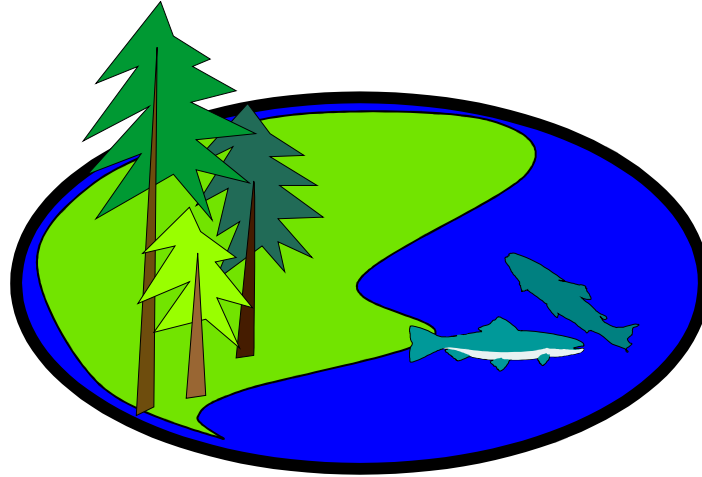


Strategies for mitigating ecological effects of hatchery programs

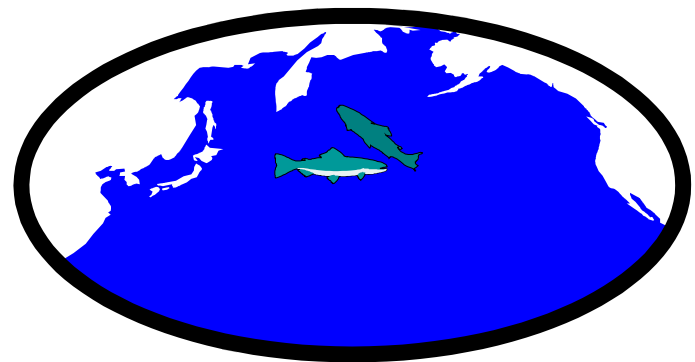
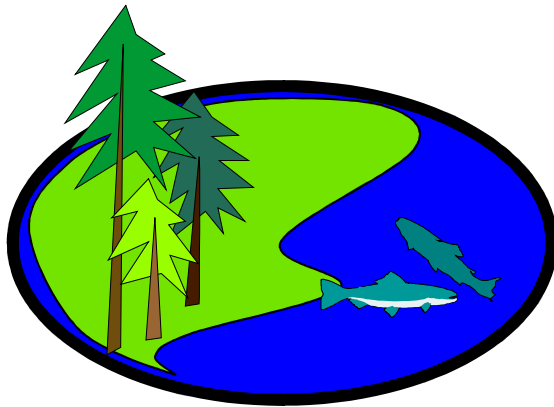


Some case studies from the Pacific Northwest

Kathryn Kostow
Oregon Department of Fish and Wildlife

Ecological risks occur when the presence of hatchery fish detrimentally affects how wild fish interact with each other, with their environment or with other species

How can these risks be avoided or decreased?



An Overview of Strategies from Kostow 2009*

- 1. Operate hatchery programs within an integrated management context**
- 2. Only implement hatchery programs that provide a benefit**
- 3. Reduce the number of hatchery fish that are released**
- 4. Scale hatchery programs to fit carrying capacity**
- 5. Limit the total number of hatchery fish that are released at a regional scale**
- 6. Only release juveniles that are actively smolting and will promptly out-migrate**

*** Kostow, 2009**

Factors that contribute to the ecological risks of salmon and steelhead hatchery programs and some mitigating strategies

An Overview of Strategies from Kostow 2009

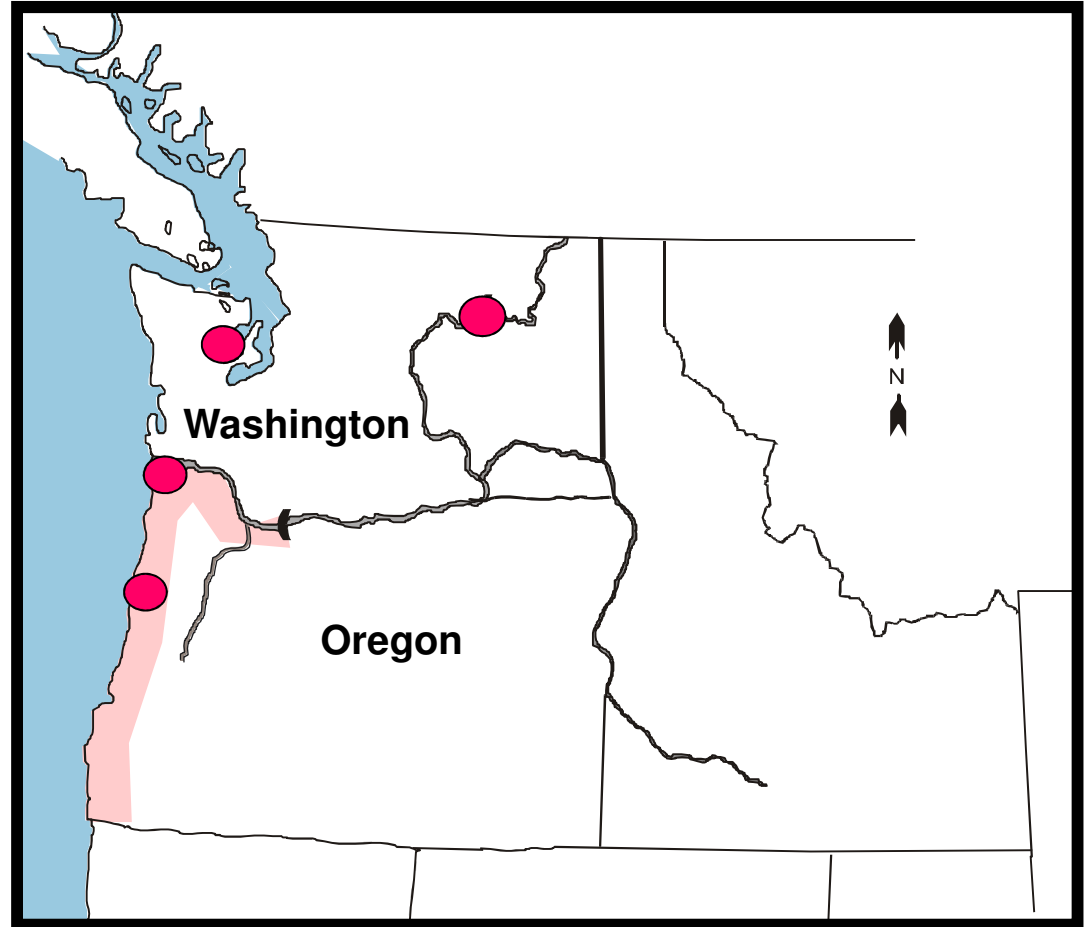
- 7. Release smaller hatchery fish, provided they are smolting**
- 8. Use acclimation ponds and volitional releases**
- 9. Locate large releases of hatchery fish away from important natural production areas**
- 10. Time hatchery fish releases to minimize ecological risks**
- 11. Restrict the number of hatchery adults allowed into natural production areas**
- 12. Mark 100% of the hatchery fish and monitor the effects of hatchery programs**

*** Kostow, 2009**

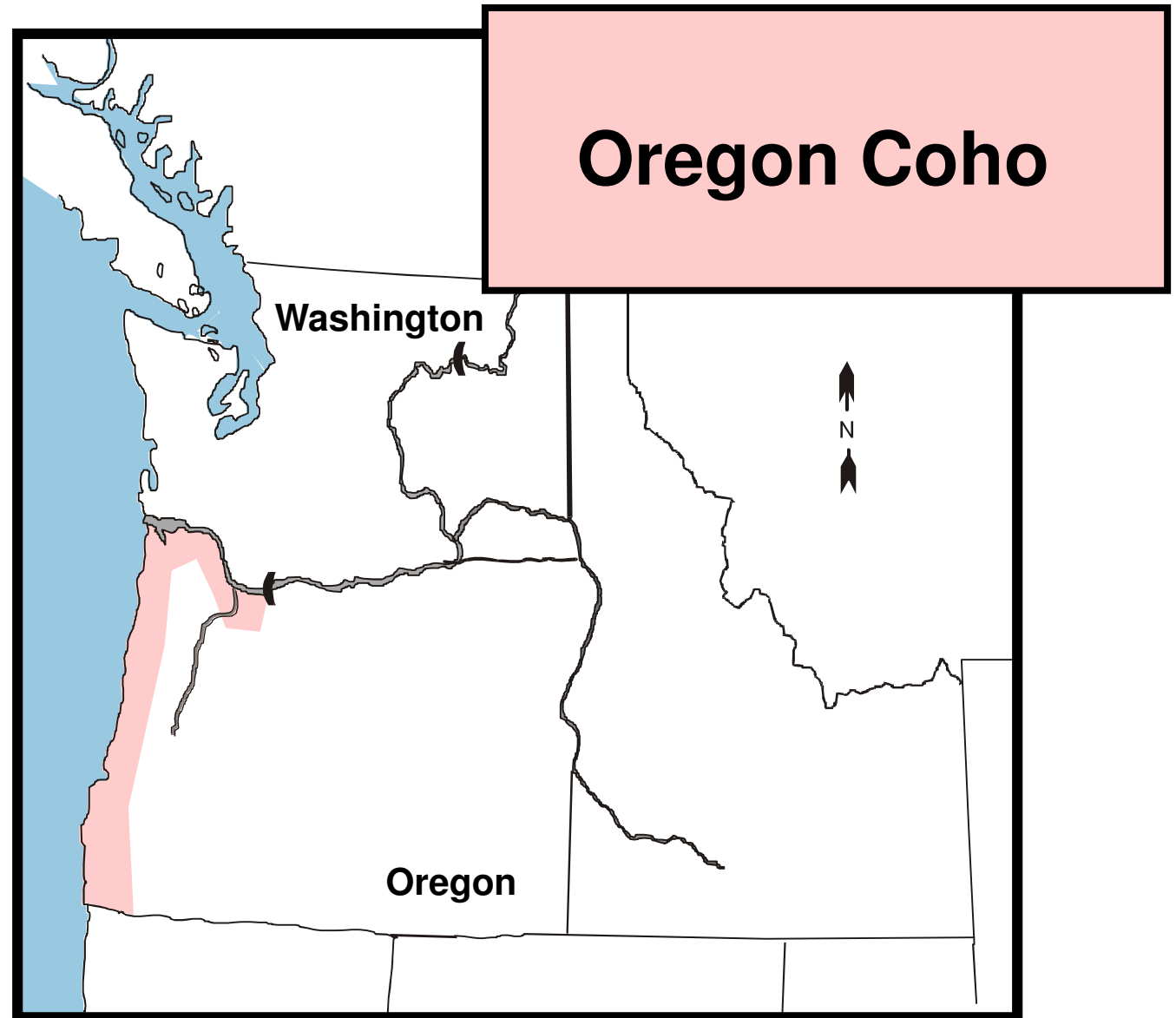
Factors that contribute to the ecological risks of salmon and steelhead hatchery programs and some mitigating strategies

