Caught Redd-handed: Using Statistics to Differentiate Redd Species Identity

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BACKGROUND

- Chinook Salmon, steelhead, and Pacific Lamprey all construct redds on the Lower American River (Figure 1).
- Historically, redds encountered during spawning surveys were identified to species based on the time of year and professional judgement.
- Due to overlap in the spawning seasons and similar redd dimensions, there is potential to misidentify the species that built the redd…

How can we improve the accuracy of our redd identification method?

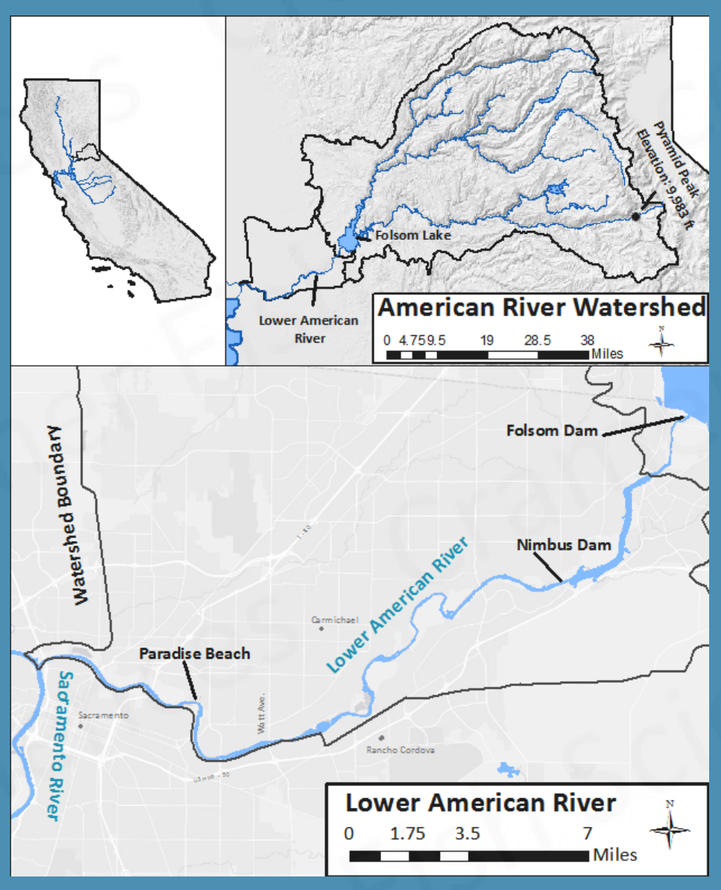

Figure 1. The American River watershed and associated Lower American River.

METHODS

- During spawning surveys, we collected data with the intention of running it through a discriminant function analysis (DFA).

- When a redd was observed during surveys we recorded the date of observation, physical measurements, and a depth and velocity profile (Figure 2).

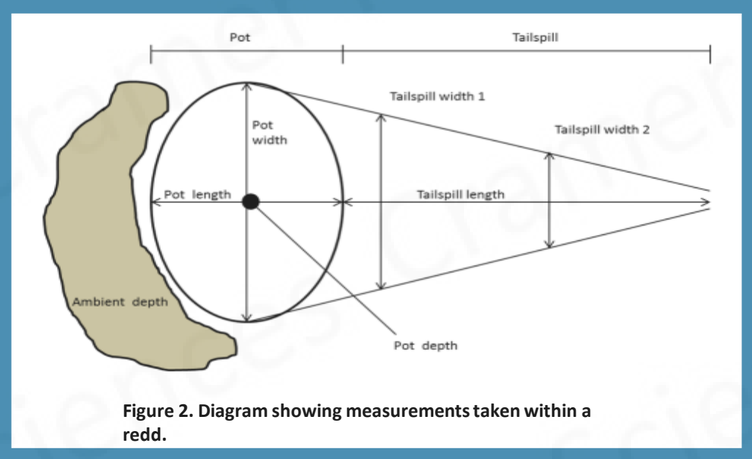

Figure 2. Diagram showing measurements taken within a redd.

- The data from redds still occupied by an identified fish were used to inform the model, which was then used to assign a species identity to unoccupied redds.

A discriminant function analysis (DFA) is used to determine which variables discriminate between two or more naturally occurring groups.

RESULTS

- After testing the DFA model against those with known identities, we found that it is capable of correctly identifying the redd species!
  - 98.6% accuracy for Chinook Salmon
  - 94% accuracy for steelhead
  - 82.2% accuracy for Pacific Lamprey

SUCCESS!

- With the results of the DFA, we can create a redd identification profile based on the average values of physical measurements, depth/velocity, and seasonal timing (Fig 3).
- The DFA show that seasonal timing (date) and velocity are the two most powerful predictors in redd species identification.

0.44 m/s velocity

10.2 cm pot depth

200.7 cm tailspill

87.1 x 87.6 cm pot

0.45 m/s velocity

11.2 cm pot depth

166.3 cm tailspill

90.5 x 91.2 cm pot

0.59 m/s velocity

9.4 cm pot depth

56.6 cm tailspill

47.9 x 49 cm pot

DISCUSSION

- The DFA's predictive power can be strengthened each year by incorporating future data when spawning fish are observed.
- With this tool, anybody who is capable of measuring redd dimensions can identify it to species correctly (including field technicians with limited experience).
- Currently the DFA is weakest at identifying Pacific Lamprey redds at 82.2% accuracy. This is due to the more limited sample size of n = 41 (as opposed to Chinook n = 142 and steelhead n = 249) and can be improved by more data collection.
- Since different species prefer different substrate sizes in their redd construction, it is likely that the DFA's predictive power can be further improved by more precise substrate data collection.
- <u>FUTURE DIRECTION</u>: In an effort to further reduce bias and increase the efficiency of the DFA, Cramer Fish Sciences is experimenting with more precise and efficient substrate data collection techniques using videography and automated image analysis.

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