Comparing Fish Sampling Methods in the Sacramento - San Joaquin Delta

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Introduction

The Lodi Fish and Wildlife Office (LFWO) Delta Juvenile Fish Monitoring Program (DJFMP) is a long-term fish monitoring program that uses a variety of gear types to capture salmonids and co-occurring fish species in both pelagic and littoral habitats of the Sacramento and San Joaquin Delta. The DJFMP deploys two methods for sampling these littoral habitats. Beach seines (Figure 1) are often used to sample unobstructed shorelines (boat ramps, exposed shorelines, etc.) while boat electrofishing (Figure 2) allows for sampling of more obstructed areas (dense vegetation, banks, and undercuts). Centrarchids have had a growing success establishing themselves as an invasive species within the Delta, but primarily occupy these more difficult to reach vegetated areas that are often inaccessible with beach seines. Salmonids are historically the focal point of these monitoring studies, but here we attempt to similarly evaluate a group of fishes that does not generally occupy the same niche. We used data from DJFMP seine and electrofishing surveys in order to compare patterns in centrarchid and salmonid catches between sampling methods.

Methods

Figure 1: DJFMP deploying a beach seine.

Figure 2: Field technicians retrieving stunned fish from an electrofishing boat.

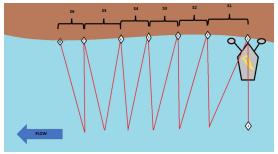

Figure 3: Electrofishing sampling diagram. Multiple approaches along the shoreline constitute one sample.

Data were obtained from open access datasets published in the Environmental Data Initiative for the LFWO DJFMP beach seine and efishing programs. To help limit any differences caused by seasonal changes, data was filtered to only samples obtained within the same years and months of each other. Samples were also sorted by location, with comparisons being made within subregions of the Delta. To be classified as a subregion, an area had to have a minimum of one seine and electrofishing site. For centrarchids, samples were compared from across the Delta, while comparisons of salmonid catch were focused on waterways that traditionally host migrating salmon (Figure 4). Seine sites are fixed stations while electrofishing sites are sampled randomly. Because traditional methods of calculating catch per unit effort (CPUE) for each method are so different, we examined patterns in catch by calculating the proportion of total catch occupied by the fish family of interest (Figure 5a & b). CPUE was calculated and sorted based on location and time of year to create heat maps for the two sampling methods (Figure 6a & b). All data transformations and analyses were performed in R (version 4.1.2).

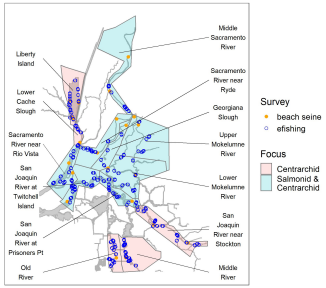

Figure 4: DJFMP sampling subregions

Results and Future Direction

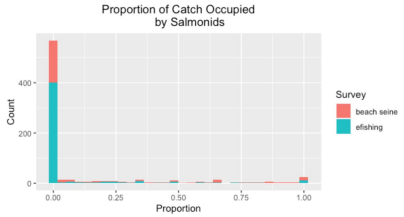

Figure 5a: Electrofishing samples predominantly consist of low proportions of salmonids, while beach seines have a wider range of success.

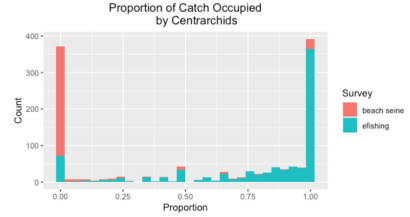

Figure 5b: Most beach seine sites have low catch proportions of centrarchids, while many efishing samples consist solely of centrarchids.

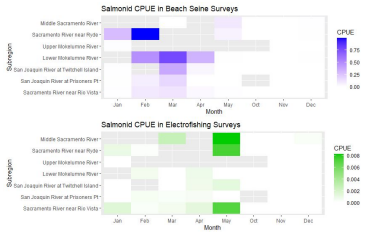

Figure 6a: Beach seines sample greater salmonid CPUE in the late winter months, while electrofishing has sampling success well into late spring months.

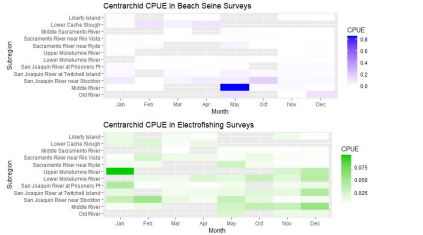

Figure 6b: Beach seines sample relatively low centrarchid CPUE year round, while electrofishing has fairly consistent success throughout the year.

Electrofishing catches a higher proportion of centrarchids

- Electrofishing samples dense vegetation and obstructed areas which is the preferred habitat of centrarchids
- Electrofishing consistently captures centrarchids year round

Seining catches a higher proportion of salmonids: Seining salmonid CPUE is dependent on the time of year.

Future Direction

- Incorporate and compare additional sampling methods i.e., trawling
- Analyze catch patterns for other fish families found in the Delta
- Investigate ways to compare CPUE of sampling methods
- Expand LFWO electrofishing to a longer-term sampling program, continuing to supplement beach seine data

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