



Evaluation of Reservoir Drawdown on Outmigration Behavior and Survival at the Lookout Point Project During Fall 2023

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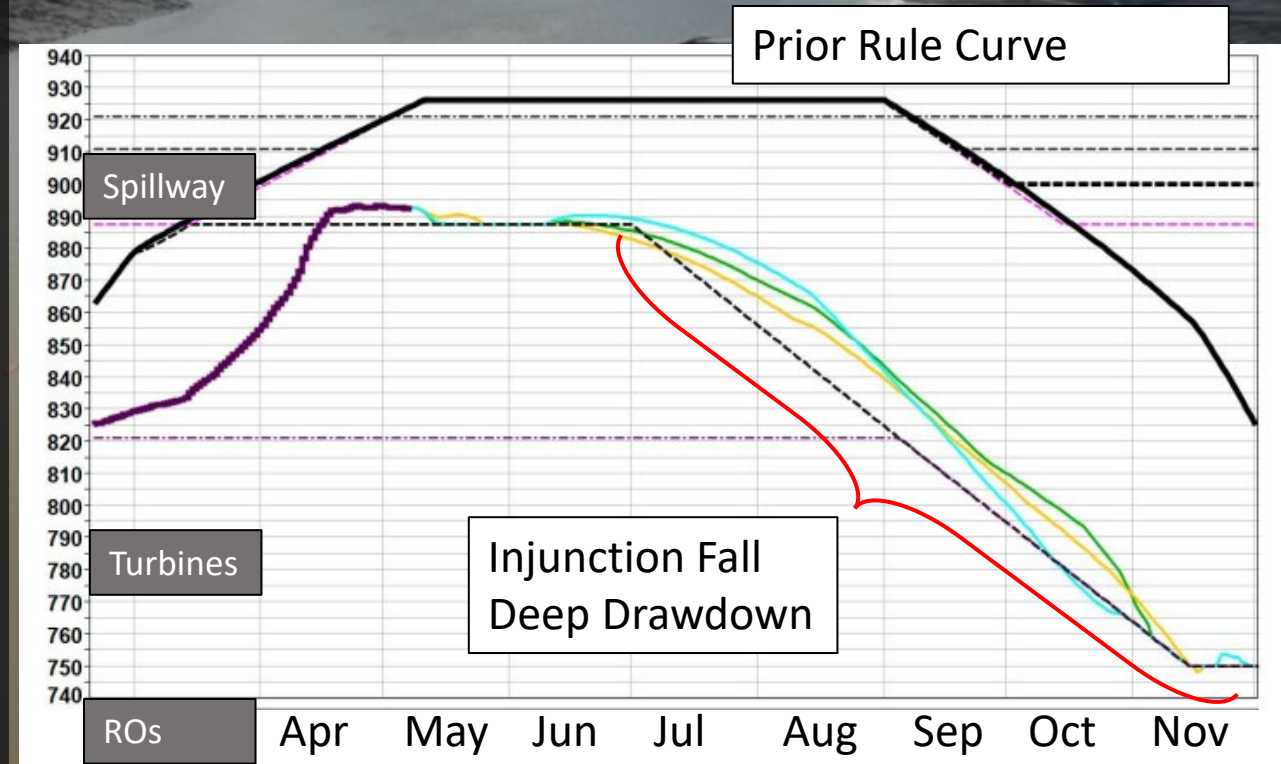
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2023 Deep Drawdown

- **Biological goal:**
“Provide improved volitional downstream passage and survival for juvenile spring Chinook salmon through Lookout Point Reservoir and past Lookout Point Dam in the fall.”
- **Target populations:**
 1. Reservoir Rearing Fry
 2. Fall Migrants
- **Expectations:**
“High passage efficiency and survival anticipated.”

Document 278-1 (Injunction Measure 16):

<https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll7/id/24342>

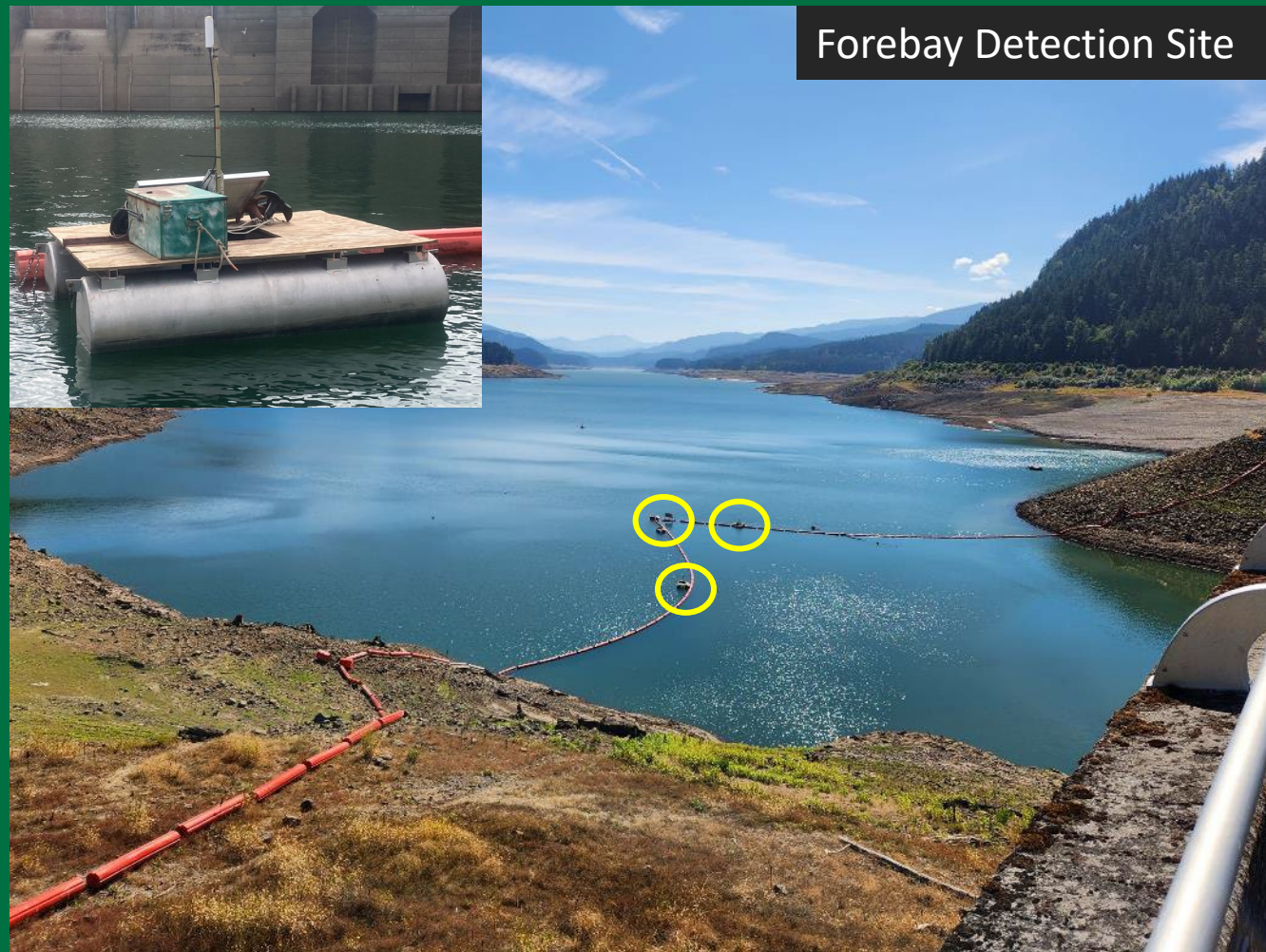


Acoustic Telemetry Evaluation

Head of Reservoir
Release Site



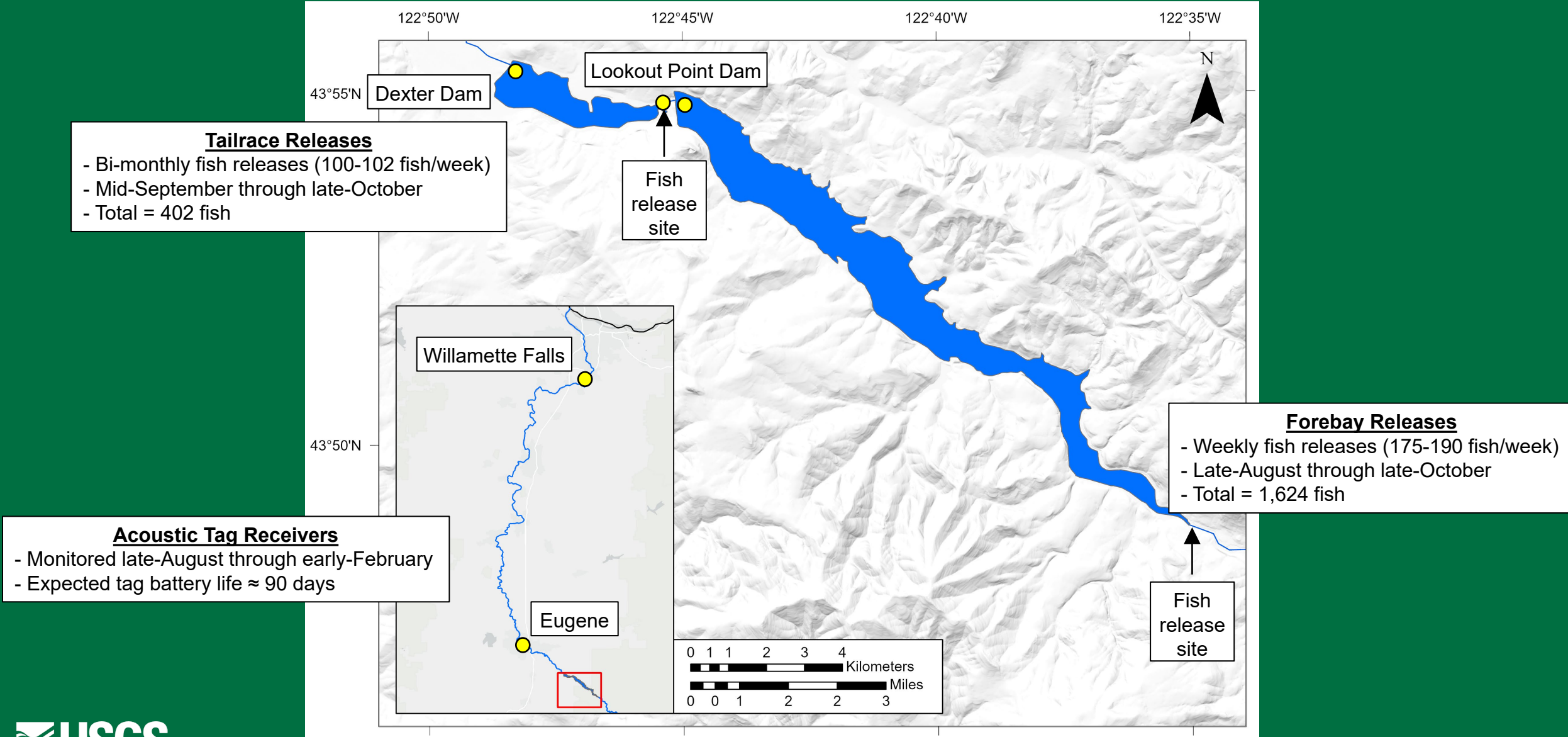
Forebay Detection Site

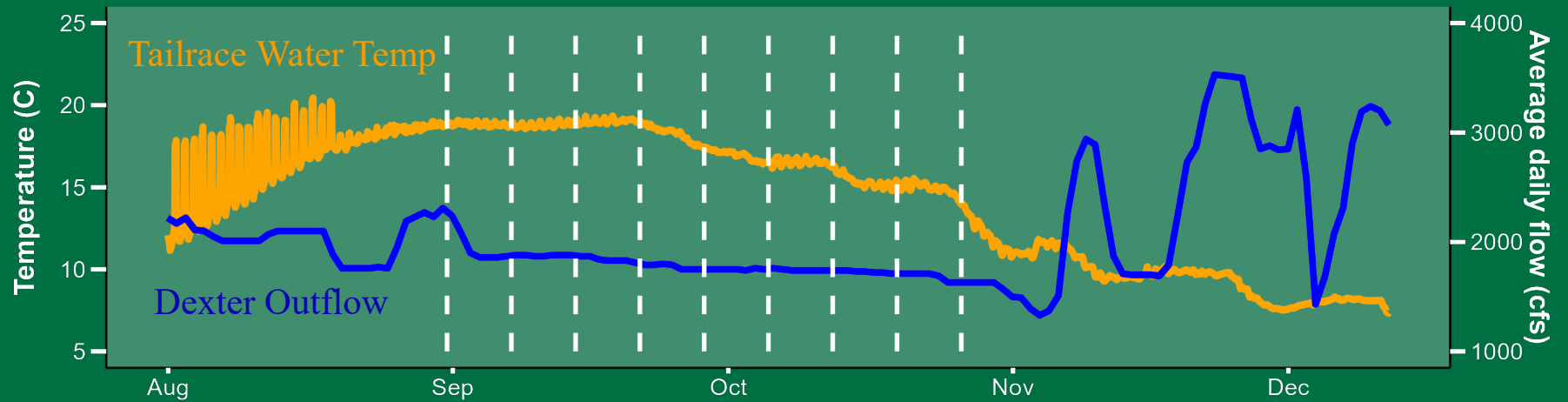
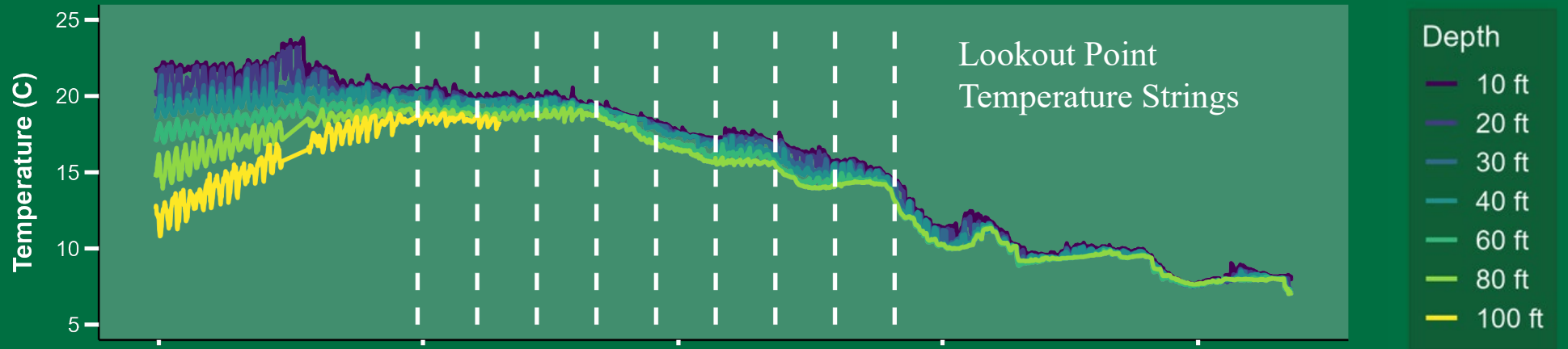
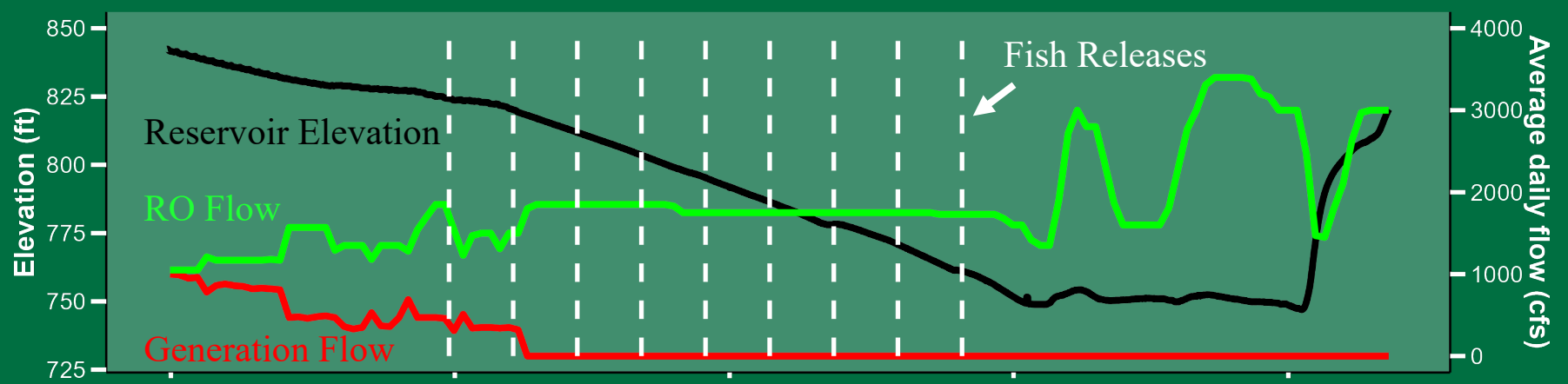


