

Evaluation of movement and survival of juvenile steelhead (*Oncorhynchus mykiss*) and coho salmon (*Oncorhynchus kisutch*) in the Klickitat River, Washington, 2018–2019

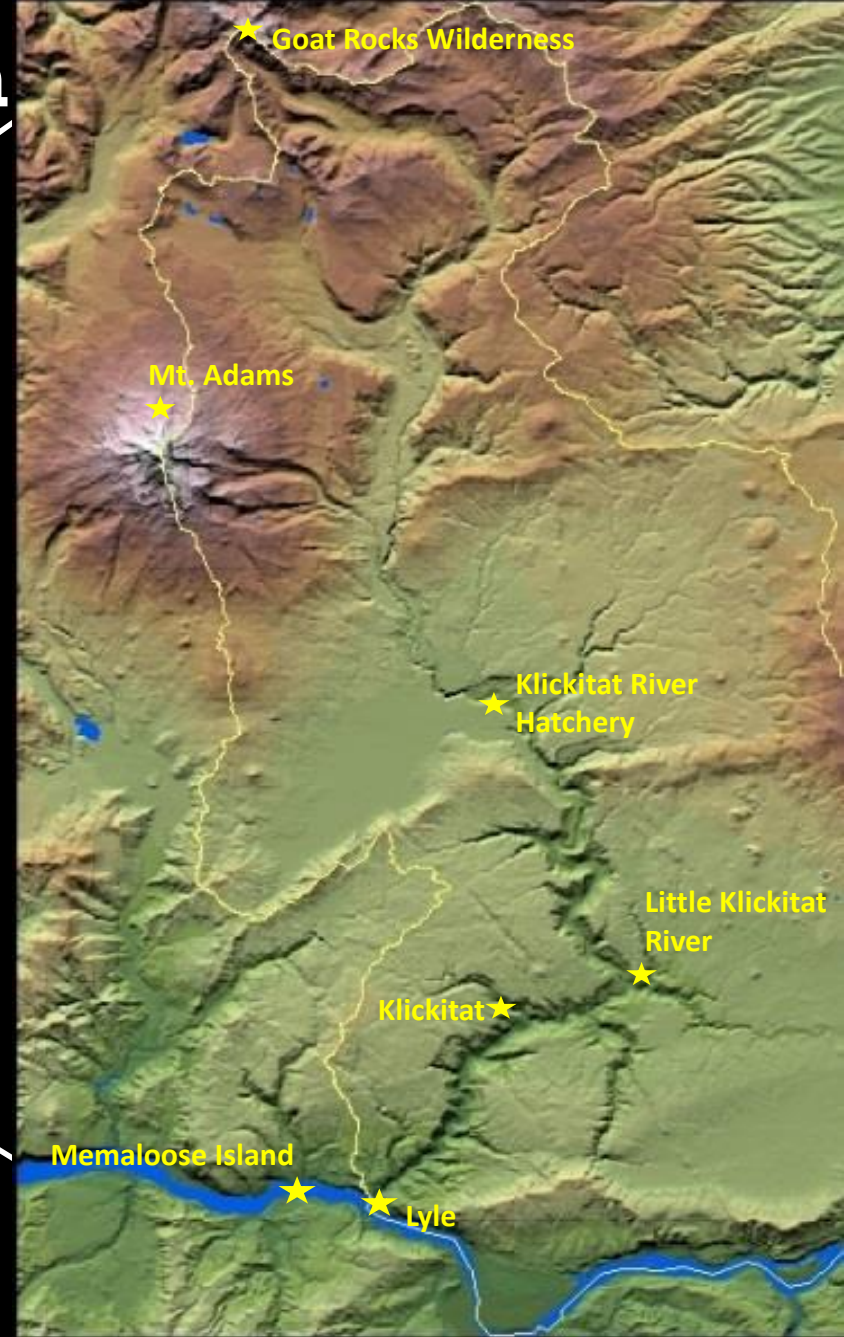


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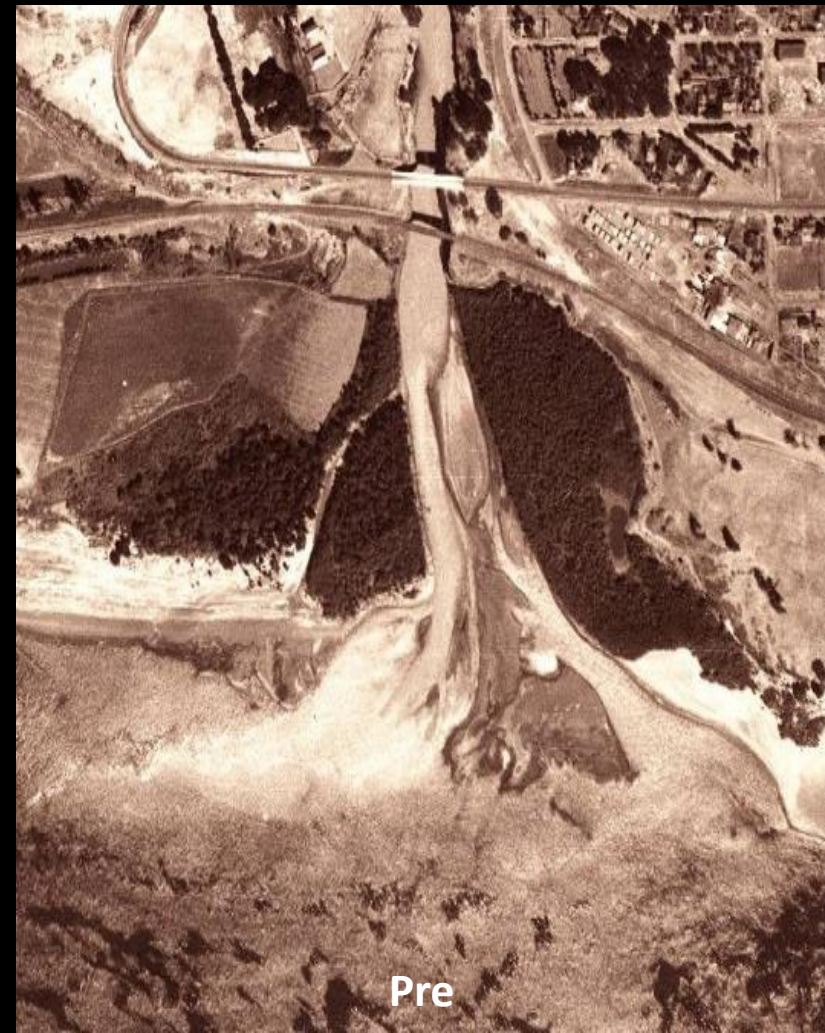


Klickitat River Sub-basin



- South-central Washington State
- Drainage area: 3,501 km²
- ~153 km free flowing length
- Hatchery ~70-km upstream of Columbia River Confluence
- Enters Columbia River at river km 290.3
- 55.2 km upstream of Bonneville Dam

