Species Status Assessment

Class: **Bivalvia**
Family: **Unionidae**
Scientific Name: ***Epioblasma triquetra***
Common Name: **Snuffbox**

Species synopsis:

Epioblasma triquetra is believed to be extirpated from the New York. Historically, this species had only been seen prior to the 1950s in Lake Erie at Bay View, Buffalo Creek, and the Niagara River. It is possible that very small populations may be found in larger tributaries of Lake Ontario and the Niagara River, as well as in the Allegheny basin (Strayer & Jirka 1997). One recently-dead shell was found in 1999.

E. triquetra is the most widespread species of the Epioblasma family (Williams et al 2008). This species is listed as state and federally endangered and is ranked by The Natural Heritage Program as historic in New York and as vulnerable throughout its range.

I. Status

a. Current and Legal Protected Status

i. **Federal** ______Endangered______________________**Candidate?** __________

ii. **New York** _____Endangered – Species of Greatest Conservation Need______

b. Natural Heritage Program Rank

i. **Global** ____G3 - Vulnerable____

ii. **New York** ____SH - Historic_______________**Tracked by NYNHP?** __________

Other Rank:
U.S. Endangered Species Act (USESA): Listed endangered (2012)
Canadian Species at Risk Act (SARA) Schedule 1/Annexe 1 Status: E (2003)
Committee on the Status of Endangered Wildlife in Canada (COSEWIC): Endangered (2011)
IUCN Red List Category: Not evaluated
American Fisheries Society Status: Threatened (1993)

Species of Regional Northeast Conservation Concern (Therres 1999)

Status Discussion:
This species is declining throughout its widespread range and has become increasingly rare, although several dozen occurrences remain, many of them with good viability. Distribution is greatly fragmented but remains relatively wide. Long-term viability of most populations is questionable, especially those in large rivers where zebra mussel populations are now established. The degree of decline has not been established (NatureServe 2013).

II. Abundance and Distribution Trends

a. North America

i. Abundance

__X__ declining ____increasing _____stable ____unknown

ii. Distribution:

__X__ declining ____increasing _____stable ____unknown

Time frame considered: ______________________________

b. Regional

i. Abundance

____ declining ____increasing ____stable _____unknown

ii. Distribution:

____ declining ____increasing ____stable ______unknown

Regional Unit Considered:______Northeast______________________
Time Frame Considered: ______________________________

c. Adjacent States and Provinces

CONNECTICUT **Not Present ___X___ No data _______**

i. Abundance

____ declining ____increasing ____stable ____unknown

ii. Distribution:

____ declining ____increasing ____stable ____unknown

Time frame considered: ____
Listing Status: ____ SGCN? __________

MASSACHUSETTS **Not Present __X____ No data _______**

i. Abundance

____ declining ____increasing ____stable ____unknown

ii. Distribution:

____ declining ____increasing ____stable ____unknown

Time frame considered: ____
Listing Status: ____ SGCN? ________

NEW JERSEY **Not Present ___X___ No data _______**

i. Abundance

____ declining ____increasing ____stable ____unknown

ii. Distribution:

____ declining ____increasing ____stable ____unknown

Time frame considered: ____
Listing Status: ____ SGCN? __________

ONTARIO **Not Present _________** **No data _______**

i. **Abundance**

____ declining ____increasing __x___stable ____unknown

ii. **Distribution:**

____ declining ____increasing ___x__stable ____unknown

Time frame considered: __________2003-2013____________
Listing Status: ___S1 Federally and Provincially Endangered___________

PENNSYLVANIA **Not Present _________** **No data _______**

i. **Abundance**

____ declining ____increasing ____stable ____unknown

ii. **Distribution:**

____ declining ____increasing ____stable ____unknown

Time frame considered: ____
Listing Status: ____S1 - Endangered_____________________________ SGCN? __________

QUEBEC **Not Present ___X___** **No data _______**

i. **Abundance**

____ declining ____increasing _____stable ____unknown

ii. **Distribution:**

____ declining ____increasing ______stable ____unknown

Time frame considered: ____
Listing Status: _________ ____

VERMONT **Not Present ___X___** **No data ________**

i. **Abundance**

____ declining ____increasing ____stable ____unknown

ii. **Distribution:**

____ declining ____increasing ____stable ____unknown

Time frame considered: ____

Listing Status: __________ ________________________________ SGCN? __________

d. NEW YORK **No data _______**

i. **Abundance**

_x_ declining ____increasing ____stable _____unknown

ii. **Distribution:**

__x_ declining ____increasing ____stable ______unknown

Time frame considered: __Since pre-1950__________________________________

Monitoring in New York.