Examples of implementing these strategies

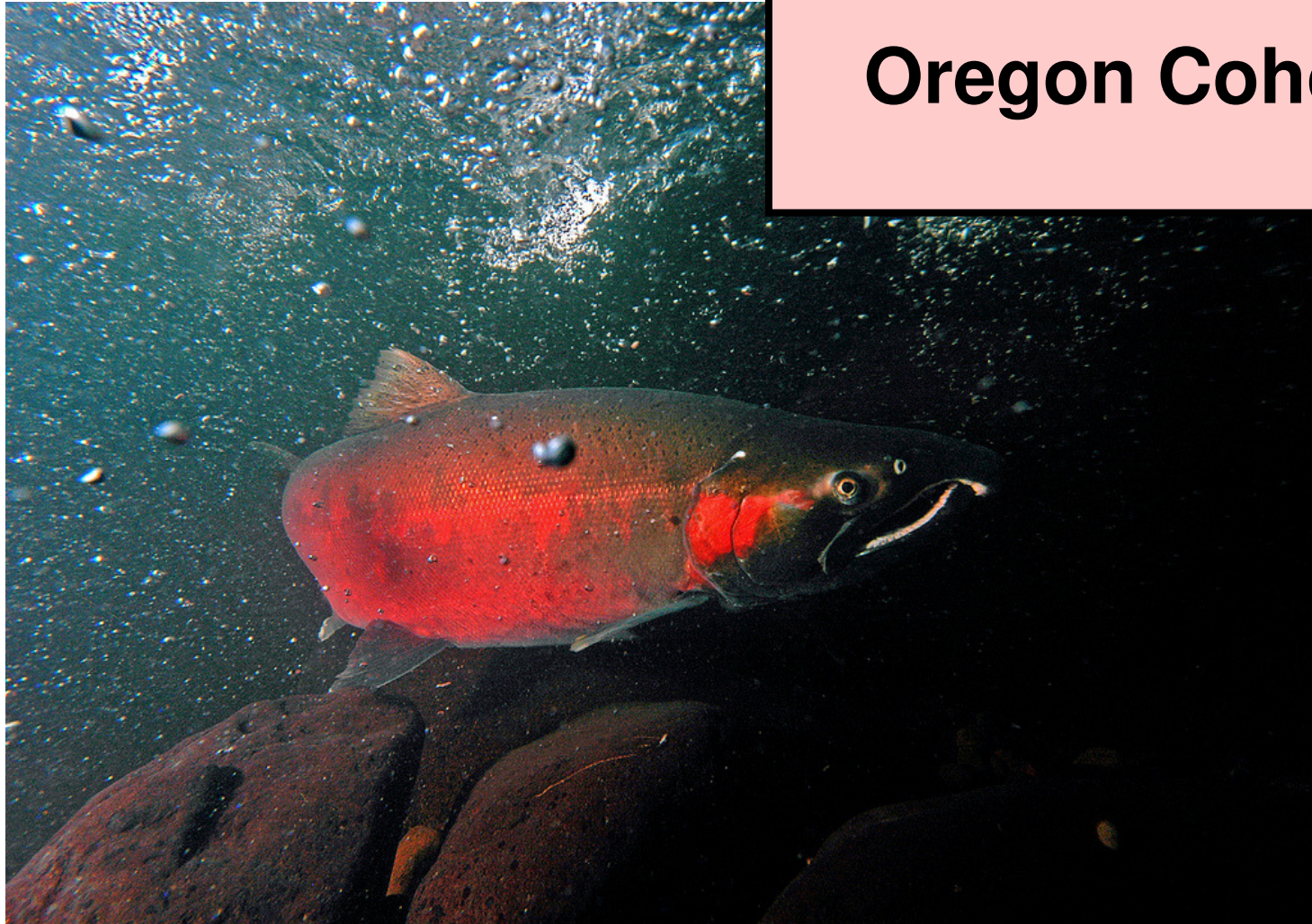
Five Case Studies from Oregon and Washington



Case Study



Oregon Coho



ESA Threatened Species

Oregon Coho: 1960 - 1990

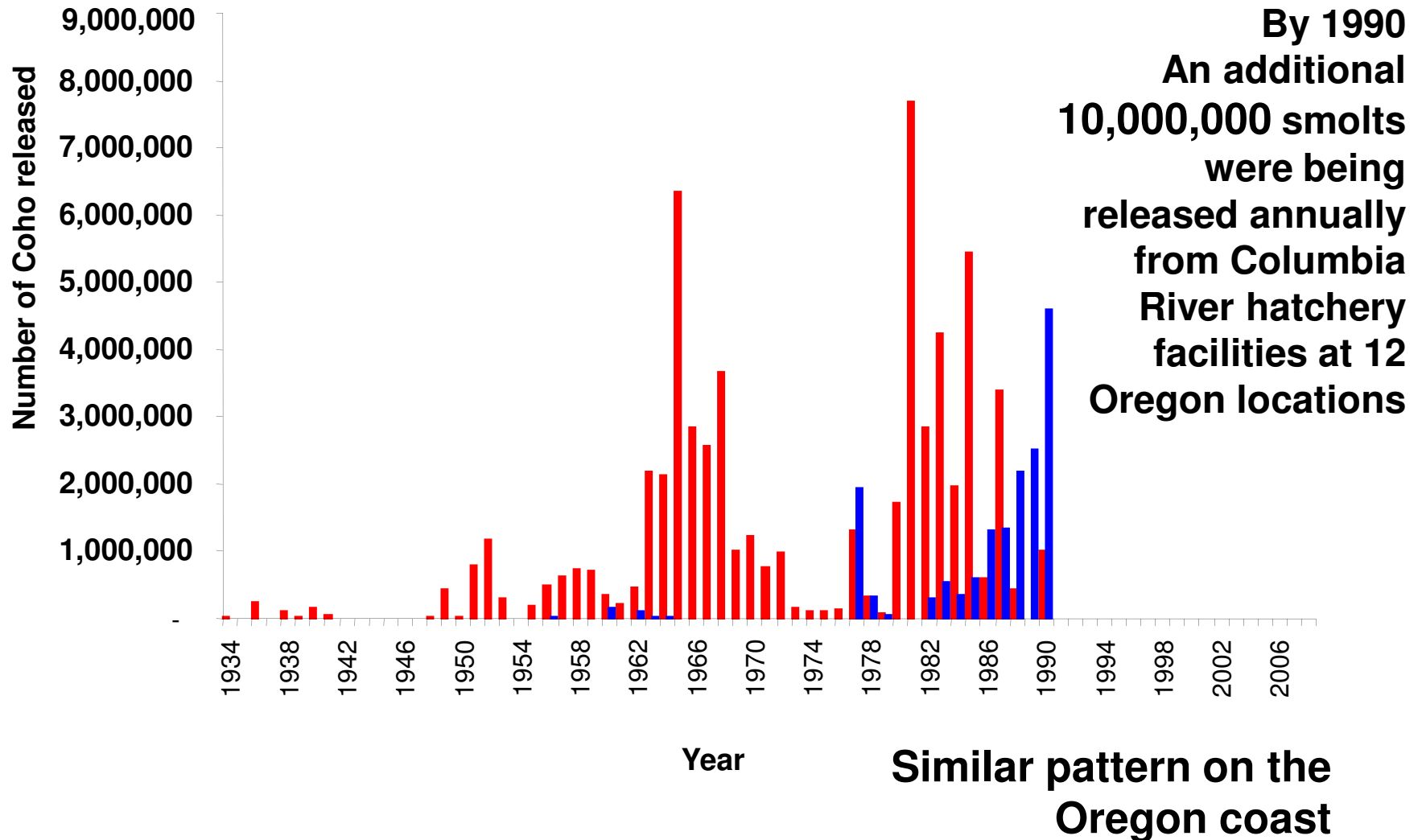
1960 to 1990:

ODFW policy was to use natural habitats to rear hatchery Coho

1980 ODFW Coho Plan:

The lower Columbia would be managed for Coho hatchery production and harvest

**Number of Coho pre-smolts and smolts
released into natural habitats in the Lower Columbia,
1934 – 1990 (Oregon only)**



Oregon Coho: **Impacts on productivity**

Nickelson et al. 1986

Use of Hatchery Coho Salmon (*Oncorhynchus kisutch*) to Rebuild Wild Populations in Oregon Coastal Streams:

Demonstrated that the planting of hatchery Coho pre-smolts into natural habitats depressed natural productivity

Lichatowich and McIntyre, 1987

Use of Hatcheries in the Management of Pacific Anadromous Salmonids

Demonstrated an association with increased hatchery Coho releases, decreased Coho harvest and declining wild Coho abundance in Oregon

Flagg et al. 1995

The Effect of Hatcheries on Native Coho Salmon Populations in the Lower Columbia River

The combination of hatchery programs and harvest was driving lower Columbia River Coho to extinction

Nickelson 2003

The influence of hatchery coho salmon (*Oncorhynchus kisutch*) on the productivity of wild coho salmon populations in Oregon coastal basins

Hatchery Coho smolt releases depressed the productivity of wild Coho on the Oregon coast

Buhle et al. 2008

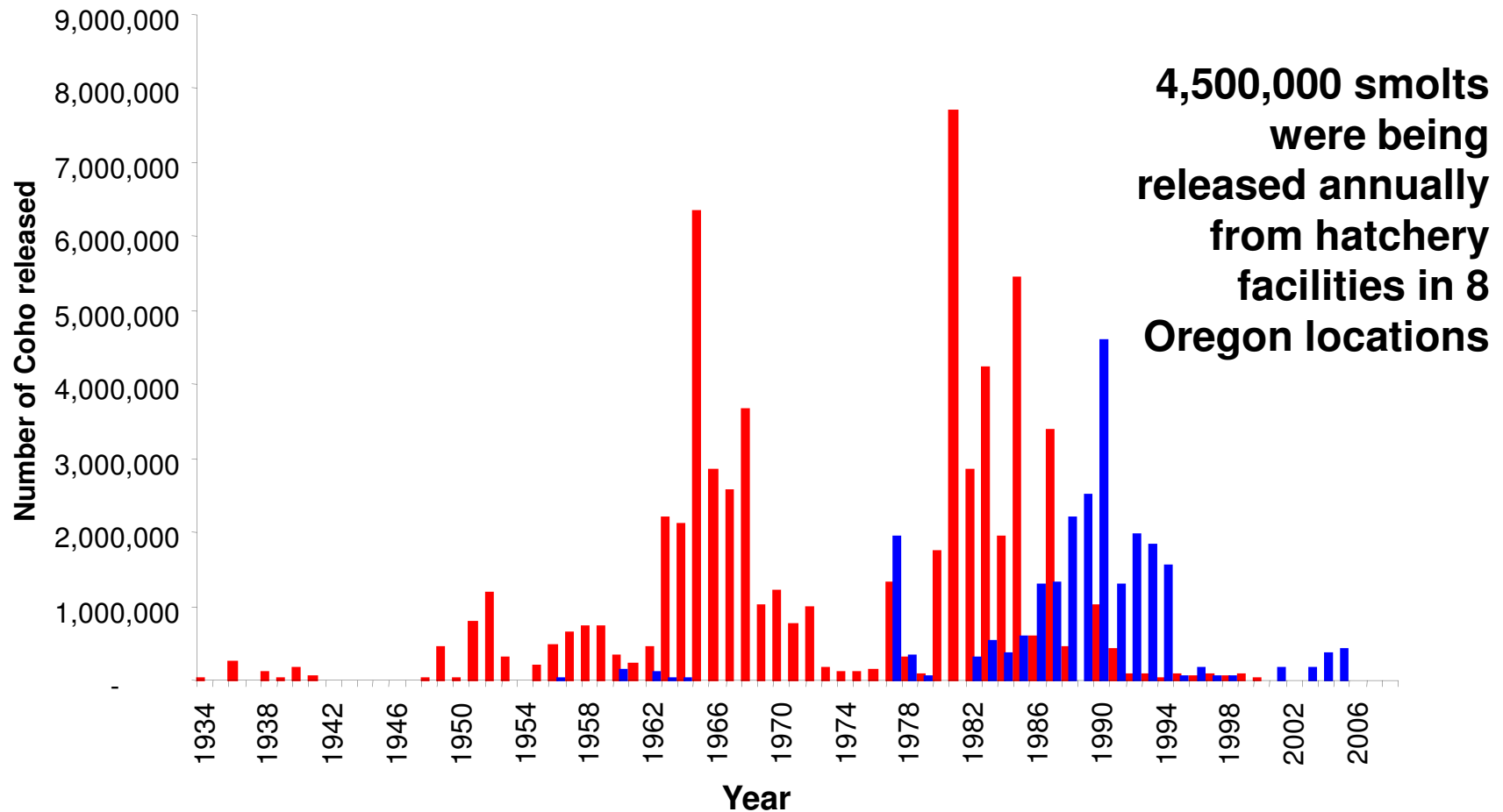
Using an unplanned experiment to evaluate the effects of hatcheries and environmental variation on threatened populations of wild salmon