Klickitat River – Pre & Post -Bonneville Conditions



Klickitat River – Post-Bonneville Conditions



California Gull



Small Mouth Bass



Walleye



Northern Pike Minnow



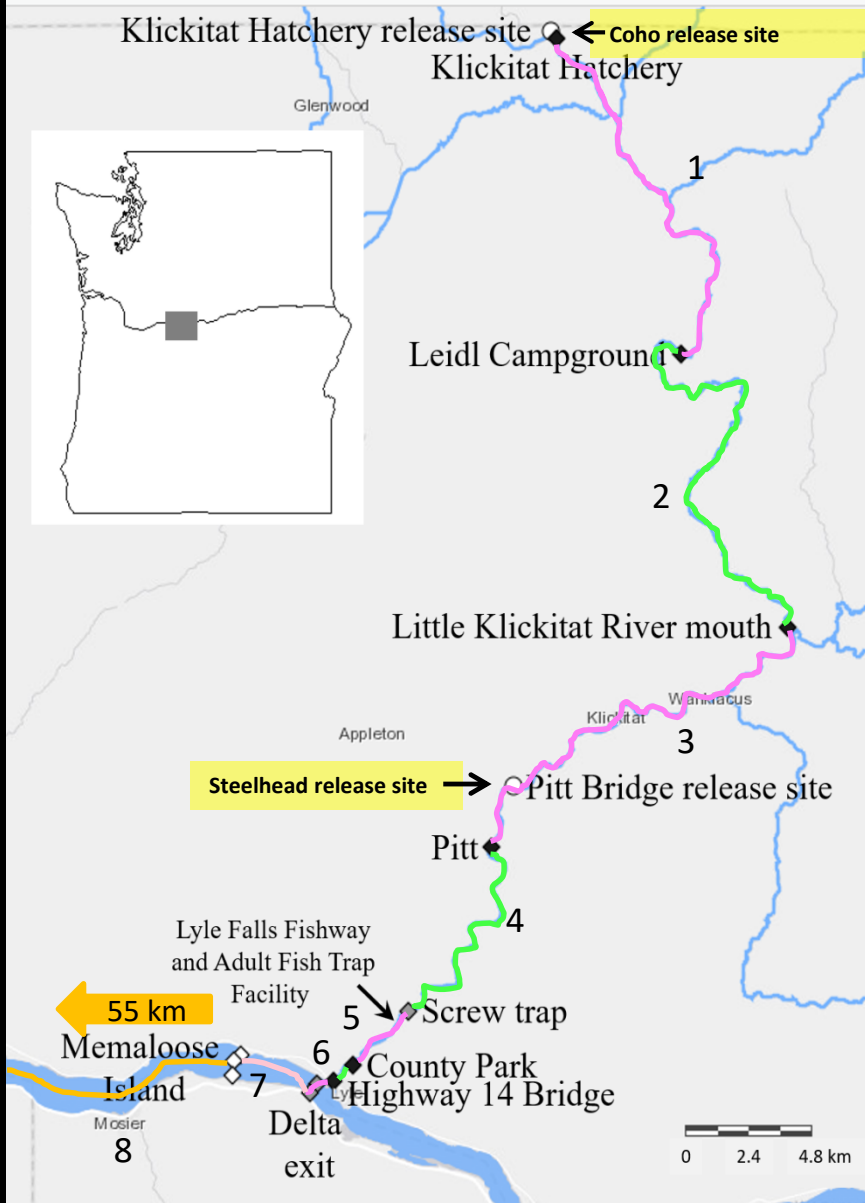
Reach 6 – Backwater area

Study Objectives



- Determine reach-specific travel times and survival of tagged natural-origin juvenile steelhead and hatchery-origin juvenile coho
- Determine how long hatchery-origin juvenile coho remained in the river after hatchery release

Study Design



1	17.1	Release to Leidl Campground
2	18.8	Leidl Campground to Little Klickitat R. mouth
3	2.8/18.6	Release/Little Klickitat R. mouth to 2.8 km below Pitt Bridge
4	9.8	2.8 km below Pitt Bridge to screw trap
5	3.3	Screw trap to county park
6	1.0	County park to Highway 14 Bridge
7	1.0/4.2	Highway 14 Bridge to delta exit/Hwy Bridge to Memaloose
8	52.3/49.1	Delta exit /Memaloose to Bonneville Dam or estuary

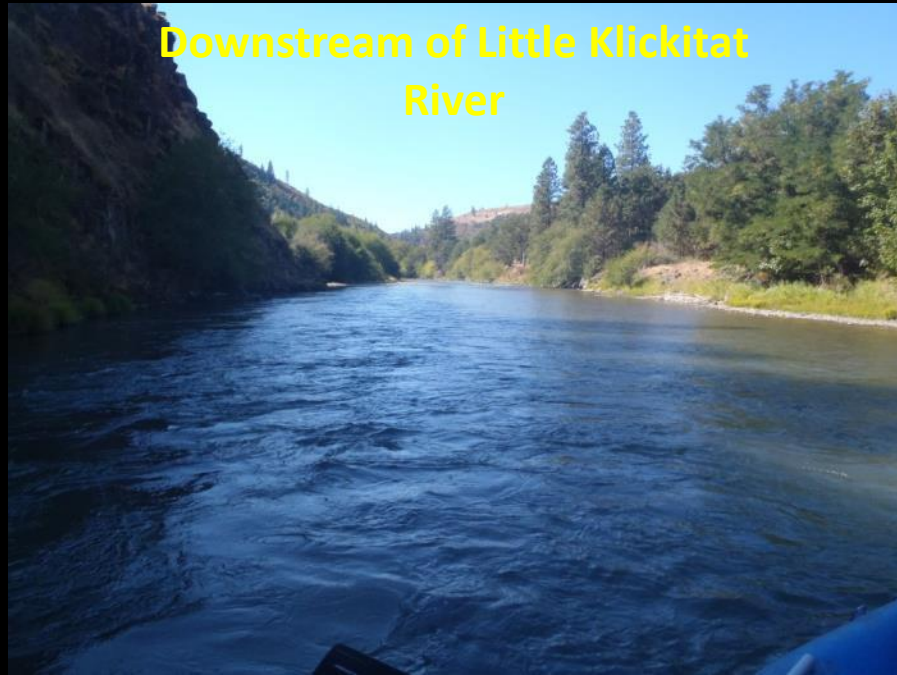
Reach 1 – Klickitat Salmon Hatchery to Leidl Campground (17.1 km)



Reach 2 – Leidl Campground to Little Klickitat River Mouth (18.8 km)



Reach 3 – Little Klickitat River/Pitt Bridge to 2.8 km below Pitt bridge (2.8/18.6 km)



Reach 4 – 2.8 km below PIT bridge to screw trap (9.8 km)



Upper reach



Lower reach



Downstream end of reach

Reach 5 – Screw trap to County Park (3.3 km)

Lyle Falls and Lyle Falls Adult Fish Trap



Upstream view of gorge from Fisher Hill Rd Bridge



Lower end of reach at County Park



Reach 6 – County Park to Hwy 14 (1.0 km)



Reach 7 – Klickitat River Delta Exit/Memaloose Island (1.0/4.2 km)



