BPA: Making Senses of Salmon Runs

Local News

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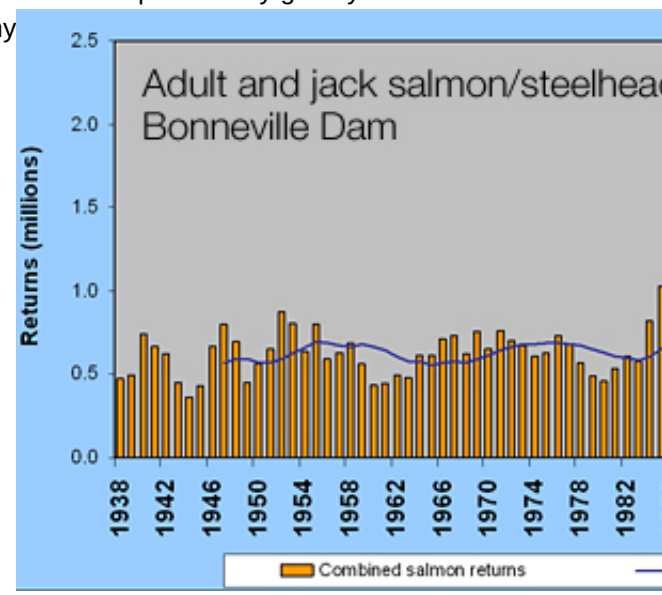
Portland, OR - While the vast majority of ESA-listed stocks have shown significant increases in abundance since their listings in the 1990s, the return numbers for each species vary greatly between individual years. Recent studies may help explain why



State fishery managers last week released their preseason forecast for 2013 returns of salmon and steelhead to the Columbia River. After two years when salmon and steelhead returns were among the highest since recordkeeping began (*see graph, Adult returns to Bonneville Dam*), this year forecasts are down for some stocks.At the same time, runs of most Columbia Basin salmon and steelhead have increased since the first Endangered Species Act listings in the 1990s. Fish returns appear to be on the upswing.

Is there a trend, and what does it mean?“All natural populations vary in abundance from one year to the next,” says BPA fisheries biologist Jason Sweet. Trying to understand the causes of these variations is what continues to challenge the experts who study and forecast salmon returns. In 2012, for instance, State fisheries managers forecast a huge spring chinook run. The run undershot forecasts by half. Meanwhile, the 515,000 adult sockeye return was by far the largest on record since 1938.There are 13 stocks, known as Evolutionarily Significant Units, of ESA-listed salmon and steelhead in the Columbia Basin. There are up to 28 individual populations within each of those 13 ESUs – originating from different tributaries in the Basin. Juvenile coho, steelhead, chinook and sockeye all migrate out at different times of the year and to different parts of the ocean. They return to spawn at different times of the year and to different parts of the Basin – the Upper Columbia, mid-Columbia, Willamette or Snake River and tributaries.Even within species, there’s huge variation. The sockeye that ballooned the return in 2012 came from the Okanogan in northern Washington and Canada, buoyed by a careful water management program among utilities there to help keep spawning areas submerged while eggs incubated. At the same time, the Snake River sockeye return, after three successive years of record-breaking returns, was

down a bit in both 2011 and 2012.University of Washington scientists who have been able to reconstruct salmon runs using sediment cores from sockeye lakes in Alaska have shown that this variation among salmon runs in the same Basin was true hundreds of years before harvest, dams and habitat encroachment.This is one reason why biologists never look at one year in isolation to assess the state of the salmon. Instead, they compare returns in any single year with rolling averages over several years – 10 year and 4-year rolling averages are typical.

It’s the oceanSalmon-friendly ocean conditions By far the clearest indicator of salmon returns is the Pacific Decadal Oscillation, a climate index based upon patterns of variation in sea surface temperature of the North Pacific that have historically run in about 20-year cycles. Sea surface temperatures are strongly affected by the direction of winter winds in the North Pacific. Winter winds blowing chiefly from the southwest result in a warmer ocean current. Winds from the north create cooler conditions. Cold PDOs have produced the best conditions for Columbia Basin salmon and the marine life that they prey on off the west coast of the United States.A more local condition affecting salmon directly off the Oregon and Washington coasts is coastal upwelling. Cool winds along the Oregon coast send surface water away from the coastline and move cool, high-salinity, nutrient-rich water upward. Upwelling increases the plankton and other organisms that the young salmon feed on in their first months in the ocean.

Salmon returns typically ebb and flow in cycles that correlate closely with ocean conditions. Scientists have long known that ocean conditions strongly affect salmon survival.

A team of scientists from NOAA and Oregon State University have now found that Pacific ocean conditions are far better predictors of adult salmon returns to the Columbia River than 31 other factors, including previous year’s returns or regional physical conditions such as off-coast upwelling. (*See box, Salmon friendly ocean conditions*.)

Biologists know that survival through the first 6-12 months in the ocean really sets the bar for how many Chinook and coho adults will likely return as adults. Cool water and plentiful food are most important in their first year of life in the ocean, when the young fish are most vulnerable to predators. The NOAA Science Center has found that it can predict the size of salmon return in any one year with a good degree of accuracy based on the ocean conditions 2-3 years before. (For more on NOAA’s Ocean Indicators analysis, see NOAA’s webpage.)

Interestingly, salmon runs historically have always experienced even longer and wider variations. The University of Washington researchers identified natural cycles of salmon “boom” and “busts” of up to 200 years among salmon returning to Southwest Alaska – far longer than the typical 20-year ocean cycles.

Helping salmon in freshwater

Early forecasts for 2013 Using ocean conditions in 2010-2011, when this year's returning adult fish entered the ocean, the NOAA Science Center is forecasting 200,000 spring chinook to return to Bonneville Dam in 2013.State fisheries managers, known as the Columbia River Compact, rely on the chinook jack return as a key variable in models used to predict returns for the next year (jacks are chinook that return after just one year in the ocean.) Preliminary Compact forecasts are for 141,400 upriver spring chinook to return to the mouth of the Columbia River in 2013. (The Compact forecasts returns to the mouth of the Columbia rather than Bonneville Dam. Some fish are harvested before they reach the Dam, which would make the forecast lower.)While we obviously have little control over ocean conditions, we can help get good numbers of juvenile fish safely to the ocean. Working with other federal agencies, states and tribes, BPA is improving spawning and rearing habitat in the Columbia River Basin and helping fish get safely past the dams.

These improvements are making a difference. Today, Sweet says, juvenile fish survival through all eight dams on the lower Snake and Columbia rivers is as good as or better than it was when there were only four federal dams there.

And, he adds, "we have updated data for 49 of the 58 ESA-listed populations that spawn above

Bonneville Dam. Of those, 47 have increased in abundance since the ESA listings in the 1990s. That's a strong record that we want to continue."
“This says to us to keep following the path we’re on because it's working.”