Annual and Seasonal Variation in Fish Species Assemblages in Created and Restored River and Estuarine Habitats in the Napa River, California

Sharon Kramer, Lauren Dusek, Steve Kramer, Scott Wilcox
Stillwater Sciences
and
Mike Dietl
U.S. Army Corps of Engineers

INTRODUCTION

The Napa River/Napa Creek Flood Protection Project was designed by the Napa County Flood Control and Water Conservation District and the U.S. Army Corps of Engineers to provide flood protection for and improve habitat in the vicinity of the City of Napa by reconnecting the Napa River to its floodplain, creating wetlands throughout the area, maintaining fish and wildlife habitats, and restoring the natural characteristics of the river. Construction of the Project is currently phased over seven years from 2000 through 2006.

The Napa Project is being implemented along 6.9 miles of the Napa River in Napa County, California. The Project extends from the west side of the river from Newport North Marina to the Highway 29 Bridge. Project features include breaching dikes, lowering levees, and channel modifications to create floodplain and marsh plain terraces; relocate bridges; and construct levees, floodwalls, pump stations, maintenance roads, and recreation trails for the reach of the river from Highway 29 to Trancas Street.

The Napa Project includes the Napa River Enhancement Plan for the South Wetlands Opportunity Area (SWOA). This enhancement plan calls for restoration of physical and biological processes in the Napa River estuary and the SWOA. Enhancement activities include creating 104 acres of emergent marsh, converting 262 acres of farmland to emergent marsh, and creating and enhancing 136 acres of seasonal wetlands.

Program Objectives

The purpose of the Fisheries Monitoring Program (FMP) is to determine fish use of the restored and created habitats (open water, marsh plain, and floodplain) created by the Napa Project, with special emphasis on threatened and endangered species.

1) Document presence and relative abundance of fish species (particularly delta smelt and Sacramento splittail) utilizing restored and created habitats.

2) Document life stages and seasonality of fish species (particularly delta smelt and Sacramento splittail) in restored and created habitats.

3) Determine if correlations exist between collected fish species and environmental conditions at each sampling site.

Tule perch

Pre-restoration condition in the SWOA in June 2001 (left) and post-construction habitat (middle and right).

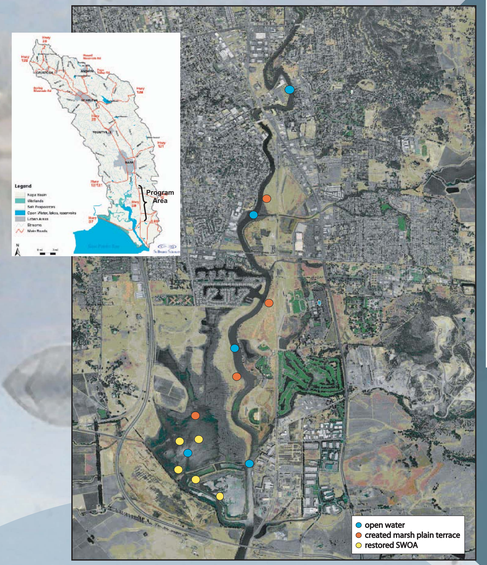
Methods

Sampling locations were established and represented three habitat types that may attract breeding and rearing of native fish species: marsh plain terrace, floodplain terrace, and open water habitat. There are seven sites within the South Wetlands Opportunity Area (SWOA), including two sites in the Horseshoe Bend channel and five sites north of the levee breach. The three marsh plain sites are located east of the SWOA area and along the main waterway of the Napa River (see map to right). The four open water sites are located throughout the main waterway of the Napa River.

Fish surveys began in July 2001 and have continued through July 2004. Four gear types were used to sample fish in the Project area. Fyke nets were used in small channels in the marsh plain and floodplain terraces where fish were likely to be concentrated during a falling tide. The purse seine was used in the open water sites, during high tide slack water. The otter trawl was used in the open water sites at varying tidal heights. The beach seine was used in the marsh plain and floodplain terraces at varying high tidal heights and during flooding periods.

Collected fish were identified to species, measured, weighed, and photographed. In addition, reproductive state and noticeable lesions were noted for listed species and splittail. Finally, environmental conditions, including discharge, vegetation conditions, dissolved oxygen, turbidity, tidal elevation, water temperature, salinity, and water depth were documented.

Creation of marsh plain terraces: Pre-restoration condition (left), post-construction habitat (middle), and sampling habitat at high tide (right).



