



# Impacts of Catch and Release Angling on Salmon and Steelhead

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## Full length article

# Influence of angling methods and terminal tackle on survival of salmon and steelhead caught and released in the Cowlitz River, Washington

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## ARTICLE INFO

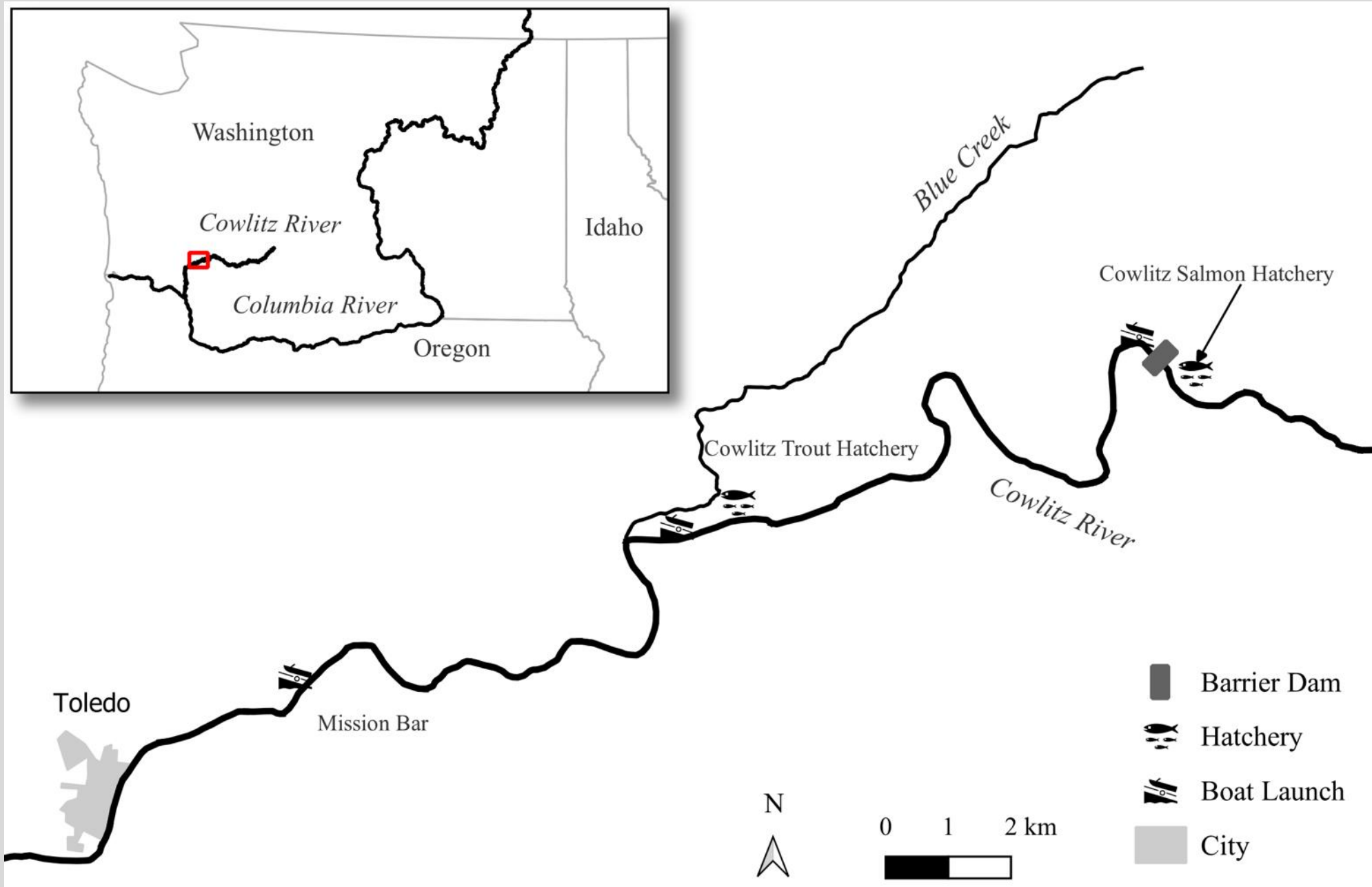
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**Keywords:**  
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Mark-Selective  
Angling  
Salmon  
Steelhead  
Survival  
Hooking Mortality

