# Baseline Monitoring of VSP Parameters for Spring Chinook Salmon and Steelhead Trout Above and Below Project Dams

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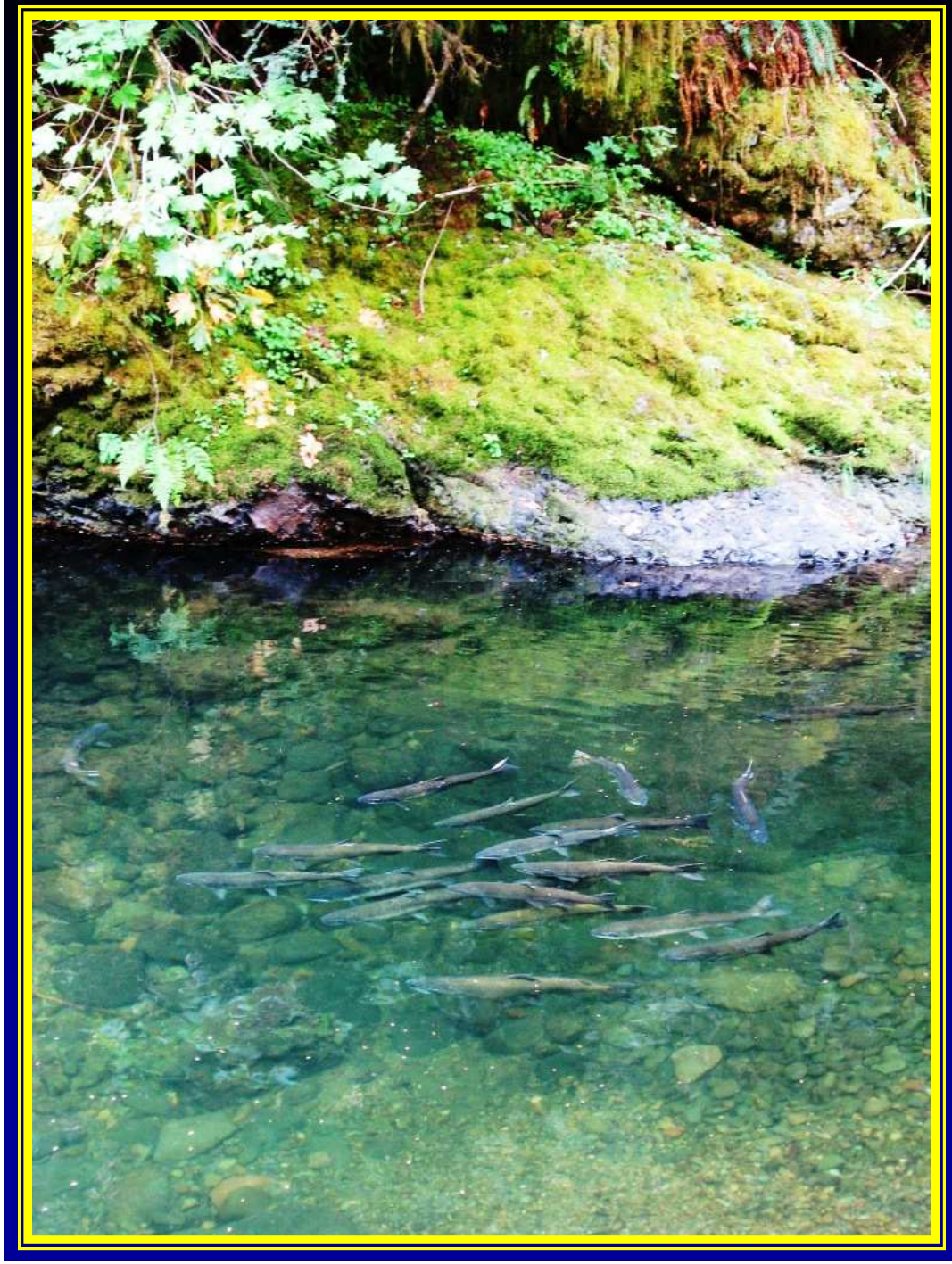
# Willamette Biological Opinion
# Hatchery Research, Monitoring, and Evaluation

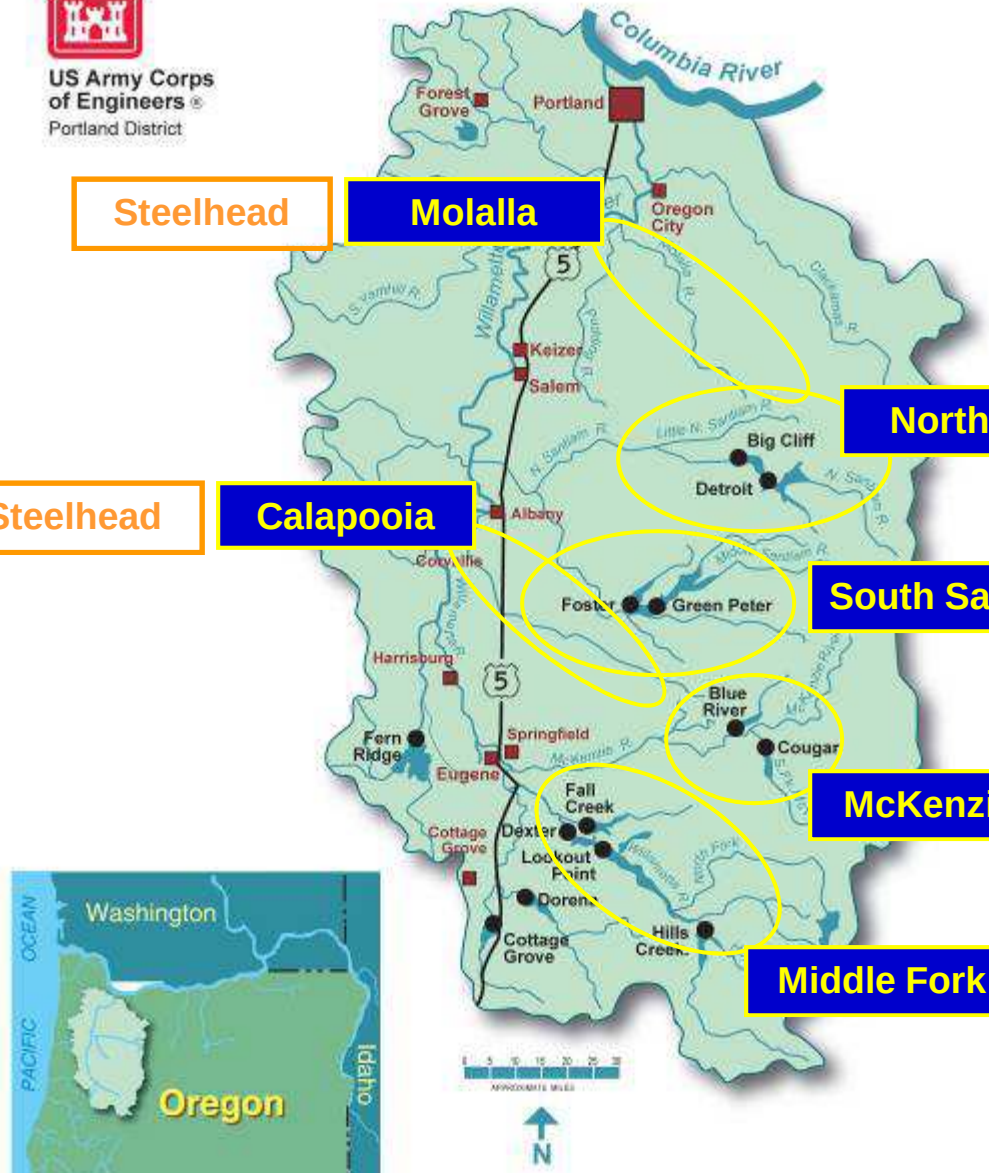
OREGON
Fish & Wildlife



- **Hatchery RME Activities**
- Monitoring hatchery operations and conducting research focused on hatchery programs
- Spawning ground surveys (upstream & downstream of dams),
  - Distribution & abundance of redds, carcass sampling, proportion hatchery-origin spawners (PHOS) prespawn mortality, straying, diversity

