# Spring Chinook Salmon Spawning Surveys in the Upper Willamette River Basin in 2019

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US Army Corps of Engineers ®

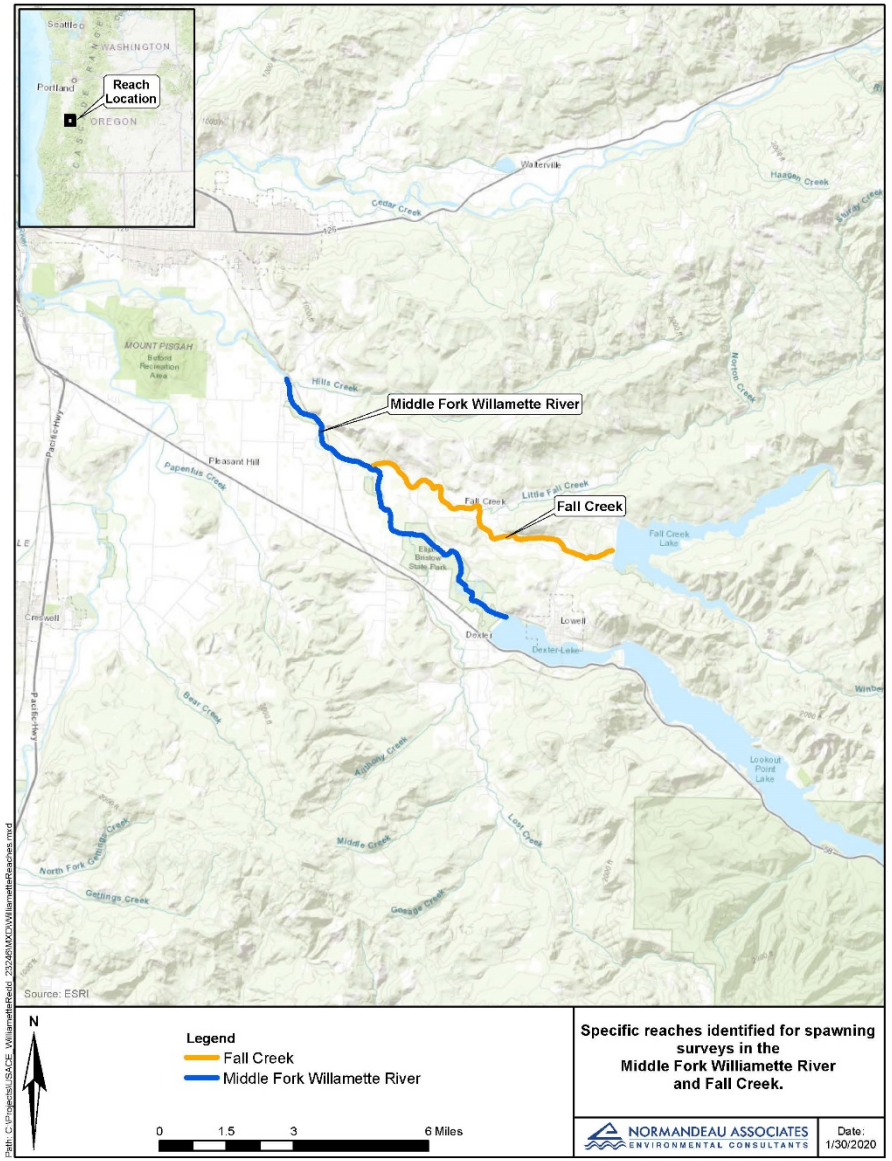
# Objectives

Provide spawning surveys related to the mitigation, production, and release of spring Chinook into the upper Willamette Basin

- Carcass Collections
- Redd Counts

# Project Locations





# Project Locations

| River & *Reach* |
|---|
| **McKenzie** |
| *Spawning Channel* |
| *Ollalie to Belknap* |
| *Belknap to Paradise* |
| *Paradise to McKenzie Trail* |
| *McKenzie Trail to McKenzie Bridge* |
| *McKenzie Bridge to Hamlin* |
| *Hamlin to S.F. McKenzie* |
| *South Fork McKenzie to Forest Glen* |
| *Forest Glen to Rosboro Bridge* |
| *Rosboro Bridge to Ben Kay* |
| *Helfrich to Leaburg Lake* |
| *Leaburg Dam to Leaburg Landing* |
| *Leaburg Landing to Deerhorn* |
| *Deerhorn to Hendricks* |
| *Hendricks to Bellinger* |
| *Bellinger to Hayden Bridge* |
| **South Fork McKenzie** |
| *Cougar to Bridge* |
| *Bridge to Phase 2* |
| *Phase 2 to Phase 1* |
| *Phase 1 to Mouth* |
| **Lost Creek** |
| *Spring to Cascade* |
| *Cascade to Limberlost CG* |
| *Limberlost CG to Split Point* |
| *Split Pt to Hwy 126 Bridge* |
| *Hwy 126 Bridge to Mouth* |