## ABSTRACT

Efforts to recover depressed stocks of salmon and steelhead trout in North America include implementation of mark-selective recreational fisheries, whereby anglers are allowed to harvest hatchery-origin fish but must release natural-origin fish. Catch and release angling (C&R) is generally thought to be an effective tool for conservation relative to traditional retention fisheries due to high survival of released adult salmon and steelhead in freshwater. Studies designed to estimate C&R mortality have produced highly variable results among species and size classes of fish, gear types, and environmental conditions. Therefore, crude approximations of C&R mortality are commonly used to quantify impacts to natural-origin salmon and steelhead. In addition, managers often restrict use of certain angling methods and terminal tackle that are assumed to result in higher mortality, leading to a multiplicity of different regulatory requirements with limited empirical support. We conducted a novel three-year mark-recapture study in the Cowlitz River, Washington to estimate effects of a variety of factors hypothesized to influence salmon and steelhead C&R survival using a control-treatment design. Three species of anadromous salmonids were captured and released as treatments using various angling techniques and terminal tackle. Fight time, handling time, and water temperature were recorded during each capture event. Non-angled fish were captured in a trap and released back into the fishery to serve as controls. Recovery rates of Coho Salmon differed less than a percent between angled and non-angled fish across multiple gear types, indicating negligible effects of C&R. Angled Spring Chinook Salmon experienced 3.6–10.2 % C&R mortality relative to non-angled control fish, depending on terminal tackle. Barbless hooks were associated with higher survival than barbed hooks for both Chinook and Coho Salmon, although differences were small for Chinook and negligible for Coho. In contrast, steelhead trout angled on barbed hooks were recovered at slightly higher rates than those caught on barbless hooks. We also found evidence for a reduction in landing rates when angling using barbless hooks. Finally, use of bait increased the probability that salmon would be hooked in a critical location such as the esophagus or stomach. Our findings are useful for assessing trade-offs between conservation measures and harvest opportunity when defining fishing regulations in mark-selective salmon and steelhead fisheries.







Species	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY
Spring Chinook												
Fall Chinook												
Coho												
Winter Steelhead												
Summer Steelhead												









