



# **Cowlitz River Studies: Past, Present, and Future**

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**Cowlitz River Fisheries & Watershed Science Annual Conference**  
**April 2017**

# Research Overview

Topic	Research period	Status
Juvenile salmon survival in Lake Scanewa and passing through Cowlitz Falls Dam	2010 - 2016	Final analysis and reporting summer 2017
Adult salmon behavior at alternate release site on Cispus River	2016 - present	Research in progress
Effects of mitigation trout on anadromous fish reintroduction efforts	2010 - present	New study summer 2017



# PREVIOUS STUDIES

Juvenile Salmon Survival



Reservoir Survival

Dam Passage Survival

# Juvenile Salmon Survival

- Reservoir Passage Survival

- Radiotelemetry study using fish collected at dam
- Released in upper reservoir
  - 22.3 km upriver from dam : Cowlitz
  - 8.9 km upriver from dam: Cispus
- Monitored as they approached the dam
- Numbers of fish released (number of sacrificed fish)



Year	Steelhead		Coho salmon		Chinook salmon	
	Cowlitz	Cispus	Cowlitz	Cispus	Cowlitz	Cispus
2010	50 (2)	51 (2)	50 (2)	50 (4)	50 (2)	50 (2)
2011	56 (3)	55 (2)	55 (2)	55 (2)	55 (2)	55 (2)
2016	129	128	107	106	0	0
Total	235 (5)	234 (4)	212 (4)	211 (4)	105 (4)	105 (4)

# Juvenile Salmon Survival

- Reservoir Passage Survival

- Estimates of survival probabilities with 95% confidence intervals

Year	Cowlitz River releases	Cispus River releases
Steelhead		
2010	1.000 (1.000-1.000)	0.960 (0.881-1.000)
2011	1.000 (1.000-1.000)	0.982 (0.922-0.999)
2016	0.975 (0.928-1.000)	0.994 (0.962-1.000)
Coho salmon		
2010	0.979 (0.910-0.999)	1.000 (1.000-1.000)
2011	0.964 (0.893-0.995)	0.945 (0.865-0.986)
2016	0.958 (0.907-0.989)	0.856 (0.773-0.919)
Chinook salmon		
2010	0.900 (0.797-0.963)	0.920 (0.824-0.975)
2011	0.927 (0.839-0.977)	0.907 (0.811-0.966)

# Juvenile Salmon Survival

- Reservoir Passage Survival Summary

- Steelhead: 0.960 to 1.000
- Coho: 0.856 to 1.000
  - Estimates for all sites and years exceeded 0.945 except Cispus arm releases in 2016
- Chinook: 0.9000 to 0.927



- Travel Times

- Steelhead and Coho < 1 d on average (10 - 12 d max)
- Chinook ~ 2 d on average (20 - 30 d max)

# Juvenile Salmon Survival

- Dam Passage Survival



- Radiotelemetry study
  - Chinook salmon in 2013 and 2014
- Paired release – recovery study design
- Released at 4 locations
  - Cowlitz arm of reservoir (PUD ramp), 1.2 km upstream of dam
  - Cowlitz arm of reservoir (Day Use Park), 3.6 km upstream of dam
  - Cispus arm of reservoir, 8.9 km upstream of dam
  - Dam tailrace, 0.3 km downstream of dam
- Numbers of fish released (number of sacrificed fish)

Year	Species	Reservoir	Tailrace	Total
2013	Chinook	300	98 (10)	398
2014	Chinook	421	139 (8)	560

# Juvenile Salmon Survival



- Dam Passage Survival

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Year	Species	Survival Estimate	95% CI
2013	Chinook	0.861	0.813 – 0.909
2014	Chinook	0.789	0.652 – 0.926

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- Report planned for summer 2017 to include both reservoir and dam passage survival from all of our study years
  - Will include covariate analyses



# CURRENT STUDIES

## Alternate Release Site Evaluations



Coho Salmon

Steelhead

# Evaluations of the Adult Salmon Alternate Release Site

- Trap and haul release sites for adult salmon
  - Lake Scanewa at the Day Use Park
  - Cowlitz River near Packwood
  - Cispus River near Yellowjacket Creek
- New release site in Cispus River at FS Road 28 crossing (Tom Music Bridge), 0.8 miles downstream of original site
  - Better release conditions, more stable site
- Evaluate short-term and long-term effects
  - Coho salmon in fall-winter 2016 – **short-term effects**
  - Steelhead during spring 2017 – **long-term effects**





