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Highlighted Research and Partnerships

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Open Water Control

- Open water control and eradication are major challenges
- Successful efforts in small, closed systems
- Eradication has relied on potash or copper compounds
- Treatments do not scale to large lakes and reservoirs

Millbrook Quarry, VA



San Justo Reservoir Eradication Plan

- San Justo mussel eradication
 - Zebra mussels detected in 2008
 - Reservoir closed to public use
 - Examining the effectiveness of whole reservoir potash treatment
 - Conducted on-site efficacy testing in 2016
 - Eradication plan developed
 - Funding yet not allocated



Biological Control

- Scalability
- “Traditional” biocontrols using parasites or predators
- Genetic biocontrols emerging with new molecular techniques
 - CRISPR/Cas9
 - Gene drive

Salvinia weevil



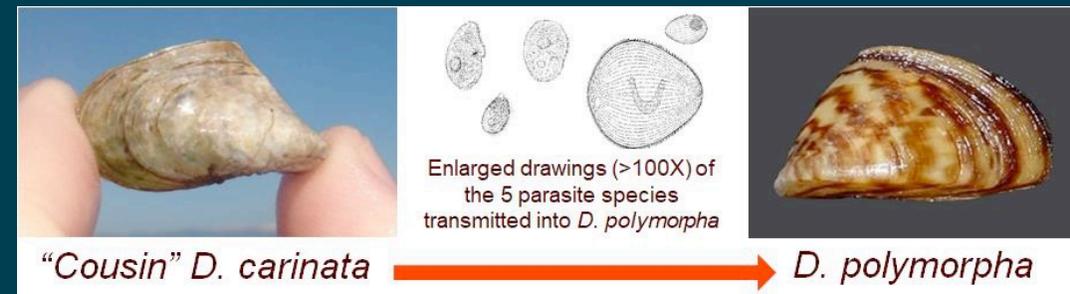
Scott Bauer, USDA

CRISPR/Cas9



Open Water Control

- Biological Control with Parasites
 - Partnership with Molloy and Associates
 - Searching for mussel parasites in Eurasia
 - Studying species related to zebra and quagga mussels
 - Testing if parasites can infect quagga and zebra mussels and cause mortality



