



Impacts of Catch and Release Angling on Anadromous Salmonids

**Ian Courter, Benjamin Briscoe, Mark Roes, Tara Blackman,
Sean Gibbs, Katie Kennedy, Thomas Buehrens**

Funding: PSMFC, Stephen Phillips



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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

Ian I. Courter^{a,*}, Thomas Buehrens^{b,1}, Mark Roes^a, Tara E. Blackman^a, Benjamin Briscoe^a, Sean Gibbs^{a,2}

^a Mount Hood Environmental, PO Box 744, Boring, OR 97009, USA

^b Washington Department of Fish and Wildlife, 1111 Washington St. SE, Olympia, WA 98501, USA

ARTICLE INFO

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Steelhead
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Hooking Mortality

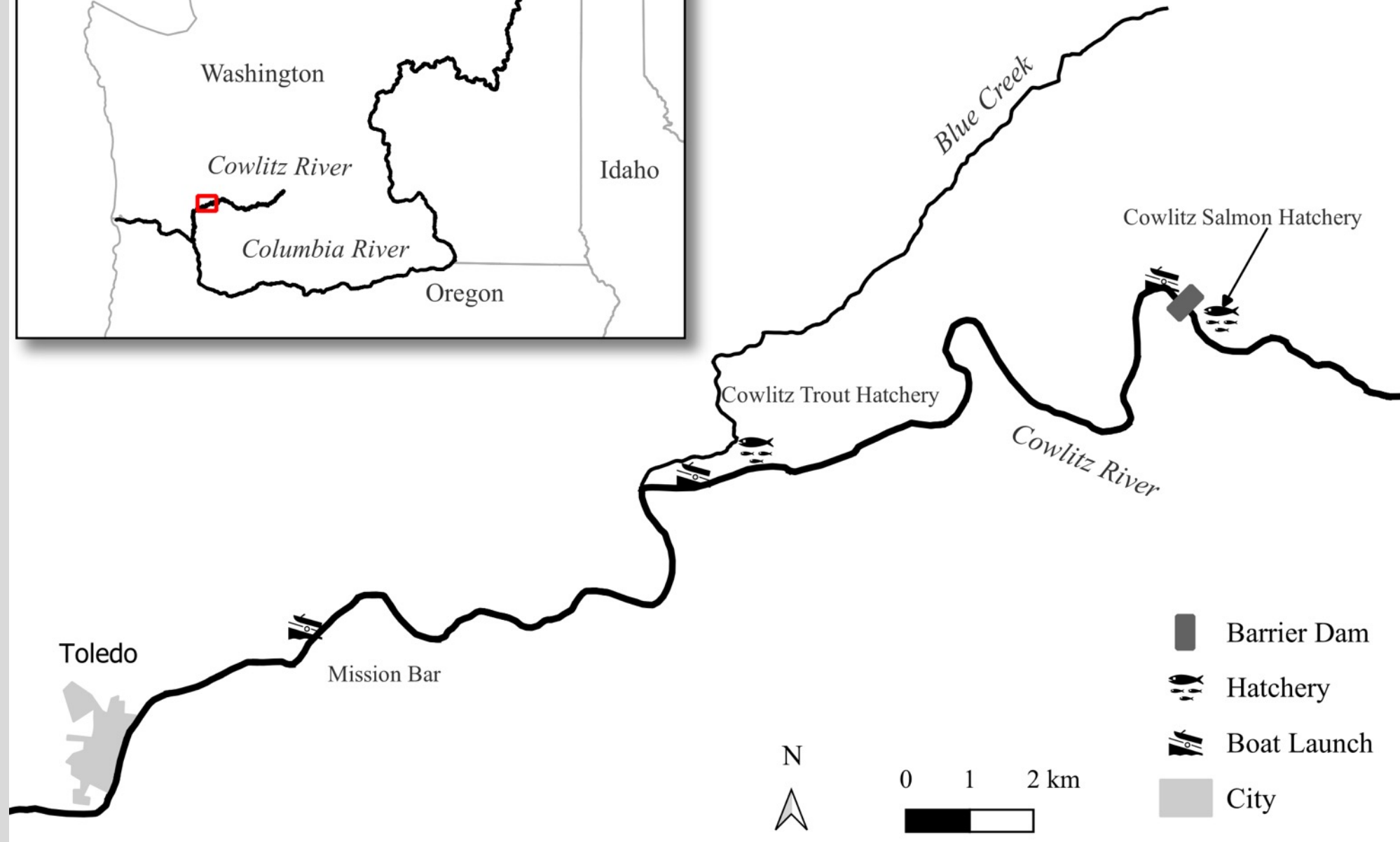
ABSTRACT

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.