| River & *Reach* |
|---|
| **Horse Creek** |
| *Pothole Creek to Trail Bridge* |
| *Trail Bridge to Separation Creek* |
| *Separation Creek to Road Access* |
| *Road Access to Braids* |
| *Braids to Avenue Creek* |
| *Avenue Creek to Horse Creek Bridge* |
| *Horse Creek Bridge to Mouth* |
| **Middle Fork Willamette** |
| *Dexter Dam to Pengra Landing* |
| *Pengra Landing to Jasper* |
| **Fall Creek** |
| *Fall Creek Dam to Pengra Bridge* |
| *Pengra Bridge to Fall Creek Mouth* |
| **Santiam** |
| *Confluence to Jefferson* |
| *Jefferson to I-5 Bridge* |
| *I-5 Bridge to Mouth* |
| **South Santiam** |
| *Foster Dam to Pleasant Valley* |
| *Pleasant Valley to McDowell Creek* |
| *McDowell Creek to Waterloo* |
| *Gill's Landing to Sanderson's* |
| *Sanderson's to Mouth/Jefferson* |

| River & *Reach* |
|---|
| **North Santiam** |
| *Big Cliff Dam to Minto* |
| *Minto Dam to Packsaddle* |
| *Packsaddle to Gates Bridge* |
| *Gates Bridge to Mill City* |
| *Mill City to Fisherman's Bend* |
| *Fisherman's Bend to Mehama* |
| *Mehama to Powerlines* |
| *Powerlines to Upper Bennett* |
| *Upper Bennett (North Channel) to Stayton* |
| *Upper Bennett (South Channel) to Stayton* |
| *Stayton to Shelburn* |
| *Shelburn to Greens Bridge* |
| *Greens Bridge to Mouth* |
| **Little North Santiam** |
| *Elkhorn Bridge to Salmon Falls* |
| *Salmon Falls to Camp Cascade* |
| *Camp Cascade to Narrows* |
| *Narrows to Golf Bridge* |
| *Golf Bridge to Bear Creek Bridge* |
| *Bear Creek Bridge to Lomkers Bridge* |
| *Lomkers Bridge to NF Park* |
| *NF Park to HWY 22 Bridge* |
| *Hwy 22 Bridge to Mouth* |

- 10 Rivers
- 66 "Reaches"
- Over 360 river kilometers

# Methods

## Carcass Collection

- Crews floated/walked reaches and collected the data from carcasses
- Surveyed reaches every two weeks* (temporal design)
- Fork Length
- Sex (Egg retention %)
- Clipped/Unclipped
  - Otoliths of unclipped/unknown fish (Analyzed by ODFW)
- Scales (Aging by ODFW)
- DNA Sample
- Coded Wire Tags (Processed by ODFW)

# Methods

## Carcass Collection

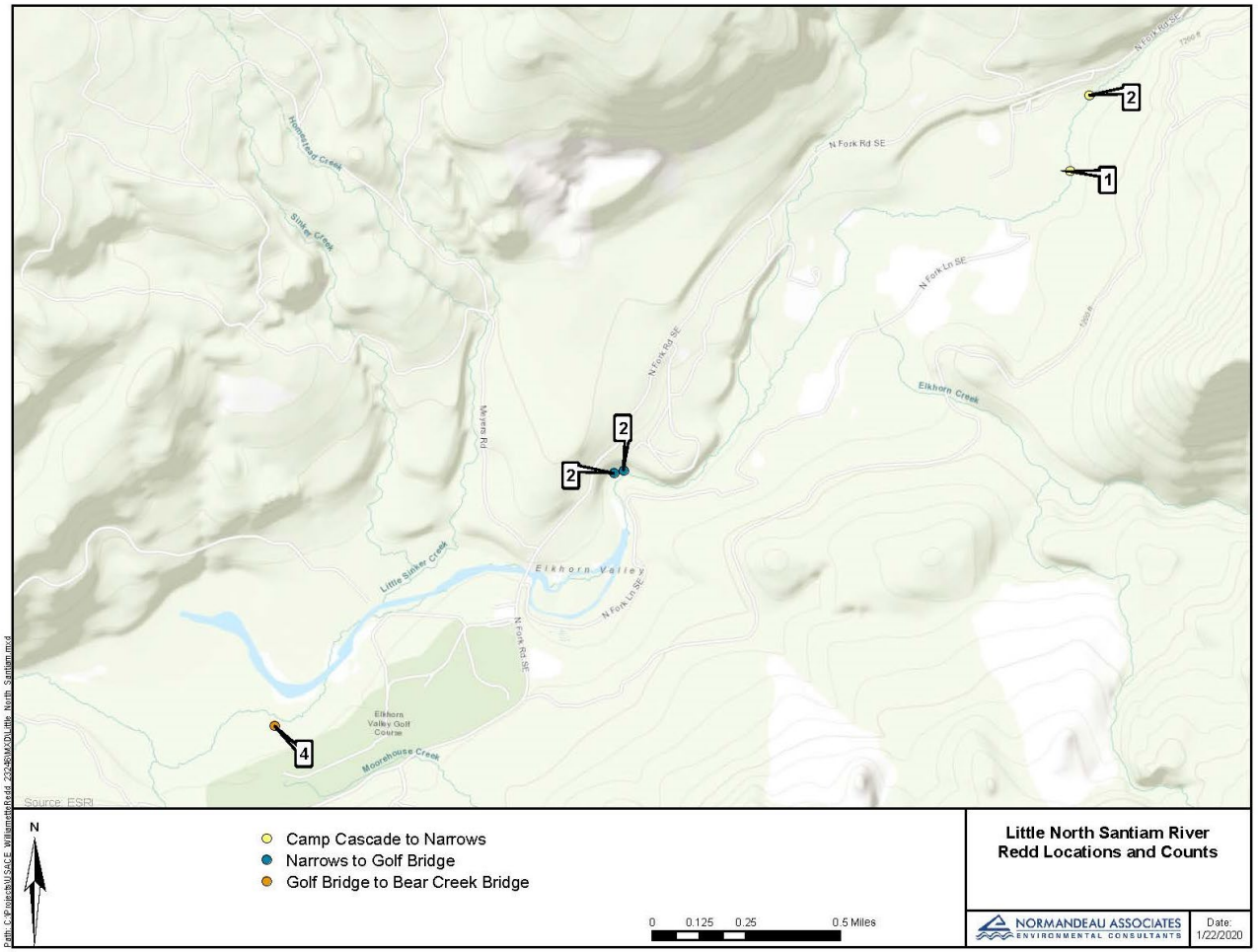
- Prespawn Mortality (females)
  - ≥50% egg retention (Sharpe et al. 2017)
- Proportion Hatchery Origin Spawners
  - Clipped fish + thermal marked unclipped fish/total fish

