COSSARO Candidate Species at Risk Evaluation

for

Snuffbox (*Epioblasma triquetra*)

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

Assessed by COSSARO as ENDANGERED

November, 2011

Final

PART 1

CURRENT STATUS AND DISTRIBUTION

Current Designations:

GRANK – **G3_** (Assessed 28/04/2009 NatureServe, accessed 27/11/2011)
NRANK Canada – **N1** (Assessed 14/07/2006 NatureServe, accessed 27/11/2011)
COSEWIC – **Endangered** (COSEWIC, Nov 2011)
SARA – **Endangered** (Schedule 1) (Environment Canada, 2003)
ESA 2007 – **Endangered** (Ministry of Natural Resources, 2008)
SRANK – **S1** (NHIC/NatureServe, accessed 27/11/2011)

Distribution in Ontario:

Snuffbox has been known from 31 records from Lake Erie and Lake St. Clair and from the Ausable, Sydenham, Thames, Grand, and Niagara rivers. It is now known only from several sites in the Sydenham and Ausable Rivers (COSEWIC 2011).

Distribution and Status Outside Ontario:

Snuffbox is the most widely distributed member of the genus *Epioblasma*. Historically, the Snuffbox was reported from 18 US states as well as from Ontario. It has not been recorded in any other Canadian province. It is listed as Endangered or Threatened in 8 states and has an S1 rank in 10 states. Historically, Snuffbox was found in Alabama, Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Mississippi, Missouri, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, Wisconsin, and Ontario (NatureServe 2011). The genus *Epioblasma* is the most imperiled of the 50 genera of freshwater mussels in North America: of the 25 recognized species and subspecies, 10 are in danger of extinction, and 14 may already be extinct (COSEWIC 2011).

PART 2

ELIGIBILITY FOR ONTARIO STATUS ASSESSMENT

2.1 APPLICATION OF ELIGIBILITY CRITERIA

Taxonomic Distinctness
Yes The Snuffbox, *Epioblasma triquetra* (Rafinesque, 1820), is a small, sexually dimorphic species of freshwater mussel that is not morphologically similar to any other mussel in Canada.

Designatable Units Although there are documented genetic differences in *E. triquetra* between the Sydenham and Ausable rivers (Galbraith *et al.* 2010), these differences in allelic frequencies are not sufficient to warrant splitting the two Canadian populations into separate Designatable Units. It is of interest that in the Great Lakes and Ohio River drainages, it is likely that Logperch (*Percina caprodes*), a putative host for Snuffbox, is responsible for the genetic population structure observed in *E. triquetra*.

Native Status
Yes Snuffbox has been recorded in Ontario since 1885.

Presence/Absence
Present – Has recently (1998-2011) been collected in the Sydenham and Ausable Rivers.

2.2 ELIGIBILITY RESULTS

1. The putative taxon or DU is valid. **Yes**

2. The taxon or DU is native to Ontario. **Yes**

3. The taxon or DU is present in Ontario, extirpated from Ontario or extinct? **Present.**

PART 3

ONTARIO STATUS BASED ON COSSARO EVALUATION CRITERIA

3.1 APPLICATION OF PRIMARY CRITERIA (Rarity and Declines)

1. Global Rank
Threatened G3 Indicates that the species is globally rare (NatureServe 2011).

2. Global Decline
Endangered This species is declining throughout its range and has become increasingly rare, although several dozen occurrences remain; many of them with good viability. The snuffbox historically occurred in 208 streams and lakes in 18 States and one Canadian province, and is now known from only 74 streams, representing a 65% decline in occupied streams (COSEWIC 2011). The most recent records from one-third of these streams represented only one or two live or freshly dead individuals (USFWS 2010). Long-term viability of most populations is questionable especially those in large rivers where Zebra Mussel (*Dreissena polymorpha*) populations are now established (NatureServe 2011).

3. Northeastern North America Ranks
Endangered The Snuffbox is listed S1, S2, SH or SX in 100% of the Northeastern jurisdictions in which it is or was found (Appendix 1).

