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Washington

April 26, 2012

## MEMORANDUM

**TO:** Chair Dukes and members of the Council

**FROM:** Tony Grover, Fish and Wildlife Division Director

**SUBJECT:** **Presentation on comparative survival study and results for 2011:**

Jack Tuomikoski, staff, and Michelle Dehart, Executive Director, of the Fish Passage Center will present the latest 2011 findings from the Comparative Survival Study (CSS) along with a brief history of the CSS project.

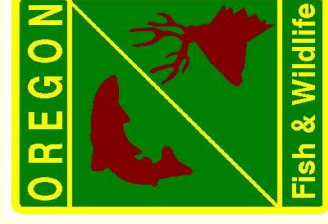
The CSS (BPA Project 199602000) began in 1996 with the objective of establishing a long term dataset of annual estimates of the survival rate of generations of salmon from their outmigration as smolts to their return to freshwater as adults to spawn (smolt-to-adult return rate; SAR). The study was implemented with the express need to address the question of whether collecting juvenile fish at dams, transporting them downstream of Bonneville Dam (BON) and then releasing them was compensating for the effect of the Federal Columbia River Power System (FCRPS) on the survival of Snake Basin spring/summer Chinook salmon that migrate through the hydrosystem.

The CSS is a long term study within the Council's Fish and Wildlife Program (NPCC FWP) and is funded by Bonneville Power Administration (BPA). Study design and analyses are conducted through a CSS Oversight Committee (CSSOC) with representation from Columbia River Inter-Tribal Fish Commission (CRITFC), Idaho Department of Fish and Game (IDFG), Oregon Department of Fish and Wildlife (ODFW), U.S. Fish and Wildlife Service (USFWS), and Washington Department of Fish and Wildlife (WDFW). The Fish Passage Center (FPC) coordinates the PIT-tagging efforts, data management and preparation, and CSSOC work. All draft and final written work products are subject to regional technical and public review and are available on FPC and BPA websites: FPC: <http://www.fpc.org/documents/CSS.html> and BPA: <http://www.efw.bpa.gov/searchpublications/index.aspx?projid>

# Comparative Survival Study

Presenter: Jack Tuomikoski

Hood River, OR NPCC May 8<sup>th</sup>, 2012



# Background

- **Initiated in 1996 by states, tribes & USFWS to estimate survival rates at various life stages**
  - **Designed to assess hydrosystem operations on state, tribal, and federal fish hatcheries and LSRCP**
  - **PATH** – “can transportation . . . compensate for the effect of the hydrosystem?”
  - **NPCC has established the need to collect annual migration characteristics including survival**
  - **NOAA biological opinions require research, monitoring and evaluation**
- **Management-oriented large scale monitoring**
  - **Observational study**
  - **Aligned with basin wide monitoring needs (RME)**

# Background

## ■ GOALS

1. Quantify the efficacy of transportation
  - Develop a more representative control group
2. Compare survival rates within and across species
3. Establish long term data set

# Background

- **CSS data is derived from PIT tags**
  - **Tagged specifically for CSS**
  - **Cooperative marking between CSS and other research studies**
    - **reduce costs/handling, eliminate duplication**
  - **Groups marked for other studies**

# Background

- **Collaborative scientific process was implemented for study design and to perform analyses**
- **CSS project independently reviewed and modified a number of times**
  - **Draft report typically posted – Aug 31st**
  - **ISAB, ISRP and other entities**

# History of ISAB/ISRP Reviews of CSS

- 1997 – **ISAB** First review
- 1998 – **ISAB** Extend to other species  
& life history types (Steelhead)  
nonparametric bootstrap approach
- 2002 – **ISRP** Additional evaluate bootstrap,  
compare with likelihood methods,  
Monte Carlo simulator evaluation

# History of ISAB/ISRP Reviews of CSS

## 2003 – **ISAB** *Review of flow augmentation*

“understanding of the relation between reach survival, instantaneous mortality, migration speed, and flow”

## 2006 – **ISAB** *Review of 2005 CSS report*

- 1) “finer scale analyses of the relationships between survival and specific operational actions or environmental features”
- 2) Develop a ten year summary report



# History of ISAB/ISRP Reviews of CSS

## 2007 – **ISAB/ISRP** Review CSS "10-year" report

- 1) continue coordination  
cost savings/ avoid redundancy
- 2) Address: Are PIT tag SARs < run reconstruction SARs and conduct a comprehensive study to determine why

## 2009 – **ISAB** Tagging Report

Compare CSS SARs with Run Reconstruction SARs

## >2009 **ISAB** annually reviews CSS reports

The CSS is a joint project of the state & tribal fishery managers and the USFWS

### **DESIGN**

- WDFW, CRITFC, USFWS, ODFW, IDFG

### **IMPLEMENTATION & TAGGING**

- FPC: Logistics, coordination
- PTAGIS: Raw Data; FPC: Reports, Estimates

### **DATA PREPARATION & ANALYSIS**

- CSS Oversight Committee
- Fish Passage Center

### **REGIONAL REVIEW**

- Draft on BPA & FPC websites
- Regional Public Review; ISAB, ISRP, FPAC, NMFS, etc.

### **FINAL REPORT**

- Posted on BPA & FPC websites

# Stocks Included

## ■ Snake River (SARs)

17 +

- 8 sp/su Hatchery Chinook
- 2 natural stocks - (sp/su) Chinook & steelhead
- 5 + hatchery steelhead groups (by basin and A or B)
- 2 Hatchery Sockeye
- Fall Chinook – under development

## ■ Upper Columbia River (SARs)

5

- 1 sp Hatchery Chinook (Leavenworth)
- 1 Hatchery steelhead (HxW)
- 2 natural sp Chinook aggregates
- 1 natural steelhead aggregate

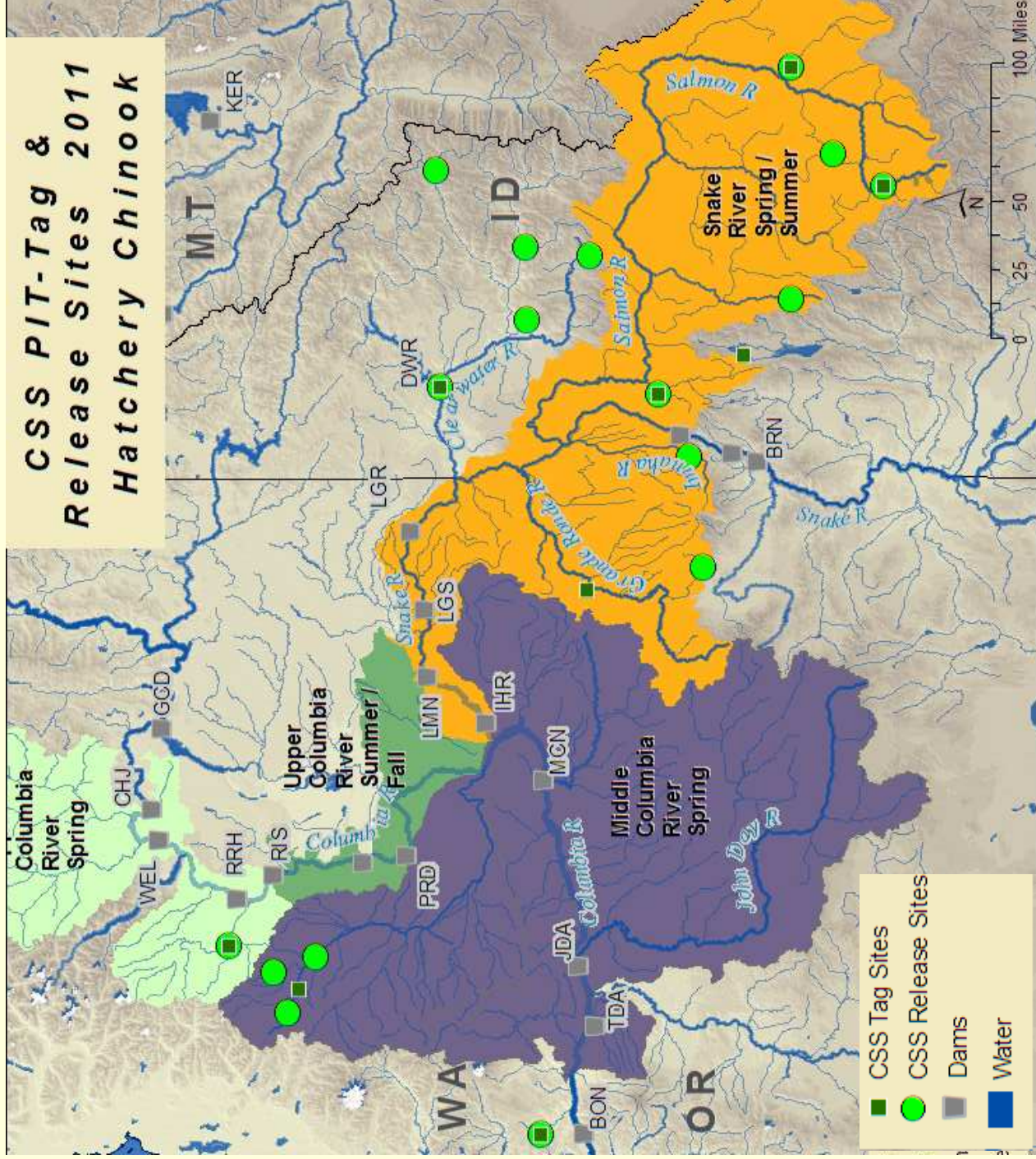
## ■ Middle Columbia River (SARs)

