CSMEP Hydro Subgroup Report

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Nampa ID
April 12-14, 2005

Outline

- Questions
- Conceptual Framework & Performance Measures (PMs)
- Monitoring Designs to Answer Questions
  - Evaluation
  - Sampling, Response: see handout
- Need from Other Subgroups (see handout, last pg)

Questions We Examined

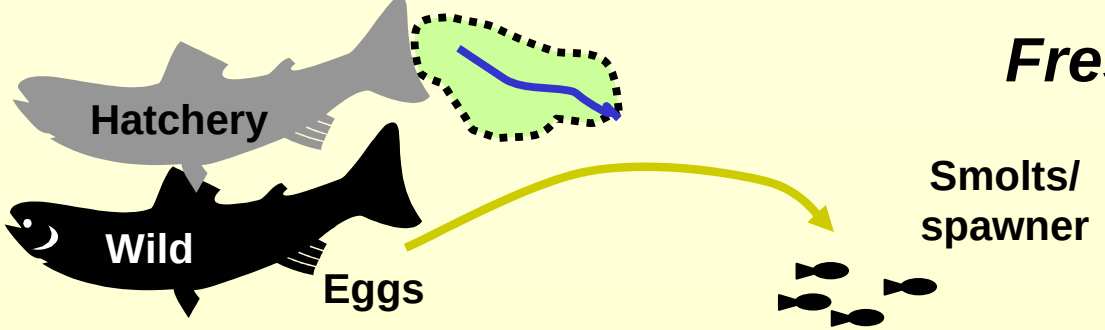
1. Is SAR sufficient for 1) NPCC goal & 2) recovery goals?
2. Has hydrosystem complied with performance standards set out in 2000 FCRPS BiOp?
3. Is transportation more effective than in-river passage?
4. What's the incremental mortality of Snake R fish populations (passing 8 dams) as compared to lower Columbia stocks (passing 1-3 dams)?
5. What is the relative survival of transported fish post-BONN, compared to in-river fish?

Questions We Examined cont'd

6. What's the inferred delayed mortality of both in-river and transported fish?
7. What's the effect of different within-season transportation management actions on SARs and post-BONN survival of transported fish?
8. What is the effect of different flow/spill management actions in the hydrosystem on a) SAR and Sp/Sp ratios and b) in-river survival?
9. Have freshwater habitat restoration actions been sufficient to compensate for hydrosystem direct and delayed mortality, as measured on the Snake R aggregate sp/sum chinook stock? <*Hydro/Habitat Subgroup*>

