# The All-H-Analyzer Model:

# Overview and Applications in Anadromous Fisheries Management

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Yakama Nation Fisheries - YKFP

# Presentation Outline

2. Model Synopsis
    A. Basic background information
3. Model Components and Data Requirements
    A. 4 H's
4. Agency Use and Relative Applications
    A. Hatchery Scientific Review Group (HSRG)
    B. Columbia Basin Fish & Wildlife Authority (CBFWA)
    C. NOAA Fisheries
    D. Yakima Bureau of Reclamation (BOR)
    E. Co-managers  (YN,  Klickitat spring chinook)

# Model Synopsis: 4-H's
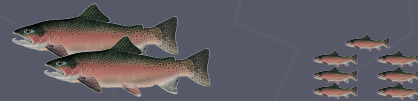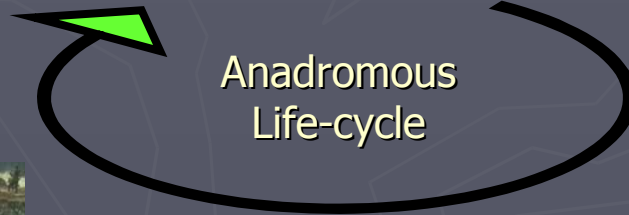
## Habitat

## Hatcheries

## Harvest

Anadromous
Life-cycle

## Hydro (out of basin $S$)

# Model Synopsis

1. Developed by WA State Fishery Co-managers and HSRG
   A. Hypothesis/understanding of integration between four "H" components

2. Platform For Other Models
   A. Habitat productivity
   B. Out of basin survival

3. Model considered a work in progress

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# Harvest



## Geographic Areas

1. Ocean Fisheries
   A. Alaska, Canada, U.S.
2. Lower Columbia Fisheries
   A. Zones 1-5 sport, commercial
3. Mid Columbia R. Fisheries
   A. Zone 6 Tribal C&S, commercial
4. Terminal Fisheries
   A. Tribal & Sport

- Differential rates
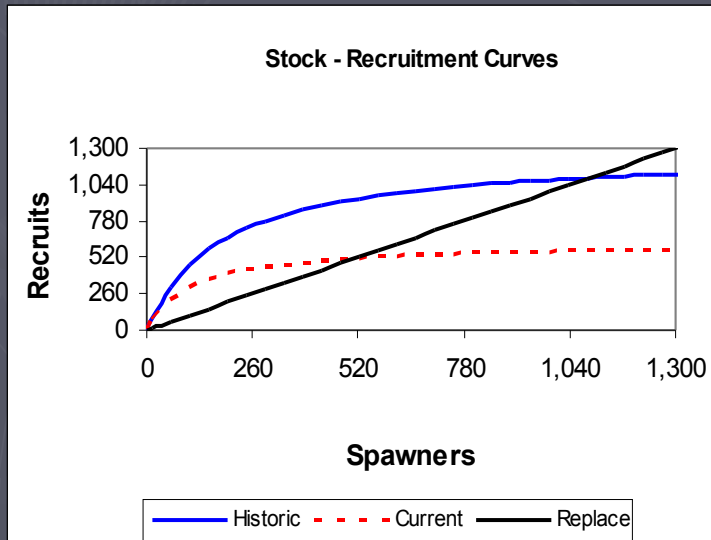  - Total exploitation rate

# Out of Basin Survival (Hydro)

➢ **Model Inputs**

  ➢ Juvenile outmigrant srv.

  ➢ Ocean srv.

  ➢ Adult migrant srv.

