Studies of the Zebra Mussel in a CVP Reservoir and Applications to DWR's Mussel Management Program

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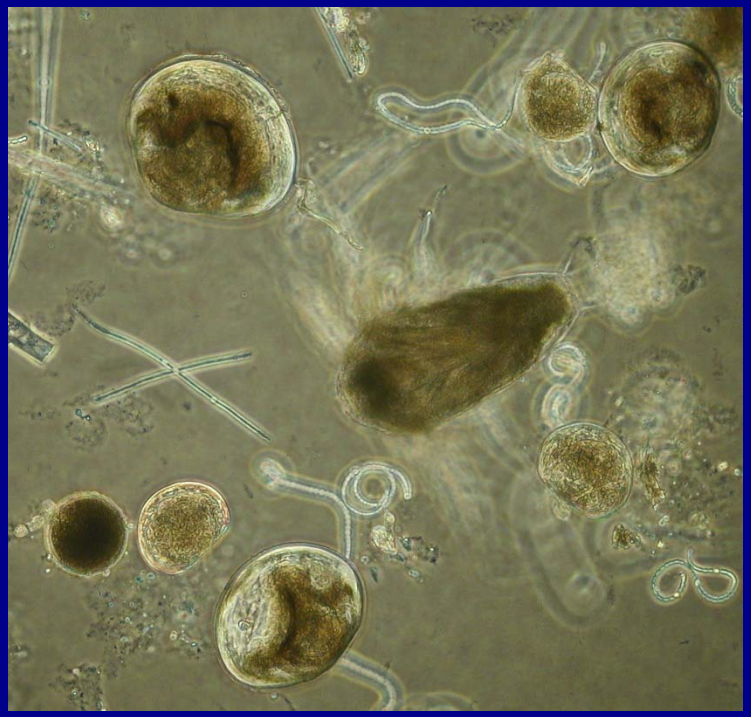
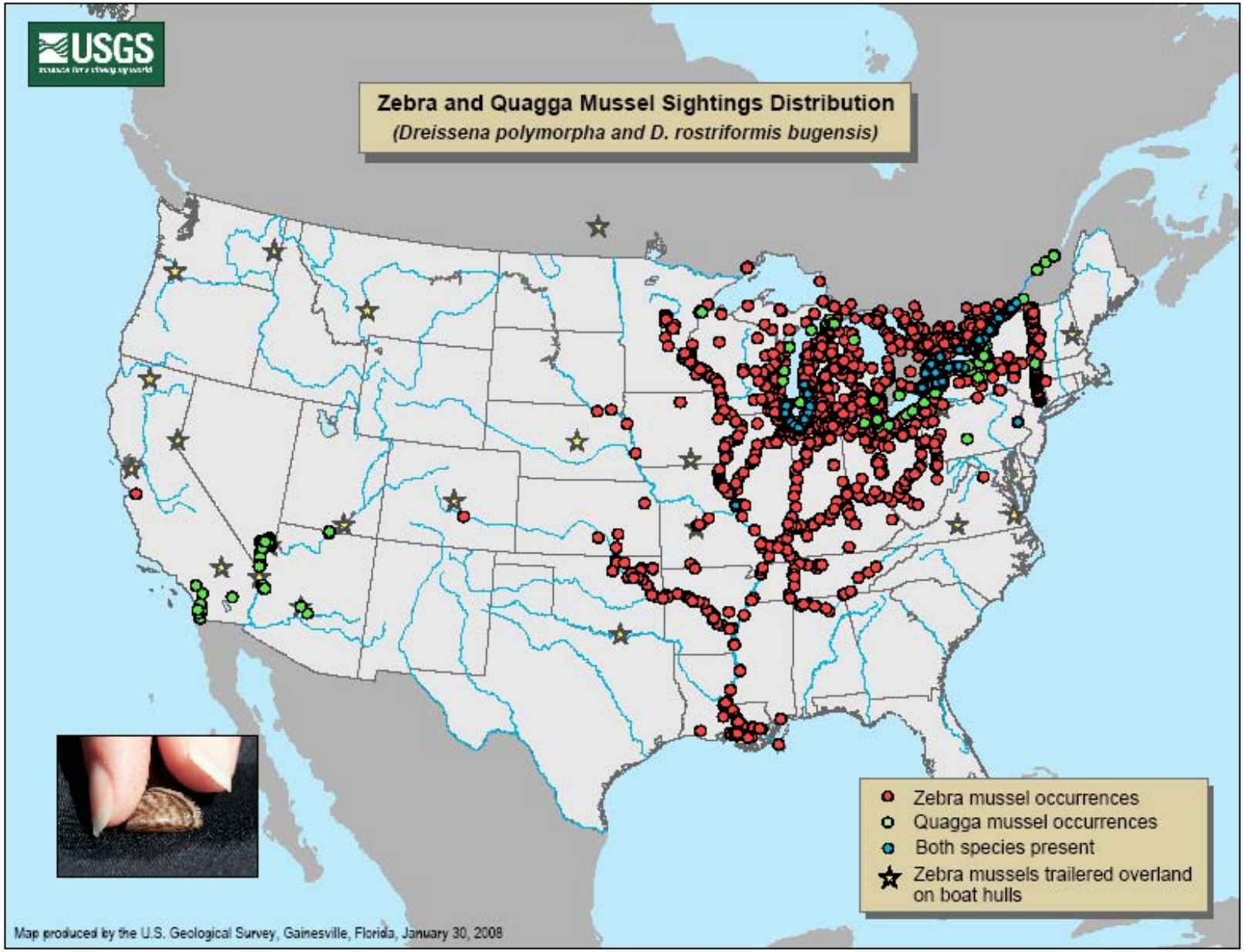
Zebra and Quagga Mussels