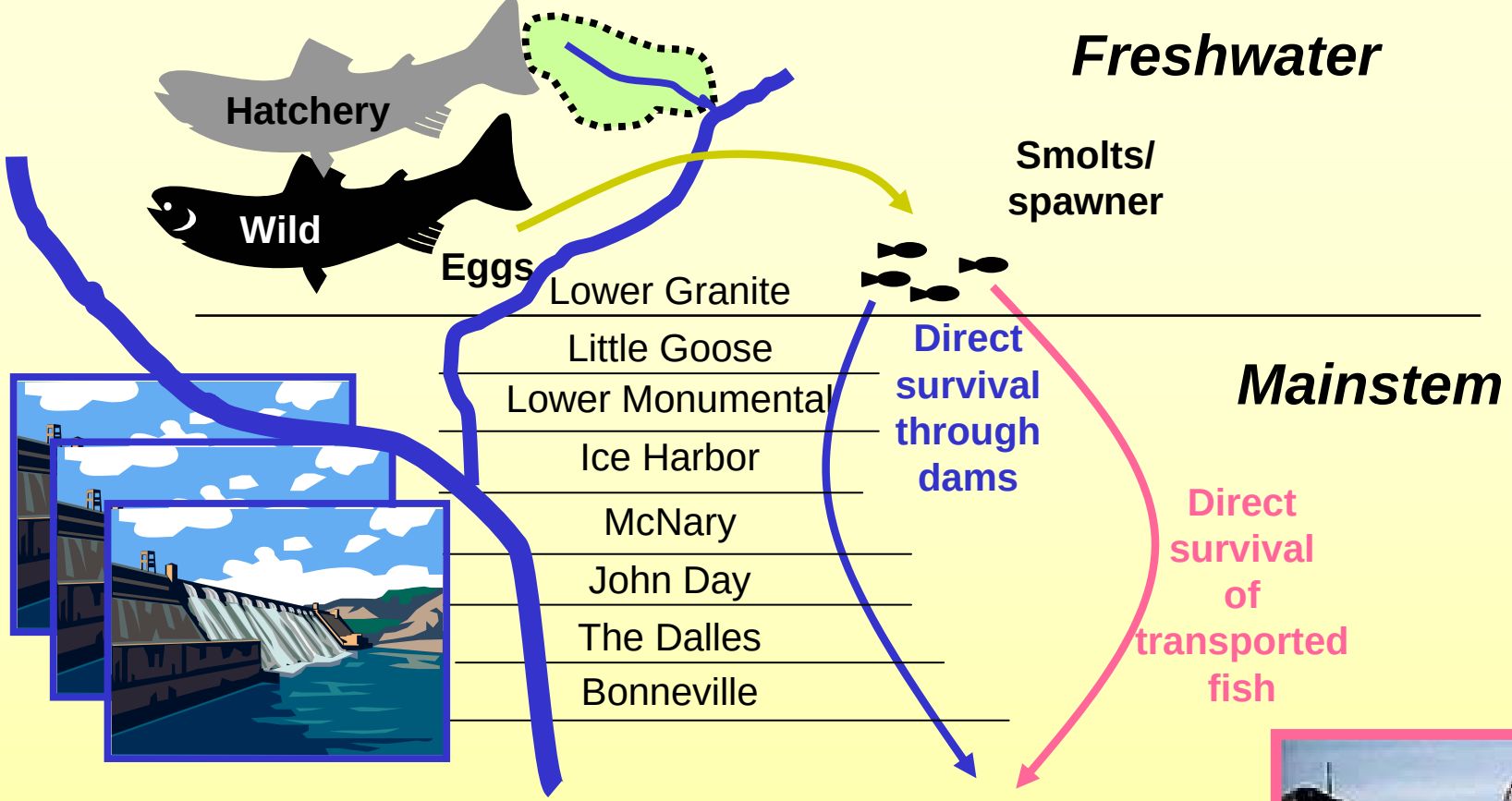
Other Questions We Didn’t Get To

- What are effects of changes at individual dams on project survival through bypass, spill and turbine routes?



