

# **State of the Science Workshop on Fish Predation on Central Valley Salmonids in the Bay-Delta Watershed**

## **Background**

State and Federal agency staffs and interested stakeholders have worked to articulate a problem statement and develop a process to assess the current state of science understanding on fish predation of Central Valley salmonids for the Bay-Delta watershed as part of a broader effort to understand the role of predation on listed species. Fish predation is a concern of many entities and the resulting workshop and state of the science synthesis will provide an objective understanding of the current knowledge and lay a foundation for future project planning and research needs. The projects that this effort will inform include the:

- 1) Selection of projects for the Striped Bass Settlement
- 2) Bay Delta Conservation Plan Conservation Measures
- 3) Biological Opinions for the long-term operations of State and Central Valley Water Projects
- 4) Fisheries Agency Coordination
- 5) Delta Plan
- 6) SWRCB Bay-Delta Water Quality Control Plan

## **Workshop Purpose**

The purpose of this workshop is to have an independent panel of experts summarize the current state of knowledge on predation of Central Valley salmonids by other fish. This information will clarify the understanding of the role of fish predation on salmonids and associated factors in salmonid life history for policy decisions focused on improving Central Valley salmonid populations. Additionally, the Panel will be asked to identify data and science gaps that exist and identify a framework for research to support future management decisions.

## **Charge to Panel**

To accomplish the above stated workshop purpose, the invited Panel will review and assess the assembled bibliography that includes key predation studies in the Bay-Delta watershed; the Panel will conduct a brief presentation of their experience relevant to the goals of the workshop. Additionally, in a workshop setting, the Panel will hear presentations highlighting the current scientific understanding (knowledge and gaps) regarding fish predation on salmonids and receive public comment; the Panel will consider the questions posed below during the workshop and ask questions as appropriate of the speakers. Relevant comments made during the workshop will be addressed in the final report as well. Finally, the Panel will identify important data and science gaps and a framework for follow-up research that should be conducted in the near future.

## **Questions for Panel to Address**

- What is the ecological context of predation by fish on Central Valley salmonids, and what can be learned from other systems that could inform our understanding of predation on anadromous salmonids?
  
- What do the available data and analyses tell us about the rates and population level effects of fish predation on Central Valley salmonids? Specifically:

- Are there appropriate methods for estimation of predation rates and population level effects from the existing data?
  - What biological and physical factors are likely to affect the impacts of predation on salmonids? Have these factors changed over time, and do they vary between the major basins (i.e., San Joaquin and Sacramento)? Do these factors vary among the major reaches of the system (e.g., spawning areas, riverine reaches, delta, bay, ocean)?
  - What is understood about the interactions among major factors influencing predation on salmonids (e.g., interactions among predators, hydrology and temperature, etc.)?
- What related science is generally agreed upon; what are the key disagreements or uncertainties?
  - What future work (e.g., feasible scientific studies, modeling, and pilot experiments) should be done to address key knowledge gaps by testing clearly stated hypotheses to substantially reduce scientific uncertainties that lead to disagreement? Please provide guidance on appropriate study design and methods for estimating predation rates and population level effects.

Species to focus on: Central Valley salmonids (spring-run, winter-run, fall-run and late fall-run Chinook salmon, and Central Valley steelhead)

Geography: The entire watershed (anadromous waters of Central Valley including ocean component)

Life stage(s): all (but focus is on the juvenile - fry, parr, and smolt)

### **Final Deliverables**

- Panel report addressing questions
- Research Strategy

### **Overall Process (Draft Timeline):**

Feb.-March 2013: Outreach to Stakeholders

March-May 2013: Workshop Planning

July 22-23, 2013: Hold Public Workshop; present panel; have presentations; take public comment

Early Sept. 2013: Post Panel Report

### **Problem Statement**

By the mid-1980's the population of winter-run Chinook salmon had collapsed such that the spawning escapement in 1994 was estimated to be fewer than 200 fish. These numbers increased to 17,153 in 2006, but then declined to 1,596 in 2010 and continued downward to just 824 in 2011. Escapement of spring-run Chinook (from several Central Valley streams) has declined precipitously over the last few decades as well. From the mid-1970's through the mid-1990's numbers had increased to nearly 15,000 in 2005. Then, numbers fell sharply to only 1,904 fish in 2010 for Butte, Deer, and Mill Creeks combined. For

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2011, spring-run Chinook numbers rose to 2,767 for these important tributaries and were recorded at 3,064 for the Sacramento River system (CDFG 2011; personal communication Gingras 2012 and Low 2012). Unfavorable ocean conditions are thought to have been the proximate cause of this recent collapse, but other stressors may have compounded the problem. These stressors include (in no particular order): barriers and impediments to migration, water diversions, habitat loss and degradation, impaired water quality, commercial and recreational fishery effects, hatchery effects, and predation from non-native fish (NMFS 2009).

