Recovery Outline For
Yellow Lance (*Elliptio lanceolata*)
May 2018

Photo courtesy of S. McRae, USFWS

I. INTRODUCTION

This document outlines a preliminary course of action for the recovery of the Yellow Lance until a comprehensive recovery plan for the species is approved. The Yellow Lance is a freshwater mussel species native to the Atlantic Slope drainages of Maryland, Virginia, and North Carolina. The Yellow Lance was listed as a threatened species on April 3, 2018 (83 FR 14189). The primary threat to this mussel is habitat degradation resulting from the cumulative impacts of land use change and associated watershed-level effects on water quality, water quantity, habitat connectivity, and instream habitat quality; all these stressors are exacerbated by the effects of climate change. This species' small, isolated populations, low genetic diversity and reduced range also increase its vulnerability to stochastic and catastrophic events.

Listing and Contact Information:

Listing Classification:	Threatened range wide
Effective Listing Date:	May 3, 2018
Lead Agency, Region:	U.S. Fish & Wildlife Service, Southeast Region
Lead Field Office:	Raleigh, NC Ecological Services Field Office
Contact Biologist:	Sarah McRae, 919-856-4520, sarah_mcrae@fws.gov

II. RECOVERY STATUS ASSESSMENT

A. BIOLOGY/THREATS ASSESSMENT

The Yellow Lance is a freshwater mussel found in eight drainages from the upper Chesapeake River Basin in Maryland to the Neuse River Basin in North Carolina. The Yellow Lance is a bright yellow, elongate mussel with a shell over twice as long as tall, usually no more than 3.4 inches in length. They are omnivores that primarily filter feed on a wide variety of microscopic particulate matter suspended in the water column, including phytoplankton, zooplankton, bacteria, detritus, and dissolved organic matter (Haag 2012). Juveniles likely pedal feed (i.e., use cilia patches on their foot muscle to aid in eating) in the sediment, whereas adults filter feed from the water column. Like most freshwater mussels, they have a unique life cycle that relies on fish hosts for successful reproduction. Following release from the female mussel, floating glochidia (larvae) attach to the gills and scales of host minnows.

The Yellow Lance is a sand-loving species often found buried deep in clean, coarse to medium sand and sometimes migrating with shifting sands, although it has also been found in gravel substrates. The species is dependent on clean (i.e., not polluted), moderate flowing water with high dissolved oxygen content in riverine or larger creek environments. Most freshwater mussels, including the Yellow Lance, are found in aggregations (mussel beds) that vary in size and are often separated by stream reaches in which mussels are absent or rare. Genetic exchange occurs between and among mussel beds via sperm drift, host fish movement, and movement of mussels during high flow events.

The effects of development/urbanization on the species and its habitat may include alterations to water quality, water quantity, and habitat (both in-stream and stream-side). Most notably, stormwater runoff over impervious surfaces contributing concentrated contaminants, including nitrogen, phosphorus, chloride, insecticides, polycyclic aromatic hydrocarbons, and personal care products which affect water quality parameters such as temperature, pH, dissolved oxygen, and salinity. In turn, changes in those parameters alter the water chemistry and could make the habitat unsuitable for the Yellow Lance. Sediment in stormwater runoff increases water turbidity and temperature and originates locally from poorly maintained construction sites, timber harvest tracts, agricultural fields, and clearing of riparian vegetation. Excessive sediments disrupt feeding and spawning of mussels and their host fish, causes potential suffocation, and ultimately impact both mussel and host fish growth, survival, and reproduction. The Yellow Lance is not found in impounded waters and is intolerant of lentic (standing water) habitats. Because the Yellow Lance uses smaller host fish (e.g., minnows), it is even more susceptible to impacts from habitat fragmentation due to increasing distance between suitable habitat patches and a low likelihood of host fish swimming over that distance. Even improperly constructed culverts at stream crossings can act as significant barriers, and have some similar effects as dams on stream systems. Fluctuating flows through the culvert can vary significantly from the rest of the stream, preventing fish passage and scouring downstream habitats. If a culvert ends up being perched above the stream bed, aquatic organisms cannot pass through it. These barriers not only fragment habitats along a stream course, they also contribute to genetic isolation of the Yellow Lance. Hydrilla (*Hydrilla verticillata*), an aquatic plant, alters stream habitat, decreases flows, and contributes to sediment buildup in streams, which can cause suffocation for filter-feeding mussels, reduce stream flow, and make it difficult for mussels' interactions with host fish necessary for development. Hydrilla occurs in several watersheds where the Yellow Lance occurs, including recent documentation from the Tar River in NC.

