Yakama Nation Fisheries

Yakima/Klickitat Fisheries Project

Historical Timeline

1855: Treaty with Confederated Yakama Tribes

1970s: Boldt and Belloni decisions
U.S. v OR and U.S. v WA

1977-1988: U.S. v Oregon Columbia River Fish Management Plans

1980: Northwest Power Act

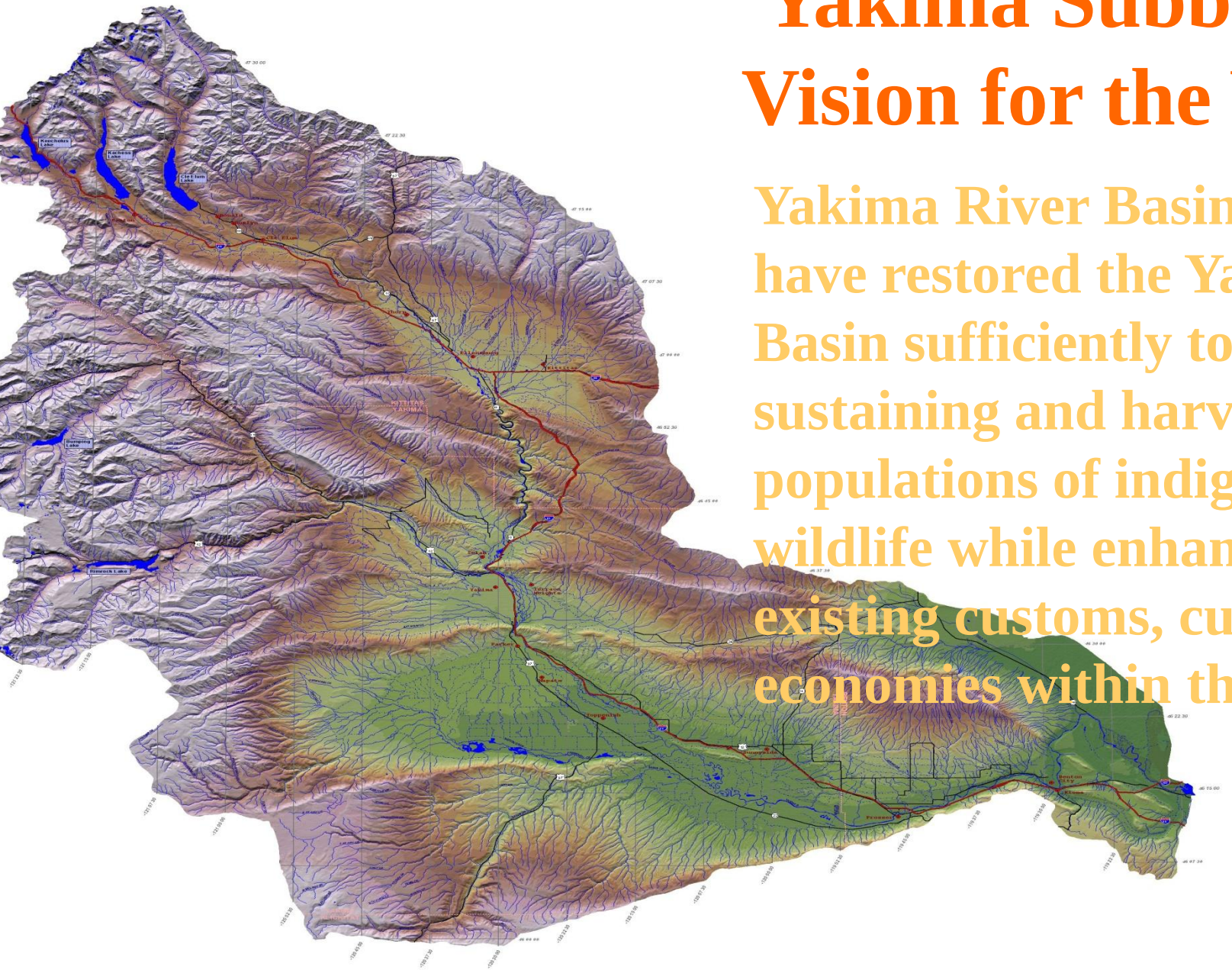
1982

The Council first encouraged BPA to "fund the design, construction, operation, and maintenance of a hatchery to enhance the fishery for the Yakama Indian nation as well as all other harvesters."
(NPPC 1982)

1996

To test the hypothesis that new supplementation techniques can be used in the Yakima River Basin to increase natural production and to improve harvest opportunities, while maintaining the long-term genetic fitness of the wild and native salmonid populations and keeping adverse ecological interactions within acceptable limits.

(Final EIS 1996)



Yakima Subbasin Plan Vision for the Year 2020

Yakima River Basin communities have restored the Yakima River Basin sufficiently to support self-sustaining and harvestable populations of indigenous fish and wildlife while enhancing the existing customs, cultures, and economies within the basin.

YAKIMA/KLICKITAT FISHERIES PROJECT (YKFP)

- Salmon Supplementation and Reintroduction
- Research, Monitoring, and Evaluation
- Habitat Acquisition and Enhancement
- Ecosystem Modeling (to support these efforts)

Yakima/Klickitat Fisheries Project

Cooperating Agencies

BPA
- Funding
- NEPA
- Review

NPCC
- Review
- Priority
- 5 Yr. Plan

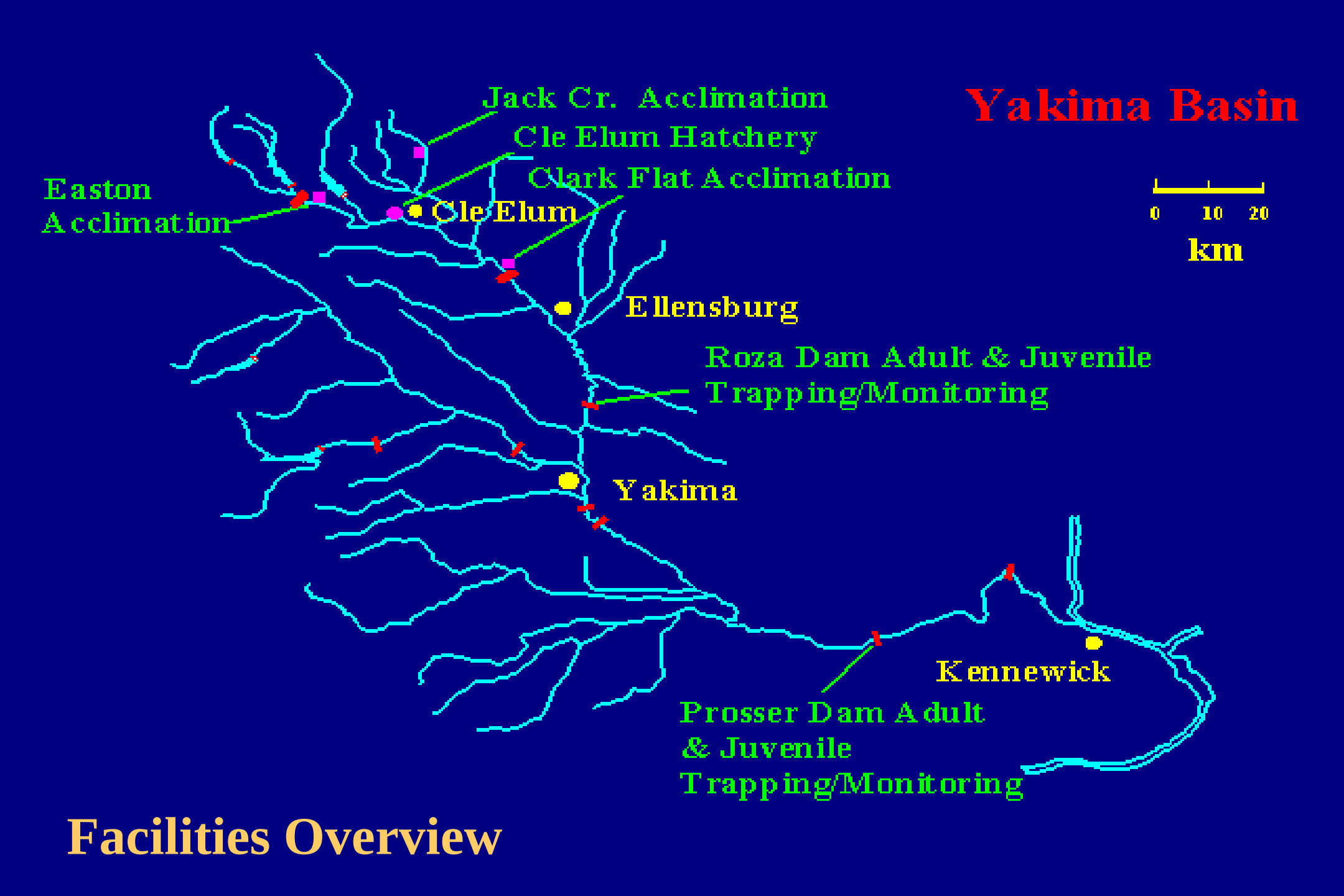
USFWS
- ESA
- Fish Health
- Mitchell Act/Marking

USFS
- Habitat

YSFWRB
- Habitat

BOR
- Passage
- Water
- Facilities O & M
- Phase II Screens

NOAAFish
- ESA
- Physiology
- Homing



Facilities Overview

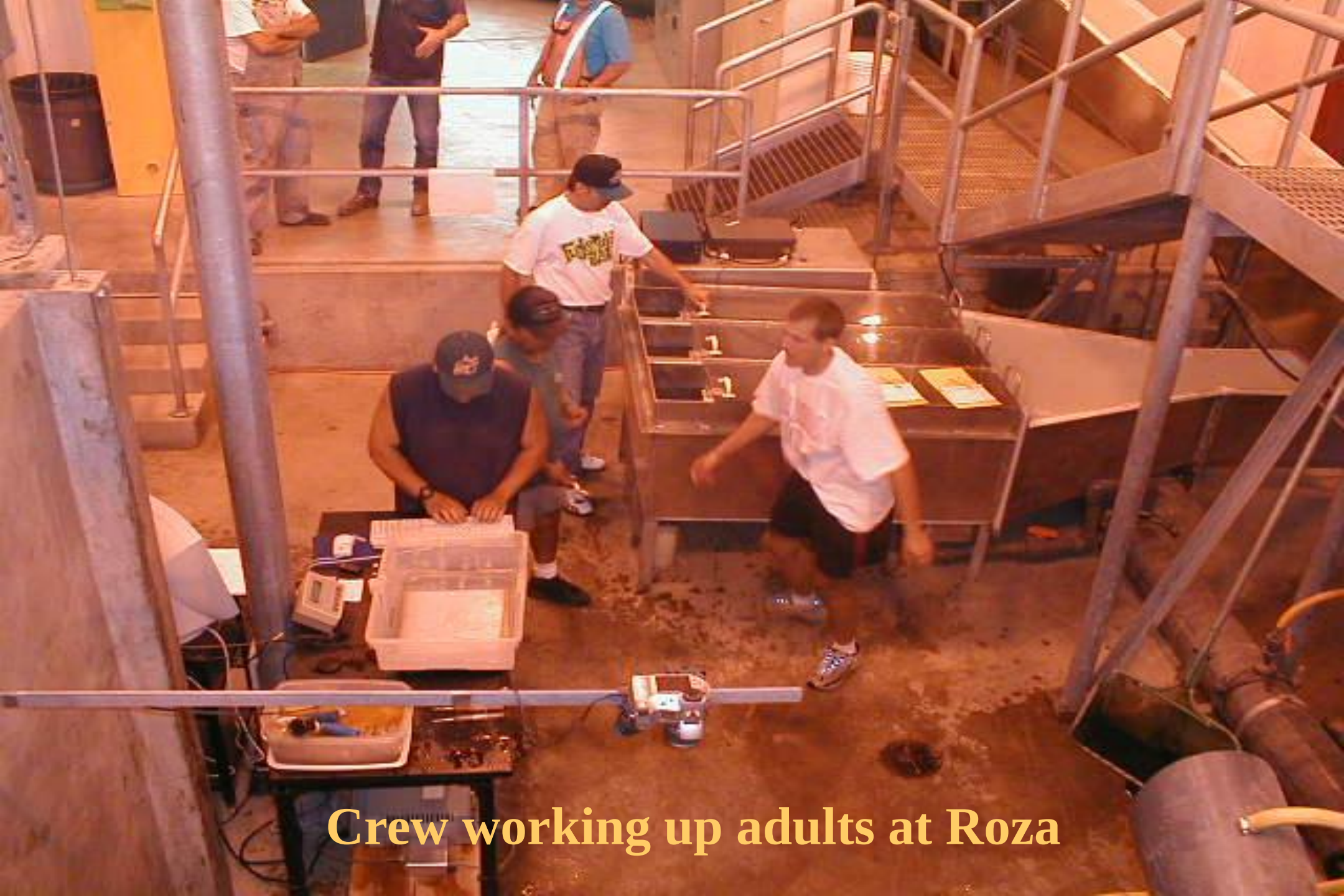

Prosser Dam
Denil ladder, trap and
adult monitoring facility
Flow
Video Counting and
Automatic PIT detection
Chandler Irrigation Canal

