



*Editorial*

## Understanding Central Valley Chinook Salmon and Steelhead: It is Time to Get off the Dime!

Randy Brown, Co-Editor-in-Chief  
San Francisco Estuary and Watershed Science  
brown.randall@comcast.net

### BACKGROUND

Chinook salmon and steelhead are important biological components of the Central Valley ecosystem. The adults spawn in many streams, the young may spend a few to several months in these streams and in the San Francisco Estuary on their way to the ocean. When the adults return to their natal streams they transfer some of the ocean derived nutrients, organic matter, and energy to the lotic foodweb. Chinook salmon and steelhead together form the basis of economically important commercial and recreational fisheries – both in the ocean and inland waters. Chinook salmon and steelhead also are important because they are part of the historic culture in the Central Valley and qualify as “charismatic macrofauna” with which the public can readily identify. This identification is demonstrated by the Feather River and American River salmon festivals that annually attract thousands of adults and children.

The abundances of the four Chinook salmon races (winter, spring, fall, late fall) and steelhead are often used to judge the ecological health of the Central Valley ecosystem. This judgment is in part because spring and winter Chinook are respectively listed as threatened and endangered under the state and federal endangered species acts and the steelhead is listed as threatened pursuant to the federal Endangered Species Act. The late fall and fall runs are federal candidate species. An important ecological objective is to restore habitat and reduce the impacts of

other factors so that the two salmon races and steelhead populations recover to the point they can be delisted.

To complicate matters considerably, in the Central Valley we have six hatcheries that produce and release all four races of Chinook salmon and steelhead. Five of these hatcheries are mitigation hatcheries – Coleman, Feather River, Nimbus, Mokelumne, and Merced. Two of the hatcheries, Feather River and Mokelumne, also rear and release “enhancement” salmon that are grown specifically to increase the numbers of salmon available to the ocean fisheries. The other hatchery, Livingston Stone National Fish Hatchery, supplements the winter Chinook run. These hatcheries collectively produce and release impressive numbers of fish each year:

- Fall Chinook – 30 million, mostly smolt sized fish, from the five mitigation hatcheries;
- Spring Chinook – About two million smolts from the Feather River Hatchery;
- Late fall Chinook – About one million advanced smolts from Coleman National Fish Hatchery;
- Winter Chinook – About 250,000 advanced smolts from Livingston Stone National Fish Hatchery;
- Steelhead – About 1.5 million yearlings from Coleman, Feather River, Nimbus and Mokelumne hatcheries.

Release strategies vary with the race and the hatchery. However, most fall Chinook from the Feather River and Nimbus hatcheries are released off-site in San Pablo Bay,

and “enhancement” fish from the Mokelumne hatchery are also released in the estuary. The offsite release strategy is to increase the number of salmon available to the fisheries and subsequent escapement, but does cause increased straying when the adults return to freshwater. Steelhead juveniles are released near the hatchery, but most often downstream, in part to minimize the risk of hatchery steelhead preying on naturally spawned juvenile Chinook salmon.

The hatchery releases and the progeny of naturally spawning fall Chinook salmon support economically and socially important commercial and recreational fisheries in the nearshore ocean off California (and to a lesser extent off Oregon) and an inland recreational fishery. The other races are caught in the fisheries but not to the same extent. Immature and adult steelhead are subject to an intense inland sport fishery and only hatchery steelhead can be kept by anglers. (All hatchery steelhead are marked by removing their adipose fin.) The hatchery releases have unintended adverse affects on naturally spawning salmon and steelhead.

Over the past few decades California has spent hundreds of millions of dollars to protect, restore, and propagate Central Valley Chinook salmon; some of this funding has been provided through the CALFED Bay-Delta Program. Overall, restoration, protection, and propagation projects have been geared towards:

- Restoring stream beds;
- Improving instream temperature conditions;
- Installing and upgrading fish screens and fish ladders;
- Restoring and protecting riparian habitat;
- Improving instream flow conditions;
- Supplementing winter Chinook production through environmentally hatchery operation;
- Controlling fish diseases in hatcheries, with goal of limiting spread of disease from hatchery to wild fish; and
- Opening and restoring salmonid habitat on Battle Creek;

Using environmental water programs (the CALFED Environmental Water Account, the CVPIA's b(2) program, and the CALFED Environmental Water Program)

to provide flows and reduce water project pumping to improve conditions for salmonids and other fish.

In addition to the projects mentioned above, state and federal water project operations on many streams and in the Sacramento-San Joaquin Delta have been modified to protect salmonids, with emphasis on protecting listed species. The ocean and inland fisheries are regulated to reduce harvest, again with the actions taken mostly to protect listed species.