US Distribution



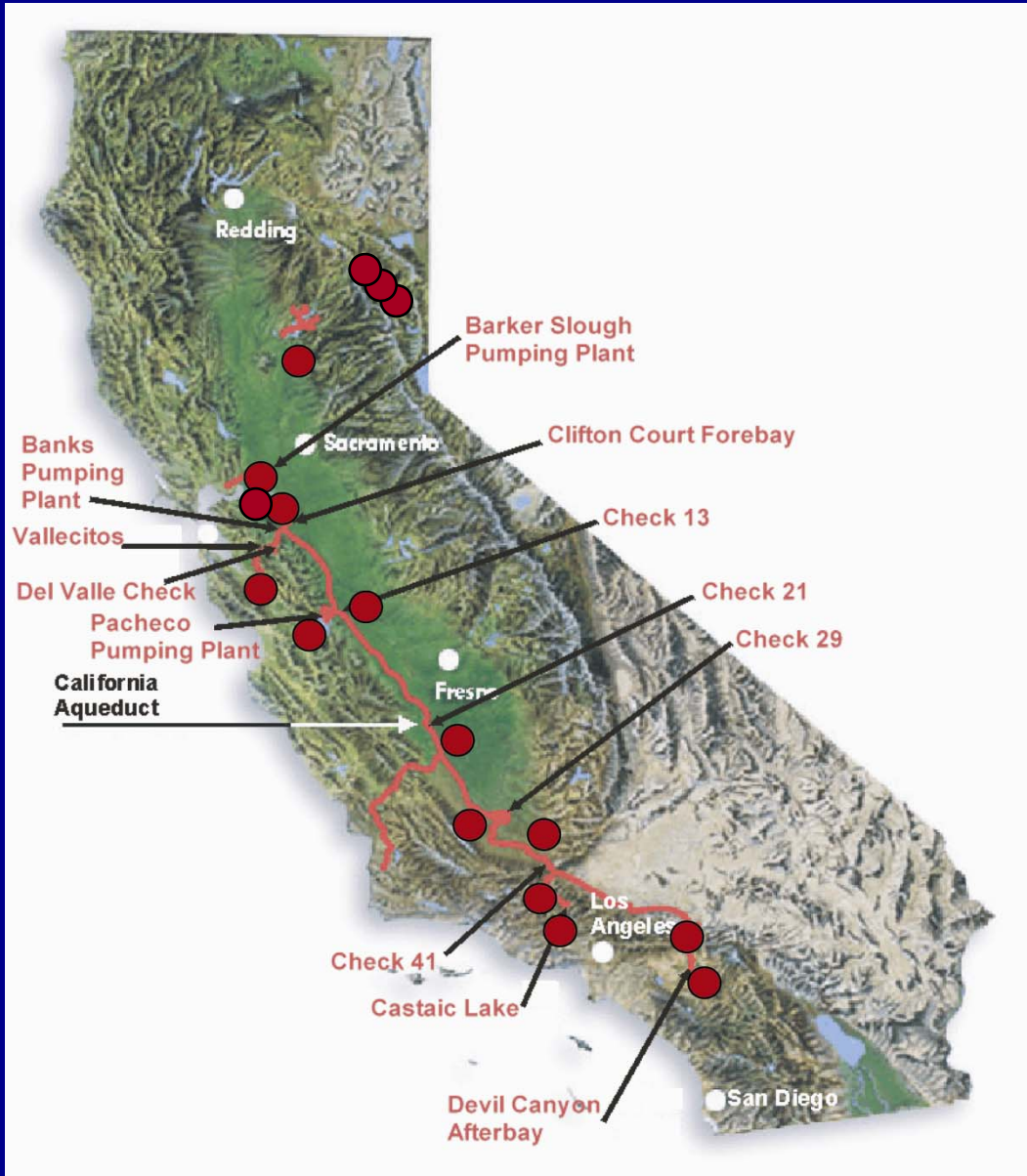
What's Vulnerable in the SWP?

Increased O&M Costs

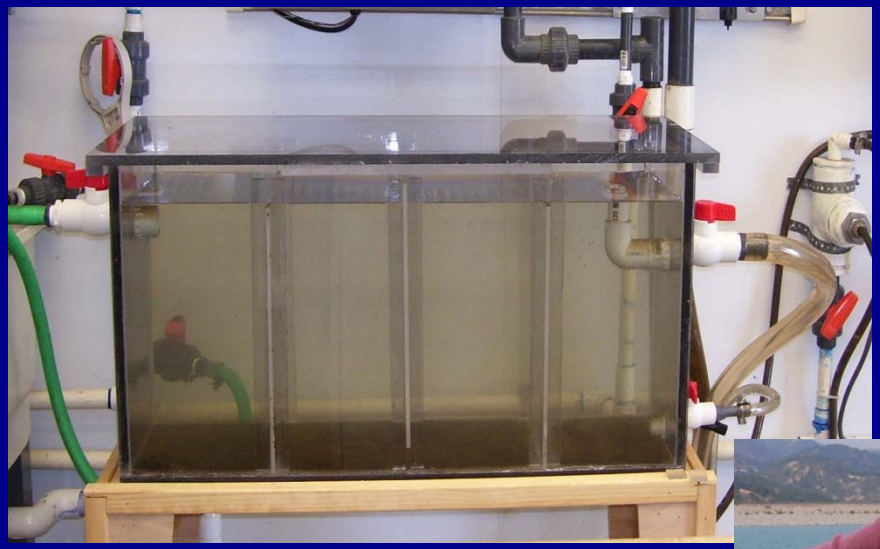
- Metropolitan WD of So. Calif.
  - >$10 million/year
- State Water Project
  - ~$40-50 million/year (projected)

SWP Early Detection Mussel Monitoring Program

- Source waters to "system"
  - lakes, delta, canal
  - potential nursery
- Inlets to facility
  - pump house, power plant
- Terminal reservoirs
- 650+ samples



Sampling Methods

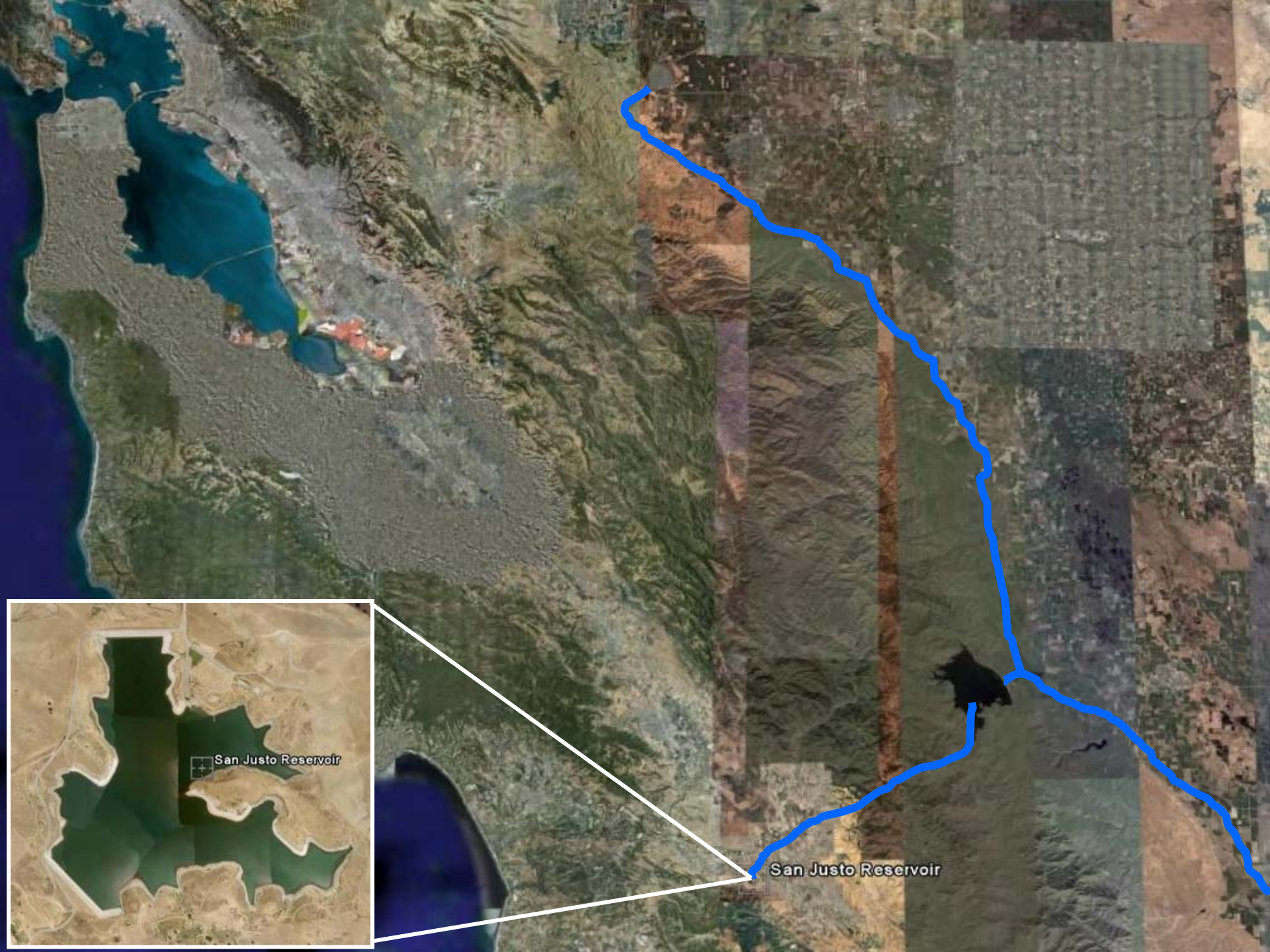


Management Plans

- Vector Management Plan
  - prevention and risk reduction
  - equipment decon, boat inspection, fish stocking, monitoring, outreach and education
- Rapid Response Plan
  - immediate actions and resources at first detection
  - delineation, notification, vector control, eradication
- Long-Term Mussel Management and Control Plan
  - management of existing population
  - biofouling, tolerance, “The Toolbox” (engineering, operations, and population management strategies)