4. Northeastern North America Decline
Endangered The Snuffbox has been drastically reduced in range and is endangered in all Northeastern states where it occurs. There is not a clear estimate of the extent of decline in this precise region, but it seems highly likely that it has declined more than 50% (COSEWIC 2011, NatureServe 2011; USFWS 2010; see Global Decline above).

5. Ontario Occurrences
Endangered There are 24 historical EO's in Ontario, only 5 of which are extant (NHIC 2011). Recent intensive surveys conducted at 66 sites on tributaries to Lake Erie, Lake St. Clair and lower Lake Huron in 1997-1999 (Metcalfe-Smith *et al*. 1998, 1999), yielded 34 specimens from 13 different sites on the Ausable and Sydenham rivers. Only seven of these specimens were alive, and all seven were taken from four sites on the Sydenham River. Weathered shells accounted for most of the remaining specimens (21), but fresh shells were found at several sites on the Sydenham, one site on the Thames, and two sites on the Ausable River (COSEWIC 2011). Thus, the species is extant on 4-13 ‘sites’ on the Sydenham and Ausable Rivers, and possibly one site on the Thames River (COSEWIC 2011). These represent three locations under COSEWIC guidelines (COSEWIC 2011).

6. Ontario Decline

Insufficient information The absence of living specimens at 15 of 19 historic sites in Ontario represents a 79% decline (COSSARO 2001). However, there is no detectable decline over the past 15 years, which is roughly the length of three generations of this species. The original COSEWIC assessment (2001) concluded that this mussel was confined to the Sydenham River, but live mussels from a reproducing population were subsequently found in the Ausable River beginning in 2006. This apparent increase is due to an increased sampling effort rather than to any real change in abundance and distribution (COSEWIC 2011). Similarly, given the paucity of data from the Ausable River, it is impossible to determine if *E. triquetra* populations have changed there over time, and if reproduction is still occurring (COSEWIC 2011).

7. Ontario's Conservation Responsibility

Not in any category The Ontario range represents <<10% of the global range..

3.2 APPLICATION OF SECONDARY CRITERIA (Threats and Vulnerability)

8. Population Sustainability

Not in any category Information on sex ratios and size class structure can sometimes be used to infer population health and reproductive success. The sex ratio of males to females was 66% M: 34% F in the Sydenham in 2009, and 57% M: 43% F in the Ausable from 2006-2009. Sex ratios in healthy populations of *E. triquetra* are nearly 1:1 (Trdan and Hoeh 1993). As such there may be a slightly disproportionate number of males in both rivers, however this apparent imbalance may not be significant and could even be a sampling bias towards larger males. The broad range of sizes for specimens of both sexes indicates that several year classes are represented in both the Sydenham and Ausable rivers, suggesting there is ongoing recruitment in both populations (COSEWIC 2011). Metcalfe-Smith *et al*. (2007) also noted sex ratios of Snuffbox skewed towards males (77% M: 23% F) and suggested that the paucity of female specimens in the Sydenham River "may have serious consequences for the continued survival" of this species in the system.

9. Lack of Regulatory Protection for Exploited Wild Populations

Not in any category Freshwater mussels are considered fish under the federal *Fisheries Act*, and therefore, some habitat protection is afforded to them.

10. Direct Threats

Endangered. The Snuffbox requires high-quality streams where there is little disturbance to the substrate or riparian zone. In Ontario, *E. triquetra* declines can be attributed to deterioration in water quality resulting from urban and agricultural runoff, siltation, stream modification, impoundments, and introduction of the non-indigenous Zebra Mussel (Watson *et al*. 2000, Williams *et al.*1993, COSEWIC 2011, NatureServe 2011). The Snuffbox is sensitive to siltation, pollution (including toxic spills), habitat

perturbation, inundation of riffle habitat, invasive Zebra Mussels, and loss of glochidial hosts (Logperch). Impoundment and diversion of rivers likely destroyed much of the habitat for Snuffbox during the last century. Zebra Mussels have made the habitat unsuitable throughout a large portion of the Snuffbox's former range, i.e., lakes Erie and St. Clair, connecting channels, and the lower Grand River. Snuffbox has not been found in the near shore refuge sites of Lake St. Clair utilized by other mussels (COSEWIC 2011). Long-term brooders such as Snuffbox may be more sensitive than short-term brooders to the energy depleting effects of Zebra Mussels. Existing Sydenham River populations are not threatened by Zebra Mussels because that river is not navigable by boats, which help spread this exotic species.

