

## Trinity River Restoration Program Performance Measure:

# Spawning Escapement of Naturally Produced Salmonids

**Hypothesis:** The Trinity River Restoration Program (TRRP) flow and habitat modifications will increase juvenile production of target species, leading to increased escapement of naturally produced adult salmonids.

**Importance:** Essentially this assessment, coupled with harvest assessments, is the ultimate measure of success for the main hypothesis of the program; i.e., flow and habitat manipulations will lead to increased freshwater production of anadromous salmonids, which will lead to increased escapement and harvest of naturally produced adult salmonids.

**Objective:** The objective of this study is to estimate the spawning escapement of naturally produced salmonids in the Trinity River Basin and evaluate progress toward stated TRRP adult spawning escapement goals.

*General Objectives from the [Integrated Assessment Plan](#) (IAP):*

1. Increase/improve habitats for freshwater life stages of anadromous fish to the extent necessary to meet or exceed production goals.
2. Restore and maintain natural production of anadromous fish populations
3. Restore and sustain natural production of anadromous fish populations downstream of Lewiston Dam to predam levels, to facilitate dependent tribal, commercial, and sport fisheries' full participation in the benefits of restoration via enhanced harvest opportunities

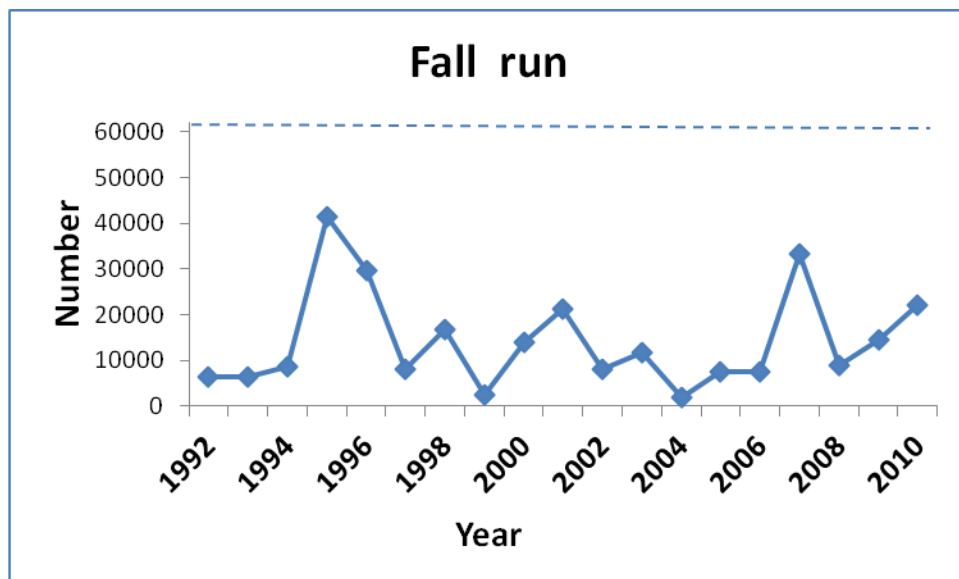
*Specific Objectives Relating to the Assessment or Objectives from the IAP*

- 4.1.1 Increase escapement of naturally produced fall-run Chinook salmon to 62,000 adults
- 4.2.1 Increase escapement of naturally produced spring-run Chinook salmon to 6,000 adults
- 4.3.1 Increase escapement of naturally produced coho salmon to 1,400 adults
- 4.4.1 Increase escapement of naturally produced steelhead to 40,000 adults

**Targets, Predicted or Desired Response:** The targets are presented in the Specific Objectives section, above. The predicted response is a long-term increase in escapement over time. Due to the stochastic nature of environmental parameters, we expect variable escapement of all species with a long-term net increase over time.

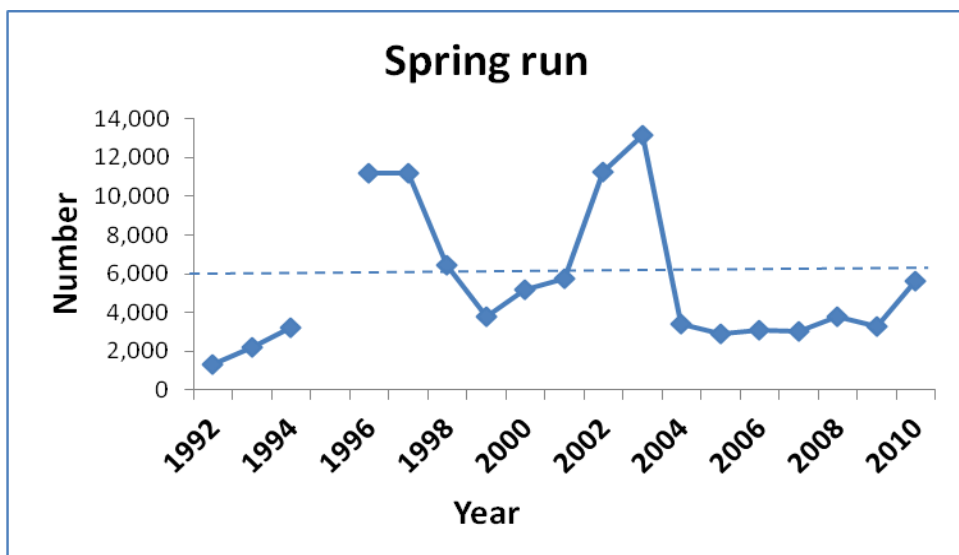
**Technical Approach:** The relative contributions of hatchery- and natural-origin fish was estimated based on (1) annual run-size (harvest and escapement) estimates, (2) the total marking of hatchery coho salmon and steelhead, and (3) the 25-percent constant fractional adipose fin clip and coded-wire tag marking of Chinook salmon. The proportion (either direct or expanded for the 25-percent mark rates) of hatchery marked fish observed at mainstem weir sites was applied to total run-size estimates to derive the natural component of the run. We examined whether salmon escapement was increasing over time (Mann-Kendall trend analysis) for each salmon species.

