# LIFE HISTORY DIVERSITY AND RESILIENCE

## SPRING CHINOOK IN THE WILLAMETTE RIVER BASIN

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Thanks to the biologists who worked on this project in past years,
and to the many seasonal employees who collected much of the data

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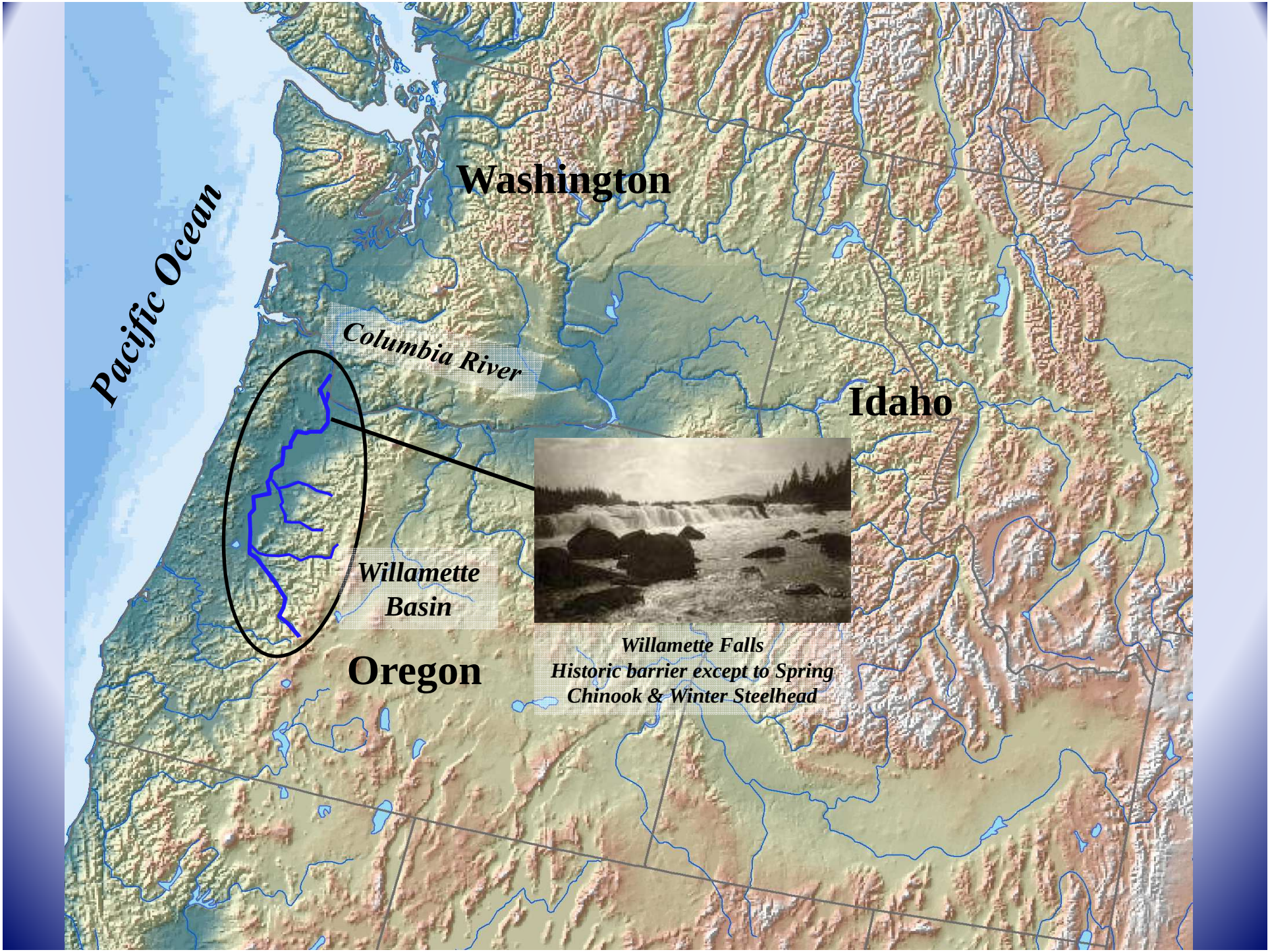

Pacific Ocean
Washington
Columbia River
Idaho
Willamette
Basin
Oregon
Willamette Falls
Historic barrier except to Spring
Chinook & Winter Steelhead

Spring Chinook found in Eastside tributaries

Dams block access to upper reaches of Spring Chinook rivers

Large hatchery program (annual release 5–8 million smolts)

