



Gas Supersaturation May Reduce the Survival of Yearling Chinook Salmon in the Lower Columbia River and Ocean Plume

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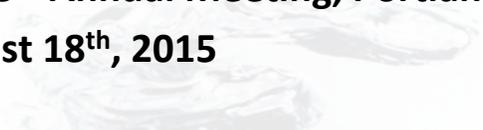
David Welch, Kintama Research Services

Melinda Jacobs Scott, formerly Kintama Research Services

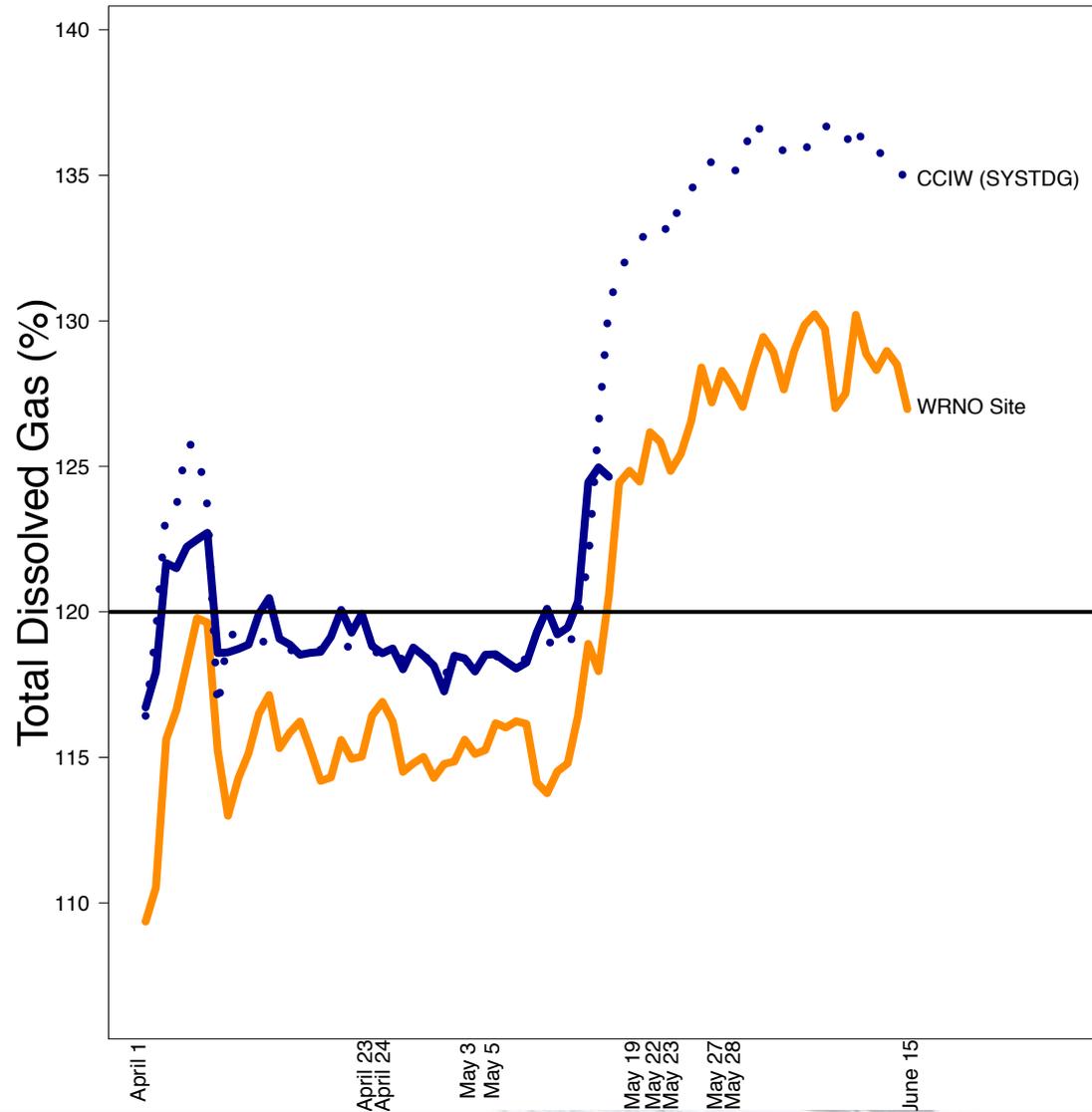
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American Fisheries Society 145th Annual Meeting, Portland, Oregon