Methods



Klickitat Salmon Hatchery

HONOR. PROTECT. RESTORE

Methods



Pre/Post tag - Coho holding tanks



Klickitat Hatchery rearing pond – Coho collection site

Methods



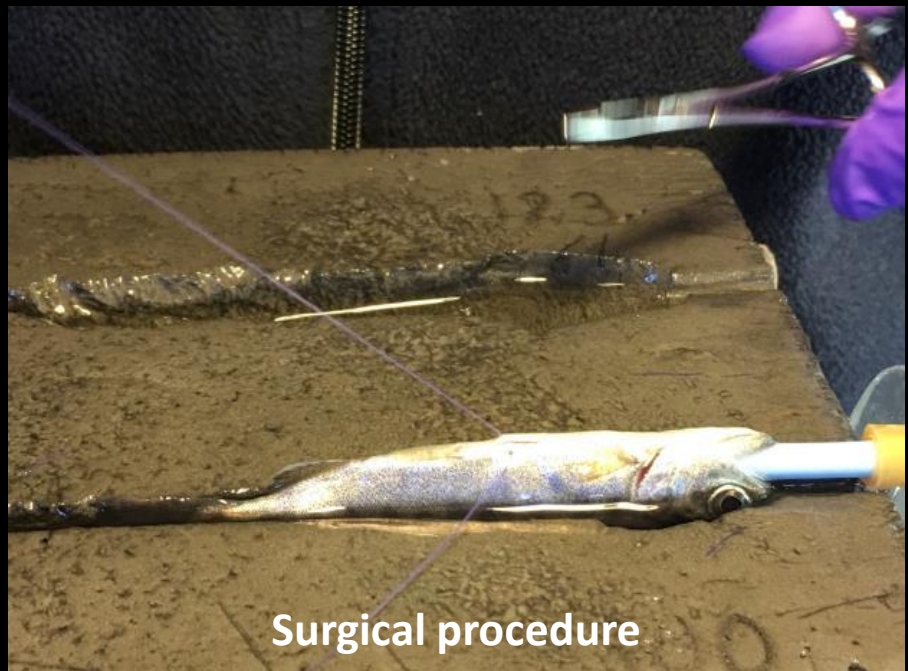
Surgery trailer



Acoustic transmitter tag



12.5 mm PIT tag



Surgical procedure

Methods