San Justo Reservoir

- ZMs discovered January 2008
- Well-established population
- Receives CVP water


San Justo Reservoir
San Justo Reservoir

Research Elements

- Timing of spawning and settlement
  - entrainment into facilities, timing of control treatments
- Growth and mortality rates
  - size class, depth, WQ
- Biofouling rates
  - performance of infrastructure and “tolerance” level
  - frequency of treatments
- Field test antifouling coatings

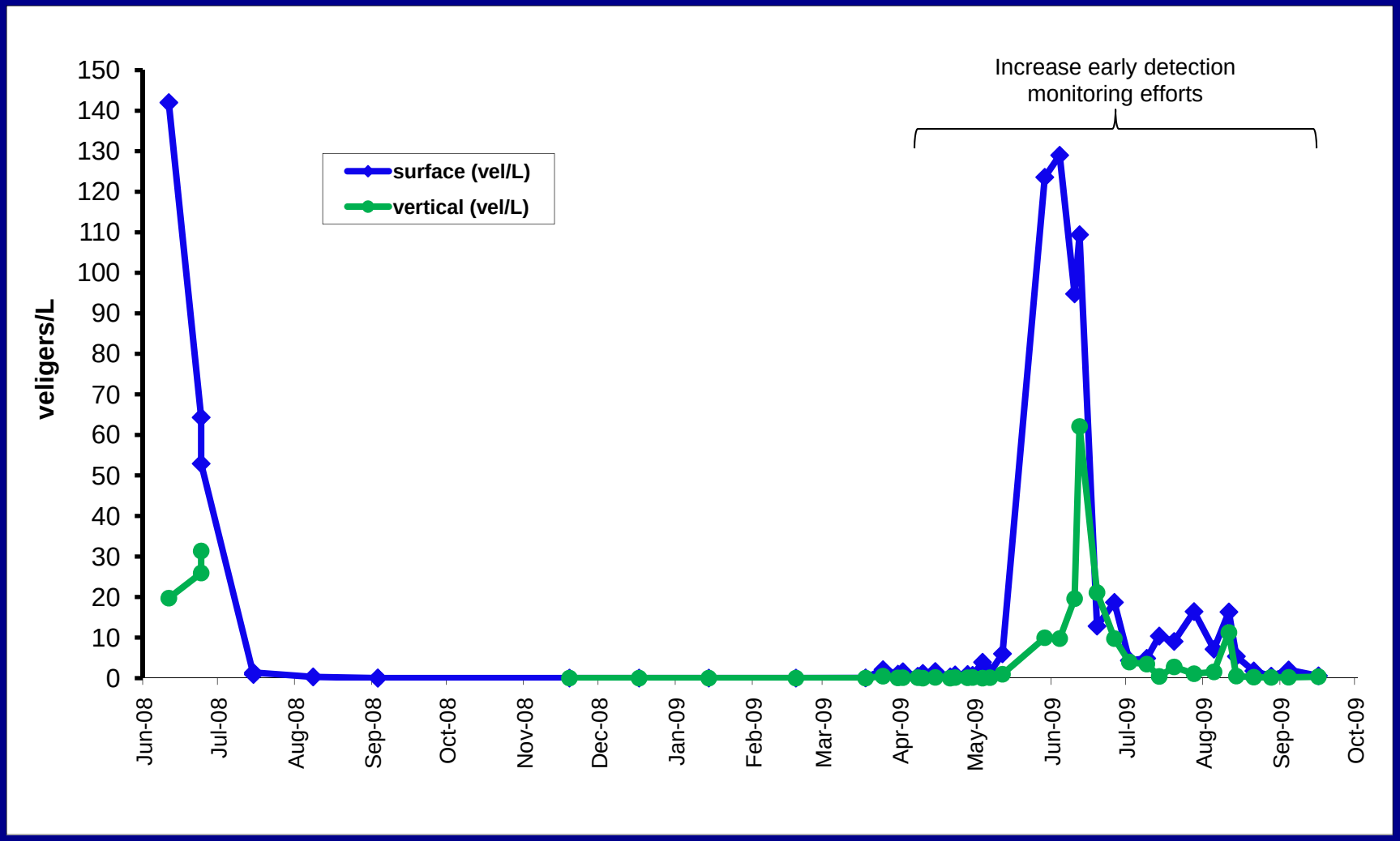
Spawning

- Derived from veliger abundance data

- Weekly to monthly plankton tows
  - vertical tow, 2x20m, 50L
  - surface tow, 1x40m, 50L