Agriculture is the main form of land use in the Grand, Thames, Sydenham and Ausable river basins. Thus, water and habitat quality are impaired by inputs of pesticides, fertilizers, livestock manures and sediment. The Snuffbox may also be more sensitive to sedimentation than most other mussels due to its burrowing habits. The decline in the overall range of this species suggests that it cannot tolerate poor water quality. As remaining populations in Ontario are located in areas of intensive farming, exposure to agricultural runoff is probably an important threat. Mussels with few host fishes are more sensitive to changes in the fish community than those with many hosts. Only two of the five known hosts for Snuffbox are native to Ontario, and there is some evidence that the most likely host, the Logperch, is declining in some areas.

A potential threat to hosts (and thus to juvenile unionids) is the Round Goby (*Neogobius melanostomus*), which have recently invaded the Sydenham and Ausable rivers and now overlap the range of Snuffbox. Goby densities are currently low in these rivers, but are likely to increase as the invasion progresses. Should Round Gobies severely infest the Sydenham and Ausable rivers, they have the potential to negatively impact Snuffbox in the future by competing with its hosts, Logperch and Blackside Darter (*Percina maculata*) (both benthic fishes), as well as preying on juvenile and even young adult Snuffbox (Poos *et al.* 2010).

11. Specialized Life History or Habitat-use Characteristics

Endangered The Snuffbox is found in small to medium-sized creeks to larger rivers and lakes in swift currents of riffles and shoals or wave-washed shores of lakes over gravel and sand with occasional cobble and boulders (USFWS 2010). It is likely extremely sensitive to siltation because of its specialized habitat requirements (i.e., shallow riffle/run areas with course substrates) and burrowing habits (Watson *et al.* 2000). The need for high quality streams makes Snuffbox extremely vulnerable to the many sources of pollution and modification of host streams. These impacts are evident from the rapid and extensive loss of the species across its range. Logperch and Blackside Darter are the only species of fish present in the Sydenham River that are known to serve as glochidial (larval) hosts to Snuffbox. Host specialization may thus place *E. triquetra* at greater risk, especially if these hosts are themselves declining as appears to be the case (COSEWIC 2011).

3.3 COSSARO EVALUATION RESULTS

1. Criteria satisfied in each status category

List the Number of primary and secondary criteria met in each status category:

ENDANGERED – [4/2]
THREATENED – [1/0]
SPECIAL CONCERN – [0/0]

List the Number of Ontario-specific criteria met in each status category: *(These are primary criteria numbers 5, 6 and 7.)*

ENDANGERED – [1]
THREATENED – [0]
SPECIAL CONCERN – [0]

2. Data Deficiency

No. The number of criteria assessed as "insufficient information" is 1.

3. Status Based on COSSARO Evaluation Criteria

The application of COSSARO evaluation criteria suggests that **Snuffbox** is **Endangered** in Ontario.

PART 4

ONTARIO STATUS BASED ON COSEWIC EVALUATION CRITERIA

4.1 APPLICATION OF COSEWIC CRITERIA

Regional (Ontario) COSEWIC Criteria Assessment

Criterion A – Decline in Total Number of Mature Individuals
Not in any category There is no evidence of sufficient decline in the past or future three generations**.**

Criterion B – Small Distribution Range and Decline or Fluctuation
Endangered - Both B1 and B2 are applicable as EO (1482 km^2) and IAO (308 km^2) are below the thresholds for Endangered (< 5,000 km^2 and < 500 km^2, respectively). As the species is found at only two locations with one fresh shell being collected at another location in 1998, sub-criterion "a" (number of locations less than or equal to 5) is applicable. There is a continuing decline inferred in the quality of habitat so sub-criterion "b(iii)" also is applicable.