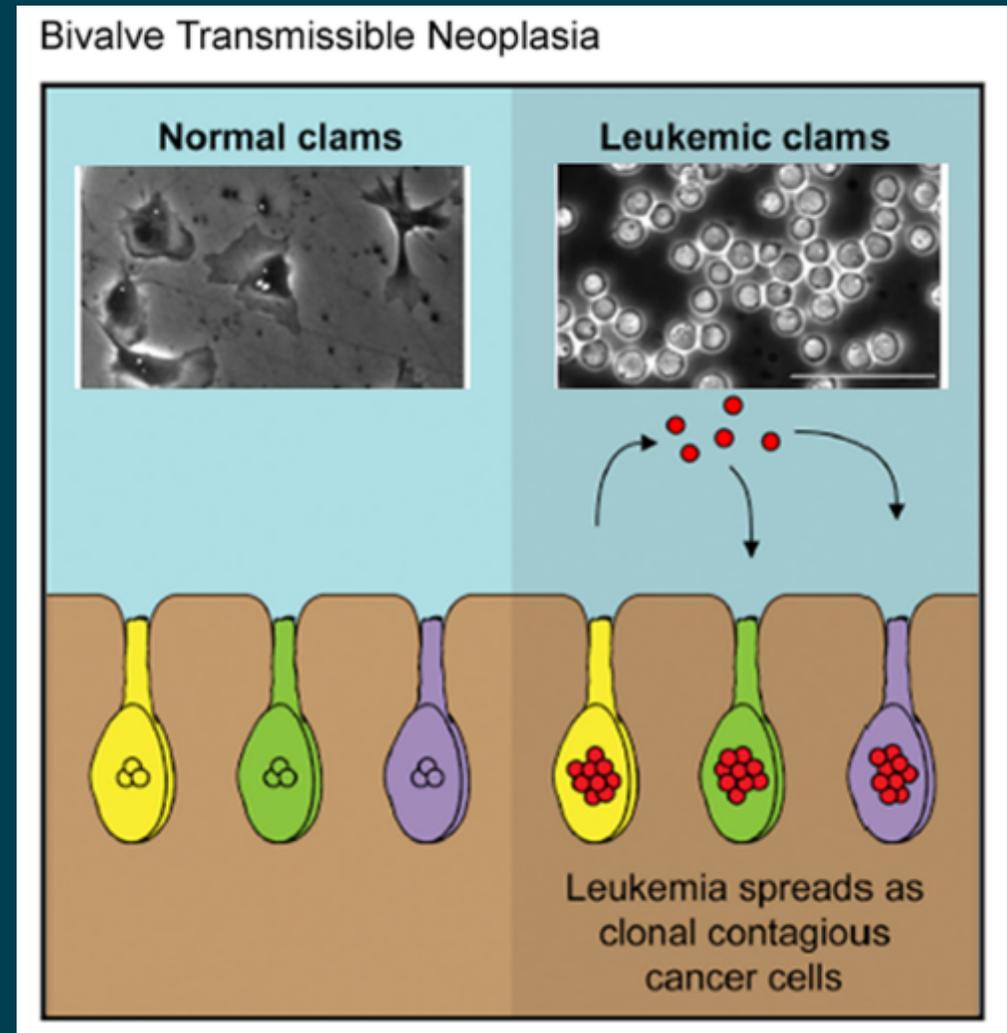
Open Water Control

- Biological Control with Parasites
 - Field laboratory established in Montenegro
 - 2,372 dreissenid dissections
 - Collections in Turkey, Montenegro, and Macedonia
 - 12 parasite species observed (ciliates, trematodes, and mites)
 - Successful transinfection trials in lab and field
 - 13 collaborators across Europe



Open Water Control

- Engineered Disseminated Neoplasia
 - Cooperative agreement with Biomilab (prize challenge winner)
 - Based on naturally occurring neoplasia (cancer) in marine bivalves
 - Goal to replicate this neoplasia in quagga and zebra mussels

