

ISAB Review of the Proposed Spill Experiment

April 9, 2014



The Independent Scientific Advisory Board (ISAB) for the Columbia River Basin Fish and Wildlife Program serves the Northwest Power and Conservation Council, NOAA Fisheries, and the Columbia River Basin Indian Tribes.

Key Elements of Spill Proposal

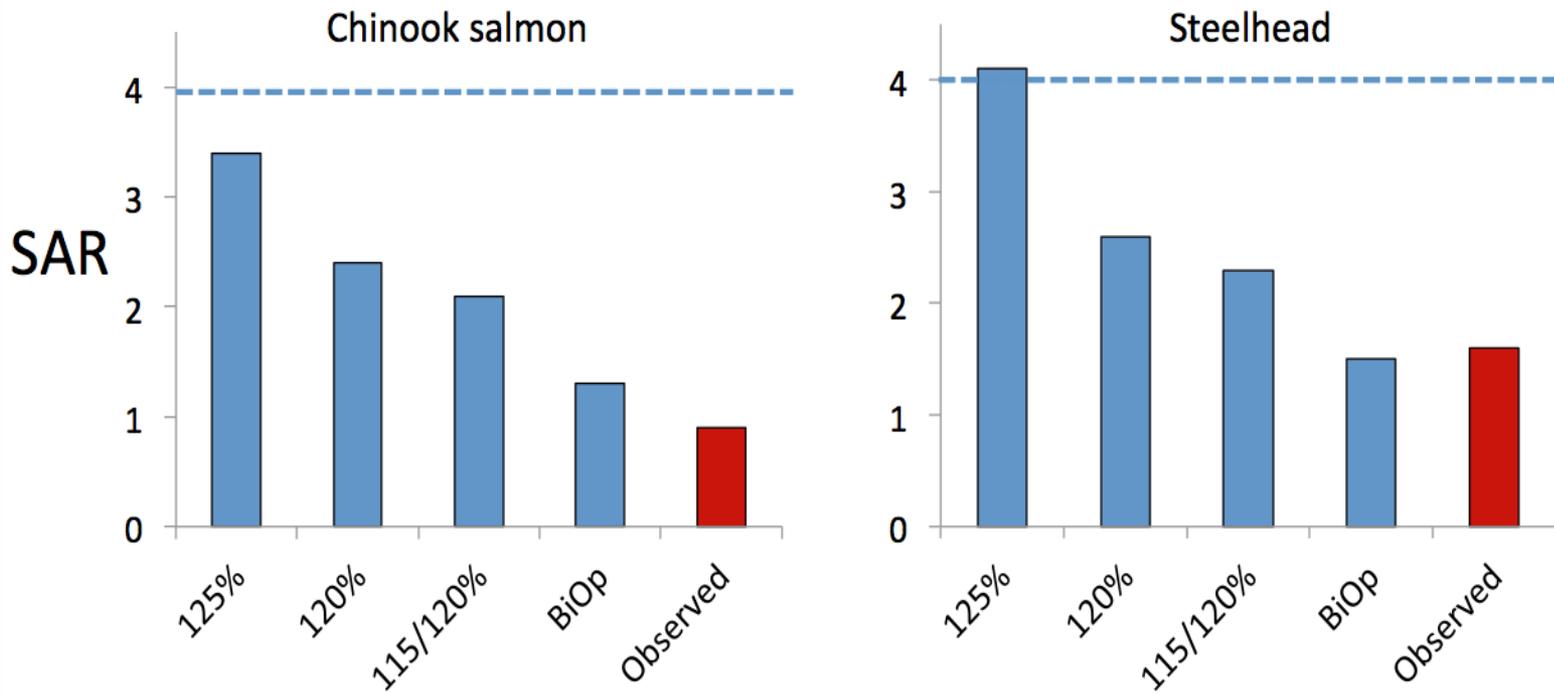
- Increase spill to 125% of total dissolved gas level or biological constraints (voluntary).
- When: 3 April through 20 June; 10 year period; review after 5 years.
- Location: federal Lower Snake and Lower Columbia River Hydroelectric projects

Experiment Approach

- Use the Comparative Survival Studies (CSS) PIT-tag monitoring framework.
- Monitor smolt-to-adult survival rates.
- Compare survival rates with past values and model predictions.
- Include “off-ramps” to ensure hydrosystem viability and “on-ramps” to offset reduced hydropower generation.

