

**Ontario Species at Risk Evaluation Report for Spiny
Softshell (*Apalone spinifera*)**

Committee on the Status of Species at Risk in Ontario
(COSSARO)

Assessed by COSSARO as Endangered

December 2016

Final

Tortue-molle à épines (*Apalone spinifera*)

La tortue-molle à épines est une tortue longévive à carapace molle qui atteint la maturité tardivement. En Ontario, son aire de répartition est désormais limitée au Sud-Ouest de l'Ontario. La surveillance des trois plus grands sites de nidification de la province a révélé un déclin de 45 % de la population des femelles matures en 15 ans, entre 1999 et 2014. La perte d'habitat et la prédation par des espèces indigènes sont les facteurs qui menacent le plus la nidification; les pertes peuvent atteindre 100 % dans les sites non protégés. Au cours des 20 dernières années, les mesures de protection intensive des nids à l'aide de treillis métallique et l'incubation des oeufs ex-situ ont donné de bons résultats dans un site, même si ce site a récemment subi d'importantes pertes d'habitat, pertes qui pourraient contrer les progrès réalisés en matière de recrutement grâce au travail d'intendance actif.

La zone d'occurrence de la tortue-molle à épines a reculé de 71,5 % au cours des deux dernières générations (35 à 70 ans), l'espèce ayant disparu de plusieurs endroits de son ancienne aire de répartition ontarienne. Sur tous les lieux où l'on trouve encore l'espèce, seuls quatre enregistrent une population estimée supérieure à 10 individus. Compte tenu de son recul très marqué au cours des trois dernières générations, qui devrait se poursuivre en raison des menaces constantes qui pèsent sur elle (pertes d'habitat, prédation, perturbations dues aux activités récréatives), la tortue-molle à épines est considérée comme une espèce en voie de disparition en Ontario.

Cette publication hautement spécialisée «COSSARO Candidate Species at Risk Evaluation for Spiny Softshell» n'est disponible qu'en anglais conformément au Règlement 671/92, selon lequel il n'est pas obligatoire de la traduire en vertu de la Loi sur les services en français. Pour obtenir des renseignements en français, veuillez communiquer avec le ministère des Richesses naturelles et des Forêts au recovery.planning@ontario.ca.

Executive summary

Spiny Softshell turtles are long-lived, late-maturing turtles with a soft carapace. In Ontario, their range is now restricted to southwestern Ontario. Monitoring of the three largest nesting sites in the province reveal a decline of 45% of mature females over the 15-year period of 1999 to 2014. Habitat loss and predation by native predators are the greatest threats to nesting success with losses of up to 100% of unprotected nesting sites. Intensive nest site protection using wire cages as well as ex-situ egg incubation for the past 20 years has been successful at one site, though extensive habitat loss at that site in recent years may counter gains in recruitment resulting from the active stewardship efforts.

The Extent of Occurrence of Spiny Softshell has decreased by 71.5% over the past two generations (35 years to 70 years) as it has disappeared from several locations throughout its former range in Ontario. All but four of the remaining locations where the species is found have an estimated population of 10 or fewer individuals. Spiny Softshell is assessed as Endangered in Ontario due to high rates of decline within the past three generations, which are suspected to continue due to ongoing threats, including habitat loss, predation, and disturbance from recreational activities.

1. Background information

1.1. Current designations

- GRANK: G5 (NatureServe 2016)
- NRANK Canada: N5
- COSEWIC: Endangered (May 2016)
- SARA: Threatened (Schedule 1)
- ESA 2007: Threatened (1996)
- SRANK: S2

1.2. Distribution in Ontario

The primary range of Spiny Softshell in Ontario is in the southwestern portion of the province where it occupies rivers and coastal wetlands. The largest subpopulations occur in four locations. All but four of the remaining locations where the species is found are each believed to have an estimated population of 10 or fewer individuals and are thought to represent declined and small occurrences of the species (COSEWIC 2016). Most of the riverine habitat is privately owned, whereas the Great Lake coastal habitats are mostly under government ownership.

