# Winter Steelhead Monitoring in Western Oregon: Converting Redds to Fish


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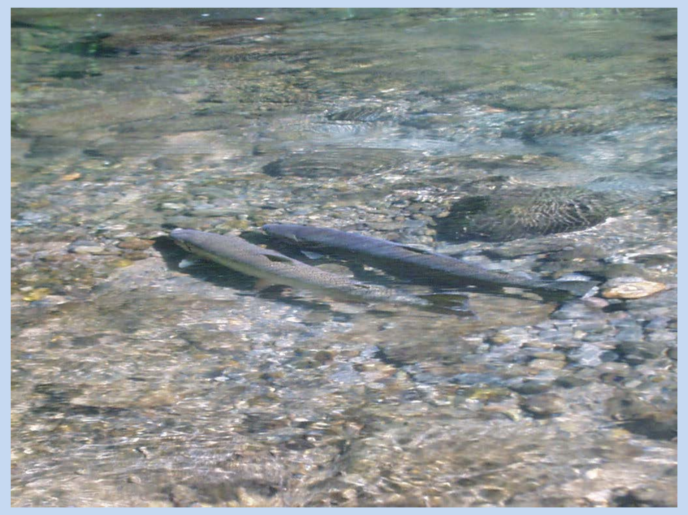

## Overview

The use of redds as a metric for monitoring salmonid spawner abundance is well established. However, monitoring based on estimated redd abundance creates a disconnect with harvest management and population viability assessments, which are typically based on numbers of fish. From methodology development work conducted by ODFW in the late 90's a linear regression was developed to predict total adult winter steelhead from redd counts along the Oregon Coast. Variation in observed redd to fish conversions suggested temporal and spatial differences. Thus, use of average or modeled conversion methods could lead to inaccurate annual estimates of winter steelhead spawners over such a broad geographic scale. Base monitoring covers four distinct population segments in Oregon from Washington to California borders. Developing multiple calibration sites that can provide annual estimates of redd to fish conversions across the monitoring area could address this issue. The following poster describes current monitoring methods, previous redd to fish conversion research, and some results of new research.

## Base Monitoring Methods

**Field Methods**

- Randomly selected and spatially balanced (GRTS) site draw.
- Survey targets per scale:
  - Population (30 sites per population).
  - DPS (50 sites per monitoring area).
- Sites visited on a 14-day rotation.
- New redds marked on each visit.
- Live steelhead are counted based on mark status.
- Sites are attempted from February – May.

**Analysis Methods**

1. Check on survey visit frequency:
   - No gaps of 21 or more days.
   - No more than 1 gap of 15 to 20 days.
2. Calculate No. Redds/Mile, by site.
3. Calculate Expansion Factor: Spawning Miles/Surveys.
4. Calculate Estimate (Redds/Mile * Expansion Factor).
5. Divide into Wild and Hatchery based on fin clip data.
6. ***Convert redds to fish**