# Methods

## Redd Counts

- Crews collected carcasses and counted redds concurrently on all but four high density reaches
- Carcass collection and redd counts occurred on separate days on high density reaches
- Collected GPS locations of redd clusters

# Methods




## Redd Counts

- Generated redd maps utilizing GIS
- Redd density
- Spawner abundance estimates (redds x 2.5, Sharpe et al. 2017)

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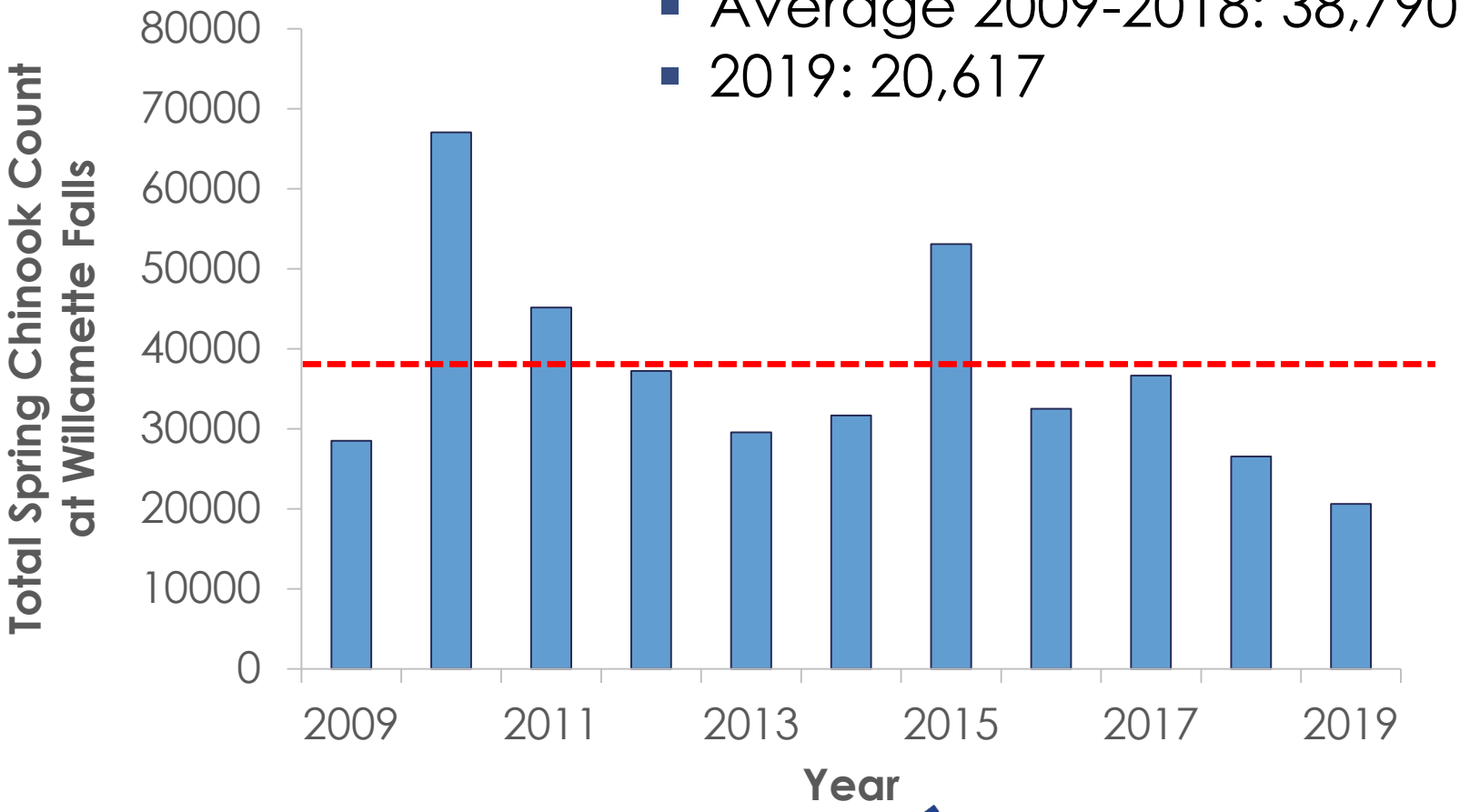
# 2019 Willamette Falls