Prosser Denil Facility

Prosser Hatchery and Juvenile Fish Monitoring Facility

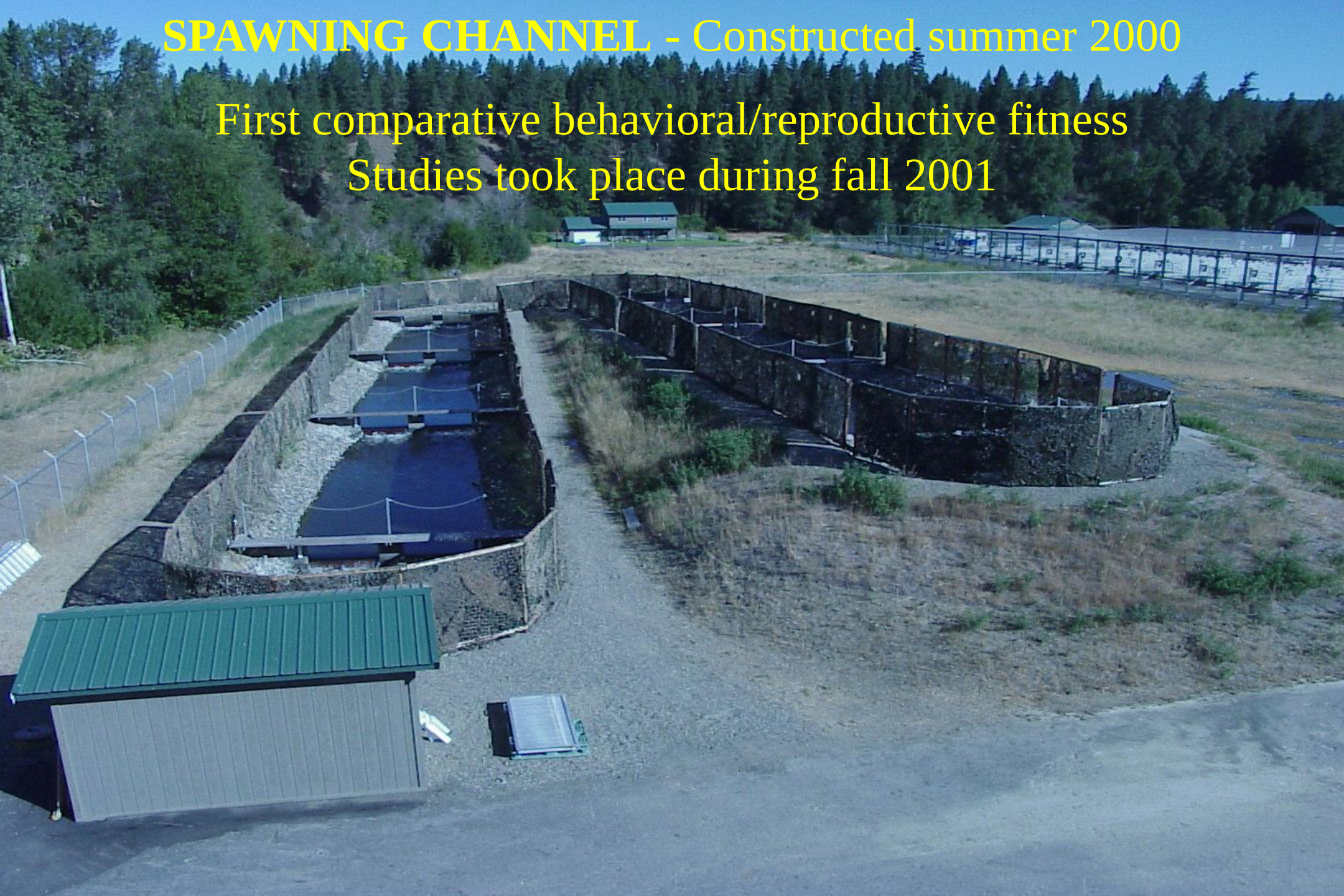
Marion Drain Fall Chinook Facility

Roza Dam Fish Monitoring Facilities



Crew working up adults at Roza

Cle Elum Supplementation and Research Facility


SPAWNING CHANNEL - Constructed summer 2000
First comparative behavioral/reproductive fitness
Studies took place during fall 2001

Semi-Natural Raceway at Cle Elum

Marking Crew at Cle Elum

Easton Acclimation Site

Jack Creek Acclimation Site

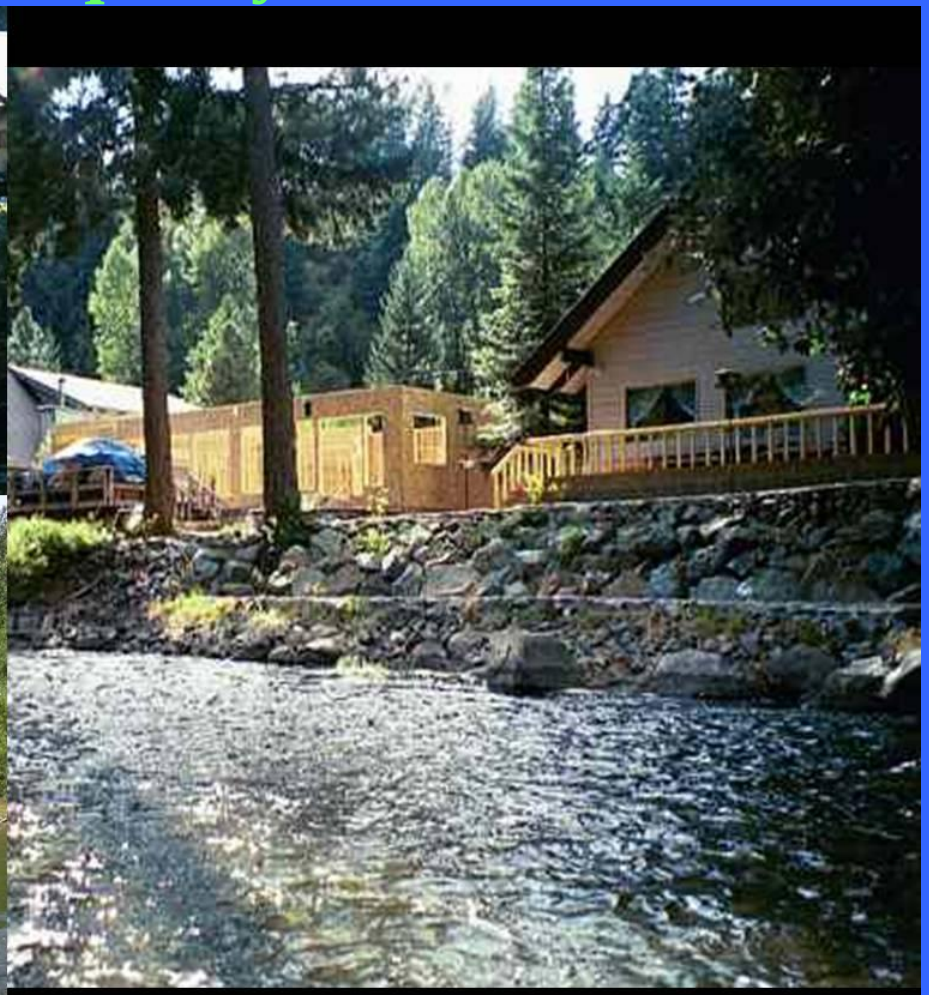
Clark Flat Acclimation Site

Why do we need Salmon Supplementation?

Estimates of Historical Anadromous Fish Runs in the Yakima Subbasin as Compared to YKFP Planning era Run Size

Species/Race	Pre-1900 Run	1980s Average
Fall Chinook	132,000	600
Spring Chinook	200,000	4,200
Summer Chinook	68,000	0
Coho	110,000	200
Summer Steelhead	80,500	1,800
Sockeye	200,000	0

ICTRT* Assumption: Competing demands for water and land use will not lessen. Human population growth in the Northwest will continue to apply pressure on salmon habitat quantity and quality.



* Interior Columbia Technical Recovery Team

ICTRT Assumption: Major dams will stay in place for the foreseeable future

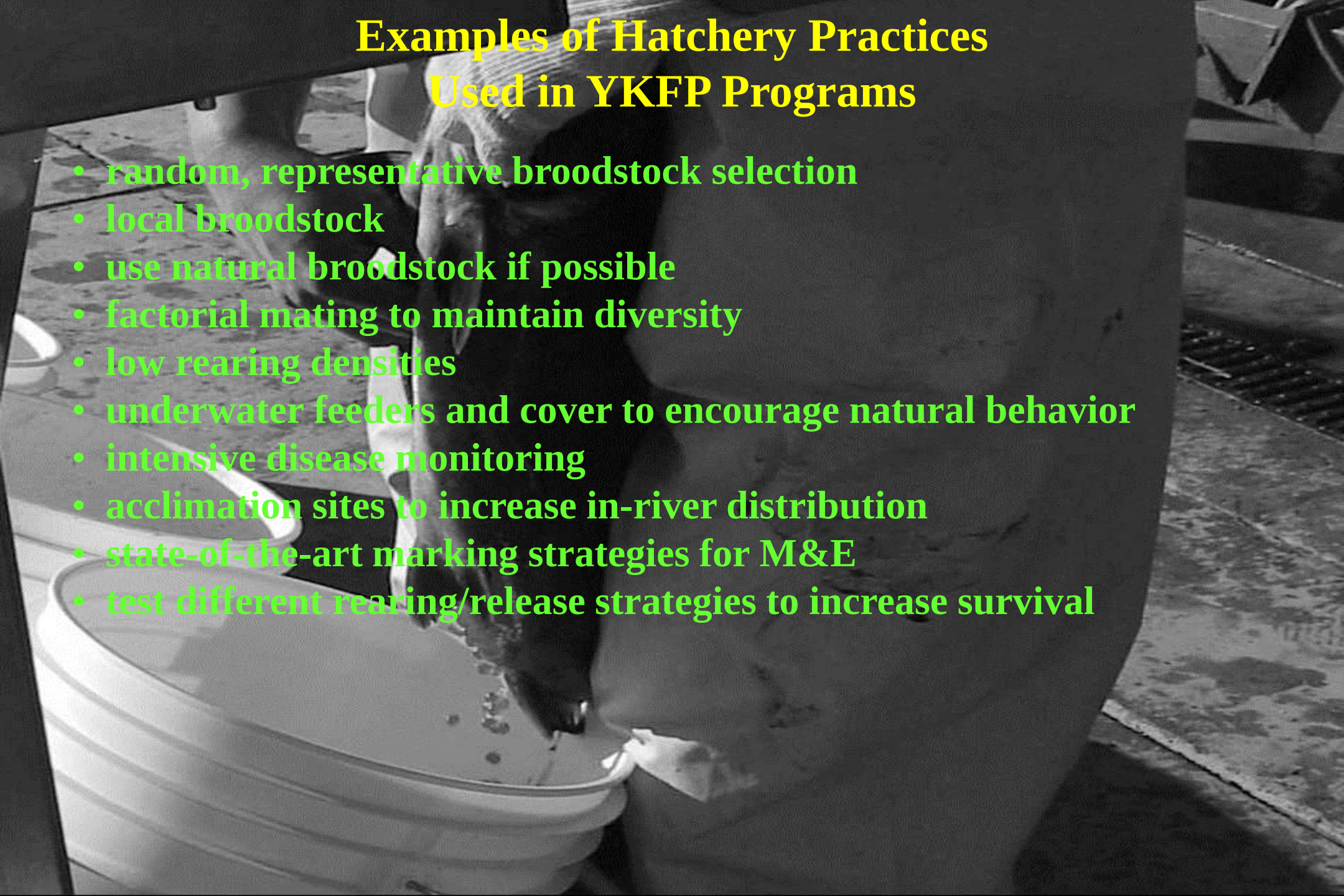

ICTRT Assumption: There is a core federal commitment to harvest fisheries as provided by Treaty Trust responsibility, sustainable fisheries mandates and mitigation agreements.

“The question we must deal with is not whether the domestic and the wild are separate or can be separated; it is how, in the human economy, their indissoluble and necessary connection can be properly maintained.”

- Wendell Berry

SPECIES ENHANCED IN YKFP

- ALL STOCKS in Basin - Tiered
- SPRING CHINOOK - initial stock 1997
- COHO FEASIBILITY - since 1996
- FALL CHINOOK - 1998
- STEELHEAD – Modeling, Planning, (and Kelt Reconditioning)
- OTHER SPECIES - Reviewed for Potential

