate nesting substrates, thereby affecting the possibility of successfully using the site. Recurrent low water levels can promote the growth of vegetation on nesting sites, preventing their use for egg laying. Destruction of overwintering habitat can result if water depth is altered to a point where overwintering requirements are no longer met and the potential for displacement or mortality arises. Additionally, the construction and operation of water control structures is likely to create a barrier that impedes movements of the Spiny Softshell, thereby fragmenting habitat and preventing the species from accessing suitable habitat areas within a home range, as well as preventing dispersal to adjacent local populations. The creation and operation of water control structures within and outside the bounds of critical habitat could result in destruction of critical habitat if the water levels that contribute to critical habitat suitability are not maintained (i.e., hydrology of critical habitat). There is an increased likelihood that such activities could result in the destruction of critical habitat during the nesting and overwintering periods. Further studies are required to set thresholds/conditions to which such activities within and outside of critical habitat are likely to result in habitat destruction.	X	X	X

Description of Activity	Description of Effect	Location of the Activity Likely to Destroy Critical Habitat		
		Within Critical habitat		Outside Critical Habitat
		Nesting, foraging, mating, overwintering or thermoregulation habitat	Commuting and/or dispersal habitat	
Construction of new road infrastructure (e.g., roads, bridges and culverts)	Construction of roads (paved, gravel or dirt roads) and bridges at any time of year may cause permanent destruction (loss) or degradation of suitable nesting, overwintering, or movement habitat. Such construction can compact areas of nesting habitat and cover areas with rip rap and other foreign materials which are unsuitable as nesting sites. If construction of road crossings over water (culverts, bridges, etc.) or road ditching is conducted in the winter, there is the possibility of altering water levels and negatively impacting overwintering sites and/or leading to mortality (e.g., through the use of cofferdams to remove water from an area as well as the use of heavy machinery which can impact suitable habitat below the high water mark). Construction of roads may also impede commuting movement (e.g., access to nesting sites). A single event could cause destruction of critical habitat. If such activities occurred within or outside the boundaries of critical habitat there could be an impact to the habitat or individuals. Water level alterations outside of suitable habitat could lead to decreased water levels over hibernacula, increasing the risk of Spiny Softshell to overwintering mortality. Existing road surfaces, road shoulders and bridges are not included in the description of critical habitat and therefore the continuation of maintenance activities on the roads and bridges following appropriate habitat mitigation BMPs are not likely to result in destruction of critical habitat.	X	X	X
Shoreline alteration (e.g., re-profiling, linearization or hardening of stream banks)	Changes to the structure and composition of shores/banks (e.g., excessive removal of native vegetation, addition of stabilizing materials such as concrete, loss of meanders and associated fine and coarse substrates) at any time of year may create permanent unsuitable conditions for nesting, thermoregulation, and foraging habitat(s). Shoreline hardening may also impede movement. A single event could cause critical habitat destruction. If these activities were to occur within the boundaries of critical habitat, they would directly destroy or degrade the habitat. If these activities were to occur outside the boundaries and upstream, they could indirectly impact the habitat, for example through sediment loading. Currently, all shoreline development within critical habitat is likely to result in destruction of critical habitat.	X	X	X

