HYDROPOWER IN THE COLUMBIA RIVER: HISTORY OF FISH PASSAGE DEVELOPMENT AND IMPLICATIONS FOR THE MEKONG RIVER

David Hand, US Fish and Wildlife Service
John Beeman, US Geological Survey
Hydropower and Fish Passage in the Columbia

- Overview of Columbia River
- Timeline of dam construction + fish passage
- Highlight major themes
- Implications for the Mekong
Columbia River

Length: 2,000 km.

Source:
Columbia Lake,
British Columbia

Drainage area:
- 67 million hectares
- Larger than France,
  Belgium, &
  Netherlands combined
- 7,500 cms daily mean flow
- 219 major dams:
  ... 176 in U.S.
  ... 43 in Canada
<table>
<thead>
<tr>
<th></th>
<th>Columbia</th>
<th>Mekong</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catchment (km²)</td>
<td>670,000</td>
<td>795,500</td>
</tr>
<tr>
<td>Length (km)</td>
<td>2,000</td>
<td>4,900</td>
</tr>
<tr>
<td>Mean discharge (m³s⁻¹)</td>
<td>7,500</td>
<td>14,500</td>
</tr>
<tr>
<td>Number of fish species</td>
<td>~100</td>
<td>800-1,100</td>
</tr>
<tr>
<td>Mainstem Dams</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>(existing or planned)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tributary Dams</td>
<td>&gt;250</td>
<td>~200</td>
</tr>
<tr>
<td>(existing or planned)</td>
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</tbody>
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Adapted from Ferguson et al 2011 and D. Wills USFWS
Mainstem Dam Construction Begins

- Rock Island
- Bonneville
- Grand Coulee
- McNary
- Chief Joseph
- The Dalles
- Brownlee
- Rocky Reach
- Priest Rapids
- Wanapum
- Wells

- Oxbow
- Ice Harbor
- Hells Canyon
- Lower Monumental

Columbia River Basin

COE, Snake River, Ice Harbor Dam

Timeline:
- 1930
- 1940
- 1950
- 1960
- 1970
- 1980
- 1990
- 2000
- 2010
- John Day
- Little Goose
- Lower Granite
Fish Passage Then

- Downstream passage through turbines
- Upstream passage through fish ladders
Fish Passage Today

- **Downstream**
  - Spill
  - Surface weirs
  - Flow Augmentation
  - Juvenile Bypass
  - Transportation
  - Turbine redesign

- **Upstream**
  - Lamprey Passage Systems
  - Spill Patterns
Political Will

- Fish Conservation = Power Generation

- Government/Legal Driven
  - Treaties, NW Power Act, Endangered Species

- Broad goals measurable objectives

- Basing decision on SCIENCE
Ecosystem Approach

- Initial salmonid focus
Ecosystem Approach

- Initial salmonid focus

- Salmon passage ≠ non-salmon passage

NOAA
Adaptive Management

- Test passage designs
- Rigorous monitoring
- Flexibility
Long Term Commitment

- 80+ years of work
  - Complex
  - Long-term monitoring

- Financial
  - $US 500 Million annually
  - $US 3.3 Billion 1982-2001
  - Forgone power generation
<table>
<thead>
<tr>
<th>Political Will</th>
<th>Columbia</th>
<th>Mekong</th>
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<tbody>
<tr>
<td>Strong</td>
<td></td>
<td>Developing</td>
</tr>
<tr>
<td>Measurable</td>
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<td>Broad Goals</td>
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<td>Objectives</td>
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<tr>
<th>Ecosystem Approach</th>
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<tbody>
<tr>
<td>100 species</td>
<td></td>
<td>&gt;1,000 species</td>
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<tr>
<td></td>
<td></td>
<td>Little known</td>
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<th>Adaptive Management</th>
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<th>Mekong</th>
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<tbody>
<tr>
<td>Monitoring</td>
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<td>Limited monitoring</td>
</tr>
<tr>
<td>Flexible</td>
<td></td>
<td>Inflexible</td>
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<thead>
<tr>
<th>Long Term Commitment</th>
<th>Columbia</th>
<th>Mekong</th>
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<tbody>
<tr>
<td>80+ years</td>
<td></td>
<td>Unknown</td>
</tr>
<tr>
<td>Costly</td>
<td></td>
<td>Limited $</td>
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