Reservoir Operations / Flow Survival Symposium
9-10 November 2004

# Effects of Summer Flow Reductions in the Upper Columbia on Adult Salmonid Migrants

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**Question:**

What impacts will shifting Columbia River flow from summer to fall have on adult salmon and steelhead migrants?

**Area of concern:**

Mid- and Lower Columbia River

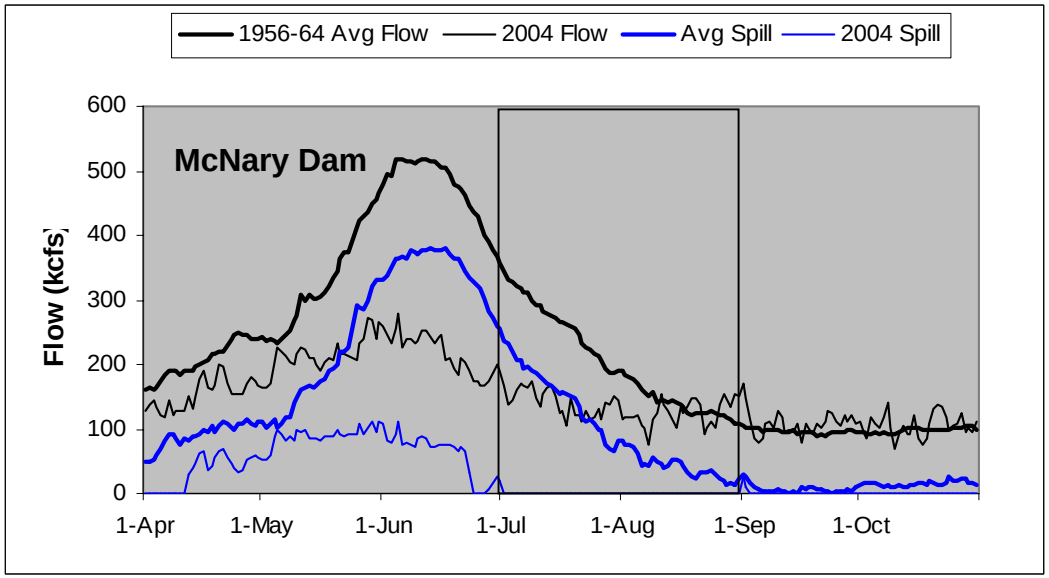
**Stocks of concern:**

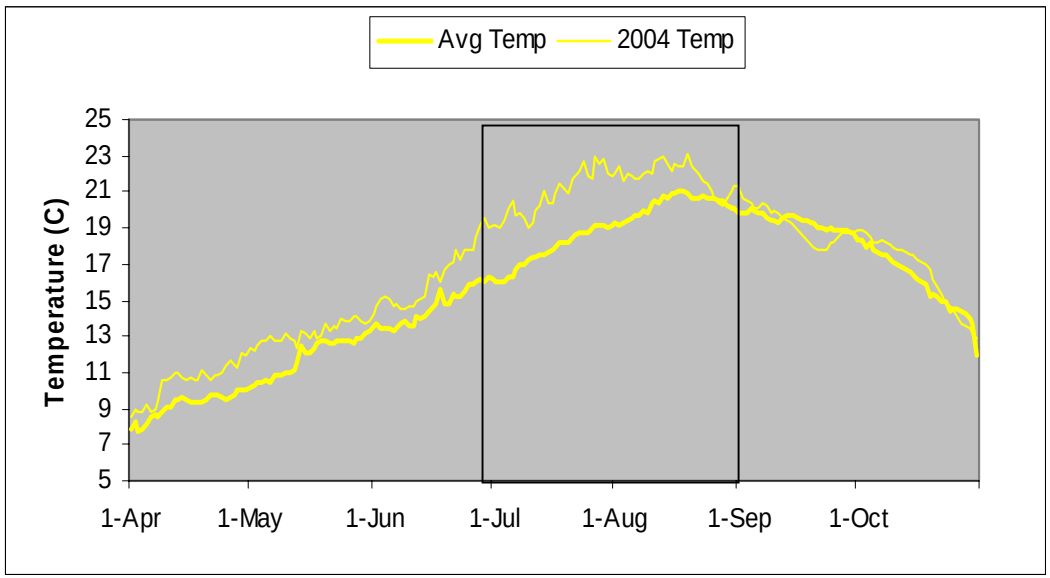
Sockeye salmon, summer and fall Chinook salmon, Steelhead, Pacific lamprey

**Considerations:**

Direct and indirect effects from changes in flow and temperatures.