## Geographic Scope

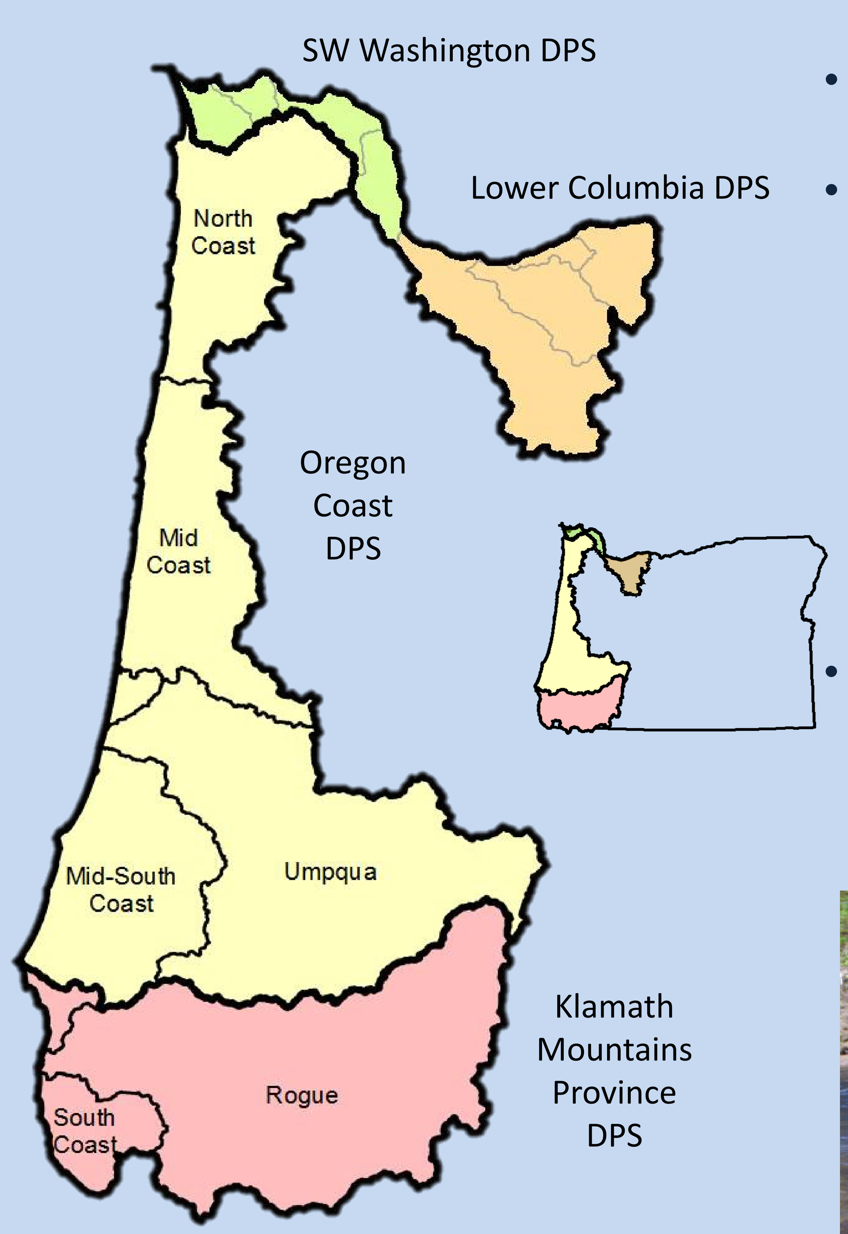


*Figure 1. Area Monitored*

- 4 Distinct Population Segments (DPS's) Monitored (Figure 1)
- Estimates made at different scales
  - SW Washington and Lower Columbia DPS's at Population level
  - Oregon Coast DPS at Monitoring Area level
  - No KMP DPS estimate, but annual sites monitored
- Method development and most consistent data for Oregon Coast DPS.
  - About 6,500 miles (10,500 km) of steelhead spawning habitat

## Redd to Fish Conversion Research

**Redd to Fish Conversion Development (1998-2002)**

- Focused effort in five calibration sites of various basin size:
- Sites above areas of known steelhead abundance:
  Fishhawk Creek (Nehalem Basin), Mill Creek (Siletz Basin), Mill Creek (Yaquina Basin), Upper Smith River (Umpqua Basin), West Fork Smith River (Umpqua Basin)
- Fourteen separate redd to fish data points showed a strong linear relationship (Figure 2).