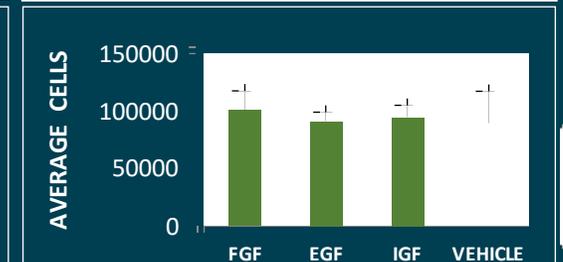
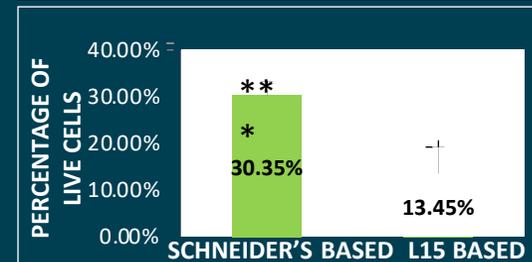
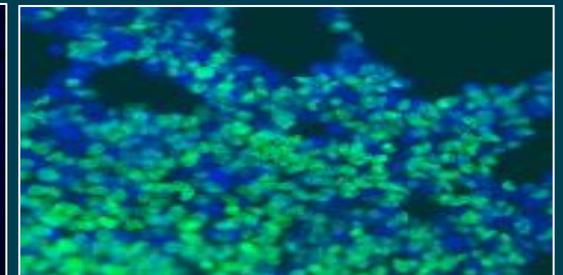
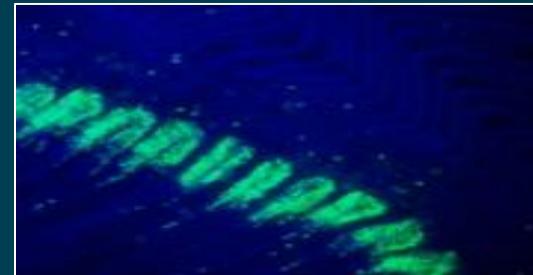
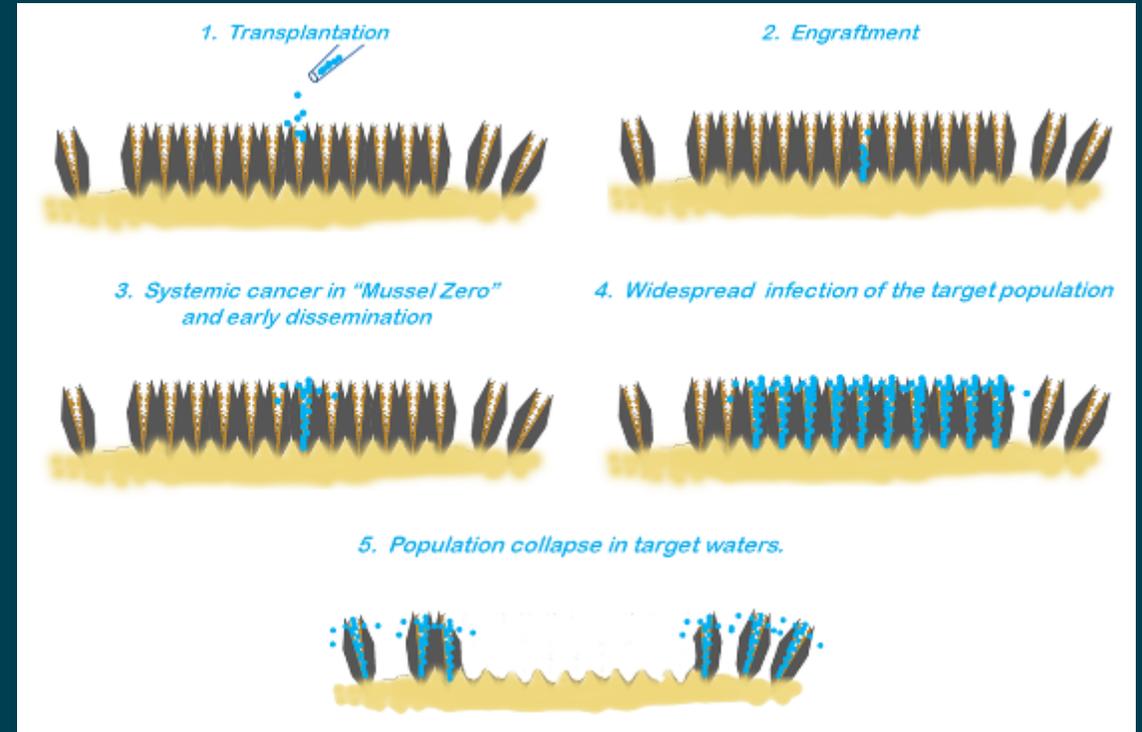


