

Braiding Indigenous management and AI for effective, equitable and transparent fishery management

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Traditional Salmon Fisheries



Celilo Falls – Washington/Oregon



Smoking salmon – Western Washington

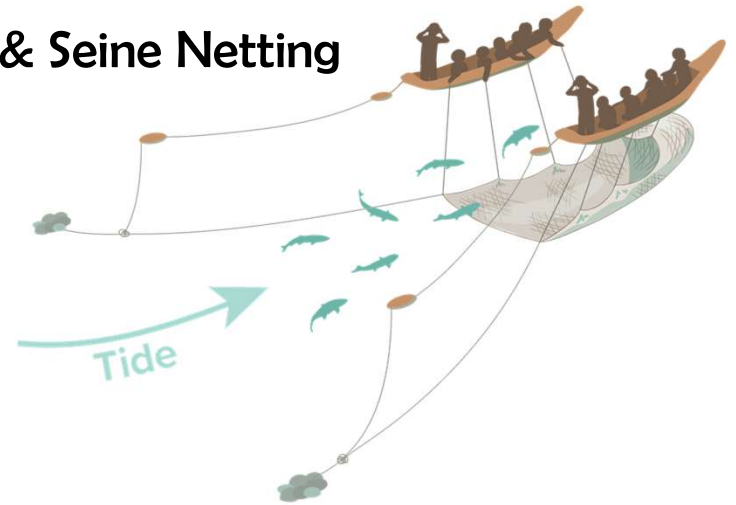


Kitwanga Weir – Skeena River

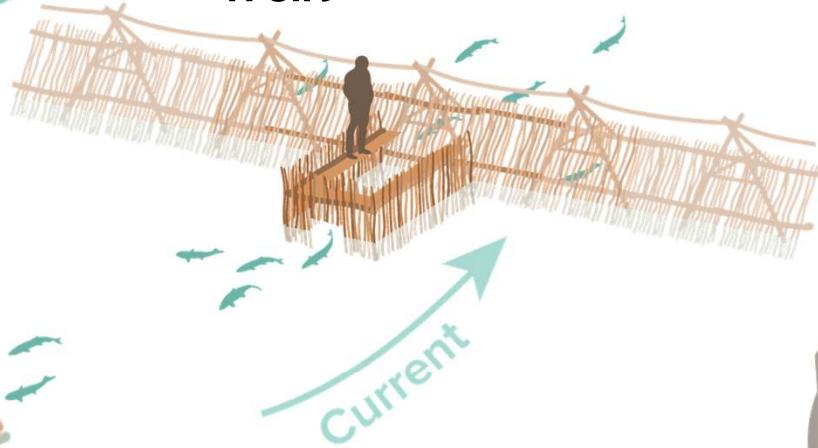
Intertidal Fish Traps



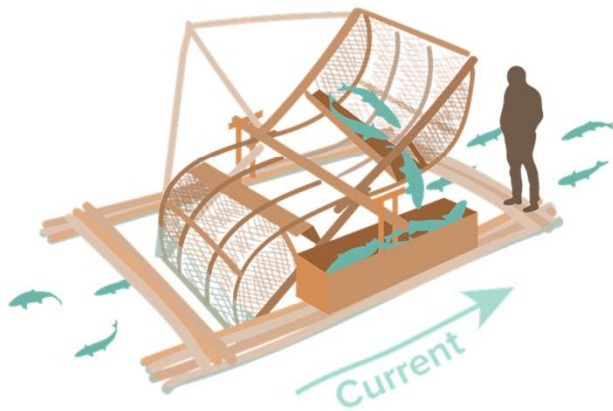
Reef & Seine Netting



Weirs



Fish Wheels



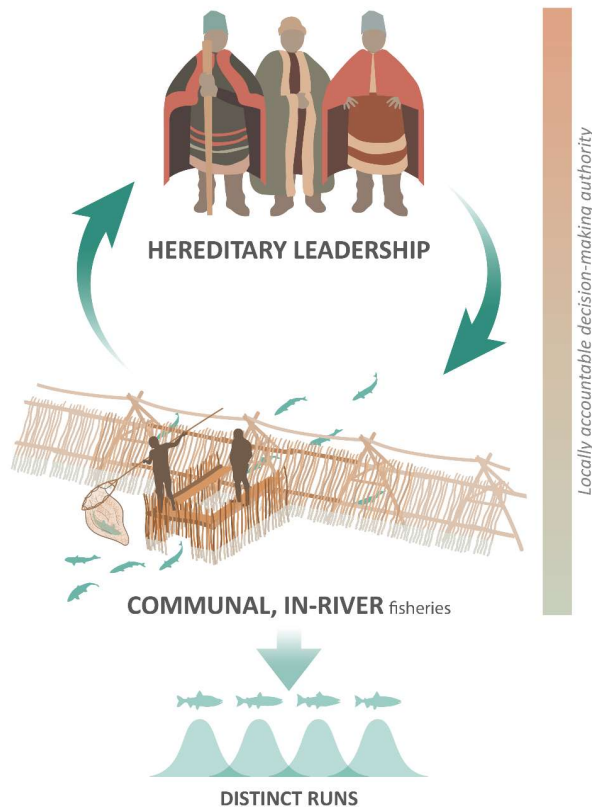
Dip Netting



Resilient Local Salmon Fisheries

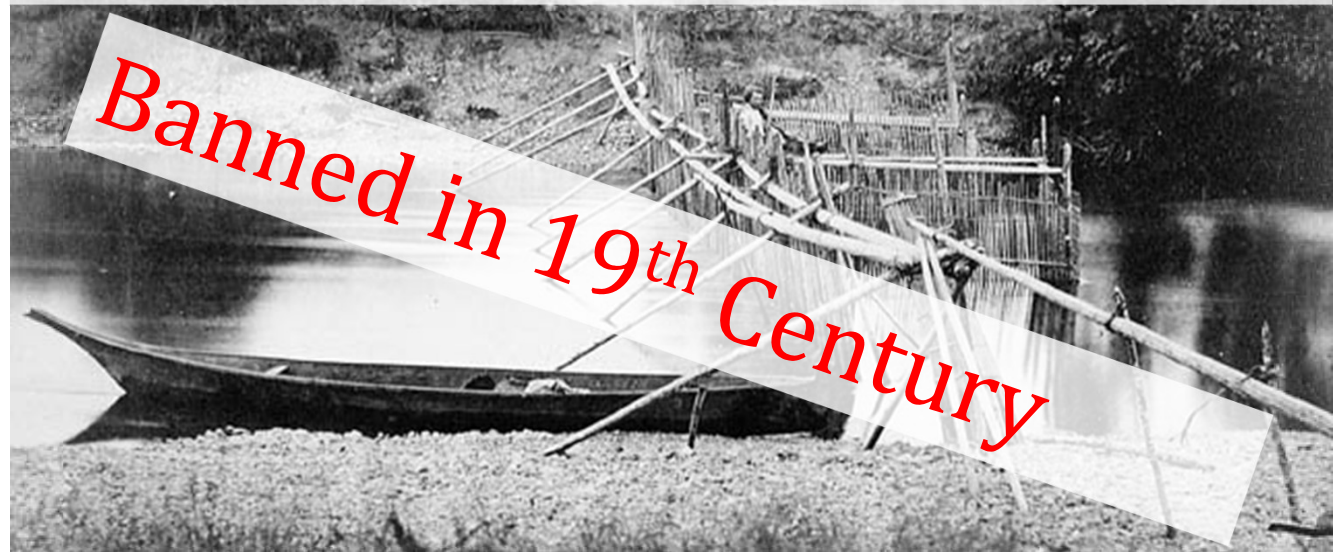
Indigenous management:
Stewardship is linked to harvest