**Method & Gear Type**

**Hook location**

**Hook Size/Type/Barb**

**Fight Time**

**Handling Time**

**Species**

**Sex**

**Fork-length**

**Angler Exp.**

**Fish Condition**

**Knotted vs. Knotless nets**

**Water temp**



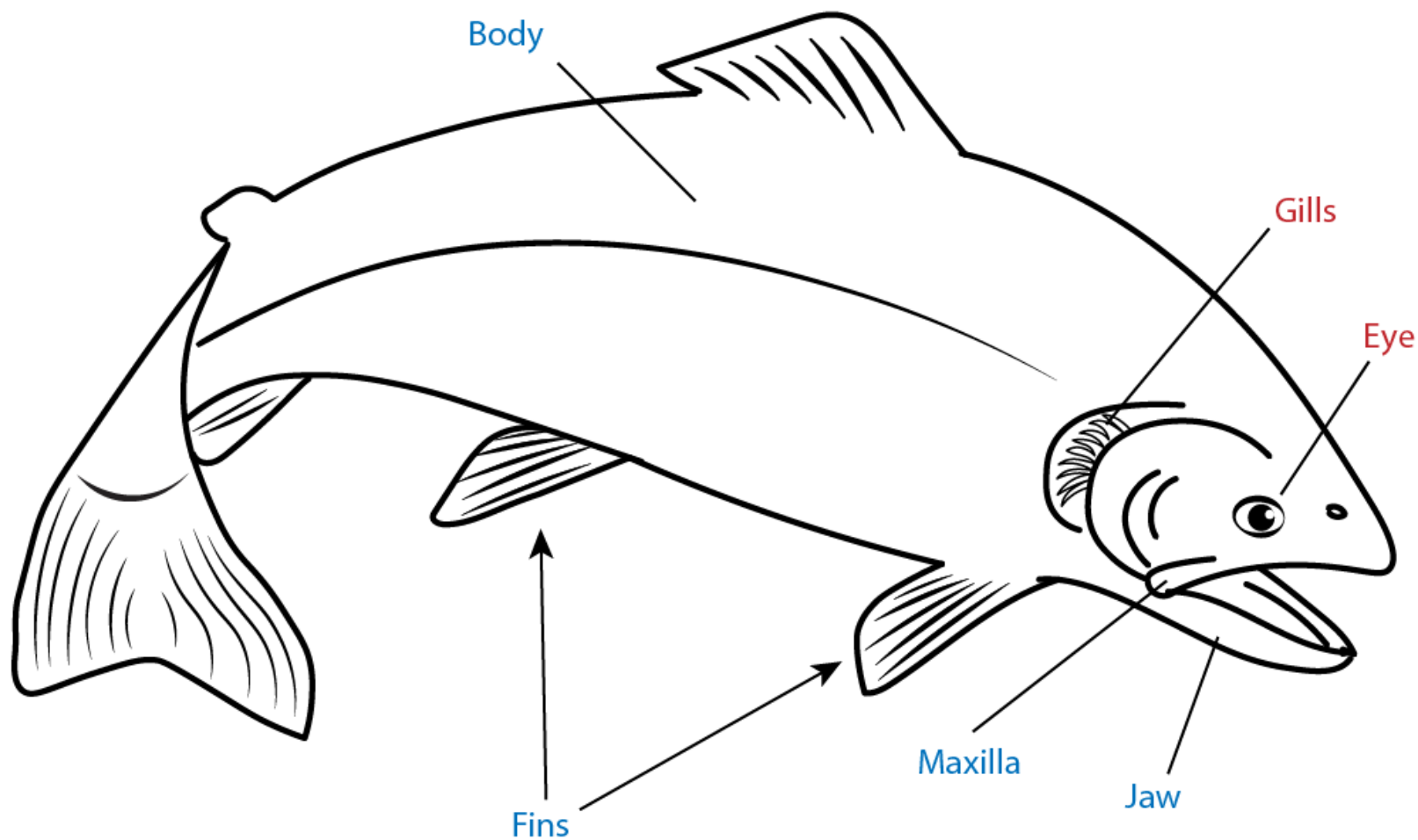
## Boat Angling



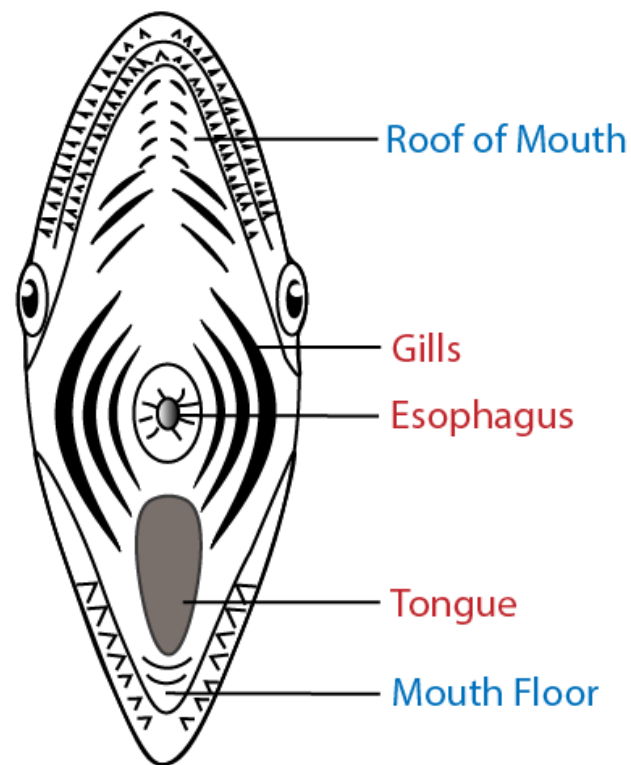
## Bank Angling







Mouth Interior



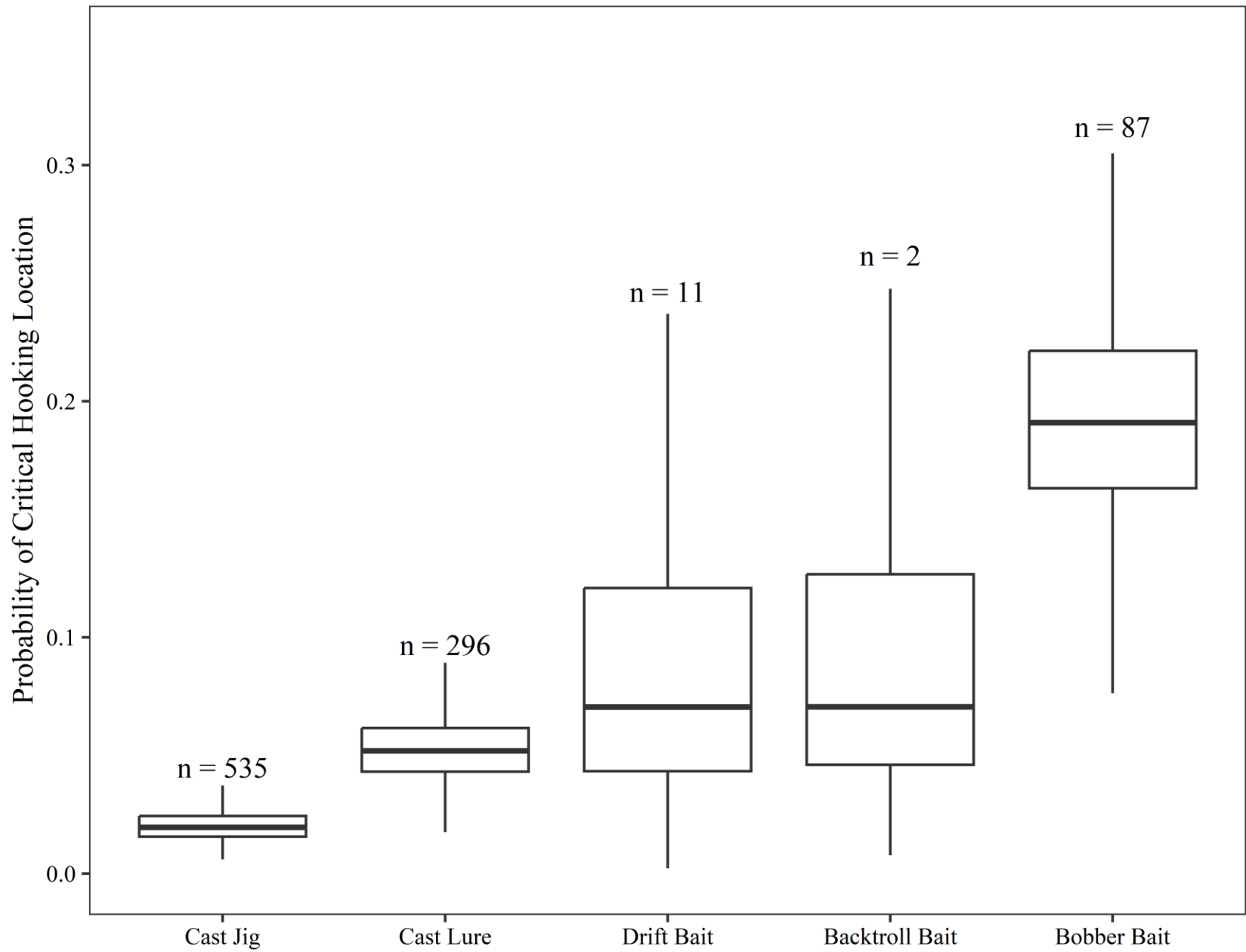
**Critical vs Non-critical**  
Hooking Locations