Freshwater

Habitat & Hatchery Actions



Freshwater

Smolts/ spawner

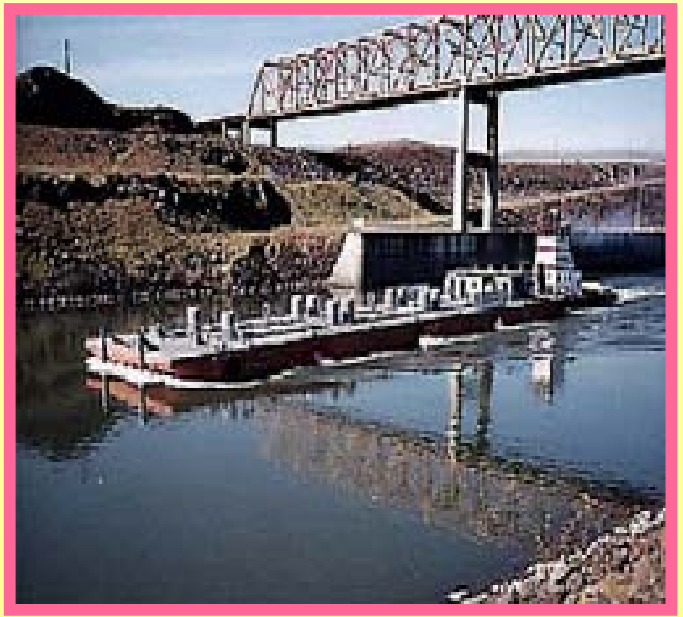
Direct survival through dams

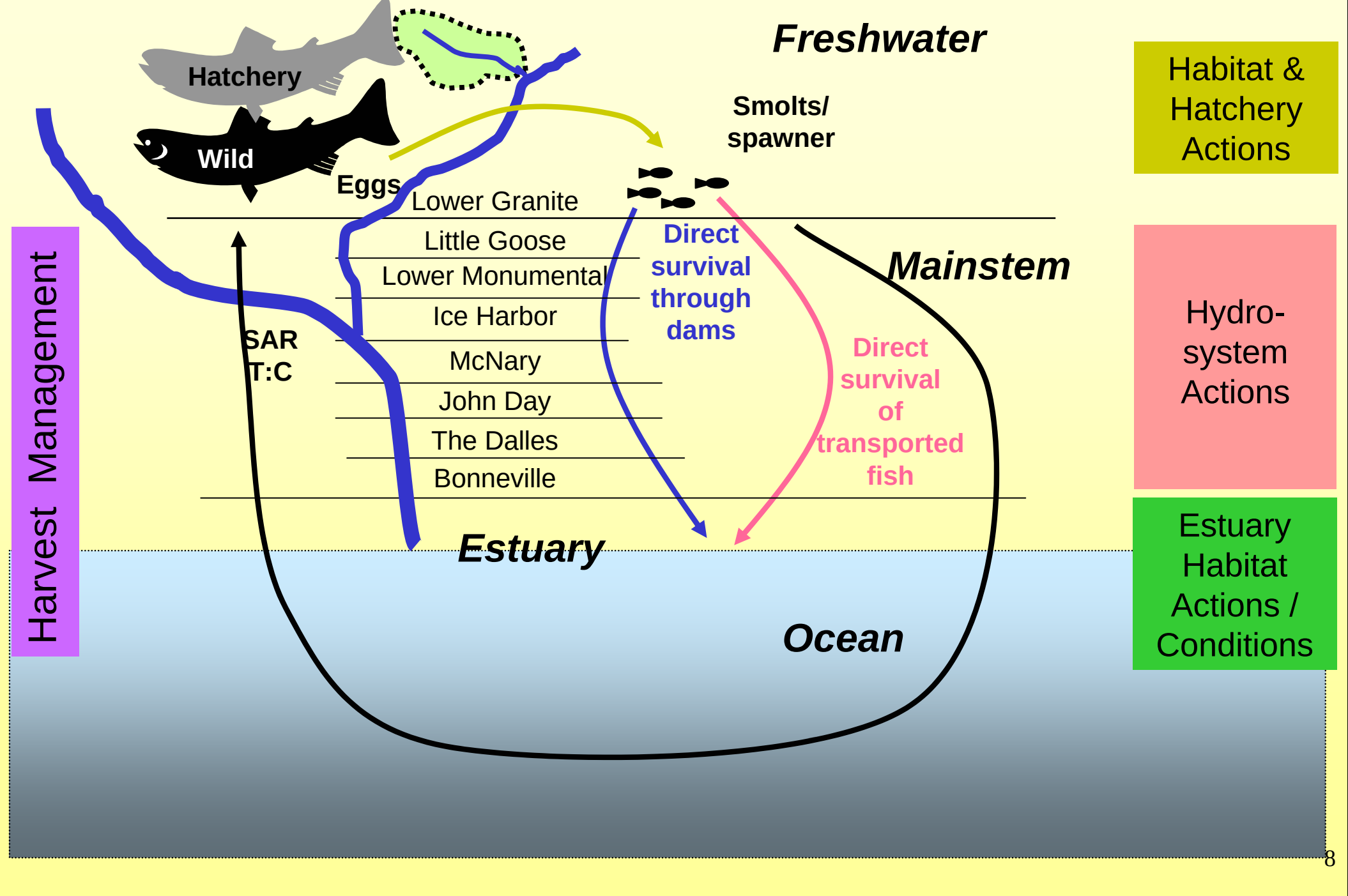
Mainstem

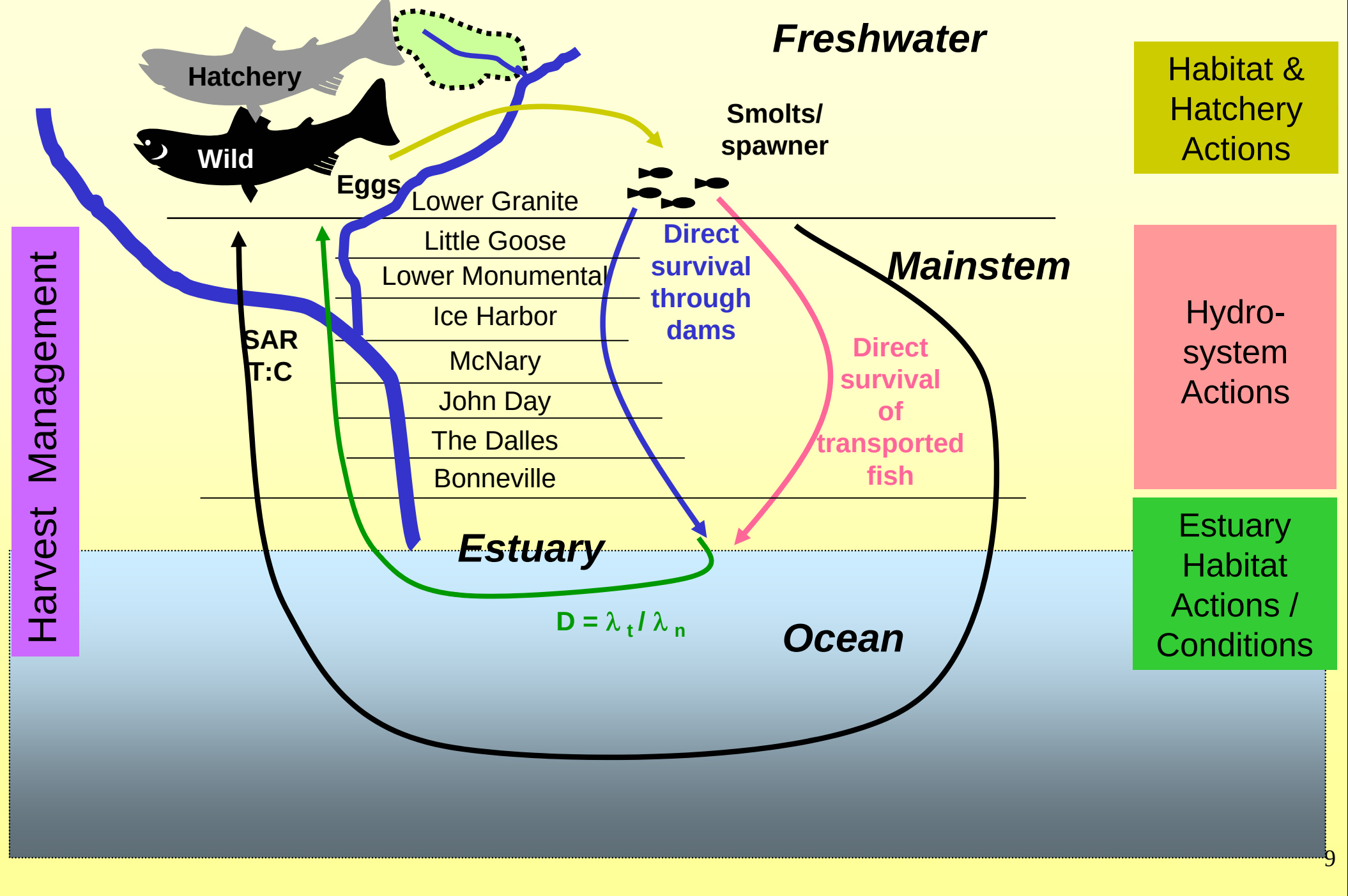
Direct survival of transported fish

Habitat & Hatchery Actions

Hydro-system Actions




Freshwater
Habitat & Hatchery Actions
Hatchery
Wild
Smolts/ spawner
Eggs
Lower Granite
Little Goose
Lower Monumental
Ice Harbor
McNary
John Day
The Dalles
Bonneville
Direct survival through dams
Mainstem
Hydro-system Actions
SAR T:C
Direct survival of transported fish
Harvest Management
Estuary
Estuary Habitat Actions / Conditions
Ocean