Hatchery Coho spawners on the Oregon coast had density-dependent effects on natural productivity

**Oregon Coho:
Strategies adopted, 1990 to present:**

- 1. Integrated management context***
 - 2. Release only if it provides a benefit***
 - 3. Reduce the number released***
 - 4. Limit releases at a regional scale***
 - 5. Limit releases at a regional scale***
 - 6. Release only smolts***
 - 7. Use acclimation ponds and volitional releases***
 - 8. Use acclimation ponds and volitional releases***
 - 9. Location of releases***
 - 10. Location of releases***
 - 11. Restrict hatchery adults***
 - 12. Mark and monitor***
- Bonus: Eliminate releases of hatchery pre-smolts into natural production areas***

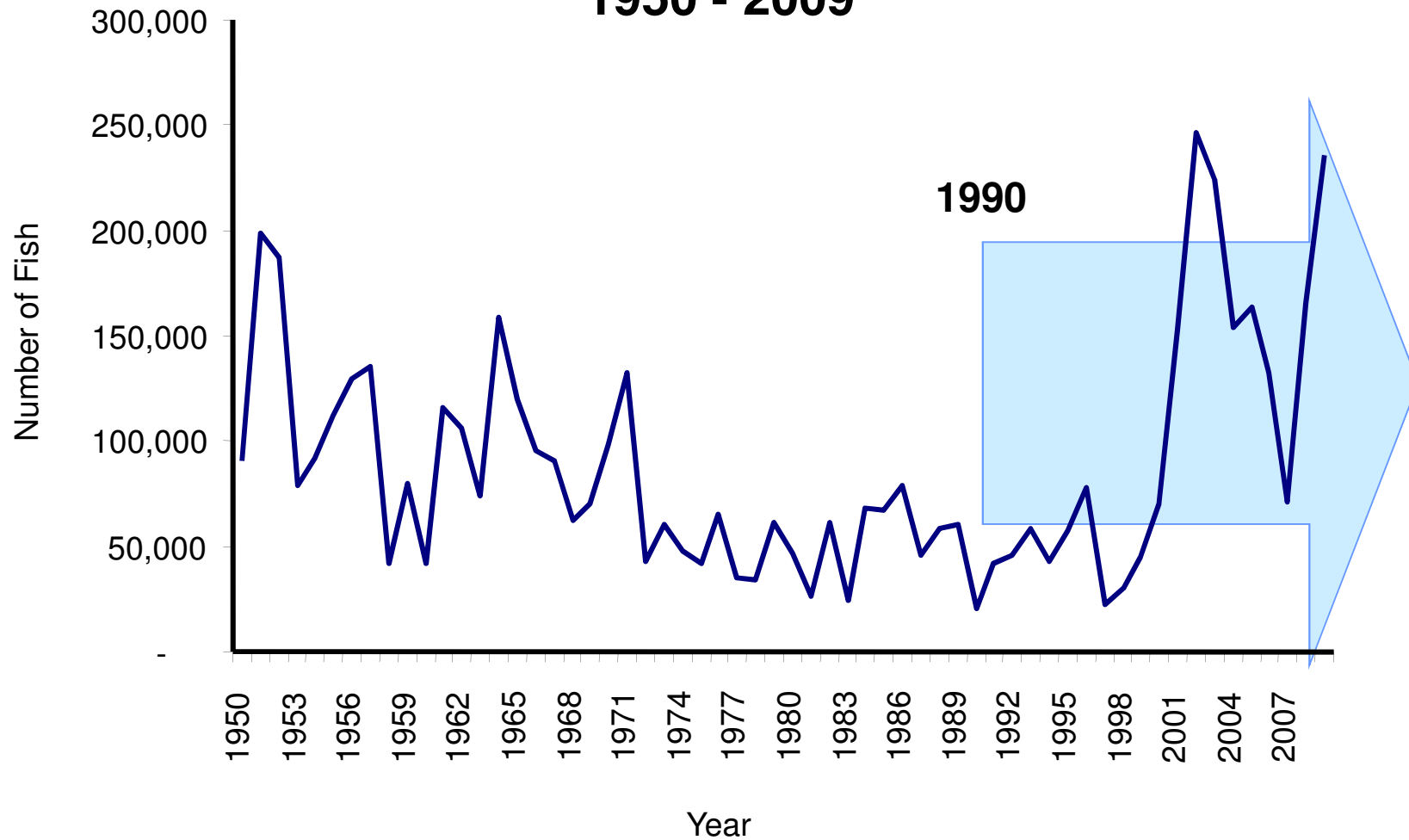
**Number of Coho pre-smolts and smolts
released into natural habitats in the Lower Columbia,
1934 – 2008 (Oregon only)**



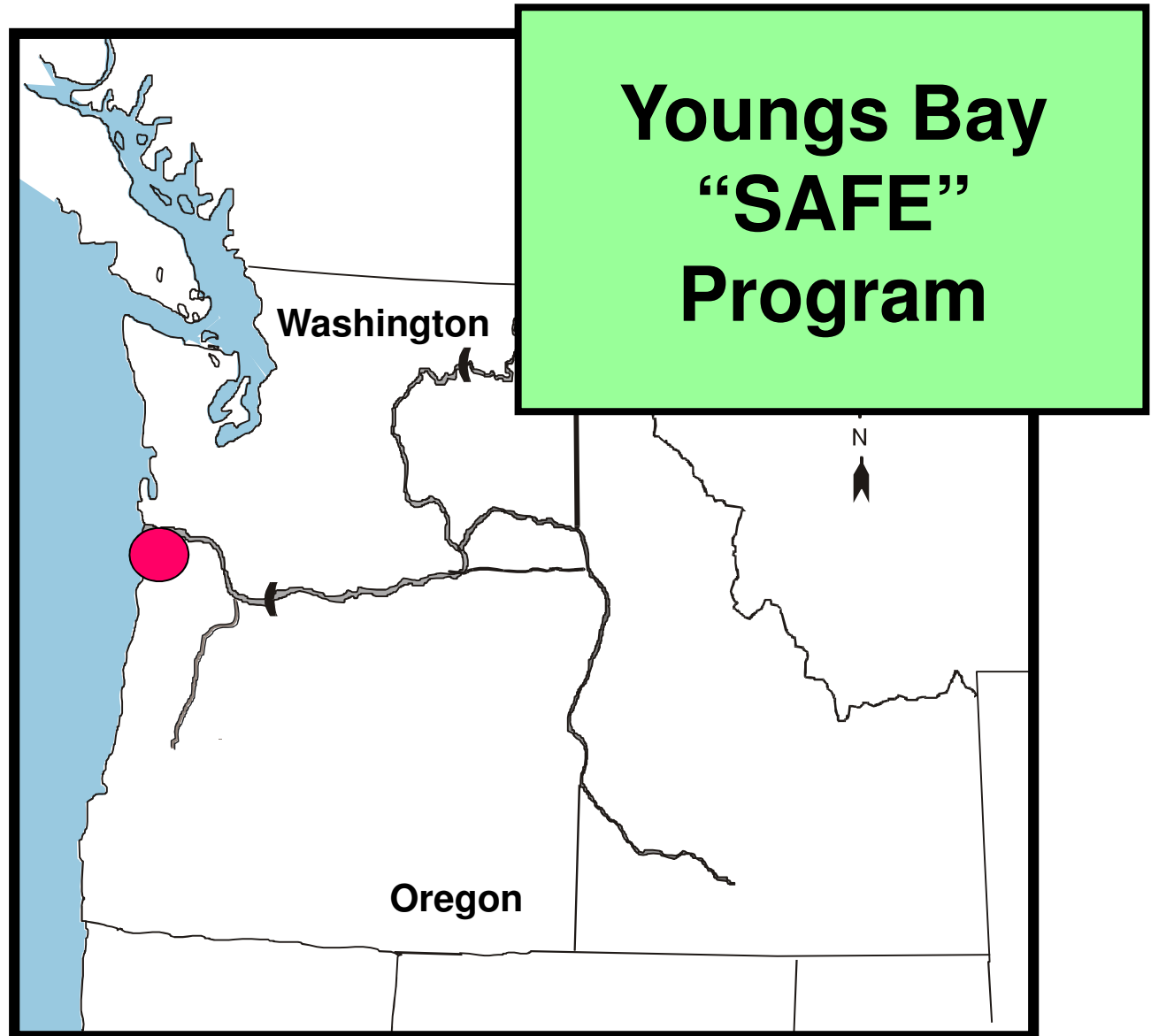
Oregon Coho: 2010

- **Pre – smolt releases discontinued**
- **Releases into natural habitats discontinued**
- **Lower Columbia: On-station releases down to 45% of 1990 releases; fewer release locations**
- **Oregon Coast: On-station releases down to 11% of 1990 releases; fewer release locations**

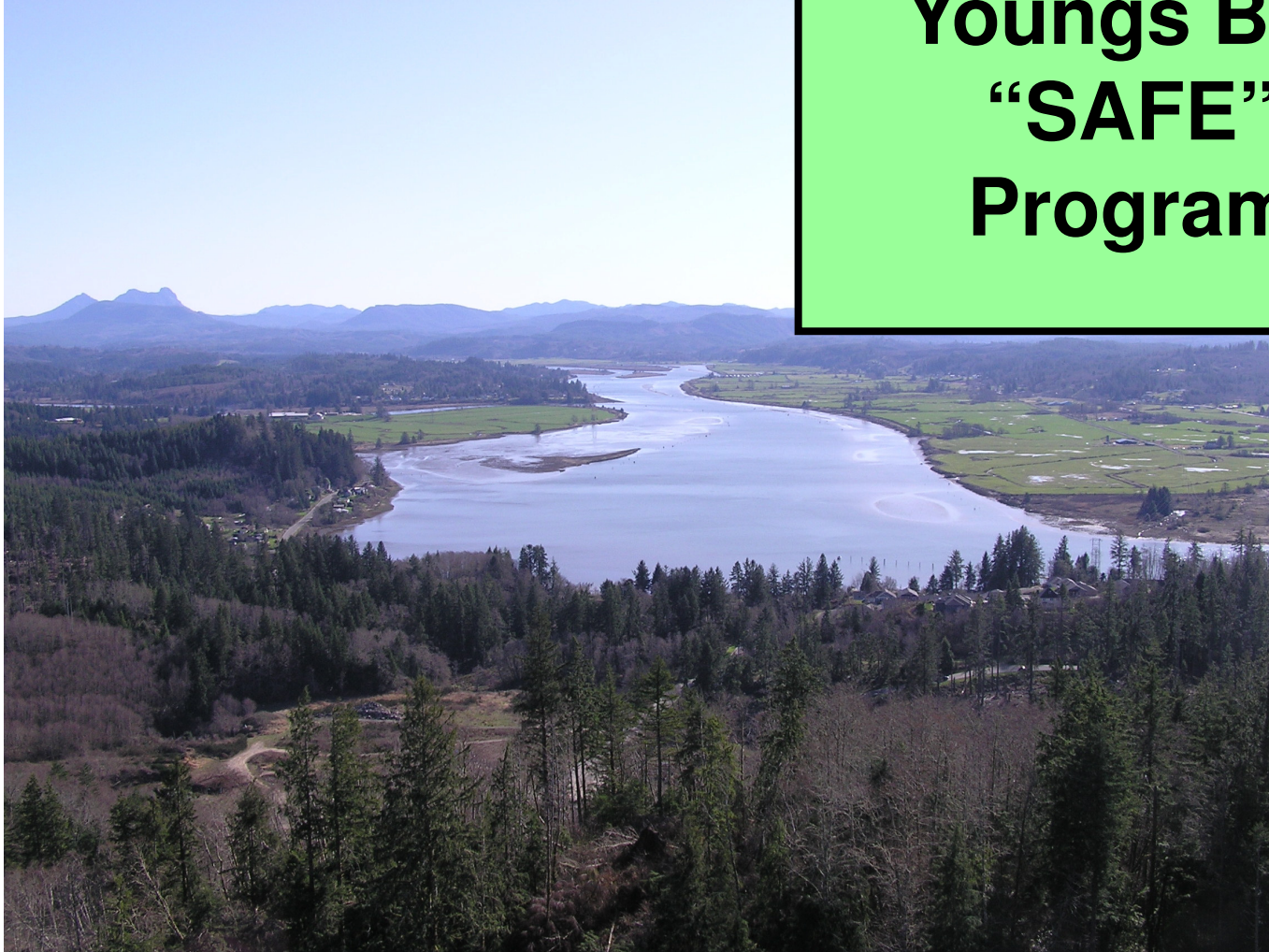
Oregon Coho Wild Fish Abundance 1950 - 2009