Spiny Softshell has also been reported from the Ottawa River and Lake Ontario; however, those reports could not be confirmed and were only ever occasional observations. Some of the more recent observations from these areas accompanied by photographs were determined to be non-native subspecies that must have been released individuals (COSEWIC 2016). In one of the four main subpopulations in the province, annual spring turtle surveys from 2005 to 2011 resulted in 34-66 sightings per year. In 1994, up to 87 individuals were observed. Three additional areas where annual nest site monitoring has occurred from 1999 - 2014 contain the majority of Spiny Softshells in Ontario. In these three subpopulations there was an estimated combined total of 368 mature females based on nest counts in the most recent sampling year (COSEWIC 2016). Assuming an equal sex ratio, the number of mature individuals estimated for these three sites was 736. A sum of the population estimates for the four largest areas in Ontario equals 770 – 802 mature individuals.

The previous COSEWIC status report estimated the Carolinian subpopulation to be 800 – 1000 mature individuals (Fletcher 2002), adding “the sections of the Ontario population that have been consistently observed over the past 5 years appear to be stable” (p.v). Data from nest site monitoring at the three largest oviposition sites in Ontario in 1999/2000 reveal a total population estimate of 1340 mature individuals (assuming that each nest represents one mature female and an equal sex ratio) for those three sites alone. Thus, earlier estimates of the number of mature adults in the Carolinian subpopulation were underestimated.

NHIC has a total of 31 Element Occurrences (EOs) documented for Spiny Softshell in Ontario (Table 1). Four of these EOs were recently determined to be erroneous, likely having been misidentified individuals (J. Crowley, personal communication 2016). The

EOs are ranked for their probability of persistence according to the guidelines by Hammerson *et al.* (2011). Of the valid EOs, three are ranked A: Excellent viability; one is ranked AB: Excellent to Good viability; one is ranked BC: Good to Fair viability, one is ranked Fair viability; and 6 are ranked D: Poor viability. These rankings were assigned to most of the EOs in the late 1990s and should not be interpreted as assurances of viability under current conditions and trends. Rather, they can be used to consider the relative order of subpopulation sizes and habitat extent. Two occurrences could only be ranked as extant (E) because not enough information was available to assign a ranking. Twelve additional EOs were last observed between 1930 and 1986 and are considered historical (H) and one extirpated (X). At most of these historical locations, Spiny Softshells were last seen in the 1970s. The Extent Of Occurrence (EOO) for all 27 valid EOs was approximately 87 288 km² including those now considered historical and extirpated. COSEWIC determined the current EOO for Spiny Softshell in Ontario to be 24 851 km² representing a 71.5% reduction in extent of occurrence, mainly within two generation periods (70 years). This is primarily a result of the occurrences in the eastern part of its range now being considered historic or extirpated.

To determine the number of locations for this species, the most significant threats to the species must be considered. According to the COSEWIC threats calculator, the two most significant threats to Spiny Softshell in Canada are dams and water management/ use (flooding nests) and problematic native species (nest predation). Each of the EOs with a ranking of C (Fair) to A (Excellent) is found in a different watershed and is arguably geographically distinct such that a single threatening event is unlikely to rapidly affect all individuals of the taxon present in more than one of these EOs at once. Therefore, there are at least 6 locations for this species in Ontario: more if EOs with poor or unknown viability are considered. COSEWIC 2016 considered there to be approximately 10 locations for Canada, including the Quebec subpopulation (which accounts for one of the COSEWIC locations). Therefore the number of locations for Ontario is at least 6, and at most 9.