# The Willamette Basin

US Army Corps of Engineers
Portland District







Steelhead — Molalla

Chinook — North Santiam — Steelhead

Steelhead — Calapooia

Chinook — South Santiam — Steelhead

McKenzie — Chinook

Middle Fork — Chinook

*Courtesy USACE*

# VSP Monitoring Guidelines
(Crawford and Rumsey 2011)

- VSP Adult Spawner Abundance
  - Incorporate a robust unbiased adult spawner abundance sampling design with known precision and accuracy
  - Monitor ratio of marked hatchery salmon and steelhead to unmarked natural origin fish in all adult spawner surveys
  - Calculate the average coefficient of variation for all adult natural origin spawner databases for ESA populations and provide that information to all interested parties
  - Provide adult spawner data with a coefficient of variation (CV) on average of 15% or less for all ESA population
  - Conduct a power analysis for each natural population monitored within an ESU to determine the power of the data to detect a significant change in abundance and to provide that information to all interested parties
  - Promote standardization of methodologies

# VSP Monitoring Guidelines
## (Crawford and Rumsey 2011)

- VSP Productivity
  - Develop at least 12 brood years of accurate spawner information as derived from cohort analysis in order that NOAA can use the geometric mean of recruits per spawner to develop strong productivity estimates
  - Obtain estimates of juvenile migrants for at least one significant population for each major population group (MPG) within an ESU or distinct population segment (DPS)

# VSP Monitoring Guidelines
(Crawford and Rumsey 2011)

- **VSP Spatial Distribution**
  - Determine spatial distribution of listed species with the ability to detect a change in distribution of ± 15% with 80% certainty

# VSP Monitoring Guidelines
(Crawford and Rumsey 2011)

- **VSP Species Diversity**
  - Short term strategy: use species distribution, spawn timing, age distribution, fecundity, and sex ratios to determine status/trend in species diversity of natural populations
  - Long term strategy: Directly monitor genetic diversity (SNPs baseline for each population within each MPG and ESU/DPS)

# Additional Monitoring Guidelines
(Crawford and Rumsey 2011)

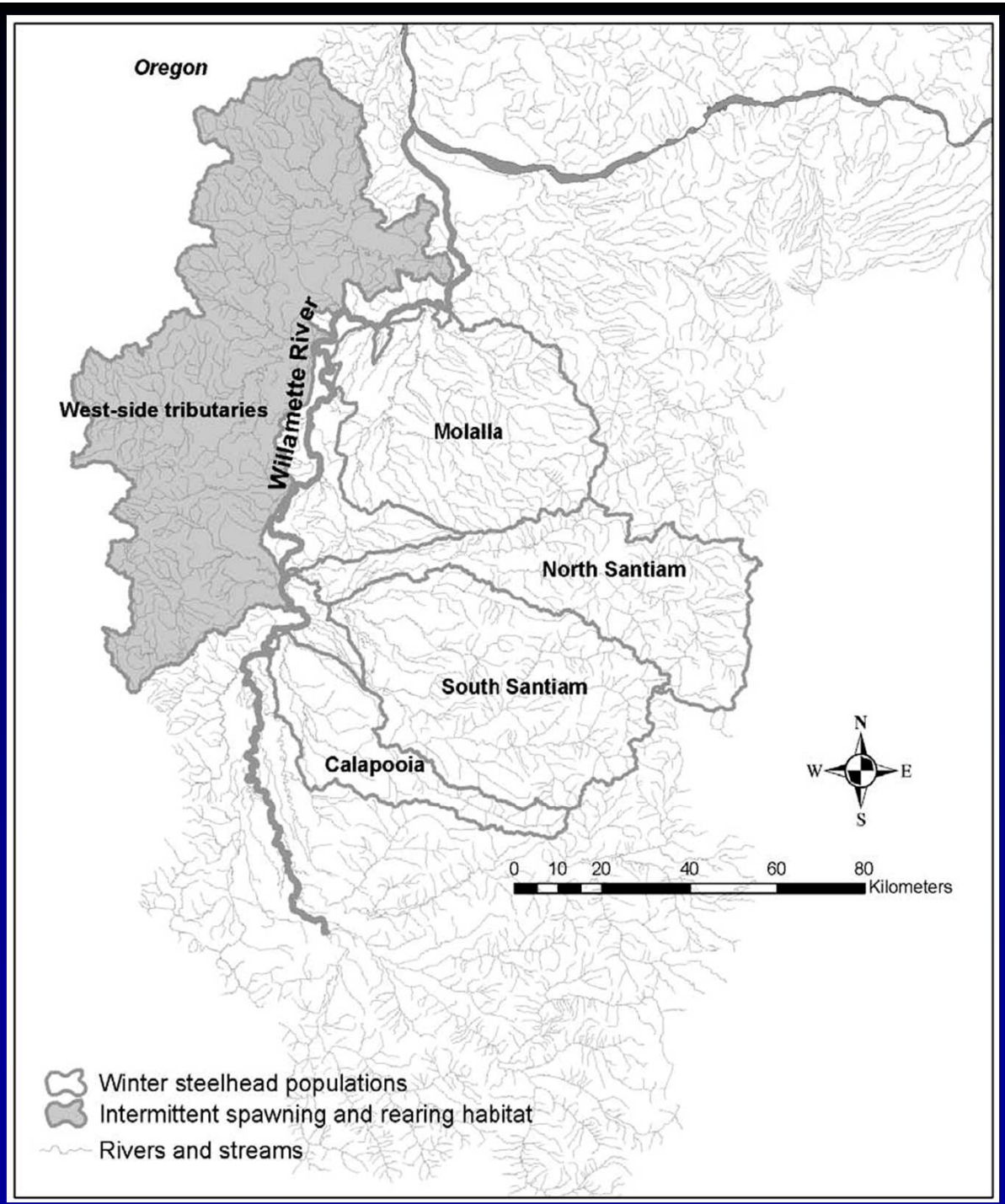
- **Threats Due To Hatchery Production**
  - Determine annually the percent hatchery origin spawners (PHOS) and natural origin spawners (PNOS) for each population. Estimates should be evaluated to determine their precision and ability to detect changes and to determine the trend toward reaching Hatchery and Genetic Management Plan (HGMP) targets
  - Periodically calculate proportion of natural influence (PNI) for primary populations within the ESU for supplementation
  - Every hatchery should monitor the spatial and temporal distribution of juvenile fish released from the program

