COLUMBIA RIVER HATCHERY SCIENTIFIC REFORM GROUP (HSRG) and RESEARCH IN THE YAKIMA BASIN

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Goals of Hatchery Reform

1) Help to conserve the naturally spawning populations; and
2) Support sustainable fisheries

Hatcheries as a Tool

- Productive, natural habitat provides the greatest certainty
- Hatcheries must be designed, operated, and evaluated in an ecosystem perspective
- Successful programs provide more benefit than risk relative to the watershed
- Thoughtful selection of strategy
  - Integrated or segregated

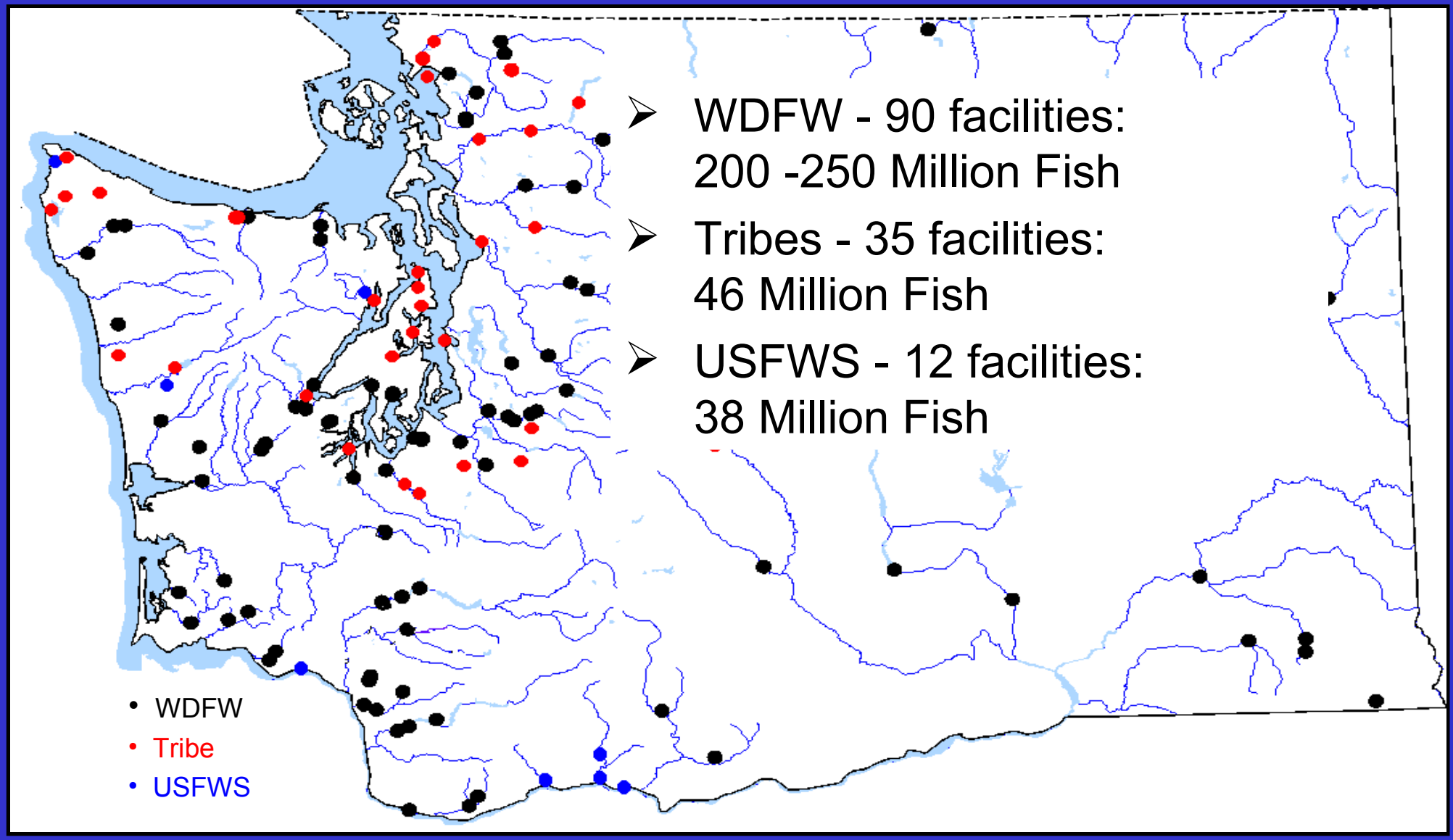
Hatcheries as a Tool

- "Balanced portfolio" represents highest likelihood for success in watershed
- Adaptive management encourages improvement through learning by doing
- Hatchery programs managed by state, tribes, and federal government under legal framework of United States v. Washington and United States v. Oregon decisions

Hatcheries as a Tool

US v Washington

"For the tribes to bear the full burden of the decline caused by the non-Indian neighbors without sharing the replacement achieved through the hatcheries, would be an inequity and inconsistent with the Treaty."


WDFW - 90 facilities:
200 -250 Million Fish
Tribes - 35 facilities:
46 Million Fish
USFWS - 12 facilities:
38 Million Fish
WDFW
Tribe
USFWS

Economic Benefits

- Hatcheries produce between 75% (Puget Sound) and 90% (Columbia River) of total harvest.
- Fisheries provide recreational opportunities for more than one million people every year
- Anglers spend $854 million in Washington annually
- Commercial fisheries generate $250 million in economic benefits