As part of a State Wildlife Grant, NYSDEC Region 8 Fisheries and Wildlife staff is conducting a baseline survey of tributaries in central and western NY for native freshwater mussels 2009 – 2017.

Trends Discussion:

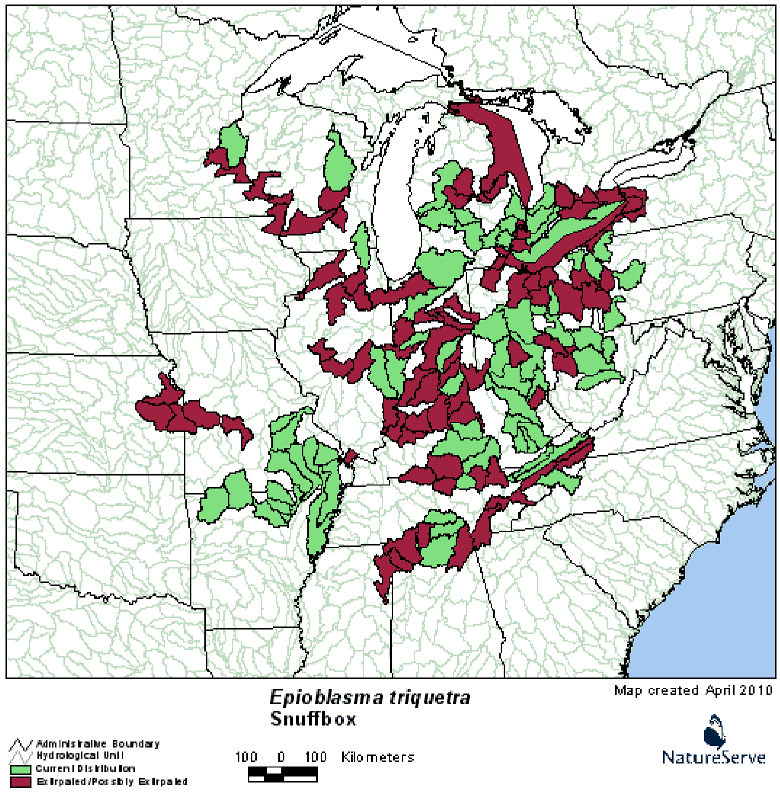

Figure 1. Range wide distribution of *E. triquetra* in North American (NatureServe 2013).

III. New York Rarity, if known:

Historic	# of Animals	# of Locations	% of State
prior to 1970		3	2 of 56 HUC 8 wtrsheds
prior to 1980			
prior to 1990			

Details of historic occurrence:

New York *E. triquetra* has been collected from Lake Erie at Bay View, Buffalo Creek, and the Niagara River. All of these collections were made prior to 1950, (Strayer & Jirka 1997).

Current	# of Animals	# of Locations	% of State
	0	0	0

Details of current occurrence:

There are no recent occurrences of this species in New York (Strayer & Jirka 1997, The Nature Conservancy 2009, Harman and Lord 2010, White et al. 2011, Mahar and Landry 2013, NY Natural Heritage Program 2013, NatureServe 2013). Strayer and Jirka (1997) recommend searching for this species in the Niagara River and the larger tributaries of Lake Ontario and the Niagara River. It should also be sought in the Allegheny basin, as it has been found in Pennsylvania only a few kilometers from the New York border.

