

**Preventing the Spread of  
New Zealand Mudsnails  
(*Potamopyrgus antipodarum*)**

Brian Finlayson

California Department of Fish and Game

# NZMS

## General Biology

- Gastropod order prosobranchia (lungless snails)
- Parthenogenetic (clonal) livebearer
- Length 5-6 mm
- Calcified operculum – tight seal
  - 50% survival 25 d in damp media
  - Survive w/o water > several hours
- High reproductive potential
  - 120 embryos/brood pouch
  - 230 juveniles/snail/year
  - 50k individuals/m<sup>2</sup>
- NZ pop male/female – generally female in North America

# NZMS

## Environmental Controls

- Cosmopolitan habitat requirements
- Spread by ballast water & damp fishing gear
- England (1830) – Germany (1899) – France (1923) – Norway (1957) – Switzerland (1980) – Ukraine (1976)
- Snake Rv, ID (1987) – Lk Ontario, NY (1991) – Madison Rv, MT/WY (1995) – Columbia Rv, OR (1997) – Owens Rv, CA (2000)
- Completion w/ native gastropods (T&E)
- Current (impractical in field) control methods
  - Freezing
  - Desiccation
  - Hot water

# Current NZMS Distribution California



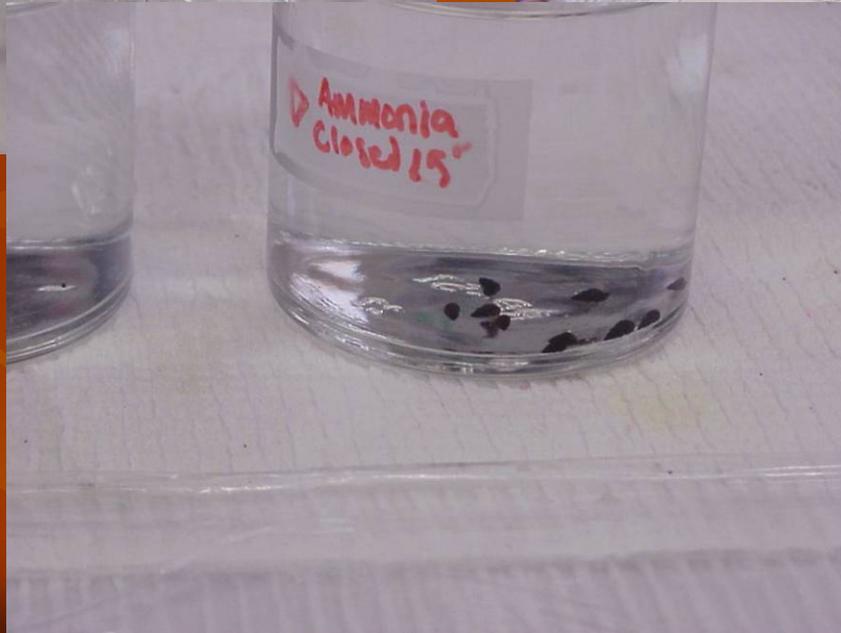
# NZMS



# Preventing the Spread of NZMS San Francisco Bay-Delta Estuary

- ABAG funded study (CALFED)
- 4-Phase Study
  - Compound efficacy in 5 min
  - Compound corrosiveness on gear
  - Field practicality & ease
  - Outreach/education for BMPs
- Cooperative study
  - CDFG researchers
  - USFWS, NCCFFF, CalTrout & TU collaborators
  - Gear from manufacturers
  - Ken Davis and Bob Ford invaluable

