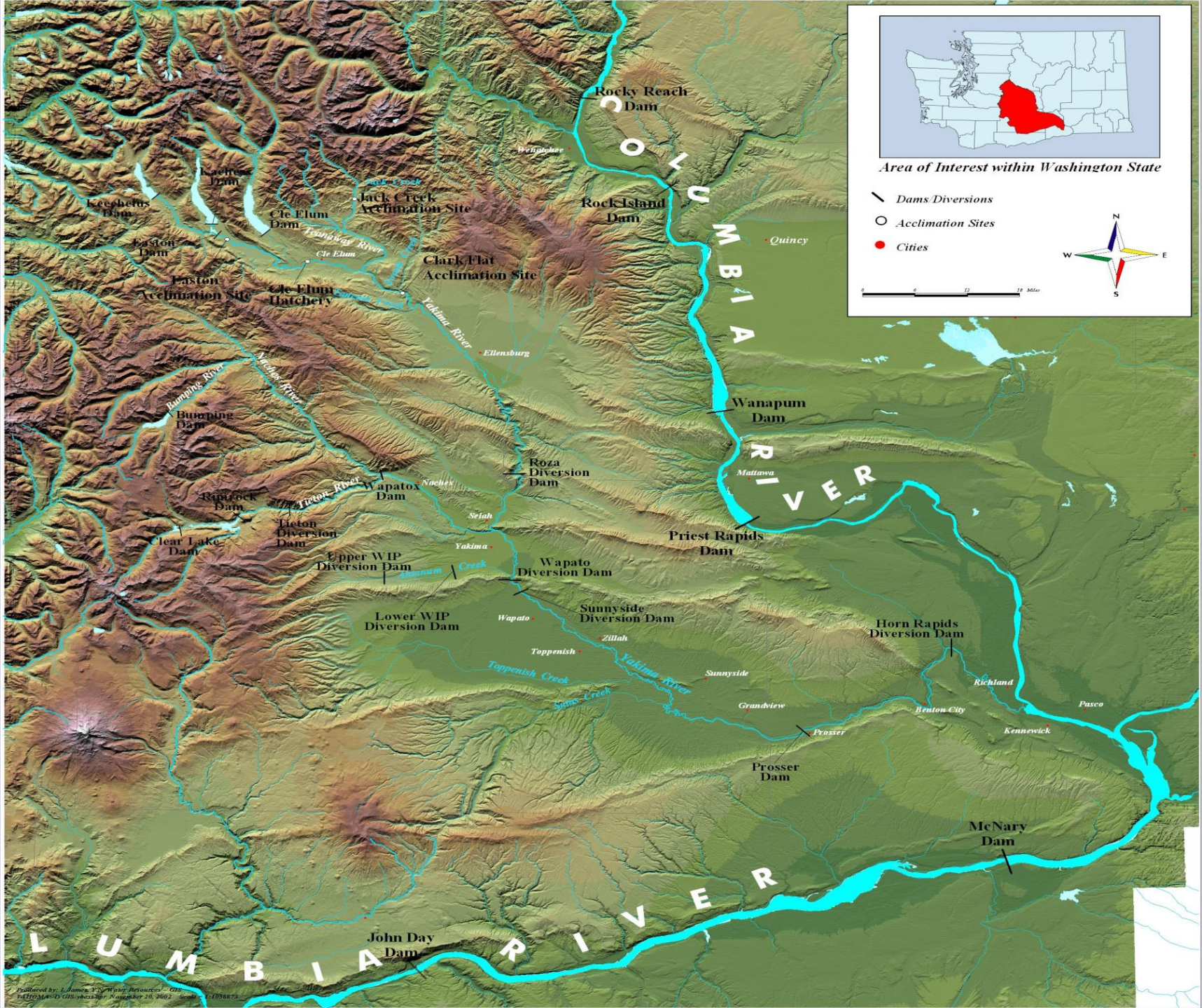
Yakima Basin Science & Management Conference 2008

YKFP CWU BPA BOR
YBFWRB

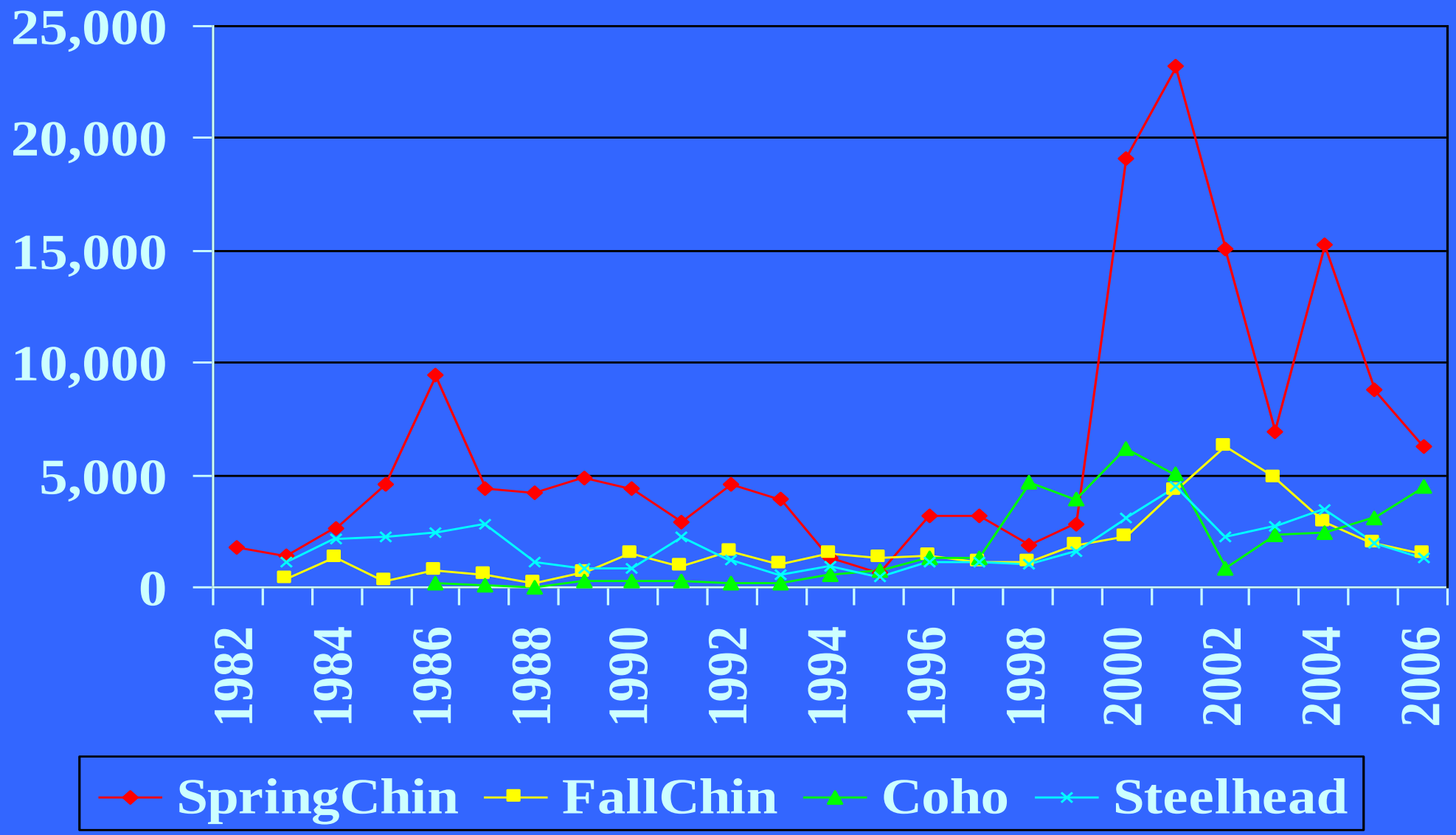
Overview of Research and Management Activities in the Yakima Basin


Area of Interest within Washington State
Dams/Diversions
Acclimation Sites
Cities
N
S
E
W
Rocky Reach Dam
Rock Island Dam
Wanapum Dam
Priest Rapids Dam
McNary Dam
John Day Dam
Prosser Dam
Roza Diversion Dam
Wapato Diversion Dam
Sunnyside Diversion Dam
Horn Rapids Diversion Dam
Upper WIP Diversion Dam
Lower WIP Diversion Dam
Tieton Diversion Dam
Wapatox Dam
Rimrock Dam
Clear Lake Dam
Bumping Dam
Easton Dam
Keechelus Dam
Cle Elum Dam
Lake Cle Elum
Easton Acclimation Site
Cle Elum Hatchery
Jack Creek Acclimation Site
Clark Flat Acclimation Site
COLUMBIA RIVER
Yakima River
Naches River
Bumping River
Tieton River
Cowiche Creek
Toppenish Creek
Satus Creek
Wenatchee
Quincy
Ellensburg
Mattawa
Naches
Selah
Yakima
Wapato
Zillah
Toppenish
Sunnyside
Grandview
Prosser
Richland
Benton City
Kennewick
Pasco

Estimates of Historical Anadromous Fish Runs in the Yakima Subbasin as Compared to Recent Run Size (5-year Average, 2002-2006)

Species/Race	Pre-1900 Run	Recent Average
Fall Chinook	132,000	3,500
Spring Chinook	200,000	10,500
Summer Chinook	68,000	0
Coho	110,000	2,600
Summer Steelhead	80,500	2,400
Sockeye	200,000	0

Yakima River Salmon by Species, 1982 - Present



YAKIMA/KLICKITAT FISHERIES PROJECT (YKFP)

- MODELING EDT and AHA
- SALMON SUPPLEMENTATION AND REINTRODUCTION PROGRAMS
- HABITAT ACQUISITION AND ENHANCEMENT PROGRAMS

Yakima/Klickitat Fisheries Project

Federal Agencies Cooperating

BPA
- Funding
- NEPA
- Review

NPPC
- Review
- Priority
- 5 Yr. Plan

USFWS
- ESA
- Fish Health

USFS
- Habitat

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

NOAAFish
- ESA
- Physiology
- Homing

SPECIES TARGETED IN YKFP

- ALL STOCKS IN BASIN - TIERED
- SPRING CHINOOK INITIAL STOCK 1997
- COHO FEASIBILITY PART OF PROGRAM
- FALL CHINOOK 1998
- STEELHEAD – MODELING, PLANNING, (and KELT RECONDITIONING)
- SUMMER/FALL CHINOOK
- SOCKEYE

YKFP SUPPLEMENTATION AND RESEARCH PROGRAM

Purpose

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

Wednesday June 11 – Fish Science

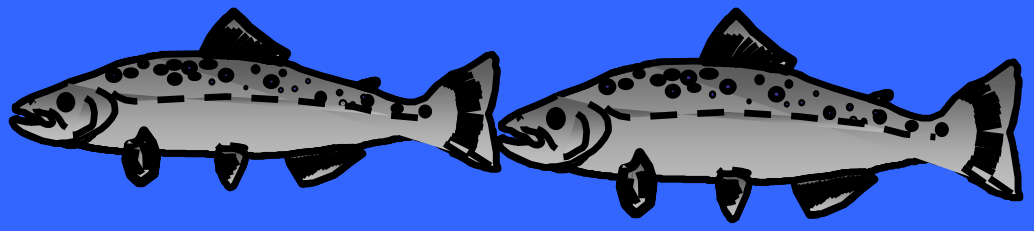
- YBFWRB Panel
- Scott Nicolai – Watershed Overview
- Hatchery Scientific Reform Group (HSRG)
- Spring Chinook Genetic Identification
- Demographics
- Predation
- Competition
- Reproductive Success
- Homing and spawning site selection
- Precocial research

