

State of San Francisco Bay 2011

Appendix O

Steelhead Trout Production as an Indicator of Watershed Health

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Introduction

The Steelhead Trout Production indicator described in this document was not included in *The State of San Francisco Bay 2011* but could be utilized in future evaluations of the Bay by SFEP.

Background and Rationale

Urban and agricultural development over the last 150 years has diminished the quality and quantity of freshwater habitat in streams tributary to the San Francisco Estuary and led to a substantial decline in the region's salmonid abundance, including steelhead (*Oncorhynchus mykiss*) populations (Leidy *et al.* 2005). Steelhead in San Francisco Estuary tributaries are included in the Central California Coast Steelhead Distinct Population Segment (DPS) and are listed as threatened for purposes of the federal Endangered Species Act (Good *et al.* 2005). Efforts to protect and restore the estuary's tributary streams, including activities that benefit steelhead, such as modifying fish passage barriers, reducing sedimentation, and providing instream flows for habitat, are being undertaken throughout the region. Implementing monitoring programs to assess the effectiveness of these recovery efforts is essential to gauging the health of the estuary's watersheds.

A steelhead outmigrant monitoring program is proposed as an indicator of health in San Francisco Estuary watersheds. (This method commonly is called "smolt trapping" although all sizes and life history stages are sampled.) Monitoring has been identified by the National Marine Fisheries Service (NMFS) as critical to measure salmonid recovery, as smolt abundance is a key component in producing population size estimates and determining regional trends and population viability (NMFS 2010). Because steelhead complete one year or more of their life cycle in freshwater and are sensitive to changes in habitat conditions (e.g., flow, dissolved oxygen, temperature, turbidity, etc.), they are ideal indicators of stream health. Smolt trapping is an effective means of measuring the aggregate watershed condition for areas upstream of the trap and is a valuable tool for evaluating the success of restoration efforts and directing long-term management and restoration activities (Ketcham *et al.* 2005). In addition, although smolt trapping is focused on salmonids, it also provides additional information on the presence and relative numbers of other aquatic species.

Data regarding the outmigration of juvenile steelhead are virtually absent for watersheds tributary to the San Francisco Estuary, with the notable exceptions of information gathered recently by the Napa County Resource Conservation District and the Santa Clara Valley Water District. Becker *et al.* (2007) found that eight of the San Francisco Estuary's watersheds account for about 75 percent of steelhead habitat resources in the region. The drainages of Alameda, Coyote, San Francisquito, Corte Madera, Sonoma and Suisun creeks and the Guadalupe and Napa rivers comprise these "anchor" watersheds, in which monitoring juvenile steelhead outmigration is expected to produce robust data characterizing salmonid populations in the region. The collective data set could serve as an estuary-wide indicator of watershed health. Liermann and Roni (2008) suggest that monitoring programs implemented to determine whether restoration projects are

increasing salmonid abundance must be established in multiple watersheds to produce results that can be generalized.

Data Sources

The steelhead trout outmigrant indicator will be calculated using data from the Napa County Resource Conservation District's (RCD) salmonid outmigrant monitoring program, initiated in 2009, and in the future will incorporate data from additional sampling sites in watersheds tributary to the San Francisco Estuary. The Napa County RCD conducted salmonid outmigrant monitoring at one sampling station in the lower mainstem Napa River in 2009 and 2010 using a rotary screw trap (RST) installed at a location allowing for the capture of migrating salmonids from all upstream tributaries, at approximately 1,500 feet upstream of the upper extent of tidal influence. The trap was operated in 2009 from March 17 through May 26 and in 2010 from February 17 through June 14 (NRCD 2009; NRCD 2010).