Two types of hatchery programs

1. Genetically Segregated Broodstocks

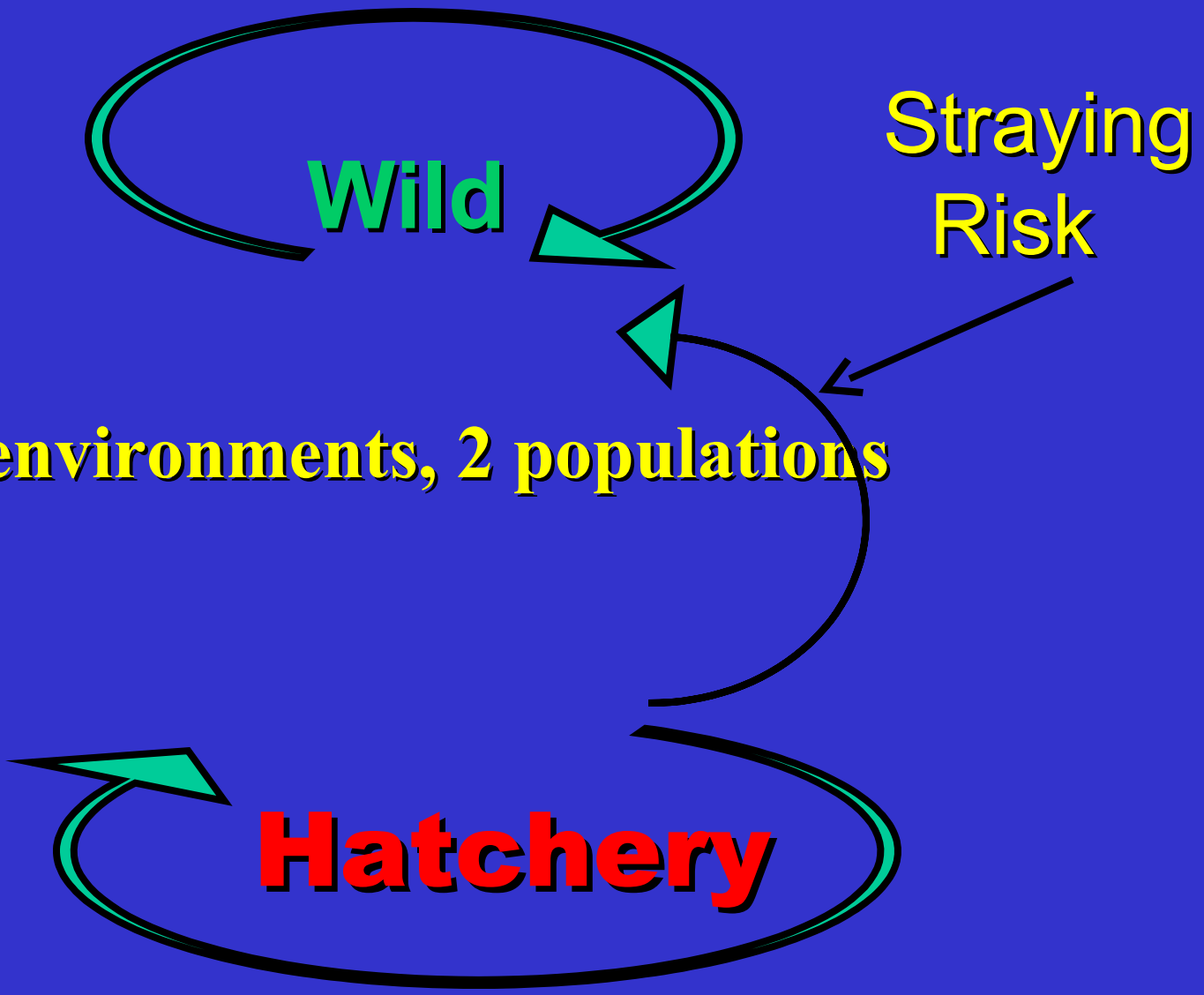
2. Genetically Integrated Broodstocks

Two primary purposes of hatchery fish

9. Provide fish for harvest (most cases)

2. Natural spawning (some cases)

Gene Flow: Segregated Hatchery



Segregated Hatchery Programs: Summary

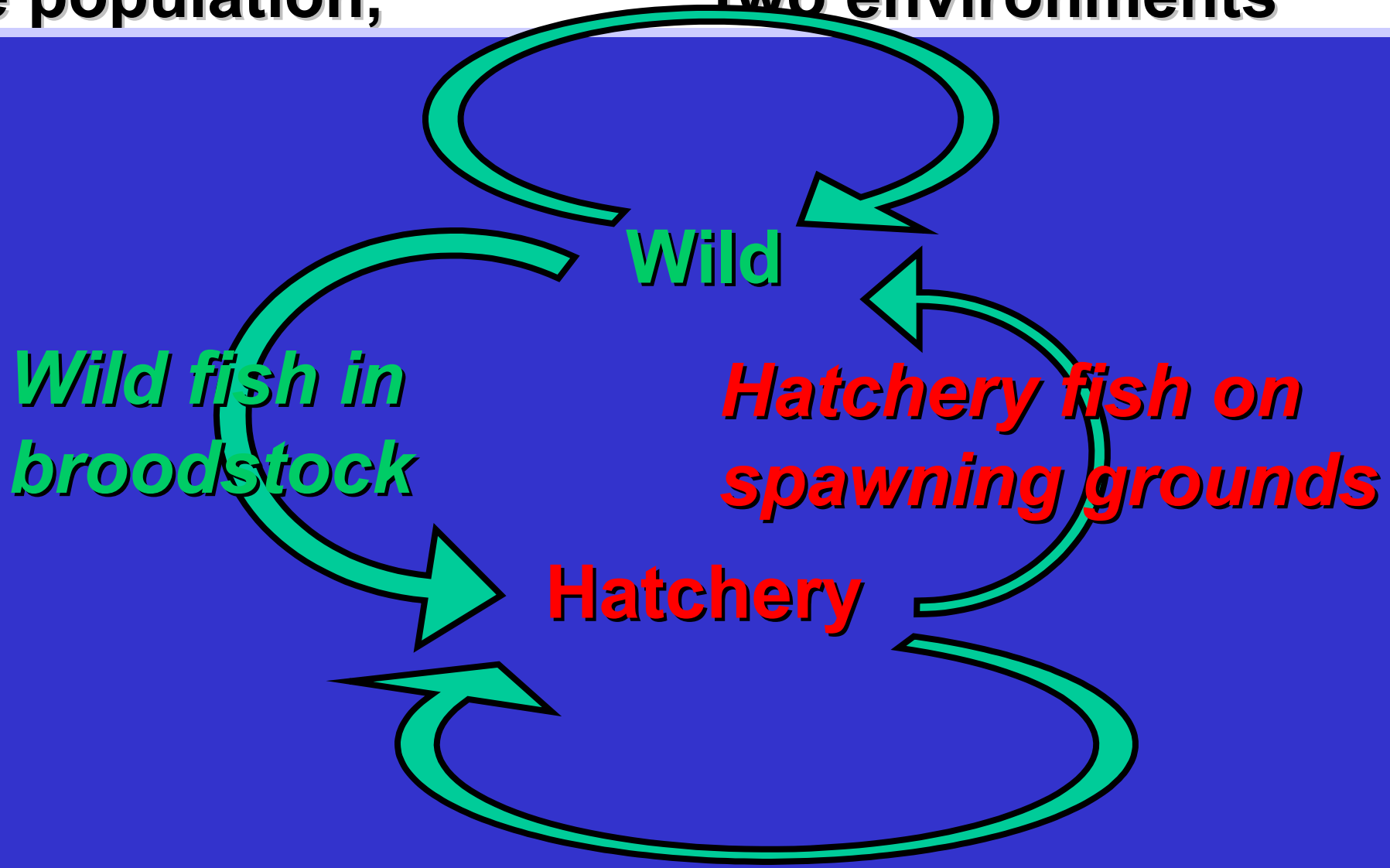
- *Segregated* programs create a new, hatchery-adapted population distinct genetically from natural populations
- Hatchery fish may pose significant genetic and ecological risks to naturally spawning populations