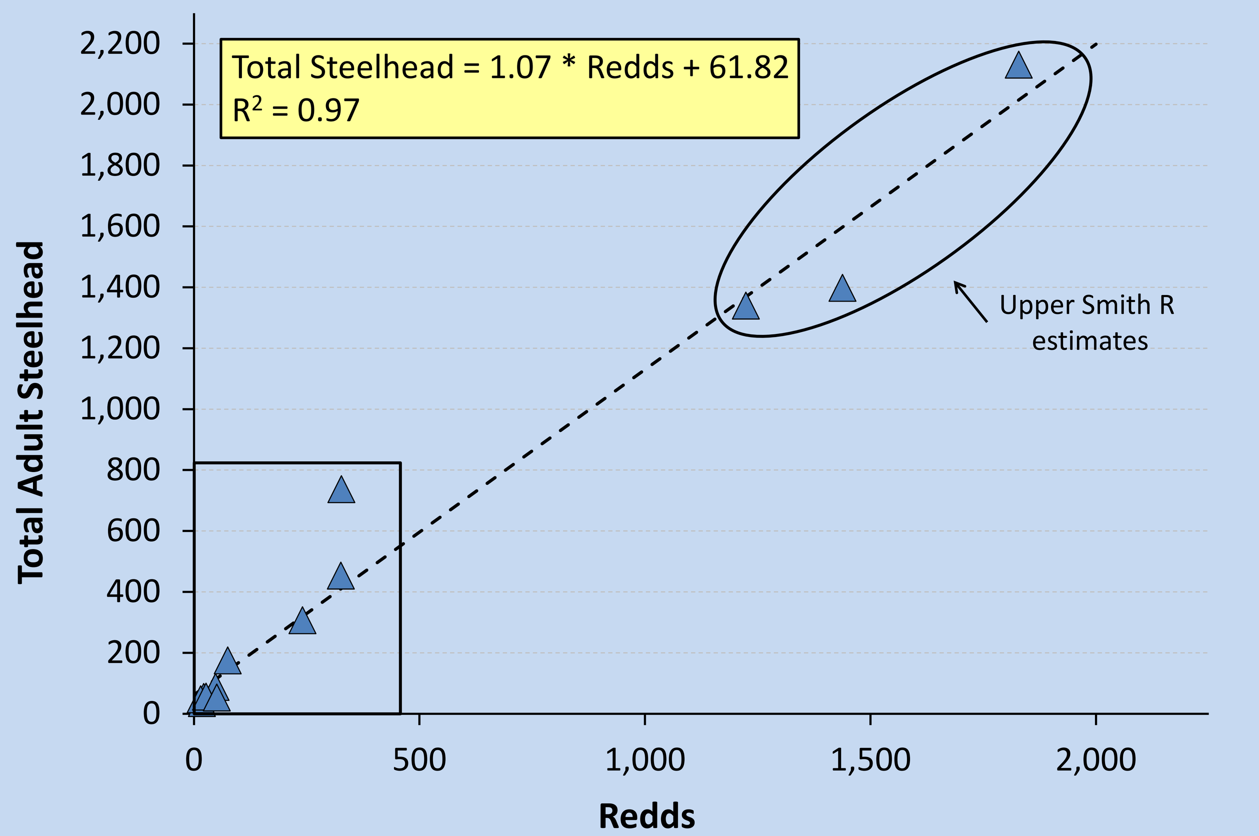


*Figure 2. Relationship between total steelhead and redds at five calibration sites on the Oregon Coast, 1998–2002.*

**Re-Analysis (2010)**

- Two distinct groups apparent : greater than 1200 redds and less than 500.
- Upper Smith River est. leverages regression line causing an unrealistic Y intercept.
- Also, causes an unrealistic slope (1.07) : Average spawner-to-redd ratio = 1.75
- Published spawner-to-redd ratios:
  - 2.5 steelhead / redd (Boydstun & McDonald 2005)
  - 1.7 steelhead / redd (Duffy 2005)
  - 1.1 – 1.6 steelhead / redd (Gallagher 2005)
- Re-analysis using an ANCOVA model.
  - Two Continuous variables: No. of Sth & No. of Redds
  - Categorical variable: Smith R vs. Not Smith R

*Table 1. Results of ANCOVA model and past sampling*

| Method | Regression Slope or Quotient | Y Intercept |
|---|---|---|
| ANCOVA model | **1.70** | **3.74** |
| Old Linear Regression | 1.07 | 61.82 |
| | | |
| Average Quotient (AQ), All sites and Years | 1.75 | -- |
| AQ - Fishhawk Cr, n=3 | 1.96 | -- |
| AQ – Mill Cr (Siletz), n=2 | 2.08 | -- |
| AQ - Mill Cr (Yaquina), n=3 | 2.08 | -- |
| AQ – W FK Smith R, n=3 | 1.64 | -- |
| AQ – Smith R, n=3 | 1.08 | -- |

- ANCOVA results more in-line with expected values (Table 1).
- Total Steelhead = (1.70 * Redds) + 3.74

## New Results

- New set of calibration sites started in 2014 with at least one site in each monitoring area, except for Mid-South (Figure 3).