Freshwater
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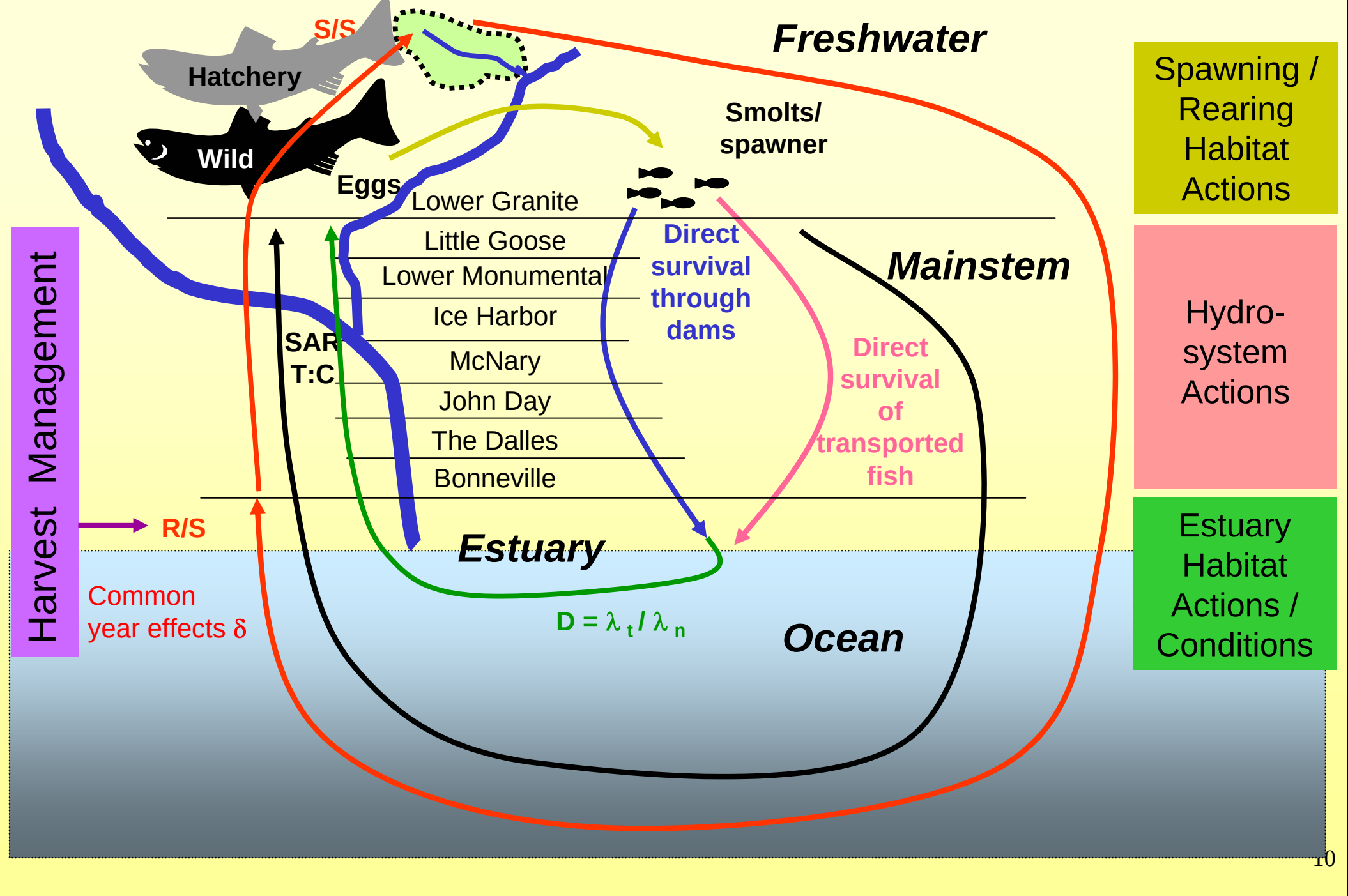
S/S
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Most PMs Provided by Current Monitoring

- CSS initiated in 1996 by states, tribes, Fish Passage Center, USFWS to estimate survival rates at various life stages
  - Compare survival rates for chinook from 3 major areas (Snake, Upper Columbia, Lower Columbia)
  - Develop more representative control for transport evaluations
  - information derived from PIT tags of wild, natural and hatchery juveniles
  - confidence intervals estimated by bootstrapping
  - results reviewed by ISAB, ISRP, FPAC, NMFS
- Other project / reach survival data from NOAA, Corps
- Run reconstructions (IDFG, ODFW, WDFW)