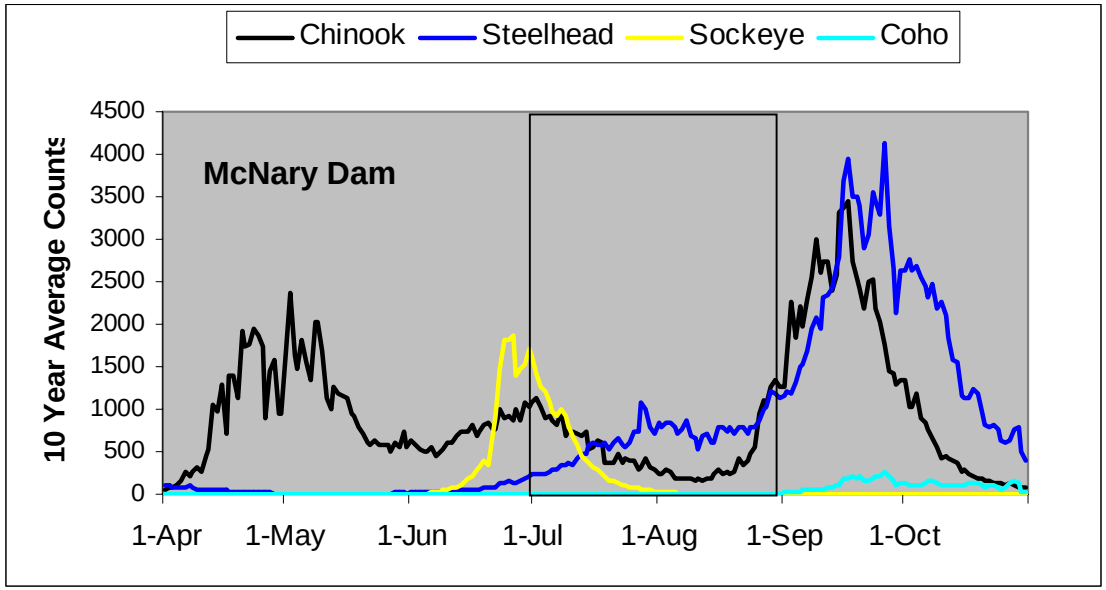
# Historical and Recent Flow, Spill, and Temperature Patterns