Predation is a natural process in all ecosystems and predation of fish by fish is a subset of that process. Predatory fish that consume juvenile salmonids (including non-native game fish) have historically been present in the Bay Delta watershed. Due to the continued decline of Central Valley salmon including State and Federally listed spring-run and winter-run salmon, an understanding of the role of fish predation on species life history, factors that affect it, and its interaction and context with other stressors is needed. It is recognized that fish predation of juvenile anadromous salmonids occurs by both native (i.e., pike minnow) and non-native (i.e., striped bass) fish species. To identify the extent of fish predation effect upon juvenile and adult anadromous salmonids by both native and non-native fish species individually and cumulatively within the overall suite of potential population stressors, there is a need to assemble known information.

To accomplish this, an expert panel will be convened to prepare a synthesis of the current state of the science with the idea that this information will lay a foundation for projects being discussed to better understand the role of predation. The focus will predominantly be on the juvenile life stages of the Central Valley salmonids, but the adult life stage will be considered. It is expected that the synthesis (and subsequent projects) will inform decision makers regarding the role fish predation plays on the population size and dynamics of Central Valley salmonids.

### **Citations**

California Department of Fish and Game (CDFG). 2011. Report and Recommendation to the Fish and Game Commission in Support of a Proposal to Revise Sportfishing Regulations for Striped Bass. December 2011.

Gingras, Marty. 2012. Personal Communication.

Low, Alice. 2012. Personal Communication.

National Marine Fisheries Service (NMFS). 2009. Public draft Recovery Plan for the evolutionarily significant units (ESU) of Sacramento River Winter-run Chinook salmon and Spring-run Chinook salmon and the distinct population segment of the Central Valley steelhead. October 2009.

### **Background and Reference Documents for the Panel**

The Panel members have been provided with the following documents for required reading and background:

- Charge to the Panel
- History on the fisheries agencies stakeholder meetings
- Annotated bibliography (abstracts for the reference papers listed below)

- The Delta Plan Chapter 4
- Bay-Delta Conservation Plan Conservation Measure #15 (3-14-13 version)
- Reference papers:
  1. Brown, L.R. and Michniuk, D. 2007. Littoral fish assemblages of the alien-dominated Sacramento-San Joaquin Delta, California, 1980-1983 and 2001-2003. *Estuaries and Coasts* 30(1): 186-200.
  2. Buchanan, R.A., J.R. Skalski, P.L. Brandes, and A. Fuller. 2013. Route Use and Survival of Juvenile Chinook Salmon through the San Joaquin River Delta, *North American Journal of Fisheries Management*, 33:1, 216-229.
  3. Cavallo, B., Merz, J., and Setka, J. 2012. Effects of predator and flow manipulation on Chinook salmon (*Oncorhynchus tshawytscha*) survival in an imperiled estuary. *Environ. Biol. Fish.* DOI 10.1007/s10641-012-9993-5: 1-11.
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  5. Clark, K. W., M. D. Bowen, R. B. Mayfield, K. P. Zehfuss, J. D. Taplin, and C. H. Hanson. 2009. Quantification of pre-screen loss of juvenile steelhead in Clifton Court Forebay. Fishery Improvements Section Bay-Delta Office CA Department of Water Resources In collaboration with: National Marine Fisheries Service Central Valley Fish Facilities Review Team Interagency Ecological Program Management Team.
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  7. W. Kimmerer and R. Brown. 2006. A Summary of the June 22-23, 2005 Predation Workshop, Including the Expert Panel Final Report. CBDA and CDWR.
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  10. Michel, C. 2010. River and estuarine survival and migration of yearling Sacramento River Chinook Salmon (*Oncorhynchus Tshawytscha*) smolts and the influence of environment. Master of Arts, Ecology and Evolutionary Biology, University of California, Santa Cruz.
  11. Nobriga, M.L., M. Chotkowski, and R. Baxter (2003). "Baby steps toward a conceptual model of predation in the delta: preliminary results from the Shallow Water Habitat Predator-Prey Dynamics Study." *IEP Newsletter* 16(1): 19-27.

12. Nobriga, M.L. 2009. Bioenergetic modeling evidence for a context-dependent role of food limitation in California's Sacramento-San Joaquin Delta. *California Fish and Game* 95(3): 111-121.
13. Nobriga, M. L., and F. Feyrer. 2007. "Shallow-water piscivore-prey dynamics in California's Sacramento-San Joaquin Delta." *San Francisco Estuary and Watershed Science* 5(2): Article 4.
14. Perry, R. W, P.L. Brandes, J.R. Burau, A.P. Klimley, B. MacFarlane, C. Michel, and J.R. Skalski. 2013. Sensitivity of survival to migration routes used by juvenile Chinook salmon to negotiate the Sacramento-San Joaquin River Delta. *Environ Fish Biol* 96:381-392.
15. San Joaquin River Group. 2013. Salmon smolt survival investigations. Ch. 5 in 2011 Annual Technical Report on implementation and monitoring of the San Joaquin River Agreement and the Vernalis Adaptive Management Plan (VAMP), Prepared for California Water Resources Control Board in compliance with D-1641.
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