“Quagga 2.0” Dreissenid Research Update

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Outline

- General Background Information
- Current Distribution
- Research at Lake Mead National Recreation Area
- Control Options
- Questions

Background

Quagga Mussel
Dreissena bugensis

- Adults up to 4 cm
- Native to the Dneiper River and Ponto-Caspian Sea
- Described in 1890 by Andrusov from the Bug River
- Discovered in 1989 in the Great Lakes (initially Erie)
- Found in the Mississippi River (1995) & the Ohio River (2004)
- Found in Lake Mead, Lake Mohave and Lake Havasu (January 2007)

Zebra Mussel
Dreissena polymorpha

- Adults < 50 mm
- Native to the Black, Caspian and Azov Seas
- Described in 1769 by Pallas from the Caspian Sea and Ural River
- Discovered in 1988 in the Great Lakes

Background

Quagga Mussel
Dreissena bugensis

- Minimum spawning temp. 5°C
- Max Depth > 130 m
- Hard & soft sediments
- Feeds on small particles (5.0 – 35um)
- Assimilation efficiency 81% (Baldwin et al. 2002)

Zebra Mussel
Dreissena polymorpha

- Minimum spawning temp. 12°C
- Max Depth < 80 m
- Hard substrate
- Feeds on small particles (0.4 – 40 um)
- Assimilation efficiency 63% (Baldwin et al. 2002)

Background

Quagga Mussel & Zebra Mussel
Dreissena bugensis *Dreissena polymorpha*

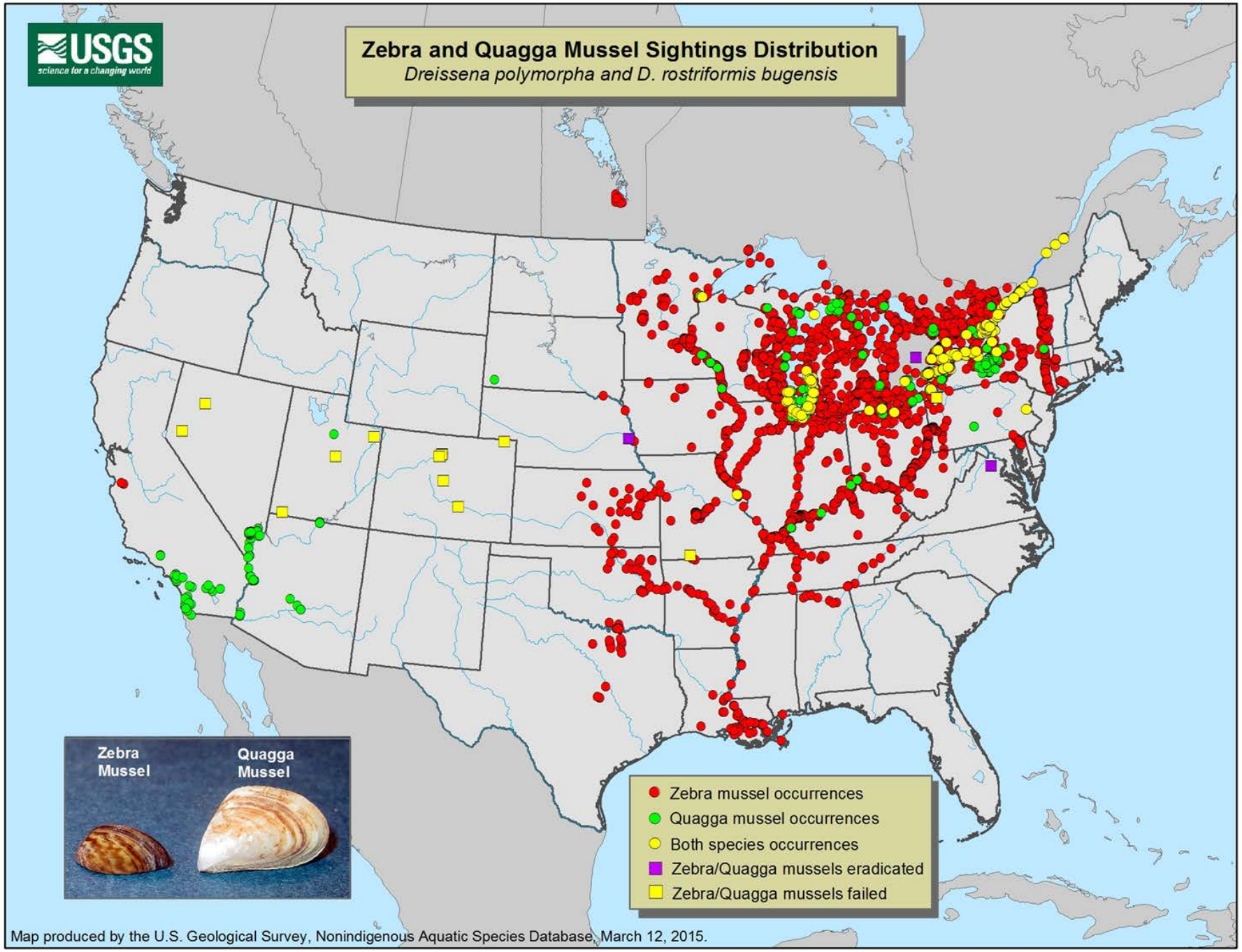
- Variable lifespan for adults (3-9 years)
- Dioecious (separate male and female individuals)
- External fertilization (occurs in the water column)
- One female can release >40,000 eggs per cycle, with up to 1 million eggs released in a spawning season
- The genus *Dreissena* is highly polymorphic and prolific with high potential for rapid adaptation attributing to its rapid expansion and colonization (Mills et al. 1996).