HABITAT ENHANCEMENT
IMPROVING CULVERT PASSAGE

Cle Elum Supplementation & Research Facility

OCT/SNT Rearing

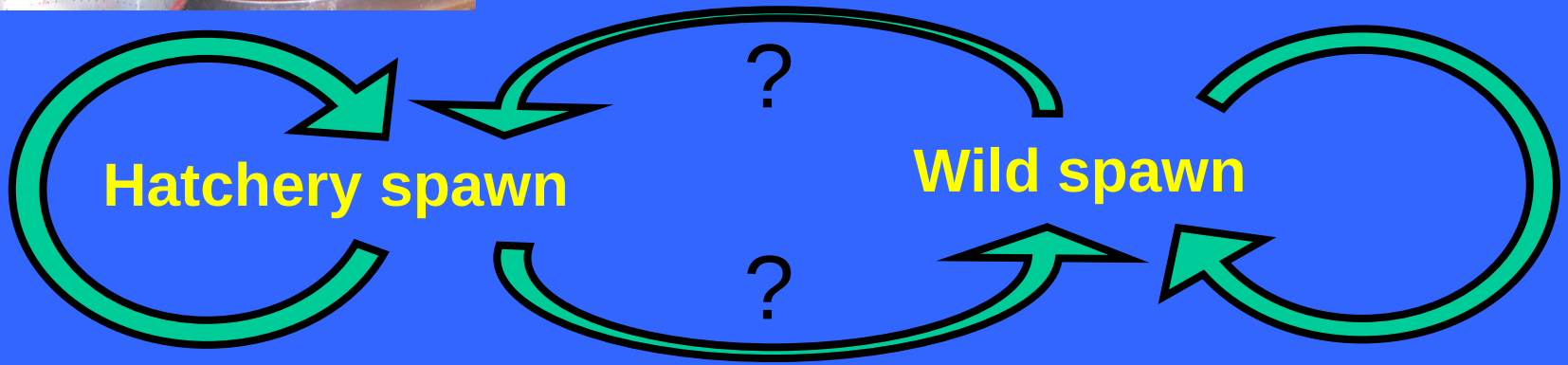
Smolt and Adult Survival Results



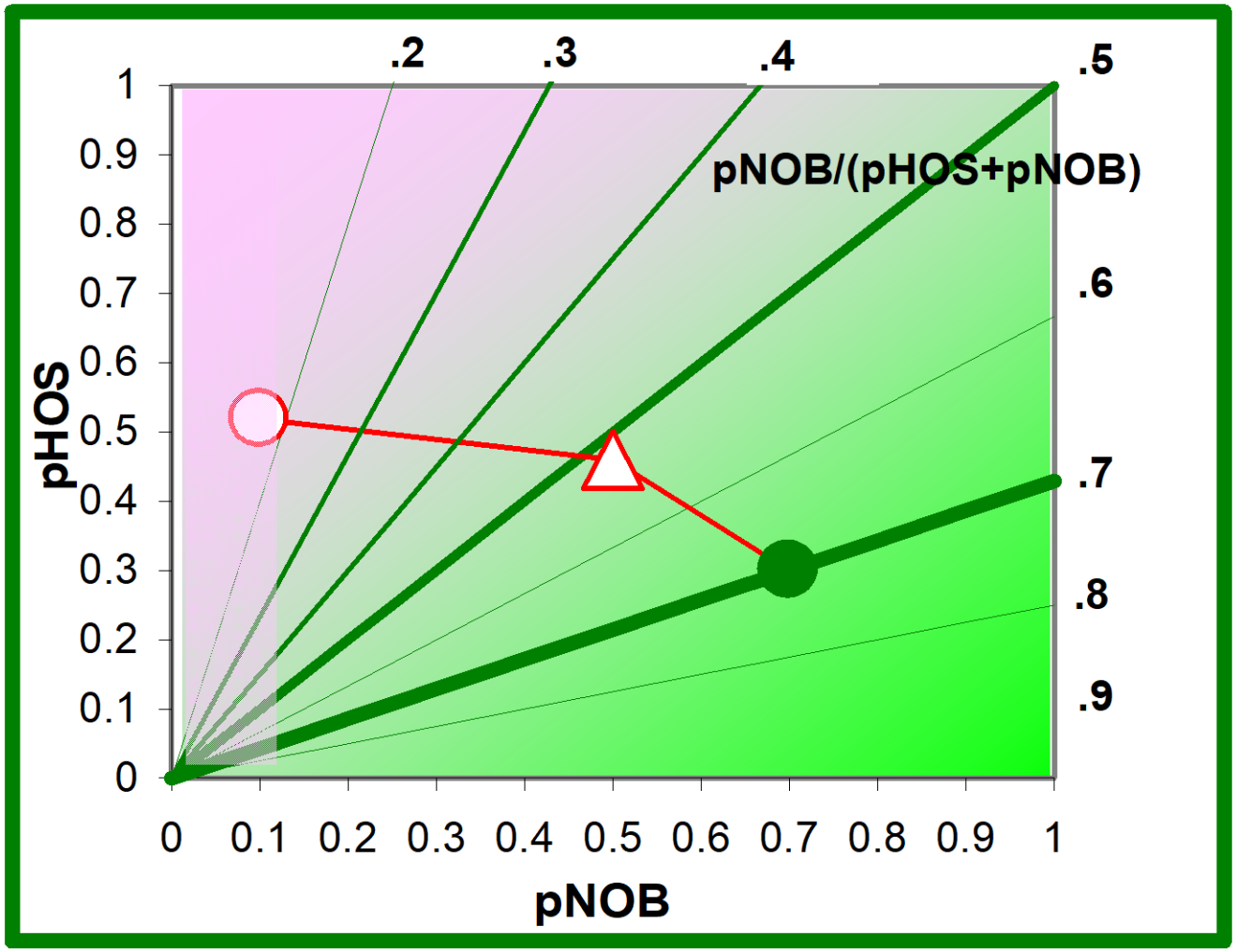
Hatchery Reform:
Genetic *Integration* vs. *Segregation* of Hatchery Broodstocks

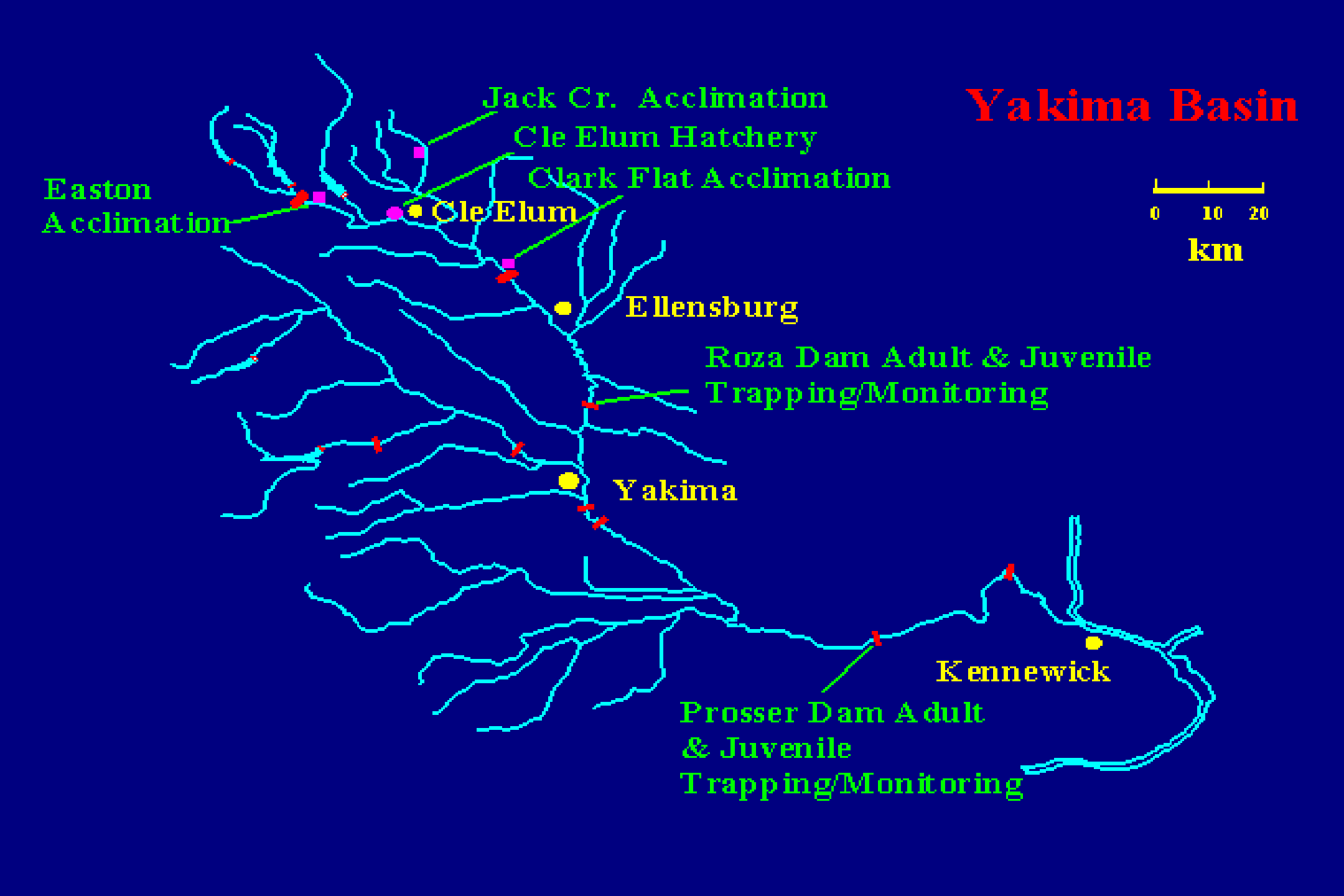
Donald E. Campton
U.S. Fish and Wildlife Service
Abernathy Fish Technology Center
Longview, WA

Historical Hatchery Problem: Unknown gene flow between two environments



Unknown gene flow


.2
.3
.4
.5
pNOB/(pHOS+pNOB)
.6
.7
.8
.9
pHOS
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
pNOB


Yakima Basin
Jack Cr. Acclimation
Cle Elum Hatchery
Clark Flat Acclimation
Easton
Acclimation
Cle Elum
Ellensburg
Roza Dam Adult & Juvenile
Trapping/Monitoring
Yakima
Kennewick
Prosser Dam Adult
& Juvenile
Trapping/Monitoring
0
10
20
km

