# Delta Smelt Enclosures:

First Deployment Findings & Work in Progress

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## May 2017 Delta Smelt Reinforcement Workshop



#### Delta Smelt Culture Program: from Experiments to Reinforcement

by California-Nevada Chapter of the American Fisheries Society

- Participants from CDWR, UC Davis, CDFW, USBR Cramer Fish Sciences, USFWS, and AFS Cal-Neva
- "How can cultured Delta Smelt be more broadly used to support species recovery?"
- Day 1: invited speakers and presentations
- Day 2: discussion, identify knowledge gaps

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#### RESEARCH

#### Considerations for the Use of Captive-Reared Delta Smelt for Species Recovery and Research

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#### ABSTRA

An extreme decline in Delm Study (Mypowerus reacopur(frant) abundance has led to a number of management actions to support this endangered species, including the development and refinement of enhance techniques and the creation of a refug-

egulation. The wild Delta Smelt population has diminished to the point that many in the scientific using cultured fish needs to be experimentally evaluated as a possible management tool. Concern about supplementation include the effectiveness of this action, and its patential to direct attention and funding from other needed management actions such of a 2 day workshop that described the current refus population, and identified key touce for potential stare use of cultured Delta Smelt for assurch and commutement. Expanded use of cultured Debt for complexities that include legal constraints and permitting requirements. Developing policies that allow for in situ experiments using cultured Belta Smalt appears to be a precursor for advancing. elicies that might allow supplementation actions Releases of entired fish, either experimentally or a a management action, clearly need to be conducted of his an adaptive management program that is integrated with other strategies, including hubitat restoration. We describe a general framework for valuating the potential risks of supplementation and include suggestions for how to reduce risks and baseline information about Delta Smelt and the existing culture pragram to proceed with targeted ickl research that utilizes cultured fish. Finally, give the dire status of this species, we conclude that rapid practices toward the development of a viable and

# Knowledge Gap: Response of Delta Smelt to Enclosures

- Design Delta Smelt cages for future field studies, evaluation of management actions, and possible soft release using cultured fish
- Other Identified Knowledge Gaps
  - Create Hatchery and Genetic Management Plan
  - Understand hatchery domestication effects
  - Develop hatching frames for egg release
  - Identify optimal physical tagging method
  - Pathogen screening of cultured and wild Delta Smelt
  - Outreach and environmental education

### **Experimental Questions**

- Can cultured Delta Smelt survive under field conditions?
- Does survival or growth differ among cage prototypes?
- Differential survival with location?
- Critical information about cages: durability, biofouling, fish escape, prey entry
- To maximize benefits of study, other parallel studies
  - eDNA (Genomic Variation Lab at UC Davis & DWR)
  - Pathogen screening (R. Connon Lab at UC Davis)

## Design & Laboratory Testing of Delta Smelt Cages

- Laboratory testing (materials, mesh porosity size, food availability, spatial usage, behavior)
- Designed 3 prototypes; each with 3' diameter & 4' tall
- Leads: Dennis Cocherell & Nann Fangue (UC Davis)

