

Boat Electrofishing in the California Delta:

Species detection probability and role in long-term monitoring of the Delta fish community

Ryan McKenzie and Brian Mahardja
Delta Juvenile Fish Monitoring Program
U.S. Fish and Wildlife Service, Lodi Fish and Wildlife Office
Contact: ryan_mckenzie@fws.gov

Objective

Assess the benefit of adding boat electrofishing to long-term fish monitoring in the Delta.

- The California Delta is a diverse ecosystem inhabited by a number of economically, culturally, and ecologically important fish species.
- To monitor temporal and spatial trends, long-term fish monitoring programs within the Delta use a number of different gear types to capture fish species across life stages and habitats.
- However, concerns have been raised that current monitoring may not effectively monitor for certain species (e.g. juvenile Chinook Salmon), and/or life stages, that inhabit areas that are not accessible by current gear types (e.g. rip-rap banks, shallow vegetated areas).



Methods

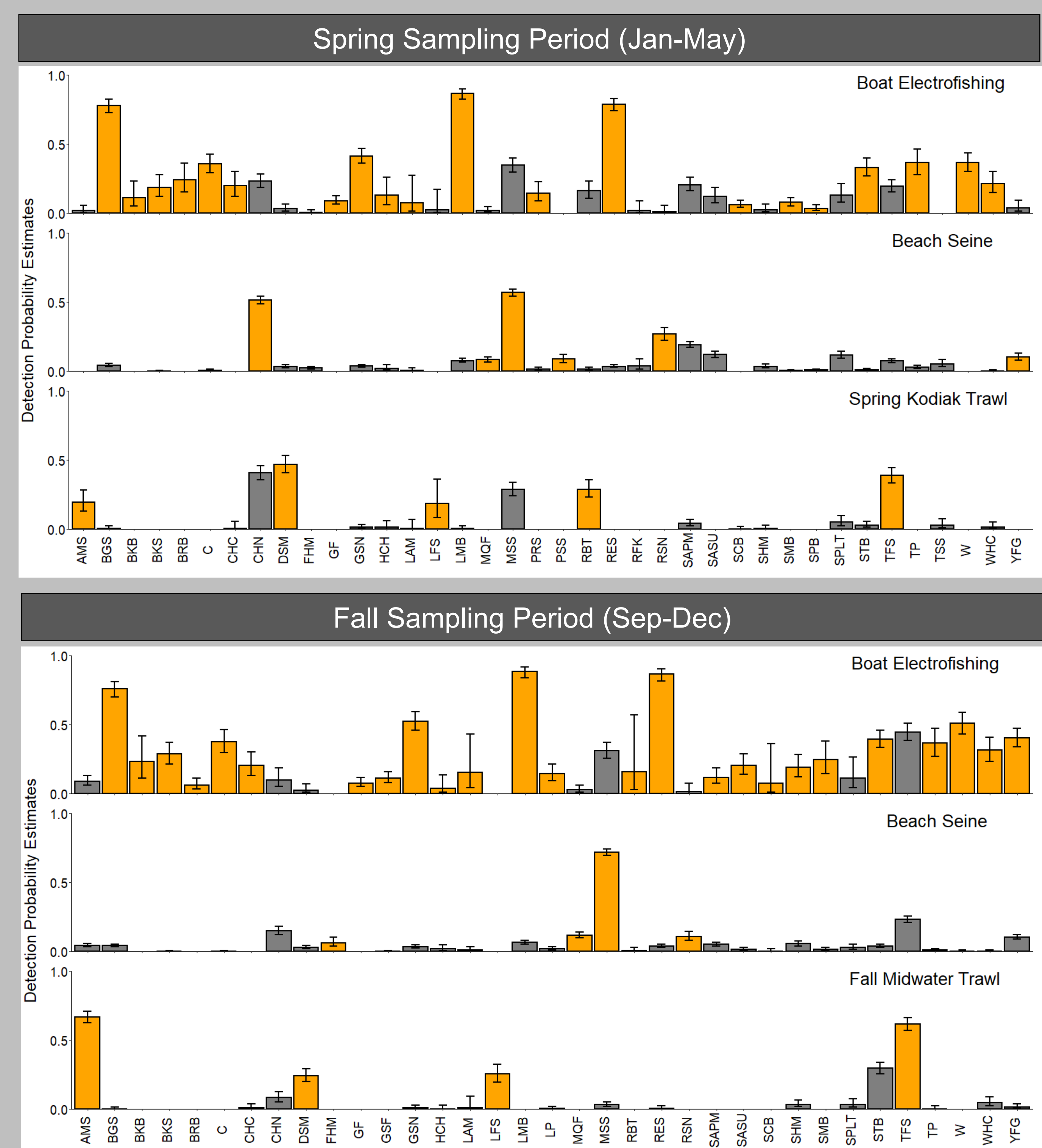
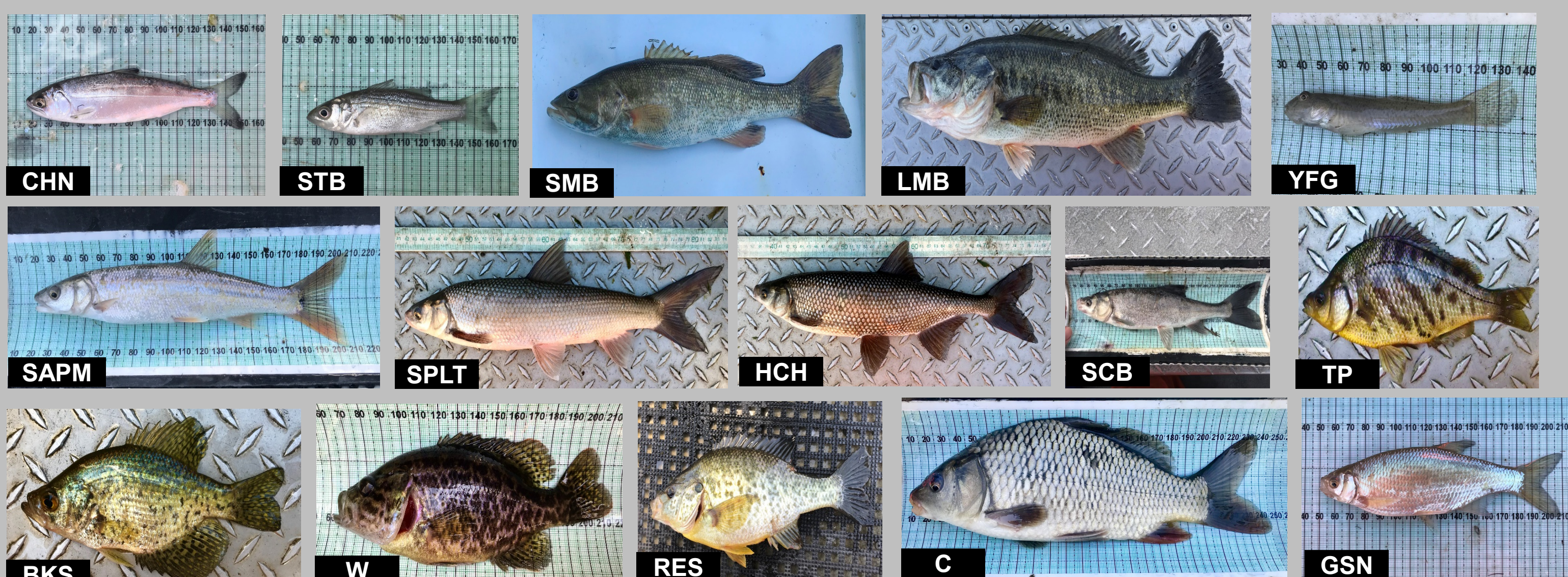
Compare species detection probability between long-term monitoring and boat electrofishing gear types.