*Table 2. Results of monitoring in 2014.*

| Study Basin | STW | Redds | Fish/Redd | Sampling scheme |
|---|---|---|---|---|
| Lewis & Clark R | 260 | 125 | 2.08 | Complete trap count & total census of spawning habitat. |
| North Fork Nehalem R | 445 | 323 | 1.38 | Mark-recap estimate & random sample of spawning habitat. |
| East Fork Trask R | 224 | 65 | 3.45 | Complete trap count & random sample of spawning habitat. |
| Mill Cr (Yaquina) | 58 | 32 | 1.81 | Complete trap count & total census of spawning habitat. |
| Fall Cr (Alsea) | 261 | 205 | 1.27 | Mark-recap estimate & random sample of spawning habitat. |
| West Fork Smith R | 286 | 204 | 1.40 | Mark-recap estimate & only high use spawning habitat sampled. |
| | | | $\bar{x}$ = 1.90 | |

*Table 3. Results of monitoring in 2015.*

| Study Basin | STW | Redds | Fish/Redd | Sampling scheme |
|---|---|---|---|---|
| Lewis & Clark R | 613 | 581 | 1.06 | Complete trap count & total census of spawning habitat. |
| North Fork Nehalem R | *Results Pending* | | | Mark-recap estimate & random sample of spawning habitat. |
| East Fork Trask R | 342 | 156 | 2.19 | Complete trap count & random sample of spawning habitat. |
| Mill Cr (Yaquina) | 94 | 49 | 1.92 | Complete trap count & total census of spawning habitat. |
| Fall Cr (Alsea) | 515 | 333 | 1.55 | Mark-recap estimate & random sample of spawning habitat. |
| West Fork Smith R | 569 | 175 | 3.25 | Mark-recap estimate & only high use spawning habitat sampled. |
| | | | $\bar{x}$ = 1.99 | |