Regulatory mechanisms have been inadequate to protect the species from sediment runoff and turbidity within its habitat associated with land surface runoff and municipal/industrial discharges. There are currently no requirements within the scope of other statewide environmental laws to specifically consider the Yellow Lance or ensure that a project will not significantly impact the species. Genetic diversity of this mussel has likely declined due to fragmentation and separation of reproducing Yellow Lance populations (USFWS 2018). Species that are restricted in range and population size are more likely to suffer loss of genetic diversity due to genetic drift, potentially increasing their susceptibility to inbreeding depression, decreasing their ability to adapt to environmental changes, and reducing the fitness of individuals (Allendorf and Luikart 2007; Soulé 1980). It is likely that some of the Yellow Lance populations are below the effective population size required to maintain long-term genetic and

population viability (USFWS 2018). In addition to the impacts on the Yellow Lance individually, it is likely that several of the above summarized risk factors are acting synergistically or additively on the species. The combined impact of multiple stressors is likely more harmful than a single stressor acting alone. Furthermore, species with limited ranges, fragmented distributions, and small population sizes are thought to be especially vulnerable to the effects of climate change (USFWS 2018), especially extreme events like floods and drought. Since sedentary freshwater mussels have limited refugia from disturbances such as droughts and floods, and since they are thermo-conformers whose physiological processes are constrained by water temperature within species-specific thermal preferences, climate-induced changes in water temperature can lead to shifts in mussel community structure (Galbraith et al. 2010).

B. CONSERVATION ACTIONS

The Service and State Wildlife Agencies are working with numerous partners to help manage this ecosystem, primarily by providing technical guidance and offering development of conservation tools to meet both species and habitat needs in aquatic systems from Maryland to North Carolina. There is a lot of effort to work with agriculture producers through the U.S. Department of Agriculture's Natural Resource Conservation Service to install riparian buffers along streams (J.Slacum (USFWS) email to S.McRae (USFWS) on 11/30/2016). Land Trusts are targeting key parcels for acquisition, federal and state biologists are surveying and monitoring species occurrences, and recently there has been a concerted effort to ramp up captive propagation and species population restoration via augmentation, expansion, and reintroduction efforts.

In 2014, North Carolina Wildlife Resources Commission staff and partners began a concerted effort to propagate the Yellow Lance in hopes of augmenting existing populations in the Tar and Neuse River basins. In July 2015, 270 Yellow Lances were stocked into Sandy Creek, a tributary of the Tar River (NCWRC 2015b). Annual monitoring to evaluate growth and survival is planned, and additional propagation and stocking efforts will continue in upcoming years.

III. PRELIMINARY RECOVERY STRATEGY

A. RECOVERY PRIORITY NUMBER WITH RATIONALE

The Yellow Lance is assigned a recovery priority of 8C, which indicates the species faces a moderate degree of threat and has a high recovery potential, including potential conflict with construction or other development projects or other forms of economic activity. The degree of threat is considered moderate because the species is not facing immediate extinction, however the threats to Yellow Lance habitat are numerous and ongoing, thus contributing to continual population decline. The decline of the Yellow Lance is primarily the result of habitat loss and degradation from declines in water quality, loss of stream flow, riparian and instream fragmentation, and deterioration of instream habitats, all of which are exacerbated by continued urbanization and effects of climate change. Recovery potential is considered high because several biological and ecological limiting factors are known, threats to the habitat are known and can be managed for or avoided, and high quality habitats can be targeted for protection to enable recovery of the species. The recovery tool of captive propagation is currently underway and is likely to have a high probability of success. The conflict with construction or other development projects is relevant because the range of the species is within the rapidly urbanizing mid-Atlantic region.

B. RECOVERY STRATEGY/INITIAL ACTION PLAN

The ultimate goal of the recovery effort is to ensure the long-term survival of the Yellow Lance by controlling or reducing threats to the extent that populations are self-sustaining and protections afforded by the Endangered Species Act are no longer required. The initial plan is to work with partners, landowners, and stakeholders to reduce and alleviate threats to the Yellow Lance. We plan to work cooperatively with County, State (MD/VA/NC), and Federal agencies to protect habitat integrity and quality of river and creek segments that currently support or could support the species. Specifically, we will pursue programmatic conservation agreements to enable species restorations and programmatic consultations with state road departments to minimize and mitigate impacts from bridge/culvert construction and maintenance activities. We will evaluate existing regulatory processes to minimize and mitigate the loss and degradation of Yellow Lance habitat resulting from urbanization, oil and gas exploitation, and easement maintenance. We will encourage development of state laws/regulations that are protective of the species. We will utilize existing Clean Water Act regulatory mechanisms (Sections 401 and 404). We will continue to engage county officials or planners about voluntary conservation efforts for the species, and work with all partners to continue to assess habitat and existing threats to determine the recovery possibilities where the species has limited documentation. We will also support community based watershed stewardship planning and action, as well as land trust property acquisition and protection to benefit the species.

