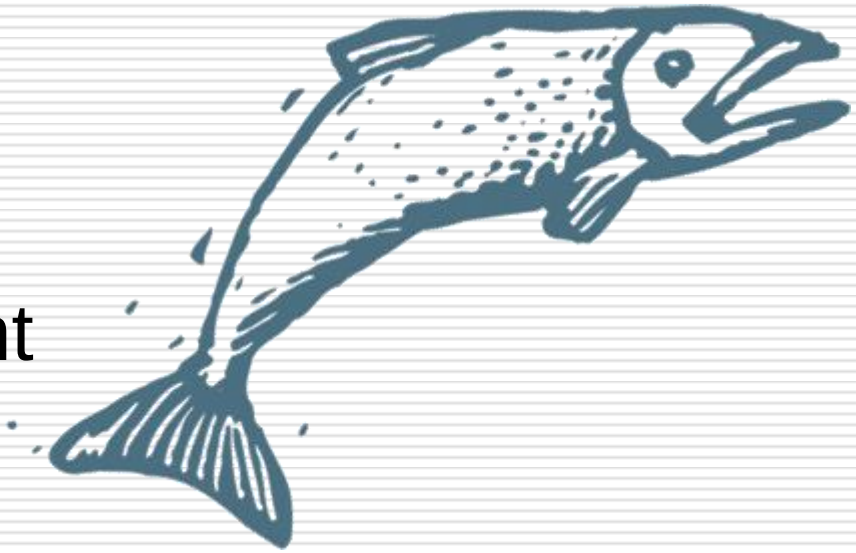
Hatchery Reform in the Pacific Northwest:

Applying Science to
Hatchery and
Harvest Management



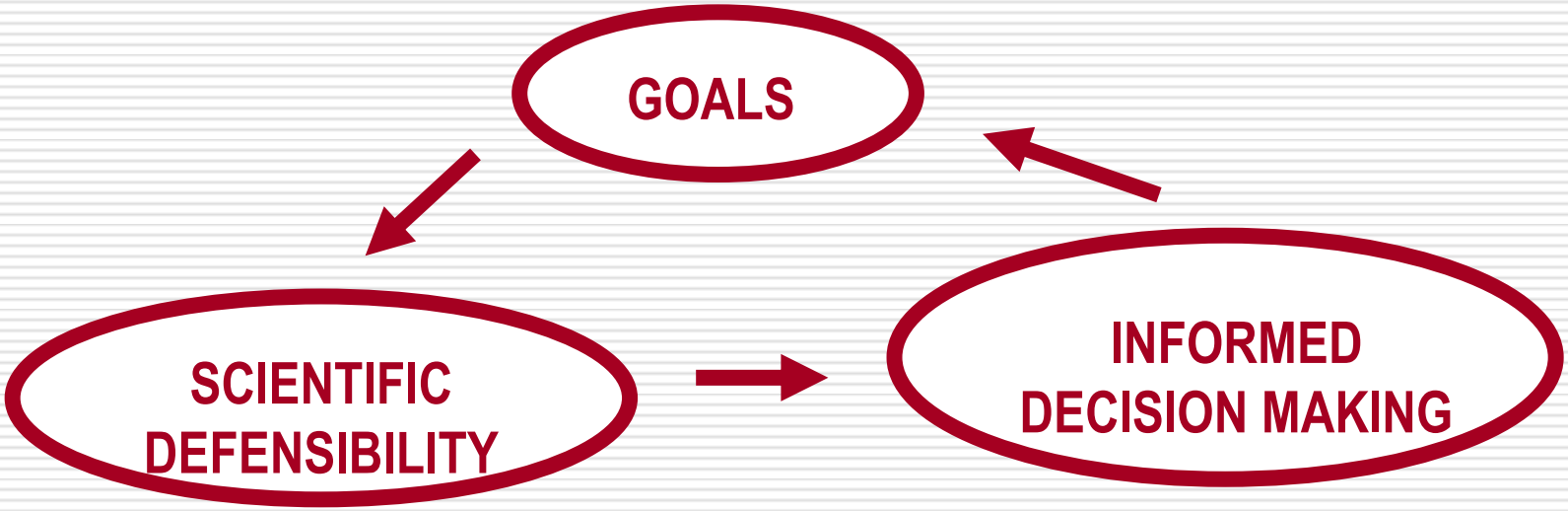
Hatchery Scientific Review Group

The Hatchery Reform Project is a systematic, science-driven review of hatchery programs to achieve two goals:

1. Helping to conserve naturally spawning populations.

2. Supporting sustainable fisheries. (Both commercial and recreational)

Principles for Hatchery Management



Cornerstones and Priorities for Implementing Hatchery Reform

- Broodstock Management
  - Integrated and Segregated
- Population Designations
  - Primary, Contributing, Stabilizing
- Compliance with environmental regulations

HSRG 101

- Broodstock Management Strategies
  - Integrated, Segregated
- Population Designations
  - Primary, Contributing, Stabilizing
- All-H Analyzer (AHA)

Definition of Terms

(used to estimate the direction and amount of gene flow)

pNOB=% Natural Origin fish in the hatchery broodstock

pHOS=% Hatchery Origin fish on the spawning grounds

PNI = Proportionate Natural Influence
pNOB/(pNOB+pHOS)

Definition of Terms-cont.

pHOS census =% Hatchery Origin fish on the spawning grounds (count). Rough estimate of gene flow.

pHOS effective = estimated % Hatchery Origin fish on the spawning grounds that actually reproduce (less than pHOSc). Better estimate of gene flow. What HSRG Standards are based on.

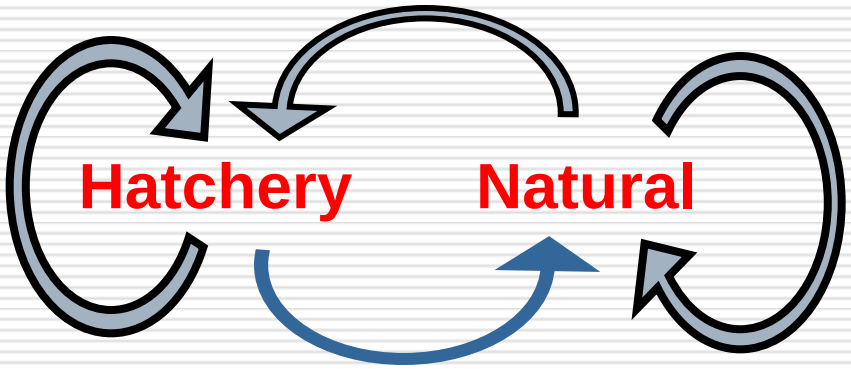
PEHC= Proportion Effective Hatchery Contribution. Actual measurement of gene flow through use of genetic techniques. A better estimate of gene flow.

Genetic *Integration* or *Segregation*

Integrated Broodstock

Goal: ***One population, Minimize genetic divergence***

(*Natural*-origin fish in broodstock)

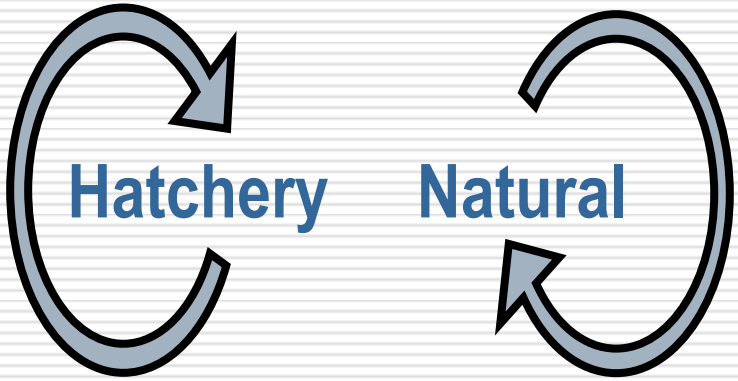


One gene pool

Segregated Broodstock

Goal: ***Two populations, Allow genetic divergence***

(Only *Hatchery* fish in broodstock)



Two gene pools

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.

