

Chittenango ovate amber snail
(Novisuccinea chittenangoensis)

5-Year Review:
Summary and Evaluation

U.S. Fish and Wildlife Service
New York Field Office
Cortland, New York

May 2019

5-YEAR REVIEW

Species reviewed: Chittenango ovate amber snail (*Novisuccinea chittenangoensis*)
May 2019

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U.S. FISH AND WILDLIFE SERVICE
5-Year Review for Chittenango ovate amber snail (*Novisuccinea chittenangoensis*)
May 2019

1.0 GENERAL INFORMATION

1.1 Reviewers

Lead Regional Office: Region 5, Mr. Martin Miller, (413) 253-8615,
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Lead Field Office: New York Field Office, Ms. Robyn Niver, (607) 753-9334,
robyn_niver@fws.gov

Cooperating Field Office: none

Cooperating Region: none

1.2 Methodology Used to Complete the Review: This 5-year review was conducted by the lead endangered species biologist for the Chittenango ovate amber snail (COAS) and species experts. It summarizes new threats and status information gathered since the 2011 Review (officially signed in 2012) (Service 2012).

1.3 Background

1.3.1 FR Notice announcing initiation of this review: 83 Federal Register 39113
(August 8, 2018): Initiation of 5-Year Reviews of 19 Northeastern Species

1.3.2 Listing history:

FR notice: 43 FR 28932
Date listed: July 3, 1978
Entity listed: species
Classification: threatened

1.3.3 Associated rulemakings: none

1.3.4 Review History: This review constitutes the third 5-year status review of the COAS since its listing. Information that has become available since the last review has been used to evaluate and assess the current status of the COAS.

1.3.5 Species' Recovery Priority Number at start of review: 5

1.3.6 Recovery Plan:

Name of plan: Chittenango ovate amber snail (*Novisuccinea chittenangoensis*)
Recovery Plan, First Revision

Date issued: July 11, 2006

Date(s) of previous plan/revision(s): March 1983

2.0 REVIEW ANALYSIS

2.1 Application of the 1996 Distinct Population Segment (DPS) policy

2.1.1 Is the species under review listed as vertebrate? No, the species is an invertebrate; therefore, the DPS policy is not applicable.

2.2 Recovery Criteria

2.2.1 Does the species have a final, approved recovery plan containing objective, measurable criteria? Yes

2.2.2 Adequacy of recovery criteria:

2.2.2.1 Do the recovery criteria reflect the best available and most up-to-date information on the biology of the species and its habitat? Yes

2.2.2.2 Are all relevant listing factors addressed in the recovery criteria?
Yes

2.2.3 List the recovery criteria as they appear in the recovery plan, and discuss how each criterion has or has not been met, citing information.

Stabilization Criteria:

In order to consider *Novisuccinea chittenangoensis* as **stabilized**, the following criteria should be met:

1. The population at Chittenango Falls is shown to be stable or improving for 10 years. To accomplish this, a baseline population size and distribution must be determined.

This criterion has not been met. See 2.3.1.2 for details.

2. At least two healthy captive colonies of *Novisuccinea chittenangoensis* are successfully established in order to: (1) provide a source for augmenting the population at Chittenango Falls or introductions to new sites, (2) buffer against extinction in the wild, and (3) provide a source of *Novisuccinea chittenangoensis* for various scientific experiments related to their recovery.

A healthy captive population is defined as having sufficient genetic diversity and being large enough to meet population goals, which will be specified in a new protocol based in part on the results of genetics research as well as results of research into the optimal conditions for propagation of *Novisuccinea chittenangoensis*.

The U.S. Fish and Wildlife Service (Service) funded the State University of New York College of Environmental Science and Forestry (ESF) through the Great Lakes Restoration Initiative (GLRI) to develop new captive management protocols.

Genetics research on the captive population has not yet been undertaken as part of the current project, but effort has been made to maintain genetic variation in the colony using strategies including making an effort to not breed siblings together, or to backcross siblings with parents. Rotating wild-caught parents out of the captive colony and replacing them with other wild caught adults is also a strategy for preventing the loss of genetic variation in the captive colony. Additional work on managing founders and the colonies' genetics may be appropriate.