- Average 2009-2018: 38,790
- 2019: 20,617

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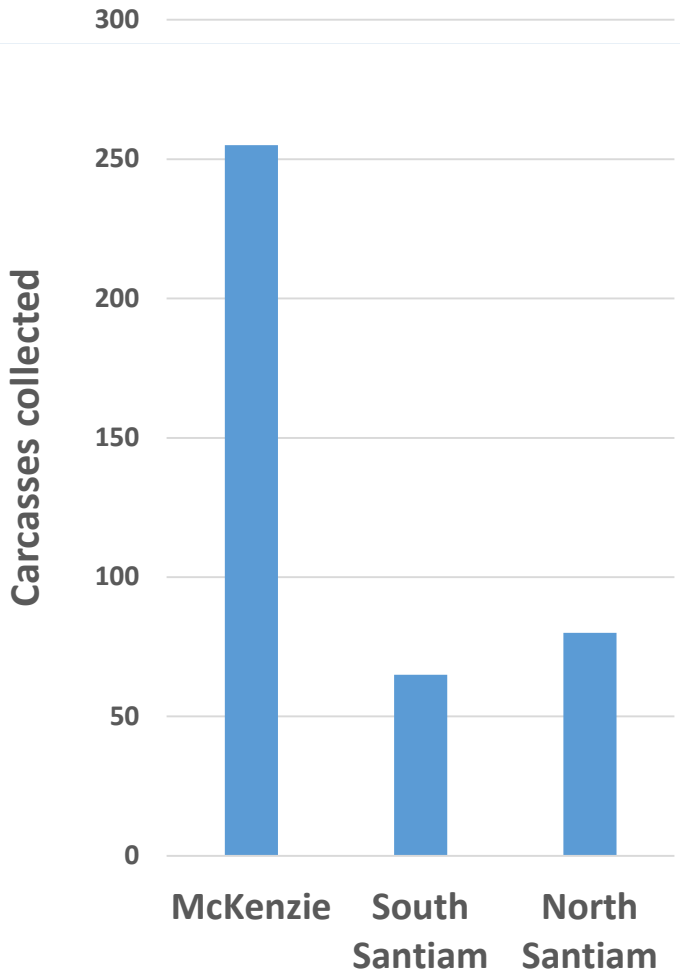
# Results

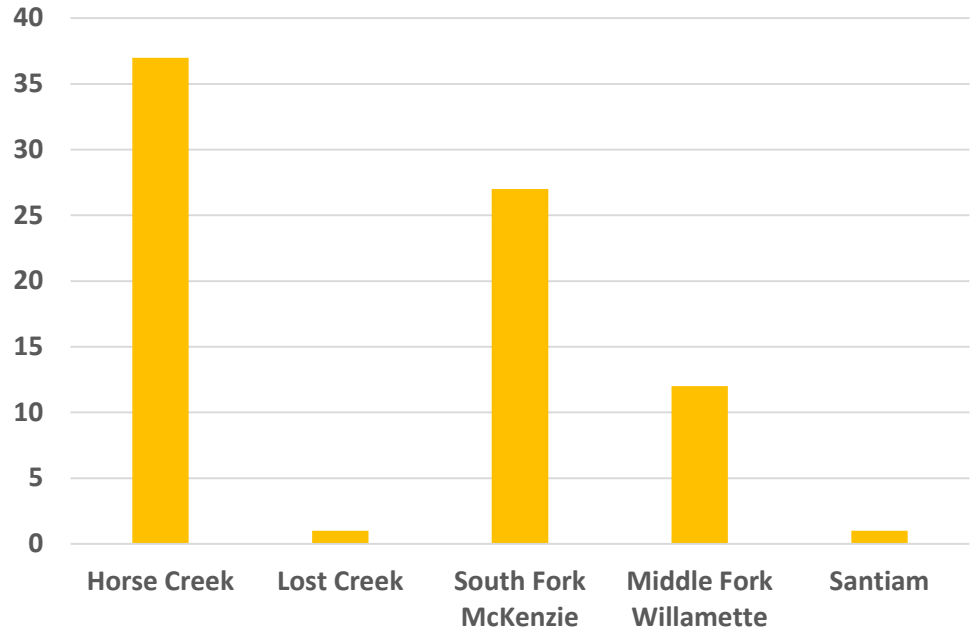
## Carcass Collection

- July 3 – October 17
  - First carcass 7/4 , last carcass 10/16
- 433 surveys
- 478 carcasses collected

