Smith River Verification Study

Comparing snorkeling and electrofishing for large spatial scale juvenile salmonid monitoring

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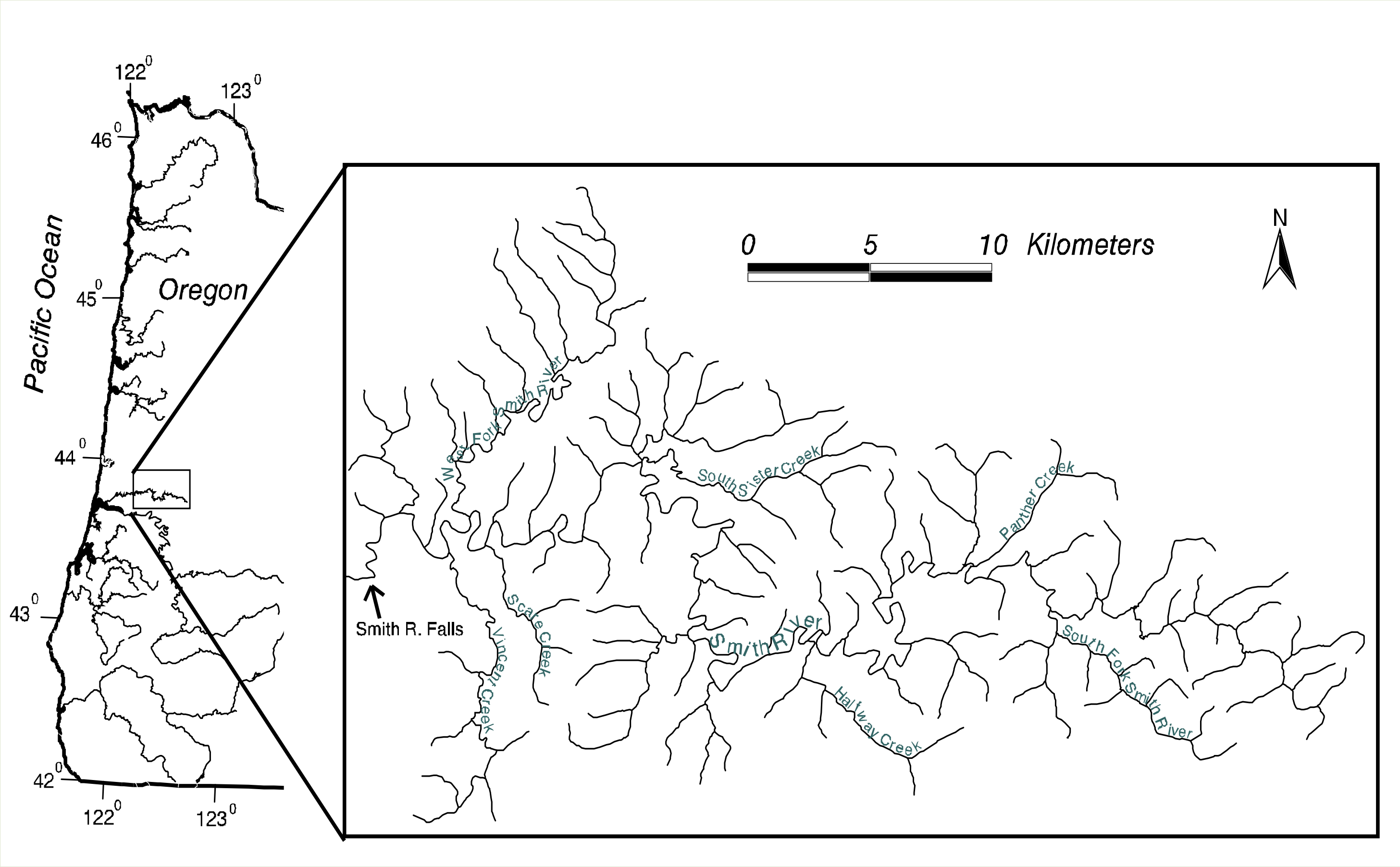
- Purpose: on large scales which method is better for monitoring of juvenile salmonid trends

- Optimal
  - Detect fish for distribution
  - Survey large and consistent portion of the population for abundance
  - Precision
  - Cost

- Accuracy and Shallow Water v. Sample Size and Big Water

Location and Scale



Wadeable (304 km)
- **lower order**
- **ACW < 10m**

Intermediate (24 km)
- **3rd order**
- **ACW 9-12m**

Non-wadeable (90 km)
- **3rd order or higher**
- **ACW > 12m**

Methods
Electrofishing

- GRTS (Stevens, 2002) based
- 36 sites per year in wadeable streams
- Electrofishing: removal estimates (Armour, 1983) with block nets on a habitat unit by habitat unit basis
- 20x ACW and encompass GRTS point