Cody Gilbertson describes methods in her M.S. Thesis (Gilbertson 2016) and subsequent publication (Gilbertson et al. 2019). Two captive colonies have been established to date (one at ESF and one at the Rosamond Gifford Zoo) (Rundell 2019; Gilbertson 2018; Rundell 2018). A basic timeline is provided in appendix A.

In terms of a general summary of captive efforts, COAS mate and produce much larger numbers of eggs than can reasonably be reared to maturity with current staffing and lab facilities. About 200 to 300 snails can generally be reared each summer with new founders periodically brought in. We also do not want to completely swamp the wild population with tens of thousands of snails as we continue to investigate the wild population size and success of captive releases. Additional information is needed to assess whether these releases are contributing favorably to the wild population and assessing the best timing and densities for any future releases.

3. The genetic distinctiveness of *Novisuccinea chittenangoensis* from other snails occupying the site is demonstrated.

*We believe we have met this criterion through work by Dr. Tim King, previously of the U.S. Geological Survey (USGS). In 2003, the USGS (T. King, unpublished data) amplified and sequenced the cytochrome oxidase I region of mitochondrial DNA and the ITS-1 region of nuclear DNA in *Novisuccinea chittenangoensis* and *Succinea* sp. B. The results (sequence divergence of 10 to 15 percent) suggest large differences between the two species. No hybridization was observed.*

*In addition, studies are underway to determine which extant succineids are most closely related to the COAS. Despite past work on the COAS itself we do not have much information on the phylogenetic and biogeographic context for this species. Work is at an early stage, but so far the COAS is looking to be close to *S. putris* but distinct from it.*

*Another snail, *Succinea ovalis*, could potentially be tested for hybridization. However, as far as we know, this species does not occur within the COAS habitat, but above the falls and farther upstream (C. Gilbertson, pers. comm).*

4. With respect to the five listing factors, threats to the species are abated as follows (noting that no risks to the snail were identified under Factor B or, for as long as the snail is listed, Factor D):

Factor A. Protection of the snail's Chittenango Falls habitat by the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP) is perpetuated.

No new information since 2011 Review - NYSOPRHP permanently owns the habitat and manages access to the site.

Factors C and E. A sufficient understanding of the relationship between *Novisuccinea chittenangoensis* and *Succinea sp. B* is gained and effective measures to reduce any negative interactions are in place.

*Investigations have shown that control of *Succinea sp. B* does not appear warranted at this time (Campbell et al. 2015).*

Factor E. A sufficient understanding of any future threat of hybridization is gained to allow an effective response.

See Criterion #3, above.

5. Monitoring of threats and effects of management practices indicate that recovery actions are contributing to the improved status of the species.

This is ongoing. We are assessing effects of release of captive-reared individuals primarily through annual population monitoring.

Delisting Criteria

If and when the population is shown to be stable or increasing for at least five generations (10 years), recovery of *Novisuccinea chittenangoensis* can then focus on meeting conditions for delisting. **Delisting** will be considered when the following criteria (in addition to criteria 1-3) are met.

4. The *Novisuccinea chittenangoensis* population at Chittenango Falls must include at least 1,000 snails with occupancy of both the lower and middle ledges. The population must be stable (or improving) for at least 10 years.

This criterion has not been met. See 2.3.1.2 for details.

5. Threats to the snail are abated as follows:

Factor A. All sites with *Novisuccinea chittenangoensis* are permanently protected through acquisition, conservation easement, or another form of agreement.

Currently there is only one site (Chittenango Falls), and it is protected by the NYSOPRHP.

Factor A. Written management/monitoring plans are in place for each site.

This criterion has not been met.

Factor A. A sufficient understanding of habitat and biological requirements is gained to conduct management efforts.

Gilbertson et al. (2019) found the COAS to consume leaves of sunbleached sugar maple collected in spring and summer, boxelder collected in October and November, and sunbleached hackberry, thin cherry, and red oak. New leaf litter species observed to be consumed not included in the published study are: pignut hickory collected in the spring (after snow melts) and paw paw leaves (C. Gilbertson, pers. comm.).

