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Stable isotope analysis reveals different trophic niche spaces for wild and hatchery origin juvenile Chinook salmon in the Nisqually Delta

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Integrated diet analyses reveal different trophic niche spaces for juvenile Chinook salmon in the Nisqually River Delta

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Weinstein et al. 2013: Restoration planners should and must view restoration goals in the context of the full estuarine mosaic.
How do juvenile salmon benefit from estuarine habitat?
How do juvenile salmon benefit from estuarine habitat?
WHO is eating WHAT, and WHERE?
WHO is eating WHAT, and WHERE?

1. Where are hatchery and unmarked juvenile Chinook salmon foraging?
2. What prey taxa are they eating?
3. What is the energetic quality of their diets?
Diet varies ontogenetically

WHO is eating WHAT, and WHERE?

1. Where are hatchery and unmarked juvenile Chinook salmon foraging?
2. What prey taxa are they eating?
3. What is the energetic quality of their diets?
Average catch-per-set by habitat type

- Hatchery
- Unmarked

<table>
<thead>
<tr>
<th>Habitat Type</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forested</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Transition</td>
<td></td>
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</tr>
<tr>
<td>Emergent Marsh</td>
<td></td>
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<td></td>
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<tr>
<td>Mudflat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nearshore</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Log-abundance (ind/CPS)
WHO is eating WHAT, and WHERE?

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WHO is eating WHAT, and WHERE?

1. Where are hatchery and unmarked juvenile Chinook salmon foraging?
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3. What is the energetic quality of their diets?
Dietary energy content

- Stomach energy content (kJ)

- Size class: Unmarked, Hatchery

- Graph showing energy content across different size classes, with markers for Unmarked and Hatchery groups.
Conclusions

- Hatchery and unmarked (wild) fish occupy different niches in terms of:
  1) Outmigration timing
  2) Habitat use
  3) Prey consumption

- Hatchery fish are less likely to use tidal riverine forested marsh

- As a result, they may be missing out on high energy-density prey
Partners and Collaborators

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**USFWS**: Jesse Barham, Doug Roster, Marian Bailey, Jean Takekawa

**Graduate Supervisory Committee**: Dave Beauchamp, Julian Olden, Si Simenstad, Christian Torgersen
### Juvenile Chinook populations:

<table>
<thead>
<tr>
<th>Population Type</th>
<th>Nooksack</th>
<th>Skagit</th>
<th>Snohomish</th>
<th>Nisqually</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total outmigrants</td>
<td>33,100 – 325,300</td>
<td>1,000,100 – 7,712,300</td>
<td>33,600 – 1,024,300</td>
<td>34,700 – 245,700</td>
</tr>
<tr>
<td>Fry outmigrants</td>
<td>300 – 43,400</td>
<td>444,400 – 6,553,000</td>
<td>26,200 – 432,900</td>
<td>3,500 – 93,800</td>
</tr>
<tr>
<td>Hatchery releases</td>
<td>610,000 – 1,940,000</td>
<td>150,000 – 890,000</td>
<td>1,820,000 – 4,300,000</td>
<td>3,350,000 – 4,246,000</td>
</tr>
</tbody>
</table>

Greene et al. 2018

Hatchery juveniles:

- Released over a two-week period
- ~20 mm larger than unmarked (wild) fish
- Spend less time in the delta before moving to offshore
- Genetic/behavioral differences

Davis et al. *in review*