BECKMAN COULTER
Life Sciences

Analyzing Mussel/Mollusk Propagation Using the Beckman Multisizer 4e

What is Mussel Propagation and why is it important?

- The culturing of juvenile freshwater mussels to a mature age that will survive in rivers or estuaries throughout the U.S.
- Involves monitoring the water quality and feed content to determine if the body of water is suitable for all elements of the mussel lifecycle.
- There has been a notable decline in freshwater mussel populations
- Mussels innately are a natural filter and therefore an integral part of keeping the rivers and estuaries clean and healthy. Additionally, they provide a food source for harvesting.

Introduction

Why would a fish hatchery require a Particle Counter?

"We are counting particles in our water sources used as feed. This is a combination of algae, bacteria, and suspended fine sediments. The mussels we raise are filter feeders so anything of appropriate size is ingested as food. Young mussels have a siphon size of < 8 µm, so we have to make sure that our feed is below that size". - Josh Abel, San Marcos Aquatic Resources Center, US Fish & Wildlife Service

The early analytical work performed in this application revolved around the use of Microscopy, but it was found to be time consuming, subjective, and prone to errors. The use of a Coulter Principle based instrument provided a major step forward in verifying both the size of the feed and concentration much more accurately. Judging by the number of Multisizers sold into this application, the Multisizer 4e has proven to be the device of choice to monitor the size and concentration of the feed uptake. Additionally, it has been instrumental in improving the yield of the freshwater mussels. The following Figure 1 graph is an example of the critical size and concentration distribution of the algae (phytoplankton) food source the mussels require for efficient propagation which, as mentioned earlier, is < 8 µm. These measurements were conducted with the Beckman Coulter Multisizer 4e and were accomplished in under 60 seconds. Competing technologies (Microscopes/Hemocytometers) could not begin to approach measurement results shown below. What used to take hours now takes seconds.

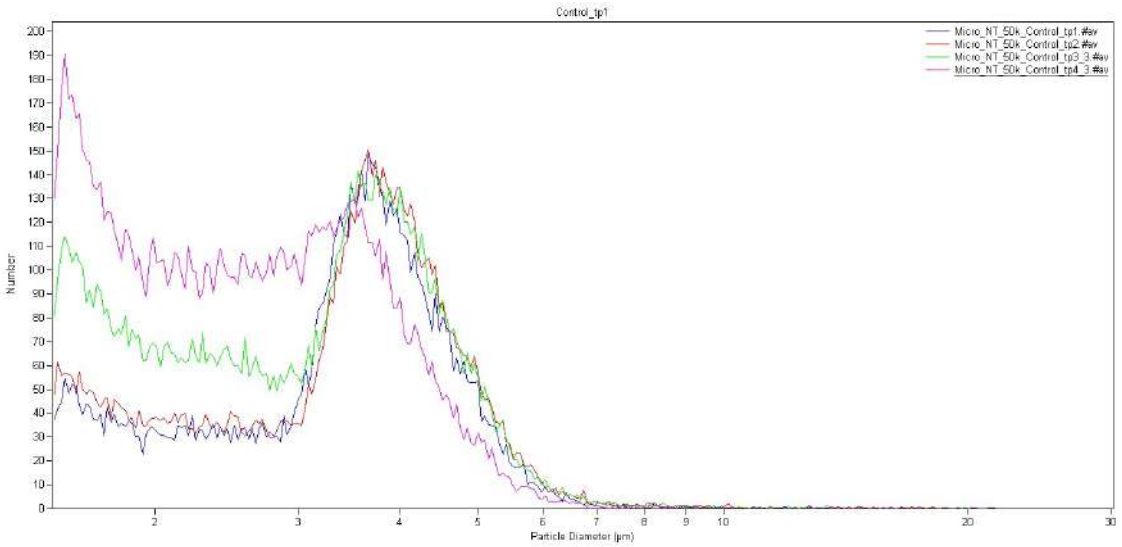

Figure 1

Advantages of the Multisizer 4e vs. Microscopy

- Sizing and counting accuracy, especially when counting thousands of particles vs. hundreds
- Speed of analysis, i.e. sample preparation time and measurements done in minutes vs. hours
- More thorough and accurate analysis provides more effective control parameters. This result produces more efficient control of the uptake feed size, which translates into a higher yield of viable mussels.
- Powerful software allows user to analyze results using multiple parameters post measurement
- Microscopically it is impossible to recreate this this type of data with a hemocytometer consideration sizing accuracy, counting accuracy and time savings.

The following is a list of facilities who are current users of the Multisizer instruments for the purpose of studying Mussel/Mollusk propagation

- Genoa National Fish Hatchery - Multisizer 3
- Virginia Fisheries and Aquatic Wildlife Center at Harrison Lake - Multisizer 4e
- San Marcos Aquatic Resource Center - Multisizer 4e
- Inks Dam National Fish Hatchery, Burnet Texas - Multisizer 4e
- Uvalde National Fish & Wildlife Hatchery, Uvalde, Texas - Multisizer 4e
- North Carolina State University, Department of Applied Ecology - Multisizer 4e
- University of North Carolina-Wilmington, Oyster Propagation - Multisizer 4e
- South Carolina State Hatchery, Grass Carp sterility - Multisizer 4
- U.S. Fish and Wildlife at Sunderland, Massachusetts - Multisizer 4e

References

"Why does a Fish Hatchery Need a Particle Counter?" From USFWS Midwest Region Fishlines Newsletter 2014 Aug 7 **https://www.fws.gov/midwest/fisheries/library/R3-Fishlines/2014-aug7.pdf**

"Approaches for evaluating the effects of bivalve filter feeding on nutrient dynamics", in Puget Sound, Washington: **https://pubs.usgs.gov/sir/2013/5237/pdf/sir20135237.pdf**

"The hatchery culture of bivalves: a practical Manual: Food and Agriculture Organization of the United Nations." See 3.3.3 Estimating algal density (Coulter Counter (Multisizer) or Hemocytometer) no mention of the algal size distribution. **http://www.fao.org/docrep/007/y5720e/y5720e08.htm**

Global diversity of freshwater mussels (Mollusca, Bivalvia) in freshwater. Bogan, A.E. 2007. Freshwater Animal Diversity Assessment (pp. 139-147). Springer, Dordrecht.

https://usfwsnortheast.wordpress.com/2014/02/07/friday-flick-life-cycle-of-a-freshwater-mussel/

https://www.fws.gov/midwest/Endangered/clams/mussels.html

Authors

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He has created and developed many of the liquid systems production processes for the BEC Particle products. These include but are not limited to the: 8011+, PODS+, ROC, and HRLD Sensors. He has been in the Particle Counting and Characterization industry for 22+ years in a multitude of engineering and technical capacities ranging from Metrology to Customer Service, Technical Training and Applications Support. He is a member of the NFPA U.S. TAG to ISO/TC 131/SC 6 - Contamination control group.

Ed Hoff is a Sr. Staff Sales Specialist for Beckman Coulter Particle Counting and Characterization organization.

His career has spanned 47+ years in Product Management, Applications support, and most recently supporting the Sales Teams. He has created and managed the development of many of the Beckman characterization products including the Multisizer Series and LS Series of laser diffraction instruments. He spent his first 20 years in Product Management/ Development, Applications Support/Customer training, and participating on multiple ASTM technical committees. For the last 27 years he has served within the Sales organization as both a Sales Manager and Technical Sales Specialist.

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PART-4945APP02.19