Veliger Abundance

June '08 – Oct '09



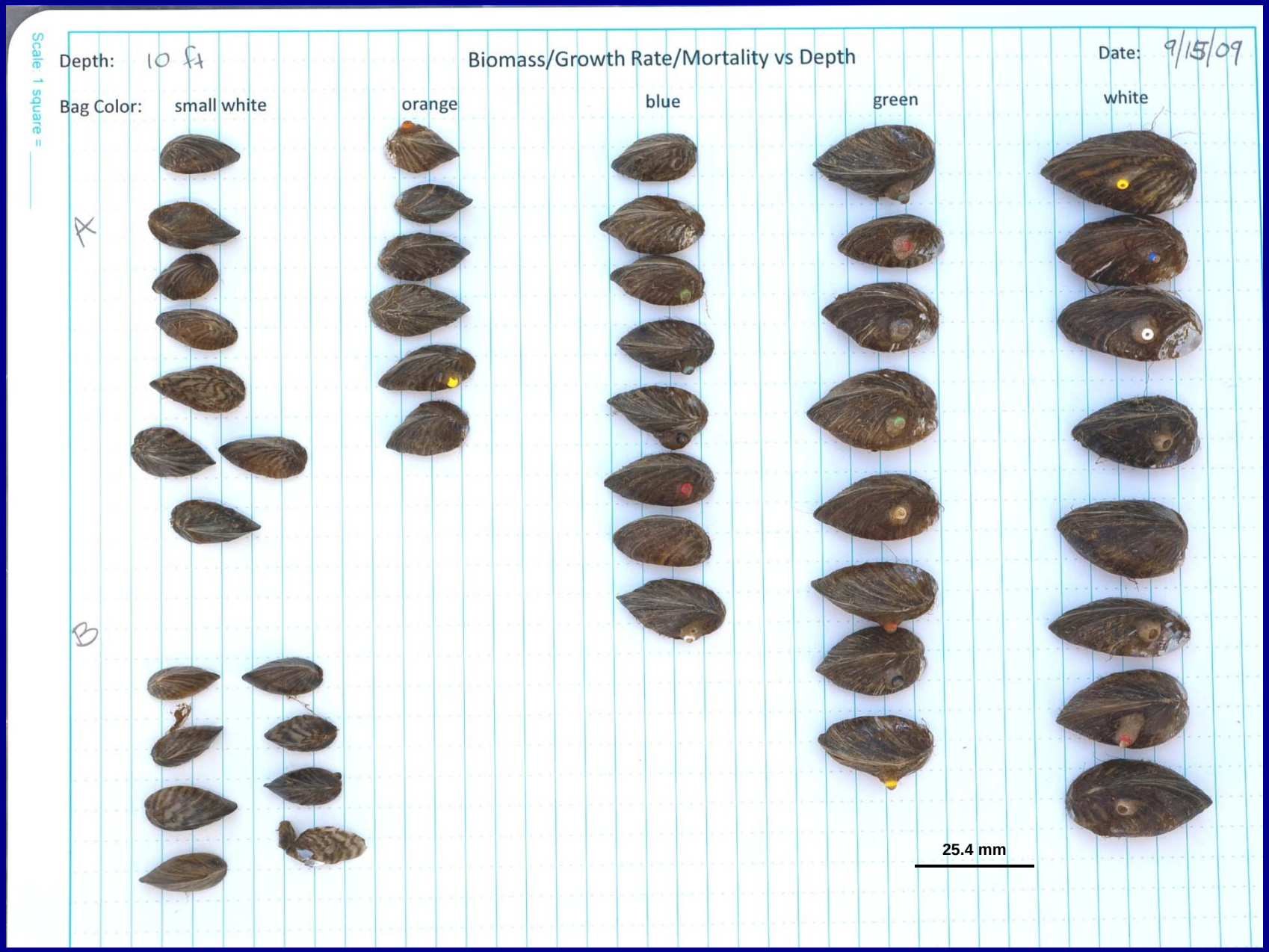
Growth Rate

- 5 size classes

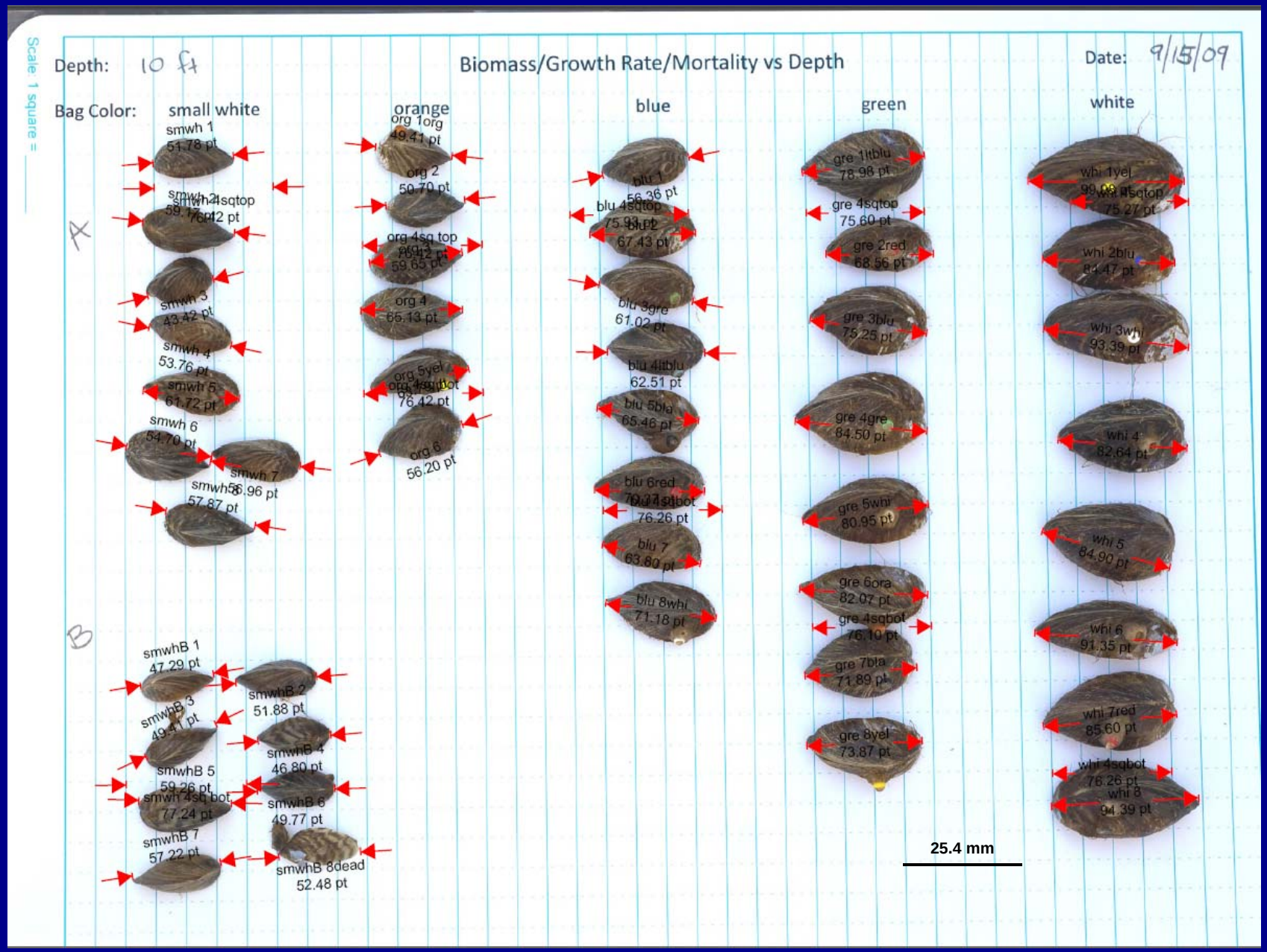
3-6mm 10-12.6mm 12.6-19mm 19-25mm 25+mm

- 8 mussels per size class per treatment
  - All 8 mussels placed in one color-coded bag
- 8 depths
  - 5, 10, 15, 20, 25, 30, 40, 50 (feet)
  - All mussels at 10ft depth are marked to track individual growth rates
- Recorded length, volume, mortality on a monthly basis

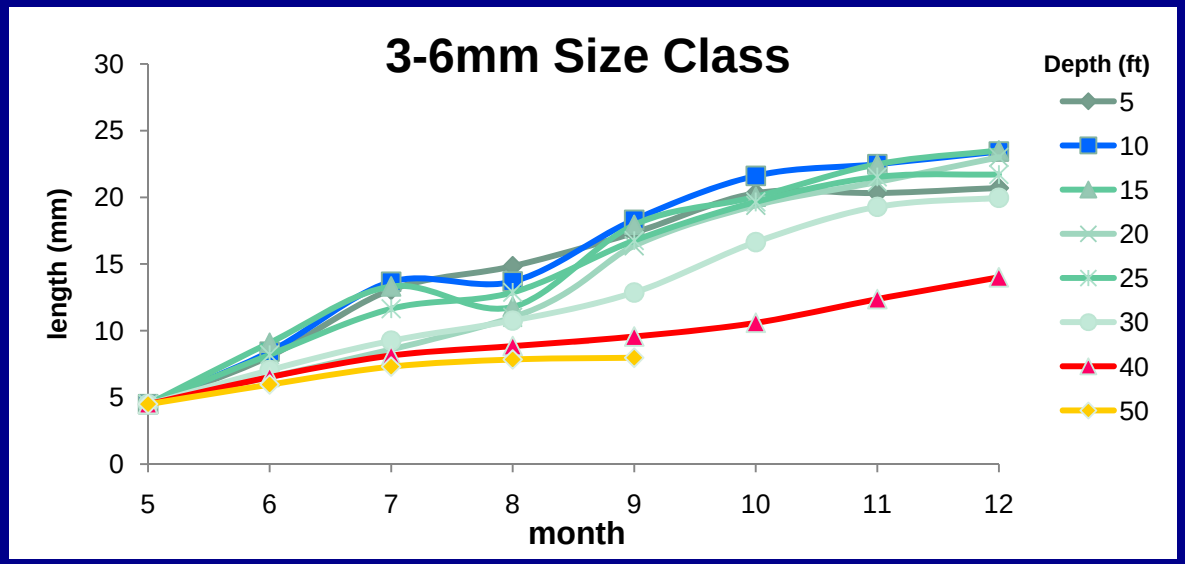
Mussels are photographed on graph paper.



