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April 2, 2024

MEMORANDUM

TO: Fish and Wildlife Committee members

FROM: Stacy Horton, Washington Policy Analyst/Biologist

SUBJECT: Adult Steelhead Survival through the Columbia River System

BACKGROUND:

Presenters: Dan Rawding, Columbia River Science and Policy Coordinator Washington Department of Fish and Wildlife, Fish Program, Science Division and Andrew Murdoch, Eastern Washington Science Division Manager, Fish Program, Washington Department of Fish and Wildlife

Summary: There has been much emphasis on the survival of juvenile salmon and steelhead as they migrate downstream through the hydrosystem. In this presentation we will provide estimates of adult steelhead survival as these fish migrate upstream to their spawning grounds. In the first part of the presentation, we provide the survival estimates for the Asotin steelhead population as they migrate from Bonneville Dam past Lower Granite Dam to their natal stream in Southeast Washington. In the second half of the presentation, we will present survival estimates of steelhead in the upper Columbia River from Priest Rapids Dam to their natal stream. This includes the survival of steelhead that overshoot, migrate upstream of their natal stream, and migrate downstream past one or more dams to return their spawning grounds.

Relevance: The 2014 Columbia River Basin Fish and Wildlife Program (Program) includes a strategy for *Mainstem hydrosystem flow and passage operations* that calls for the management of dams and reservoirs to improve fish passage and survival through the system. Program, P. 60.

System operations for multiple purposes have a direct impact on fish habitat and overall fish survival, compromising habitat conditions for spawning, rearing, resting, and migration. The Program calls for improvements to adult fish passage facilities at mainstem dams, cool water releases to facilitate adult migration, an emphasis on research, monitoring and evaluation, more accurate fish counts, adult conversion rates, and behavior studies. Program, P. 66. The Program specifically calls on the Corps to investigate the use of, or need for, surface flow outlets during the winter months to provide a safer fallback route for over-wintering steelhead and kelts. Program, P. 67.

The 2020 Addendum to the 2014 Columbia River Basin Fish and Wildlife Program includes a biological objective to achieve annual adult salmon and steelhead survival standards for the Bonneville Dam to Lower Granite reach and the Bonneville Dam to McNary Dam reach. Addendum, S4, P. 13.

- For Snake River steelhead migrating from Bonneville Dam to McNary Dam, the survival standard is 90.1%.
- For Upper Columbia River steelhead migrating from Bonneville Dam to McNary Dam, the survival standard is 84.5%.
- Middle Columbia River steelhead use Snake River steelhead as a surrogate until a standard can be developed.
- Lower Columbia River steelhead do not have an adult performance standard, it is assumed survival is adequate if Snake River steelhead standards are met.
- Upper Willamette River steelhead have no adult performance standard

Annual adult salmon and steelhead survival for the Bonneville Dam to Lower Granite Dam reach and the Bonneville Dam to McNary Dam reach inform the Mainstem Hydrosystem Flow and Passage strategy performance indicator. Addendum, P. 27.

Mainstem passage actions are important for the protection of biological diversity, and a periodic assessment is important to capitalize on what's been learned.

Background: Both the upper Columbia and the Snake River steelhead are listed for protection under the Endangered Species Act.

The NOAA Fisheries 5-Year Review for the Upper Columbia River steelhead includes recommendations for tributary habitat actions that improve resiliency to climate change; are implemented at a watershed scale; include floodplain reconnections; and calls for a reduction of predation by pinnipeds in the Lower Columbia. Distinct population segments (DPS) for the Upper Columbia River steelhead include naturally spawned anadromous *O. mykiss* (steelhead) originating below natural and

manmade impassable barriers from the Columbia River and its tributaries upstream of the Yakima River to the U.S.-Canada border and a number of upper Columbia artificial production programs.

The Snake River steelhead Distinct population segments (DPS) include all naturally spawned anadromous *O. mykiss* (steelhead) originating below natural and manmade impassable barriers from the Snake River basin. Populations are located in the lower Snake River, Grande Ronde River, Imnaha River, Clearwater River, Salmon River and Hells Canyon Tributaries. A good example of the conditions encountered by Snake River steelhead is the Tucannon River and Asotin Creek populations where NOAA expressed concerns about the lack of stream complexity, excess sediment, low stream flows, high stream temperatures, degraded riparian conditions, reduced floodplain connectivity, and specific to the Tucannon - passage barriers. Each of the populations for the different river systems has a set of emergent, on-going, and future habitat actions that need to be implemented or addressed. The DPS also includes steelhead from a number of artificial production programs.

More Info:

Upper Columbia River Steelhead:

<https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/upper-columbia-river-steelhead>

2022 5-Year Review: Summary & Evaluation of Upper Columbia River Spring-run

<https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/upper-columbia-river-steelhead>

Snake River Steelhead:

<https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/snake-river-basin-steelhead>

2022 5-Year Review: Summary & Evaluation of Snake River Basin Steelhead

<https://www.fisheries.noaa.gov/resource/document/2022-5-year-review-summary-evaluation-snake-river-basin-steelhead>

Adult Summer Steelhead Survival in the Columbia River Hydrosystem

Dan Rawding

Andrew Murdoch



*Washington
Department of*
**FISH and
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Summer Steelhead Overview

- Adults pass Bonneville Dam (BON) during the summer (June – September)
- Migration timing between BON and spawning area is variable
- Adults spawn the following spring (March – May)
- After spawning adults move downstream to the ocean
- Some adults survive to make additional spawning returns
- Snake & Upper Columbia River steelhead are listed for protection under the Endangered Species Act (ESA).