Decision Making



Traditional fisheries:

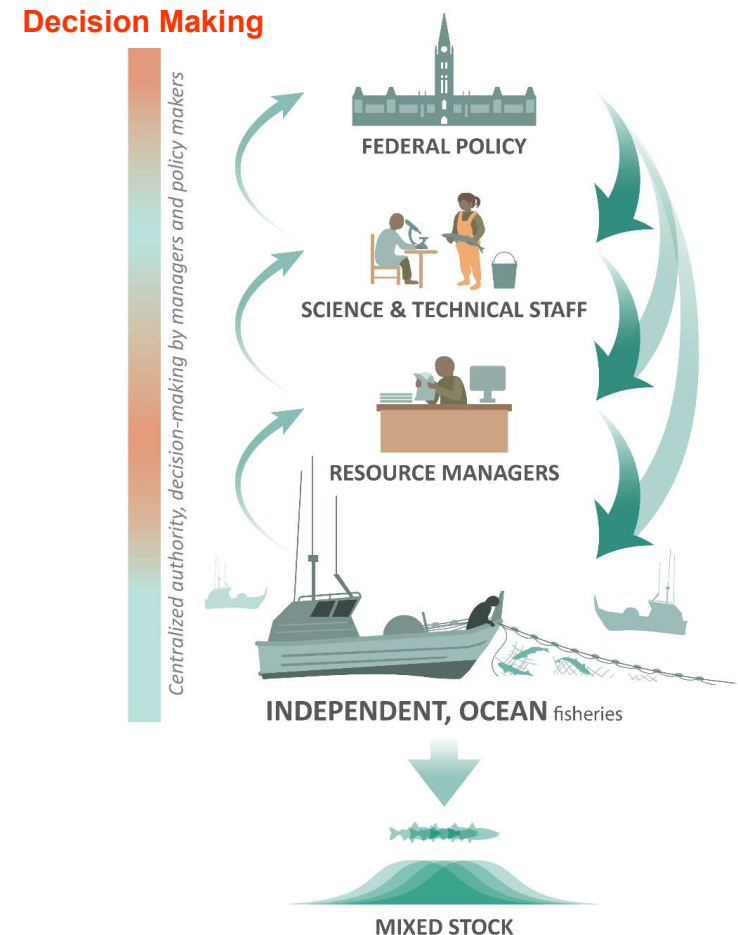
1. Scale – single population fisheries
2. Harvest & stewardship processes linked
3. Place-based fisheries incentivize stewardship



Mixed-stock fisheries

1. **Management often unresponsive to local fishers**, creating distrust
2. High **incidental harvest of non-target species** and populations
3. Mobile fishers and mixed-stock harvest **masks population declines & limits incentives to reduce impacts** of overharvest or habitat loss
4. Absence of **in-season data limits opportunities for adaptive management** to reduce overharvest risks

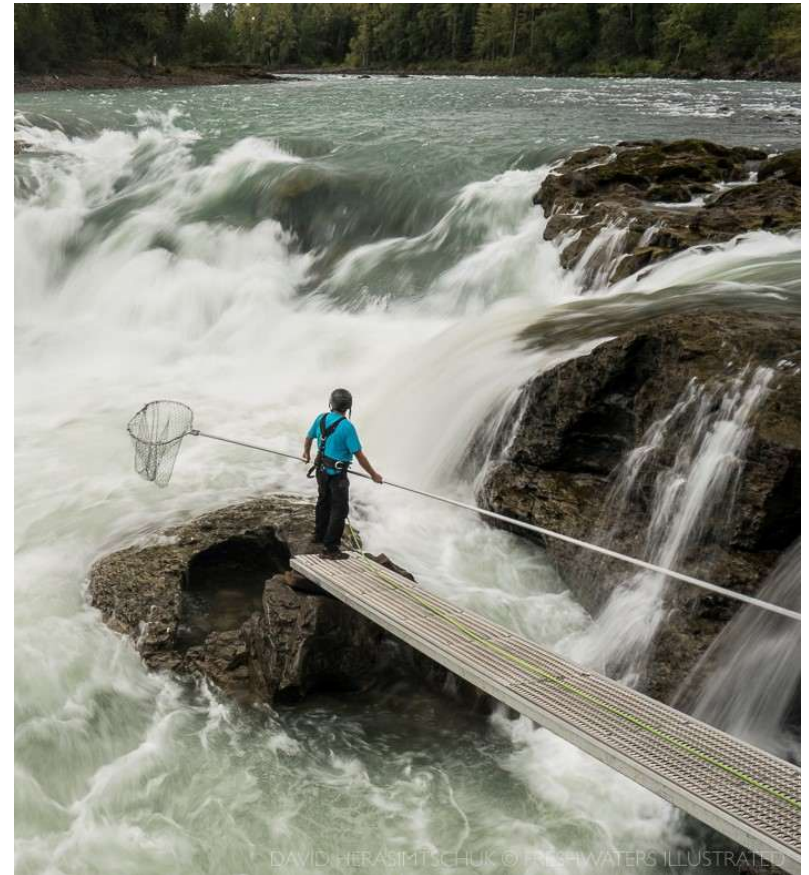
Contemporary management:
Science, management and fishing are compartmentalized



