



Salmonid Habitat Usage and Movement in Restored and Unrestored Reaches

Insights from a Multiscale Study

Virginia White, Stine Griep, Keith van den Broek, Carlos Polivka, David Glisson

Introduction and Study Purpose

Investigate engineered log jam (ELJ) utilization by juvenile Steelhead and Chinook:

- Residency within structures and reach
- Movement and activity patterns between structures, within a reach, and between reaches and reach

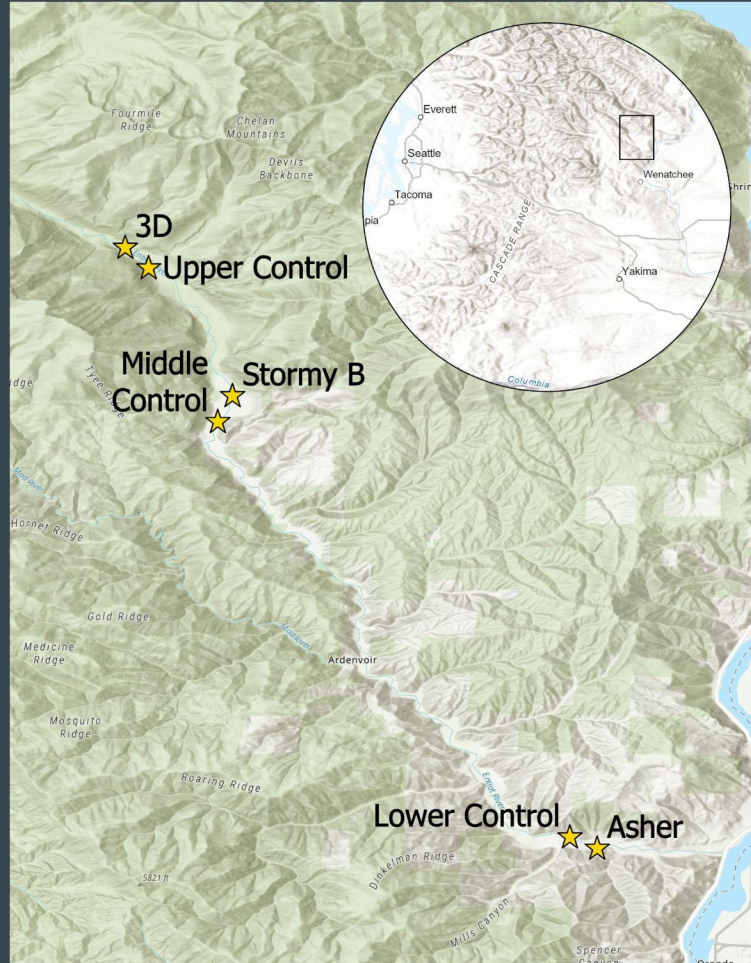
Purpose: Use this information to inform optimal ELJ size, design, and location in habitat restoration



Photo: Stine Greip

Study Area: Entiat River

- Restored and unrestored reaches
- Study reaches dispersed among lower, middle, and upper river
- Varied reach size and reach habitat



Lower Entiat

Restored Reach: Asher



Unrestored Reach: Lower Control

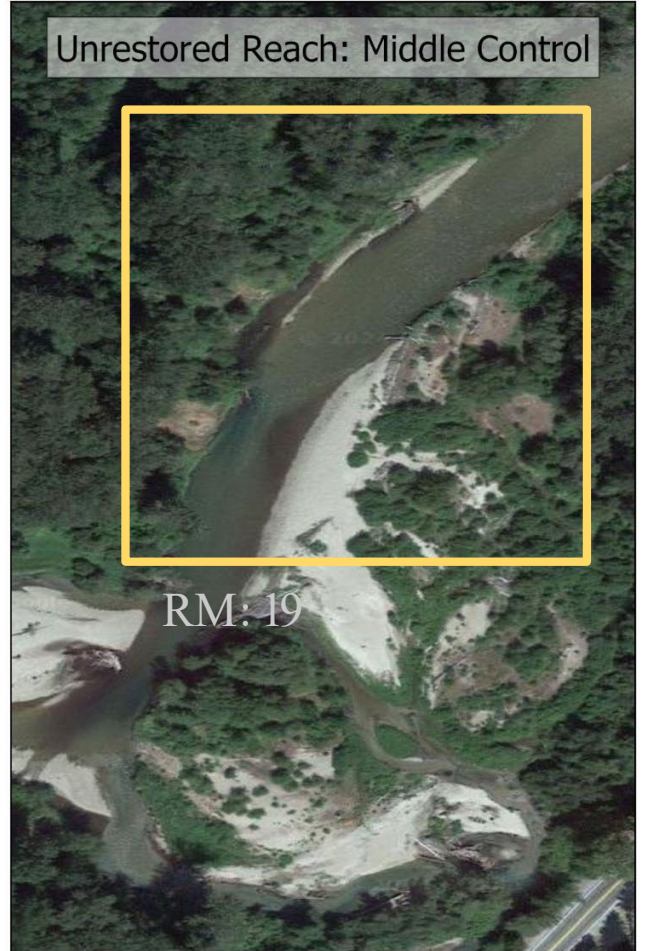


Middle Entiat

Restored Reach: Stormy B



Unrestored Reach: Middle Control



Upper Entiat

Restored Reach: 3D



RM: 25

Unrestored Reach: Upper Control



RM: 24

A photograph of a river with a large log jam. Several researchers in waders are wading in the water, likely conducting a fish sampling event. The river is surrounded by dense green forest. The water is clear, showing the rocky riverbed. The log jam is composed of many large, weathered logs and branches. The researchers are wearing bright orange or red waders, making them stand out in the water. One researcher is holding a net, and another is looking into the water. The background shows a lush green forest with tall trees. The overall scene is a natural, outdoor setting for scientific research.