# Four Ongoing "Uncertainty Research" Projects

- Basinwide genetic diversity of spring Chinook
- Genetic stock identification and relative natural production of Willamette River steelhead
- Hatchery-wild crosses of spring Chinook salmon in the context of reintroduction
- Spring Chinook liberation strategies

# Winter-run Steelhead Trout

# Upper Willamette Steelhead DPS



# Methods

Video counts at Willamette Falls

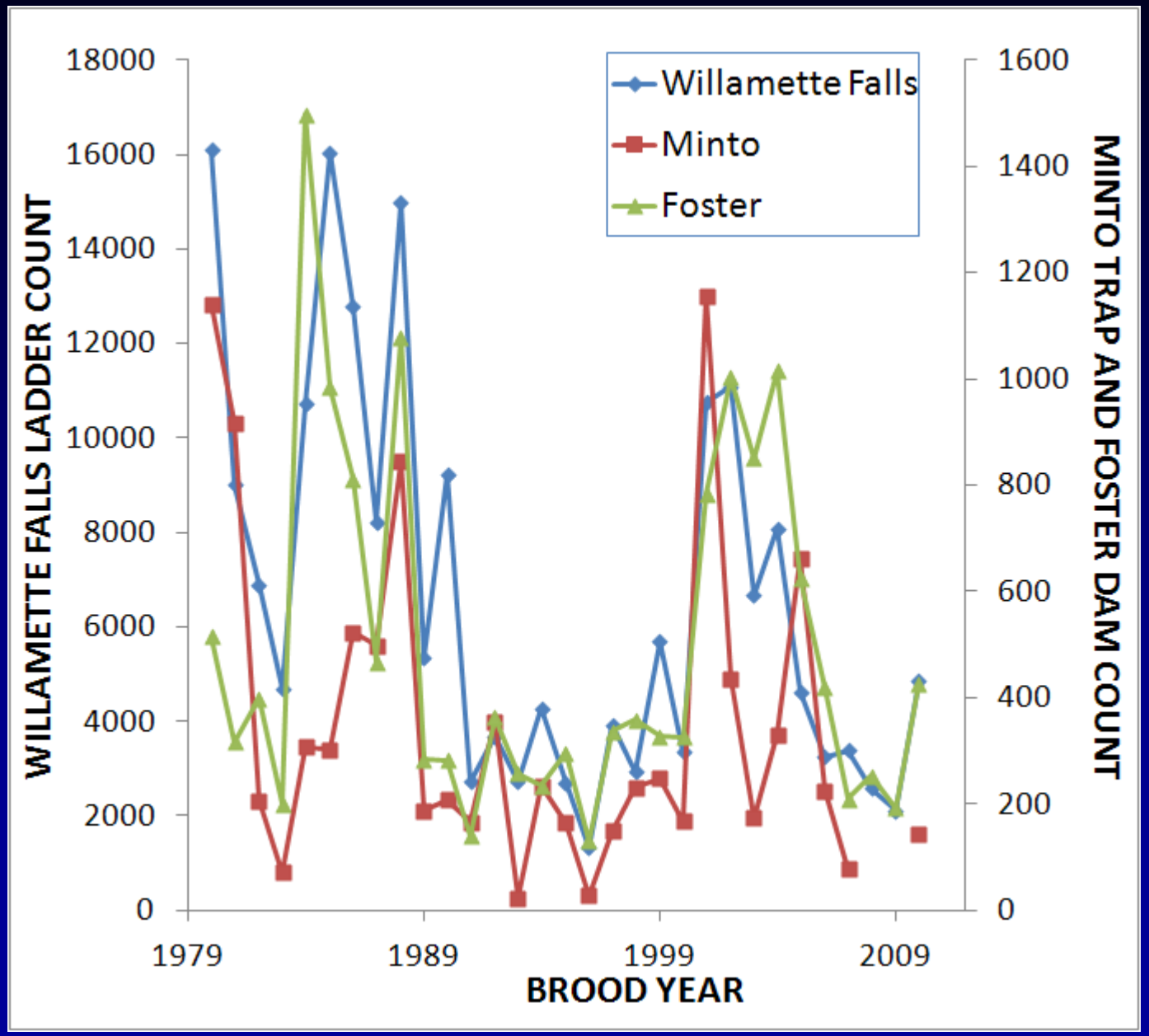
Trap counts at Minto (N. Santiam) and Foster Dam (S. Santiam)

Peak redd counts in index reaches

# Winter Steelhead Counts and Redd Surveys

| Brood Year | Dam/Trap/Ladder Counts | | | Redds per Mile | | | |
|---|---|---|---|---|---|---|---|
| | Willamette Falls | Minto | Foster | Molalla | North Santiam | South Santiam | Calapooia |
| 1980 | 16097 | 1140 | 515 | 25.2 | | | 8.0 |
| 1981 | 9004 | 918 | 317 | 20.6 | | | 5.5 |
| 1982 | 6894 | 207 | 399 | 18.1 | | | 13.4 |
| 1983 | 4702 | 71 | 200 | 12.4 | 31.0 | 15.4 | 10.8 |
| 1984 | 10720 | 307 | 1497 | 17.5 | | | |
| 1985 | 16043 | 303 | 984 | 24.4 | 51.6 | 29.2 | 15.8 |
| 1986 | 12776 | 523 | 811 | | | | |
| 1987 | 8222 | 498 | 467 | | 33.5 | 20.7 | 13.7 |
| 1988 | 15007 | 844 | 1079 | 21.5 | 18.1 | 20.0 | 12.5 |
| 1989 | 5361 | 187 | 284 | 17.2 | 35.0 | 13.4 | 5.2 |
| 1990 | 9229 | 208 | 282 | | | | |
| 1991 | 2722 | 166 | 139 | 10.9 | 25.5 | 20.7 | 8.8 |
| 1992 | 3679 | 355 | 363 | 14.8 | 18.4 | 18.1 | 3.4 |
| 1993 | 2725 | 23 | 258 | 4.5 | 20.4 | 9.8 | 1.1 |
| 1994 | 4275 | 235 | 234 | 18.1 | 19.4 | 17.2 | 4.6 |
| 1995 | 2702 | 164 | 297 | 7.0 | 13.0 | | 3.1 |
| 1996 | 1322 | 28 | 131 | 3.1 | | | |
| 1997 | 3925 | 149 | 337 | 4.6 | 15.6 | 6.1 | 7.2 |
| 1998 | 2924 | 231 | 359 | 11.0 | 21.0 | 6.5 | 10.2 |
| 1999 | 5697 | 249 | 328 | 8.5 | | | |
| 2000 | 3359 | 168 | 326 | 14.8 | | | 6.4 |
| 2001 | 10752 | 1156 | 783 | 12.9 | 25.0 | 23.6 | 12.7 |
| 2002 | 11092 | 436 | 1002 | | 23.9 | 12.1 | 10.0 |
| 2003 | 6665 | 173 | 850 | | 29.7 | 11.2 | 13.1 |
| 2004 | 8087 | 330 | 1015 | 31.6 | 28.6 | 24.0 | 19.5 |
| 2005 | 4623 | 662 | 626 | | 12.2 | 8.5 | 3.8 |
| 2006 | 3251 | 225 | 419 | 9.4 | 13.1 | 6.6 | 6.3 |
| 2007 | 3388 | 77 | 210 | | 10.0 | 14.4 | 5.2 |
| 2008 | 2589 | | 253 | | 2.3 | | |
| 2009 | 2110 | | 192 | | | | 1.1 |
| 2010 | 4856 | 143 | 426 | | 5.7 | 1.5 | 4.8 |
| 2011 | | | | | | 5.6 | 3.8 |

