Estimating Chinook Salmon Fecundity Using Image Analysis

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1 Introduction

Fecundity estimates of Chinook salmon (*Oncorhynchus tshawytscha*) in the lower San Joaquin River basin are used in escapement survey analyses for river production estimates on each tributary.

Currently, estimates are based on a 1988 gravimetric ovarian skein weight study of 48 female salmon (Trumble et al.).

This project will develop a protocol for counting live salmon eggs to provide more Chinook salmon fecundity data.
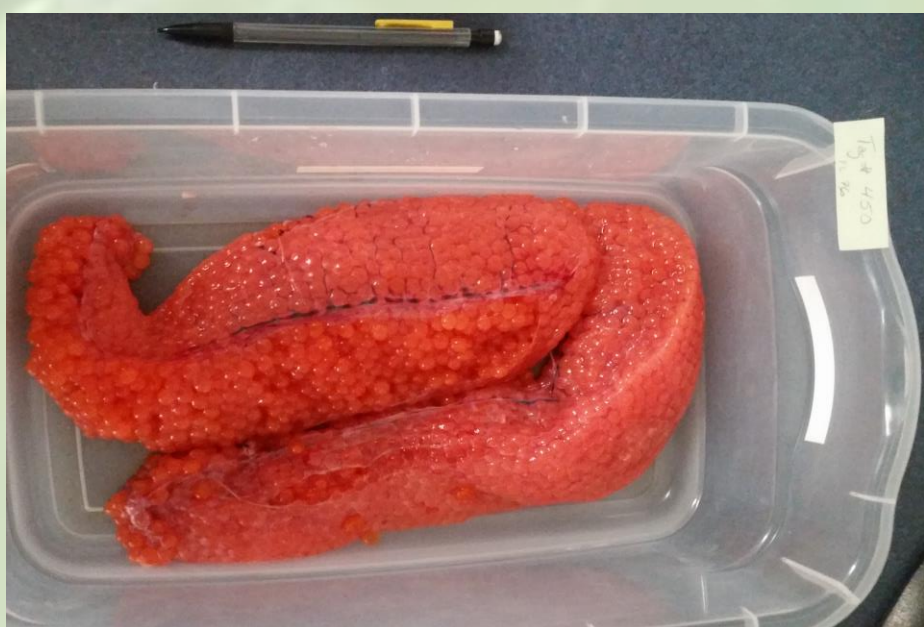
Objective – Provide an accurate, efficient, and safe process for counting live eggs during the spawning process at the Merced River Fish Facility.

2 Methods

Eggs from Chinook females that died in the Merced River Fish Facility trap before spawning, and Rainbow trout (*Oncorhynchus mykiss*) from the Stanislaus River found dead during escapement surveys were used.

The process from the placement of the eggs on the tray to a finished imaged egg count took approximately 1 hour per tray.
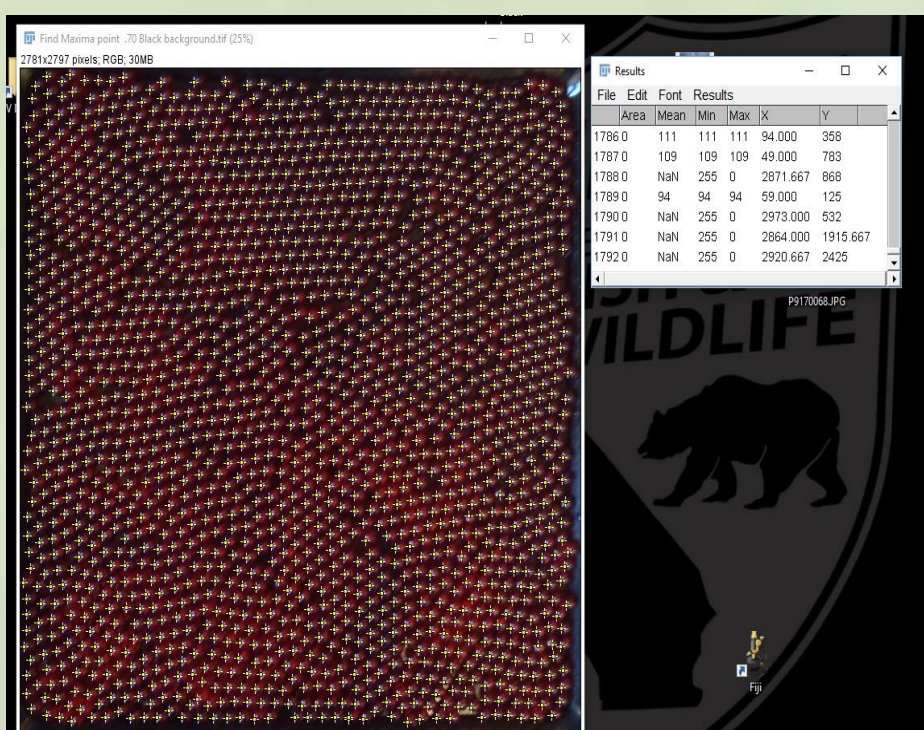
Unripe eggs are manually removed from the ovarian skeins.