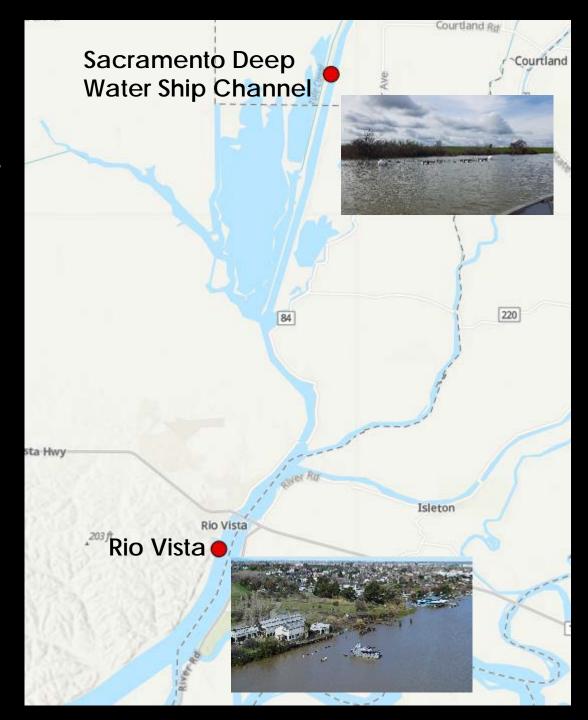


## Field Testing

2 sites; 4 week deployment/site





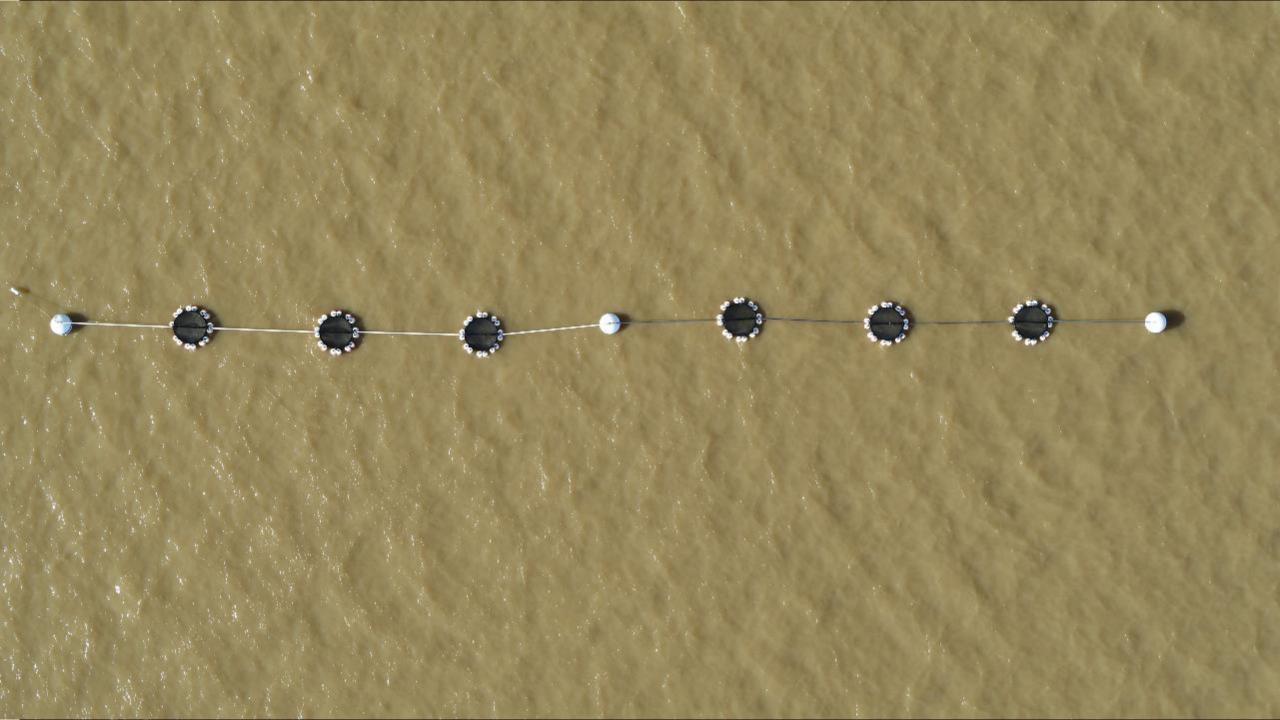


← Army Base/upstream

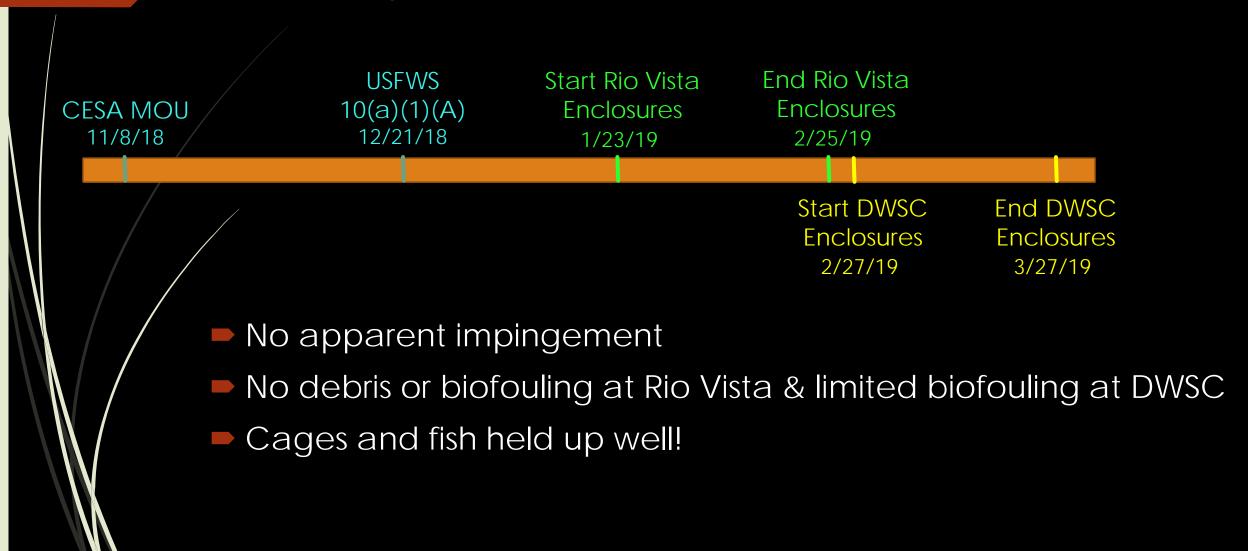
#### Rio Vista Deployment

В Α Perforated steel with 5/32" Perforated steel with 1/8" Perforated steel with 1/8" Perforated steel with 5/32" Perforated steel with 5/32" Perforated steel with 5/32" HOLES ON 3/16" HOLES ON 3/16" Centers HOLES ON 3/16" Centers HOLES ON 3/16" Centers HOLES ON 3/16" HOLES ON 3/16" Centers Centers (63% openness) (41% openness) (41% openness) (41% openness) + wrap Centers (63% openness) (41% openness) + wrap Set #1 Set #2

