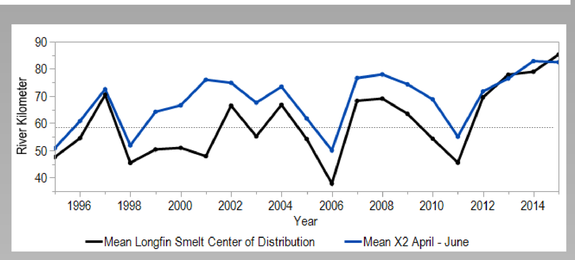
Longfin Smelt Distribution: Abundance and Evidence of Spawning in San Francisco Bay Tributaries

Christina Parker, Levi Lewis, Arthur Barros, Malte Willmes, Micah Bisson, James A. Hobbs
Wildlife, Fish and Conservation Biology, University of California, Davis
Contact: chrparker@ucdavis.edu

Aim of this Project

Prior to 2015, monitoring efforts for larval smelt did not extend west beyond Napa River. In wet years, it was shown that Longfin Smelt were potentially distributed beyond that area. To document the distribution and relative abundance of adults, larvae, and juvenile recruits, UCD's Hobbs Lab began sampling tributaries to the San Francisco Bay, downstream of the Delta.

CDFW 20-mm yearly Longfin smelt catch mean center of distribution in river kilometers and mean X2. For geographical reference, Port Chicago is represented by the dashed line at 64 river km.



Background

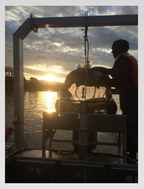
Longfin Smelt, a small, anadromous, pelagic fish native to the San Francisco Estuary of California, live 2-3 years and migrate to Low-Salinity Zones (1-6 psu) from December through February to spawn from nearshore ocean (Moyle 2002). Decline of Longfin Smelt began in the 1980s and in 2009, due to continued decrease in population, they were listed as threatened under the California Endangered Species Act.

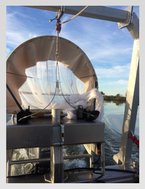
Methods

Surveys were conducted in Napa River, Sonoma Creek, Petaluma River, San Pablo Bay (2016 and 2017), and South San Francisco Bay tributaries. To ensure both spatial and environmental coverage of potential nursery habitats, sample locations when possible, were determined by salinity zones (fresh, 1-3, 4-6, 7-9 and 10 ppt). Results presented here focus on larval and juvenile life stages.

Larval surveys were conducted bi-weekly from January through February using a duplicate of California Department of Fish and Wildlife (CDFW) Smelt Larval Sled with 505 um mesh net mounted on a D-shaped rigid-frame with skis on the bottom. Late larvae and juveniles are sampled from March through May using a duplicate of CDFW's 20-mm net with 1600 um mesh also attached to a D-shaped rigid-frame with skis.