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**Eggs are single layered on tray and photographed.**

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Imaged eggs are counted using ImageJ program.

Find Maxima plugin was used to automate a partial count of the eggs in each photo. The rest were manually counted. The eggs in each photo were manually recounted using the Cell Counter plugin to check the accuracy.

3 Results

Eggs from five Chinook salmon and two Rainbow trout were counted using images. Other data collected:
- Fork length
- Scale sample for aging
- Date of collection
- Location
- 5 mm grid in each image for egg measurements
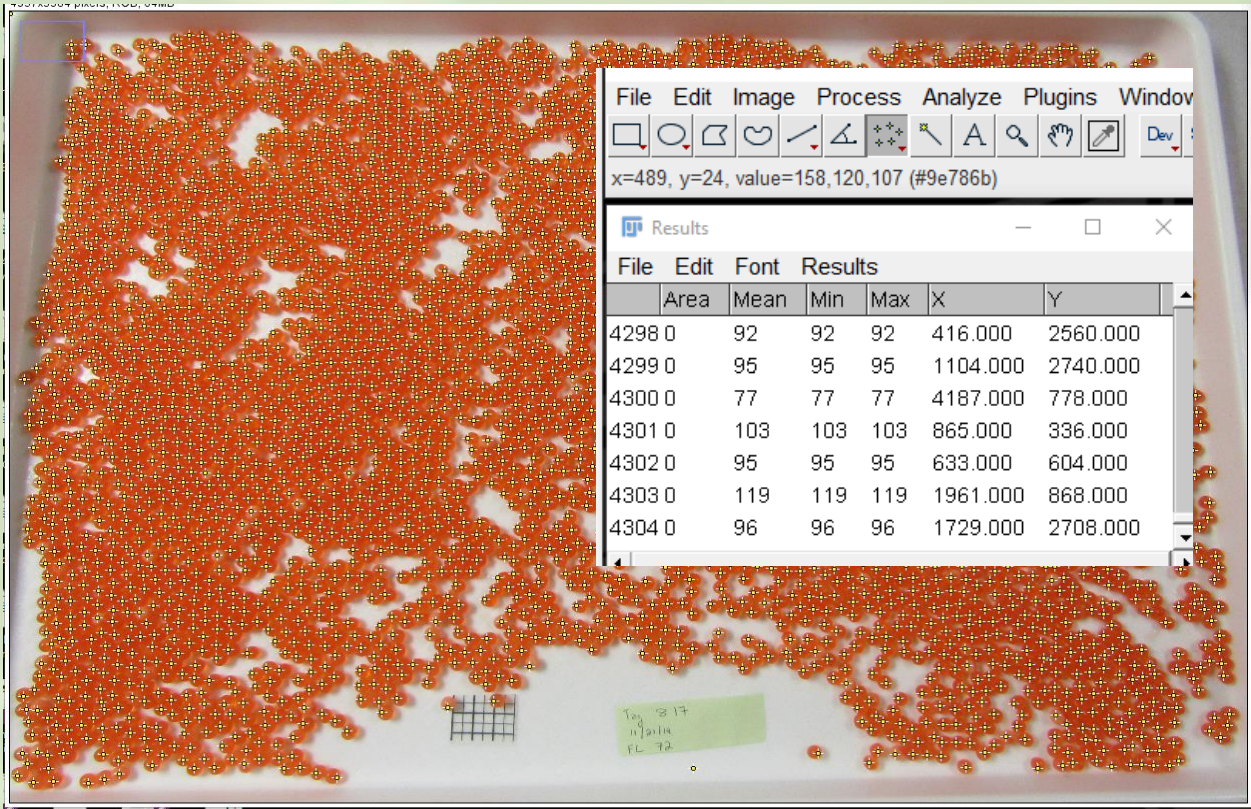
Fecundity can be compared with length and age. Fecundity trends can be studied, as well as egg size measurement data.