Tailrace
Release Site



Study Area and Timing of Fish Releases

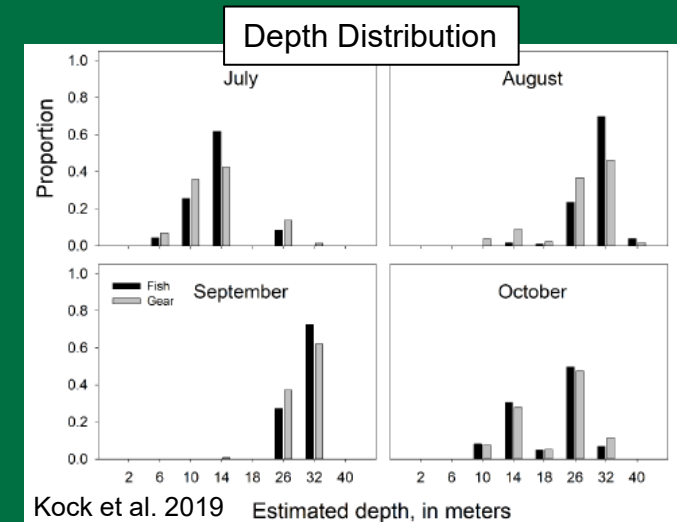
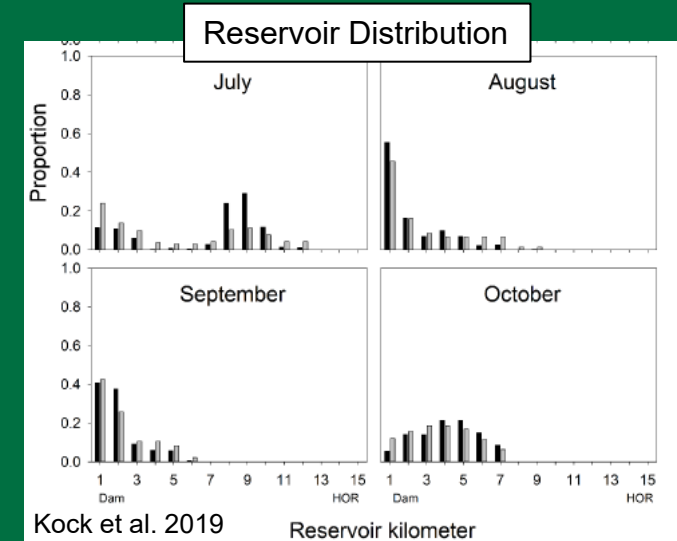
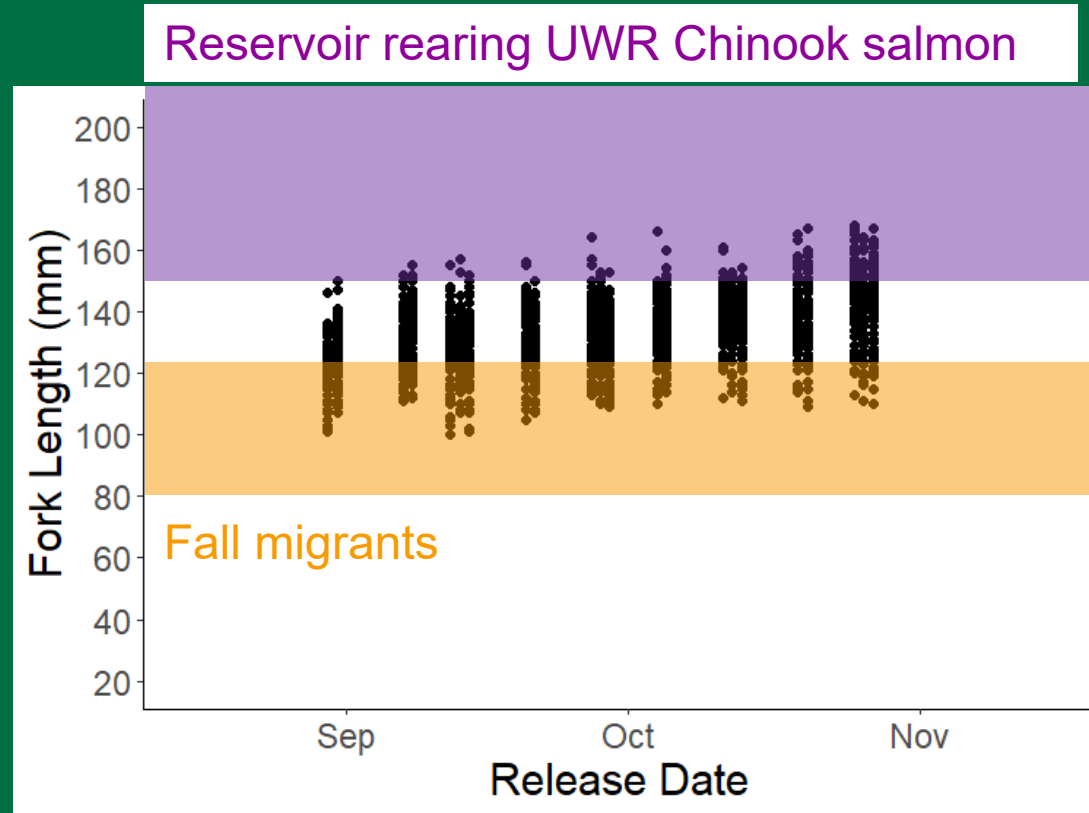
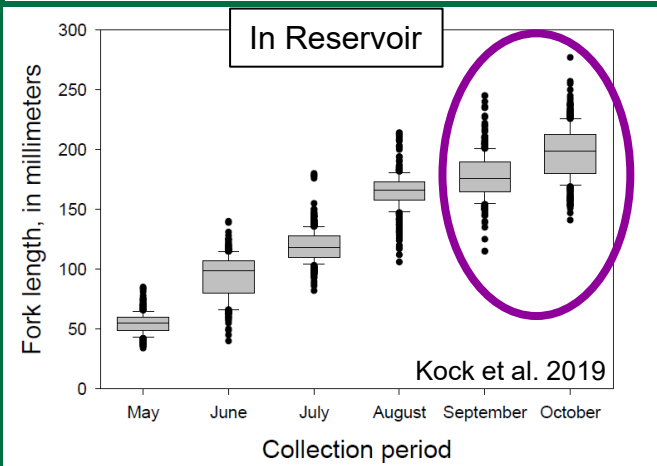
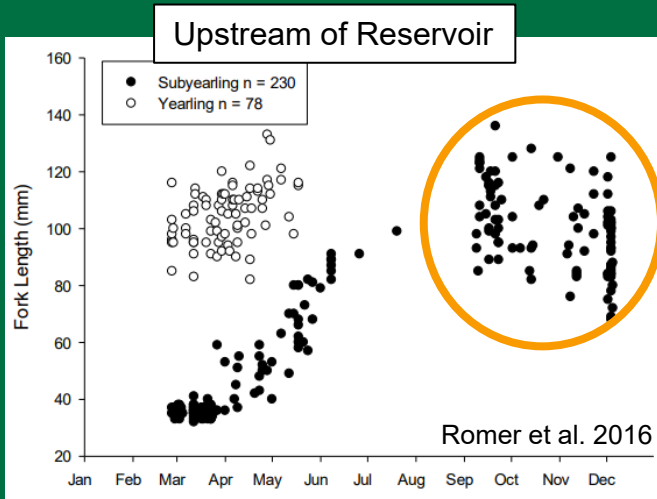




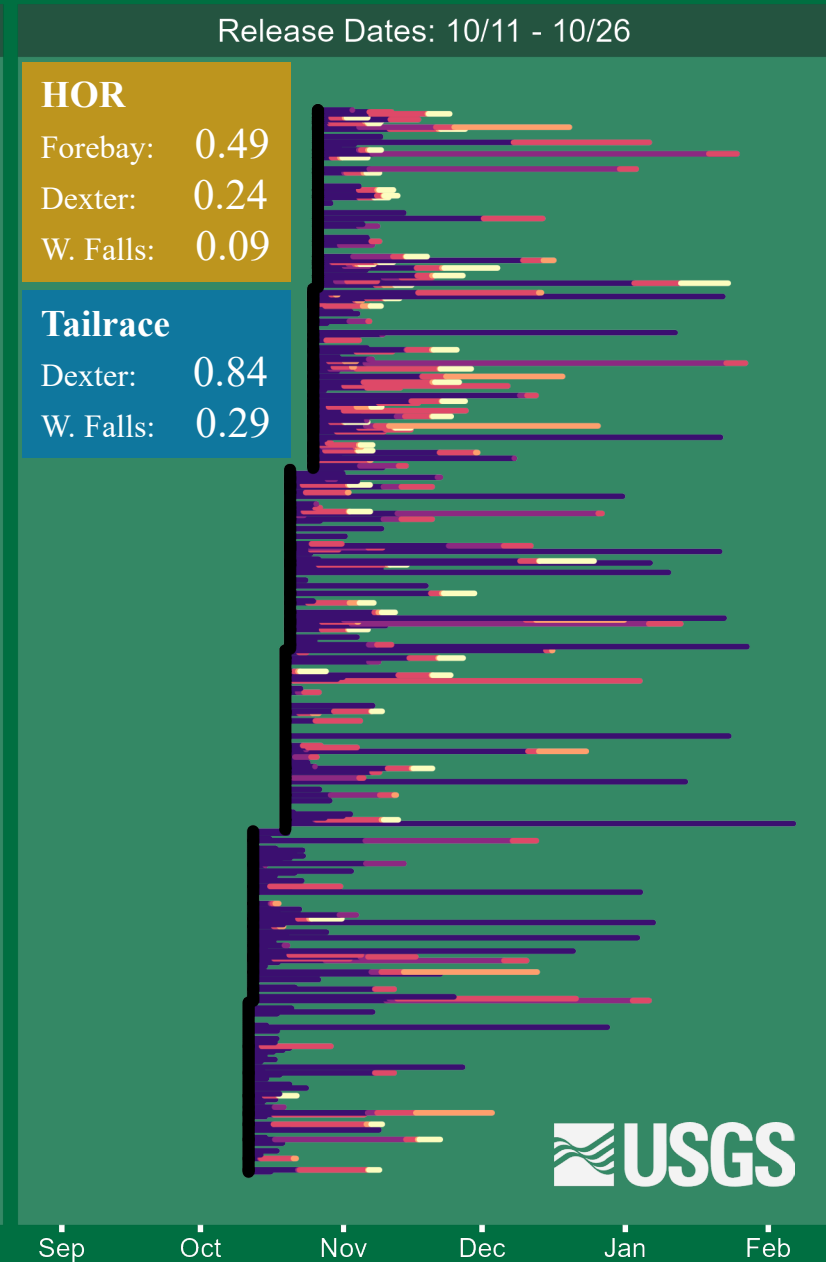
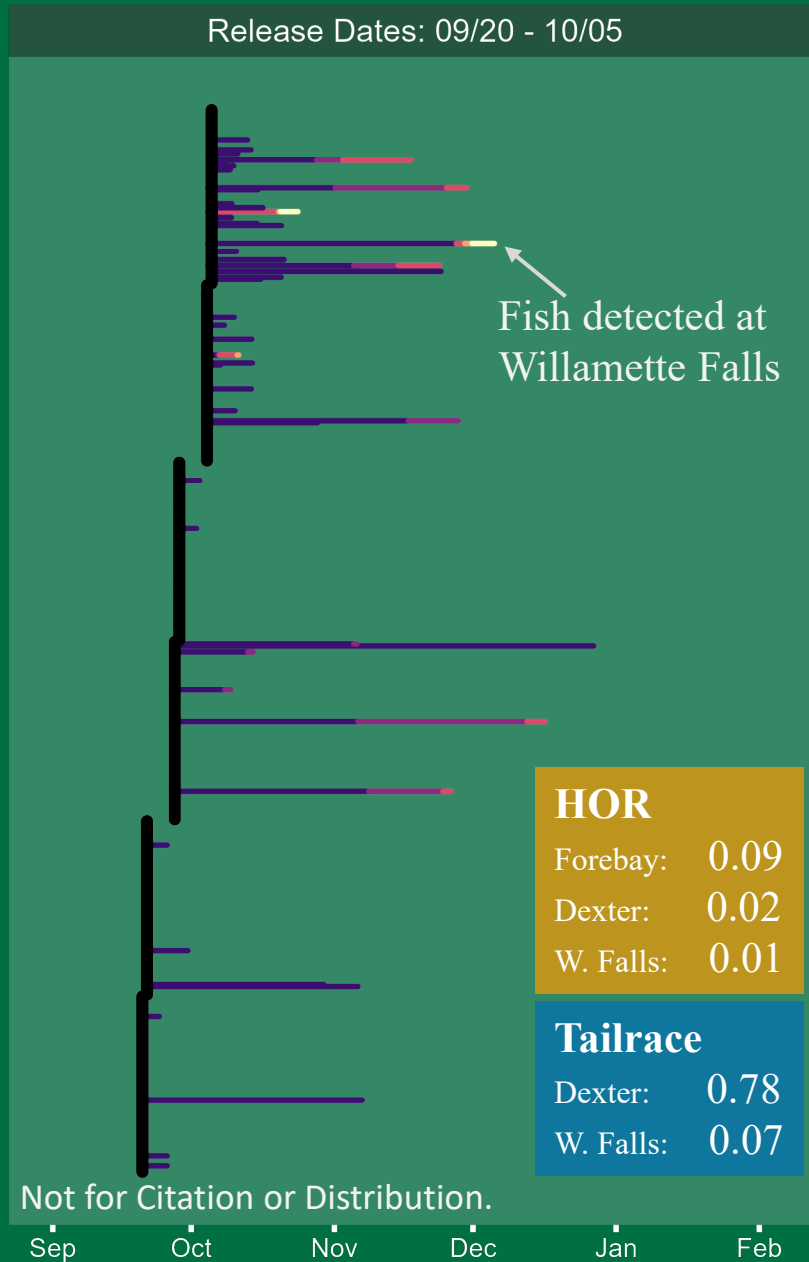
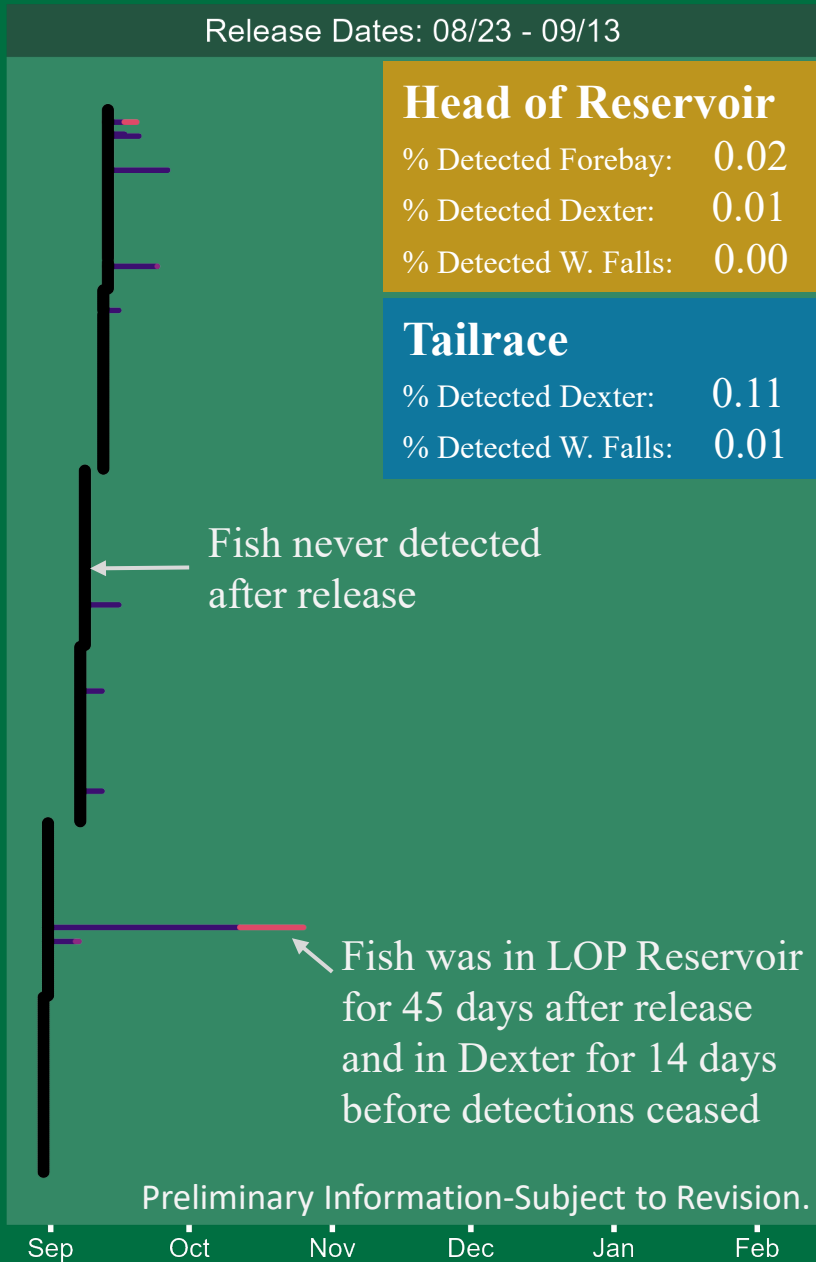
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Representativeness of Study Fish to Target Populations