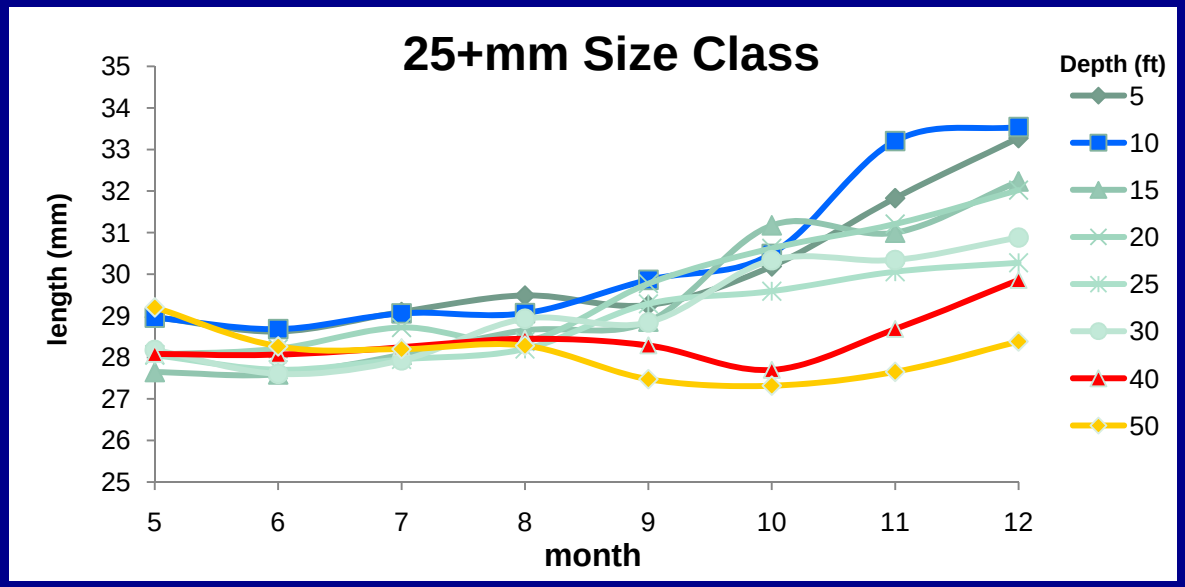
Each mussel is measured using measurement software.