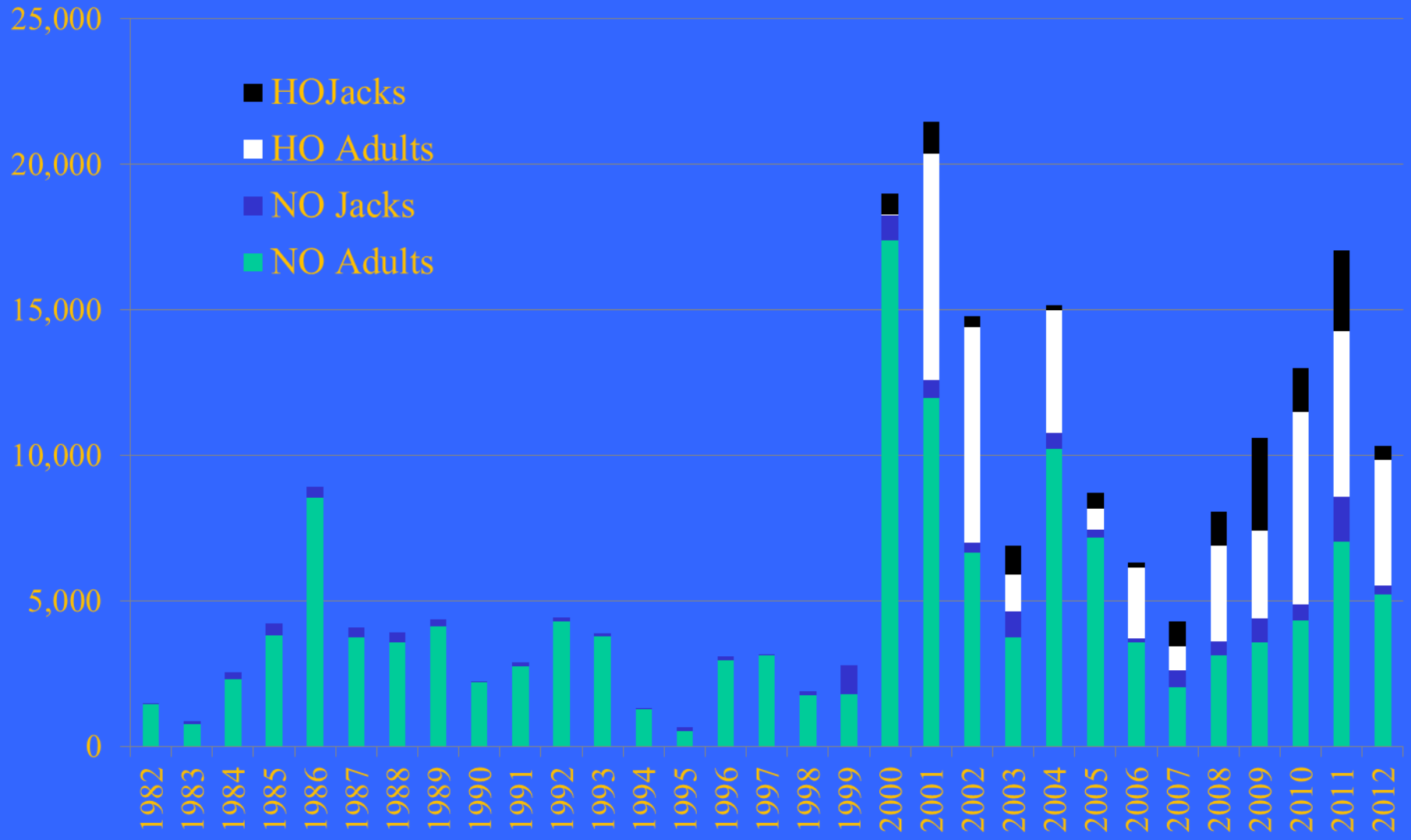


Examples of Hatchery Practices Used in YKFP Programs

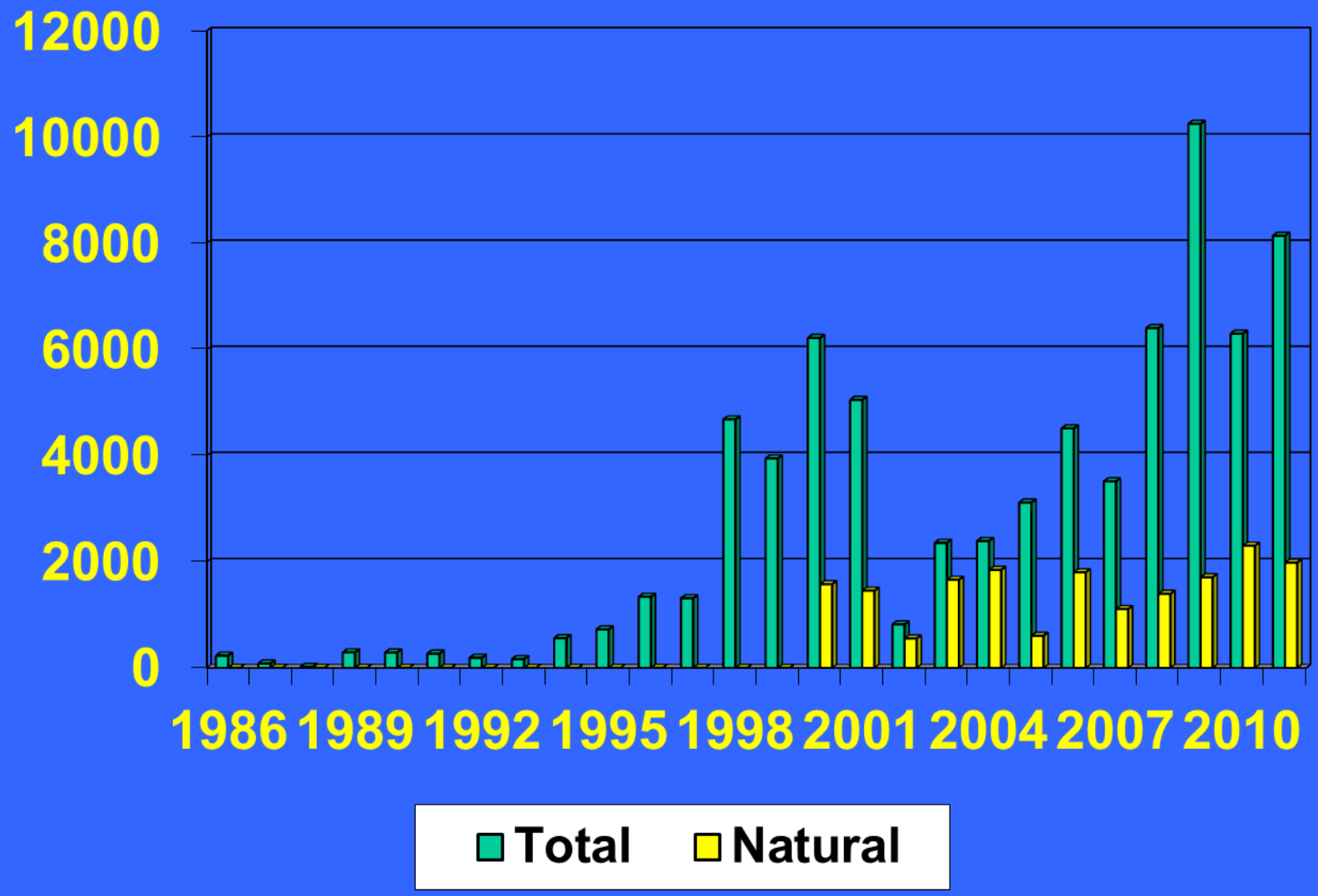
- random, representative broodstock selection
- local broodstock
- use natural broodstock if possible
- factorial mating to maintain diversity
- low rearing densities
- underwater feeders and cover to encourage natural behavior
- intensive disease monitoring
- acclimation sites to increase in-river distribution
- state-of-the-art marking strategies for M&E
- test different rearing/release strategies to increase survival

Demographic Benefits

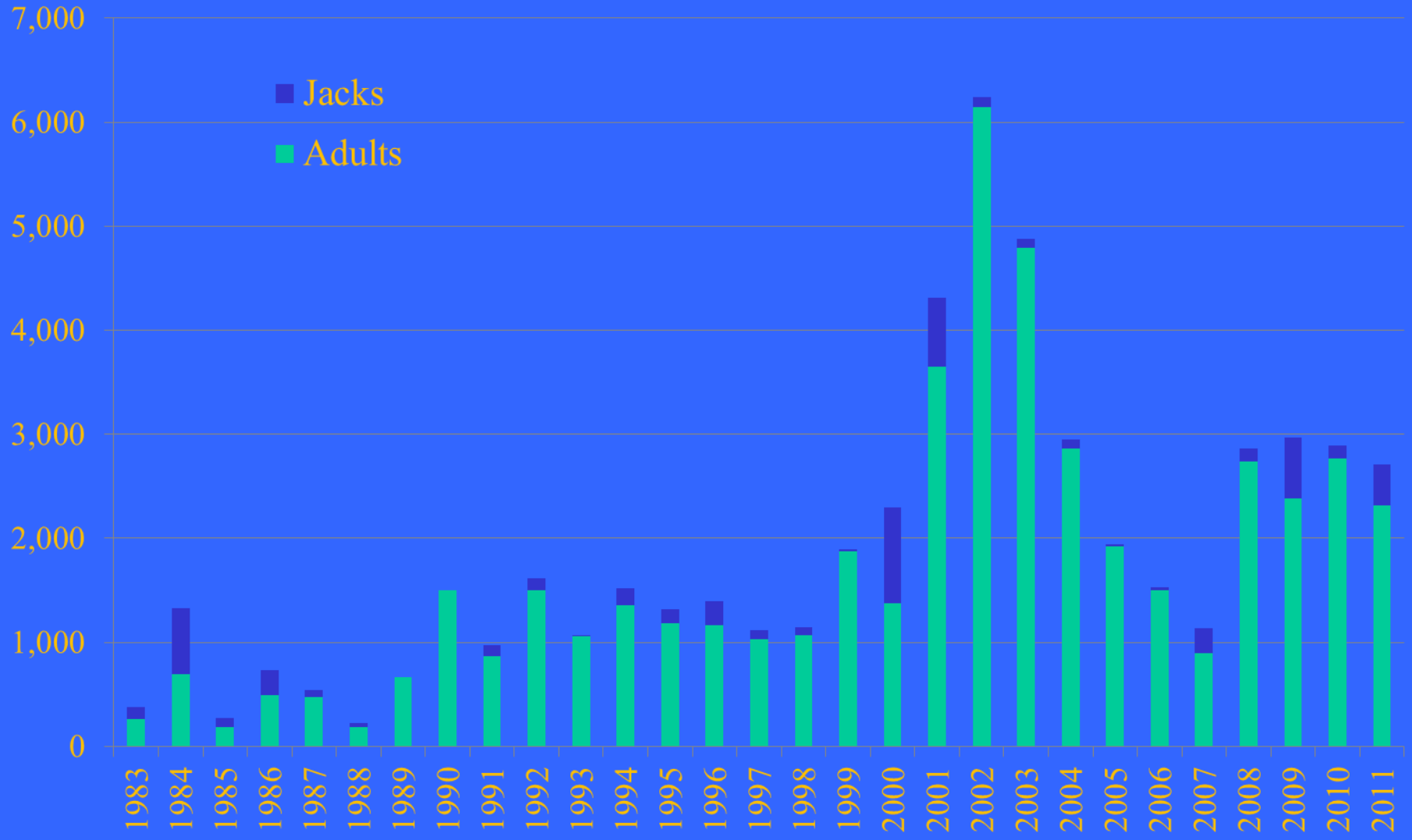
Spring Chinook Abundance at Prosser Dam, Yakima River, WA



Yakima River Coho Returns, 1986 – 2011



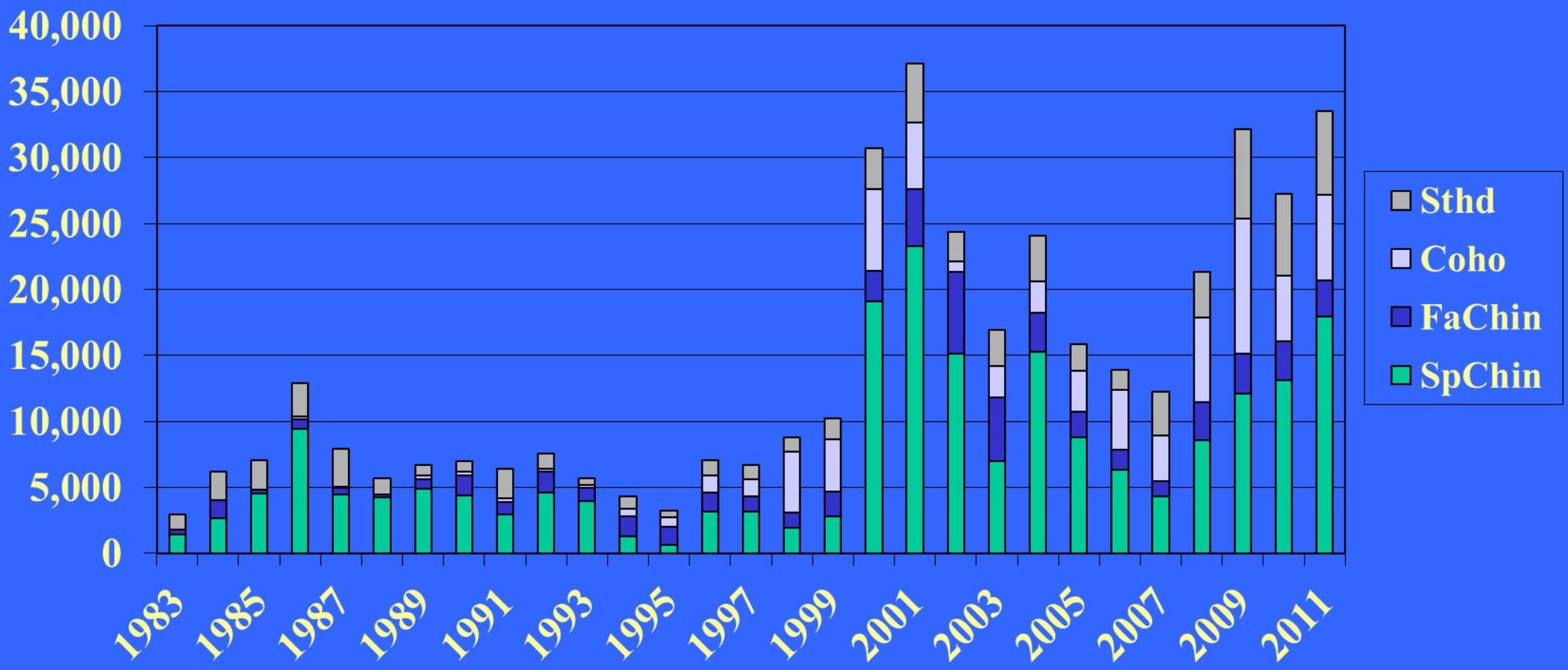
Fall Chinook Abundance at Prosser Dam, Yakima River, WA



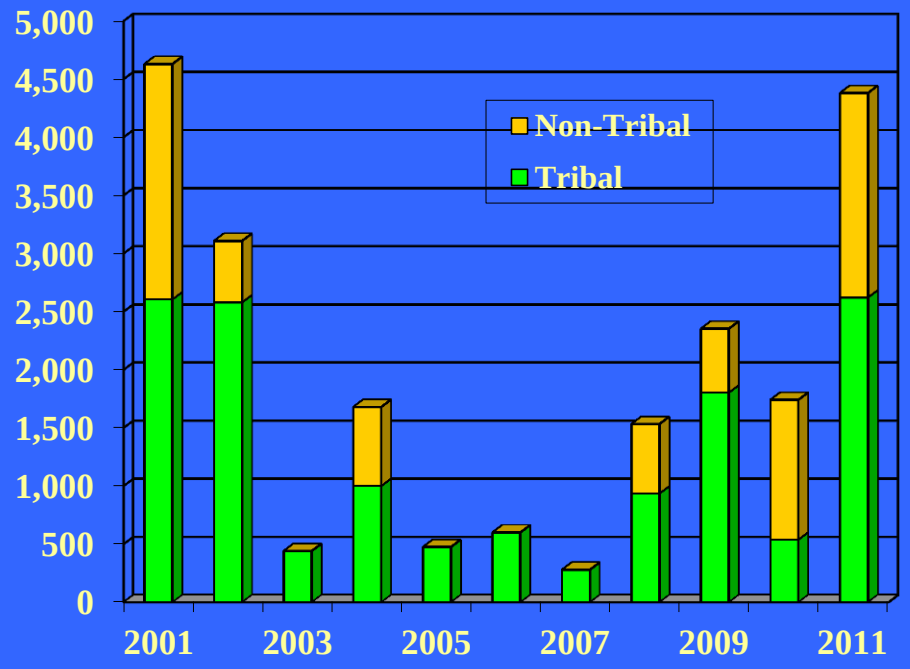
Historical, Pre-YKFP, and Present Runs

Species	Historical	1980s	1996-Present
Fall Chinook	132,000	600	2,600
Spring Chinook	200,000	4,200	10,100
Summer Chinook	68,000	0	--
Coho	110,000	200	4,200
Summer Steelhead	80,500	1,800	3,200
Sockeye	200,000	0	--

Yakima River Runs, 1983-Present



Creating Harvest Opportunities

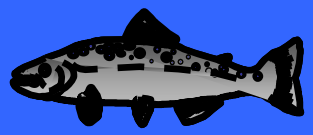


Research, Monitoring, and Evaluation

Critical Management Uncertainties Identified by ISRP/ISAB and NPCC

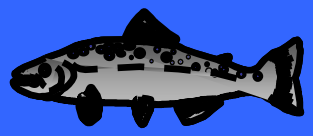
- *What are the range, magnitude, and rates of deterioration of natural spawning fitness of integrated (supplemented) populations*?
- *Determine the rate of domestication and re-naturalization of hatchery salmon populations.*
- *Is it possible to integrate natural and artificial production systems in the same basin to achieve sustainable long-term productivity?*

Hatchery Fish Performance will be Measured in Four Areas

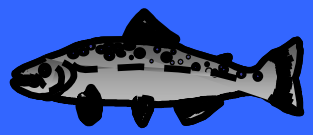


Post-release Survival (smolt release to adult)

Reproductive Success (smolts/spawner)



Long Term Fitness (genetic diversity and long term stock productivity)



Ecological Interactions (population abundance, and distribution, growth rates, predation and competition)

Survival Comparison of Spring Chinook Salmon Reared in a Production Hatchery under Optimum Conventional and Semi-Natural Conditions

D.E. Fast, D. Neeley, D.T. Lind, M.V. Johnston, C.R. Strom, W.J. Bosch, C.M. Knudsen, S.L. Schroder, and B.D. Watson

Transactions of the American Fisheries Society 137:1507–1518

We found insufficient evidence to conclude that seminatural treatment (SNT; i.e., rearing in camouflage-painted raceways with surface and underwater structures and underwater feeders) of juvenile Chinook salmon resulted in higher survival indices than did optimum conventional treatment (OCT; i.e., rearing in concrete raceways with surface feeding) for the specific treatments and environmental conditions tested.