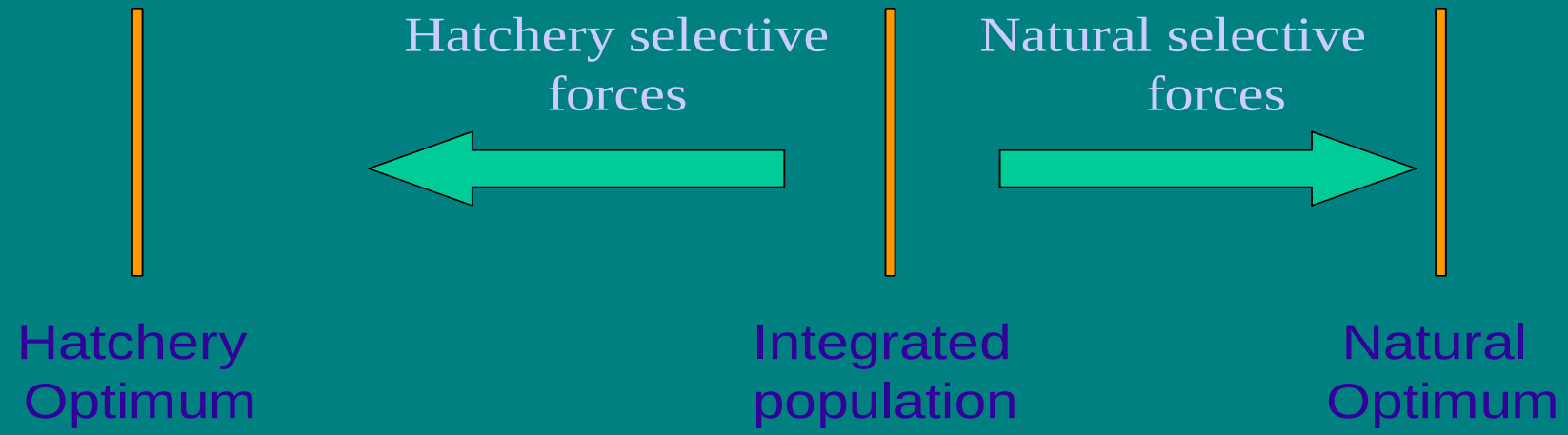
Most appropriate as harvest programs when:

- Very low probability of hatchery fish spawning with natural populations.
- Producing fish 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.