Sampling Methods: Mark + Recapture

- Restored reaches: snorkel all structures
- Unrestored reaches: snorkel all 15 randomly selected 3x3m replicates
- Fish capture
 - Identify species and lifestage
 - Measure fork length
 - Mark with PIT tag, or record recapture
 - Recover and return to structure
- July - December, 8-10 sampling events
- Environmental data

Sampling Methods: Array Recapture

- Array installed into one ELJ at Stormy B
- 5 antenna
- Almost continuous data from 8/20/23
- 1/15/24
- Natural Log Jam (NLJ) across the river held Antenna “T” until 11/9/23

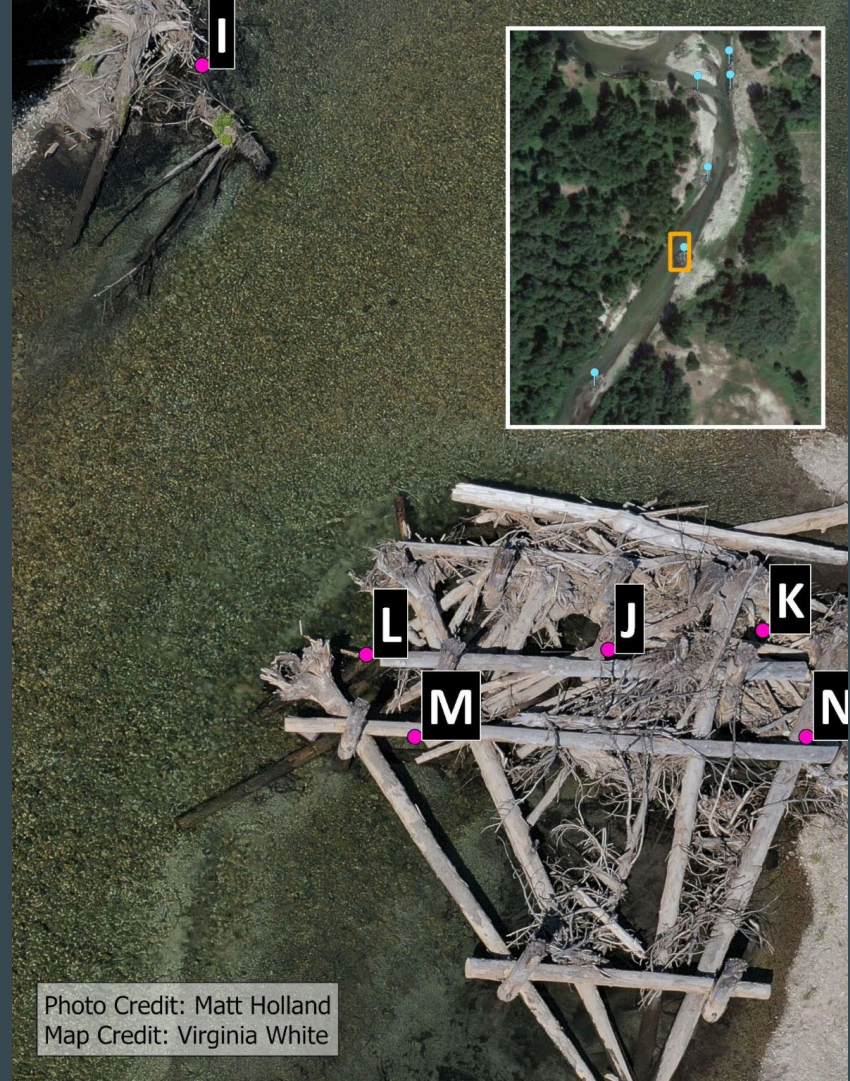
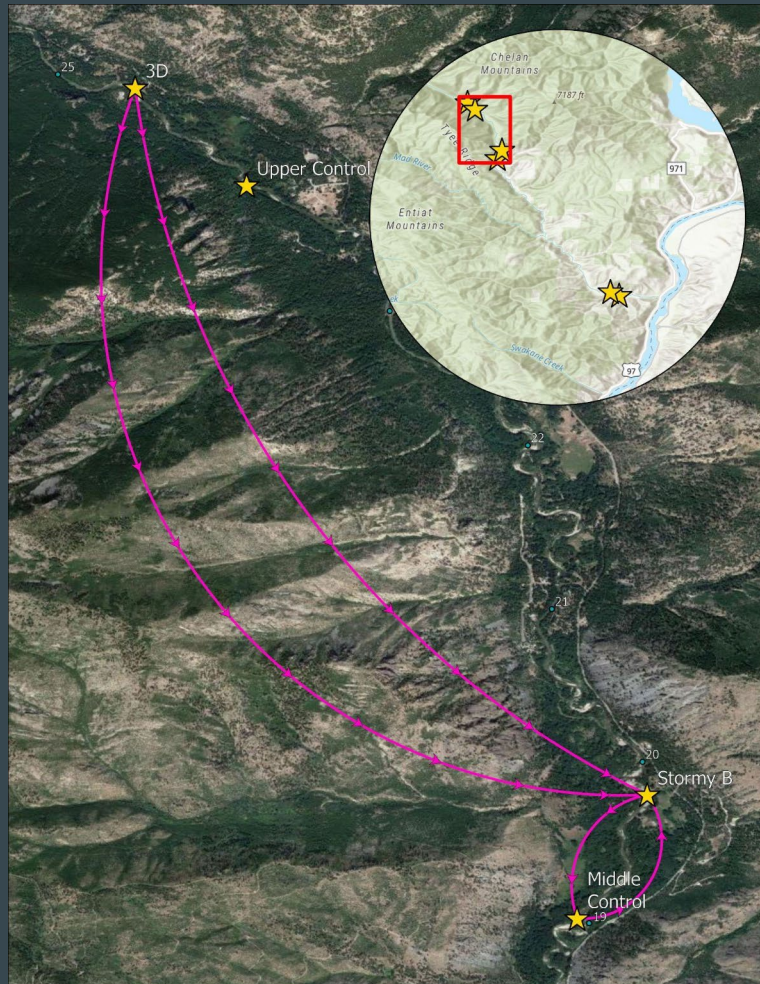


