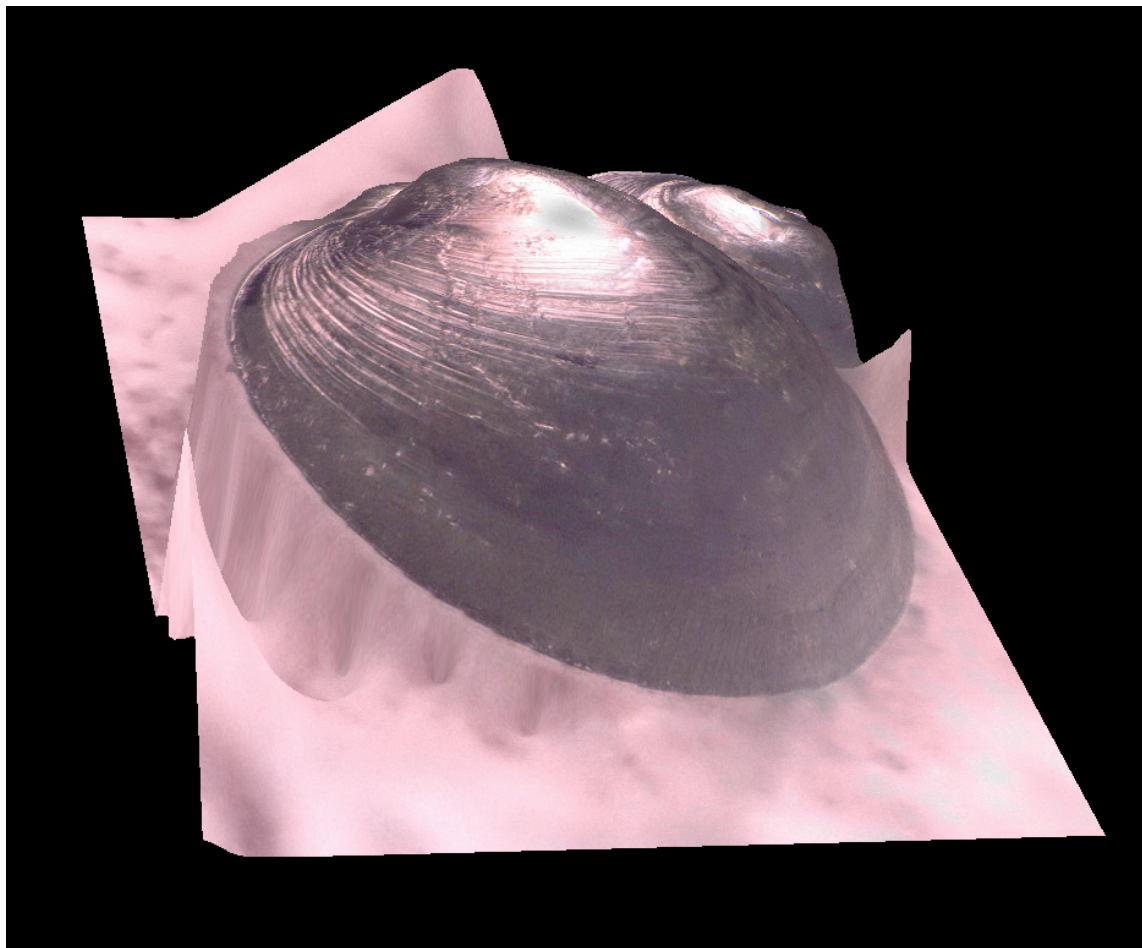


RECLAMATION

Managing Water in the West

Invasive Mussel Veliger Morphology

Research and Development Office
Science and Technology Program
(Final Report) ST-2018-1875-01 (8530-2018-61)



Three-dimensional model of an invasive mussel veliger created with Keyence VHX microscope



U.S. Department of the Interior
Bureau of Reclamation
Research and Development Office