5

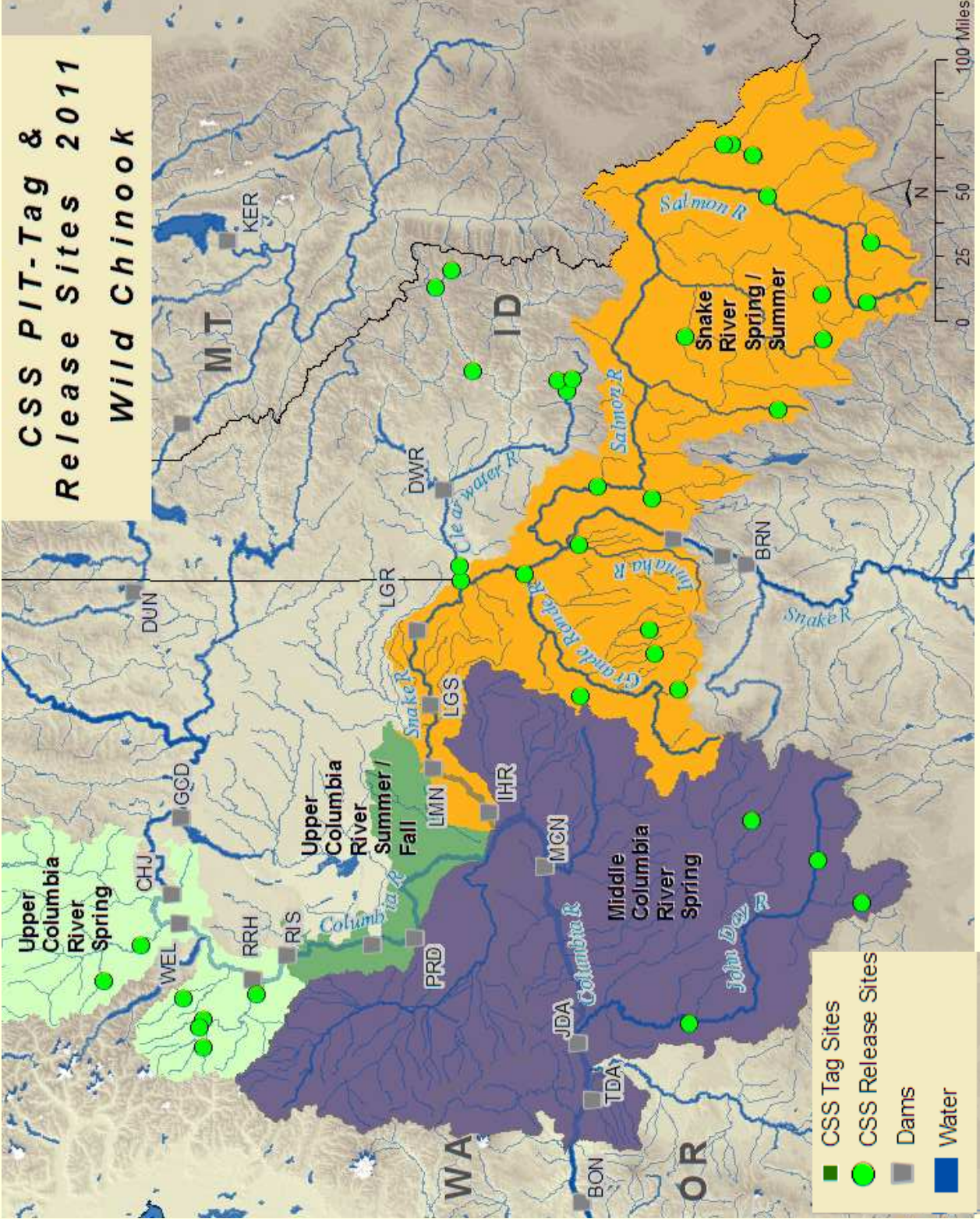
- 2 sp Hatchery Chinook (Carson, Cle Elum)
- 2 natural steelhead (Deschutes, John Day)
- 1 natural sp Chinook (John Day)