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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

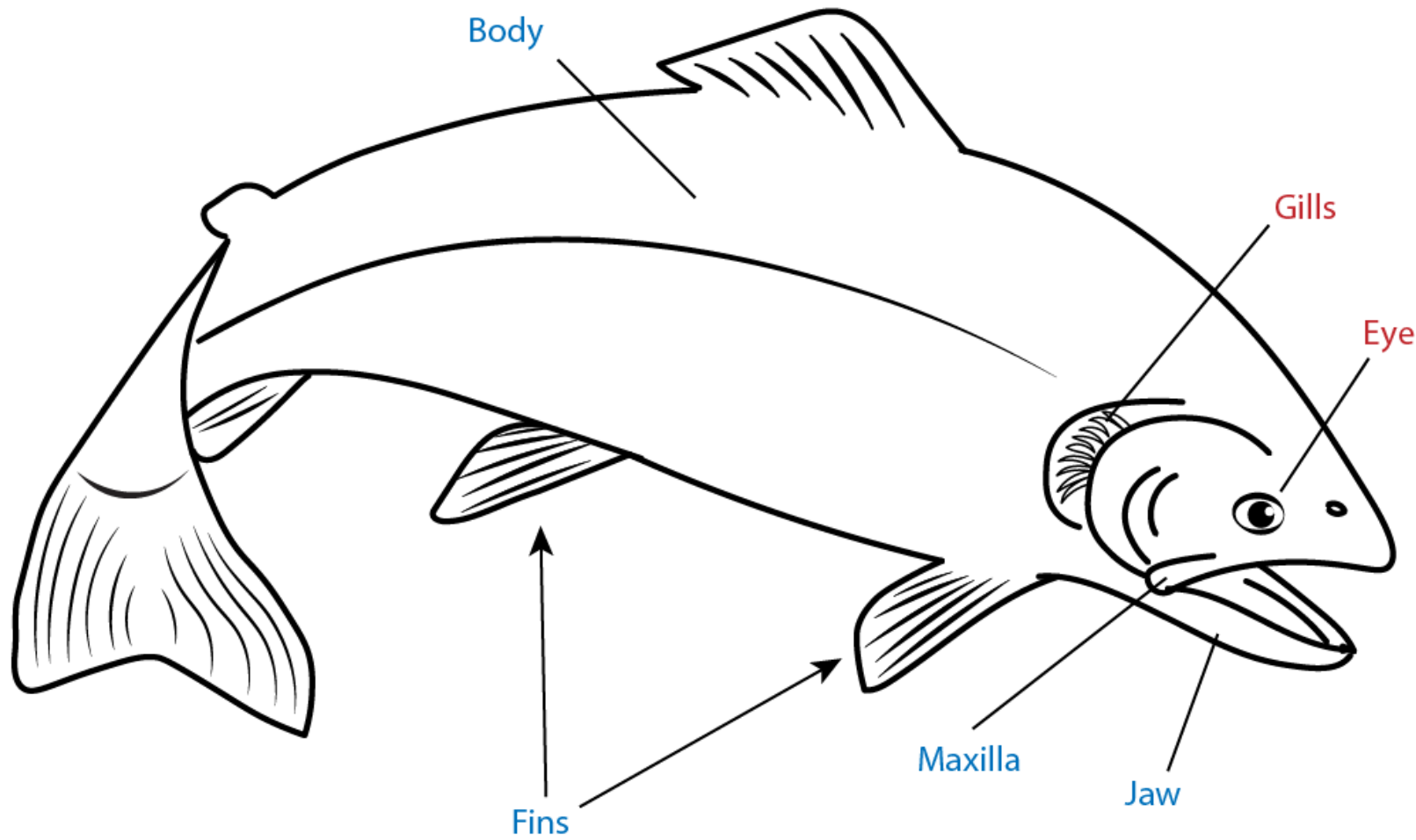


Boat Angling

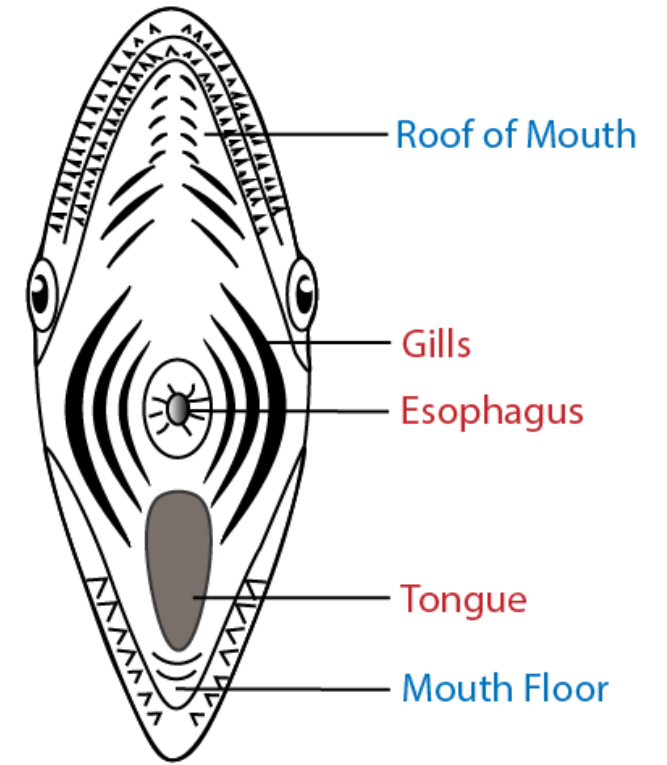


Bank Angling





Mouth Interior