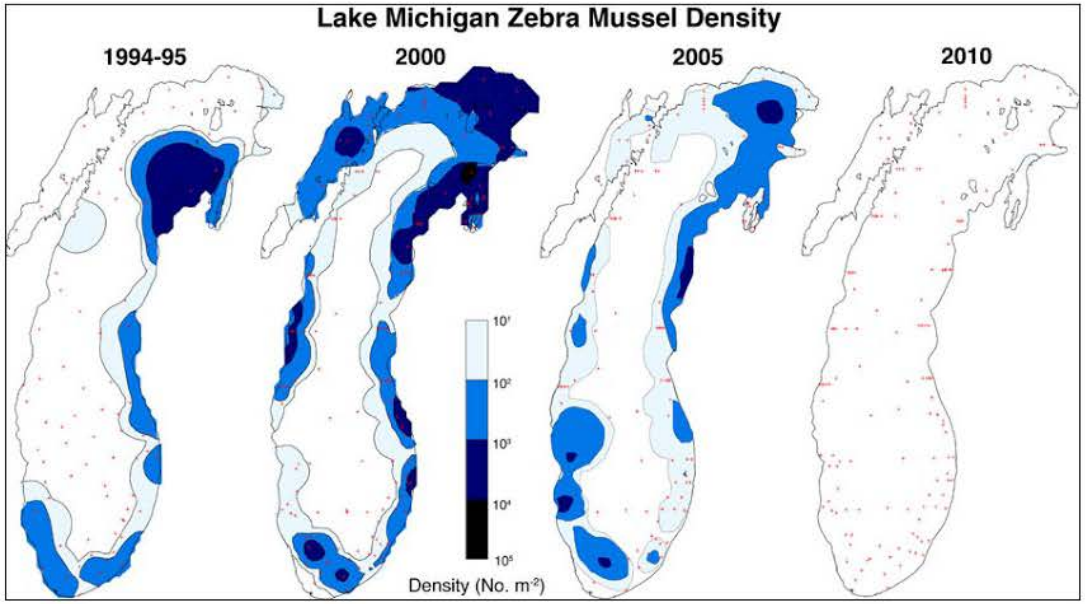
Background

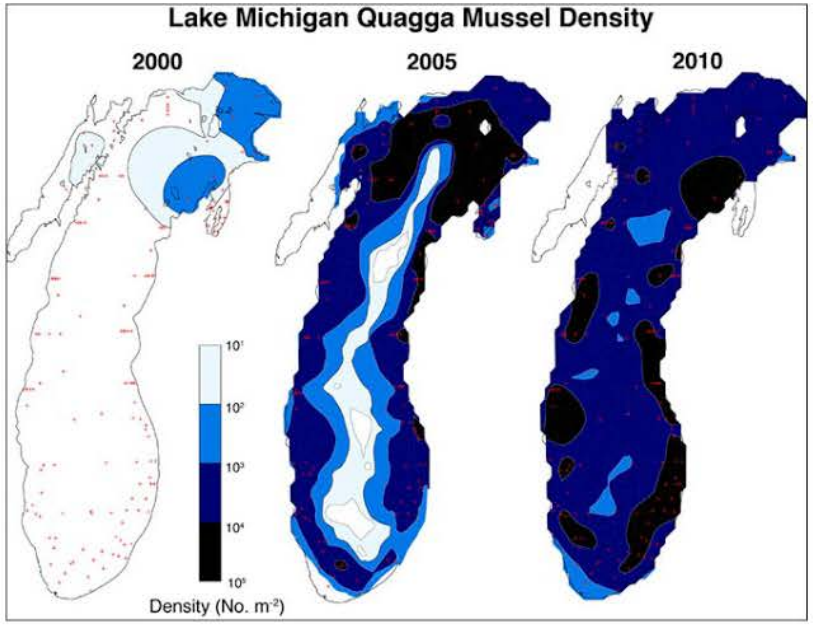
Quagga Mussel & Zebra Mussel

Dreissena bugensis *Dreissena polymorpha*

- Filter feeders, filter approx. 1 L/per day
- Remove phytoplankton and suspended solids
- Produce fecal pellets and pseudofeces that can have concentrated contaminant loads (300,000 x higher)
- Bioaccumulate contaminants
- Biofouling
- Ecosystem alteration


USGS
science for a changing world
Zebra and Quagga Mussel Sightings Distribution
Dreissena polymorpha and D. rostriformis bugensis
Zebra Mussel
Quagga Mussel
Zebra mussel occurrences
Quagga mussel occurrences
Both species occurrences
Zebra/Quagga mussels eradicated
Zebra/Quagga mussels failed
Map produced by the U.S. Geological Survey, Nonindigenous Aquatic Species Database, March 12, 2015.





Three years after quagga mussels were discovered in Lake Michigan, zebra mussels still made up more than 98% of the lake's invasive mussel population. By 2005, that relationship had flipped, with quaggas making up 97.7% of the invasive mussel population. Note that by 2010, quagga mussels have displaced zebra mussels and are now far more abundant and widespread than zebra mussels ever were.

Thunder Bay National Marine Sanctuary 2013 Condition Assessment
http://sanctuaries.noaa.gov/science/condition/tbnms/pressures.html

Research at Lake Mead NRA

Research

Presence/ Absence (using SCUBA / ROV)

Veliger Sampling (using plankton tows)