10

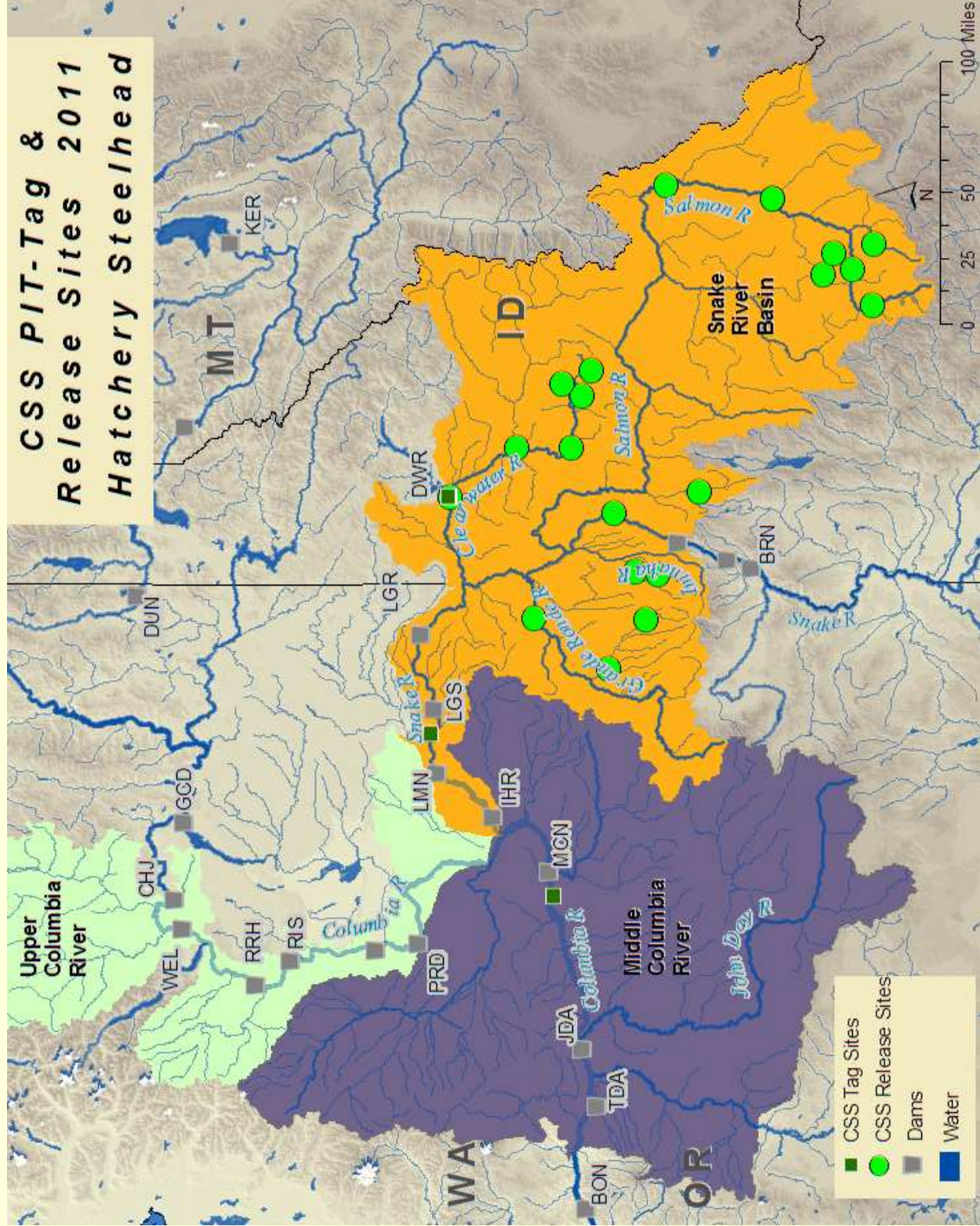
# Spatial Coverage: Hatchery Chinook



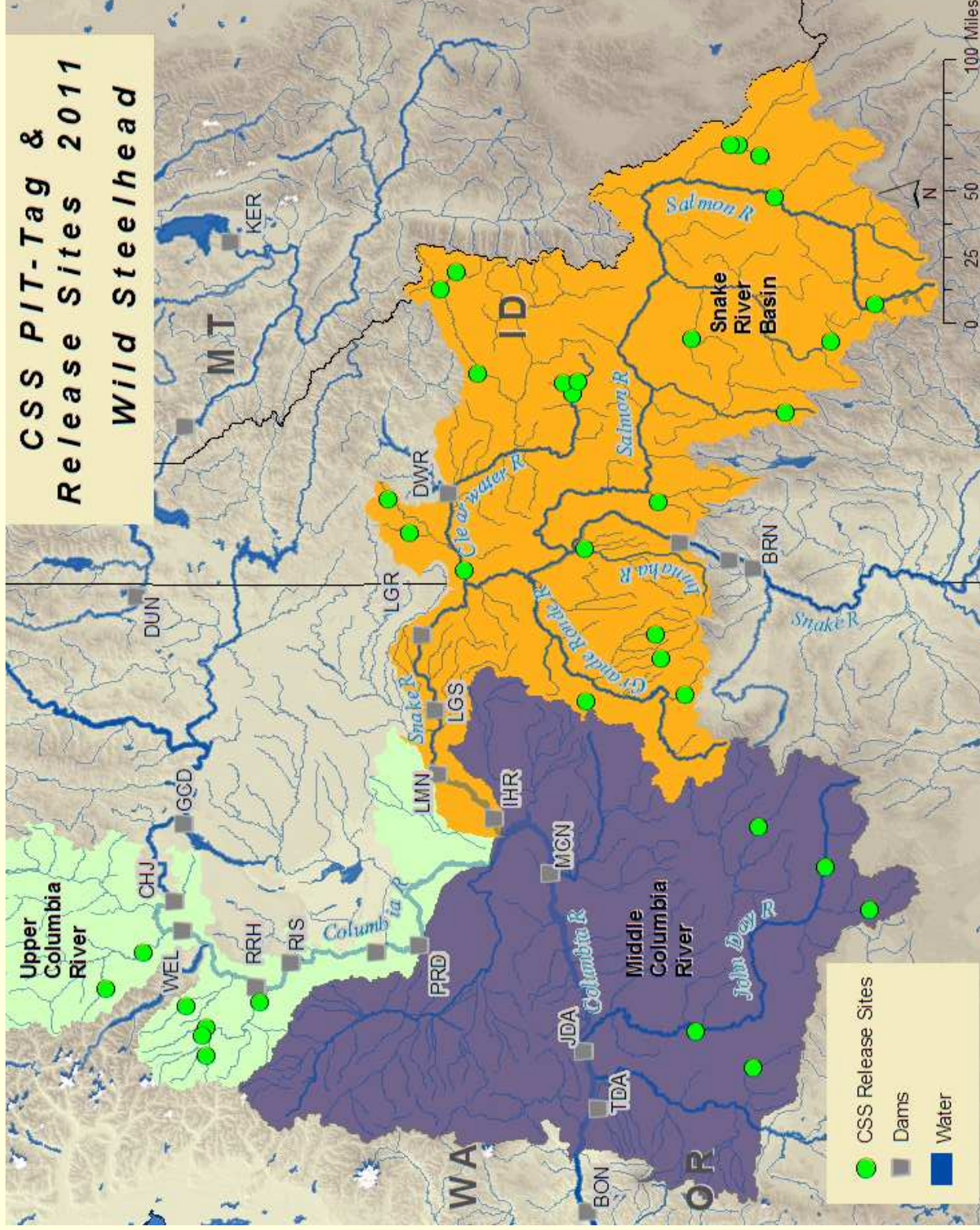
# Spatial Coverage: Wild Chinook



# Spatial Coverage: Snake River Hatchery Steelhead

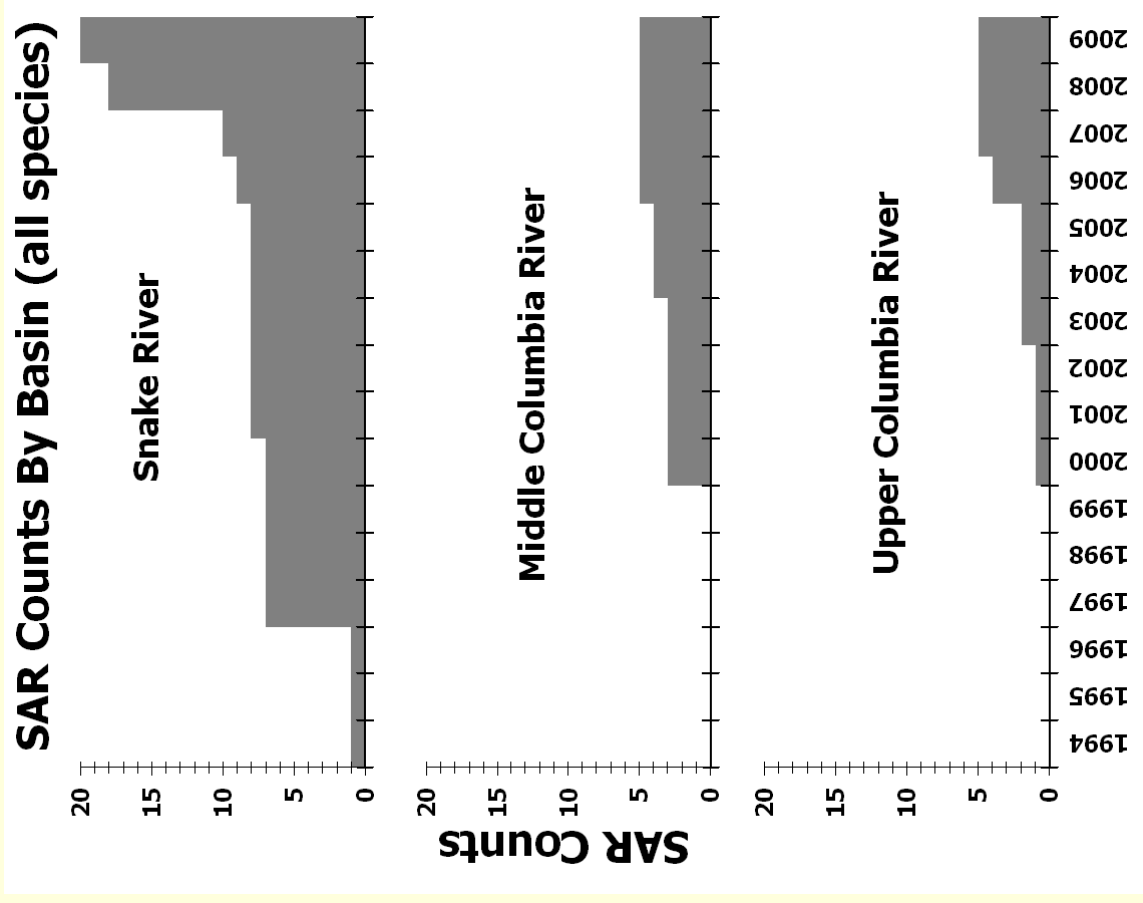


# Spatial Coverage: Wild steelhead



# TEMPORAL COVERAGE

- **Snake River**
  - Longer Time Series
  - More groups developed
- **Mid./Upper Columbia**
  - Begin in 2000 (BOA adults)
  - Fewer groups developed
  - Still in-work