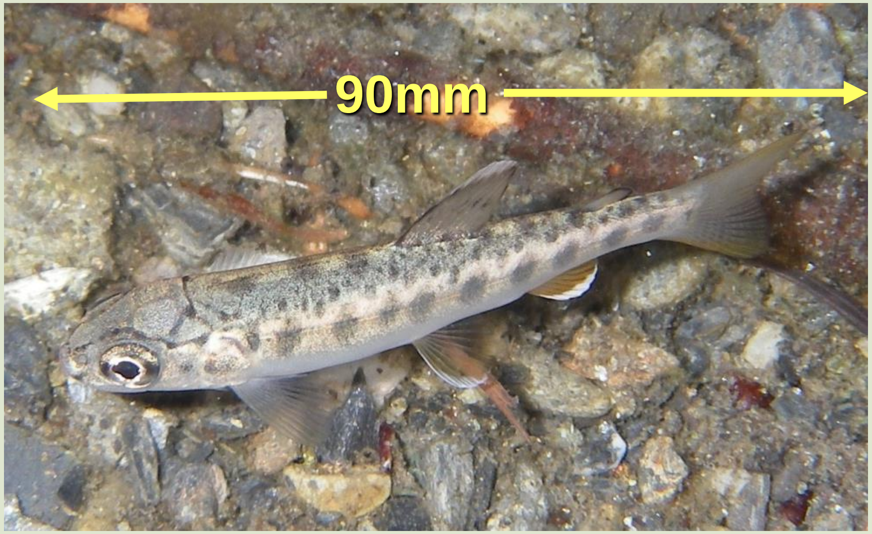
Methods
Snorkeling

- 1000 m reach, same GRTS points encompassed
- Only pools > 40cm deep and 6 m^2 in surface area
- Single pass, enumerate salmonids
- Additional sites in Non-wadable streams
- Resurveys

Methods

Clarifications

- **Only Steelhead > 90mm in fork length**
- **Six seasons**
  - 2001 to 2004
  - 2007 and 2008



Methods

Metrics

- **Distribution**
  - Site Occupancy = n of sites with steelhead/n of sites sampled
- **Abundance**
  - Population Estimates = Fish per meter x Site weight
    - Fish/Meter = sum of count or removal estimate/survey length
    - Site weight = total length of each stream type/number of site completed in type
- **Variance**
  - From Stevens statistical analysis (2002)
- **Significance**
  - p-value < 0.05
- **Cost**
  - Crew hours = time x crew size

Methods
Metrics

- **Snorkeling**
  - Only in pools
  - Filtered for Wadeable and Non-Wadeable streams

- **Electrofishing**
  - Only in wadeable streams
  - Filtered for estimates in all habitat types

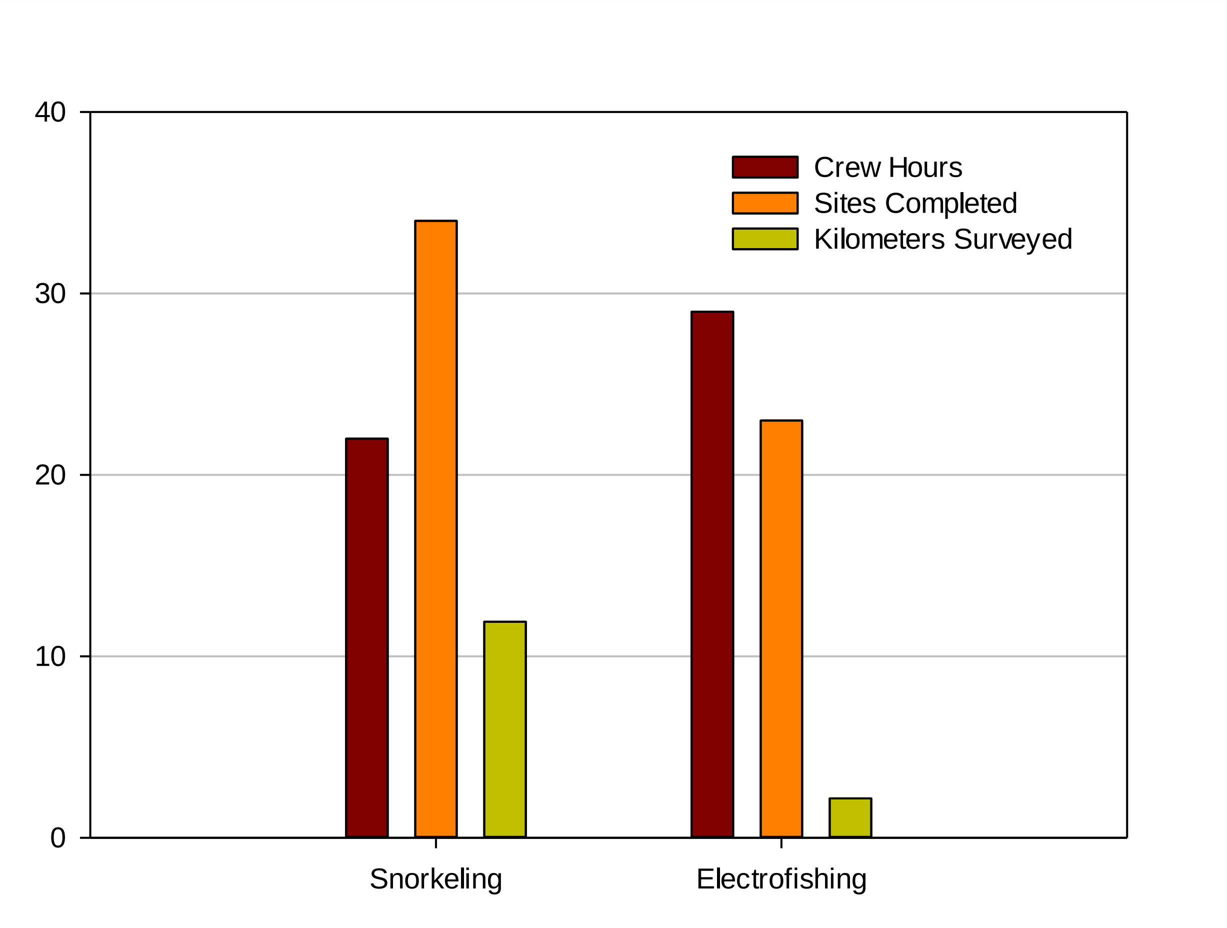
Results

Accuracy

- **Snorkel counts average 43% of removal estimates**
- **Visual counts and removal estimates for steelhead.**
  - Hillman et al. (1992)
  - Johnson (unpublished data)
  - Mullner et al. (2005)