*Given the high survival and numbers of eggs per egg mass obtained in the lab using these food sources, one option to consider is resource supplementation at Chittenango Falls to help increase COAS numbers. However, it may also increase numbers of *Succinea* sp. B.*

Factor D. *Novisuccinea chittenangoensis* is ensured continued protection by New York State after Endangered Species Act protections are removed.

No new information since 2011 Review.

Factors C and E. Any negative interaction between *Novisuccinea chittenangoensis* and *Succinea* sp. B or other species is controlled with minimal management intervention.

*Investigations have shown that control of *Succinea* sp. B does not appear warranted at this time (Campbell et al. 2015).*

Factor E. Searches for any other potential extant populations that have been completed, and the extant population at Chittenango Falls has been successfully augmented.

We are unaware of any other extant populations, and no current searches are recommended given the failure to find any COAS in all surveys to date. Augmentation of the population at Chittenango Falls using captive-bred individuals from the captive colony at ESF has begun and are considered experimental.

Factor E. Searches for potential introduction sites have been completed, the potential for introduction has been thoroughly evaluated, and, if warranted, one or more additional *Novisuccinea chittenangoensis* populations have been successfully established.

Funding to address this criterion has been obtained through the GLRI, and studies will likely begin in 2020.

6. Monitoring of threats and effects of management practices indicate that recovery actions have led to a secure status for the species.

This is ongoing. We are assessing effects of release of captive-reared individuals primarily through annual population monitoring.

2.3 Current Species Status and Updated Information

2.3.1 Biology and Habitat

2.3.1.1 New information on the species' biology and life history:

As discussed in the Recovery Plan, the establishment of a captive population would be important for providing a back up to the single, precariously positioned (e.g. susceptible to rock slides and flooding) wild population, and for potential augmentation of the wild population. Molloy (1995) originally started a captive colony at ESF in 1990. Offspring from Molloy's captive colony went to several zoos, and the last snail in captivity died in November 2002 (Service 2006). However, recently ESF successfully re-established a captive population of COAS at the ESF lab. Re-establishment of this captive population resulted in completion of a thesis entitled "Developing captive ex situ populations of the endangered Chittenango ovate amber snail *Novisuccinea chittenangoensis* (Succineidae: Pulmonata: Mollusca) for population augmentation in New York" (Gilbertson 2016).

One thesis chapter focused on diet and captive methods and was subsequently published in the *Journal of Molluscan Studies* (Gilbertson et al. 2019). As stated above, Gilbertson et al. (2019) conducted extensive feeding trials and found the COAS to consume leaves of sunbleached sugar maple collected in spring and summer, boxelder collected in

October and November, and sunbleached hackberry, thin (transparent when held to light) cherry, and red oak. Gilbertson's thesis (2016) includes a detailed husbandry protocol for COAS colony care in captivity.

Gilbertson (2016) observed reproduction and development of captive snails and found that egg masses were laid approximately 7 days after mating. A white dot was at the center of an egg as early as day 1 if the egg was fertile, and eggs consistently took about 28 days to hatch. When the snails were fed with a diet of preferred leaf litter, the average number of eggs/mass was 35 ± 4 , and average number of snails hatched/mass was 33 ± 4 . Gilbertson also observed evidence of sperm storage when an isolated snail continued to lay fertile eggs for up to 2 months after last possible mating.

Gilbertson and Wyatt (2016) evaluated euthanasia techniques for land snails (using *Succinea sp. B*) and found the best to be a 2-step method of inducing anesthesia by immersion in 5-percent ethanol followed by immersion in a euthanizing and tissue-preserving solution of 70-percent to 95-percent ethanol or 10-percent neutral buffered formalin.

2.3.1.2 Abundance, population trends, demographic features and/or trends:

Mark-release-recapture studies have been conducted at the wild population since 2002 (Table 1, Campbell et al. 2015, Gilbertson 2016, Gilbertson 2018).

Table 1. Chittenango ovate amber snail wild population estimates from 2002 to 2018.