In 2012 (pending funding), outmigrant trapping will be expanded to include three additional locations in the Napa River watershed, one in Upper Penitencia Creek (Coyote Creek watershed), and two Sonoma Creek watershed sites. Outmigrant trap locations in the Napa River watershed will be selected from candidate sites in Napa, Redwood, Milliken, Tulucay, Carneros, and Huichica creeks. Together with the sampling results from the mainstem Napa River monitoring location, new sampling results will account for steelhead smolt production in approximately 95 percent of all spawning and rearing habitat available to salmonids below major barriers in the watershed. If additional funding is secured, outmigrant traps are expected to be operated at locations in the Alameda, San Francisquito, and Corte Madera creek watersheds in the following year. Trapping will be conducted at all sampling stations during the 14 weeks between about February 15 and June 1. Results will be used to develop salmonid population estimates and track ecological responses to ongoing habitat restoration. A future goal is to expand the juvenile steelhead outmigrant monitoring program to include sampling stations in all eight anchor watersheds identified in Becker *et al.* (2007).

Methods and Calculations

The steelhead trout outmigrant indicator will be calculated using trap data from the mainstem Napa River sampling station operated by the Napa County RCD, and in the future will incorporate data from the additional sampling sites listed previously. Results will be normalized to reflect annual catch-per-unit-effort, or number of steelhead smolts captured per day of trapping in each sampling year, to correct for annual differences in trapping duration. The indicator will be calculated as the annual percent change in catch-per-unit-effort.

Goals, Targets and Reference Conditions

The steelhead smolt catch-per-unit-effort from sampling beginning in 2009 will be used as the reference condition against which change can be measured. Once trapping at additional sites has been established, results can be used to develop population estimates, to compare inter-annual variability among and within watersheds, and to correlate trapping results with environmental data (*e.g.*, streamflow) and restoration efforts.

Quantitative goals for recovery of steelhead populations exist for several watersheds tributary to the San Francisco Estuary, but may overestimate production potential. Further, due to the absence of historical data, reference conditions are not well understood. However, available information indicates a significant decline in the distribution and abundance of steelhead in the region (Leidy *et al.* 2005). Annual sampling will allow for the refinement of quantitative recovery goals in the watersheds where they are assigned, and development of goals for those watersheds without such assignments.

Results

Results from the Napa County RCD's salmonid outmigrant monitoring program for each year of sampling (2009 – 2010) at the mainstem Napa River site are shown in Figure 1. The catch-per-unit-effort was 1.78 steelhead smolts per day in 2009 and 2.48 steelhead smolts per day in 2010, representing a 39.3 percent increase in catch per unit effort of smolts from 2009 to 2010.

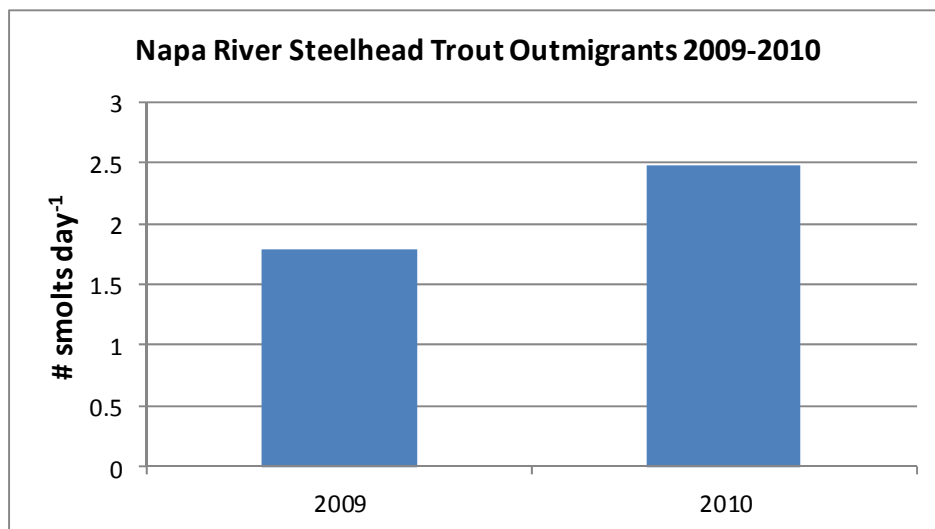


Figure 1. Results from salmonid outmigrant monitoring conducted on the mainstem Napa River in 2009 and 2010. The chart shows the number of steelhead smolts captured per day of rotary screw trap operation in each sampling year.

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