CSS Model Predictions

- Applied peer-reviewed models to spill levels



- unpublished analysis by CSS (H. Schaller)

Council Questions

- **Is the spill proposal, and the postulated increases in fish survival, consistent with scientific methods?**
- **If not, what adjustments will ensure that the proposal is scientifically based?**
- **What are the potential biological risks and/or benefits, e.g., increased total dissolved gas effects on other aquatic species?**
- **Is the proposed spill experiment likely to add to our knowledge regarding spill, juvenile dam passage survival, and adult fish returns (SARs)?**

ISAB Review Approach

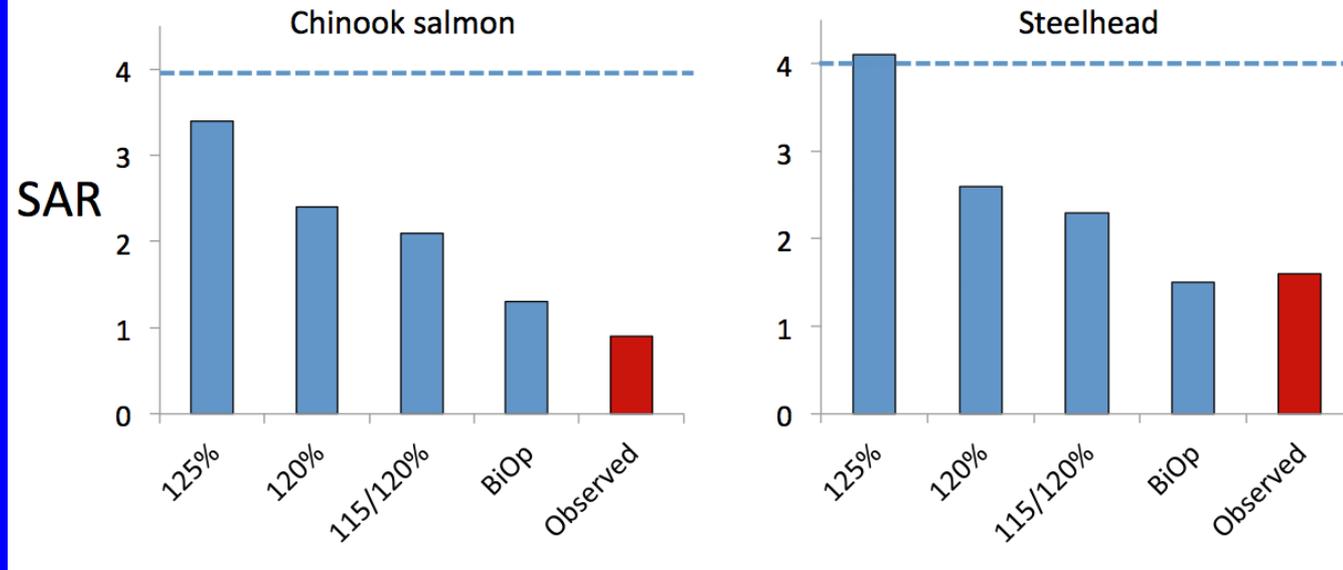
- Briefings
 - CSS, BPA, ACOE, Dr. Skalski
- Comment memos
 - Skalski, agencies, FPC, etc.
- Published manuscripts and reports on gas bubble disease

Q1a-c: Adequate hypothesis, appropriate study design, sufficient duration?

- No. A detailed study plan is needed.
 - quantitative hypotheses
 - synthesis of existing data
 - describe field methods, monitoring, statistical analysis and alternative approaches
 - discuss controls for dynamic ocean conditions, including PDO, transported fish ratio (TIR), etc.
 - respond to critical comments, peer review
- Still, hypothesis has worthwhile merits.

Update CSS Model & Predictions

- Applied peer-reviewed models to spill levels



- Incorporate new years of data; test new variables
- Is 3.5x benefit reasonable given expected changes in dam passage?
- Address statistical issues raised by stakeholders (C.I.)
- Did predictions account for water transit time?
- Address changes in spillway passage
- Estimate change in spill percentage to achieve 125% TDG

Q1d. Is it possible to isolate spill as a causative factor for changes in fish survival?

- Unlikely to isolate spill as a causative factor for changes in fish survival.
 - correlation not cause and effect.
 - experimental approach might, if feasible.
- But multiple lines of evidence including correlations can be used to evaluate the influence of increased spill.
 - change in turbine v. spill passage; FTT

What are the potential biological risks?