Results

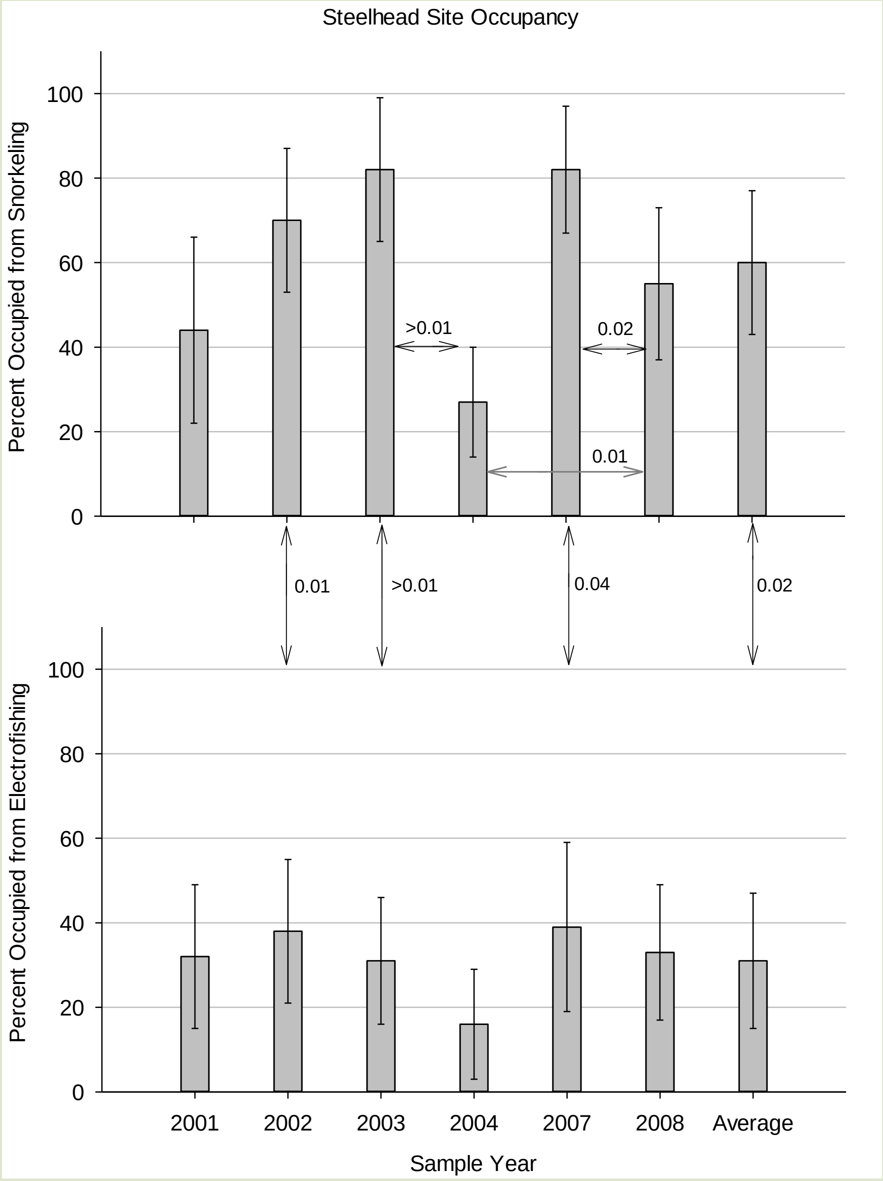
Sample effort – Sample size



- **Snorkeling required 75% of the Electrofishing effort**
- **Snorkeling completed and average of 11 additional sites per season**
- **11,900m of stream v. 2171m of stream**
- **Snorkeling sampled 2.9% of the distribution; Electrofishing sampled 0.5%**

Results

Distribution Estimates



- Snorkeling averages 29% higher than electrofishing
- Smaller confidence intervals increase sensitivity to trends
- CI from snorkeling = 32% of estimate
- CI for Efishing = 55% of estimate