New York's Contribution to Species North American Range:

% of NA Range in New York	**Classification of New York Range**
____ 100 (endemic)	**____ Core**
____ 76-99	**__X__ Peripheral**
____ 51-75	**____ Disjunct**
____ 26-50	**Distance to core population:**
__X__ 1-25	**____350____**

IV. Primary Habitat or Community Type:

1. N/A

Habitat or Community Type Trend in New York:

____ Declining ____Stable ____ Increasing __X__Unknown

Time frame of decline/increase: ______________________________

Habitat Specialist? __X__ Yes ______ No

Indicator Species? __X__ Yes ______ No

Habitat Discussion:

E. triquetra is typically a medium to high water quality species (Watters et al. 2009). It is chiefly found in medium-sized to large rivers in shallow riffles (depths of 2 inches to 2 feet) with clear, swift-flowing water and firm coarse sand and gravel substrates (Metcalfe-Smith et al. 2005, Cummings and Mayers 1992, McMurray et al. 2012, Parmalee and Borgan 1998, Watters et al. 2009, Spoo 2008). However, there is some evidence that it occurs most frequently in clear, hydrologically stable, low-gradient streams (Strayer & Jirka 1997). It has also been found in some lakes (ie. Lake Erie) (Strayer & Jirka 1997) and impoundments, but this is probably not a preferred habitat (Watters et al. 2009). This species is typically buries itself deeply in the substrate (Strayer and Jirka 1997, McMurray et al. 2012, Watters et al. 2009, Metcalfe-Smith et al. 2005, Williams et al. 2008).

V. New York Species Demographics and Life History

_____ Breeder in New York

____ Summer Resident

____ Winter Resident

____ Anadromous

____ Non-breeder in New York

____ Summer Resident

____ Winter Resident

____ Catadromous

____ Migratory only

__x___Unknown

Species Demographics and Life History Discussion:

Upstream males release sperm into the water. Females downstream take up the sperm with incoming water. Fertilization success may be related to population density, with a threshold density required for any reproductive success to occur. Eggs are fertilized within the female. Like nearly all North American mussels, this species must parasitize an often specific vertebrate host to complete its life cycle. It is suspected that some mussel populations are not recruiting because their hosts no longer occur with them. Once released by the female, glochidia must acquire a suitable host or die, usually within 24-48 hours. After attaching to a suitable host, glochidia encyst, usually at the fish's gills or fins and receive food and dispersal. Once the glochidia metamorphose into juveniles, they drop from the host. If they land in suitable substrate, they will burrow into the substrate, where they may remain for several years (Watters et al. 2009). *E. triquetra,* in particular, has a rather drastic approach to parasitizing its host fish. The female specimens entrap the snout of the host fish in the shell. It then releases the glochidia directly through the gills of the host fish (Barnhart et al. 1998). This type of behavior limits this species' host fish selection to only those that can survive the encounter long enough for the glochidia to develop (Zanatta 2009).

In the adult form, freshwater mussels are basically sessile; movement is limited to a few meters of the lake or river bottom. The only time that significant dispersal can take place is during the parasitic phase. Infected host fishes can transport the larval unionids into new habitats, and can replenish depleted populations with new individuals. Dispersal is particularly important for genetic exchange between populations. Dispersal is likely to be a slow process for mussels which use resident fishes with limited home ranges as their hosts (COSEWIC as cited in NaturesServe 2013).

This species is bradytictic, with eggs present in early September, glochidia forming in mid-September, and glochidia overwintering on the female until the following April or May. Individuals older than 15 years are rare (Watters et al. 2009). *E. triquetra* glochidia have been reported to transform on black sculpin (*Cottus baileyi*), mottled sculpin (*Cottus bairdi*), banded sculpin, (*Cottus carolinae*), Ozark sculpin (*Cottus hypselarus*), blackspotted topminnow (*Fundulus olivaceous*), logperch (*Percina caprodes*), blackside darter (*Percina maculata*), and Roanoke darter (*Percina roanoka*) (Watters et al. 2008).

VI. Threats:

Dams: Dams affect both upstream and downstream mussel populations by disrupting natural river flow patterns, scouring river bottoms, changing water temperatures, and eliminating habitat. Adapted to living in flowing water, the snuffbox cannot survive in the lakes or slow water created by dams. Snuffbox mussels depend on host fish to move upstream. Because dams block fish passage, they also prevent mussels from moving upstream, isolating downstream mussels from upstream populations. This fragmentation leads to small, unstable populations that easily die out.

Pollution: Adult mussels, because they are sedentary (meaning that they tend to stay in one place), are easily harmed by toxins and poor water quality caused by pollution. Pollution may come from specific, identifiable sources such as accidental spills, factory discharges, sewage treatment plants and solid waste disposal sites or from diffuse sources like runoff from cultivated fields, pastures, cattle feedlots, poultry farms, mines, construction sites, private wastewater discharges, and roads. Contaminants may directly kill mussels, but they may also reduce water quality, affect the ability of surviving mussels to have young, or result in lower numbers or disappearance of host fish.

