

# University of Washington

## School of Aquatic & Fishery Sciences

### Columbia Basin Research

# Salmon Insider

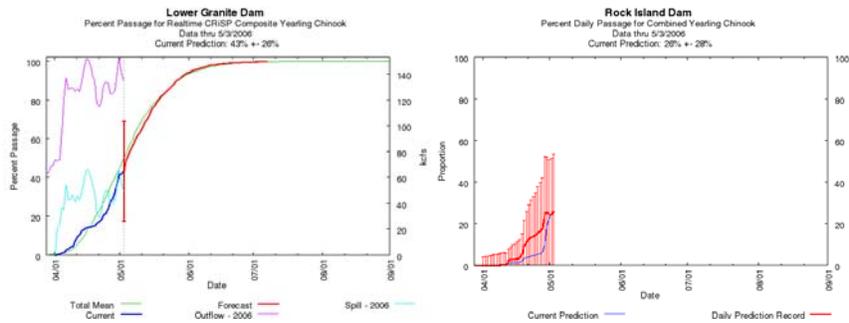
Columbia Basin Research Newsletter

Spring 2006

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.

## Inside . . .

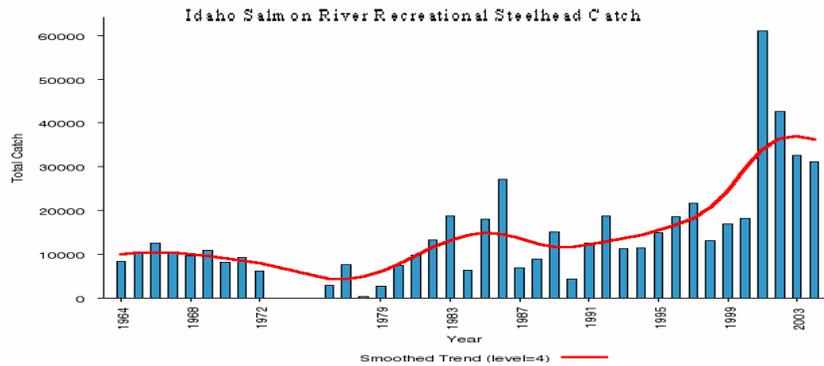
### Inseason Forecasts for 2006 Salmonid Migration



### Research Highlight:

Linking Environmental & Population Heterogeneity through Vitality

### CBR Second-Tier Harvest Database



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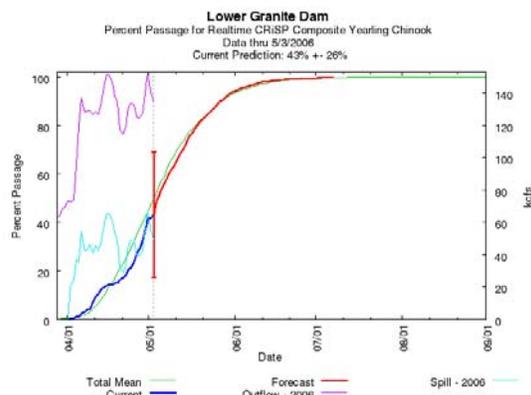
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## Inseason Forecasts for Salmonid Migration

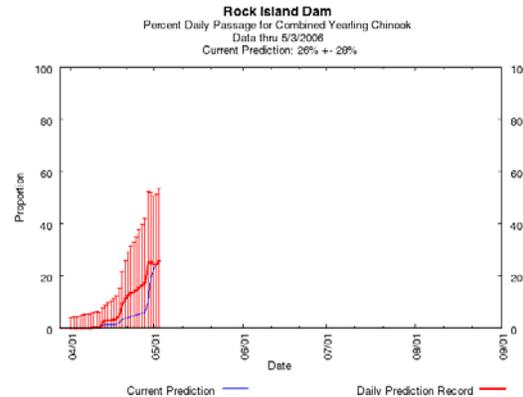
From April through October, we predict the run timing and arrival distributions of juvenile and adult salmonid stocks at monitoring sites along the Snake and Columbia rivers and provide our predictions to the public on the CBR [Inseason Forecasts](#) website. These predictions of the current status of the runs are updated daily throughout the migration season, incorporating “real time” observed data for the stocks from such sources as the Pacific States Marine Fisheries Commission, Fish Passage Center, US Army Corps of Engineers, and Chelan County PUD, with hydrographic and operational information from the Bonneville Power Administration and the US Army Corps of Engineers.