# Results

## Carcass Collection

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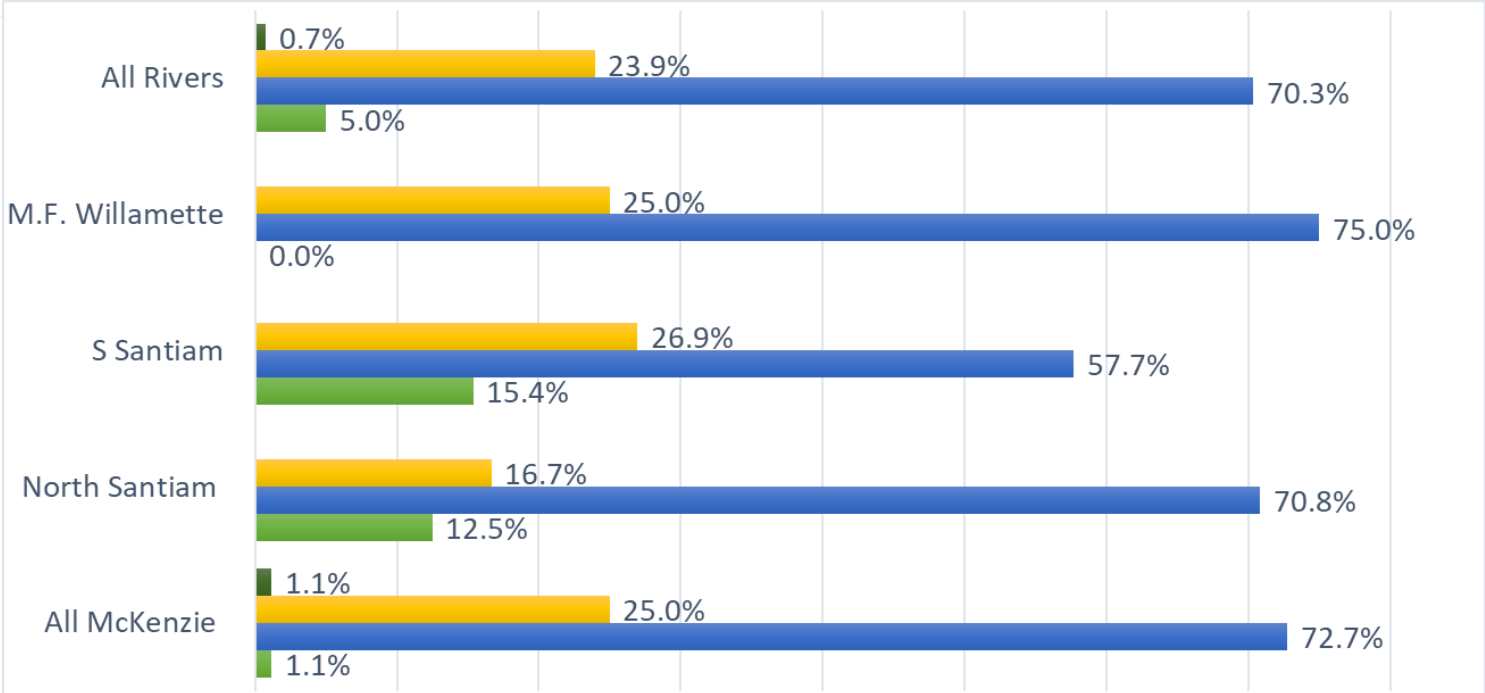
# Results

## Age Structure by Drainage




| | All McKenzie | North Santiam | S Santiam | M.F. Willamette | All Rivers |
|---|---|---|---|---|---|
| 6 | 1.1% | | | | 0.7% |
| 5 | 25.0% | 16.7% | 26.9% | 25.0% | 23.9% |
| 4 | 72.7% | 70.8% | 57.7% | 75.0% | 70.3% |
| 3 | 1.1% | 12.5% | 15.4% | 0.0% | 5.0% |

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# Results

| PSM by Drainage | PSM | Spawned | Total | PSM % |
|---|---|---|---|---|
| Middle Fork Willamette | 2 | 0 | 2 | 100% |
| McKenzie | 6 | 191 | 197 | 3% |
| South Santiam | 6 | 38 | 44 | 14% |
| North Santiam | 2 | 40 | 42 | 5% |

## Prespawn Mortality

- Most fish either retained nearly all of their eggs, or spawned completely
  - 1.4% of carcasses had 30-70% egg retention

# Analysis

## PSM 2019 vs. 2018

Decreased in 2019

- South Santiam 2019 (14%), 2018 (18%),
- McKenzie above Leaburg Dam
  - 2019 (3%), 2018 (16%)
- McKenzie below Leaburg Dam 2019 (12%), 2018 (14%)
- North Santiam 2019 (5%), 2018 (37%)

Increased in 2019*

- Middle Fork Willamette 2019 (100%) 2018 (50%)

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# Analysis

## Prespawn Mortality

- Another study (Bowerman et al. 2017) of 14 years of data in the basin indicated that hatchery fish may experience higher levels of PSM.
- Compared proportions of PSM for hatchery and natural origin fish using Fisher's Exact Test (confidence level 0.05)
- All Rivers PSM 2018 – Hatchery 0.180, Natural origin 0.178, Fisher's Exact: p = 1.0
- All Rivers PSM 2019– Hatchery 0.092, Natural origin 0.036, Fisher's Exact: p = 0.074

