



*Independent Scientific Advisory Board
for the Northwest Power and Conservation Council,
Columbia River Basin Indian Tribes,
and NOAA Fisheries*

The ISAB recommends that there be an *experiment* with monitoring to study effects of hydrosystem load following on survival and behavior of migrating juvenile salmonids.

Dr. Richard Whitney, ISAB Ad Hoc Member

May 11, 2005

FEASIBILITY:

- The ISAB carefully considered the pros and cons and concludes that an experiment is feasible this year if there is full agency cooperation.
 - Too late for spring chinook and steelhead, but fall chinook remain.
- More details on a suggested experimental design are given in our letter to the Council, NOAA Fisheries, and CRITFC.
- Requires cooperation of hydrosystem operators to ensure rigorous adherence to a predetermined schedule of alternating periods of load following and no load following (probably weekly).
 - Requires existing studies of survival and behavior to add an element to study plans.

HISTORY:

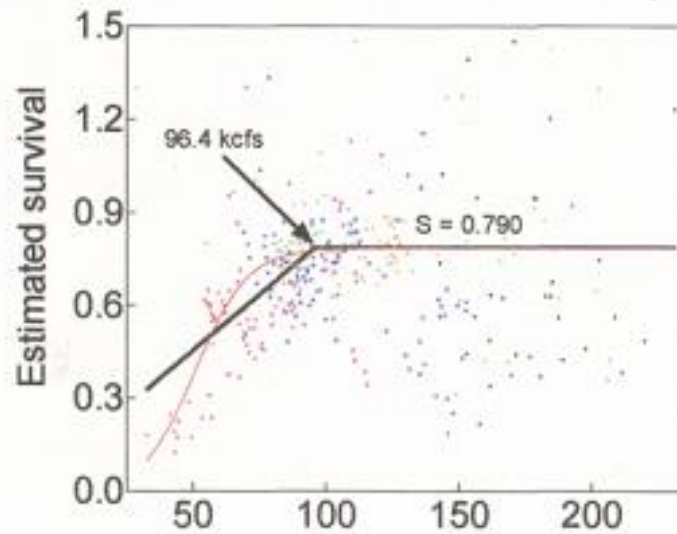
1982, the first Fish and Wildlife Program included flow augmentation (water budget) -- a measure intended to improve survival of juvenile salmonids.

1992, the Council insisted there be a study (experiment) to evaluate the flow/survival hypothesis.

To date, since 1980 that formed the basis for Council's decision, studies are not clear or convincing because there has been no experiment.

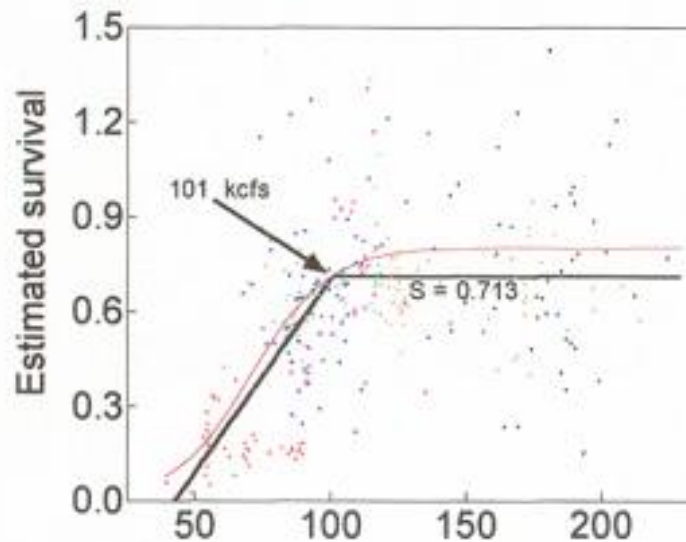
Without an experiment, many more decades of passive observation would be required to separate out the factors that affect survival of juvenile salmonids.

Yearling chinook salmon 1995-2001.