<u>May be appropriate when:</u>

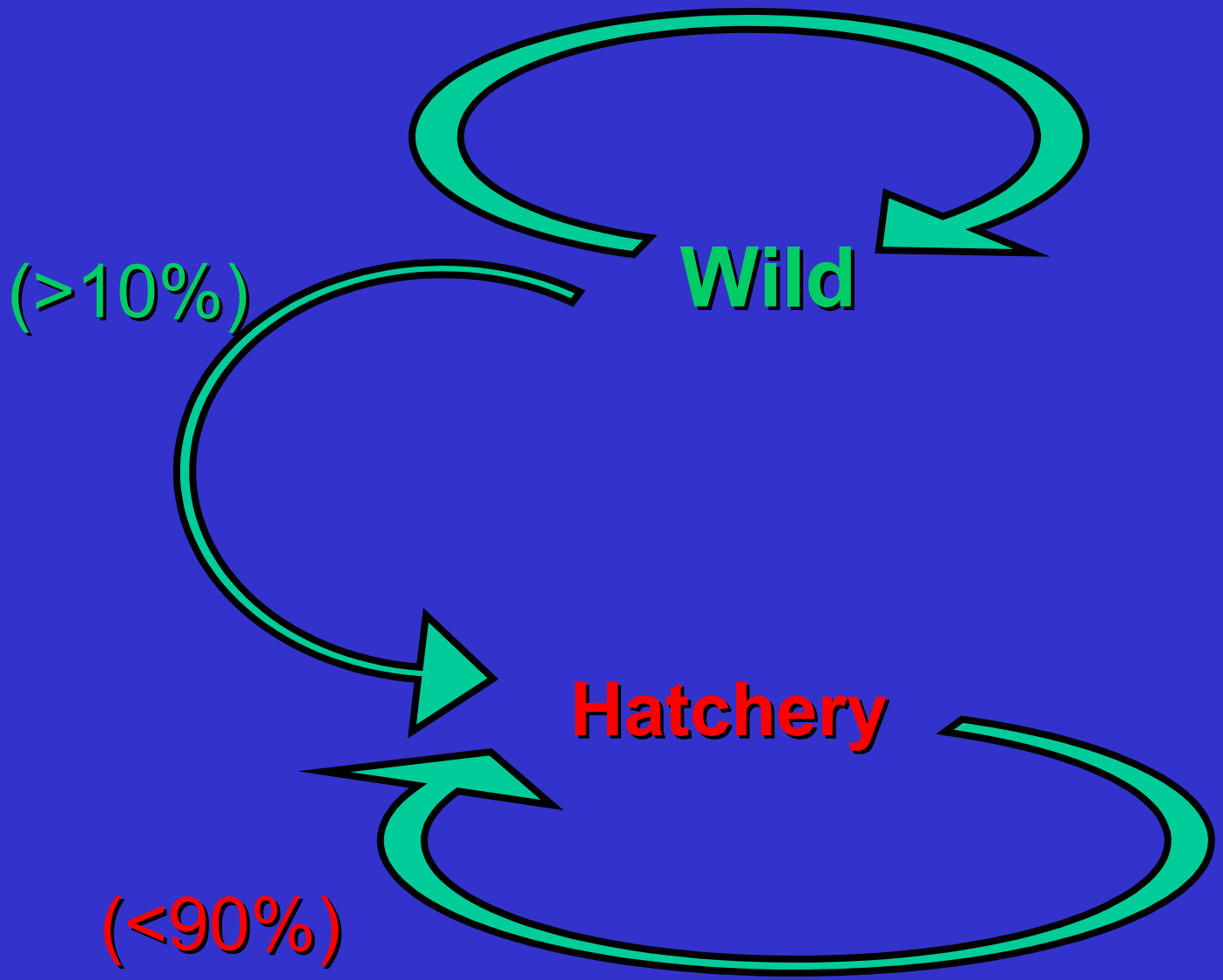
- Very low probability of hatchery fish spawning with natural populations
- Mitigation programs where spawning habitat no longer exists (e.g. mitigation for a hydro-dam)
- Where smolt release and adult recollection facilities are physically separated from natural spawning areas

Integrated Hatchery Programs

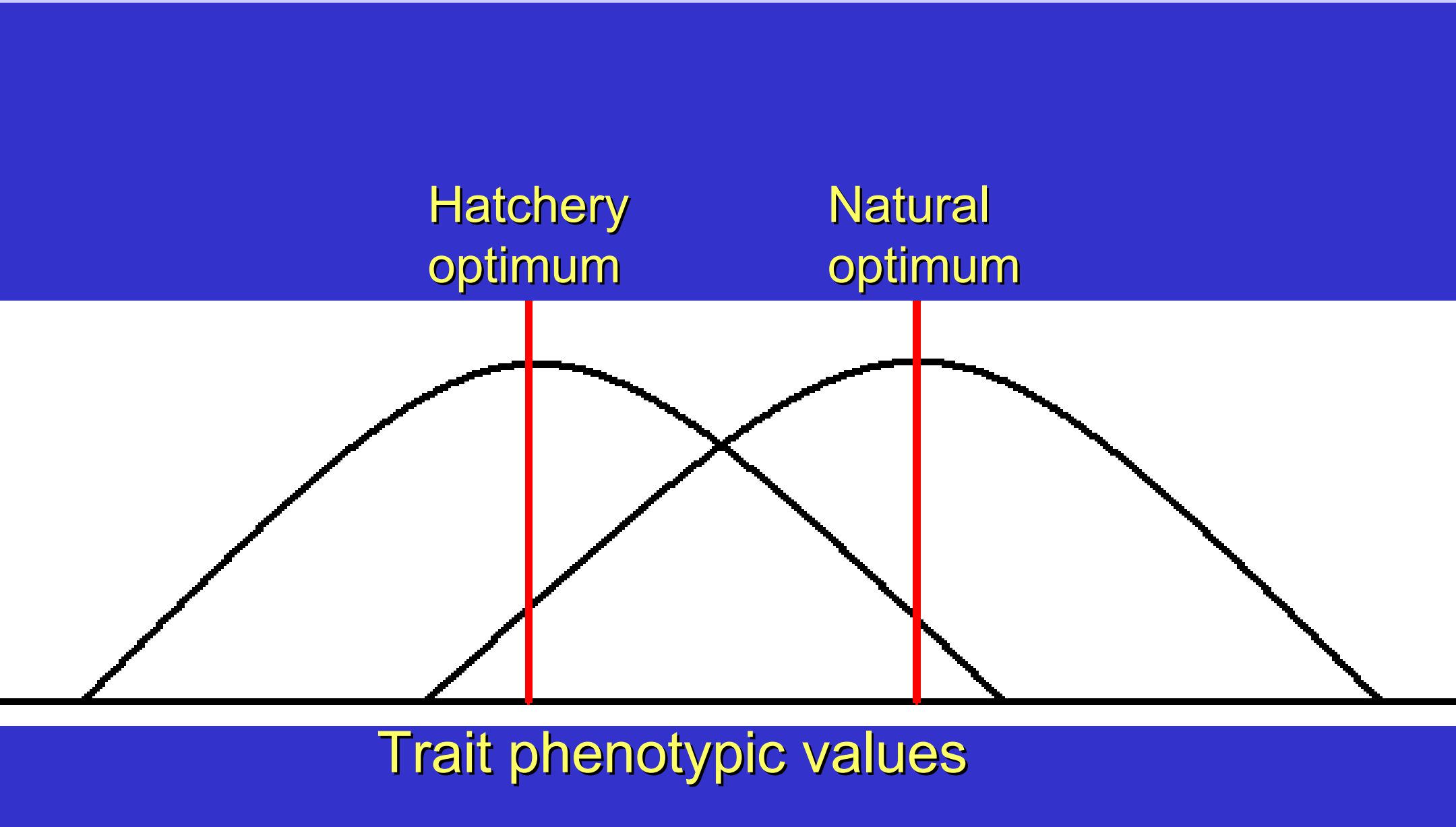
one population, two environments



Minimum gene Flow: Integrated Hatchery



Fitness Optima in Two Environments



Population Parameters

- *HOS* = hatchery-origin spawners
- *NOB* = natural-origin broodstock
- *pHOS* = proportion of natural spawners composed of hatchery-origin adults *(HORs)*
- *pNOB* = proportion of hatchery broodstock composed of natural-origin adults *(NORs)*

Integrated Hatchery Programs: Summary

- Goal: Natural selection in the wild drives the fitness of the population as a whole
- *Integrated* programs are intended to artificially increase the demographic abundance of a natural population gene pool
- Requires a self-sustaining natural population to provide fish for the broodstock
- May be most appropriate for hatchery programs with (a) conservation goals or (b) when the risks of natural spawning by HORs needs to be minimized

Key Points: Integrated/Segregated

- Must be able to ID hatchery- and natural-origin fish in broodstock and on spawning grounds
- Program sizes must be matched to productivity and capacity of natural environment
- Must be able to control numbers of hatchery fish spawning naturally
- Both strategies represent trade-offs