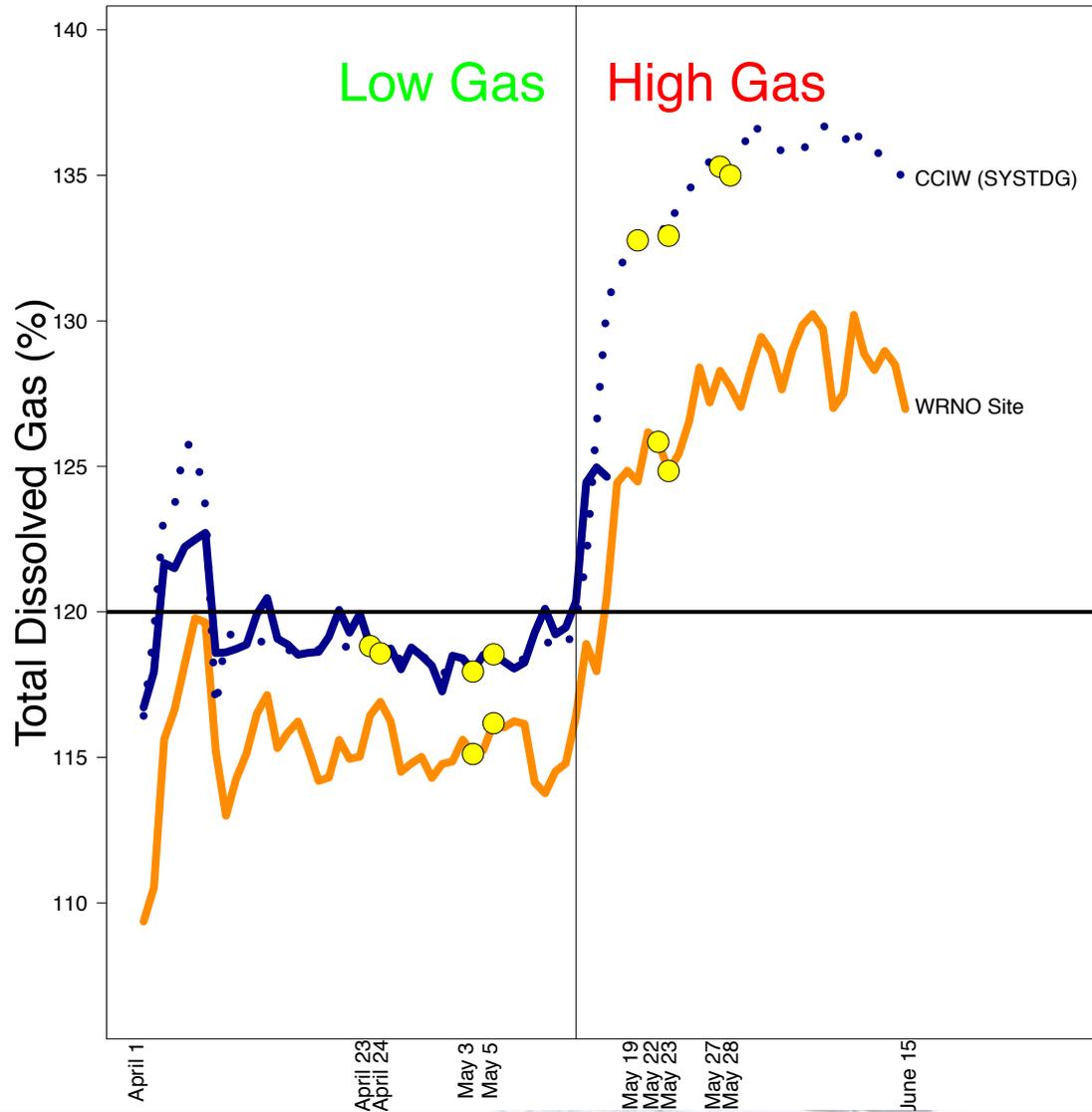
August 18th, 2015