Photo Credit: Matt Holland
Map Credit: Virginia White

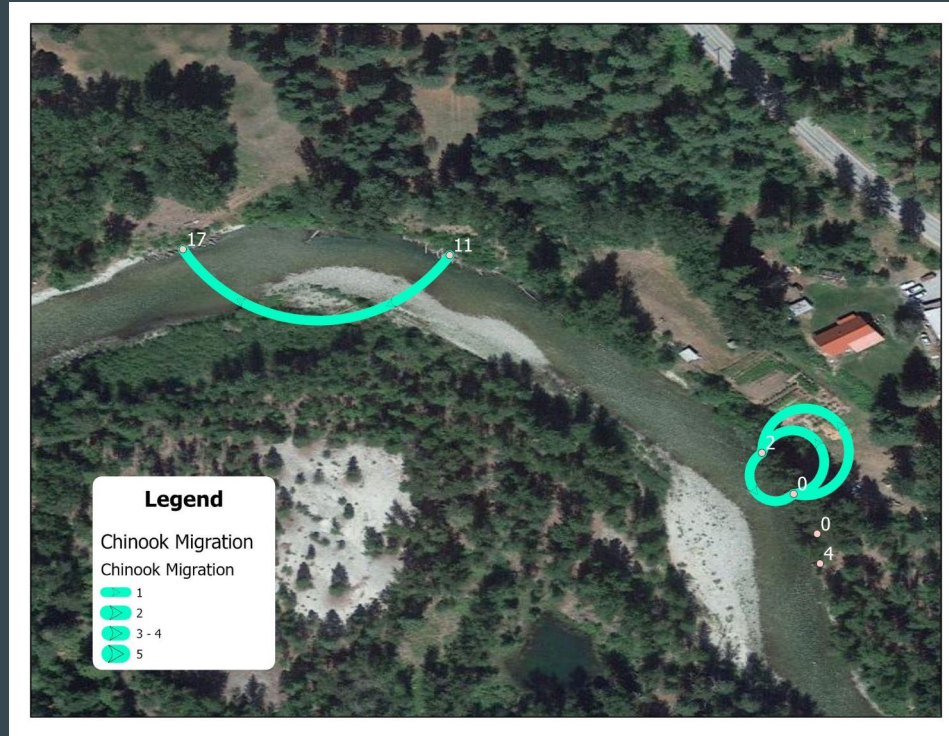
Mark and Recaptures

Origin Reach	Mark	Recapture	array	Total
<i>Stormy B</i>	816	174	93	816
<i>3D</i>	129	29	2	129
<i>Asher</i>	66	1		66
<i>Middle control</i>	63		1	63
<i>Lower control</i>	2			2
<i>Upper control</i>	2			2
Total	1078	204	96	1078