# Smolt Survival

Rearing  
Habitat  
Actions

**FRESHWATER**



**LGR**

$S_{LGR-MCN}$

**MCN**

$S_{MCN-BON}$

**BON**

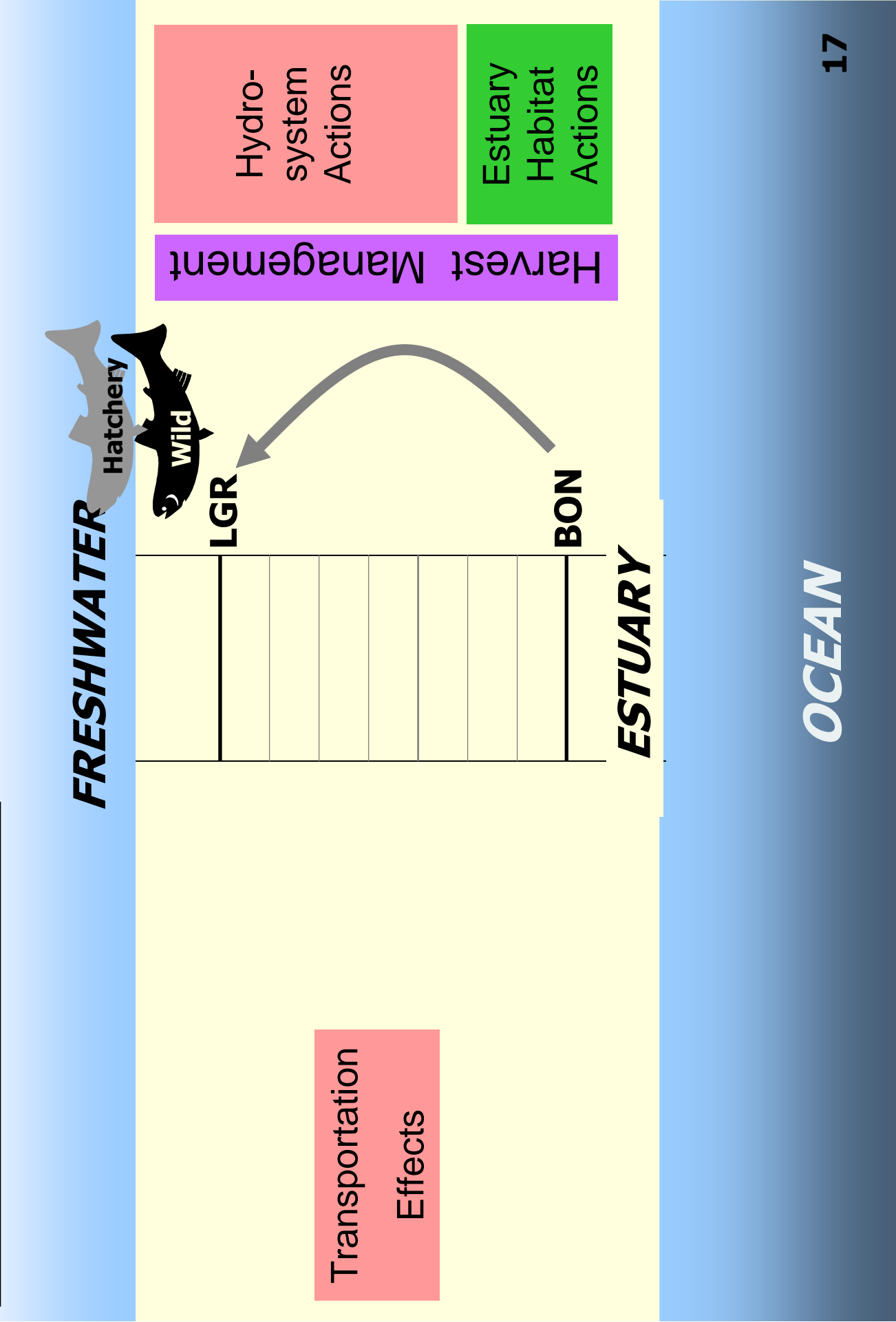
$S_R$

**ESTUARY**

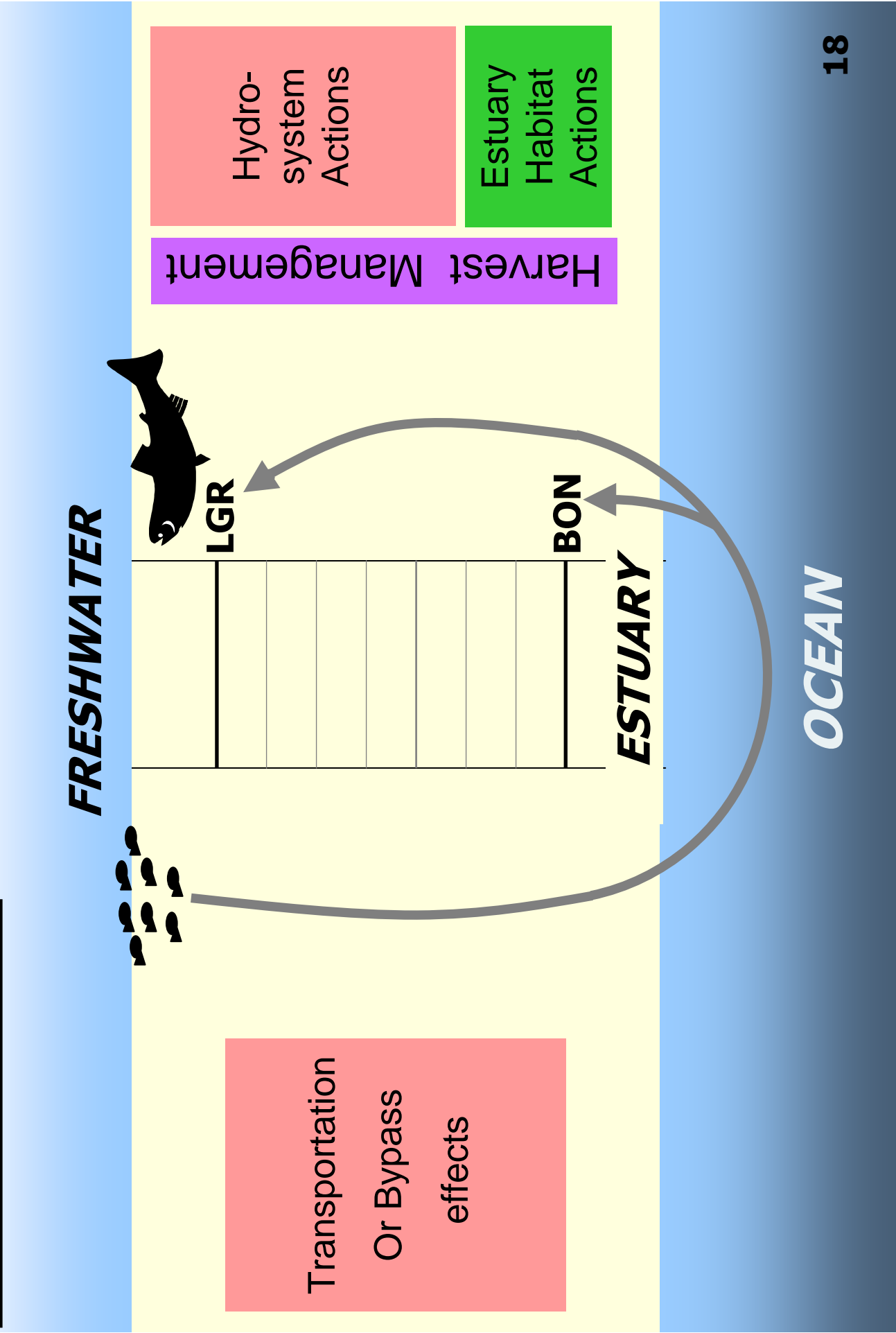
Hydro-  
system  
Actions

**OCEAN**

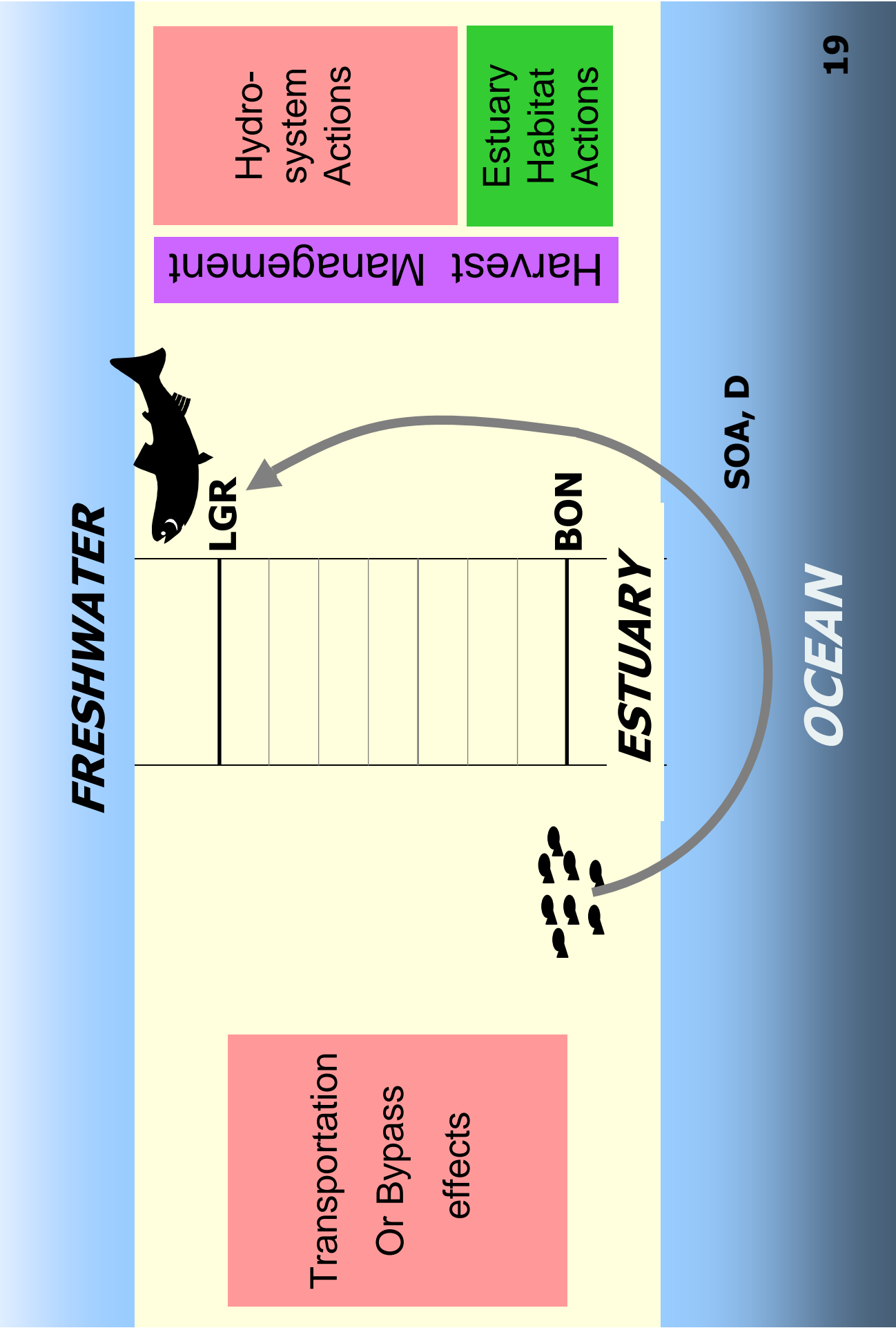
# Adult Success



# SARS, TIRS



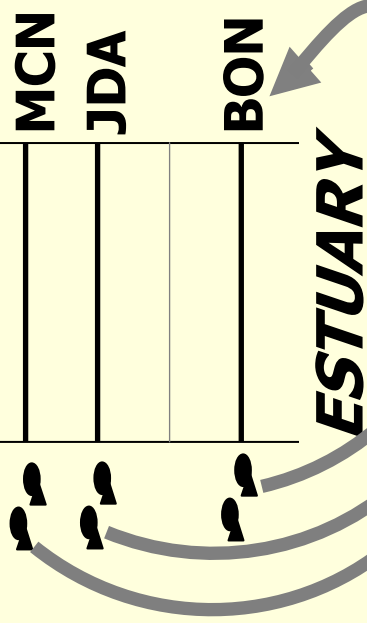
# Post BON Survival



# Mid and Upper Columbia R. SARS

**FRESHWATER**

Regional  
Monitoring &  
Evaluation



**OCEAN**

# What does CSS provide for the region?

- **Long term consistent information collaboratively designed and implemented**
- **Information easily accessed and transparent**
  - **CSS PIT-tags accessed by any PTAGIS users, including fisheries managers, researchers, and academics.**
- **Long term indices (identify bottlenecks) :**
  - *Travel Times*
  - *In-river Survival Rates*
  - *In-river SARs by route of passage*
  - *Transport SARs*
  - *Adult success, conversion*
- **Comparisons of SARs**
  - *Transport to In-River*
  - *NPCC SAR goal*
  - *By geographic location*
  - *By hatchery group*
  - *Hatchery to Wild*
  - *Chinook to Steelhead*
- *Management questions: hydropower operations, hatchery evaluations, habitat evaluations*



# 2011 CSS Activities

- **Workshop (Jul 26<sup>th</sup>-28<sup>th</sup>, 2011)**
  - **GOALS:**
    - **Expand the scope of CSS review**
      - 27 attendees from agencies and universities
    - **Synthesize information regarding freshwater and ocean factors that affect survival for Columbia River Basin Salmon and steelhead**
  - **Opportunity for leading investigators to:**
    - **share and compare results**
    - **collaboratively develop priorities for future work in CSS**
  - **facilitated by ESSA Technologies Ltd.**
- **2011 Annual Report**

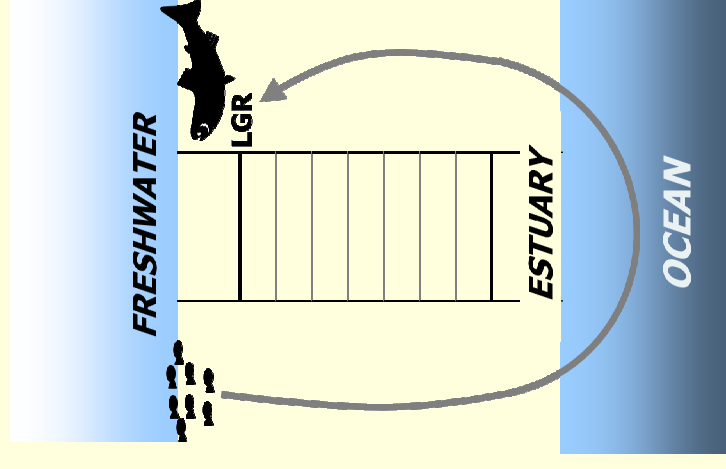
# 2011 Report

## ■ Snake River (SARs)

- 8 sp/su Hatchery Chinook
- 2 natural stocks - (sp/su) Chinook & steelhead
- 5 + hatchery steelhead groups (basin and A or B)
- 2 Hatchery Sockeye
- Fall Chinook – under development

## ■ Report organization

- Chinook SARs through 2009
- Steelhead SARs through 2008
- Juvenile metrics through 2010





# CSS 2011: Chinook Overall SARs

OVERALL SARs (with jacks)

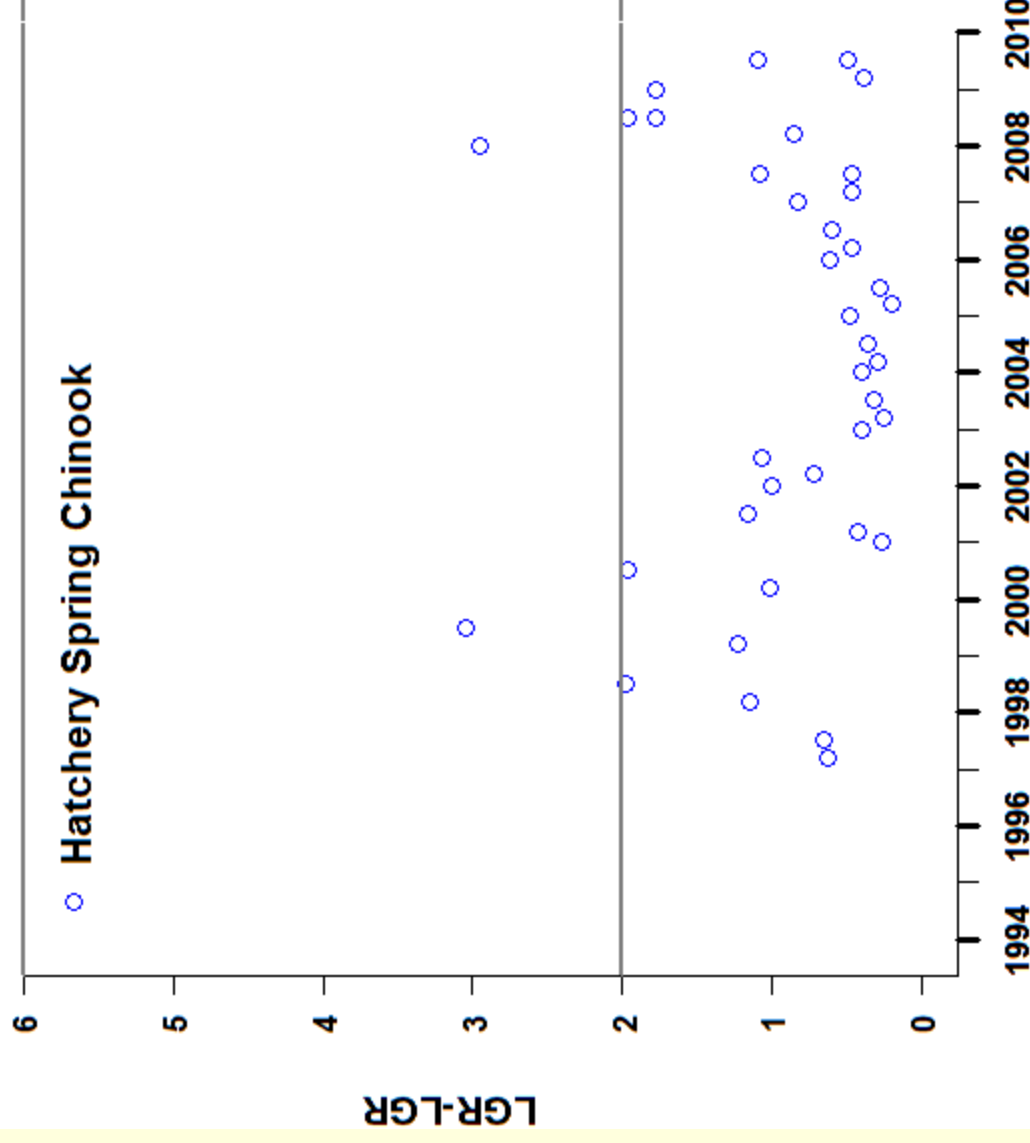
- NPCC GOAL of 2-6 % SAR for recovery; mean = 4