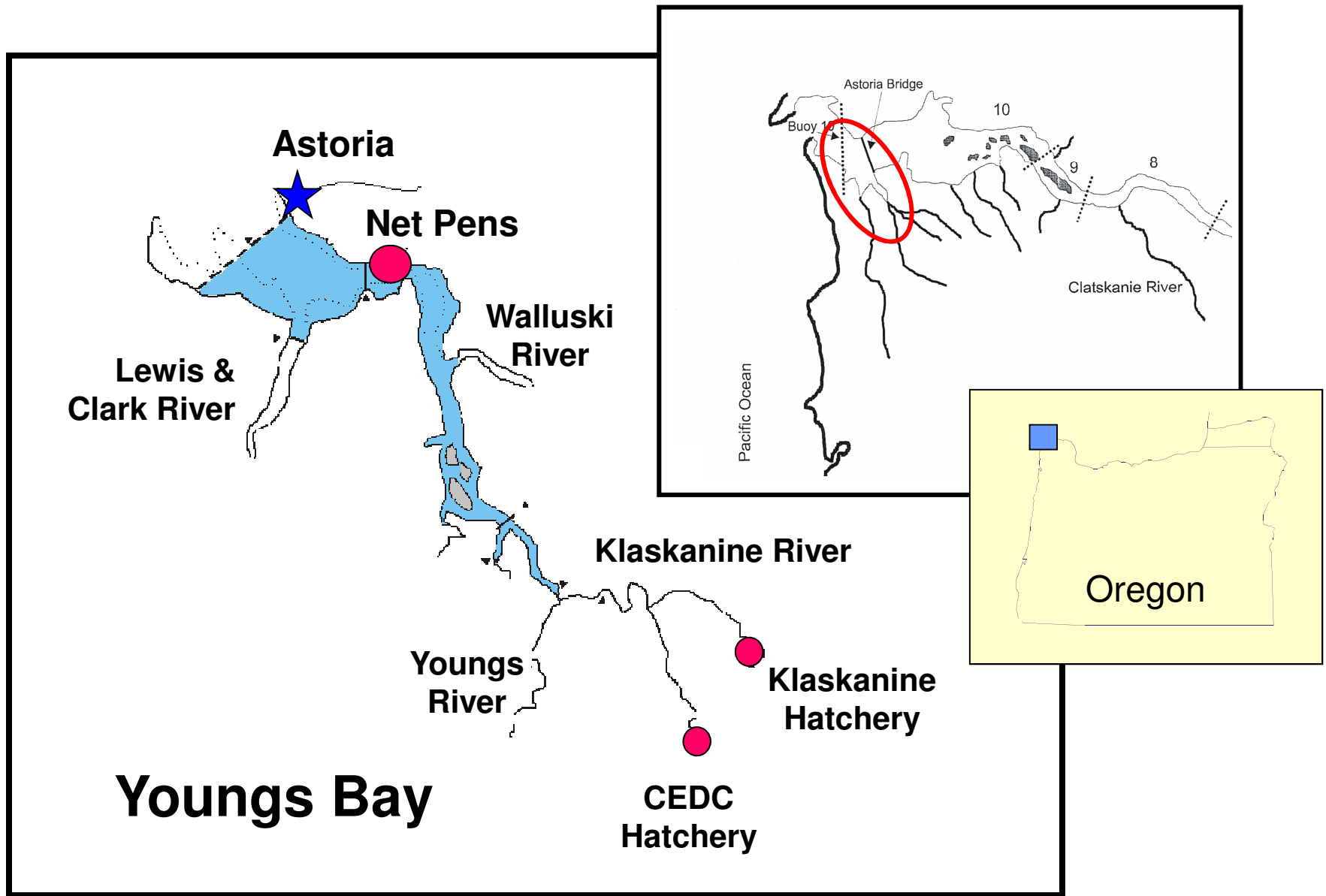


Case Study



Youngs Bay “SAFE” Program



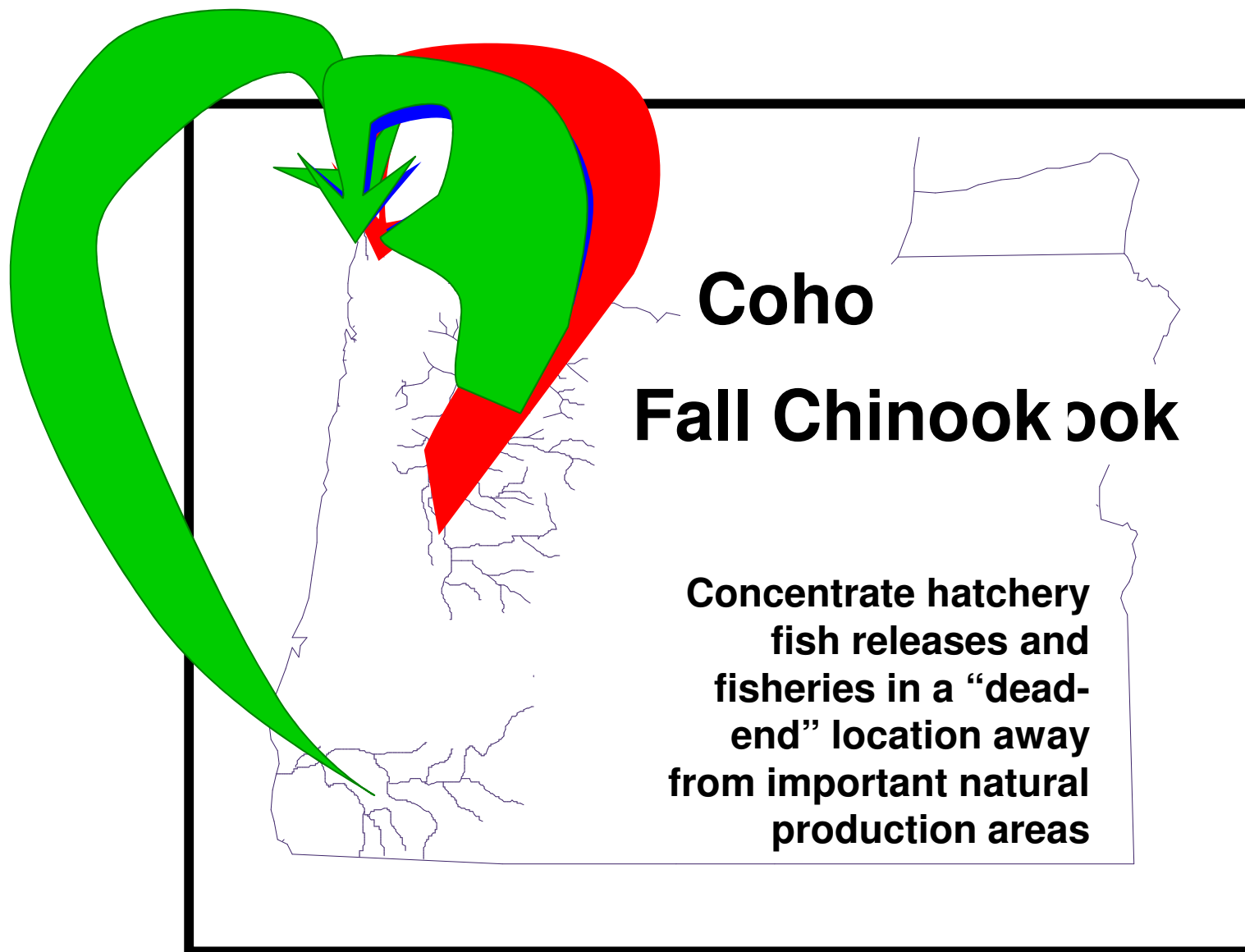


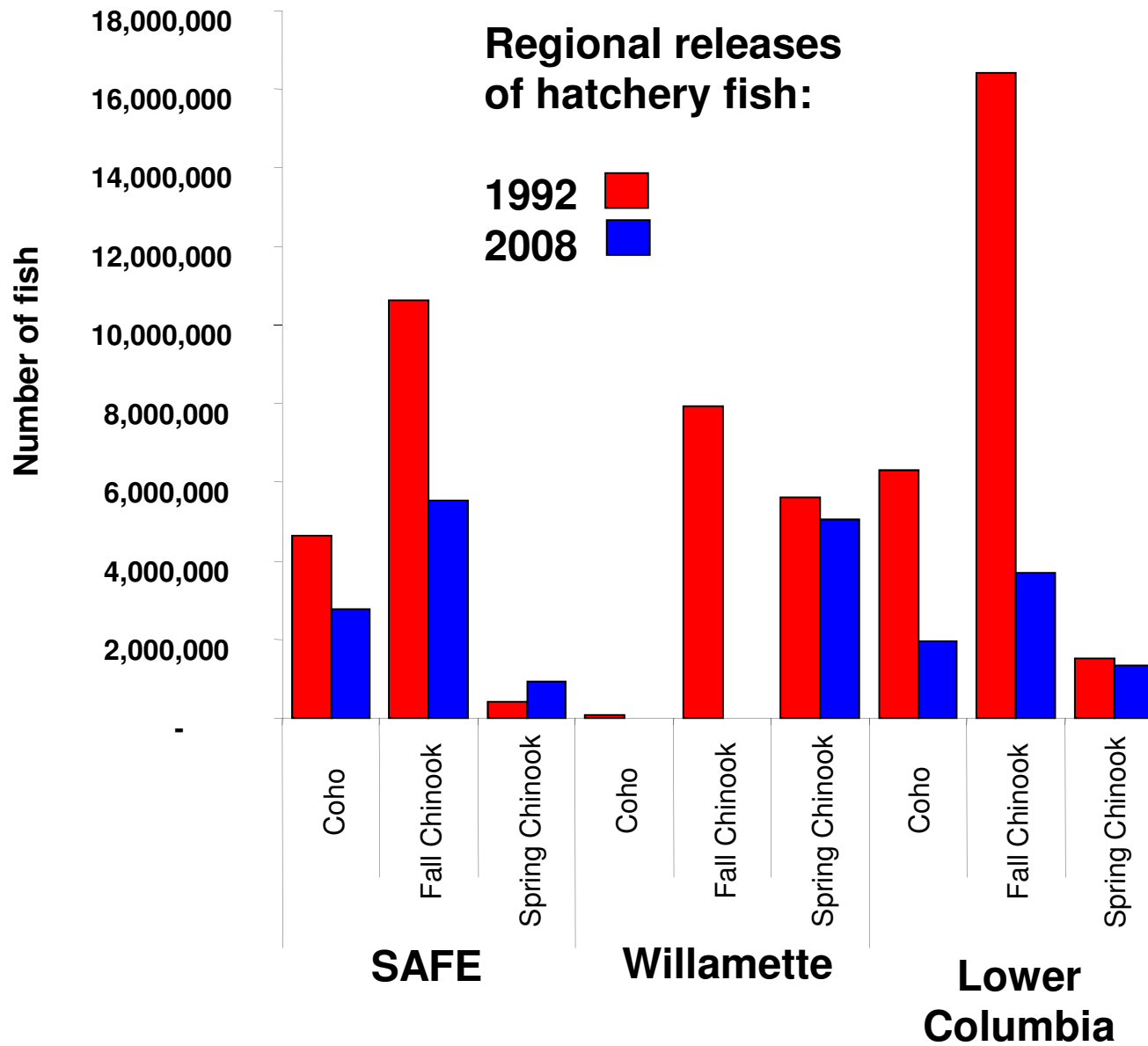
Youngs Bay “SAFE” Program

Strategies adopted, 1993 to present:

1. *Integrated management context*
2. *Release only if it provides a benefit*
5. ***Limit releases at a regional scale***
6. *Release only smolts*
8. *Use acclimation ponds and volitional releases*
9. ***Location of releases***
10. *Time of releases*
11. *Restrict hatchery adults*
12. *Mark and monitor*

The Concept of a “SAFE” Program:





Dual purposes of this program:

- 1. Provide a quality commercial and recreational fishery**



Dual purposes of this program:

1. Provide a quality commercial and recreational fishery

- **Hatchery adults need to be highly desirable in terminal fisheries:**

**Spring Chinook
Late-running Coho
Bright Fall Chinook**

- **Need a good return of adults for the number of smolts released:**

High smolt-to-adult survival

Duel purposes of this program:

- 2. Keep the hatchery fish (and fisheries) away from important natural production areas**

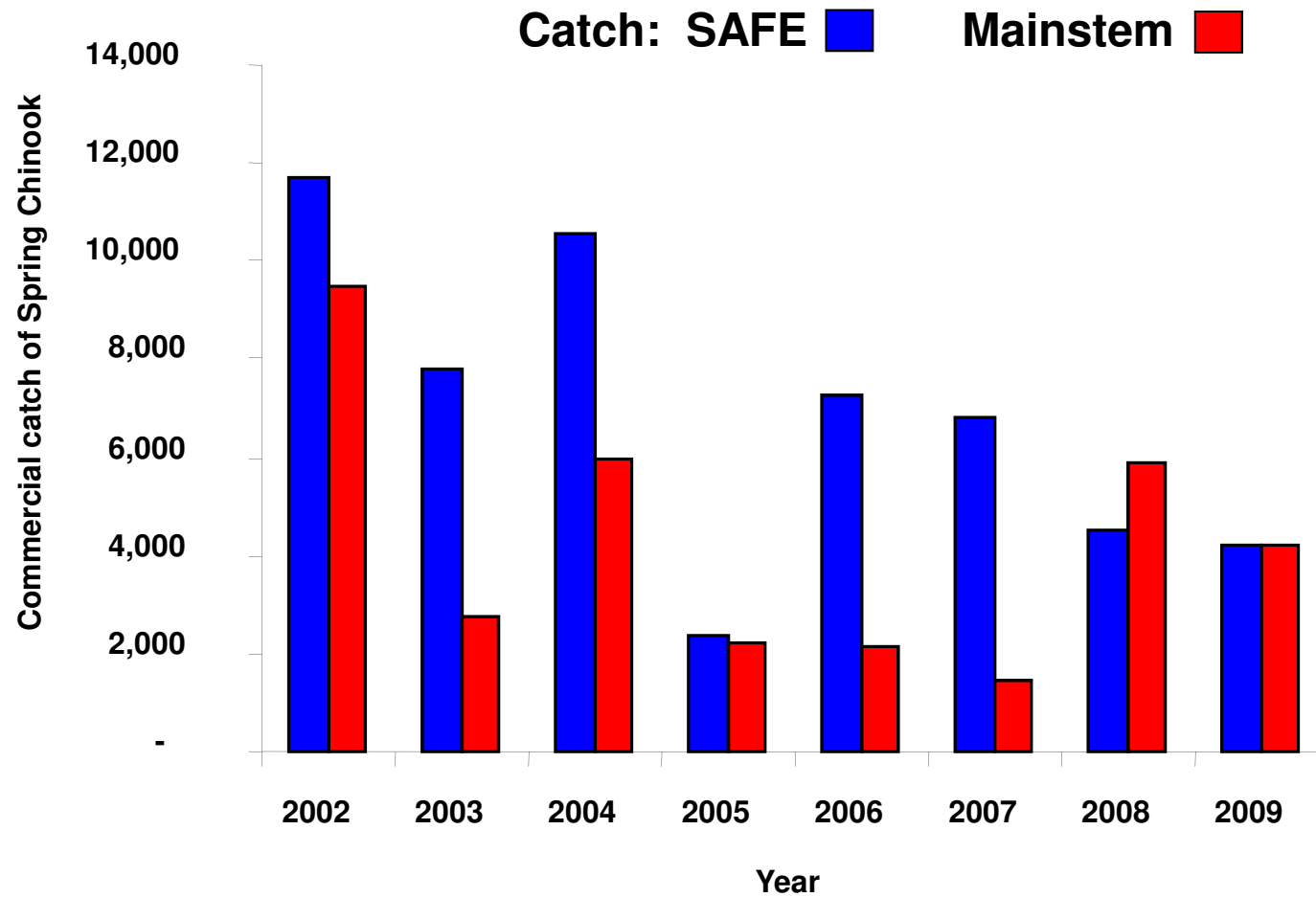


Duel purposes of this program:

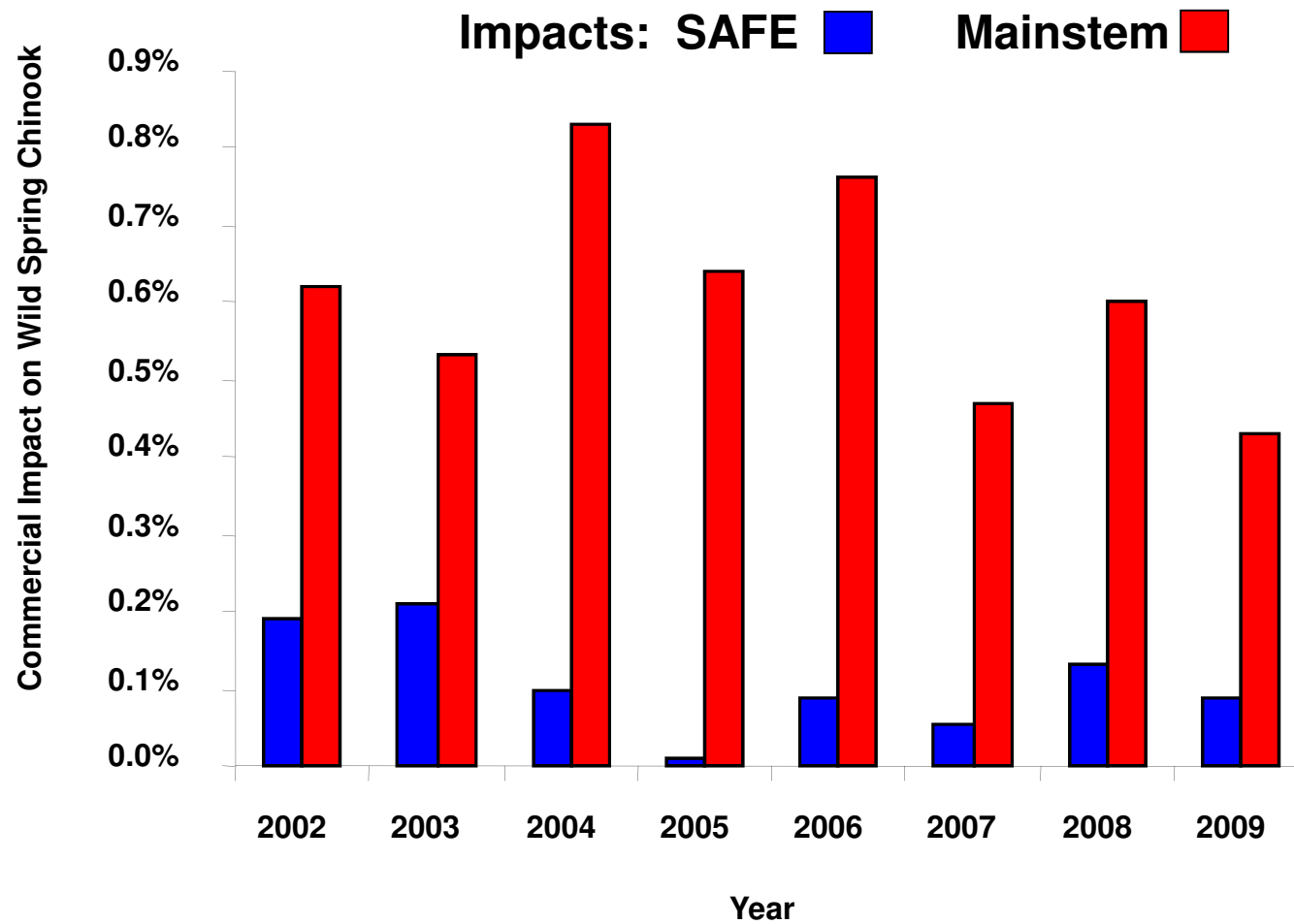
2. Keep the hatchery fish (and fisheries) away from important natural production areas

- **All releases are acclimated smolts inside the bay**
- **Smolts are released at night on out-going tides and promptly enter the ocean**
- **No straying by adults into areas out-side of Youngs Bay; accomplished by choice of release locations in the bay**
- **Terminal fisheries in the bay catch most of the returning hatchery adults**
- **Fisheries are located away from wild fish migration corridors in mainstem Columbia**