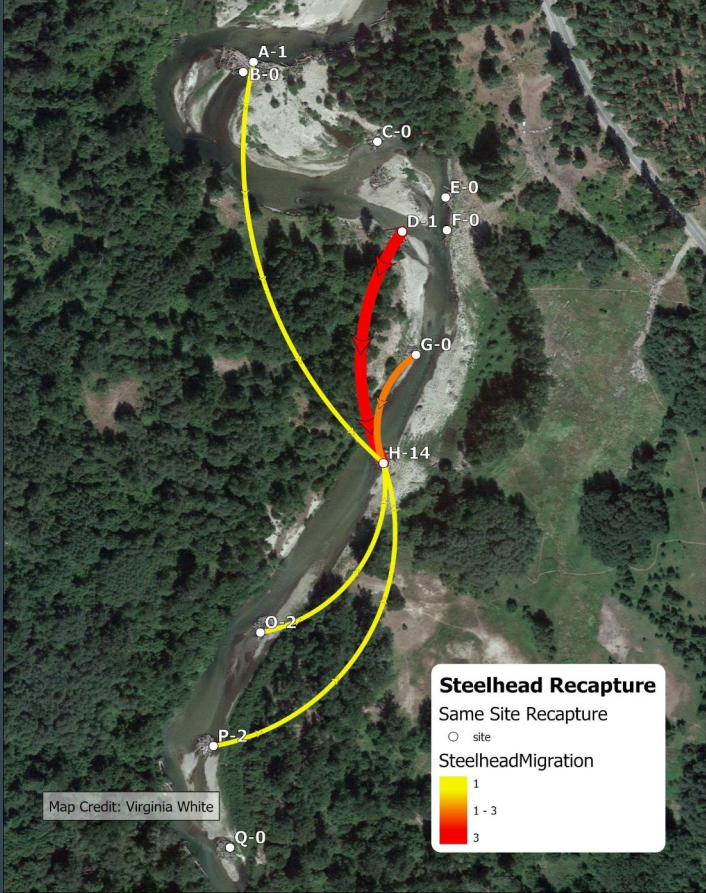
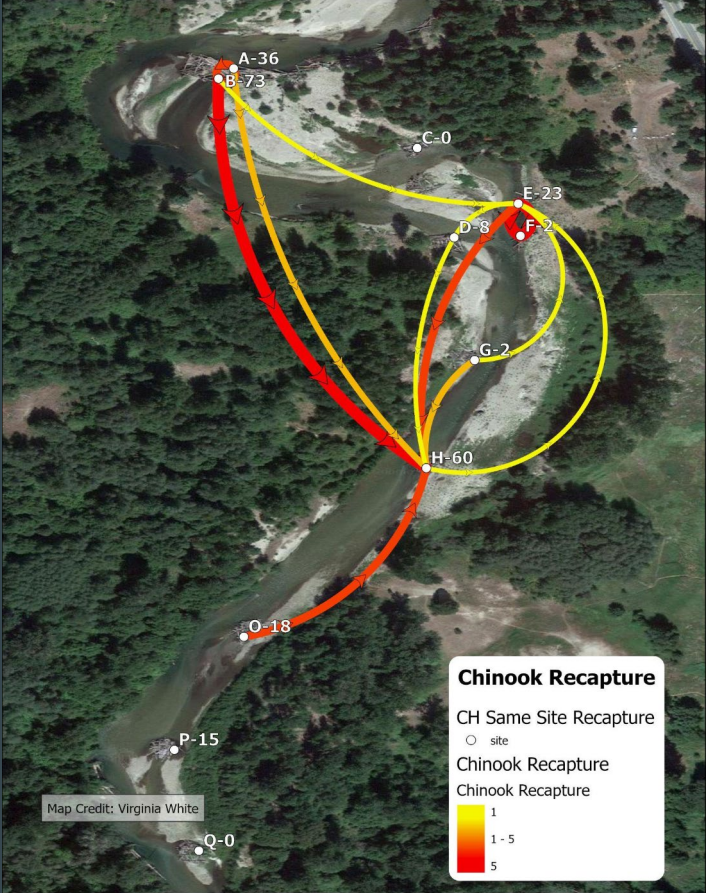
Movement Between Reaches