Atlas et al. 2021. *BioScience*

Learning from Indigenous management

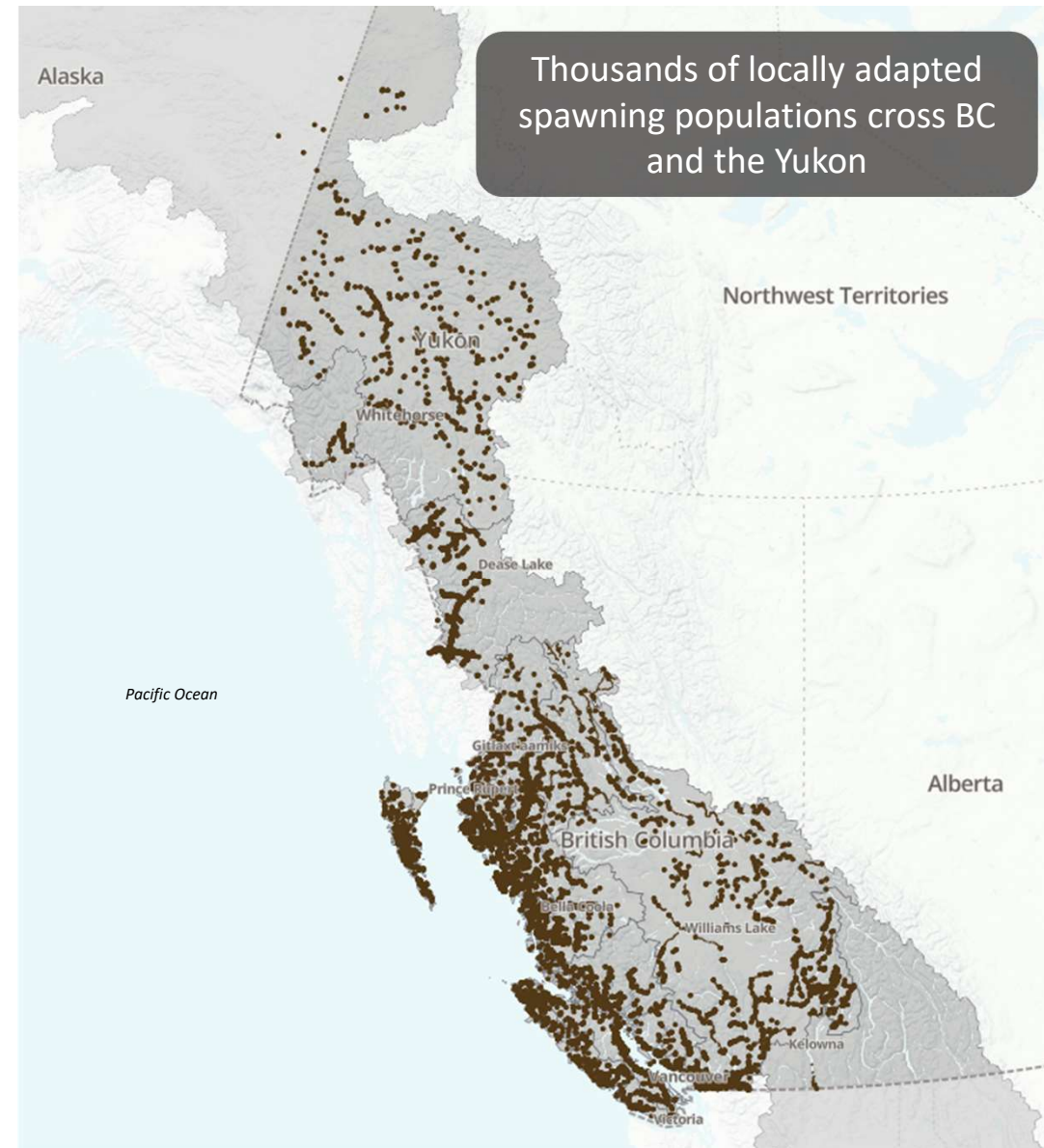
1. Place-based management of salmon and steelhead is most biologically and socially sustainable.
2. Transformation needed to advance locally empowered decision making.
3. Linking monitoring and fishing opportunities creates incentives for reliable data and long-term stewardship.
4. Indigenous People play central role in ongoing management of salmon.



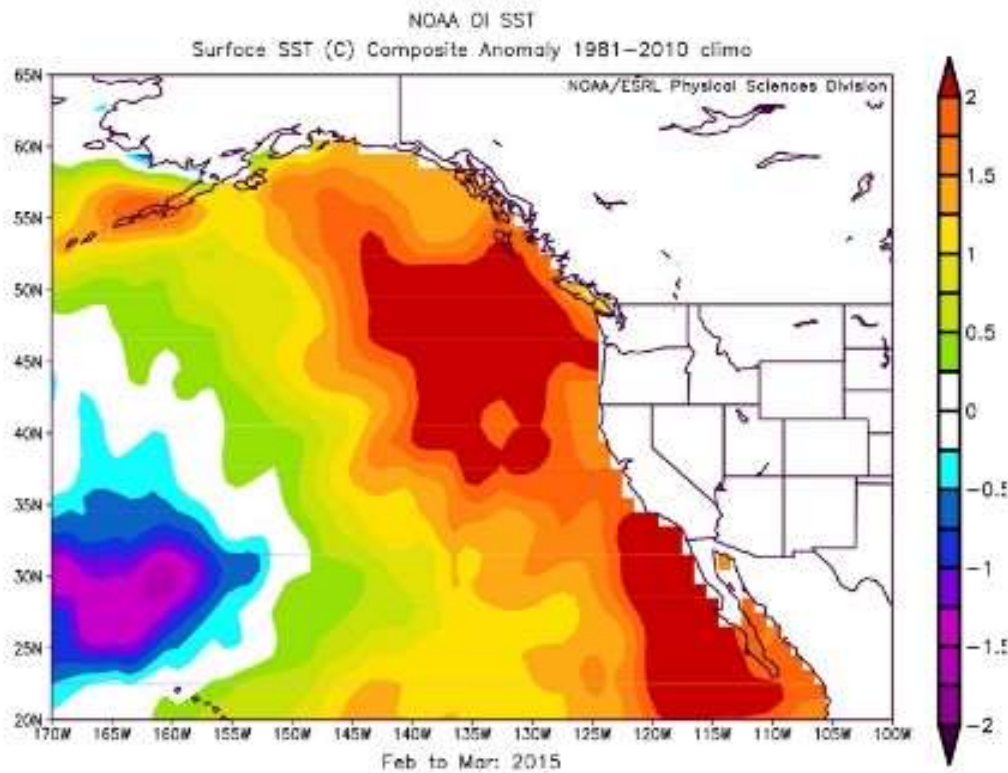
AI tools to support sustainable fisheries

- Managers have unenviable job of monitoring thousands of populations
- Resources for monitoring are limited
- Forecasting error is increasing?
- How to provide reliable, in-season data on populations at this scale?