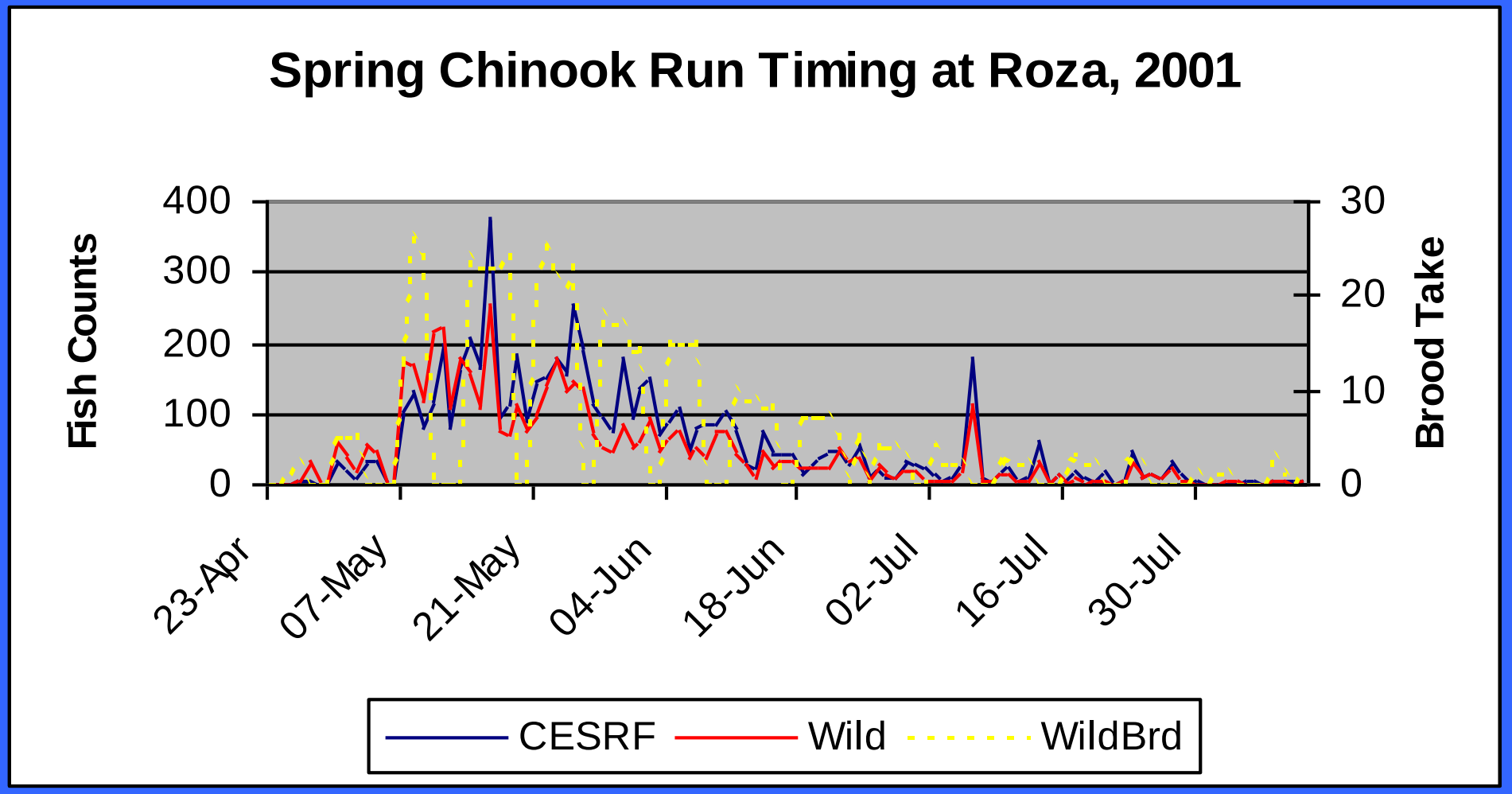
Adult and Juvenile Fish Passage

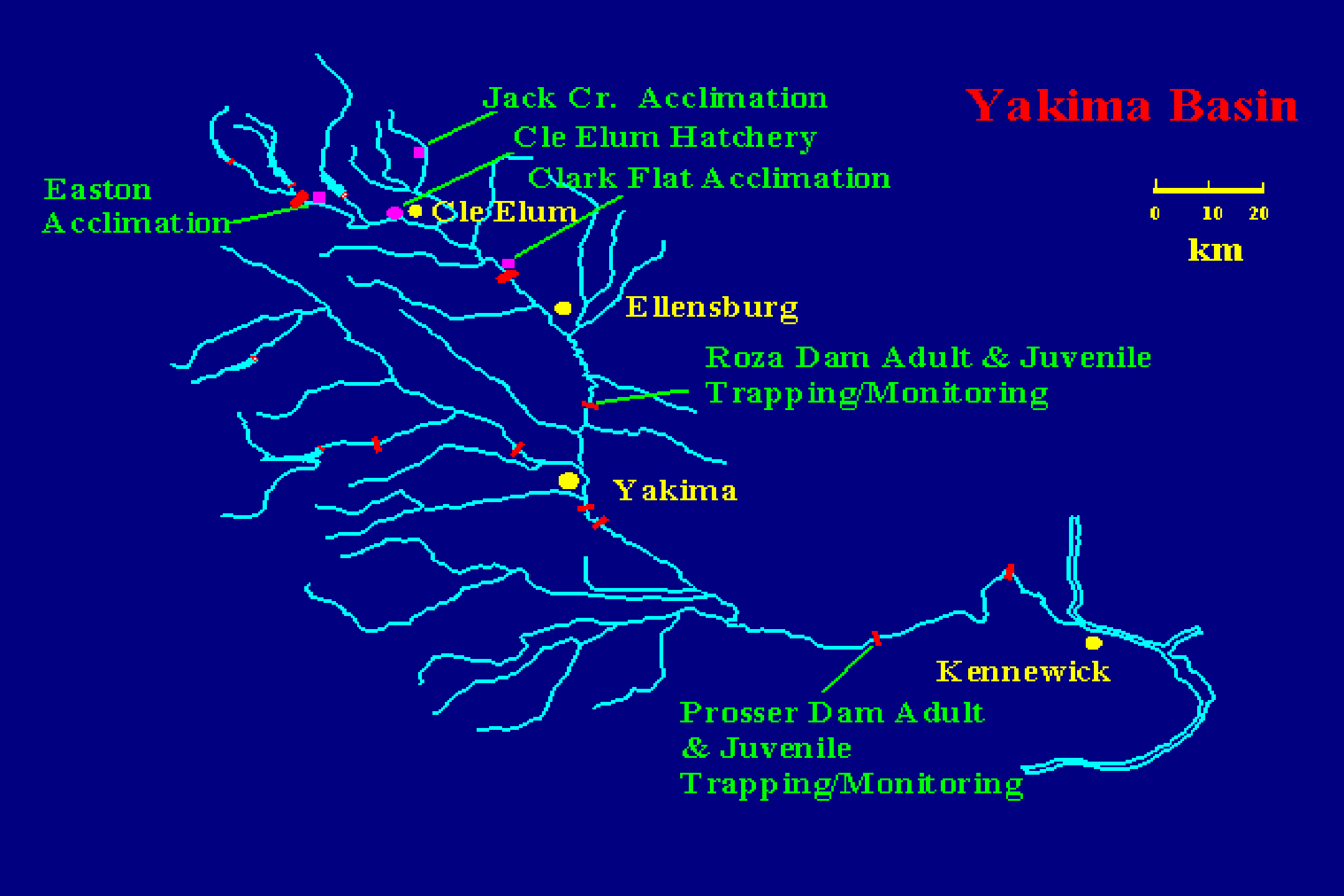
MISSION OF FACILITY

- Collect Broodstock
- Enumerate Spawning Escapement
- Monitor Characteristics of Escapement (age, length, weight, DNA,)
- Enumerate Hatchery Returns (by Treatment, Acclimation Site and Brood Year)

BROODSTOCK COLLECTION GENETIC GUIDELINES

- COLLECTION THROUGHOUT ADULT RUN TIMING
- RANDOM COLLECTION OF ADULTS
- TAKE NO MORE THAN 50% OF ADULTS INTO HATCHERY (HALF THE ADULTS SPAWN IN THE WILD)
- Integrated Hatchery Concept - PNI


Spring Chinook Run Timing at Roza, 2001
Fish Counts
Brood Take
400
300
200
100
0
30
20
10
0
23-Apr
07-May
21-May
04-Jun
18-Jun
02-Jul
16-Jul
30-Jul
CESRF
Wild
WildBrd


Yakima Basin
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Ellensburg
Roza Dam Adult & Juvenile
Trapping/Monitoring
Yakima
Kennewick
Prosser Dam Adult
& Juvenile
Trapping/Monitoring
0
10
20
km


P# No. FL


Female #1
Female #2
Male #1
Male #2

Research Monitoring Activities

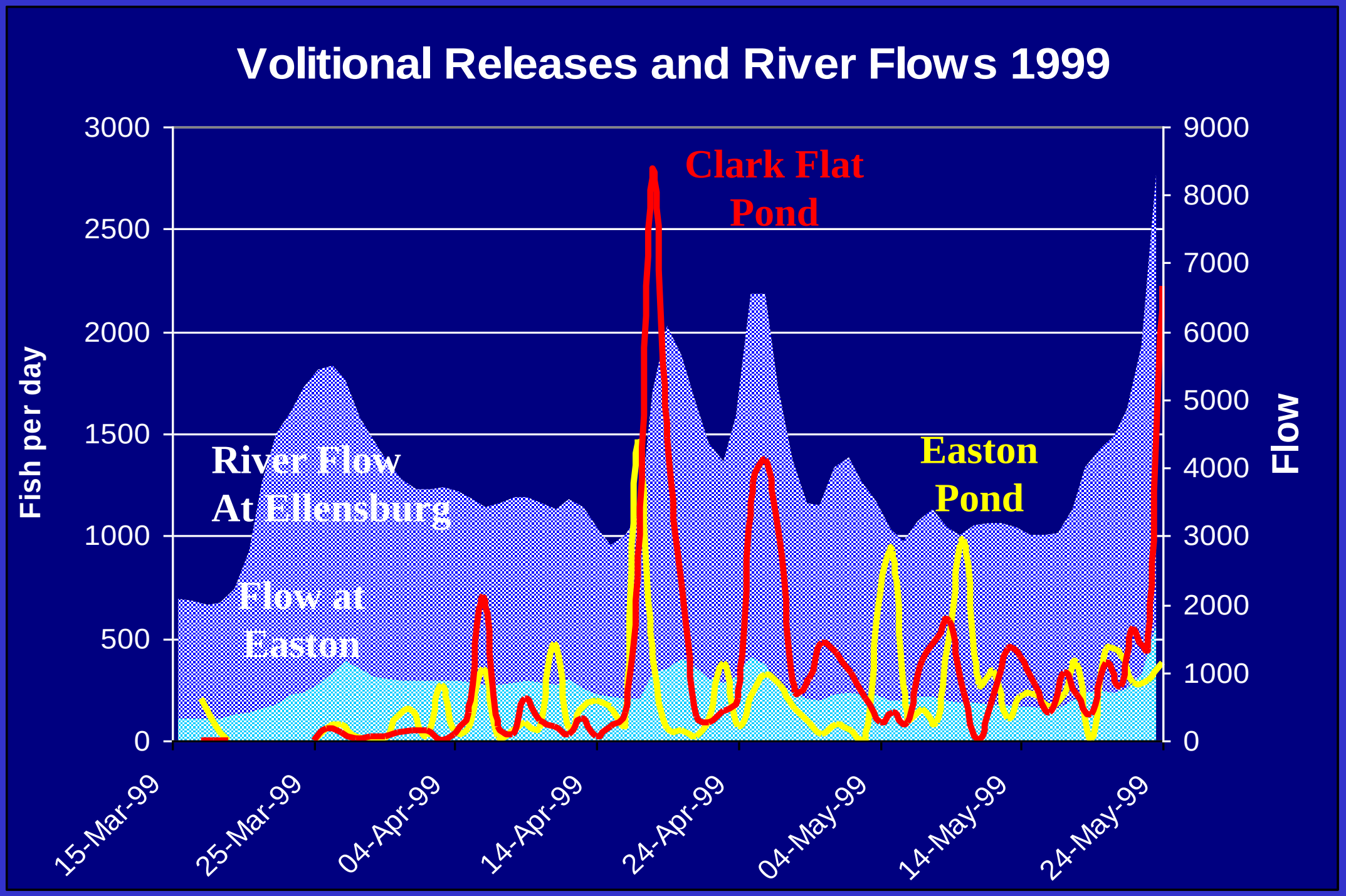
Designed to test the performance of the two treatments of artificially reared fish (OCT vs. SNT),
and to compare their performance with naturally reared fish.

REARING CRITERIA for BY's 1997-2001

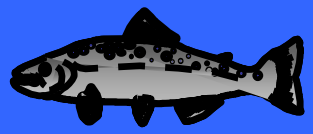
- **OPTIMUM CONVENTIONAL TREATMENT-OCT**
  PRODUCTION VESSEL – 100'X10'X3.5'
  LOW DENSITY – 0.75 LB/FT3
  45,000 FISH PER VESSEL
  TEMPERATURE – <55F

- **SEMI-NATURAL TREATMENT -SNT – IDENTICAL TO OCT - PLUS**
  OVERHEAD COVER,
  SUBSTRATE,
  INSTREAM COVER,
  UNDERWATER FEEDERS

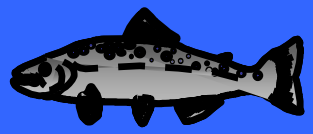
Upper Yakima River Basin


Volitional Releases and River Flows 1999
Fish per day
Flow
3000
2500
2000
1500
1000
500
0
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
15-Mar-99
25-Mar-99
04-Apr-99
14-Apr-99
24-Apr-99
04-May-99
14-May-99
24-May-99
Clark Flat Pond
Easton Pond
River Flow At Ellensburg
Flow at Easton

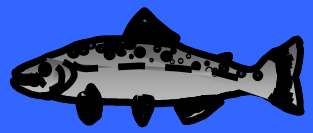
Hatchery Fish Performance will be Measured in Four Areas



Post-release Survival (smolt release to adult)

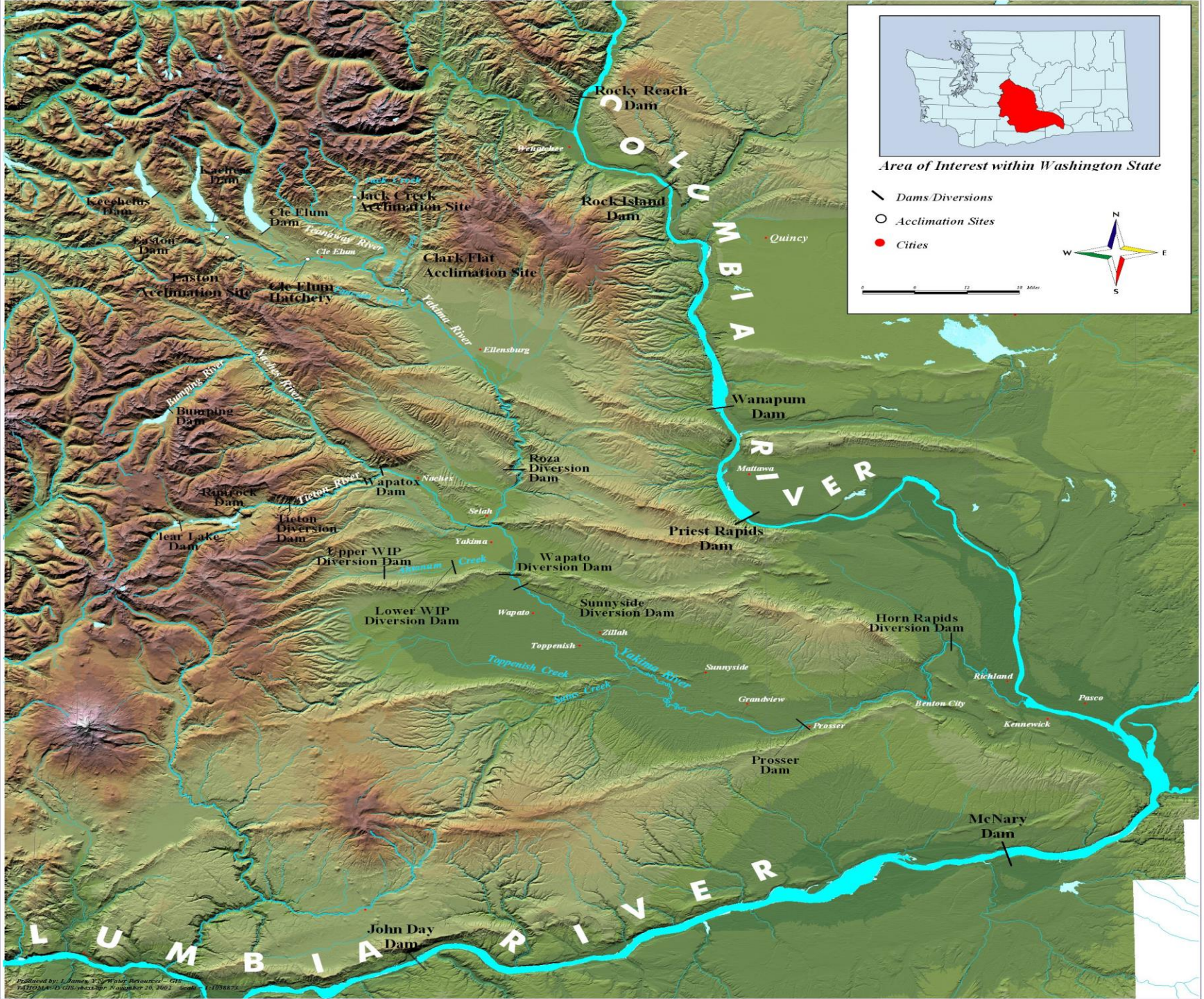


Reproductive Success (smolts/spawner)