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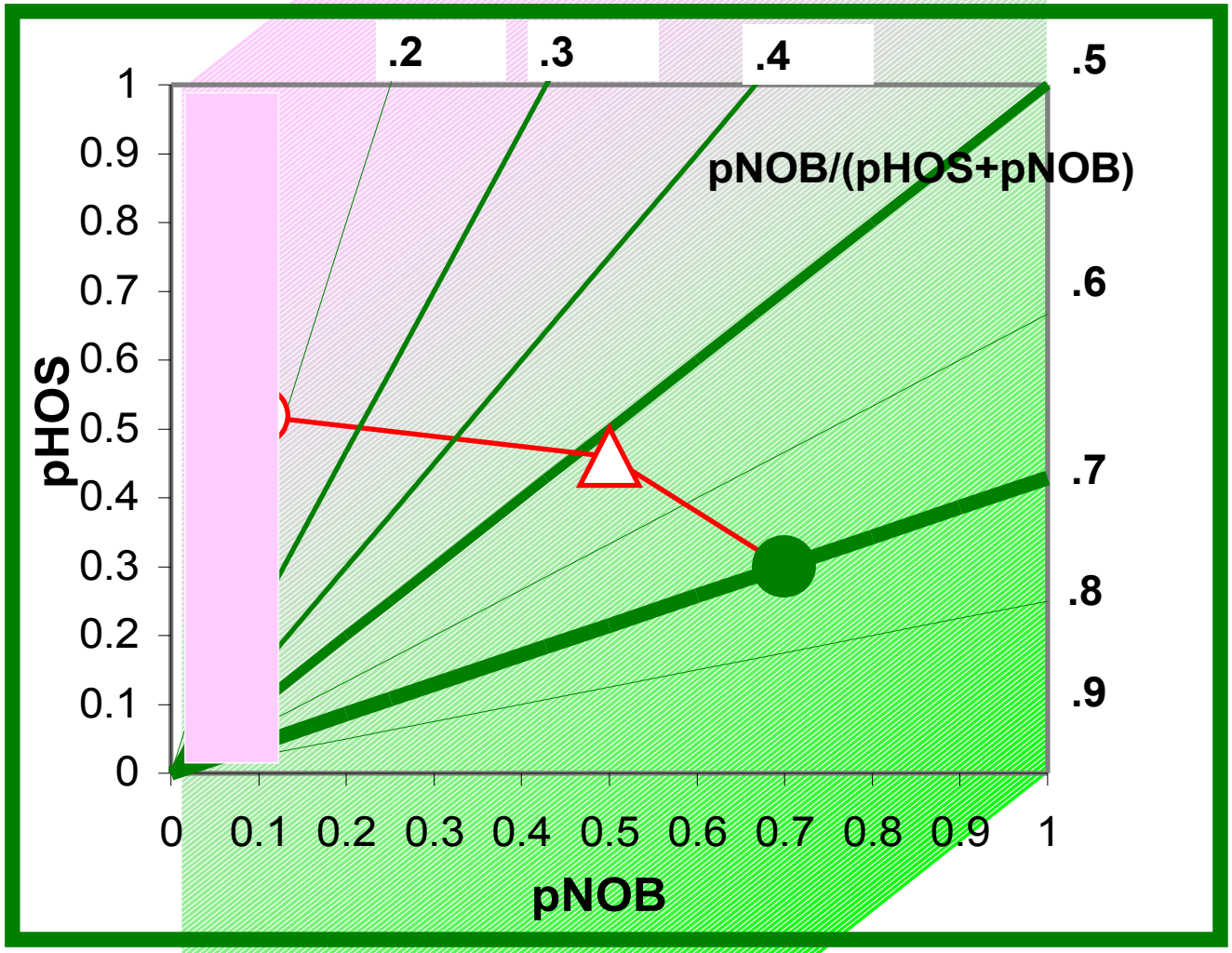
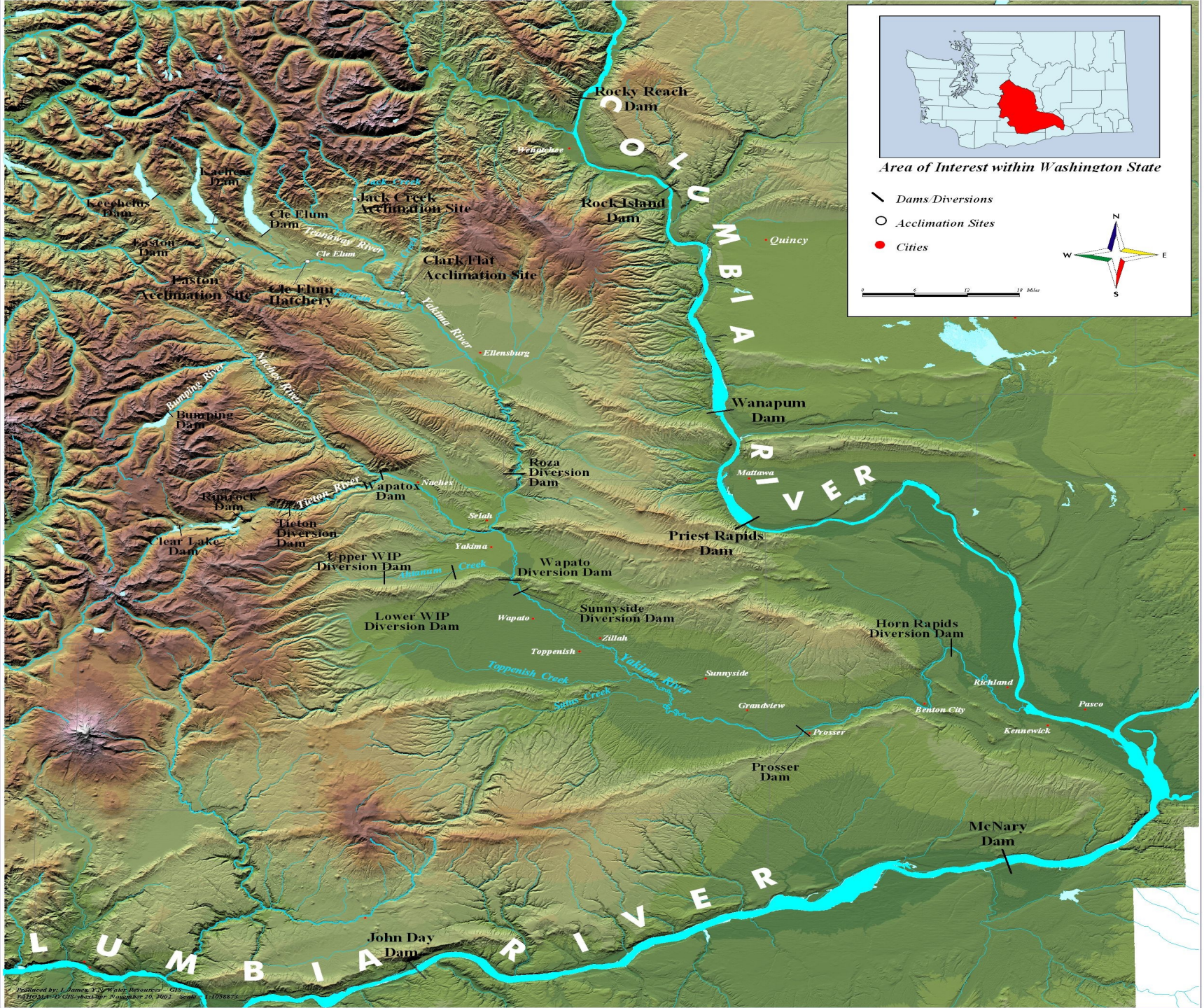

.2
.3
.4
.5
.6
.7
.8
.9
pNOB/(pHOS+pNOB)
pHOS
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1
pNOB