Table 1. Summary of Element Occurrences for Spiny Softshell in Ontario

EO ID	EO rank	Past Population Estimate (year)	Most Recent Population estimate (year)
1192	A	442 (1999)	252 (2006)
1189	A	412 (1999)	398 (2014)
1196	A	87 (1994)	66 (exact year unknown – 2000s)
1201	AB	486 (2000)	86 (2013)
11838	BC	One juvenile caught in (1990)	unknown
11839	C?	“many” observed (1993)	~10
11834	D?	Only a few ever observed in a given year (1995)	A few individuals
1204	D	Occasional sightings (2003)	unknown
1197	D	3 observations (2004)	<10
21314	D	2 seen in 1997	Considered Extirpated by COSEWIC (2016)

21315	D	One report in 1997	Not reported since 1997
22456	D	3-4 individuals seen (1990) no verifications or other information	Not reported since 1990
34304	E	One adult seen in 2000	Not reported since 2000
11837	E	One observed in 1994	Not reported since 1994

1.3. Distribution and status outside Ontario

Quebec is the only other province where Spiny Softshell occurs in Canada. It is considered extirpated from two of the rivers that the species formerly occupied in the province, and only one viable subpopulation in a single river-lake system remains in Quebec.

In the United States, Spiny Softshell range from New York and Pennsylvania in the east, westwards to Montana, and in the south extends from northern Mexico through the Gulf States to Florida. Beyond its native range, Spiny Softshell has been introduced to California, Nevada, Arizona, New Jersey, and Utah (van Dijk *et al.* 2011). Where its subnational status has been ranked in the U.S., the species is secure or apparently secure in most of its core range in the U.S. (NatureServe 2016). Spiny Softshell are listed as Special Concern in New York. (Appendix 2)

1.4. Ontario conservation responsibility

Ontario's conservation responsibility for Spiny Softshell is low with less than 5% of the global range. The global range of the species is estimated to be greater than 2 500 000 km² (NatureServe 2016). In Canada (including the single viable subpopulation in Quebec) the species' extent of occurrence is calculated to be 51 070 km² and its index of area of occupancy is 600 km² (COSEWIC 2016).

1.5. Direct threats

The overall threat ranking for Spiny Softshell is very high according to the COSEWIC threats calculator. One of the most significant threats for Spiny Softshell at the site with the largest subpopulation is damming/ water control measures. Flood control measures that aim to release water levels at a sustained rate prolong the amount of time that nests are submerged, which has resulted in some nest losses observed from 1995 to 1999 and destruction of all nests at one of the major nesting sites in 2000 (COSEWIC 2016). While shoreline erosion reduces Spiny Softshell habitat, shoreline stabilization efforts also contribute to habitat loss through altered sediment deposition rates and create barriers to shoreline habitat use.

Another highly significant threat identified in the COSEWIC threats calculator is problematic native species, which predate upon eggs and young. While native predators have always been a risk to Spiny Softshell turtles, their level of impact is exasperated by

reduced habitat availability, especially for oviposition sites, making nests more concentrated and more susceptible to predation. Furthermore, urban and agricultural development over the past century has created favourable conditions for some native predators such as Striped Skunks (*Mephitis mephitis*), Raccoons (*Procyon lotor*), Virginia Opossums (*Didelphis virginiana*), Red Foxes (*Vulpes vulpes*) and Coyotes (*Canis latrans*) to thrive. Wire cages are used to protect some nests from predation; however, not all nests can be protected and some nests have been predated upon before the cages could be installed. Up to 100% of unprotected nests in some oviposition sites were observed to have been predated upon (COSEWIC 2016).

Medium threats include non-native invasive species, recreational activities, fishing, livestock and farming, and hunting/collecting.

Spiny Softshell turtles require nesting sites that are free of vegetation. Establishment of exotic invasive plants such as Purple Loosestrife (*Lythrum salicaria*), European Common Reed (*Phragmites a. australis*) and Japanese Hops (*Humulus japonicus*) over the past 15 years has occurred in all known oviposition sites in Ontario. “The changes in habitat availability and quality from 1994 to 2014 along the largest communal nest site have been all-encompassing, resulting in complete loss of oviposition habitat in all but a single sandbar. This sandbar is not suitable for nesting due to desiccation of eggs in late summer and trampling by cattle” (COSEWIC 2016, p.12).