Adapted from Metzger et al. 2015



Open Water Control

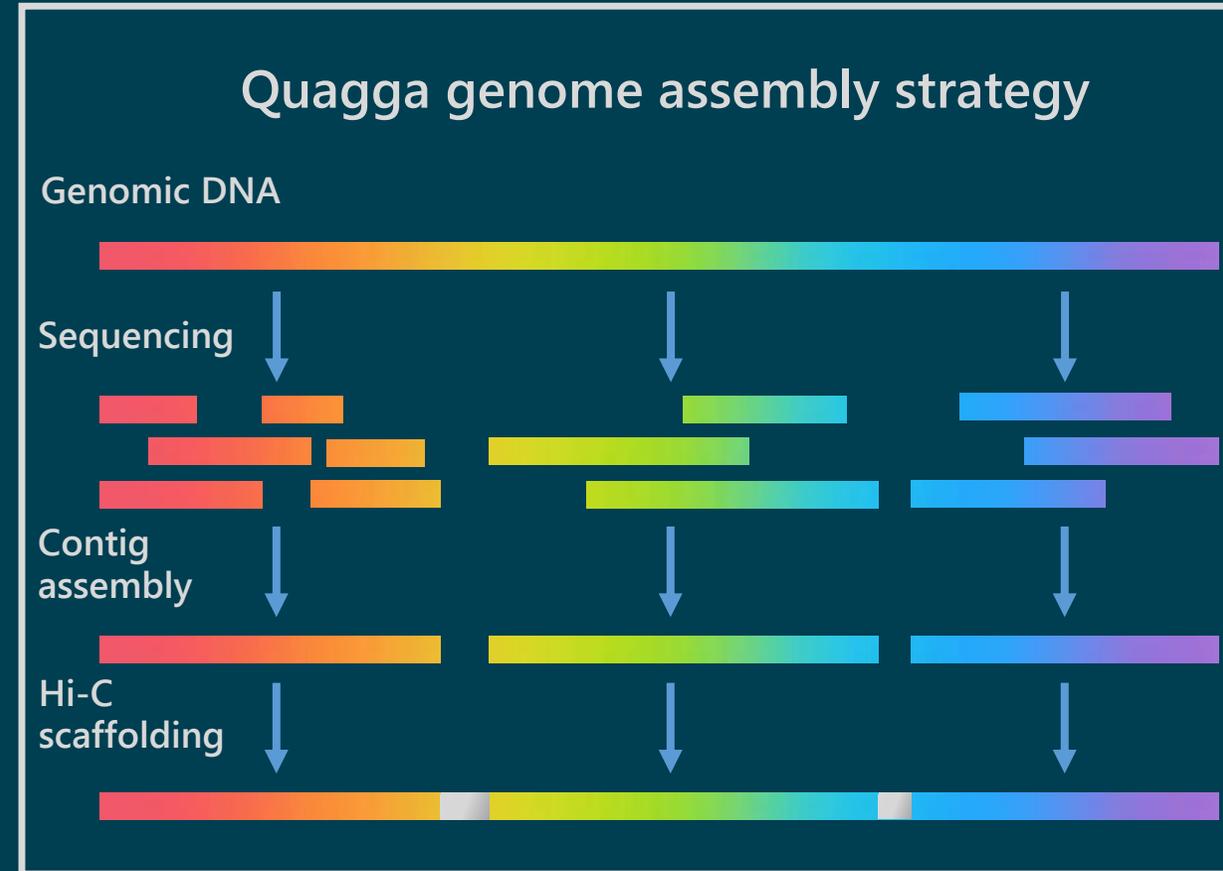
- Engineered Disseminated Neoplasia
 - Biomilab progress
 - Set up mussel aquaculture facility
 - Developing methods for culturing mussel cells
 - Examining mussel chromosomes
 - Working on gene transfer technique and identifying gene targets
 - Starting with a novel system