THE BIG IDEA

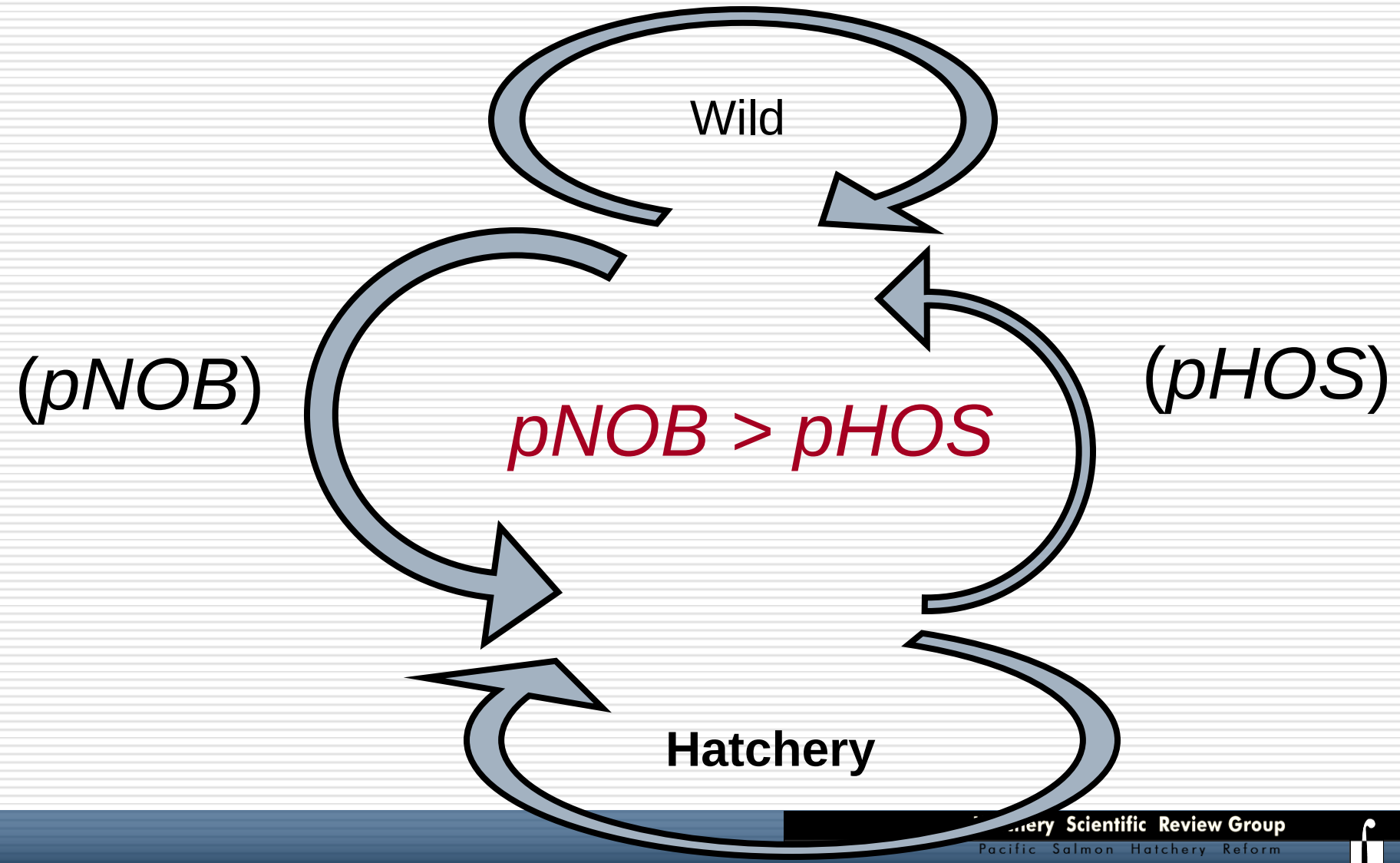
Theory Behind Guidelines for Integrated Programs (from model of Ford 2002)

Natural selection pulls an integrated population in two directions.



Equilibrium point is determined by balance between hatchery-to-wild and wild-to-hatchery gene flow rates.

Integrated gene flow constraint



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. (Habitat, Harvest).
- 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.

HSRG 101

- Broodstock Management Strategies
  - Integrated, Segregated, Stepping stone
- Population Designations
  - Primary, Contributing, Stabilizing
- All-H Analyzer (AHA)

Population Designations

What the HSRG uses (LCRSRP)

- **Primary**—biologically significant, core, key, highly viable, important to recovery. Historically were a large segment of the population structure. Need to be at low risk of extinction.

- **Contributing**– of some significance, are viable but lower in abundance than Primary. Contribute to diversity.

- **Stabilizing**—a population, but may not have ever been a large segment of the population structure.

Population Designations

Why are they important?

- Describes different levels of risk tolerance.
- Not all populations are created equal.
- Evaluation -apples to apples.
- Balance—helps to ensure an ESU has diversity, spatial structure, resiliency.