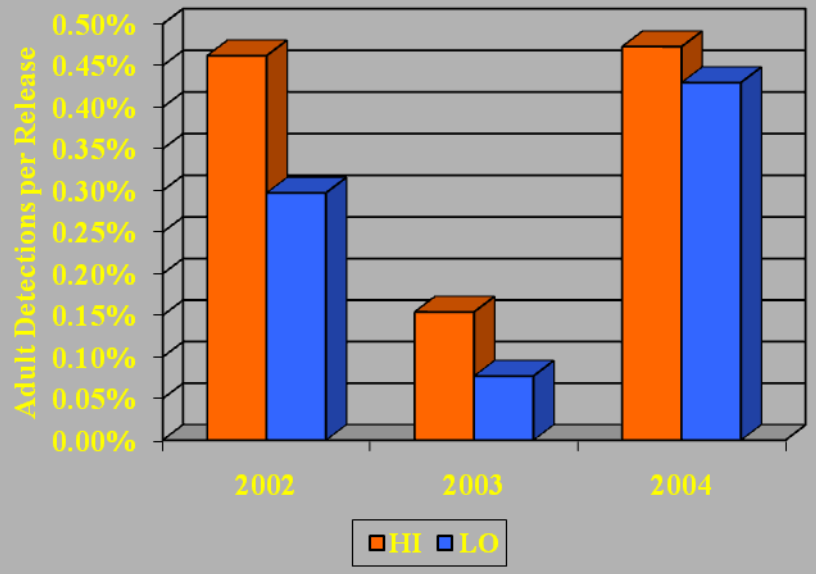
Assessment of High Rates of Precocious Male Maturation in a Spring Chinook Salmon Supplementation Hatchery Program

Larsen, D. A., B. R. Beckman, K. A. Cooper, D. Barrett, M. Johnston, P. Swanson, and W. W. Dickhoff

Transactions of the American Fisheries Society 133:98–120

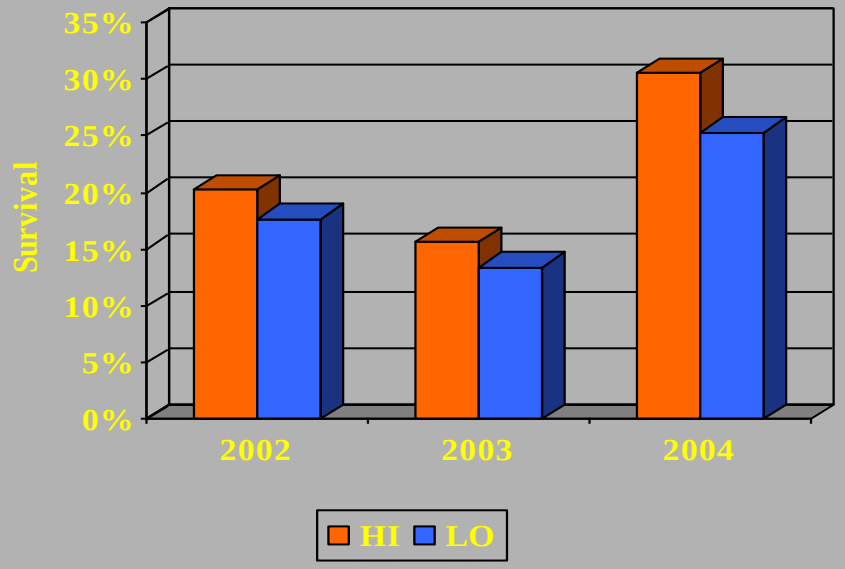
Can a more natural growth feeding regime result in reduced rates of precocialism while maintaining the survival attained with standard feeding regimes?

HI / LO Growth Treatment



Adult PIT Returns to Bonneville

Smolt Survival to McNary



Genetics Lab – Chinook

- Stock identification at Chandler to determine abundance by stock
- Pedigree assessments – Roza and spawning channel
- Gender identification at Roza Dam to determine sex ratio of supplementation fish

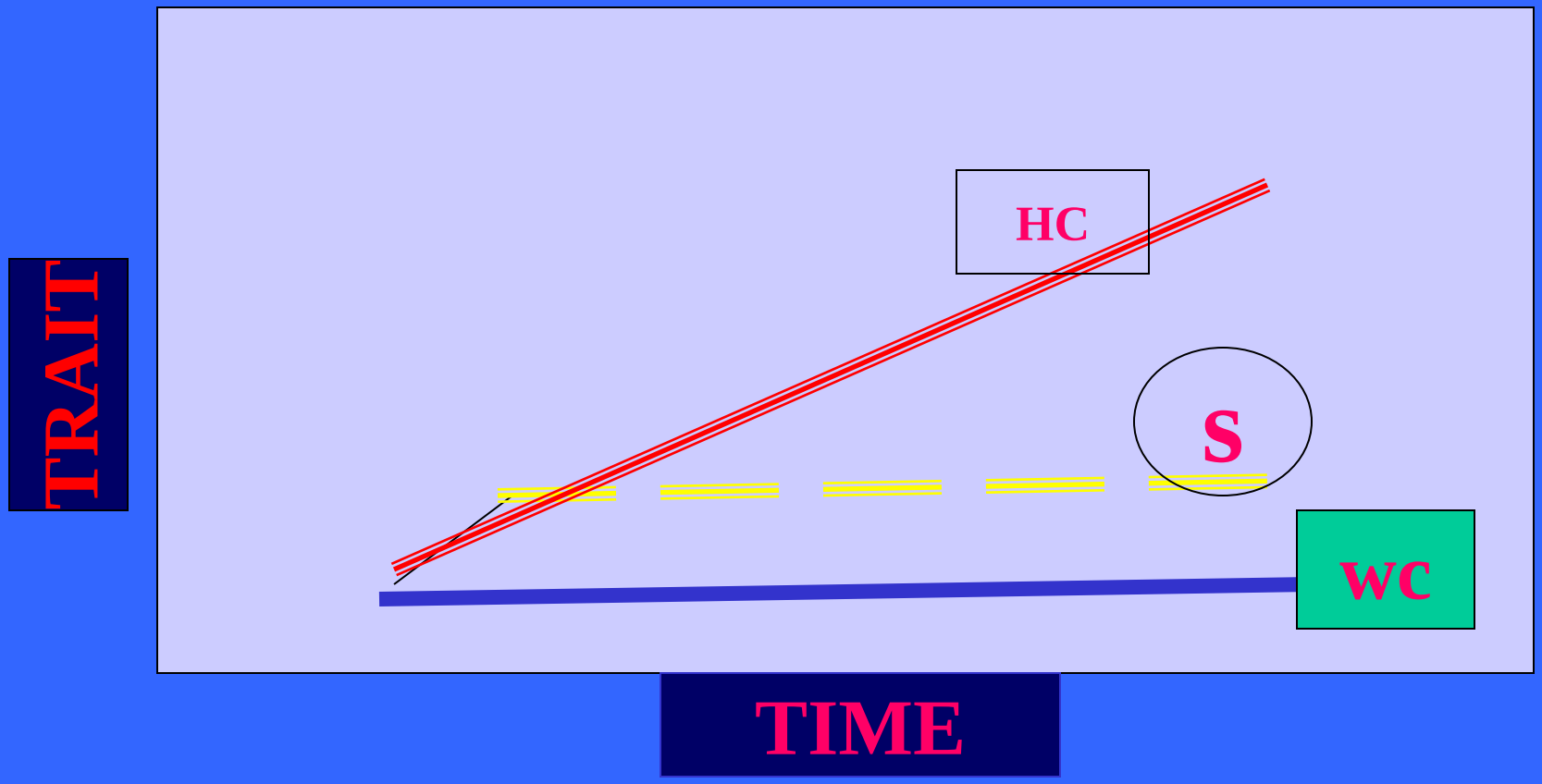
Genetics Lab - Steelhead

- Determine stock characterization (enables abundance estimation of mixed populations by stock)
- Evaluating resident x anadromous mating

DOMESTICATION RESEARCH

- S_H = wild/natural parents; 1 generation in CESRF
- S_N = wild/nat. + S_H fish spawning in the wild
- S : S_H x S_N spawning in the wild for multiple generations
- HC : S_H + S_H (1^{st} gen.) then HC x HC spawned at the CESRF for multiple generations
- WC : unsupplemented Naches spring chinook

DOMESTICATION – HYPOTHETICAL OUTCOMES



Domestication-Adult and Juvenile Traits

- 15 juvenile and 14 adult traits monitored in Supplementation, Hatchery, and Naches lines

JUVENILE TRAITS

- Emergence Timing
- Kd at Emergence
- Egg-fry Survival
- Developmental Abnormalities
- Fry-Smolt Survival
- Juvenile morphology
- Smolt survival
- Natural Smolt Survival
- Smolt-Adult Survival HC Line
- Outmigration Timing
- Food Conversion
- Length-Weight
- Agonistic/Competitive Behavior
- Predator Avoidance
- Precocialism

ADULT TRAITS MONITORED

- Adult Recruits
- Age Composition
- Sex-at-Age
- Sex Ratio/Age
- Run Timing
- Spawn Timing
- Fecundity
- Egg Size
- Reproductive Effort
- Fertility
- Morphology
- Spawning Behavior
- Spawning Success

Comparison of Life-History Traits Between First-Generation Hatchery and Wild Upper Yakima River Spring Chinook Salmon

C.M. Knudsen, S.L. Schroder, C.A. Busack, M.V. Johnston, T.N. Pearsons, W.J. Bosch, and D.E. Fast

Transactions of the American Fisheries Society 135:1130–1144

Comparison of Female Reproductive Traits and Progeny of First-Generation Hatchery and Wild Upper Yakima River Spring Chinook Salmon

C.M. Knudsen, S.L. Schroder, C. Busack, M.V. Johnston, T.N. Pearsons, and C.R. Strom

Transactions of the American Fisheries Society 137:1433–1445

Behavior and Breeding Success of Wild and First-Generation Hatchery Male Spring Chinook Salmon Spawning in an Artificial Stream

S.L. Schroder, C.M. Knudsen, T.N. Pearsons, T.W. Kassler, S.F. Young, E.P. Beall and D.E. Fast

Transactions of the American Fisheries Society, 139:989-1003

Breeding Success of Wild and First-Generation Hatchery Female Spring Chinook Salmon Spawning in an Artificial Stream

S.L. Schroder, C.M. Knudsen, T.N. Pearsons, T.W. Kassler, S.F. Young, C.A. Busack, and D.E. Fast

Transactions of the American Fisheries Society, 137:1475-1489

Morphological Differences Between Adult Wild and First-Generation Hatchery Upper Yakima River Spring Chinook Salmon

Craig Busack, Curtis M. Knudsen, Germaine Hart, and Paul Huffman

Transactions of the American Fisheries Society 136:1076-1087

Non-target Taxa Monitoring

- Evaluate status of non-target (e.g. rainbow/steelhead, cutthroat and bull trout) as well as target (Chinook and coho salmon) fish rearing in the Yakima Basin

Impacts of Early Stages of Salmon Supplementation and Reintroduction Programs on Three Trout Species

T.N. Pearsons, A.L. Fritts, and J.L. Scott

North American Journal of Fisheries Management 27:1-20

Changes to Rainbow Trout Abundance and Salmonid Biomass in a Washington Watershed as Related to Hatchery Salmon Supplementation

T.N. Pearsons and G.M. Temple

Transactions of the American Fisheries Society, 139:502-520

Domestication-Predation/Competition

- Monitoring long-term fitness of supplementation fish through experimentation at the Cle Elum Supplementation and Research Facility

The effects of domestication on the relative vulnerability of hatchery and wild spring Chinook salmon to predation

A.L. Fritts, J.L. Scott, and T.N. Pearsons

Canadian Journal of Fisheries and Aquatic Sciences 64:813-818

The effects of hatchery domestication on competitive dominance of juvenile spring Chinook salmon

T.N. Pearsons, A.L. Fritts, and J.L. Scott

Canadian Journal of Fisheries and Aquatic Sciences 64:803-812

Residual/Precocious Wild and Hatchery Spring Chinook

- Distribution and abundance of residual spring chinook
- Comparing the abundance and composition of wild and hatchery precocious males on the spawning grounds.