**Results:** Variable escapement of all species over time is seen in the figures below. However, no long term increase was detected over time for naturally produced spring- and fall-run Chinook (Figures 1 and 2), or for naturally produced coho salmon (Figure 3). A positive growth slope over time was calculated for natural fall-run steelhead (Figure 4). Due to low target for natural coho, coho appear to be close to the target in many years. The dashed blue line indicates the goal for natural adult escapement for each species (Figures 1-4). When we examine natural origin escapement alone we do not meet our predicted increases in numbers.

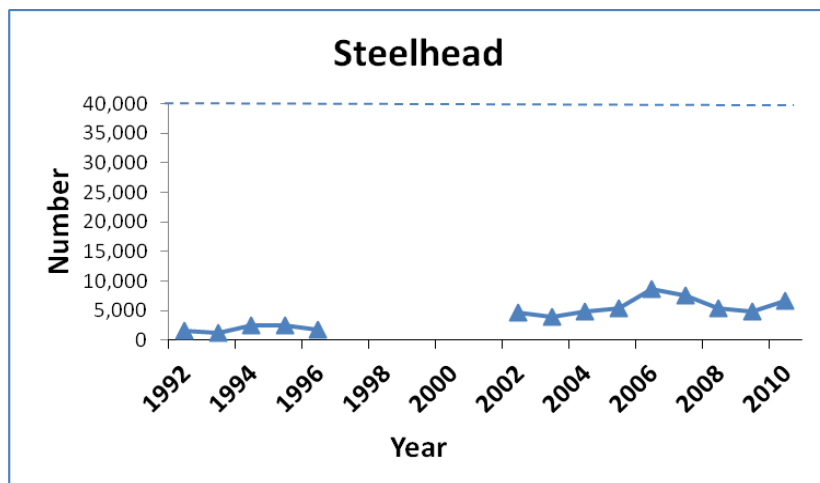
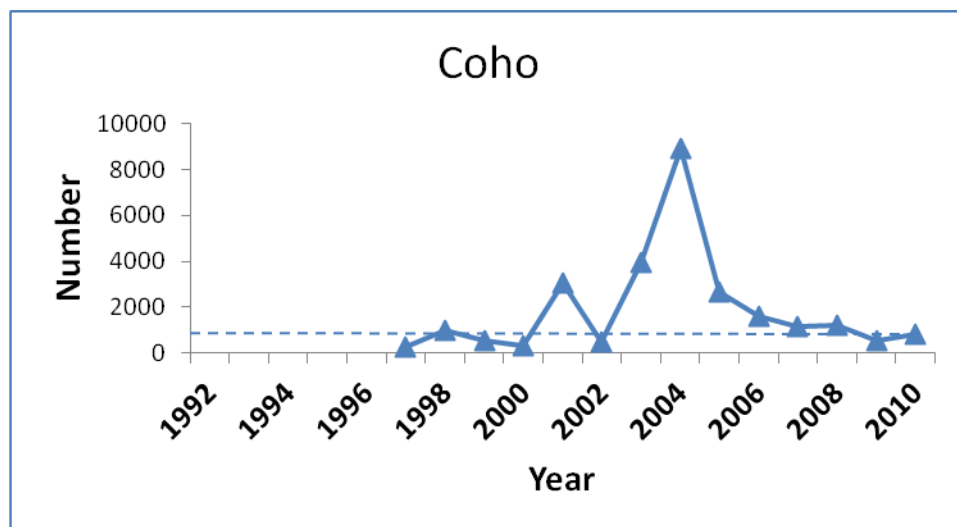


**Figure 1.** Natural origin fall- run Chinook adult escapement in the Trinity River from 1992 to 2010.

**Figure 2.** Natural origin spring-run Chinook adult escapement in the Trinity River from 1992 to 2010.



**Figure 3.** Natural origin coho salmon adult escapement in the Trinity River from 1997 to 2010.



**Figure 4.** Natural origin fall steelhead adult escapement in the Trinity River from 1992 to 2010.

As we continue to collect annual escapement data, we plan to:

1. Incorporate harvest and environmental data (flow, temperature) into models to evaluate whether river conditions, harvest, or other factors have a significant effect on the adult returns; and
2. Evaluate the influence of variable harvest rates on returns over time. Changes from year to year in harvest management varied over time (e.g. two years where the ocean fisheries were closed most of the season).
3. Estimate juvenile habitat carrying capacity to model smolt output potential and survival to validate current program escapement goals.

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