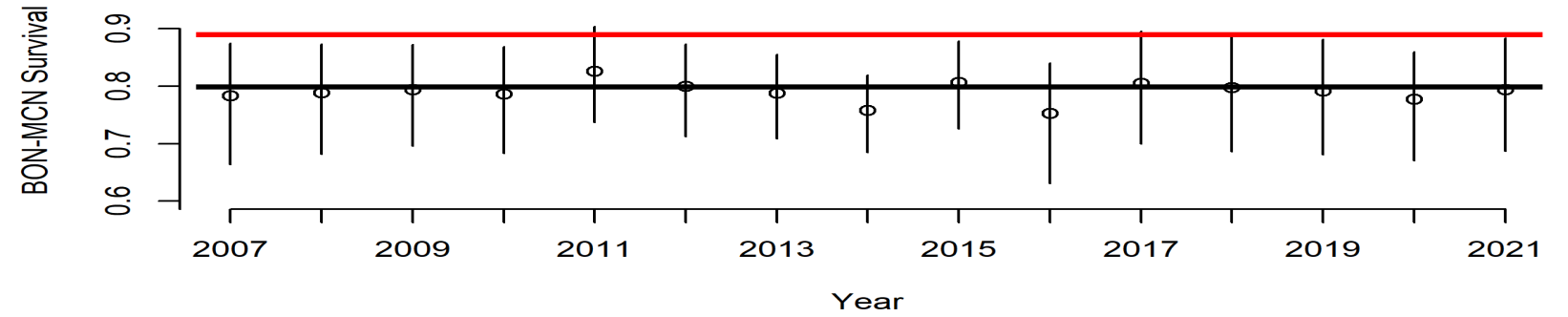
Columbia River Hydrosystem



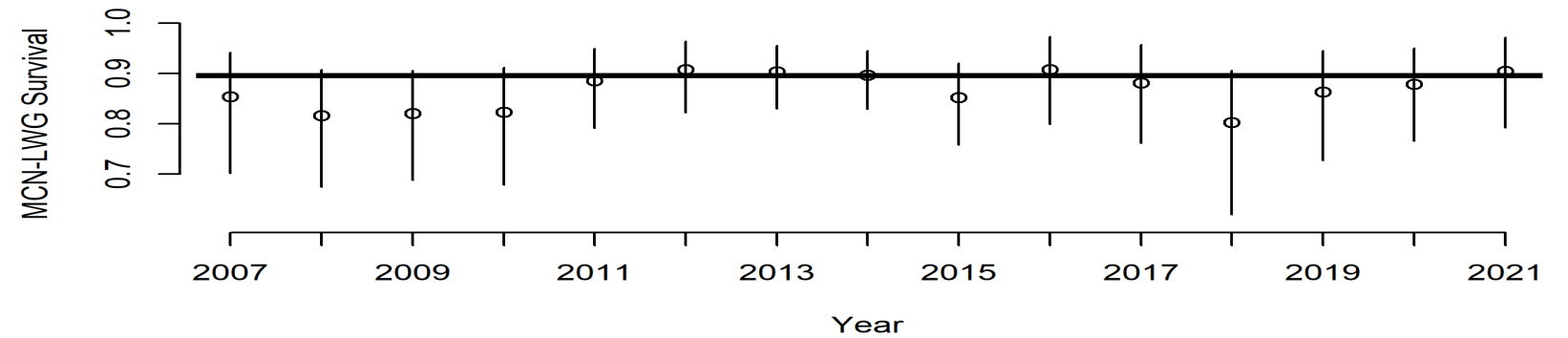
Asotin Creek

Adult Asotin Summer Steelhead Survival (2007-2021)

