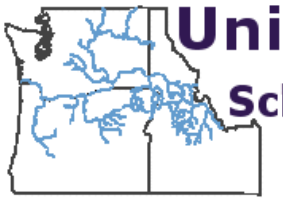
# Salmon Insider

Columbia Basin Research Newsletter

Spring 2004



# University of Washington

## School of Aquatic & Fishery Sciences

## Columbia Basin Research

Columbia Basin Research (CBR) is a scientific research group at the University of Washington, School of Aquatic & Fishery Sciences. We investigate salmon biology and survival in the Columbia and Snake river basins. We provide user-friendly data analysis and modeling tools, and maintain DART, an interactive secondary database, for the fisheries community and the general public.

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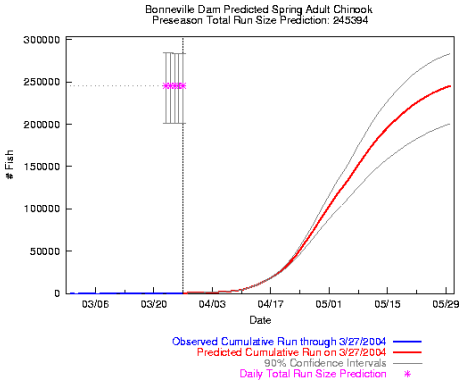
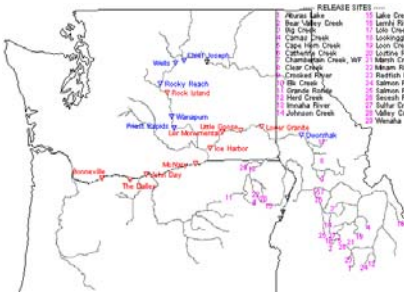
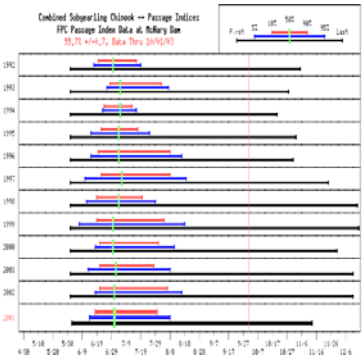
### Adult Run-Size & Run-Timing Forecasts



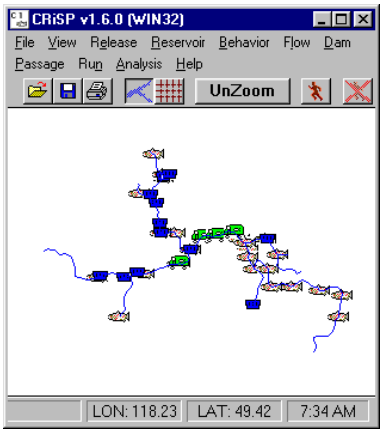

### 2004 Smolt Run-Timing Forecasts




### 2004 Smolt Run-Timing Forecasts (Cont.)



### CRiSP Theory & Practice

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# Adult Run-Size and Run-Timing Forecasts at Bonneville and Upstream

During the upstream migration season, we produce daily run-size and run-timing predictions for adult spring and fall chinook runs at Bonneville Dam and run-timing from the Bonneville Dam tailrace to the upstream dams on the Columbia and Snake Rivers.

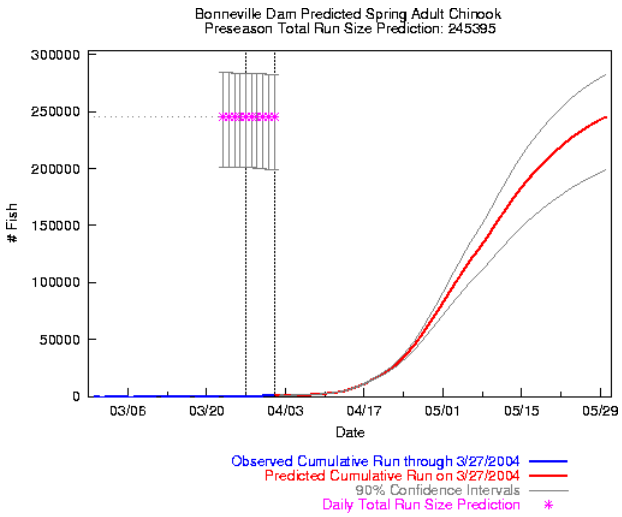
The adult upstream forecaster consists of the *Escapement Forecaster* that predicts the arrival timing and run-size of adult salmon at Bonneville Dam and the *Adult Upstream Model* that predicts the run-timing of the fish at dams above Bonneville Dam.