Screw trap and floating PIT tag array



Juvenile steelhead bucket corral



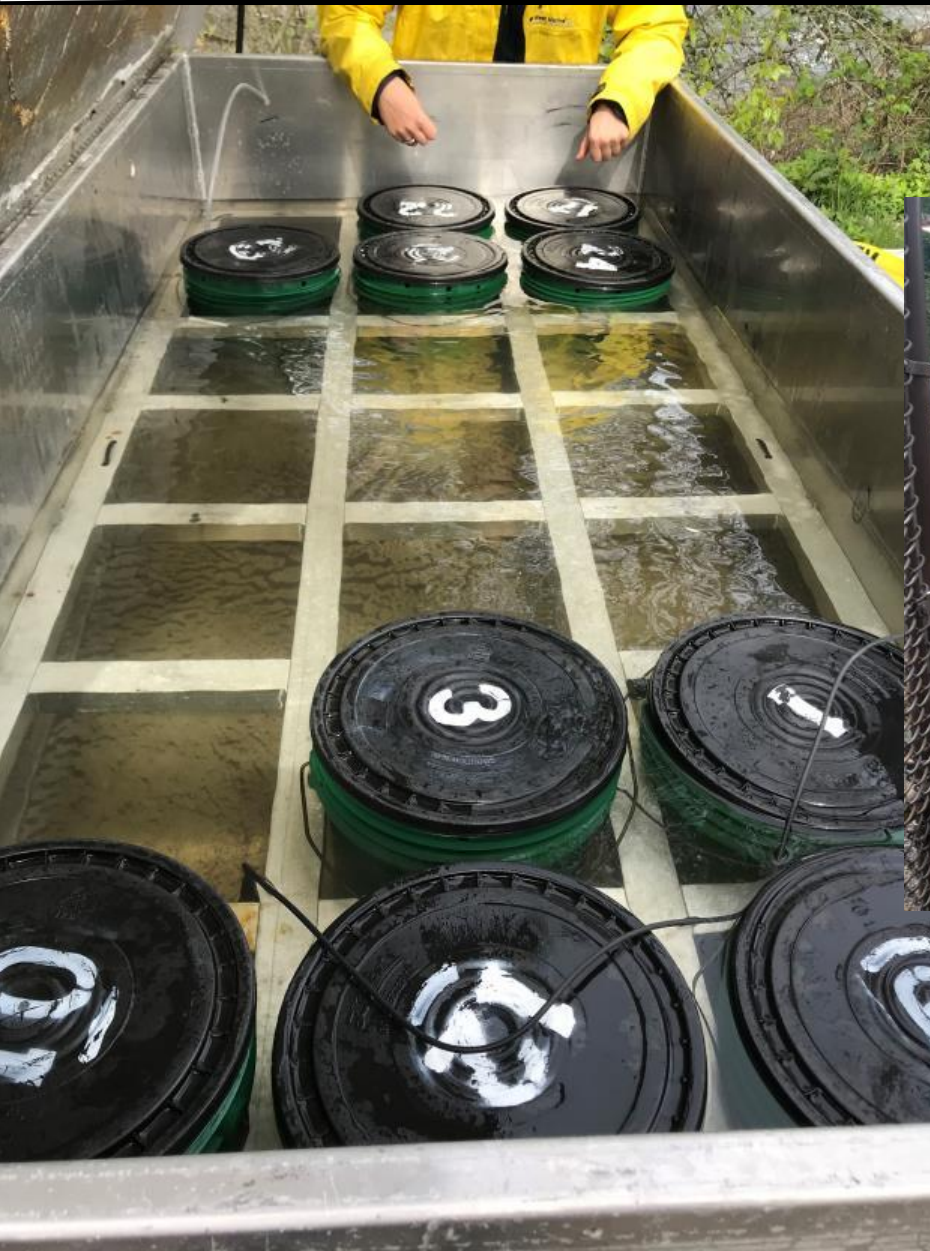
Natural-origin juvenile steelhead

Methods

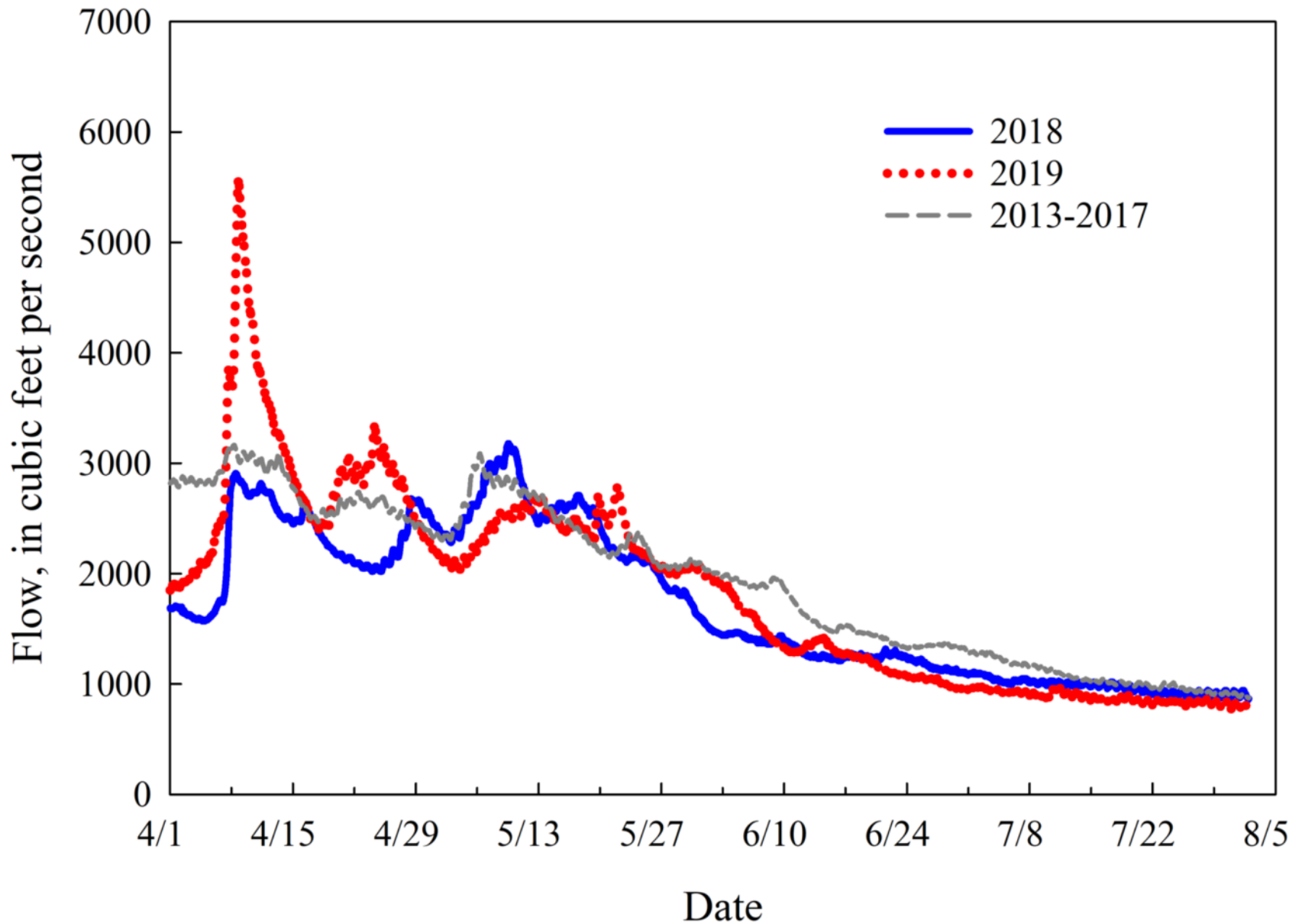


Lyle Adult Fish Trap

Methods



Results

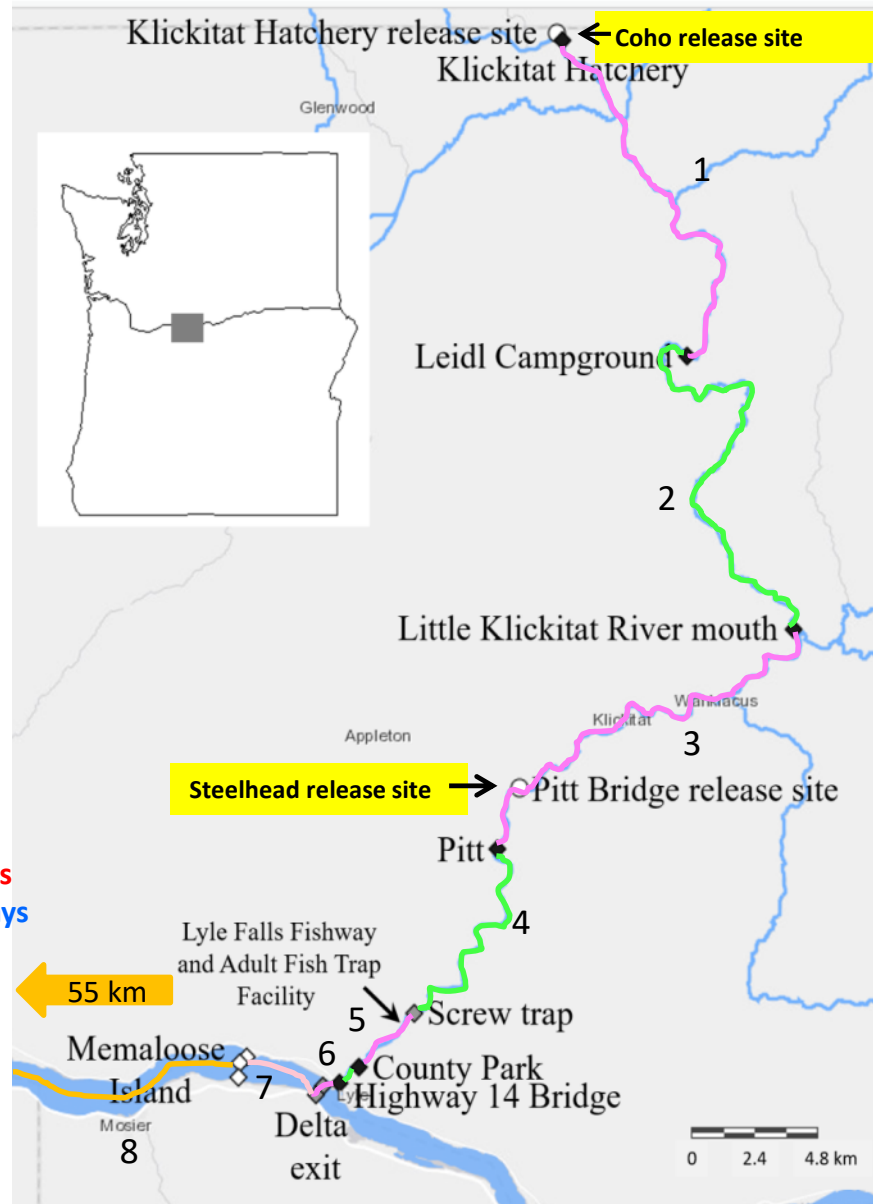
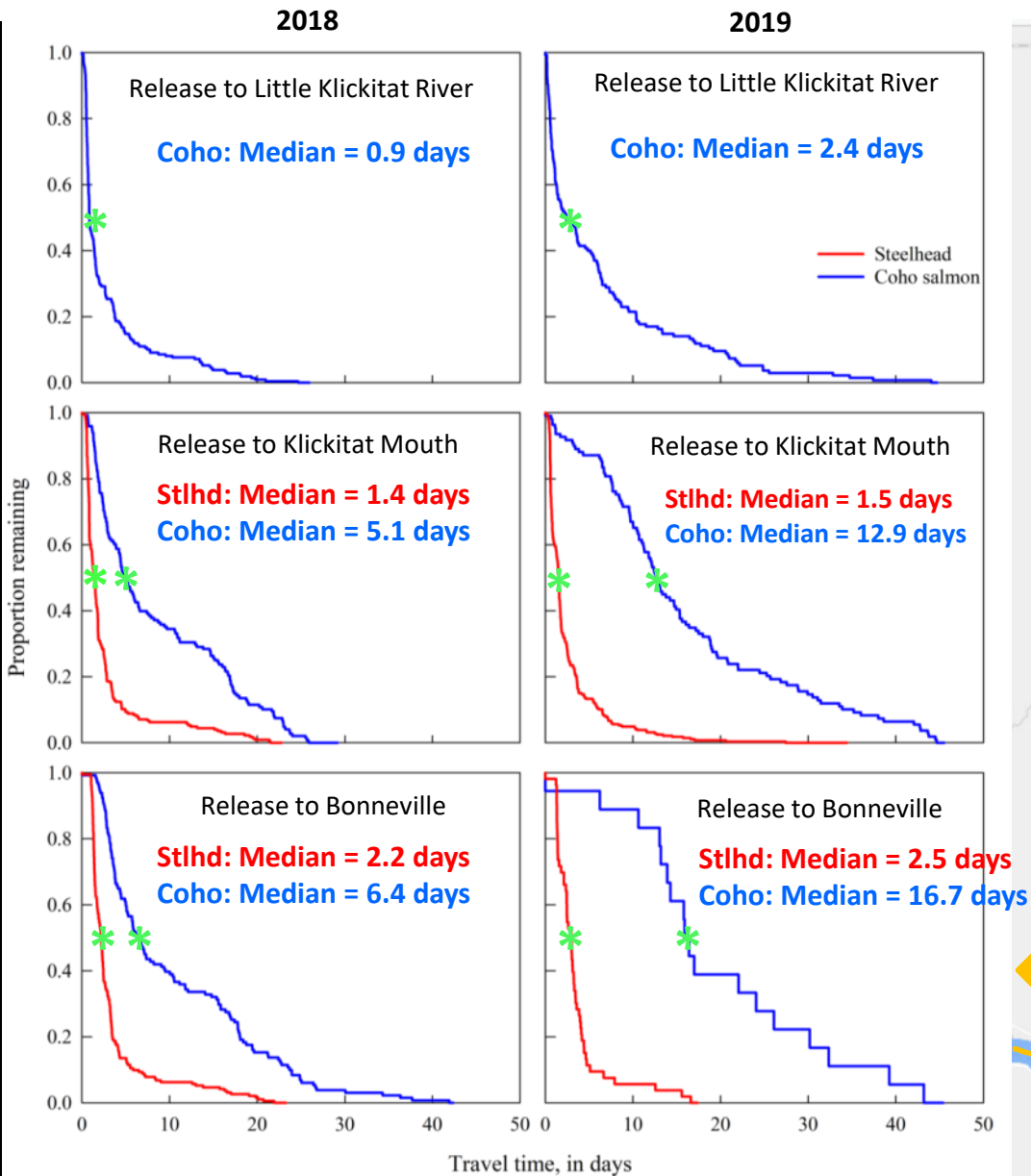