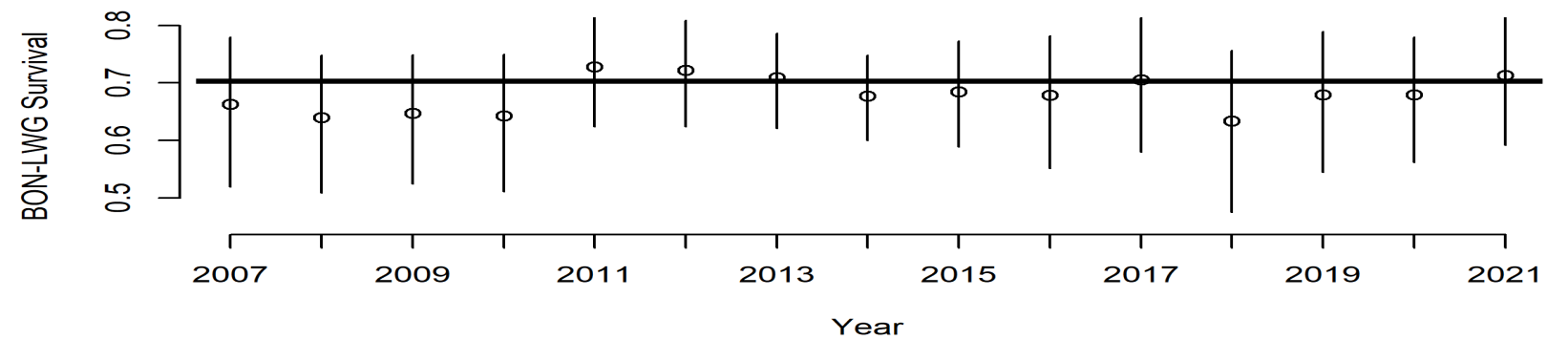
BON-MCN Survival



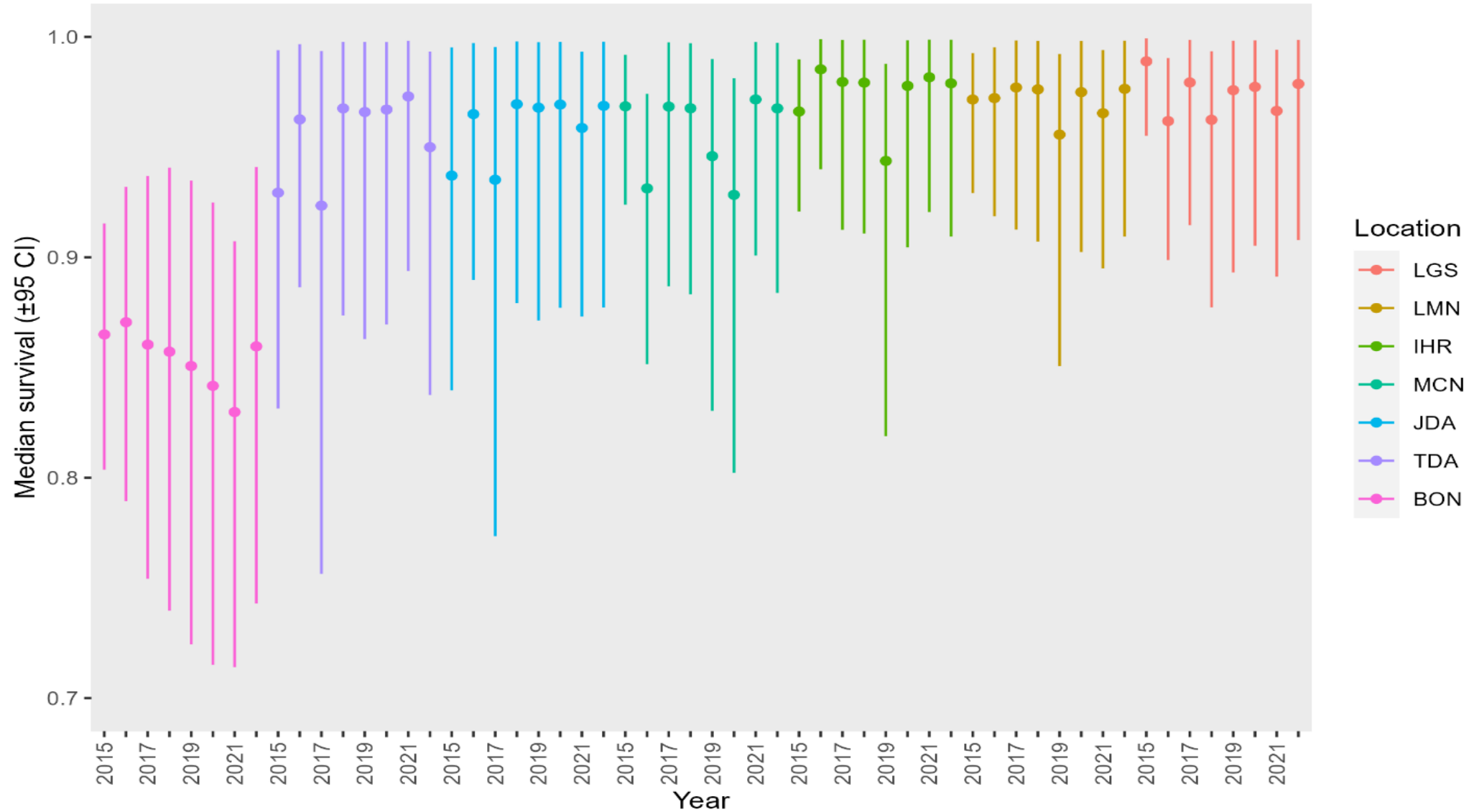
MCN-LWG Survival



BON-LWG Survival



Adult Asotin Steelhead Survival between Dams (2015-2022)



An aerial photograph of a large dam and power plant facility on the Columbia River. The dam is a long concrete structure with multiple spillways. Water is visible flowing through the spillways. To the right of the dam is a large industrial building, likely the power plant. In the foreground, several high-voltage power lines and towers are visible. The background shows a wide river and a hilly, arid landscape.

Columbia River Overshoot Steelhead Review

Andrew Murdoch (WDFW)

Kevin See (WDFW)

Definitions

Overshoot – A fish that migrates upstream of its natal tributary.

Example: Natal Yakima River basin fish migrates above Priest Rapids Dam (PRD).

Overshoot Fallback – A fish that migrates upstream of a dam, then migrates or “falls back” downstream of the dam.

Example: Natal Yakima River basin fish migrates above PRD, then returns to Yakima River basin to spawn.

Stray – A fish of non-local origin that spawns in a non-local stream.

Example: Natal Yakima River basin fish migrates above PRD and spawns in the Wenatchee River.

Overshoot

(Richins and Skalski 2018)

Frequency

0% - 71%

Spatial scale

Population or larger

Mechanisms

Thermoregulation
Hatchery practices
Hydro-related operations

Stray

(Keefer and Caudill 2014)

0 - 13%*

Individual

Incomplete/interrupted imprinting
Adult sensory failure
Adult memory failure
Density dependent response
Life history effects (age at return)

* The extent overshooting confounded reported stray rates is unknown.

Where do overshoot steelhead come from and go?

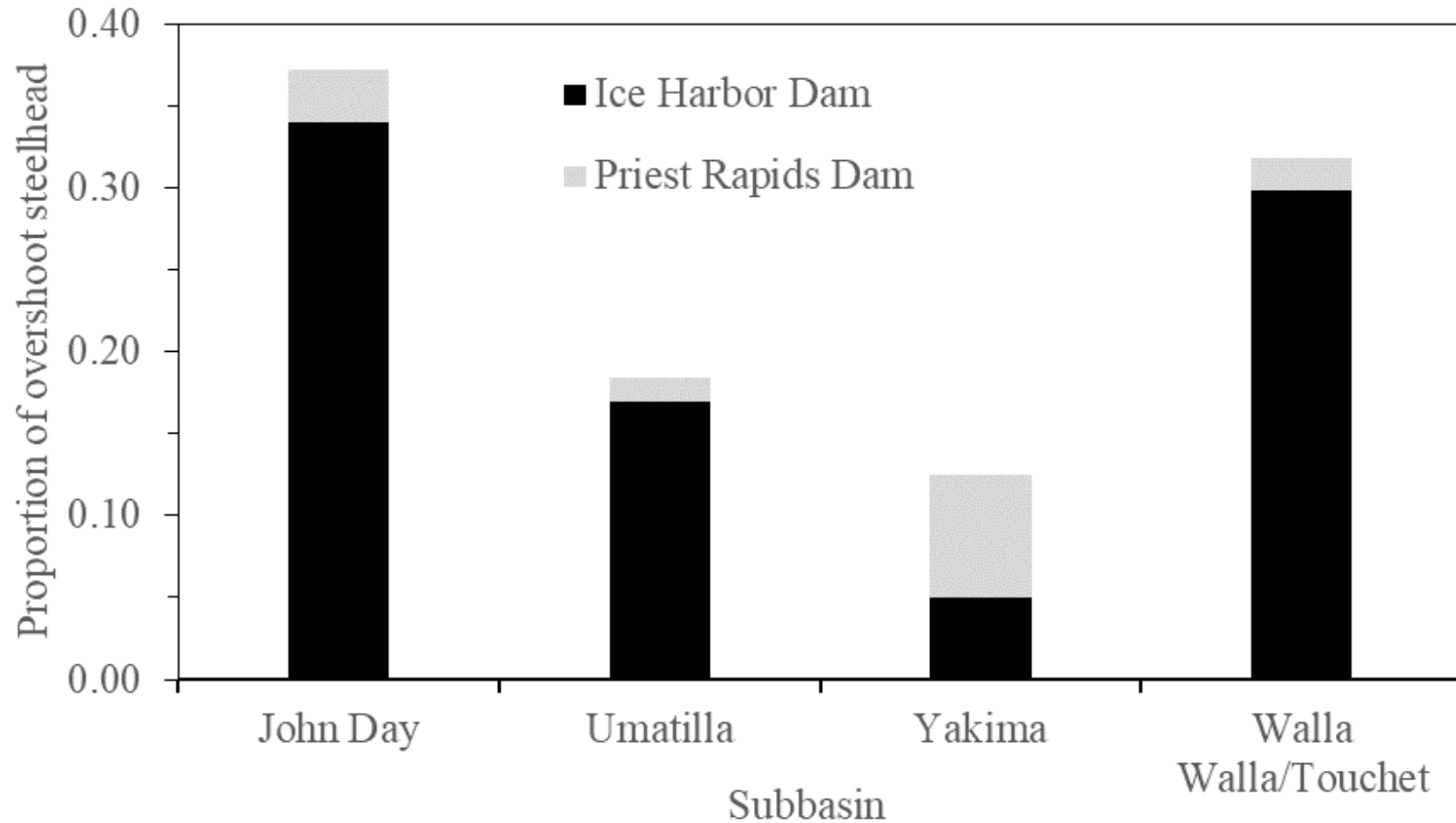
(Font size reflects relative abundance)