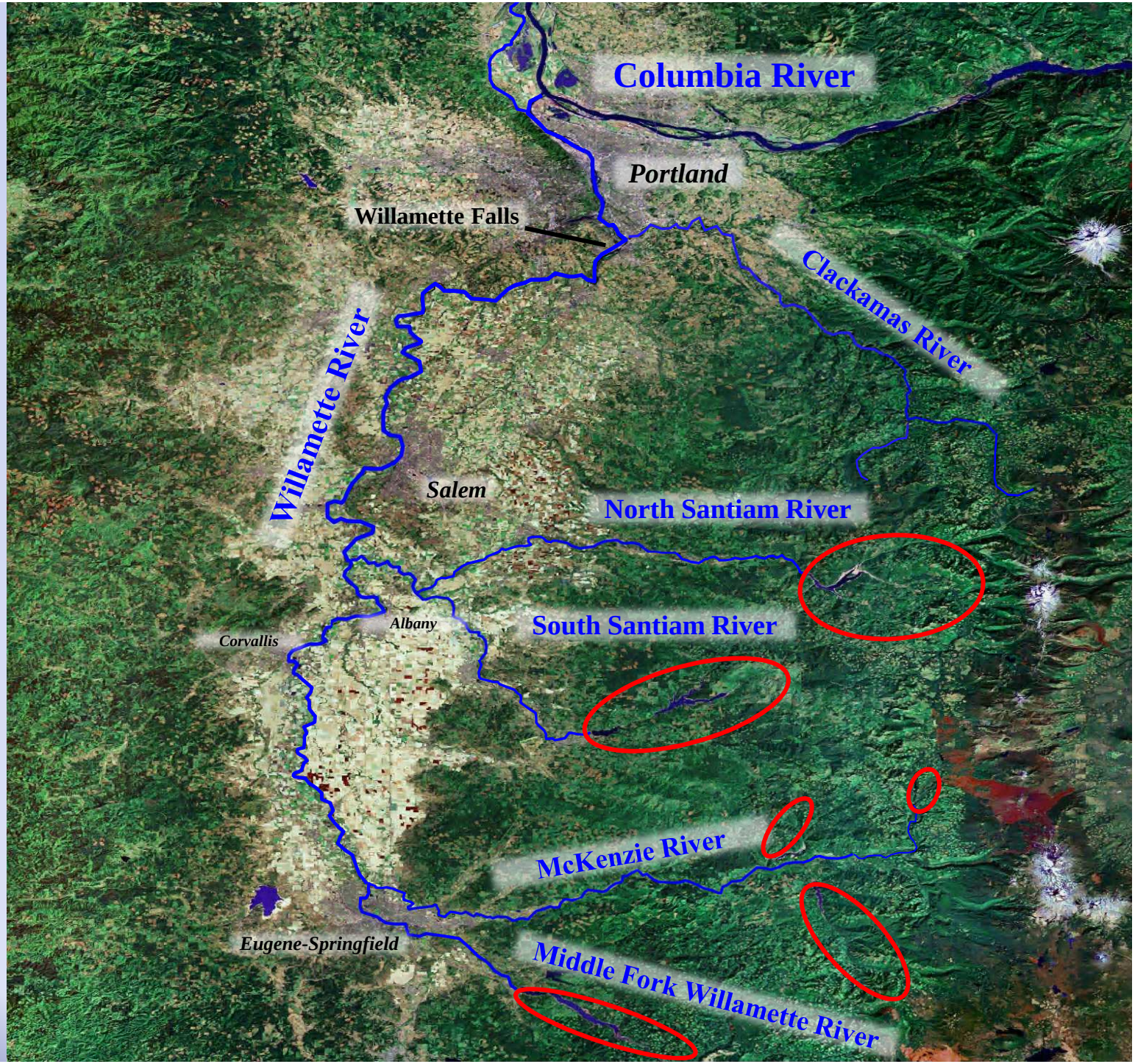
Listed as ‘threatened” species in 1999

**Willamette Basin:**

Largest watershed in Oregon (30,000 km$^2$ )

70% of Oregon population

Largest urban areas in Oregon



# *Why Study Life Histories?*

**Information** → **Perception (of fish & habitat)** → **Possibilities (strategies)**

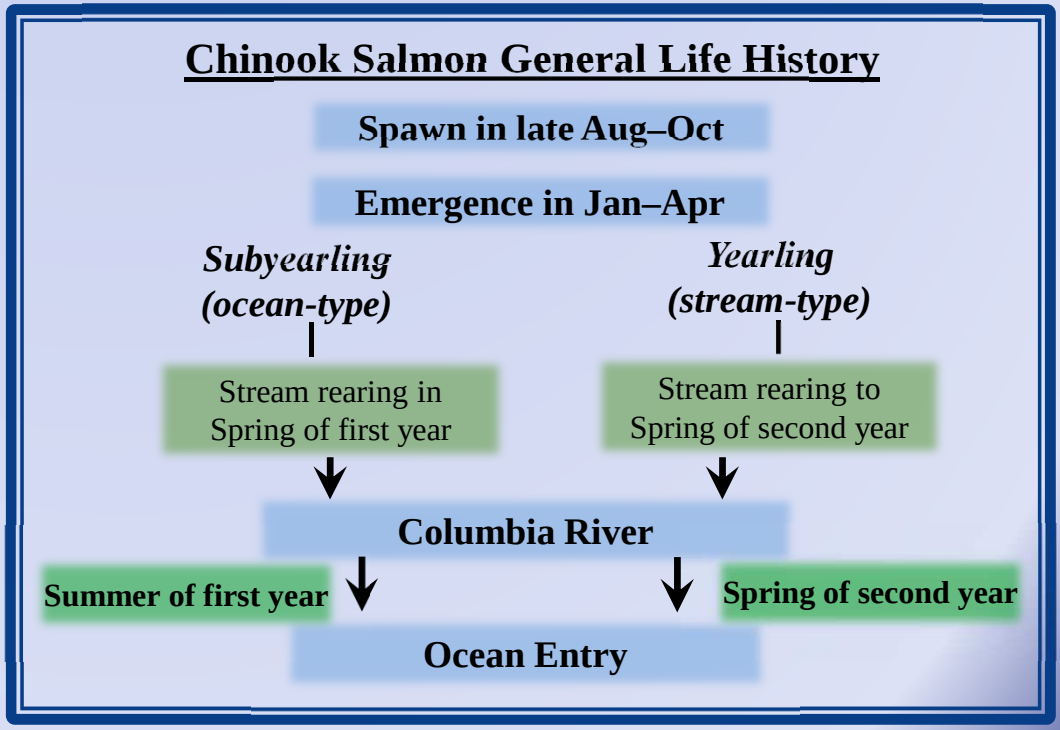
***Perception (knowledge) of life history and habitat use will influence consideration and choice of recovery goals & strategies***

***Life History Information*:**

- **What life histories or variants are present?**
- **What habitats are used & when?**
- **What life histories are productive?**
- **What life histories are lost or depressed?**