Sedimentation: Although sedimentation is a natural process, poor land use practices, dredging, impoundments, intensive timber harvesting, heavy recreational use, and other activities accelerate erosion and increase sedimentation. Sediment that blankets a river bottom can suffocate mussels. Accelerated sedimentation may also reduce feeding and respiratory ability for snuffbox mussels, leading to decreased growth, reproduction, and survival.

Nonnative Species: The invasion of the nonnative zebra mussel into the U.S. poses a serious threat. Zebra mussels proliferate in such high numbers that they use up food resources and attach to native mussel shells in such large numbers that the native mussel cannot eat or breath. In free-flowing, relatively shallow rivers, zebra mussels do not appear to be as devastating to native mussels as they are in impounded rivers or lake environments. Some species have even been shown to be recovering beyond pre-zebra mussel invasion levels, while others have been effectively eliminated from the western basin of Lake Erie by these exotics (Strayer 2009). Another invasive species, the round goby, is a nonnative fish species that may displace native host fish species, thus reducing the ability of the snuffbox to reproduce (USFWS Snuffbox Factsheet, January 2012). In a recent study performed by Schwalb et al. in 2011, a log perch (*Percina caprodes)*, a known obligate host fish for *E. triquetra* population was studied by its dispersal potential. This study found that *P. caprodes* remain in a small area, which could restrict the dispersal and/or (re)colonization of *E. triquetra*, which may explain why the species populations are unable to rebound quickly from a sharp decline.

Are there regulatory mechanisms that protect the species or its habitat in New York?

_______ No **_____ Unknown**

___X__ Yes

In February 2012, the U.S. Fish and Wildlife added the snuffbox to the list of endangered species giving the species full protection under the Endangered Species Act. The ESA provides protection against practices that kill or harm the species and requires planning for recovery and conservation actions.

Mussel habitats receive some generic protection under several New York State regulations (NYCRR) promulgated under the authority of the New York Environmental Conservation Law (ECL), specifically Part 608 of the NYCRR: Use and Protection of Waters, and Part 617 of the NYCRR: State Environmental Quality Review (SEQR). Part 608 provides protection of some mussel habitats by regulating and requiring environmental review of the modification or disturbance of any "protected stream", its bed or bank, and removal of sand, gravel or other material from its bed or banks (608.2 Disturbance of Protected Streams). This does not provide adequate protection of mussels and their habitats as it only protects streams or particular portions of a streams for which there has been adopted by NYSDEC or any of its predecessors any of the following classifications or standards: AA, AA(t), A, A(t), B, B(t) C(t), or Streams designated (t)(trout) also include those more specifically designated (ts)(trout spawning). Mussels habitats may also receive some additional protections as the construction, repair, breach or removals of dams, and the excavation and placement of fill in navigable waters are subject to regulation and environmental review under Part 608, 608.3 and 608.5 respectively. Under part 608, projects requiring a permit can be conditioned by NYSDEC to include best management practices, such as sediment and erosion protections. Through the review process, these projects can also be modified to reduce impacts in order to meet permit issuance standards.

Under Part 608, protection of unlisted species of mussels is general and relatively limited. More importantly, Class C and D waters with mussels do not receive protection under these regulations. A significant portion of the New York's mussel resources occur within Class C and D waters. An additional but not insignificant gap in protection occurs because agricultural activities consisting of the crossing and re-crossing of a protected stream by livestock or wheeled farming equipment normally used for traditional agricultural purposes or of withdrawing irrigation water in a manner which does not otherwise alter the stream, are exempt from these regulations and environmental review.

Water quality certifications required by Section 401 of the Federal Water Pollution Control Act, Title 33 United States Code 1341(see subdivision (c) of this Section)may provide protection for freshwater mussels and their habitats from some activities that would potentially have adverse impacts by regulating construction or operation of facilities that may result in any discharge into navigable waters. Water quality certifications set water quality-related effluent limitations, water quality standards, thermal discharge criteria, effluent prohibitions and pretreatment standards for projects on navigable waters.