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

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


Area of Interest within Washington State
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Wanapum Dam
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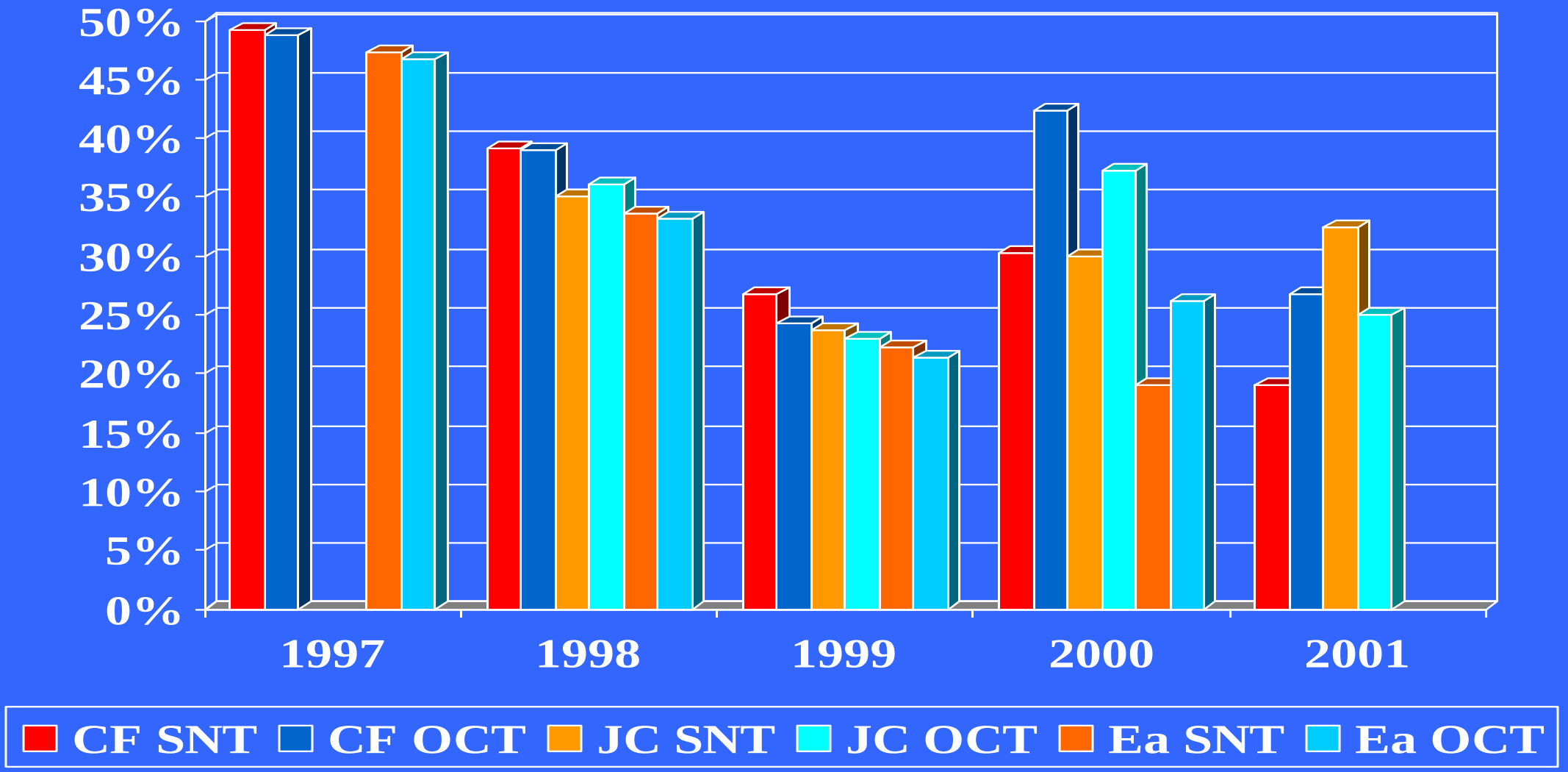
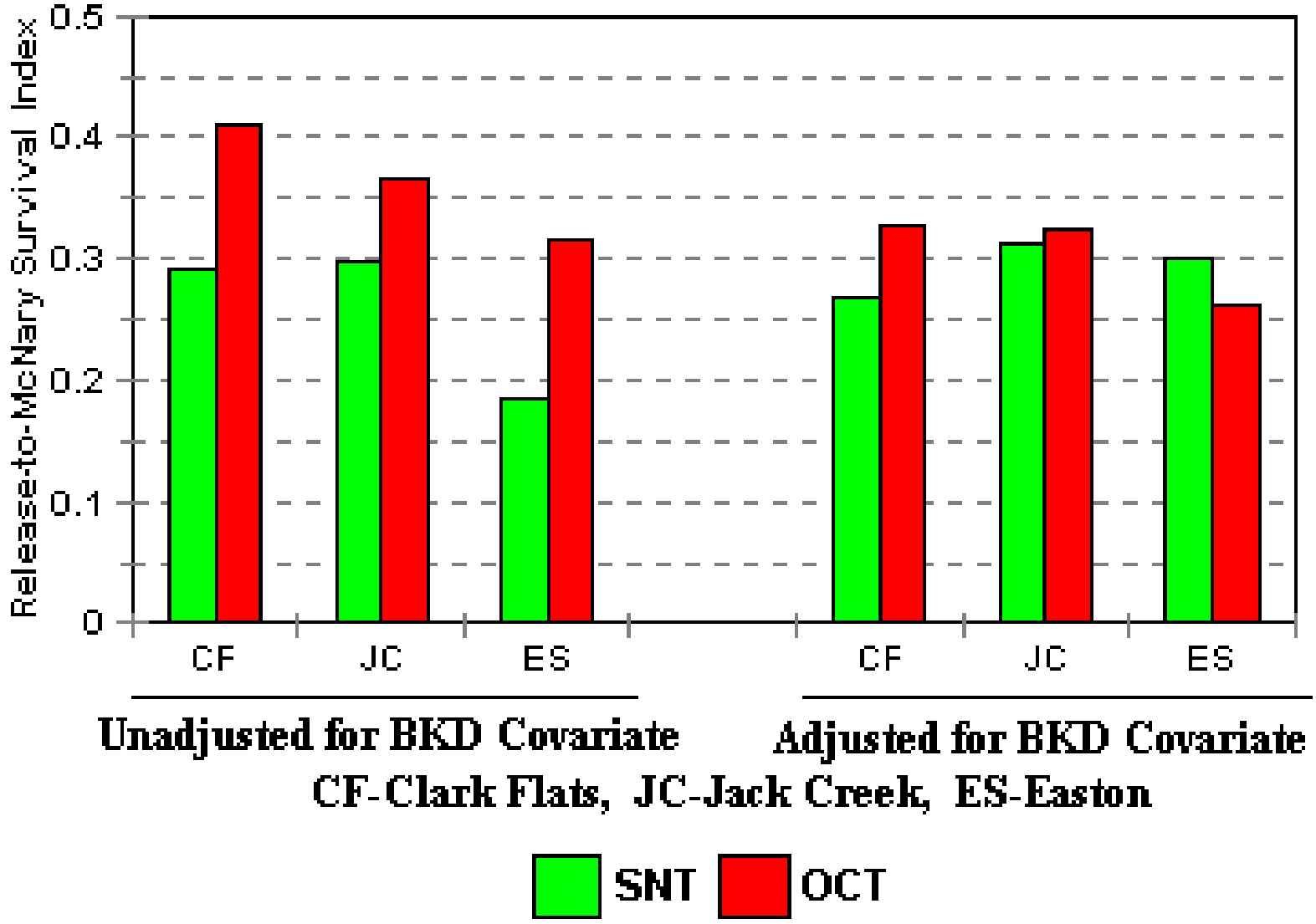
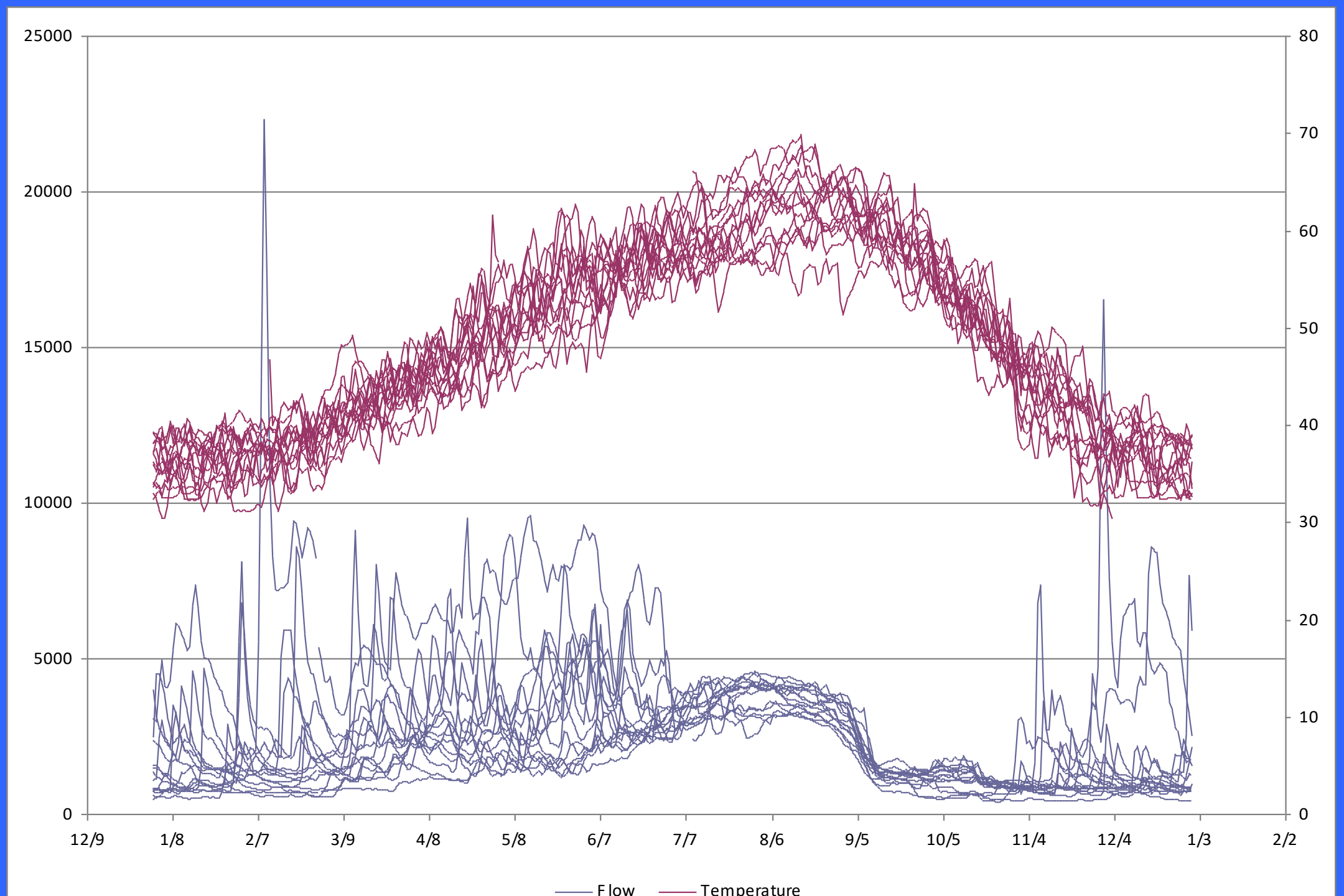
McNary Dam
John Day Dam
Prosser Dam
Horn Rapids Diversion Dam
Sunnyside Diversion Dam
Wapato Diversion Dam
Upper WIP Diversion Dam
Lower WIP Diversion Dam
Roza Diversion Dam
Wapatox Dam
Tieton Diversion Dam
Clear Lake Dam
Rimrock Dam
Bumping Dam
Easton Dam
Easton Acclimation Site
Cle Elum Dam
Cle Elum Hatchery
Keechelus Dam
Kachess Dam
Jack Creek Acclimation Site
Clark Flat Acclimation Site
Yakima River
Columbia River
Wenatchee
Quincy
Ellensburg
Cle Elum
Mattawa
Yakima
Wapato
Zillah
Toppenish
Sunnyside
Grandview
Prosser
Benton City
Kennewick
Richland
Pasco
Selah
Naches
Toppenish Creek
Satus Creek
Ahtanum Creek
Tieton River
Teanaway River
Bumping River
Naches River

