

**Ontario Species at Risk Evaluation Report for Eastern  
Banded Tigersnail (*Anguispira kochi kochi*)**

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

Assessed by COSSARO as Endangered

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Final

## Escargot-tigre à bandes (*Anguispira kochi kochi*)

L'escargot-tigre à bandes est un escargot terrestre pulmoné (capable de respirer) d'assez grande taille (de 2 à 2,5 cm) qui habite les forêts et boisés caducifoliés sablonneux et calcaires des îles du lac Érié. Malgré des efforts de recherche raisonnables déployés de 2013 à 2015, il n'a pu être recensé aux trois endroits où il l'avait été auparavant. Parmi les menaces locales figurent les changements climatiques (sécheresse, tempêtes violentes et inondations), l'altération de l'habitat attribuable à la surabondance des colonies de cormorans à aigrettes, la prolifération de plantes invasives et des vers de terre, et l'utilisation des sentiers à des fins récréatives. En raison de son aire de répartition restreinte et des pertes relatives aux sous-populations enregistrées et anticipées, cette sous-espèce a été classifiée comme espèce en voie de disparition en Ontario.

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## Executive summary

Eastern Banded Tigersnail is a relatively large (2.0-2.5 cm), pulmonate (air-breathing) terrestrial snail that occurs in calcareous and sandy deciduous woodland and forest habitat on islands in Lake Erie. Despite reasonable search effort in 2013-2015, it has not been found in 3 locations where it had previously been reported. Localized threats include climate change (drought, severe storms, and flooding), habitat modification from hyperabundant Double-crested Cormorant colonies, invasive plants and earthworms, and recreational trail use. With a restricted range, documented losses of subpopulations and predicted on-going losses, this subspecies has been classified as Endangered in Ontario.

# 1. Eligibility for Ontario status assessment

## 1.1. Eligibility conditions

### 1.1.1. Taxonomic distinctness

Pilsbry (1948), identified three subspecies of Banded Tigersnail based on the morphological characteristics of specimens collected from the Lake Erie Islands. All three 'subspecies' were found together at Pelee Island and Middle Island. COSEWIC (2017) indicates that the differences in shell appearance actually correspond with shell aging and weathering, and considers there to be only one subspecies: *Anguispira kochi kochi* in Ontario.

### 1.1.2. Designatable units

Only one designatable unit applies for Eastern Banded Tigersnail in Ontario. Although Lake Erie prevents gene flow between insular subpopulations (suggesting potentially discrete subpopulations on each island), preliminary DNA barcoding reveals >99% genetic similarity among specimens from Middle Island and three sites on Pelee Island (COSEWIC, 2017). Therefore there is no evidence at this point in time to consider the different island subpopulations to be genetically distinct.

### 1.1.3. Native status

The Carnegie Museum of Natural History has specimens of this species collected in Essex county in 1916 (COSEWIC, 2017). There is no evidence to suggest that its presence in Ontario is a result of human intervention (COSEWIC, 2017). It is considered Native to Ontario.

### 1.1.4. Occurrence

Fieldwork in 2015 confirmed the presence of live populations of this species in Ontario at Middle Island and Pelee Island, Essex County (COSEWIC, 2017).

## 1.2. Eligibility results

Eastern Banded Tigersnail (*Anguispira kochi kochi*) is eligible for status assessment in Ontario.

## 2. Background information

### 2.1. Current designations

The NatureServe data is not available at the subspecific level; therefore, the designation for at the species level was used for the GRANK and NRANK below.

- GRANK: G5 (NatureServe 2017)

- NRANK Canada: N3
- COSEWIC: Endangered (April 2017)
- SARA: No Status (No Schedule)
- ESA 2007: No Status (not previously assessed)
- SRANK: S1S2 (ranked in 2015)

## 2.2. Distribution in Ontario

Extant populations of Eastern Banded Tigersnail were confirmed at several sites on Pelee Island as well as Middle Island from fieldwork conducted in 2013 to 2015 (COSEWIC, 2017).

Specimens had been collected from private land near Alvinston, Lambton County in 1991; however, 4 hours of search effort in 2015 failed to detect any individuals or shells (COSEWIC, 2017). It is presumed to be extirpated at that site.