The State Environmental Quality Review (SEQR, Part 617 NYCRR) may also protect mussels and their habitats by requiring the consideration of environmental factors into the existing planning, review and decision-making processes of state, regional and local government agencies for activities that require discretionary approval. SEQR requires the preparation of an Environmental Impact Statement, including an alternatives analysis, for those activities that may result in a substantial adverse change in ground or surface water quality; a substantial increase in potential for erosion, flooding, leaching or drainage problems; the removal or destruction of large quantities of vegetation or fauna; substantial interference with the movement of any resident or migratory fish or wildlife species; impacts on a significant habitat area; substantial adverse impacts on a threatened or endangered species of animal or plant, or the habitat of such a species; other significant adverse impacts to natural resources; or, a substantial change in the use, or intensity of use, of land including agricultural, open space or recreational resources, or in its capacity to support existing uses.

New York State has numerous laws and regulations that both directly or indirectly protect waters of the state (mussel habitats) including regulations governing direct discharges to surface and groundwater, storm water, agricultural activities, pesticides, flood control, and dams. Without these regulations, mussels would certainly be in worse shape; however, most of these generic protections are not adequate in scope or specific enough to mussel threats to protect the mussel resources of New York State.

Describe knowledge of management/conservation actions that are needed for recovery/conservation, or to eliminate, minimize, or compensate for the identified threats:

- Assess the need and opportunity for relocation/reintroduction efforts. Conduct relocation or reintroduction where adequate sources can be identified and appropriate stream conditions exist (water quality, habitat, host species etc).

- Evidence of historic occurrence of multiple New York State extirpated mussel species exists for the Niagara River. These species include: *Epioblasma triquetra, Lampsilis teres, Lampsilis abrupta, Obovaria olivaria, Potamilus capax*, *Quadrula pustulosa*, *Quadrula quadrula, Simpsonaias ambigua, and possibly Truncilla donaciformis*. To assess the potential for future reintroduction efforts, a pilot program relocating common species to suitable sections of the Niagara River should be initiated and its results assessed to gage the possible success of reintroduction efforts for extirpated species in this waterbody.

- Modify marine mussel regulations or the definition of protected wildlife in NYCRR to clarify that freshwater mussels are protected under ECL. Current regulations could be interpreted that freshwater mussels may only be protected as shellfish without a season within the Marine District.

- Through landowner incentive programs or regulation, riparian buffers, particularly those that also provide shade, should be added/maintained/widened, along agricultural fields, subdivisions, and along major roads to decrease the levels of nitrogen, pesticides, sediment, heavy metals, and salts from entering these aquatic systems, as well as to moderate water temperature. Studies have suggested decreasing sediment loads entering aquatic systems as the best way to decrease the impact of numerous stressors for mussels in general (Roley & Tank 2012).

- Require all state agencies to maintain appropriate vegetative buffers along streams, rivers and lakes on state-owned or state managed properties.

- Following any reintroduction efforts, develop and implement a comprehensive monitoring strategy that identifies protocols, including locations and specific intervals, for regular monitoring of known mussel populations to detect assess trends and detect dangerous declines.

- Update wastewater treatment facilities in Buffalo to eliminate combined sewer outflows.

- Coordinate with local wastewater treatment facilities to improve ammonia removal of treated discharge. This has been documented as a threat to Unionids at multiple life stages, and therefore needs to be addressed (Gillis 2012).

- Mussel sensitivity to particular pollutants should be considered or addressed in the regulation of wastewater and stormwater discharges to groundwater and surface waters, State Pollutant Discharge Elimination Systems (SPDES). This should be reflected in effluent limitations for discharges, including discharges from P/C/I facilities (Private/Commercial/Industrial), CAFO facilities (Concentrated Animal Feeding Operations), High Volume Hydraulic Fracturing Discharges, and Wastewater treatment plants, etc. Discharges whose receiving waters have mussels, particularly those with known populations of mussels listed as Endangered, Threatened, Special concern or SGCN, should be carefully reviewed for potential impacts to mussels. For example, deleterious levels of ammonia (a component of many types of discharges) and molluscicides (a commonly used water treatment chemical in discharged water) should not be permitted.