Designation Standards

Primary—

- **Integrated hatchery programs--PNI ≥ 0.67; pHOS ≤30%**
- **Segregated hatchery programs—pHOS < 5%**

Contributing—

- **Integrated hatchery programs--PNI > 0.50; pHOS ≤30%**
- **Segregated hatchery programs—pHOS < 10%**

Stabilizing—

- **Integrated hatchery programs—current condition**
- **Segregated hatchery programs—current condition**

HSRG 101

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What is AHA Really?

1. AHA is a gene flow calculator. It uses 4 H's as inputs.
2. Currency is adult spawning fish (wild & hatchery).
3. Calculates the number of natural and hatchery fish produced and where they end up spawning.
4. Result is an estimate of the fitness loss due to domestication.
5. It estimates fitness gain when domestication pressure is removed (estimates the increased productivity of natural stocks).

Thoughts on Using AHA

- Does not absolutely define effects of actions
- Provides hypotheses for interaction of Hs and population
- M&E required to test hypotheses and adjust actions (fitness assumptions)
- Does not analyze ecological impacts of hatcheries (predation, competition)

AHA | Go To Dashboard | Go To Populations | Go T

Naselle River Chinook

←Click here to Select Population

Population Recovery Designation: Primary
Phase Transition Trigger:
Recovery Phase: Local Adaptation

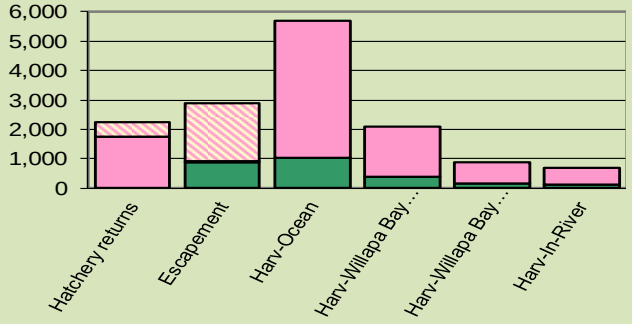
OPEN Saved Baseline
SAVE BASELINE

Hatchery Purpose:		Both	No Hatchery
Hatchery Program Type:		Segregated	None
Scenario Name:		Both	Baseline
	Description:		None
Habitat Potential		*Productivity*	*Capacity*
	Adults	4.00	6,150
	Smolts	400.0	615,000
Smolt to Adult Survival	***Ocean Surv.*** | *Tot. SAR*	0.0100	0.01
	Passage Surv.: ***Juv.*** | *Adults*	1.00	1.00
	Adjusted: ***Prod.*** | *Capacity*	4.00	6,150
Harvest Rates		*Unm. (NORs)*	*Marked (HORs)*
	Ocean	0.400	0.400
	Willapa Bay Commercial	0.243	0.243
	Willapa Bay Recreational	0.135	0.135
	In-River	0.120	0.120
	Total Exploitation Rate:	0.654	0.654
Hatchery Program	Target: pNOB | pHOS		5%
	Broodstock | Smolt Release	1749	3,000,000
	BS Export | Realized | *BS Import*		
	Homing Rate | *Nbr of Strays*	50%	-
	Hatch. Recr/Spawner | *Fitness*	6.0	Y
		←Weir Efficiency	-

		65%	-
		6.0	Y
		←HOR Adults Outplanted	

Expected Average Outcomes

pHOS: 65% PNI: -



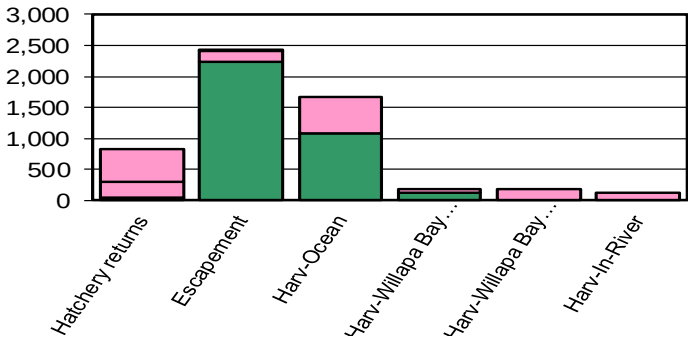
Alternatives Analysis Naselle River Chinook 12/6/14