***Use Information To*:**

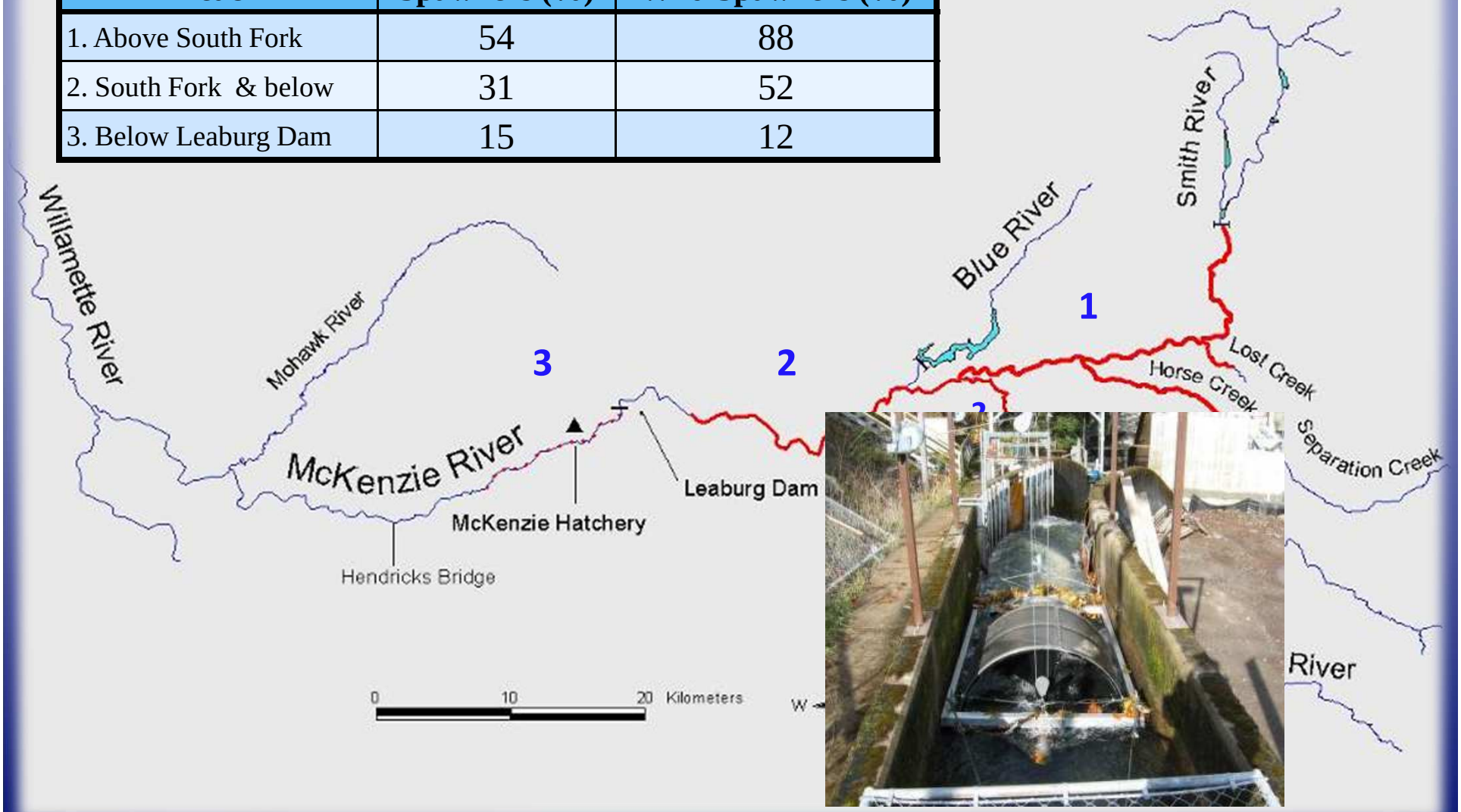
- **Develop recovery goals and strategies**
- **Link strategies to proper scales (spatial & temporal)**
- **Identify habitat usage & constraints**



# McKenzie River as Template: most intact watershed, largest wild population

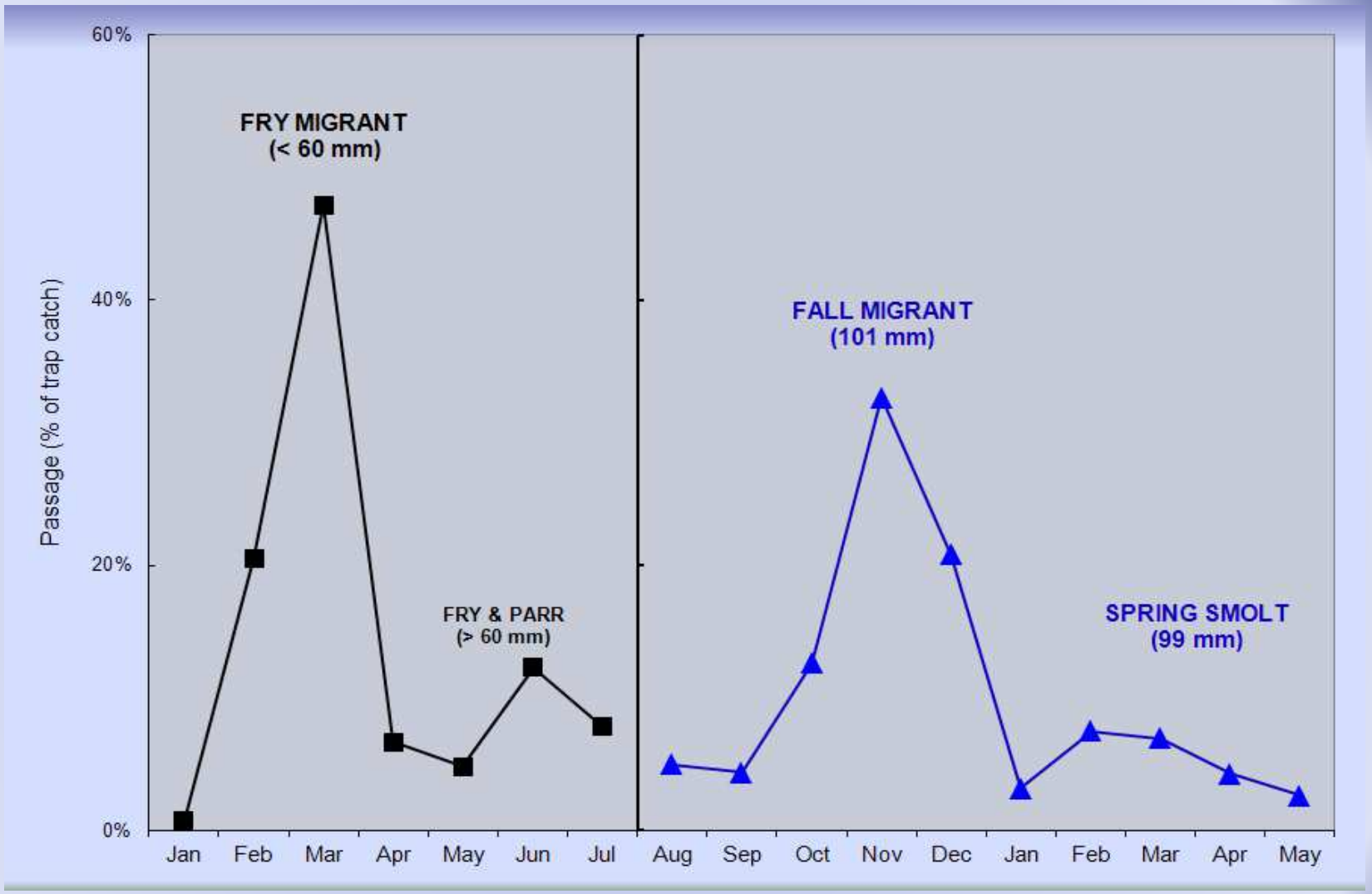
## Sample juvenile Chinook at Leaburg Dam and Downstream