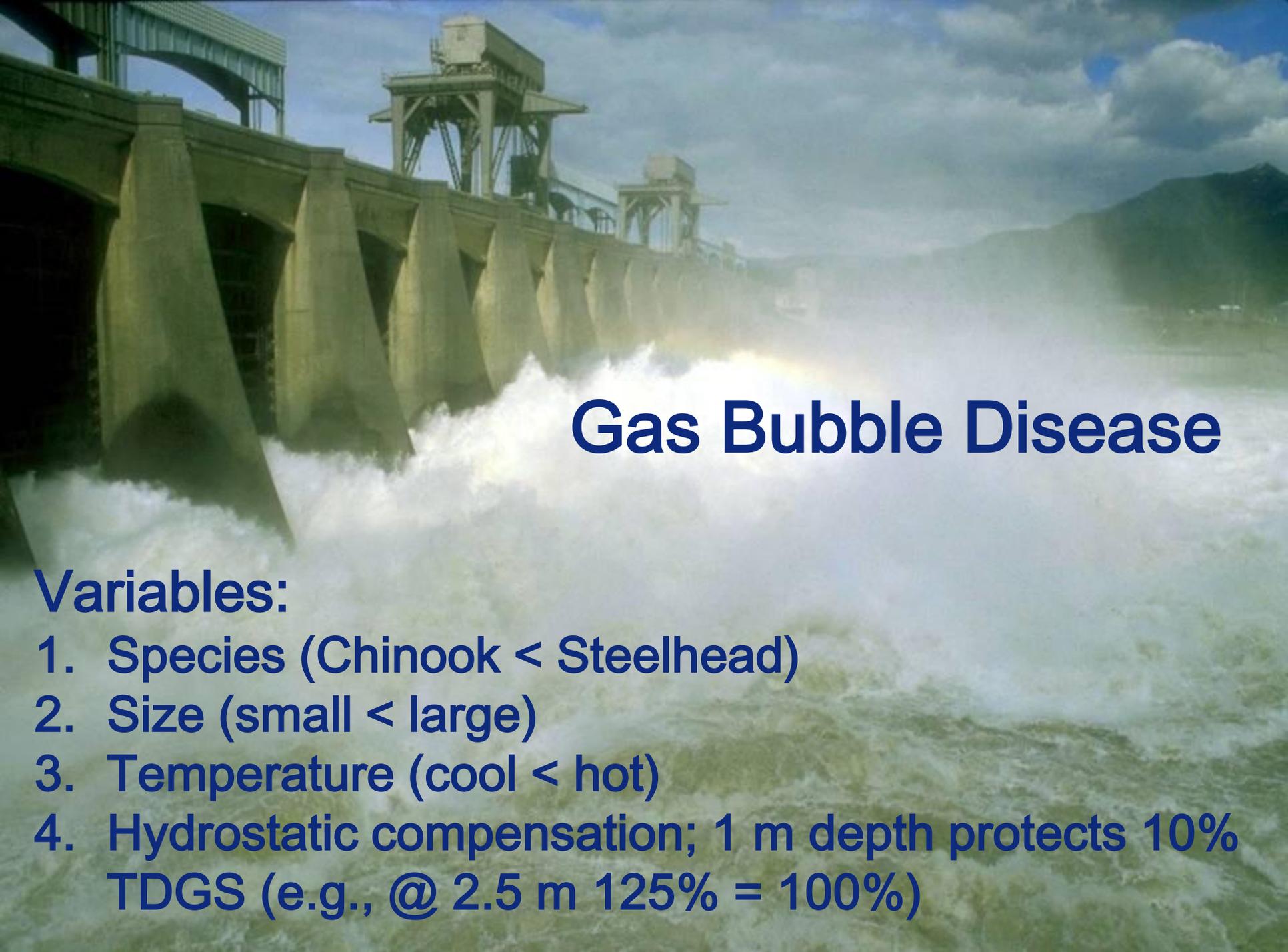
- Gas bubble disease (GBD)?
- Adult migration delay?
- Interfere with BiOp actions?
- Reduce availability of fish for transportation.