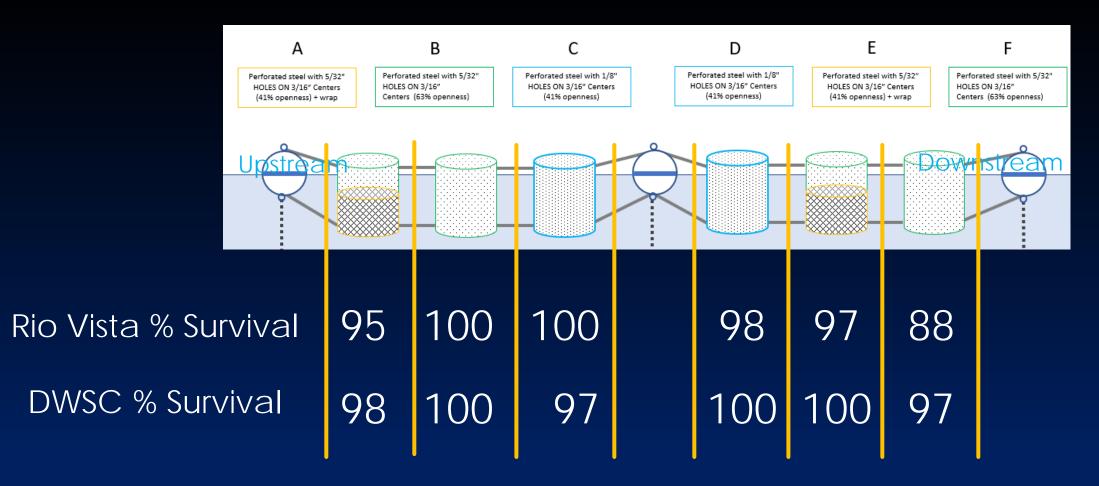




## First Deployment Timeline & Some Observations



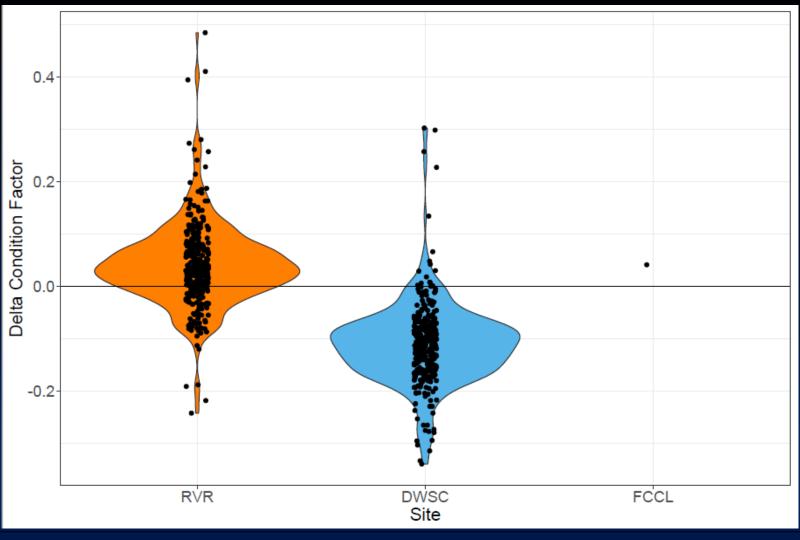
# Very High Cage Survival



~98% survival across cage types and sites

# Condition Factor (Fish Health)

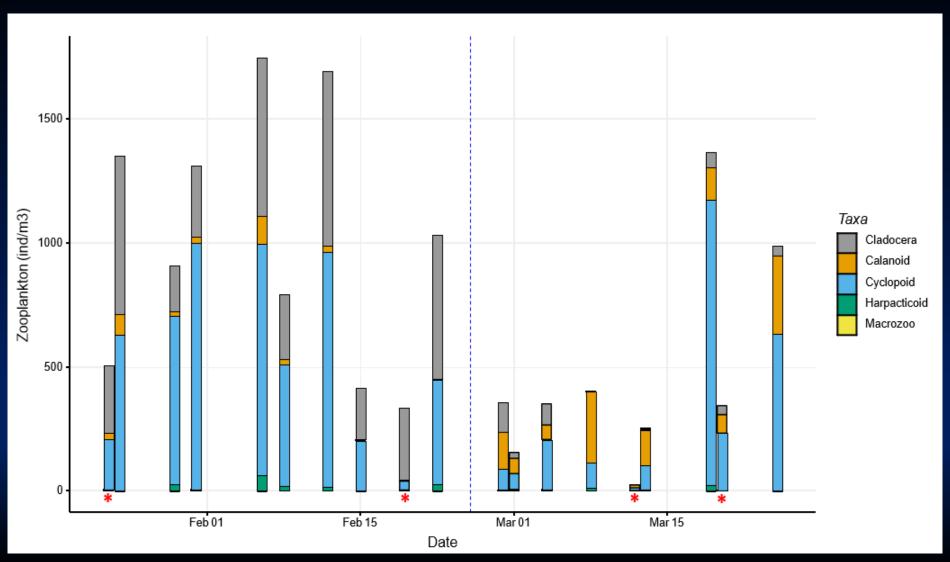
Condition
Factor
Change
(from start to end of study)



Similar weight:length ratios = no decline in general fish health

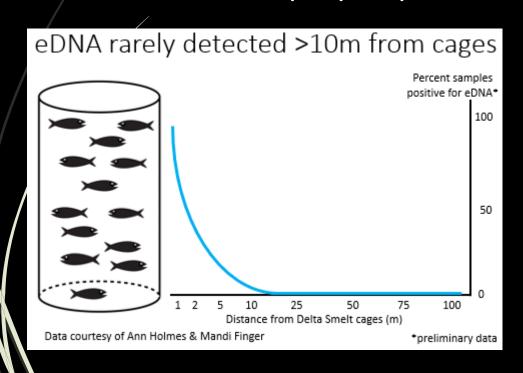
# Zooplankton abundance near cages

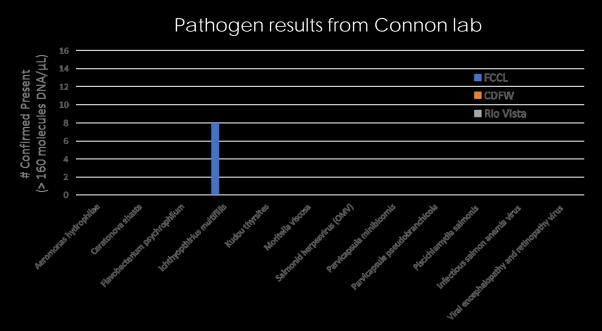




## Wrapping Up First Round of Deployments

- Results from additional studies: eDNA & disease
- Gut content analysis forthcoming
- Manuscript preparation