OPEN Saved PLAN 1

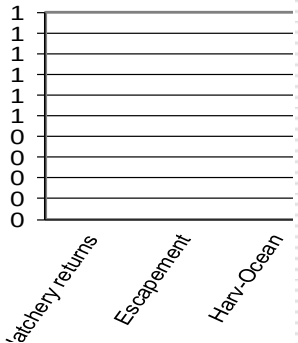
Set PLAN 1 To Baseline | SAVE PLAN 1 | Set PLAN 2 To Baseline

Both Integrated	No Hatchery None	Both Segregated
Option 1a		
	None	
Productivity *Capacity*		*Productivity* *Capacity*
4.00 6,150		
400.0 615,000		#DIV/0!
0.010 0.01		0.010 0.01
1.00 1.00		1.00 1.00
4.00 6,150		#DIV/0!
Unm. (NORs) *Marked (HORs)*		*Unm. (NORs)* *Marked (HORs)*
0.300 0.300		
0.048 0.053		
0.030 0.135		
0.024 0.120		
0.369 0.495		
15% 8%		5%
294 504,416	-	#DIV/0!
		#DIV/0!
80% -	65% -	80% -
6.0 Y	6.0 Y	6.0 Y
←Weir Efficiency -	←HOR Adults Outplanted	←Weir Efficiency -

