

# **Relationship Between Subbasin Objectives and Basin-Wide Objectives for Anadromous Salmon and Steelhead in the Columbia River Basin**

## **Introduction**

In May 2008 the Members of the Columbia Basin Fish and Wildlife Authority (CBFWA) directed the Anadromous Fish Advisory Committee (AFAC) of CBFWA to “develop the linkages between the population level objectives and the programmatic level objectives” contained within the Northwest Power and Conservation Council’s (Council) Columbia Basin Fish and Wildlife Program (Program). This assignment was intended to be a technical analysis that would result in an estimate of the number of salmon and steelhead returning to the Columbia River Basin if all subbasin objectives were met. Results from the analysis may be used to assess progress likely to be realized towards the Council’s interim goal of 5 million adult salmon and steelhead if subbasin objectives are achieved.

In addition to reviewing the methods used and results from this assignment, the Members should consider how to best include the Bonneville Power Administration (BPA) and the Council in discussions of the analysis. The Members may choose to invite BPA and Council staff to discuss the analysis with the Members Advisory Group (MAG) or with the Members, or both.

## **Background**

The goal of 5 million adult salmon and steelhead returning to the Columbia River Basin originated from an analysis of annual hydropower-related losses completed by the Council in 1986 (Council 1986). The Council used two methods to estimate hydropower-related losses, with each method employing various alternative assumptions. One method estimated hydropower-related losses at 7-8 million fish, whereas the other method estimated losses to be 5-11 million fish. In 1987, the Council set an interim goal of doubling what was then the estimated run size of 2.5 million fish to 5 million fish (Council 1987), because recovering all losses “may not be feasible because biological, socio-economic and other limits on fish production may prevent such rebuilding.” The Council did not set a target date in 1987 for achieving the doubling goal. In 1994, the Council’s Program included a sub-goal to “further rebuild populations by 2030 to a level that will support commercial and sport harvest and contribute to the Council’s interim goal of doubling the abundance of salmon and steelhead in the basin” (Council 1994). In 2000, the Council’s Program set 2025 as the target to achieve runs of 5 million fish (Council 2000).

The location at which to count fish has changed since inception of the 5 million fish goal. The Council’s 1987 and 1994 programs state that counts should include the number of adults returning to the mouth of the Columbia River plus the number of adults caught in the ocean (Council 1987; 1994). The 2000 Program sets the goal of 5 million fish at Bonneville Dam (Council 2000). Counts of total returns including ocean harvest and counts at Bonneville Dam are both important indicators of the status of salmon and steelhead in the Columbia River Basin; therefore, both are included in this analysis.

For the most part, subbasin or population-specific objectives have been developed through the subbasin planning process, and more recently, through the recovery planning process for fish listed under the Endangered Species Act. These plans address numbers of fish desired to return to the subbasin of origin, and often (but not always) delineate naturally-produced and hatchery fish.

The purpose of this analysis is not to re-calculate hydropower-related losses or to evaluate the appropriateness of subbasin-specific or basin-wide objectives and goals. This analysis is intended to inform discussions regarding the relationships among objectives and goals. Considerable additional information is available now relative to 1986, when the Council estimated hydropower-related losses. Foremost is current or recent information on status and objectives at the subbasin level, and in some areas at the more specific population level. This additional information at these more specific levels provides the impetus for examining the relationship among goals and objectives at various levels.