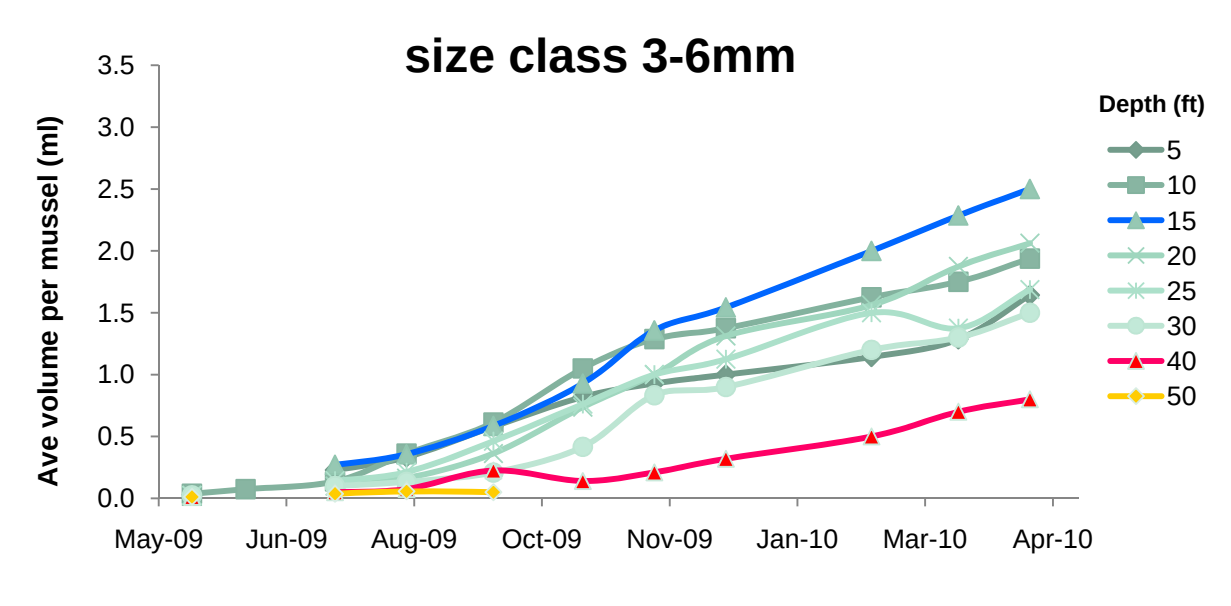
Change in Length over Time

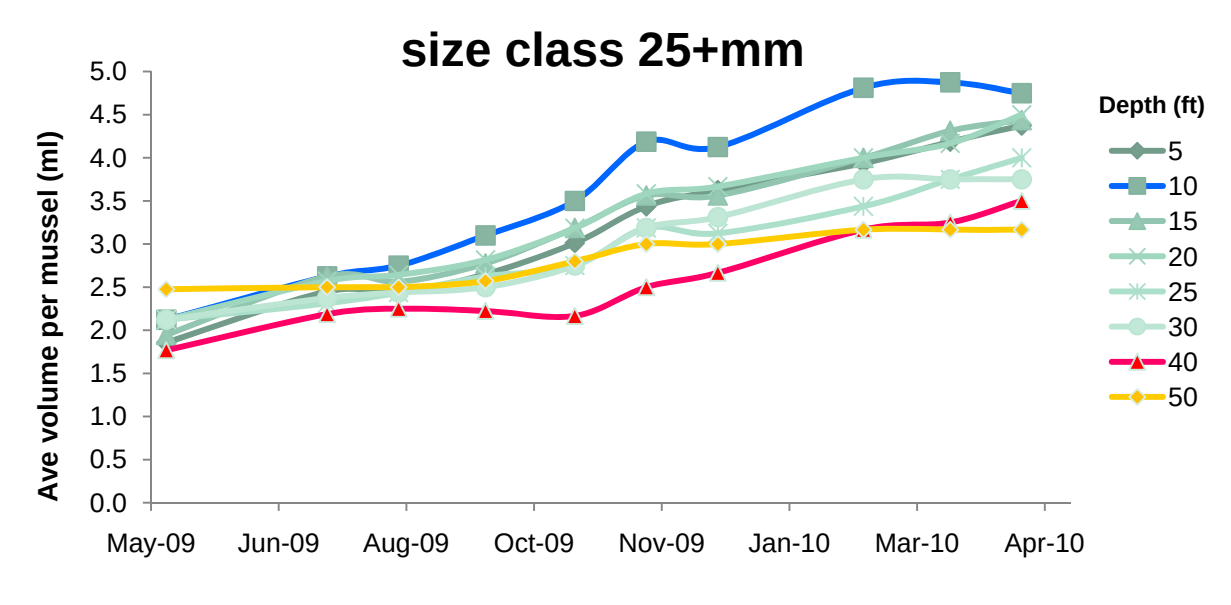


Stratification as a management tool



Change in Biomass over Time





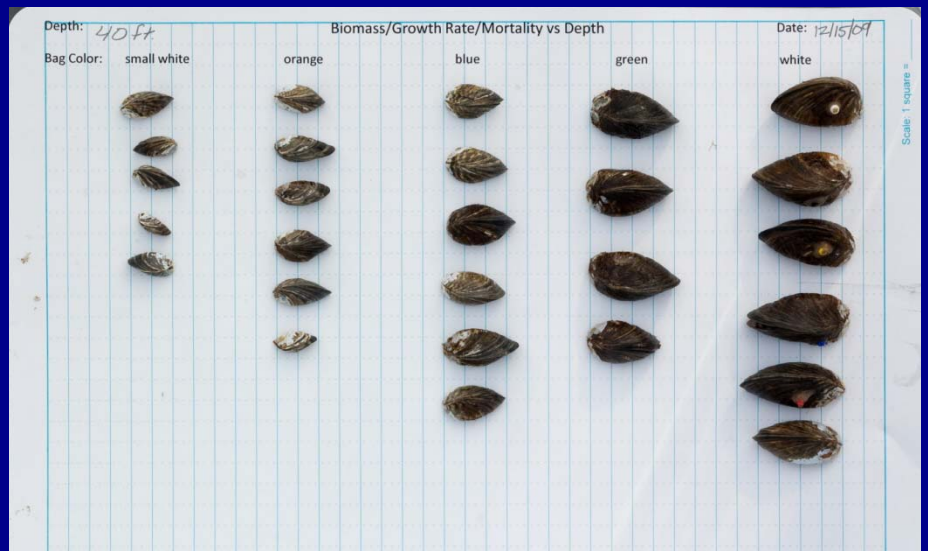
Size Comparison between Depths

Dec 2009

5 ft

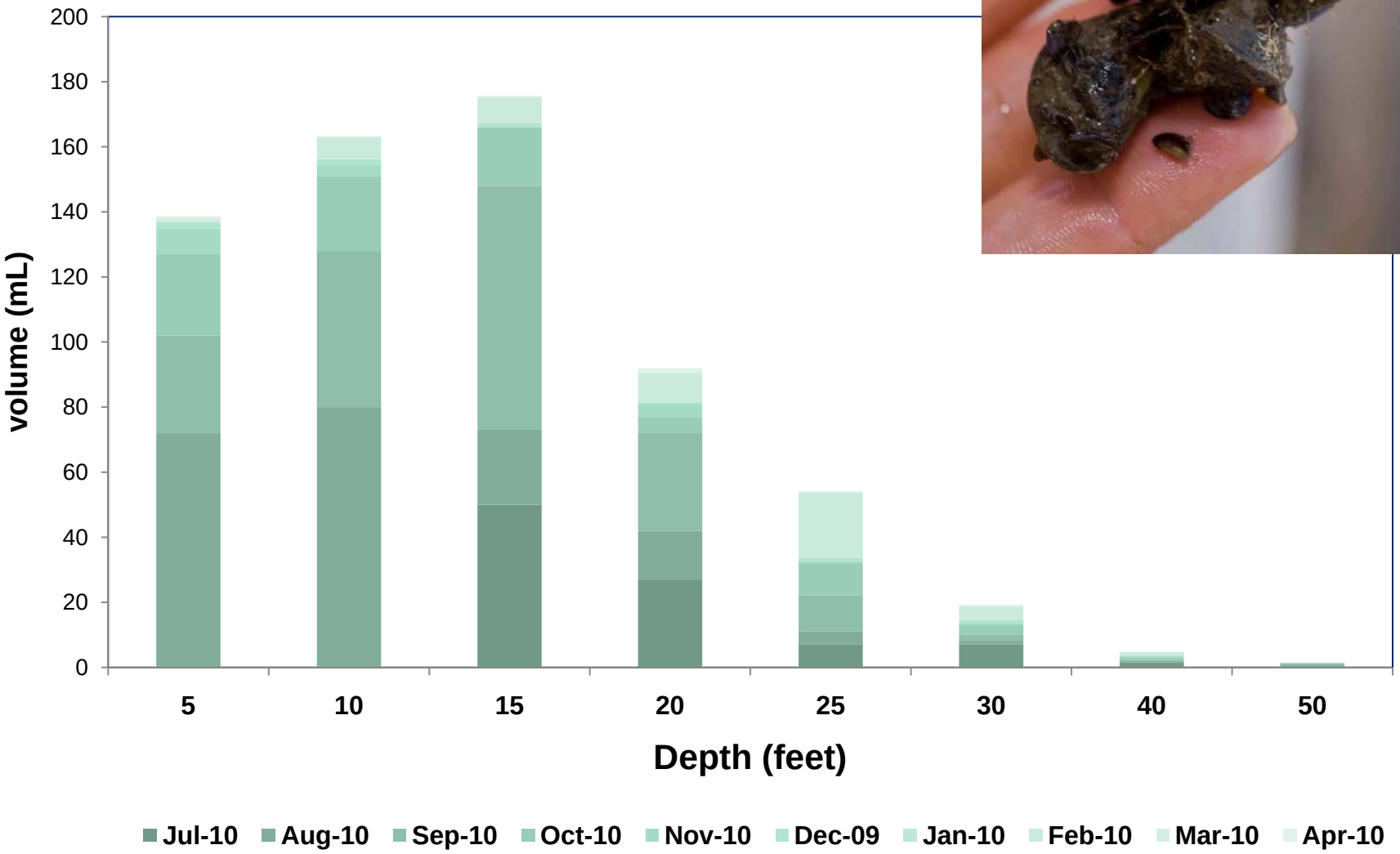
3-6 **10-12** **12-19** **19-25** **25+** **Size Class (mm)**