Survey year	Best model	Population estimate	SE
2002	p(·), φ(·), pent(t)	262.4	35.68
2003	p(·), φ(·), pent(t)	225.1	31.76
2004	p(t), φ(·), pent(t)	716.5	68.97
2005	p(·), φ(t), pent(t)	784.2	38.1
2007	p(t), φ(·), pent(t)	551.1	20.01
2008	p(t), φ(·), pent(t)	322.6	27.59
2009	p(t), φ(·), pent(t)	339.2	52.85
2010	p(·), φ(·), pent(T)	434.1	32.15
2012	p(·), φ(t), pent(t)	974.5	99.21
2014	p(·), φ(T), pent(·)	310.1	38.74
2015	p(·), φ(T), pent(t)	357.2	54.49
2016	p(·), φ(T), pent(·)	271.1	98.91
2017	p(·), φ(·), pent(·)	159.9	24.61
2018	p(·), φ(·), pent(t)	260.8	97.96

2.3.1.3 Genetics, genetic variation, or trends in genetic variation: The 2011 Review included a summary of the last genetics studies. Since that time, the information has been published by King et al. (2012).

2.3.1.4 Taxonomic classification or changes in nomenclature: The listed entity, COAS, continues to have an incorrect genus (*Succinea* instead of *Novisuccinea*) in the Code of Federal Regulations. The Service will

correct the species' taxonomic nomenclature in a forthcoming rulemaking.

2.3.1.5 Spatial distribution, trends in spatial distribution, and/or historic range: No additional information since 2011 Review.

2.3.1.6 Habitat or ecosystem conditions: Some additional smaller rock falls have occurred since the large rockslide in 2006. For example, in spring 2016 a large boulder and other smaller rocks came down into COAS habitat blocks 12-14.

2.3.1.7 Other:

Outreach and public support efforts have significantly increased since 2011. Examples include:

Time Warner Cable News *Going Green*. “Efforts to save an endangered snail living at Chittenango Falls.” (Available in Syracuse, Rochester, Albany, Kingston, Buffalo). 16 June 2014.

Syracuse.com. “Snail Sex in SUNY ESF Lab Could Save endangered, Thumb-Sized Species.” 4 August 2015.
https://www.syracuse.com/outdoors/index.ssf/2015/08/sex_in_suny_esf_lab_could_save_endangered_thumb-sized_snail.html

ScienceDaily. “Near-Extinct, Tiny Snail Coaxed into Captive Reproduction in Laboratory.” 28 September 2015.

WRVO October 2015 story.
<https://www.wrvo.org/post/scientists-working-save-endangered-species-extinction-central-new-york>

The Daily Orange. “A Snail’s Pace: SUNY-ESF Grad Student Breeds Endangered Chittenango Falls Snail Species in Captivity.” 5 October 2015.

Scientific American November 2015 blog post.
<https://blogs.scientificamerican.com/extinction-countdown/stowaway-snail/>

WNYC Radio’s *Hypothesis*. “A Big Effort to Save Tiny Snails.” 3 December 2015.
<http://www.wnyc.org/story/big-effort-save-tiny-species>

NYSOPRHP April 2016 blog post.
<https://nystateparks.blog/tag/chittenango-ovate-amber-snails/>

LocalSYR.com. “Joint Effort to Protect Snail Found Only in Chittenango” (video

news coverage). 13 Sept. 2017. https://www.localsyr.com/news/joint-effort-to-protect-snail-only-found-in-chittenango_20170913211746/810655030

WSYR TV. “Endangered Snails Bred in ESF Lab Released into the Wild.” 13 September 2017.

Time Warner Cable News *Going Green.* “Tracking Snails.” (Available in Syracuse, Rochester, Albany, Kingston, Buffalo). 29 September 2017.