## Current Deployments Underway

- Primary Goal
  - Test enclosures in different seasons & locations to provide information about the potential limits of their utility
- Secondary Goal
  - Evaluate potential effects of water management actions on Delta Smelt in enclosures
    - Suisun Marsh Salinity Control Gate Action
    - North Delta Food Web Action
    - ► Fall X2 Action

# Study General Timeline

Approved Permits CDFW CESA MOU 7/19/19 USFWS 10(a)(1)(A) 7/24/19 IACUC 7/24/19

Start Summer End Summer Enclosures 7/29/19

Enclosures 8/28/19

Start Fall Enclosures 10/9/19

**End Fall Enclosures** 11/7/19

### Summer

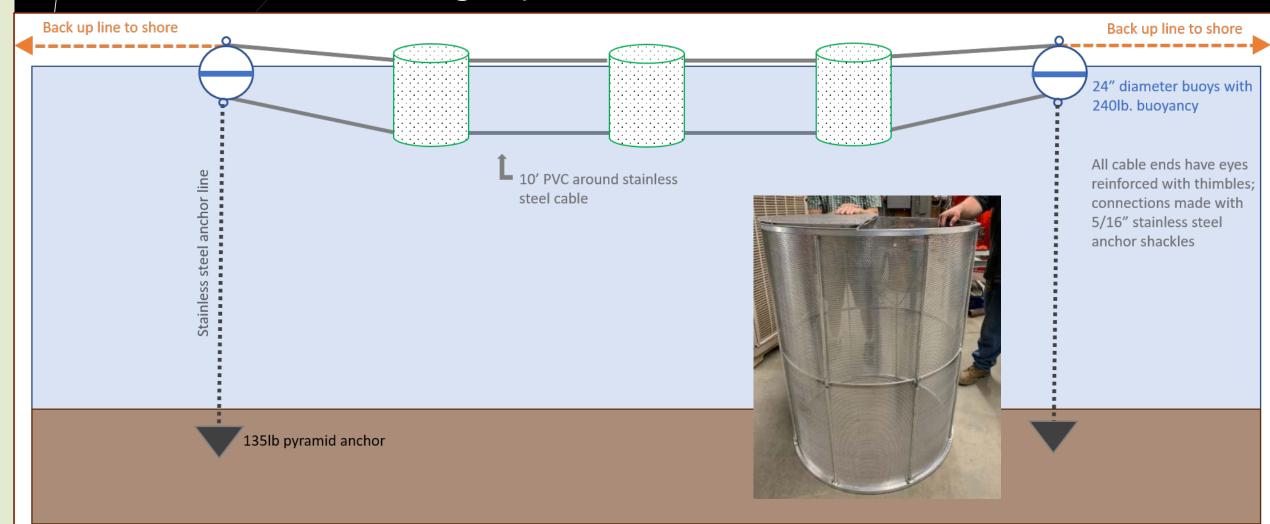
Yolo Bypass (retrieved 8/19) & Rio Vista (retrieved 8/28)

#### Fall

Rio Vista & Suisun: 10/9 deployment & 11/6 retrieval Yolo: 10/10 deployment & 11/7 retrieval

# Cage Configuration

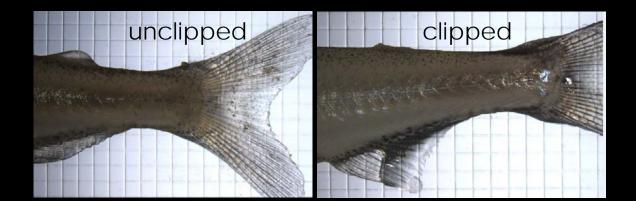
3 identical cages per site



# Preparation & Preconditioning at FCCL

- Converted from dry feed to Artemia
- Adipose clipped to mark since too small for VIA tag
- Temperature acclimation to 18.5 C to increase survival in higher temps of Delta

