Experimental evaluation of alternative spawning strategies to produce Delta smelt for supplementation

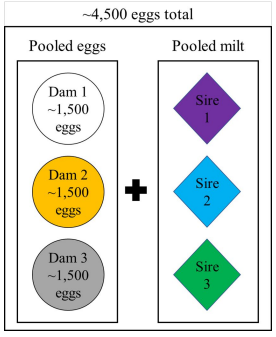
Mary E. Badger[1], Melanie E.F. LaCava[1], Isoline M. Donohue[1], Tien-Chieh Hung[2], Luke Ellison[2], Amanda J. Finger[1], Evan W. Carson[3]

1 Genomic Variation Laboratory, Department of Animal Science, University of California, Davis; 2 Fish Conservation and Culture Laboratory, Department of Biological and Agricultural Engineering, University of California, Davis; 3 U.S. Fish and Wildlife Service

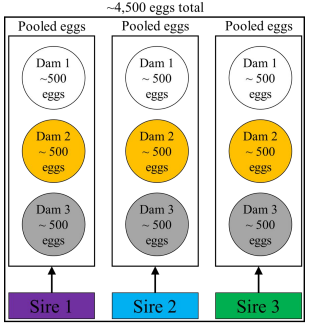
Background

Cultured Delta smelt are used to produce fish for supplementation to avert extinction in the wild. The cultured population, however, is at risk of losing genetic diversity once found in the wild. The Supplementation Strategy thus targets genetic management of increased production of Delta smelt for release.

Pooled Cross Strategy



Factorial Cross Strategy



Methods

We performed captive spawning experiments to assess the effects of two alternative spawning strategies on effective population size (N_e):

1. *Pooled strategy (sperm competition)*: eggs (3 dams) pooled, milt (3 sires) pooled, then gametes admixed for fertilization [4 replicate tanks]
2. *Factorial strategy (no sperm competition)*: eggs (3 dams) admixed & divided (3 bowls). Each bowl received milt from 1 of 3 sires [10 replicate tanks]

For each replicate tank, we subsampled larvae, genotyped and assigned parentage, then estimated variance in reproductive success, family size, and N_e

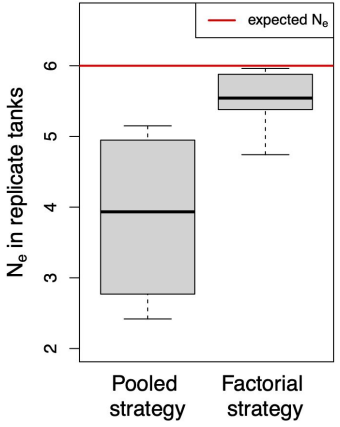
This study was informed by two other studies at the IEP. Use the QR codes to visit them now!

FCCL Methods Poster

Alternative Spawn Poster

Sperm Competition Poster

Results



N_e = genetic effective population size, an important metric derived from combined influences of the number of spawning fish and the evenness of parent contributions to offspring

N_e values below the expected value indicate failed pair crosses and/or uneven contributions among crosses

Release N_e (N_{eR}) = combines N_e of replicate tanks, as when spawns are combined for release into the wild. Relative to the expected (ideal) N_{eR} = 60, the pooled strategy resulted in N_{eR} = 35 and the factorial strategy in N_{eR} = 55

Significance

Short Term: Identification of an alternative spawning strategy that supports production efficiency and genetic management required for large-scale supplementation

Long term: Protection against loss of genetic diversity, increased inbreeding, and reduction in fitness while supporting a sustained population of supplemented Delta Smelt in the wild