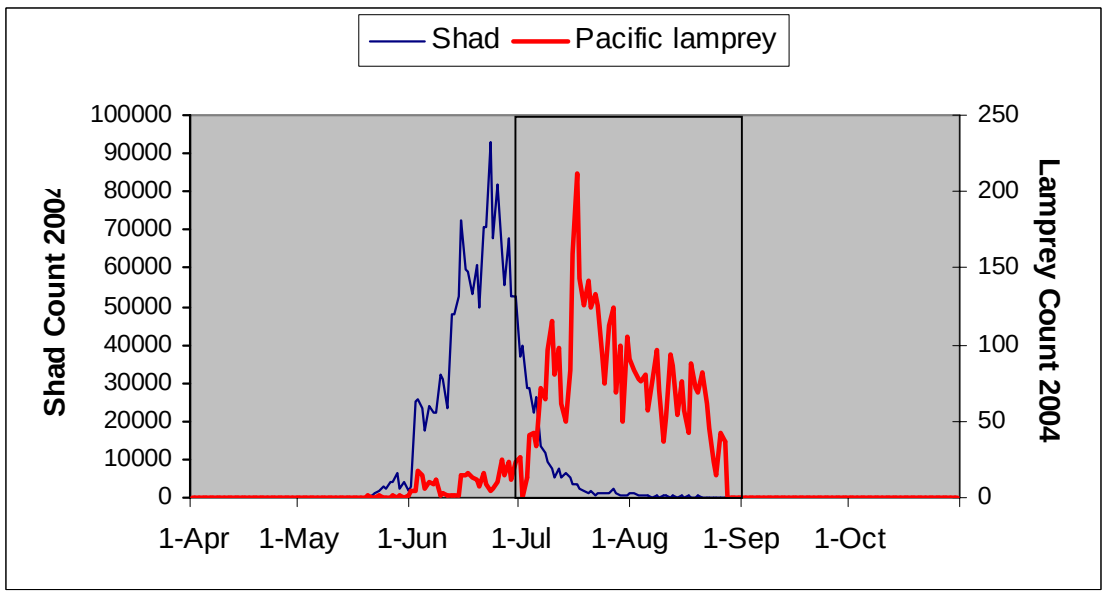



C. Peery, University of Idaho, 10 November 2004, Summer spill

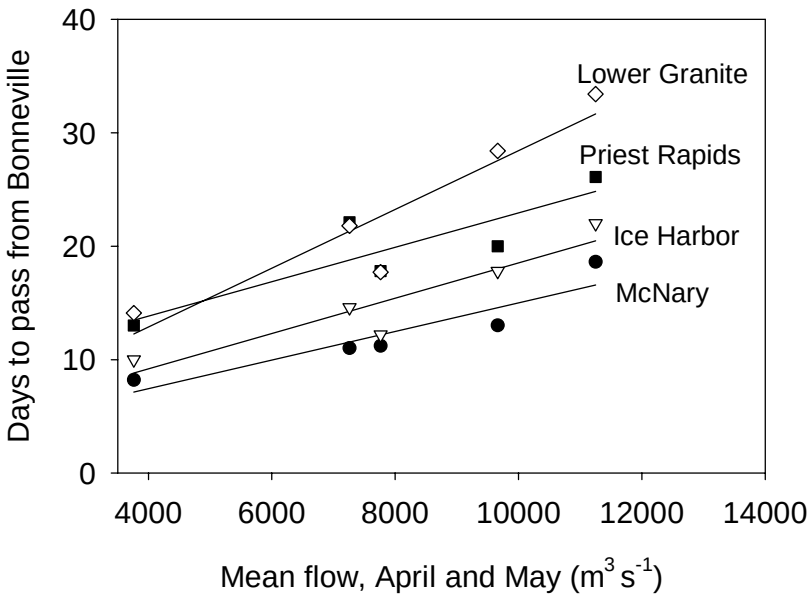
# What stocks will be affected most?