In Reach: 0: Lookout Point Reservoir 1: LOP Tailrace 2: Dexter Forebay 3: Upper Willamette 4: Lower Willamette



Statistical Framework

BIOMETRIC PRACTICE

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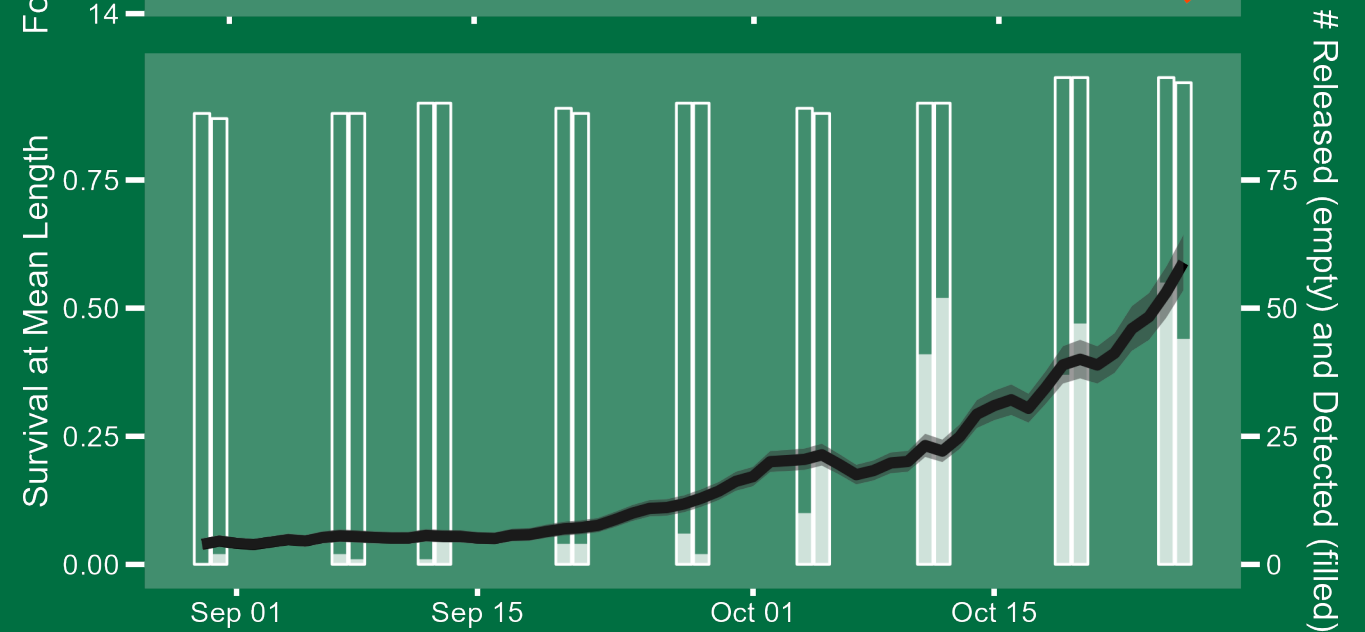
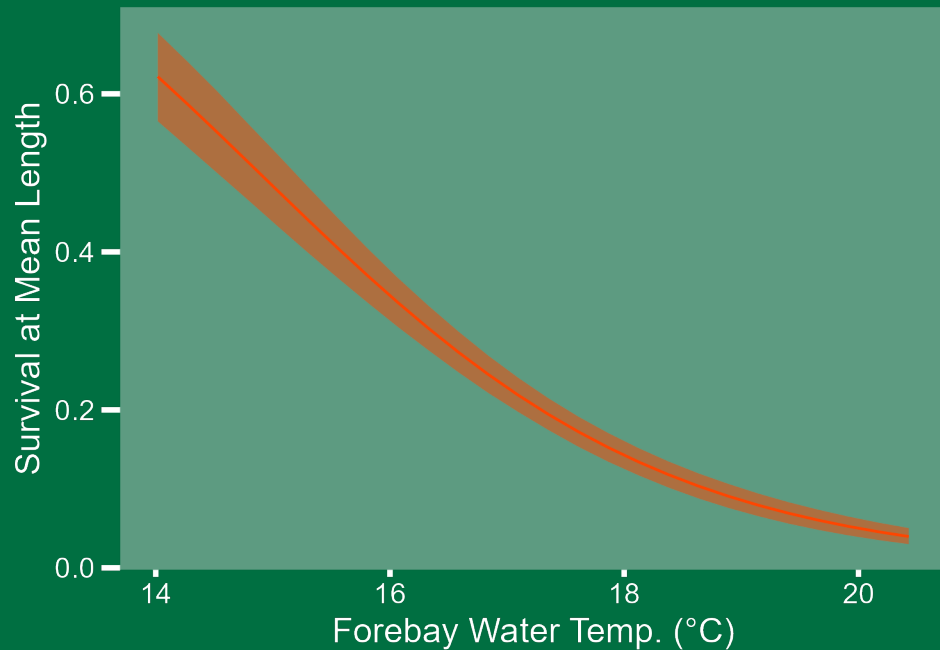
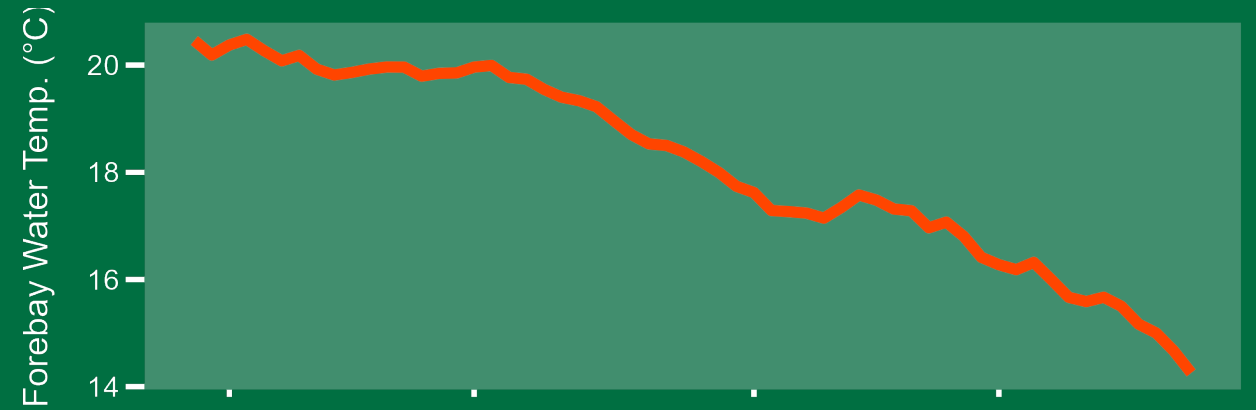
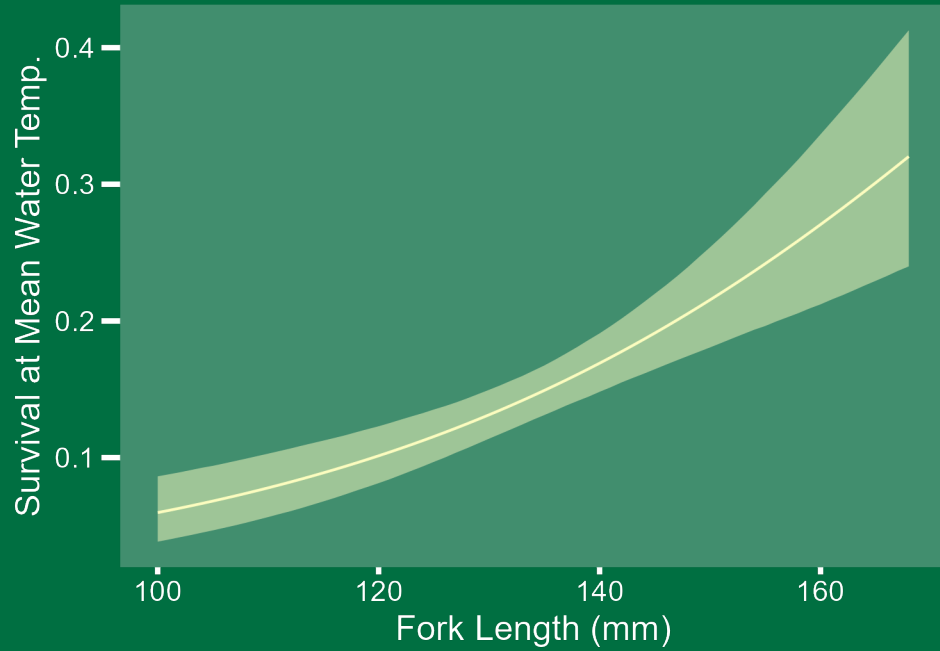
A temporally stratified extension of space-for-time
Cormack–Jolly–Seber for migratory animals

Dalton J. Hance | Russell W. Perry | John M. Plumb | Adam C. Pope

- Fish passage is a dynamic process in space and time
- We need statistical models to translate raw observations into inference
- Our framework focuses on relationships over time, not just point estimates

Reach	Apparent Survival	Median Residence Time
Release to Forebay	LOP Forebay Mean Daily Temp + Fish Length	LOP Forebay Mean Daily Temp
Forebay to Tailrace	LOP Forebay Elevation + RO Flow + Fish Length	LOP Forebay Elevation + RO Flow
Tailrace to Dexter Forebay	LOP Tailrace Mean Daily Temp + Fish Length	LOP Tailrace Mean Daily Temp
Dexter Forebay to Eugene	DEX Outflow + Fish Length	DEX Outflow
Eugene to Willamette Falls	Willamette Flow @ Eugene + Fish Length	Willamette Flow @ Eugene