Commercial and recreational fishing can affect Spiny Softshells as unintentional bycatch. The extent of the threat from commercial fishing is unknown. However, there are increasing numbers of reports of dead turtles embedded with hooks from recreational fishing (COSEWIC 2016). It is not clear whether the increasing number of reports reflects higher incidence of mortality from recreational fishing or from increased public awareness about this species at risk.

Many of the aquatic areas used by Spiny Softshells are popular areas for recreational activities. Collisions with vessels and propellers are known to cause injury and mortality in other turtle species. Recreational use of shoreline habitat, including beaches for ATV and 4x4 use, horseback riding, hiking, and camping threatens nesting success, habitat quality and disturbance of adults. Increased human use associated with new housing development and the creation of trail systems has further reduced habitat quality in some areas. Spiny Softshells are sensitive to disturbance and will abandon nesting and thermoregulation areas that are frequently disturbed (Bolton and Brooks 2007).

Agricultural activities pose a threat to Spiny Softshell in a number of ways. Livestock with access to riparian and shoreline areas can trample individuals, nests, and habitat and increase nutrient loads of the aquatic environment. Reduced riparian buffers can accelerate erosion, increase sedimentation and increase runoff of fertilizers and pesticides.

Spiny Softshell are known to be collected for the pet trade, and for medicinal and culinary purposes. Hundreds of Spiny Softshell eggs have been destroyed or stolen from protected nests in Ontario (COSEWIC 2016). In 2013, thirty-one Spiny Softshells

were ceased from a Toronto restaurant, which advertised turtle soup on their menu (Ballingall 2013).

Other threats with unknown or negligible impact include housing development, dredging, road mortality, road and bridge construction, pier construction, cyanobacterial blooms, household sewage and urban waste water (COSEWIC 2016).

Stewardship practices such as education and awareness initiatives, tree planting, agricultural impact reduction, wetland rehabilitation, and garbage cleanup have been implemented within the range of Spiny Softshell. However, rates of habitat loss exceed rates of habitat restoration and improvement for this species (COSEWIC 2016).

1.6. Specialized life history or habitat use characteristics

In the southern part of Spiny Softshell's range, females are sexually mature when their plastron length is 18-20 cm. Plummer and Mills (2015) found that female Spiny Softshells reached maturity at 12-14 years with a plastron length of 18 cm in Arkansas. In Ontario, Bolton and Brooks (2006) found that females captured at nesting sites had a minimum plastron length of 23.1 cm, possibly suggesting a later age of maturity. COSEWIC (2016) uses an estimate of 15 years for females to reach reproductive age. The delayed age of maturity for Spiny Softshell render this species particularly vulnerable to population decline.

Spiny Softshell turtles require a variety of habitats to complete their lifecycle: sand to fine or coarse gravel mixed with sand close to water is required for nesting; muddy or sandy areas underwater are necessary for thermoregulation, gestation, and nursery habitat; denuded shorelines, floating vegetation, fallen trees, rocks and concrete structures in or near water are used for basking; while deep, oxygen rich pools are necessary for foraging, thermoregulation and hibernation (COSEWIC 2016). All these habitat types must be available and accessible to Spiny Softshells to complete their annual cycle. Although females are known to move long distances (up to 30 km), much of the historical habitat for this species has already been lost and much of what remains is considered suboptimal with continued degradation (COSEWIC 2016).

Furthermore, Spiny Softshell is the most sensitive of all turtles in Canada to anoxic or hypoxic conditions (Reese *et al.* 2003); thus, finding suitable hibernation sites with sufficient oxygen for long overwintering periods is critical for this species in particular, especially at the northern extremes of its range.

2. Eligibility for Ontario status assessment

2.1. Eligibility conditions

2.1.1. Taxonomic distinctness

Genetic and morphological analyses distinguish *Apalone spinifera* from other species of the *Apalone* genus in North America (Gardner *et al.* 1995, Weisrock and Janzen 2000).