2. **Data Sources**

  A. Data

  B. Modeled survival

  ➢ FCRPS BiOp

# Freshwater Habitat



### Stock - Recruitment Curves



1. ## Model Inputs
   A. Beverton-Holt Stock Recruitment function
      1. Capacity & Intrinsic Productivity
      2. Population/Subbasin scale

2. ## Parameter Sources
   A. Empirical data
   B. Scientific based models
      1. EDT
      2. SHIRAZ

# Hatcheries



1. **Model Inputs**
   1. # broodstock
   2. Proportion of hatchery and Wild
   3. Demographics and Survival
      - Juvenile release number
   4. Returning Hatchery adult destination (%)
      1. Hatchery rack or natural spawning grounds

# Types of Hatchery Programs

- ## Segregated Program
  - Isolate hatchery/wild populations
  - HSRG: <5% pHOS



Wild

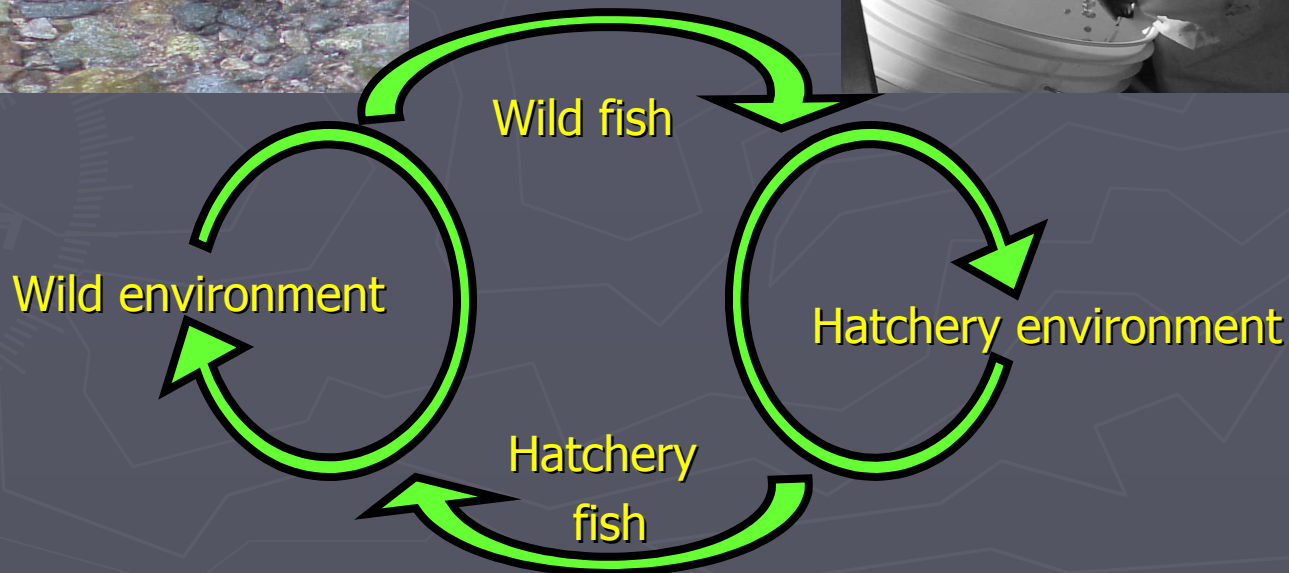- ## Appropriate Conditions
  - Harvest augmentation
  - Mitigation



Hatchery

# Types of Hatchery Programs

- **Integrated Program**
  - Single population
  - "Integrate" adult reproduction

- **Appropriate Conditions**
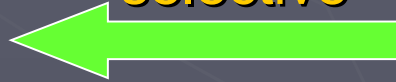  - Conservation goals
  - Suitable Habitat