The *Escapement Forecaster* predicts the arrival timing of the run at Bonneville Dam. Using pattern matching algorithms, it compares the observed adult visual counts at Bonneville Dam to the historical counts to predict the percent of the run that has passed Bonneville Dam on the current day and to project the remaining timing of the run. The tool also forecasts total run-size at Bonneville Dam. The pre-season run-size forecast is based on jack counts of the previous year and is blended smoothly with the pattern match prediction as the season progresses.

The *Adult Upstream Model* takes the projected escapement at Bonneville as input and predicts the arrival timing at dams above Bonneville Dam. The model contains a temperature and flow based submodel for reservoir passage and submodels for dam passage, fallback, and straying. It also includes a bioenergetics model to predict fish migratory energy consumption. River flow and temperature are modeled with the CRiSP model. The Adult Upstream Model has been calibrated to radio-tag data as well as 1998-2003 adult PIT-tag returns at Bonneville and Lower Granite.

The first figure shows our pre-season prediction for 2004 Bonneville Dam spring chinook escapement. This would be the 3rd largest run since counts began in 1938. The total observed adult spring chinook escapement at Bonneville Dam was 391818 in 2001 and 269428 in 2002. The river mouth forecast by Interjurisdictional Fisheries Management Program (see table) would be the 2nd largest since 1938. The second figure shows our current prediction for run-timing at Bonneville Dam for adult spring chinook with observed run-timing for the past six years. Although it is very early in the season, the Escapement Forecaster predicts that the 2004 run is later than the most recent years.

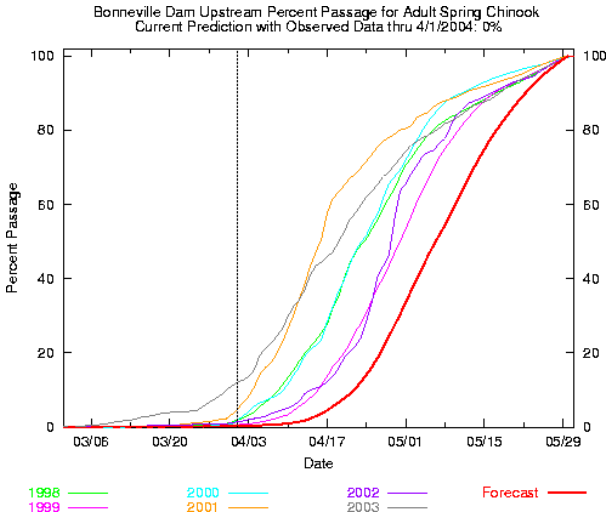
For 2004 upstream forecasts and more details, see http://www.cbr.washington.edu/crisprt/index_adult.html.




**2004 Columbia River Adult Spring Chinook**

| | Location | # Fish |
|---|---|---|
| 2003 Jack Chinook Observed | Bonneville Dam | 14258 |
| 2004 Pre-season Run-size Prediction | Bonneville Dam | 245395 |
| 2004 IFMP Upriver Run Forecast* | Columbia River Mouth | 360700 |

*http://www.dfw.state.or.us/ODFWhtml/InfoCntrFish/InterFish/04fish forecasts.pdf



# 2004 Smolt Run-Timing Forecasts for ESA-Listed Salmonid Stocks

Every year, wild parr of ESA-listed stocks of salmon and steelhead in the Interior Columbia Basin are injected with passive integrated transponder (PIT) tags (see http://www.psmfc.org/pittag/Overview/) and released back to their natal streams. They are then individually tracked at detection facilities at Snake and Columbia River dams during their outmigration to the ocean. Since 1994, release/recovery data such as these have been used by Program RealTime to provide, online to the fisheries community and to the public, predictions of passage percentages and forecasts of run-timing to the dams.