## Methods

Relating subbasin objectives to the interim 5 million fish goal required compilation of subbasin-specific objectives, and estimates of fish harvested or otherwise “lost” during migration to estimate the number of adult salmon and steelhead returning to the Columbia River Basin. Objectives for each species/race in each subbasin were taken from the most recently developed sources available. Sources of objectives for fish spawning naturally, in order of priority, were (1) broad-sense recovery goals from draft recovery plans, (2) objectives from subbasin plans agreed upon by all co-managers, (3) objectives from subbasin plans not agreed upon by all co-managers, (4) agency-specific management plans, and (5) capacity for “restored” habitat as estimated by the All-H Analyzer during development of Program amendment recommendations by CBFWA (CBFWA 2008). Sources of objectives for all other fish returning to a subbasin (hatchery fish returning to hatcheries or to spawn naturally, within-subbasin harvest, etc.) were (1) objectives from subbasin plans agreed upon by all co-managers, (2) objectives from subbasin plans not agreed upon by all co-managers, (3) agency-specific management plans, and (4) return and harvest objectives from hatchery and genetic management plans (HGMPs). Results provided here include all fish (i.e., wild and hatchery fish combined). Further detail on objectives for natural spawners, hatchery returns, harvest, etc., and the source for each objective is given in the attached spreadsheet of detailed results.

Estimating the number of fish harvested or “lost” prior to reaching each subbasin was necessary to expand subbasin-specific fish numbers to overall fish numbers. This included estimating (1) ocean harvest, (2) mainstem harvest below Bonneville Dam, (3) “other” losses below Bonneville Dam, (4) mainstem harvest above Bonneville Dam, and (5) migration losses above Bonneville Dam. Estimated harvest rates were high because achieving all subbasin objectives would result in large run sizes, which in turn would allow maximum harvest rates. In addition, because of these large run sizes, fisheries were assumed to be non-selective. Ocean harvest rates for each species/race were based on the maximum harvest rates observed over the past 25 years. Mainstem harvest rates were based on the maximum rates allowed in the 2008-2017 *U.S. v. Oregon* Management Agreement (NOAA Fisheries 2008a).

In addition to harvest, some adult salmonids experience mortality caused by pinniped predation below Bonneville Dam and by migration through the hydropower system. Rates for mortality below Bonneville Dam were based on estimated mortality rates from pinnipeds found in the 2008 Biological Opinion (NOAA Fisheries 2008b). Rates for migration losses above Bonneville Dam were based on estimates of mortality per hydropower project also found in the 2008 Biological Opinion (NOAA Fisheries 2008b). Further detail on estimated harvest and loss rates is given in the attached spreadsheet of detailed results.

### **Results (Preliminary)**

Achievement of all subbasin objectives would likely result in approximately 3.9 million adult salmon and steelhead migrating to the Columbia River mouth, including those harvested in the ocean (Table 1). About 2.4 million adults would migrate past Bonneville Dam, with about 2.0 million fish reaching their subbasin of origin. Fish from the Mountain Snake, Columbia Plateau, and Lower Columbia/Estuary provinces comprise over 75% of the estimated number of salmon and steelhead returning when all current objectives are met.

Spring Chinook, fall Chinook, summer steelhead, and coho comprise approximately 85% of the estimated returns when all current objectives are met (Table 2). Detailed information on the estimated number of each species and race from each subbasin and province is given in the attached spreadsheet of detailed results.

### **Discussion**

Results indicate that achieving subbasin objectives may not result in realization of the basin-wide interim goal of 5 million adult salmon and steelhead returning to the Columbia River Basin. This is most apparent when comparisons are made to the goal from the 2000 Program (Council 2000) of 5 million fish migrating past Bonneville Dam. Achievement of current subbasin objectives may result in returns totaling less than 50% of that goal.

Discrepancies among estimated returns should not necessarily be considered evidence that current subbasin objectives or basin-wide goals are inappropriate. Time frames differ among objectives and goals, rendering simple evaluations difficult. Target dates vary among most recovery plan and subbasin plan objectives depending on how they were developed. Many, but not all, subbasin plans used a 10-year horizon to establish objectives. The basin-wide goal was established using 2025 (Council 2000) or 2030 (Council 1994) as a target. Results from this analysis may therefore merely assess progress likely to be realized towards the Council's interim goal of 5 million adult salmon and steelhead if current subbasin objectives are achieved.