Rochester Democrat & Chronicle June 2018 story and video. <https://www.democratandchronicle.com/story/news/2018/06/08/only-150-these-snails-thought-remain-world/655051002/>

New York Upstate Outdoors August 2018 story and video. https://www.newyorkupstate.com/outdoors/2018/08/suny_esf_snail_whisperer_helping_to_save_endangered_upstate_ny_species_video.html

Buffalo News Channel 2 WGRZ September 2018 story and video. <https://www.wgrz.com/article/sports/life-at-a-snails-pace-the-ovate-amber-snail-of-chittenango-falls/71-594821189>

The Service also helped form a new informal group (“Snailblazers”) focused on COAS conservation efforts. Participants include the New York State Department of Environmental Conservation, NYSOPRHP, ESF, and Rosamond Gifford Zoo. The Snailblazers have a pamphlet, Facebook page <https://www.facebook.com/Snailblazers-1701883819847688/>, and web presence and have recently produced a freely available children’s book focused on COAS conservation, entitled *The Story of Chitt, A Very Special Snail* (available at the following link: <https://www.uniteforliteracy.com/aza/wildlife/book?BookId=1698>

Additional outreach projects, including a COAS exhibit at the Rosamond Gifford Zoo (which includes a climb-on COAS sculpture), are planned for 2019.

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

2.3.2.1 Factor A. The present or threatened destruction, modification, or curtailment of its habitat or range: While the site is protected (as part of a State Park) and there is really no risk of development or other loss of the site, humans continue to trespass into the COAS habitat area. Additional monitoring and restriction of human access is appropriate.

2.3.2.2 Factor B. Overutilization for commercial, recreational, scientific, or educational purposes: No additional information since 2011 Review.

- 2.3.2.3 Factor C. Disease or predation:** Predation evidence was observed on captive raised and released COAS during the summer of 2018. Bite marks on shell appear to be from a small mammal. Additional studies are recommended.
- 2.3.2.4 Factor D. Inadequacy of existing regulatory mechanisms:** No additional information since 2011 Review.
- 2.3.2.5 Factor E. Other natural or manmade factors affecting its continued existence:** As mentioned above, additional small rockslides have occurred within the COAS habitat since the large rockslide in 2006. As noted in the 2011 review, rockslides are likely to continue. Increasing COAS population size at the Chittenango Falls may be the only option to buffer against future events.

In addition to rockslides, flooding is also a continuous threat. In 2017, major flooding washed away blocks 4 and 5 of COAS habitat. A large group of joe pye weed (*Eutrochium purpureum*) plants were swept away from the habitat where COAS are regularly found leaving the substrate barren.

As discussed in the 2006 and 2011 reviews, the Service has been concerned about the presence of *Succinea sp. B* that may be competing with *Novisuccinea chittenangoensis* for food and/or breeding or wintering habitat. At the time of the 2011 review, a report by Campbell et al. (2010) summarized the best available information regarding competition and coexistence at the Chittenango Falls. Since that time, Campbell et al. (2015) published these findings in a peer-reviewed journal and restated that past manual removal of *Succinea sp. B* has not been an effective means of control at the Chittenango Falls and is not warranted (no significant threat to COAS at this time).

The 2011 Review identified a new potential threat, pale swallowwort (*Cynanchum rossicum*). Since that time, pale swallowwort has been found in blocks 9 to 14, and persists there currently. From captive observations, COAS do not consume dead or fresh pale swallowwort leaves (Gilbertson pers. com). Therefore, if it takes over the habitat, it may reduce foraging options for COAS.

For more information on Factor E, please see page 15 of the Recovery Plan.

2.4 Synthesis

Based on the single, small wild population (zero wild population redundancy and low population resiliency) and continuing imminent threats of future rockslides, flooding, and

human entrance into the site, we conclude that the COAS is currently on the brink of extinction in the wild and therefore should be classified as an endangered species rather than a threatened species.

3.0 RESULTS

3.1 Recommended Classification: Uplist to endangered

Rationale: The species should be uplisted to endangered given its single known location (zero wild population redundancy), current small population size and declining trend and current and anticipated ongoing threats (poor wild population resiliency), as described above.

3.2 New Recovery Priority Number: 5 (maintain current)

Rationale: The rarity and acute threats facing this snail and its habitat indicate a high threat level. The current lack of management options for abating the threats of overcompetition by invasive species and natural disturbances such as rock slides and flooding, indicate a low potential for recovery. While COAS are successfully reproducing in captivity, we have yet to see any meaningful increase in the wild population after pilot releases of captive-reared snails. The species does occur within a protected area, thus precluding economic conflicts. In accordance with table 3 in 48 FR 184: 43104, a priority number of 5 is based on high threat, low recovery potential, taxonomic standing as a species, and no economic conflicts.