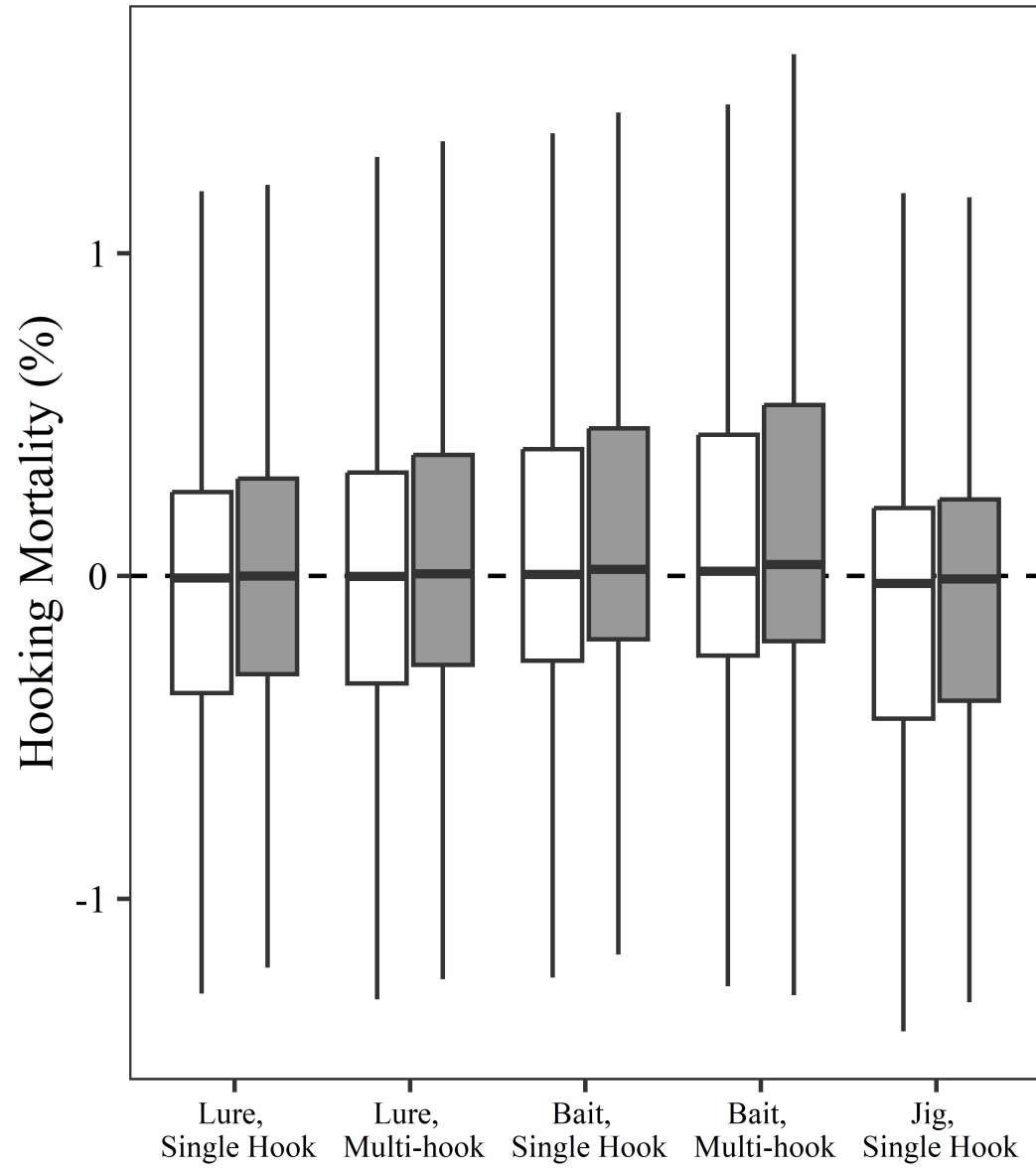


Critical vs Non-critical
Hooking Locations

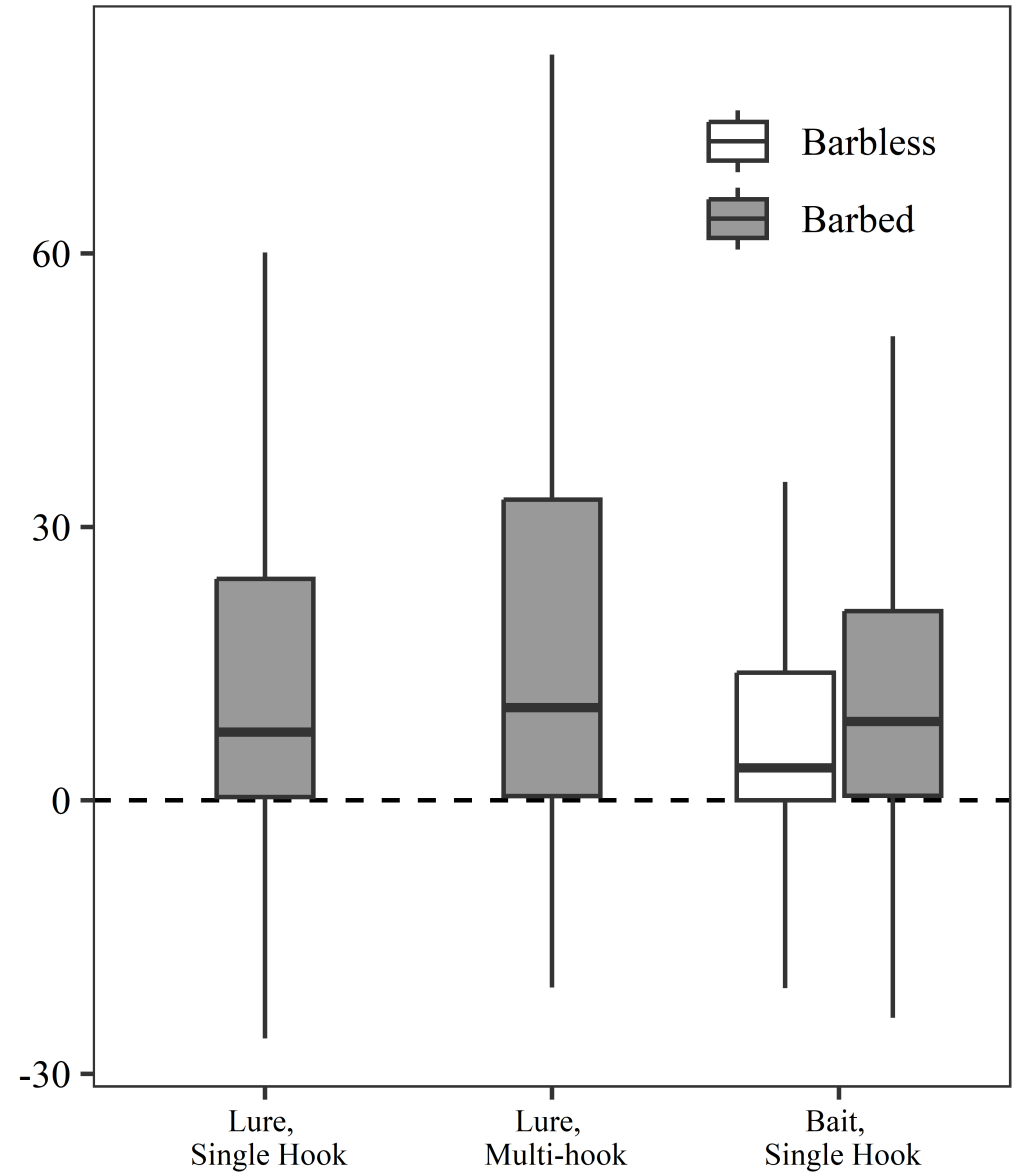
Results

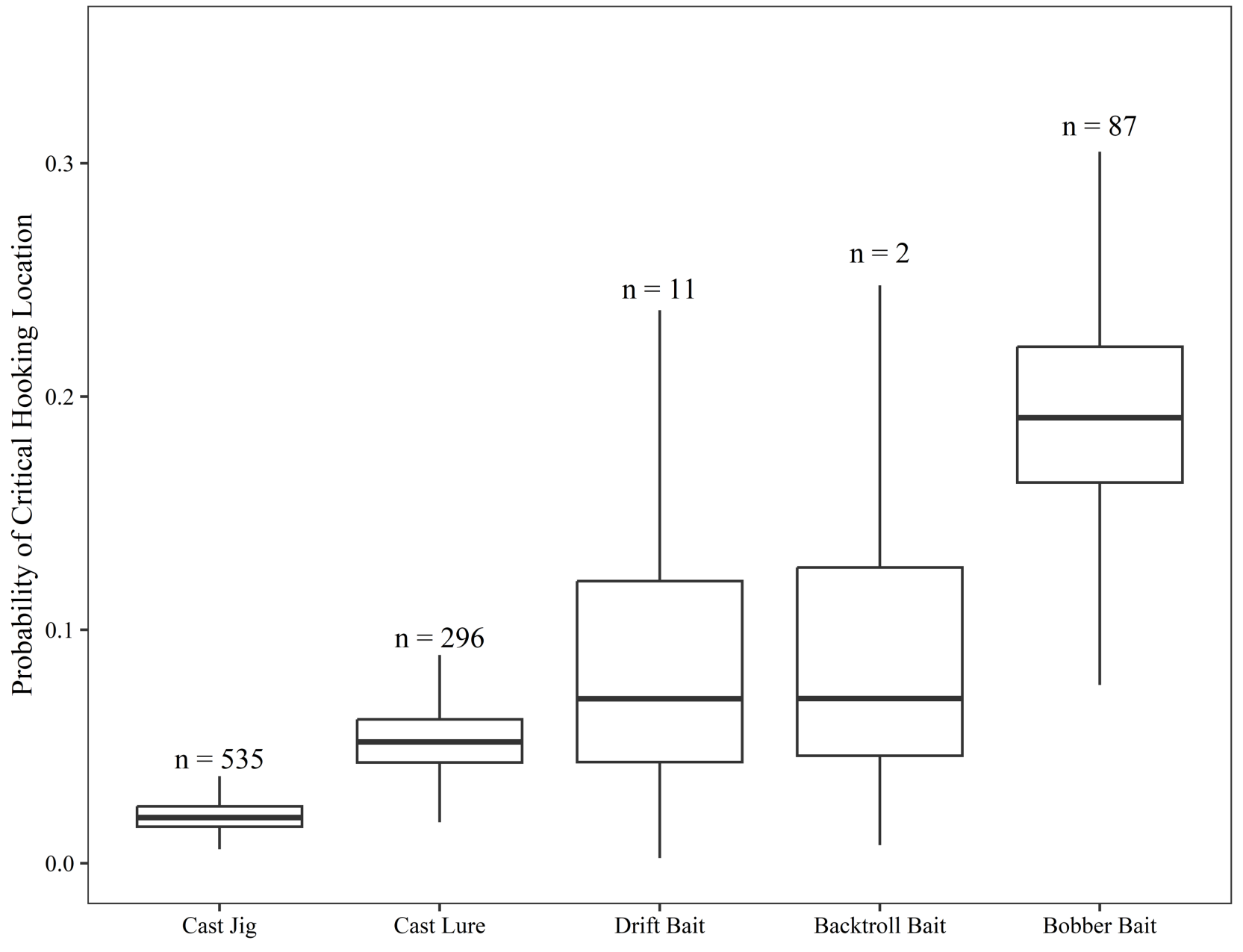
1. Spring **Chinook** experienced **3.6-10%** C&R mortality based on gear and hook type
2. C&R mortality for **Coho** was **<1%** regardless of gear or hook type
3. Small benefit of barbless hooks for Chinook and Coho Salmon
4. Steelhead recaptured at a higher rate when barbed hooks used
5. Higher landing rate for barbed v. barbless hooks

