Riparian response to an Alternative Arrow Reservoir operational regime in the Upper Columbia

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Canadian Columbia River Watershed

- 15% of Columbia R. watershed area
- 30-35 % of runoff for entire Basin
- Up to 50% of floodwaters
- Three CRT reservoirs
Arrow Lakes Reservoir

150 miles long (same as Lake Roosevelt behind Grand Coulee dam)

Full pool area of 179 square miles (43 % larger than LR)

Live storage 7.1 million acre-feet (36 % greater than LR)
Arrow Lakes Pre-Regulation

1922-1968
Average fluctuation 21 ft.
Hugh Keenleyside Dam Inauguration  Late 1960’s
Arrow Lakes Pre and Post Regulation

1970-2013
Average fluctuation 41 ft.

1922-1968
Average fluctuation 21 ft.
Arrow Reservoir Ecosystem Impacts

- Lakes: 86,467 acres
- Wetlands/ Ponds: 8,735 acres
- Rivers/Floodplains: 21,866 acres (69 miles)
- Streams: 128 acres (58 miles)
- Uplands: 9,500 acres

From: Utzig and Schmidt 2011
• Inspired by Arrow Lakes residents
• Commissioned and funded by the Province of British Columbia.
• Examined only Arrow Lakes Reservoir footprint
Assessment Criteria

- Vegetation
- Wildlife
- Fish and aquatic resources
- Recreation
- Agriculture
- Erosion
- Archaeology
- Commercial navigation
- Power Generation
- Flood Storage
Hypothesis: Many Arrow values are directly influenced by the health of the Riparian Zone
Photos Credit: Arrow Lakes Historical Society.
Mature Riparian Establishment and Maintenance

Flood Frequency: 1 in 7 years average

Inundation duration: up to 35 days
Scenario 1: Stable elevation 4 in 5 years at 1,425 ft.
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Scenario 1: Flood up to full pool 1 in 5 years
Scenario 2: Stable elevation 6 in 7 years at 1,420 ft.
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35 days
Positive effect

• Increase in riparian vegetation above the stable elevation (S2>S1)
• Increase in shallow water biological productivity and diversity
• Increase in terrestrial wildlife habitat and ungulate winter range.
• Less bird nest flooding; better wildlife access to wetlands
• improved white sturgeon spawning and incubation habitat conditions

• Improved access to recreational sites; improved boating
• Improved commercial navigation and operations on the reservoir.
• Decreased dust generation
• Increased agricultural opportunities.
• Reduced shoreline erosion
Uncertain/Mixed

- Affect on pelagic (deep water) fish
- Fish spawning habitat and migration in lower reaches of tributaries (positive for S2)
- Aquatic ecosystem productivity in Revelstoke Reach (compounded by Revelstoke Dam peaking operation)
- Conservation of archaeological sites; some better; some worse.

Neutral effects

- Annual power generation from 185 MW Arrow Lakes Generation Station (S1 slightly positive)
- Burbot spawning and egg incubation
Negative effects

- Reduced flood storage capacity (0.9 - 2 million acre ft less than recent operations.

- Increase in aquatic plants that invasive fish species favor.
## Conclusions

### Scenario Comparison with Existing Operations

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<thead>
<tr>
<th>Vegetation</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
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<tr>
<td>Terrestrial</td>
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<tr>
<td>Wetland</td>
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<tr>
<td>Wildlife</td>
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<td>Herptiles</td>
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<tr>
<td>Songbirds</td>
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<tr>
<td>Water/shoreline birds</td>
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<tr>
<td>Mammals</td>
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<th>Fisheries</th>
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<td>Pelagic productivity</td>
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<tr>
<td>Pelagic fish</td>
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<tr>
<td>Tributary access</td>
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<td>Tributary spawn/rear</td>
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<td>Littoral habitat</td>
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<td>Macrophytes &amp; Invasive spp.</td>
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<td>Large River Productivity</td>
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+ relative benefits  - relative negative impacts  o changes are neutral  ? effects uncertain
Conclusions
Scenario Comparison with Existing Operations

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<th>Fishes (cont’d)</th>
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<td>Burbot &amp; sturgeon</td>
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<td>Shoreline</td>
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http://blog.gov.bc.ca/columbiarivertreaty/