Date Sample Received	Location	Species	Tag #	FL (cm)	Image Count
12/11/2018	Stanislaus River	ST/RBT	1825	49	2676
11/4/2019	Stanislaus River	ST/RBT	1839	49	1553
10/21/2019	MRFF	CHN	46	80	5432
11/7/2019	MRFF	CHN	450	76	4471
11/12/2019	MRFF	CHN	645	63	3421
11/18/2019	MRFF	CHN	745	84	5476
11/21/2019	MRFF	CHN	817	72	4303

4 Discussion

➢ 1st goal - apply protocol at the Merced River Fish Facility on live eggs from every fall-run Chinook female spawned.

➢ 2nd goal - fully automate counting process using ImageJ Trainable Weka plugin and recordable macro.

➢ Currently two options:
- Automate partial count and complete manually - best option as it requires least amount of time.
- Manually count each egg in the photo – slow, but best option if image is blurry or dark.
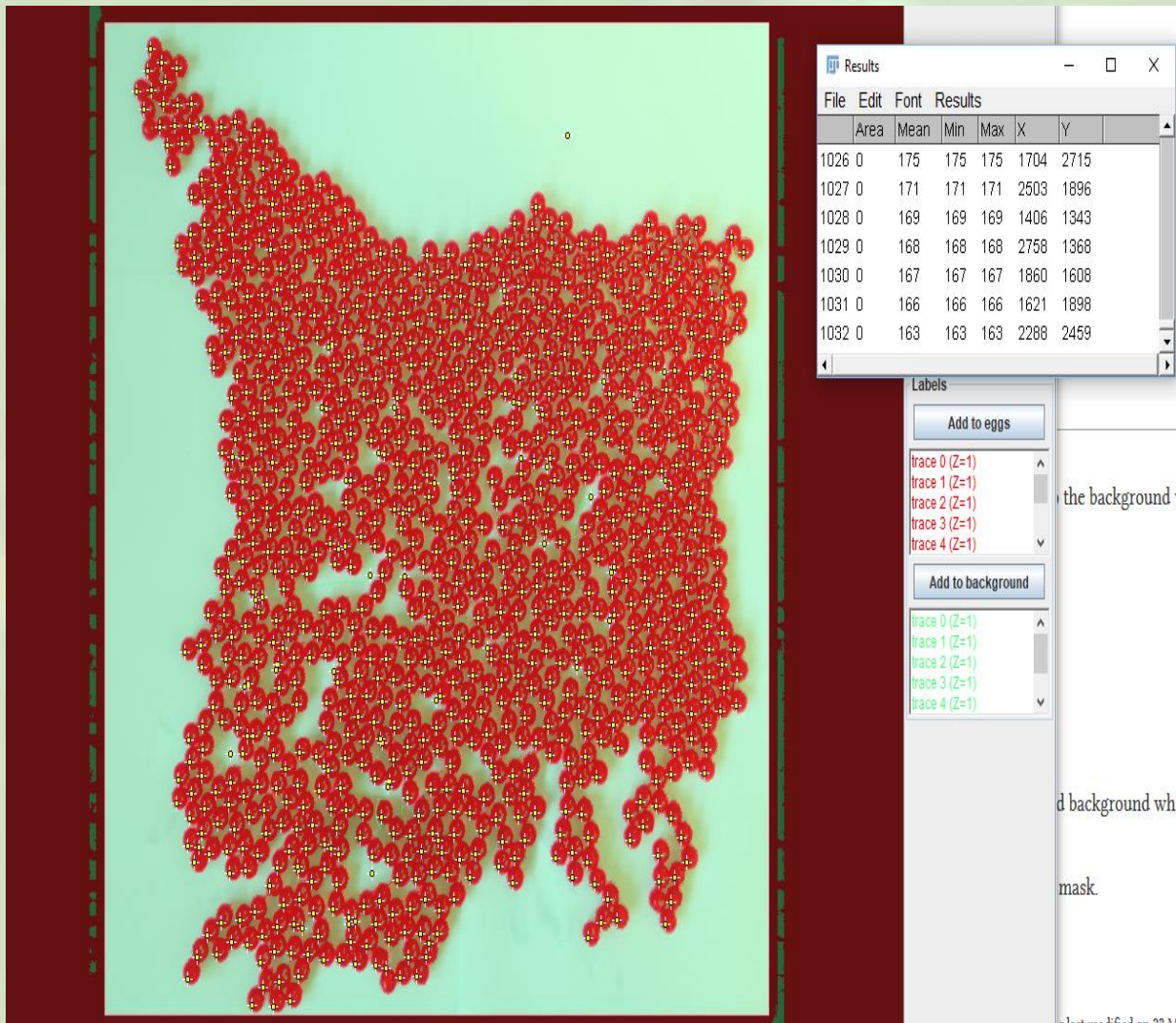
Partially automated count using FIJI Trainable Weka Plugin
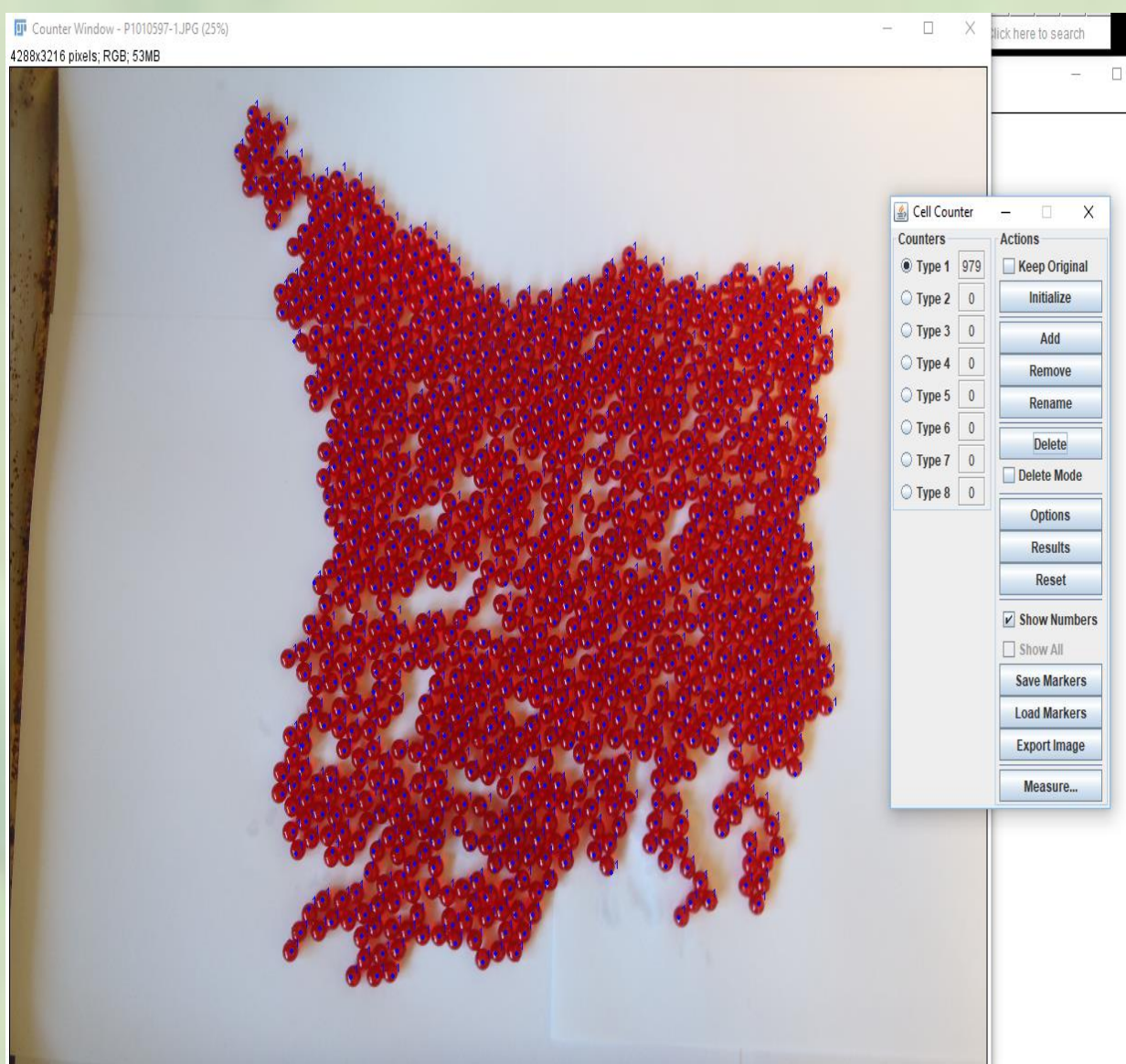
Manual count using FIJI Cell Counter Plugin

Management Implication - Provides an inexpensive technique for acquiring broader knowledge of Chinook salmon fecundity in the San Joaquin basin using eggs from female fish being spawned at a hatchery.

Reference
Trumble, S., Chadwick, C., Loudermilk, W. 1988. Draft Report