Wild fish

Wild environment

Hatchery environment

Hatchery fish

# Environmental Adaptation



Hatchery
Optimum

Hatchery
selective

forces

Integrated
population

Natural
selective

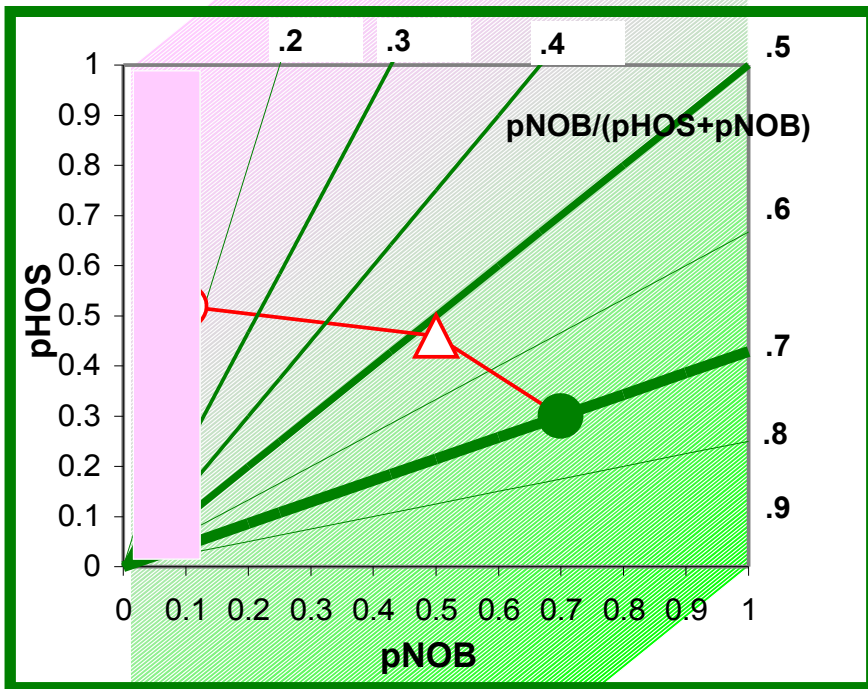forces

Natural
Optimum

# The PNI Concept:



1. **PNI- Proportion of Natural Influence**

3. **Integrated programs:**
   1. Minimum
      - 0.5
   2. Biological Significance
      1. 0.67

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# Model Applications



Interior Columbia Basin

1) <u>Hatchery Scientific Review Group (HSRG)</u>

B. Evaluation of hatchery programs
   1. Effects on natural pops
C. Instrumental tool

E. Recommendations
   1. Type of program
      - Segregated
      - Integrated
   2. Size (juvenile release #)
   3. Hatchery broodstock
   4. Wild/hatchery interactions