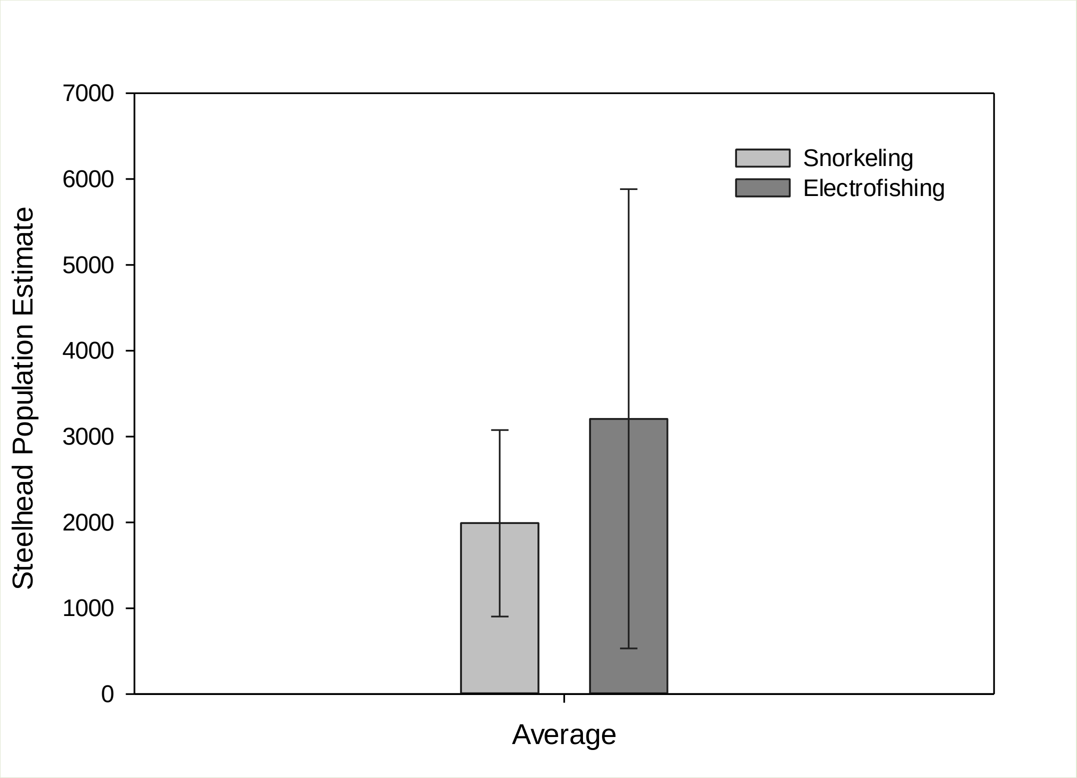
Results
Abundance

- Precision - sensitivity
- Non wadeable v. shallow
- Trends - Variation

Results
Precision

- **Precision**
  - **Snorkeling 35 – 71%, Ave 55%**
  - **Electrofishing 64 – 96%, Ave 83%**