Convert to Artemia 7/1 Raise Temp Transfer to Field 7/10 7/19 7/29 & 7/30

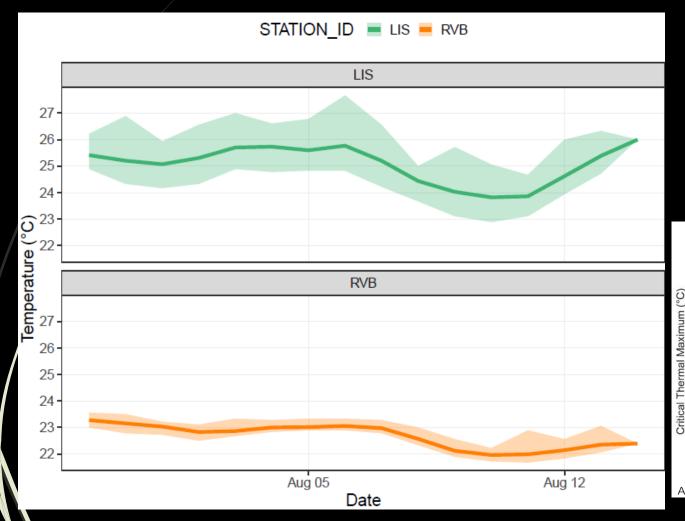


# Cage Monitoring Activities

- Signs of cage damage
- Delta Smelt mortality
- Biofouling/cage scrubbing
- Environmental monitoring
  - Nearby continuous monitoring stations (15-min intervals)
    - Weekly checks with handheld YSI
  - Velocity
    - Handheld Hach FH950 & continuous monitoring stations
  - Weekly Zooplankton tows (50 um mesh)
  - Contaminants (Teh lab; October)

Post-mortem fish data collection & analysis will occur similarly to last deployments

# Preliminary: Good Survival Despite Temperatures Repeatedly Nearing Reported Thermal Tolerance

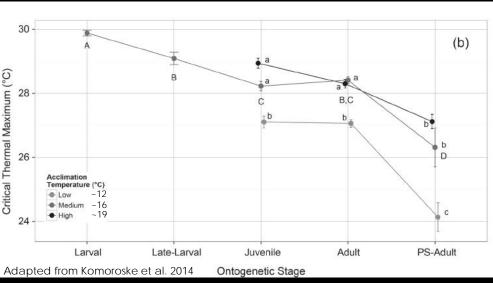


#### Confirmed Mortalities as of 8/16/19

Yolo Bypass: 3 out of 60

- 6 other morts likely on cage bottom

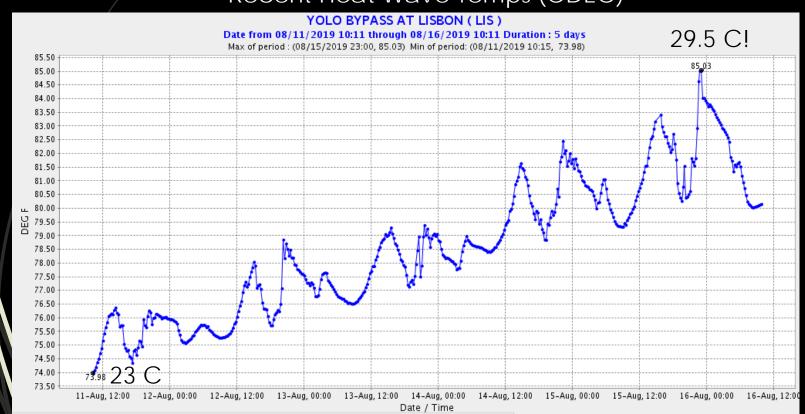
Rio Vista: 2 out of 180



# Field Testing of Thermal Limits (CT<sub>max</sub>)

Do hatchery Delta Smelt have greater thermal plasticity than previously thought?

Recent Heat Wave Temps (CDEC)



 $CT_{max}$  = ~30 C for FCCL Delta Smelt acclimated to 20 C (Davis et al. 2019)

How high can they go?



# Preparing for Future Work

- Use in conjunction with management actions (e.g. flow-related & wetland restoration)
- Field testing of temperature tolerance
- Pilot test new enclosures for rearing earlier life stages
- Concept designs & testing of enclosures for larger #s

# Questions?