Description of Activity	Description of Effect	Location of the Activity Likely to Destroy Critical Habitat		
		Within Critical habitat		Outside Critical Habitat
		Nesting, foraging, mating, overwintering or thermoregulation habitat	Commuting and/or dispersal habitat	
Intensive farming practices (e.g., field corn)	Intensive farming practices (e.g., field corn) at any time of year may lead to siltation of nearby waterbodies, impairing feeding opportunities; it could also lead to removal of native vegetation and natural bare ground areas, causing temporary or permanent alteration of nesting and thermoregulation habitat. Increased use of pesticides and fertilizers may degrade or permanently alter overwintering and foraging habitat directly (e.g., through impairments to water quality) and indirectly (e.g., changes to food availability). If these activities were to occur outside the bounds of critical habitat, it could result in destruction or degradation of critical habitat if the characteristics that contribute to critical habitat suitability are not maintained. A single event could cause critical habitat destruction. Studies are necessary to set thresholds/conditions regarding proximity to critical habitat, and at what level of intensification would result in critical habitat destruction.	X	X	X
Livestock farming and ranching	Farming practices such as allowing livestock to graze within critical habitat or to access waterways within critical habitat can also degrade or destroy nesting, foraging, thermoregulation, and overwintering habitat. Livestock trample the habitat and remove natural vegetation which can temporarily or permanently alter the structure of the habitat. Livestock accessing the waterway can also kick up the substrate and cause siltation downstream which could degrade foraging habitat downstream. If these activities were to occur outside the bounds of critical habitat, it could result in destruction or degradation of critical habitat if the characteristics that contribute to critical habitat suitability are not maintained. A single event within critical habitat could lead to habitat destruction. Currently, all farming practices allowing livestock to enter critical habitat is likely to result in destruction of critical habitat.	X	X	X

Description of Activity	Description of Effect	Location of the Activity Likely to Destroy Critical Habitat		
		Within Critical habitat		Outside Critical Habitat
		Nesting, foraging, mating, overwintering or thermoregulation habitat	Commuting and/or dispersal habitat	
Activities that cause degradation of water quality (e.g., discharges of domestic, commercial, industrial or municipal liquid or solid waste)	Discharges of domestic, commercial, industrial or municipal liquid or solid waste in water are some of the activities that could contaminate water with hazardous chemical and biological materials or heavy metals or lead to eutrophication. Activities leading to siltation or runoff of pesticides and fertilizers (e.g., agricultural activities) can also degrade water quality. The degradation of water quality and/or reduction of oxygen levels (creating anoxic conditions) in aquatic habitats within or outside critical habitat, at any time of the year, could temporarily or permanently alter or destroy foraging, overwintering, nursery and thermoregulation habitats. Continuous, sporadic, or recurrent episodes of such discharges could lead to habitat destruction. Studies are necessary to set thresholds/conditions for these activities.	X		X
Activities that introduce exotic and/or invasive species (e.g., planting of non-native plant species, moving fill)	The introduction of exotic and/or invasive species may lead to degradation or complete loss of habitat through the reduction of nesting, foraging, thermoregulation, overwintering, nursery and movement habitat. For example, dense stands of non-native Common Reed can overgrow nesting sites thereby preventing turtles from nesting, and/or can impede movements to and from nesting, overwintering, or foraging habitats. They can also decrease level of sun exposure, altering thermoregulation habitat. A single event within critical habitat could lead to habitat destruction because once seeds are introduced it can lead to rapid expansion of invasive species.	X	X	X

8. Measuring Progress

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

Long-term (50 years) performance indicator:

- The abundance of the Spiny Softshell has been maintained or increased, such that self-sustaining local populations persist where the species occurs in Canada.

Medium-term (10-15 years) performance indicator:

- Local populations of Spiny Softshell have been stabilized or increased in population abundance.

9. Statement on Action Plans

One or more action plans will be posted on the SAR Public Registry for the Spiny Softshell by December 2023. Parks Canada multi-species action plans identify recovery measures specific to national parks and other national heritage places where species occur (for a list of current multi-species action plans including the Spiny Softshell, refer to the documents section of the SAR Public Registry).

10. References

Due to the vulnerability of some species to illegal collection, specific references providing sensitive information have been removed from this version of the recovery strategy. To support protection of the species and its habitat, the exhaustive list of references may be requested on a need-to-know basis by contacting Environment and Climate Change Canada's Recovery Planning section at ec.planificationduretablissement-recoveryplanning.ec@canada.ca

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Appendix A: Subnational Conservation Ranks of Spiny Softshell (*Apalone spinifera*) in Canada and the United States

Table A-1 – Ranks of Spiny Softshell in Canada and the United States. (NatureServe2017)