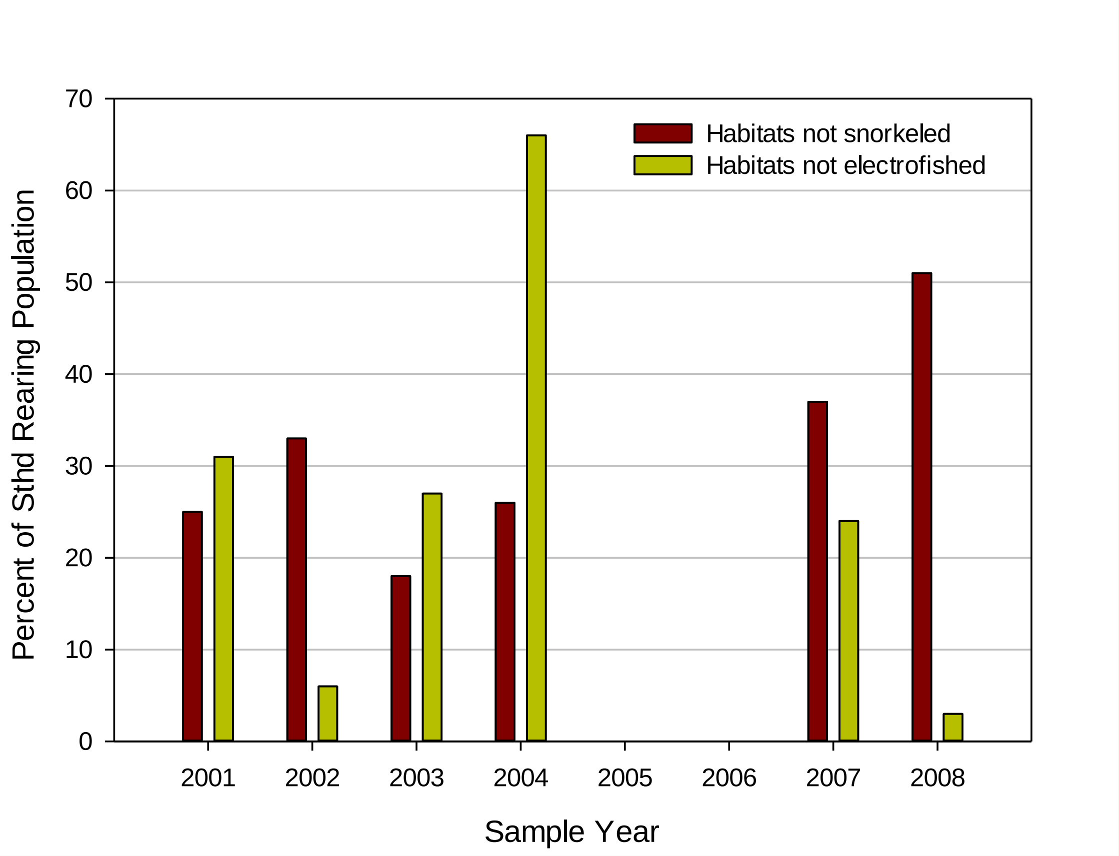
- **Snorkeling more precise**



Results

Abundance

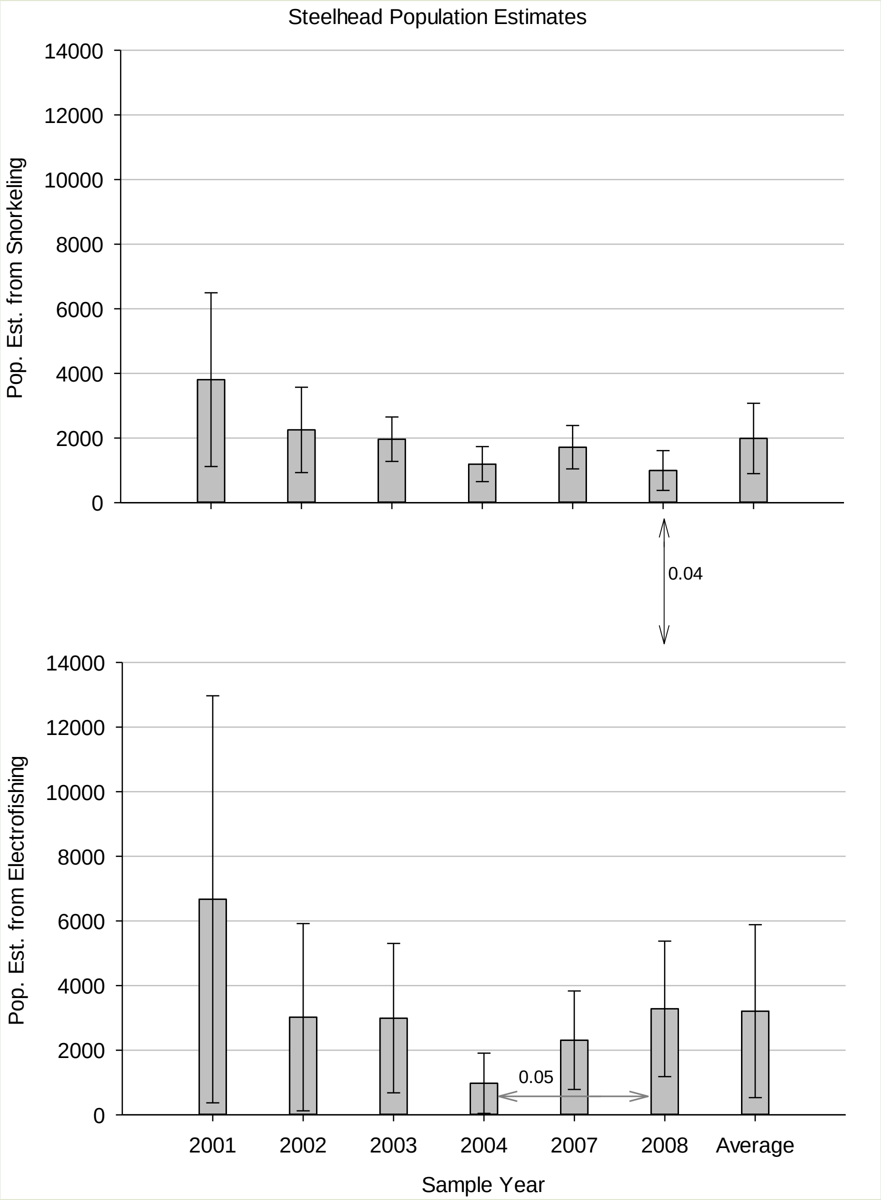
- **Most in snorkel pools – ave. 69%**
- **More steelhead in habitats not snorkeled**
- **More variation in habitats not electrofished.**



