

Effects of Temperature on Incubation Period, Hatching Success and Conditions of Delta Smelt Eggs



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BACKGROUND

- Delta Smelt (*Hypomesus transpacificus*) is an endangered indicator species endemic to the San Francisco Estuary



Figure 1: Map of the San Francisco Estuary. Source: sfestuary.org

- Impacts of climate change and human activities have altered the abundance of Delta Smelt

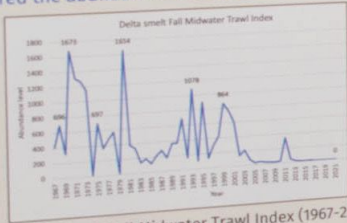


Figure 2. Delta smelt Fall Midwater Trawl Index (1967-2021). Source: CDFW

- Delta Smelt has specific habitat requirements including temperature, pH level, and salinity

Temperature (°C)	12 - 16.9°C
pH level	7.5 - 8.2
Salinity (ppt)	1.0 - 7.0 ppt

Figure 3. Delta Smelt Handbook, University of California, Davis.

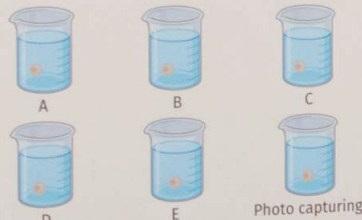
- The objective of this study is to investigate the physiological tolerance of Delta Smelt embryos to different temperatures by incubating embryos at four different temperatures (10°C, 14°C, 18°C, and 20°C) and to determine hatching success and conditions of larvae

HYPOTHESIS

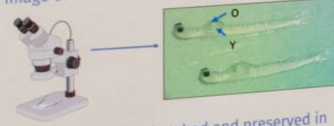
We hypothesize that hatching success and conditions of embryos treated at higher temperatures will be lower than embryos treated at lower temperatures.

METHODS

- 4 Treatments: 10°C, 14°C, 18°C, and 20°C
- 5 replicates of 10 embryos per replicate beaker: Beaker A, B, C, D, E
- One beaker of 20 embryos for each treatments to determine daily embryonic development



- We took one embryo from the photo capturing beaker for each treatment and captured an image of the embryo under a microscope daily



- Euthanize fish once hatched and preserved in 10% buffered formalin for examination under microscope

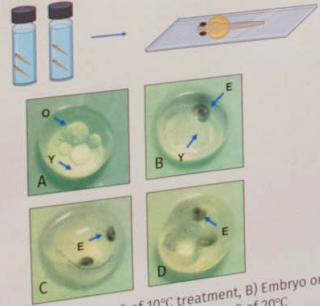


Fig-4. A) Embryo at day 3 of 10°C treatment, B) Embryo at day 5 of 20°C treatment, C) Embryo at day 3 of 10°C treatment, and D) Embryo at day 9 of 14°C treatment. O= oil globule, Y= yolk sac, E= eye

RESULTS

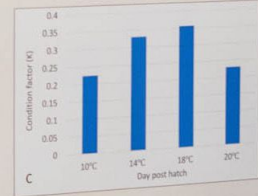
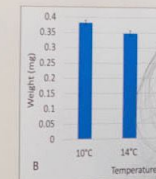
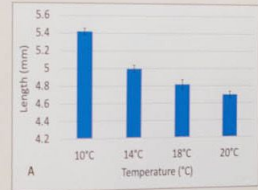


Fig-5. A&B) Length (L) and Weight (W) of Delta Smelt at 0 day post hatch (DPH), C) Condition factor (K) of Delta Smelt 0 DPH, and D) Area of yolk sac of Delta Smelt at 0 DPH

- Water temperature had a significant negative influence on body length (ANOVA, $F_{3, 227} = 14.1, P < 0.0001$; Fig-B) of 0 DPH Delta Smelt larvae
- Water temperature had a significant influence on condition factor (ANOVA, $F_{3, 43} = 2.44, P = 0.0771$; Fig-D) of 0 DPH Delta Smelt larvae

DISCUSSION

- Null hypothesis was mostly rejected
- Hatch rate was similar between all treatment with 1-2% difference
- Embryos at 20°C hatched earliest, with 10°C last
- Hatched embryos developed best at 10°C (length and weight)
- Condition factor and area of yolk sac was at highest between 14°C and 18°C
- Thus, there appears to be a trade-off between size and time to hatch, where larvae hatch slowest at the coldest temperature, but are more robust when they do hatch

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Background

Common bean, cowpea, and tepary bean are important grain legumes that provide staple sustenance for millions of people in the world including the United States, sub-Saharan Africa, and Asia. Due to climate change and food scarcity, it is essential to accelerate improvement and food security through nutritional quality in breeding and genomic selection. In this study, a cowpea MAGIC (multi-parent generation inter-cross) population (multi-parent inter-specific population and different common bean breeding lines are being used to assess compositional traits under different conditions.

Methods

This study includes a cowpea MAGIC (multi-parent generation inter-cross) population, a multi-parent inter-specific population and different bean breeding lines. The MAGIC population has been growing at the Plant Sciences Center, University of California, Davis, campus since July 2022. Stand count data was collected using an UAV (DJI Phantom 4 Pro) with a multispectral camera.

Image-based segmentation for leaf area was performed using the number of green pixels in a combined total value, and pixels at different thresholds were used to determine the relationship between leaf area and stand count.

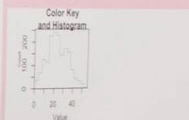


Figure 2 depicts the physical position of the experimental stand counts based on their row and column position and height. The Color Key on the Color Key and Histogram shows the distribution of stand counts across the field.

Take a picture to download my references.