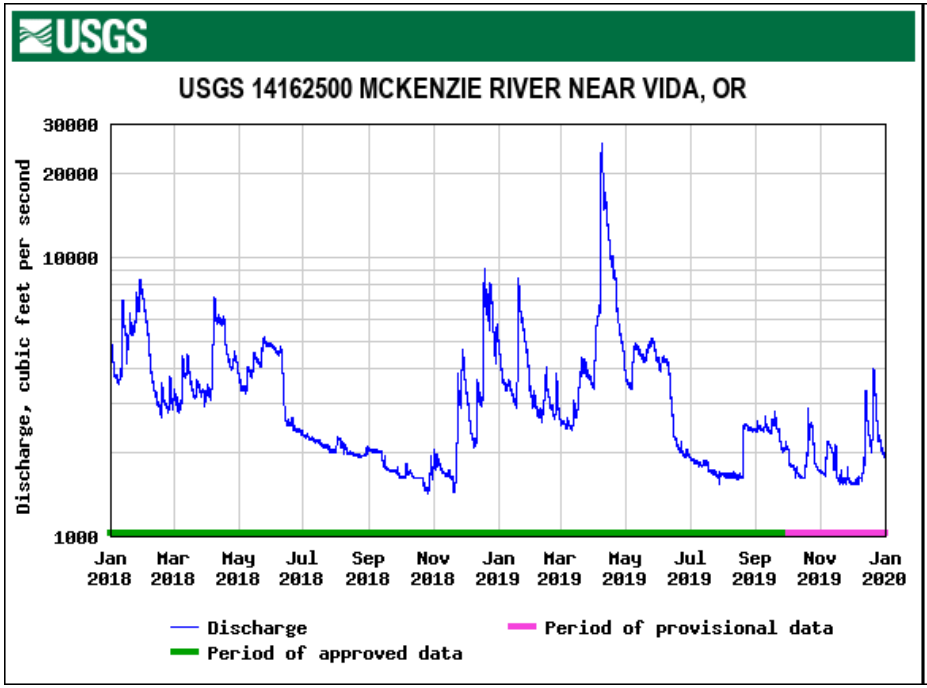
  Our data did not appear to support higher PSM rates in hatchery fish in 2018 or 2019.

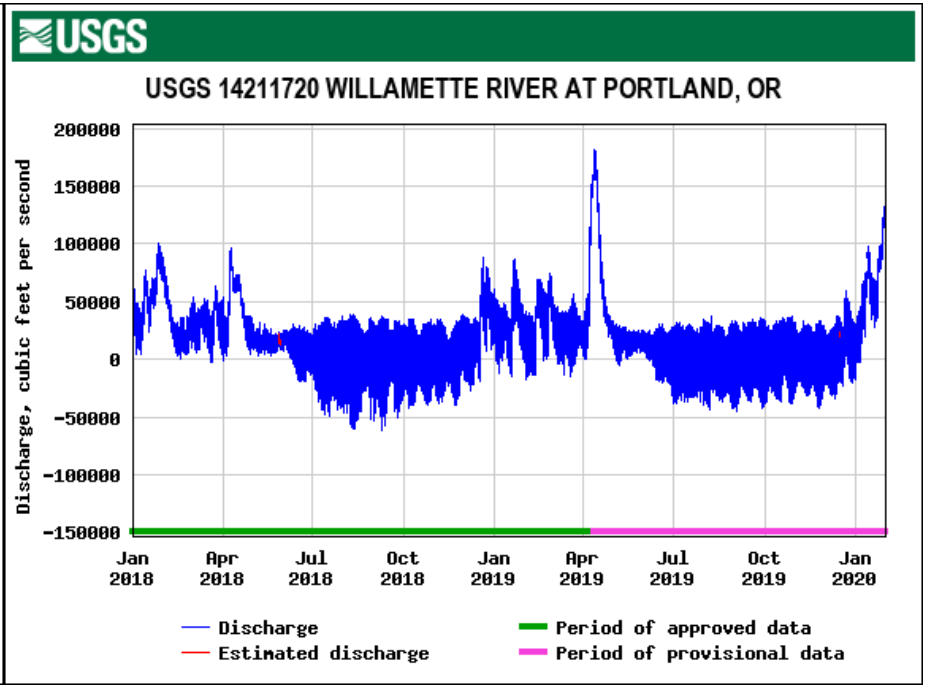
- **Lower PSM in 2019 (0.06) than 2018 (0.18) (Fisher's Exact: p<0.001)**

# Discussion

## Why Lower Levels of PSM in 2019 vs. 2018?

- Temperature?
- Flow?
- Other Factors?

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# Results

| River | Hatchery | Natural Origin | pHOS |
|---|---|---|---|
| **McKenzie** | 108 | 147 | 0.42 |
| **Horse Creek** | 3 | 34 | 0.08 |
| **Lost Creek** | 0 | 1 | 0.00 |
| **South Fork McKenzie** | 10 | 17 | 0.37 |
| **South Santiam** | 36 | 29 | 0.55 |
| **North Santiam** | 9 | 71 | 0.11 |
| **Santiam** | 1 | 0 | 1.00 |
| **M. F. Willamette** | 9 | 3 | 0.75 |