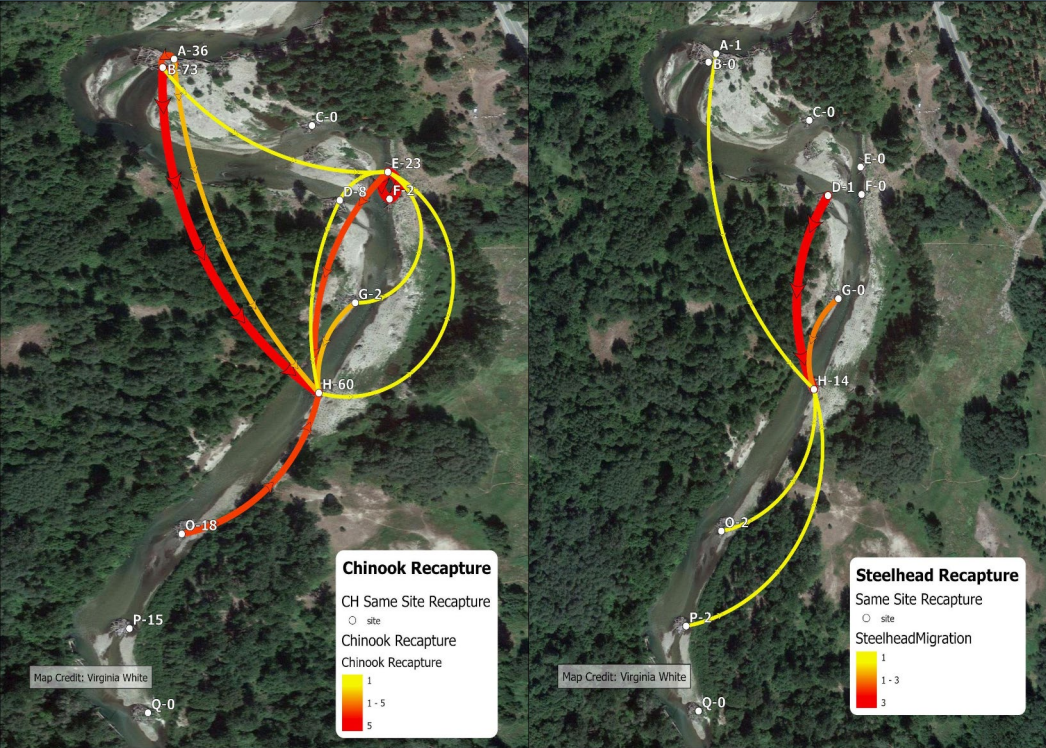
Restored Reach Movement: 3D



Restored Reach Movement: Stormy B

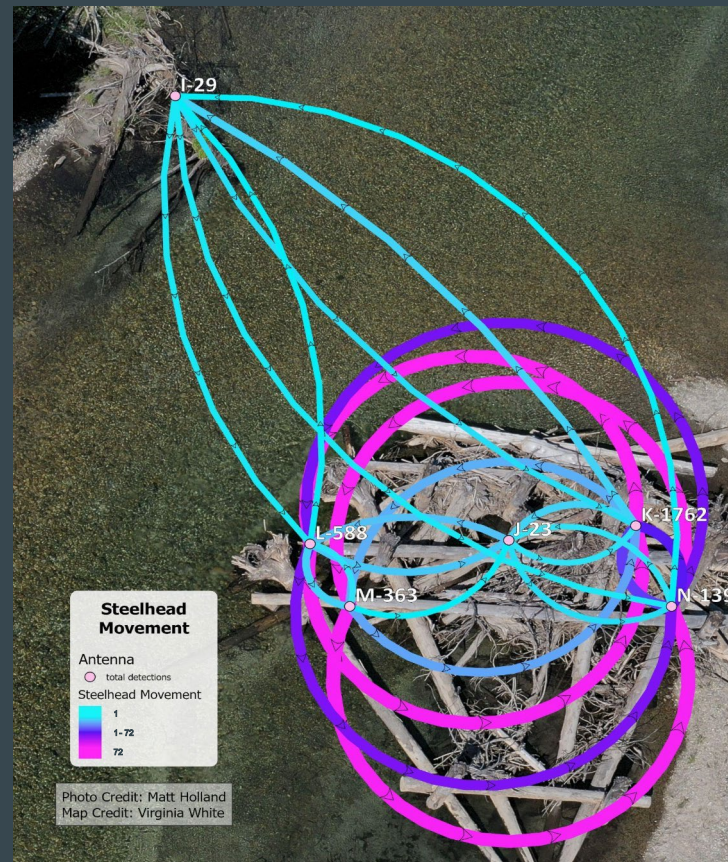
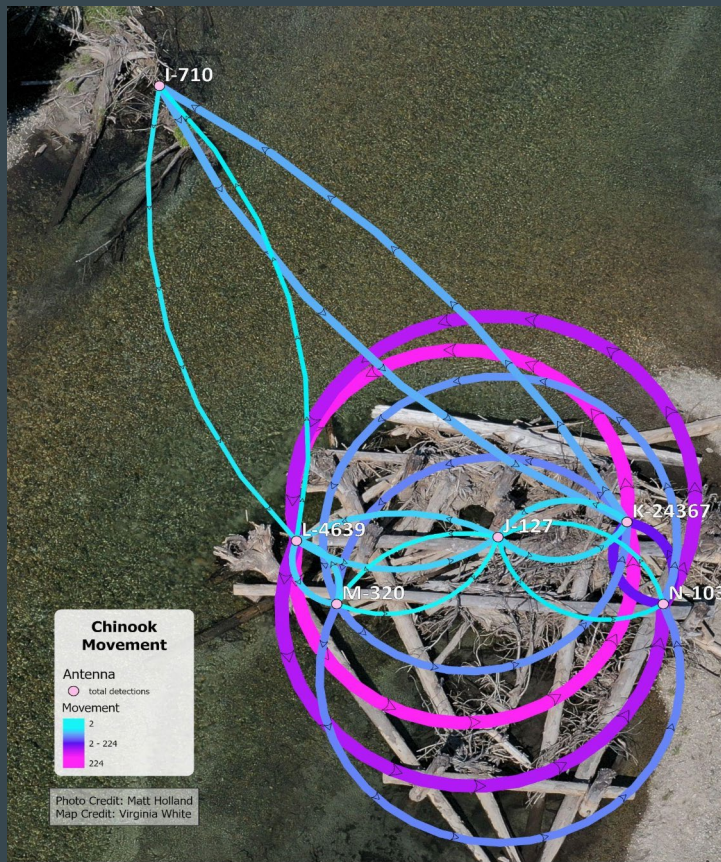