| Reach | Spawners (%) | Wild Spawners (%) |
|---|---|---|
| 1. Above South Fork | 54 | 88 |
| 2. South Fork & below | 31 | 52 |
| 3. Below Leaburg Dam | 15 | 12 |



# Catch of Wild Spring Chinook in Leaburg Dam Bypass Trap

## Migration from Primary Spawning Areas




**Seine Downriver & PIT tag late Spring - Fall**

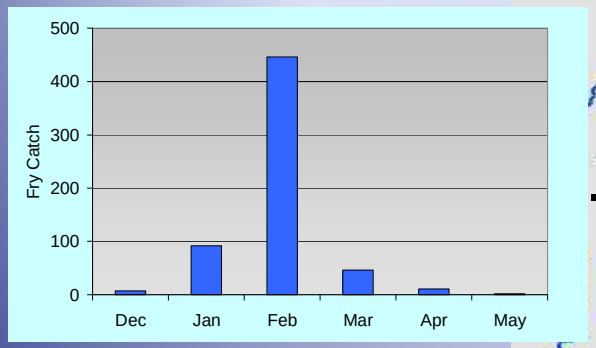
**PIT tag & Release at Trap**

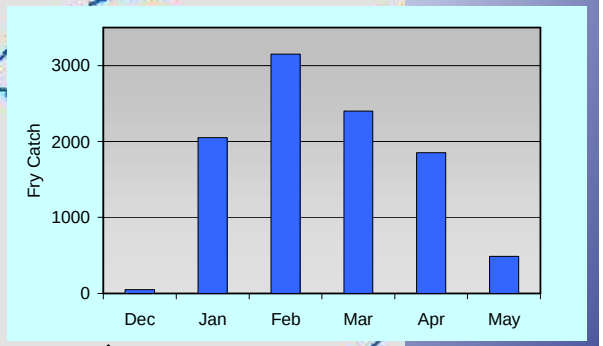
# Fry Migration from McKenzie River Trap catch 1999-2001