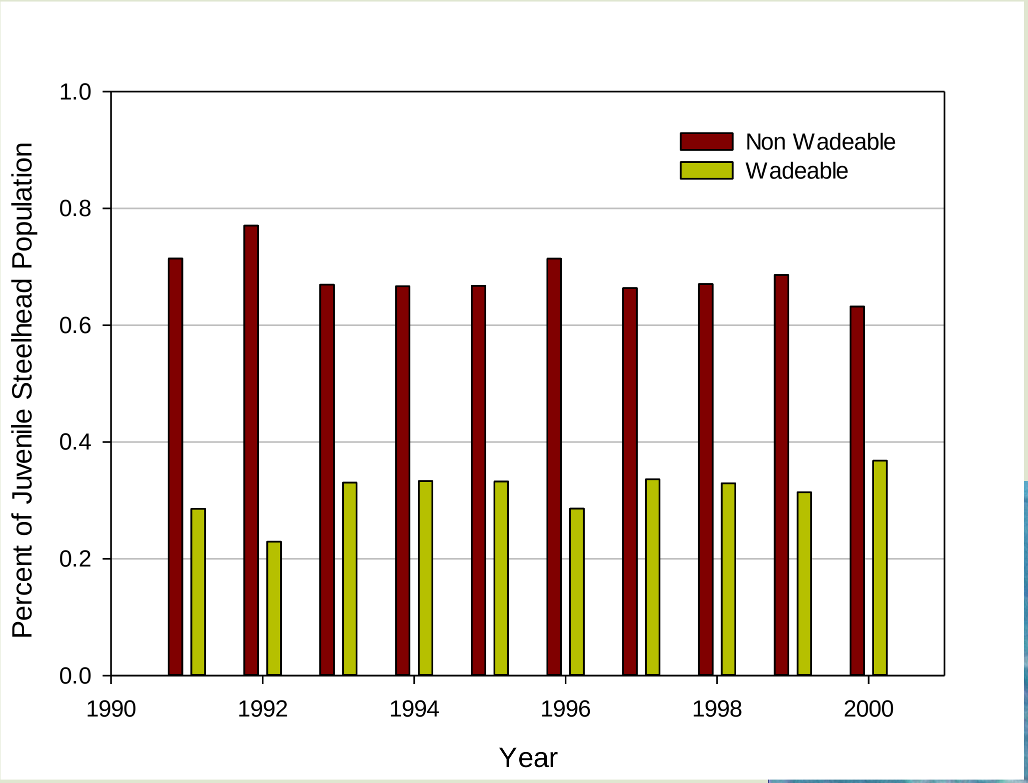
Results

Abundance

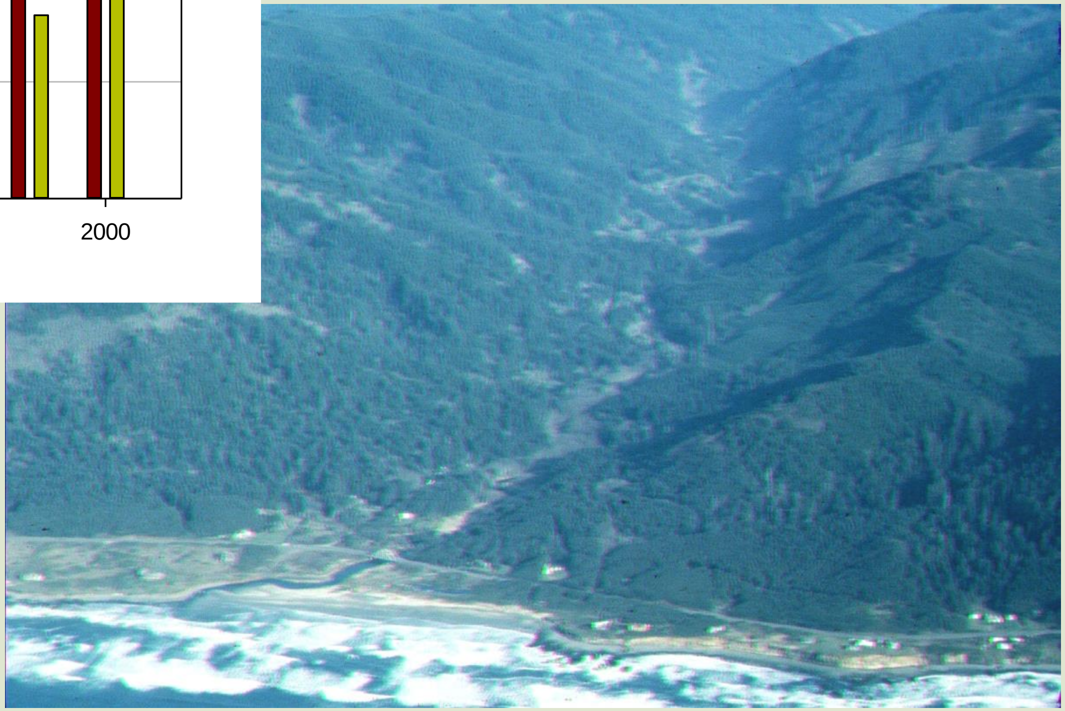
- **Faulty Trends**
  - 66% in non-wadeable (2004)
  - 3% non-wadeable (2008)
  - 51% in habitats not snorkeled (2008)
- **Need to expand sampling**