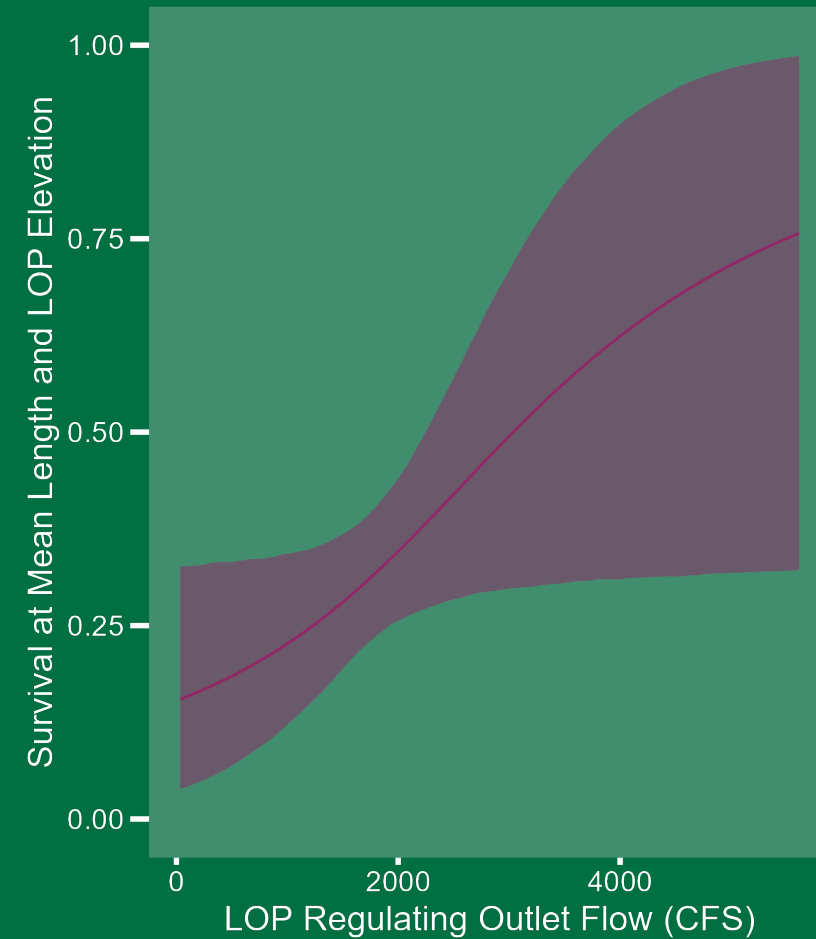
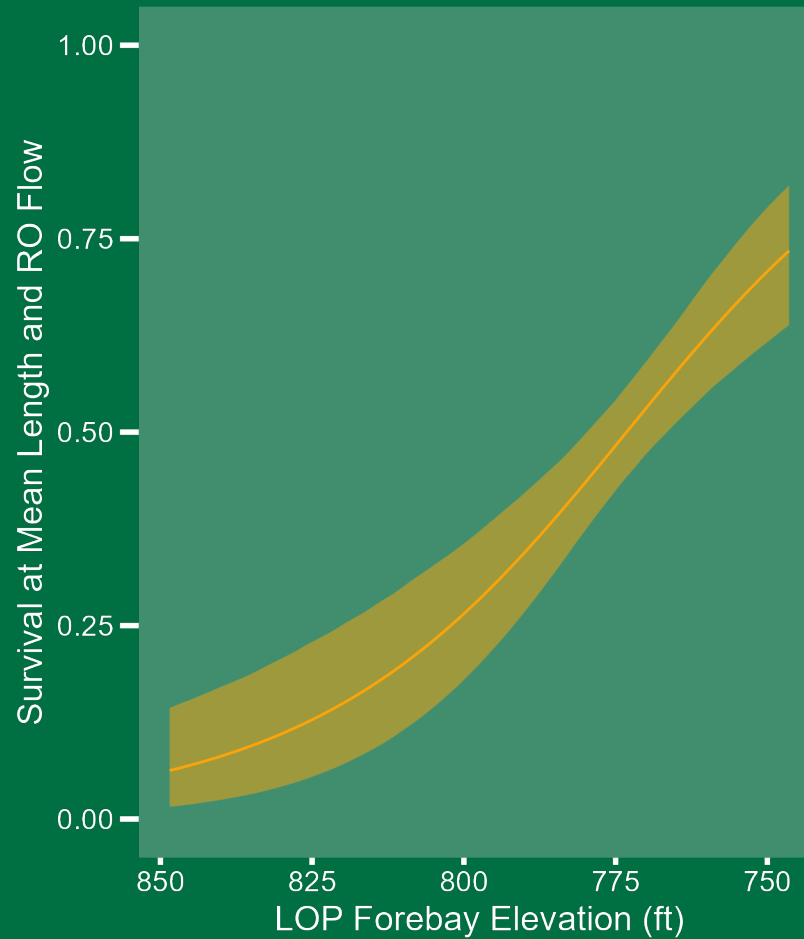
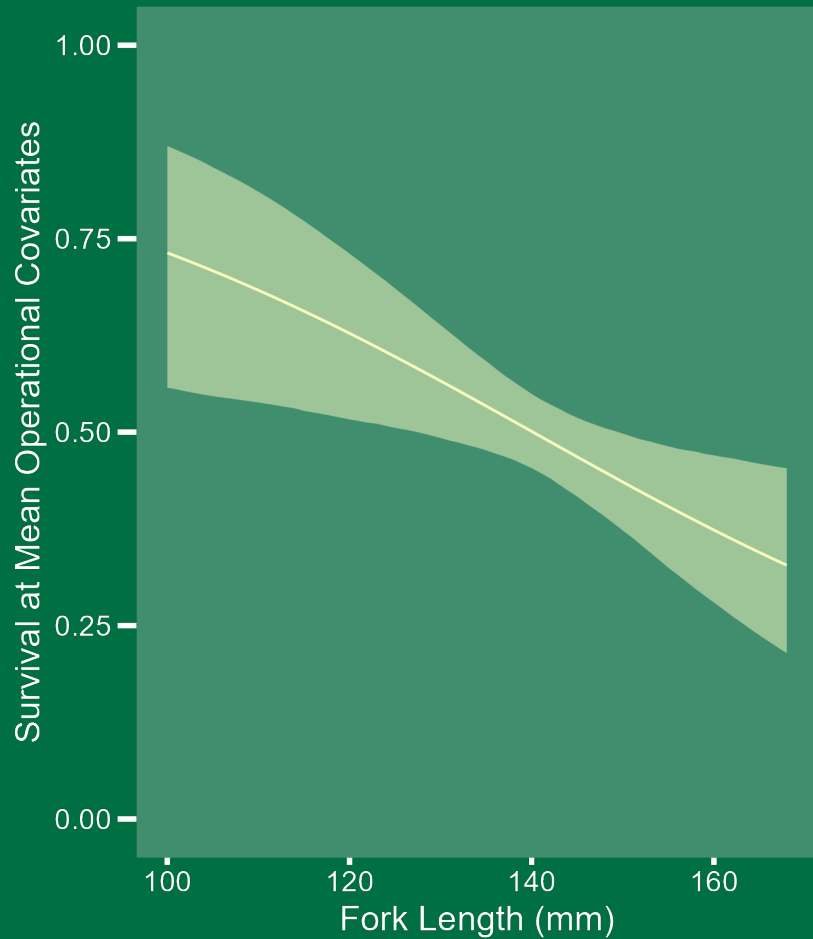
Apparent Survival: Release to Forebay



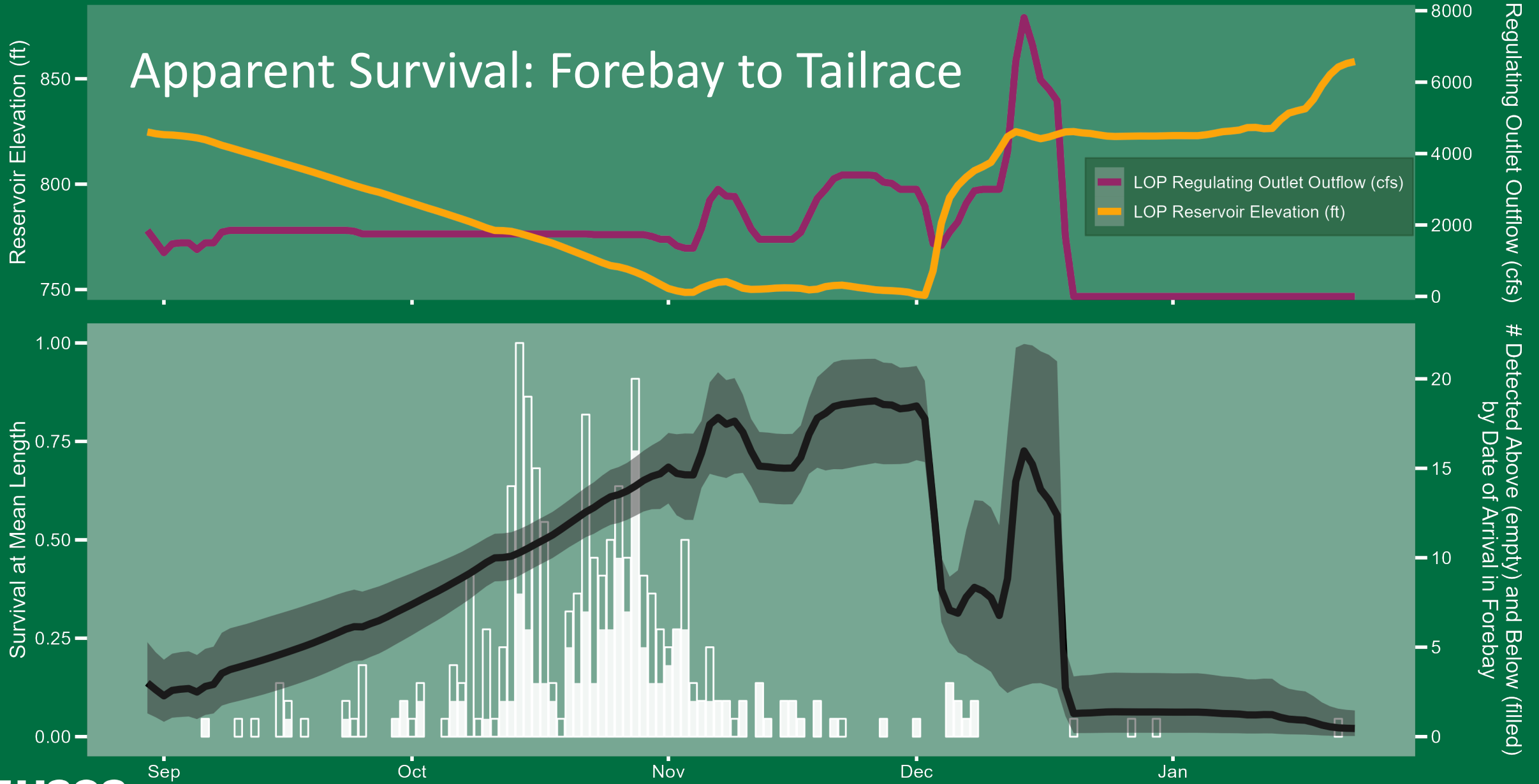
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Apparent Survival: Forebay to Tailrace

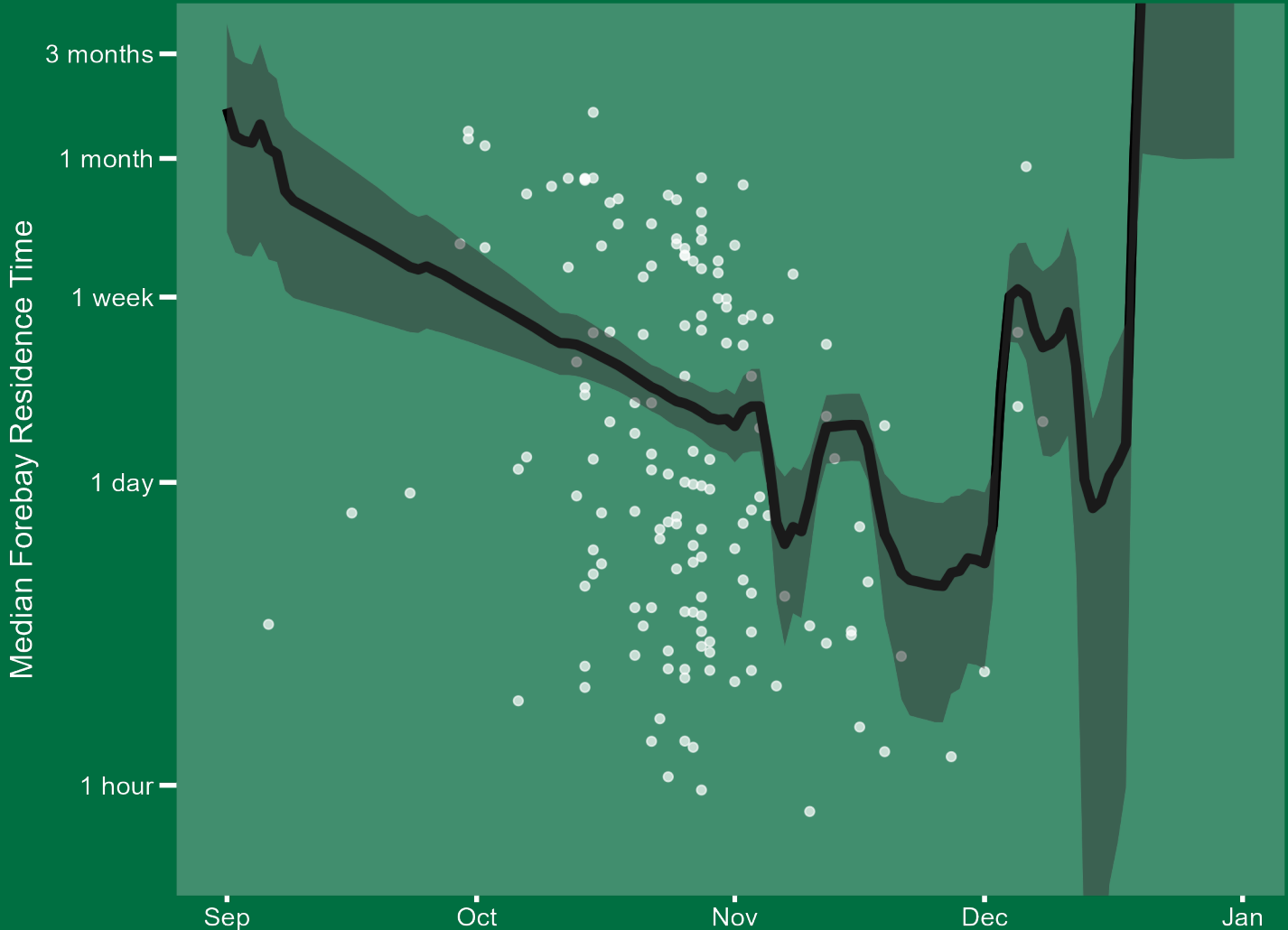
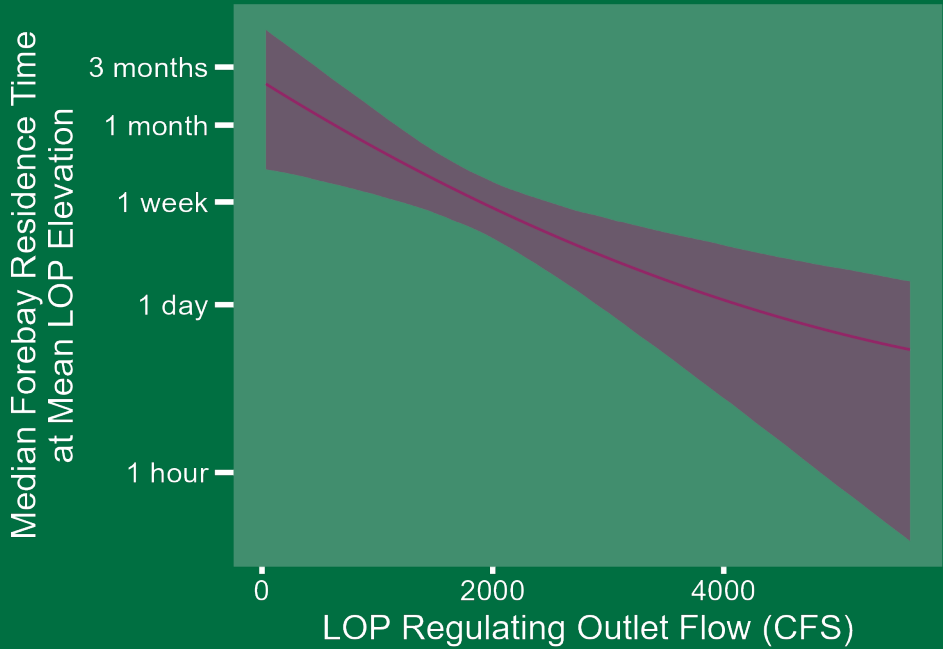
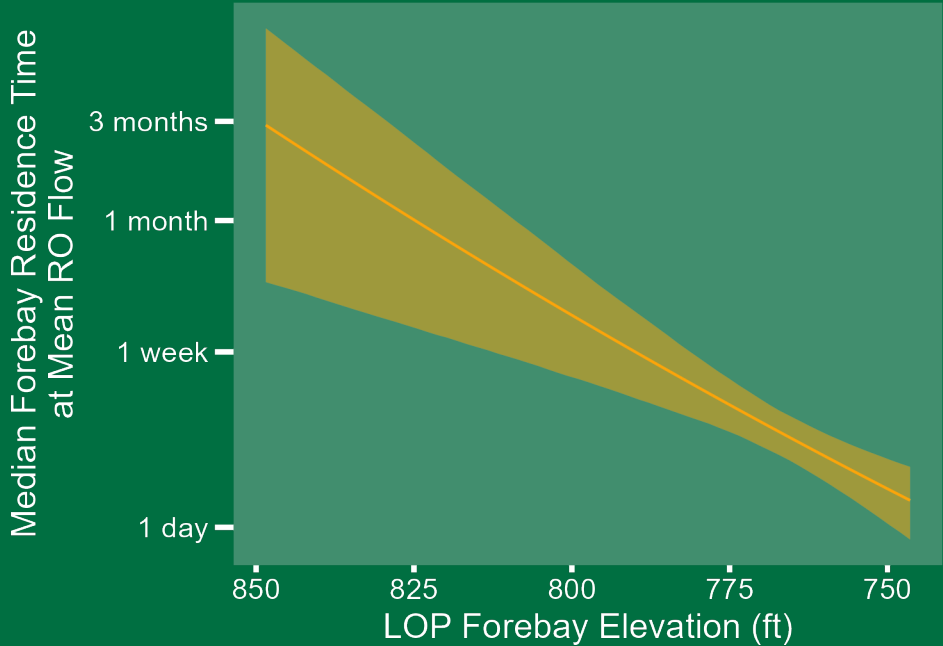