# Winter Steelhead Adult Counts



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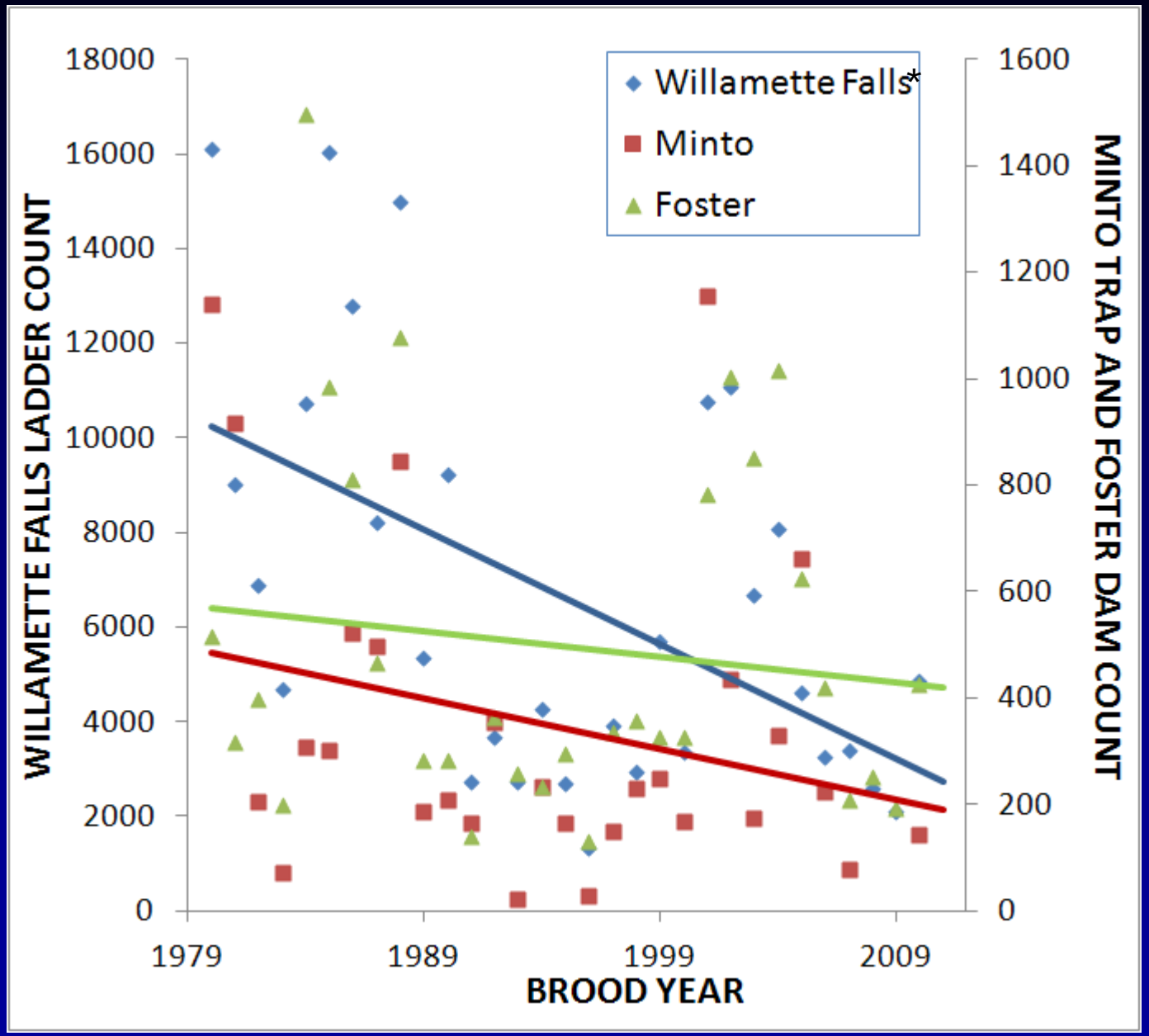
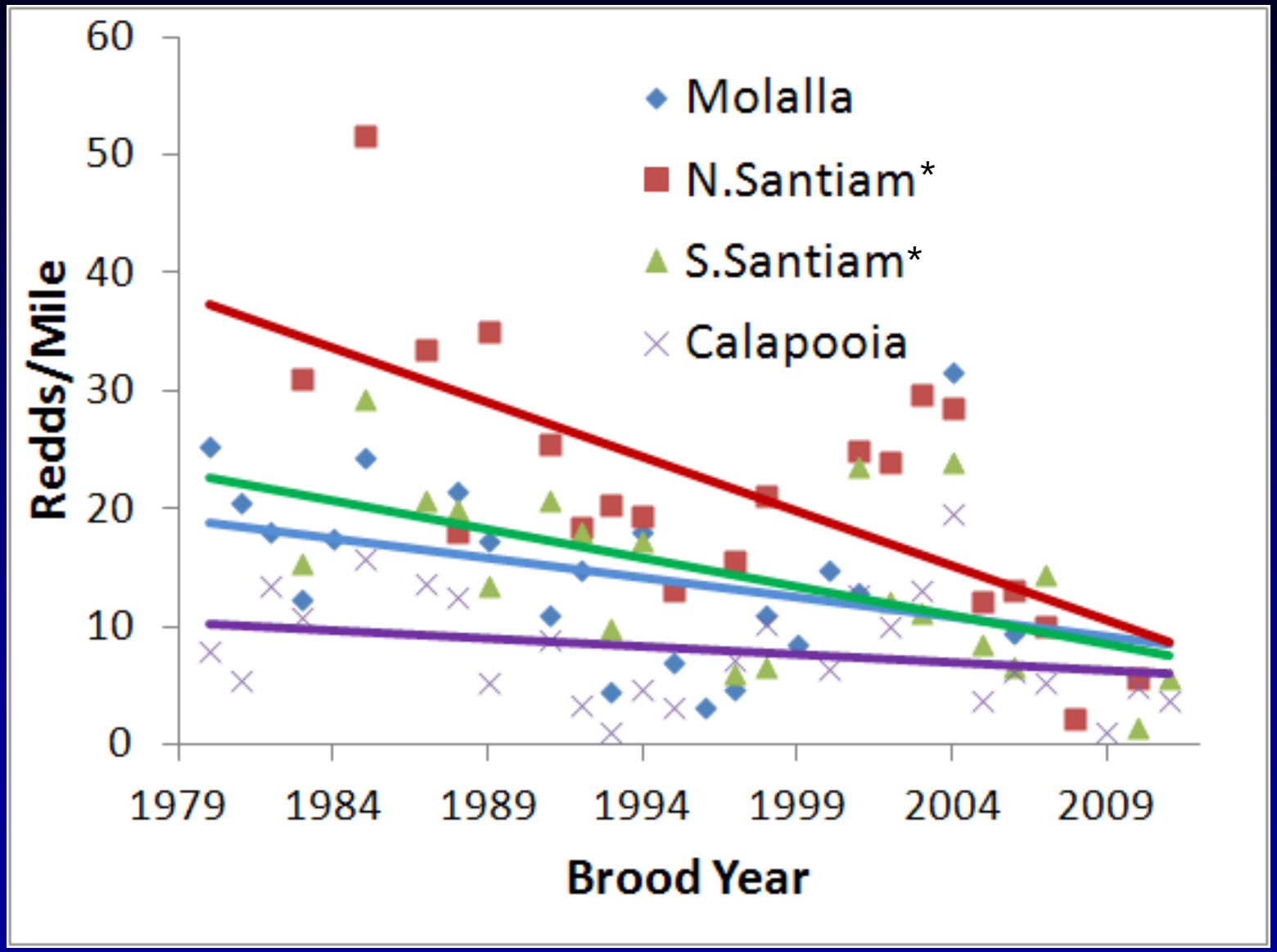