Gas Bubble Disease

Gas in tissue forms bubbles

Mortality caused by stopping blood flow



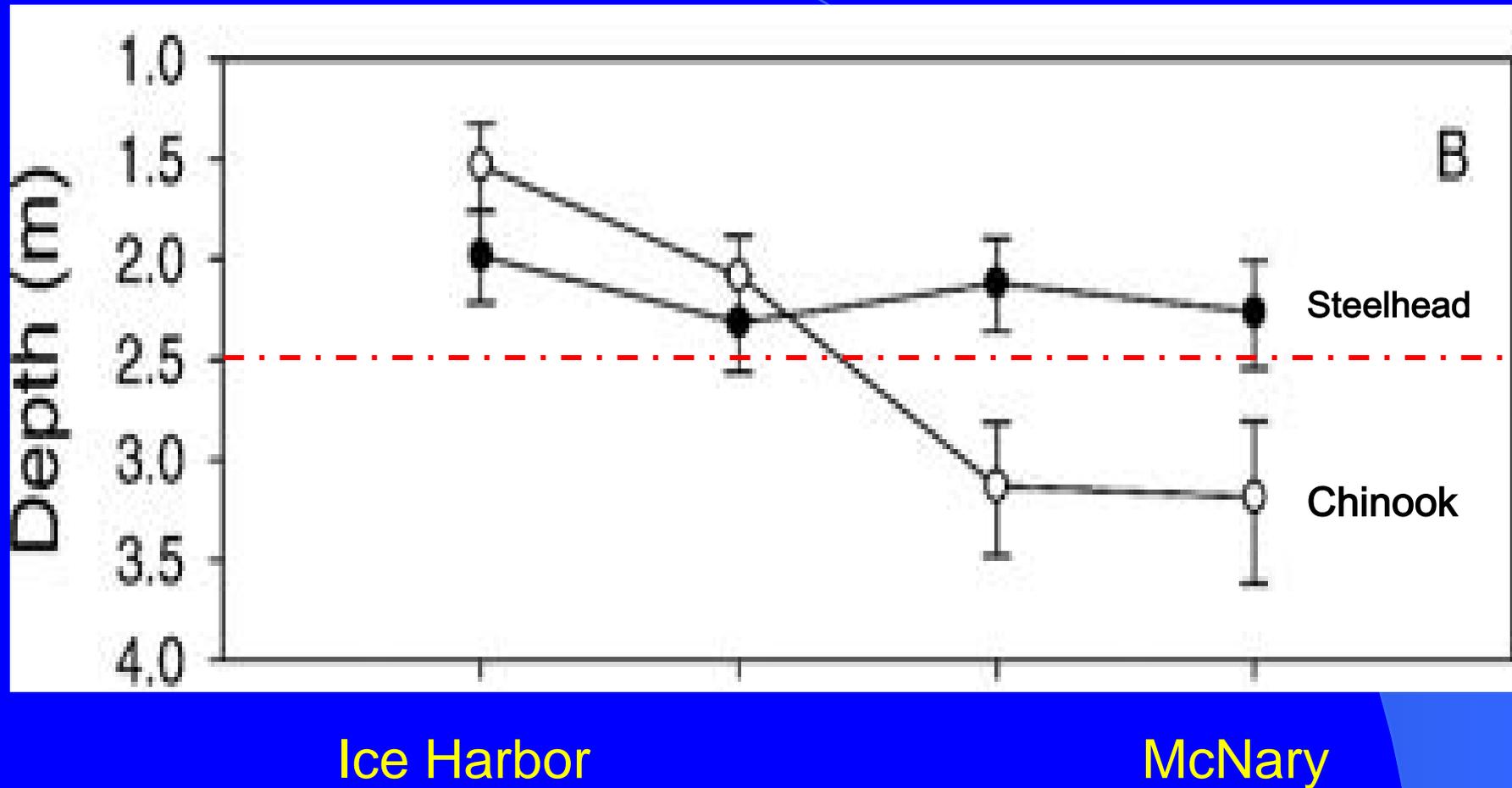


Gas Bubble Disease

Variables:

1. Species (Chinook < Steelhead)
2. Size (small < large)
3. Temperature (cool < hot)
4. Hydrostatic compensation; 1 m depth protects 10% TDGS (e.g., @ 2.5 m 125% = 100%)

Fish Depth (mean \pm 95% CI)