Coho



Spring Chinook







- Radio-telemetry study
- Tagged angled Spring Chinook
- Tracked until onset of spawning
- C&R mortality rate of 12%
- Results similar to 10% used in CRB recreational fisheries

ARTICLE

Postrelease mortality of spring Chinook Salmon from a mark-selective recreational fishery in the Yakima River, Washington

Anthony L. Fritts | Gabriel M. Temple | Cade Lillquist | Dan Rawding

Washington Department of Fish and Wildlife, Olympia, Washington, USA

Correspondence
Anthony L. Fritts.
Email: anthony.fritts@dfw.wa.gov

Abstract

Objective: Fishery managers often implement mark-selective fishing regulations that provide harvest opportunity on abundant hatchery salmon populations while requiring release of at-risk natural-origin populations. However, implementing these decisions requires fisheries managers to account for postrelease mortality of any natural-origin fish caught and released by anglers, which can be variable and is unknown for spring Chinook Salmon *Oncorhynchus tshawytscha* recreational fisheries in eastern Washington. Therefore, the objective of this study was to estimate and examine the factors affecting the postrelease mortality of spring Chinook Salmon caught and released from an inland recreational mark-selective fishery in the Yakima River, Washington.

Methods: We conducted a 2-year paired control and treatment radio-telemetry study using 171 treatment fish caught and released during a recreational fishery and 194 control fish captured in a nearby fishway. Subjects were subsequently tracked throughout the summer, and postrelease mortality was estimated on September 1. Stepwise logistic regression was used to analyze potential explanatory variables recorded at the time of capture.

Result: The estimated postrelease mortality of these fish was 12% (95% CI = 2–23%) just prior to the onset of spawning. We also inferred using logistic regression that anatomical hook location explained most of the variation in mortality rates of angled fish.

Conclusion: Our estimate of postrelease mortality is similar to estimates derived in other studies for recreational freshwater Chinook Salmon fisheries as well as the current 10% rate used to manage Columbia River spring Chinook Salmon recreational fisheries.

KEYWORDS

Chinook Salmon, fisheries, hooking mortality, mark-selective fishery

INTRODUCTION

and U.S. Census Bureau 2016). However, fisheries opportunities have decreased as populations of natural-origin



Will Lubenau

- Mark-recapture study design
- Tagged Steelhead at downstream trap
- Recaptured in sport fishery
- C&R mortality rate of 1.6%
- Used to inform impact rate of sport fishery on wild fish

Encounter rates and catch-and-release mortality of steelhead in the Snake River basin

William J. Lubenau¹ | Timothy R. Johnson² | Brett J. Bowersox³ |
Timothy Copeland⁴ | Joshua L. McCormick⁵ | Michael C. Quist⁶

¹Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Moscow, Idaho, USA

²University of Idaho, Moscow, Idaho, USA

³Idaho Department of Fish and Game, Lewiston, Idaho, USA

⁴Idaho Department of Fish and Game, Boise, Idaho, USA

⁵Idaho Department of Fish and Game, Nampa, Idaho, USA

⁶U.S. Geological Survey, Idaho Cooperative Fish and Wildlife Research Unit, University of Idaho, Moscow, Idaho, USA

Correspondence

William J. Lubenau
Email: will.lubenau@idfg.idaho.gov

Funding information

Pacific Coastal Salmonid Recovery Fund

Abstract

Objective: The potential influence (i.e., impact rate) of catch-and-release fisheries on wild steelhead *Oncorhynchus mykiss* is poorly understood and is a function of the abundance of wild fish, how many fish are encountered by anglers (i.e., encounter rate), and the mortality of fish that are caught and released. In Idaho, estimates of wild steelhead encounter rates have been derived using the number of wild and hatchery steelhead passing Lower Granite Dam, the number of hatchery steelhead harvested, and the number of hatchery steelhead caught and released. The method includes assumptions that hatchery and wild steelhead have equal encounter rates and catch-and-release mortality is 5% for wild steelhead. Here, we investigated wild and hatchery steelhead encounter rates by anglers, estimated catch-and-release mortality, and concatenated both aspects to examine how existing recreational steelhead fisheries influence wild steelhead mortality.

Methods: We sampled, tagged, and released 1,251 spawn-year 2020 (SY2020) and 1,956 spawn-year 2021 (SY2021) adult steelhead at Lower Granite Dam with T-bar anchor tags and passive integrated transponder (PIT) tags to estimate steelhead encounter rates and catch-and-release mortality. Differences in survival of caught steelhead and those not reported as caught were evaluated using detections at various locations (e.g., PIT arrays, weirs).

Result: Estimated encounter rates were 43.7% (95% credible interval; 28.2%, 100.0%) for wild fish and 46.7% (29.6%, 100.0%) for adipose-clipped fish in SY2020. In SY2021, encounter rates were 47.2% (32.4%, 100.0%) for wild fish and 52.3% (37.1%, 100.0%) for adipose-clipped fish. Based on detections of caught fish and those not reported as caught, catch-and-release mortality of wild steelhead was estimated to be 1.6% (0.0%, 5.2%). Wild steelhead impact rates were 0.7% (0.0%, 2.7%) in SY2020 and 0.7% (0.0%, 2.8%) in SY2021.