## THE PROBLEM

Although there has been, and continues to be, considerable monitoring and research devoted to understanding Central Valley salmonids, there has been relatively little coordination among the activities. This lack of coordination results in methods that may not be providing statistically robust population estimates of the life history stage of interest (for example, numbers of spawners), nor is much of the information, including the metadata on methods, made readily available to scientists and managers.

The lack of coordination also manifests itself in a piecemeal monitoring and research program. There are good to great monitoring and research efforts at such disparate geographic locations such as the Delta, the Feather, Stanislaus, and Tuolumne rivers and Mill, Deer, and Butte creeks. We can all learn from these efforts, but communication is relatively poor and the results of many of the studies do not make it into the open scientific literature and thus are not widely available. The ocean is mostly an unstudied black box.

We still don't have good estimates of the hatchery contribution to the fisheries and spawning populations, although recent efforts at the Feather River and Mokelumne River hatcheries are yielding some insight. Lack of quantitative escapement and tag recovery data preclude accurate estimates of straying rates, even for hatcheries in which reasonable numbers of fish have been coded wire tagged. Also we have a poor understanding of the effects of the hatcheries on naturally spawning salmonids. We do know that the Central Valley fall Chinook genotype has been homogenized due to hatchery and other fish management practices.

Without a coordinated and comprehensive salmon research and monitoring program we are unable to assess progress towards:

- Meeting the Central Valley Project Improvement Act's (CVPIA) salmonid doubling plan goals;
- Evaluating the benefits of specific CALFED and other projects for restoring naturally spawning salmon and steelhead in the Central Valley;
- Evaluating the benefits of changes in water project operations and fishery regulations on salmonid populations; and
- Evaluating the effects of salmonid hatcheries on naturally spawning salmonids.

## THE OPPORTUNITY

There are several signs that progress is being made with regard to salmon and steelhead in the Central Valley. In no particular order, some of these signs are:

- We are gaining a good understanding of the genetic structure of salmon and steelhead populations and this information is now being used to sort out difficult life history questions.
- Recent modeling work on winter Chinook sponsored by the California Urban Water Agencies (CUWA) has resulted in considerable information being assembled and made available in a conceptual model\*. Steve Cramer, CUWA's principal contractor in these efforts, has also developed a spreadsheet model that encompasses the entire life cycle.
- The salmonid session at the October 2004 CALFED Science Conference demonstrated the breadth and depth of research and analysis being conducted in the Central Valley.
- A recently released report by Ken Newman and Dave Hankin\* on a CALFED sponsored effort describes what they think it will take to develop a comprehensive constant fractional marking program for Central Valley Chinook salmon hatcheries.
- Work by California Department of Fish and Game biologists on Mill, Deer and Butte creeks is leading to a better understanding of the complex and variable, spring run life history.
- Work on the Feather River and at the Feather River Hatchery is helping get a handle on salmonid behavior on a hatchery dominated stream.

- The Interagency Ecological Program – including its salmon element – is undergoing an extensive CALFED sponsored program review.
- CALFED's Independent Science Board is launching a comprehensive effort to look at monitoring, research, and analysis (science) needs in the estuary and watershed.
- The NOAA Fisheries-sponsored Central Valley Technical Recovery Team is addressing major technical issues associated with species recovery, including publication of a paper on population structure<sup>1</sup>.

## THE CHALLENGE

It is time for Central Valley salmon biologists and managers to come up with a comprehensive science program that is geared to providing the various parties with the information they must have to make sound protection, restoration, and management decisions and assess the effects of these decisions. We have been making good progress in many areas, but it is now time to bring it all together. To that end, CALFED and the CVPIA's Anadromous Fish Restoration Program will sponsor a technical workshop this summer (probably August) to bring the major players and some outside experts to the table. A primary workshop goal will be to develop a written description of a comprehensive program or an agreed upon process for arriving at a program, and to define and meet salmonid monitoring, research and analytical needs. To the extent possible, the science program will be specific on monitoring (sites, protocols, data storage, etc.), research priorities and funding requirements and funding sources. The salmonid program is expected to be an integral part of the broader CALFED Independent Science Board's monitoring program assessment and development efforts. I believe that we have the technical and financial wherewithal to pull this off, although it will not be easy. The stars seem to be in a promising alignment and it is up to us to take advantage of it and move forward. We need the support of individual biologists and managers – your support – to make it all happen.

1. Like many salmon reports in the Central Valley, the reports noted with an asterisk are not widely available. If you are interested in obtaining copies, please contact me at brown.randall@comcast.net. Note that the Newman-Hankin report will be revised to take new data on Central Valley salmon catch and escapement into account.