Age/growth analysis

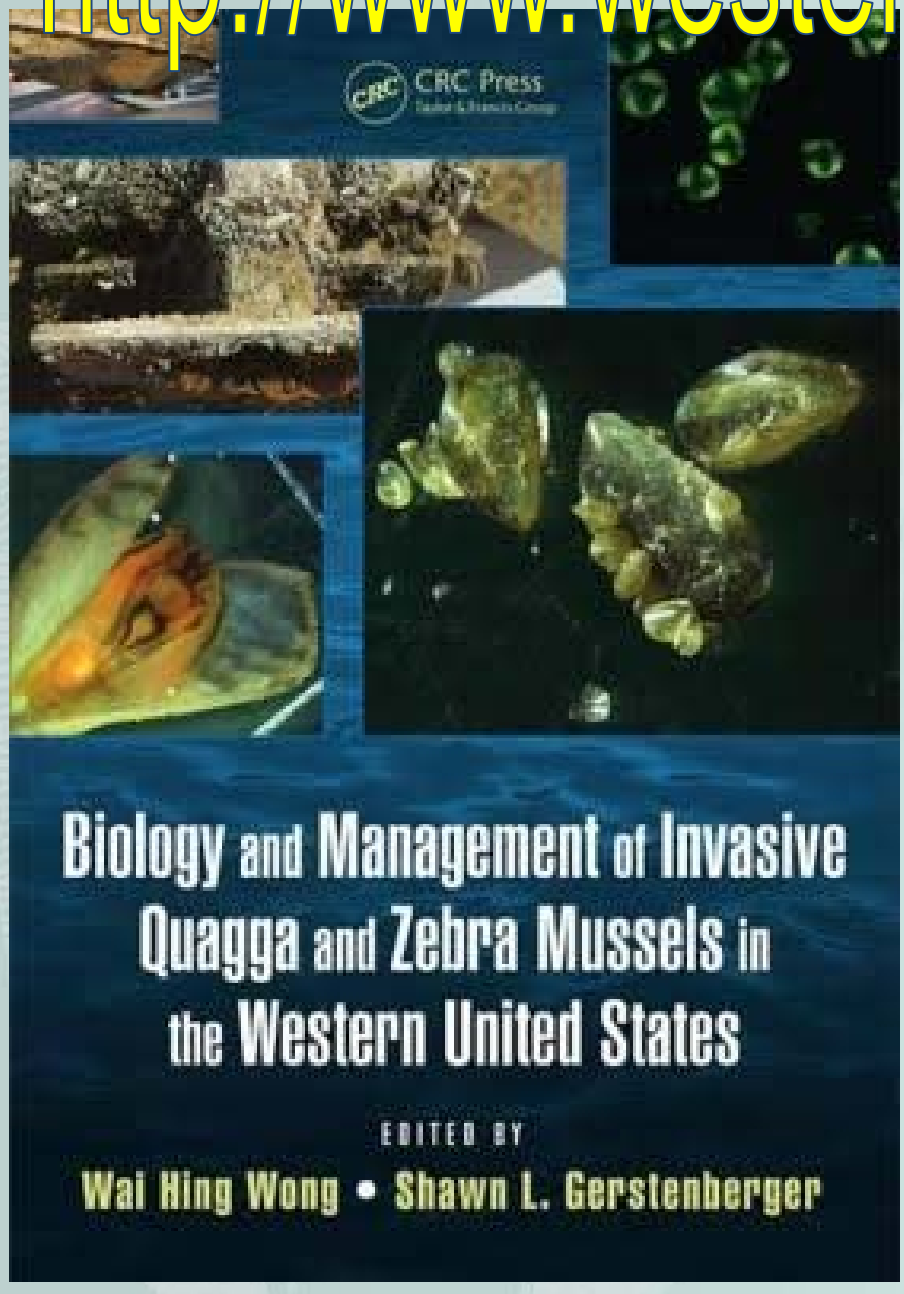
Standardized monitoring of critical habitats

