

# RECLAMATION

*Managing Water in the West*

## **Detecting Environmental Impacts of Invasive Mussel Infestations: Development of an Algae and Zooplankton Database using FlowCam™ Technology**

**Research and Development Office  
Science and Technology Program  
Final Report ST-2016-2387-1**



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



## **Mission Statements**

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.



**REPORT DOCUMENTATION PAGE**

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## PEER REVIEW DOCUMENTATION

### Project and Document Information

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Document Detecting Environmental Impacts of Invasive Mussel Infestations:  
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Technology \_\_\_\_\_

Document Author(s) Jacque Keele Document date June 8, 2016

Peer Reviewer: Denise M Hosler

### Review Certification

**Peer Reviewer:** I have reviewed the assigned items/sections(s) noted for the above document and believe them to be in accordance with the project requirements, standards of the profession, and Reclamation policy.

Reviewer Denise M. Hosler Date reviewed June 10, 2016  
(Signature)





## **Disclaimer**

The work described in this report is the results of the data gathering effort and is not meant to be an endorsement of Fluid Imaging's FlowCam™ instruments.

## **Acknowledgements**

The authors wish to acknowledge all of the individuals, both past and present laboratory members, who have analyzed FlowCam™ samples. We also wish to acknowledge the reviewers of these documents. Finally, we wish to thank the Research Office for funding this project.

## **Executive Summary**

In 2010, Reclamation's Detection Laboratory for Exotic Species (RDLES) purchased the FlowCam™ to analyze and catalog zooplankton in raw water samples from across the Western United States. Since its purchase over 4600 samples have been analyzed using the FlowCam™. This has enabled RDLES to build a large catalog of images that will allow researchers to assess how zooplankton populations change in response to a Dreissenid mussel invasion. The goal of this project was two-fold. The first goal was to create a standard operating procedure for the sample preparation and analysis on the FlowCam™. The second goal was to compile the locations that have been sampled and how many samples from each location have been analyzed. This will allow RDLES researchers to pinpoint which bodies of water have the most data and which ones are lacking. It will also assist RDLES researchers in the future in determining which samples need to be analyzed by FlowCam™.



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*FlowCam Compilation Excel Spread Sheets in project folder with this report*

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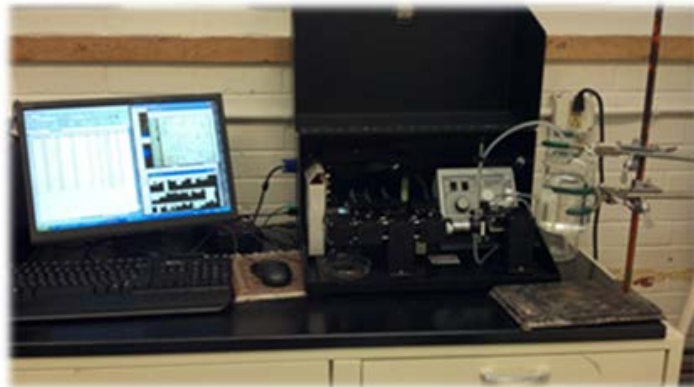
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# Main Report

The following research questions were initially proposal when this research was started. First, can Reclamation develop a fast and cost effective method to monitor the impact of invasive mussels on the health of the ecosystem? Second, will the development of a FlowCam™ classification library, filters, and database streamline this monitoring process and provide valuable information on the diversity and abundance of indicator organisms, such as algae and zooplankton?

The first research question can be accomplished with the FlowCam™. The FlowCam™ can very easily be used to create libraries of organisms that can be visually searched to determine what types of zooplankton are present in the sample. Zooplankton sampled with the FlowCam™, can generally be identified to higher taxonomic levels. The ability to identify sampled zooplankton to the species level may be limited to the dependence on a single image; however this level of identification may be unnecessary for the ecological questions at issue.

The second research goal, building filters, has been a much harder one to address. Following the visit of the Fluid Images researcher there was a realization that the building of filters would be a much larger undertaking that previously thought. It is a challenge of the instrument, and its software, that the building of filters is not intuitive to the user. In addition, it appears that individual filters would likely need to be developed for each individual water body, rather than being able to develop a master library that could be rapidly deployed for all samples. Thus, it is likely more efficient to look thought the images and record by hand the type and number of organisms present.