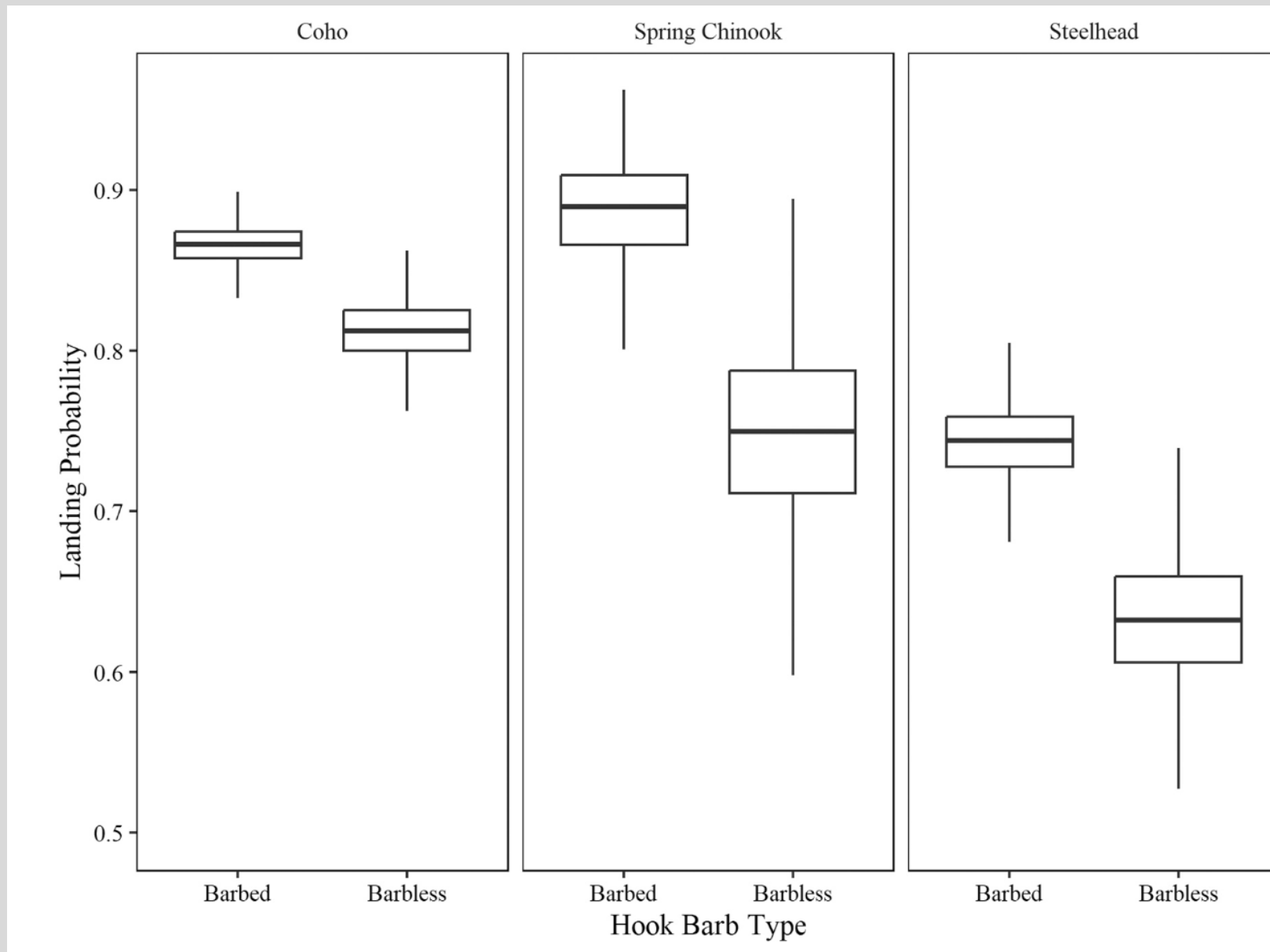


# Cowlitz River Study Results

- Spring Chinook 3.6-10% mortality
- Coho <1% mortality
- Slight benefit of barbless hooks
- Higher landing rate for barbed v. barbless hooks









# What about fishing from a boat versus the bank?

Variable	Boat	Bank
Proportion Landed	0.76	0.68
Proportion Recaptured	0.68	0.64
Median Fight Time	64 seconds	84 seconds
Median Handle Time	77 seconds	110 seconds
Proportion Hooked in a Critical Location	0.09	0.04



An aerial photograph of a river system. In the foreground, a large, rusted steel truss bridge spans the river. A yellow and black train is crossing the bridge. In the background, a concrete dam with a spillway is visible. The river flows from the dam towards the bridge. The surrounding landscape is hilly and somewhat barren.

## Yakima River Spring Chinook: Fritts et al. 2023

- Radio-telemetry study
- Fish angled at Roza Dam
- Tracked until onset of spawning
- C&R mortality rate of 12%