Within *Apalone spinifera*, only the Eastern Spiny Softshell subspecies *A.s.spinifera* is represented in Canada. McGaugh *et al.* (2008) propose that *A.s.spinifera* and *A.s.hartwegi* (found in the U.S., west of the Mississippi River) should be combined as a single subspecies: *A.s.spinifera*.

2.1.2. Designatable units

Weisrock and Janzen's (2000) analysis of mtDNA polymorphisms found that the Ontario specimens clustered strongly with samples from Illinois, Indiana, Montana, and Quebec to form a northern clade of *Apalone spinifera*. This northern grouping is consistent with patterns of post-glacial dispersal into the species' northern range. McGaugh *et al.*'s (2008) expanded research into this phylogeographic division using additional mtDNA samples and nuclear DNA markers concluded that the clades did not warrant elevation to the species level. Weisrock and Janzen (2000) found some elevated levels of genetic diversity among Ontario specimens, which they hypothesized to be of recent evolutionary origin rather than relict polymorphisms from ancestral populations. The genetic structure found within those Ontario samples were from two out of three individuals that were all sampled within the same river system where interbreeding of this highly motile species is likely. COSEWIC considered the Canadian population of *Apalone spinifera* to be a single designatable unit with two subpopulations comprised of the Carolinian subpopulation (Ontario) and the Great Lakes/St. Lawrence subpopulation (Quebec). Presumably there had been gene flow between these two populations historically, before they were fragmented by development over the past century. A single designatable unit will be used for the Ontario subpopulation in this assessment.

2.1.3. Native status

In Ontario, the earliest records for the species in the NHIC database are from 1858 at the Don River, pre-1888 on Walpole Island and 1905 in London (NHIC 2016). A quote of a 1789 description of a meal along the Thames River confirms the presence and alludes to the abundance of Spiny Softshell in southern Ontario at that time, "hundreds of soft-shelled river turtles were scooped off floating logs to make supper that everyone enjoyed. Turtle's eggs found in the sandy, muddy islets were fried in bears' oil or eel fat, a real delicacy" (Gray 1956, p. 91).

2.1.4. Occurrence

Spiny softshell turtles are extant in Ontario. NHIC has records of the species from several locations in the province over the past 5 years.

2.2. Eligibility results

Spiny Softshell (*Apalone spinifera*) is eligible for status assessment in Ontario.