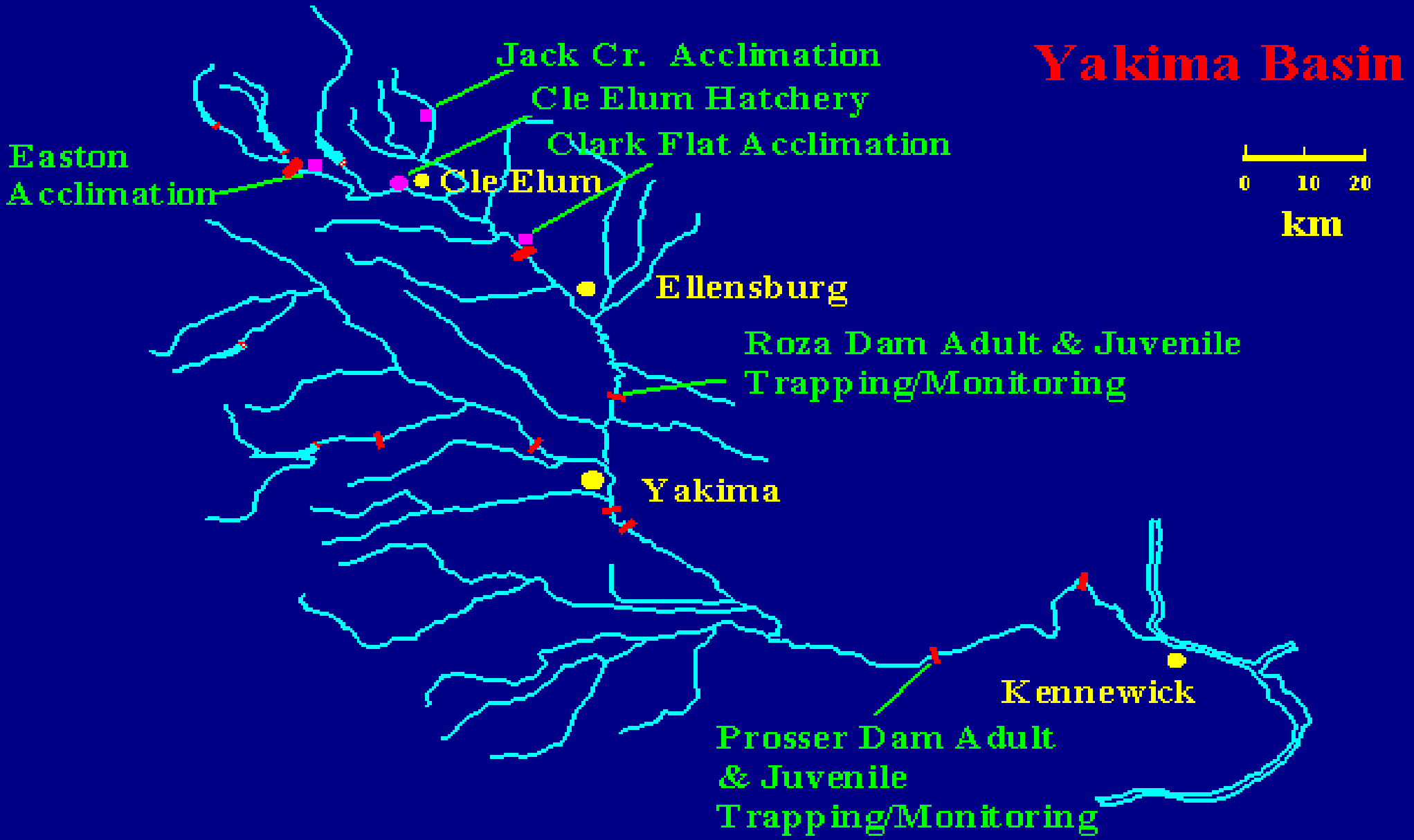

Area of Interest within Washington State
Dams/Diversions
Acclimation Sites
Cities
N
S
E
W
0 6 12 18 Miles
Rocky Reach Dam
Rock Island Dam
Wanapum Dam
Priest Rapids Dam
McNary Dam
John Day Dam
Prosser Dam
Horn Rapids Diversion Dam
Sunnyside Diversion Dam
Wapato Diversion Dam
Roza Diversion Dam
Upper WIP Diversion Dam
Lower WIP Diversion Dam
Tieton Diversion Dam
Wapatox Dam
Clear Lake Dam
Rimrock Dam
Bumping Dam
Cle Elum Dam
Lake Cle Elum
Jack Creek Acclimation Site
Clark Flat Acclimation Site
Easton Acclimation Site
Cle Elum Hatchery
Easton Dam
Keechelus Dam
Kachess Dam
COLUMBIA RIVER
Yakima River
Naches River
Bumping River
Tieton River
Teanaway River
Cle Elum
Ellensburg
Yakima
Selah
Naches
Wapato
Toppenish
Zillah
Sunnyside
Grandview
Prosser
Benton City
Kennewick
Pasco
Richland
Mattawa
Quincy
Wenatchee
Toppenish Creek
Satus Creek
Ahtanum Creek

Estimates of Historical Anadromous Fish Runs in the Yakima Subbasin as Compared to Recent Run Size (5-year Average, 2001-2005)

Species/Race	Pre-1900 Run	Recent Average
Fall Chinook	132,000	4,050
Spring Chinook	200,000	13,870
Summer Chinook	68,000	0
Coho	110,000	2,730
Summer Steelhead	80,500	2,890
Sockeye	200,000	0

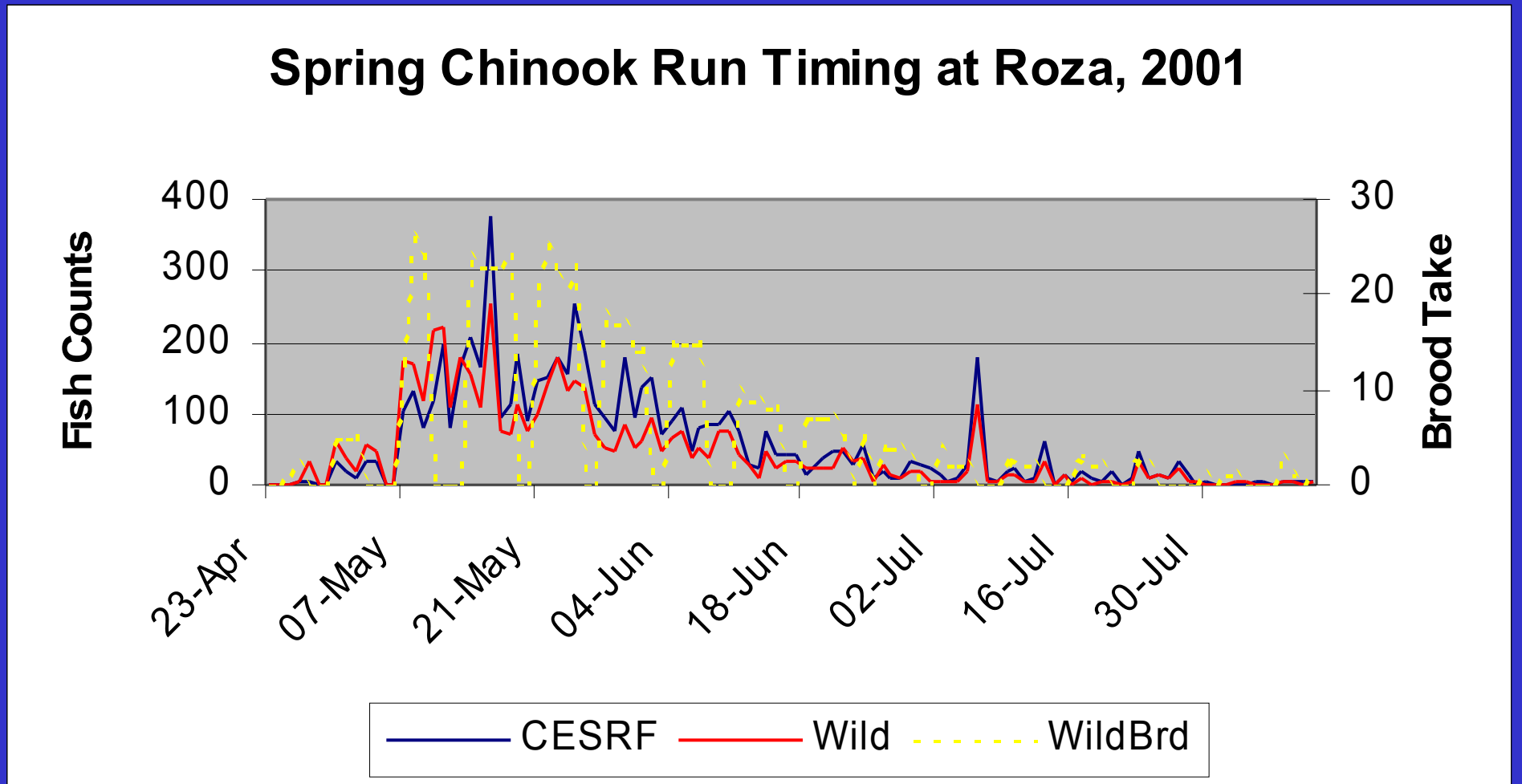
YAKIMA/KLICKITAT FISHERIES PROJECT (YKFP)