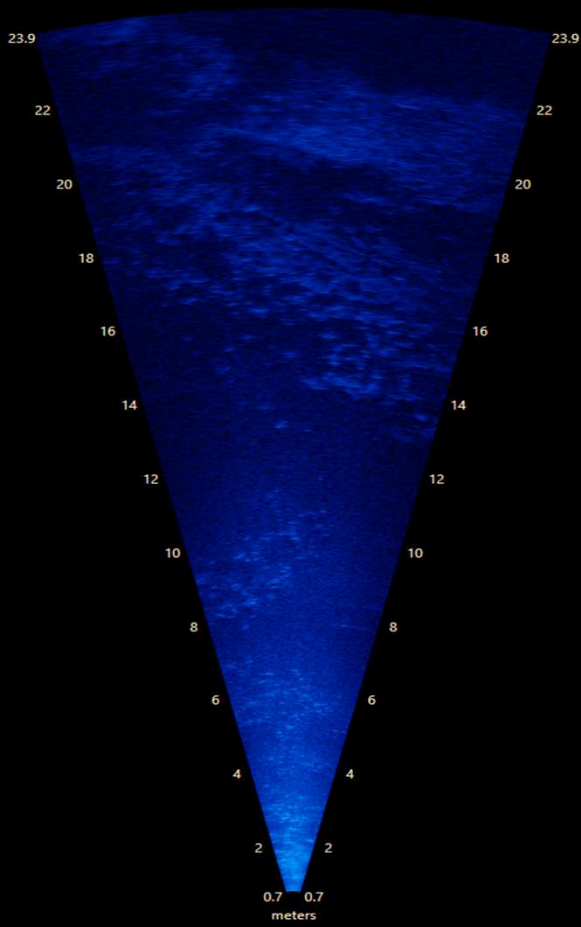
AI tools support rapid data processing and analysis to inform in-season decisions



Salmon ecosystems face accelerating climate changes



Addressing a clear technology need



Goals and outcomes of our work

1. Empower local and Indigenous communities with in-season information to support adaptive and precautionary management
2. Shift some management decision making and harvest opportunity to local communities supporting in-river and local harvest opportunity.
3. Support long-term health of salmon social-ecological systems, and food security of local salmon-dependent communities.
4. Elevate co-development in process of creating AI tools, to build trust and ensure benefits to end users of the technology.



What is the Salmon Vision collaborative



TAKU RIVER TLINGIT
First Nation

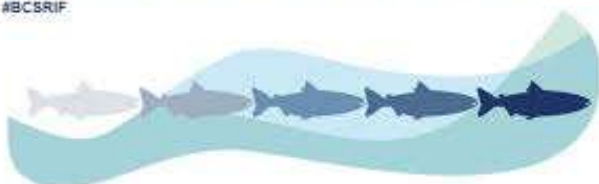


Gitanyow
Fisheries
Authority



NUXALK
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BC Salmon Restoration and Innovation Fund
#BCSRIF