No records of Eastern Banded Tigersnail have been reported from East Sister Island, North Harbour Island or Hen Island since specimens were collected there in 1916 (COSEWIC, 2017). F.W. Grimm noted that he had observed “the largest and most voluminous shells I’ve seen for this species” on Middle Sister Island in 1996 (NHIC, 2017). However, only old, dry shells were located during 3.5 hours of search effort there during a subsequent visit in 2013. Potential habitat on East Sister Island and Middle Sister Island has been destroyed by the deposition of guano by colonies of very abundant Double-crested Cormorants (*Phalacrocorax auritus*). Anthropogenic habitat alteration is believed to have eliminated potential habitat for Eastern Banded Tigersnail on North Harbour Island. The species is presumed extirpated on East Sister Island, North Harbour Island and Middle Sister Island. Its status on Hen Island could not be determined due to lack of access on private land (COSEWIC, 2017).

Only three Element Occurrences (EOs) are recognized for this species by NHIC: two on Pelee Island and one on Middle Island. COSEWIC (2017) suggests that Middle Island comprises one “location” and a range of 1-6 “locations” exists on Pelee Island, depending on a range of scenarios of localized to island-wide threats representing the most plausible threat to rapidly affect all individuals within the island’s Eastern Banded Tigersnail subpopulations.

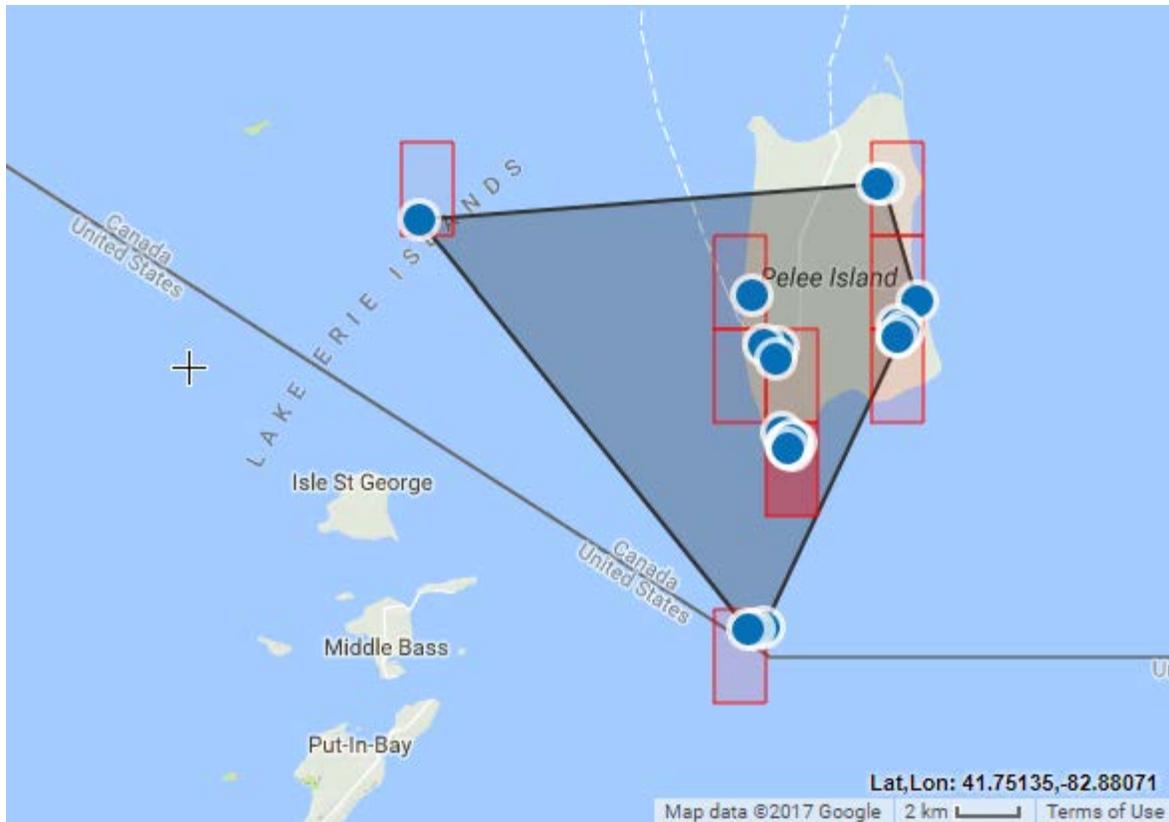


Figure 1. Distribution of Eastern Banded Tigersnail in Ontario. Shaded area is the minimum convex polygon of extant subpopulations and subpopulations of unknown status (Hen Island – island with blue dot furthest west). Derived from NHIC (2017) observation data using [GeoCAT](#), 2017.