## Proportion Hatchery Origin Spawners

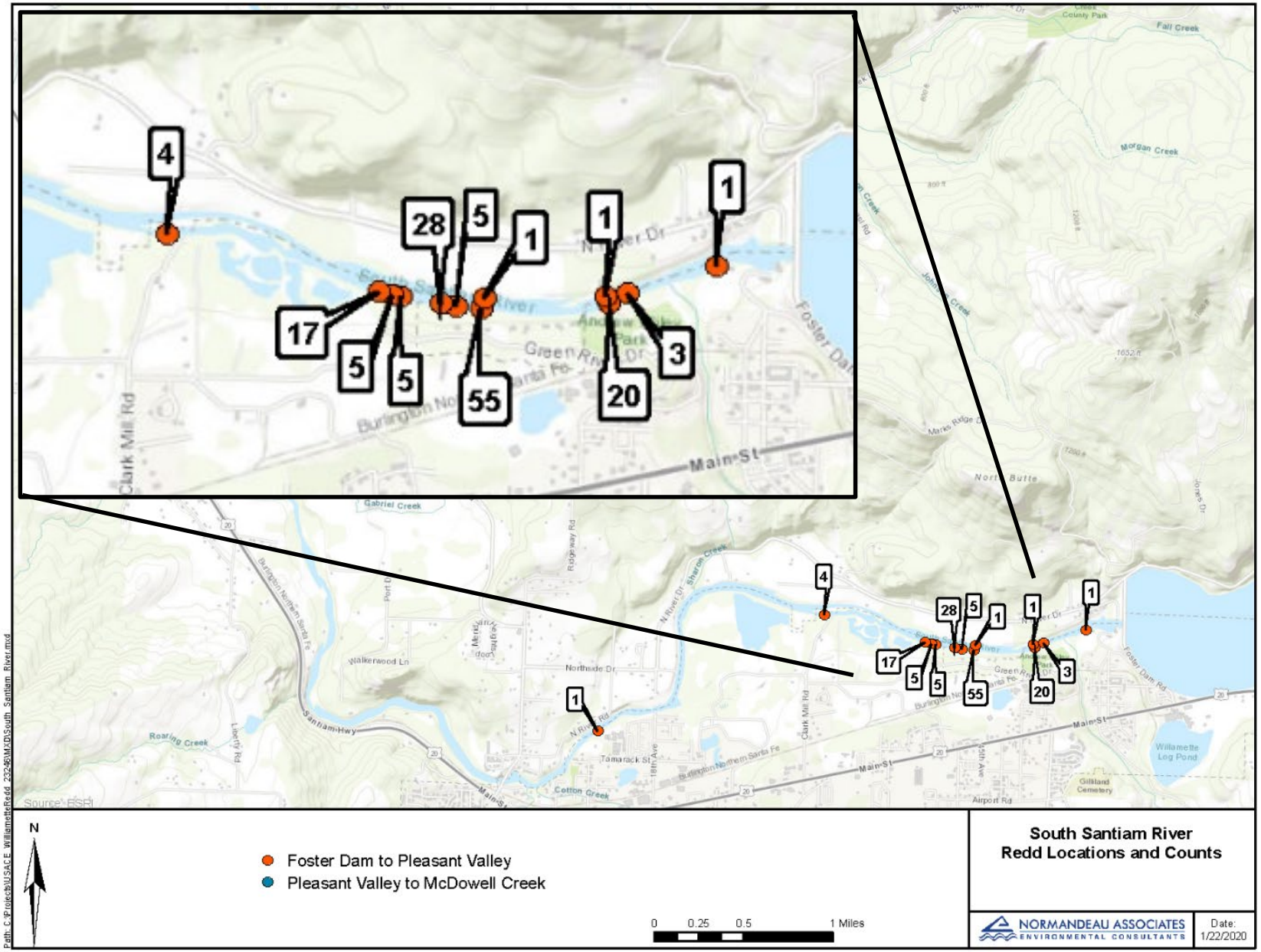
- >0.5 on the S. Santiam, Santiam, and M.F. Willamette
- Lowest on the tributaries of the McKenzie above Leaburg Dam (Horse Creek and Lost Creek) and on the N. Santiam

# Results

## Redd Counts and Density

- Initiation of spawning Sept. 5, peak last week of Sept., final Survey Oct. 17
- Peak redd counts were generally from the last two weeks

| River | Surveyed Length (km) | # of Redds | Redds/km |
|---|---|---|---|
| McKenzie | 115.53 | 1034 | 9.0 |
| South Fork McKenzie | 7.08 | 265 | 37.4 |
| Lost Creek | 7.72 | 30 | 3.9 |
| Horse Creek | 21.72 | 118 | 5.4 |
| Santiam | 19.47 | 0 | 0.0 |
| North Santiam | 74.17 | 271 | 3.7 |
| Little North Santiam | 27.84 | 11 | 0.4 |
| South Santiam | 54.55 | 165 | 3.0 |
| Middle Fork Willamette | 12.71 | 0 | 0.0 |
| Fall Creek | 6.1 | 2 | 0.3 |


4
28
5
1
17
5
5
55
1
20
3
1
Clark Mill Rd
Main St
Gabriel Creek
Roaring Creek
Cotton Creek
Santiam Hwy
Northside Dr
Tamarack St
Walkenwood Ln
Ridgeway Rd
Clark Mill Rd
Foster Dam Rd
Morgan Creek
Fall Creek
Willamette Log Pond
Airport Rd
Source: ESRI
N
Foster Dam to Pleasant Valley
Pleasant Valley to McDowell Creek
0 0.25 0.5 1 Miles
South Santiam River
Redd Locations and Counts
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Date:
1/22/2020
Path: C:\Projects\USACE Willamette\Redd 2324\MXD\South Santiam River.mxd

# Analysis

## Redd Counts 2019 vs. 2018

### Increased

- McKenzie- 1034 redds (2019) up from 374 (2018)
- South Fork McKenzie- 265 redds (2019) up from 55 (2018)
- Horse Creek- 118 redds (2019) up from 90 (2018)
- Little North Santiam- 11 redds (2019) up from 2 (2018)

### Decreased

- South Santiam- 165 redds (2019) down from 653 (2018)

### Similar

- North Santiam- 271 redds (2019) down from 284 (2018)
- Lost Creek – 30 redds (2019) up from 24 (2018)
- Fall Creek- 2 redds (2019) up from 1 (2018)