Outmigrant SNT and OCT Treatment Release-to-McNary-Dam Survival Indices within Sites for Brood-Years 1997 through 2001 (1999 through 2003 Outmigrants)

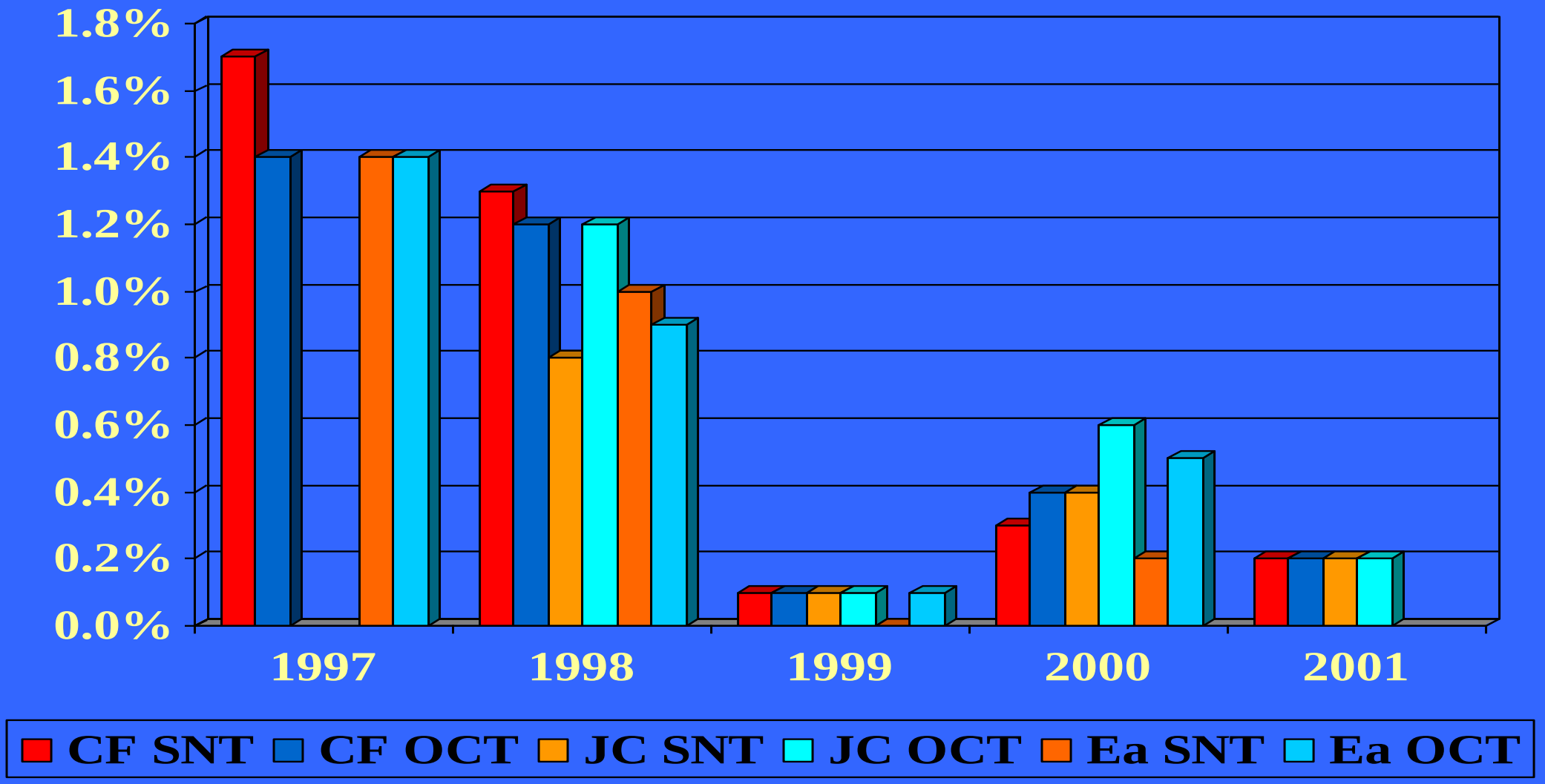


2000 Brood Survival Incices Unadjusted and Adjusted for BKD Covariate

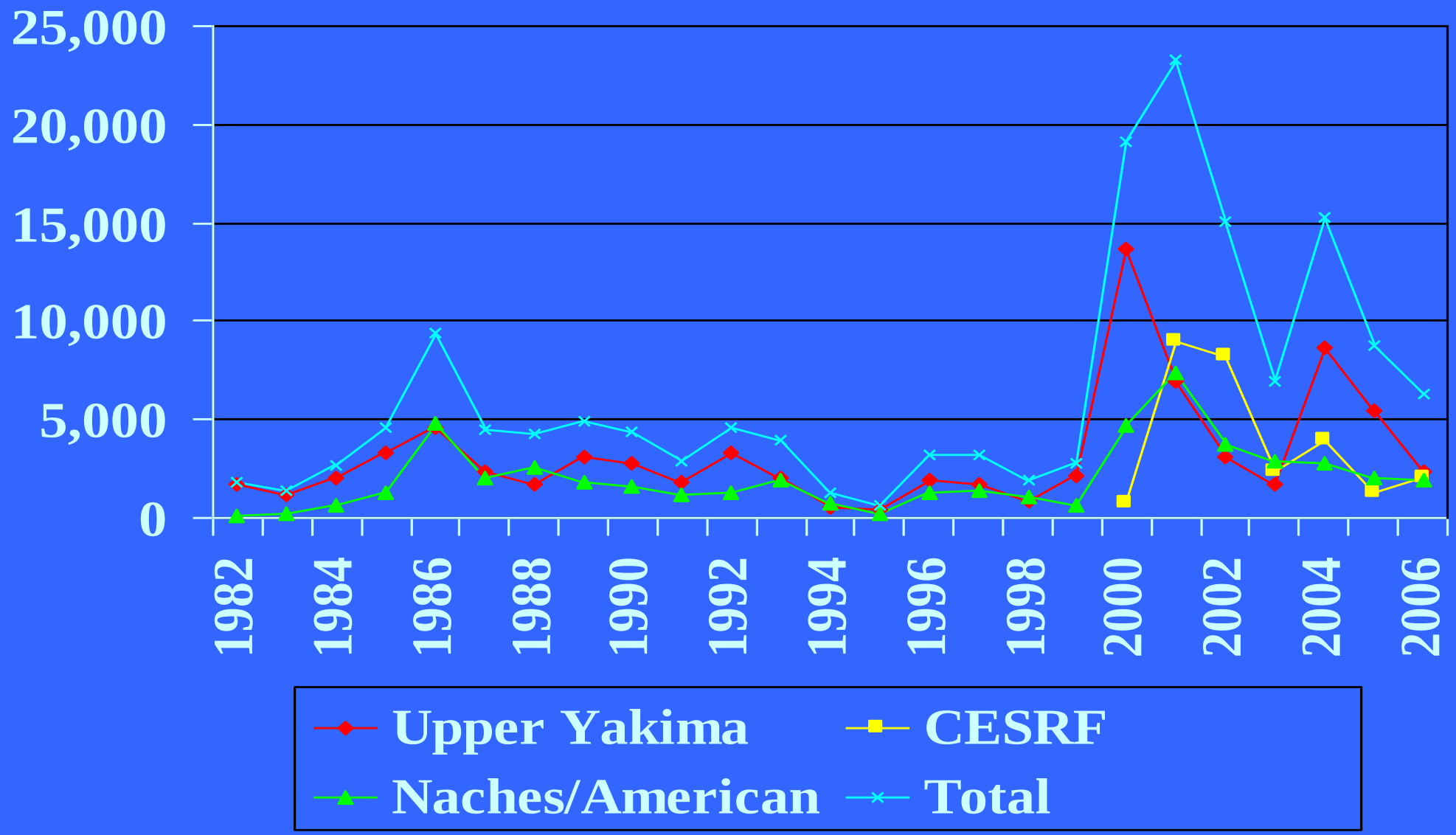



25000
20000
15000
10000
5000
0
80
70
60
50
40
30
20
10
0
12/9
1/8
2/7
3/9
4/8
5/8
6/7
7/7
8/6
9/5
10/5
11/4
12/4
1/3
2/2
Flow
Temperature

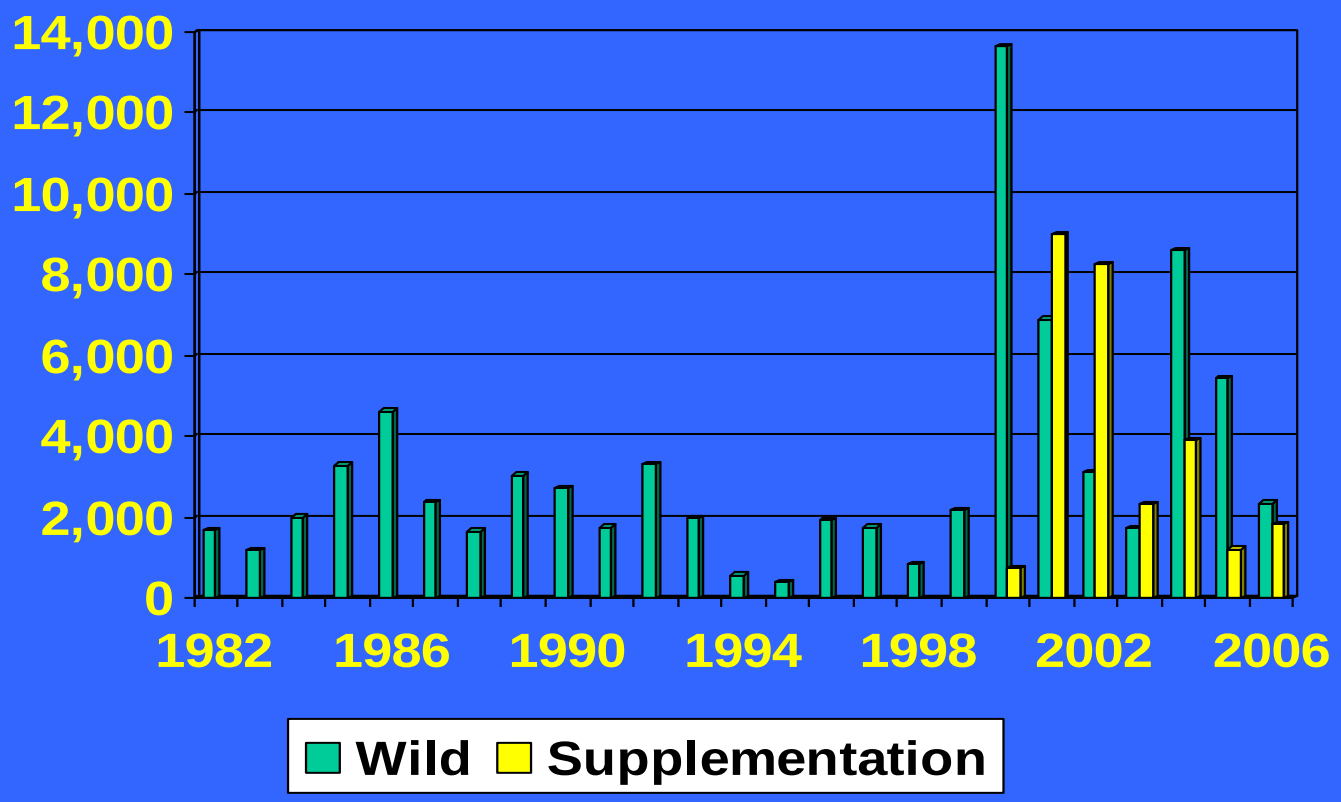
Adult SNT and OCT Treatment Survival Indices within Sites for Brood-Years 1997 through 2001 (2000 through 2005 Adult Returns)