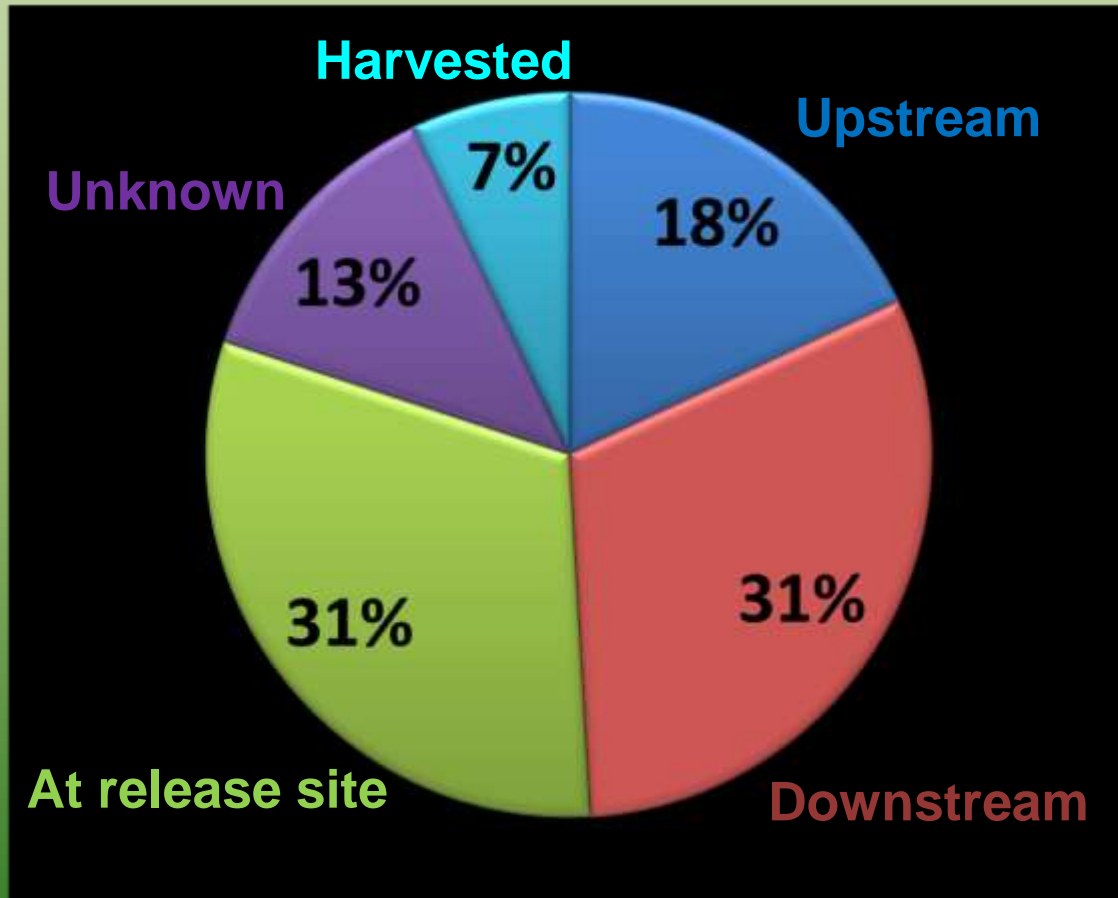
# Coho Evaluation

- 2 releases of radio-tagged coho salmon
  - October 18, 2016: 20 fish
  - November 15, 2016: 19 fish
- Tagged fish were transported per normal operations
- Monitored for 4-6 weeks after release
  - Oct release tracked more intensively than Nov release
- Goal: describe behavior & movements after release