Recovery actions for the Yellow Lance will focus on surveying and monitoring existing populations (especially in areas of historical importance, including the Rappahannock, James, and Nottoway populations), protecting habitat within the Tar River basin, and bolstering low condition populations (as defined and described under Section 3.3 Current Condition in the Species Status Assessment Report (USFWS 2018)) through species augmentations to improve resiliency. Recovery actions (not in priority order) include:

1. Establish long-term monitoring of Yellow Lance populations with associated habitat characteristics and conditions.
2. Continue to develop and implement technology for maintaining and propagating the Yellow Lance in captivity, including collection of broodstock from each MU.
3. Develop an augmentation and reintroduction plan for the species and assess the feasibility of reintroducing the species into restored habitats within its historical range.
4. Conduct research on the genetics of the Yellow Lance and apply the results toward management and recovery actions for the species.
5. Work with local entities, including land trusts, local governments, and watershed groups, to restore and/or protect stream reaches where the species currently exists and where we plan to reintroduce the species.
6. Develop and implement programs to educate the public and private industry (like pulp, paper, and timber mills: oil and gas industry; municipalities) on the need and benefits of ecosystem management, and to involve them in watershed stewardship and Yellow Lance recovery efforts.
7. Evaluate and identify existing stressors and sources of threats throughout the species' range; evaluate or refine BMPs and utilize existing agency programs to minimize, mitigate, and/or remove threats, incentivize conservation, and prioritize areas in the Rappahannock, James, Nottoway, and Tar drainages for protection, enhancement, and restoration, including assessing water usage and land use changes.

8. Monitor exotic invasive species and investigate possible control measures.
9. Utilize section 7(a)(1) and 7(a)(2) of the Endangered Species Act as mechanisms for conservation of the Yellow Lance.

IV. PREPLANNING PROCESS

A. PLANNING APPROACH

A Species Status Assessment has already been prepared for the Yellow Lance. We will quickly prepare a recovery plan for the Yellow Lance using the detailed science in the SSA. An SSA begins with a compilation of the best available information on the species (taxonomy, life history, and habitat) and its ecological needs at the individual, population, and/or species levels based on how environmental factors are understood to act on the species and its habitat. Next, an SSA describes the current condition of the species' habitat and demographics, and the probable explanations for past and ongoing changes in abundance and distribution within the species' ecological settings (i.e., areas representative of geographic, genetic, or life history variation across the range of the species). Lastly, an SSA forecasts the species' response to probable future scenarios of environmental conditions and conservation efforts. Overall, an SSA uses the conservation biology principles of resiliency, redundancy, and representation (collectively known as the "3Rs") as a lens to evaluate the current and future condition of the species. As a result, the SSA characterizes a species' ability to sustain populations in the wild over time based on the best scientific understanding of current and future abundance and distribution within the species' ecological settings. An SSA is in essence a biological risk assessment to aid decision makers who must use the best available scientific information to make policy decisions.
The recovery plan will include objective and measurable criteria which when met, will ensure the conservation of the species. Recovery criteria will address all meaningful threats to the species, as well as estimate the time and the cost to achieve recovery. The Raleigh Ecological Services Field Office will lead the recovery planning effort, with review by the Chesapeake Bay and Virginia Ecological Services Field Offices. The draft plan should be finalized and sent to the Regional Office for review by April 2020. The final recovery plan should be finalized and sent to the Regional Office for review by April 2021. These timelines may change as affected by available resources and regional priorities.

B. STAKEHOLDER INVOLVEMENT

During the recovery planning process, input, comments and review will be sought from multiple stakeholders within Maryland, Virginia, and North Carolina. These will include State and Federal agencies, industrial, agricultural, and forestry groups, research universities, and conservation organizations. Many stakeholders are currently cooperating in ongoing conservation planning within the Upper Tar River Basin.

Approve: _____ Date: 5/3/18
Assistant Regional Director, Region 4