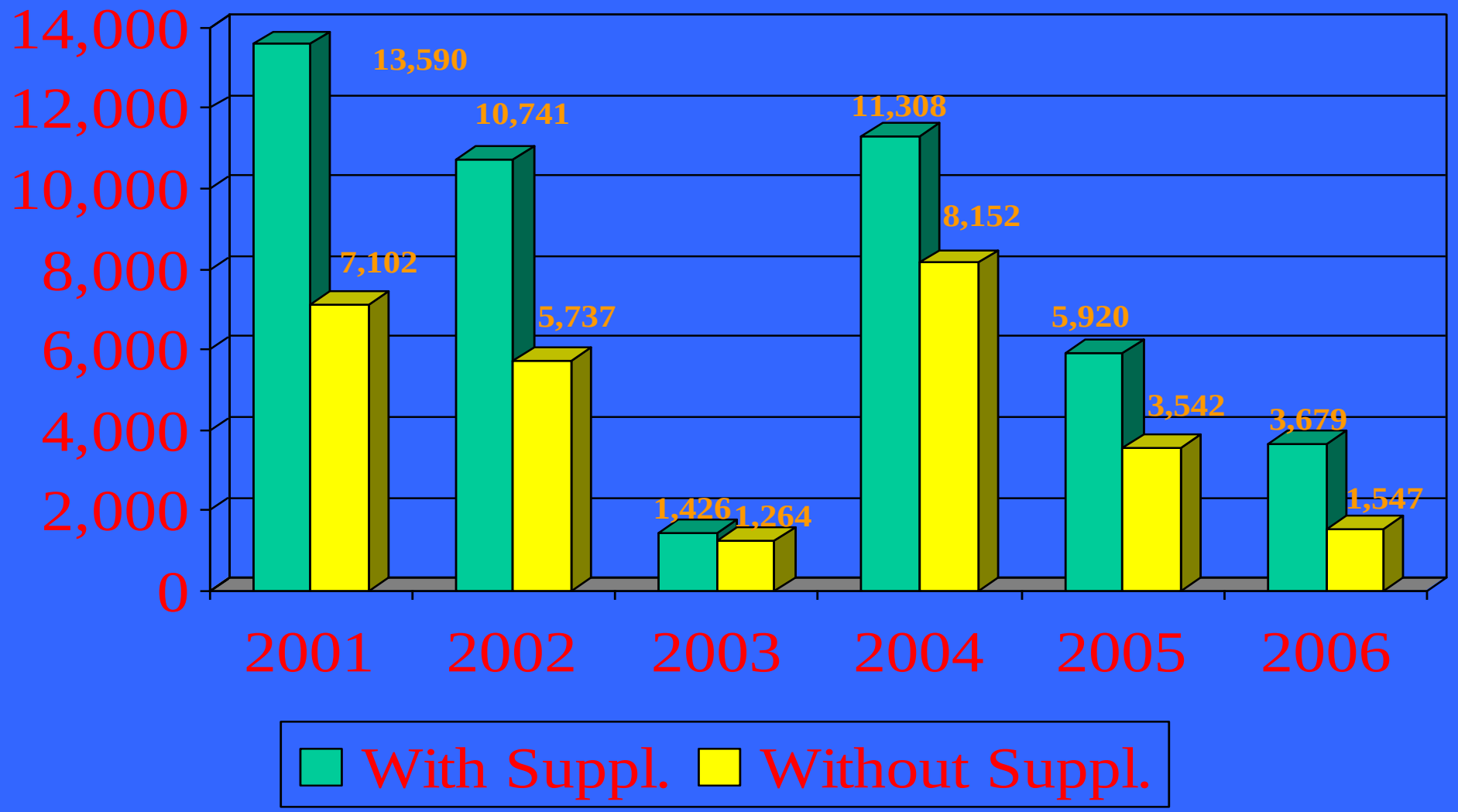
Yakima River Spring Chinook by Stock, 1982 - Present



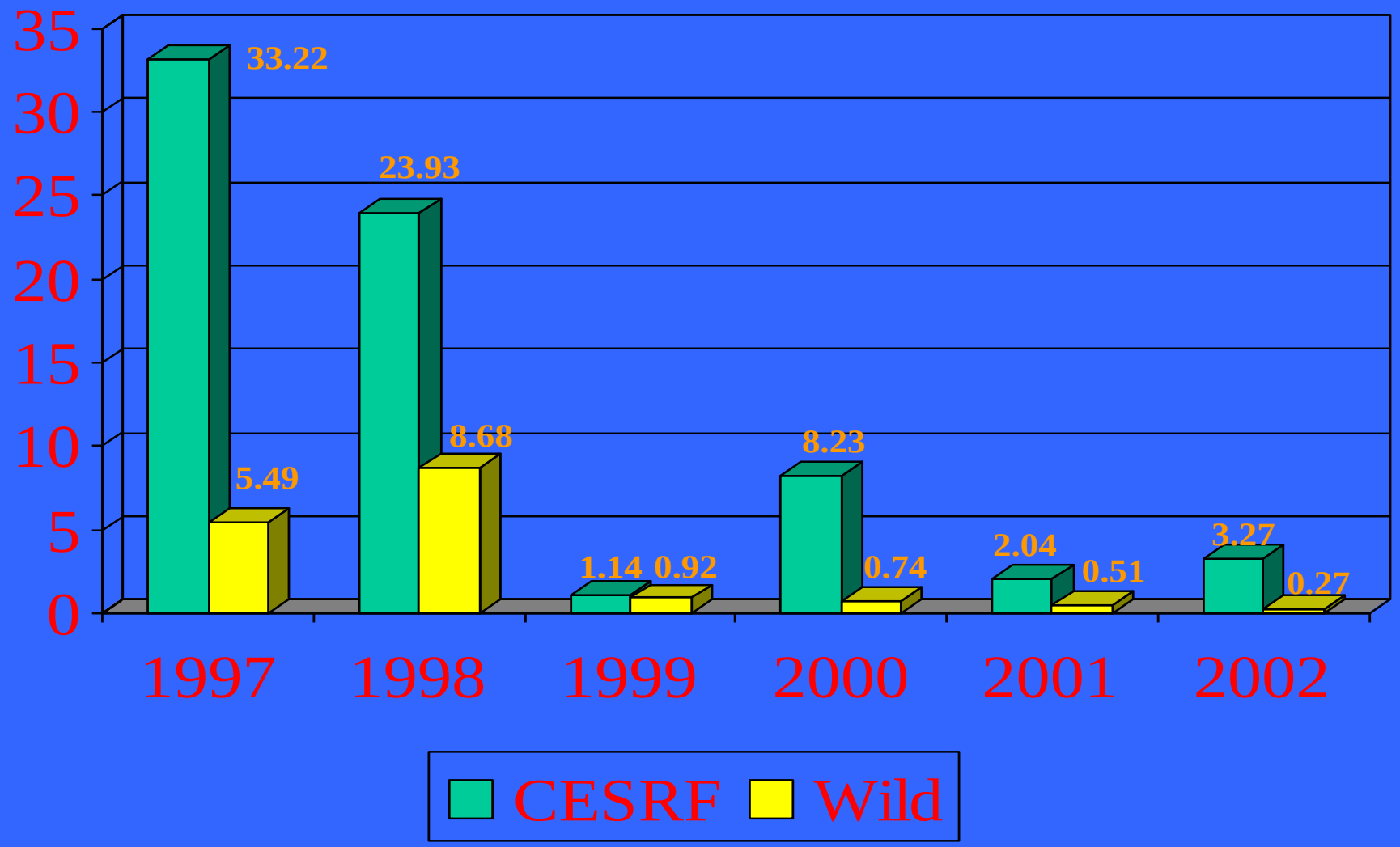
Upper Yakima Spring Chinook Returns, 1982 – 2006



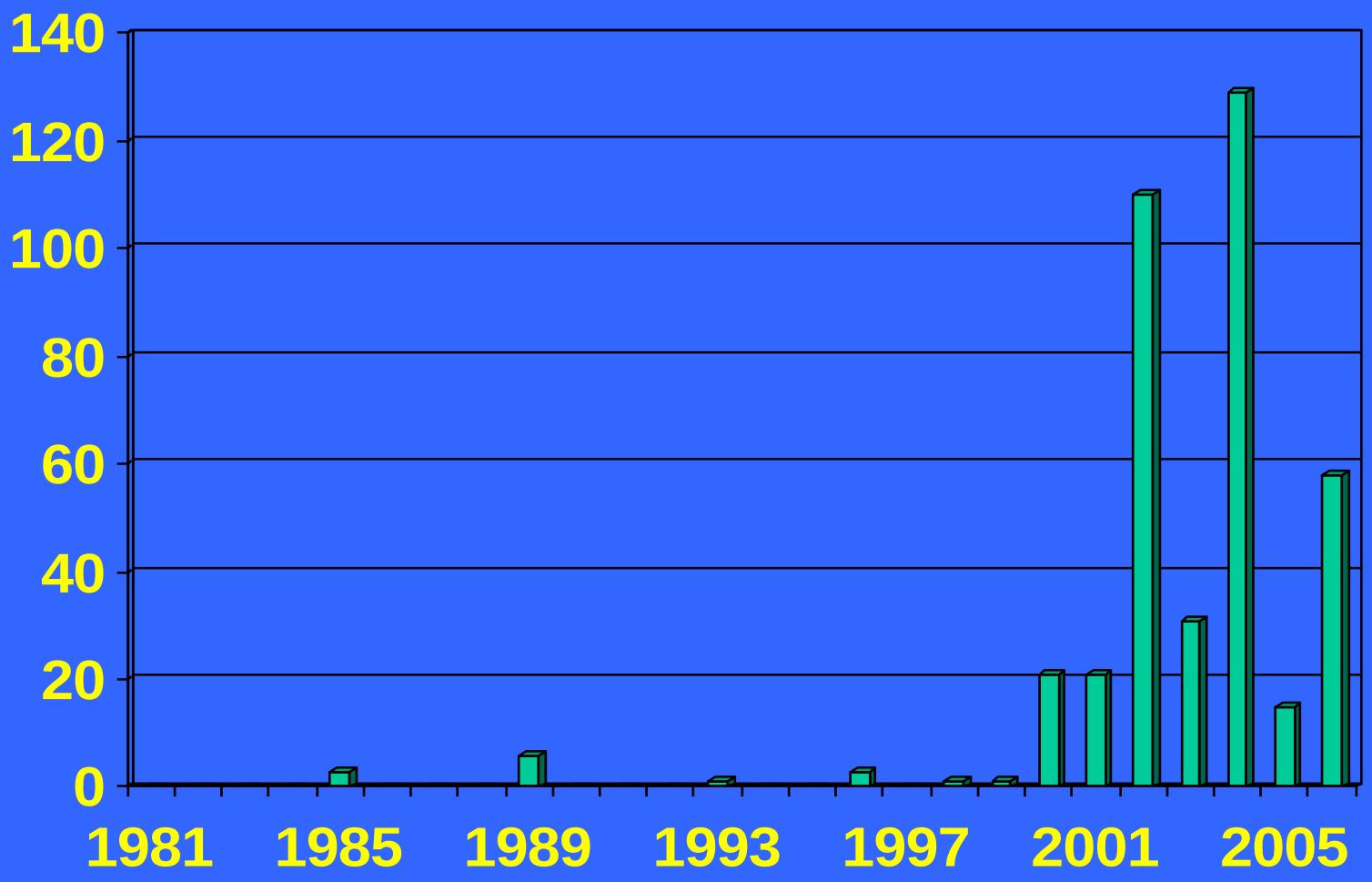
Upper Yakima Spring Chinook
Age 4 Returns with and without Supplementation