Protocol Changes

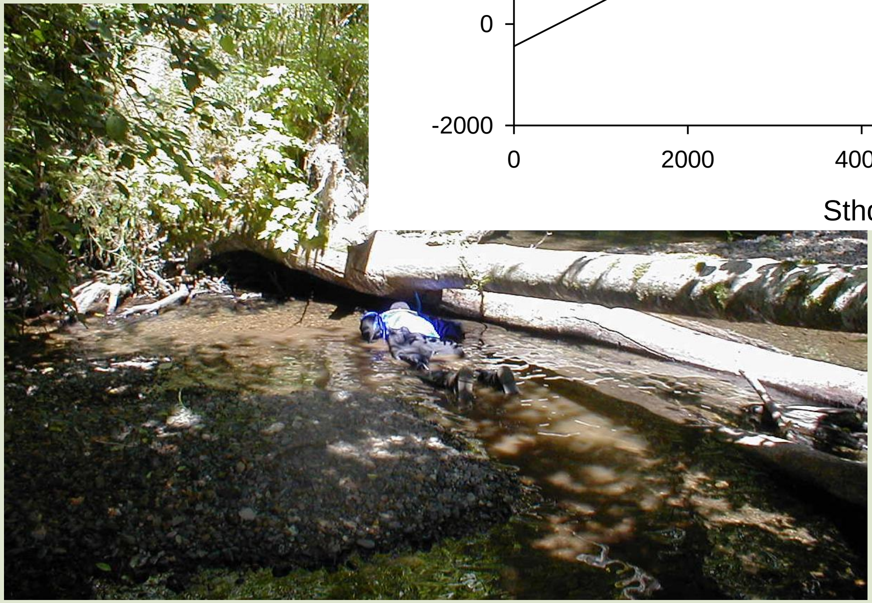


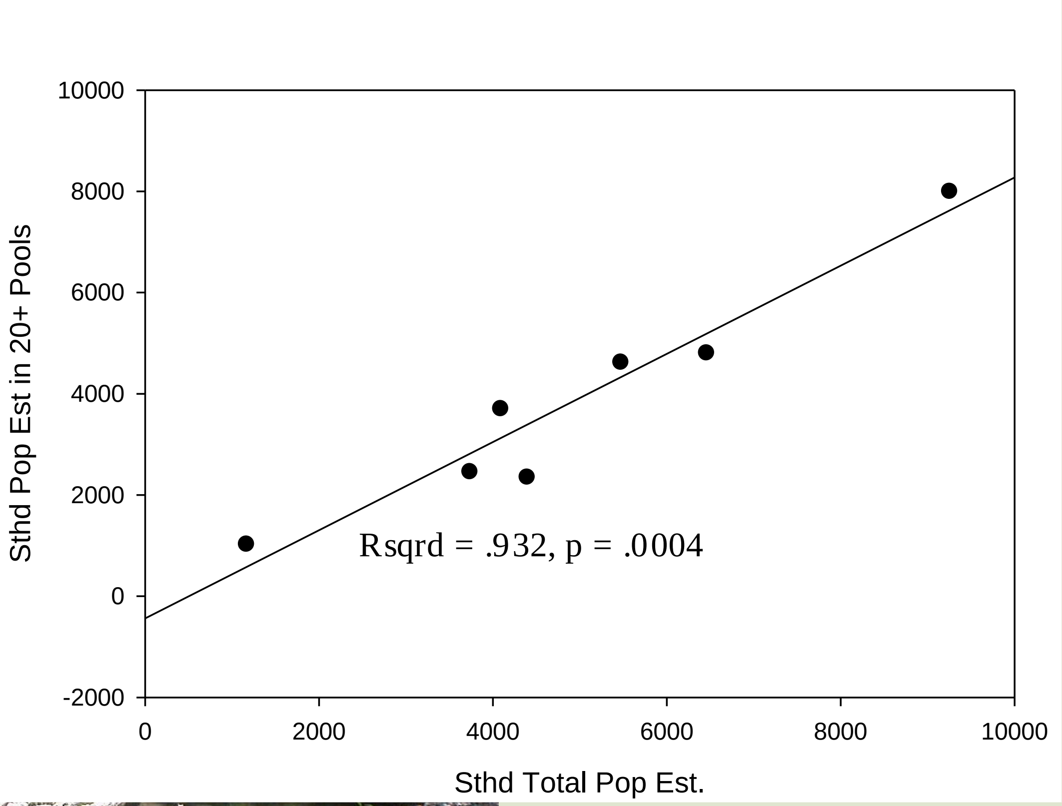
- Need for non wadeable sampling stressed by Tenmile Study (Johnson, 2005)
- 63 – 77% of steelhead in non wadeable portions



Protocol Changes

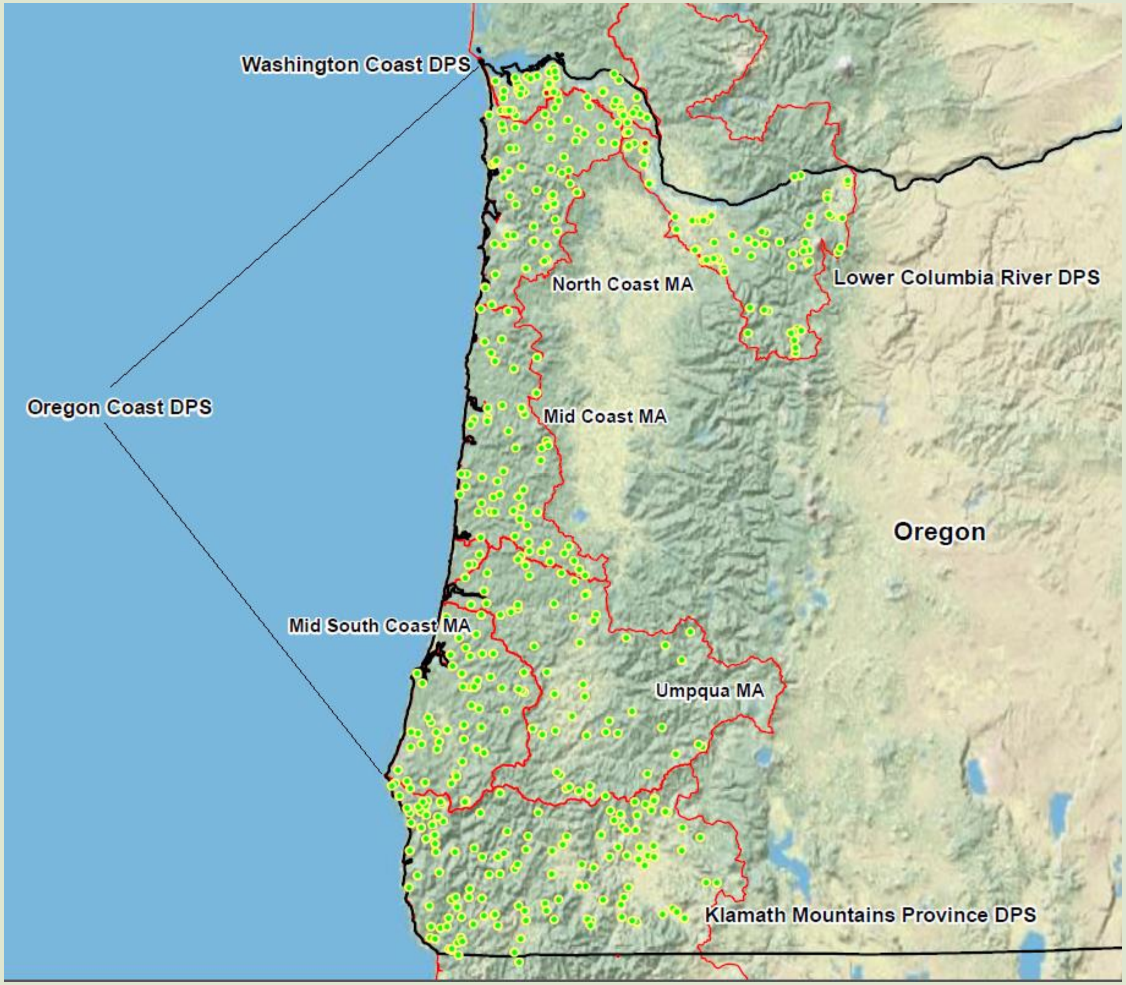
- **At 40cm:**
  - **69%**
  - **49 – 82%**
- **At 20cm:**
  - **78%**
  - **54 – 91%**