Hobb's Lab LONSME


Smelt Larval net

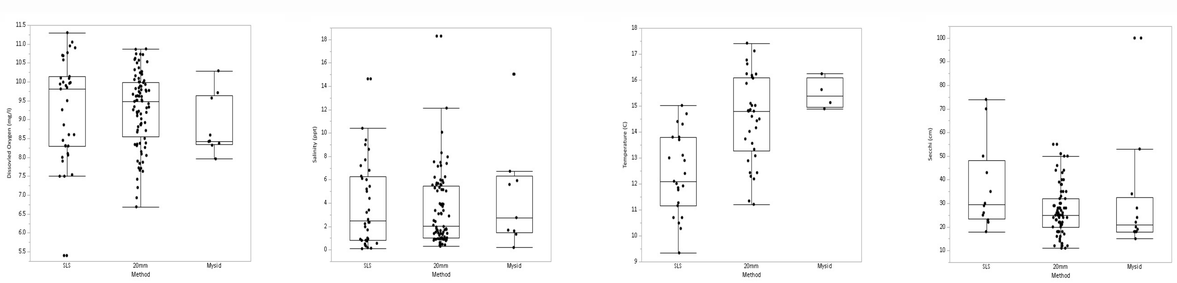

20-mm net

Juvenile Longfin Smelt

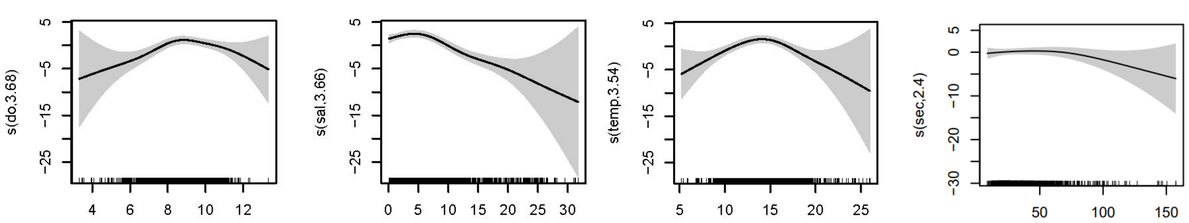
Both nets are towed in a stepped oblique fashion for 10 minutes and samples from UCD's SLS, 20mm nets were preserved in 95% ethanol. Samples from UCD's 2015 SLS and monthly mysid trawls as well as CDFW's SLS and 20mm nets were preserved in 10% formalin. Samples were sorted for all individuals. Fish were identified to the lowest possible taxonomic level, counted, and 30 of each species were randomly chosen to be measure for total length.

Water Quality Variables

Water quality was collected at the beginning and end of each trawl including: secchi, trawl depth, tide, tide height, temperature (C), salinity (ppt), specific conductance (us/cm), pH, dissolved oxygen saturation (percentage), dissolved oxygen (mg/l), and nephelometric turbidity units (NTU).



Dissolved oxygen, salinity, temperature, and secchi by gear type for all UCD trawls which captured Longfin Smelt.



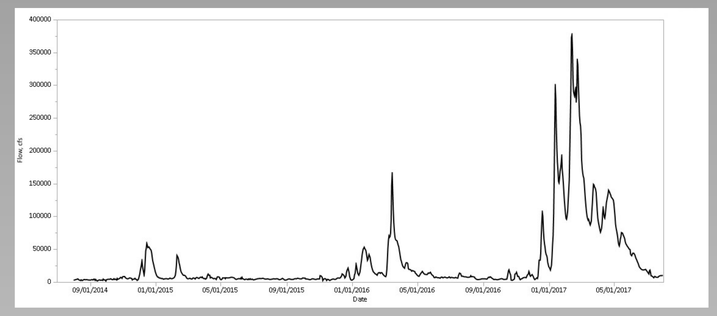
GAMs of dissolved oxygen (mg/l), salinity (ppt), temperature (C), and secchi for trawls which captured Longfin Smelt.

Outflow and Distribution by Year

Larval and juvenile Longfin Smelt catch per unit effort of Longfin Smelt shifted downstream from 2015 through 2017 based on a variety of water quality variables. Increase in outflow increases lower salinity freshwater habitat in the San Francisco Bay tributaries.

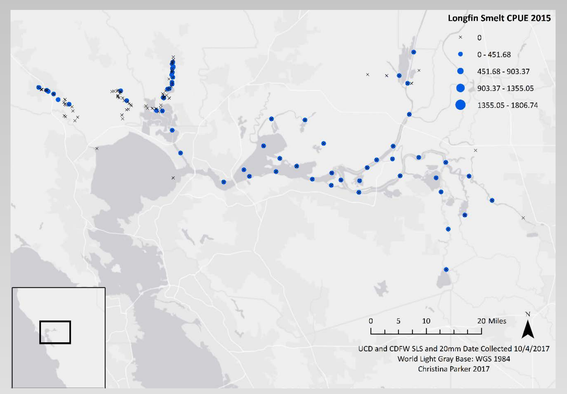
A metric for evaluating outflow is the Net Delta Outflow Index which is calculated by summing river inflows, precipitation, agricultural consumptive demand, and project exports.