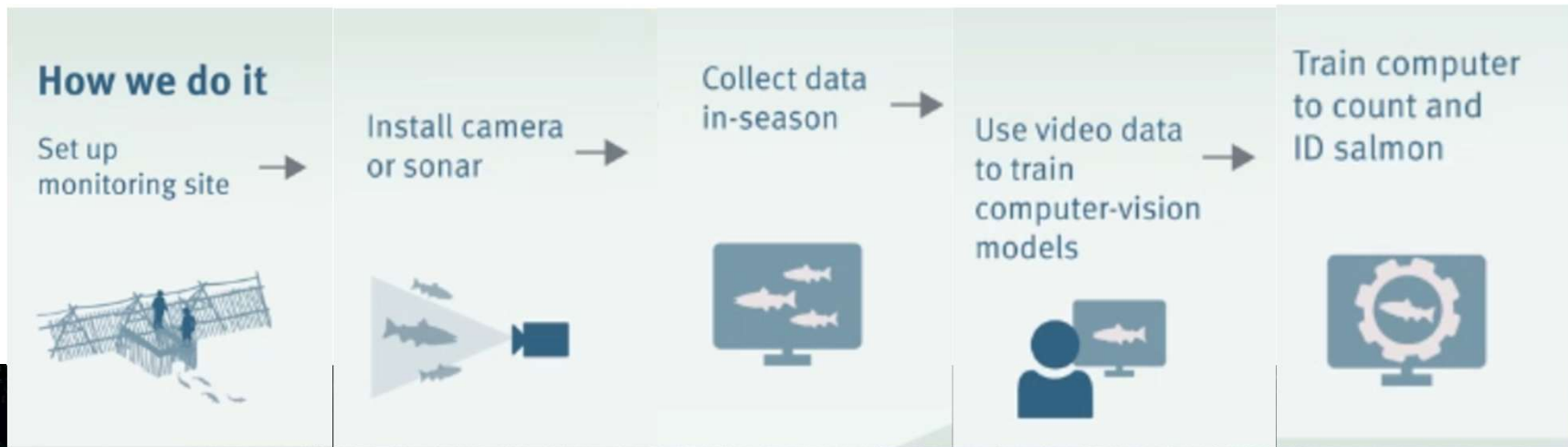
Heiltsuk
Nation



Wuikinuxv
First Nation



AI training and deployment cycle



IP Camera

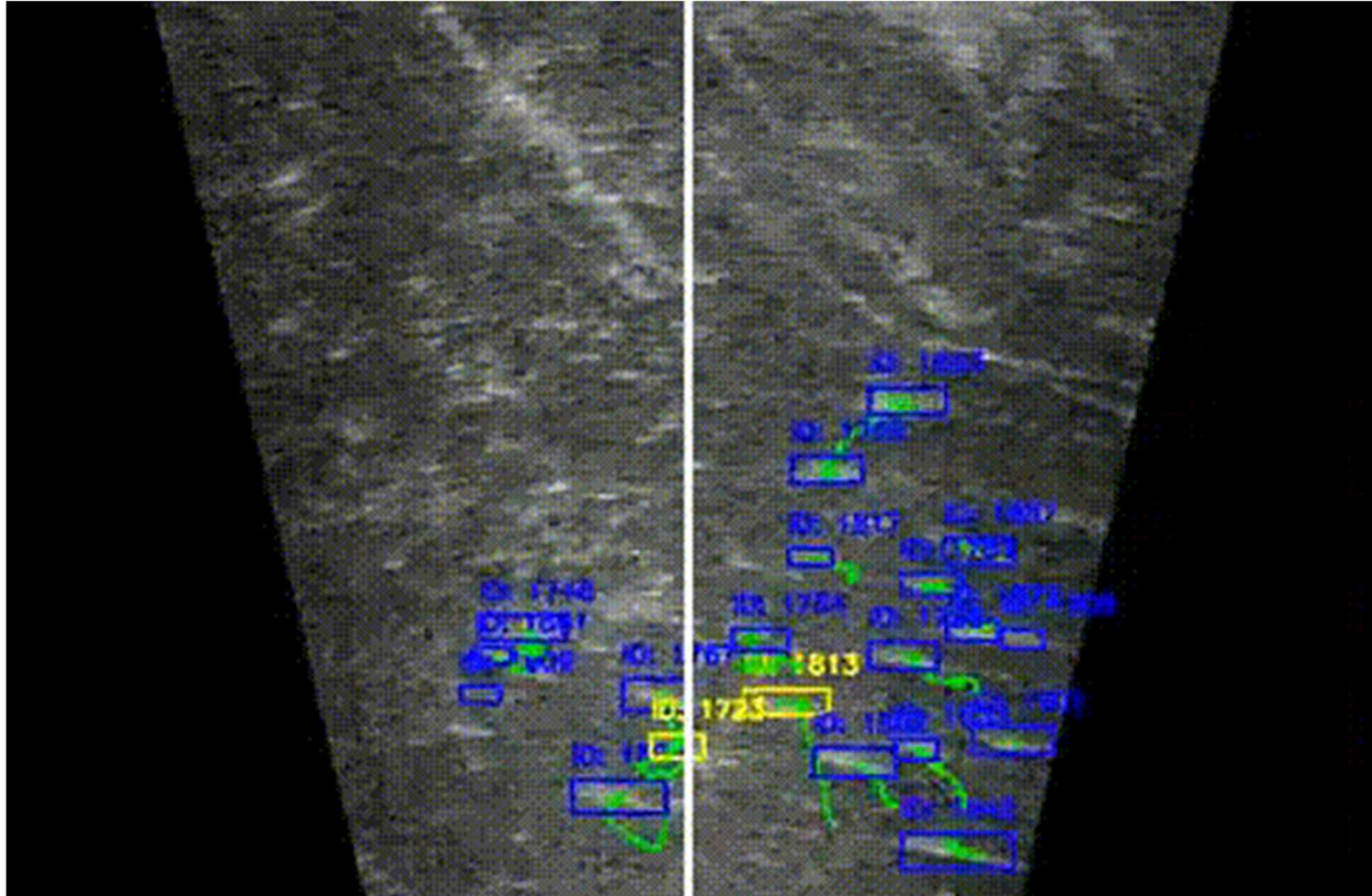
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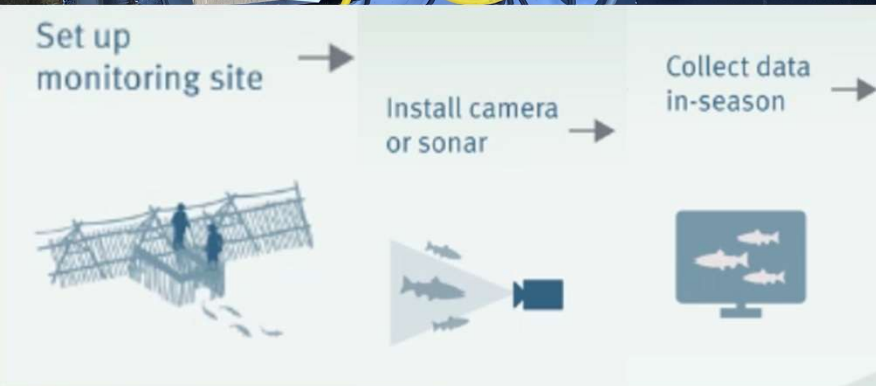
Computer-vision counting for video monitoring



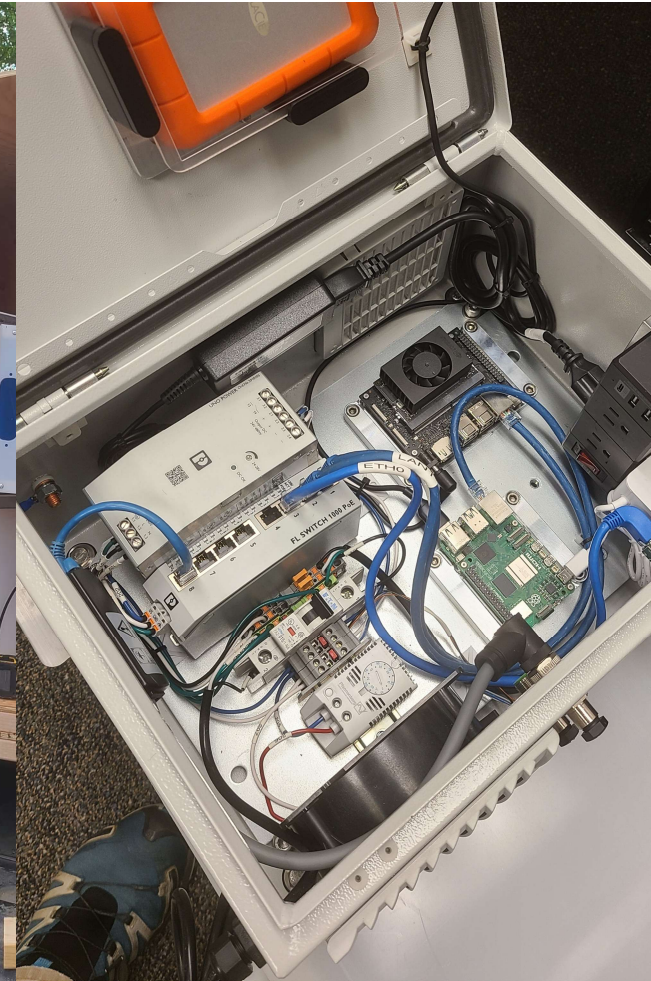
Automated detection and tracking for sonar