# Model Applications
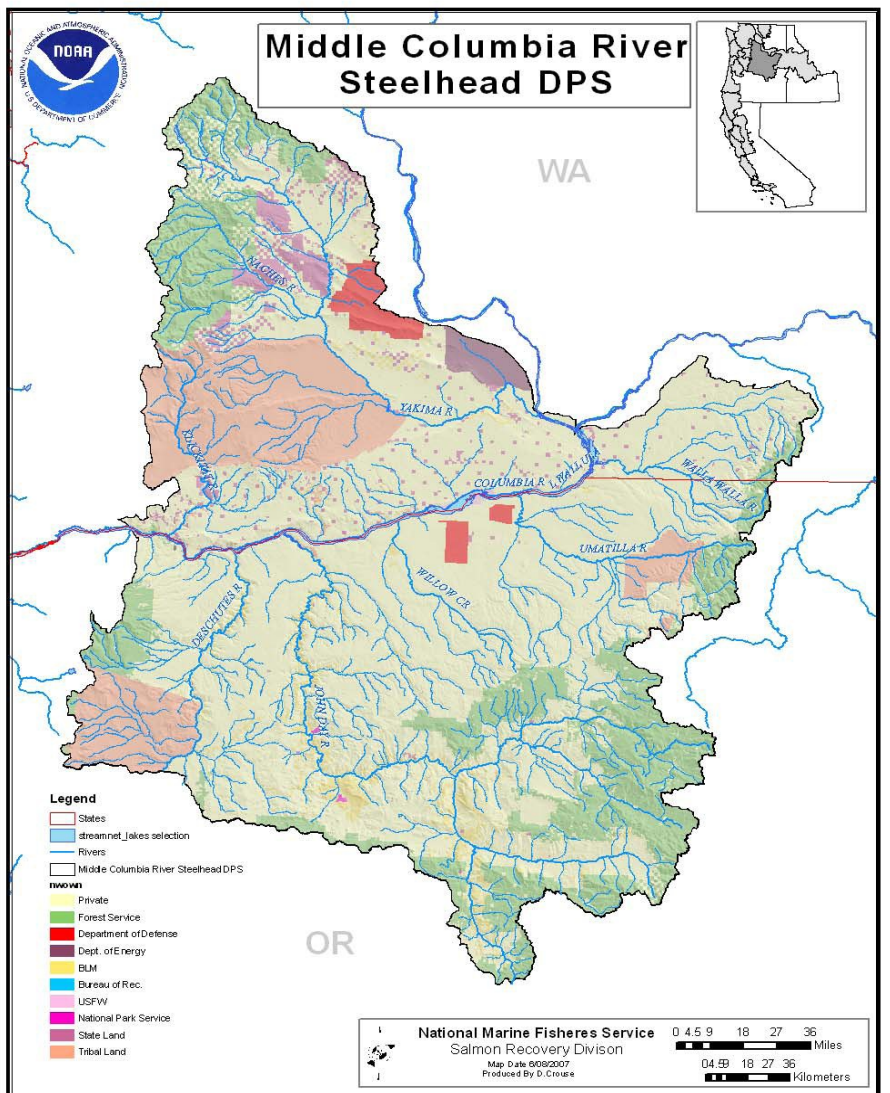


1) **NOAA Fisheries**

B. Salmon Recovery Planning
   1. All H analysis- Mid C Sthd DPS
      a. Population A/P
      b. 4-H components
         ➢ Freshwater habitat
         ➢ Juvenile outmigrant Survival
         ➢ Predation
         ➢ Estuarine habitat
         ➢ Harvest
      c. Cumulative benefits
         ➢ Multiple actions
      d. Future viability
         ➢ Populations
         ➢ DPS

# Model Applications



Interior Columbia Basin

1) <u>Columbia Basin Fish & Wildlife Authority (CBFWA)</u>

B. Develop amendments to the NPPC fish and wildlife program
   1. Primary Objective
      a. H components
         1. Move pops toward biological goals
   2. Population specific measures
      a. Existing plans
   3. Analysis provide basis
      1. Prioritizing Strategies
      2. Suites of actions

# Model Applications



Yakima River Basin Water Storage Feasibility Study



1) **Yakima Bureau of Reclamation (BOR)**

B. Yakima Basin Storage Study
   1. Feasibility of Storage Augmentation
      - Fish
      - Irrigation
      - Future municipal water supply

   3. Effects on Habitat Potential
      - EDT Model

   5. AHA model- Final analysis
      - Natural production
      - Hatchery fish
      - Economic benefits
        - Harvest
   6. Additional habitat Restoration
      - Build upon flow augmentation
      - Continued use of EDT/AHA