Upper Columbia (Priest Rapids Dam)	Snake River (Ice Harbor Dam)
Snake River DPS	John Day MPG
Entiat Population (Wells Dam)	Tucannon Population
Yakima MPG	Umatilla/Walla Walla MPG
Umatilla/Walla Walla MPG	Yakima MPG
John Day MPG	
Wenatchee Population	

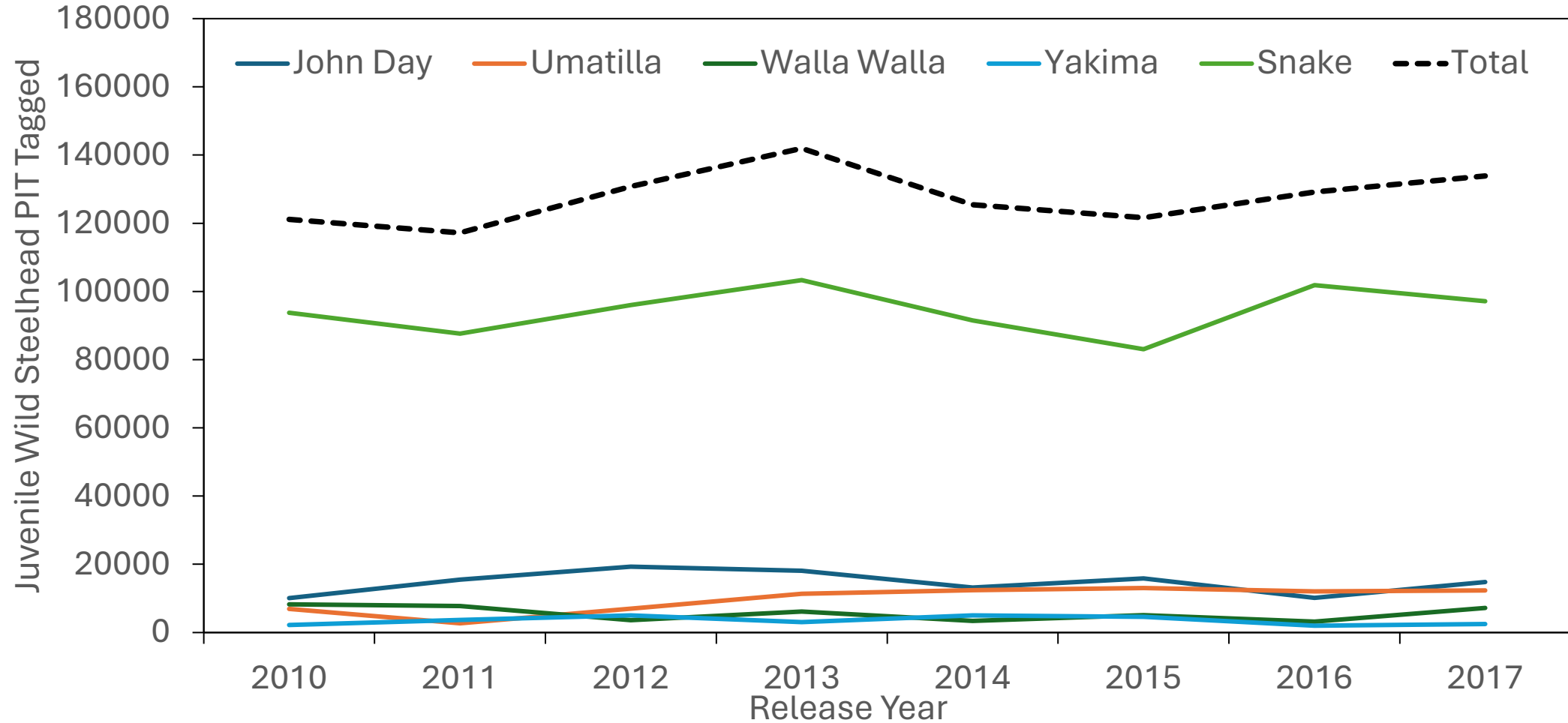
No Overshooting (Cool water populations)