Spring Chinook Catch



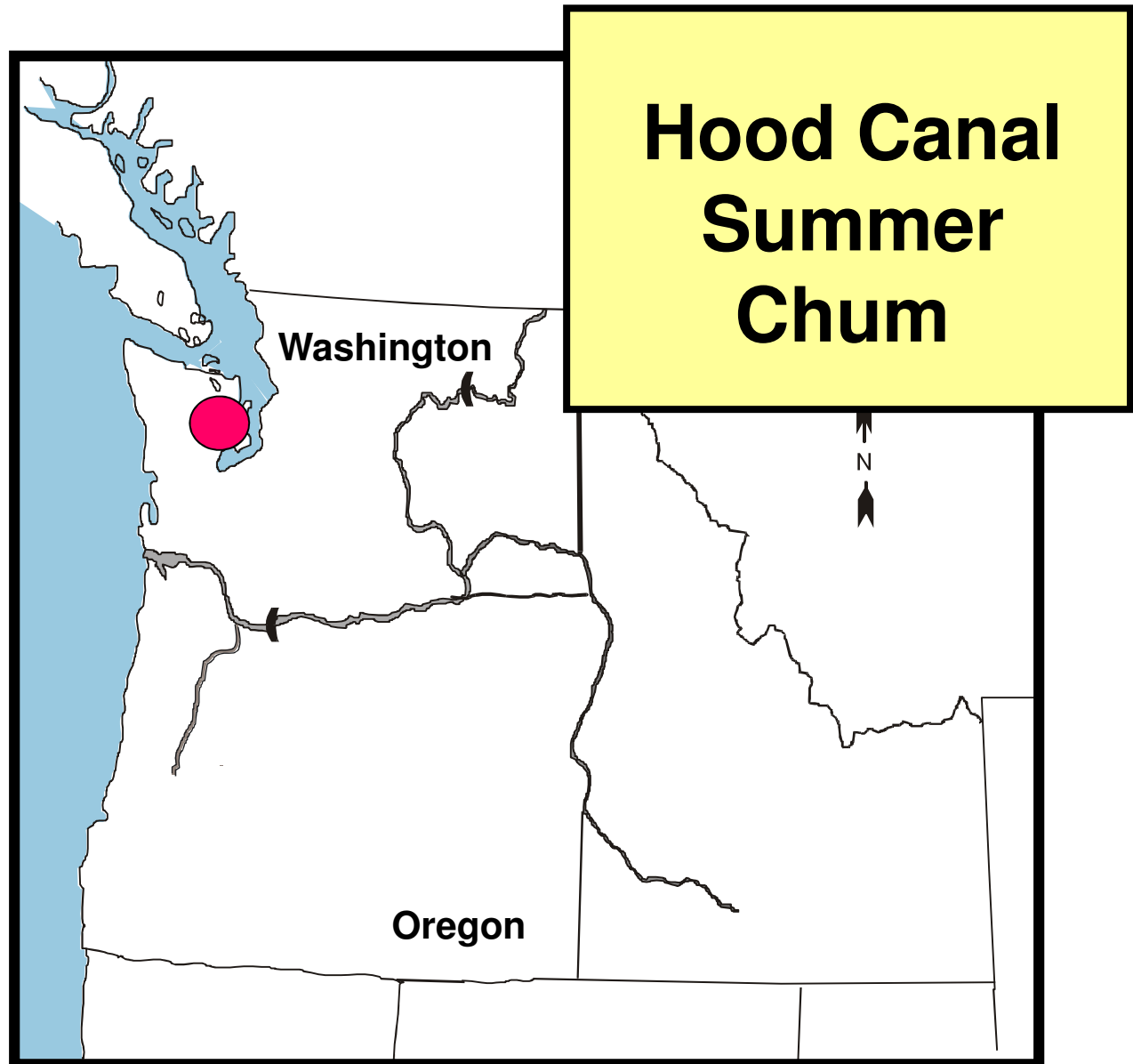
Spring Chinook Impacts



Consequences?

**Natural production in the Youngs
Bay tributaries is sacrificed**

Case Study

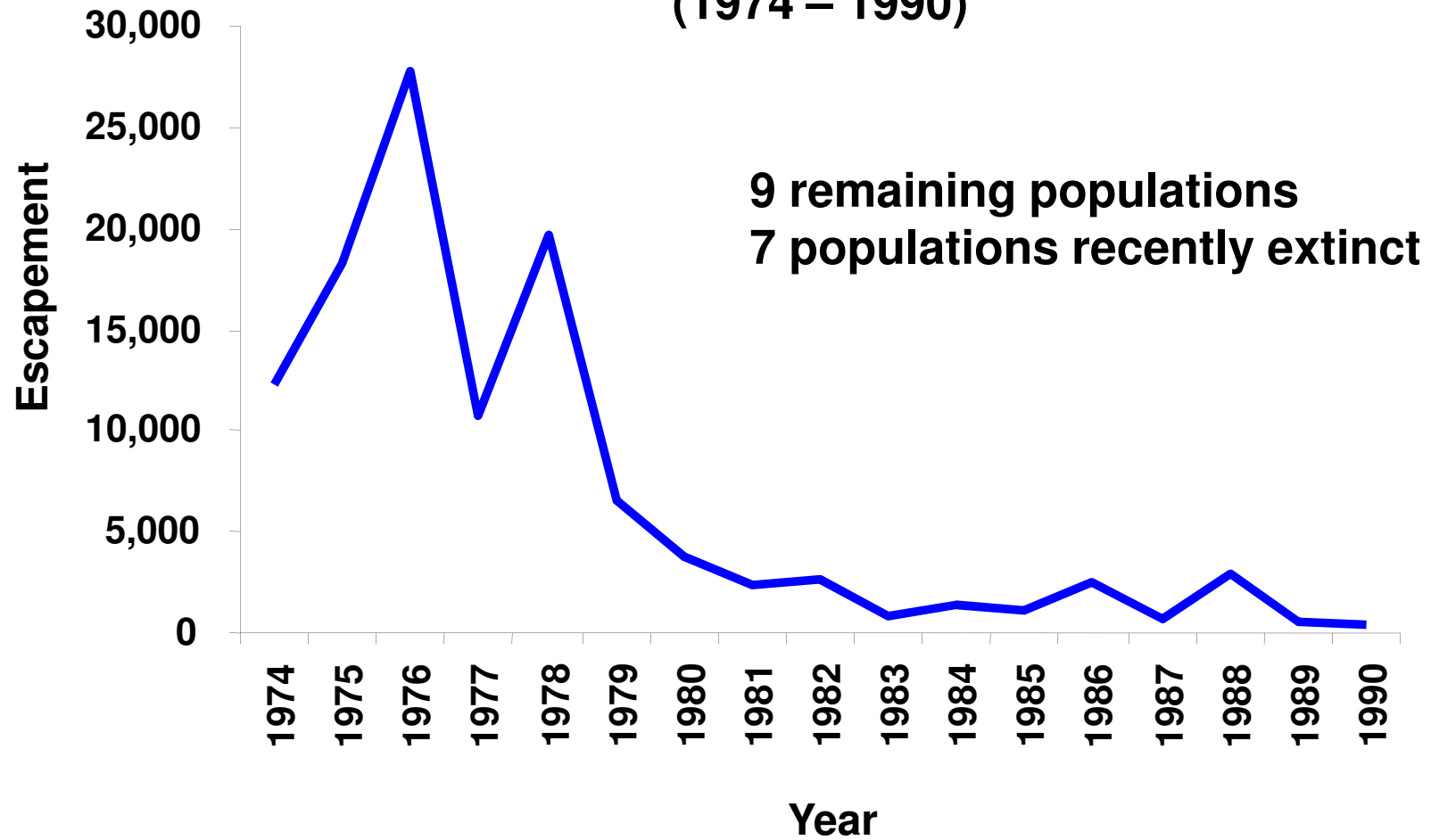


Hood Canal Summer Chum



ESA Threatened Species

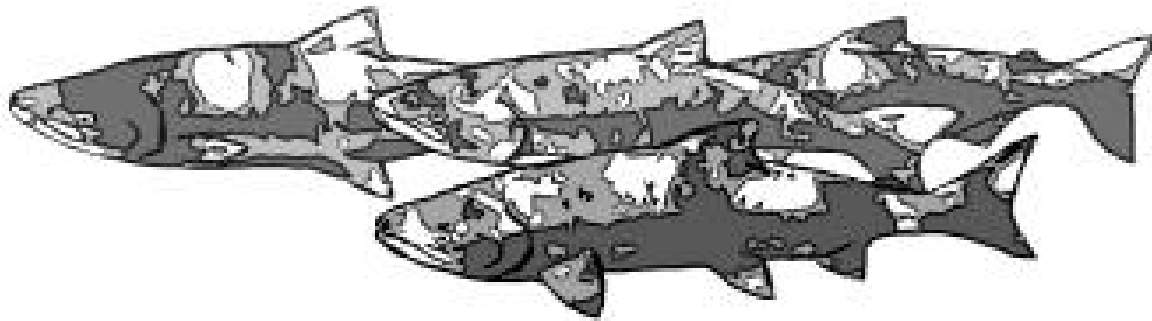
Hood Canal Summer Chum (1974 – 1990)



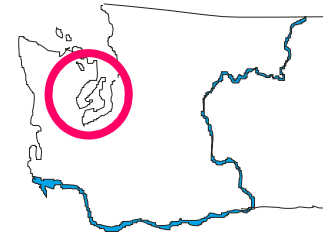
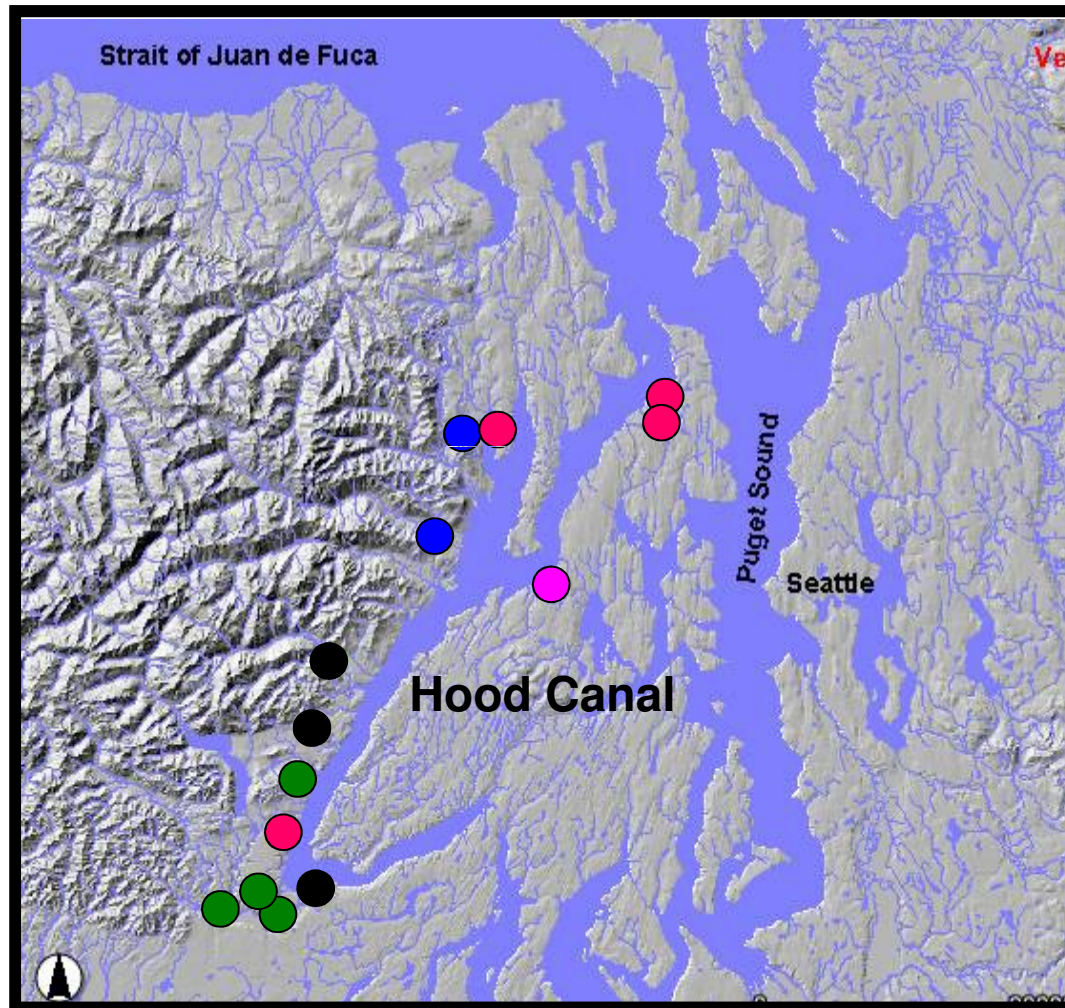
Summer Chum Salmon Conservation Initiative

A plan to recover Summer Chum

**Formally adopted in 2000
Actions initiated in early 1990s**



Hatchery facilities in Hood Canal



- State
- Tribal
- Federal
- Private
- U of W

**Species
(early 1990s):**

- Fall Chum
- Fall Chinook
- Coho
- Odd-year Pink
- Winter Steelhead
- Cutthroat

Hatchery elements of the Conservation Initiative

For Summer Chum:

Short - term programs to:

**Supplement 6 populations
Wild reserves 3 populations
Reintroduce 3 populations**

**Programs began in 1992
and will be discontinued
when goals are met
(Several are already
discontinued)**

For other species:

**Take measures to decrease
hatchery risks to Summer Chum**

**Fall Chum (competition and
predator attraction)**

Steelhead (predation)

Cutthroat (predation)

Coho (predation)

**Fall Chinook (predation and
competition)**

Odd-year Pinks (competition)

Summer Chum Hatchery Program

Strategies adopted, 1992 to present:

1. *Integrated management context*
2. *Release only if it provides a benefit*
4. *Scale to carrying capacity*
9. *Location of releases*
10. *Time of releases*
12. *Mark and monitor*

Bonus: Release Larger hatchery fry to facilitate niche separation and avoid competition for food

Hatchery programs for other species

Strategies adopted 1990 to present to decrease risks to Summer Chum:

- 1. *Integrated management context***
- 3. *Reduce the number released (steelhead, cutthroat)***
- 6. *Release only smolts (steelhead, Coho, Chinook)***
- 8. *Use acclimation ponds and volitional releases***
- 9. *Location of releases***
- 10. *Time of releases (after summer chum out-migration)***

Bonus: Restrict trout releases to land-locked waters (cutthroat)

Case Study

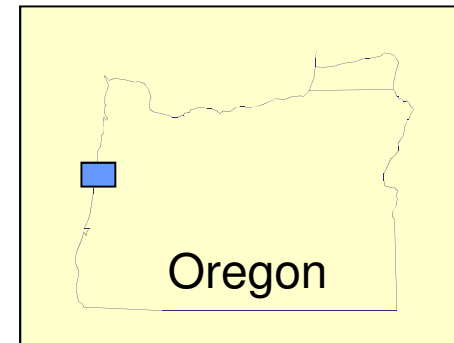
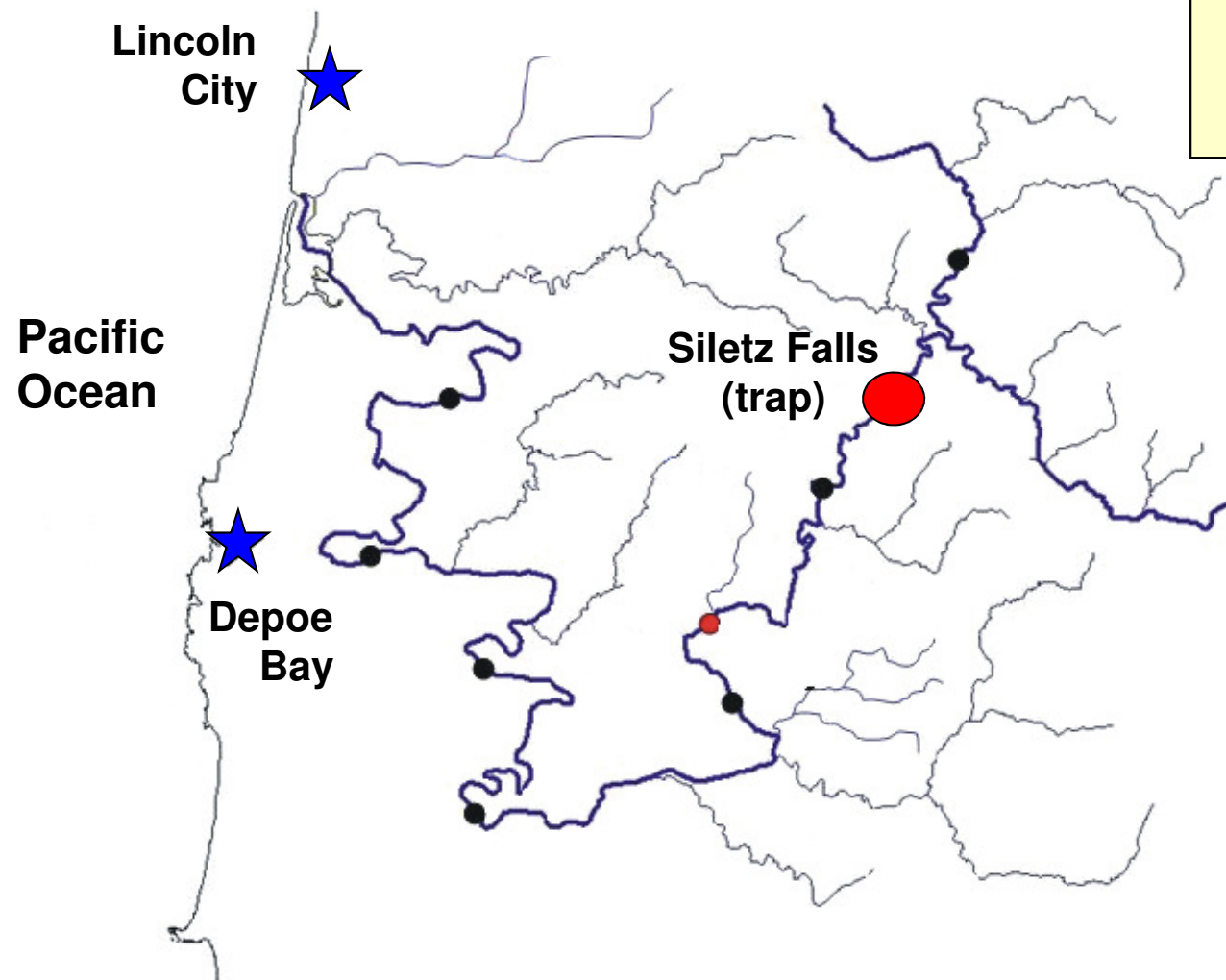


**Siletz
Summer
Steelhead**

**Siletz
Summer
Steelhead**



Siletz River



**Winter flows at Siletz Falls:
Historic natural passage barrier to winter- run salmonids**



1952:

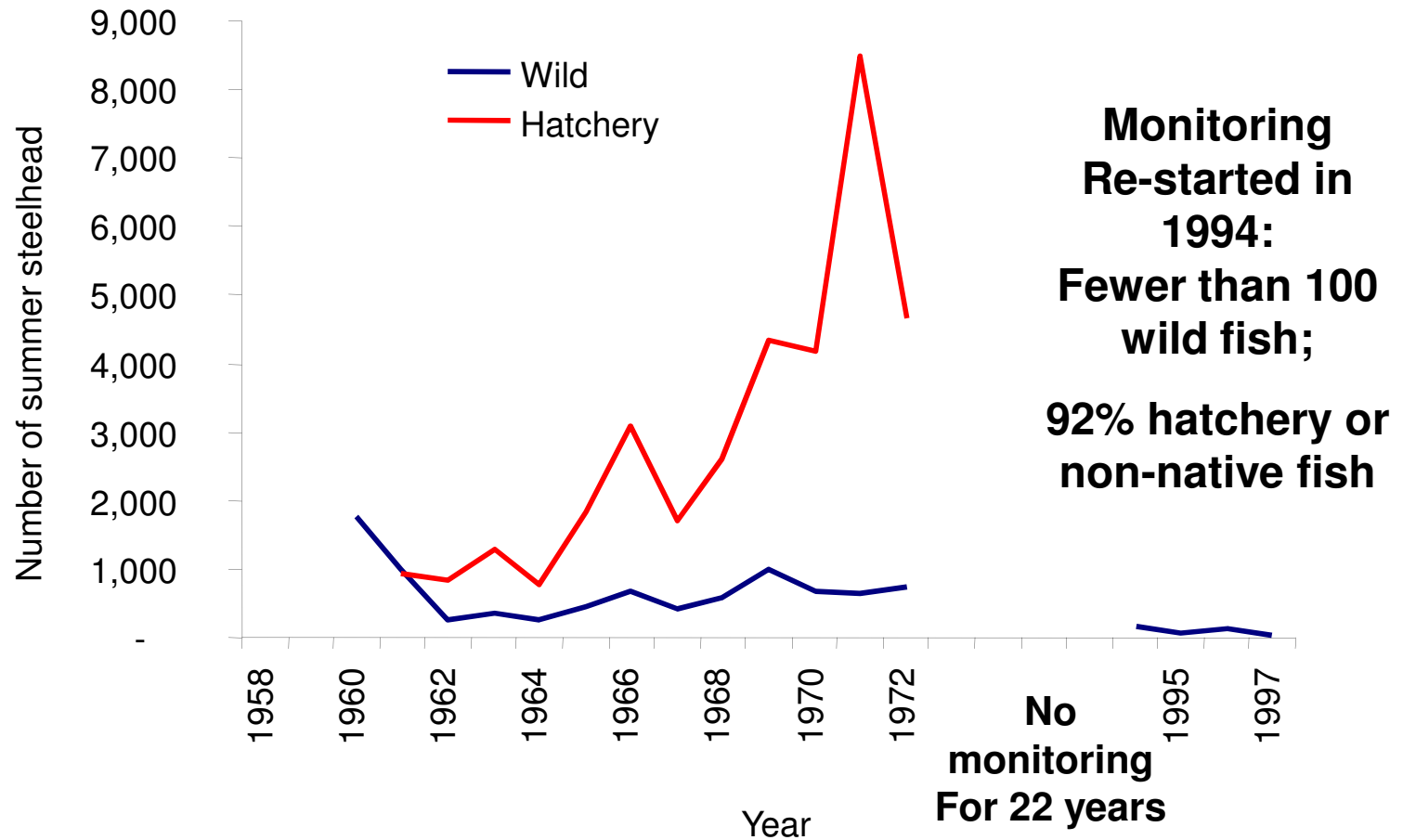
**A fish ladder was constructed
around Siletz Falls**

Passage was opened to winter- run populations:

**Winter Steelhead
Coho
Fall Chinook**

**Also initiated hatchery programs for winter
and summer steelhead, coho and cutthroat
trout, including smolt and parr releases
above the falls**

Number of wild and hatchery summer steelhead Passing Siletz Falls



**Siletz Summer Steelhead
Strategies adopted, 1994 to present:**

**Eliminate passage of all hatchery
and non-native salmonids**

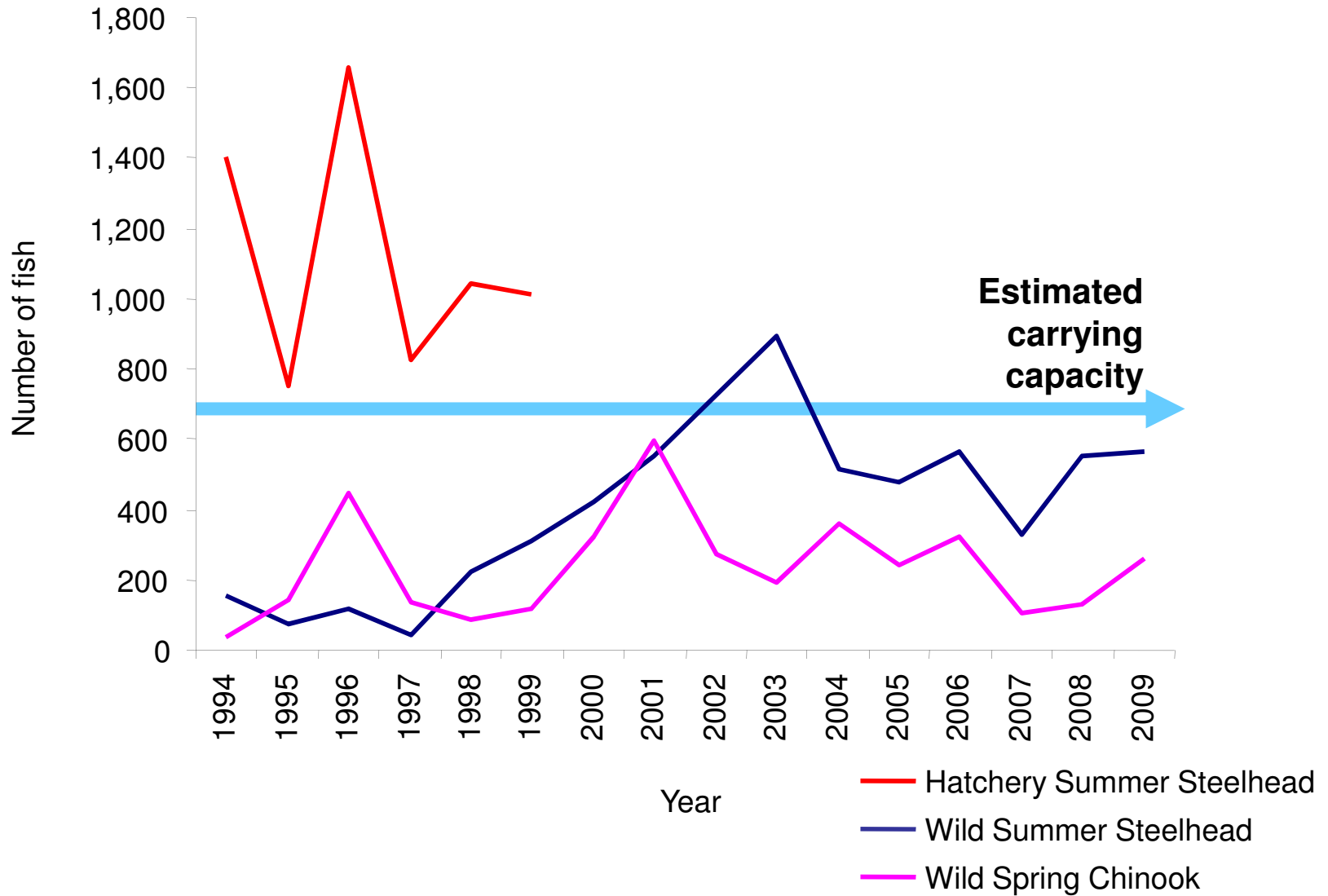
**Short-term supplementation of the
Summer Steelhead population
(1994 to 1999)**