Results

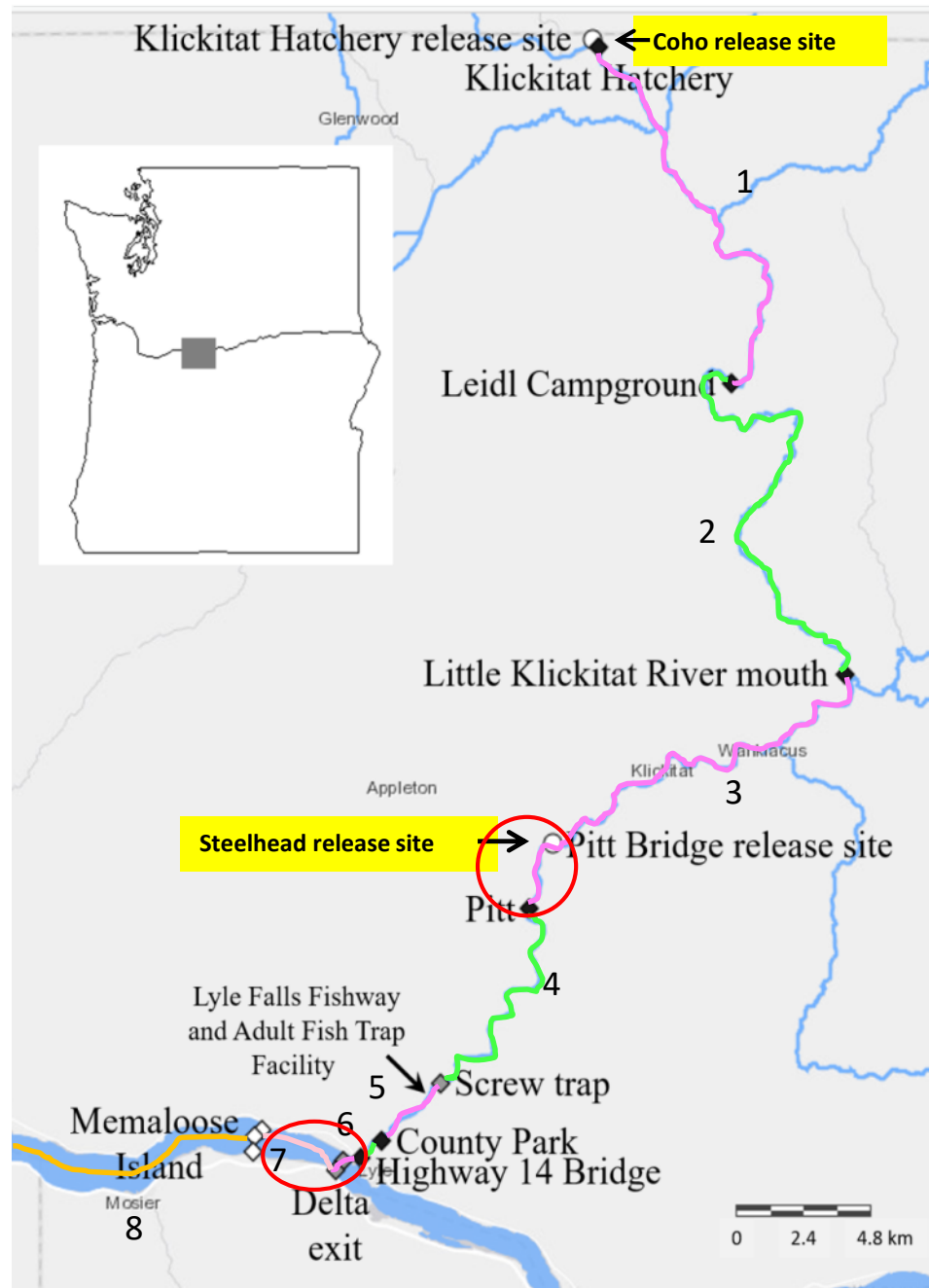
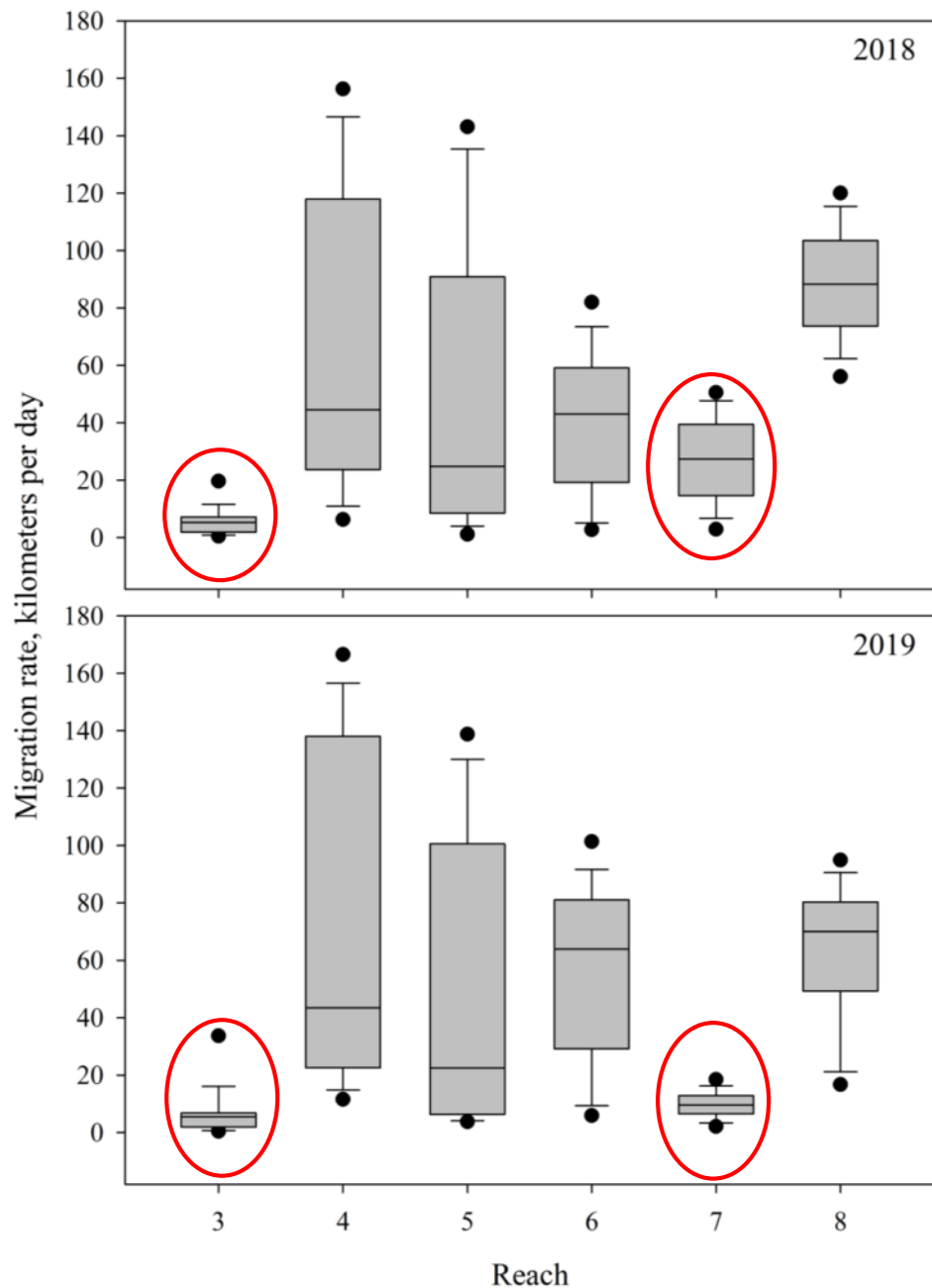
Release date, number, and fork length of acoustic tagged juvenile steelhead and coho

Species	Year	Release Date Range	Number of Releases	Number of Fish	Fork Length Range (mm)
Steelhead	2018	Apr. 18-June 08	8	272	133-229
Steelhead	2019	Apr. 17-June 13	12	340	136-257
Coho	2018	May 09-May 11	3	250	90-133
Coho	2019	May 03-May 04	2	150	99-136