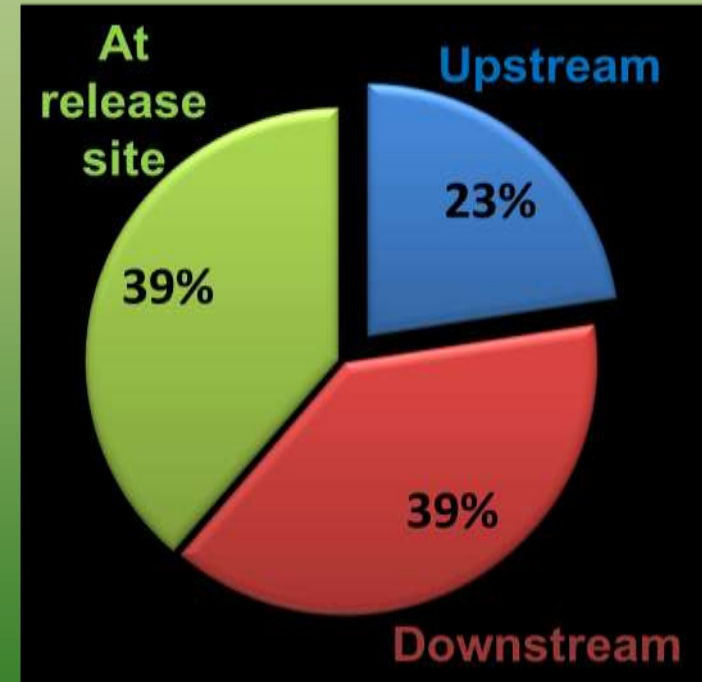


# Coho Evaluation

All Tagged Fish (n=39)



Without harvested and unknown fates (n=31)

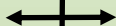


# Coho Evaluation

- 3 fish were confirmed to have been harvested
- 5 fish had unknown fates
  - 1 in release #1 and 4 in release #2
  - Possible causes: battery failure or reduced tracking intensity
- Timing of movements
  - Fish remained at release site for ~ 1 d before moving
- Maximum displacement *upstream*
  - All but one fish within ~ 3 miles
  - 1 fish moved upstream 10 miles
- Maximum displacement *downstream*
  - Half of the fish stayed within ~ 3 miles
  - ~Half moved ~ 6.5 miles, and 1 fish moved downstream 16 miles

# Upstream (7 fish)

River mile 30



rm 26.5 (near Twin Cr.)

10 river miles upstream from release

rm 20

rm 19 (near N.F. Cispus)

rm 18

rm 17.5

Release Site

rm 16.6

At release site  
(12 fish)

rm 16 (In Yellowjacket Cr.)

rm 14 (Near Churchel Rd.)

rm 10 (Nash Cr. Area)

River mile 2

rm 0.5

16 river miles downstream from release

# Downstream (12 fish)

Release #1 (orange oval)  
Release #2 (purple oval)

At release site (12 fish)  
3 orange ovals  
3 purple ovals  
3 purple ovals  
3 purple ovals