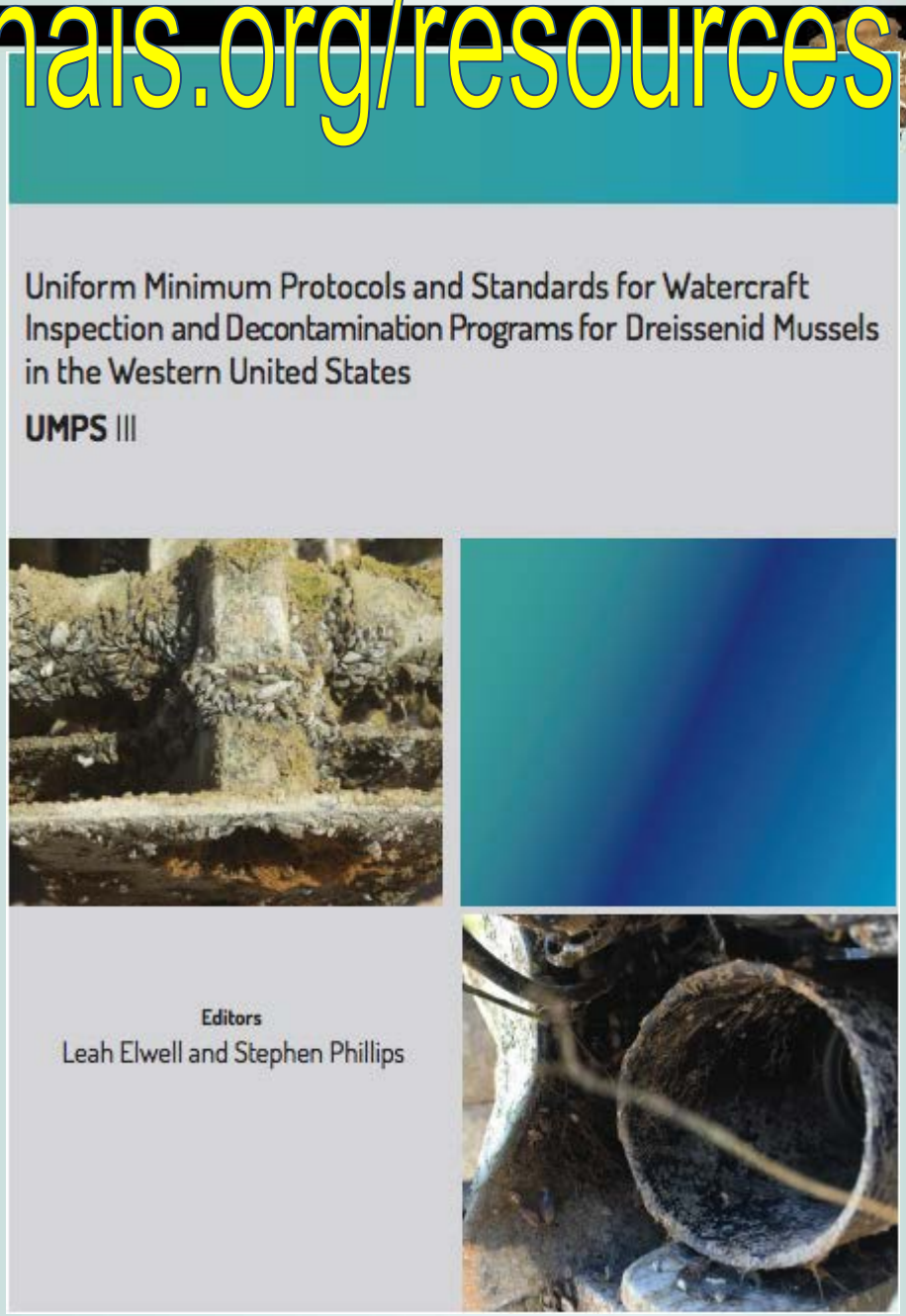
(fish spawning beds, cultural resources, intakes)