Restored Reach Movement: Stormy B

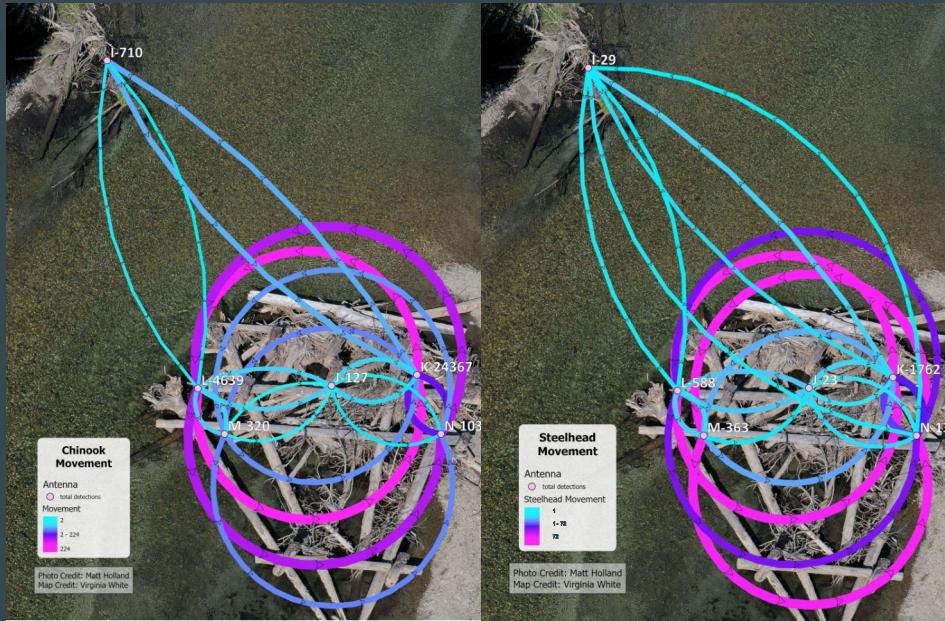


1. Most of the recaptures were same-structure
2. Movement downstream and upstream, across the river, and varied distance
3. Directly adjacent structures had great movement
4. More movement between clustered structures than further apart structures