Protocol Changes

- **Lower depth applied to coast wide surveys in 2010:**
  - Increase pop est by 8%
  - 7% smaller CIs
  - Increases occupancy; decreases occupancy CI



Conclusions

- Electrofishing more accurate
- Snorkeling less costly, Samples 5x more habitat
- Snorkeling more accurate and sensitive to trends in distribution

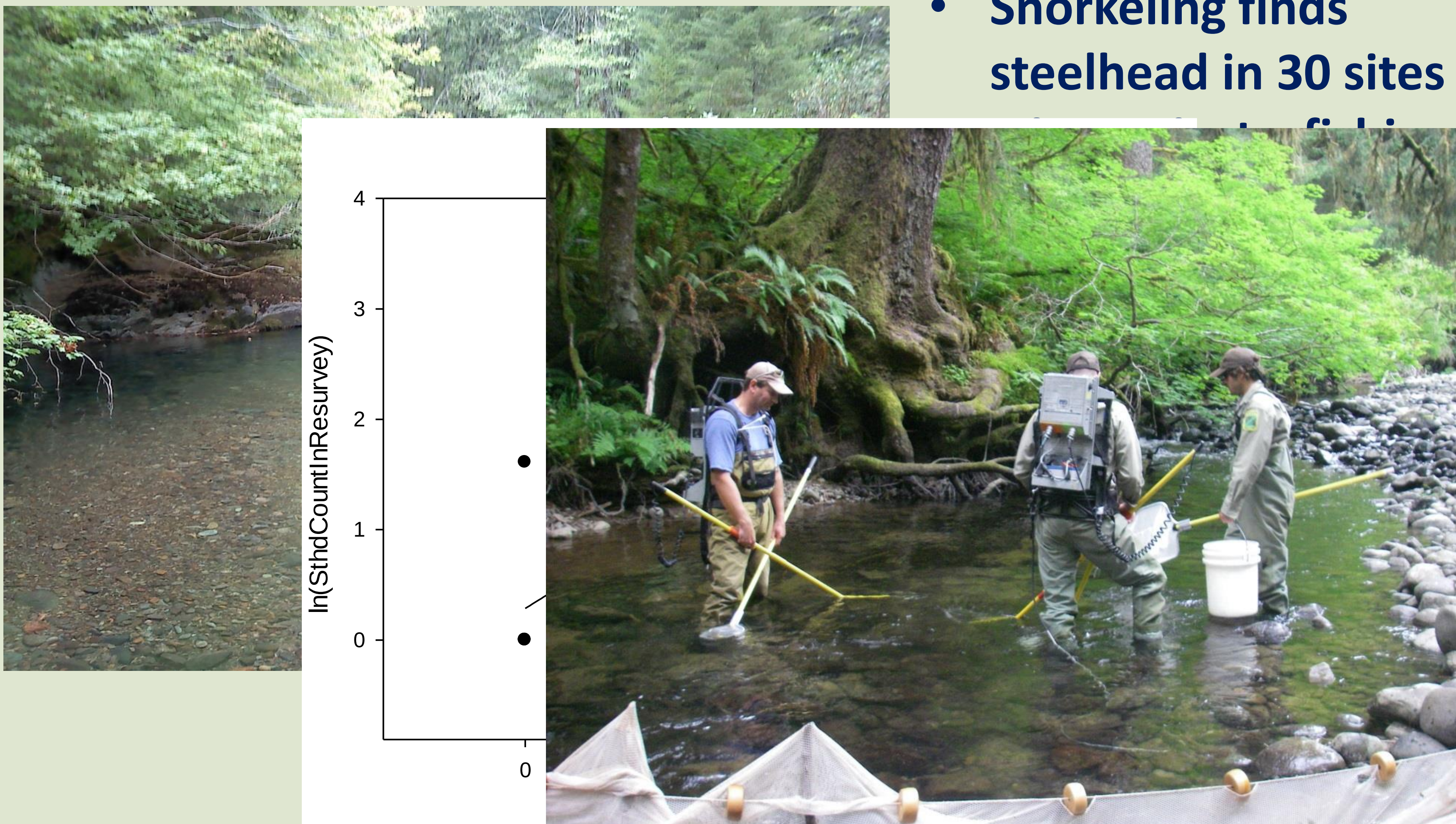
Conclusions

- Snorkeling more sensitive to trends
- Need to sample in non- wadeable
- Use lower pool depth criteria

Questions

Results

Distribution Estimates



- **Snorkeling finds steelhead in 30 sites**