- MODELING (EDT) and AHA
- SALMON SUPPLEMENTATION AND REINTRODUCTION PROGRAMS
- INTEGRATED and SEGREGATED PROGRAMS
- HABITAT ACQUISITION AND ENHANCEMENT PROGRAMS


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

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)


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

Cle Elum Supplementation & Research Facility (CESRF)

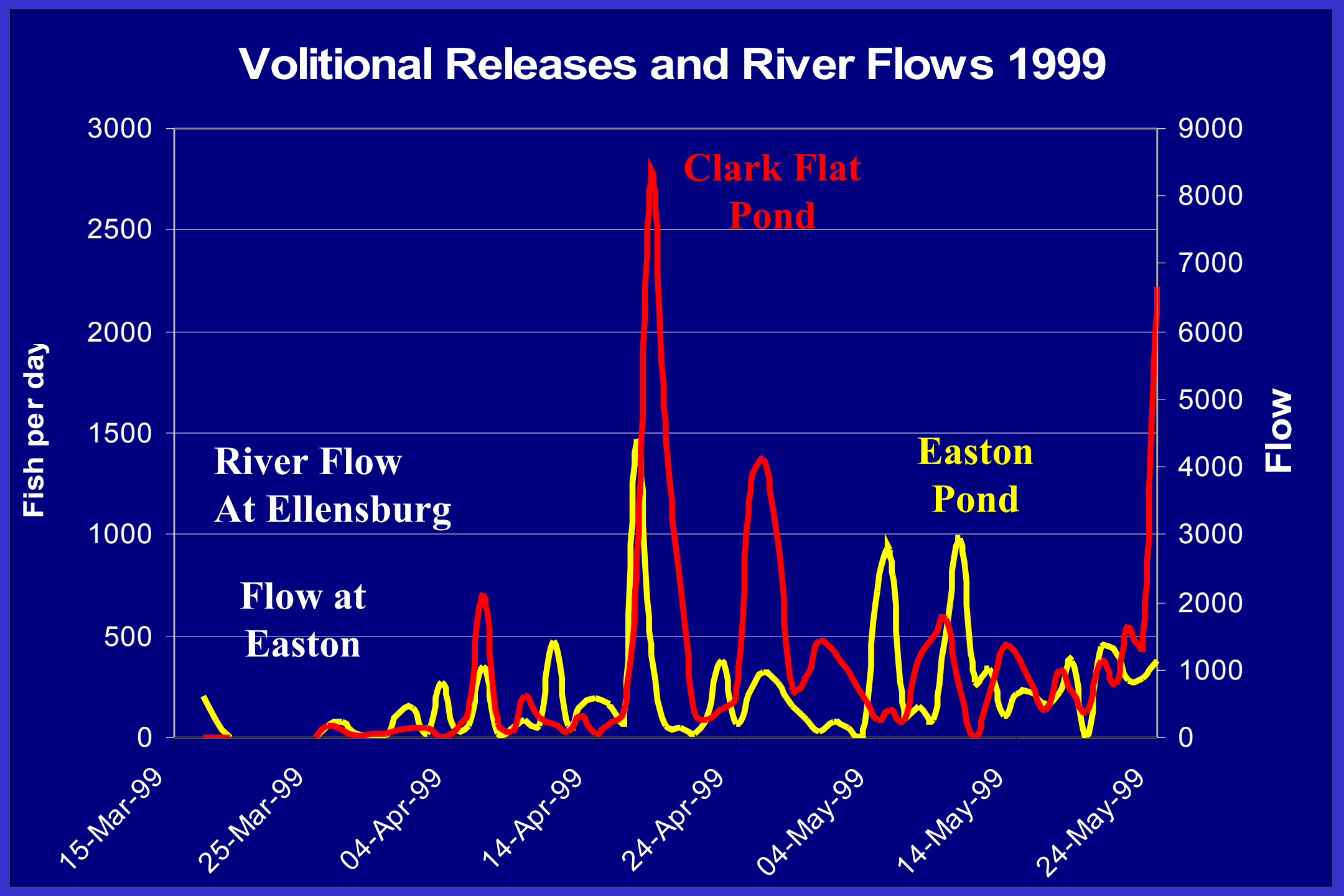

F1
F1


Q# No. 58

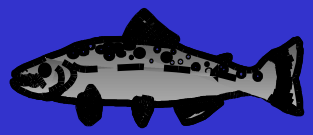

Female #1
Female #2
Male #1
Male #2

-Upper Yakima Acclimation Sites

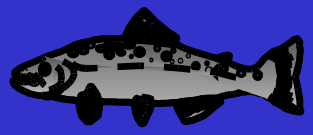
HOMING FIDELITY


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
Clark Flat Pond
Easton Pond
River Flow At Ellensburg
Flow at Easton
15-Mar-99
25-Mar-99
04-Apr-99
14-Apr-99
24-Apr-99
04-May-99
14-May-99
24-May-99

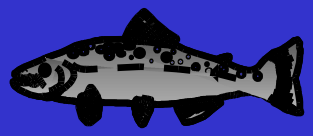
Hatchery Fish Performance will be Measured in Four Areas



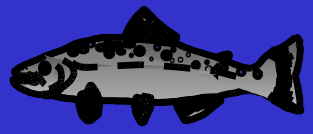
Post-release Survival (smolt release to adult)



Reproductive Success (smolts/spawner)