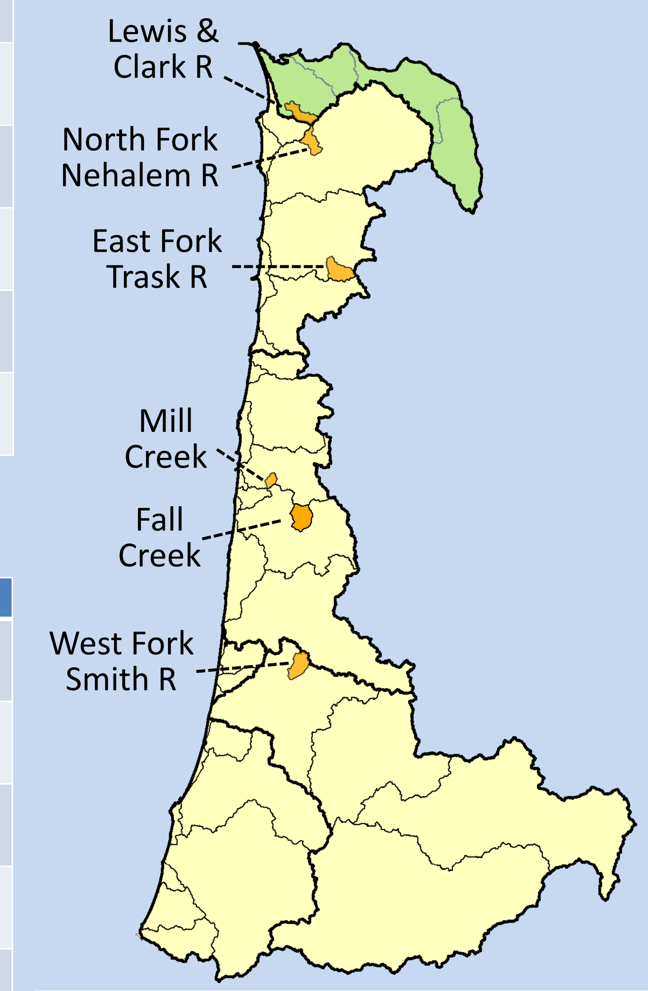


*Figure 3. Location of current calibration sites.*

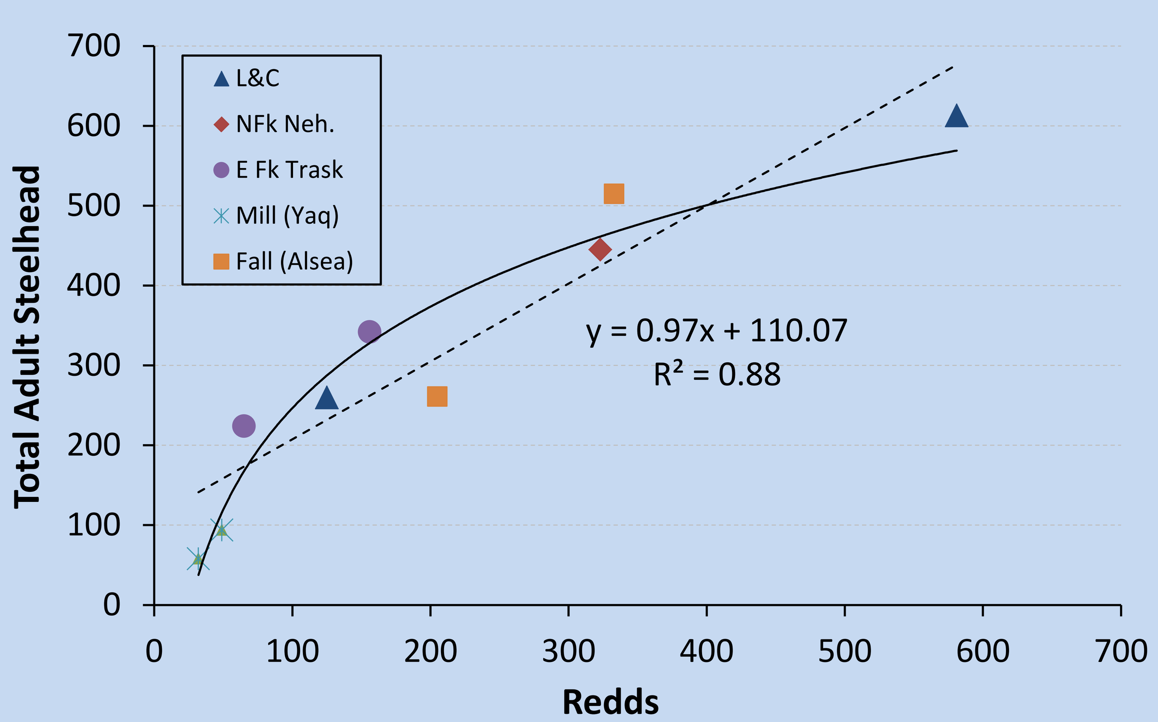


*Figure 4. Relationship between total steelhead and redds at five calibration sites on the Oregon Coast, 2014–15.*

- Again, lots of between site and year variation (Tables 2 & 3)
- Linear regression on fish to redds shows a tight relationship (Figure 4), but again regression values appear nonsensical.

## Future Considerations

- Explore other (non-linear) relationships (see figure 4)
- Model previous results with other variables like basin size, fish density, flow, and or float versus foot surveys
- Assess relationships in good versus bad visibility years
- Add a Mid-South coast site and a Lower Columbia site?
- Improve estimation techniques (i.e. stratification)
- Assess relationships using Females per Redd


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