### 2.3. Distribution and status outside Ontario

In Canada, Eastern Banded Tigersnail is found only in Ontario. In the U.S., its distribution extends south to Tennessee, west to Missouri and east to western Pennsylvania (COSEWIC, 2017). Historic records exist from Georgia and Oklahoma; however, the current status of the subspecies in these states is unknown (COSEWIC, 2017). Little to no information is available on its status outside of Ontario at this time.

### 2.4. Ontario conservation responsibility

Much less than 25% of the global range of the subspecies occurs in Ontario as measured by estimated extent of occurrence across its reported global range.

### 2.5. Direct threats

Climate change is considered to be the most likely threat affecting Eastern Banded Tigersnail on Middle Island and Pelee Island. In particular droughts and temperature extremes (especially hard frosts without snow cover) were identified through the COSEWIC threats calculator exercise (COSEWIC, 2017) as the greatest threats. Although the effects of extreme weather events have not been studied on Banded

Tigersnails specifically, droughts can make land snails susceptible to desiccation, and have been shown to cause mass mortality in another land snail species when the drought occurred shortly after arousal from winter hibernation (Nicolai and Ansart, 2017). In other land snail species drought was also observed to cause lower viability of eggs and sperm thereby lowering reproductive success (Nicolai and Ansart, 2017). Severe storms and flooding may threaten subpopulations on Middle Island and in low lying patches of habitat on Pelee Island. Flooding threatens terrestrial gastropods in several ways: by interfering with their breathing, by causing swelling if water enters their body compartments, by physically displacing individuals, by introducing water-borne toxins, and by altering habitat (Nicolai and Ansart, 2017).

Other threats include trampling at sites with recreational trail use, habitat change from invasive plants and earthworms, competition with invasive terrestrial snails, and potential predation by Wild Turkeys (*Meleagris gallopavo*) and Ring-necked Pheasants (*Phasianus colchicus*) on Pelee Island. Alteration of soil conditions and vegetation structure by Double-crested Cormorants is implicated in the elimination of habitat for Eastern Banded Tigersnail on Middle Sister and East Sister Island. Active management of cormorant numbers by Parks Canada seems to be moderating their impacts on the snail on Middle Island (COSEWIC, 2017). Erosion at Fish Point is also anticipated to pose a long-term threat to subpopulations at Pelee Island's southernmost point (COSEWIC, 2017).

## 2.6. Specialized life history or habitat use characteristics

Terrestrial gastropods are particularly vulnerable to the effects of climate change because of their sensitivity to local temperatures for parts of their life cycle (dormancy, reproduction), need for moisture to maintain skin condition and mucous-production, and their slow dispersal ability that limits their capability of escaping hostile conditions (Nicolai and Ansart, 2017).

## 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

Insufficient information. Systematic population estimates are only available from 2015 and no previous population estimates are available for comparison. Although a reduction in extent of occupancy can be determined from the loss of habitat on East Sister, Middle Sister, and North Harbour Islands, it is not possible to verify that there were extant populations on these islands within the past 15-18 years (3 generations).

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

Endangered B1ab(i,ii,iii,iv,v) and B2ab(i,ii,iii,iv,v). The extent of occurrence (including Hen Island where the status of Eastern Banded Tigersnail is unknown) is calculated to be 102 km<sup>2</sup>. This is well within the threshold for Endangered under criterion B1. The 36

km<sup>2</sup> index of area of occupancy for this subspecies also within the threshold for Endangered under criterion B2. If the lower end of the range of locations is considered, subcriterion a) applies. Given the close proximity of all the locations to one another, it is likely that an extreme weather event would affect more than one of the locations similarly, thus the lower range of number of locations seems reasonable for this species if extreme weather is the greatest threat. For subcriterion b) continuing declines in extent of occurrence (i), index of area of occupancy (ii), area, extent and quality of habitat (iii), number of locations or subpopulations (iv) and, consequently, number of mature individuals (v) are observed based on documented losses from three island and one mainland subpopulation and further projected losses from climate change and other identified threats.