Abundance and Distribution of Precociously Mature Male Spring Chinook Salmon of Hatchery and Natural Origin in the Yakima River

T.N. Pearsons, C.L. Johnson, B.B. James, and G.M. Temple

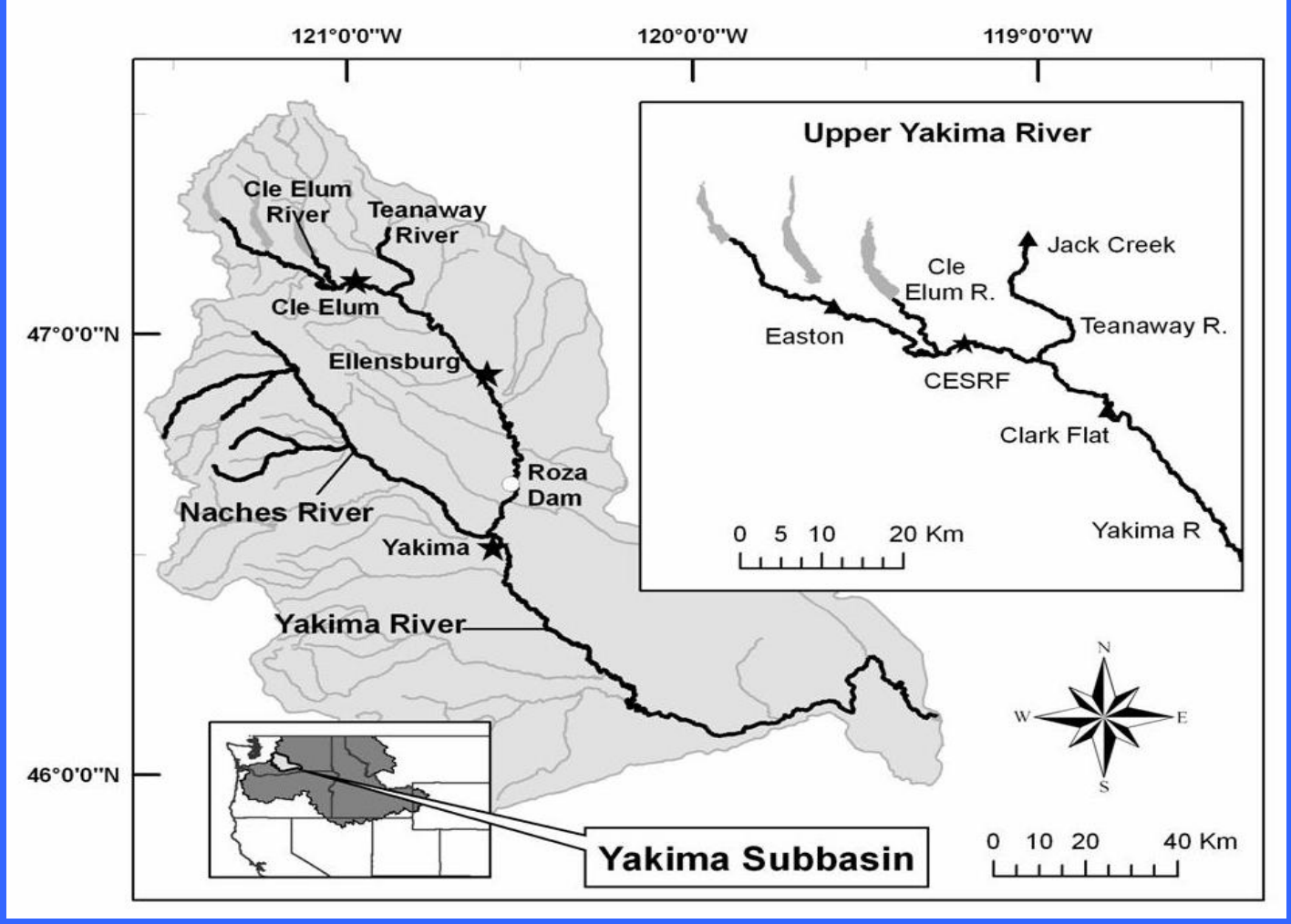
North American Journal of Fisheries Management 29:778-790

Capacity and Productivity of Spring Chinook

- Evaluating inter- and intra-specific competition for food and space (e.g. flow, territory size, overlap, microhabitat) in the upper Yakima River, and determining how these affect density dependence.

Monitoring and Evaluation of Avian Predation on Juvenile Salmonids on the Yakima River, Washington

Monitoring Natural Production



1st Brood

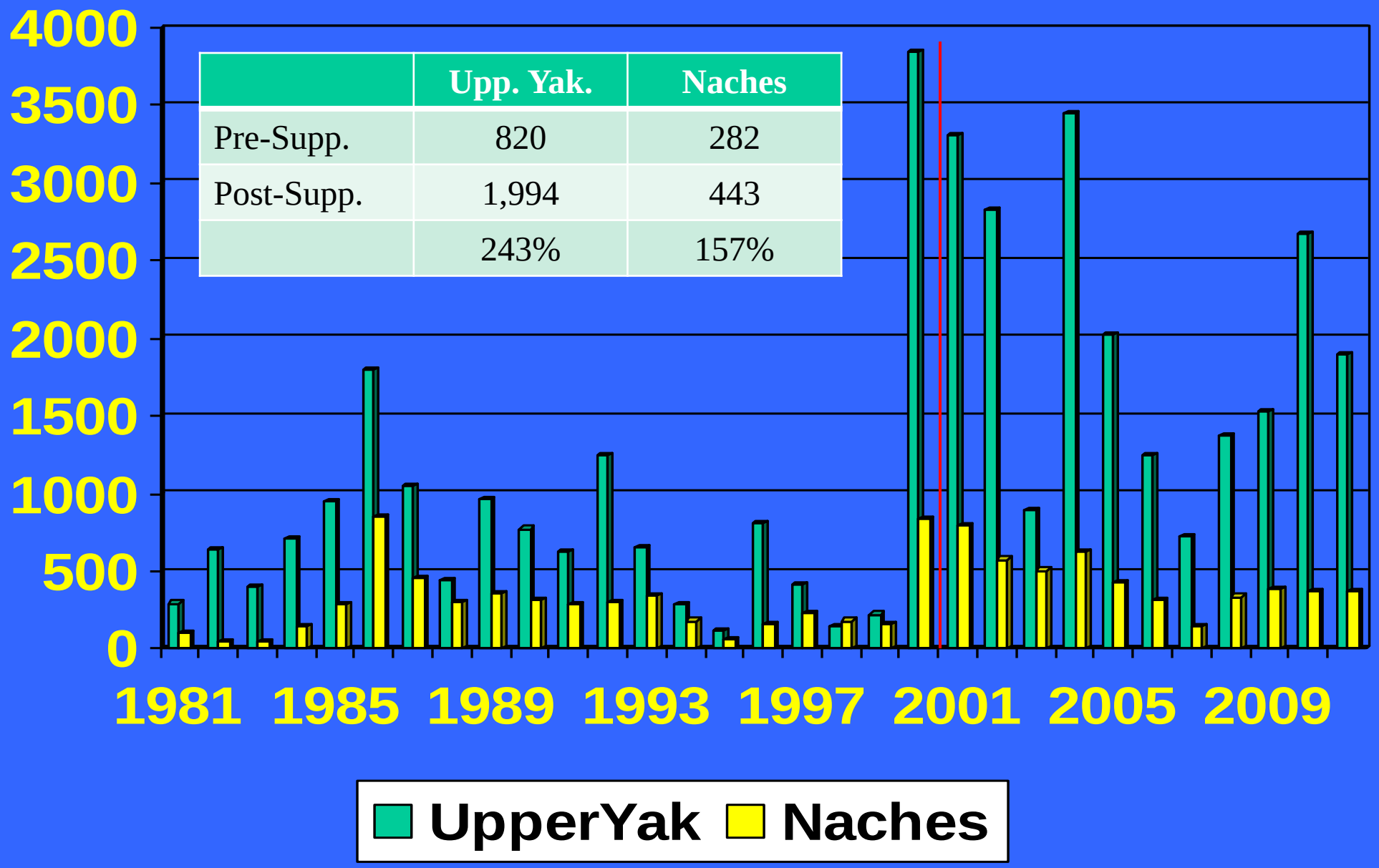
Integrated HxW spawning in the wild

Integrated F1 progeny return

Integrated F2 progeny return

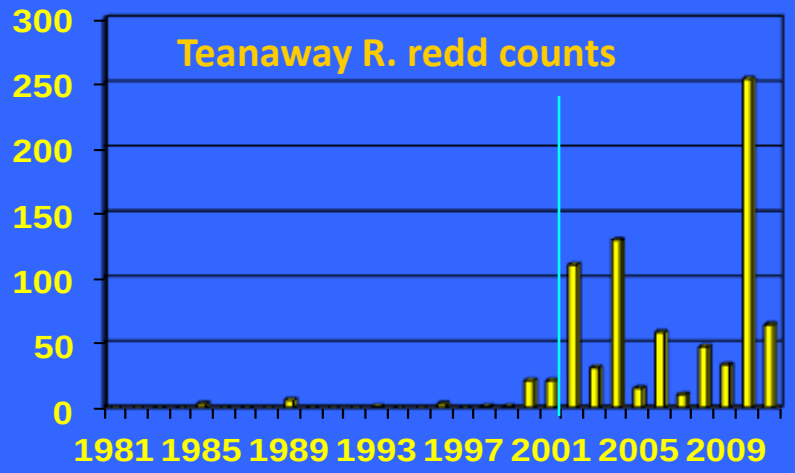
1997 2001 2005 2009 2013

Upper Yakima vs Naches Redds, 1981-2011

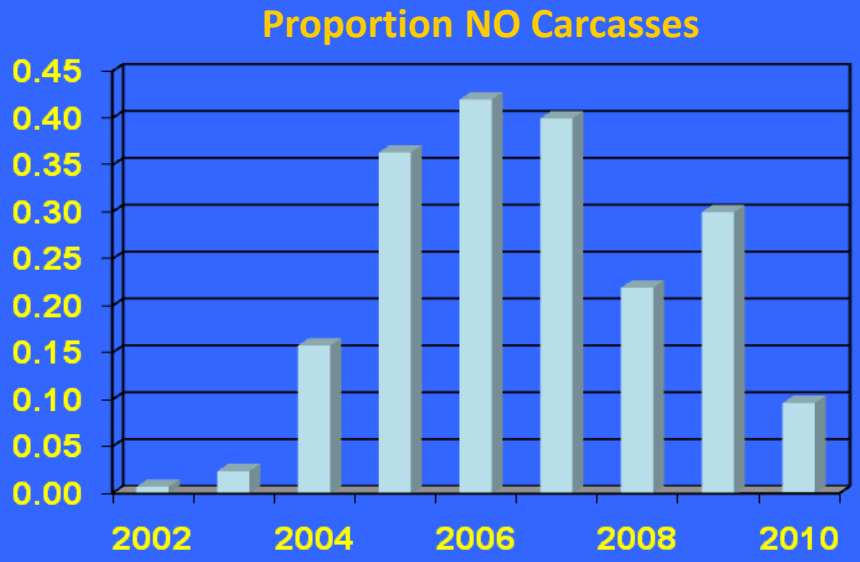


	Upp. Yak.	Naches
Pre-Supp.	820	282
Post-Supp.	1,994	443
	243%	157%

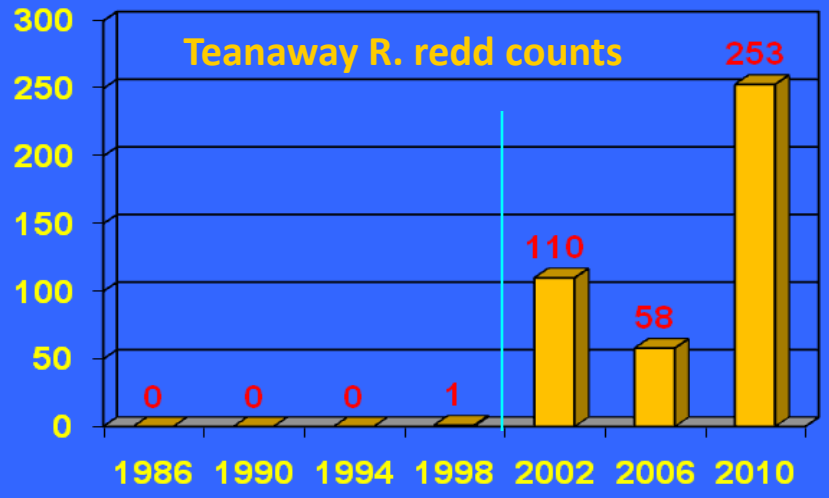
Evidence of Hatchery-Origin Reproductive Success: Teanaway R. Spring Chinook



- pre-supplementation average: 3
- post-supplementation average: 75

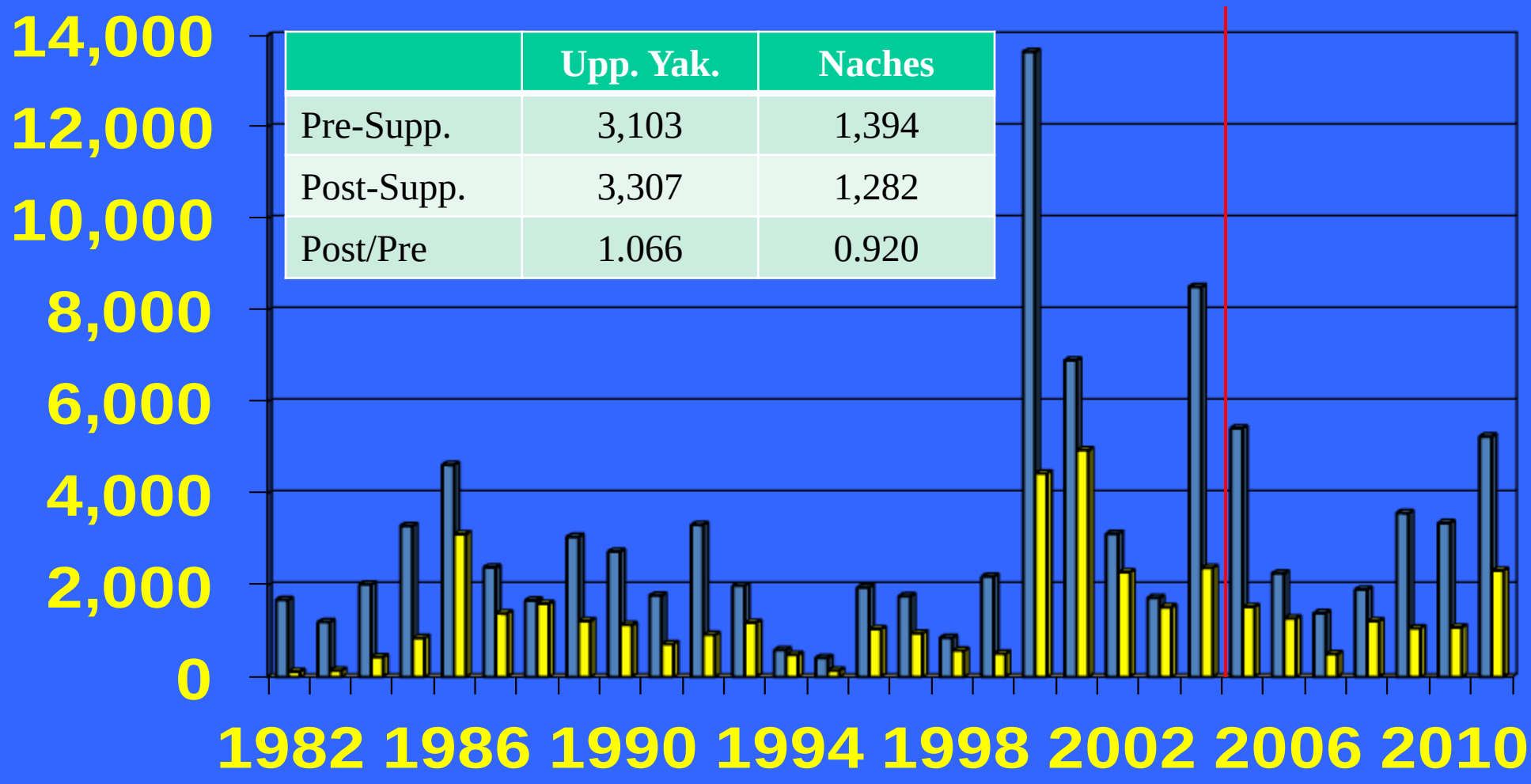


Let's look at one 4-year brood cycle:



Upper Yakima vs Naches Natural-Origin Returns, 1982-2011

	Upp. Yak.	Naches
Pre-Supp.	3,103	1,394
Post-Supp.	3,307	1,282
Post/Pre	1.066	0.920



Evaluating the Feasibility of Reestablishing a Coho Salmon Population in the Yakima River, Washington

William J. Bosch, Todd H. Newsome, James L. Dunnigan, Joel D. Hubble, Douglas Neeley, David T. Lind, David E. Fast, Linda L. Lamebull, and Joseph W. Blodgett

North American Journal of Fisheries Management 27:198-214

Summary

Natural-origin SARs > hatchery-origin

Natural-origin fish larger than hatchery-origin

Natural-origin fish returned and spawned later

Increasing coho returns to upriver areas

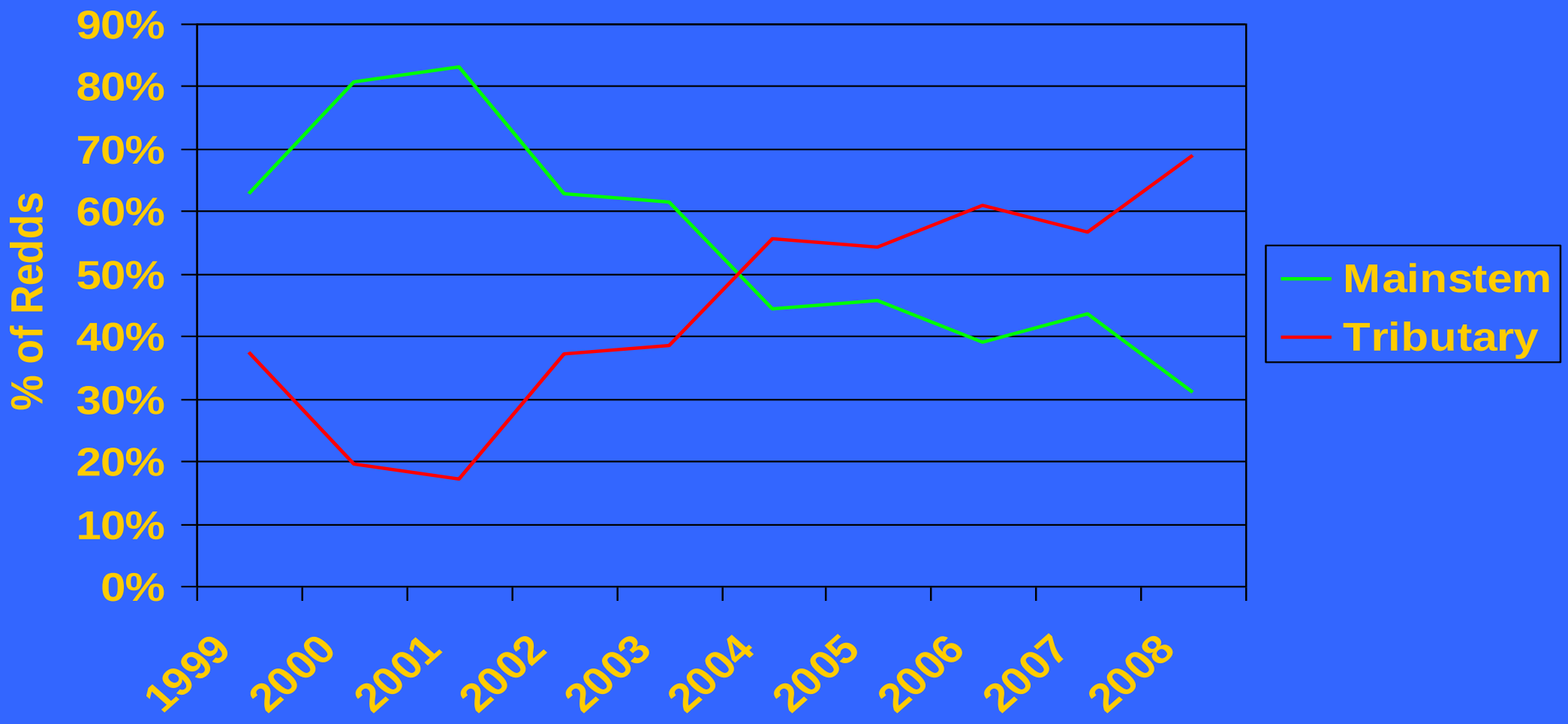
Evidence of robust and sustained spawning aggregates in multiple locations

1999-2001 studies of residualism, predation, and competition suggest ecological interactions are minimal

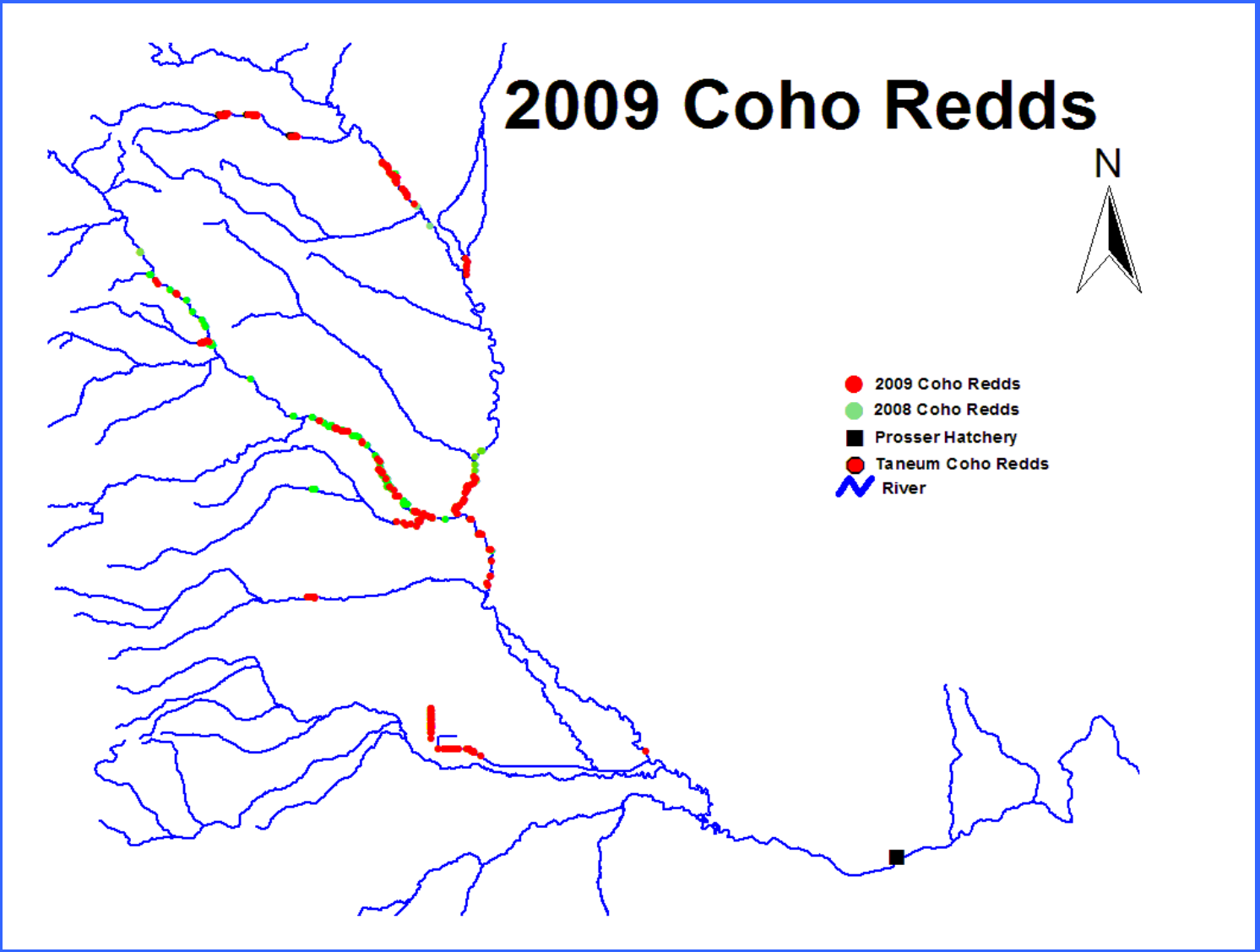
Current Coho Program Strategies

- Maximize use of local brood stock
- Yearling smolt releases
- Adult outplants
- Parr releases

Yakima Basin Coho
Mainstem vs Tributary Spawning



Yakima Basin Coho
Spatial Distribution

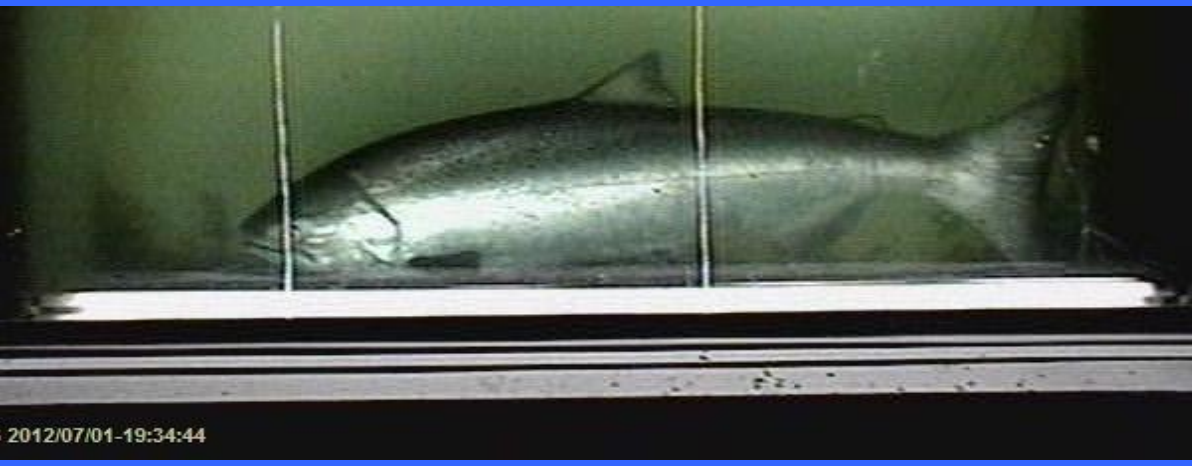


Related Research:

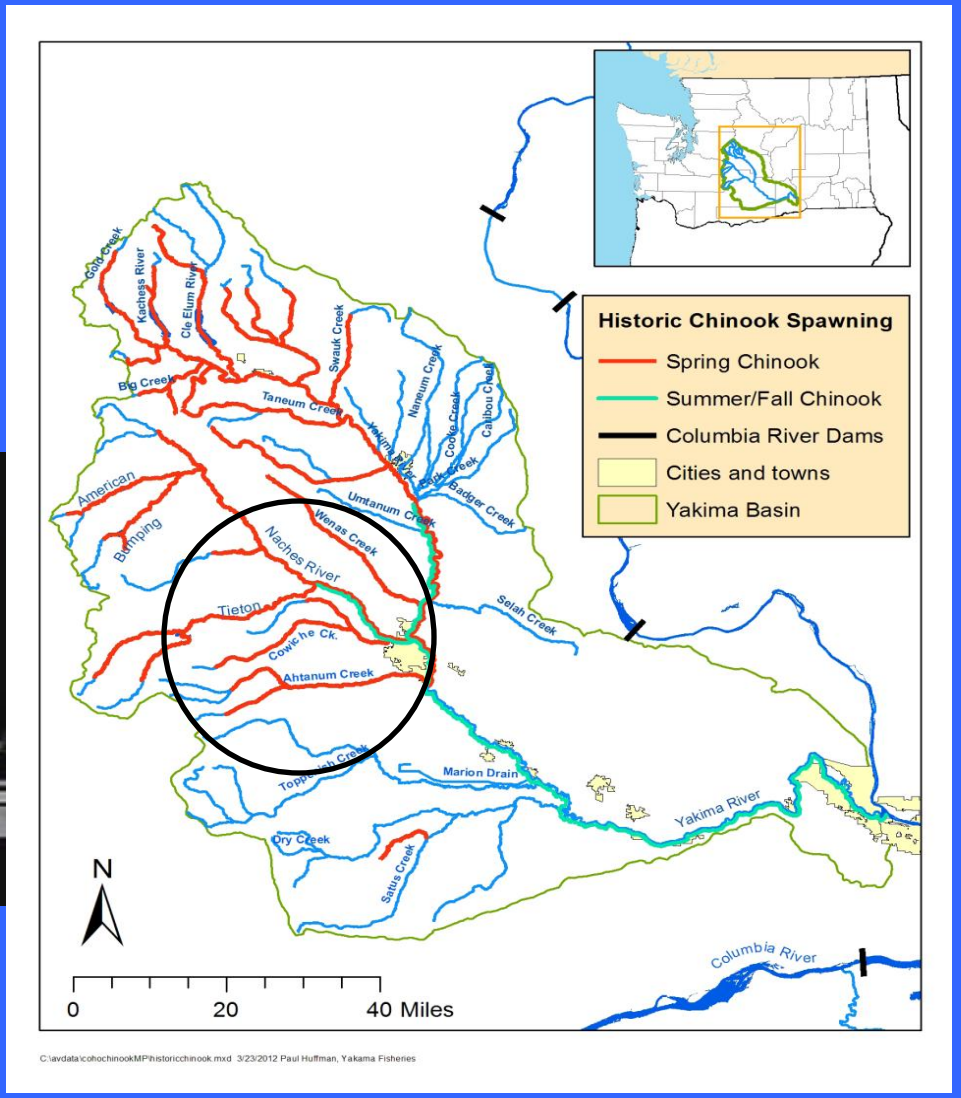
- Summer Chinook Restoration
- Dam Passage / Sockeye Restoration
- Steelhead Kelt Reconditioning / VSP
- Lamprey Restoration – Feasibility & Planning