- Deschutes
- White Salmon
- Klickitat
- UCR Steelhead in the Snake River

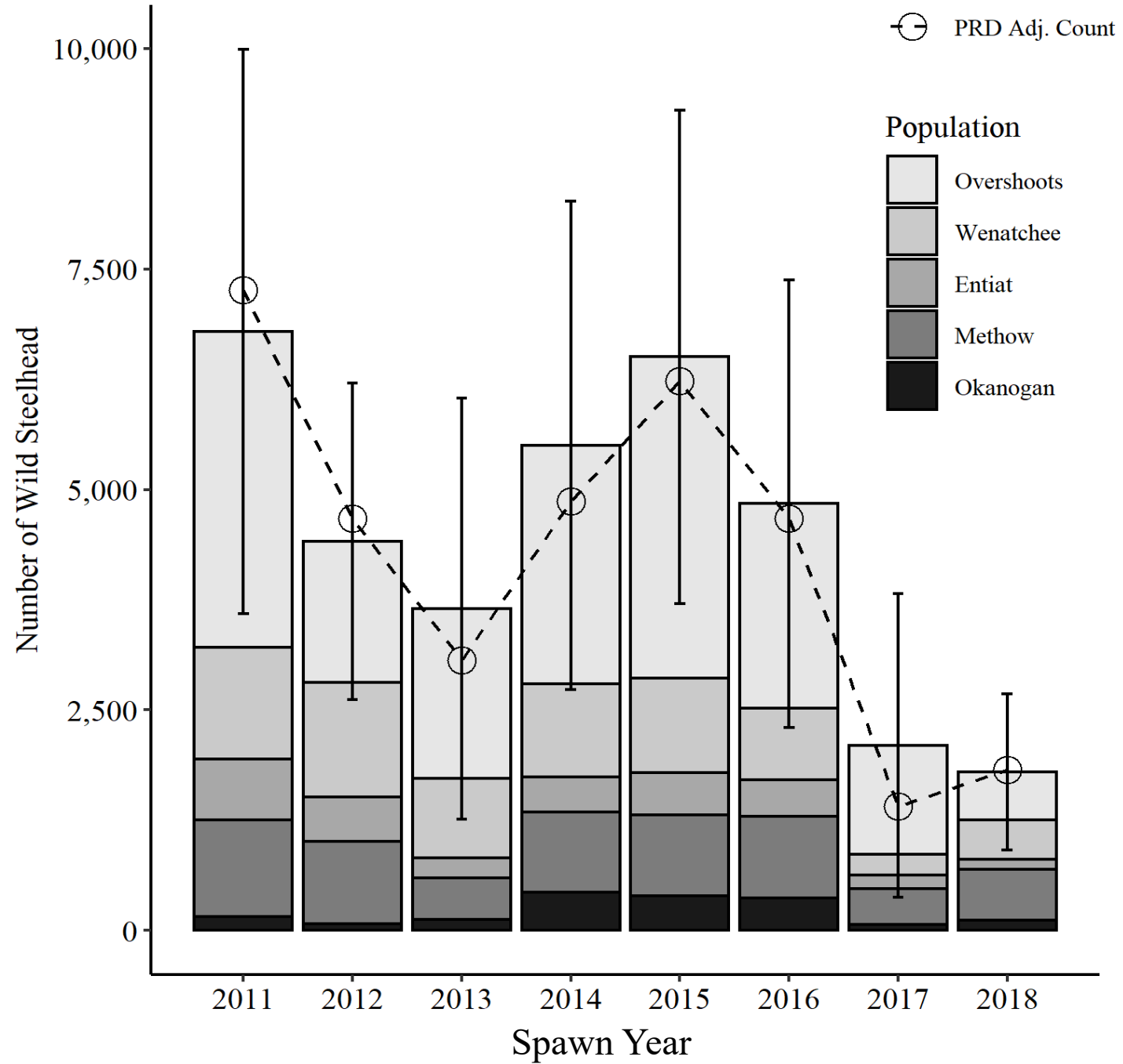
Known Wild Steelhead Overshoots: Mid-Columbia Steelhead DPS (2010-2017)



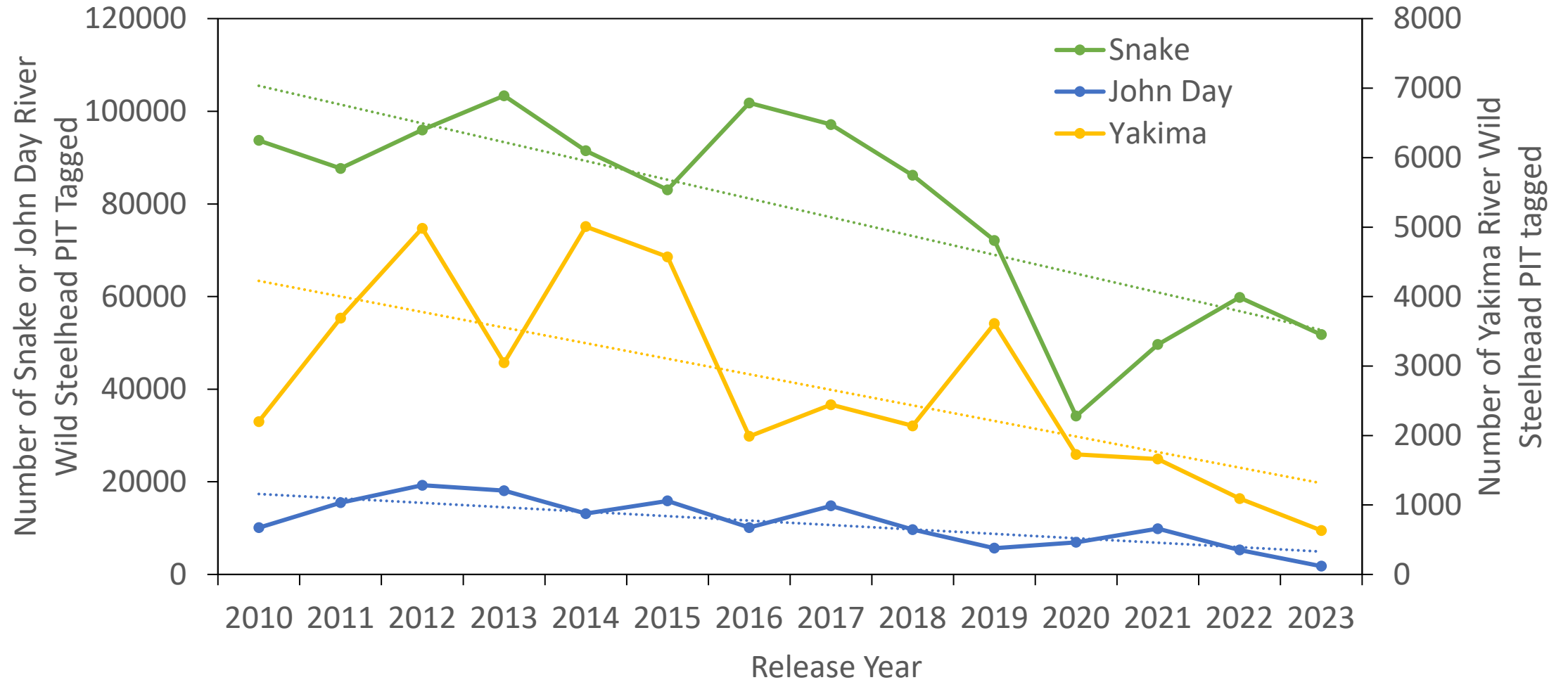
Adults Tagged as Juveniles = Known Overshoots