## ■ Sp. Chinook

### stocks:

RAPH  
DWOR  
CATH  
SAWT

- Nearly all estimates below 2%
- High correlation between stocks



# CSS 2011: Chinook Overall SARs

OVERALL SARs (with jacks)

- **Su. Chinook stocks:**

MCCA

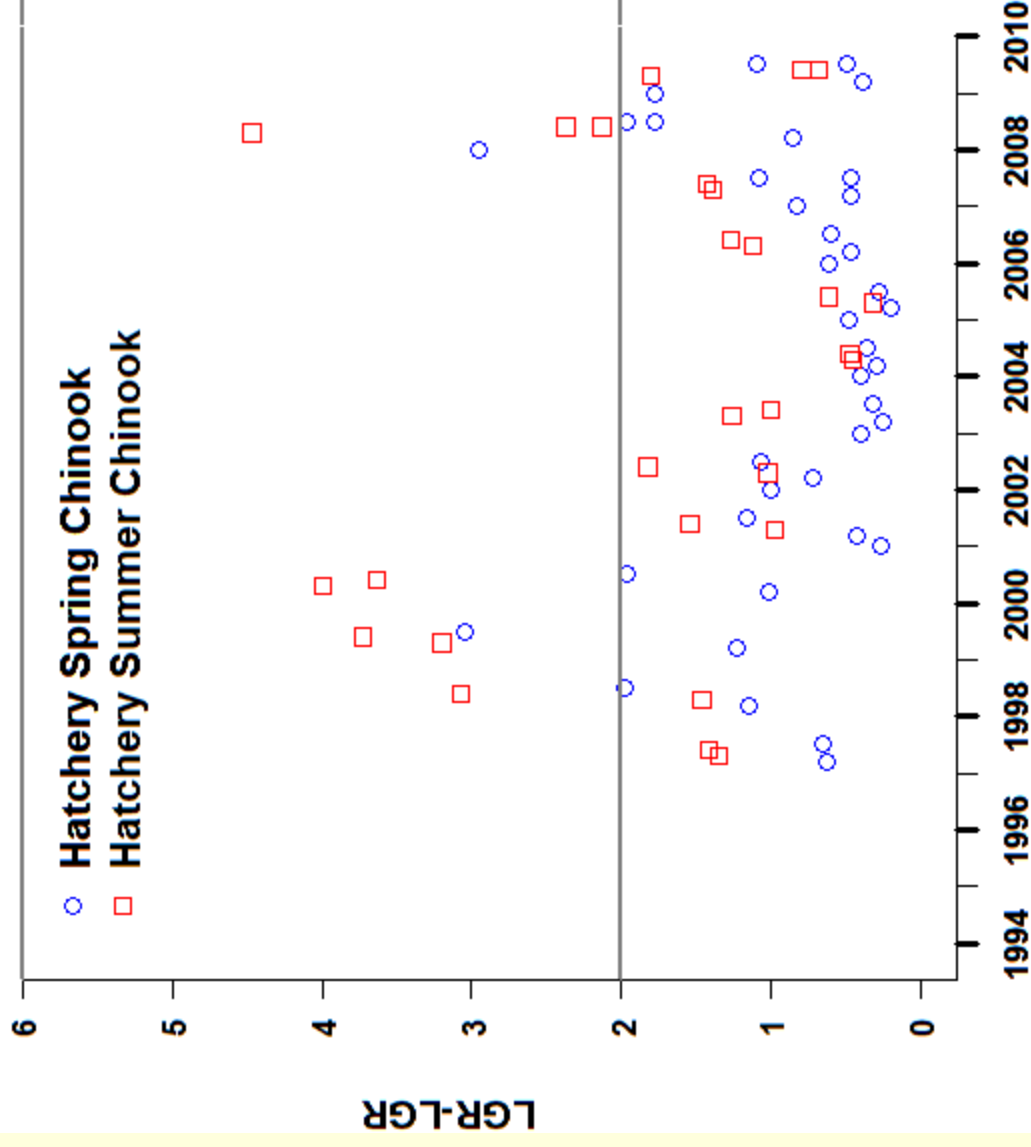
IMNA

PAHH

- **Summer stocks higher than spring**

- **High correlation between stocks**

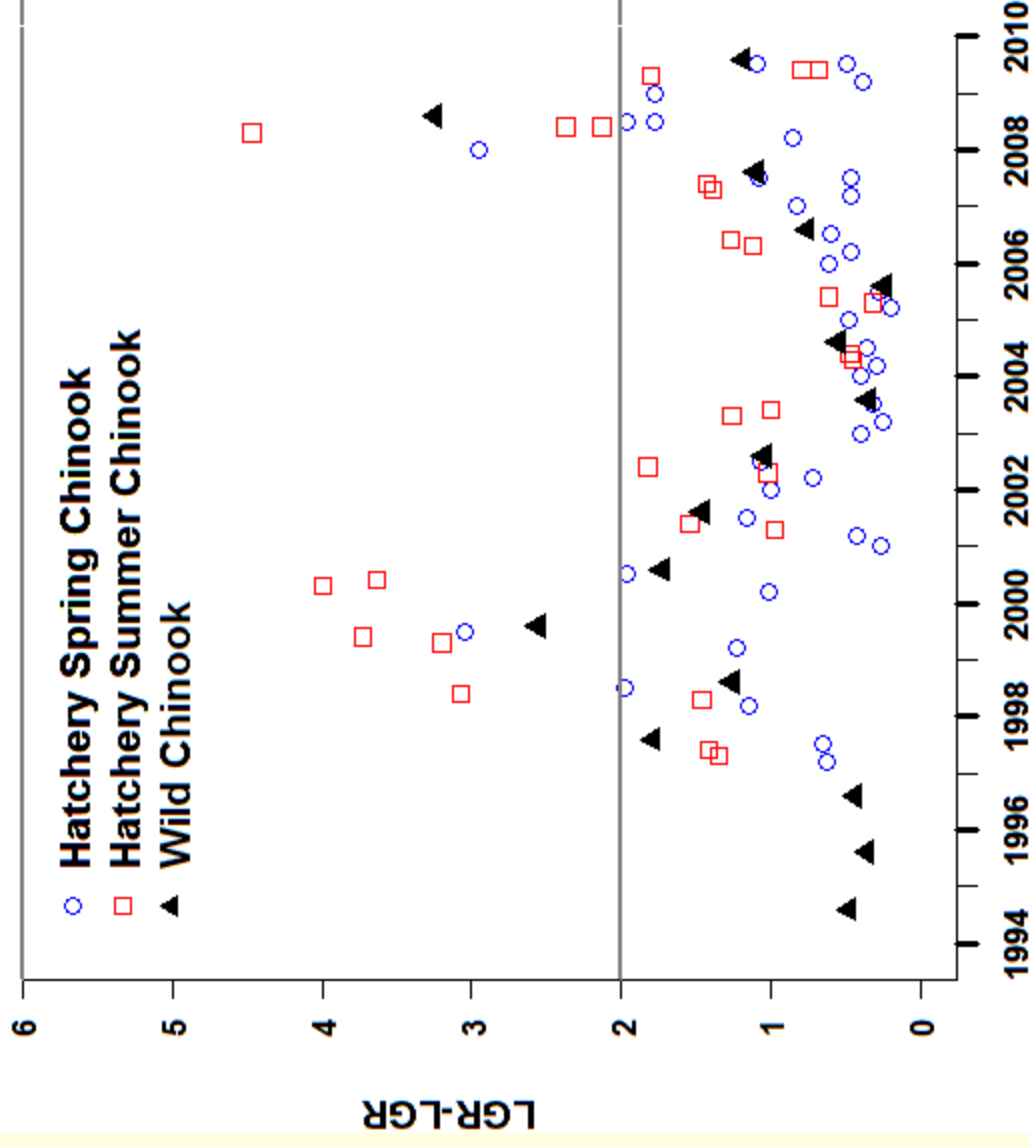
- **1999, 2000, 2008**  
some estimates above 2%



# CSS 2011: Chinook Overall SARs

OVERALL SARs (with jacks)

- Wild sp/su aggregate
- High correlation across Chinook stocks
- Most are less than 2%