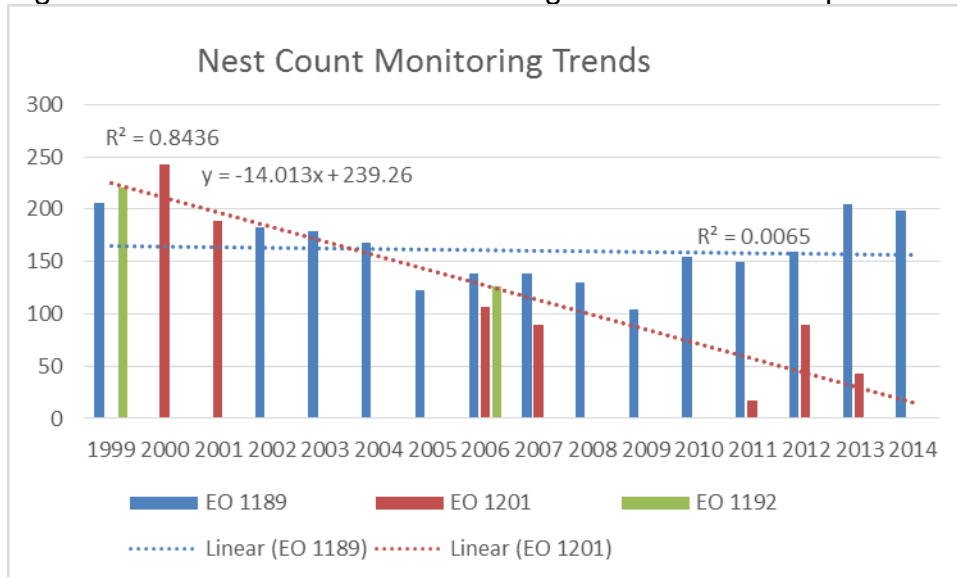
3. Ontario status assessment

3.1. Application of endangered/threatened status in Ontario

3.1.1. Criterion A – Decline in total number of mature individuals

Meets Endangered under A2bc+3bc+4bc. Nest site monitoring at the three largest communal oviposition sites over the past 15 years (1999/2000 to 2014) reveal an overall 45% decline of mature individuals. The 13-year trend line for one of the sites (EO 1201) is nearly identical to the decline at site EO 1192) over 7 seven years, with a decline of 14 nesting females per year (82% decline over 13 years at EO 1201 and 43% decline over 7 years at EO 1192). At the third site (EO 1189) the annual decline was just under 10 nesting females per year from 1999 to 2009 (50% decline over 10 years). Increases in numbers of nesting females at the third site from 2010 to 2014 may be a result of intensive efforts over the past 20 years at that site to protect nests from predation: female Spiny Softshells hatching in the early years of these interventions have recently reached breeding age and their nests were likely being counted at the oviposition sites, at least partially accounting for increases since 2010 (S. Gillingwater, personal communication, 2016).

Figure 1. Nest Counts at the three Largest Communal Oviposition Sites in Ontario.



Although there have been recent increases in numbers of mature females at EO 1189, at this same site, “changes in habitat availability and quality from 1994 to 2014 has been all encompassing, resulting in complete loss of oviposition habitat in all but a single sand bar. This sandbar is not suitable for nesting due to desiccation of eggs in late summer and trampling by cattle” (COSEWIC 2016, p. 12). Nearly complete loss of nesting habitat at this site will likely confound recent increases in mature females into the future. Given that 3 generations for Spiny Softshell amounts to 105 years, and in as few as 15 years the three largest breeding sites experienced an average 45% decline in mature individuals, the threshold for Endangered is likely exceeded.

There has also been a decline in the Extent of Occurrence for Spiny Softshell in Ontario over the past three generations. From the earliest records in NHIC’s Element Occurrence database (all but two of the records were from 1905 onwards) to 2016, the EOO has been reduced from 87 288 km² to 24 851 km², representing a 71.5% loss.

Given that most of the locations in Ontario have very small numbers of individuals, and the documented declines in even the largest subpopulations, continued contraction of the EOO in the province over the next 100 years is very likely. If the six locations that currently have a population estimate of 10 individuals or more are the only remaining locations for Spiny Softshell 100 years from now, the EOO will have declined by at least another 9 000 km² translating to a reduction of approximately 1/3 of the current EOO. If only the locations with more than 50 individuals persist in the next 100 years (the four largest subpopulations), the EOO would be reduced by nearly 15 000 km² from current levels, representing a reduction of over 50% of the current Extent of Occurrence.

The combined past losses and suspected continued declines in numbers of mature individuals and EOO indicate that these criteria are also met for Endangered for any 100 year period including both the past and future (A4).

3.1.2. Criterion B – Small distribution range and decline or fluctuation

Meets Threatened under B2ab(i,ii,iii,iv,v). The Index of Area of Occupancy is under 2000 km² (B2). The number of locations is equal to or less than 10(a). There is observed and projected continuing decline in both extent of occurrence (bi) and index of area of occupancy (bii) with many EOs classified as either extirpated or historical. Decline in the quality of habitat, especially nesting sites has been documented (biii). Continued loss can be expected in several locations where EOs have been assessed as having low population viability (biv). Projected decline in number of mature individuals is based on loss of reproductive habitat and reduced nesting success (bv).