3.3 Listing and Reclassification Priority Number: 2 (maintain current)

Rationale: Based on table 1 in 48 FR 184: 43103, the magnitude of the threats facing the COAS is rangewide and severe, and the threats are documented and imminent, leading to a priority number of 2.

4.0 RECOMMENDATIONS FOR FUTURE ACTIONS

- If possible, the NYSOPRHP should explore increasing staff presence at the Chittenango Falls to educate the public about the COAS and reduce trespass into the habitat.
- The NYSOPRHP should attempt to learn more about trespasser demographics and size of groups trespassing.
- The NYSOPRHP should determine what languages any signage/pamphlets should be written in.
- The Service and partners should explore new outreach and funding options.
- The Service and partners should continue to implement the Recovery Plan.
- The Service should revise the official scientific name in the Code of Federal Regulations and ECOS.

5.0 REFERENCES

Data and literature are located within the Service's New York Field Office, 3817 Luker Road, Cortland, New York 13045.

Campbell, S.P., J.L. Frair, and J.P. Gibbs. July 2010. Competition and coexistence between the federally-threatened Chittenango Ovate Amber Snail (*Novisuccinea chittenangoensis*) and a non-native snail (*Succinea* sp. B). Final Progress Report to the U.S. Fish and Wildlife Service. SUNY College of Environmental Science and Forestry, Syracuse, New York.

Campbell, S.P., J.L. Frair, J.P. Gibbs, and R.J. Rundell. 2015. Coexistence of the endangered, endemic Chittenango ovate amber snail (*Novisuccinea chittenangoensis*) and a non-native competitor. *Biological Invasions* 17:711-723.

Gilbertson, C.R. 2016. Developing captive ex situ populations of the endangered Chittenango ovate amber snail *Novisuccinea chittenangoensis* (Succineidae: Pulmonata: Mollusca) for population augmentation in New York. M.S. Thesis. State University of New York College of Environmental Science and Forestry, Syracuse, NY.

Gilbertson, C.R. 2018. Scientific collection – COAS propagation report 2018. New York State Department of Environmental Conservation Endangered/Threatened Species: Scientific #141. State University of New York College of Environmental Science and Forestry, Syracuse, NY.

Gilbertson, C.R., R.J. Rundell, and R. Niver. 2019. Determining diet and establishing a captive population of a rare endemic detritivore, the endangered *Novisuccinea chittenangoensis* (Pilsbry, 1908) (Pulmonata: Succineidae). *Journal of Molluscan Studies* 85:41-47.

Gilbertson, C.R. and J.D. Wyatt. 2016. Evaluation of euthanasia techniques for an invertebrate species, land snails (*Succinea putris*). *Journal of the American Association for Laboratory Animal Science* 55(5):577-581.

King, T.L., M.S. Eackles, A.R. Breisch, and R. Niver. 2012. Assessing genetic diversity, fine-scale population structure and demographics in the narrow endemic Chittenango ovate amber snail (*Novisuccinea chittenangoensis*). *Conservation Genetics Resources* 4:439-442.

Rundell, R.J. 2018. Final Performance Report Grant F17AP00234. Removing the threat of stochastic extinction for the Chittenango ovate amber snail (COAS): a collaborative captive propagation effort to develop ex situ populations in New York State. State University of New York College of Environmental Science and Forestry, Syracuse, NY.

- Rundell, R.J. 2019. Final Performance Report Grant F18AP00384. Removing the threat of stochastic extinction for the Chittenango ovate amber snail (COAS): a collaborative captive propagation effort to develop ex situ populations in New York State. State University of New York College of Environmental Science and Forestry, Syracuse, NY.
- U.S. Fish and Wildlife Service. 2006. Chittenango Ovate Amber Snail (*Novisuccinea chittenangoensis*) Recovery Plan, First Revision. Hadley, Massachusetts. xiii + 55 pp.
- U.S. Fish and Wildlife Service. 2012. Chittenango Ovate Amber Snail (*Novisuccinea chittenangoensis*) 5-Year Review: Summary and Evaluation. Cortland, New York.