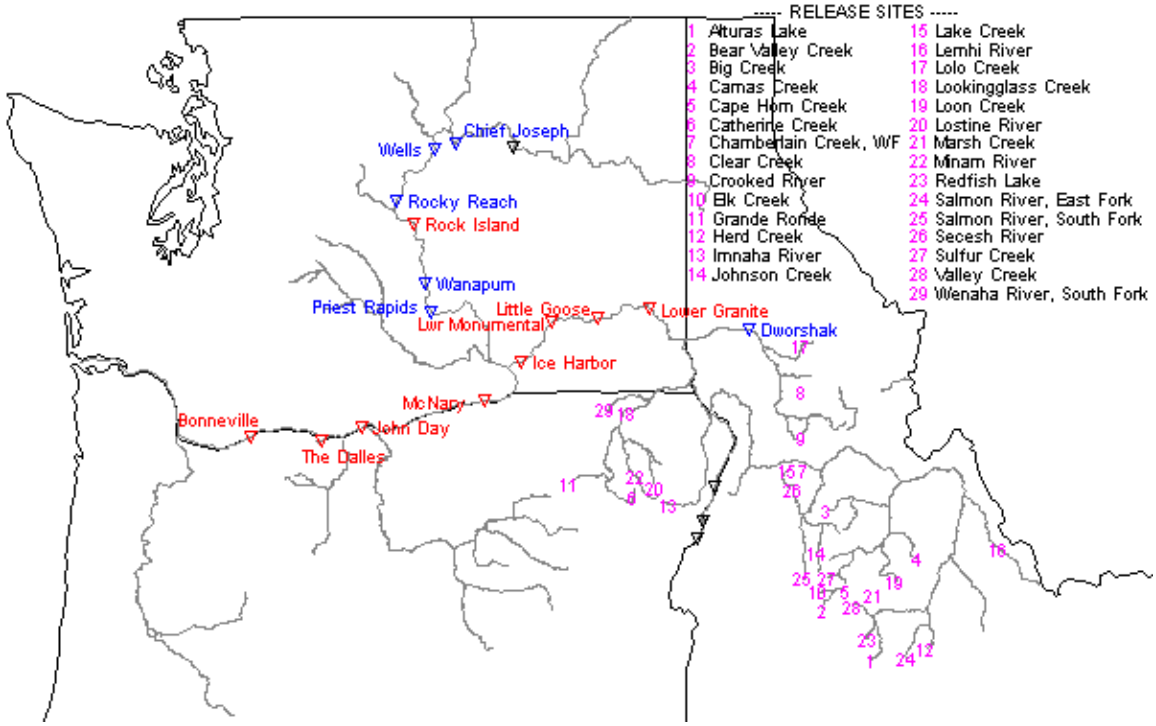
In 2004, passage predictions and run-timing forecasts to Lower Granite Dam (LWG) will be provided for 21 stocks of wild Snake River spring or summer chinook salmon (1 from the Imnaha River; 4 from the Grande Ronde River drainage; 15 from the Salmon River drainage; and 1 from the Clearwater River drainage), and for hatchery-reared sockeye salmon implanted to Redfish Lake in Idaho.

In addition to stocks for which release/recovery data are available, we provide predictions and forecasts for runs-at-large of wild PIT-tagged salmon and steelhead to Lower Granite and McNary dams. These ESU wild runs-at-large include Snake River sockeye salmon, Snake River spring/summer and fall chinook salmon, Snake River steelhead trout, Upper Columbia River fall chinook salmon, and Upper Columbia River steelhead trout.

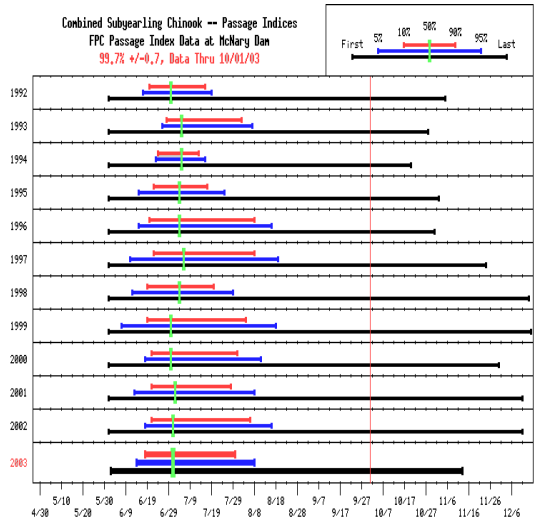
Passage indices provided by the Fish Passage Center (including runs-at-large of combined wild and hatchery yearling and subyearling chinook salmon, coho and sockeye salmon, and steelhead trout) will be used in 2004 to predict and forecast passage status to Rock Island, McNary, John Day, and Bonneville dams.