# Winter Steelhead Redd Surveys



# Summary

- For Steelhead…
  - Continued evidence for a decreasing trend in abundance counterbalanced by evidence for resiliency within the populations
  - Need for increased emphasis on expanding survey efforts throughout the DPS (at least)
    - Needs to yield abundance, productivity, distribution AND diversity
  - Very substantial issues with escapement of hatchery fish still exist (Teel and Vandoornik work on this issue is underway)

# Spring Chinook Salmon

# Methods

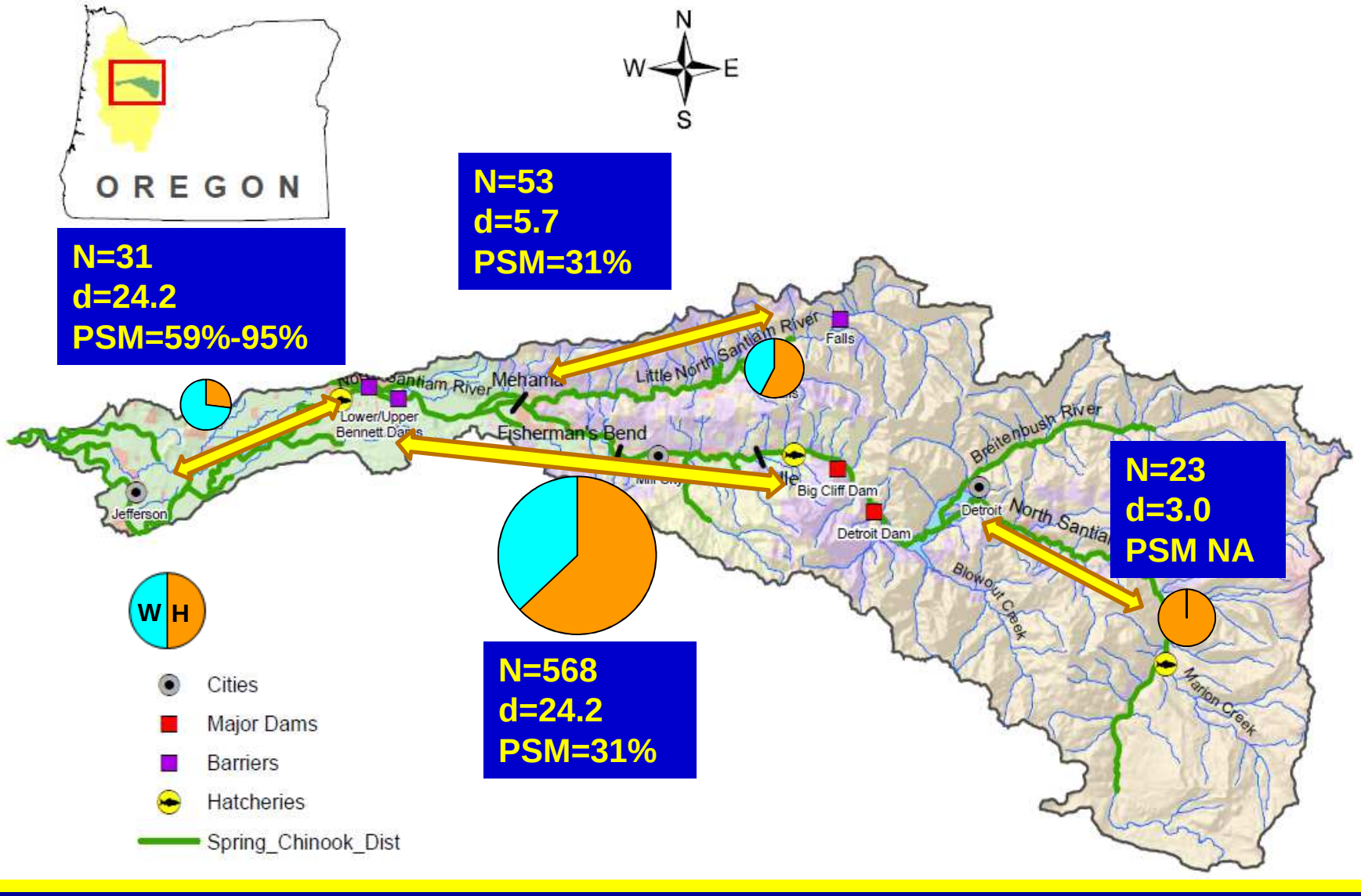
Redd Surveys

Carcass Sampling

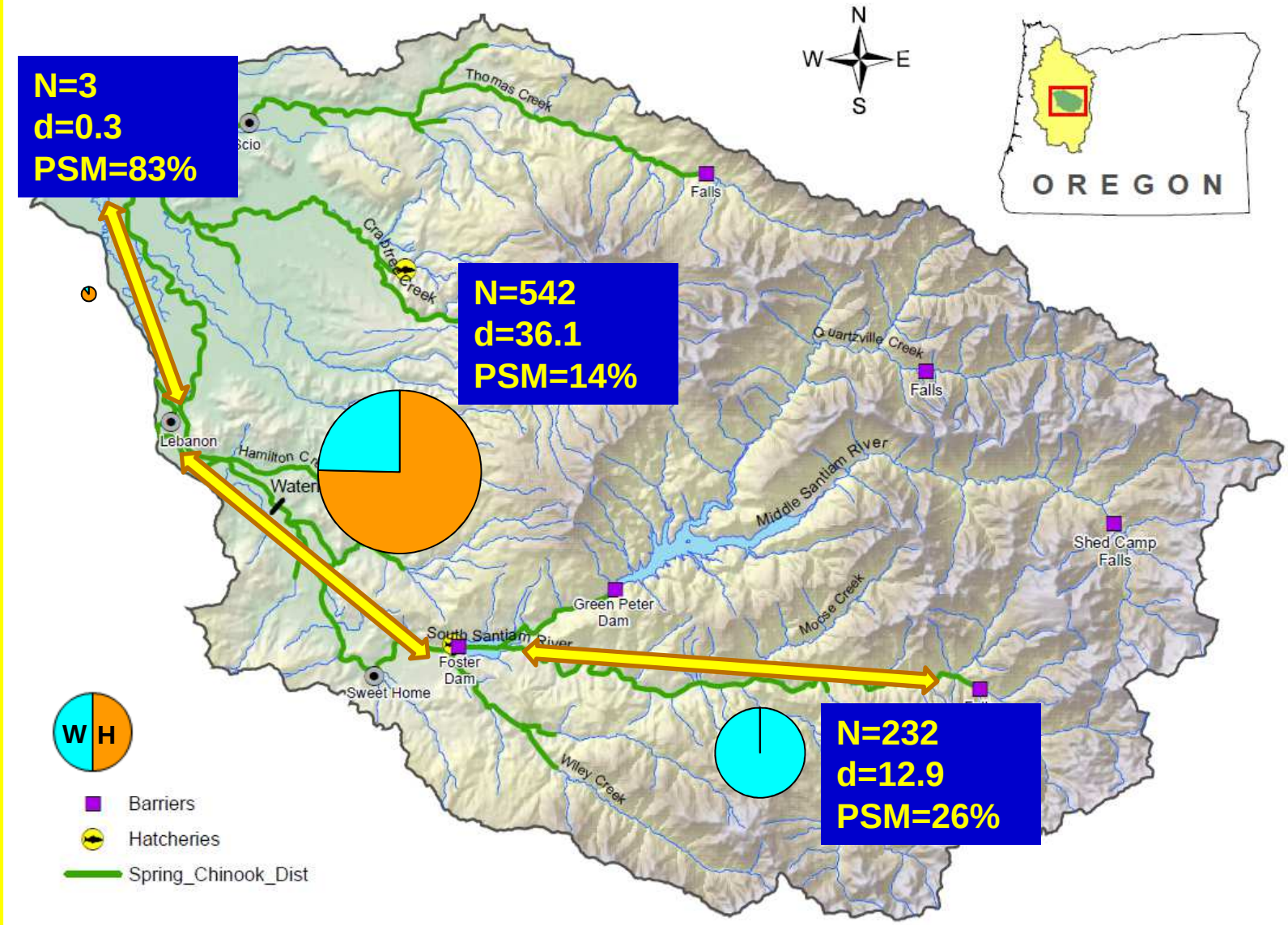
# 2011 Redds and Deads

| Basin, section | Redds | mi | d | Processed Carcasses | Unclipped | Clipped | PHOS | PNOS | Spawned Females | Unspawned Females | PSM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **McKenzie** | | | | | | | | | | | |
| above forest Glen | 868 | 46.2 | 18.8 | 253 | 223 | 30 | 12% | 88% | 165 | 3 | 2% |
| Leaburg - Forest Glen | 300 | 18.1 | 16.6 | 102 | 63 | 39 | 38% | 62% | 48 | 7 | 13% |