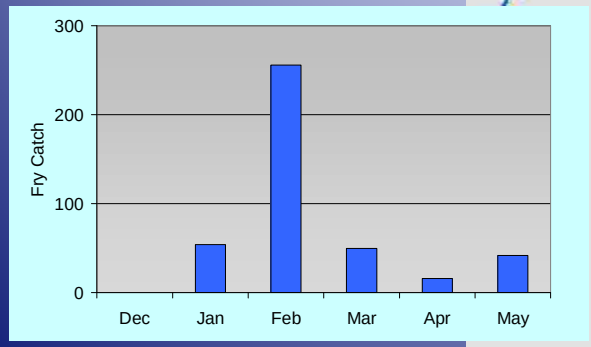
## Pole seine catch

**March 2011**

- 29–47 mm
- 35–55 mm
- 37–72 mm



# Spring – Summer Rearing & Migration

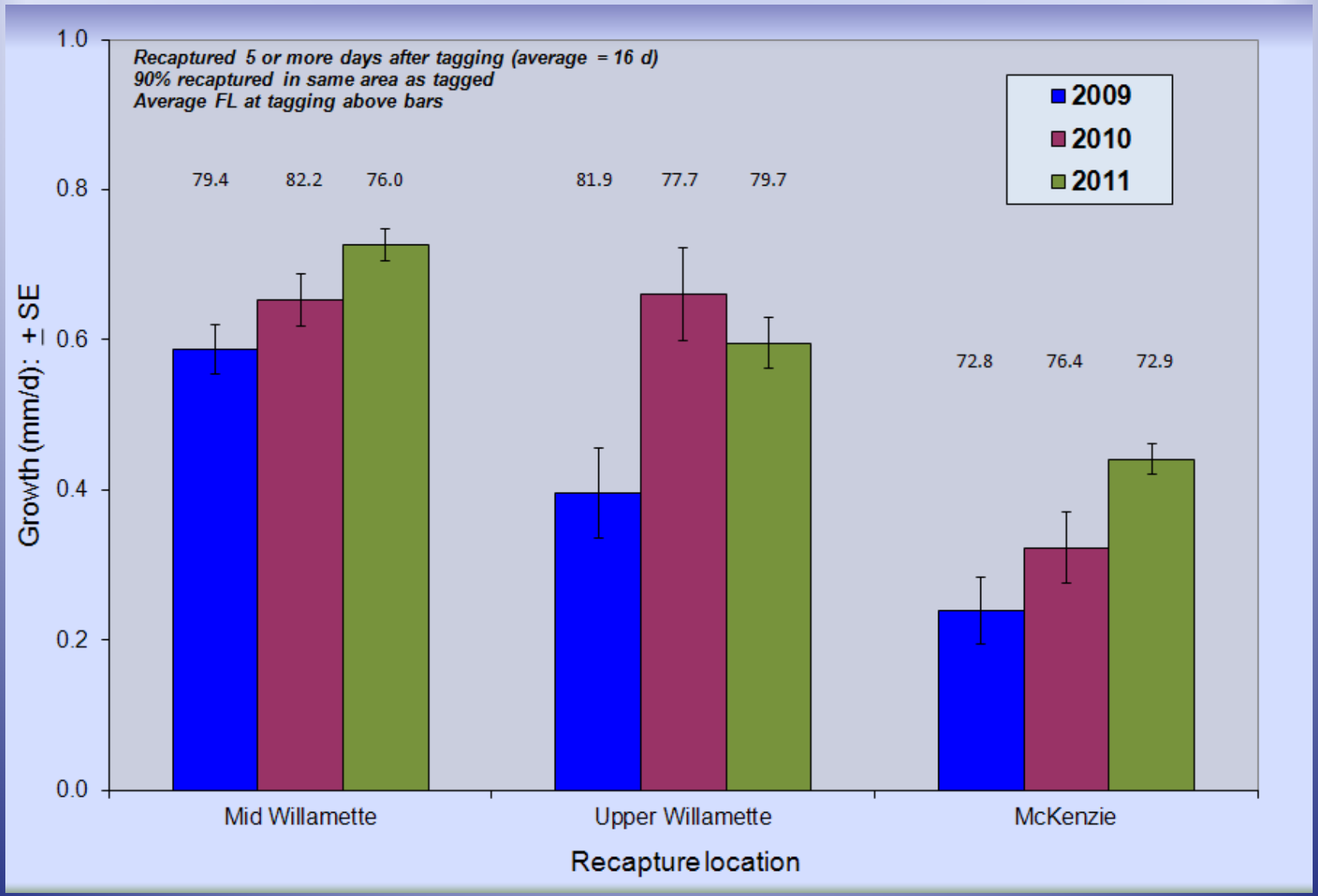
- Lower McKenzie
- Willamette
- Santiam

**Fry too small to tag at time of migration to lower tributaries or Willamette**

**Seine downstream after fry have grown**