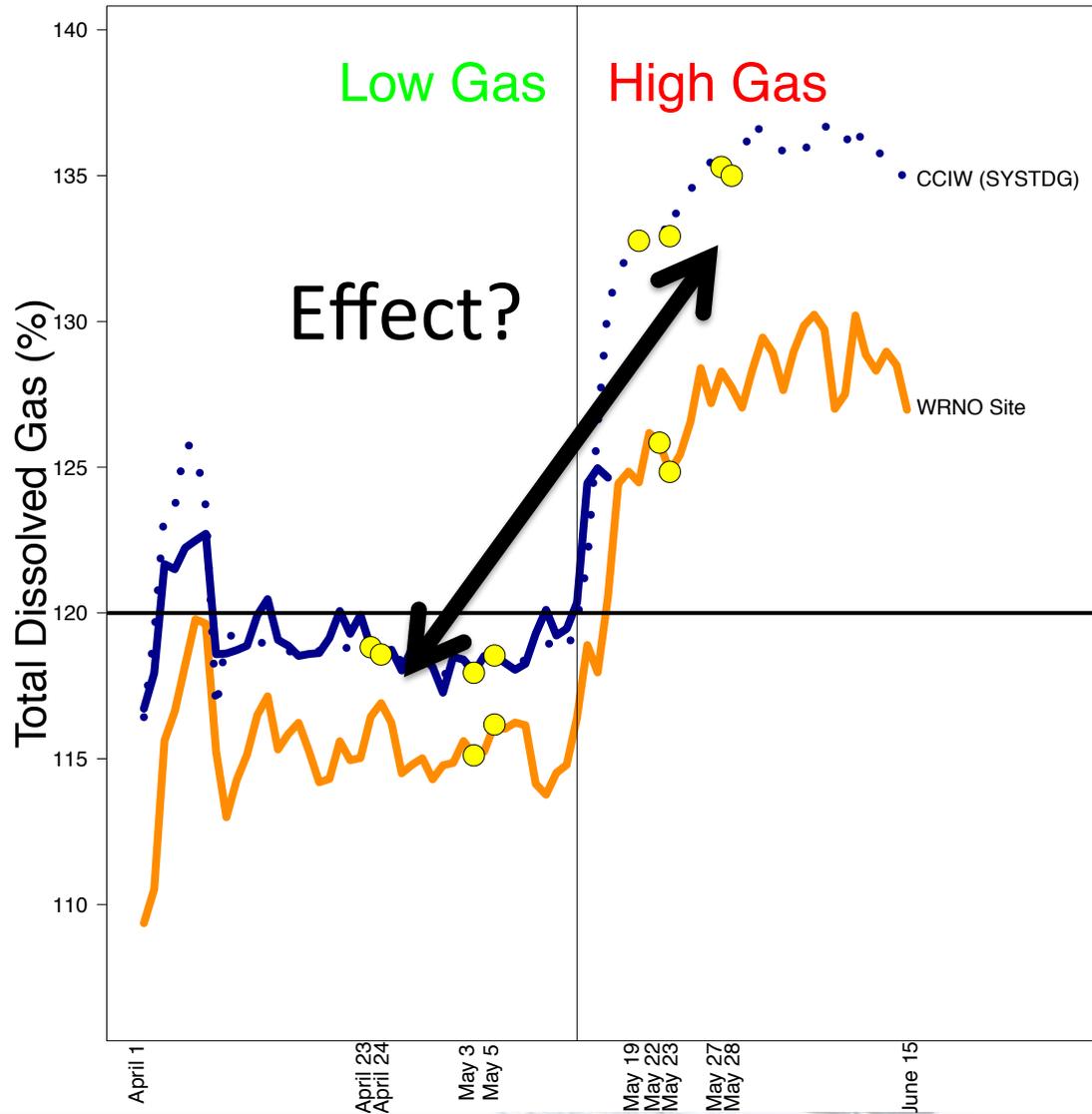
2011 TDG below Bonneville Dam



What effect on smolts?