| below Leaburg Dam | 220 | 6 | 36.7 | 197 | 79 | 118 | 60% | 40% | 95 | 23 | 19% |
| **North Santiam** | | | | | | | | | | | |
| above Bennett Dam | 568 | 23.5 | 24.2 | 777 | 288 | 489 | 63% | 37% | 336 | 121 | 26% |
| below Bennett Dam | 31 | 2 | 15.5 | 37 | 27 | 10 | 27% | 73% | 2 | 41 | 95% |
| Little North Santiam | 53 | 9.3 | 5.7 | 52 | 22 | 30 | 58% | 42% | 11 | 5 | 31% |
| Above Detroit | 23 | 7.7 | 3.0 | 5 | 0 | 5 | 100% | 0% | 1 | 0 | 0% |
| **South Santiam** | | | | | | | | | | | |
| above Lebanon Dam | 542 | 15 | 36.1 | 750 | 185 | 565 | 75% | 25% | 441 | 72 | 14% |
| below Lebanon Dam | 3 | 9.5 | 0.3 | 9 | 1 | 8 | 89% | 11% | 1 | 5 | 83% |
| Above Foster | 232 | 18 | 12.9 | 283 | 283 | 0 | 0% | 100% | 95 | 34 | 26% |
| **Mid. Fk Willamette** | | | | | | | | | | | |
| Dexter–Jasper | 99 | 9 | 11.0 | 137 | 41 | 96 | 70% | 30% | 70 | 24 | 26% |
| NF Middle Fork | 115 | 18.1 | 6.4 | 56 | 2 | 54 | 96% | 4% | 8 | 32 | 80% |
| Fall Creek | 58 | 16.3 | 3.6 | 64 | 64 | 0 | 0% | 100% | 20 | 10 | 33% |
| Little Fall Cr | 55 | 5.1 | 10.8 | 30 | 3 | 27 | 90% | 10% | 11 | 3 | 21% |