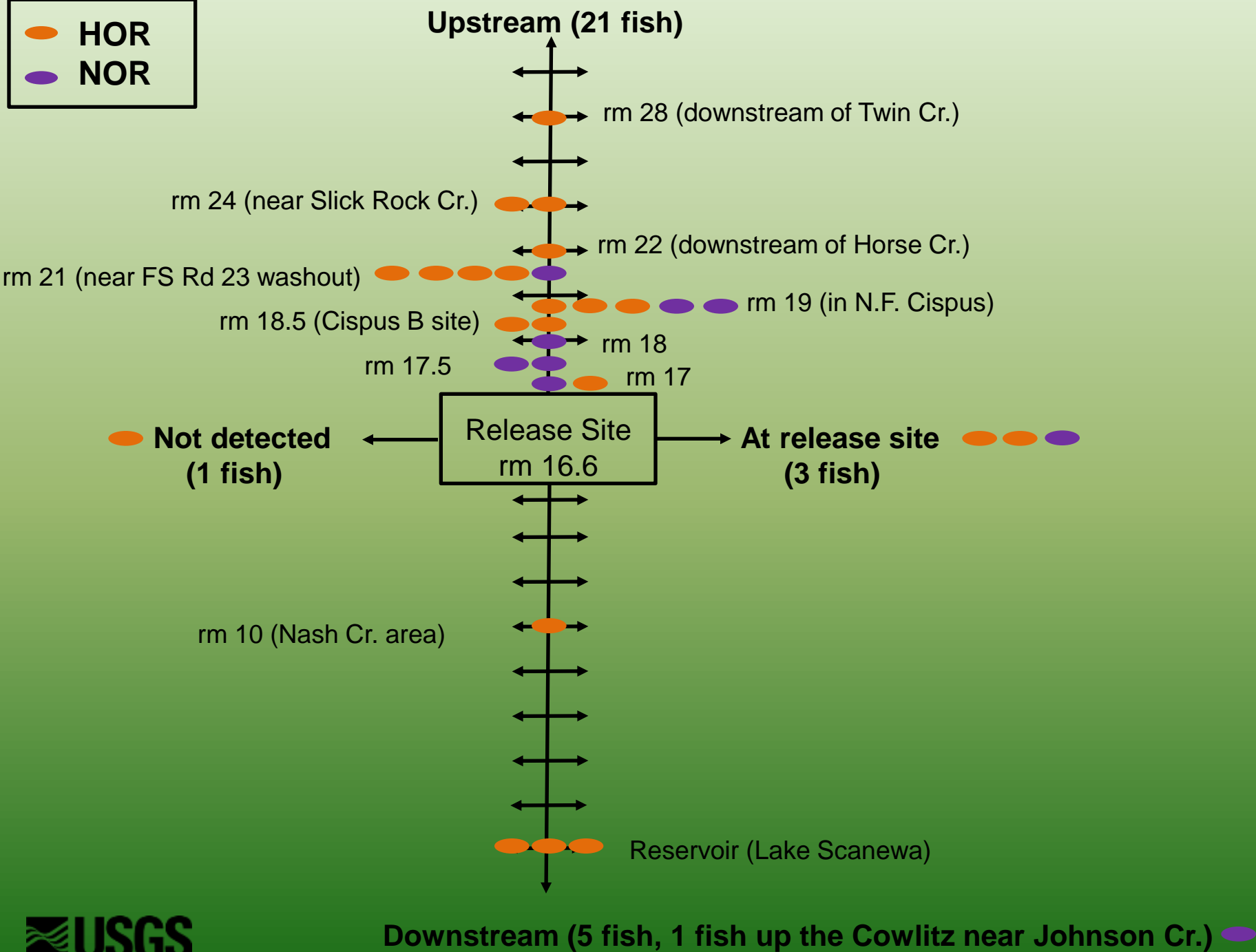
# Steelhead Evaluation

- **Goal:** determine fish behavior, fall-back rates, and spawning fates following release
  - Monitor through spawning period
- **Plan:** release 150 tagged fish, some at the Day Use Park and some at the new release site
- **Current status:** 6 releases of radio-tagged steelhead
  - Currently have 30 tagged fish in the system
    - 2/3 HOR + 1/3 NOR
  - All fish released at the new site
  - Tagging and releases ongoing





**HOR**  
**NOR**



# Steelhead Evaluation

- As of yesterday:
  - 21 fish (70%) upstream of release site
  - 3 fish (10%) at the release site
  - 5 fish (17%) downstream of release site
  - 1 fish (3%) unknown
- Movement timing
  - Relative to coho, steelhead are moving very shortly (hours) after release



# FUTURE STUDIES

Effects of Mitigation Trout on  
Anadromous Fish

# Effects of Mitigation Trout



- 2010 creel survey and study of food habits
  - Creel summary 2011
- Monitored movements of radio-tagged trout in 2013-2015
- New study in 2017-18 will build upon and expand these efforts

# What is known about planter trout?

- Trout size determines the risk of predation
  - Trout >250 mm (~10 inches) likely to eat fish
- Few trout stomachs contained fish
  - 1,236 stomachs examined, many empty
  - Lots of inedible food items (rocks, sticks, cigarette butts, pine needles)
  - Juvenile salmon found in 2.6% of large trout and 0.2% of smaller trout
- Most tagged trout (93%) died in the fall and winter following stocking (similar trends reported in the literature)
- Tagged trout moved throughout the reservoir
  - Between the Cowlitz and Cispus arms and into dam forebay
  - Some evidence of movement into rivers



# Trout Evaluation 2017-18

- Goal is to inform two potential concerns
  - Consumption of juvenile salmon
  - Interference with spawning anadromous fish
- **Consumption Concern:**
  - Collect trout stomachs monthly for 1 year to evaluate food habits and risk to juvenile salmon
    - Previous effort lacked detail in fall and winter
  - Use bioenergetics modeling to assess impact to anadromous fish



# Trout Evaluation 2017-18

- **Interference Concern:**

- Monitor trout with radiotelemetry
- Track trout June 2017 – July 2018
- Estimate trout survival
- See if trout move up into rivers during steelhead spawning



	Bud Allen Campground	Day Use Park	Cispus River arm of the reservoir
June planting	50 fish	50 fish	50 fish
July planting	50 fish	50 fish	50 fish
August planting	50 fish	50 fish	50 fish

# Trout Evaluation 2017-18

- Summer of 2018 analysis and reporting
  - Are trout consuming juvenile salmon?
    - How many survive and/or avoid harvest?
    - Do they get big enough to eat juvenile salmon?
    - Do they eat many juvenile salmon?
  - Do release locations or dates make a difference?
  - Are trout co-located in the rivers with steelhead during the spawning period?





# Acknowledgements

## Funding:

Lewis County PUD

## Fieldwork and Logistics:

Joe First and staff at Cowlitz Falls Dam

John Serl and the staff of the Cowlitz Falls Fish Facility

Eric Shoblom, Scott Gibson, Jamie Murphy, and  
Missy Baier (Tacoma Power)



# Questions?