Adult Longfin Smelt

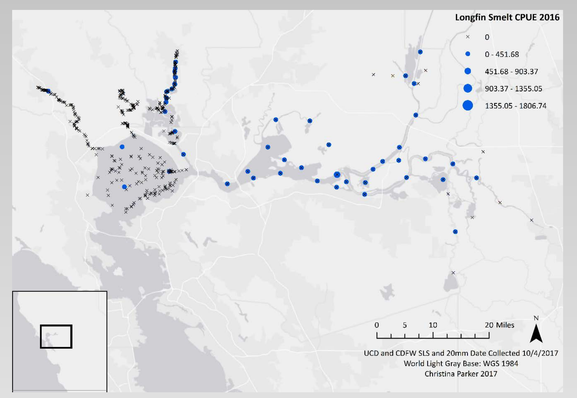


In 2015 and 2016, larval and juvenile Longfin Smelt distribution was spread out throughout the North Bay tributaries with higher catch per unit efforts (CPUE) found east of the Carquinez Strait. No larval or juvenile fishes were found in the South Bay tributaries despite presence of ripe adults. In 2017, however, larger (CPUE) was found west of Carquinez Strait, and larval and juvenile fishes were captured in Coyote Creek and Lower South Bay.

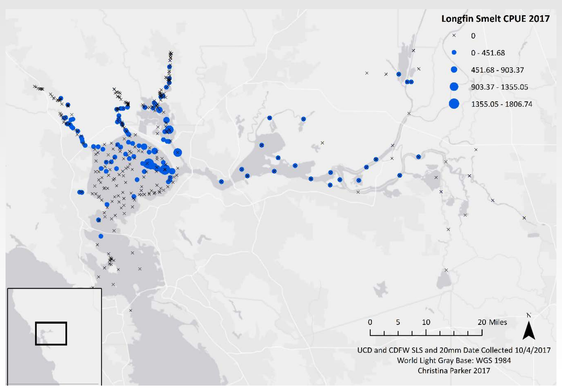
2015

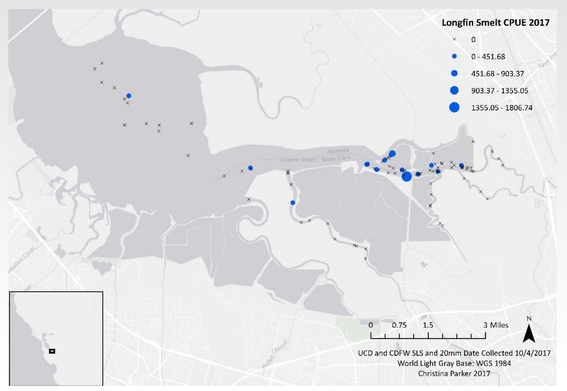


2016



2017





Discussion and Next Steps

Otoliths from the larval and juvenile Longfin Smelt captured by UCD in 2016 and 2017 are currently being processed to assist in determining if those fishes were spawning in these tributaries or if they were moved by tidal forces. Additional field work is needed to give a complete picture of Longfin Smelt's use of areas west of the Carquinez Strait in a wet year.

Hobb's Lab is currently studying the diets of captured Longfin Smelt larval and juvenile life stages as well. We hope to answer questions regarding food availability and preferences as well as competition with other species. We have collected copepod samples with the fish samples and are currently processing them to compare to gut contents of captured fish.

Look for additional information in Interagency Ecological Program's upcoming Newsletter, Volume 30 Issue 1.

Acknowledgements

Hobbs Lab Staff and Interns
CA Dept of Water Resources (Contract Number (4600011196)
CA Dept of Water Resources: Louise Conrad, Karen Gehrts, Ted Sommer
CA Dept of Fish and Wildlife: Randy Baxter and Kathy Hieb