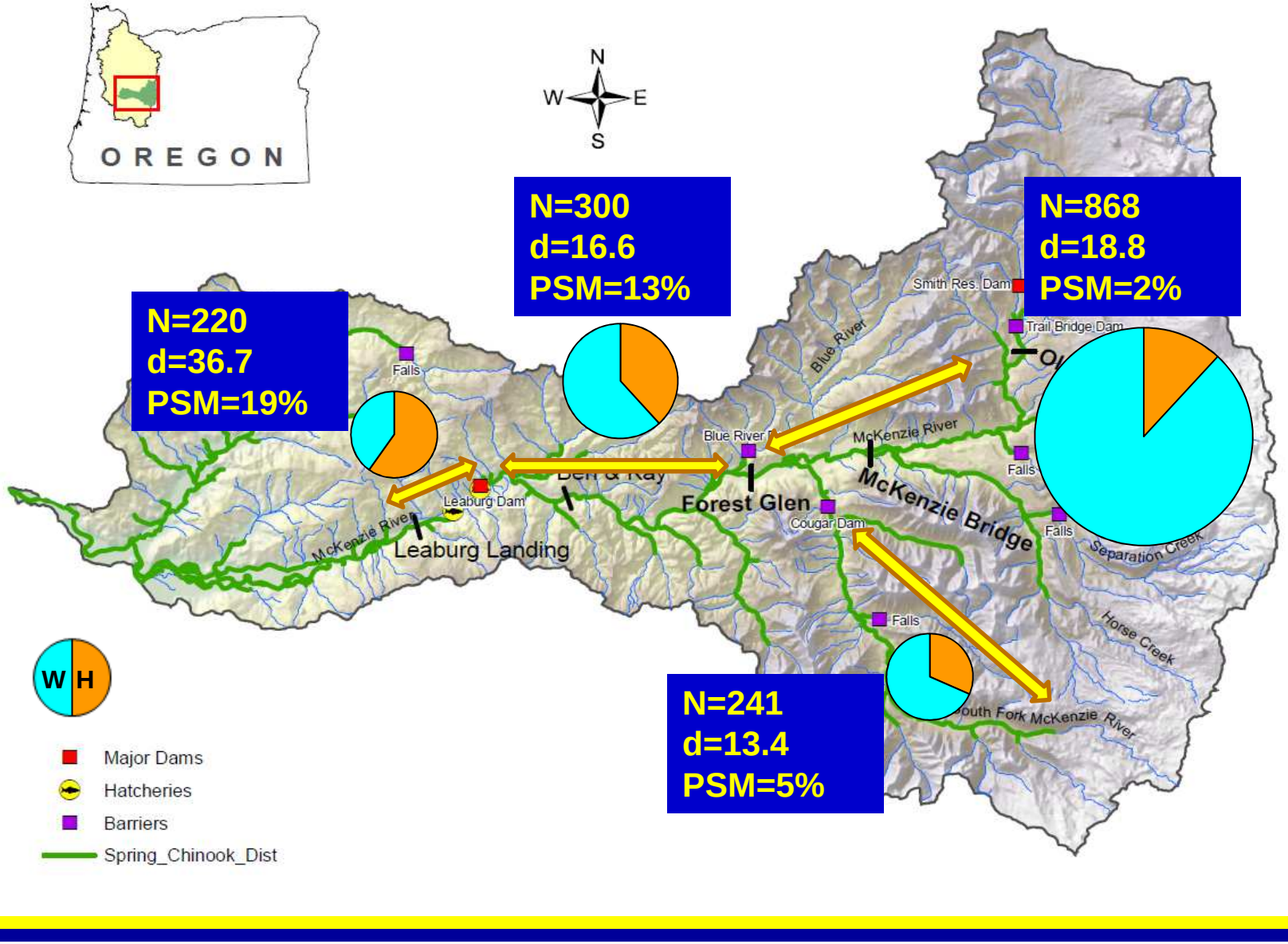
# North Santiam River 2011



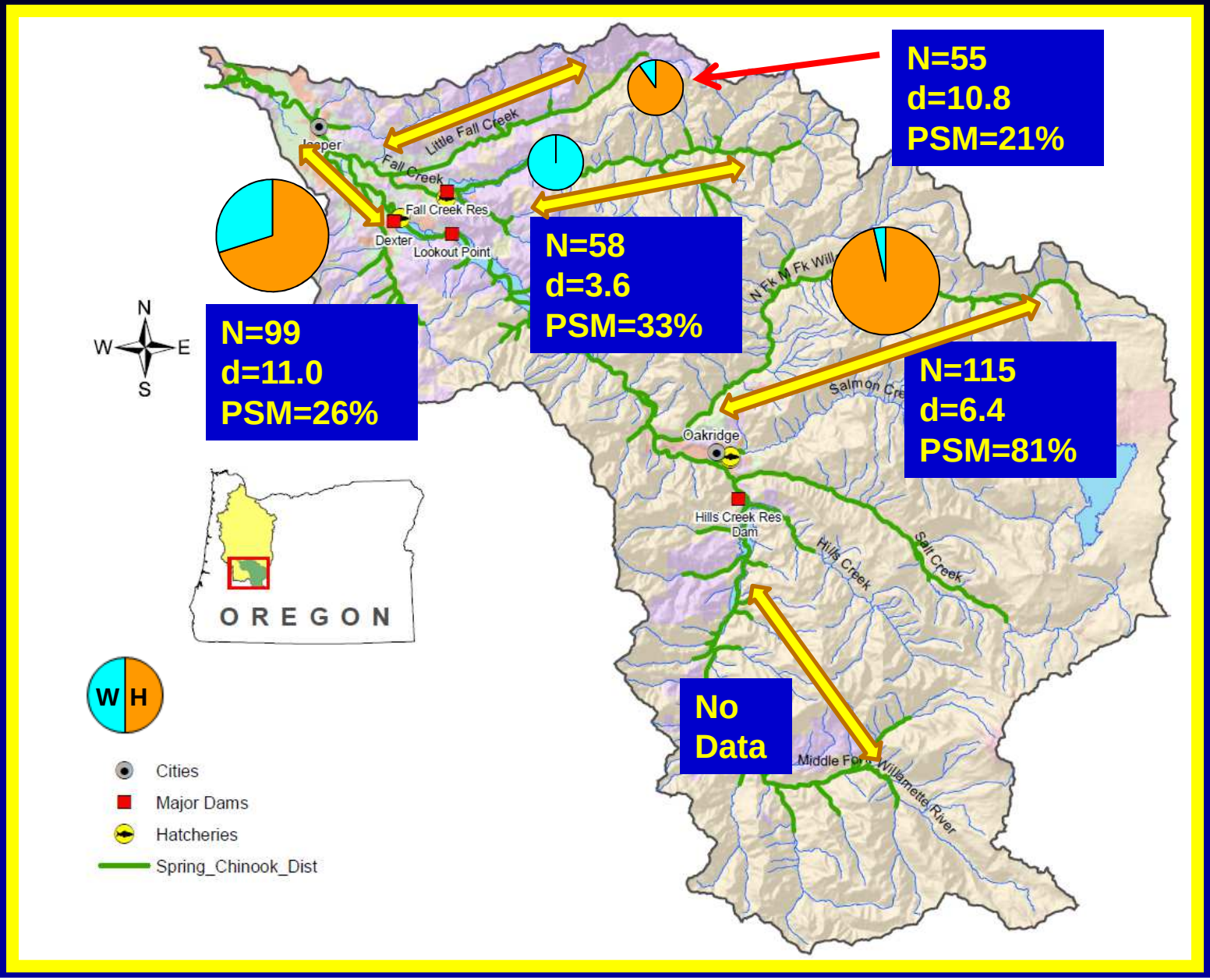
# South Santiam River 2011



# McKenzie River 2011



# Middle Fork Willamette River 2011



# Additional Monitoring Guidelines
(Crawford and Rumsey 2011)

- **Threats Due To Hatchery Production**
  - Determine annually the percent hatchery origin spawners (PHOS) and natural origin spawners (PNOS) for each population. Estimates should be evaluated to determine their precision and ability to detect changes and to determine the trend toward reaching Hatchery and Genetic Management Plan (HGMP) targets
  - Periodically calculate proportion of natural influence (PNI) for primary populations within the ESU for supplementation
  - Every hatchery should monitor the spatial and temporal distribution of juvenile fish released from the program