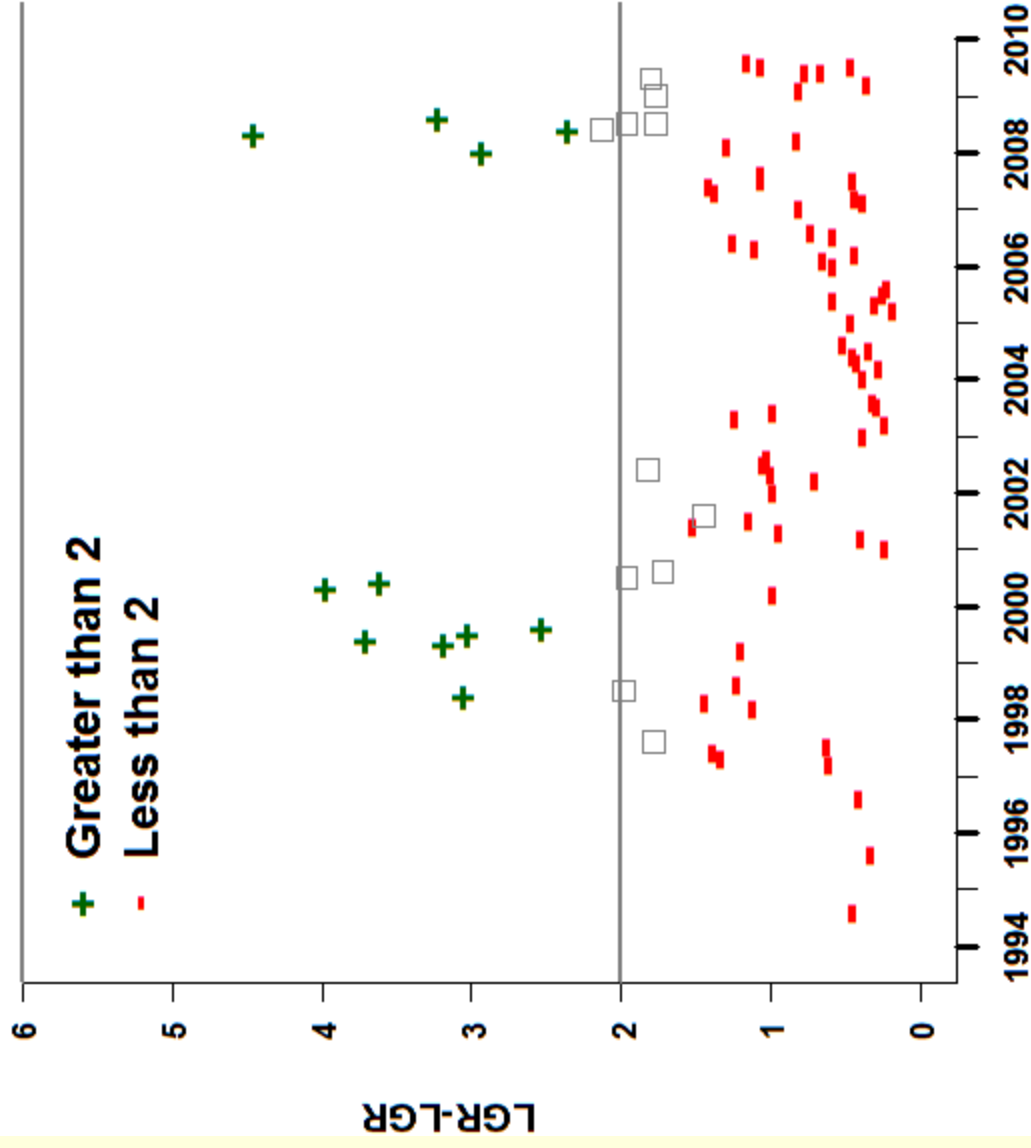


# CSS 2011: Chinook Overall SARs

OVERALL SARs (with jacks)

- 12.8% SARs > 2
- 74.4% SARs < 2
- 12.8% SARs = NS

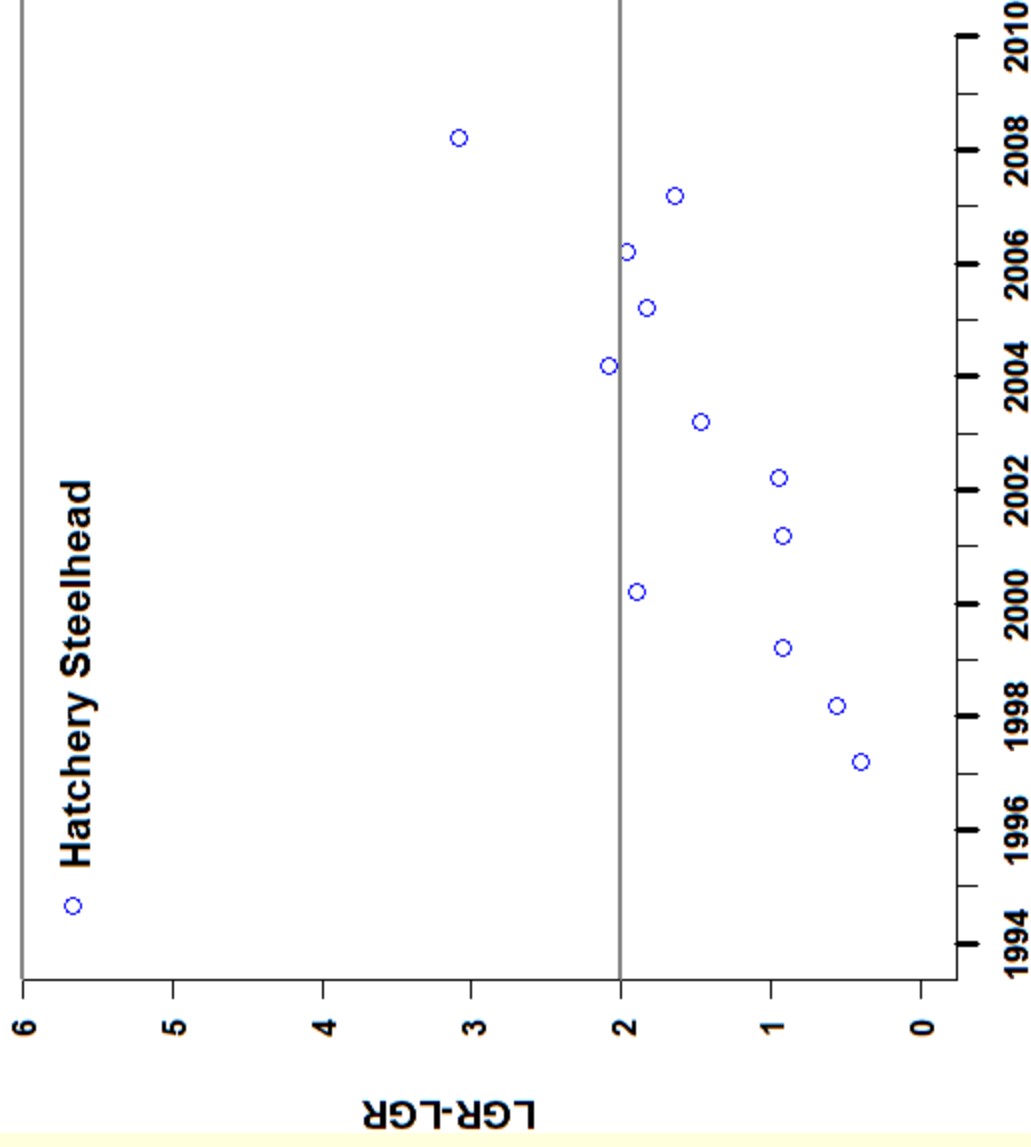
- Not meeting NPCC goal



# CSS 2011: Steelhead Overall SARs

## OVERALL SARs

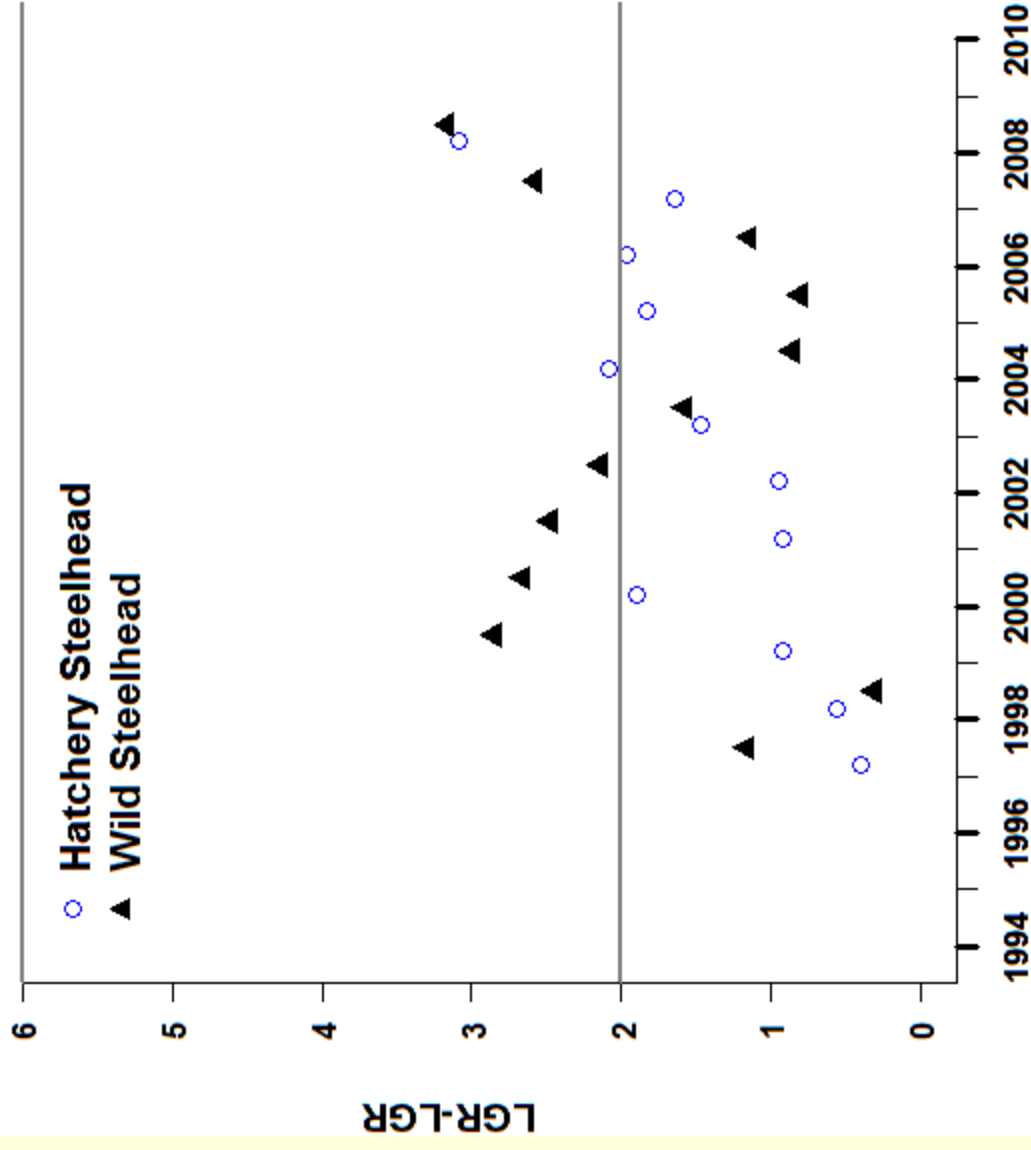
- Hatchery Steelhead
- Several estimates below 2
- 2008\* Highest in time series