Criterion C – Small and Declining Number of Mature Individuals
Not in any category The total maximum number of mature individuals, estimated to be over 61,000, is well above the thresholds for this criterion (< 10,000 for Threatened), and there is no evidence of a recent decline in number of mature individuals.

Criterion D – Very Small or Restricted Total Population
Not in any category - Nearly meets the criteria for D2 Threatened as the species is found at fewer than 5 locations and is prone to the effects of human activities (e.g., degraded water quality and invasive species). However, it is difficult to assert that these threats are likely to occur over a very short time frame.

Criterion E – Quantitative Analysis
Insufficient information Probabilities for extinction were not calculated.

Rescue Effect
No. All Canadian populations of *E. triquetra* are isolated from one another and from U.S. populations by large areas of unsuitable habitat, making the likelihood of re-establishing extirpated populations by immigration negligible. The Logperch and Blackside Darter hosts of *E. triquetra* are not capable of the large-scale movements required to connect populations (Woolnough *et al*. 2009; Schwalb *et al*. 2011). Furthermore, *E. triquetra* populations in adjacent U.S. states are all endangered or extirpated.

Special Concern Status - No

4.2 COSEWIC EVALUATION RESULTS

1. Criteria satisfied in each status category

Indicate whether or not a criterion is satisfied in each of the status categories.

ENDANGERED – [yes]
THREATENED – [no]
SPECIAL CONCERN – [no]

2. Data Deficiency

No

3. Status Based on COSEWIC Evaluation Criteria

The application of COSEWIC evaluation criteria suggests that **Snuffbox** is **Endangered** in Ontario.

PART 5

ONTARIO STATUS DETERMINATION

5.1 APPLICATION OF COSSARO AND COSEWIC CRITERIA

COSSARO and COSEWIC criteria give the same result. **Yes**

5.2 SUMMARY OF STATUS EVALUATION

Snuffbox is classified as **Endangered** in Ontario.

The Snuffbox is a small freshwater mussel and is the most widely distributed member of the genus *Epioblasma* and is morphologically distinct from any other mussel in Canada. Historically known from 208 streams and lakes in 18 states plus Ontario, it is currently found in only 74 streams, representing a 65% decline . Remaining populations are small and geographically isolated. In Ontario, there were 31 known historical records for Snuffbox from Lake Erie, Lake St. Clair, and the Ausable, Sydenham, Thames, Grand, and Niagara rivers. It is now restricted to a few sites in the Sydenham and Ausable Rivers. It occupies shallow riffles in clean, clear, swift-flowing rivers with firm gravel/sand,silt-free substrates. Current population trends are unknown, but reproduction is still occurring. Impoundment and diversion of rivers likely destroyed much of this species' habitat during the last century. Major current threats to Snuffbox are siltation, pollution habitat perturbation, loss of riffle habitat, invasive dreissenid mussels, and loss of glochidial hosts. Dreissenid mussels have made Snuffbox habitat unsuitable throughout a large portion of its former range. The two remaining populations are in areas of intensive farming and subject to siltation and pollution. Small remaining populations, restricted distribution, and ongoing threats qualify Snuffbox as **Endangered** in Ontario.

Information Sources

Literature Cited

COSEWIC. 2011. COSEWIC 2-month interim update status report on the Snuffbox *Epioblasma triquetra* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 63 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Galbraith, H., C. Wilson, and D.T. Zanatta. 2010. Report to Fisheries and Ocean Canada: 2009 activities for unionid landscape genetics project. Fisheries and Oceans Canada, Burlington, Ontario. 17 pp.

Metcalfe-Smith, J.L., D.J. McGoldrick, D.T. Zanatta, and L.C. Grapentine. 2007. Development of a monitoring program for tracking the recovery of endangered freshwater mussels in the Sydenham River, Ontario. Environment Canada, WSTD Contribution No. 07-510.