40 ft



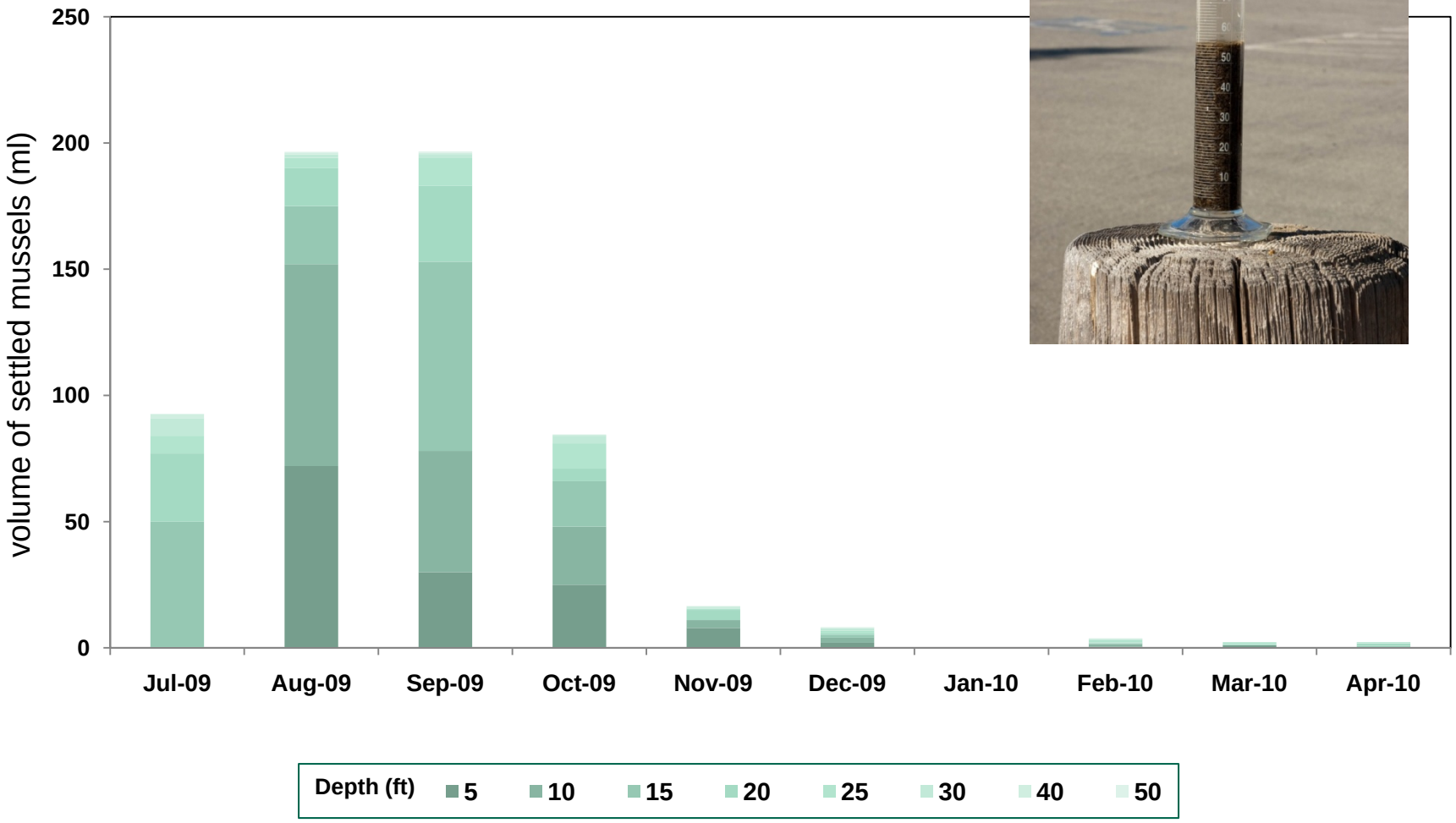
Settlement by Depth

July '09 – April '10



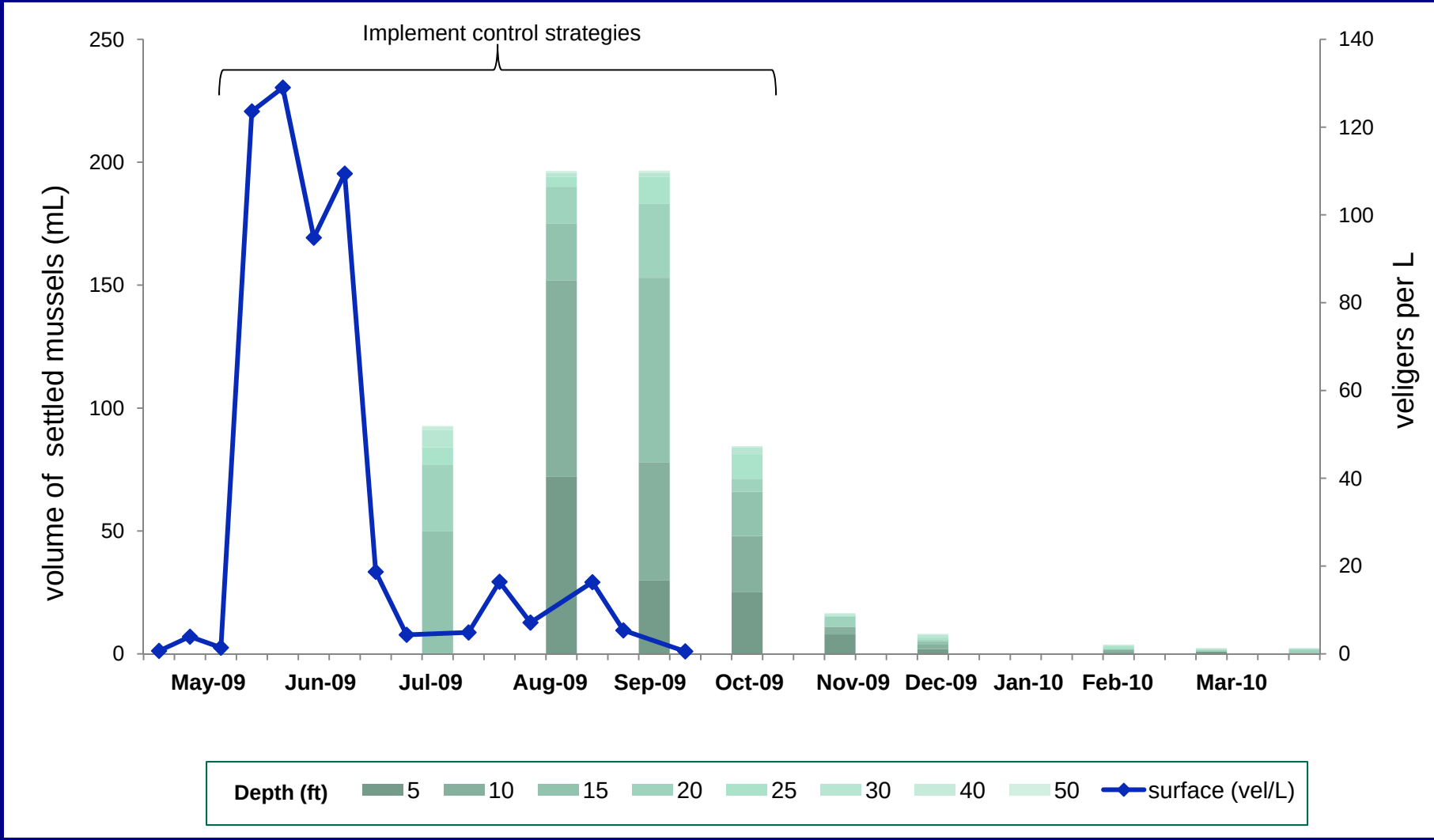
Seasonal Settlement

July '09 – April '10



Comparison of Veligers to Settled Mussels

April '09 – April '10



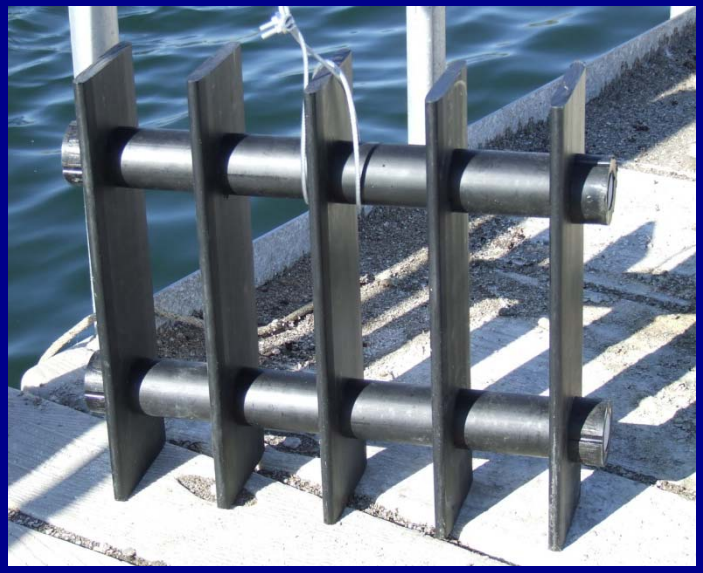
Weight of Biofouling on Structures

0 months → 3 months → 6 months

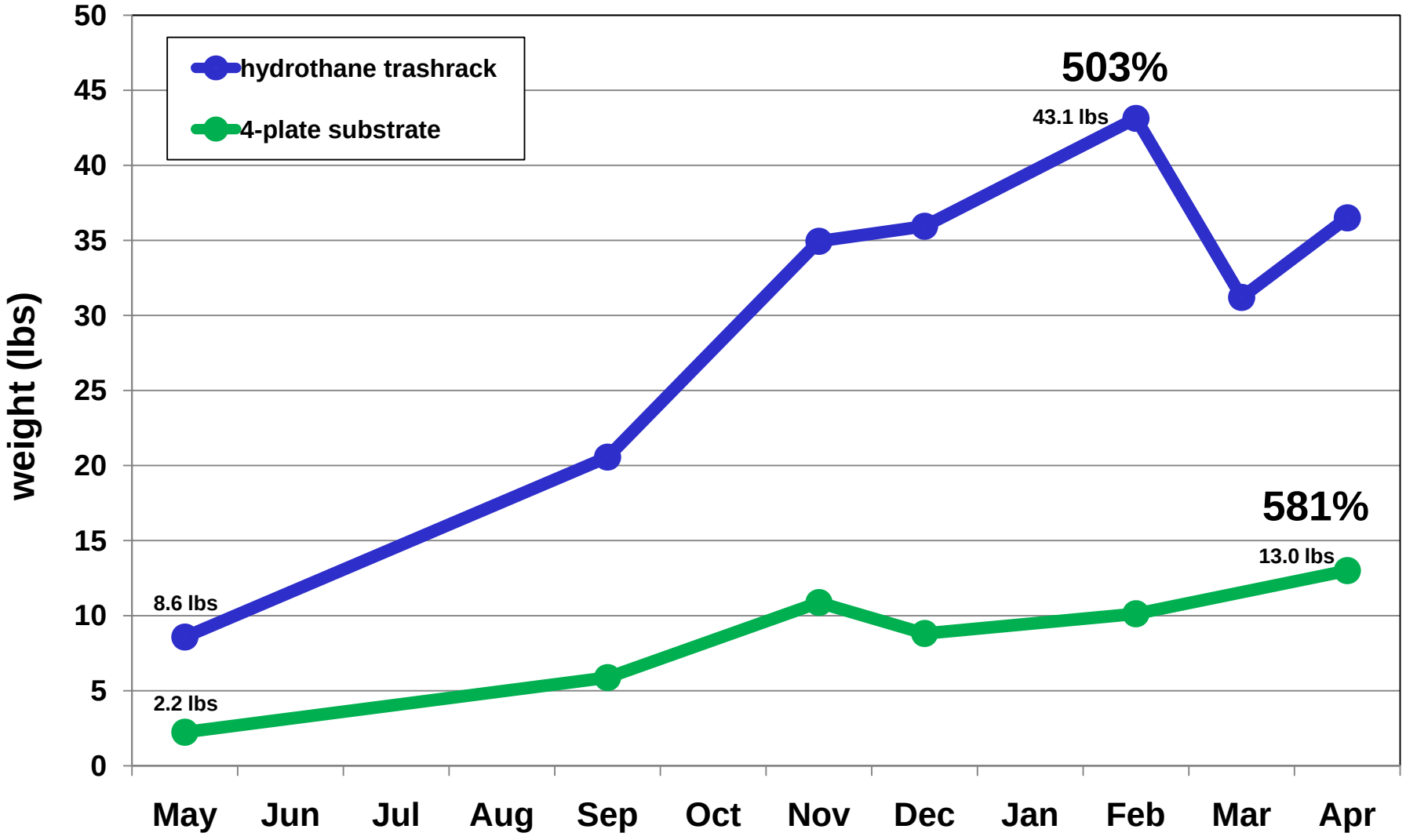
Weight of Biofouling on Structures

Plastic Trash Rack

Hydrothane HDPE

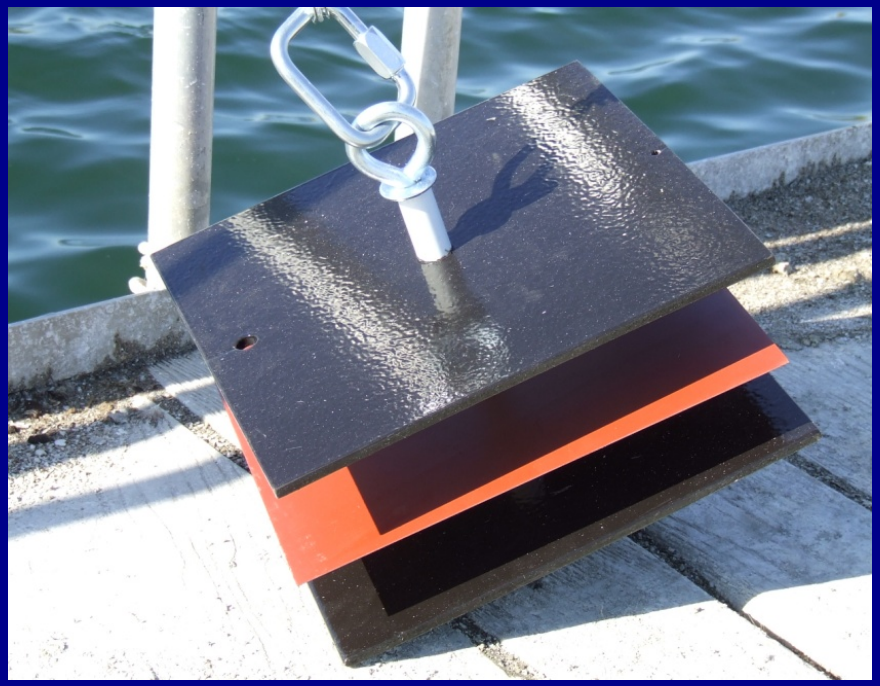


Weight of Biofouling



Coatings Trials

- Fuji Film - silicone-based duplex fouling release
- AquaLastic - polyurea, nano-composite, glass additive
- LuminOre – copper-based
- Sealife ZMp - proprietary
- Intersleek 900 – silicone-based Fluoropolymer foul release
- Chesterton - high solids epoxy
- NSP 120 - high solids epoxy
- Copper pipe
- Galvanized pipe



Acknowledgements

Dan Salyers	Kim Flaherty	Bill Taylor
Brian Schreier	Alicia Seesholtz	Laura Young
Heather Fuller	Ernesto Jimenez	Megan Gunvalson
Nicole Darby	Dave Meraz	Carl Dealy
Brianne Noble	Dale Kolke	Dave Robinson
Jodi Evans	Dean Messer	Mark Watson

San Benito County Water District

US Bureau of Reclamation – Mid-Pacific Region

CA Dept Fish and Game