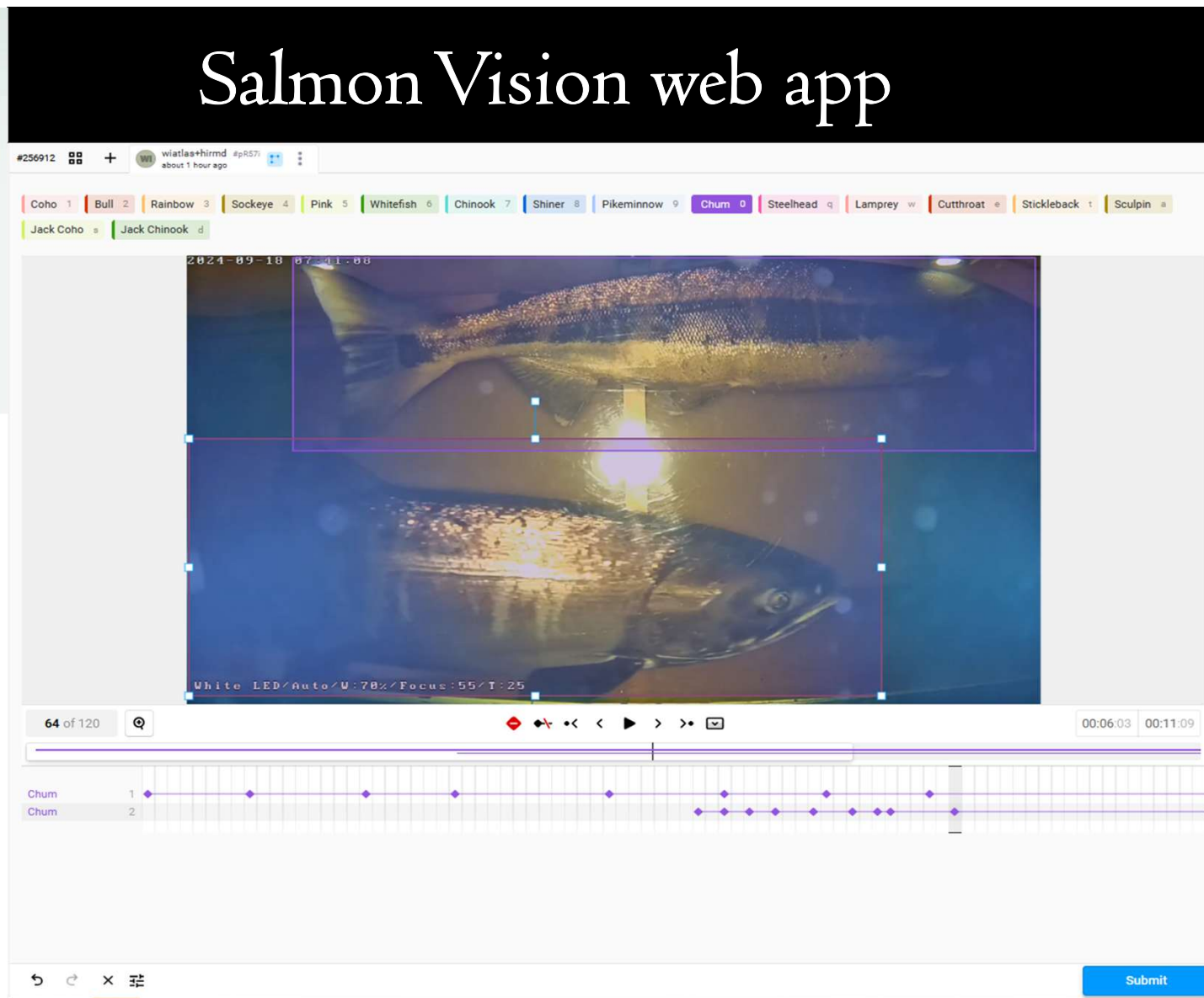
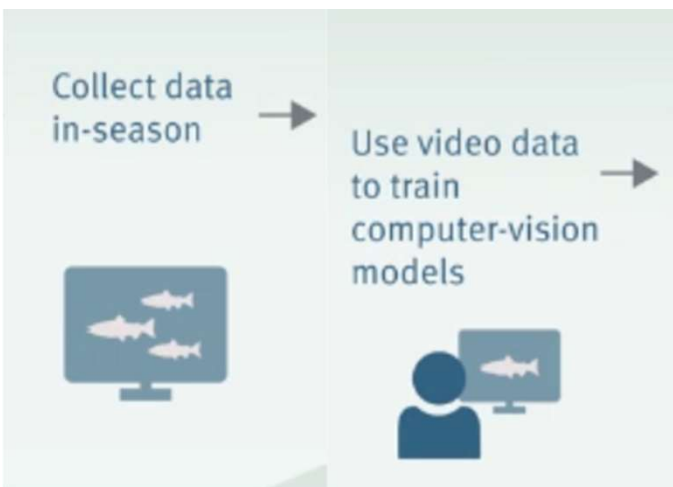


Learning from application of AI tools in the field



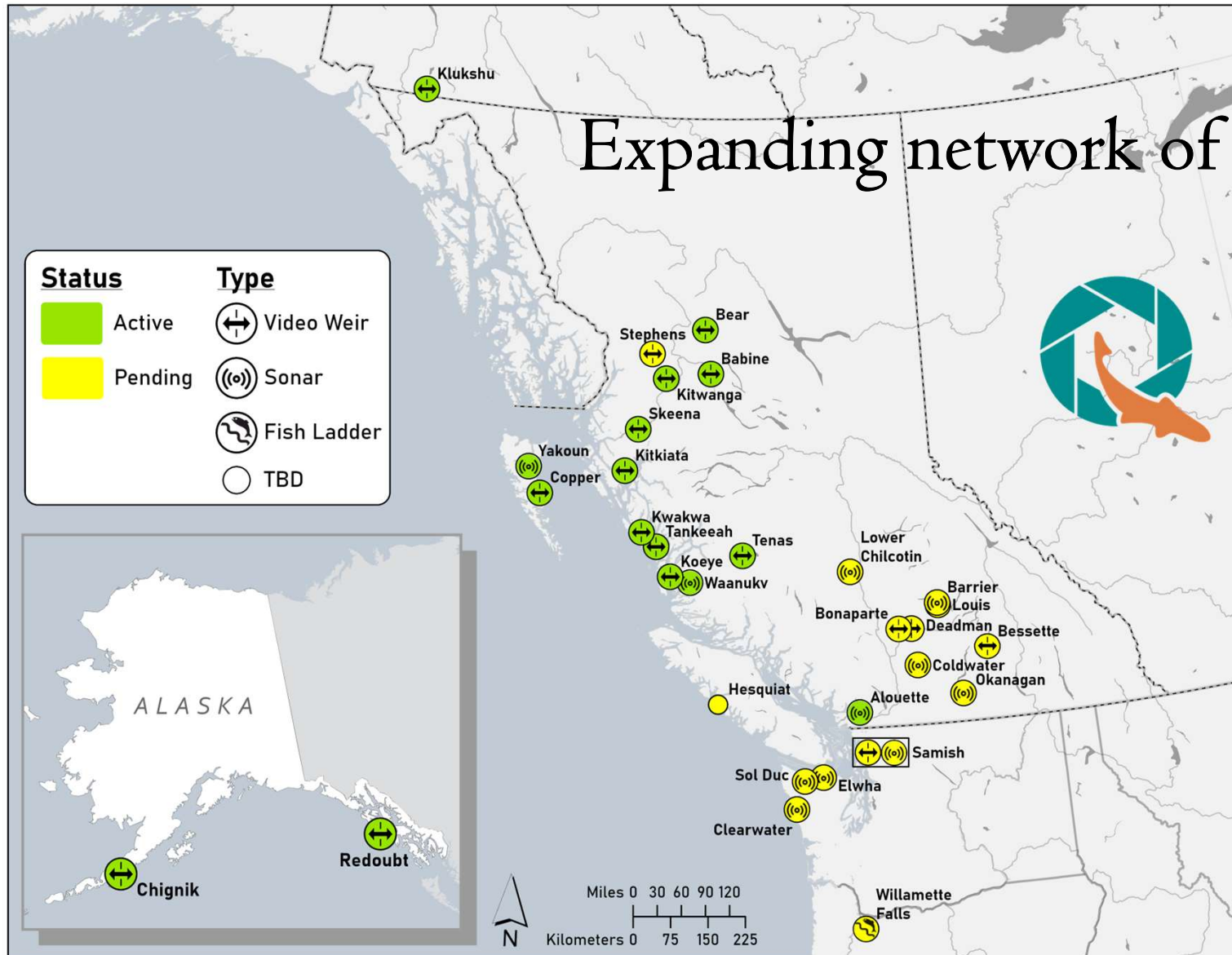
Edge systems
partnerships support
expansion of efforts





- Data review was major bottleneck for counting
- New SV web app modules launched in beta for video & sonar monitoring
- Integrates data review and annotation, unlocking rapid model improvement.