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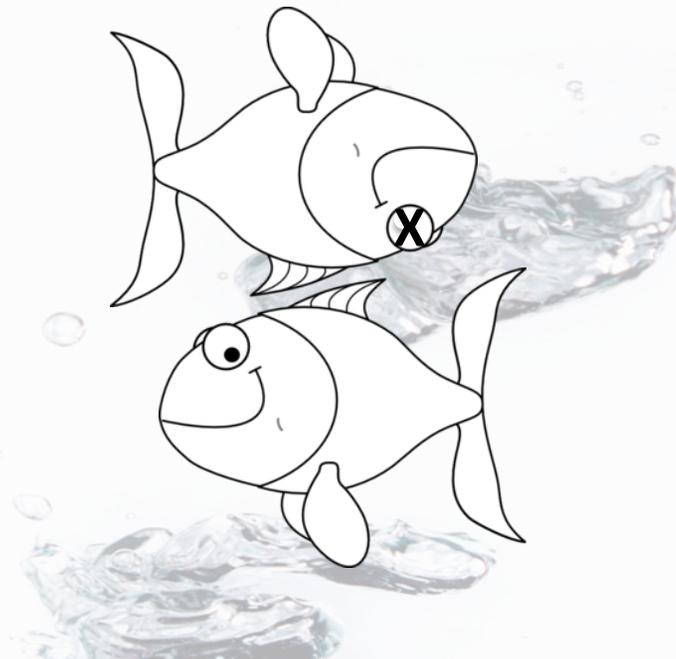
Gas Bubble Trauma (GBT)

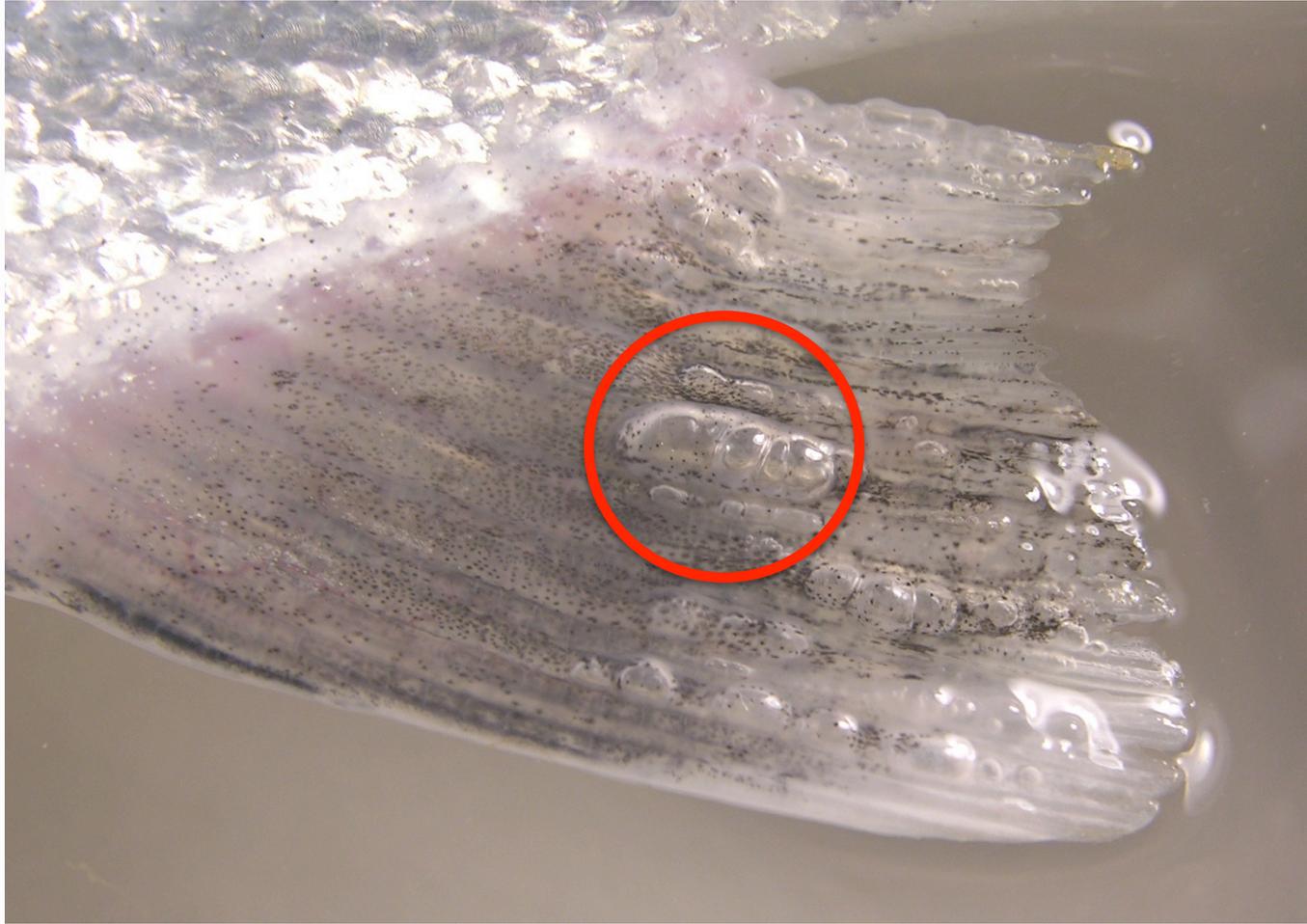
130 % TDG: GBT, LT_{20} at 3-6hrs, predation