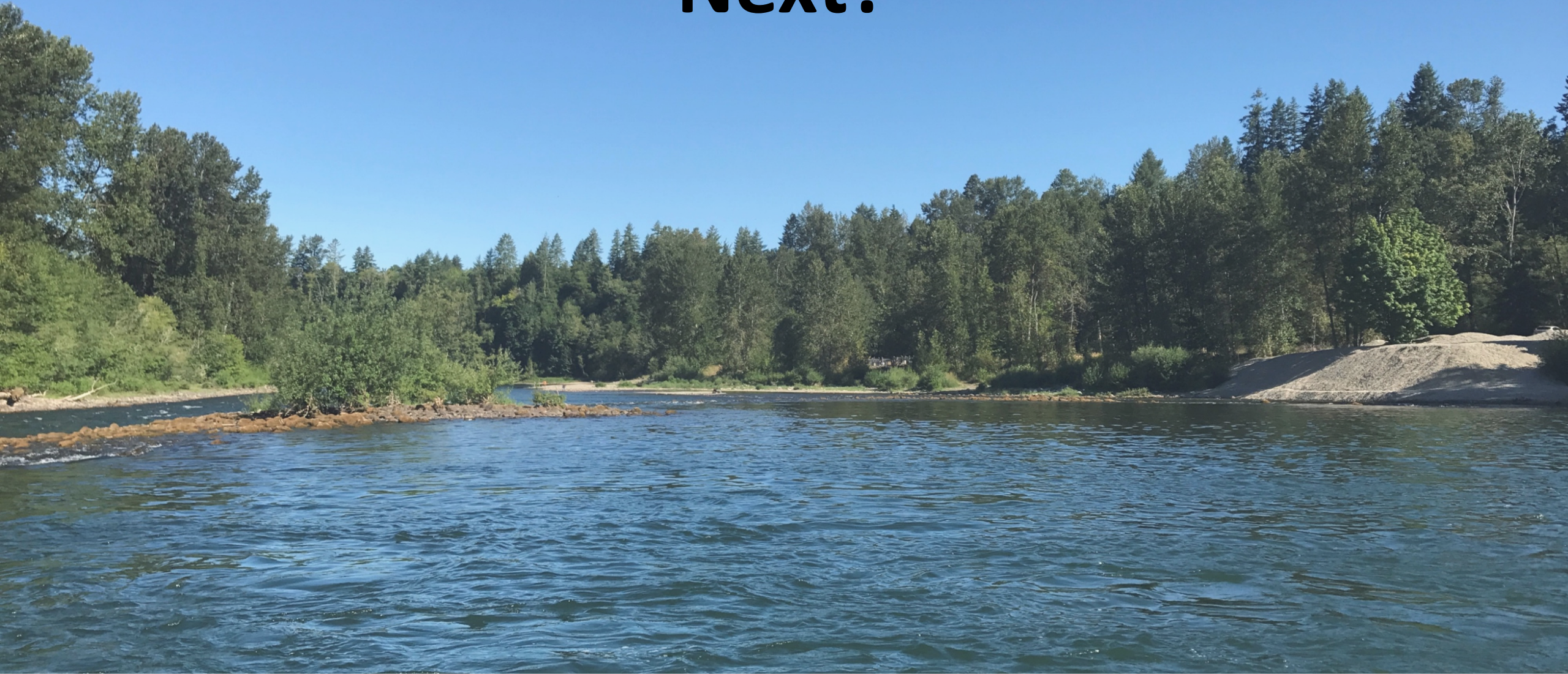
Conclusion: Estimated rates of impact on wild steelhead were consistent and low across years despite major differences in the structure of the fisheries. Our results suggest assuming that encounter rates are equal between hatchery and wild steelhead, and that steelhead catch-and-release mortality is 5%, will likely lead to a conservative estimate of the wild steelhead impact occurring from catch-and-release fisheries.

KEYWORDS

fisheries, management, tags and tagging



Next?



Hooking Mortality Metadatabase

Terminal gear type	Hook type (all barbed)	Number of hooks	Hook size	Number of fish caught
Prawn ^a	Single	1	4/0, 5/0	82
		2	4/0-4/0, 3/0-5/0	110
Salmon eggs	Single	1	4/0, 5/0	203
Spinner	Single	1	3/0, 6/0	12
	Treble	1	2, 1/0, 2/0	140
Plug	Single	1	2/0, 3/0	17
		2	2/0-2/0	1
	Treble	1	3, 2, 1/0	34
Wobbler	Single	2	5-5, 4-4, 3-3, 2-2, 1-1, 5-3, 4-3, 1/0-1/0	165
		1	3/0	62
	Treble	1	1, 2	43

Fate, number tagged, and length	Hatchery		Wild	
	Females	Males	Females	Males
1999				
Died or regurgitated tag	0	1	0	0
Killed by angler	1	5	0	1
Spawned and died	2	3	4	7
Spawned and kelted	12	6	22	5
Unknown	0	1	1	1 ^a
Total number tagged	15	16	27	14
Fork length (cm)	74.3 ± 1.6	75.4 ± 1.6	75.1 ± 0.9	82.0 ± 2.3
2000				
Died or regurgitated tag	3	0	3	3
Killed by angler	24	5	0	2
Spawned and died	8	1	6	10
Spawned and kelted	21	8	37	18
Unknown	0	0	0	5 ^a
Total number tagged	56	14	46	38
Fork length (cm)	70.0 ± 0.9	68.2 ± 1.3	73.6 ± 0.9	73.4 ± 1.3