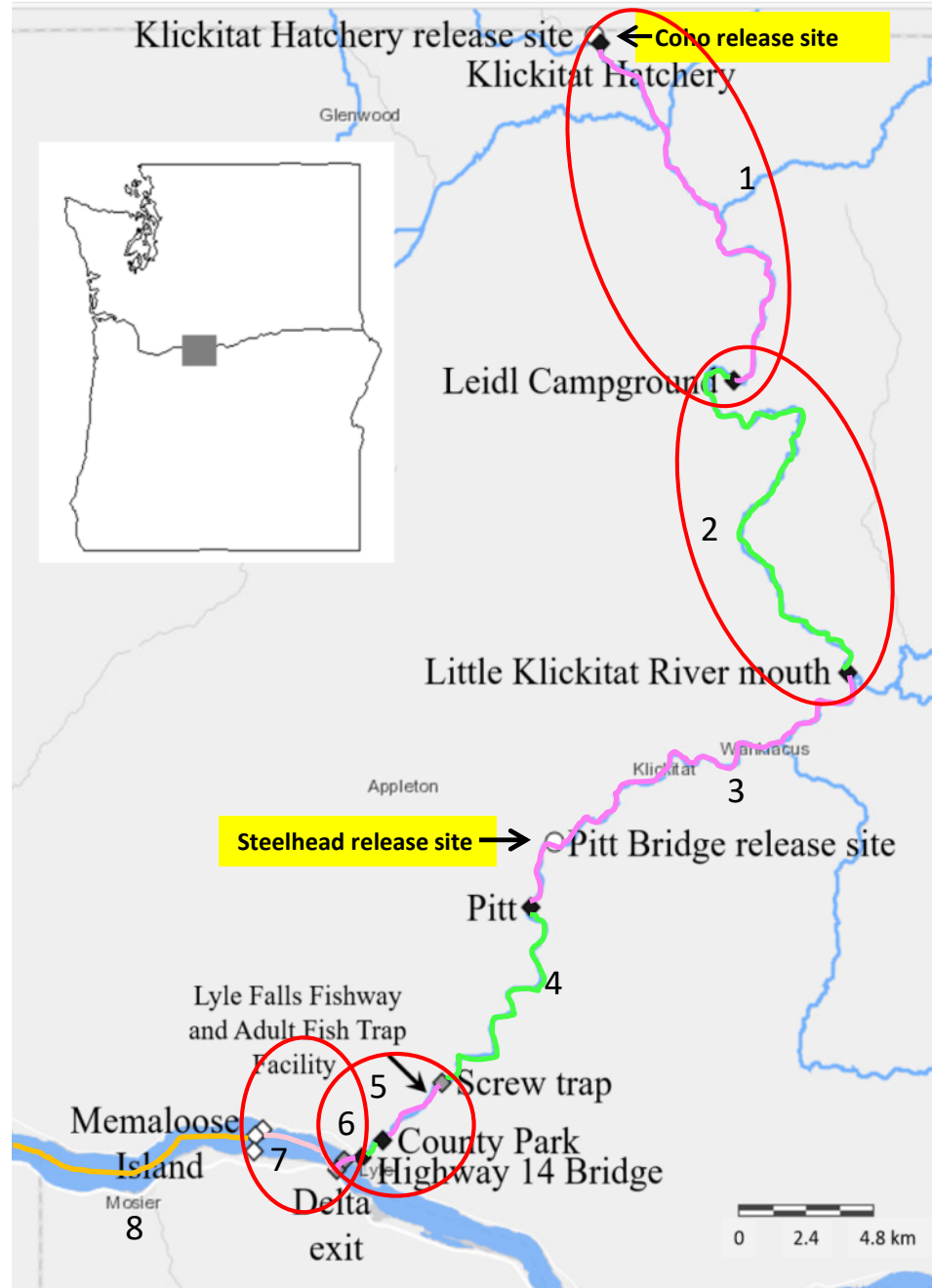
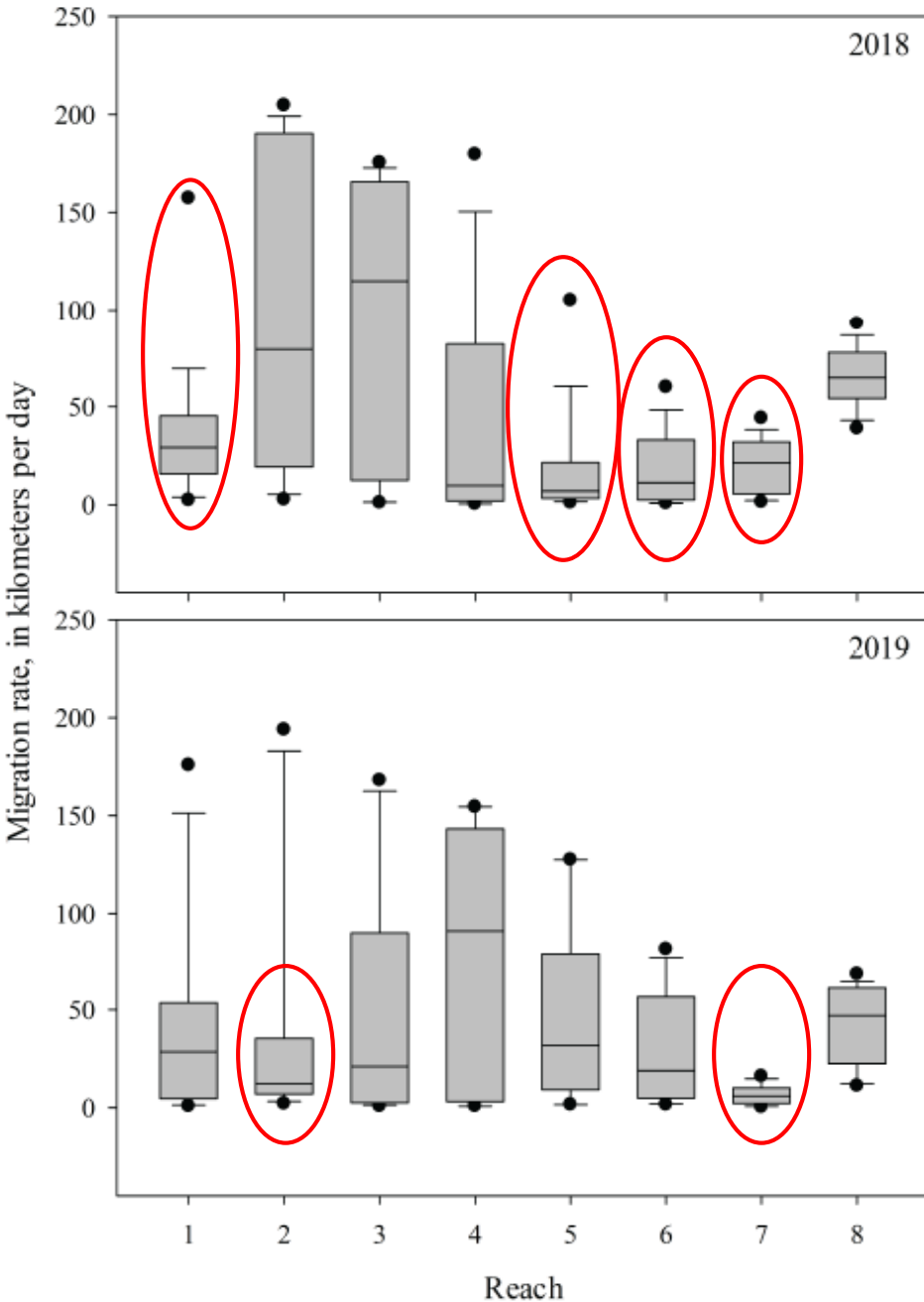
Travel time distributions for tagged steelhead and coho salmon to three locations