Spiny Softshell (*Apalone spinifera*)				
Global (G) Rank	**National (N) Rank (Canada)**	**Sub-national (S) Rank (Canada)**	**National (N) Rank (United States)**	**Sub-national (S) Rank (United States)**
G5	N2	Quebec (S1) Ontario (S2)	N5	Alabama (S3), Arizona (SNA), Arkansas (SNR), Colorado (S4), California (SNA), Florida (S3), Georgia (S5), Illinois (S5), Indiana (SNR), Iowa (SNR), Kansas (S5), Kentucky (S5), Louisiana (S5), Maryland (S1), Michigan (S4), Minnesota (S5), Mississippi (S5), Missouri (SNR), Montana (S3), Nebraska (S5), Nevada (SNA), North Carolina (S3), New Jersey (SNR), New Mexico (S4), New York (S2S3), Ohio (SNR), Oklahoma (S5), Pennsylvania (S4), South Dakota (S2), South Carolina (SNR), Tennessee (S5), Texas (S5), Utah (SNA), Vermont (S1), Virginia (S2), West Virginia (S4), Wisconsin (S4S5); Wyoming (S4)

Rank Definitions (Master et al. 2012)

S1: Critically Imperilled: At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

S2: Imperilled: At high risk of extirpation in the jursidction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

S2S3: Vulnerable/Imperilled: The risk of extirpation in the jurisdiction ranges from moderate to high due to a fairly restricted to restricted range, relatively few to few populations or occurrences, recent and widespread to steep declines, moderate to severe threats, or other factors.

N3/S3: Vulnerable: At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

S4: Apparently Secure: At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

S4S5: Secure/Apparently Secure: At no risk to fairly low risk of extirpation in the jurisdiction due to an extensive to very extensive range, abundant populations or occurrences, with little to some concern as a result of local recent declines, threats or other factors.

G5/N5/S5: Secure: At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats).

SNA: Not applicable: A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities.

SNR: Unranked: Subnational conservation status not yet assessed.

Appendix B: 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*[51]. 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 and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the Federal Sustainable Development Strategy's[52] (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that 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 strategy itself, but are also summarized below in this statement.

Most activities undertaken to protect the Spiny Softshell and its habitat will also be beneficial to other species that use similar habitat. The protection of aquatic habitats will contribute to maintaining the rich biodiversity supported by those habitats. Moreover, threat reduction and mitigation measures targeting the Spiny Softshell can contribute to reduce mortality in other animal species (e.g., efforts to eliminate pollution from aquatic environments, implement mitigation techniques to reduce fishing by-catch, etc). Some of these measures are likely to be found in other recovery documents, particularly those that deal with aquatic and riparian species. Table B-1 presents examples of species that may benefit from the recovery of the Spiny Softshell population in Canada.

[51] www.ceaa.gc.ca/default.asp?lang=En&n=B3186435-1
[52] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1

Table B-1. Some of the species at risk that may benefit from conservation and management of Spiny Softshell turtle habitat.

Common Name	Scientific Name	SARA Status
Eastern Foxsnake (Carolinian population)	*Pantherophis gloydi*	Endangered
Fowler's Toad	*Anaxyrus fowleri*	Endangered
King Rail	*Rallus elegans*	Endangered
Lake Erie Watersnake	*Nerodia sipedon insularum*	Endangered
Least Bittern	*Ixobrychus exilis*	Threatened
Eastern Hog-nosed snake	*Heterodon platirhinos*	Threatened
Eastern Sand Darter	*Ammocrypta pellucida*	Threatened
Eastern Musk Turtle	*Sternotherus odoratus*	Special Concern
Northern Map Turtle	*Graptemys geographica*	Special Concern
Snapping Turtle	*Chelydra serpentina*	Special Concern
Eastern Milksnake	*Lampropeltis triangulum*	Special Concern
Eastern Ribbonsnake (Great Lakes population)	*Thamnophis sauritus*	Special Concern
Bridle Shiner	*Notropis bifrenatus*	Special Concern
Grass Pickerel	*Esox americanus vermiculatus*	Special Concern

The above does not represent an exhaustive list. Given that specific needs may differ between species, implementation of recovery actions should be evaluated for impacts on the co-occurring species. Wherever possible, natural ecosystem processes should be maintained and allowed to evolve without human interference, because these are the processes to which species are adapted.

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