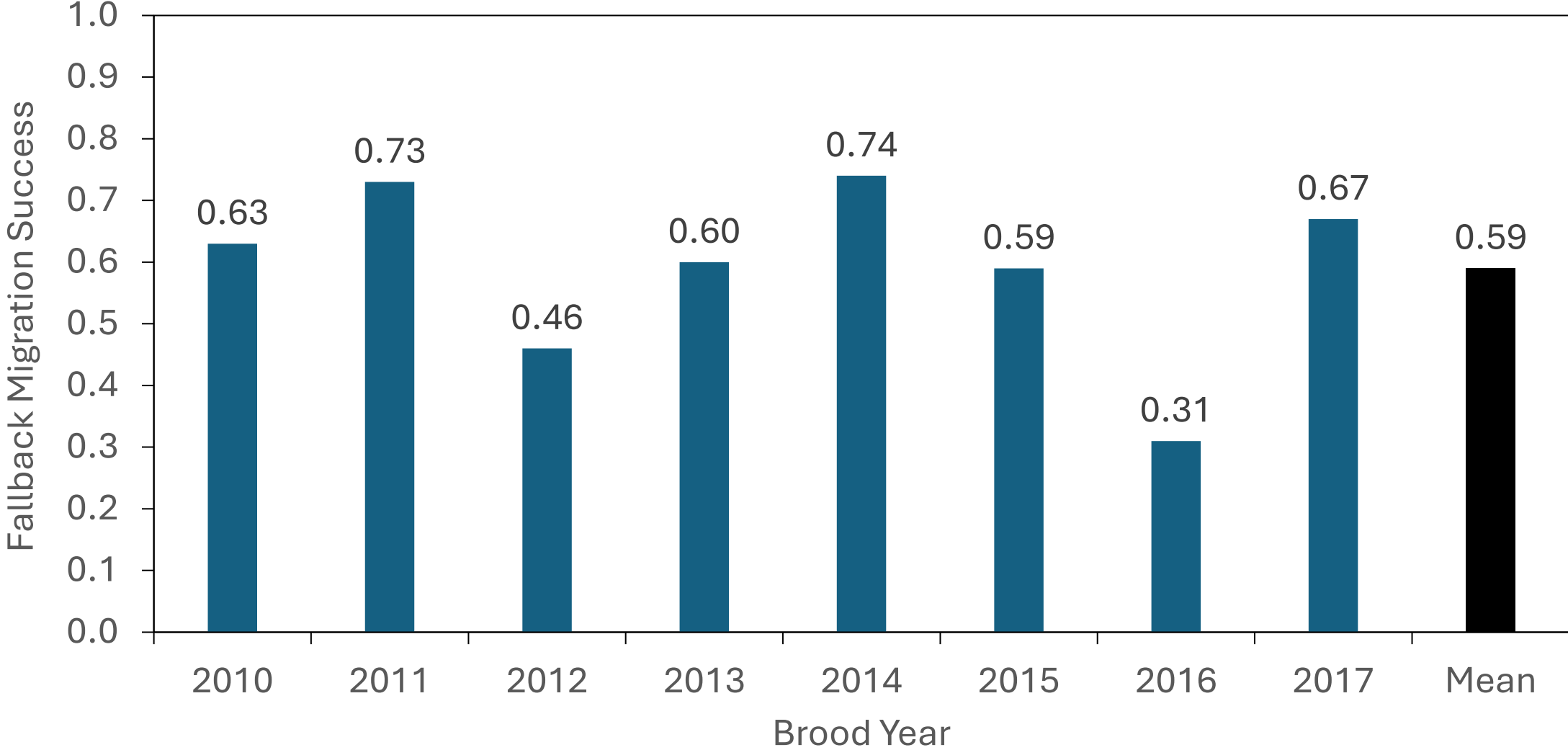
UCR Wild Steelhead



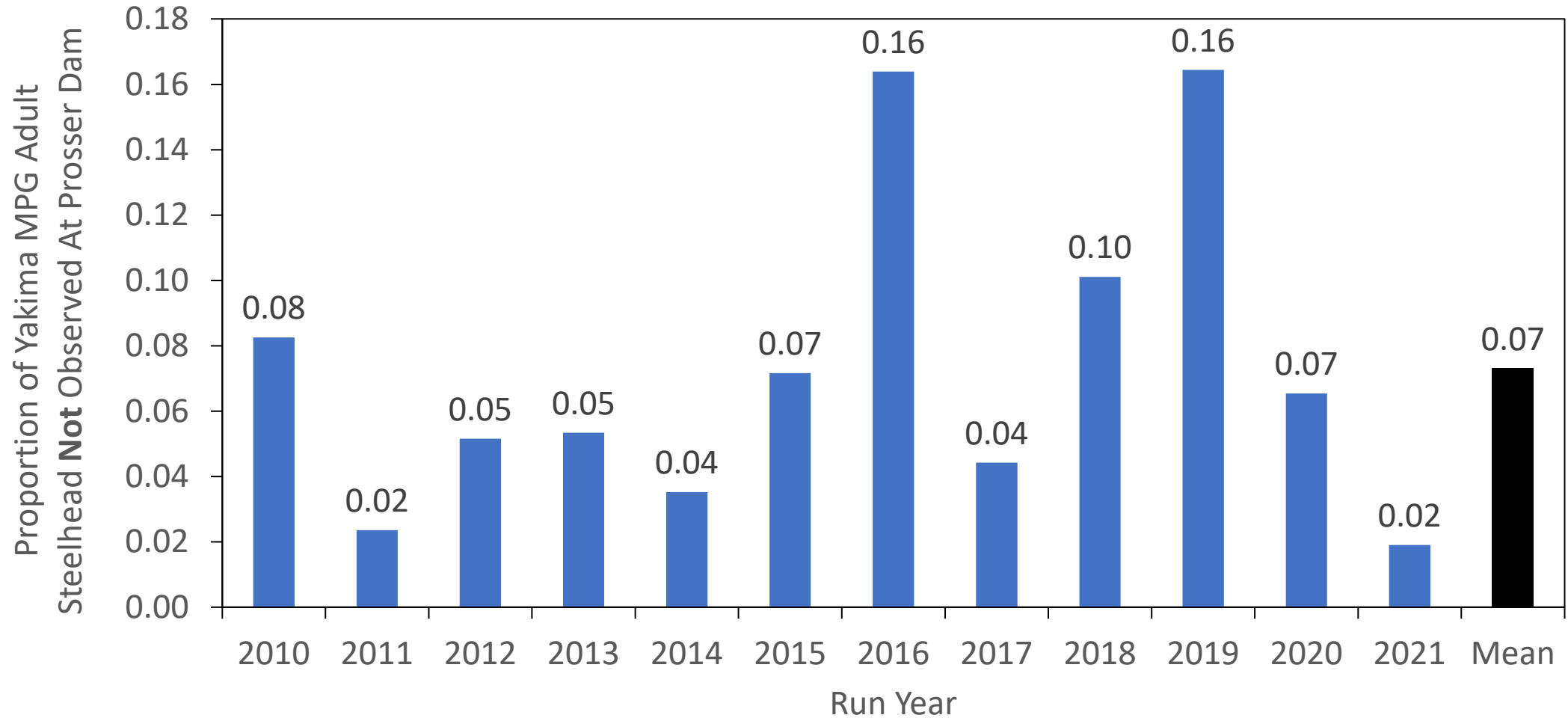
Known Overshoots = f (# of Juveniles PIT tags)