Sampling Techniques

otter trawl

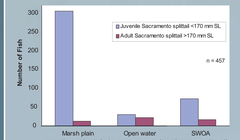
fyke net

purse seine

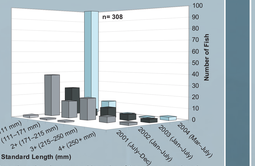
beach seine

Sacramento splittail

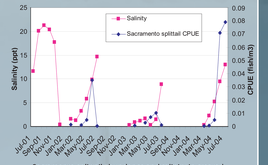
- 457 captured (407 juveniles, 50 adults) (top right figure)
- Second-most abundant native fish
- A positive correlation was found between of juvenile abundance and salinity (p=0.025) (bottom right figure).
- Significantly higher numbers of juvenile Sacramento splittail were found in the created marsh plain terrace sites than in the restored SWOA or main channel (p=0.01) (bottom left figure).



Juvenile and adult Sacramento splittail captured in all habitat types, 2001-2004.



Age class distribution and lengths of Sacramento splittail, July 2001-July 2004.



Sacramento splittail abundance and salinity in created marsh plain terraces, 2001-2004.

Fish Captured Between 2001-2004:

Starry flounder

Native:
Arrow goby
Bay goby
Chinook salmon
Chum salmon
Delta smelt*
Jack smelt
Longfin smelt
Long-jawed mudsucker
Northern anchovy
Pacific herring
Prickly sculpin
Sacramento pikeminnow
Sacramento splittail*
Sacramento sucker
Speckled sanddab
Staghorn sculpin
Starry flounder
Steelhead*
Threespine stickleback
Tule perch

Non-native:
American shad
Black crappie
Bluegill
Channel catfish
Common carp
Golden shiner
Inland silverside
Largemouth bass
Mosquito fish
Rainwater killifish
Shimofuri goby
Striped bass
Threadfin shad
Yellowfin goby
Wakasagi
White catfish

*Species of interest

Steelhead

- Three steelhead captured 2002-2004, 72–208 mm FL

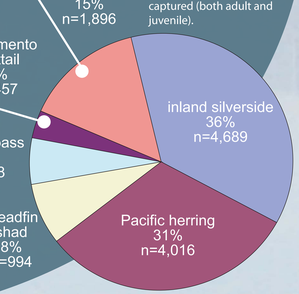
Delta smelt

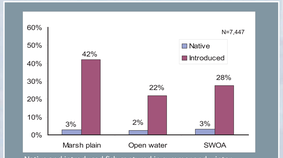
- 3,800 larval smelt captured by CDFG in 20-mm trawls, 2001.
- One adult smelt captured in the restored SWOA habitat, 2001.

RESULTS

Four years of fish monitoring have documented that the restoration of the SWOA and marsh plain terraces are providing habitat for native and non-native species. To date (July 2001-July 2002, January 2003-July 2003, and March 2004-July 2004), a total of 72,778 larval, juvenile, and adult fish have been captured, representing 36 species.

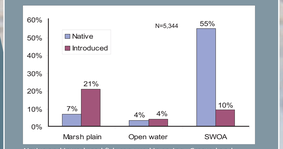
Of all fish captured from 2001-2004, inland silverside and Pacific herring were the most abundant, making up 66% of the total fish species captured (both adult and juvenile).





Native and introduced fish captured in summer and winter.

Relationship Between Native and Introduced Fish in Created, Restored, and Open Water Habitats



Native and introduced fish captured in spring. Created and restored habitat associated with the flood control design has provided habitat for native fish aduring spring months.

Additional species of note:

- *Chum and Chinook salmon*
  - Eight chum salmon captured in 2004, 57–84 mm FL.
  - Four Chinook salmon captured in 2002-2004, 49–105 mm FL.

Chum salmon

- *Striped bass*
  Juvenile striped bass abundance was positively correlated with warmer temperature in shallow water habitats (p=0.0018).
- *Pacific herring*
  - 3,300 juvenile Pacific herring were captured in 2002, significantly more than in other years
  - 90% captured in restored habitat.

- *Black Sea jellyfish*
  Thousands of Black Sea jellyfish observed in 2004.

New Zealand mudsnail

- *New Zealand mudsnail*
  New Zealand mudsnail documented in the restored SWOA, July 2004.

MANAGEMENT IMPLICATIONS:

- Created and restored marsh plain terraces and floodplain habitat provides habitat for numerous life stages of native and introduced fish in the Napa River.
- Breaching additional levees may make the restored SWOA more suitable for native fish by:
  - Increasing water circulation and flow,
  - Decreasing temperatures, and
  - Providing additional access for fish.

Acknowledgements

We would like to thank the U.S. Army Corps of Engineers, Napa County Flood Control and Water Conservation District, and Jones and Stokes Associates for help with this study.

Stillwater Sciences