Single Structure Movement: Stormy B

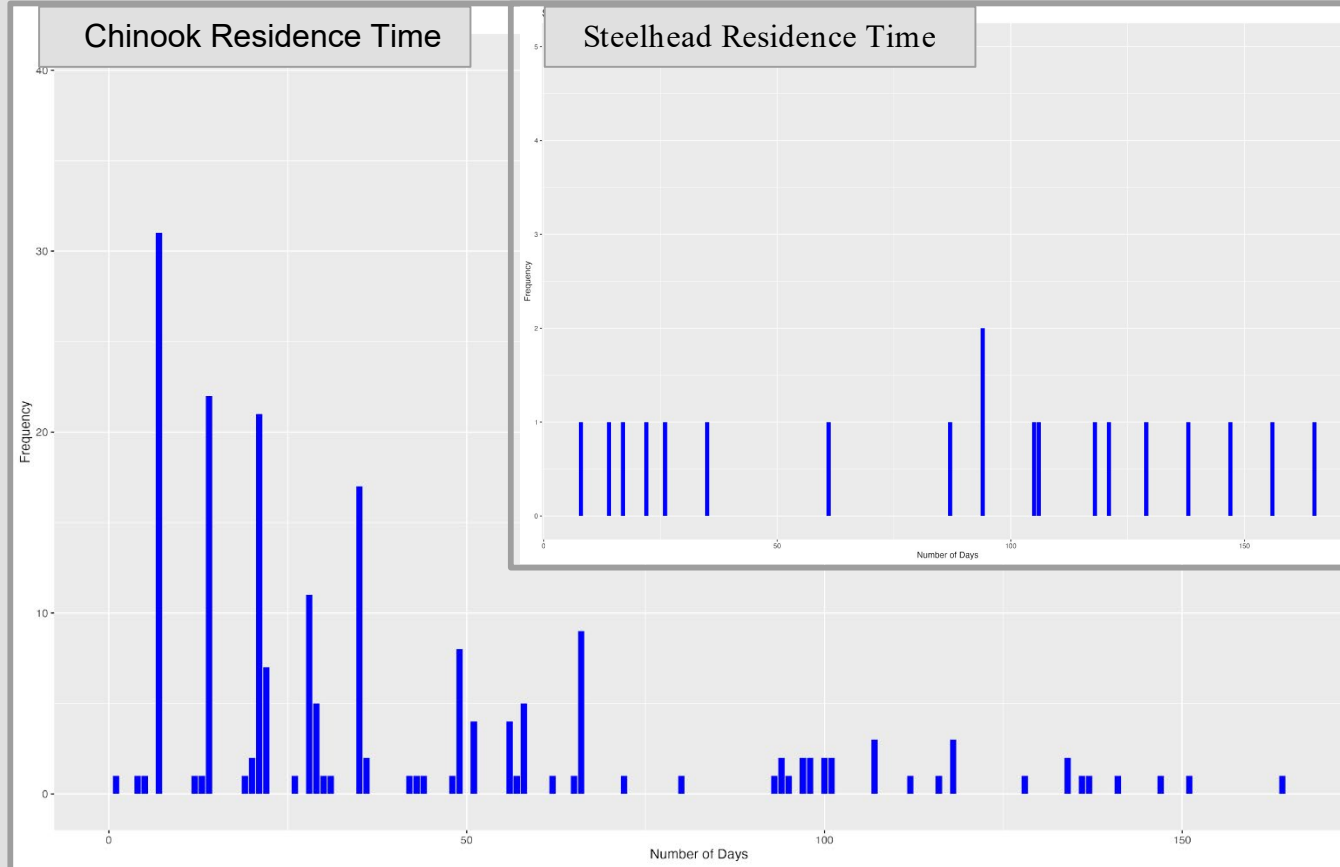


Single Structure Movement: Stormy B

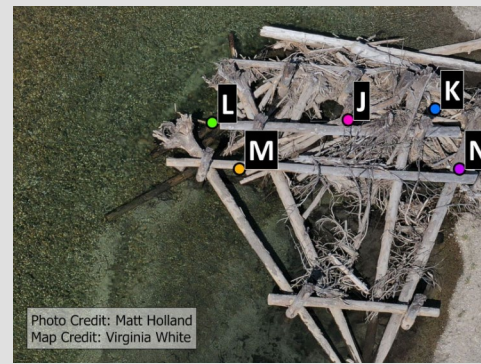


1. Antenna K was by far the most visited
2. Movement across the river, slightly more in Steelhead
3. Juveniles utilized the full width of the structure
4. Most common movement between antennas opposite of each other