Apparent Survival: Forebay to Tailrace



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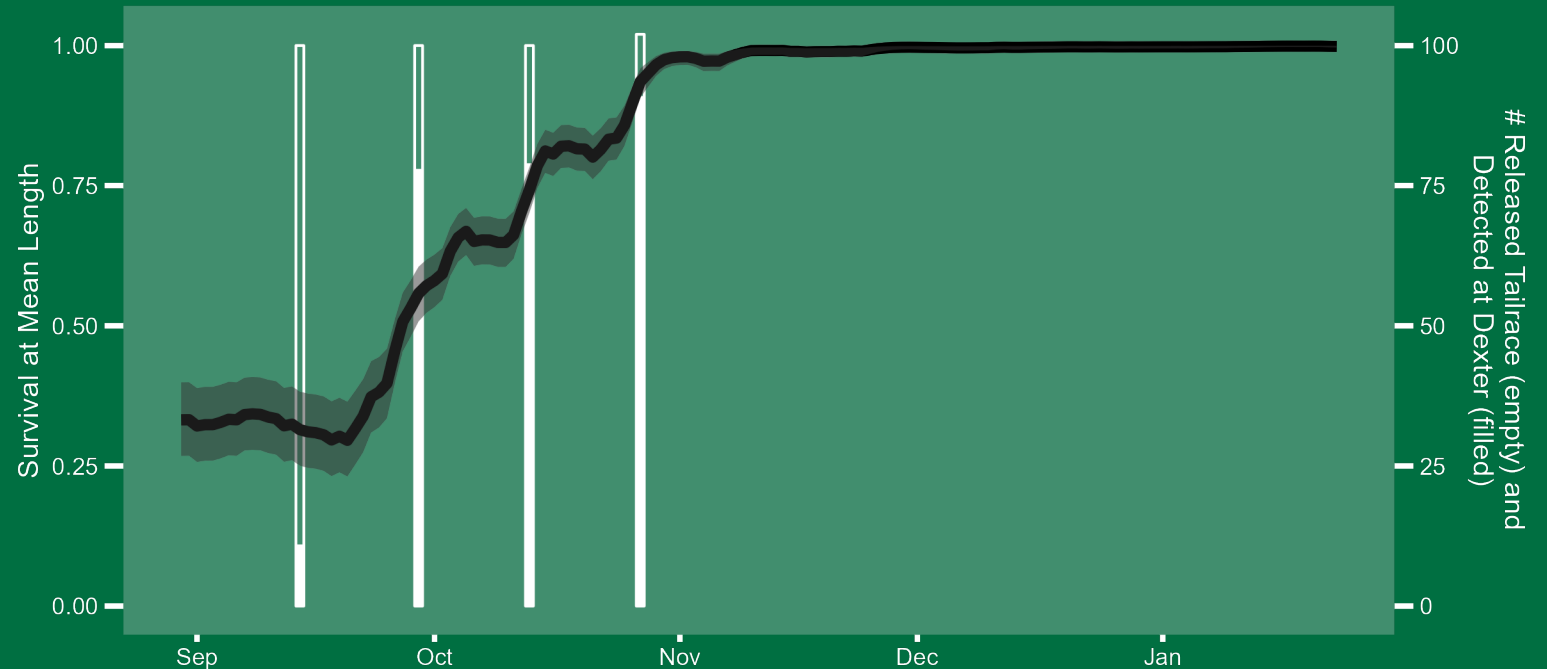
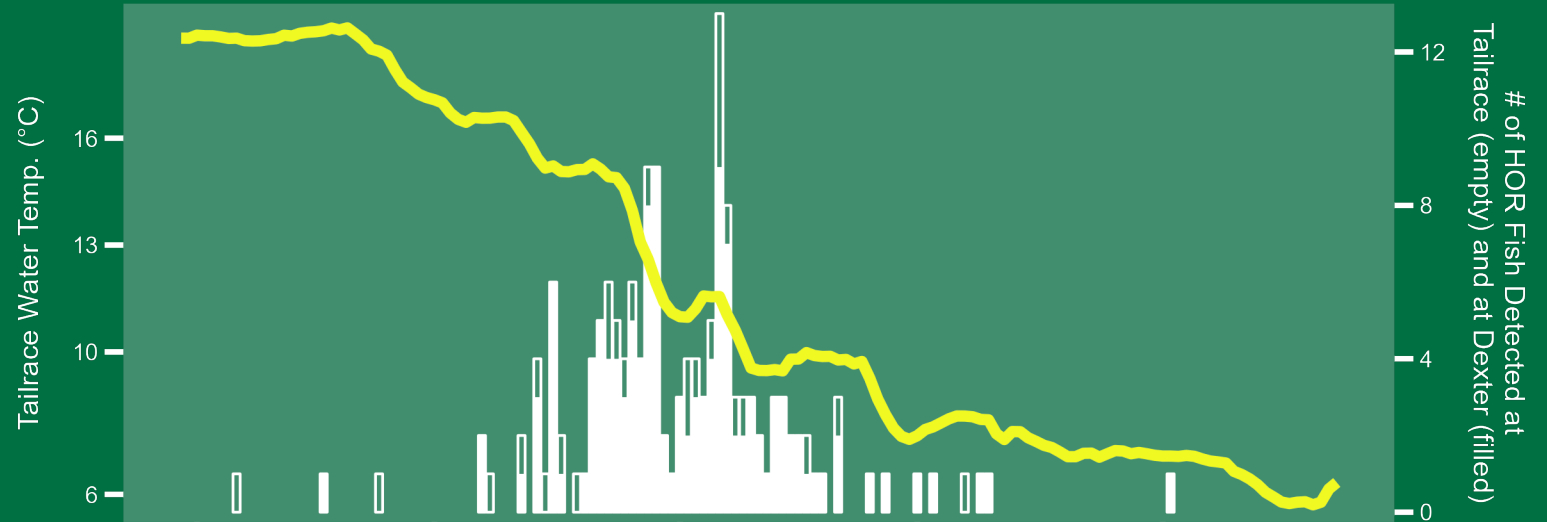
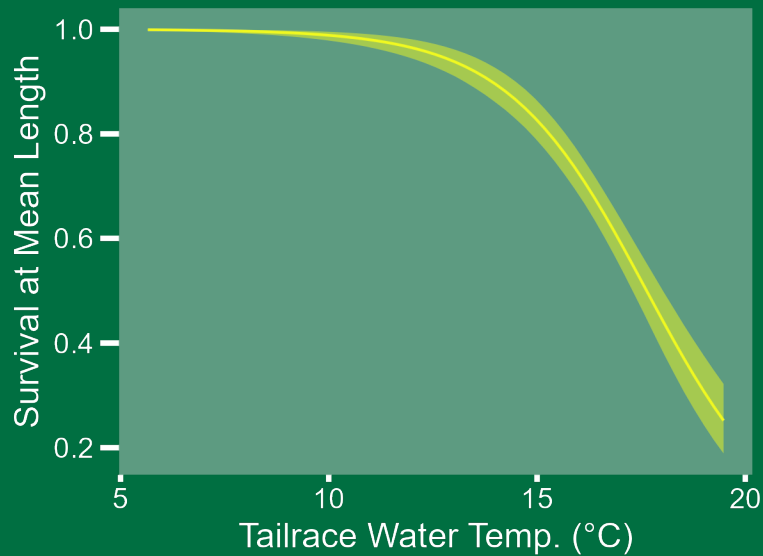
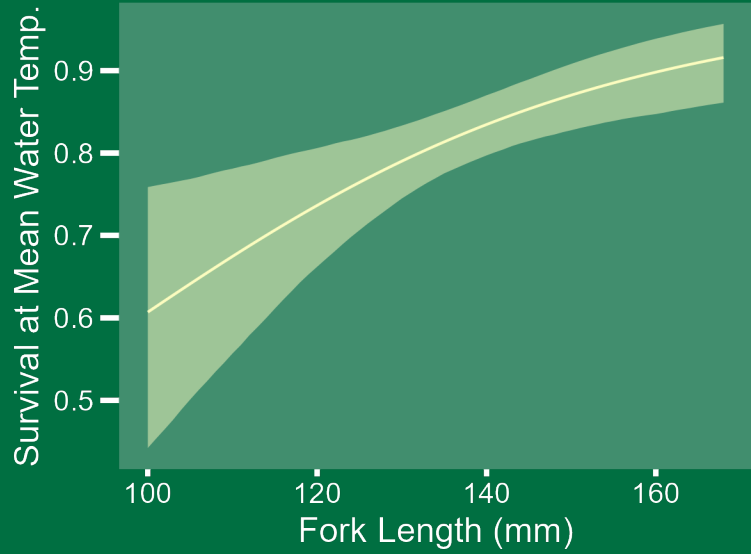
LOP Forebay Delay