120 % TDG: GBT, LT_{20} at 40-120 hrs

110 % TDG: GBT, No mortality at 22 d

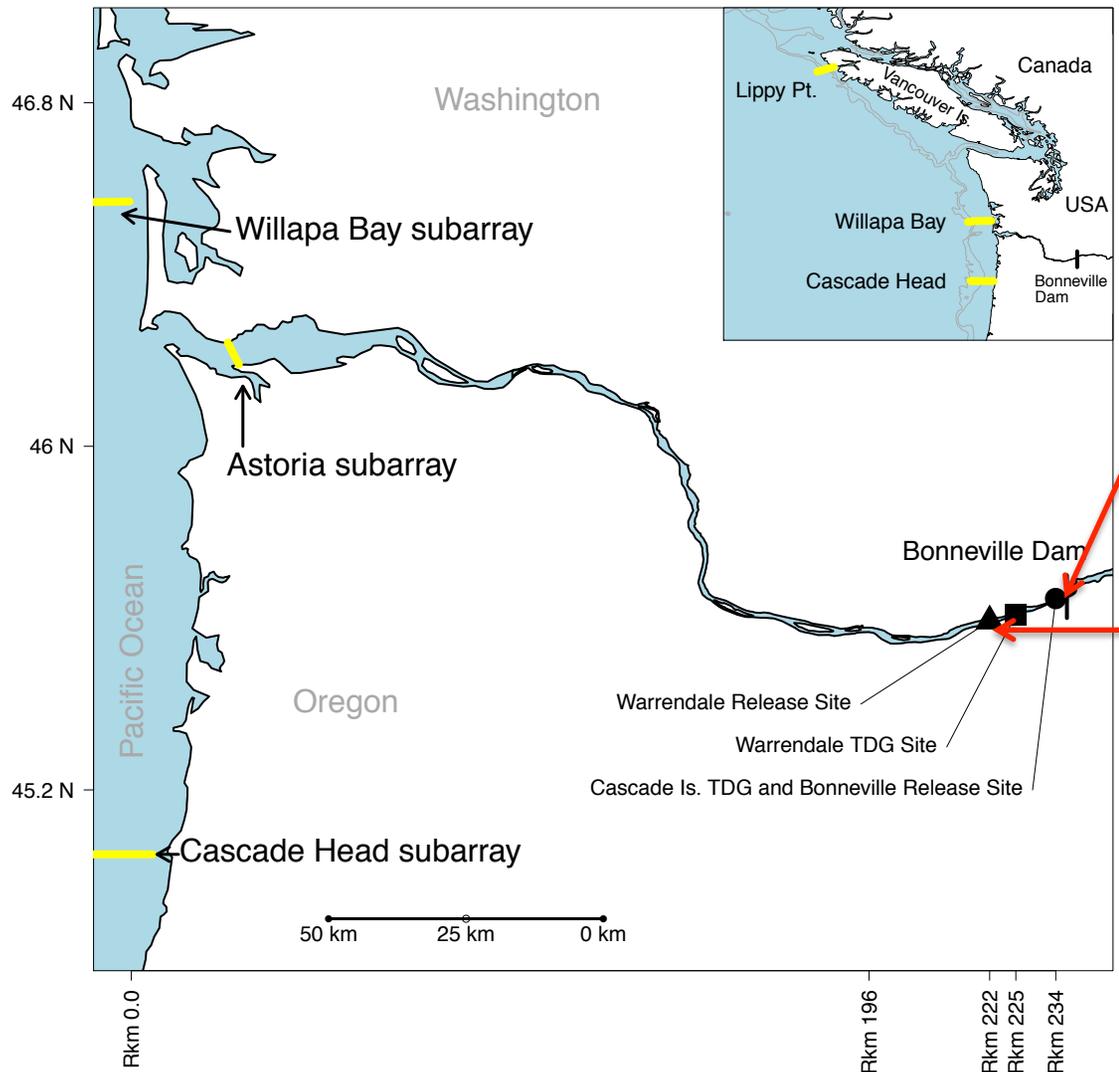
Repeated exposure increases susceptibility





