COSSARO Candidate Species at Risk Evaluation Form

for

Jefferson Salamander (*Ambystoma jeffersonianum*)

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

Assessed by COSARRO as Endangered

February 2011

Final

PART 1

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Jefferson Salamander (*Ambystoma jeffersonianum*)

Current Designations:
GRANK – G4 Dec. 28, 2001

NRANK Canada – N2 Sept. 27 1998

COSEWIC -- Endangered Nov. 2010

SARA – Threatened Schedule 1

General Status Canada – At Risk

ESA 2007 – Threatened

SRANK –S2

General Status Ontario – At Risk

Distribution and Status Outside Ontario:
The distribution of *A. jeffersonianum* is limited to eastern North America, from New York and New England southwest to Virginia, West Virginia, Kentucky and Indiana (Petranka 1998, Bogart and Klemens 1997, 2008). Isolated populations have been recorded in east-central Illinois (Petranka 1998, Mullen and Klueh 2009). For much of this range, genetic data are not available so the continental distribution of pure *A. jeffersonianum* and unisexuals that use *A*. *jeffersonianum* as a sperm donor is uncertain (Bogart and Klemens 2008). In Canada, Jefferson Salamander occurs only in southern Ontario.

The core of the range of pure *A. jeffersonianum* populations likely extends from Pennsylvania southwestward to Kentucky. The jeffersonianum genome is widely distributed in eastern North America but exists primarily in polyploidy unisexuals (Bogart and Klemens 1997). Individuals that have solely the *A. jeffersonianum* genome occur in many “hybridized” populations.

ELIGIBILITY CRITERIA

Native Status
Yes. *Ambystoma jeffersonianum*, has been known to exist in Canada only since 1976 when a population was discovered in southern Ontario (Weller and Sprules 1976). It has clearly been here much longer.

Taxonomic Distinctness
Yes. Jefferson Salamander (*Ambystoma jeffersonianum*) was first described by Green in 1827 (in Uzzell 1967). Since then there has been considerable confusion about the species' taxonomy because of the sympatric occurrence of polyploid, all-female unisexual populations of *Ambystoma* salamanders that use sperm from male Jefferson Salamanders in reproduction. Since the last report (COSSARO 2000), there has been significant new scientific information that allows more accurate and precise estimates of numbers and distribution of Jefferson Salamanders in Ontario (COSEWIC 2010, in press). This new information clarifies further the relationship between Jefferson Salamander (JJ) and sympatric populations of all female unisexual *Ambystoma* (LJJ) salamanders.

Designatable Units
There is no evidence of major genetic differences in *A. jeffersonianum* in Canada, no significant natural disjunction and all populations occur in the same ecoregion. Therefore, the species is considered a single Designatable Unit. It is possible that an assessment should be conducted on the unisexuals. They may constitute a separate DU but it would not be a Jefferson Salamander DU, because the unisexuals share genomes with other ambystomids.

PRIORITY-SETTING CRITERIA

Recent Arrival
No. Although first reported in Canada by Weller and Sprules in 1976, it has undoubtedly been present here for at least hundreds of years (Zammit and Oldham 2000).

Non-resident
No.

PRIMARY CRITERIA (rarity and declines)

1. Global Rank
Not in any category. It is a G4 as assessed by NatureServe in 2001 (NatureServe 2011). However, given the taxonomic confusion and lack of investigation to accurately identify the species from unisexuals and similar ambystomid species, Jefferson Salamanders may be less common than the NatureServe rank suggests.

2. Global Decline

Insufficient Information. There are few trend data available, and no suggestion of a widespread decline, but problems with identification without genetic data give this assessment a high degree of uncertainty.

3. Northeastern North America Ranks

Special Concern. It occurs in 15 of 28 northeastern North American jurisdictions and SRank or equivalent information is available for 14 of 15 jurisdictions = 93%. Classified as S1, S2, SH, or SX in 5 of 14 = 36% (Table 1).

4. Northeastern North America Decline

Insufficient Information. There is insufficient information to assess trends across the species' range.

5. Ontario Occurrences

Special Concern. COSEWIC recognizes 33 extant locations (COSEWIC 2010 in press), while the Ontario NHIC database identifies 46 EOs (NHIC 2011). Both sources support a Special Concern status for this criterion (20-50 occurrences)

6. Ontario Decline

Threatened. Of 87 sites from which salamanders of the Jeffersonianum complex have been recorded, only 33 have been confirmed to have *A. jeffersonianum* (JJ*)* or unisexuals (LJJ) over the past decade. Assuming all 33 locations have pure Jefferson Salamanders (JJ), then the decline over the past three generations (~33 years) is 60%. However, other samples from ponds known to have pure Jefferson Salamanders suggest the decline is higher (COSEWIC 2010 in press). Repeat surveys over a 15-year timeframe (1990-2005) revealed that most populations were declining and some were extirpated. For example, surveys of 18 historically known breeding sites along the Niagara Escarpment that were documented in 1990-91 revealed only 3 sites that were confirmed to still be supporting *A. jeffersonianum* populations in 2003-04 (COSEWIC 2010, in press), an apparent decline of 83%.