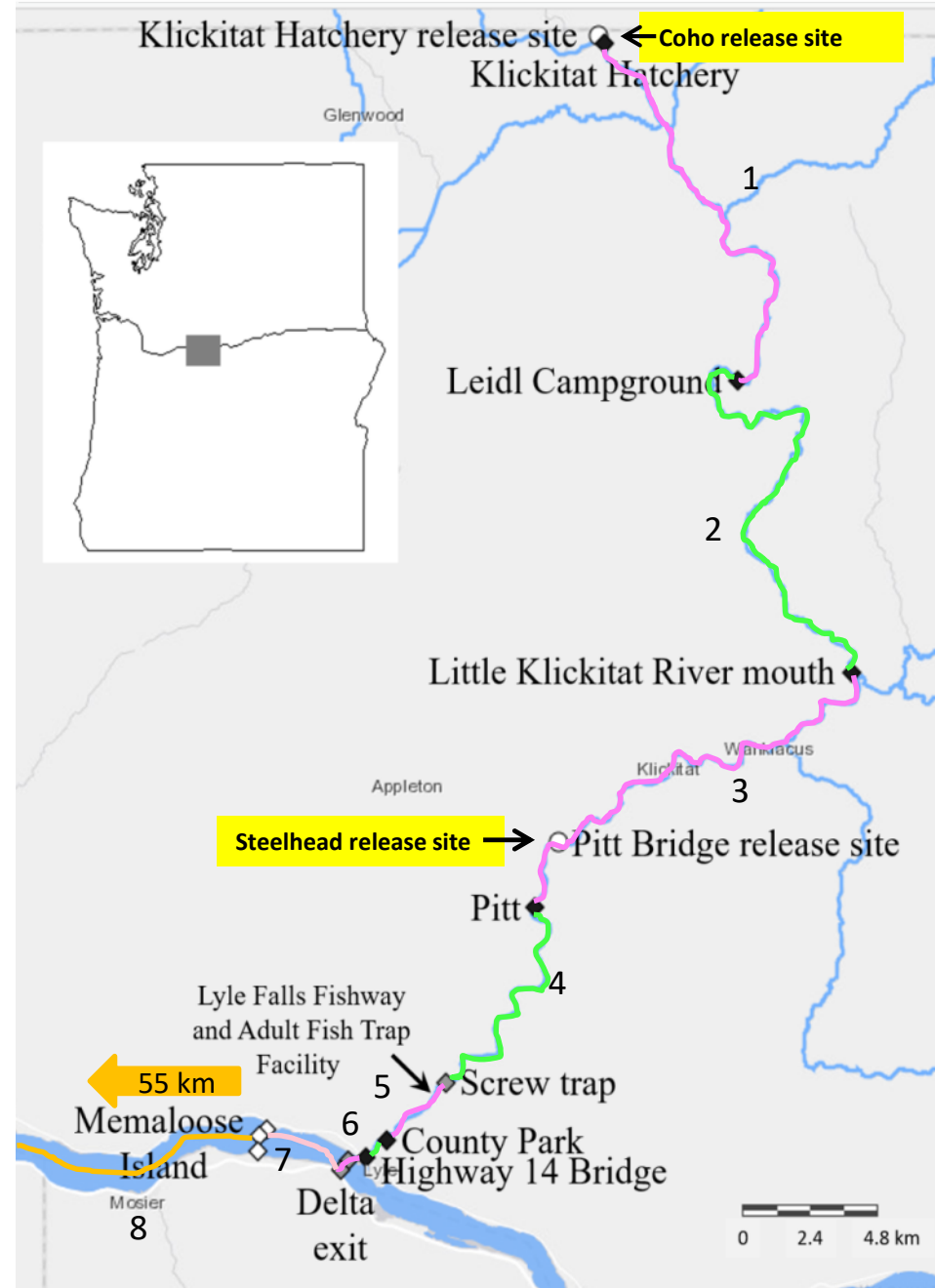
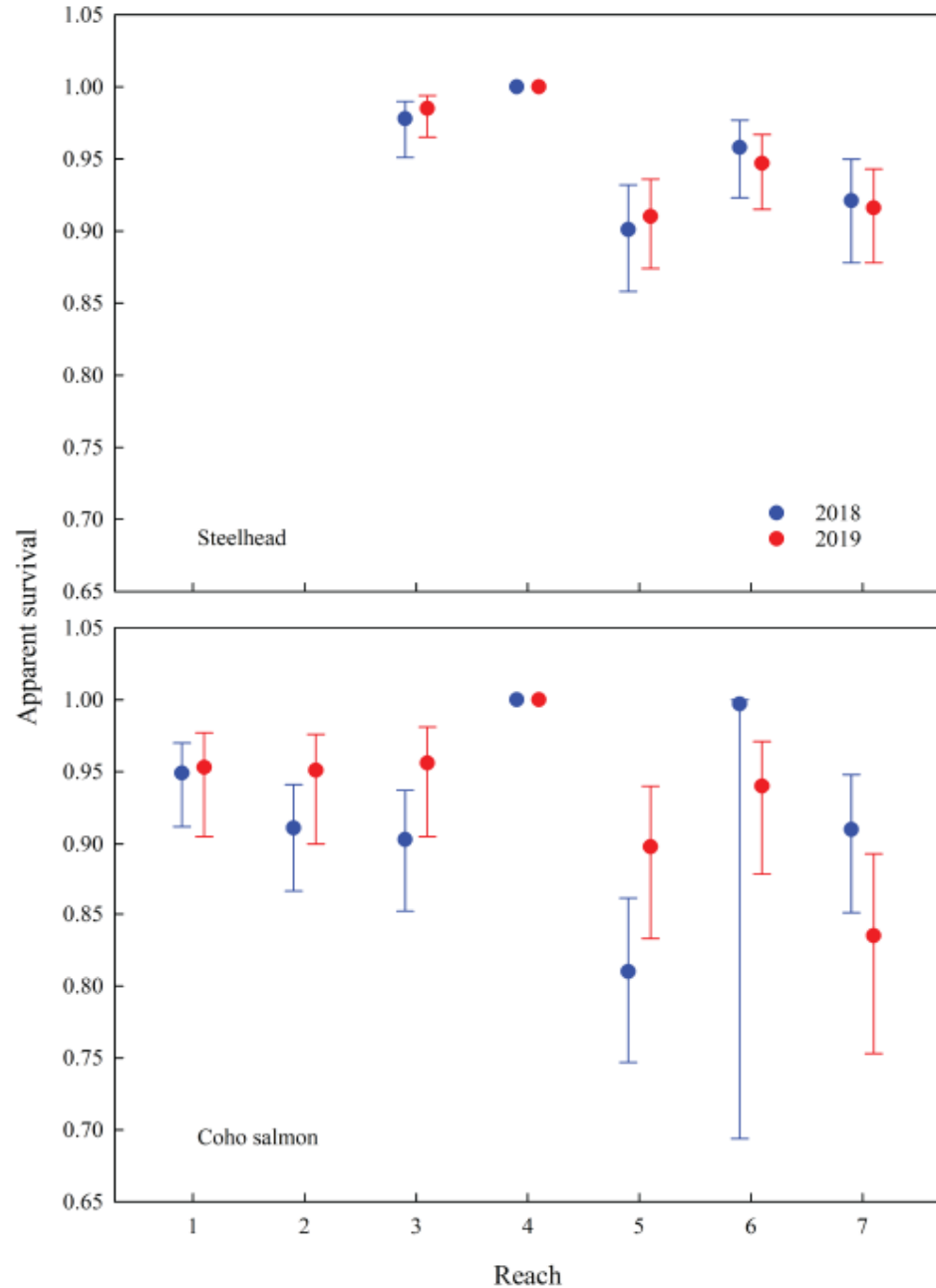
Reach-specific migration rates for juvenile steelhead



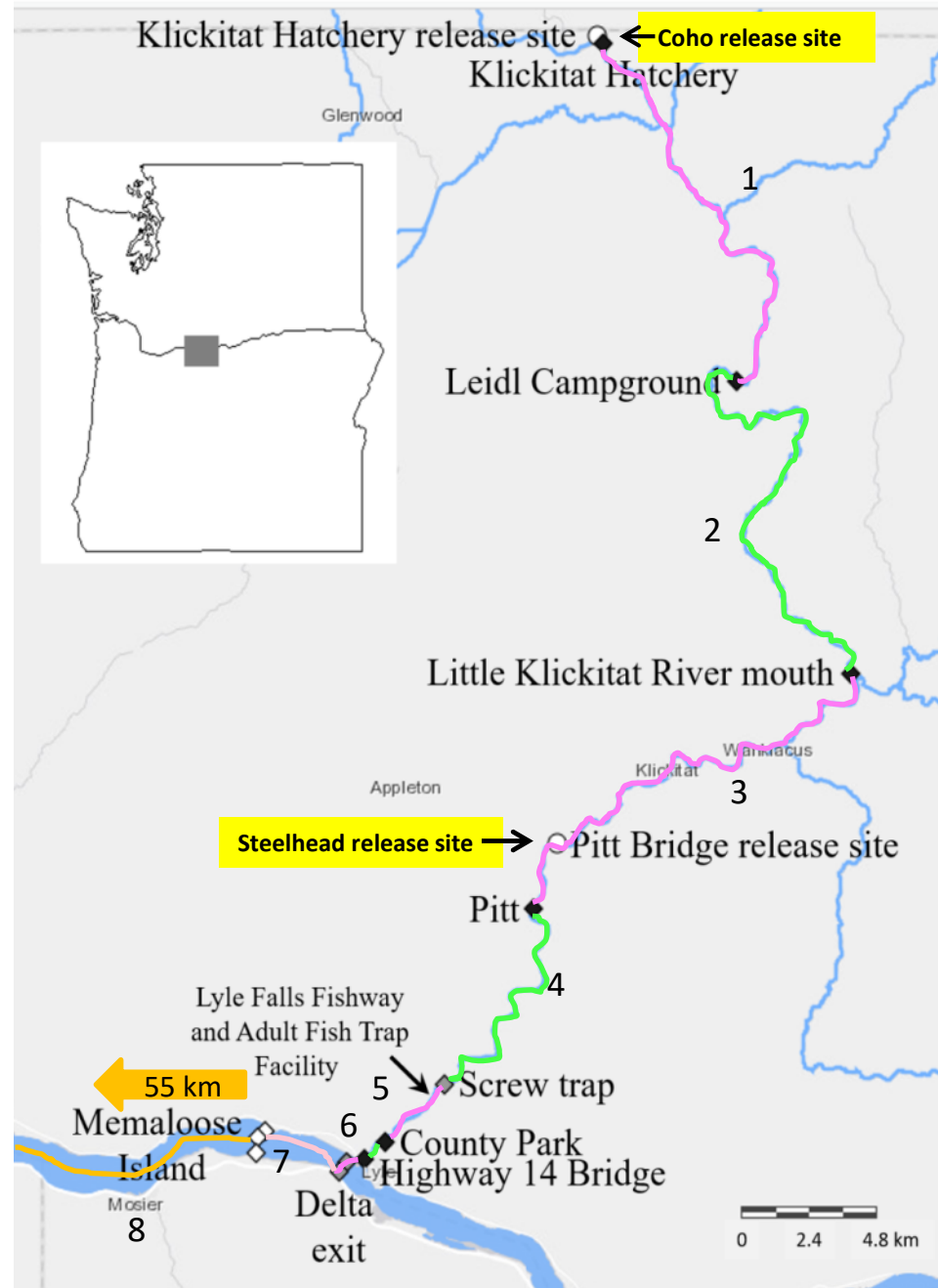
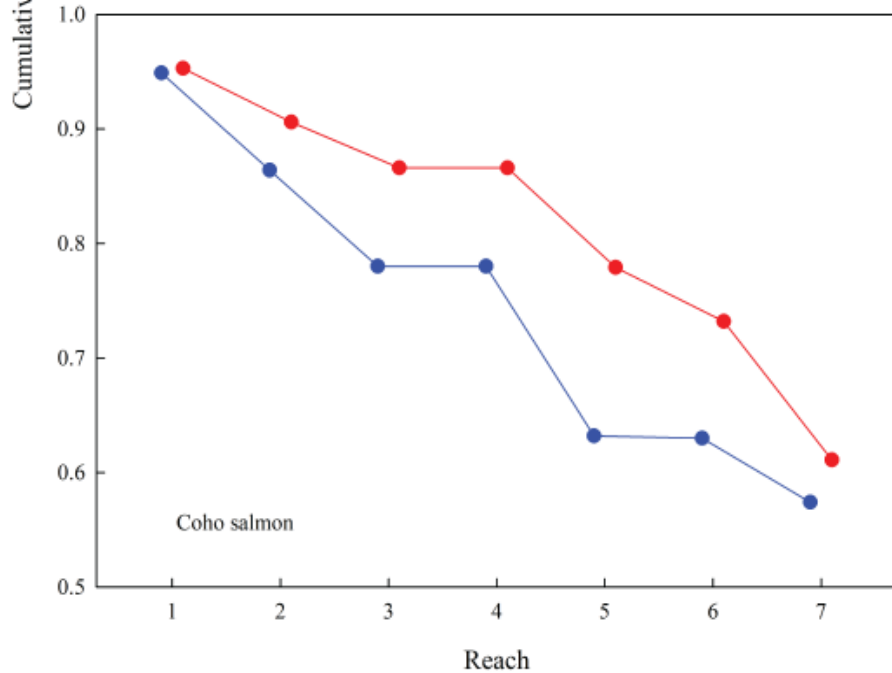
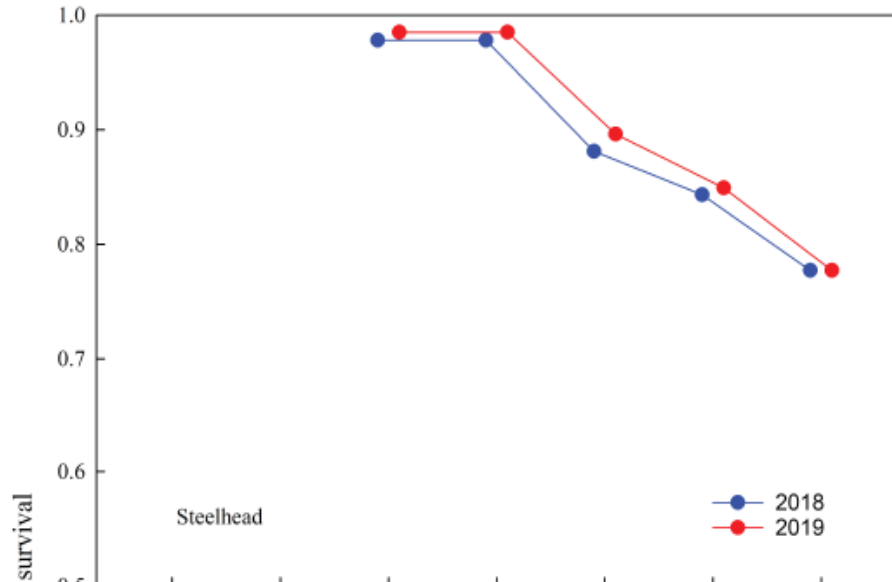
Reach-specific migration rates for juvenile coho salmon