- Within the Great Lakes watersheds, lamprey control efforts should consider specific, potentially adverse, impacts to native freshwater mussels when determining methods, including selection of lampricide formulations and concentrations. Lampricide treatment managers should use caution when using the combination of TFM and niclosamide in streams with known mussel populations and every effort should be made to maintain lampricide concentrations at or near the MLC for sea lamprey to minimize the risk to this important faunal group (Boogaard 2006).

- NYSDEC should consider sensitivity of freshwater mussels to specific pollutants in the establishment and setting of water quality standards and TMDLs for waters containing freshwater mussels. A Total Maximum Daily Load (TMDL) specifies the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. TMDLs account for all contributing sources (e.g. point & nonpoint sources, and natural background levels), seasonal variations in the pollutant load, and incorporate a margin of safety that accounts for unknown or unexpected sources of the pollutant. In essence, a TMDL defines the capacity of the waterbody to absorb a pollutant and still meet water quality standards. The Clean Water Act requires states to identify waterbodies that do not meet water quality standards after application of technology-based effluent limitations. For these "impaired waters," states must consider the development of alternative strategies, including TMDLs, for reducing the pollutants responsible for the failure to meet water quality standards.

The Comprehensive Wildlife Conservation Strategy (NYSDEC 2006) includes recommendations for the following actions for freshwater mussels:

Habitat management:

- Manage areas of important mussel populations by controlling degradation factors (e.g.. Controlling livestock access, point source or non-point source pollution, flow alteration, etc.)
- Develop methods to improve and restore freshwater bivalve habitat.

Habitat research:

- Conduct research to determine habitat parameters necessary for good populations of each species of species-at-risk listed mussels.
- Research flow requirements of freshwater bivalves and model the effects of flow changes both in volume and timing.
- Research all parameters of mussel habitat requirements including temperature, substrate, fish, flow, food, etc.

Habitat restoration:

- Restore degraded habitat areas to allow for recolonization or reintroduction of listed mussels.

Invasive species control:

- Develop a monitoring/control plan that includes measures to detect invasive species problematic to freshwater bivalves in all New York watersheds and actions that will be taken to control them before they become threats.
- Conduct research on control of exotic bivalve species that compete with native mussels and exotic crustaceans or fish which may prey on them.

Life history research:

- Research effects of pesticides and other chemicals, including ammonia, on all life stages of freshwater bivalves: sperm/egg, glochidia, larva, adults.
- Research potential interbreeding between *Alasmidonta varicosa* and *Alasmidonta marginata* and, if occurring, evaluate the potential threat to *A. varicosa* population integrity.
- Determine fish hosts for species where this is not known for populations living in New York.
- Research population dynamics of listed mussel species including connectivity of populations or subpopulations and genetic distinctness of populations or subpopulations.
- Determine or confirm breeding phenology and habitat conditions necessary for successful breeding for listed mussels (e.g.. mussel density, pop. level of fish host, temp, flow).

Modify regulation:

- Modify marine mussel regulations to be clearer that freshwater mussels are protected under ECL.

New regulation:

- Ban the importation of fish that feed on freshwater mollusks (e.g.. black carp).
- Require inclusion of all stages of freshwater mussels in testing for approval of new pesticides in New York.

Other action:

- Develop an outreach program to private landowners through the Landowner Incentive Program to educate the public about freshwater mussel protection and initiate projects to prevent or repair impacts from land use on mussels.
- Increase regional permit control of development and highway projects that may impact native mussels.
- Develop standard monitoring/survey protocols for development projects in all watersheds in New York.
- Evaluate threats to mussels in each New York watershed and prioritize areas for actions to address the threats.

- Research the best survey methods both for detection of rare species and evaluation of population status and trends.
- Begin evaluation of members of the family Sphaeridae (fingernail clams) for inclusion into the species at risk list.

Population monitoring:

- Conduct population estimates of species-at-risk listed mussel species in NY
- Conduct surveys to determine distribution of species-at-risk listed mussel species in NY.

Regional management plan:

- Incorporate freshwater mussel goals and objectives into regional water quality and fish management plans and policies.

Relocation/reintroduction:

- Where appropriate, reintroduce listed mussels into appropriate habitat within their historic range.

Statewide management plan:

- Incorporate freshwater mussel goals and objectives into statewide water quality and fish management plans and policies.

VII. References

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