# CSS 2011: Steelhead Overall SARs

## OVERALL SARs

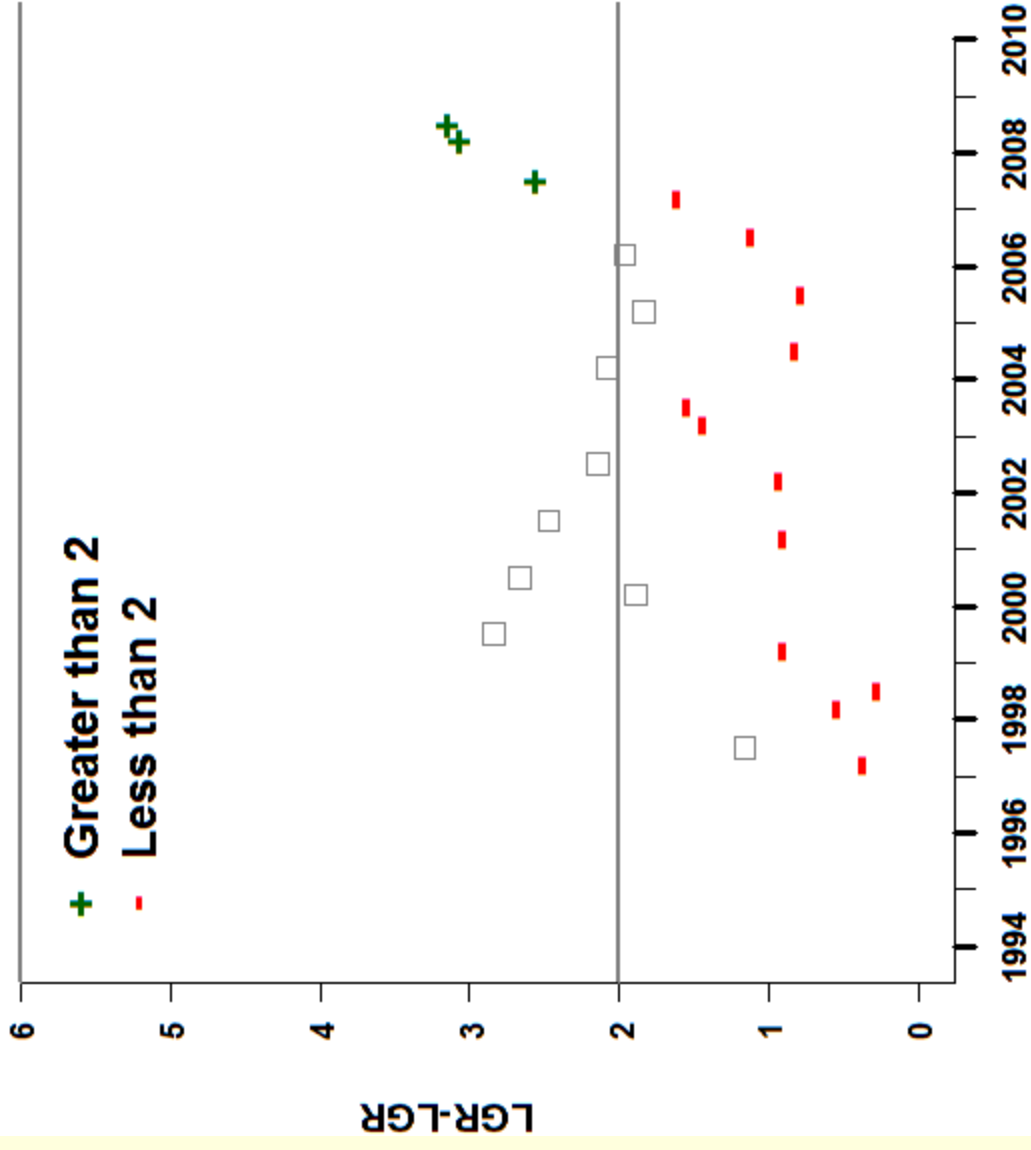
- **Wild Steelhead**
- **Less correlated than Chinook stocks**
- **Several estimates below 2**
- **2008\* Highest in time series**



# CSS 2011: Steelhead Overall SARs

## OVERALL SARs

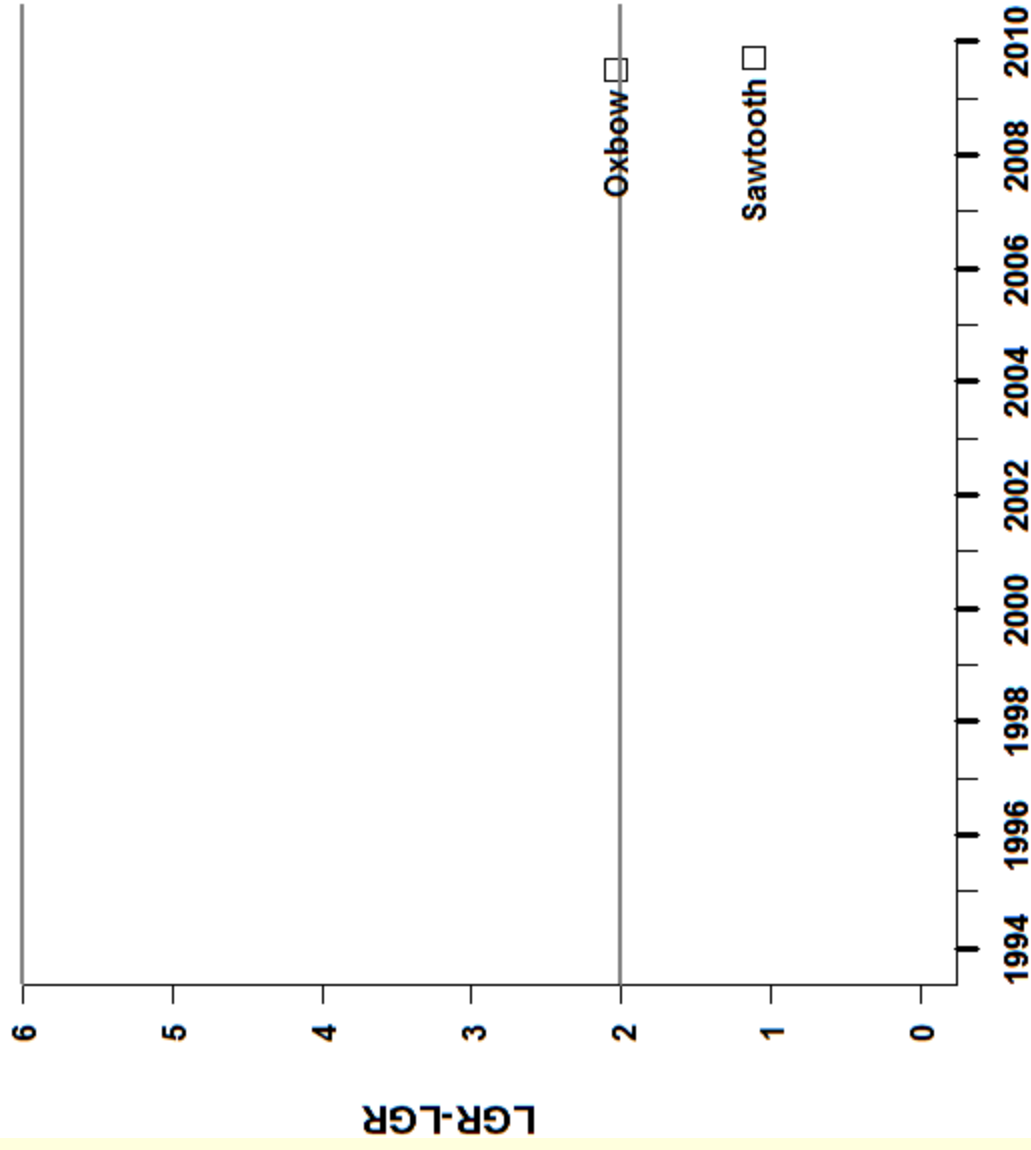
- 12.5% SARs > 2
- 50 % SARs < 2
- 37.5% SARs = NS
- Not meeting NPCC goal



# CSS 2011: Sockeye Overall SARs

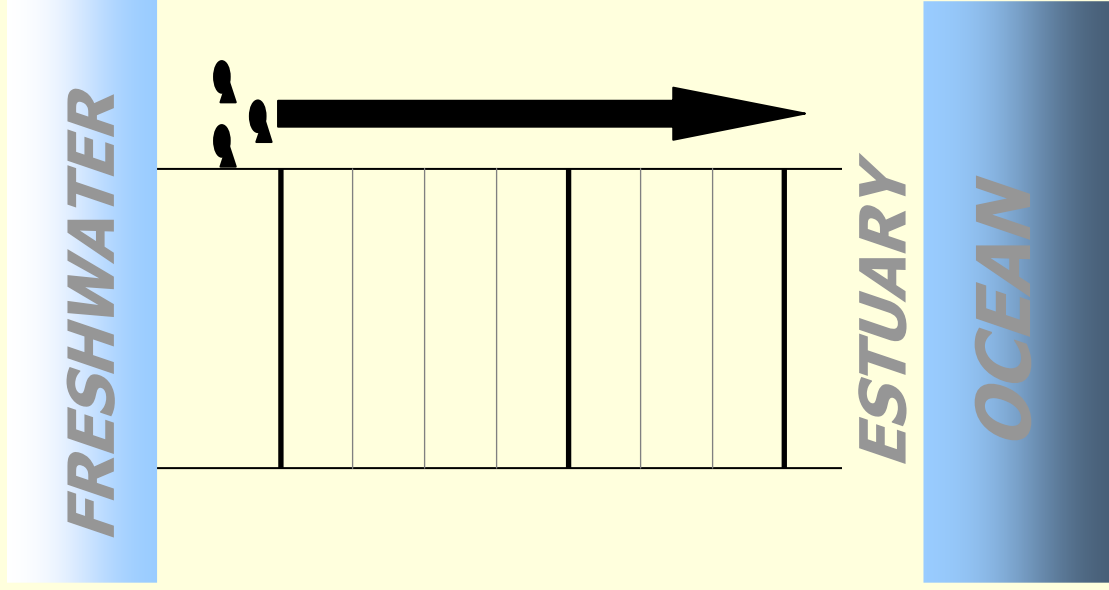
## OVERALL SARs

- First hatchery sockeye SARs
- OXBH, SAWT 2009 MY



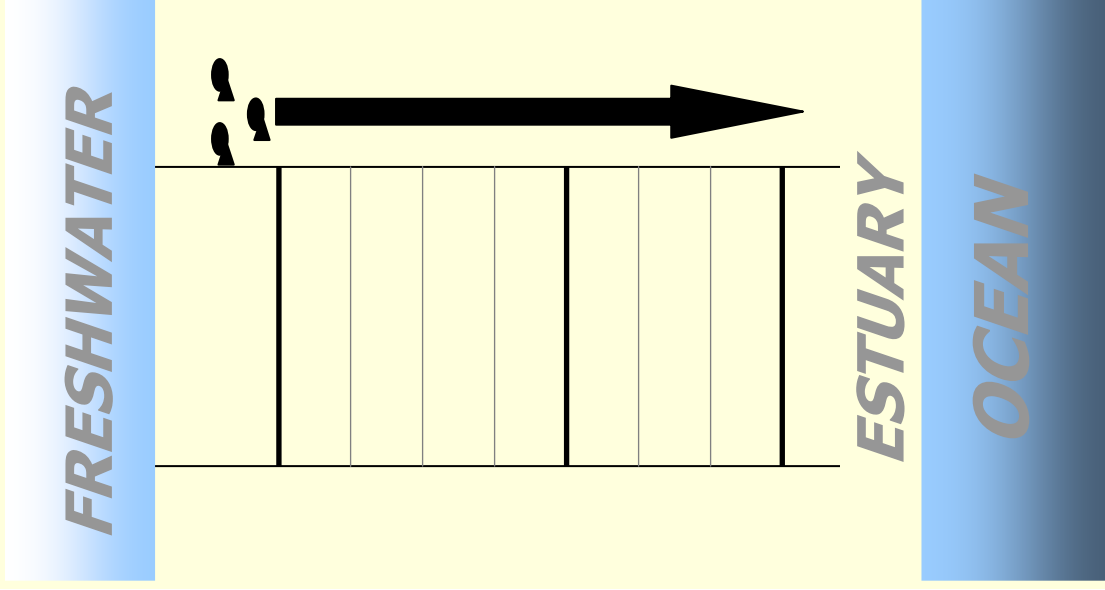


# CSS 2011: Juvenile Metrics



- Component of RM&E
- Long Term dataset of annual juvenile metrics
  - Emigration rate
  - Arrival time at dams
  - Juvenile survival
- Finer scale analyses: response to ISAB comment