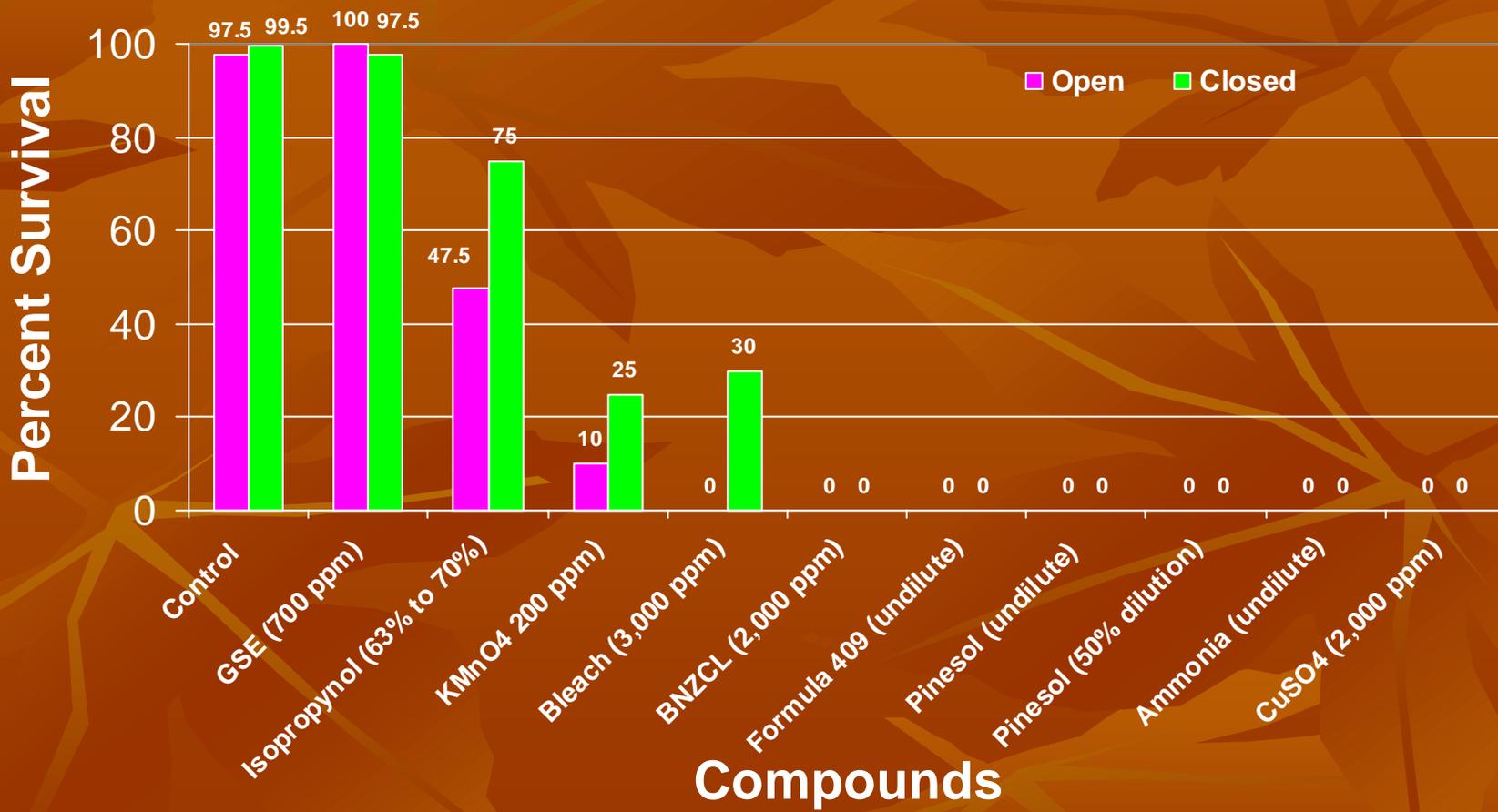
# Phase 1 Laboratory Tests



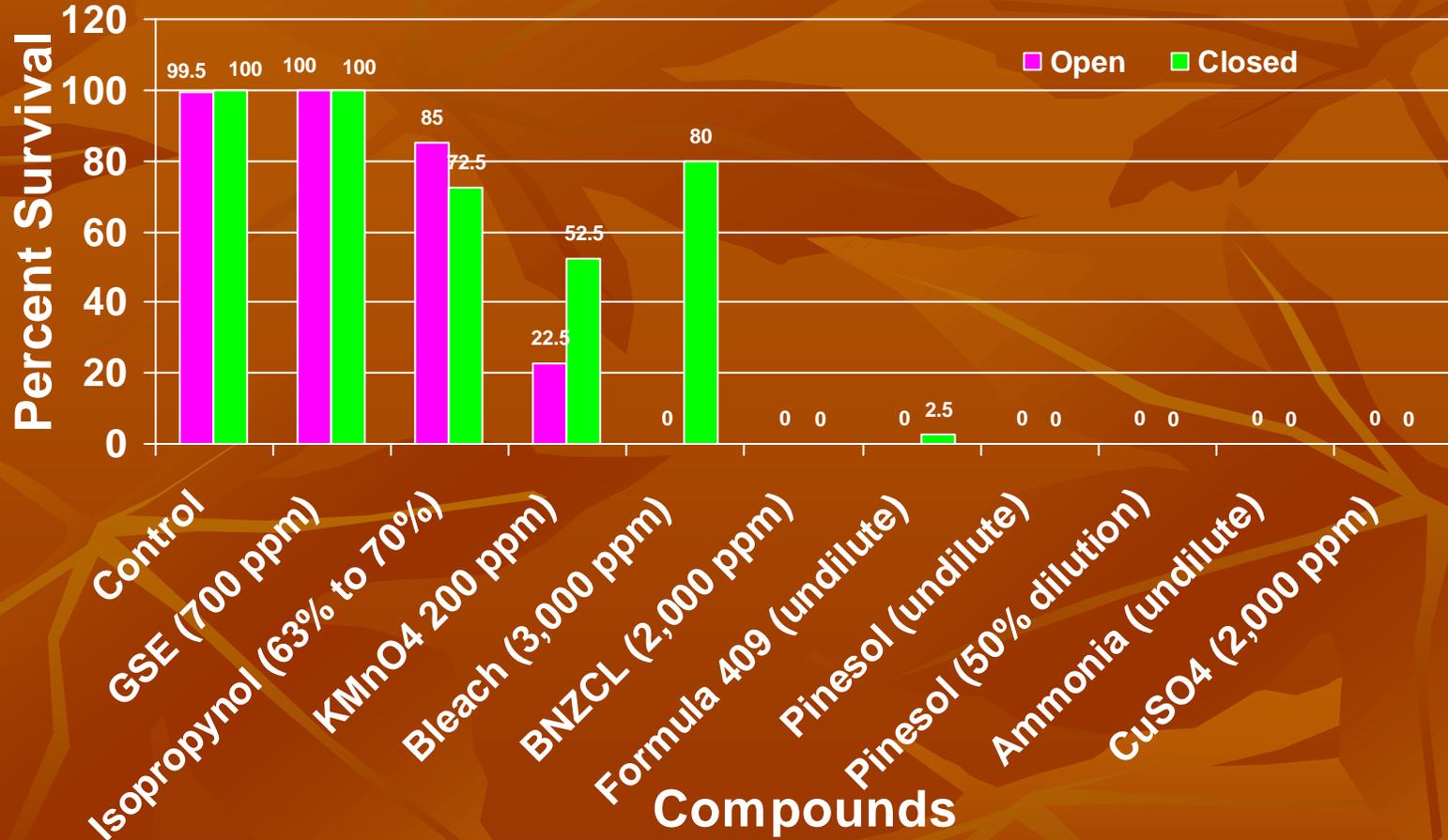
# Efficacy Tests

- 5 & 15 °C temperature
- Opercula open & closed
- 5-min exposure & 48-h recovery
- Compounds (various concentrations)
  - Grapefruit extract (GSE)
  - Isopropyl alcohol
  - Bleach (chlorine)
  - Benzethonium chloride (BZCl)
  - Formula 409<sup>®</sup>
  - Potassium permanganate (KMnO<sub>4</sub>)
  - Pinesol<sup>®</sup>
  - Ammonia
  - Copper sulfate (CuSO<sub>4</sub>)