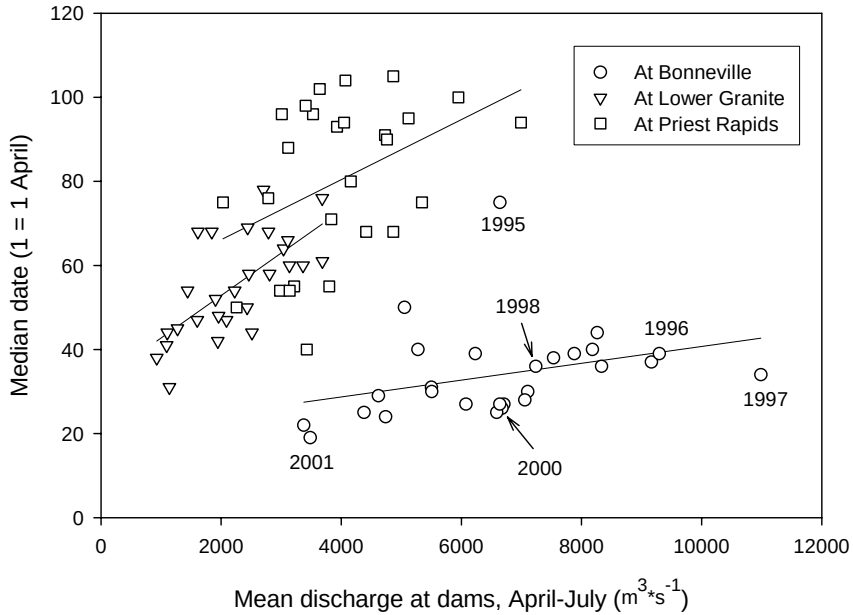



## Flow:

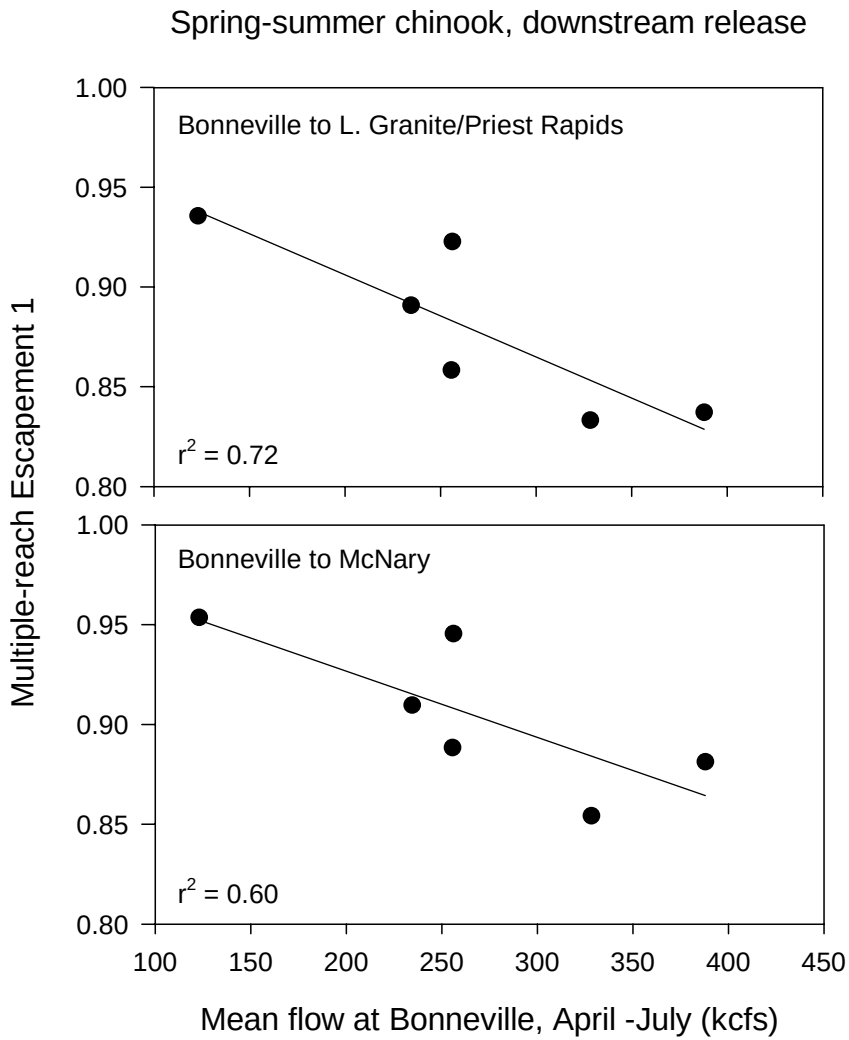
Higher flow slows passage times, retards run timing, and reduces survival in the system