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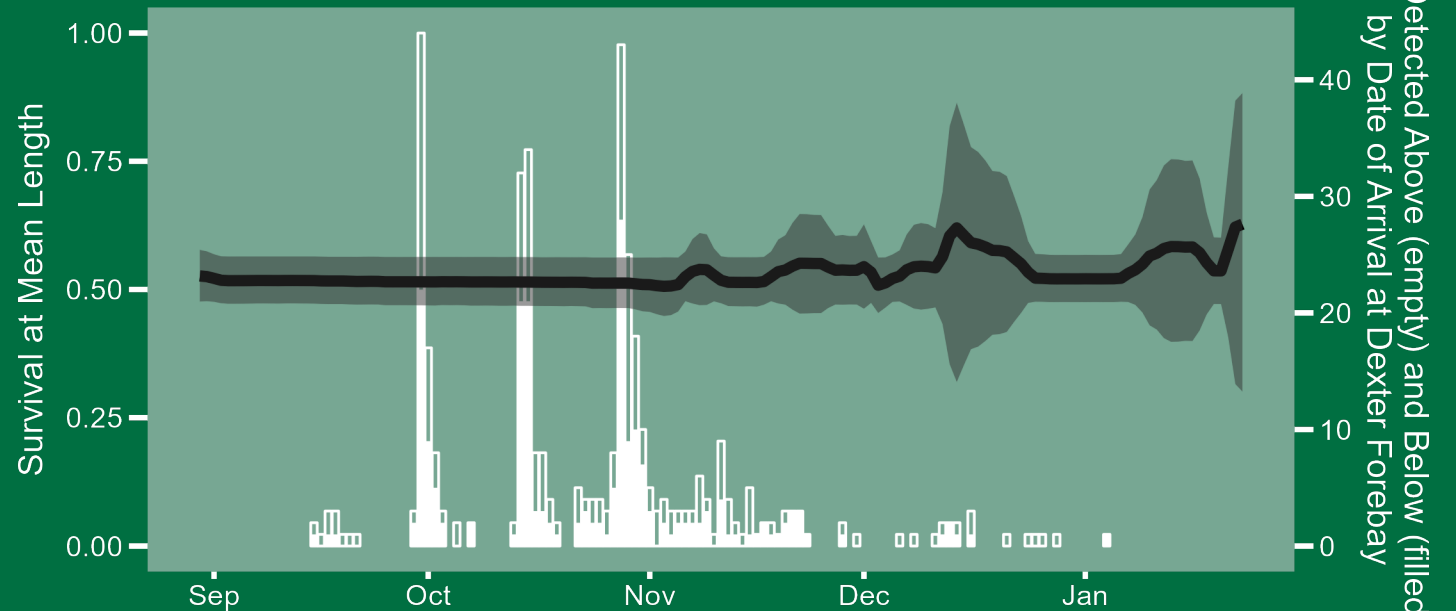
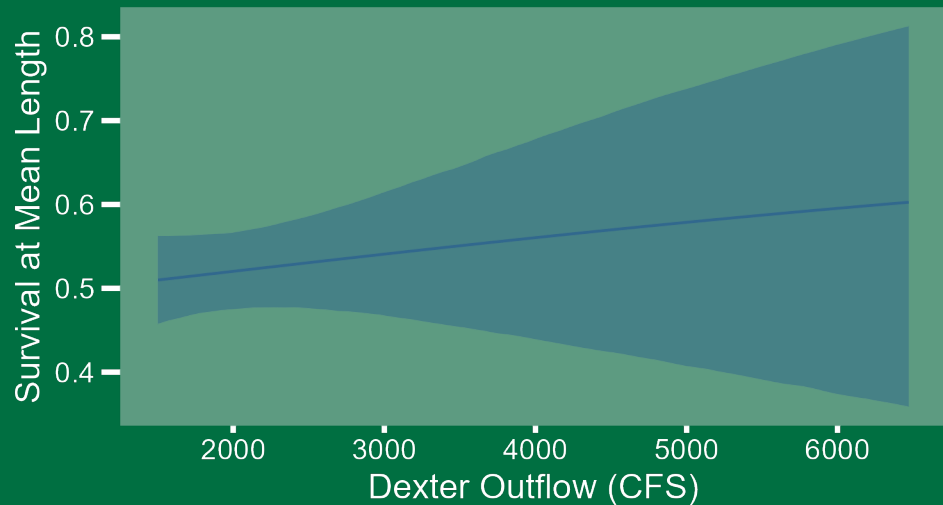
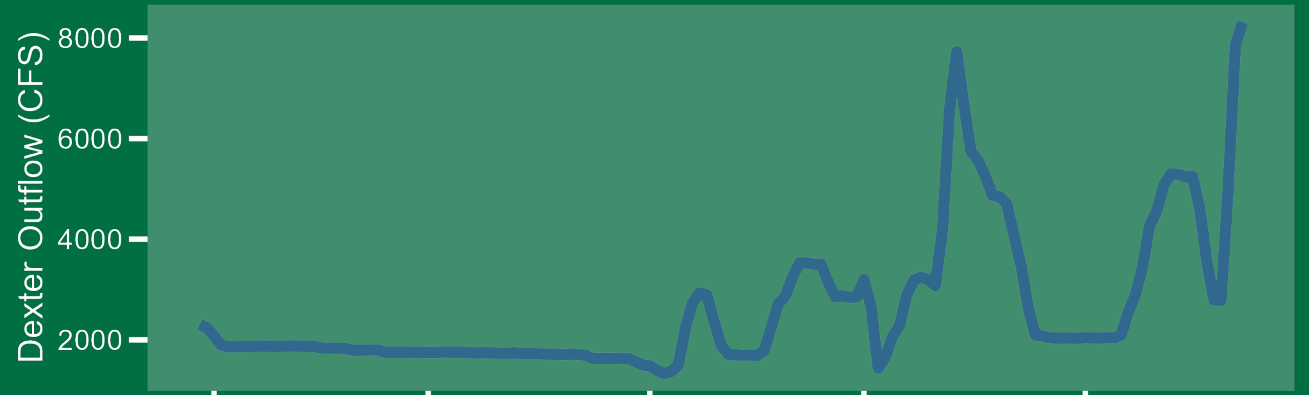
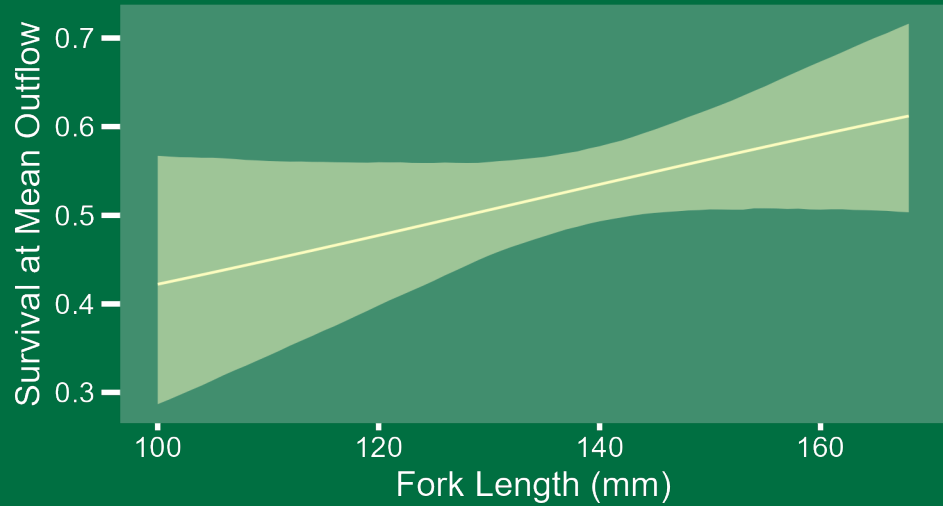
Apparent Survival: Tailrace to Dexter



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Apparent Survival: Dexter to Eugene



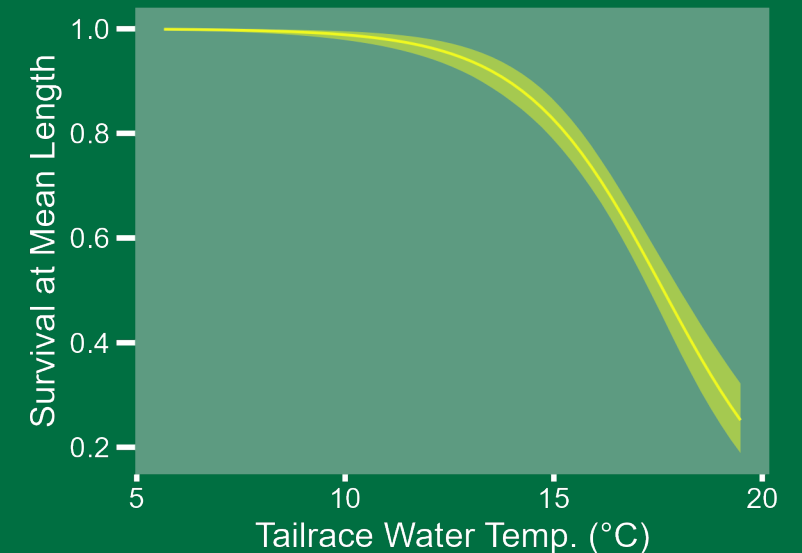
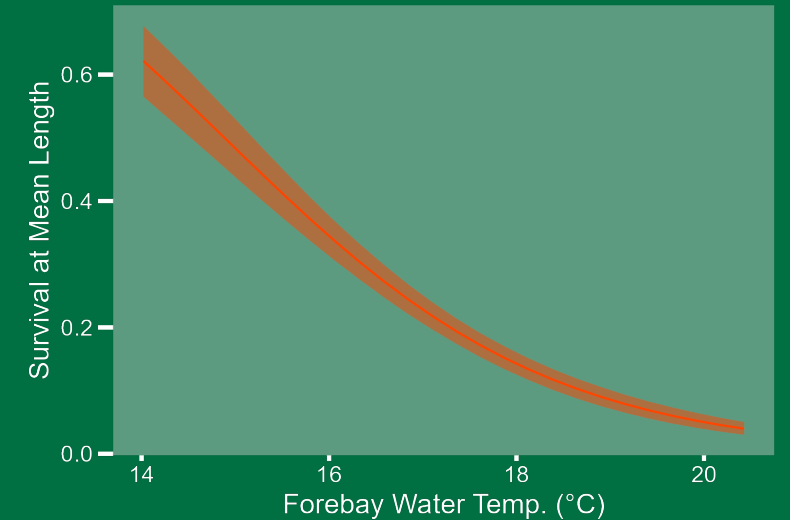
Discussion

- Our study was designed to evaluate multiple aspects of the biological goal of the implementation plan for Injunction Measure 16
- Results are *very* preliminary
 - Study ended February 4th
 - We only had time to fit one model structure
- First cut model fits well, but there is room for improvement
 - Not adjusted for tag life
 - Will explore and assess other model structures

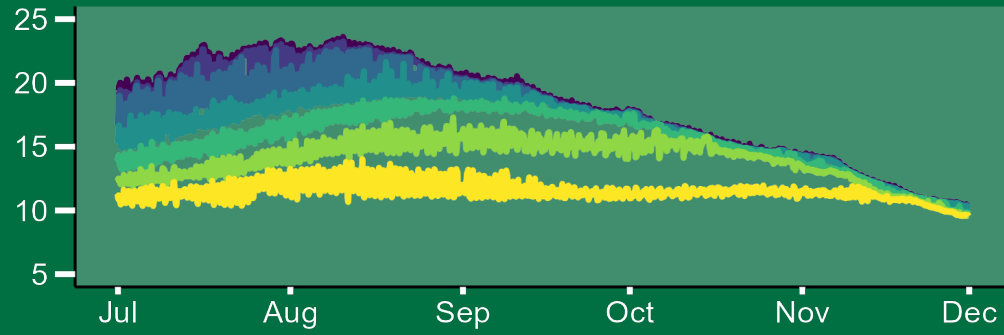
Discussion

Apparent survival was poor in Lookout Point Reservoir *and* in Dexter Reservoir in September

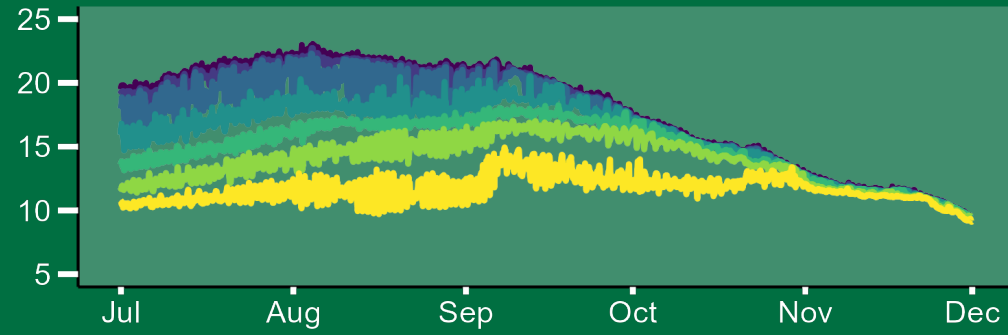
- Elevated water temperatures
 - Stressful for juvenile salmon
 - Optimum for non-native predators (e.g. smallmouth bass)
- Reservoir homothermic by mid-August
 - Reservoir rearing Chinook salmon preferentially inhabit cool water at depth
 - Drawdown operations began mid-June, regulating outlets in use by mid-July. Impact on water temperatures?



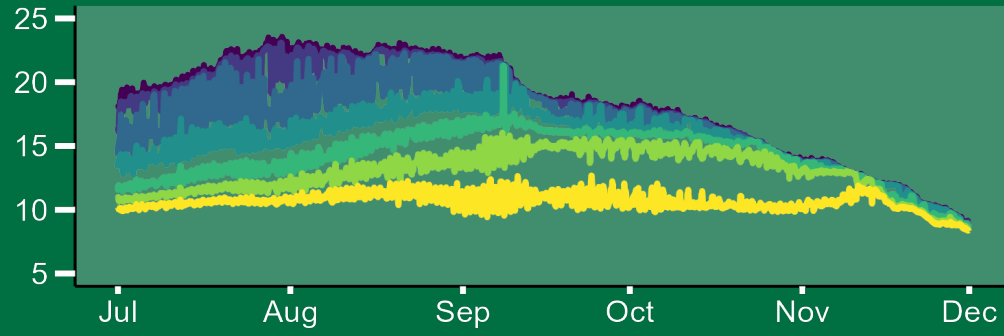
2018



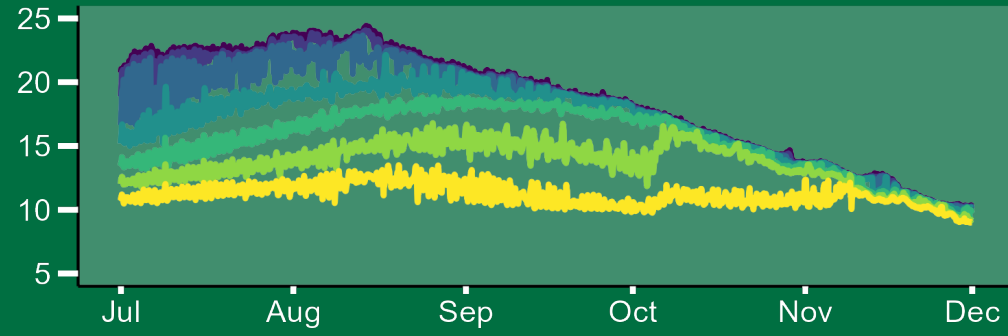
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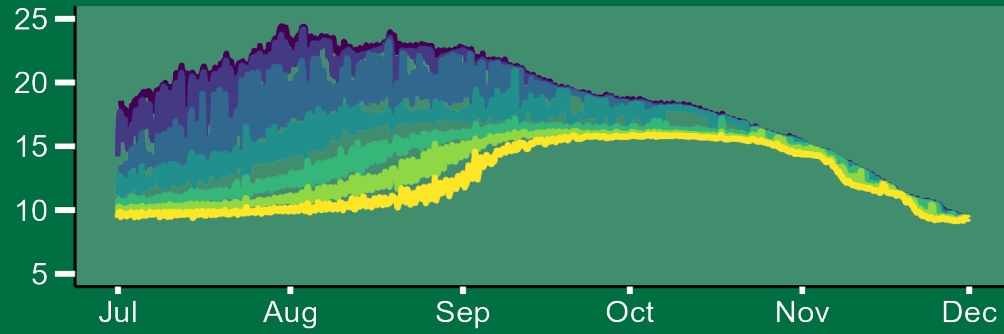
2020



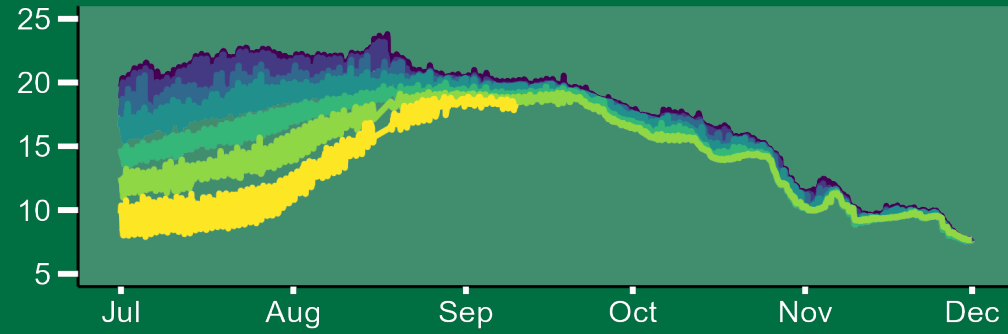
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2022