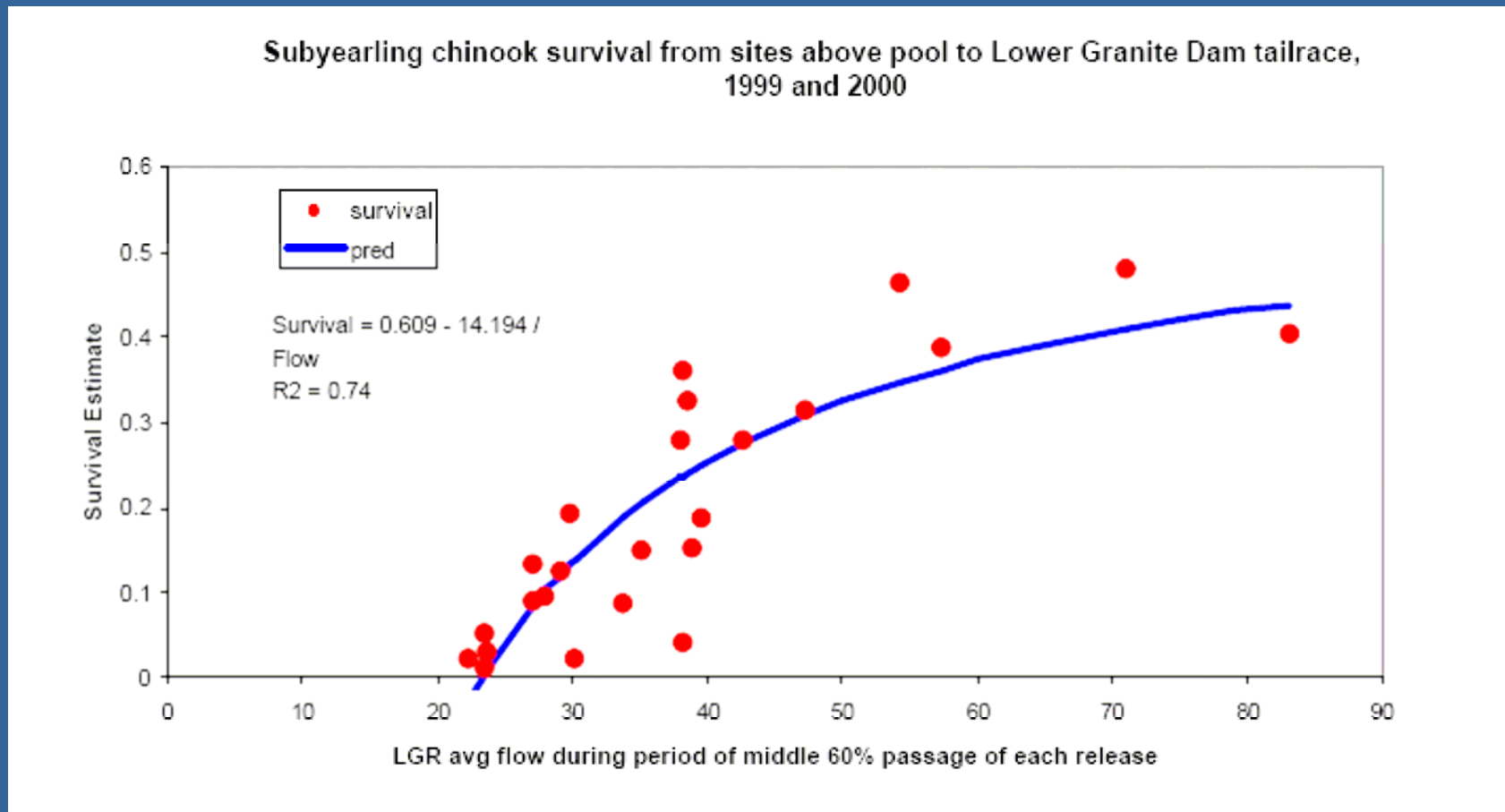
In 2001, little to no spill at all dams. In other years, spill to 2000 BiOp levels or to the gas cap.

Steelhead 1995-2001.



Relationship of Survival with Flow for Fall Chinook in the Snake River 1999 and 2000

(from Berggren attachment to Fish Passage Center Memo of 10/27/2000)