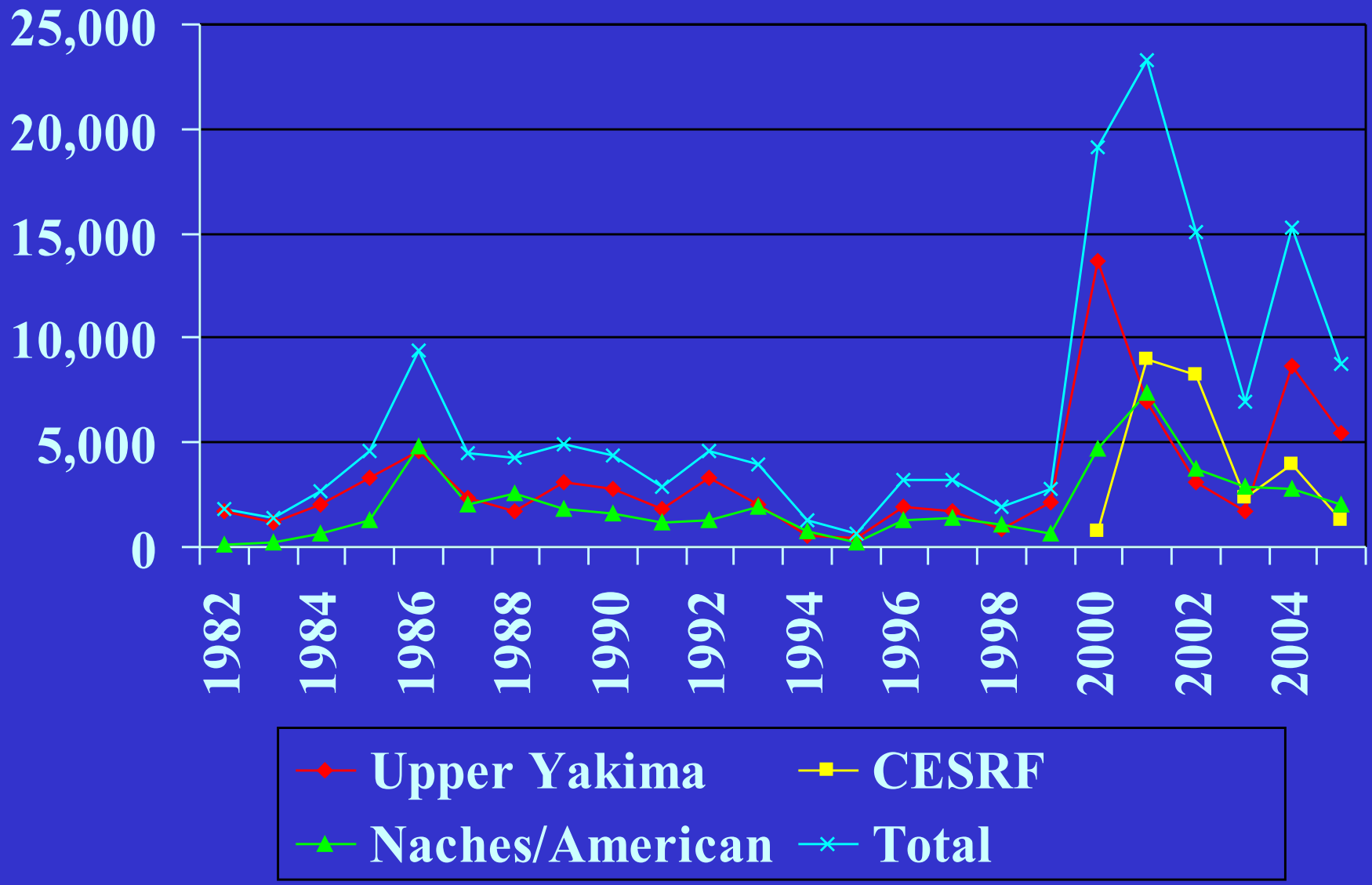


Long Term Fitness (genetic diversity and long term stock productivity)

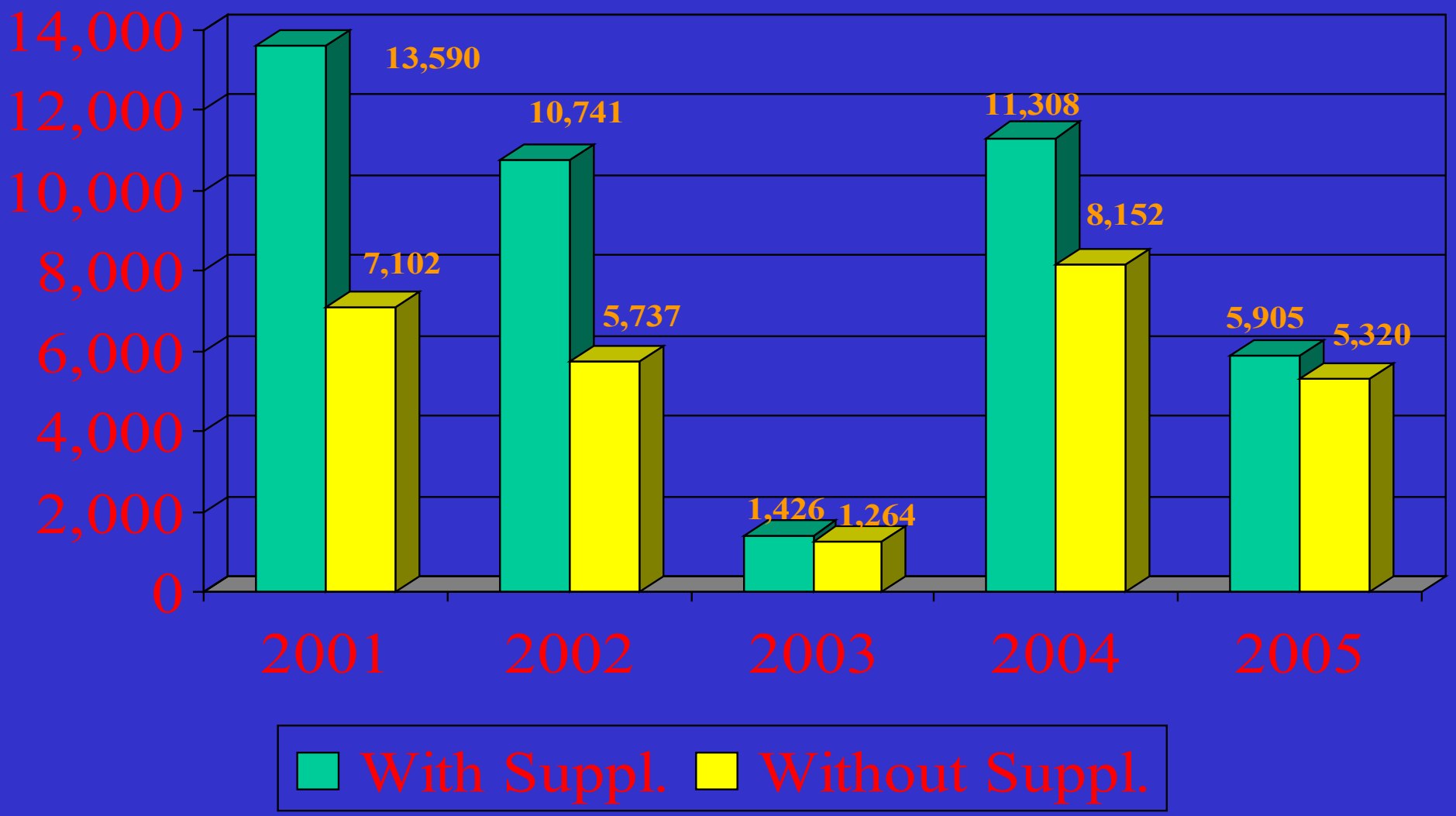


Ecological Interactions (population abundance, and distribution, growth rates, predation and competition)