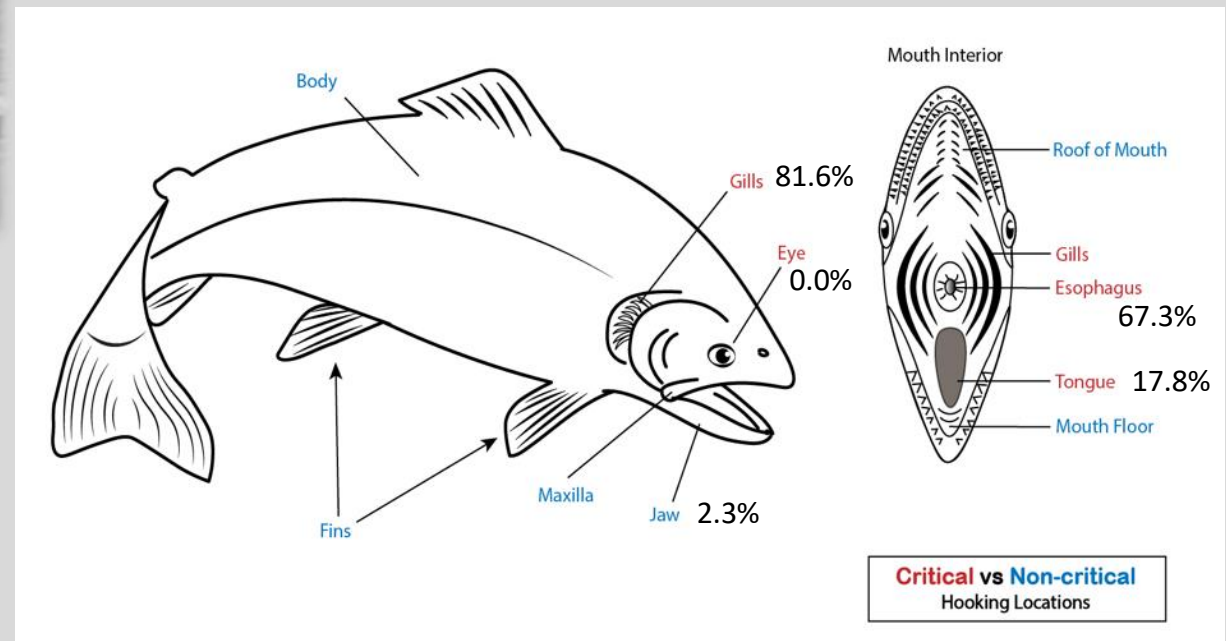




Don Ryan

## Willamette River Spring Chinook: Lindsay et al. (2004)

- Fish anchor tagged at Willamette Falls and recaptured at upstream hatcheries
- C&R mortality rate of 12.2%
- 3.2% impact rate in fishery based on encounter rates



## Snake River Summer Steelhead:

Lubenau et al. (2024)

- Fish tagged at Lower Granite Dam
- Recapture/detection of angled and non-angled fish
- C&R mortality rate of 1.6%
- 0.7% impact rate in fishery based on encounter rates



Will Lubenau



## Chilliwack River Winter Steelhead:

Nelson et al. (2005)

- Radio tagged winter steelhead in the Chilliwack River
- C&R mortality rate of 1.4 - 5.8%
- 2.5% impact rate in fishery based on encounter rates





A photograph of three large salmon, likely steelhead and coho, lying on a gravelly riverbed. A fishing rod with a wooden handle and a silver reel is positioned diagonally across the fish. The fish are arranged in a row, with their heads pointing towards the left. The background is a dense field of small, grey and brown river stones.

## **Skeena River Steelhead and Coho:**

J.O. Thomas (1995)

- Fish observed in net pens for 96 hrs
- 2% mortality Coho
- 5% mortality Steelhead





# Hooking Mortality Metadatabase

- Larger sample sizes for multiple species
- Greater spatial and temporal coverage
- Identify data gaps
- Archive data
- Publicly available

# Data acquisition



6

Publications

4

States/provinces

3

Salmon and Steelhead species







# Data cleaning, scrubbing, & merging

- Merged data is inclusive
- Has key data fields that are populated for all studies:
  - Control – Treatment
  - Catch & Release Events
  - Fate

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Filter by Metric

- ☐ Terminal Tackle
- ☐ Hook Type
- ☐ Barb Type
- ☐ Hooking Location
- ☐ Long-term Survival
- ☒ Short-term Survival
- ☐ Landing Rate
- ☐ Control Treatment

Filter by Location

- ☐ Cowlitz River
- ☐ Skeena River
- ☐ Snake River
- ☐ Vedder Chilliwack River
- ☐ Willamette River
- ☐ Yakima River