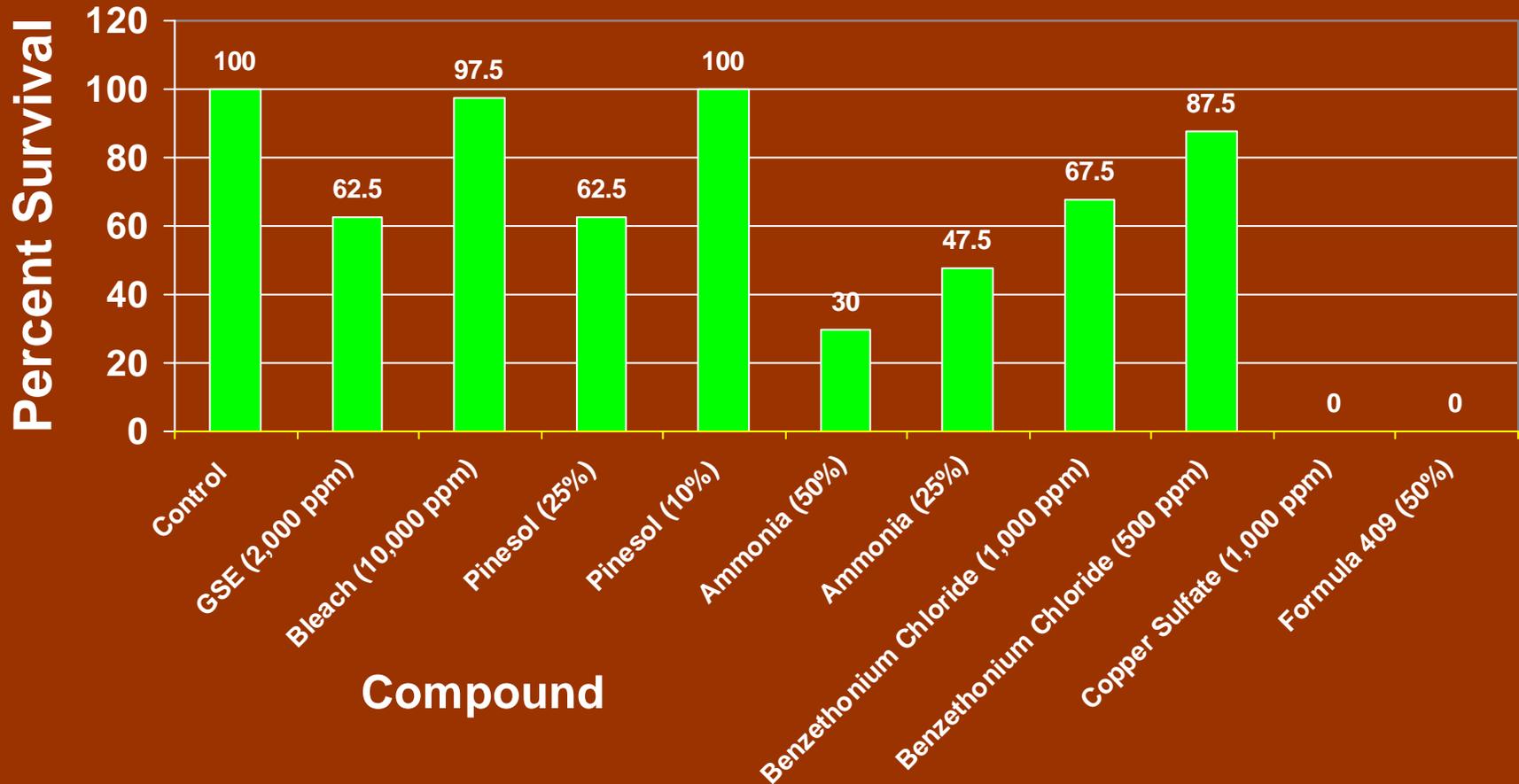
# Results 5 °C



# Results 15 °C



# Results 15 °C



# Phase 1

## Conclusions

- Higher survival w/ operculum closed
- Higher survival @ higher temp
- Operculum is key
- Efficacious solutions:
  - 1,000 ppm  $\text{CuSO}_4$  (252 ppm Cu)
  - 1,940 ppm BZCl
  - 50% Formula 409<sup>®</sup>
  - 50% Pinesol<sup>®</sup>
  - 100% bleach (60,000 NaHOCl)