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

Does not apply. Population estimates for Eastern Banded Tigersnail at Middle Island and three sites on Pelee Island (over 700,000 mature individuals) exceed the thresholds for this criterion.

### 3.1.4. Criterion D – Very small or restricted total population

Threatened. The estimated number of mature individuals exceeds 700,000; therefore, criterion D1 does not apply. The index of area of occupancy 36 km<sup>2</sup> is slightly larger than the 20 km<sup>2</sup> threshold to qualify as Threatened. However the criterion states “typically < 20 km<sup>2</sup>” which leaves some room for interpretation. If the lower end of the range of number of locations (1-7) is considered, Eastern Banded Tigersnail may qualify as Threatened: prone to the effects of stochastic events that render them capable of becoming extinct, extirpated, or critically endangered in a very short time period (1-2 generations).

### 3.1.5. Criterion E – Quantitative analysis

Does not apply. Quantitative population analyses have not been undertaken for Eastern Banded Tigersnail.

## 3.2. Application of Special Concern in Ontario

Does not apply. Eastern Banded Tigersnail qualifies as Endangered under Criterion B.

## 3.3. Status category modifiers

### 3.3.1. Ontario’s conservation responsibility

Does not apply. Banded Tigersnail is not considered globally at risk at the species level (the subspecies has not been assigned a GRANK) and considerably less than 25% of its global range is found in Ontario.

### 3.3.2. Rescue effect

Rescue effect from immigration from U.S. populations is not possible given the isolation of the Lake Erie islands from one another and from the U.S. mainland. Large bodies of water are a significant barrier to the dispersal of this species.

Captive breeding has been successful with several terrestrial gastropod species (COSEWIC, 2017); thus, human-facilitated reintroductions may be possible for extirpated subpopulations of Eastern Banded Tigersnail.

## 3.4. Other status categories

### 3.4.1. Data deficient

Not applicable. Sufficient information exists to conclude an at-risk status for Eastern Banded Tigersnail.

### 3.4.2. Extinct or extirpated

Not applicable. Recent fieldwork confirms the extant status of Eastern Banded Tigersnail in Ontario.

### 3.4.3. Not at risk

Not applicable. Eastern Banded Tigersnail qualifies as Endangered under Criterion B.

## 4. Summary of Ontario status

Eastern Banded Tigersnail (*Anguispira kochi kochi*) is classified as Endangered in Ontario based on meeting criterion B1ab(i,ii,iii,iv,v) and B2ab(i,ii,iii,iv,v). This is consistent with the COSEWIC assessment of this subspecies.

This species has not previously been assessed by COSSARO.

## 5. Information sources

COSEWIC. 2017. [COSEWIC assessment and status report on the Eastern Banded Tigersnail \*Anguispira kochi kochi\* and the Western Banded Tigersnail \*Anguispira kochi occidentalis\*, in Canada](#). Committee on the Status of Endangered Wildlife in Canada. Ottawa. xv + 82 pp. ([Species at Risk Public Registry website](#)).

NatureServe. 2017. [NatureServe Explorer](#): An online encyclopedia of life [web application]. [Anguispira kochi](#). Version 7.1. NatureServe, Arlington, Virginia. [website accessed February 21, 2018].

Nicolai, A. and A. Ansart. 2017. Conservation at a slow pace: Terrestrial gastropods facing fast-changing climate. *Conservation Physiology* 5(1). doi: 10.1093/conphys/cox007.

Pilsbry, H.A. 1948. Land Mollusca of North America (North of Mexico). Volume 2, Part 2. Academy of Natural Sciences of Philadelphia, Monograph 3:i–xlvi + 521–1113.