Expanding network of partners

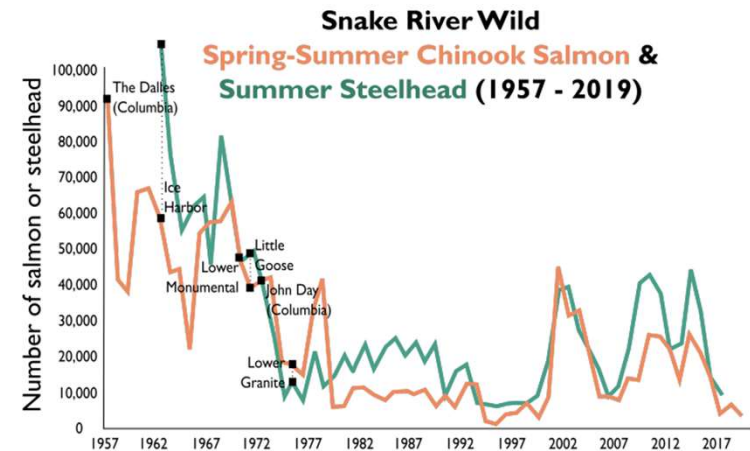
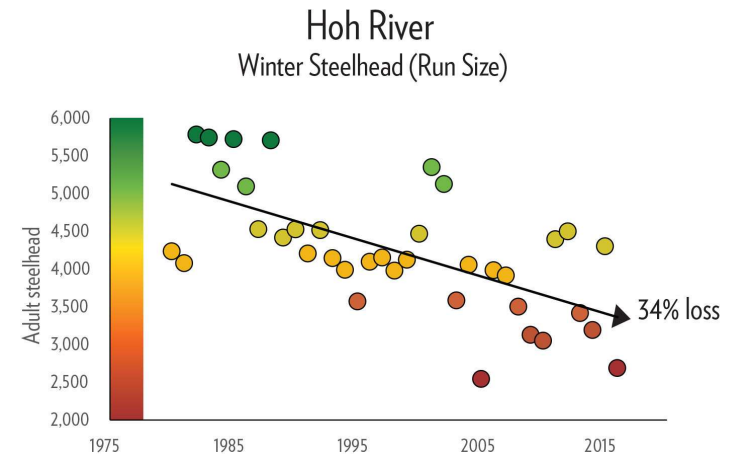
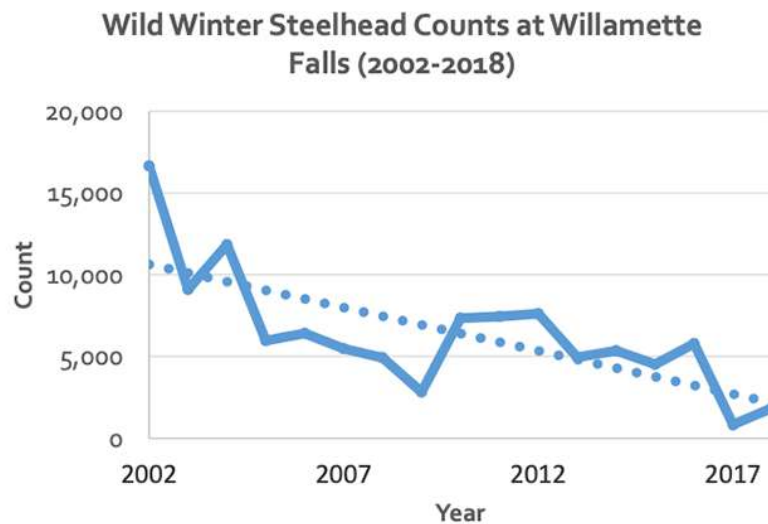


Relevance to steelhead managers



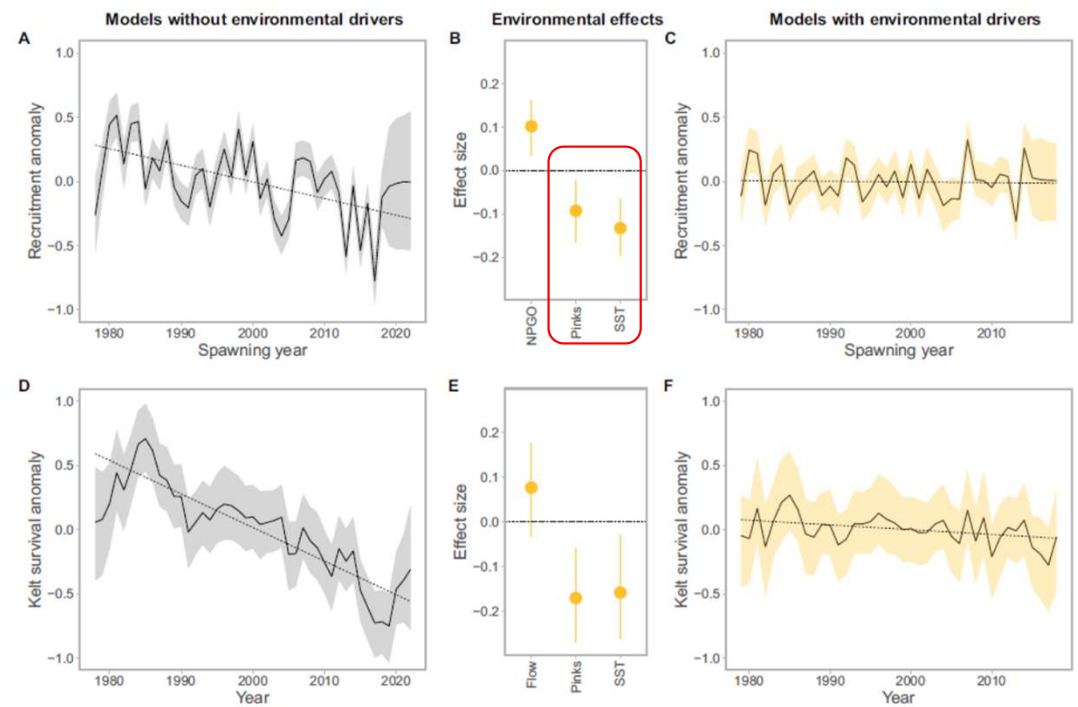
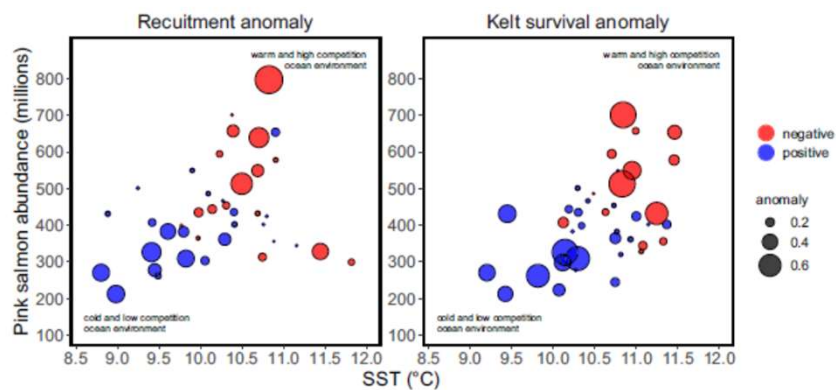
Declining steelhead increase pressure on managers