U.S. FISH AND WILDLIFE SERVICE
5-YEAR REVIEW of Chittenango ovate amber snail (*Novisuccinea chittenangoensis*)

Current classification: Threatened

Recommendation resulting from the 5-Year Review:

- Downlist to Threatened
- Uplist to Endangered
- Delist
- No change is needed

Appropriate Listing/Reclassification Priority Number, if applicable:

Review conducted by: Robyn Niver, New York Field Office

FIELD OFFICE APPROVAL:

Lead Field Supervisor, Fish and Wildlife Service

Approve David A. Stineall Date 5/16/2019

REGIONAL OFFICE APPROVAL:

Lead Assistant Regional Director, Region 5, Fish and Wildlife Service

Approve Kyle J. Hester Date 5/28/2019

Appendix A. Information on Captive Management

September 9, 2014 – 1 founder (G64) accidentally brought into captivity as a hatchling and reared.

May 21, 2015 - 2 wild caught founders (W10 and W11) were brought into captivity.

June 2015 – 632 offspring (F1) were born in captivity from the three founders.

July 7, 2015 – W10 and G64 were released at Chittenango Falls.

August 5, 2015 – W11 released at Chittenango Falls.

October 2015 – From the 632 snails, 270 hatchlings (all but 4 were too small [9 mm] to be marked) were released at Chittenango Falls. Remaining 362 snails were housed at ESF in small groups where additional mating occurred until they died.

June 8, 2017 – 3 additional wild-caught founders brought into captivity (tags: B03, NY75, and B15). DNA was gathered and archived using FTA cards for each individual. B03 and NY75 mated on 16 June 2017 and 18 June 2017. One egg mass (6 days after initial mating observation) was laid on 22 June 2017 consisting of 64 eggs all of which hatched, 49 were still surviving as of October 2018 (F1). B03 died on 29 June 2017.

June 28, 2017 – NY75 and B15 were released back to Chittenango Falls.

September 2017 – 20 captive-raised COAS (F2 - from matings between individuals from the 362 original offspring snails) were released at Chittenango Falls. All released snails were large enough (14-20 mm in length) to be marked with white tags.

June 2018 – 1 of the September 2017 released snails (W14) was found alive during a survey.

June 14, 2018 – 42 captive-raised COAS (F2 - from matings between individuals from the 362 original offspring snails) were released at Chittenango Falls. All released snails were large enough (14-20 mm in length) to be marked with white tags.

July 2018 – 1 of the 42 June 2018 released snails was found alive and 1 was found dead (appeared to be predation by rodent) during field surveys.

2018 – B03 x NY75 offspring (F1) are large enough to reproduce. One of their offspring was placed with one maturing snail of F2 generation to create an F3 generation. 144 F3 hatchlings are being reared at ESF and 94 F3 hatchlings are being reared at the Rosamond Gifford Zoo.

No snails were taken from the wild in 2018.

In terms of a general summary of captive efforts, COAS mate and produce much larger numbers of eggs than can reasonably be reared to maturity with current staffing and lab facilities.

Examples of egg production observed:

ESF lab:

- 63 dormant snails laid 676 egg masses totaling 28,703 eggs from 24 May 2016 to 17 July 2017.
- 150 non-dormant snails laid 777 egg masses totaling 32,279 eggs from 15 March 2016 to 17 July 2017.
- 19,732 eggs were laid between 25 July 2017 and 16 October 2018 (12,183 from F1 snails and 7,549 from F2 snails) (596 egg masses total).

Rosamond Gifford Zoo:

- 1,990 eggs were laid between July 2018 and September 2018 (43 egg masses total).

About 200-300 snails can generally be reared each summer with new founders periodically brought in. We also do not want to completely swamp the wild population with tens of thousands of snails as we continue to investigate the wild population size and success of captive releases. Additional information is needed to assess whether these releases are contributing favorably to the wild population and assessing the best timing and densities for any future releases.