Wild Steelhead: UCR Fallback Migration Success



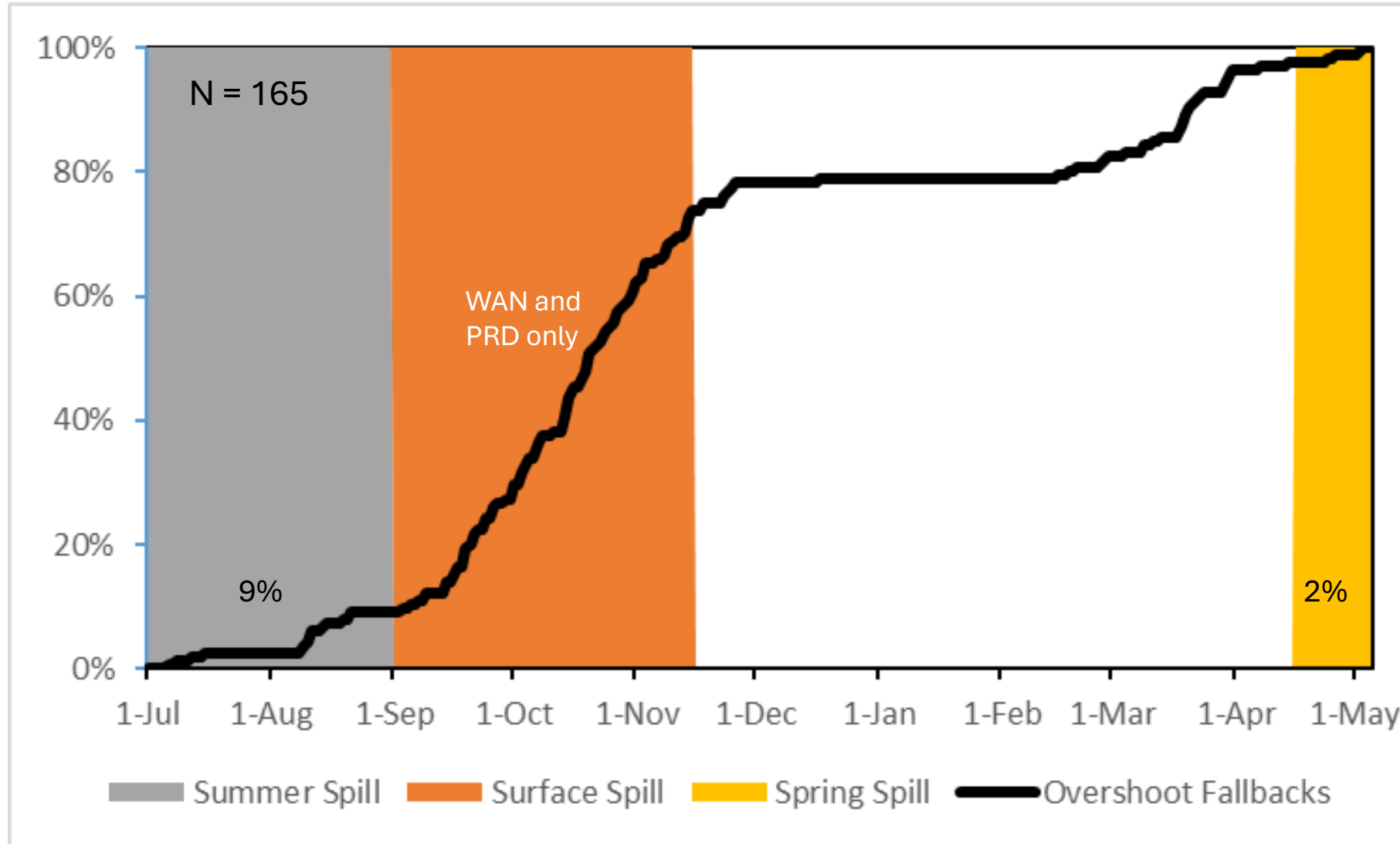
Overshoot Impacts on Yakima Steelhead MPG