- Most steelhead populations are declining in the PNW



Declining steelhead place pressure on managers

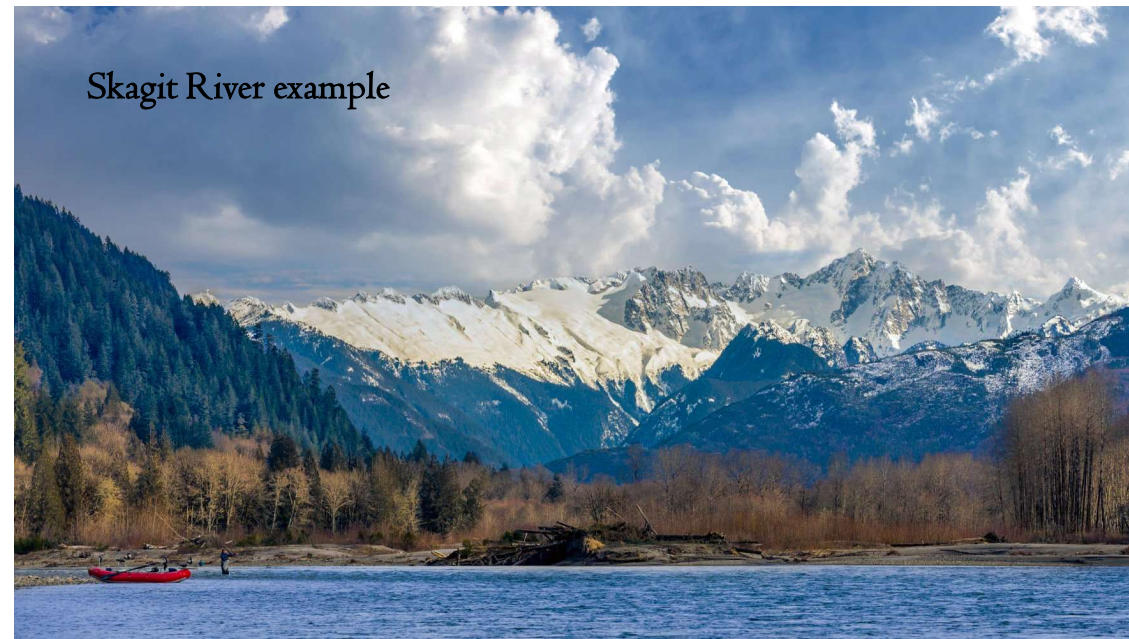
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- Range wide uncertainty due to escalating impacts of ocean warming and pink salmon



Ohlberger et al. 2025 – Fish & Fisheries

Declining steelhead place pressure on managers

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- Range wide uncertainty due to escalating impacts of ocean warming and pink salmon
- Managers have difficult task of balancing fishing opportunity with conservation needs.
- Increasing forecast error + implementation error requires in-season monitoring
- Need timely and trusted data shared by agencies, Tribes and stakeholders

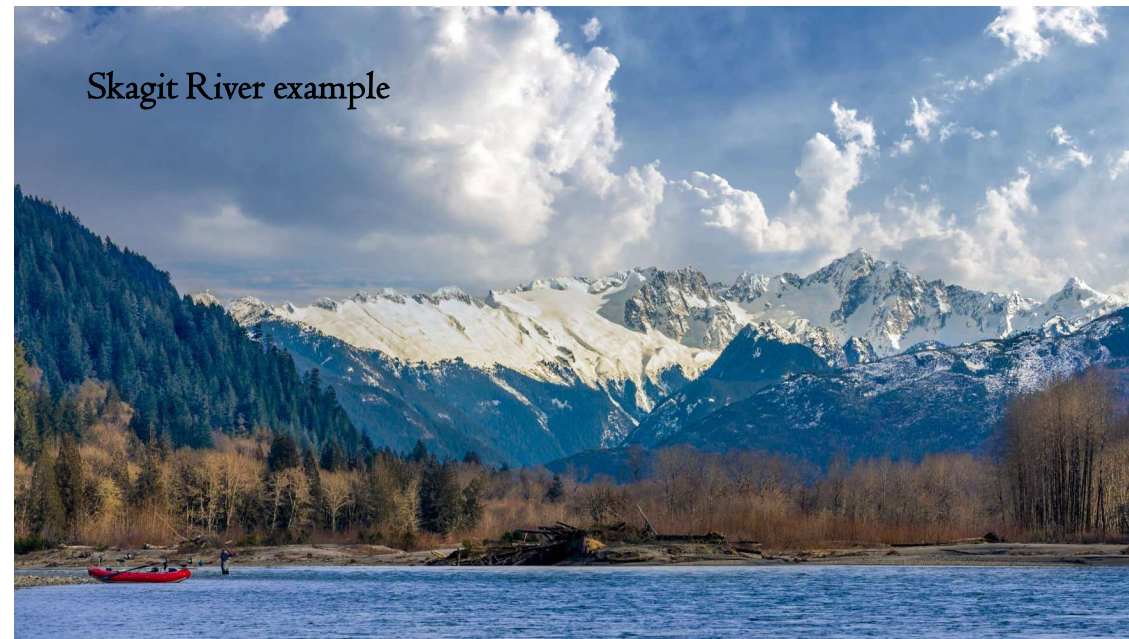


Natural Origin Steelhead Run size (pre-season forecast/in-season run update)	Allowable Harvest Impact Rate
<u>Terminal Run</u> < 4,000	4%
4,001 < <u>Terminal Run</u> ≤ 6,000	10%
6,001 < <u>Terminal Run</u> ≤ 8,000	20%
<u>Terminal Run</u> > 8,001	25%

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Implementation could be challenged by loss of state funding, limited resources for monitoring



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Advancing monitoring and conservation of steelhead

- Managers can learn from Indigenous knowledge and management that supported sustainable fisheries for millennia
- Realign monitoring and decision-making with watershed scale, uphold Treaty commitments
- Leverage emerging AI tools to provide data that is timely, reliable and cost-effective.
- Emerging opportunities for steelhead:
 1. Automated counting at weirs or sonars
 2. Computer-vision analysis of drone redd surveys
 3. Smolt counting projects in R & D