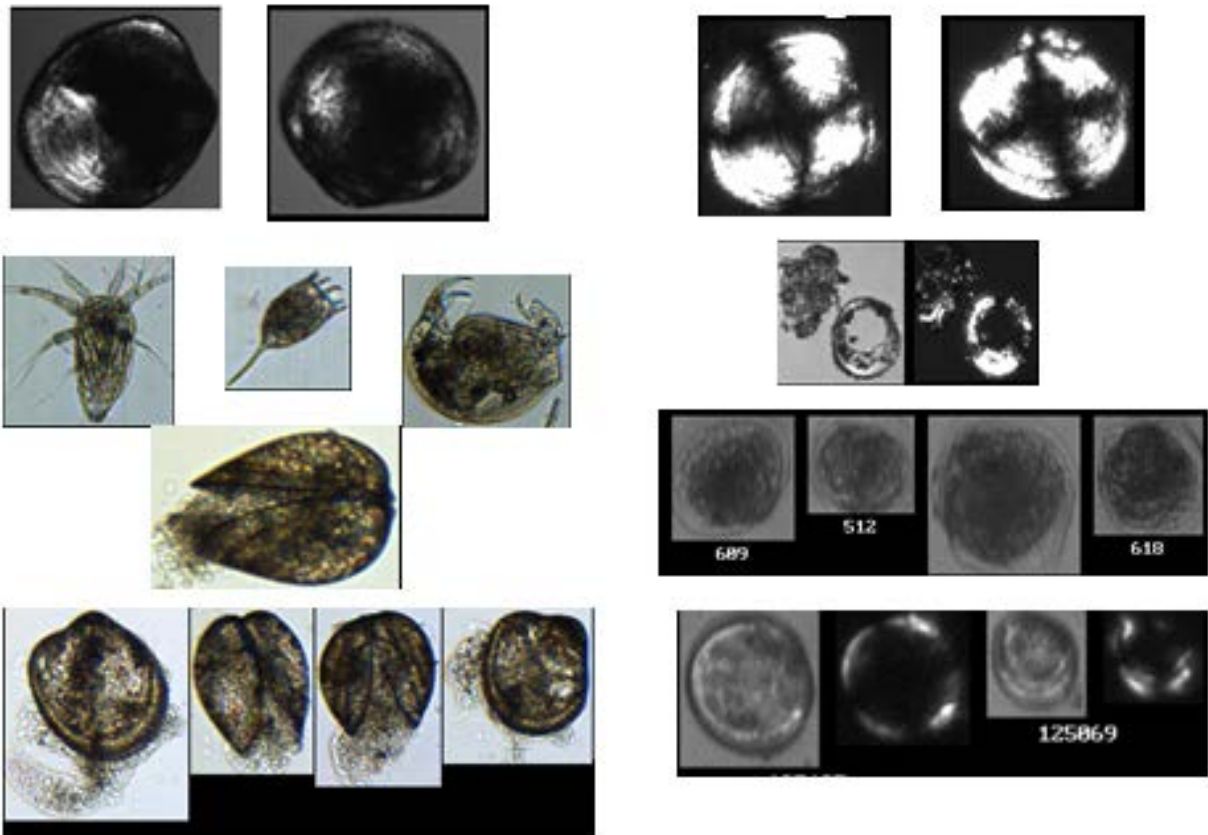
*Photograph of the FlowCam Instrument*

The tasks that were accomplished have taught RDLES researchers about the capabilities and limitations of this instrument. RDLES will continue to analyze and build libraries of water samples from across the Western United States. It is hoped that one day software that can easily analyze the data will be developed.

The following tasks were accomplished during this multi-year project:

1. Ben Spaulding, researcher from Fluid Imaging visited RDLES in July 2014 for two days to provide training on how to better use the FlowCam™ instrument and how to build filters to analyze the image data.
2. A standard operating procedure (SOP) for the sample preparation and analysis of samples by FlowCam™. This document is attached in Appendix 1.
3. During the winter of 2015 a compilation of all the samples from 2010 to 2014 was compiled to determine how many times each site has been analyzed and to better understand the FlowCam™ data that have been collected. This database will allow RDLES researchers to better pinpoint which bodies of waters need to be analyzed by FlowCam™. The Excel file is available on Share Drive File.
4. Both high school and college interns were taught how to use the FlowCam™ instrument so that they could analyze samples.

*Instrument Photos of Zooplankton and Mussel Veligers*



## References

Carmon, J. L. & Hosler, D. M. (2013). Lab Protocol: Preparation and Analysis of Dreissenid Veliger Water Samples Version 4. Technical Memorandum No. 86-68220- 13-02, Denver.

Fluid Imaging Technologies, Inc. (2009). FlowCAM Manual Version 0109. Yarmouth, ME.

## Data Sets that support the final report

If there are any data sets with your research, please note:

- Google Drive folder name and path where data are stored:  
[https://drive.google.com/a/usbr.gov/folderview?id=0B1kG9U-E0F0gaHIBcmU2V0VieDQ&usp=sharing\\_eid&ts=5759a0f6](https://drive.google.com/a/usbr.gov/folderview?id=0B1kG9U-E0F0gaHIBcmU2V0VieDQ&usp=sharing_eid&ts=5759a0f6)
- Point of Contact name, email and phone:  
Denise Hosler: Phone: (303) 445-2195; [dhosler@usbr.gov](mailto:dhosler@usbr.gov)
- Short description of the data: Excel spreadsheet compilation of all the FlowCam™ runs that have been done since 2010 to 2014. (types of information, principal locations collected, general time period of collection, predominant files types, unusual file types.)
- Keywords: Zooplankton, FlowCam™
- Approximate total size of all files: 1629 KB
- Google Drive folder name: 2387 – Algae and Zooplankton Database FlowCam