Passage monitoring reports and predictions are available for Snake, Mid-Columbia, and Lower Columbia hydroprojects for Evolutionary Significant Units (ESUs) as well as river runs as a whole for spring and fall Chinook and sockeye salmon, and steelhead. We monitor the smolt outmigration of 34 stocks, ESUs, and composite groups through 10 different hydroprojects.

The following are several examples of the 2006 migration season forecasts produced and reported on the web site.



**Figure 1.** Percent passage of composite yearling Chinook salmon at Lower Granite Dam with historical mean passage and observed outflow and spill, 5/3/06. Forecast category: [Smolt Passage \(PIT Tag\)](#). Click on figure for updated prediction and information.



**Figure 2.** Percent daily passage record at Rock Island Dam for combined yearling Chinook salmon through 5/3/06. Forecast category: [Smolt Passage \(Passage Index\)](#). Click on figure for updated prediction and record.

Passage predictions are provided to the public and to assist fisheries/hydro managers in decisions about mitigation efforts such as flow augmentation, spill, and fish transportation. Managers, provided with current information on the status of specific salmon runs, have the ability to manage the Columbia River hydrosystem to optimize salmon survival and minimize the costs of mitigation procedures.

These predictions, along with detailed displays of historical run-timing information, can be retrieved and independently analyzed using interactive software and graphs.

The Inseason Forecasts website also includes several background web pages:

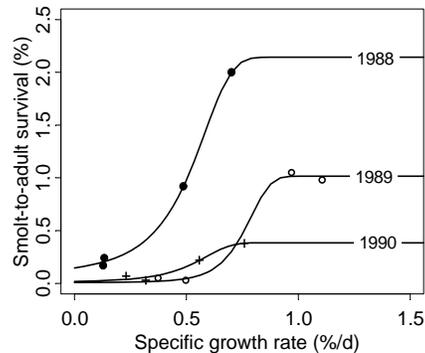
- *Publications* — Documentation of prediction methodology and post-season analysis of performance: <http://www.cbr.washington.edu/crispr/t/documents.html>.
- *Stock Map and Information* — Map of the forecast locations and stocks: <http://www.cbr.washington.edu/crispr/t/info.html>.

## Linking Environmental and Population Heterogeneity through Vitality: the Effects of Juvenile Growth on Salmon Survival

J. J. Anderson, M. C. Gildea, and D. W. Williams

The effects of environmental heterogeneity on population heterogeneity and mortality can be explored with a model that treats heterogeneity as a single hidden Markov process (vitality) that evolves as a function of environmental conditions. The model was used to study the effects of juvenile growth on salmon survival under laboratory and field conditions. Laboratory-derived measures of the effect of growth on juvenile salmon survival and vitality (Cobleigh 2003) were applied to a study by Beckmann et al. (1999) on the effect of hatchery growth rates on smolt-to-adult return (SAR) rates of salmon from Deschutes River hatcheries. The model indicates that SAR increases in a sigmoidal manner with juvenile growth (Figure 3). At growth rates above a critical threshold, the SAR is independent of growth or vitality and is determined by random mortality in the ocean. The critical threshold and the slope leading up to the threshold, depend on population-specific effects of growth on population vitality.

For salmon, the model indicates that variance in the vitality distribution—a measure of increased heterogeneity and possibly increased natural selection—is larger when juvenile growth is low. The analysis provides a unique framework in which to explore the effects of freshwater conditions on survival of salmon in the ocean.