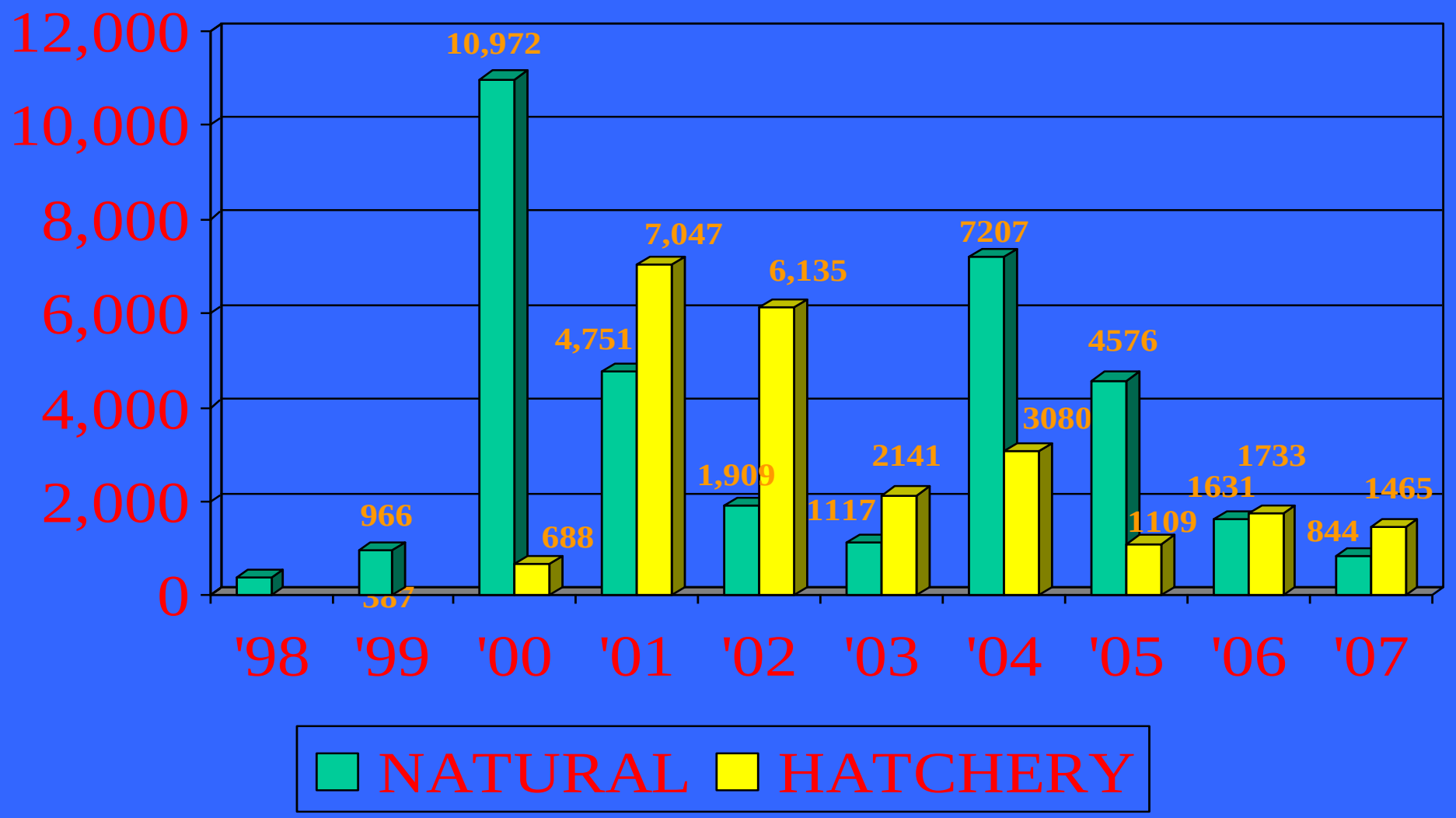
Upper Yakima Spring Chinook
Return-per-Spawner rates
Brood Years 1997-2002



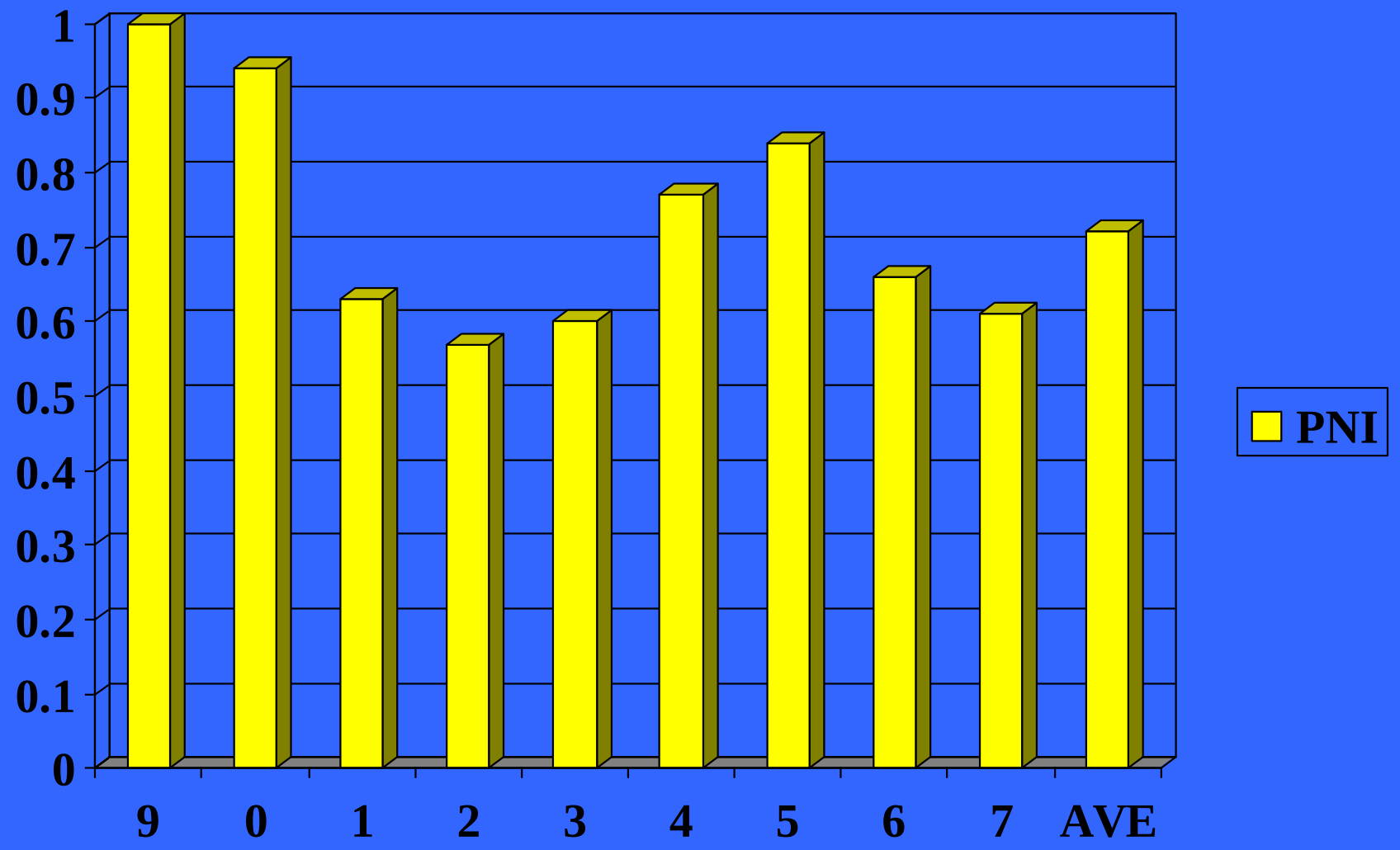
Teanaway R. Spring Chinook Redd Counts, 1981 - 2006



Upper Yakima Spring Chinook
Natural and Hatchery Fish on the Spawning Grounds



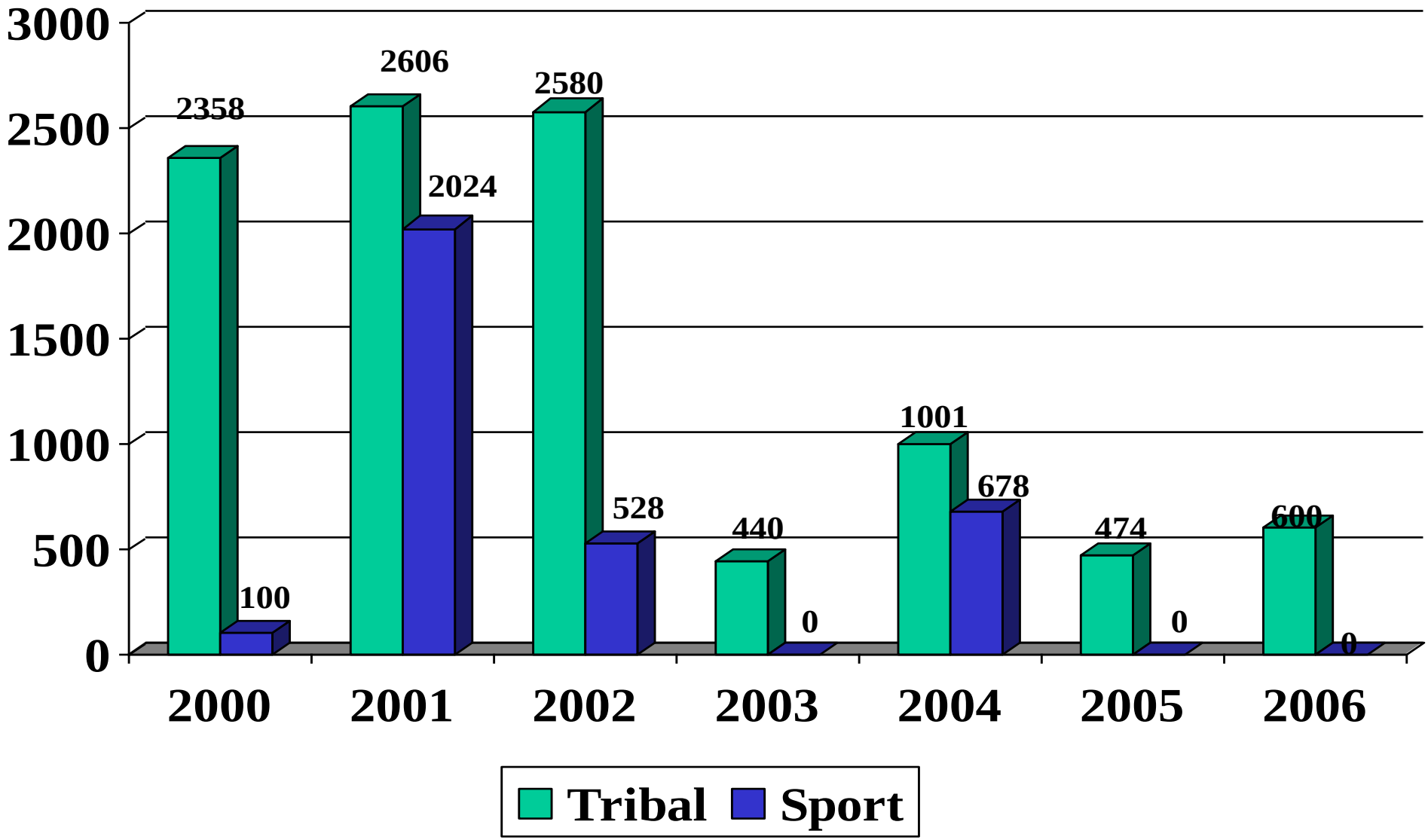
Annual and Average PNI



YKFP
Spring Chinook Supplementation Project

Enhanced the tribal subsistence
And ceremonial fisheries
&
Initiated the first sport fisheries
In over 50 years

Yakima Spring Chinook Harvest



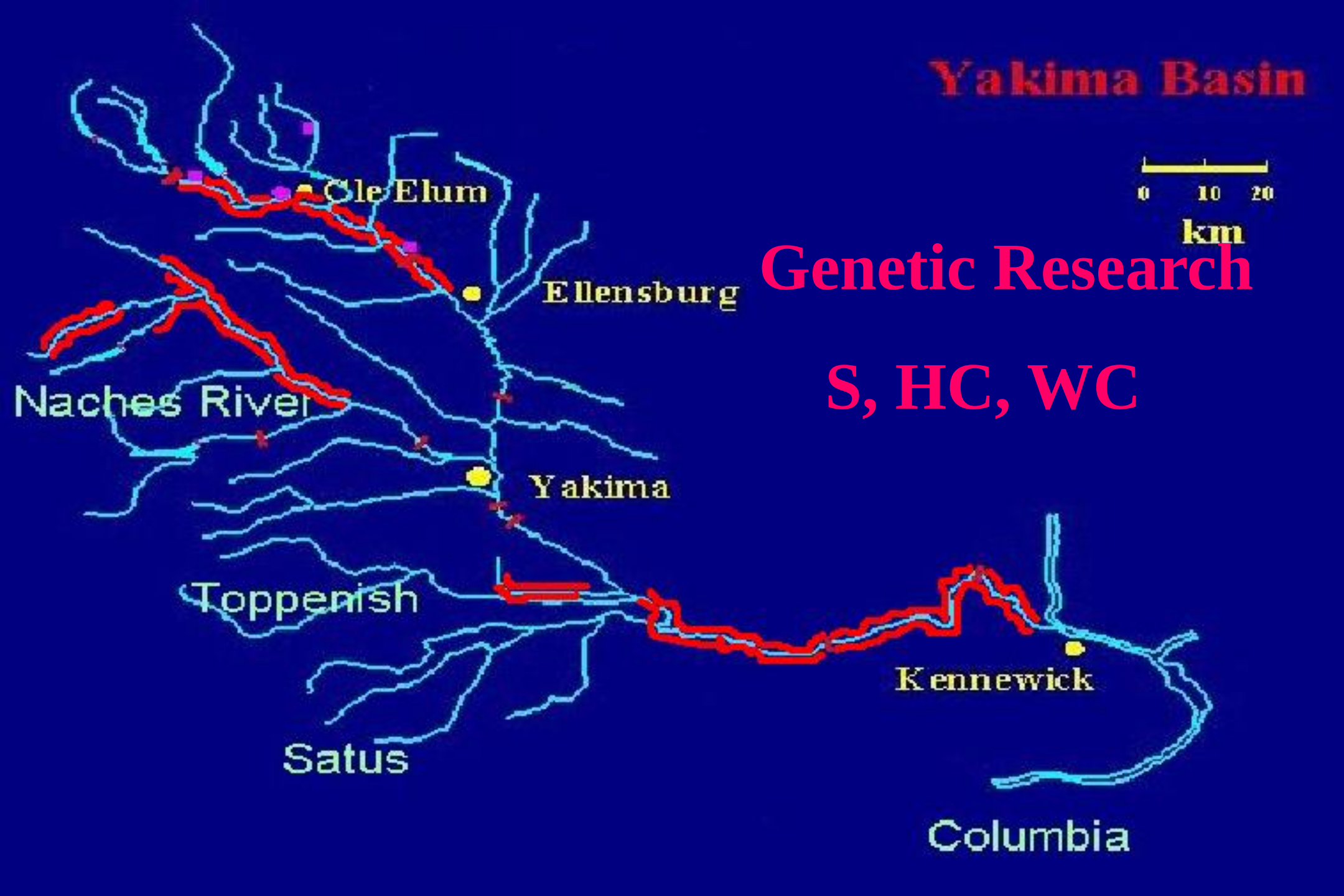
Current Hi-Low Study – Survival vs. Precocialism