Siletz Summer Steelhead Strategies adopted, 1994 to present:

- 1. Integrated management context***
- 2. Release only if it provides a benefit***
- 3. Reduce the number released***
- 4. Scale to carrying capacity***
- 6. Release only smolts***
- 9. Location of releases***
- 11. Restrict hatchery adults***
- 12. Mark and monitor***

Bonus: Eliminate passage of all non-native salmonids (both hatchery and naturally-produced)

Number of fish passing Siletz Falls: 1994 - 2009

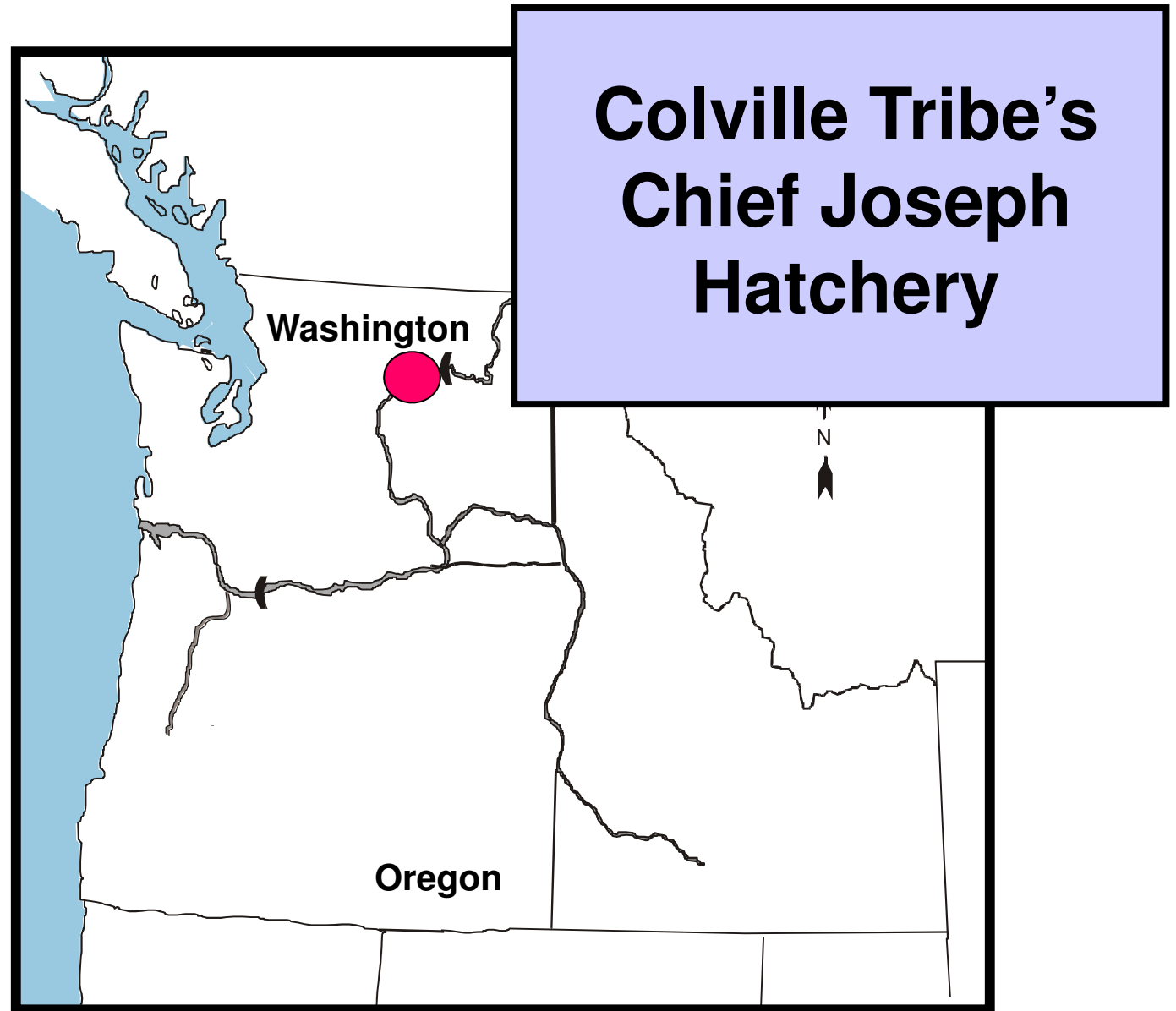


**Siletz Summer Steelhead
Strategies adopted, 1994 to present:**

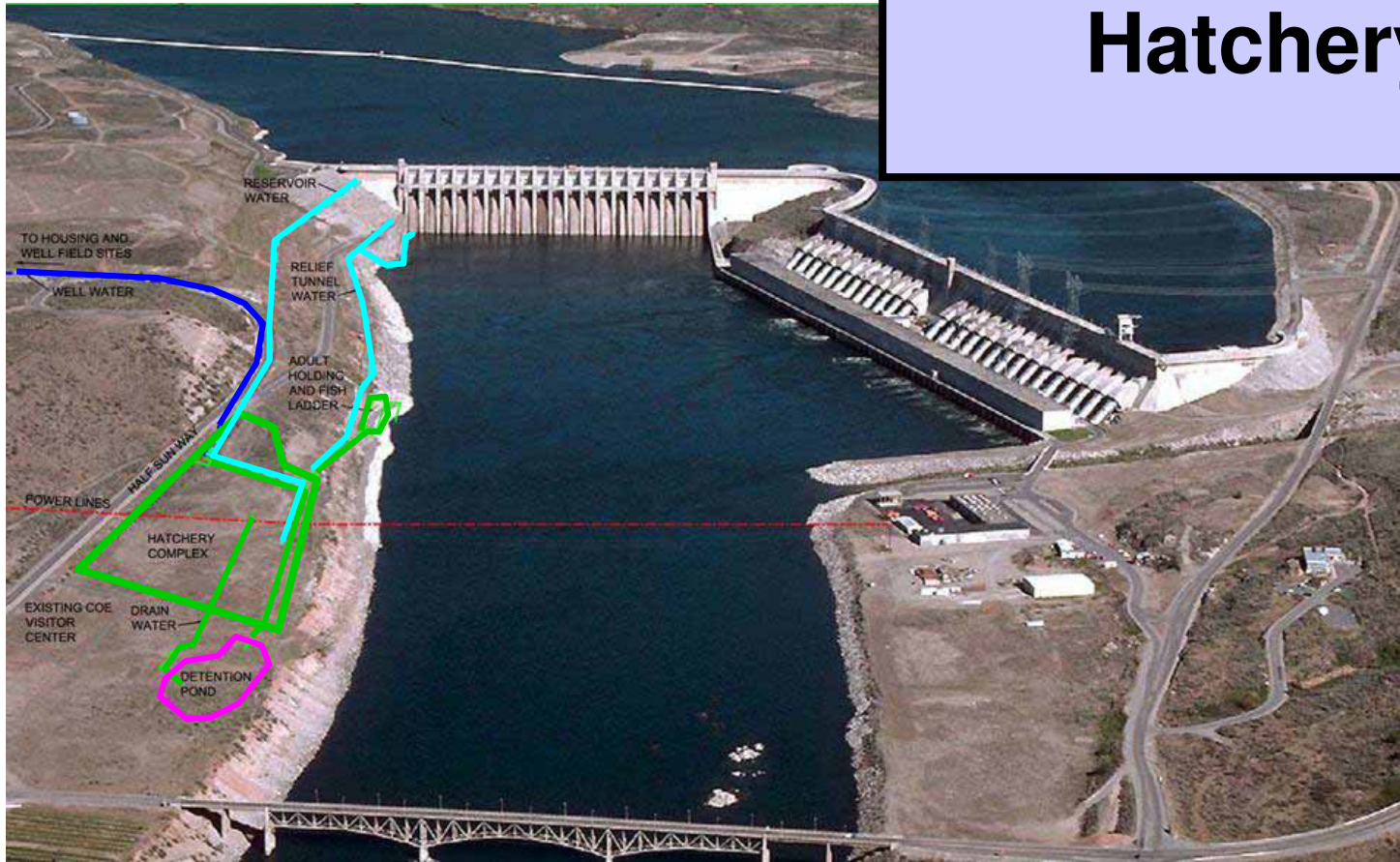
**Annually, about 3,000 adult
fish are removed at the trap;**

**Mostly winter steelhead and
hatchery summer steelhead**

Case Study



Colville Tribe's Chief Joseph Hatchery



Chief Joseph Hatchery: Program Goals:

- 1. Increase abundance, distribution, and diversity of naturally spawning summer and fall Chinook in Okanogan and Columbia rivers**
- 2. Reintroduce spring Chinook to historical Okanogan habitats**
- 3. Increase and stabilize tribal ceremonial & subsistence fisheries and a local recreational fishery**

Chief Joseph Hatchery: Program Goals:

**Supplementation
and Reintroductions
(Okanogan River)**

**Terminal mark-selective
fisheries located away
from natural production
areas (Chief Joseph Dam
tail race)**

**Wild fish abundance goals are the
measure of success;**

**Hatchery production will be reduced if needed
to reach wild abundance goals**

Chief Joseph Hatchery: Strategies Proposed

1. *Integrated management context*
2. ***Release only if it provides a benefit***
3. *Reduce the number released*
4. *Scale to carrying capacity*
8. *Use acclimation ponds and volitional releases*
9. ***Location of releases***
11. *Restrict hatchery adults*
12. *Mark and monitor*

Some Concluding Principles

- 1. The programs need to operate within a management context which may require some trade-offs and compromises**
- 2. Most programs will employ multiple strategies to mitigate ecological risks**
- 3. The most effective programs will be large in scope, covering large geographic areas such as an entire river basin**
- 4. Within a geographic area, the strategies may need to address hatchery programs for multiple species**
- 5. The programs may take years to reach complete full, effective implementation**
- 6. Attention to expected outcomes and periodic reassessment is needed to keep the programs moving in the intended direction**

Thanks!

Acknowledgments

**The following people provided information,
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