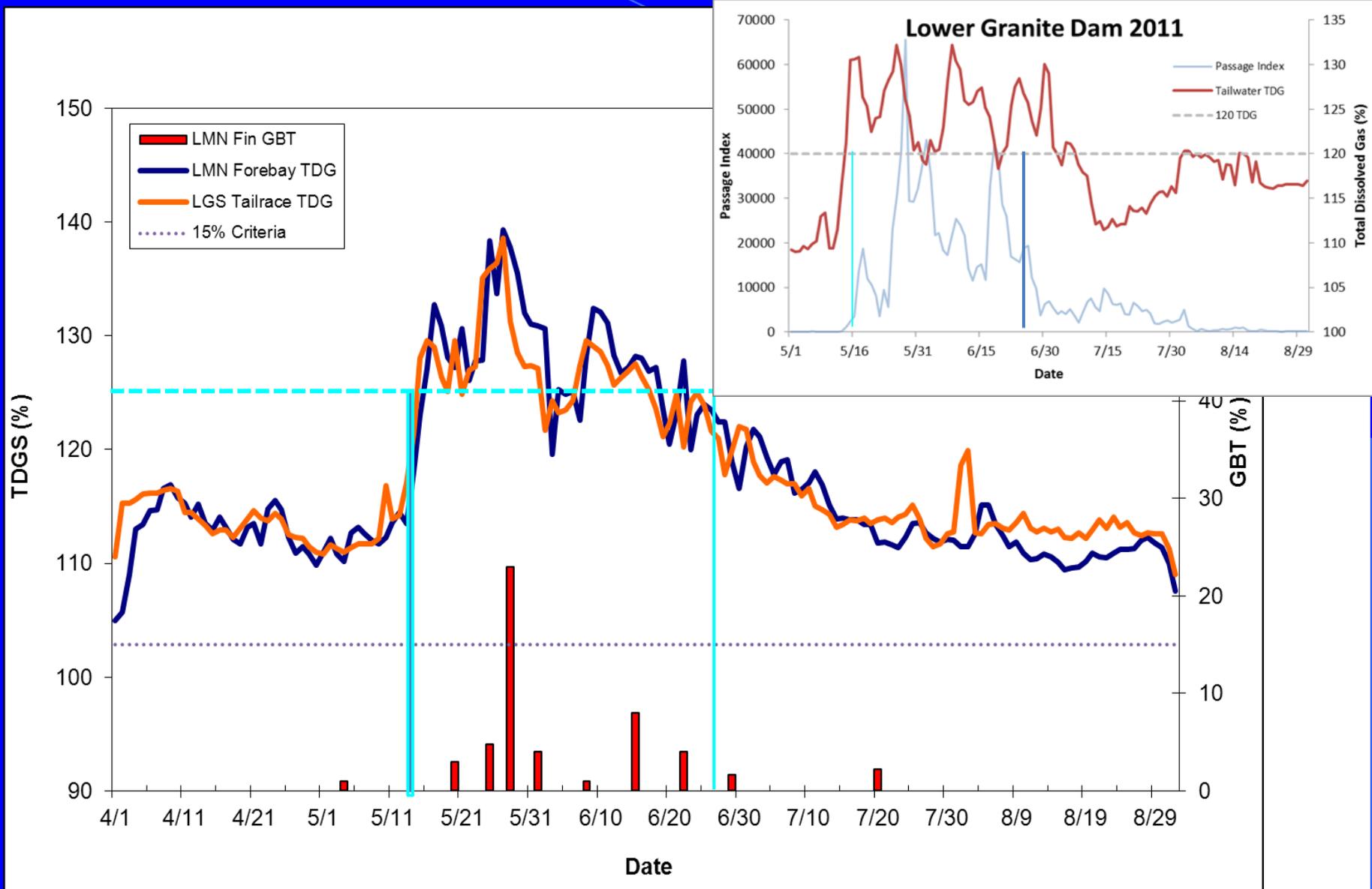


Fish Passage Center GBD Monitoring

- 1 or 2 days/week @ six dams
- Bubbles in eyes or fins
- Ranking (1 to 5) based on % covered
- Action: >15% ranked 1 or 5% ranked > 1



Lower Monumental Dam 2011 TDGS & GBD



Upriver Bright Fall Chinook Adults

- 2013 - record URB Fall Chinook < 748K
 - Many fish from 2011 juvenile migration

Other Aquatic Organisms

- Macro-invertebrates

5400+; 120% - 135% TDG; 0.6 m deep;
0.1% with signs (Ryan et al. 2000)

- Frogs

117% – 122%; 4 days; no mortalities

132%; 1 day; 40% dead (Colt et al. 1984, 1987)

- Sturgeon larva & Sucker fry

Bubbles – buoyancy – predation? (Counihan et al. 1998;
Schrank et al. 1998)

- Lamprey?

A photograph of a large dam with water cascading over its spillway. The dam is made of concrete and has a series of vertical supports. The water is white and turbulent as it falls. The sky is overcast with grey clouds.