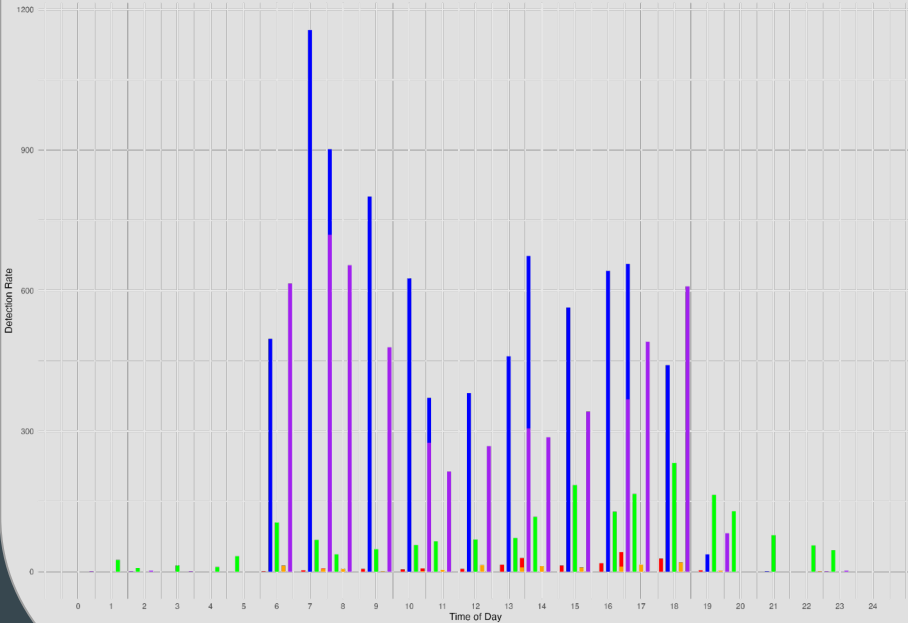
Residency: Reach Scale



Chinook Daily Activity Comparison

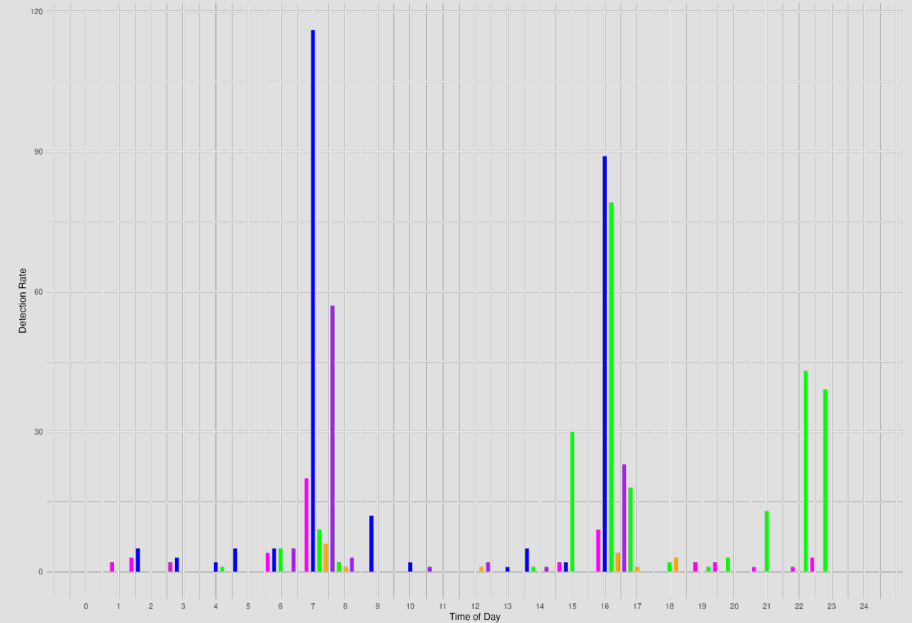


Detection Rate September Chinook



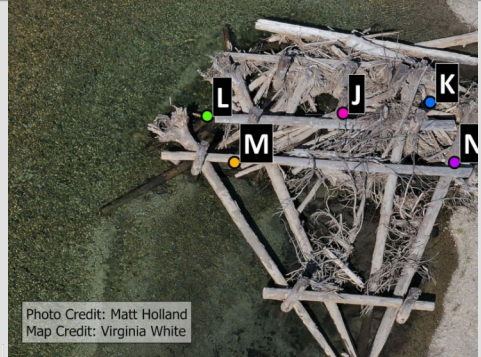
Unique tags: 53

Detection Rate December Chinook

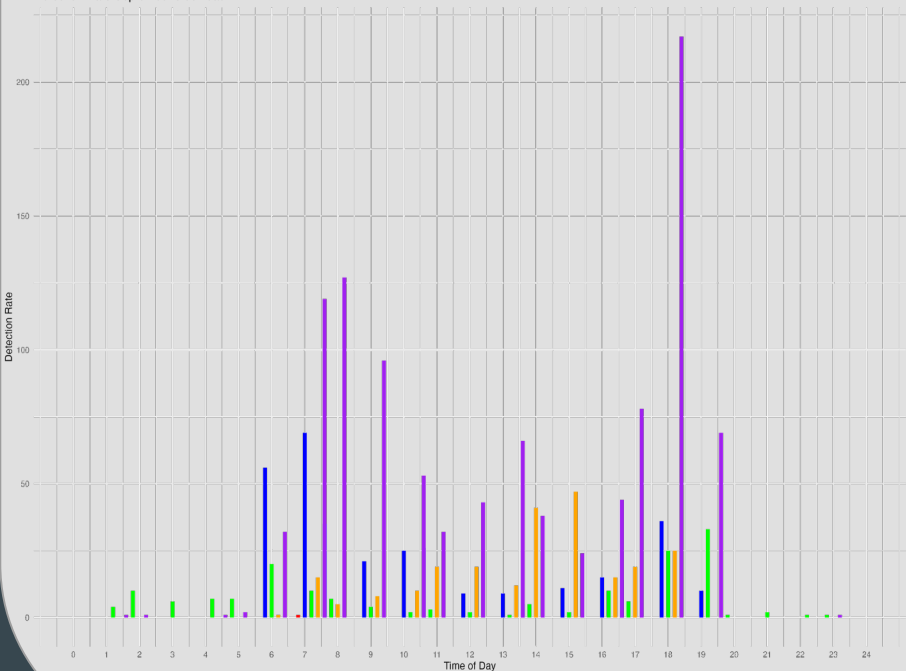


Unique tags: 24

Steelhead Daily Activity Comparison

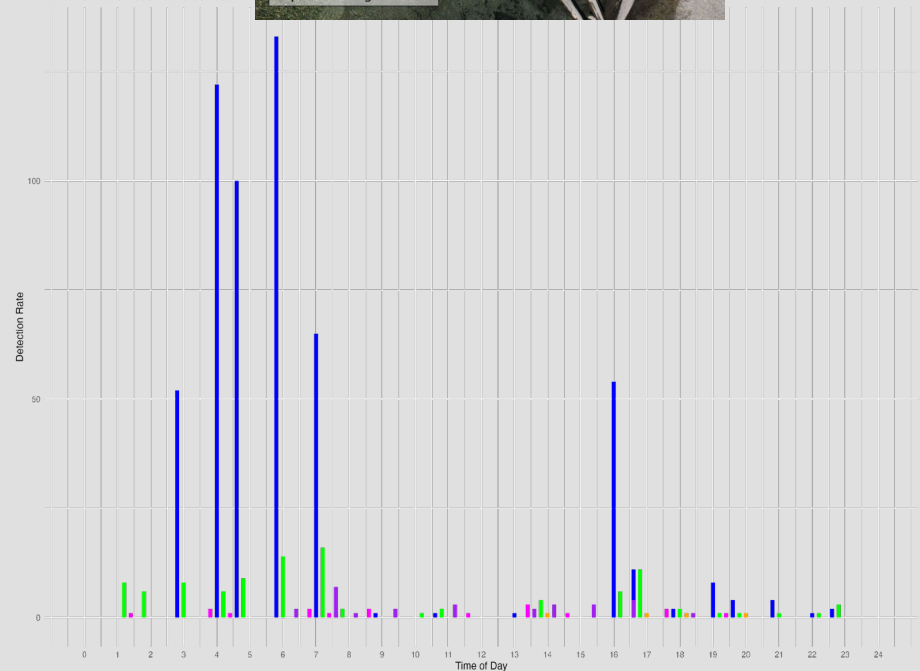


Detection Rate September steelhead



Unique tags: 18

Detection Rate December steelhead



Unique tags: 9

Summary

- At both the reach scale and structure scale, juvenile salmonids may prefer restoration projects that create complex and varied habitat to accommodate their varied and complex movement patterns.
- Additionally, the surprisingly long residency times for some juveniles further stresses the importance of designing habitat structures that can accommodate juvenile needs beyond the spring and summer.

Acknowledgement