- Datasets (Years 2002-2005; 2008-2011)
 - CDFW Fall Midwater Trawl
 - CDFW Spring Kodiak Trawl
 - USFWS Beach Seine
 - CDFW Boat Electrofishing Surveys
 - DWR-UC Davis Boat Electrofishing Surveys
- Occupancy modeling performed with 'unmarked' package in R-Statistical Software (Fiske and Chandler 2011).
- Data was subset into Spring (Jan-May) and Fall (Sep-Dec) sampling periods to account for change from Spring Kodiak to Trawl Fall Midwater Trawl.
- Detection probability was calculated by comparing samples within the same month and spatial region.

Results

Boat electrofishing improves our ability to detect and monitor many of the Delta's littoral fishes.

- Boat electrofishing had higher detection probability for many Delta fishes compared to current monitoring gears during Spring and Fall sampling periods.
- Boat electrofishing gear can sample habitats where nets are not able to fish (e.g. rip-rap shorelines, shallow-vegetated areas).
- Preliminary results suggest that adding boat electrofishing to IEP's long-term fish monitoring will improve detection probability for many species. Efforts are being undertaken by the USGS and USFWS to further develop a boat electrofishing survey for the Delta.



Code	Common Name
AMS	American Shad
BGS	Bluegill Sunfish
BKS	Black Crappie
C	Common Carp
CHC	Channel Catfish
CHN	Chinook Salmon
DSM	Delta Smelt
FHM	Fathead Minnow
GSF	Green Sunfish
GSN	Golden Shiner
HCH	Hitch
LAM	Lamprey Sp.
LFS	Longfin Smelt
LMB	Largemouth Bass
LP	Logperch
MQF	Mosquitofish
MSS	Mississippi Silverside
PRS	Prickly Sculpin
PSS	Staghorn Sculpin
RBT	Rainbow Trout
RES	Redear Sunfish
RFK	Rainwater Killifish
RSN	Redshiner
SAPM	Pikeminnow
SASU	Sacramento Sucker
SCB	Sacramento Blackfish
SHM	Shimofuri Goby
SMB	Smallmouth Bass
SPLT	Spittail
STB	Striped Bass
TFS	Threadfin Shad
TSS	Threespine Stickleback
W	Warmouth
WAG	Wagasaki
WHC	White Catfish
YFG	Yellowfin Goby



Acknowledgements: The Delta Juvenile Fish Monitoring Program is funded by the Central Valley Improvement Act, U.S. Bureau of Reclamation, and California Department of Water Resources. We would like to thank the many staff from the California Department of Fish and Wildlife (CDFW), University of California-Davis, and DJFMP for collecting and providing the long-term monitoring data used in this study. We would also like to thank our collaborators: Russel Perry, Adam Pope, and Noble Hendrix for their current efforts in developing an occupancy model for electrofishing in the Delta.

Literature Cited: Fiske, I. and Chandler, R. (2011). "unmarked: An R Package for Fitting Hierarchical Models of Wildlife Occurrence and Abundance." *Journal of Statistical Software*, 43(10), 1-23.