Filter by Species

- ☐ Chinook Salmon
- ☐ Coho Salmon
- ☐ Steelhead

Update Data

Download CSV

Data Field Dictionary

Data Summary Raw Data

Study Table

Publication	Location	Basin	Terminal Tackle	Hook Type	Barb Type	Hooking Location	Long-term Survival	Short-term Survival	Landing Rate	Fish Origin	Control Treatment	study_key	Years
Courter et al. 2023	Washington	Cowlitz River	Yes	Yes	Yes	Yes	No	Yes	Yes	Hatchery	Yes	1	2017 - 2020
Thomas 1995	British Columbia	Skeena River	Yes	Yes	Yes	Yes	No	Yes	No		No	2	1995 - 1995
Lubenau et al. 2024	Idaho	Snake River	No	No	No	No	Yes	Yes	No	Hatchery and Wild	Yes	3	2019 - 2021
Nelson et al. 2005	British Columbia	Vedder Chilliwack River					Yes	Yes	No		No	4	1999 - 2000
Lindsey et al. 2004	Oregon	Willamette River					No	Yes	No			5	1998 - 2000
Fritts et al. 2023	Washington	Yakima River	Yes	Yes	Yes	Yes	Yes	Yes	No	Hatchery and Wild	Yes	6	-

Data Summary

Species	Total	Control	Treatment	Control Recaptured	Treatment Recaptured
Courter et al. 2023, Washington, Cowlitz River, 2017 - 2020					
Chinook Salmon	386	86	300	60	134
Coho Salmon	2271	1096	1175	829	710
Steelhead	3356	2611	745	1371	187
Thomas 1995, British Columbia, Skeena River, 1995 - 1995					
Coho Salmon	44	NA	44	NA	43
Steelhead	21	NA	21	NA	20
Lubenau et al. 2024, Idaho, Snake River, 2019 - 2021					
Steelhead	3367	2969	398	1934	389
Nelson et al. 2005, British Columbia, Vedder Chilliwack River, 1999 - 2000					
Steelhead	226	NA	226	NA	222
Lindsey et al. 2004, Oregon, Willamette River, 1998 - 2000					
Chinook Salmon	1694	825	869	351	296
Fritts et al. 2023, Washington, Yakima River, -					
Chinook Salmon	395	211	184	211	183

# Database Benefits

- Near-comprehensive collection of currently available data for salmon and steelhead C&R in freshwater.
- An open access data resource to inform specific concerns about angling impacts.
- Reveals data gaps and provides study design guidance.
- Phase 2: Use the database to develop an analysis and manuscript.

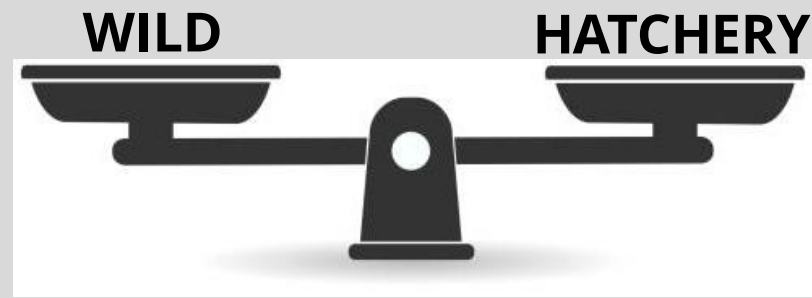
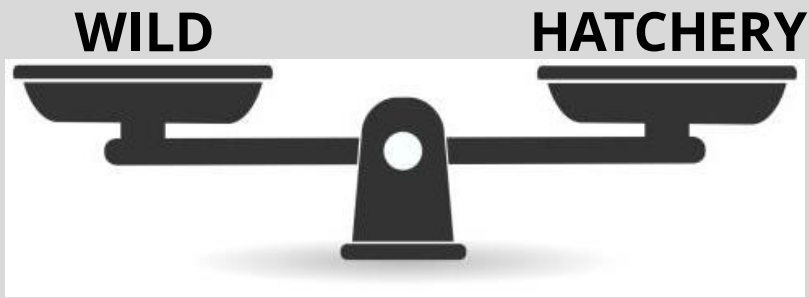




## Differential relative catchability of wild- and hatchery-origin steelhead in the Deschutes River, Oregon

T. Jason Seals<sup>1</sup> | Michelle Jones<sup>2</sup> | Ian A. Tattam<sup>3</sup> | Jeremy S. Henderson<sup>4</sup>









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