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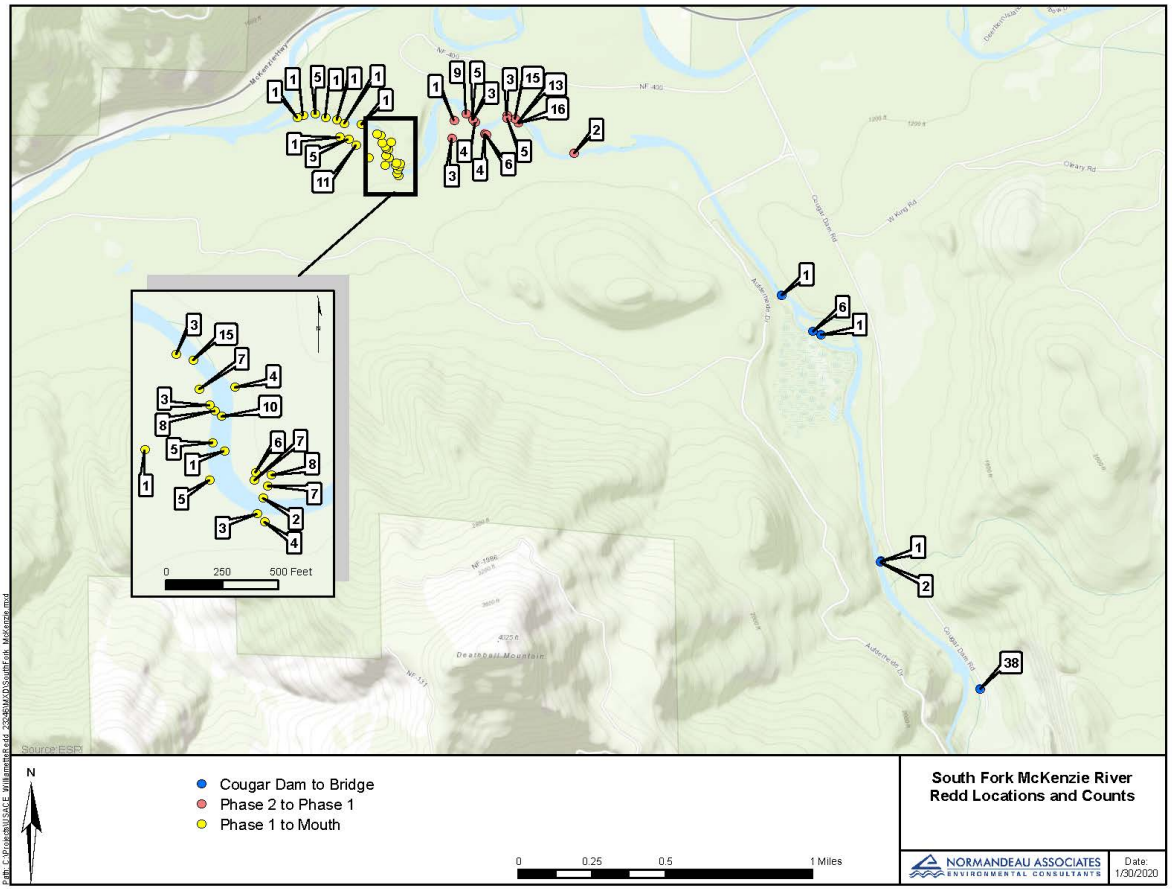
# Discussion




## South Fork McKenzie Habitat Restoration

- Cougar dam to Bridge- 49 redds (2019) 4x increase over 2018 (12 redds)
- Bridge to Mouth- 216 redds counted in 2019 5x increase over 2018 (43)
- Phase 1 to Mouth- 127 redds (2019) 9x increase over 2018 (14 redds)

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# Analysis

## Spawner Abundance by Origin

| Sections | Redd Count | Spawner Abundance (Redds*2.5) | pHOS | Hatchery-origin Abundance Estimate | Natural-origin Abundance Estimate |
|---|---|---|---|---|---|
| McKenzie above Leaburg Dam (including SF McKenzie, Horse Creek, and Lost Creek) | 1244 | 3110 | 0.34 | 1048 | 2062 |
| McKenzie below Leaburg Dam | 203 | 508 | 0.68 | 347 | 160 |
| North Santiam below Minto Dam and Little North Santiam | 143 | 358 | 0.28 | 100 | 257 |
| North Santiam above Minto Dam | 139 | 348 | 0.04 | 13 | 335 |
| South Santiam | 156 | 390 | 0.55 | 216 | 174 |
| MF Willamette and Fall Creek below Fall Creek Dam | 2 | 5 | 0.75 | 4 | 1 |
| Santiam | No redds | | | | |

# Discussion

## Little North Santiam 2019 vs. 2018

- September rains in 2019 allowed for fish to navigate to spawning areas: 11 redds in 2019 vs 2 redds in 2018

**2018**

**2019**

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# Results

## Straying (CWT)

One fish strayed from the McKenzie to the North Santiam

**2019**

| River | Strays | Total CWT |
|---|---|---|
| McKenzie | 1 | 21 |
| MF Willamette | 0 | 7 |
| North Santiam | 0 | 1 |
| total | 1 | 29 |

**2018** **Hatchery fish with read coded**

| River | Strays | Total CWT |
|---|---|---|
| McKenzie | 3 | 11 |
| South Santiam | 3 | 8 |
| total | 6 | 19 |

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# Questions?

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