From Keefer et al. 2004. TAFS 133:1413-1439




Keefer et al. *In press*. NAJFM



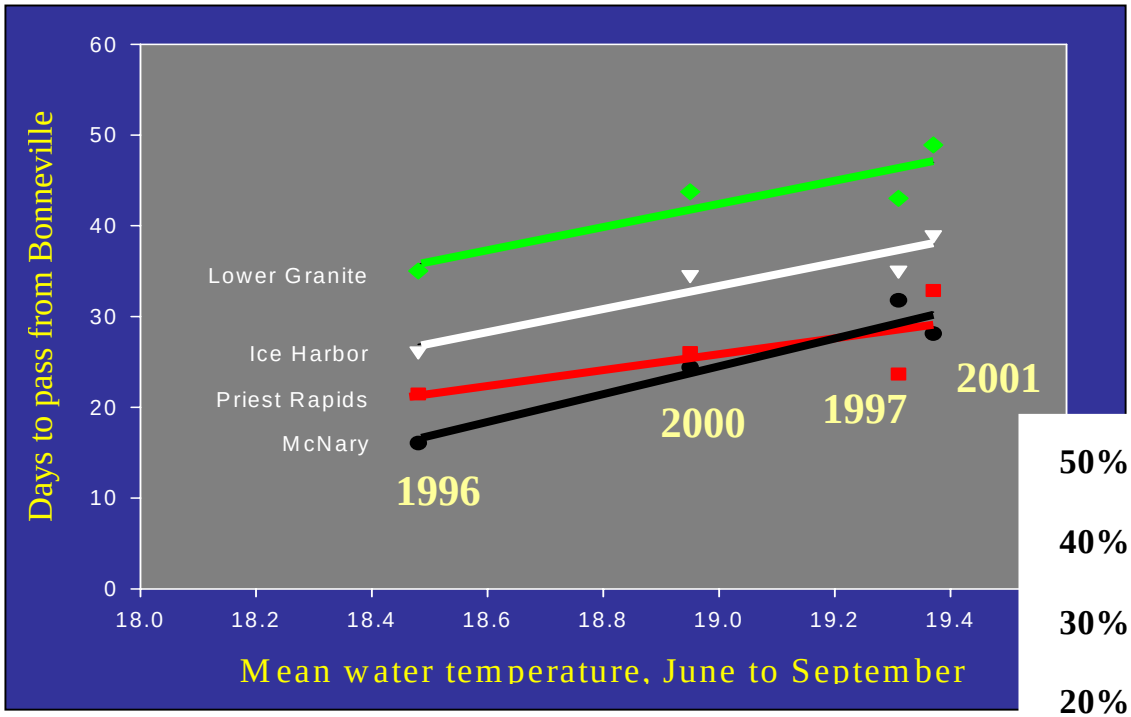

Keefer et al. Technical report.

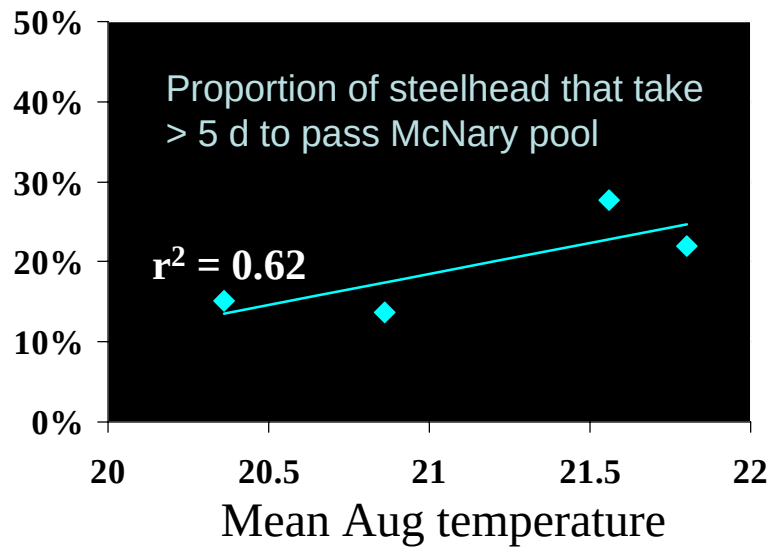
"The final fate of fish was significantly related to passage probability at nearly all projects and all runs, where fish with unknown fates had lower passage probabilities (and longer passage times) at individual projects than those fish reaching tributaries." Caudill et al. *Report in preparation.*

**Temperature:**

Spring/summer Chinook: Passage rates faster with warmer water up to ~19 C.