Yakima River Summer Run Chinook Reintroduction – Restoring Diversity

- Extirpated stock
- Started with Wells transfers
- Releasing both yearling and subyearling fish
- Intend to move to local stock once returns and infrastructure in place
- Several hundred adults returning now from three different age classes

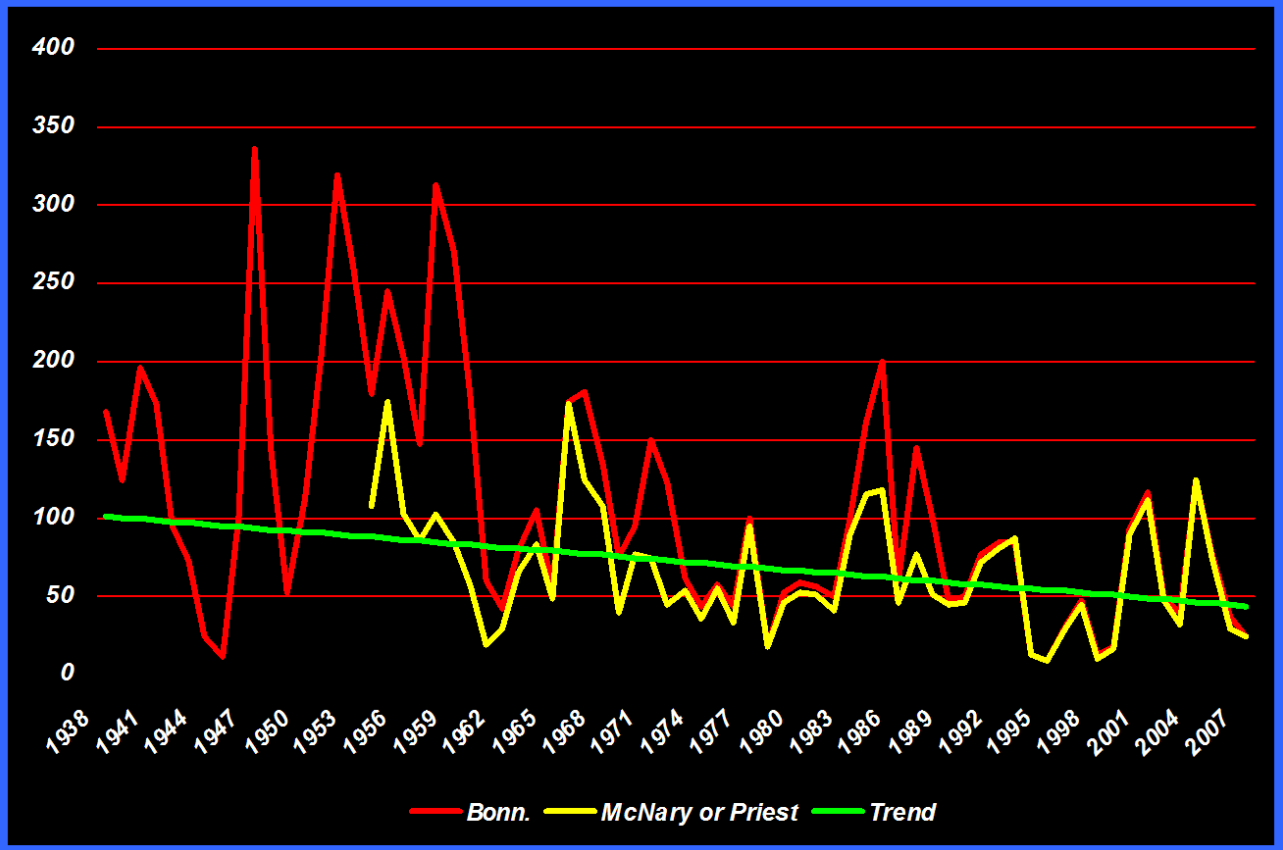


3-Ocean Adult Summer at Prosser, 7/1/2012



Yakima Basin Sockeye Restoration

Columbia River Sockeye Returns

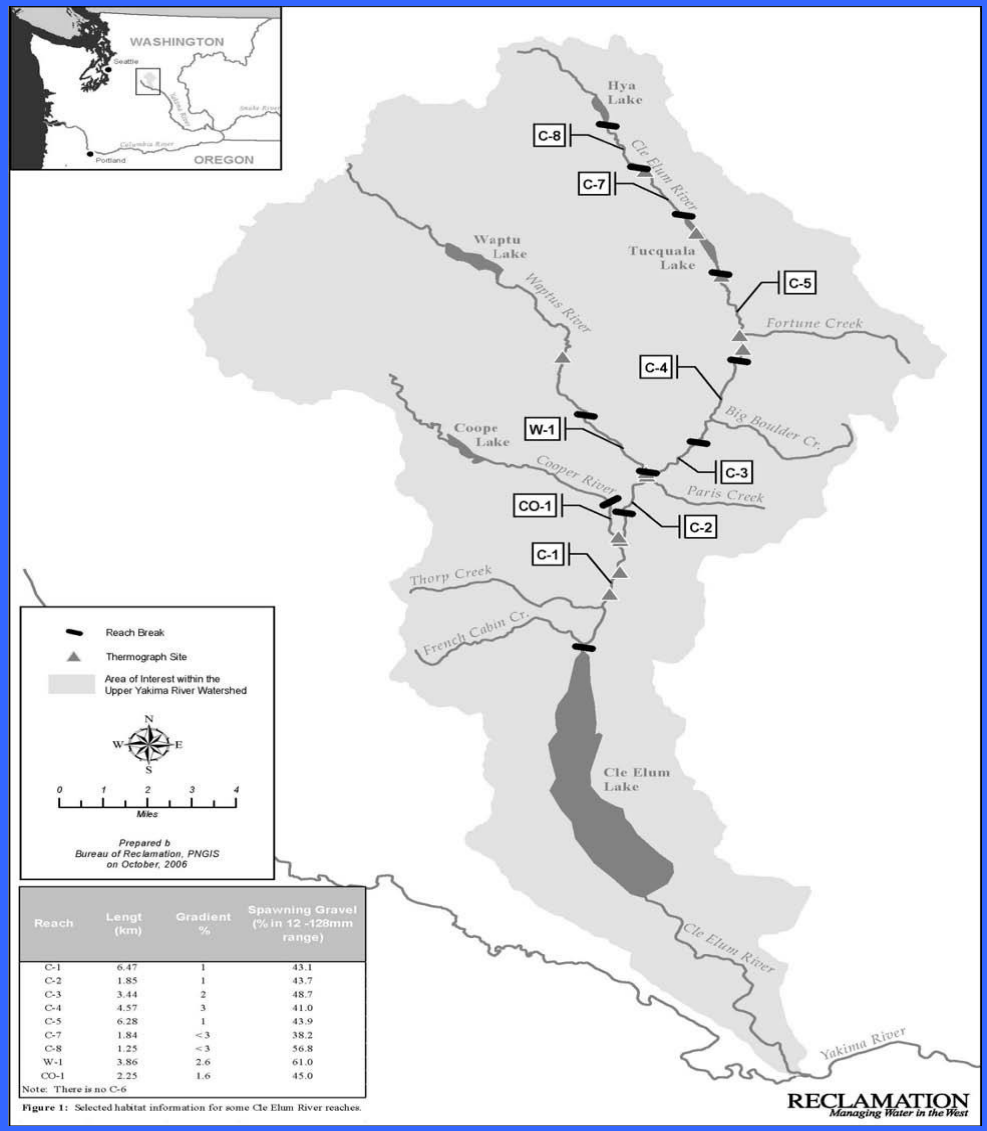


"Maintaining a metapopulation structure with good geographic distribution should be a top management priority to sustain salmon populations over the long term." - National Research Council, 1996

L. Cle Elum Sockeye Reintroduction

Year	Adults Transported
2009	1,000
2010	2,500
2011	4,500
2012	10,000

Some of the first sockeye to spawn in upper Cle Elum R. watershed in over 100 years



L. Cle Elum Sockeye Reintroduction

About 80,000 juveniles (progeny of 2009 adult plants) were estimated to have passed Prosser in 2011.

Wild smolt at Roza, 5/10/2011

Yakima River Steelhead Kelt Reconditioning

- Capture steelhead returning to ocean after completing first spawning cycle

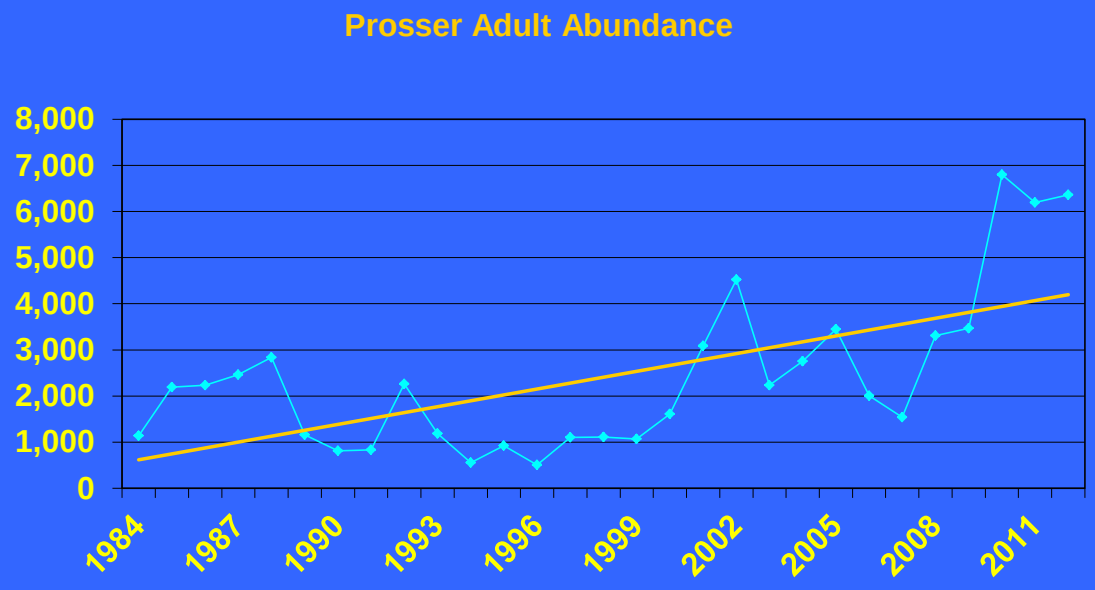
- Most (>90%) are females

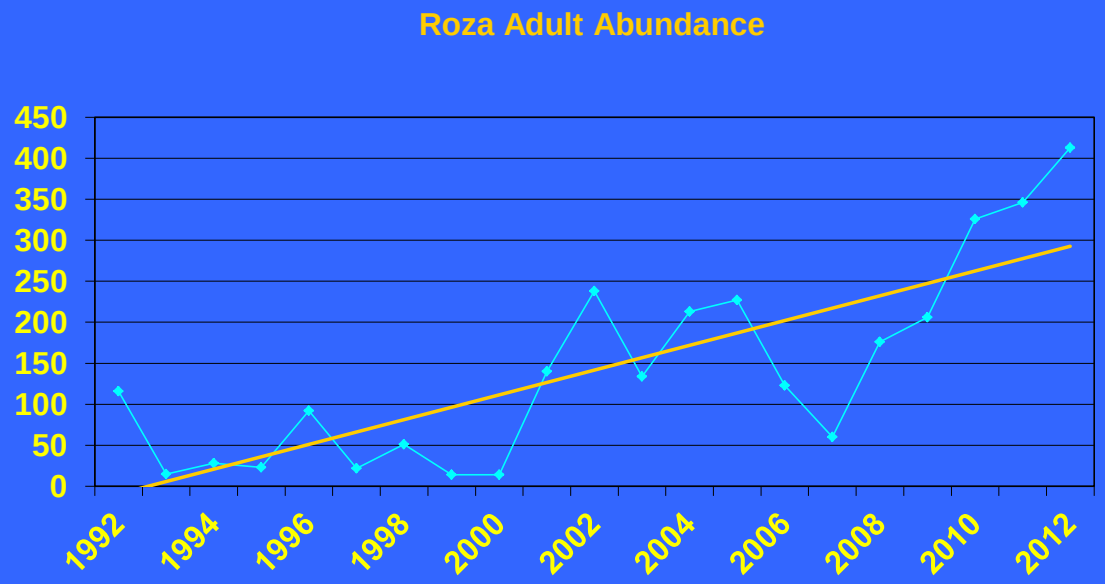
- Held and fed for 6-8 months

- Released in mid-late October (beginning of upstream migration peak)

- Select own mates, where to spawn, when to spawn

Steelhead Population Response: Abundance Trends





Yakama Nation Lamprey Restoration

- Goal: restore throughout ceded lands
- Regional collaboration
- Habitat surveys – identify limiting factors, key habitats for spawning and rearing
- Document presence and abundance
- Research and develop lamprey culture techniques

Lamprey spawning at Prosser Hatchery, 4/25/2012

Other Activities

Habitat Protection

"Rebuilding natural populations will ultimately depend on improving habitat quality and quantity" – ISRP 2011

Accomplishments

- **stream channel, floodplain, and vegetation restoration in several key steelhead producing streams on reservation**
- **protected over 1,800 acres of floodplain habitat**
- **reconnected or screened over 50 miles of tributary habitat**
- **restored over 100 acres of floodplain and side channels**
- **saving water through irrigation improvements**

SRFB Projects from 1999 to Present

YAKIMA BASIN FISH AND WILDLIFE RECOVERY BOARD

Yakima Basin

HABITAT RESTORATION PROJECTS

BEFORE: Bruton Dam blocks fish passage

AFTER: Removal restores fish passage

funded by

Washington's

Salmon Recovery Funding Board

&

National Fish and Wildlife Foundation

through the Community Salmon Fund

1999-2009

Information Management

Reports and Publications:

Forecasts, Annual Reports, Manuscripts

Excel Summary Files and Maps:

Run reconstruction; spawner/redd distribution;

Annual run size and escapement; etc.