Metcalfe-Smith, J.L., S.K. Staton, G.L. Mackie, and I.M. Scott. 1999. Range, population stability and environmental requirements of rare species of freshwater mussels in southern Ontario. Environment Canada, National Water Research Institute, Burlington, Ontario, NWRI Contribution No. 99-1577 058.

Metcalfe-Smith, J.L., S.K. Staton, G.L. Mackie, and E.L. West.1998. Assessment of the current status of rare species of freshwater mussels in southern Ontario. Environment Canada, National Water Research Institute, Burlington, Ontario, NWRI Contribution No. 98-019.

NatureServe. 2011. NatureServe Explorer: An online encyclopedia of life. Version NatureServe, Arlington, Virginia. Web site: http://www.natureserve.org/explorer. [accessed: November 2011].

Poos, M.S., A.J. Dextrase, A.N. Schwalb, and J.D. Ackerman. 2010. Secondary invasion of the round goby into high diversity Great Lakes tributaries and species at risk hotspots: potential new concerns for endangered freshwater species. Biological Invasions 12(5):1269-1284.

Schwalb, A.N., M.S. Poos, and J.D. Ackerman. 2011. Movement of Logperch –the obligate host fish for endangered Snuffbox mussels: implications for mussel dispersal. Aquatic Sciences 73:223-231.

Trdan, R.J., and W.R. Hoeh. 1993. Relocation of two state-listed freshwater mussel species (Epioblasma torulosa rangiana and Epioblasma triquetra) in Michigan. Pp. 100 in K.S. Cummings, A.C. Buchanan, and L.M. Koch (eds.). Conservation and

Management of Freshwater Mussels, Proceedings of the Upper Mississippi River Conservation Committee Symposium, St. Louis, Missouri. Illinois Natural History Survey, Champaign, Illinois.

USFWS 2010. Federal Register / Vol. 75, No. 211 / Tuesday, November 2, 2010. Proposed Rule: Endangered and Threatened Wildlife and Plants; Listing the Rayed Bean and Snuffbox as Endangered

Watson, E.T.. J.L. Metcalf-Smith, and J. DiMaio. 2000. Status of the Snuffbox, Epioblasma triquetra, in Canada. DRAFT report prepared for the Committee on the Status of Endangered Wildlife In Canada. 51 pp.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-22.

Woolnough, D.A., J.A. Downing, and T.J. Newton. 2009. Fish movement and habitat use depends on water body size and shape. Ecology of Freshwater Fish 18:83-91.

2. Community and Aboriginal Traditional Knowledge Sources: NA

No community knowledge or traditional Aboriginal knowledge was available.

3. Acknowledgements

APPENDIX 1

NORTHEASTERN NORTH AMERICA STATUS RANK AND DECLINE

	Subnational Rank *Give SRANK or write "Not Present" for each jurisdiction*	Sources - Natureserve 2011,COSEWIC 2011	Decline *Give percent decline in abundance or areal extent in each jurisdiction or indicate that there has been an unquantified but generally recognized population decline/range contraction by writing "Yes, unquantified."*	Sources
CT	Not Present			
DE	Not Present			
IL	S1			
IN	S1			
IA	SX			
LB	Not Present			
KY	S1			
MA	Not Present			
MB	Not Present			
MD	Not Present			
ME	Not Present			
MI	S1			
MN	S2			
NB	Not Present			
NF	Not Present			
NH	Not Present			
NJ	Not Present			
NS	Not Present			
NY	SH			
OH	S1			
ON	S1			
PA	S1			
PE	Not Present			
QC	Not Present			
RI	Not Present			
VA	S1			
VT	Not Present			
WI	S1			
WV	S2			

Occurs as a native species in 13 of 29 northeastern jurisdictions
Srank or equivalent information available for 13 of 13 jurisdictions = (100%)
S1, S2, SH, or SX in 13 of 13 = (100%)