# “Uncertainty Research” Addressing Additional Monitoring Guidelines

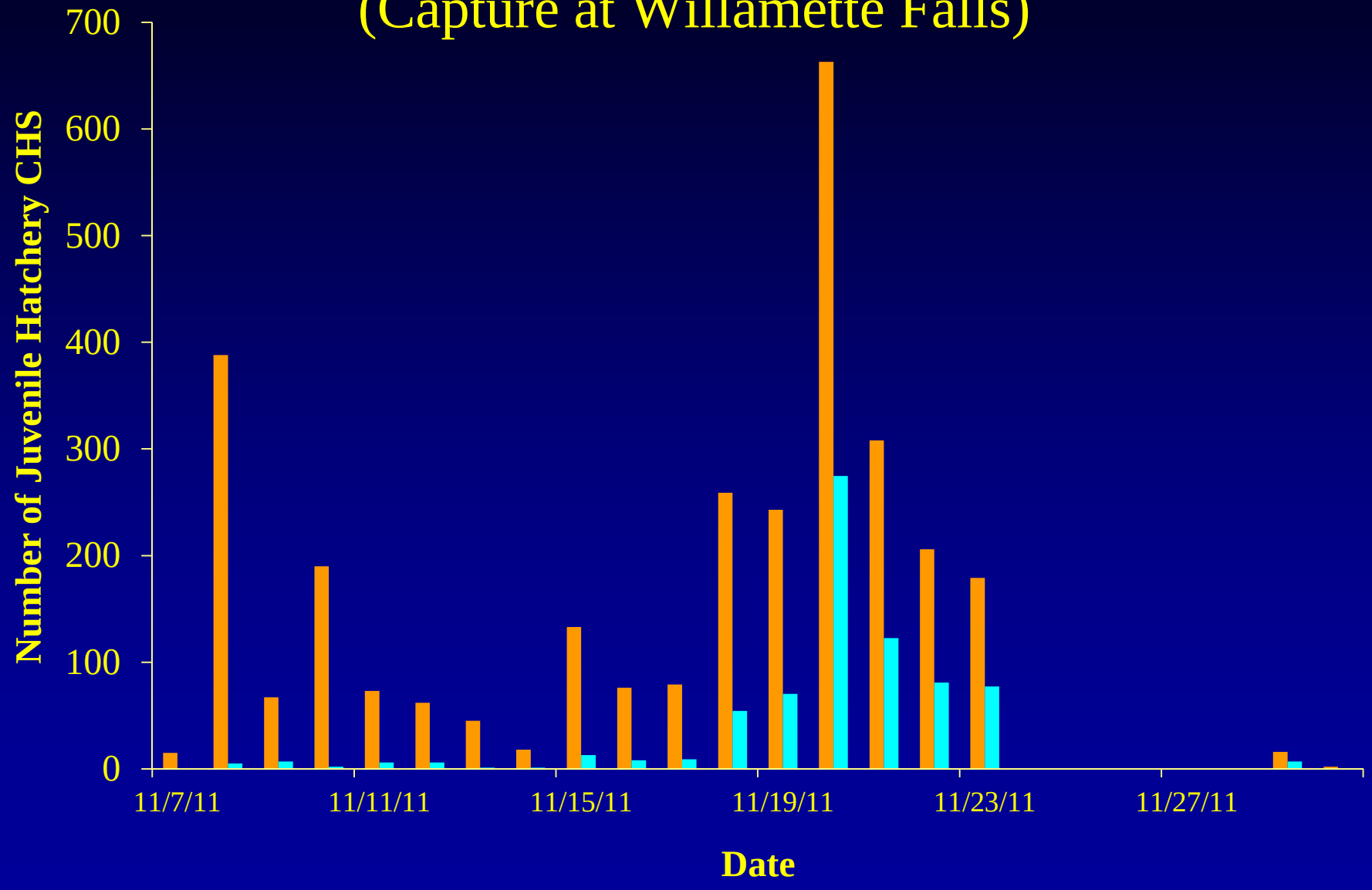
- Effect of size and time of hatchery Chinook releases on outmigration and adult returns
- Overarching Objectives
  - Rear and release hatchery spring Chinook salmon to mimic size and behavior of naturally produced yearling migrants
  - Investigate alternative rearing and release strategies to increase the proportion of fish returning.

# Methods

- The proposed work combines an assessment of in-river performance of released fish by tracking migration and survival of individual releases with an assessment of smolt to adult return (SAR) following recovery of coded wire tagged fish in fisheries, at hatcheries, and during spawner surveys.

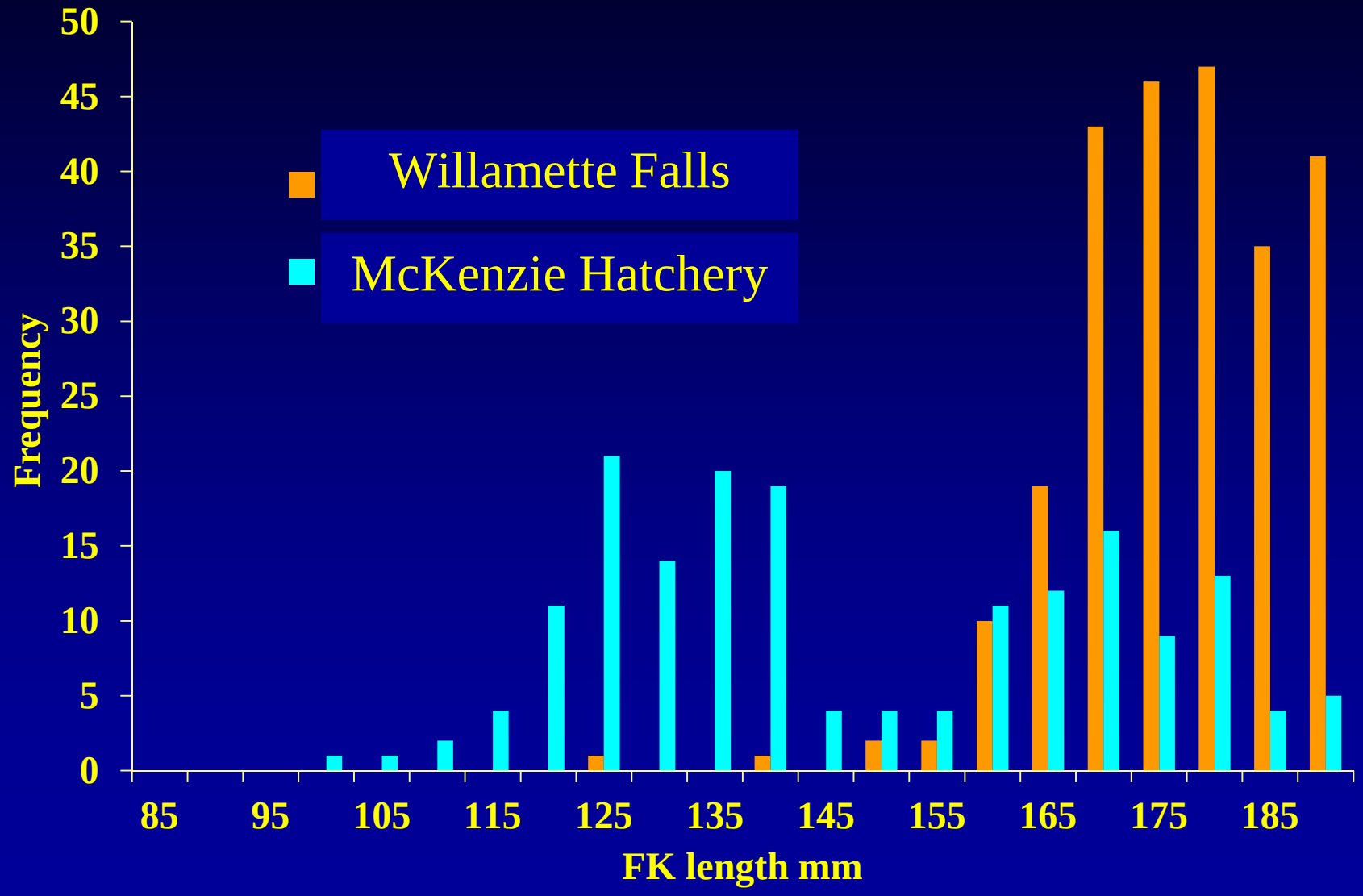
# Outmigration Timing

## (Capture at Willamette Falls)



# Outmigrant Size

## November Release



# Summary

- For Chinook…
  - Alignment between NOAA Guidance and reality is imperfect
    - Need to increase statistical rigor of abundance estimates
    - Need to add a focus on juvenile production
    - Estimates of diversity based on phenotypic variability is a reality now
    - Work on direct estimates of genetic diversity underway
  - Substantial issues with escapement of hatchery fish, PSM, the mechanics of introducing fish to depauperate habitat, and patterns of hatchery juvenile emigration still exist

# Acknowledgments


- Funding:  US Army Corps of Engineers and Federal Sport Fish Restoration Fund
- New Analyses and Archival Data
  - Juvenile Hatchery Outmigration: Craig Tinus
  - Steelhead Survey Data: Steve Mamoyac
  - Fall Cr Steelhead Counts: Greg Taylor
  - Leaburg Steelhead Counts: Mike Hogansen
  - Steelhead Status and Trends: Kevin Goodson
  - Maps: Paul Olmsted and Erin Gilbert
- Field Staff: Awesome!


Questions?