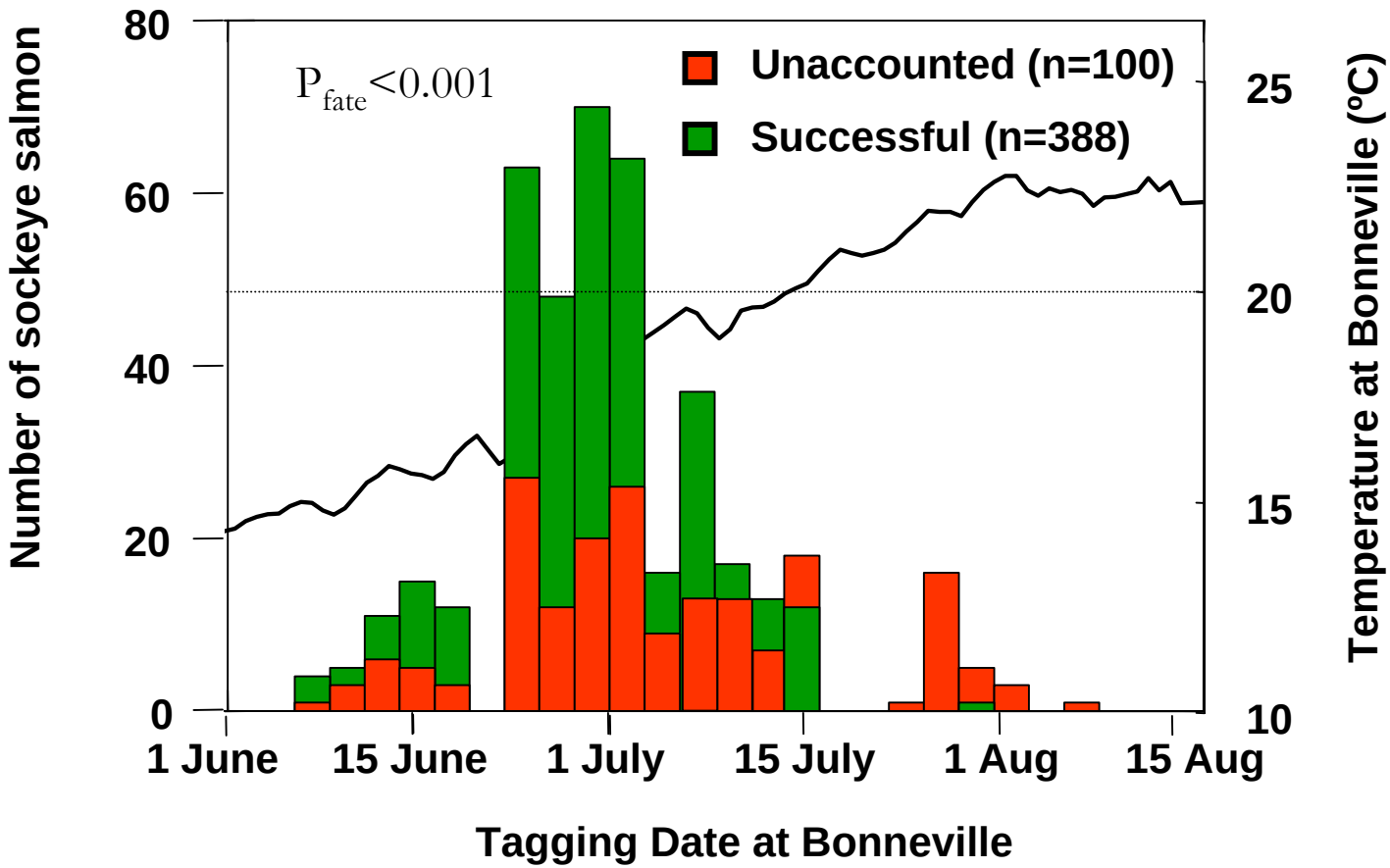
Steelhead, Fall Chinook: Passage rates slower, straying higher with warmer water.