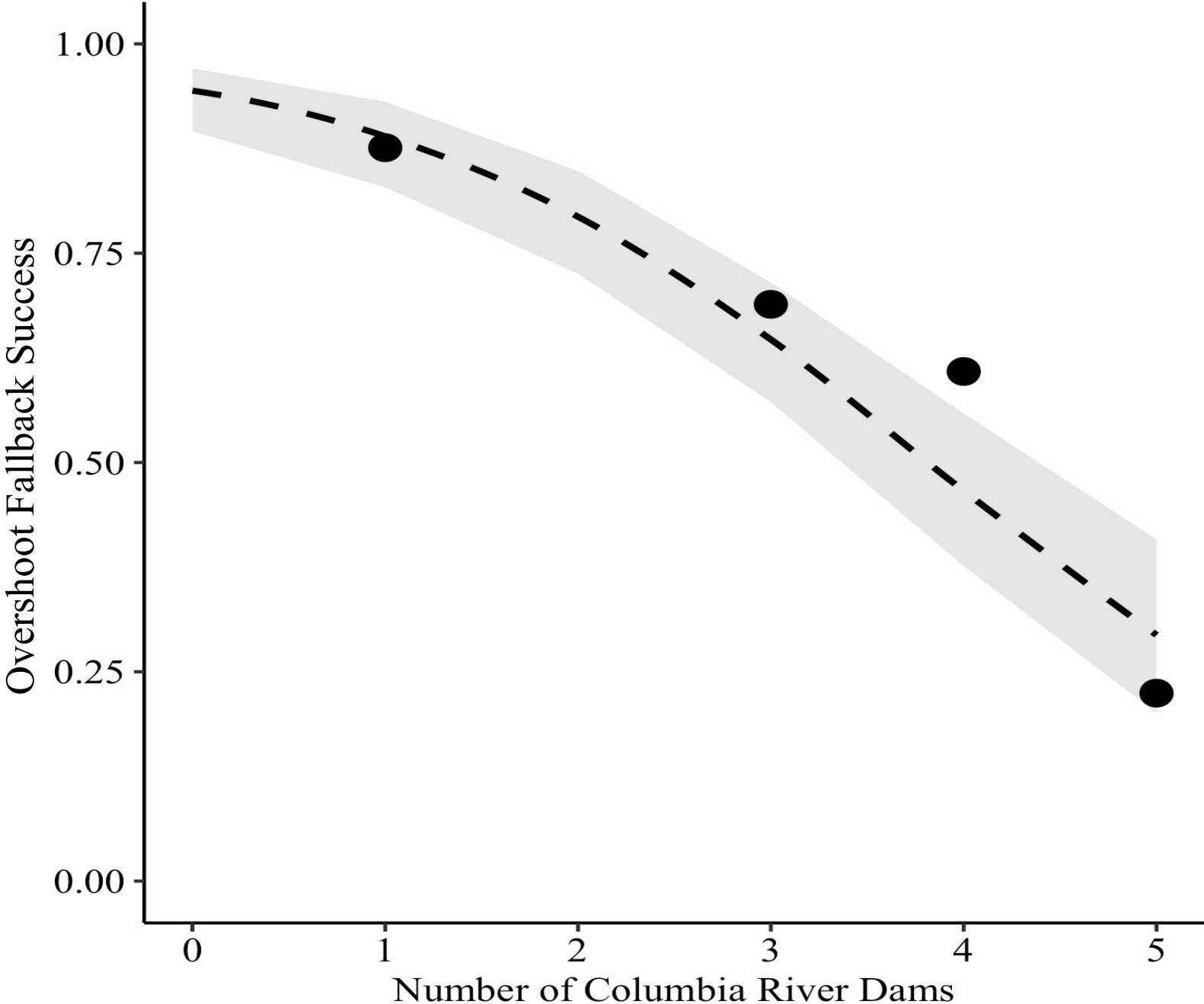
Summary

- 2 out of 5 wild steelhead at Priest Rapids Dam are overshoots
 - Greater abundance than any single UCR population
- 2 out of 5 overshoots at Priest Rapids Dam don't make back downstream
 - Only a small proportion (3%) are detected on spawning grounds

Pooled Overshoot Fallbacks at PRD (Fuchs et al. 2021 Radio tag Study 2015-2017)



Wild Steelhead Dam Effect



Overshoot Protective Measures

Project	Action	Duration	Dates
Wells	None		
Rocky Reach	None		
Rocky Island	None		
Wanapum	Bypass spill ~ 2.5 kcfs	24h/7d	Sept 1 – Nov 15
Priest Rapids	Bypass spill ~ 2.5 kcfs	24h/7d	Sept 1 – Nov 15
Lower Granite*	1 Surface weir ~ 8 kcfs	4h/7d 24h/7d	Sept 1 – Nov 15; Mar 1 – 20 Mar 21 – Apr 2
Little Goose*	1 Surface weir ~ 8 kcfs	4h/7d 24h/7d	Sept 1 – Nov 15; Mar 1 – 20 Mar 21 – Apr 2
Lower Monumental*	1 Surface weir ~ 8 kcfs	4h/7d 24h/7d	Sept 1 – Nov 15; Mar 1 – 20 Mar 21 – Apr 2
Ice Harbor*	1 Surface weir ~ 8 kcfs	4h/7d 24h/7d	Sept 1 – Nov 15; Mar 1 – 20 Mar 21 – Apr 2
McNary*	1 Surface weir ~ 8 kcfs	4h/7d 24h/7d	Sept 1 – Nov 15; Mar 1 – 20 Mar 21 – Apr 9

* 2020 CRS BiOp 4h/3d/week Oct 1 – Nov 15; March 1 -30

Conclusions

- Asotin Summer Steelhead not meeting survival target between BON and MCN.
- Mid-Columbia DPS is impacted the greatest by overshooting
- PIT tagging a consistent proportion of juveniles within overshoot populations strengthens future overshoot analysis.
- Overshoot abundance and fallback success rates can be quantified using existing models at PRD and LGR.
- Basin wide overshoot evaluation and adaptive management is possible today, but simply has not happened.
 - Protective measures are not consistent across projects

WDFW Overshoot Research funded by BPA Project #2010-034-00

- Waterhouse, L., White, J., See, K., Murdoch, A. and Semmens, B.X., 2020. A Bayesian nested patch occupancy model to estimate steelhead movement and abundance. *Ecological Applications*, 30(8), p.e02202.
- Fuchs, N.T., Caudill, C.C., Murdoch, A.R. and Truscott, B.L., 2021. Overwintering distribution and postspawn survival of steelhead in the upper Columbia river basin. *North American Journal of Fisheries Management*, 41(3), pp.757-774.
- Murdoch, A.R., See, K. and Truscott, B.L., 2022. Abundance and Migration Success of Overshoot Steelhead in the Upper Columbia River. *North American Journal of Fisheries Management*, 42(4), pp.1066-1080.