**PIT tag – recaptures for growth; detect at Willamette Falls for emigration**

# Juvenile Chinook Growth – Spring & Summer Rearing
# Willamette & McKenzie rivers

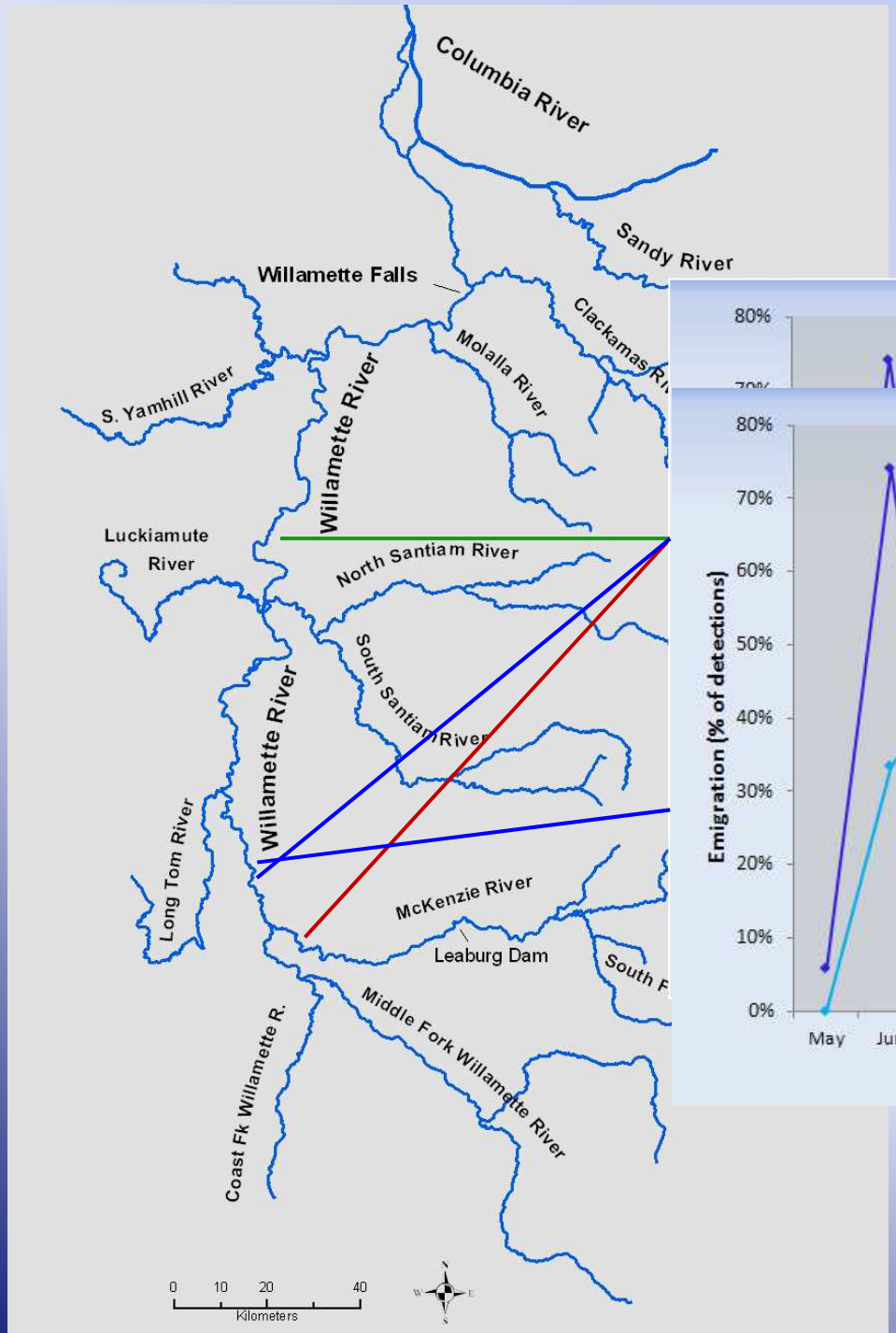


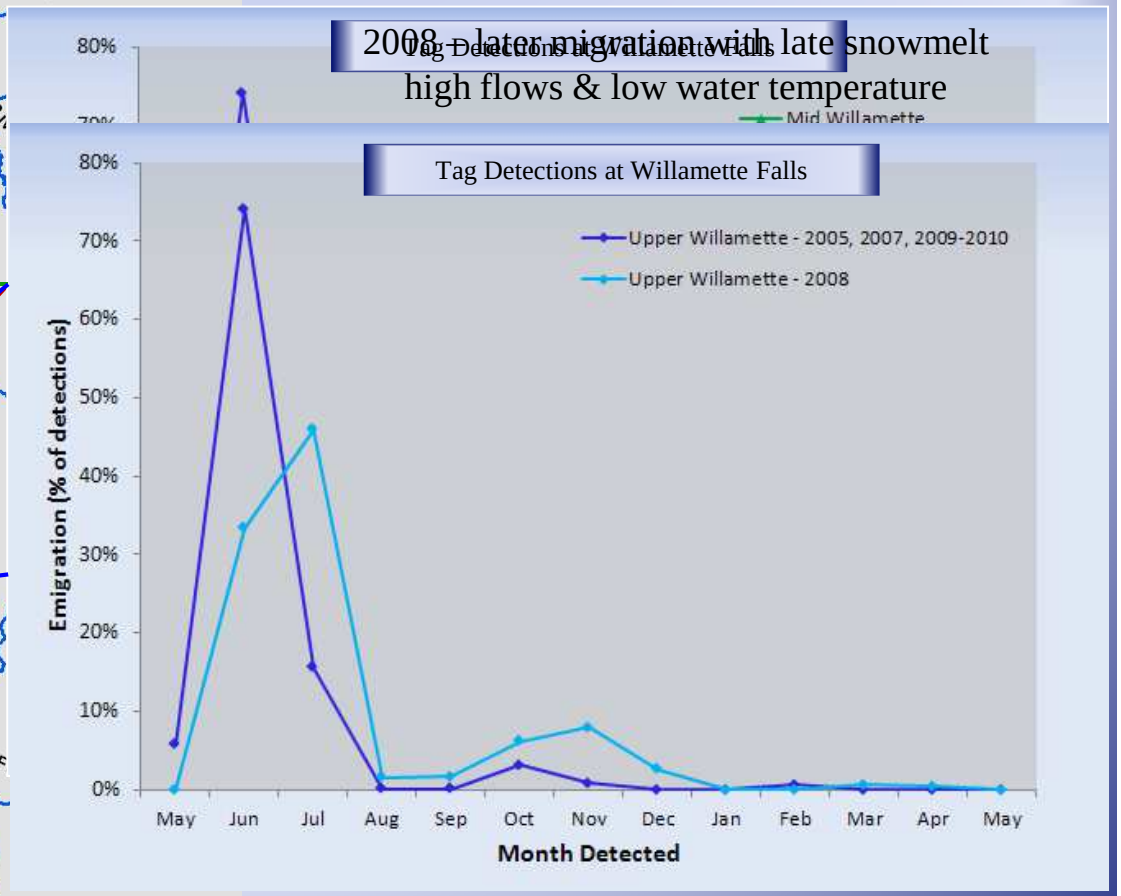
# Subyearling Migration

Most Chinook rearing in Willamette & Lower McKenzie migrate in first summer as subyearlings