Reach-specific apparent survival



Cumulative survival by reach



Results

Standardized survival estimates (survival per 100km) for natural-origin juvenile steelhead and hatchery coho

Klickitat River				Comparison to other rivers				
Speices	Year	Survival per 100 km reaches 1-7	Survival per 100 km reaches 3-7	Location	Study years	Species	Survival per 100km	Source
Steelhead	2018	NA	0.243	Klamath River, CA	2006-2009	Coho	0.725-0.854	Beeman and others, 2012
Coho	2018	0.453	0.100	Deschutttes River, OR	2014	Chinook	0.773	Hand and others, 2014
Steelhead	2019	NA	0.302	Yakima River, WA	2016	Coho	0.592-0.806	Kock and other, 2016
Coho	2019	0.511	0.153	Yakima River, WA	2016	Chinook	0.573-0.836	Kock and other, 2016

Results

Screw trap survival and acoustic telemetry survival estimates for natural-origin steelhead smolts

Year	Screw Trap Smolt Abundance	Acoustic Survival KRD	Screw Trap Survival Bonneville	Smolt Abundance KRD	Smolt Abundance Bonneville
2018	98,796 (19,869)	0.78	0.561 (0.294)	77,079	55,513 (29,104)
2019	95,167 (18,012)	0.78	0.595 (0.237)	74,230	56,681 (22,570)
2021	33,573 (4,896)	-	0.837 (0.409)	-	28,104 (13,727)
2022	34,109 (7,499)	0.78	0.581 (0.357)	26,605	19,834 (12,187)

95% confidence interval in parentheses

Conclusions

- **Steelhead outmigration rates were relatively high in reaches upstream and downstream KRD but were consistently slow through the KRD**
- **Most hatchery-origin coho salmon outmigrated quickly downstream and out of the Klickitat River while approximately 10% delay before leaving**
- **Standardized survival estimates were significantly lower than other rivers**
- **Approximately half of natural-origin juvenile *O. mykiss* losses to Bonneville occur before exiting the KRD**
- **~40% coho mortality prior to exiting KRD and consistently sustained losses from all reaches except in reach 4**
- **Future study: Biological evaluation of predatory fish**

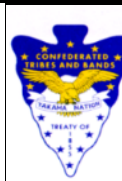
Acknowledgements

- **Funding and Materials:**

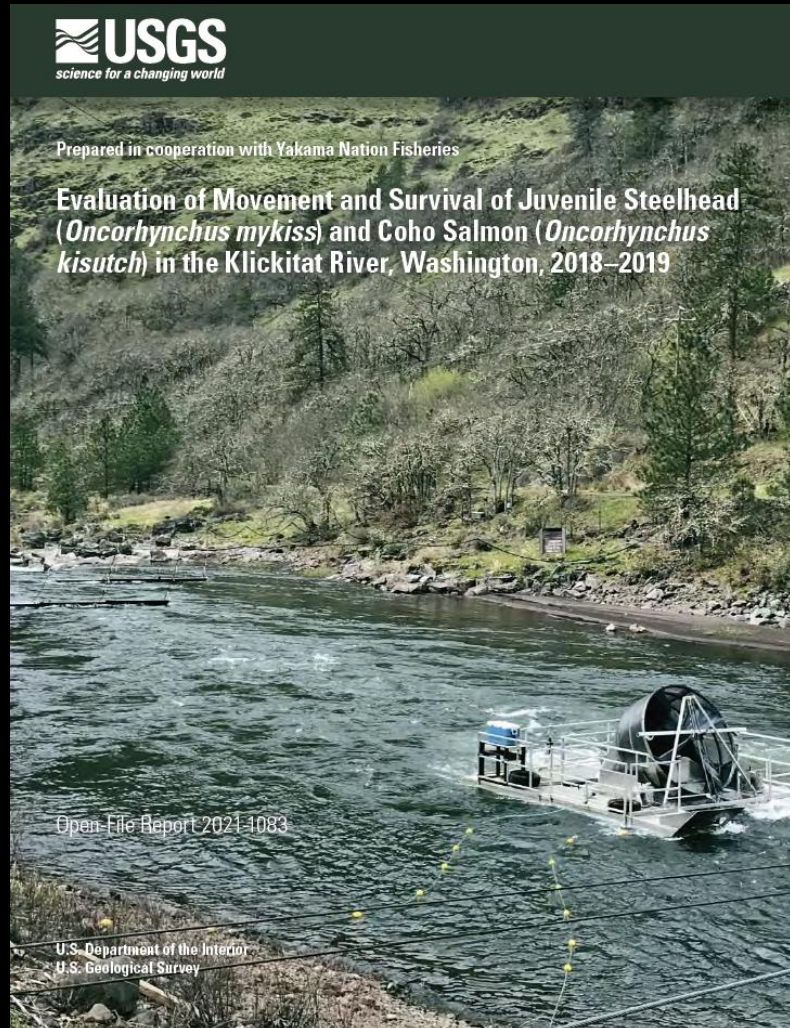
- BPA (Bonneville Power Administration)
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- Yakama Nation (YN)

- **Contributing Personnel:**

- YN – Kory Kuhn, Jerod Bartholomew, and Jason Rau
- USGS – Magen Cornett, Philip Haner, Gabriel Hanson, and Jamie Sprando



Questions?



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