

# Winter-Run IMF Brief

Key Developments in the Integrated Modeling Framework

February 4, Brief No. 2

## Observed Escapement

In this issue, we spotlight the historical spawner abundance of Winter-run Chinook, and its use to test predictive capabilities of the Integrated Modeling Framework (IMF). (for full details, see Documents/Technical Memos/Historical Simulation: Spawner Abundance at [www.spcramer.com/imf.htm](http://www.spcramer.com/imf.htm)). We found the model predicted all three major trends in the historic population size: the sharp decline during the 1970's, the continued low levels during the 1980's to mid 1990's, and the increasing numbers beginning in the late 1990's (Figure 1).



Central Valley Chinook

We used expanded counts of winter-run Chinook passing Red Bluff Diversion Dam (RBDD) as the basis for spawner abundance during 1968-1995. Beginning in 1987, the dam gates were raised during portions of the passage season for winter-run Chinook, so we used CDFG's expanded counts over RBDD through 1995. Starting with 1996 and continuing through 2002, we used the spawner abundance estimated from mark-recapture surveys of spawned carcasses. Following the recommendation of the Winter-run Chinook Project Work Team, we used the Peterson estimate for 1996-1999, and the Jolly-Seber estimate for 2000-2002.

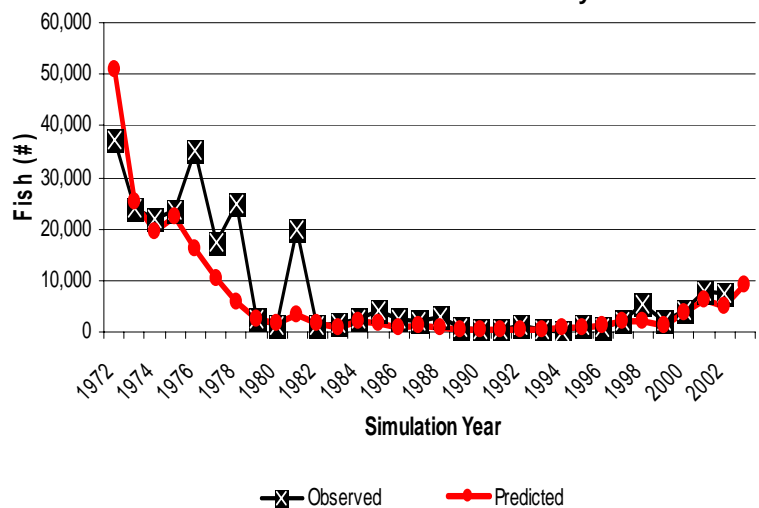


Figure 1. Observed and simulated abundance of Winter-run Chinook adults above Red Bluff Diversion Dam, 1967-2002.

Estimates for the number of adult winter-run passing RBDD each year did not account for fish that spawned below RBDD in some years. We assumed, based on results of radio tagging studies, that 40% of winter-run adults spawned below RBDD prior to 1987, after which the dam gates were raised to allow direct passage of adults during at least part of the adult migration season. We assumed that all eggs spawned below RBDD died from high temperatures, since egg mortality starts at 57 degrees F, which is typically exceeded below RBDD

In order to simulate spawner abundance during prior years, we initiated the simulation with the actual number of spawners counted over RBDD during 1968-1971 (NMFS 1997, USFWS 2001). In all years after that, the simulation predicted the number of returning fish (Figure 1) based on the observed environmental conditions and harvest rates each year. The environmental conditions included in the simulation will be summarized in a future IMF Brief, and are detailed in Technical Memo #3 posted on the web ([www.spcramer.com/imf.htm](http://www.spcramer.com/imf.htm)).

## How did we account for RBDD effects and spawning success?

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There were also temperatures lethal to winter-run eggs upstream of RBDD in some years prior to installation of the temperature control device at Shasta Dam in 1997. Using NMFS (1997) estimates of egg mortality from 1989-1996 we developed a regression of egg mortality on the mean of daily maximum temperature in August at Balls Ferry ( $r^2 = 0.92$ ). With that regression, we used temperatures recorded at Balls Ferry to predict mortality of winter-run Chinook eggs each year back to 1968. Predicted egg mortality above RBDD was most severe in 1977 (80%; Figure 2), when daily temperatures at Balls Ferry were consistently above 60°F for all of July.

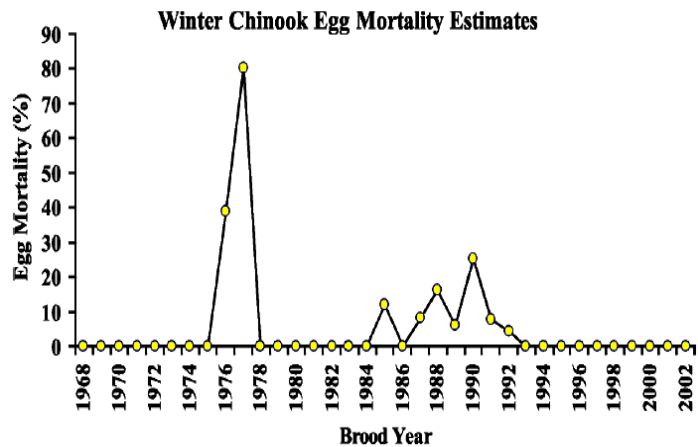


Figure 2. Estimated mortality of eggs deposited above RBDD by winter-run Chinook, 1968-2002.

In the next issue of IMF Briefs, we will describe historical estimates of harvest mortality for winter-run Chinook.

**The Next CUWA IMF Meeting is  
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**Citations and supporting evidence  
included in the complete technical  
memo available on the web site.**

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