2023



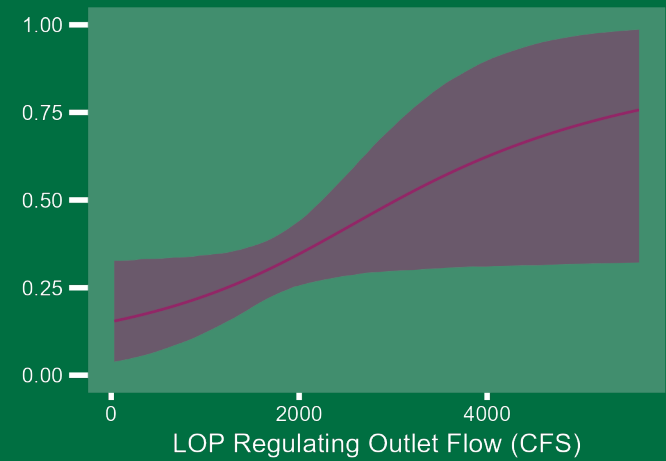
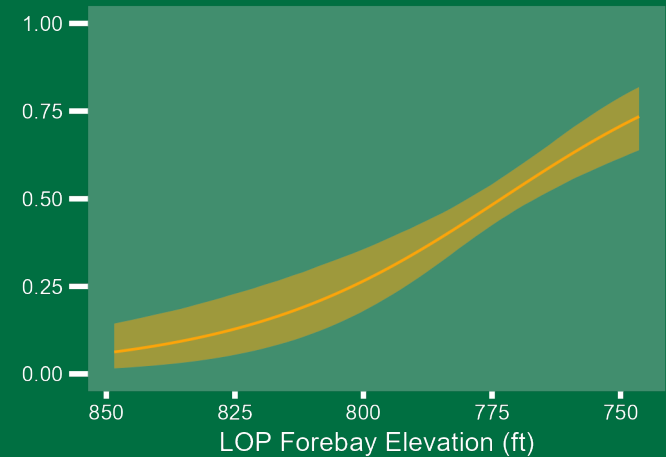
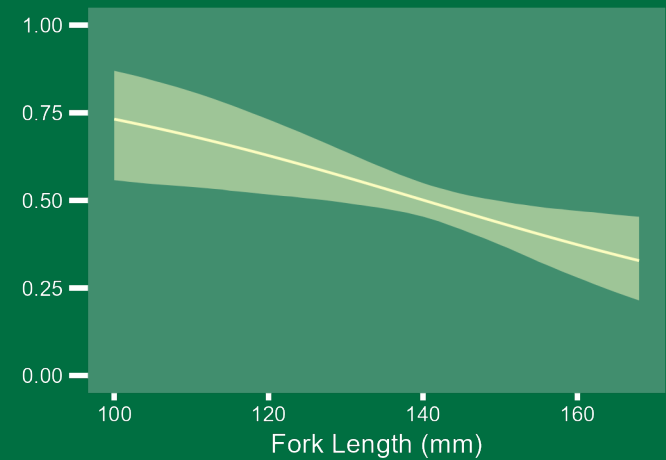
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https://www.nwd-wc.usace.army.mil/fppub/water_quality/tempstrings/

Discussion

The probability of passage and survival through LOP peaked at minimum reservoir elevation and higher RO outflows

- Higher passage and survival for smaller fish
- Maximum: 0.85 (90% CI: [0.7, 0.96]) on November 26
 - Early minimum: 0.1 [0.04, 0.2] on September 1
 - Late minimum: 0.02 [0.002, 0.07] late January
- Minimal delay (< 1 day) at lowest elevations and highest outflows
 - Evidence of “improved volitional passage”?



Conclusions

- High head dam fish passage is complex
 - Operations targeting one life stage or point in time may have unintended consequences at other places and times
 - Study designs that incorporate time and evaluate survival relationships over a range of conditions are important for identifying management levers
- The Lookout Point Project is not just LOP Dam
 - Survival and travel times varied over space and time
 - There is evidence of mortality and delay in and through Dexter reservoir and dam
- Second year study planned for this fall
 - Changes to predator community?
 - Return of the thermocline?

Acknowledgements/Questions

USACE: Scott Fielding, Todd Pierce, David Trachtenbarg, Greg Taylor

OSU Surrogate Program: Olivia Hakanson, Michelle Scanlan,
Jim Peterson

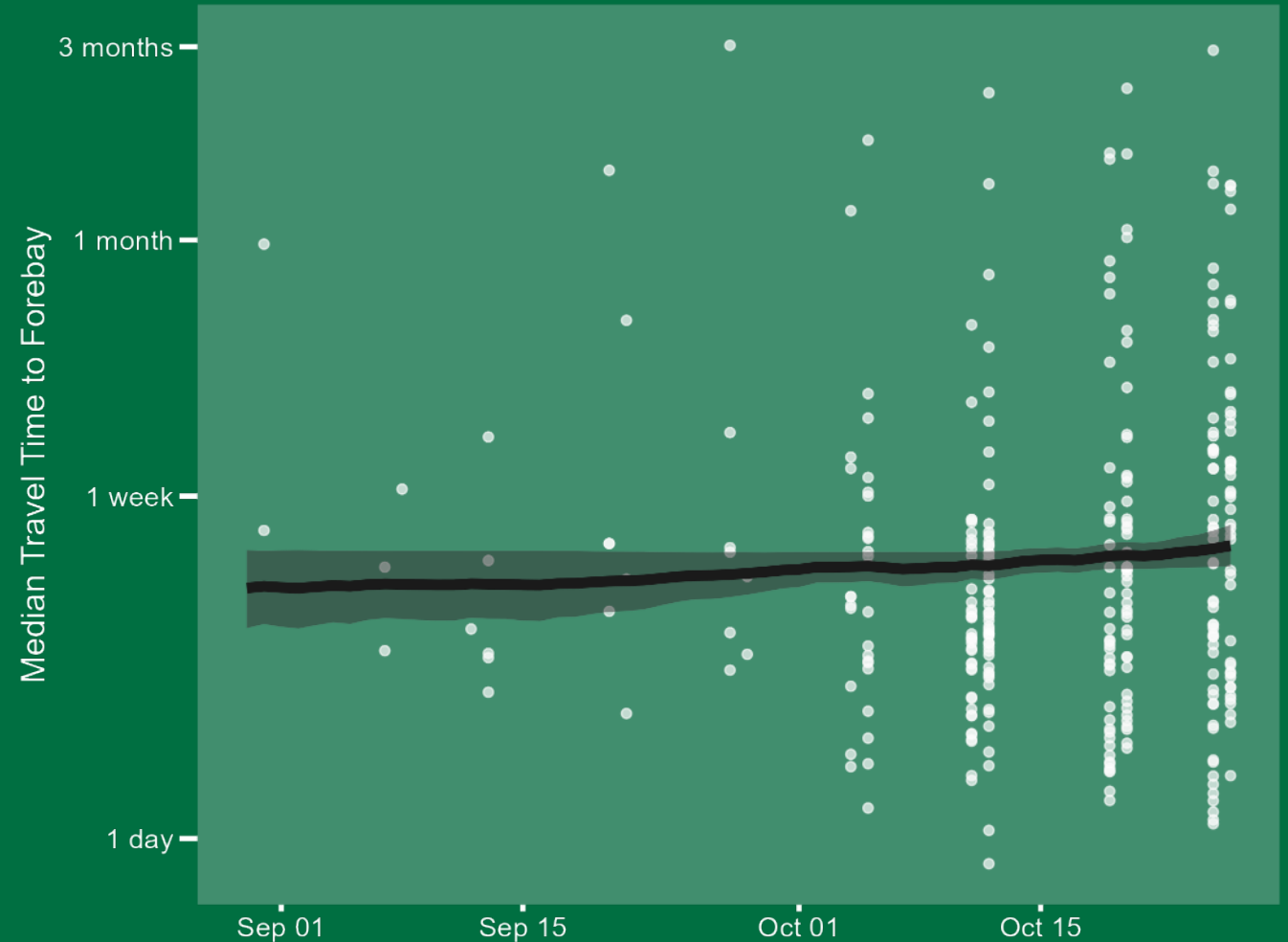
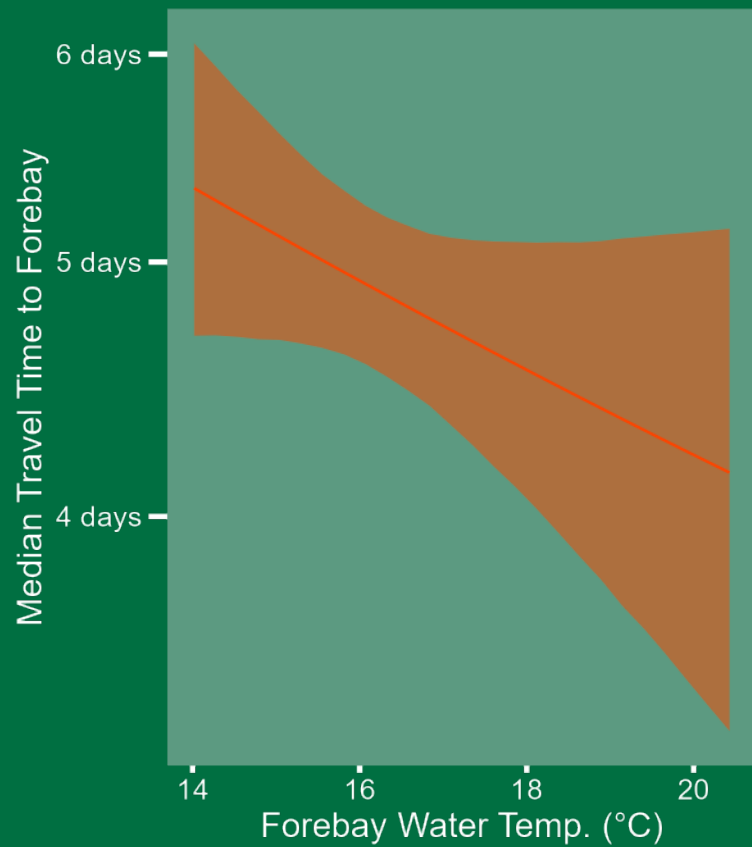
USGS: Jamie Sprando, Phil Haner, Ryan Tomka, Gabe Hansen,
Georgia Martin, Brian Ekstrom, Laurel Stratton, Karen Bartelt



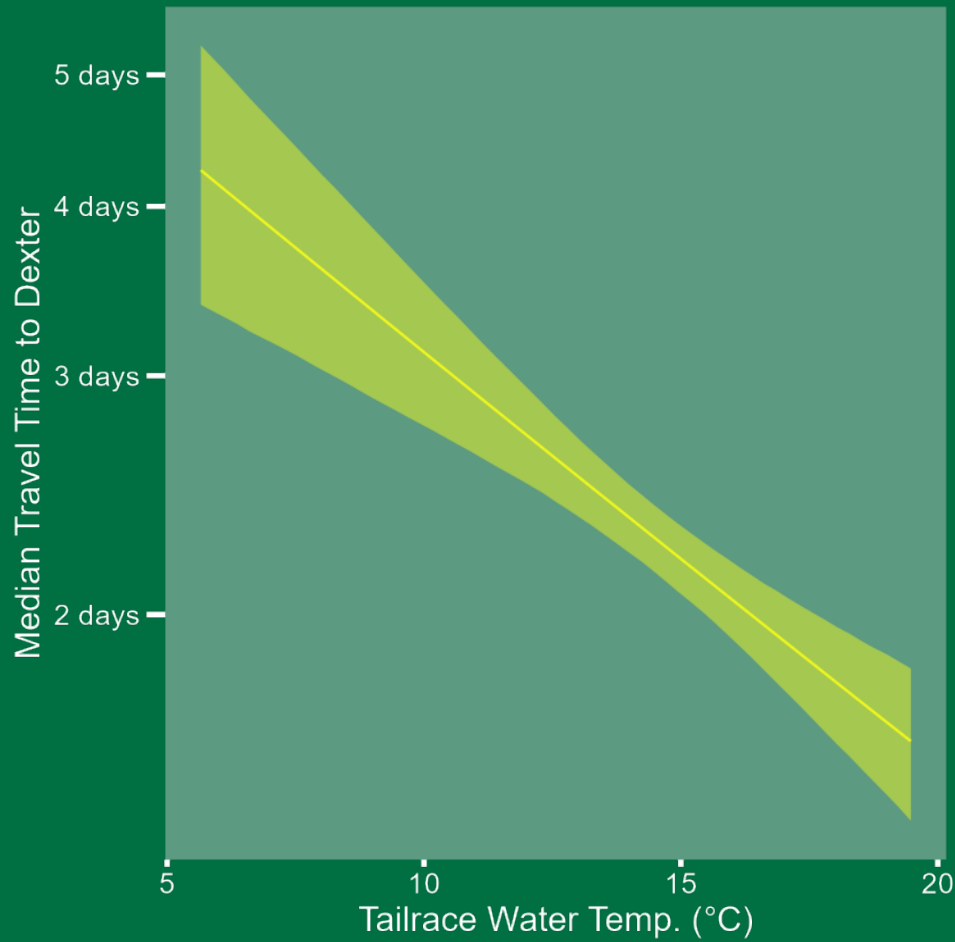
Week of	Release Site	Number released	Proportion of fish detected at				
			LOP Forebay	LOP Tailrace	Dexter Forebay	Eugene	Willamette Falls
8/31/2023	Head of Res	175	0.01	0.01	0.01	0.00	0.00
9/7/2023	Head of Res	176	0.02	0.00	0.00	0.00	0.00
9/14/2023	Head of Res	180	0.03	0.02	0.01	0.00	0.00
	Tailrace	100	-	-	0.11	0.03	0.01
9/21/2023	Head of Res	177	0.05	0.00	0.00	0.00	0.00
9/28/2023	Head of Res	180	0.04	0.03	0.01	0.00	0.00
	Tailrace	100	-	-	0.78	0.41	0.07
10/5/2023	Head of Res	177	0.18	0.04	0.04	0.02	0.01
10/12/2023	Head of Res	180	0.52	0.15	0.12	0.06	0.03
	Tailrace	100	-	-	0.79	0.46	0.28
10/19/2023	Head of Res	190	0.44	0.23	0.21	0.11	0.07
10/26/2023	Head of Res	189	0.52	0.35	0.34	0.22	0.16
	Tailrace	102	-	-	0.89	0.44	0.30