3.1.3. Criterion C – Small and declining number of mature individuals

Insufficient Information. Although the criterion for Endangered C1 is met with the total number of mature individuals much less than 2500, precise estimations of the decline over the next 2 generations are unavailable. Criterion A allows “inferred” or “suspected” reductions of mature individuals over time, criterion C1 allows only estimated declines, which differs in the nature of the evidence including aspects of data quality (IUCN, 2016). Therefore although there is a suspected continuing decline in total number of mature individuals of over 20% in the next two generations (70 years) based on nesting site monitoring as well as documented increases in habitat loss at the largest oviposition sites in the province, gaps in the available data prevent this criterion from being applicable.

3.1.4. Criterion D – Very small or restricted total population

Does not apply. The Ontario subpopulation has more than 250 individuals; therefore does not qualify as Endangered for this criterion. For threatened status, although there are estimated to be fewer than 1000 mature individuals, the index of area of occupancy is greater than 20 km² and there are greater than 5 locations.

3.1.5. Criterion E Quantitative analysis

No quantitative analysis was conducted for this species in Ontario.

3.2. Application of Special Concern in Ontario

Does not apply.

3.3. Status category modifiers

3.3.1. Ontario's conservation responsibility

Does not apply. Spiny Softshell is ranked G5 and Ontario's conservation responsibility for this species is low.

3.3.2. Rescue effect

According to COSEWIC (2016), immigration from Michigan across the Lake St. Clair/ Detroit River is possible but unlikely. They add, "New York or Ohio could provide rescue across Lake Erie but this has not been observed. Rescue across Lake Ontario is highly unlikely" (p.x.)

3.4. Other status categories

3.4.1. Data deficient

Does not apply.

3.4.2. Extinct or extirpated

Does not apply.

3.4.3. Not at risk

Does not apply.

4. Summary of Ontario status

Spiny Softshell (*Apalone spinifera*) is classified as Endangered in Ontario based on meeting criteria A2bc+3bc+4bc.

5. Information sources

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Appendix 1: Technical summary for Ontario

Species: Spiny Softshell (*Apalone spinifera*)

Demographic information

Demographic attribute	Value
<p>Generation time. Based on average age of breeding adult: age at first breeding = X year; average life span = Y years.</p>	<p>35 years Assuming 15 years age of female maturity and low rate of annual mortality 5%</p>
<p>Is there an observed, inferred, or projected continuing decline in number of mature individuals?</p>	<p>Continuing decline suspected.</p>
<p>Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.</p>	<p>Unknown.</p>
<p>Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.</p>	<p>Average loss of mature individuals at the three largest nesting sites in 15 years was 45%. Trend over past 105 years very likely exceeds 50% decline.</p>
<p>Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations.</p>	<p>Losses in the past 3 generations are likely to continue into the future with continued recreational pressures, increased habitat loss from invasive species and nest predation rates. The results of the threats calculator indicated Very High, which implies a 50 to 100% decline over the next 3 generations (105 yrs).</p>
<p>Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over any 10 years, or 3 generations, over a time period including both the past and the future.</p>	<p>Losses in the past 3 generations are likely to continue into the future with continued recreational pressures, increased habitat loss from invasive species and nest predation rates. Suspected to exceed 50% over next 100 years.</p>

Are the causes of the decline (a) clearly reversible, and (b) understood, and (c) ceased?	a. No b. Partially c. No
Are there extreme fluctuations in number of mature individuals?	No