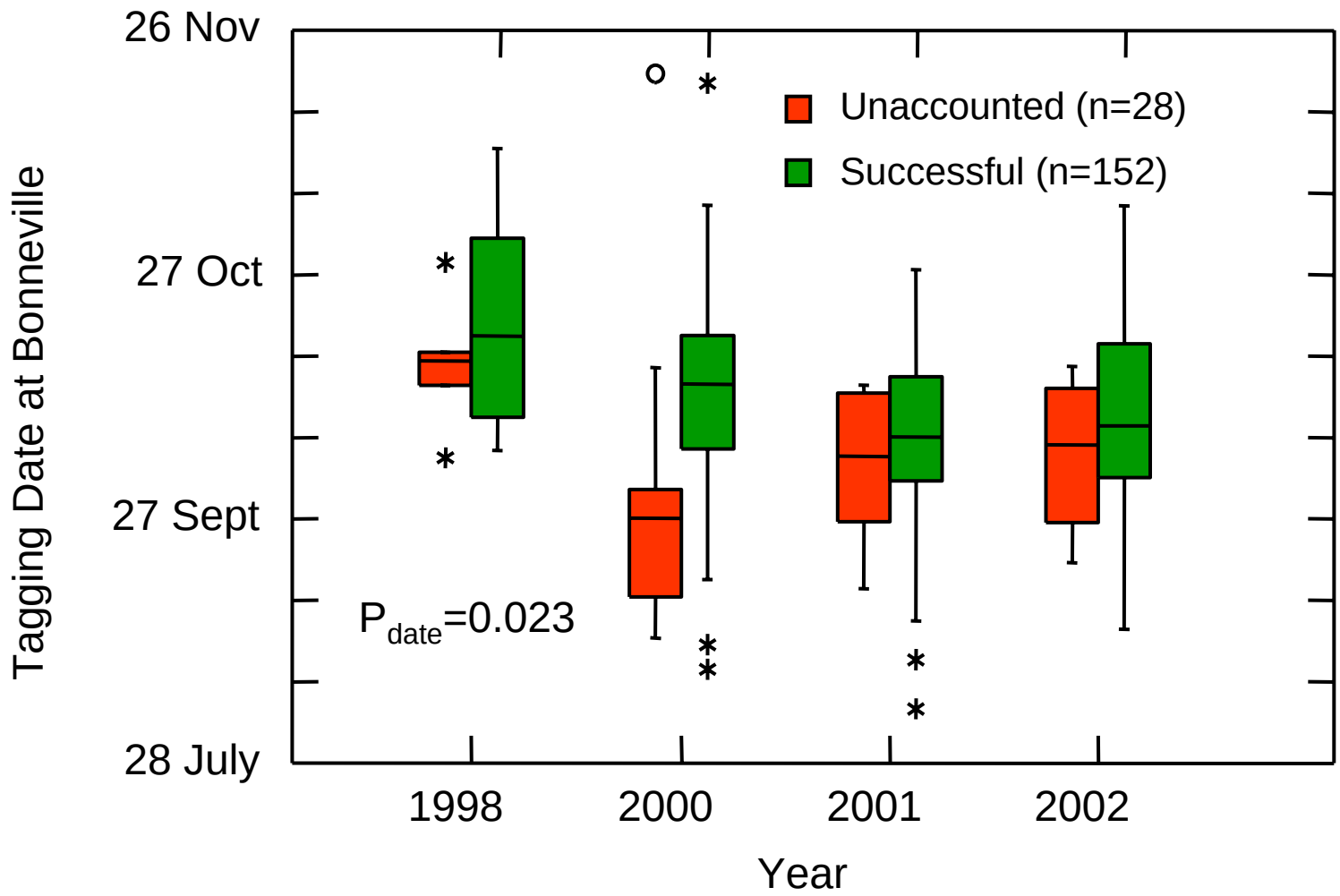
**Temperature:**

Sockeye salmon:  Fish that migrate late in the run have lower survival.



**Temperature:**

Fall Chinook salmon: Unsuccessful migrants were more likely to be early-run fish.

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## Summary

Lower flow correlated with faster travel times and higher survival.

Lower flow correlated with warmer water temperatures.

Warmer water correlated with faster travel times for spring and early summer Chinook salmon and slower travel times, increased straying, lower survival for steelhead, fall Chinook and sockeye salmon.

Indirect effects on energetics and gamete development unknown.

As flow reduced, proportion of juveniles bypassed will increase.

- Potentially lower survival and more fish barged as result?

## What future research is needed?

Delayed effects on reproductive potential (pre-spawn mortality, gamete quality)

Rearing conditions in Hanford Reach.

Potential changes to spill, bypass, transported fish proportions.