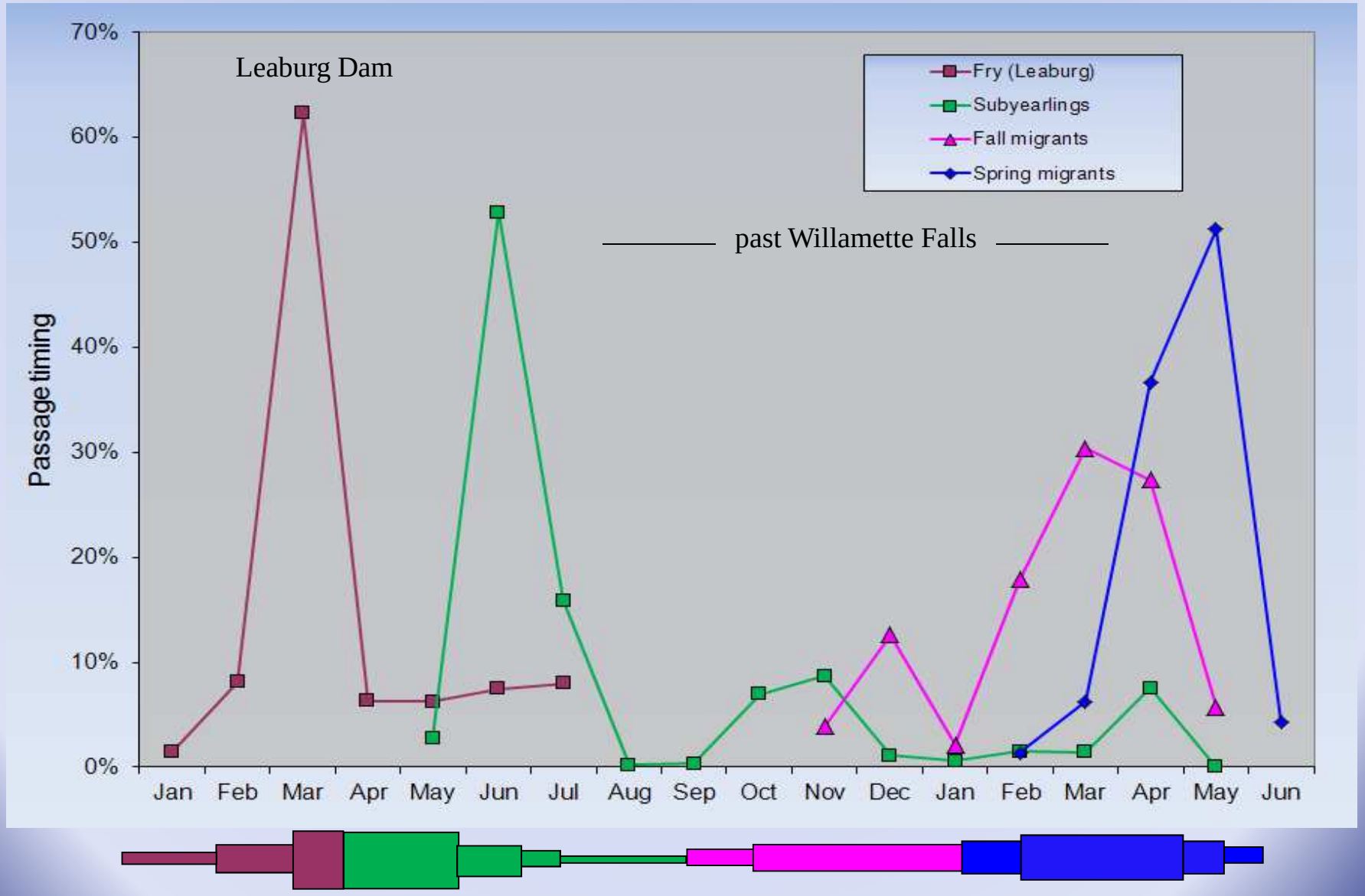
More summer–fall rearing at upstream sites