- **Program appeared to increase precocial fish on the spawning grounds.**
- **Hypothesized that growth regime allows earlier sexual maturity.**
- **Designed study to evaluate effects of high vs lower growth rate on survival and precocializm.**

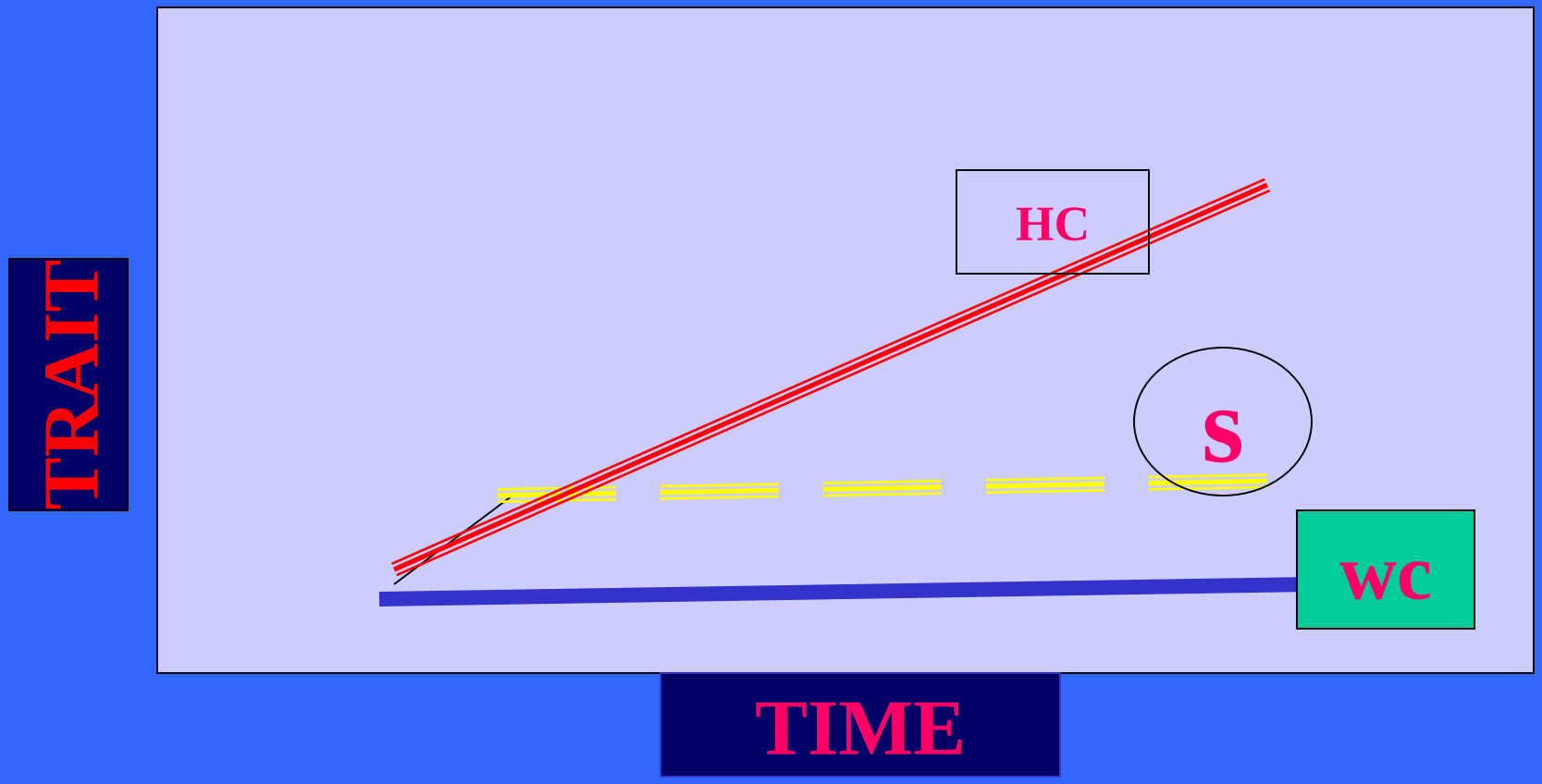
DOMESTICATION RESEARCH

- Supplementation Line – S
- Wild Control Line – WC
- Hatchery Control Line – HC

Potential to evaluate the level of domestication that is occurring in the YKFP Supplementation Line (S) and compare to the Hatchery Control Line (HC) of traditional hatcheries as well as an unsupplemented population (W).


Yakima Basin
0 10 20
km
Cle Elum
Ellensburg
Naches River
Yakima
Toppenish
Satus
Kennewick
Columbia
Genetic Research
S, HC, WC

DOMESTICATION – HYPOTHETICAL OUTCOMES

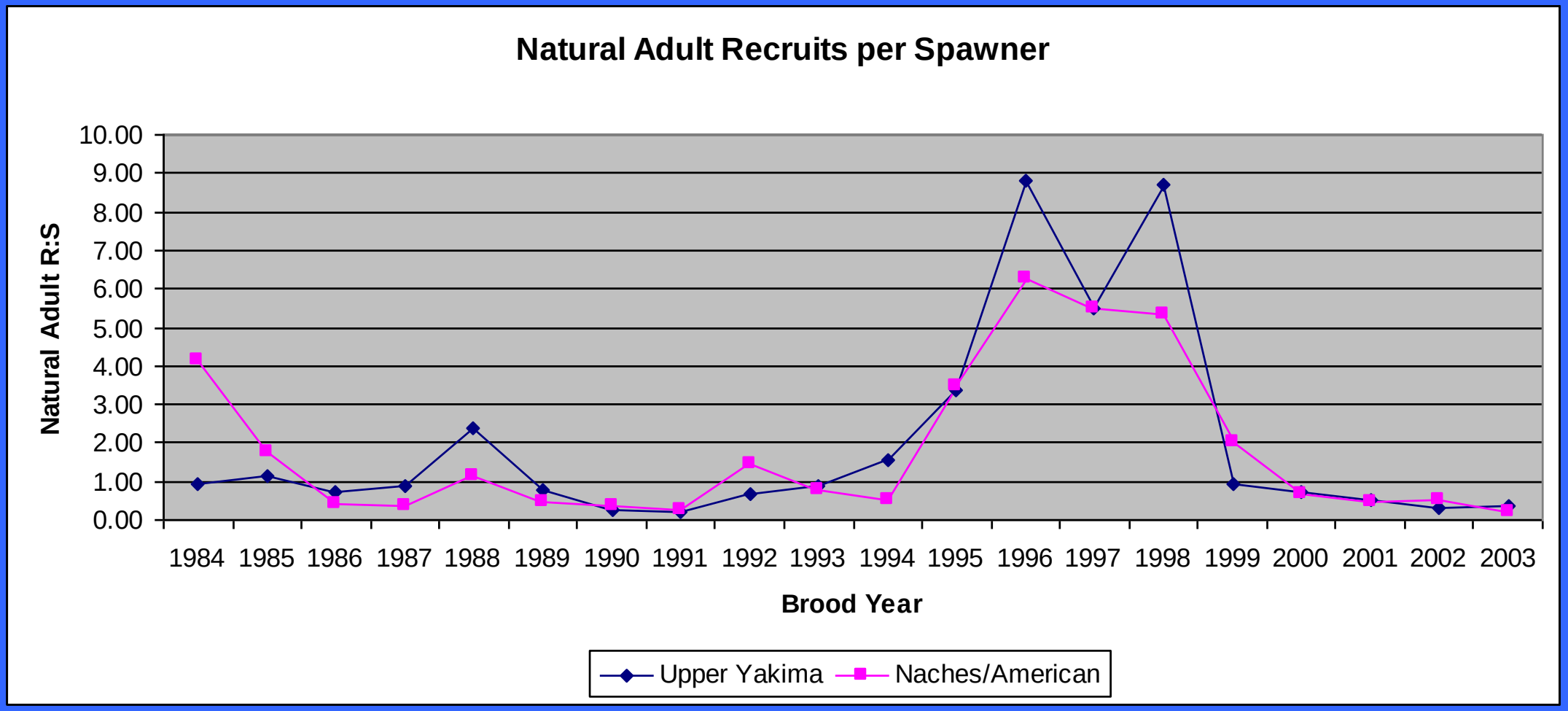


JUVENILE TRAITS

- 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


Natural Adult Recruits per Spawner
Natural Adult R:S
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
Brood Year
Upper Yakima
Naches/American

IMPROVE NATURAL PRODUCTION

3. Maintain Homing and Site Selection

* Homing to Acclimation Sites
* Redd Characterization and Selection

4. Reproductive Success

* Laboratory
* Spawning Channel
* Hatchery & Wild Redd Characteristics

HOMING FIDELITY -Upper Yakima Acclimation Sites


NRS


Reproductive Success
Comparative behavioral/reproductive fitness research

Breeding Success Of Wild & First Generation Hatchery Female Spring Chinook In An Artificial Stream

S.L. Schroder,

C.M. Knudsen,

T.N. Pearsons,

S.F. Young,

T.W. Kassler,

C. Busack

D.E. Fast &

B.D. Watson

Spawning Channel

Measuring
Reproductive
Success

Microsatellite
Pedigree
Analysis


DAD

Thursday June 12 – Fish Science

- Ecological Interactions
- Fish and Bird Predation
- Coho Salmon Reintroduction
- Fall Chinook Supplementation
- Early Fall (Summer) Reintroduction
- Steelhead genetics, Kelt Update, Monitoring on Satus, Toppenish and Ahtanum Creeks
- Panel on Water Storage Issues
- Pacific Ocean Shelf Tracking (POST)
- CWU – habitat assemblages of stream fishes
- Declining amphibians in the Yakima Basin

Northern Pike Minnow Predation and Movement

Presented by
Michael Berger, Joe Jay Pinkham
Linda Lamebull

Yakama Nation

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

Ann E. Stephenson
Yakima Klickitat Fisheries Project
Yakama Nation Fisheries

YKFP Coho Program

- Program Goal - Re-establish self-sustaining naturally spawning population of coho salmon in Yakima River

  Phase I: 1999-2003 ***Completed*** (Yes, it is possible to re-establish an extinct stock of Coho Salmon)

- Feasibility

  Phase II: 2006-2010 (Can escapement goals be obtained using an established, fully developed Yakima Basin Coho Stock and, can re-establishment occur in tributaries)

Fall Chinook Supplementation

Kelt Pictures Before and After

Cle Elum Dam Passage Study
Outfall of Flume into River

Keynote Speaker
Dr. Thomas P. Quinn

- Anderson, J. H. and T. P. Quinn. 2007. Movements of adult coho salmon (*Oncorhynchus kisutch*) during colonization of newly accessible habitat. Canadian Journal of Fisheries and Aquatic Sciences 64: 1143-1154.
- Quinn, T. P., I. J. Stewart and C. P. Boatright. 2006. Experimental evidence of homing to site of incubation by mature sockeye salmon (*Oncorhynchus nerka*). Animal Behaviour 77: 941-949.
- Seamons, TR, P Bentzen, TP Quinn. 2007. DNA parentage analysis reveals inter-annual variation in selection: results from 19 consecutive brood years in steelhead trout. Evol. Ecol. Res. 9(3):409-431.
- Quinn, TP, DM Eggers, JH Clark, HB Rich, Jr. 2007. Density, climate, and the processes of prespawning mortality and egg retention in Pacific salmon (*Oncorhynchus* spp.). Can. J. Fish. Aquat. Sci. 64:574-582.