**Tagged smolts screened for
scale loss, external marks,
lesions, etc.**





Bonneville Release Site

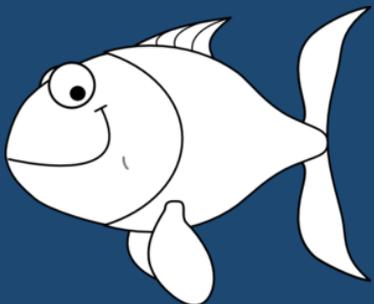
- 580 tagged smolts
- Held in flow-through tanks
- 20 GBT mortalities

Warrendale Release Site

- 200 tagged smolts
- Transported by barge in gas-stripped tanks

Estimating Effect Sizes

- Model survival for each group in each migratory segment, with a common detection parameter at each subarray
- Calculate daily survival as $S^{1/T}$
- Bootstrap resampling for estimating standard errors
- Subtract low exposure survival from high for effect size



Survival Rate (per day)

High Gas
(>120%)

Low Gas
(≤120%)

Effect
Size

Bonneville
Releases

River

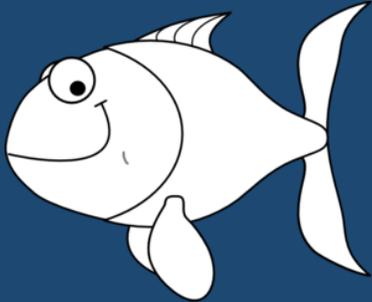
Plume

Warrendale
Releases

River

Plume





Survival Rate (per day)

High Gas
(>120%)

Low Gas
(≤120%)

Effect
Size

Bonneville
Releases

River

0.93 (.01)

0.99 (0.0)

-0.06 (.01)

Plume

0.74 (.05)

0.89 (.02)

-0.15(.05)

Warrendale
Releases

River

0.96(.01)

0.95 (.01)

0.01(.02)