September 2018

Mission Statements

Protecting America's Great Outdoors and Powering Our Future

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

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14. ABSTRACT (Maximum 200 words) A Scanning Electron Microscope (SEM) and Keyence Microscope were used to acquire images and make 3D models of invasive dreissenid mussel veligers at various growth stages as well as other species. These images can be used for training and educational outreach. The Keyence VHX microscope is recommended as a new method to obtain high magnification images of suspect invasive mussel veligers because it is a much lower cost option compared to the SEM. Three-dimensional models can also be obtained with the Keyence. Over 200 images (approximately 340 MB) were acquired and analyzed. The images can be found at https://drive.google.com/open?id=16YUs5YymugC0AcoQfsQNzTHCYF4zLKx91875					
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**Research and Development Office
Science and Technology Program**

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Final Report ST-2018-1875-01 (8530-2018-61)

Invasive Mussel Veliger Morphology

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Executive Summary

The Reclamation Detection Lab for Exotic Species (RDLES) laboratory periodically finds suspected invasive dreissenid mussel veligers in samples from Reclamation sites throughout the west. When suspects are found using microscopy, DNA analysis is also used to verify whether the suspect is an invasive dreissenid mussel species. The Scanning Electron Microscope (SEM) provides a much finer taxonomic detail compared to the 10X microscopic images.

The purpose of this research project was to support the RDLES laboratory by providing scanning electron microscope (SEM) images and 3D models (both virtual 3D models and enlarged 3D-printed models) of invasive dreissenid mussel veligers at various growth stages, and other species for the purpose of mussel research support. During fiscal year 2018, other species imaged include copepods (Phylum Arthropoda), algae, and some unknown species that will be identified at a later time by the RDLES Lab staff. 3D models were created from SEM images according to the procedures in (ST-2017-4176-01). STL files were created from these 3D models for 3D printing. Over 200 images and models (approximately 340 MB) were acquired and analyzed. The images can be found at <https://drive.google.com/open?id=16YUs5YymugC0AcoQfsQNzTHCYF4zLKx91875>

During this study, an alternate method of acquiring images and making 3D models was tested: the Keyence VHX. This microscope has a tilt head, motorized stage, and magnification up to 2000X. The microscope and accompanying software have the ability to create 3D models and save the models as STL files that can be used to print 3D models. The 3D models could be used for training and outreach by the RDLES laboratory.

When the RDLES lab requires high magnification images to verify suspected invasive veligers, the SEM is typically used at about 400 to 600X magnification. At the time of this writing, the Bureau of Reclamation pays about \$35 per hour to the U.S. Geological Survey (USGS) Microbeam Laboratory to use the SEM through an Interagency Agreement. Although this rate is reasonable, the labor cost to submit the payment through the Purchase Requisition process can double or triple this cost. However, the USGS Microbeam Lab is currently allowing BOR to use the Keyence VHX microscope at no cost. The Keyence VHX microscope provides images that are more than adequate for identifying suspect invasive dreissenid veligers. It is recommended that this SEM microscope be used in the future.

References

ST-2017-4176-01, 2017, 3D Models of Invasive Mussel Veligers, Final Report ST-2017-4176-01, Bureau of Reclamation, U.S. Department of the Interior, 61 pp.

Data Sets that Support the Final Report

- Data for this project can be found on the following share drive
 - FY18 S&T Closeout/Invasive Mussel Veliger Morphology
 - <https://drive.google.com/open?id=16YUs5YymugC0AcoQfsQNzTHCYF4zLKx91875>
- Project data are included in the following subdirectories:
 - Keyence Images
 - SEM Images
 - STL Files
- Point of Contact: Audrey Rager, arager@usbr.gov, 303-445-2377
- Keywords: 3D model, invasive mussel, Dressinid, SEM, Scanning Electron Microscope, secondary electron image, back-scatter electron image, anaglyph, focal stacking, 3D printing
- Approximate total size of all files: 340 MB