And finally, for the second successive migration season, yearling and subyearling chinook salmon, sockeye salmon and steelhead trout, indexed by the Chelan County Public Utility District will be predicted and forecasted to Rocky Reach Dam on the Upper Columbia River in 2004.

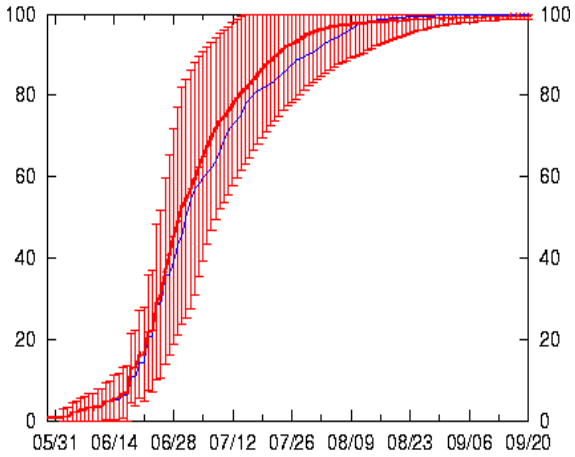
For more information, please see: http://www.cbr.washington.edu/crisprt/index.html for smolt passage predictions.



## 2004 Smolt Run-Timing Forecasts (Continued)




Above is the "Passage Prediction with Historical Timing Plot" for FPC (Fish Passage Center) passage indices of combined hatchery and wild subyearling chinook salmon outmigrating to McNary Dam in 2003 .




Above is the 2003 "Daily Record Graph" comparing Program RealTime predictions of passage percentages of FPC passage indices of combined hatchery and wild subyearling chinook salmon smolts outmigrating to McNary Dam (red) with the observed end-of-season arrival distribution (blue).

## Columbia River Salmon Passage (CRiSP) Model: Theory and Practice

The Columbia River Salmon Passage (CRiSP) model predicts downstream migration timing and survival of wild and hatchery stocks of juvenile salmon and steelhead from the tributaries of the Columbia and Snake rivers to the estuary.

The CRiSP model describes the effects of daily changes in water properties and river operations on fish migration. The mortality in the tributaries and reservoirs depends primarily on predator density, river temperature, and migration distance. Secondarily, mortality depends on fish velocity. Gas supersaturation depends on spill levels at dams; the resulting fish mortality depends on the exposure duration. Migration velocity response to flow is stock specific and also depends on the migration date and duration. The passage routes through dams and collection of fish for barging depends on dam operations. Model predictions of water temperature and gas supersaturation are calibrated with several decades of data. Fish migration survival and velocity are calibrated with PIT tag data that encompasses the years 1992-2003.

**Current Applications of CRiSP**

- *Inseason Migratory Forecasts* – We employ the CRiSP model jointly with Program RealTime to predict the arrival distributions of juvenile salmon at sites along the Snake and Columbia Rivers.
- *Spill Scenario Analysis* – CRiSP can be used to model spill scenarios. We used CRiSP to compare Columbia Basin fall chinook stock survivals under the Bi-Op and two alternative summer spill scenarios: Bi-Op conditions with no August spill and Bi-Op conditions with no July and August spill.
- *Predator Removal Analysis* - CRiSP can be used to model mitigation programs. To model the effects of predator removal on fall chinook in-river survival, we reduced the reach-specific predator densities in CRiSP by a fixed percent. In our analysis, we found the Hanford Reach fall chinook received the most benefit from enhanced predator removal programs.

For more information:
http://www.cbr.washington.edu/crisp/crisp.html.