In addition, goals and objectives of a particular scope, geographic or otherwise, should not necessarily be considered more important than goals and objectives of a different scope. For example, results indicate that meeting subbasin objectives may not result in realization of basin-wide goals; however, it is equally true that achieving a basin-wide goal may not result in achieving all subbasin objectives. Both scopes are important to consider.

Table 1. Numbers of adult anadromous salmon and steelhead expected to return to the Columbia River Basin if all current subbasin/population objectives for adult returns are achieved. Estimates for the Columbia River mouth include ocean harvest.

Province	Columbia River Mouth	Bonneville Dam	Subbasin of origin
Mountain Snake	1,209,459	1,015,259	688,300
Blue Mountain	361,974	300,967	190,489
Columbia Cascade	336,710	283,828	134,365
Columbia Plateau	816,006	618,508	443,543
Columbia Gorge	223,215	146,110	110,725
Lower Columbia/Estuary	941,823	--	451,627
Total	3,889,188	2,364,674	2,019,049

Table 2. Numbers of each anadromous salmonid species expected to return to the Columbia River Basin if all current subbasin/population objectives for adult returns are achieved. Estimates for the Columbia River mouth include ocean harvest. Spring Chinook estimates include Snake River spring/summer Chinook.

Species/race	Columbia River Mouth	Bonneville Dam	Subbasin of origin
Spring Chinook	894,717	695,222	606,626
Summer Chinook	161,767	108,651	42,755
Fall Chinook	947,736	430,438	341,533
Summer Steelhead	789,422	726,730	508,336
Winter Steelhead	73,544	8,570	67,410
Coho	673,456	89,301	209,400
Sockeye	308,850	305,762	203,990
Chum	39,616	0	39,000

Further refinement of objectives and other inputs to this exercise may occur in the future. Several methods were used to develop subbasin or population-specific objectives found in subbasin plans and recovery plans (models, professional judgment, etc.). These objectives may be refined as underlying analytical techniques are updated. One example of input refinement addresses incorporation of natural mortality rates. A small percentage of the fish harvested would likely die of natural causes in the absence of harvest. Using the difference in mortality caused by harvest may be more appropriate than using the total number of fish harvested.

Changes to hatchery and harvest rate inputs are also likely. Although most goals for existing hatcheries have been included, hatcheries currently planned but not yet operating will impact results. It is also possible that the run sizes resulting from meeting all subbasin objectives would result in allowable harvest rates being increased from the current or recent maximums, thereby increasing the estimate of the total number of fish realized by meeting all subbasin objectives.

Pacific lamprey were not included in the original loss assessment and are not included in the basin-wide goal of 5 million returning fish. Pacific lamprey are an important anadromous fish in the Columbia River Basin and are experiencing declines of similar or greater magnitude than salmonids. Although not included in this analysis, recovering losses of Pacific lamprey should be an integral component of Fish and Wildlife Program activities.

The Columbia River Basin has changed since the original estimate of hydropower-related losses in 1986, with many changes still ongoing. These changes may result in a net decrease or increase in the capacity of the Basin. Although the Basin continues to undergo changes, it is imperative to recover as many of the hydropower-related losses as possible. It is also imperative to prevent further losses. Currently, 13 of 16 defined salmon ESUs or steelhead DPSs in the Basin are listed as threatened or endangered. In addition to recovering losses in terms of numbers of adults returning to the Basin, it is critical that the need for additional listings be prevented, and that currently listed stocks are recovered.

## References

Columbia Basin Fish and Wildlife Authority. 2008. Recommendations for amendments to the Northwest Power and Conservation Council 2000 Columbia Basin Fish and Wildlife Program.

NOAA Fisheries 2008a. 2008-2017 *United States v. Oregon* Management Agreement.

NOAA Fisheries 2008b. FCRPS 2008 Biological Opinion. Supplemental Comprehensive Analysis of the Federal Columbia River Power System and Mainstem Effects of the Upper Snake and Other Tributary Actions.

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