Open Water Control

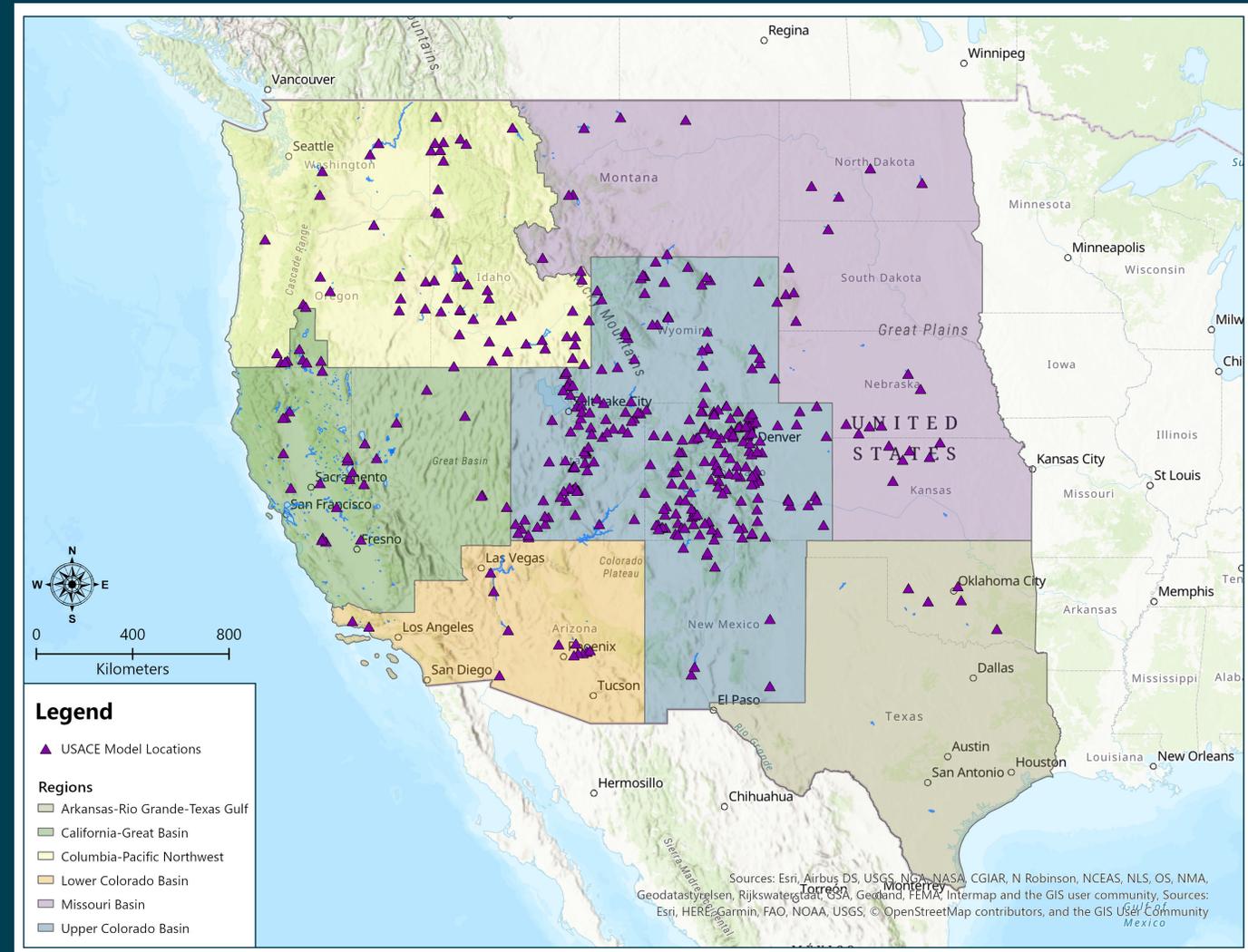
- Quagga Mussel Genome Sequencing
 - Necessary for development of genetic biocontrols
 - Collaboration with Kevin Kocot, University of Alabama
 - Chromosome-scale draft genome assembled
 - Annotation and analysis underway
 - Data being used in collaboration with Biomilabs to develop biocontrols



Modeling

- Predictive Modeling for the Western United States

- Predict potential spread of invasive mussels
- Collaboration with USACE
 - Water quality, habitat suitability
 - Boater behavior data
 - Highway proximity
 - Management
- Expanded model domain to include 404 water bodies



Modeling

- Refining Habitat Suitability Models
 - Updating mussel habitat suitability parameters based on Reclamation early detection data
 - Case studies where mussels detected but did not establish
 - Including physical, chemical, and hydrology data
 - Collaboration with USACE
 - Collecting water quality from public databases, and other Federal Labs



Lake Roosevelt Rapid Response Exercise

- On the ground exercise to prepare for detection of mussels
- Lead by WA Invasive Species Council
- Included 16 organizations (federal, state, local, international, private)
- Successfully practiced detection and response
- \$150,000 provide by Reclamation Spend Plan



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Website:
www.usbr.gov/mussels