2008 – later migration with late snowmelt high flows & low water temperature



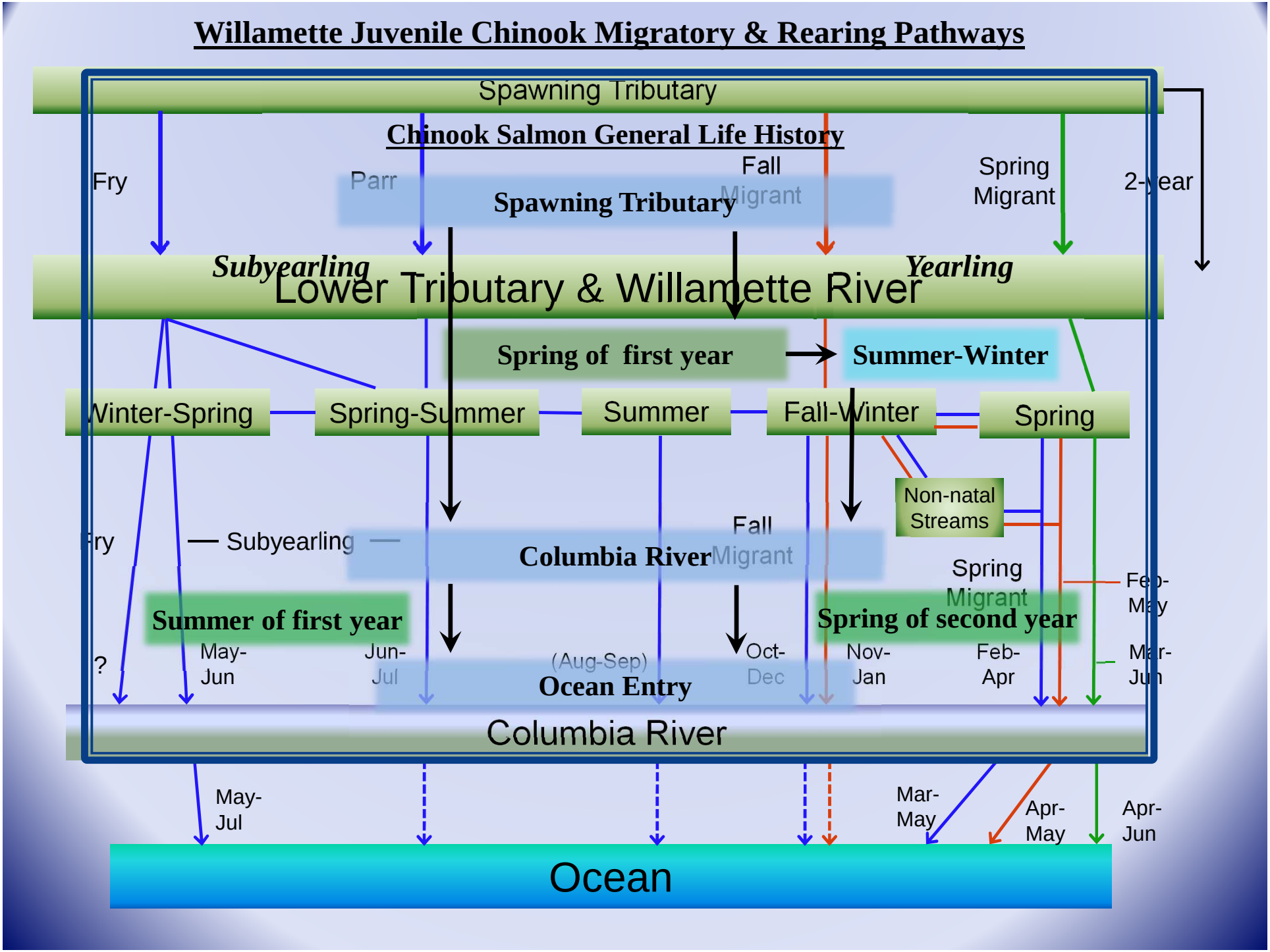



# Generalized Migration of McKenzie Juvenile Spring Chinook




Relative seasonal use of Willamette River

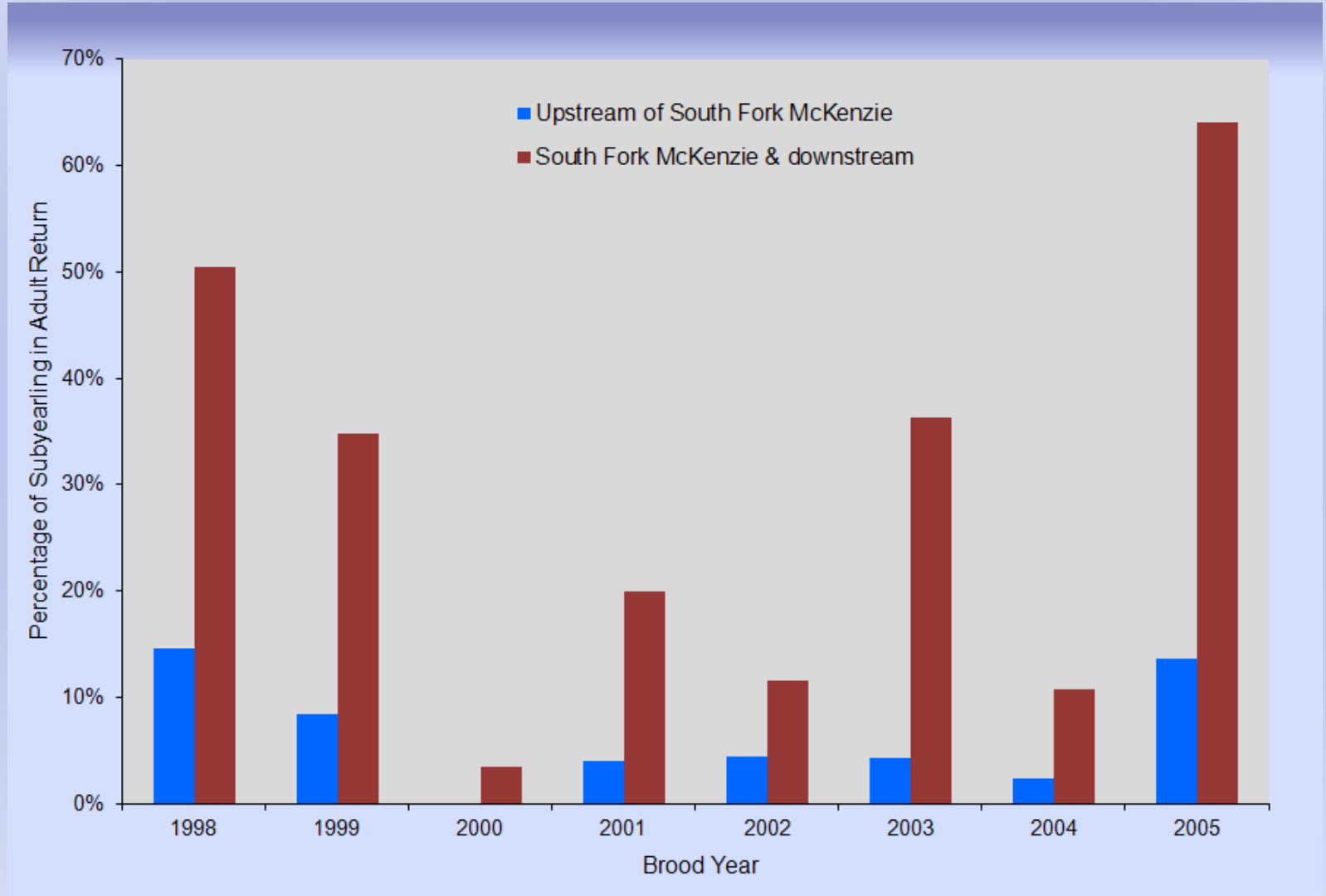
# Willamette Juvenile Chinook Migratory & Rearing Pathways



# Life History Diversity Matters – Different Life Histories Contribute (spatially & temporally)

## Contribution of Age 0 (Subyearling) in Wild Adult Spring Chinook – McKenzie Basin

**(hatchery fish identified by adipose fin clips & otolith marks)**



*Visualization of upper Willamette River downstream of McKenzie confluence*

Hulse et al. 2004. Ecological Applications 14: 325–341

**1850**

**Fry & subyearling migrations persist despite altered habitat**

**Subyearlings contribute to adult returns**

**Restore habitat complexity**

## Life History Diversity & Species Recovery

**<u>Fry dispersal</u>: adaptation that gave access to productive winter–spring rearing habitat?**

**<u>Subyearling emigrants</u>: once the most productive life history?**

**1995**

# Dynamic Rivers provide Diverse Habitats that support Diverse Life Histories


Willamette River downstream of McKenzie confluence

## *What Do We Know?*

- **Willamette Chinook have multiple rearing & migratory pathways before ocean entry**
- **Juvenile Chinook migrate into the river at different life stages**
- **Juvenile Chinook are present in the river year-round**
- **Some rear in the river for many months (up to 16)**
- **Use many different types of habitats:**
  - **Main river (shallow gravel bars, pools)**
  - **Side channels**
  - **Floodplains**
  - **Small, seasonal tributaries**

***Flooded gravel bar with willows – upstream of Salem, June 2008***

## *What Should We Do?*

- **Manage for multiple life histories**
- **Protect & conserve: stem the loss of habitat**
- **Protect intact areas & high potential habitat**
- **Land purchase or easements to allow room for river**
- **Move development out of floodplains**
- **Provide connectivity: lateral, temporal**

***Flooded channels & fields – Harkins Lake, June 2010***

***Michael Pope, Greenbelt Land Trust***