Coordinated inter-agency sampling/analysis

Targeted work on BMPs for treatment effectiveness

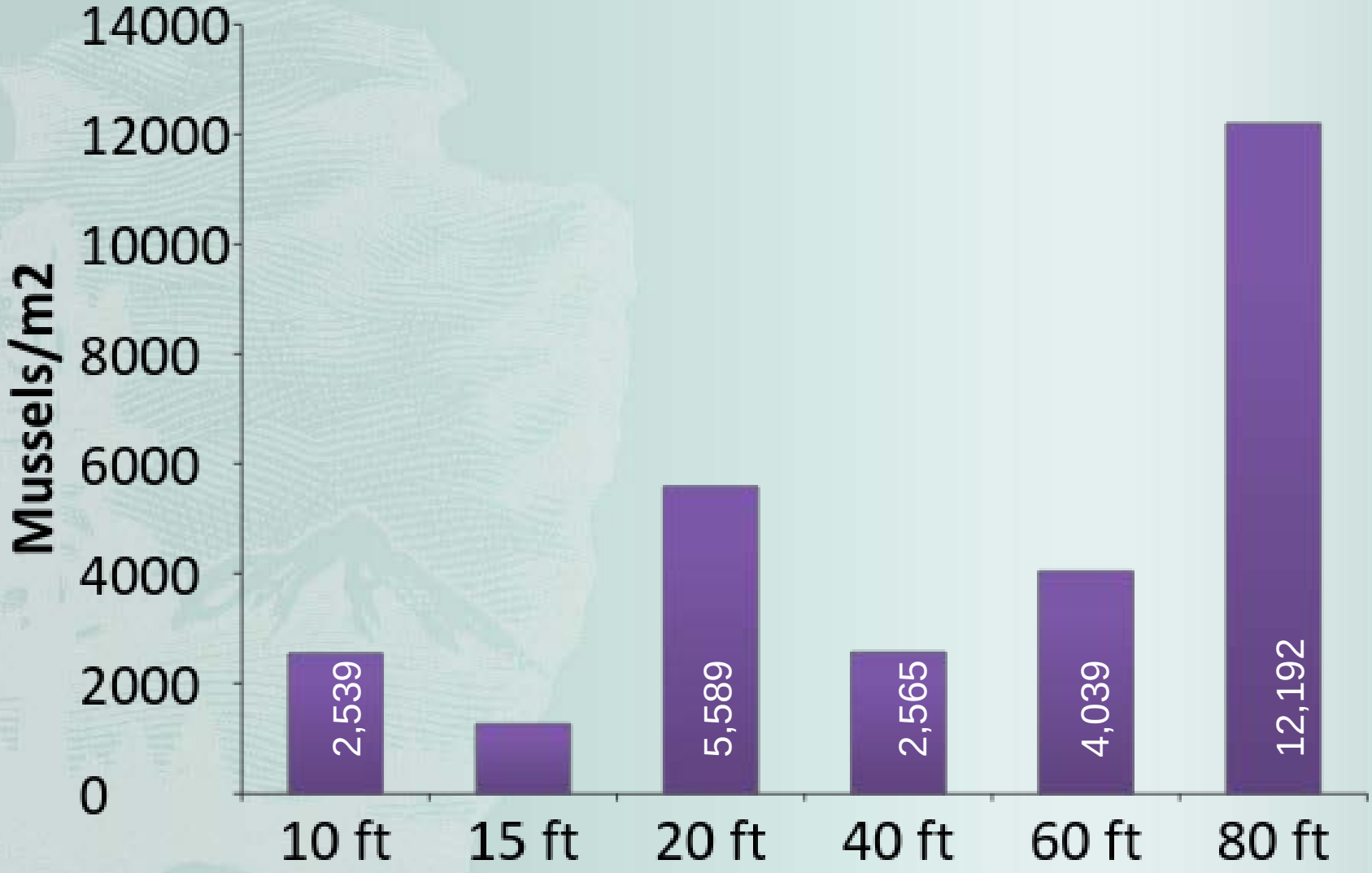
http://www.westernais.org/resources

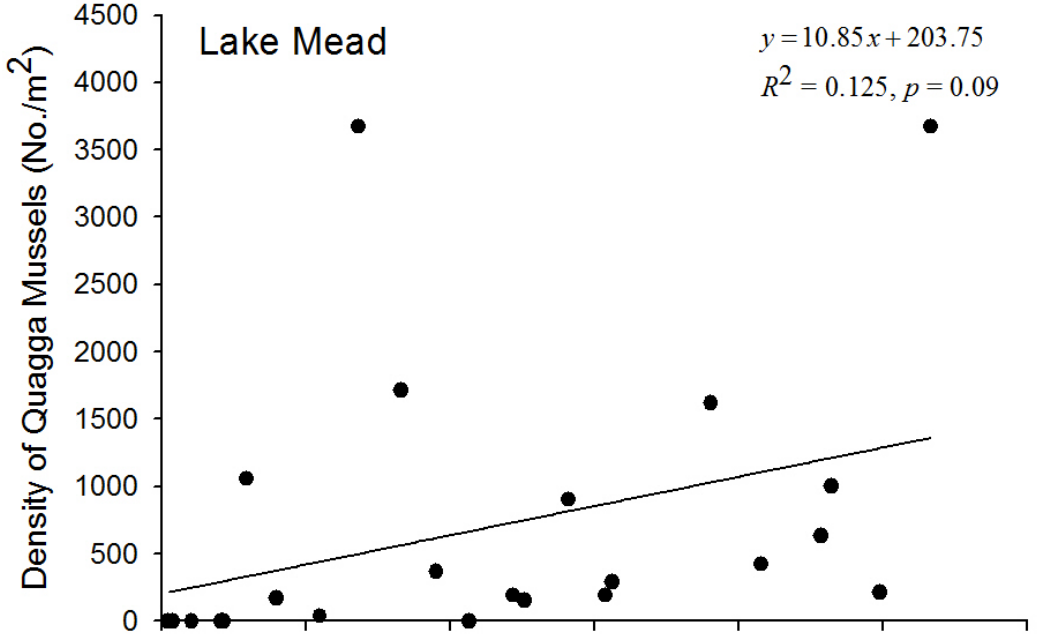


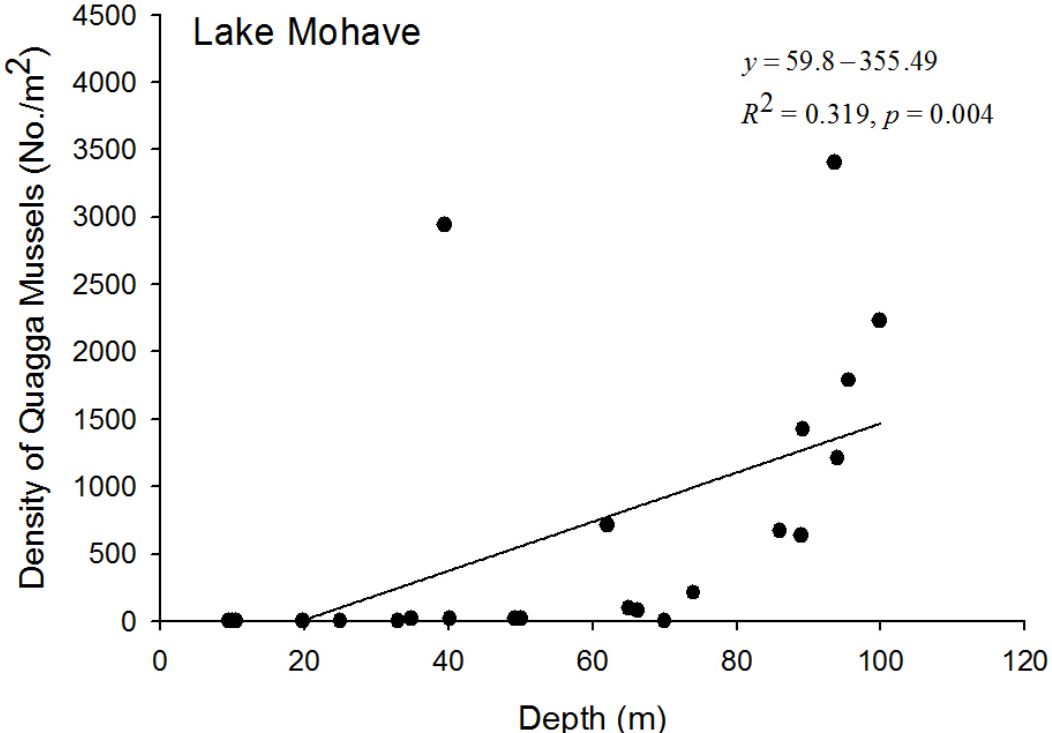


Hard Substrate Quagga Mussel Density

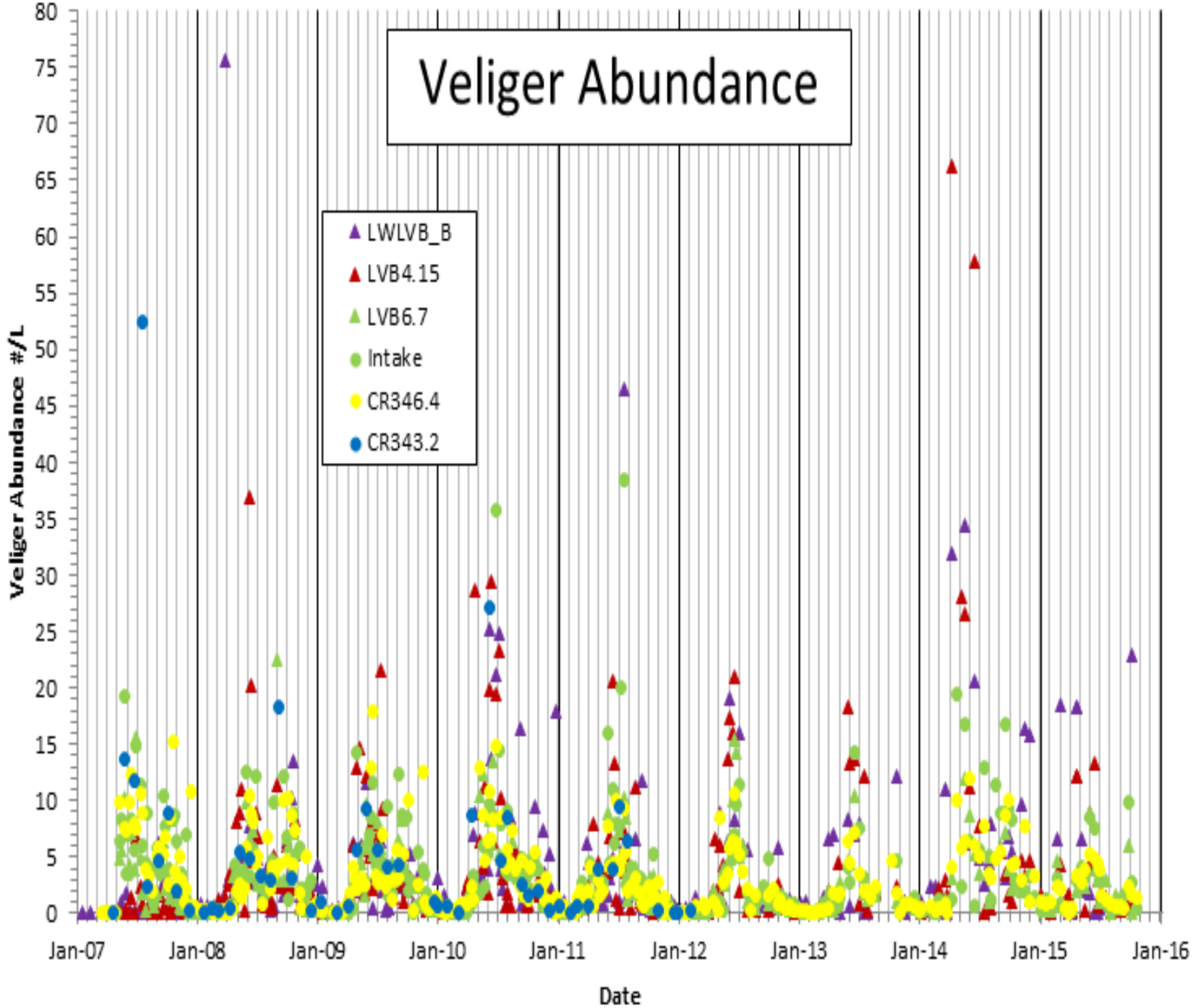
(from Black Island in Lake Mead)







Densities of quagga mussels measured from soft substrates for both Lake Mead and Lake Mohave (2013 and 2014)


