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-  U.S. v Oregon Columbia River

1988:  Fish Management Plans

1980:  Northwest Power Act
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)
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

<table>
<thead>
<tr>
<th>Agency</th>
<th>Responsibilities</th>
</tr>
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</table>
| **BPA** | • Funding  
  • NEPA  
  • Review |
| **NPCC** | • Review  
  • Priority  
  • 5 Yr. Plan |
| **USFWS** | • ESA  
  • Fish Health  
  • Mitchell Act/Marking |
| **USFS** | • Habitat |
| **BOR** | • Passage  
  • Water  
  • Facilities O & M  
  • Phase II Screens |
| **NOAAFish** | • ESA  
  • Physiology  
  • Homing |

*YSFWRB • Habitat*
Prosser Dam

Denil ladder, trap and adult monitoring facility

Video Counting and Automatic PIT detection

Chandler Irrigation Canal
Prosser Hatchery and Juvenile Fish Monitoring Facility

Chandler Irrigation Canal

Fish Screen
Marion Drain Fall Chinook Facility
Roza Dam Fish Monitoring Facilities

- Adult Monitoring Facility
- Juvenile Sampling Facility
- Roza Irrigation Canal
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
Why do we need Salmon Supplementation?
## Estimates of Historical Anadromous Fish Runs in the Yakima Subbasin as Compared to YKFP Planning era Run Size

<table>
<thead>
<tr>
<th>Species/Race</th>
<th>Pre-1900 Run</th>
<th>1980s Average</th>
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</thead>
<tbody>
<tr>
<td>Fall Chinook</td>
<td>132,000</td>
<td>600</td>
</tr>
<tr>
<td>Spring Chinook</td>
<td>200,000</td>
<td>4,200</td>
</tr>
<tr>
<td>Summer Chinook</td>
<td>68,000</td>
<td>0</td>
</tr>
<tr>
<td>Coho</td>
<td>110,000</td>
<td>200</td>
</tr>
<tr>
<td>Summer Steelhead</td>
<td>80,500</td>
<td>1,800</td>
</tr>
<tr>
<td>Sockeye</td>
<td>200,000</td>
<td>0</td>
</tr>
</tbody>
</table>
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
Fall Chinook Abundance at Prosser Dam, Yakima River, WA
## Historical, Pre-YKFP, and Present Runs

<table>
<thead>
<tr>
<th>Species</th>
<th>Historical</th>
<th>1980s</th>
<th>1996-Present</th>
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<tbody>
<tr>
<td>Fall Chinook</td>
<td>132,000</td>
<td>600</td>
<td>2,600</td>
</tr>
<tr>
<td>Spring Chinook</td>
<td>200,000</td>
<td>4,200</td>
<td>10,100</td>
</tr>
<tr>
<td>Summer Chinook</td>
<td>68,000</td>
<td>0</td>
<td>--</td>
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<td>200</td>
<td>4,200</td>
</tr>
<tr>
<td>Summer Steelhead</td>
<td>80,500</td>
<td>1,800</td>
<td>3,200</td>
</tr>
<tr>
<td>Sockeye</td>
<td>200,000</td>
<td>0</td>
<td>--</td>
</tr>
</tbody>
</table>
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


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


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

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


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


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


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


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


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 spawning in the wild

- 1997

Integrated HxW progeny return

- 2001

Integrated F1 progeny return

- 2005

Integrated F2 progeny return

- 2009

- 2013
Evidence of Hatchery-Origin Reproductive Success: Teanaway R. Spring Chinook

- Teanaway R. redd counts
- 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

<table>
<thead>
<tr>
<th></th>
<th>Upp. Yak.</th>
<th>Naches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Supp.</td>
<td>3,103</td>
<td>1,394</td>
</tr>
<tr>
<td>Post-Supp.</td>
<td>3,307</td>
<td>1,282</td>
</tr>
<tr>
<td>Post/Pre</td>
<td>1.066</td>
<td>0.920</td>
</tr>
</tbody>
</table>
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

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

% of Redds


% of Redds

Mainstem
Tributary
Yakima Basin Coho
Spatial Distribution

2009 Coho Redds
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
“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

<table>
<thead>
<tr>
<th>Year</th>
<th>Adults Transported</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>1,000</td>
</tr>
<tr>
<td>2010</td>
<td>2,500</td>
</tr>
<tr>
<td>2011</td>
<td>4,500</td>
</tr>
<tr>
<td>2012</td>
<td>10,000</td>
</tr>
</tbody>
</table>

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

Prosser Adult Abundance

Roza Adult Abundance
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
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

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

Excel Summary Files and Maps:
- Run reconstruction; spawner/redd distribution;
- Annual run size and escapement; etc.

Reports and Publications:
- Forecasts, Annual Reports, Manuscripts
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