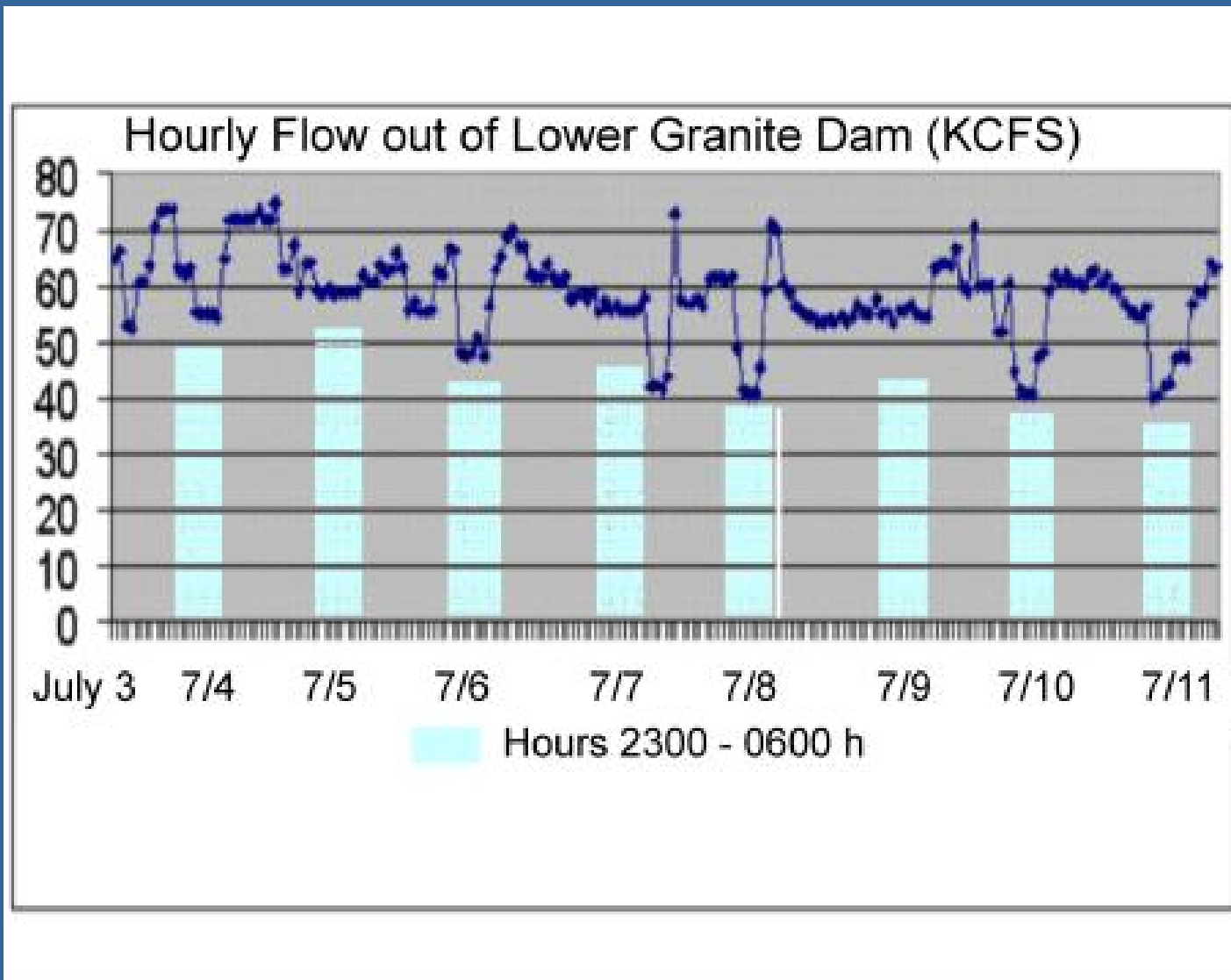
Observed effects of flow on survival in this system occur at flows below 100 kcfs:

- Fall chinook migrate later in the summer when flows are frequently below 100 kcfs.
- Their average survival is less than half that of spring chinook or steelhead.

Possible reason there is a break at 100 kcfs:

- Hydraulic capacity of the four lower Snake River dams is 110 to 125 kcfs.
- Whenever flow is above 125 kcfs, system operators will prefer to generate full time from the Lower Snake River projects. The alternative is to spill water beyond electric demand at whatever the flow.
- When flow drops below 125 kcfs, system operators will begin intermittent operation to follow electric demand, known as “load following” or power peaking.

Dam discharge rates fluctuate within a day



As flow declines:

- Fluctuations are more frequent
- Duration of unstable flows lengthens
- Changes are larger

Summary: Four major features are observed at low flows

1. Fluctuating flows due to load following
2. Complex reservoir hydraulics
 - Can induce localized flow reversal under certain conditions
3. Unusual behavior of juvenile fish
 - Do not have directional cues needed. Radiotracking studies support this interpretation
4. Increase in mortality rates of juvenile salmonids

Justification for study this year:

- Too late this year to apply an experiment to spring chinook or steelhead.
- Fall chinook can still be included. Low flows are typical during outmigration.
- Low flow makes it possible to design a study that involves more control of flow than in normal or high flow conditions.
- A study can be designed this year that should make it possible to reduce the effects of other factors related to flow, such as spill, turbidity, and others that are time-related.
- Ongoing studies need not be adversely affected, with proper design.

Expected results:

- Could measure the effects of load following (flow fluctuations) on survival and/or behavior of juvenile salmonids.
- Hydraulic changes measured in reservoirs could help explain the mechanism for effects on behavior and survival.
- Could explain cause of low survival at low flows, thus helping to identify appropriate management measures to address the problem.

Action Steps Needed:

- Commence discussion with hydrosystem operators to develop a schedule for alternating (suggested weekly) periods of load following, alternating with no load following at near base flow.
- Assign fishery agency personnel who are currently engaged in survival studies to develop a study plan to accomplish the additional objective of measuring the effects (if any) of load following on behavior and/or survival of juvenile salmonids.

(continued)

Action Steps Needed - continued

- Arrange monitoring of hydraulic conditions in the reservoirs. This may require a new project to monitor the changes in reservoir elevations and flow patterns.
- Assign to some entity the task of coordinating and collecting the necessary data to provide a summary report focused upon the question. (Existing projects might include this as a supplement to their annual progress report to BPA or other funding agency.)

Lower Snake River Flows 1995 - 2001