7. Ontario's Conservation Responsibility

Not in any category. Ontario has less than 10% of global range**,** albeit the most interesting 10%.

SECONDARY CRITERIA (threats and vulnerability)

1. Population Sustainability

Endangered. The rapid decline in distribution and abundance in the past 30 years appears to be caused by loss of habitat (COSEWIC 2010 in press) and by the increasing impact of the kleptogenic unisexuals. This threat is the so-called "Clanton effect", a term coined by Minton (1954), that would result in a population crash of both *A. jeffersonianum* and unisexuals because there would no longer be any spermatophores. The reason for this loss of spermatophores is that as the unisexuals increase they would take more and more spermatophores leading to a decline in

reproductive success of Jefferson females. The Clanton effect has not been documented in any population; however there is current research to test this hypothesis (JP Bogart pers. comm. August 2010). If male *A. jeffersonianum* are extirpated, the unisexual population crashes unless they can use another species as a sperm donor. It is also interesting to realize that unisexuals can only successfully immigrate to ponds that already have acceptable sperm donors.

2. Lack of Regulatory Protection for Exploited Wild Populations

Not in any category. There is no known harvest in Ontario. The species is protected under the *Endangered Species Act*, 2007.

3. Direct Threats

Endangered. The loss, alteration and increasing isolation of breeding ponds and their surrounding deciduous forest habitat is a major set of direct threats. The species occupies areas under intense development pressure from urbanization, road proliferation, aggregate extraction and drainage for agriculture and other activities**.** The species has an affinity for upland deciduous forests, and requires vernal (temporary), fishless ponds for breeding and are extremely philopatric. These breeding ponds become unsuitable if their hydrology changes (e. g. dry out too quickly) or if predatory fish are introduced. Migration to and from breeding ponds can be disrupted by roadways, silt fencing, drainage ditches, plantations, or other barriers (COSEWIC 2010). Clearing ponds or surrounding habitat of woody debris can also destroy salamander habitat. Even though much of the species' Ontario range is protected under the *Niagara Escarpment Act,* the Green Belt, the Canadian *Species at Risk Act* (SARA), not to mention the Ontario *Endangered Species Act* of 2007, ponds continue to be lost to anthropogenic activities. Another direct threat is from the *Ambystoma* unisexuals. These can increase to greatly outnumber pure Jefferson Salamanders and deprive the Jefferson females of sperm to fertilize their eggs. This outcome leads to the extirpation of Jefferson's from the breeding pond, and ultimately, could also lead to extirpation of the unisexuals if no other ambystomatid salamanders are present.

4. Specialized Life History or Habitat-use Characteristics

Endangered. Jefferson Salamanders require temporary, fishless ponds to breed and an extensive surrounding moist deciduous forest for other activities. This life history is not particularly specialized except in the context of the species being found almost entirely in areas currently under intense development pressure. In this ecological context, the species is highly vulnerable given its specialized needs and limited dispersal capacities. Unlike many other pond breeding amphibians, Jefferson Salamanders have an extended lifespan and late maturity and are vulnerable to increased adult mortality which occurs with increased anthropogenic disturbance and presence of roads or other features that must be crossed on breeding migrations. (COSEWIC 2010).

COSSARO CRITERIA MET (primary/secondary)
ENDANGERED – [0/3]

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

Recommended Status: Endangered

SUMMARY

Jefferson Salamander (*Ambystoma jeffersonianum*) is **Endangered** in Ontario because of recent and ongoing declines in population. Since the 2000 status report, our knowledge of the abundance and distribution of Jefferson Salamander has changed and the risk of extinction in this species has increased. Molecular genetic analysis of tissue samples allows identification of individuals and has generated more accurate and precise estimates of numbers and distribution. The new data clarify the relationship between Jefferson Salamander (JJ) and sympatric populations of all female unisexual *Ambystoma* (LJJ) salamander. In Ontario, all populations of *A. jeffersonianum* (JJ) also contain unisexual *Ambystoma* (LJJ). *Ambystoma jeffersonianum* has not been found in all populations containing LJJ unisexuals, but it is presumed that *A. jeffersonianum* is or was also present as a sperm donor. Of 87 sites known to have JJ or LJJ salamanders, only about one third still have extant populations of Jefferson Salamanders (JJ), many have fewer individuals of Jefferson Salamanders than originally thought. Unisexual LJJ females outnumber Jefferson females, often by a wide margin. The absolute number and proportion of JJ to LJJ have declined in virtually all ponds where repeated tissue samples have conclusively identified JJ from unisexual LJJ. Threats to the survival of the species include loss of ponds and terrestrial habitat to development, fragmentation of locations by roads and uninhabitable terrain. These changes also can affect local hydrology and the impact on the salamanders is amplified by introduction of predatory fish into ponds. These salamanders can live a long time (~30 years), making them very vulnerable to threats associated with development.