# Model Applications



Klickitat Hatchery (Rm 43)
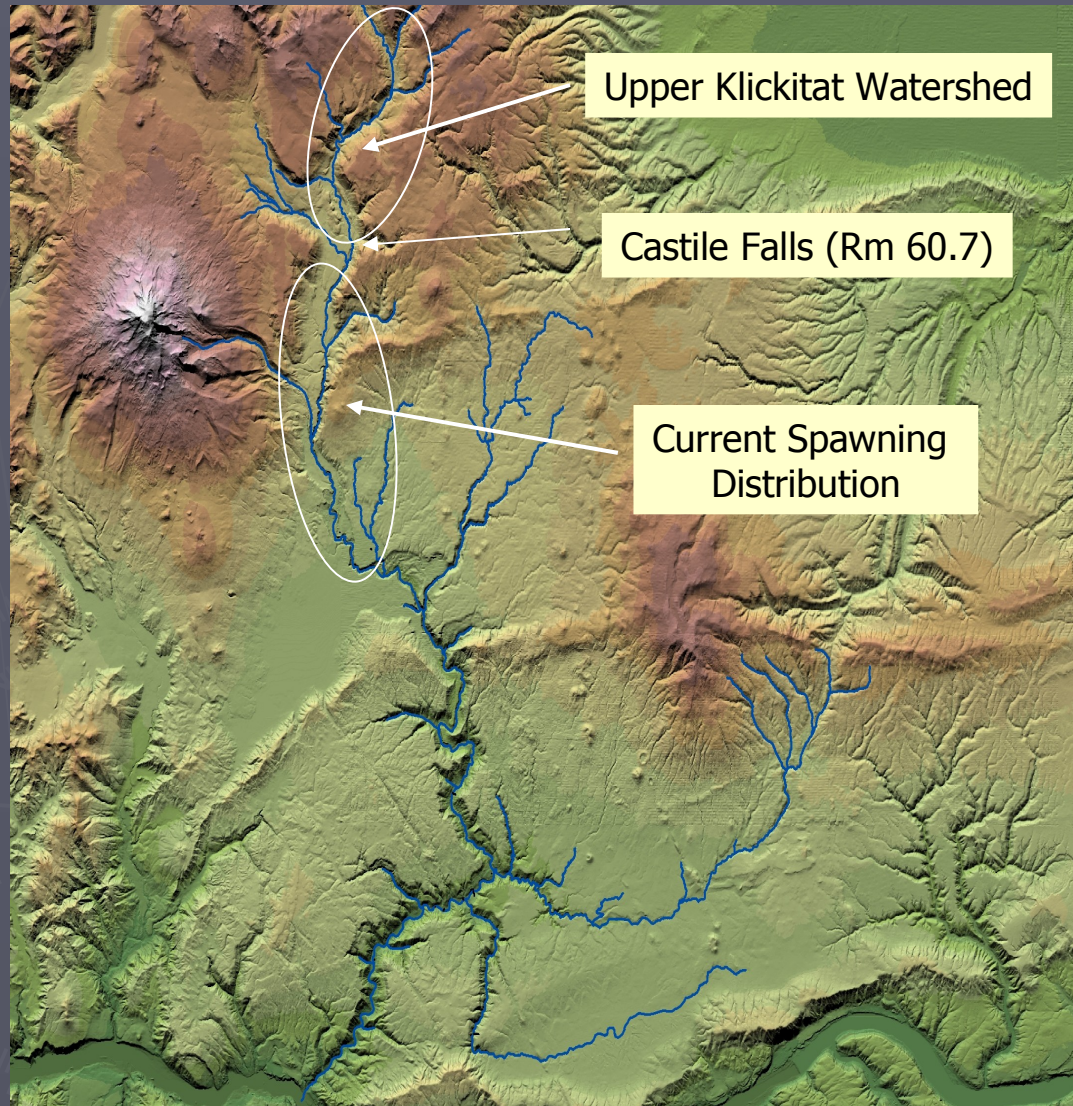
1. **Klickitat Spring Chinook**

   B. **Reform current hatchery program**
      1. Conservation
      2. Harvest

   D. **Current program**
      1. Harvest augmentation
      2. Mitigation
      3. Poorly run Segregated or Integrated program
      4. ~550 adults
      5. ~600k on-station smolt release
      6. 95-100% hatchery broodstock
      7. PHOS~ 10-20%
         ➢ PNI= 0.25

# Model Applications



Upper Klickitat Watershed

Castile Falls (Rm 60.7)

Current Spawning Distribution

1. **Klickitat Spring Chinook**
   - ➤ Integrated program

A. Goals
   1. Harvest
      - ➤ Increase opportunity
   2. Conservation
      - ➤ PNI ~0.67

C. Program Strategies
   1. Increasing PNOB
   2. Bolster natural production
      - ➤ Upper basin habitat

   4. Removal of surplus hatchery fish

# Klickitat Spring Chinook: Initial Modeling Conclusions:

2. Model configuration: Integrated hatchery program
   A. EDT/AHA
      ✓ Achieve management goals

4. Results
   A. Recolonization of habitat above Castile Falls
      A. Support needs for natural production and hatchery broodstock (25%)
      ★ PNI = 0.67

5. Critical Uncertanties
   o Realized habitat potential of Upper Basin
   o Actual PHOS
   o Mining rate of natural population

# Questions?