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

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2011 TDG below Bonneville Dam
What effect on smolts?
What effect on smolts?

Total Dissolved Gas (%)

Low Gas
High Gas

Effect?

CCIW (SYSTDG)
WRNO Site

April 1
April 23
April 24
May 3
May 5
May 19
May 22
May 23
May 27
May 28
June 15
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
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<th>Survival Rate (per day)</th>
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<td>High Gas (&gt;120%)</td>
<td>Low Gas (≤120%)</td>
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<td><strong>Bonneville Releases</strong></td>
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- Repeat exposure, flow through tank
- ~132% TDG, mortality w/ in hours

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

- 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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Questions?