Information Sources

Bogart, J.P. and M.W. Klemens. 1997. Hybrids and genetic interactions of mole salamanders (*Ambystoma jeffersonianum* and *A. laterale*) (Amphibia: Caudata) in New York and New England. American Museum of Natural History Novitates 3218: 1-78.

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COSEWIC. 2010. Update COSEWIC status report on Jefferson Salamander *Ambystoma jeffersonianum*. 2 month interim status report in press. Committee on the Status of Endangered Wildlife in Canada, Ottawa. x + 39 pp.

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Mullen, S.J. and S. Klueh. 2009. Demographics of a geographically isolated population of a threatened salamander (Caudata:Ambystomatidae) in central Illinois. Herpetological Conservation and Biology 4:261-269.

NatureServe 2011. NatureServe Explorer An online encyclopedia of life: Jefferson Salamander. *http://www.natureserve.org/explorer/*. Accessed Feb. 8 2011

NHIC 2011. Natural Heritage Information Centre Biodiversity Explorer *http://nhic.mnr.gov.on.ca/nhic_.cfm*

Petranka, J.W. 1998. Salamanders of the United States and Canada. Smithsonian Institution Press, Washington D.C... 587 pp.

Uzzell, T.M. 1967. *Ambystoma jeffersonianum.* Catalogue of American Amphibians and Reptiles 47:1-2.

Zammit, A.E. and M.J. Oldham. 2000. COSSARO candidate V,T,E species evaluation form for Jefferson Salamander (*Ambystoma jeffersonianum*). Natural Heritage Information Centre, Peterborough ON. 11 pp.

Appendix 1
NORTHEASTERN NORTH AMERICA RANK, STATUS AND DECLINE

(NatureServe 2011)[1]

CT	S3
DE	Not present
IL	S2
IN	S4
IA	Not present
KY	S4
MA	S2S3
MB	Not present
MD	S3
ME	Not present
MI	Not present
MN	Not present
NB	Not present
NF & LB	Not present
NH	S2S3
NJ	S3
NS	Not present
NY	S4
OH	SNR
ON	S2
PA	S4
PE	Not present
QC	Not present
RI	Not present
VA	S4
VT	S2
WI	Not present
WV	S3

Occurs as a native species in 15 of 28 northeastern jurisdictions
Srank or equivalent information available for 14 of 15 jurisdictions = 93%
S1, S2, SH, or SX in 5 of 14 = 36%

[1] Accessed Jan. 12 2011

PART 2
Ontario Evaluation Using COSEWIC Criteria

Regional (Ontario) COSEWIC Criteria Assessment

Criterion A – Decline in Total Number of Mature Individuals
ENDANGERED. Meets Endangered under A2bc+4bc as the total number of mature individuals has declined by more than 50% over the past 33 years. The decline has not ceased and may not be reversible. The decline is likely to continue at a similar rate or perhaps accelerate as potentially negative effects of the unisexuals increases. The decline is based on an appropriate index (number of locations) of abundance (subcriterion b) and a decline in IAO, EO and habitat quality (subcriterion c).

Criterion B – Small Distribution Range and Decline or Fluctuation
ENDANGERED. Meets Endangered under B2ab(i,ii,iii,iv,v) as the IAO (196 km²) is lower than the Endangered threshold, the species habitat is estimated to be severely fragmented, and there is an observed and inferred continuing decline in b(i,ii,iii,iv,v).

Criterion C – Small and Declining Number of Mature Individuals
Not applicable. Not applicable as the total number of mature individuals is unknown.

Criterion D – Very Small or Restricted Total Population
Not applicable.

Criterion E – Quantitative Analysis
Not applicable.

Rescue Effect
No. It is highly improbable that there could be rescue from USA populations because the species is a poor disperser. The closest U.S. populations of *A. jeffersonianum* to Ontario populations are in Cattaraugus and Wayne counties in New York where unisexual LJJ are also found (Bogart and Klemens 2008). Considering the limited movements in this species, current distribution, and barriers to dispersal, rescue from the U.S. is highly improbable

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