Plume

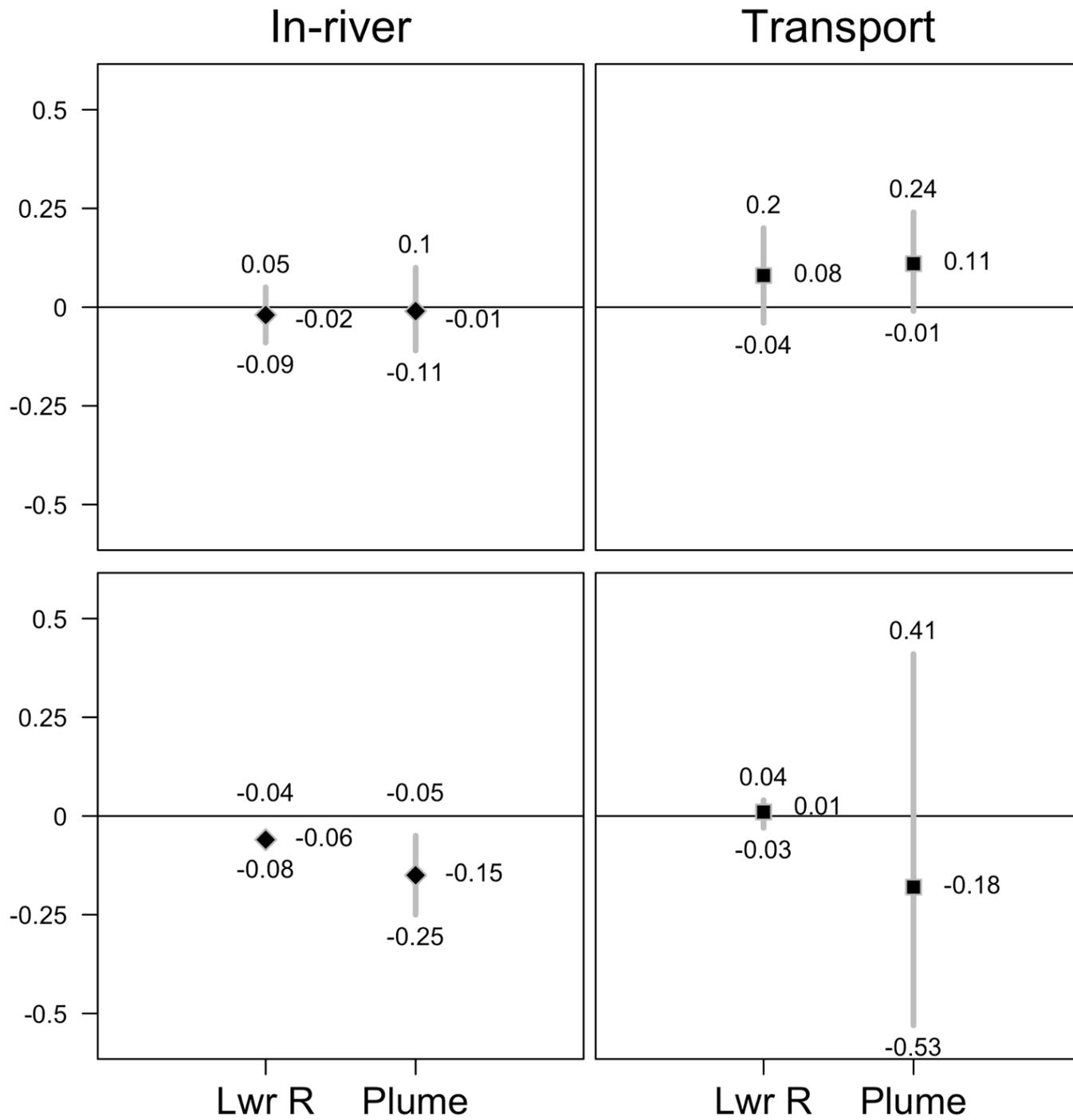
0.66 (.20)

0.84(.12)

-0.18(.24)