Year	Captured			Recovered		Died			Table probability	P
	Female	Male	Total	Female	Male	Female	Male	Total		
1996	461	351	812	4,416	3,501	6	1	7	0.10	0.15
1997	406	333	739	2,284	1,868	4	4	8	0.26	1.00
1998	89	60	149	210	199	0	1	1	0.40	0.40
1999	585	307	892	1,784	1,143	6	2	8	0.26	0.72
2000	326	221	547	2,722	1,713	2	1	3	0.43	1.00
2001	341	219	560	2,703	1,830	2	3	5	0.22	0.38
2002	532	403	935	3,341	2,436	9	2	11	0.06	0.13
Total	2,740	1,894	4,634	17,460	12,690	29 (1%)	14 (1%)	43 (1%)		



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- Fish ID Query
- Unique Capture Query

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- Effort Query subform
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- Entry Form
- Fish ID Search

survey_	Survey_Date	Survey_typ	Fish_ID	Capcod	SpeciesCode	TimeCaptur	Handl	FightTime_s	Gear	Method	HookSize	HookType	HookLocatio	Barb	KnottedNet	AnglerCode	Tag1	Tag2	Sex	FL_cm	Terr
1	10/1/2017	Angling	146	4H	UNK	6:56:00		45	B	B	2	Single	UNK	Yes	No	SG1					IST
1	10/1/2017	Angling	147	1	COHO	7:15:00	45	90	B	B	2	Double	UJ	Yes	No	SG1	3178	3179	F		65 IST
1	10/1/2017	Angling	148	3	COHO	8:14:00	30	45	B	B	2	Double	LJ	Yes	No	SG1			F		56 IST
1	10/1/2017	Angling	149	4H	UNK	8:58:00		25	B	B	2	Double	UNK	Yes	No	SG1					IST
1	10/1/2017	Angling	150	1	COHO	9:36:00	50	30	B	B	2	Double	UJ	Yes	No	SG1	3180	3181	J		30 IST
1	10/1/2017	Angling	151	3	COHO	10:26:00	35	130	B	P	2/O	Single	B	Yes	No	SB1			M		72 IST
1	10/1/2017	Angling	152	1	SCHK	10:37:00	35	168	B	B	2/O	Single	LJ	Yes	No	RM	3182	3183	F		79 IST
1	10/1/2017	Angling	153	3	FCHK	7:30:00		90	B	BT	3/O	Single	H	No	Yes	PC2			M		66 IST
1	10/1/2017	Angling	154	1	COHO	7:54:00	50	80	J	CJ	3/O	Single	UJ	Yes	Yes	IC	2771	2772	M		64 IST
1	10/1/2017	Angling	155	1	COHO	9:17:00	156	184	J	CJ	3/O	Single	IM	Yes	Yes	IC	2774	2775	M		69 IST
1	10/1/2017	Angling	156	1	FCHK	10:09:00	62	394	J	CJ	3/O	Single	UJ	Yes	Yes	IC	3026	3027	M		84 IST
1	10/1/2017	Angling	157	3	FCHK	11:30:00	20	184	B	BT	3/O	Single	S	No	Yes	AC1			F		76 IST
1	10/1/2017	Angling	158	1	FCHK	12:38:00	120	150	B	BT	3/O	Single	S	No	Yes	IC	3028	3029	M		66 IST
1	10/1/2017	Angling	159	3	FCHK	13:08:00		169	B	BT	3/O	Single	LJ	No	Yes	IC			M		71 IST
2	10/10/2017	Angling	210	1	COHO	7:40:00	152	25	B	B	2/O	Single	S	Yes	No	UA3	3140	3141	J		42 IST
2	10/10/2017	Angling	211	3	FCHK	8:25:00		300	B	B	2/O	Single	IM	No	No	UA3					IST
2	10/10/2017	Angling	212	4H	FCHK	8:45:00		180	B	B	2/O	Single	UNK	Yes	No	UA3					IST
2	10/10/2017	Angling	213	3	FCHK	9:30:00	30	300	B	B	2/O	Single	UJ	Yes	No	UA1			F		IST
2	10/10/2017	Angling	214	3	FCHK	10:24:00	30	270	B	B	2/O	Single	UJ	No	No	UA3			F		IST
2	10/10/2017	Angling	215	1	COHO	10:41:00	75	10	B	BT	2/O	Single	LJ	No	No	IC	3143	3144	J		33 IST
2	10/10/2017	Angling	216	1	COHO	11:45:00	135	45	B	B	2/O	Single	UJ	No	No	UA3	3145	3175	F		61 IST
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3	10/11/2017	Angling	220	1	FCHK	8:20:00	54	180	B	B	2/O	Single	UJ	No	No	BW	3169	3170	F		69 IST
3	10/11/2017	Angling	221	1	COHO	9:57:00	140	30	F	B	4	Single	OM	Yes	No	IC	3167	3168	J		40 IST
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3	10/11/2017	Angling	225	3	COHO	11:17:00		60	J	CJ	2/O	Single	B	Yes	No	IC			M		60 IST
3	10/11/2017	Angling	226	1	COHO	11:58:00	181	45	J	CJ	3/O	Single	IM	Yes	No	BW	3161	3162	M		69 IST
3	10/11/2017	Angling	227	3	COHO	12:36:00		46	B	B	2/O	Single	LJ	Yes	No	IC			F		65 IST
3	10/11/2017	Angling	228	3	COHO	12:42:00		50	B	B	2/O	Single	UJ	Yes	No	BW			F		65 IST
3	10/11/2017	Angling	229	4H	COHO	12:49:00		120	L	CG	2	Treble	UNK	Yes	No	IC			M		IST
3	10/11/2017	Angling	230	3	COHO	13:02:00		72	J	CJ	3/O	Single	UJ	Yes	No	BW			M		75 IST
3	10/11/2017	Angling	231	1	COHO	13:11:00	71	32	J	CJ	3/O	Single	UJ	Yes	No	IC	3159	3160	F		69 IST
3	10/11/2017	Angling	232	4H	COHO	14:12:00		15	B	B	2/O	Single	UNK	No	No	BW					IST
3	10/11/2017	Angling	233	1	COHO	14:20:00	180	70	B	B	2/O	Single	S	No	No	IC	3156	3158	F		68 IST
3	10/11/2017	Angling	234	1	COHO	14:28:00	94	25	B	D	2/O	Single	B	Yes	No	BW	3154	3155	J		40 IST