pHOS: 7% PNI: 0.69

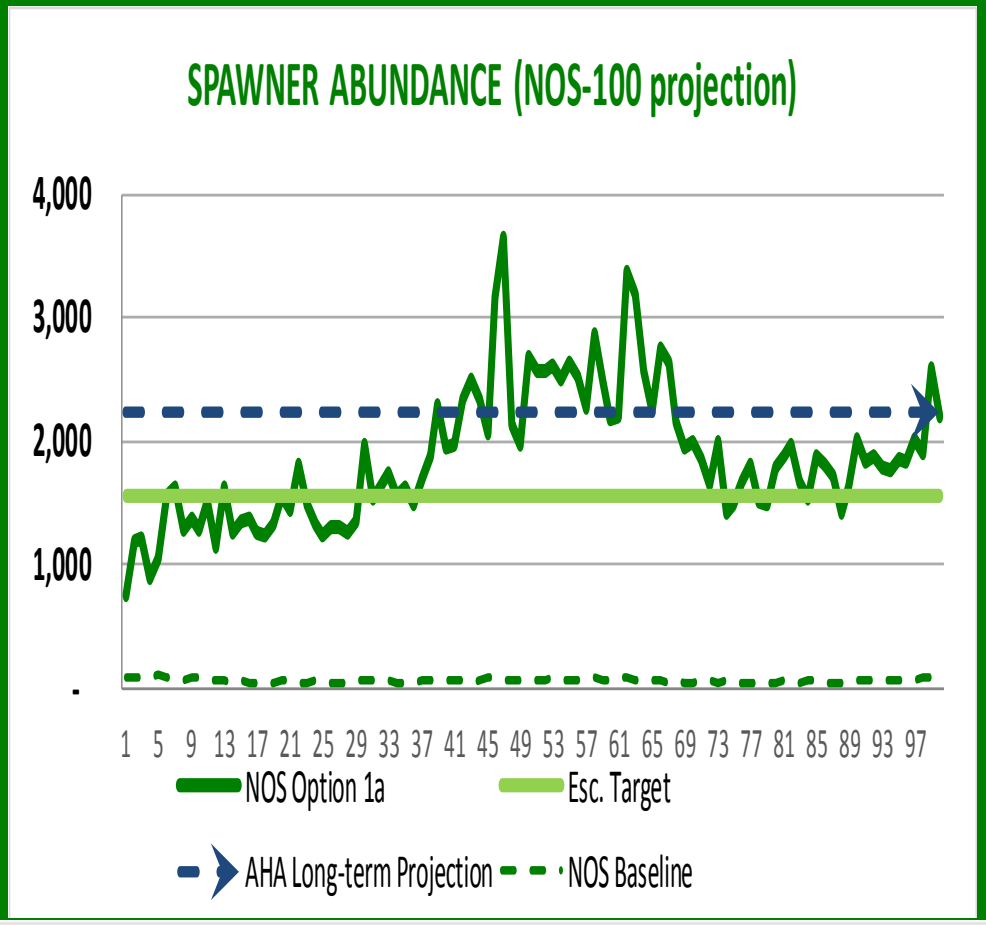


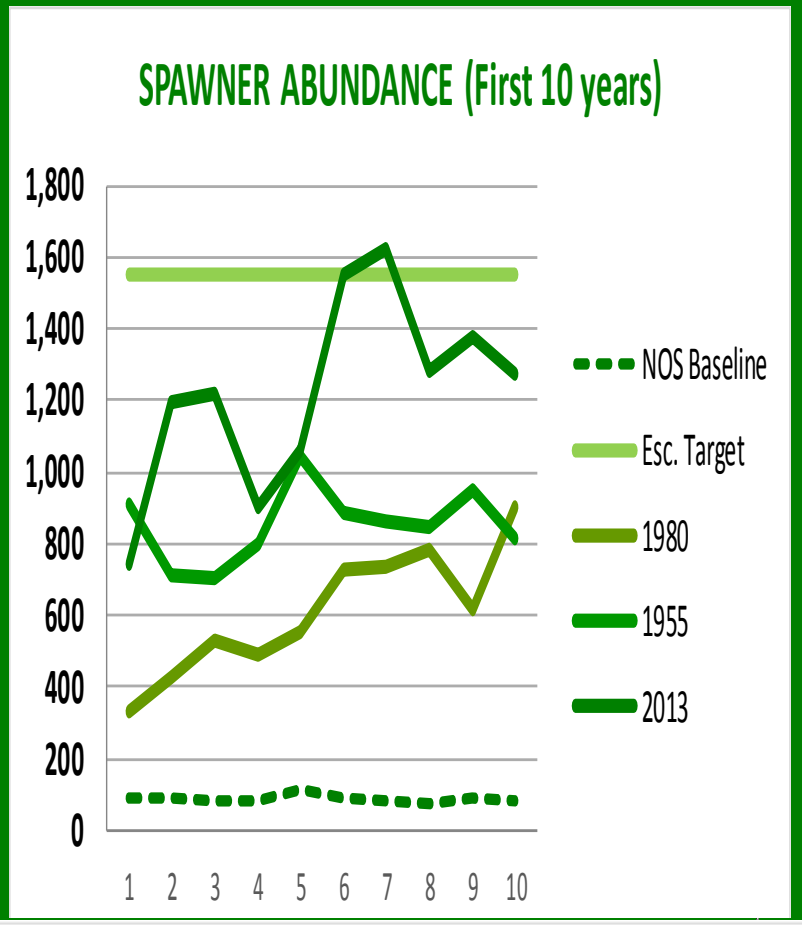
pHOS: ##### PNI: #####



Output from Life Cycle Model

RESULTS OF 100 YEAR SIMULATION (Option 1a vs BASELINE)





Role of the HSRG

HSRG has been ask to develop a tool to allow WDFW to analyze options. (both Policy and Operational)

HSRG has not been ask to review the 2010 Willapa Bay Mgt. Plan.

HSRG has not been ask to review any options developed by WDFW or stakeholders.

Hatchery Reform Principles and Recommendations of the Hatchery Scientific Review Group April 2004

Columbia River Hatchery Reform System-Wide Report February 2009

Review of the Elwha River Fish Restoration Plan and Accompanying HGMPs January 2012

On the Science of Hatcheries: An updated perspective on the role of hatcheries in salmon and steelhead management in the Pacific Northwest June 2014


www.hatcheryreform.us