Invasive Mussel Research

Sherri Pucherelli
Biologist, Invasive Species Research Coordinator
Mussel Research

• Research and Development Office
  • Science and Technology Program
• Yearly crosscut budget = $1.85M
  • 93 projects funded since 2010
  • 22 projects in progress in FY20
  • 9 submitted FY21

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Research Topics

• Control at hydropower plants
• Early detection and monitoring
• Mussel impact
• Predicting spread
• Open water control
Mussel Research Roadmap

- Identifies research needs
- Prioritizes future projects
- Research Topics
  - Prevention
  - Early detection and monitoring
  - Management and control
  - Impact assessments
  - Increasing fundamental knowledge of mussels
Mussel Control at Hydropower Plants

• **Issue: Mussel attachment**
  • Intakes, gates, instrumentation, small diameter pipes
  • Targeting the pediveliger

• **Issue: Shell debris**
  • Strainers and screens
  • Targeting the adult
Mussel Control at Hydropower Plants

• Study sites: Hoover, Davis, and Parker Dams

• Compendium of mussel control research for hydropower plants
  • 15 projects
Studies

- Microfiltration, self-cleaning filters
- Anti-foul and foul release coatings
- Zequanox
- pH manipulation
- Endothall
- Copper products
- Turbulence
- Salinity manipulation
- Ultraviolet light
- Laser pulsed pressure
- Centrifugal separator
Coatings

• Tested over 100 anti-foul and foul release coatings
• Testing at Parker Dam
• Silicone foul release most effective in flowing and static conditions
• Collaboration with:
  • USACE
  • PNNL
Ultraviolet Light

- Collaboration:
  - RNT Consulting Inc.

- Medium pressure
- 3,500 gallons/ min
- UV doses: 20-100 mJ/cm²
  - Settlement reduced by 88-99%
Ultraviolet Light

- Installed at Parker Dam

- Reduced maintenance associated with heat exchanger overheating
  - $80,000 savings per year

- 2018 S&I project of the year
Current Projects

- Carbon dioxide
- Electrical methods
- Ultrasound
- Self-cleaning strainers and filtration
Early Detection and Monitoring

• Optimizing sample collection and analysis methods
  • Preservation methods for veliger samples
    • Evaluate veliger and DNA integrity
      • Alcohol type (isopropyl vs. ethyl)
      • Final concentration (25% vs. 70%)
      • Buffer (baking soda vs. Tris)
Early Detection and Monitoring

• Genetic detection methods
  • eDNA collection methods
    • Plankton tow vs. filter

• eDNA detection from sediments
  • Is eDNA preserved in sediments?

• eRNA for early detection
  • Persistence in environment
Mussel Impact

• Survey of hydropower plants with mussel infestations
  • Systems impacted, cost, control methods

• Economic evaluation of mussel management activities
  • Cost effectiveness of prevention and control
  • Better utilization of limited funds
Mussel Impact

• Mussel settlement on trashracks at Glen Canyon Dam
  • Sonar and video show rapid progression of settlement since 2017
  • More fouling higher up, less near penstock intake elevation
  • Fouling can increase velocities, increasing head loss
  • Complete occlusion not likely
Open Water Control

- Quagga mussel genome sequencing
- Biological control
- Effectiveness of potash at San Justo Reservoir
Prize Competitions

• Tool to accelerate research on challenging topics

• Incentivize private sector and citizen solvers using prizes
2018 Mussel Prize Competition

- Objective: Seek theoretical, innovative solutions to eradicate invasive mussels from large reservoirs, lakes, and rivers
  - Species specificity
  - Cost effectiveness
  - Minimal impact to ecosystem
  - Scalable

- $100,000 cash prize
- 67 solutions judged
2018 Mussel Prize Competition

• Full prize winner
  • Steven Suhr and Marie-Claude Senut
  • Biomilab LLC.

• Engineered disseminated neoplasia
  • Utilize CRISPR/cas9 to induce a lethal species-specific cancer
  • Transferred from one mussel to another by proximity
  • Requires research on fundamental questions

• Cooperative agreement to pursue research