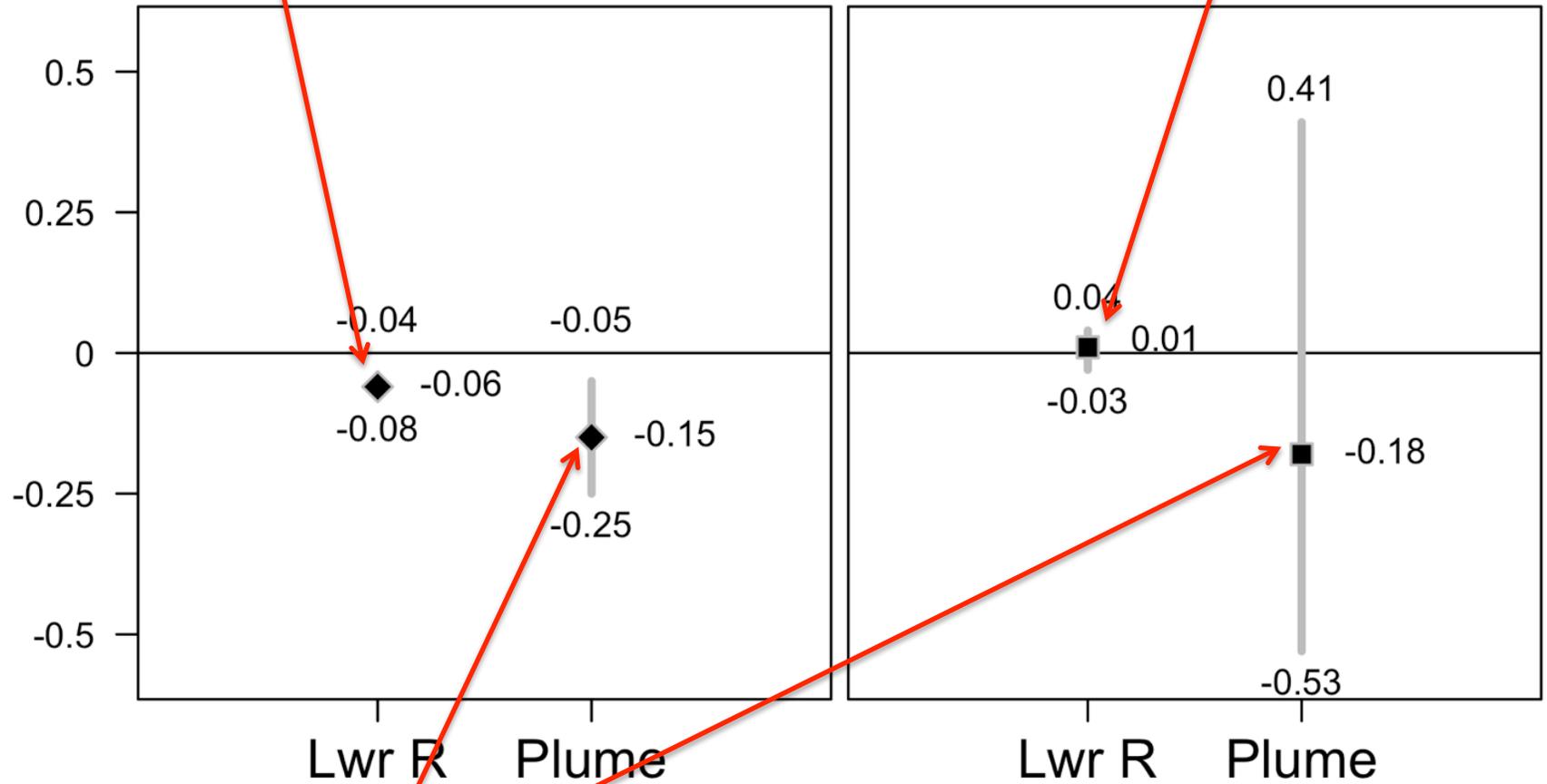
Effect Size (Survival Rate) Effect Size (Survival)



- Repeat exposure, flow through tank
- ~132% TDG, mortality w/ in hours

- Gas stripped barge
- ~125% TDG, Mortality in days
- Plume in 3 days

Effect Size (Survival Rate)



- Chronic effects expressed during habitat transition?
- Low survival relative to river
- Likely not the saltwater transition

But wait, there's more...

- **Temperature?** *8- 13 C*
- **Turbidity?** *Increases with TDG*
- **Disease?** *No significant change*

Acknowledgements

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BONNEVILLE
POWER ADMINISTRATION



The background of the slide features a vertical sequence of water splashes and bubbles. At the top, a large splash of water is shown in mid-air. Below it, a smaller splash is visible. Further down, another large splash is shown, and at the bottom, a final splash is depicted. The water is clear and dynamic, with many small bubbles rising from the splashes. The overall composition is centered and visually appealing.

Questions?