Veliger Abundance
LWLVB_B
LVB4.15
LVB6.7
Intake
CR346.4
CR343.2
Veliger Abundance #/L
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Jan-07
Jan-08
Jan-09
Jan-10
Jan-11
Jan-12
Jan-13
Jan-14
Jan-15
Jan-16
Date

Control Strategies

- Coatings (prevent veliger settling)
  - non-toxic silicone based coatings
  - Bureau of Reclamation's Technical Service Center (TSC) lab in Denver, Colorado
- Radiation (damage veligers)
  - Use of low-dose radiation in quartz lined tubes
- Nanoparticle delivery (adult mussels)

Outreach and Education

Clear, Simple, Consistent

- 100th Meridian guidelines
- CLEAN, DRAIN, DRY

FEATURE

PREVALENCE OF AQUATIC INTRODUCED SPECIES PREVENTION PROTOCOLS AT U.S. COLLEGE AND UNIVERSITY FISHERIES PROGRAMS

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MERCURY
1600 Rebel
LUND

For More Information

- USGS Fact Sheet on quagga mussels https://nas.er.usgs.gov/queries/factsheet.aspx?speciesid=95
- USGS Fact Sheet on zebra mussels https://nas.er.usgs.gov/queries/FactSheet.aspx?speciesID=5
- (May 2015) Biology and Management of Invasive Quagga and Zebra Mussels in the Western United States by Wai Hing Wong and Shawn L. Gerstenberger
- http://www.westernais.org/
- https://nas.er.usgs.gov/

Questions ?

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