GBD Conclusions

Most data = no significant issues

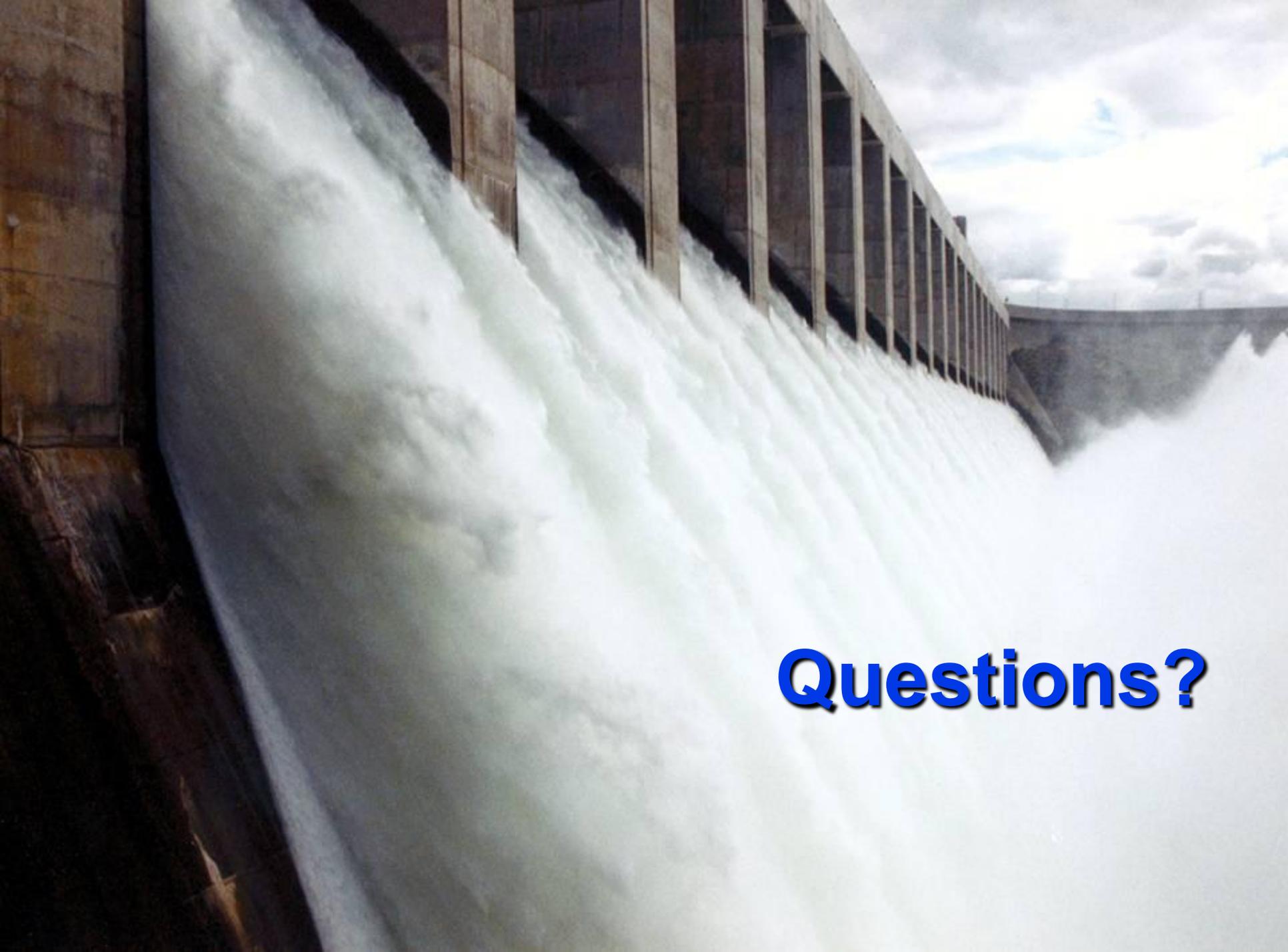
Some unknowns

- No dead fish suggests no direct mortalities, but delayed mortalities?
- 2.5 month duration?
- Sturgeon exposure?
- Lamprey exposure?

Recommend: Increased monitoring

Will the spill experiment enhance knowledge about spill, salmon survival, & adult returns (SARs)?

- Yes, assuming:
 - a detailed study plan is developed
 - Plan addresses all agency and stakeholder issues
 - Study design maximizes learning potential.
- SARs are well below goals, so alternative approaches, including the spill concept, worth exploration and discussion.



Questions?