Extent and occupancy information in Ontario

Extent and occupancy attributes	Value
Estimated extent of occurrence (EOO).	24 851 km ² (COSEWIC 2016)
Index of area of occupancy (IAO).	< 600 km ² . Figure for Canadian population (COSEWIC 2016)
Is the total population severely fragmented? i.e., is >50% of its total area of occupancy is in habitat patches that are: (a) smaller than would be required to support a viable population, and (b) separated from other habitat patches by a distance larger than the species can be expected to disperse?	a. No b. No
Number of locations.	6 -9
Number of NHIC Element Occurrences	31 EOs: 4 invalid, 1 X, 12 H, 6 D, 1 C, 1 BC, 1 AB, 3 A, 2 E
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	Yes. Declined by 71.5% in the past 100 years. If only the locations with >10 individuals persist in 100 years, the decline will be at least an additional 30%. If only the 4 locations with > 50 individuals remain, the decline will be over 50% from the current EOO.
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	Yes. As locations are lost, so is area of occupancy. Unquantified.
Is there an observed, inferred, or projected continuing decline in number of subpopulations?	Yes: only 6 of the subpopulations estimated to have more than 10 individuals.

Is there an observed, inferred, or projected continuing decline in number of locations?	Yes. Several have been lost in the past 50 years and more are non-viable and close to extirpation.
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Yes. High rates of loss of habitat at all known nesting sites in Ontario. Loss of area of nesting sites at 3 largest locations is 50% over past 20 years (COSEWIC 2016).
Are there extreme fluctuations in number of populations?	No
Are there extreme fluctuations in number of locations?	No
Are there extreme fluctuations in extent of occurrence?	No
Are there extreme fluctuations in index of area of occupancy?	No

Number of mature individuals in each sub-population or total population (if known)

Sub-population (or total population)	Number of mature individuals
Area 1	34-66
Areas 2-4	736
4 additional areas	Few individuals per site.

Quantitative analysis (population viability analysis conducted)

Probability of extinction in the wild is unknown. No population viability analysis has been conducted.

Threats

The greatest threats to Spiny Softshell, according to the COSEWIC threats calculator are Dams and Water Management/Use as well as Problematic Native Species. Medium threats included Recreational Activities, Fishing, Hunting and Collecting, and Livestock and Farming.

Rescue effect

Rescue effect attribute	Value
Status of outside population(s) most likely to provide immigrants to Ontario	Michigan: no status (S4) New York: Special Concern (S2/S3) Ohio: SNR
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	Possibly

Would immigrants be adapted to survive in Ontario?	Yes
Is there sufficient suitable habitat for immigrants in Ontario?	Possibly: there is limited habitat with continuing degradation outweighing habitat creation/restoration.
Are conditions deteriorating in Ontario?	Yes
Is the species of conservation concern in bordering jurisdictions?	Yes, in New York
Is the Ontario population considered to be a sink?	No
Is rescue from outside populations likely?	Unknown

Sensitive species

Spiny softshell is considered a sensitive species. It is known to be harvested for the pet trade and for specialized culinary dishes (e.g., Ballingall 2013).

Appendix 2: Adjoining jurisdiction status rank and decline

Information regarding rank and decline for Spiny Softshell
(*Apalone spinifera*)

Jurisdiction	Subnational rank	Population trend	Sources
Ontario	S2	declining	COSEWIC 2016
Quebec	S1	declining	COSEWIC 2016
Manitoba	Not present	N/A	N/A
Michigan	S4	N/A	N/A
Minnesota	S5	N/A	N/A
Nunavut	Not present	N/A	N/A
New York	S2S3	N/A	N/A
Ohio	SNR	N/A	N/A
Pennsylvania	S4	N/A	N/A
Wisconsin	S4S5	N/A	N/A

Acronyms

COSEWIC: Committee on the Status of Endangered Wildlife in Canada

COSSARO: Committee on the Status of Species at Risk in Ontario

ESA: Endangered Species Act

GRANK: global conservation status assessments

IAO: index of area of occupancy

MNRF: Ministry of Natural Resources and Forestry

NHIC: Natural Heritage Information Centre

NNR: Unranked

NRANK: National conservation status assessment

SARA: Species at Risk Act

SNR: unranked

SRANK: subnational conservation status assessment

S1: Critically imperiled

S3: Vulnerable

S5: Secure

IUCN: International Union for Conservation of Nature and Natural Resources

CDSEPO: Le Comité de détermination du statut des espèces en péril en Ontario