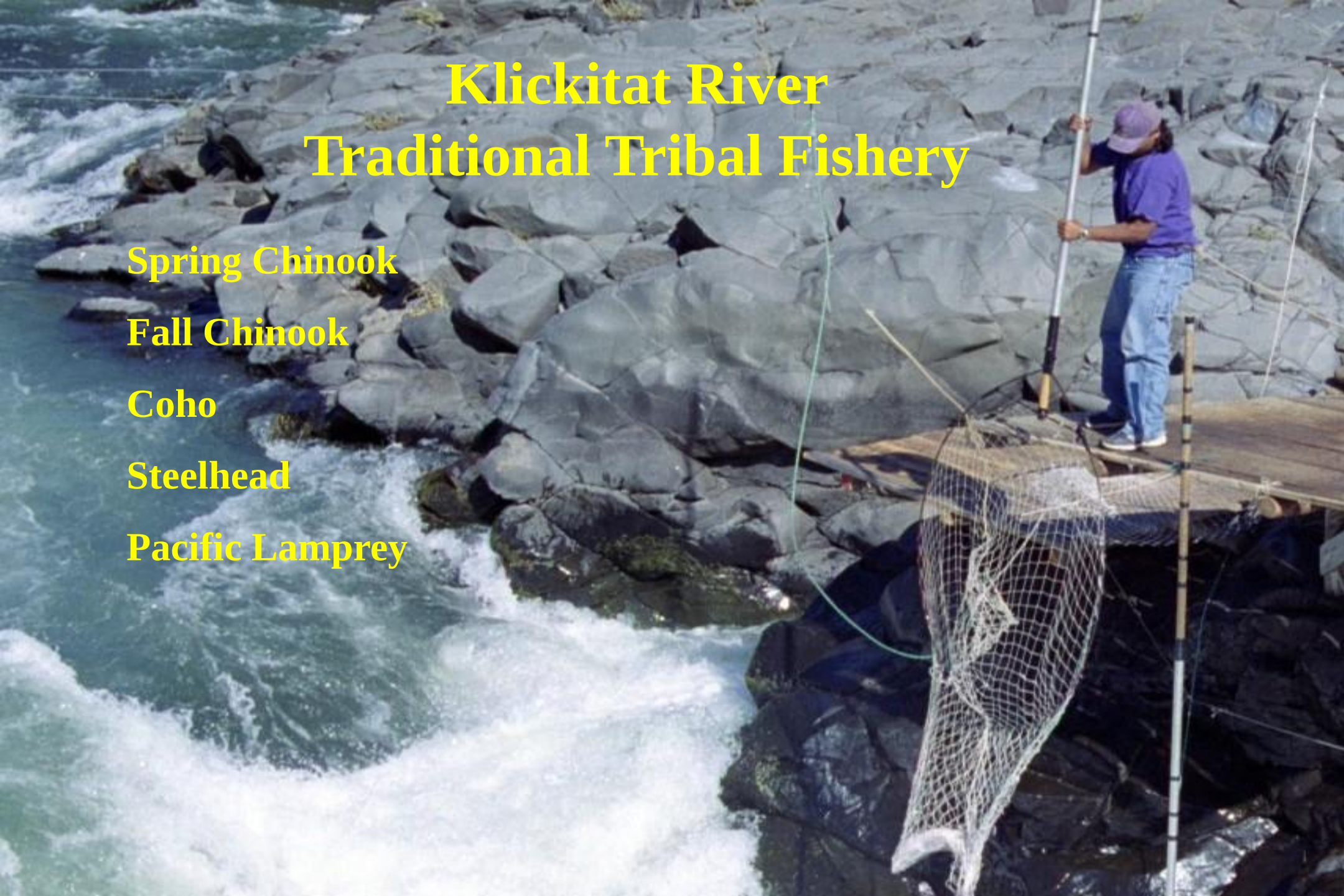
Access Databases:

hatchery brood collections, spawn, rear, and release;
juvenile outmigration; harvest; dam counts;
redd counts/ timing; spawner survey info

Information Sharing

- RMIS
- PTAGIS
- Streamnet
- DART
- http://www.efw.bpa.gov/searchpublications
- http://www.ykfp.org
- PAR, Meetings, Seminars, and Manuscripts
- Emails and special data requests

Klickitat Subbasin Activities



Klickitat River
Traditional Tribal Fishery

Spring Chinook

Fall Chinook

Coho

Steelhead

Pacific Lamprey

- One of the most important provisions secured in the Treaty of 1855 is the..."right of taking fish […] at all […] usual and accustomed stations."

Klickitat Basin
Facilities Operated by Yakama Nation

Castile Falls Fishways (RM 60)

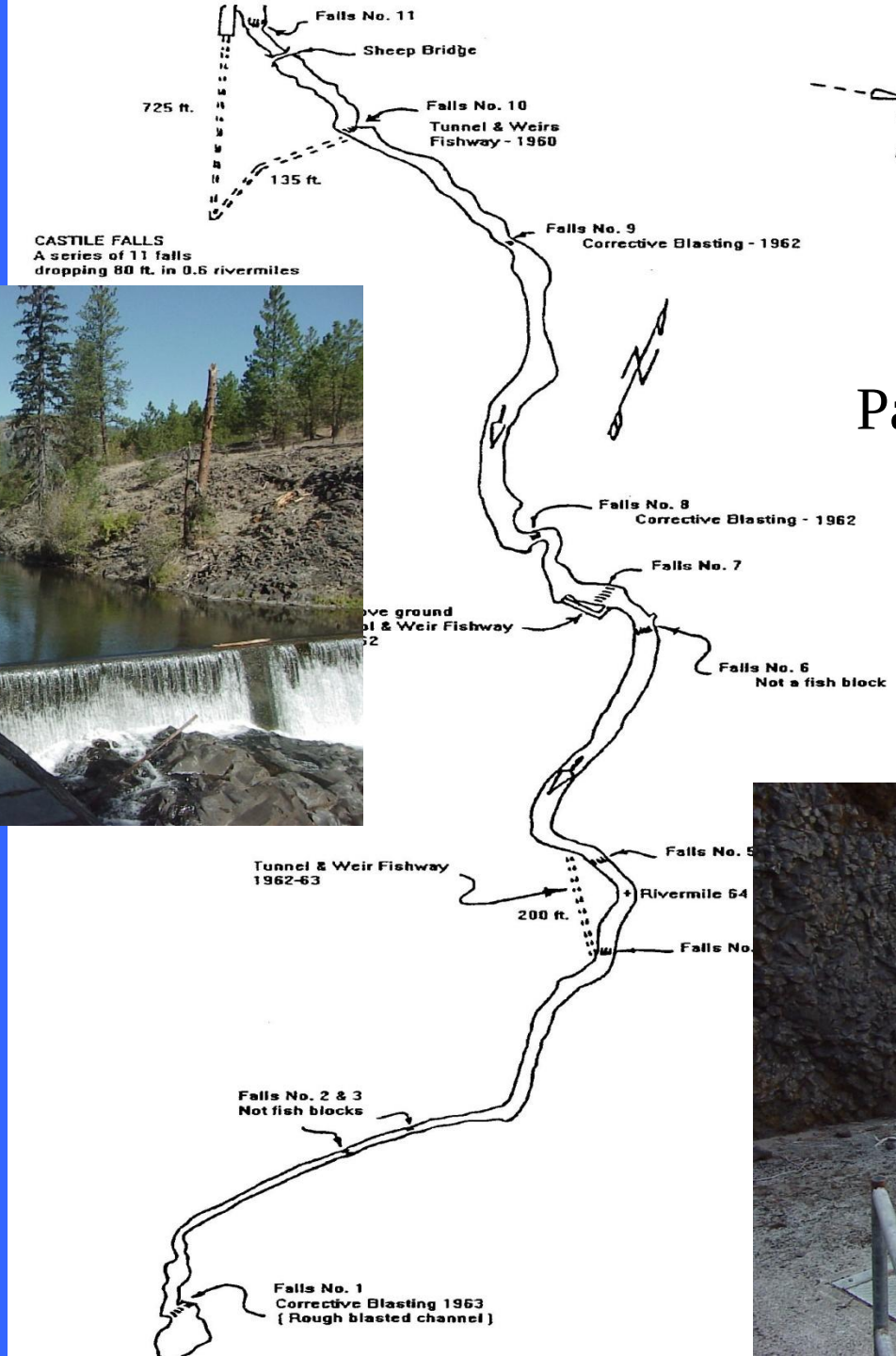
Klickitat Hatchery (RM 42)

Lyle Falls Fishway (RM 1)

Castile Falls Fishway

Passage Restored in 2004

45 Miles of Salmon Habitat Opened



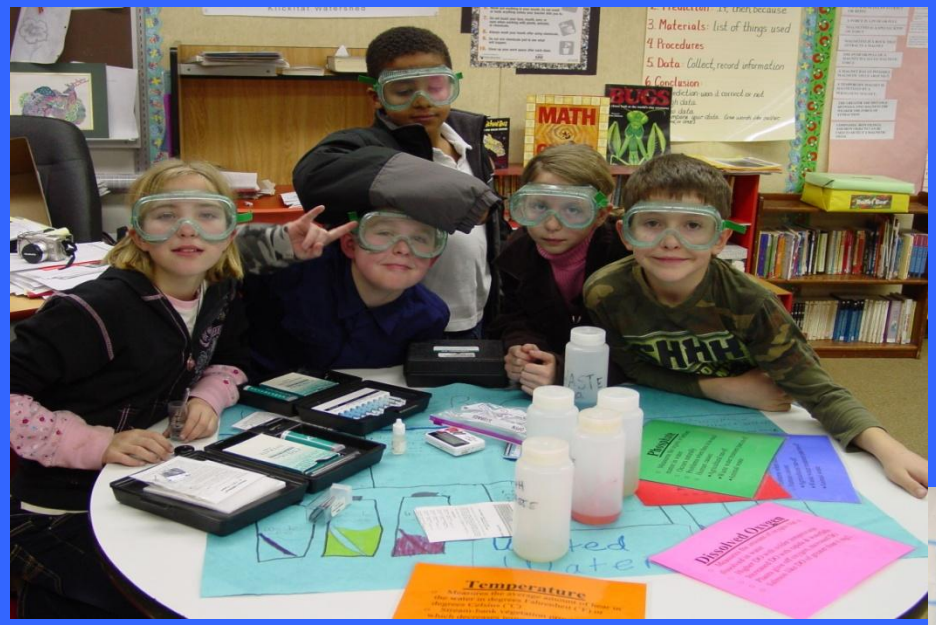
Research & Monitoring

- **Population Monitoring**
- **Habitat Inventories**
- **Trend Monitoring**

Klickitat Watershed Enhancement Project

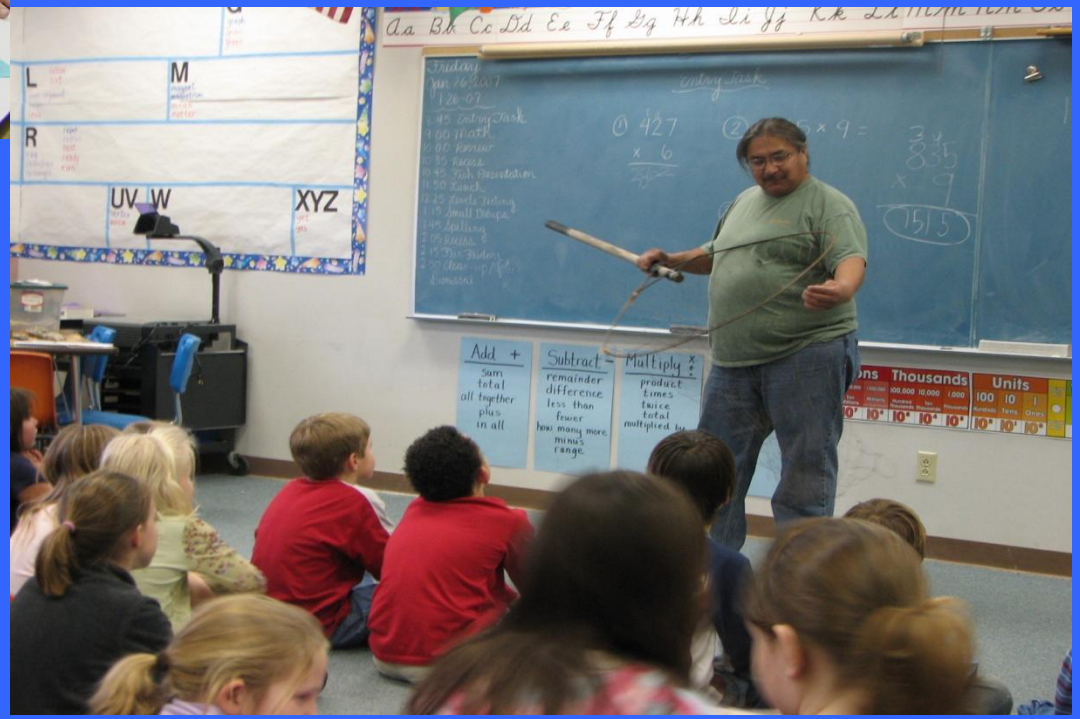
Restore watershed health to aid recovery of salmon stocks

Salmon in the Classroom



Klickitat School - 4th graders learn about salmon

Yakama Tribal member conducts a dipnet fishing presentation



For more information please go to www.YKFP.org

THANK YOU

FOR YOUR

CONTINUED SUPPORT