**Figure 3.** Relationship between the juvenile chinook salmon growth rate in hatcheries and the smolt-to-adult survival for fish from three hatcheries on the Deschutes River, Oregon, in years 1988 (●), 1989 (○) and 1990 (+).

This article has been submitted for peer review and publication. For more information, please contact Jim Anderson at (206) 543-4772 or [jim@cbr.washington.edu](mailto:jim@cbr.washington.edu).

### Literature Cited

- Cobleigh, M. M. 2003. Stress, growth, and survival of juvenile Chinook salmon. M.S. thesis. University of Washington, Seattle.
- Beckman, B. R., W. W. Dickhoff, W. S. Zaug, C. Sharpe, S. Hirtzell, R. Schrock, D. A. Larsen, R. D. Ewing, A. Palmisano, C. B. Schreck, and C. V. W. Mahnken. 1999. Growth, smoltification, smolt-to-adult return of spring Chinook salmon from hatcheries on the Deschutes River, Oregon. *Trans. Am. Fish. Soc.* 128(6):11.

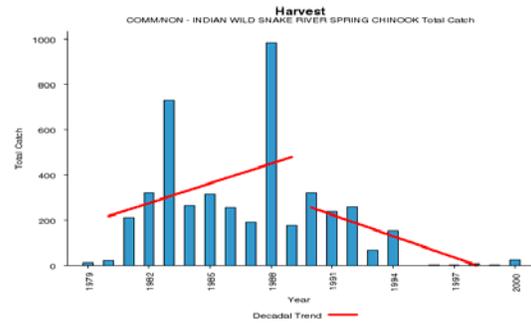
## CBR Harvest Database Soon to Debut Online

CBR is in the final stages of developing a new second-tier harvest database for the [Status & Trends](#) website. Harvest numbers consist of total annual catch estimates from fish tickets, angler catch record cards, or creel census data. The source of most estimates are state agency harvest reports from department websites. More recent numbers have been provided through generous contributions by department fisheries management personnel. Documentation will include data sources and explanatory footnotes.

The database is scheduled to go online in May, and will be consistent with other components of the [Status & Trends](#) section of our website.

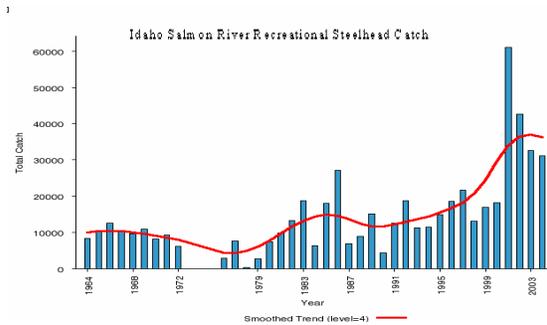
An interactive, graphical interface will allow users to assess the status and trends of mainstem and tributary location-specific commercial, recreational, ceremonial, and subsistence fisheries for most Columbia Basin salmonid species and stocks, both hatchery and wild. *Decadal trend*, *decadal mean*, and *smoothing* tools will be available to enhance visual inspection of times-series catch data.

In the following example, we see commercial wild Snake River spring Chinook harvests declining dramatically in the last decade of record.



**Figure 4.** Total commercial harvest of wild Snake River spring Chinook salmon from 1979-2000.

In the following example, the smoothing tool has been used to illustrate increasing Salmon River sport catches over the past 25 years.



**Figure 5.** Total recreational harvest of Salmon River, Idaho, steelhead from 1964-2003.

Additional features of the database will include downloadable datasets and multi-species tables of total catch estimates for specific fisheries and locations. The database will be updated regularly as the current year's catch estimates become available.

For more information, please contact Jim Griswold at (206) 616-7445 or [jimg@cbr.washington.edu](mailto:jimg@cbr.washington.edu).