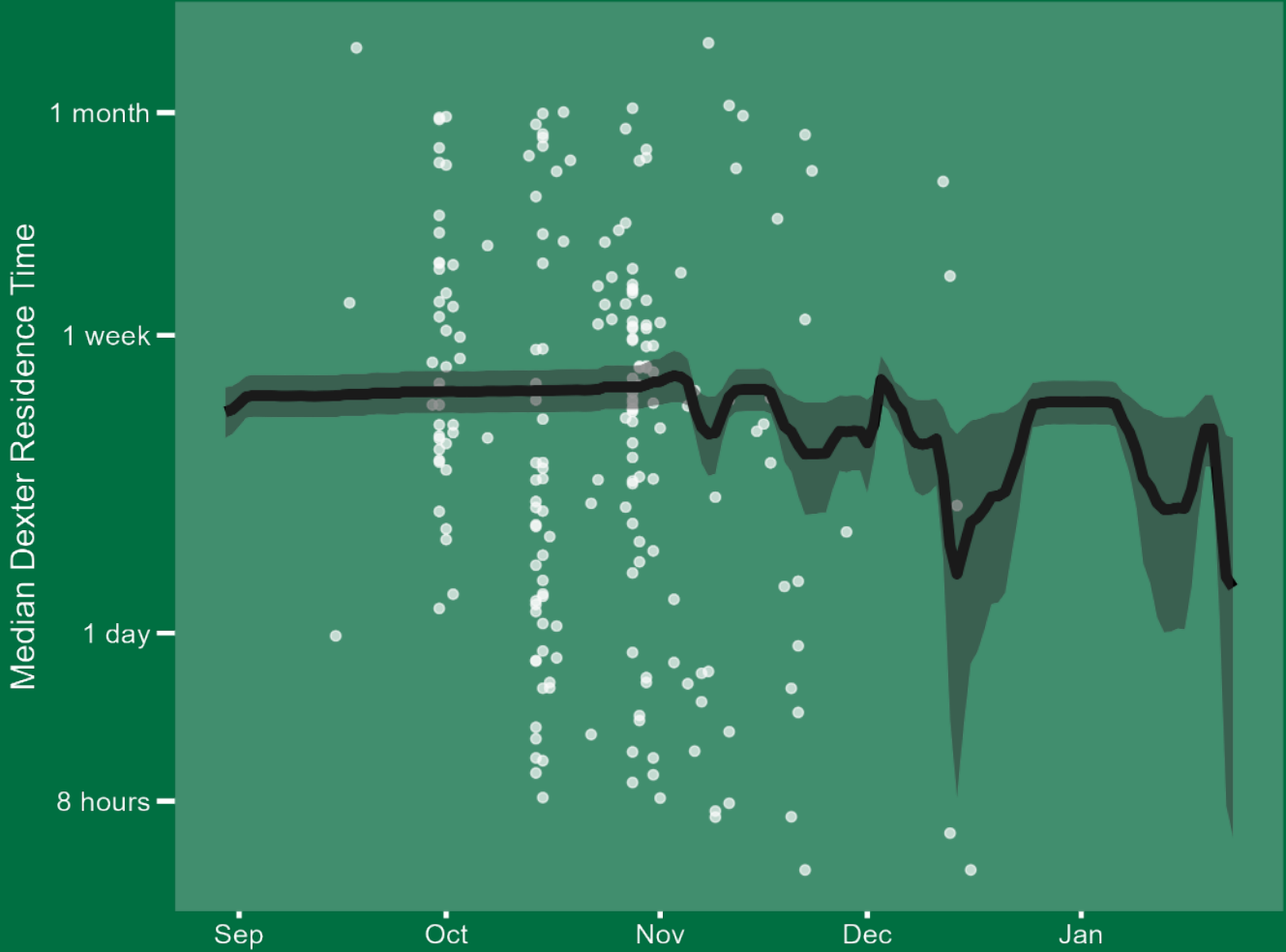
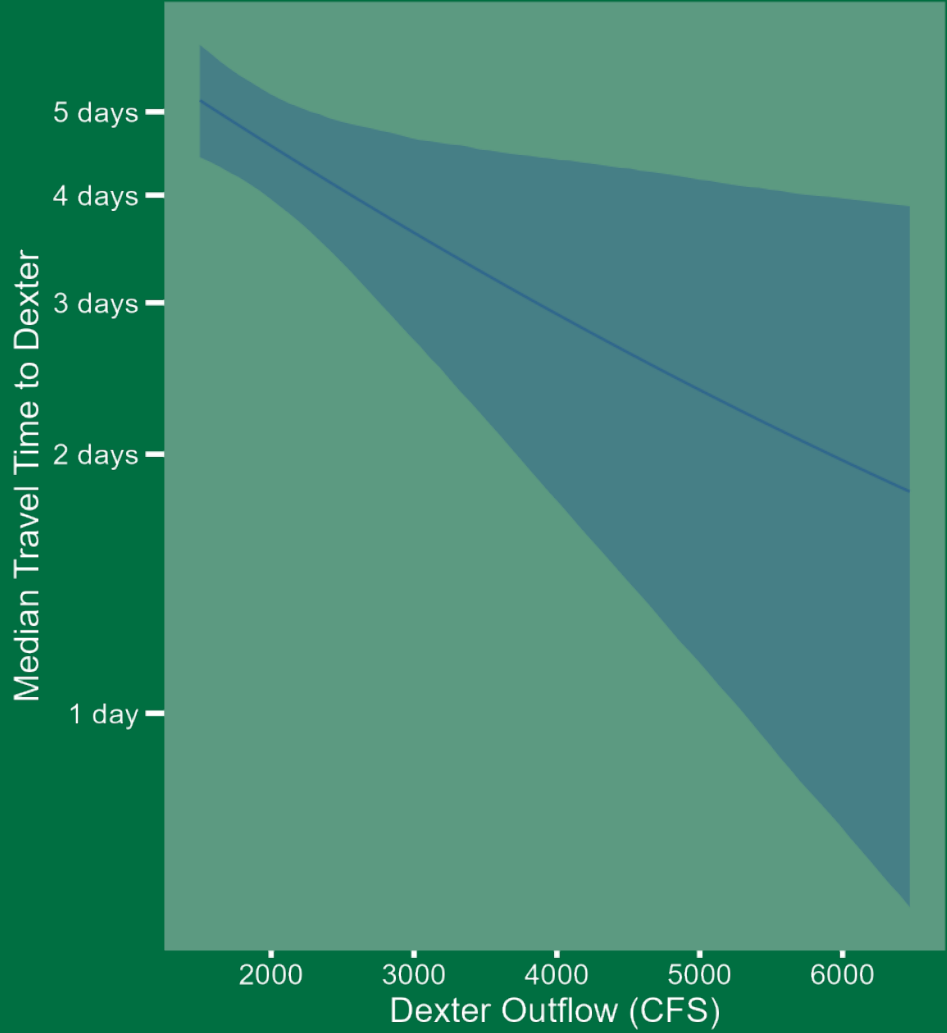
Travel Time: Release to Forebay



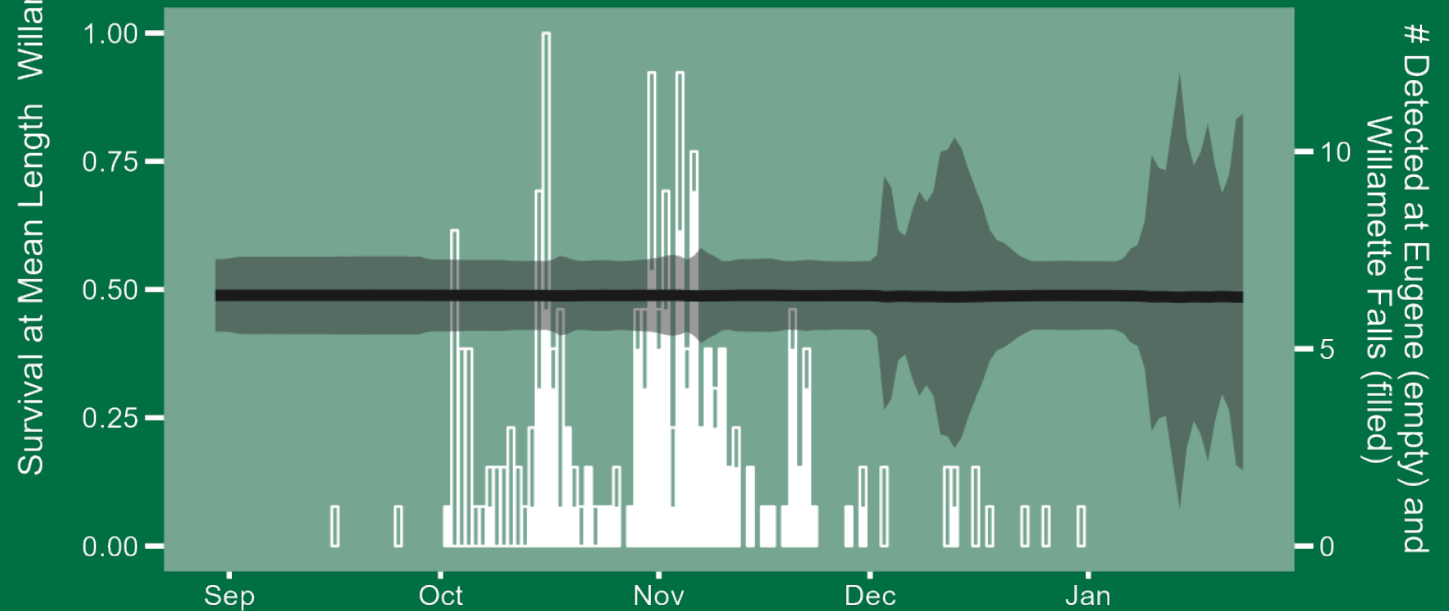
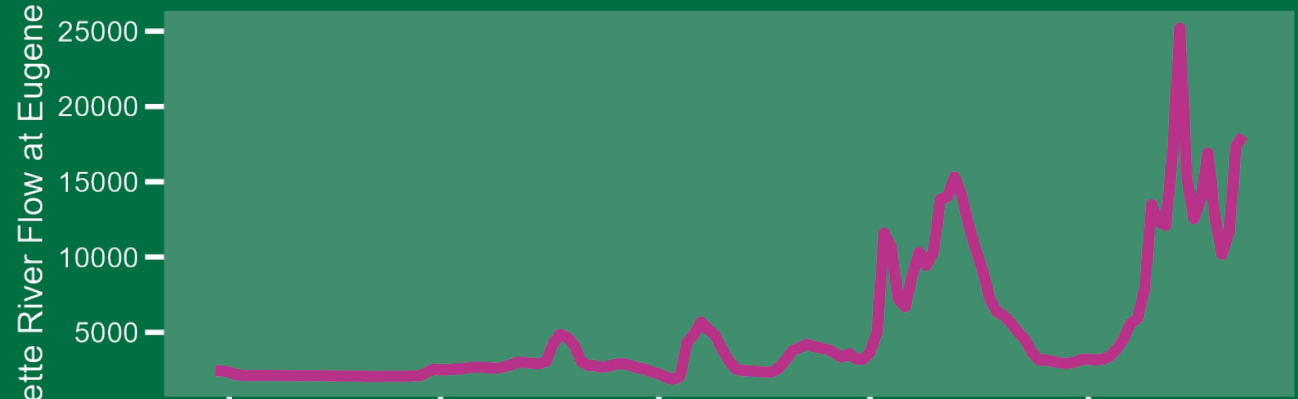
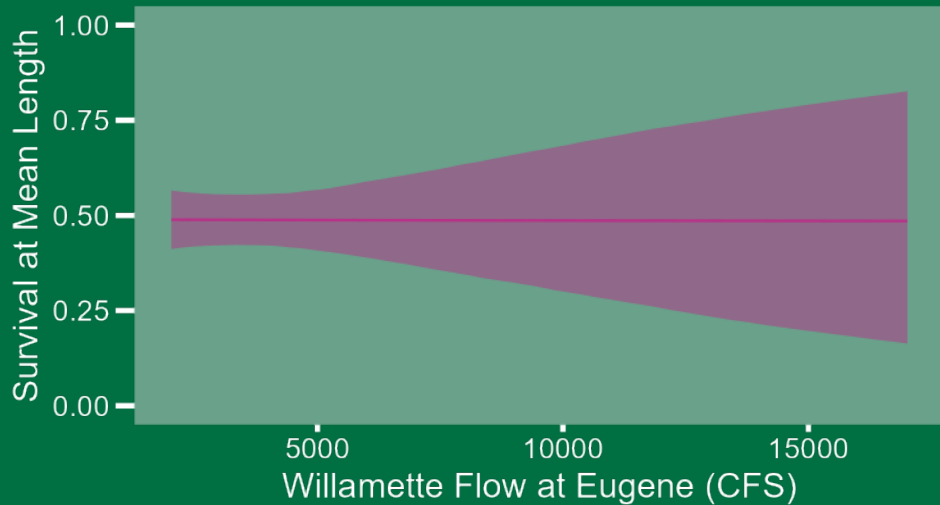
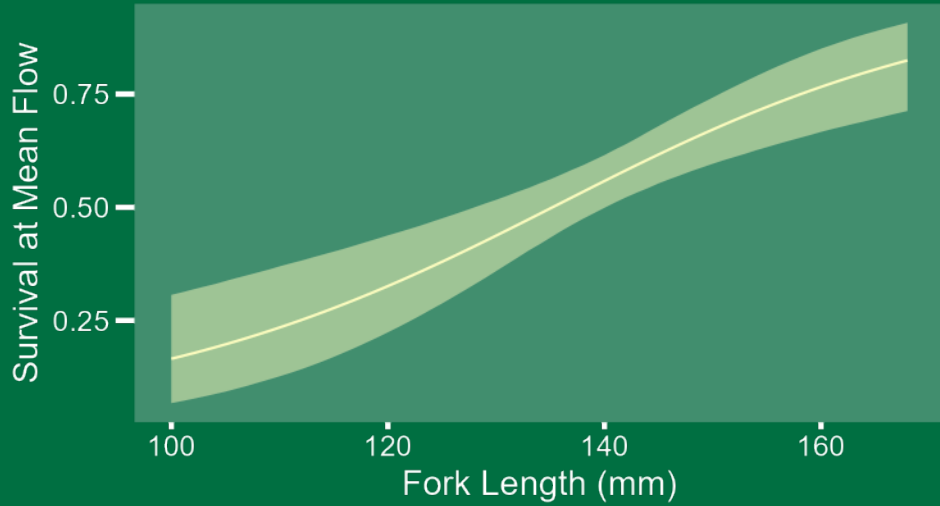
Travel Time: Tailrace to Dexter



Dexter Residence Time



Apparent Survival: Eugene to Willamette Falls



Travel Time: Eugene to Willamette Falls