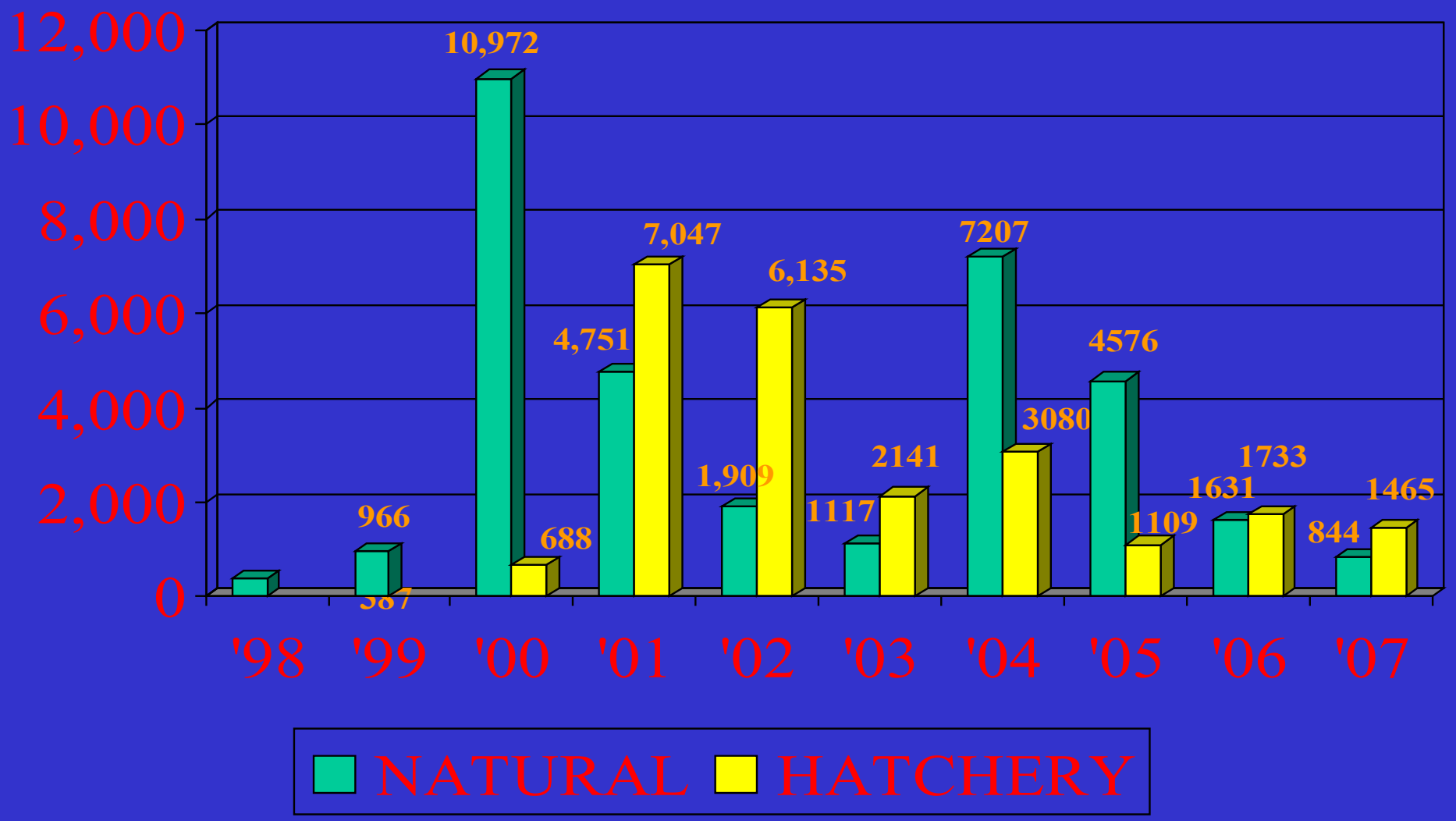
Yakima River Spring Chinook by Stock, 1982 - Present



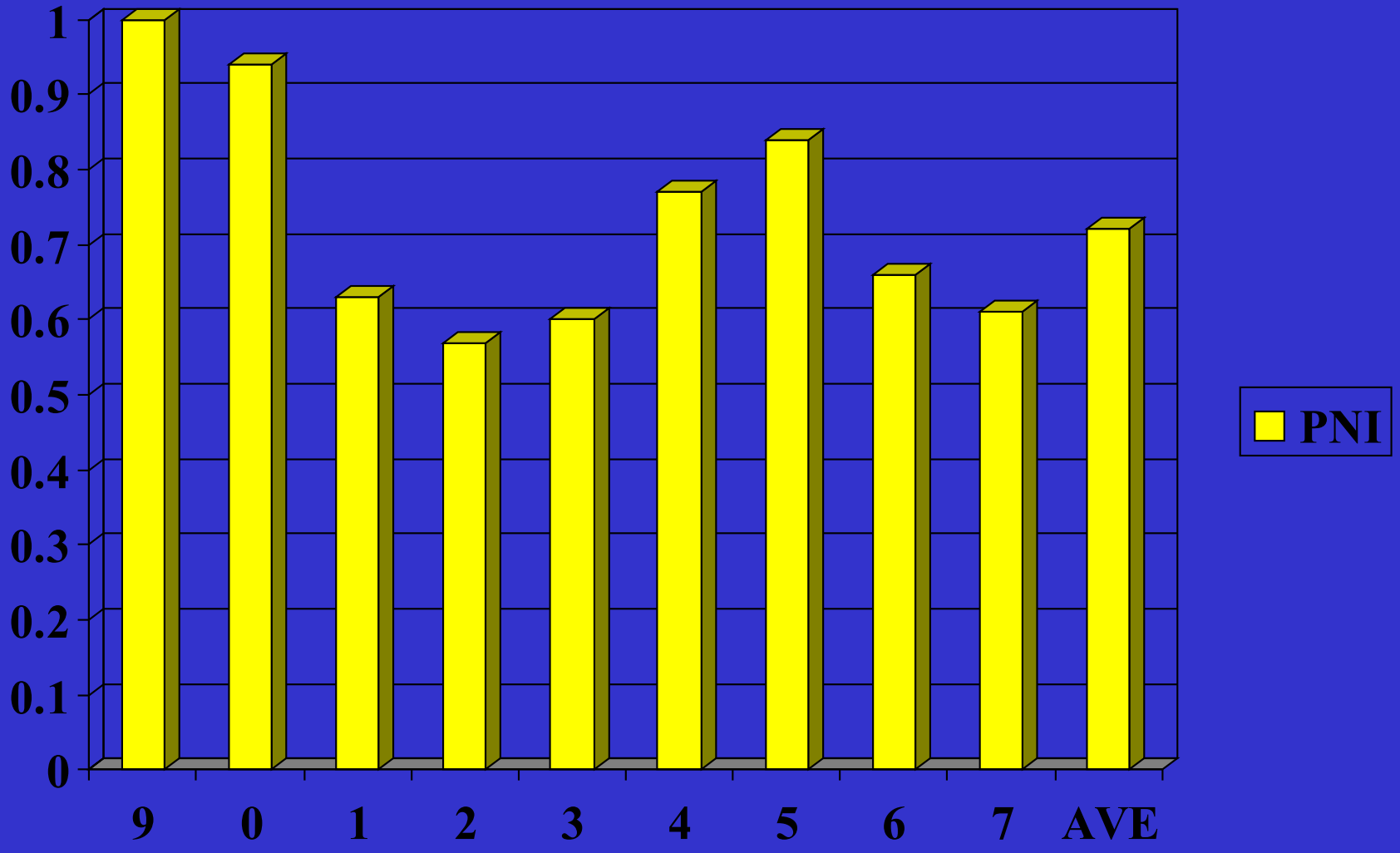
Upper Yakima Spring Chinook
Age 4 Returns with and without Supplementation



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



Annual and Average PNI



HOMING FIDELITY

GPS Salmon Redds


Reproductive Success
Comparative behavioral/reproductive fitness research


DAD

Spawning Channel

Measuring
Reproductive
Success

Microsatellite
Pedigree
Analysis

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