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survey_	Survey_Date	Survey_typ	Fish_ID	Capcod	SpeciesCode	TimeCaptur	Handl	FightTime_s	Gear	Method	HookSize	HookType	HookLocatio	Barb	KnottedNet	AnglerCode	Tag1	Tag2	Sex	FL_cm	Terr
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1	10/1/2017	Angling	147	1	COHO	7:15:00	45	90	B	B	2	Double	UJ	Yes	No	SG1	3178	3179	F		65 IST
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2	10/10/2017	Angling	218	1	COHO	13:50:00	78	205	F	B	4	Single	OM	Yes	No	IC	3171	3172	M		61 IST
3	10/11/2017	Angling	219	4	FCHK	7:53:00		412	B	B	2/O	Single	UNK	No	No	IC			M		IST
3	10/11/2017	Angling	220	1	FCHK	8:20:00	54	180	B	B	2/O	Single	UJ	No	No	BW	3169	3170	F		69 IST
3	10/11/2017	Angling	221	1	COHO	9:57:00	140	30	F	B	4	Single	OM	Yes	No	IC	3167	3168	J		40 IST
3	10/11/2017	Angling	222	1	COHO	10:21:00	70	50	F	B	4	Single	B	Yes	No	BW	3165	3166	J		33 IST
3	10/11/2017	Angling	223	1	COHO	10:34:00	51	60	F	B	4	Single	OM	Yes	No	IC	3163	3164	J		43 IST
3	10/11/2017	Angling	224	3	COHO	10:41:00		40	J	CJ	2/O	Single	IM	Yes	No	BW			M		70 IST
3	10/11/2017	Angling										Single	B	Yes	No	IC			M		60 IST
3	10/11/2017	Angling										Single	IM	Yes	No	BW	3161	3162	M		69 IST
3	10/11/2017	Angling										Single	LJ	Yes	No	IC			F		65 IST
3	10/11/2017	Angling										Single	UJ	Yes	No	BW			F		65 IST
3	10/11/2017	Angling	229	4H	COHO	12:49:00		120	L	CG	2	Treble	UNK	Yes	No	IC			M		IST
3	10/11/2017	Angling	230	3	COHO	13:02:00		72	J	CJ	3/O	Single	UJ	Yes	No	BW			M		75 IST
3	10/11/2017	Angling	231	1	COHO	13:11:00	71	32	J	CJ	3/O	Single	UJ	Yes	No	IC	3159	3160	F		69 IST
3	10/11/2017	Angling	232	4H	COHO	14:12:00		15	B	B	2/O	Single	UNK	No	No	BW					IST
3	10/11/2017	Angling	233	1	COHO	14:20:00	180	70	B	B	2/O	Single	S	No	No	IC	3156	3158	F		68 IST
3	10/11/2017	Angling	234	1	COHO	14:28:00	94	25	B	D	2/O	Single	B	Yes	No	BW	3154	3155	J		40 IST

Record: 1 of 10649

Record: 1 of 10649

Data Sets

- Cowlitz River Steelhead/Chinook/Coho (WA)
- Yakima River Chinook (WA)
- Wind River Steelhead (WA)
- Clearwater River Steelhead (ID)
- Snake River Steelhead (ID)
- Willamette River Chinook (OR)
- Vedder-Chilliwack River Steelhead (BC)
- Nicola River Chinook (BC)
- Nushagak River Chinook (AK)
- Kenai River Chinook (AK)
- Little Susitna River Steelhead (AK)

DRAFT: Fishery Data Series

Mortality of Chinook Salmon Caught and Released Using Sport Tackle in the Nushagak River, 2017–2018

by

Lee K. Borden

and

Jason E. Dye

A draft version of this report is being submitted for the 2022 Bristol Bay Finfish Board of Fisheries meeting for the sake of providing the most current information available to the board and stakeholders. As a draft, the reader should regard all information within this report as preliminary and subject to revision in the final report, which is expected to be published in the spring of 2023.

November 2022

Alaska Department of Fish and Game

Divisions of Sport Fish and Commercial Fisheries



Insights and Benefits

1. Larger sample sizes for multiple species
2. Greater spatial and temporal coverage
3. Publicly available
4. Continued research
5. Identify data gaps
6. Archive data





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