

## **New Hypotheses Emailed by Jim Geiselman on May 29, 1998.**

**Hypothesis: Adult migration survival through a drawdown reservoir reach is not significantly different than survival through the existing dam and reservoir complex.**

This is an alternative hypothesis for the effect of drawdown on adult survival rates. The hypothesis that is currently modeled under drawdown assumes that adult conversion rates through the Snake will increase by 15 percent. This is a critical uncertainty that can have substantial effects on model outputs (preliminary sensitivity analyses by Hinrichsen) and needs to be included in the assessment of management alternative A3. Under this alternative hypothesis the future adult conversion rates would have the same values under all management alternatives.

Bjornn 1990 related salmon counts at Ice Harbor Dam with redds counted in Snake River tributaries to estimate survival rates from Ice Harbor to the spawning grounds. He estimated an average survival to spawning grounds for spring and summer chinook of 55% for 1962-68 with one dam in place and 46% for 1975-1988 when all four dams were in place. (Need to get this report and test if statistically significant difference in means. Bjornn personal communication felt the sample size for 1962-68 was probably too small to compare to 1975-1988 survivals). Bjornn 1998 concluded that -we do not know if the dams and reservoirs have increased the rate of mortality because few survival estimates are available before all four of the Lower Snake dams were completed.- Bjornn 1998, using radio tags, estimated minimum survival rates from the tailrace of Ice Harbor to spawning grounds and hatcheries ranging from 54% in 1991, 61% in 1992, to 76% in 1993. This can be partitioned to 74%, 77%, and 84% survival through the hydro system and 73%, 79%, and 90% through the free flowing stretches respectively for 1991, 1992, and 1993. He found a statistically significant negative relationship between travel time and survival for two of these three years of research. He also found that fish migrated faster through a reach of dams and reservoirs than through reaches of free flowing river (6.5 days for median fish through the Snake river dam complex compared to 8.4 days for the same distance based on free flowing travel times). Paulsen 1998 found a negative relationship between flow and adult conversion rates (i.e. that there is higher survival associated with lower flow rates).

**Hypothesis: Equilibrium survival levels under drawdown vary by runoff conditions.**

This hypothesis is a critical uncertainty for the effect of drawdown on juvenile survival levels after equilibrium. The existing analyses assumes there is a constant equilibrium survival level into the future. Under this alternative hypothesis the survival rate will be keyed to runoff conditions reflecting the variability in year to year survival found in the data sets.

For the equilibrium period variability, the data from the 1960s Raymond estimates and from the pit-tag data above Lower Granite both show a range of variability in survival (need to look further at relationship to flow in these data sets - if weak or non-existent than should model as a random event to incorporate variability). Analyses of pit-tag

data for 1993 through 1996 (Survival Estimates for the Passage of Juvenile Salmonids Through Snake River Dams and Reservoirs) Smith et al, 1997 no statistically significant relationship within year between flow and fish survival. However, when the survival is looked at across years, the analyses shows a very weak but statistically significant relationship between the flow and the survival level within each of the years for migration below Lower Granite dam. Analyses of more limited data above Lower Granite is much weaker statistically but consistent with the results below Lower Granite.

**Hypothesis: The productivity of Snake River salmon stocks is a function of marine nutrients (via salmon carcasses) in freshwater rearing habitats.**

The importance of the contributions of marine-derived nutrients from salmon carcasses to stream and lake productivity and salmonid production has long been recognized. However, recently its importance to the unsustainability and further decline of weak stocks of wild salmonids has been emphasized in the scientific literature (Bilby et al, 1996; Larkin and Slaney 1997; Levy 1997a and 1997b; Mundy 1996; Piorkowski 1997). In salmon producing systems, the whole riparian ecosystem depends on salmon carcasses. Depressed levels of marine derived nutrients reduce the stream ecosystem productivity which can lead to decreased juvenile fish size, increased susceptibility to disease, reduced overwintering, migration, and marine survival, and further declines in returning adults. Results of studies in Alaskan streams suggest the fitness of coho and chinook salmon fry may relate directly to the adult run strengths to their rearing areas in the summer and fall following their hatching. In Washington coho salmon streams studies have found up to 30% of the N and C that builds the bodies of algae and aquatic invertebrates comes from the sea via returns of coho salmon.