# Phase 2

## Compound Corrosiveness

- Orvis, Simms & Patagonia waders & boots
- Decontaminant procedure
  - Random assignment
  - One mate was control (water)
  - Other mate immersed in solution for ½ h
  - Rinsed & placed in sunlight for 1 h
- Repeated every other day for 2 wk (7 exposures)
- Pictures & inspection before & after

# Bleach



# Pinsol® & Formula 409®



# BNCL & CuSO<sub>4</sub>



# Phase 2 Conclusions

## Efficacious & Noncorrosive

- $\text{CuSO}_4$  (252 ppm CU)
- BNC1 (1,954 ppm)
- Formula 409<sup>®</sup> (50 %)

# Phase 3 Field Testing Putah Creek



Photos by Ken Davis

# Phase 3

## Field Tests

- 5-min exposure @ Putah Creek
  - Tub immersion
  - Dry sack
  - Spray ( $\text{CuSO}_4$  only)
  - Water rinse
  - Water rinse & scrub (if substrate remained)
  - Filter solution & rinse water
  - Inspect snails @ laboratory

# Phase 3 Field Studies

## Putah Creek



# Phase 3 Field Testing



Photo by Ken Davis



Photo by Joe Ferreira



# Conclusions

- 5-min exposures efficacious
  - $\text{CuSO}_4$  (252 ppm CU)
  - BNCL (1,954ppm)
  - Formula 409<sup>®</sup> (50 %)\*
- Submerged in tub
- Dry sac
- $\text{CuSO}_4$  (252 ppm Cu) spray

# Outreach/Education for BMPs



**IF YOU FIND MUDSNAILS**

If you suspect you have found mudsnails, collect 5 to 10 individuals and place them in a plastic bag into which you have sprinkled water. Check against the simple traits above and on the Web page below to confirm identification.  
<http://www.esg.montana.edu/aim/mollusca/nzms>

Please save the samples and contact the Oregon Invasive Species Council (1-866-INVADER) and one of these specialists:

**Sam Chan**  
Oregon State University  
Oregon Sea Grant Extension  
[samuel.chan@oregonstate.edu](mailto:samuel.chan@oregonstate.edu)

**Robyn Draheim**  
Center for Lakes and Reservoirs  
Portland State University  
[draheim@pdx.edu](mailto:draheim@pdx.edu)

**Paul Heimowitz**  
U.S. Fish and Wildlife Service  
[Paul\\_Heimowitz@fws.gov](mailto:Paul_Heimowitz@fws.gov)

**Sherri L. Johnson**  
PNW Research Station  
USDA Forest Service  
[johnsons@slorst.edu](mailto:johnsons@slorst.edu)

To order copies, call 1-800-375-9360,  
or write [sea.grant.communications@oregonstate.edu](mailto:sea.grant.communications@oregonstate.edu)  
You can download a pdf of this brochure at  
<http://seagrant.oregonstate.edu/sgpubs/onlinepubs.html>

**NEW ZEALAND MUDSNAILS**

**HOW TO PREVENT  
THE SPREAD OF NEW ZEALAND  
MUDSNAILS THROUGH FIELD GEAR**

*This brochure is intended for researchers, monitoring crews, watershed survey groups, and anyone else who travels frequently between aquatic or riparian locations. It is intended to be used as a guide to currently accepted methods for treating field gear to prevent the spread of New Zealand mudsnails.*

June 2006

Design by Stefania M. Peda Lima.  
Cover photos: top three photos by D.L. Grist; bottom two photos by Jaina and Michae Lur.

01810506000

Copyright 2006 by Oregon State University | Published by Oregon Sea Grant

# Norwegian Decontamination Station

## *Gyrodactylus salaris*



# Future Work

- **Collaborating w/ USGS, USDA & MFW&P**
  - **Man-made water delivery systems**
- **SCWA – Putah South Canal**
  - **Copper sulfate**
  - **Bayluscide (EC formulation)**
  - **Potassium permanganate**
  - **Potassium chloride (synergist)**