# CSS 2011: Finer-Scale Analyses



- Simultaneous processes
  - Migration (FTT) & Mortality
- If we can predict these, we can predict survival
- GOAL: evaluate effects of operational and environmental features

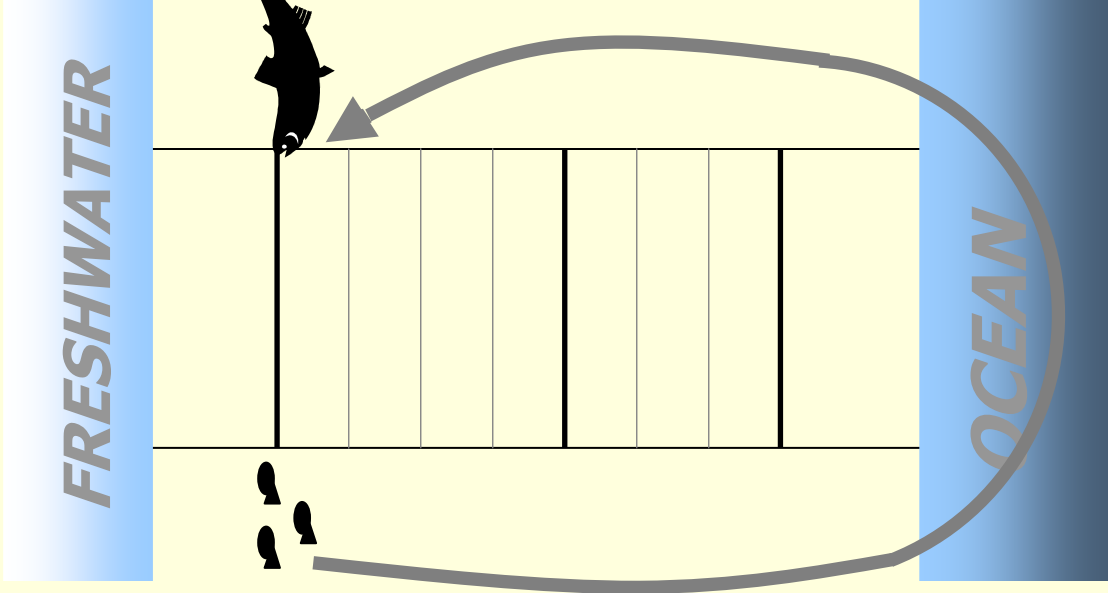
# **CSS 2011: Finer-Scale Analyses**

- **Multiple regression model factors**
  - **Seasonality (Julian Day)**
  - **Temperature**
  - **Turbidity**
  - **Average Percent Spill**
  - **Surface Passage Structures (TSW, RSW)**
  - **Water Transit Time (WTT, days)**
  - **Hatchery Composition**

# CSS 2011: Finer-Scale Analyses

- **The 2010 juvenile emigration characteristics: Water transit time (flow), spill, and Julian date were key variables affecting fish travel time and juvenile survival.**
- **Juvenile travel times, mortality rates and survival rates through the hydrosystem are strongly influenced by managed river conditions (water transit time and spill levels).**
- **Improvements for in-river survival and fish travel times can be achieved through reductions in water transit time or increased spill.**

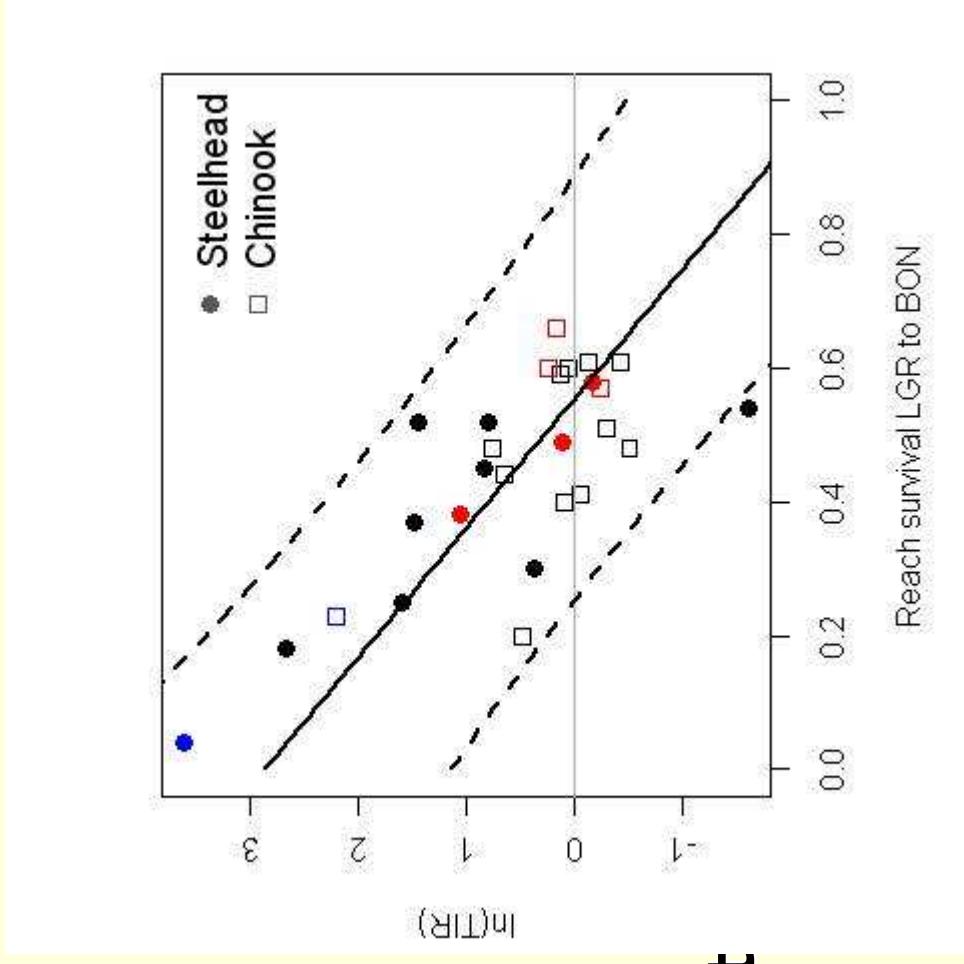
# CSS 2011: TIR



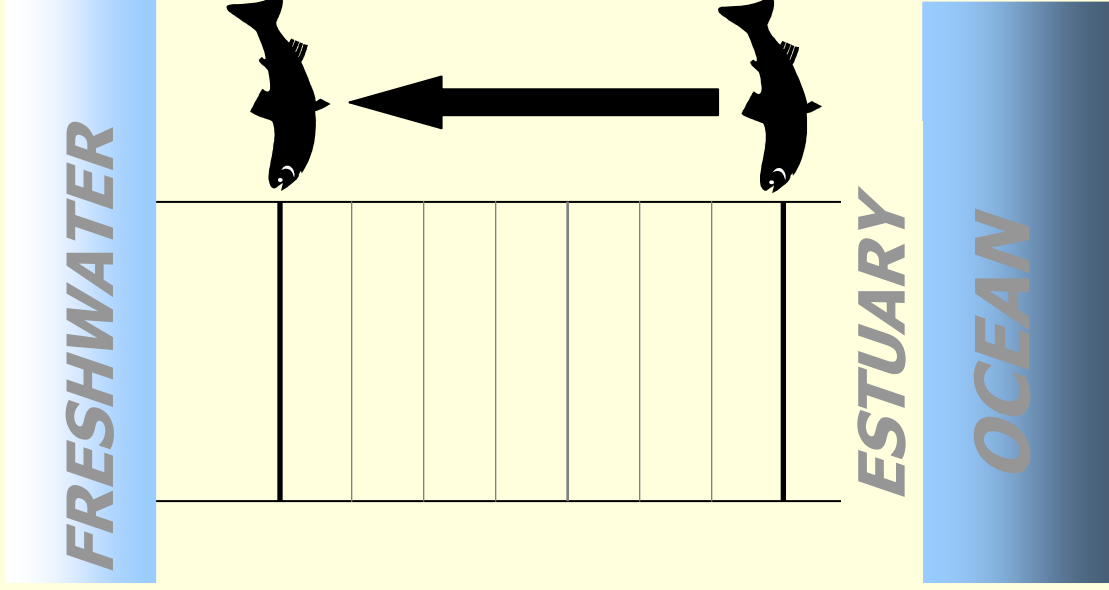
- Used to evaluate transportation program (SR stocks)
- Ratio of Transported ÷ Inriver SARs

# CSS 2011: TIR vs. in-river surv.

- TIR is directly related to in-river survival
- As in-river survival increases, TIR decreases
- When in-river surv  $\sim$  55%, transport will not be beneficial (for wild stocks)



# CSS 2011: Adult Success BON-LGR



- 3 questions
  - Effect of transportation on adult success?
  - If so, how does this compare with environmental variables?
  - Does transportation affect straying rates?

# CSS 2011: Adult Success BON-LGR

- Transported smolts had a lower success rate
  - Average of  $\sim 6\%$  lower; up to 29% lower
- Transportation was consistently a good predictor of adult success when compared with environmental variables
- Transported hatchery Chinook and hatchery or wild steelhead smolts strayed 10-39 times more often than in-river outmigrants (wild Chinook NS)