# Appendix 1: Technical summary for Ontario

Species: Eastern Banded Tigersnail (*Anguispira kochi kochi*)

## Demographic information

Demographic attribute	Value
Generation time. Based on average age of breeding adult: age at first breeding = X year; average life span = Y years.	Approximately 5-6 years
Is there an observed, inferred, or projected continuing decline in number of mature individuals?	Yes based on loss of some formerly occupied sites.
Estimated percent of continuing decline in total number of mature individuals within 5 years or 2 generations.	Unknown
Observed, estimated, inferred, or suspected percent reduction or increase in total number of mature individuals over the last 10 years or 3 generations.	Unknown
Projected or suspected percent reduction or increase in total number of mature individuals over the next 10 years or 3 generations.	Unknown
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.	Unknown
Are the causes of the decline (a) clearly reversible, and (b) understood, and (c) ceased?	a. Unknown b. Yes (for smaller Lake Erie Islands) 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).	102 km <sup>2</sup>
Index of area of occupancy (IAO).	36 km <sup>2</sup>
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. Yes
Number of locations.	1-7
Number of NHIC Element Occurrences	3

<b>Extent and occupancy attributes</b>	<b>Value</b>
Is there an observed, inferred, or projected continuing decline in extent of occurrence?	Yes
Is there an observed, inferred, or projected continuing decline in index of area of occupancy?	Yes
Is there an observed, inferred, or projected continuing decline in number of subpopulations?	Yes
Is there an observed, inferred, or projected continuing decline in number of locations?	Yes
Is there an observed, inferred, or projected continuing decline in [area, extent and/or quality] of habitat?	Yes
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)

<b>Sub-population (or total population)</b>	<b>Number of mature individuals</b>
Fish Point Provincial Nature Reserve, Pelee Island	552,000-612,000
Florian Diamante Nature Reserve, Pelee Island	146,720
Richard and Beryl Ivey Property, Pelee Island	26,850-179,000
Winery Woods	Unknown
Middle Point Woods	Unknown
Stone Road Alvar	Unknown
Middle Island	4,000 - 32,000
TOTAL	At least 729,570 - 969,720

Quantitative analysis (population viability analysis conducted)

Probability of extinction in the wild is unknown.

## Threats

A threats calculator assessment was prepared by Joseph Carney, Jill Crosthwaite, Tammy Dobbie, Robert Forsyth, David Fraser, Lea Gelling, Dwayne Lepitzki, Mhairi McFarlane, Kate Mackenzie, Annegret Nicolai, Kristiina Ovaska, and Daelyn Woolnough. The two highest threats assessed as High to Low impact were Drought and Temperature Extremes. Recreational Activities, Habitat Shifting and Alteration, and Storms and Flooding were assessed as Low impact threats.

## Rescue effect

<b>Rescue effect attribute</b>	<b>Value</b>
Status of outside population(s) most likely to provide immigrants to Ontario	Unknown
Is immigration of individuals and/or propagules between Ontario and outside populations known or possible?	No
Would immigrants be adapted to survive in Ontario?	Yes
Is there sufficient suitable habitat for immigrants in Ontario?	Yes
Are conditions deteriorating in Ontario?	Yes
Is the species of conservation concern in bordering jurisdictions?	Unknown
Is the Ontario population considered to be a sink?	No
Is rescue from outside populations likely?	No

## Sensitive species

Yes, this species is considered data sensitive.

## Appendix 2: Adjoining jurisdiction status rank and decline

Information regarding rank and decline for Banded Tigersnail (*Anguispira kochi*)<sup>1</sup>

Jurisdiction	Subnational rank	Population trend	Sources
Ontario	S2S3	unknown	NatureServe (2017)
Quebec	Not present	not applicable	NatureServe (2017)
Manitoba	Not present	not applicable	NatureServe (2017)
Michigan	SU	Unknown	NatureServe (2017)
Minnesota	Not present	not applicable	NatureServe (2017)
Nunavut	Not present	not applicable	NatureServe (2017)
New York	Not present	not applicable	NatureServe (2017)
Ohio	SNR	Unknown	NatureServe (2017)
Pennsylvania	S2	Unknown	NatureServe (2017)
Wisconsin	Not present	not applicable	NatureServe (2017)

### 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

EO: Element occurrence (as defined by NHIC)

EOO: extent of occurrence

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

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<sup>1</sup> NatureServe data were available only at the species level.