Types of Data / Analyses Provided by CSS

- Long term consistent indices:
  - Travel Times
  - In-river Survival Rates
  - In-river SARs by route of passage
  - Transport SARs
- Comparisons of SARs
  - Transport to In-River
  - By geographic location
  - By hatchery group
  - Hatchery to Wild
  - Chinook to Steelhead
- Recent CSS Workshop (Feb 2004) examined patterns of survival differences across different stock groups

CSS Tagging Locations

1. Winthrop Hatchery
2. Wells Hatchery
3. East Bank Hatchery
4. Leavenworth Hatchery
5. Dworshak Hatchery
6. Rapid River Hatchery
7. McCall Hatchery
8. Pahsimeroi Hatchery
9. Imnaha Acclim.
10. Catherine Creek Acclim.
11. Carson Hatchery
12. Warm Springs Hatchery

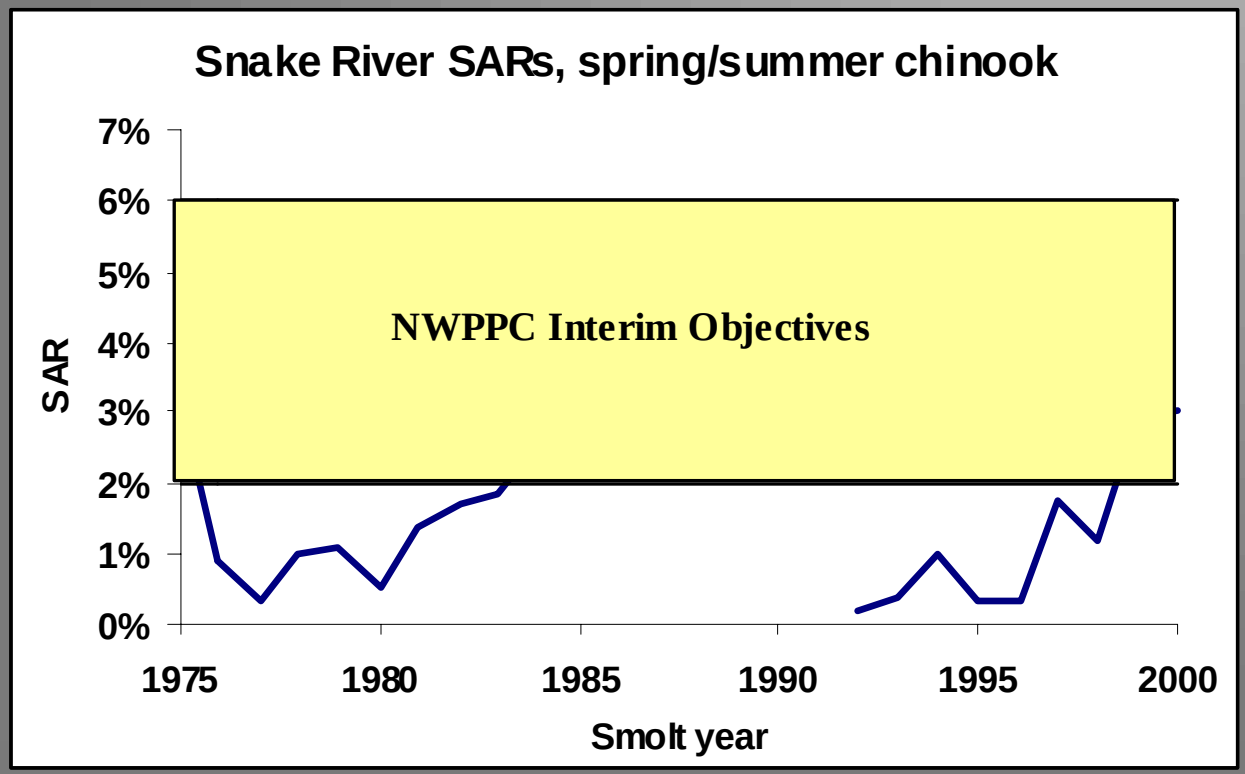
A. Salmon River Trap
B. Grande Ronde River Trap
C. Snake River Trap
D. Clearwater River Trap
E. John Day River Trap

Species Coverage in CSS and NOAA studies

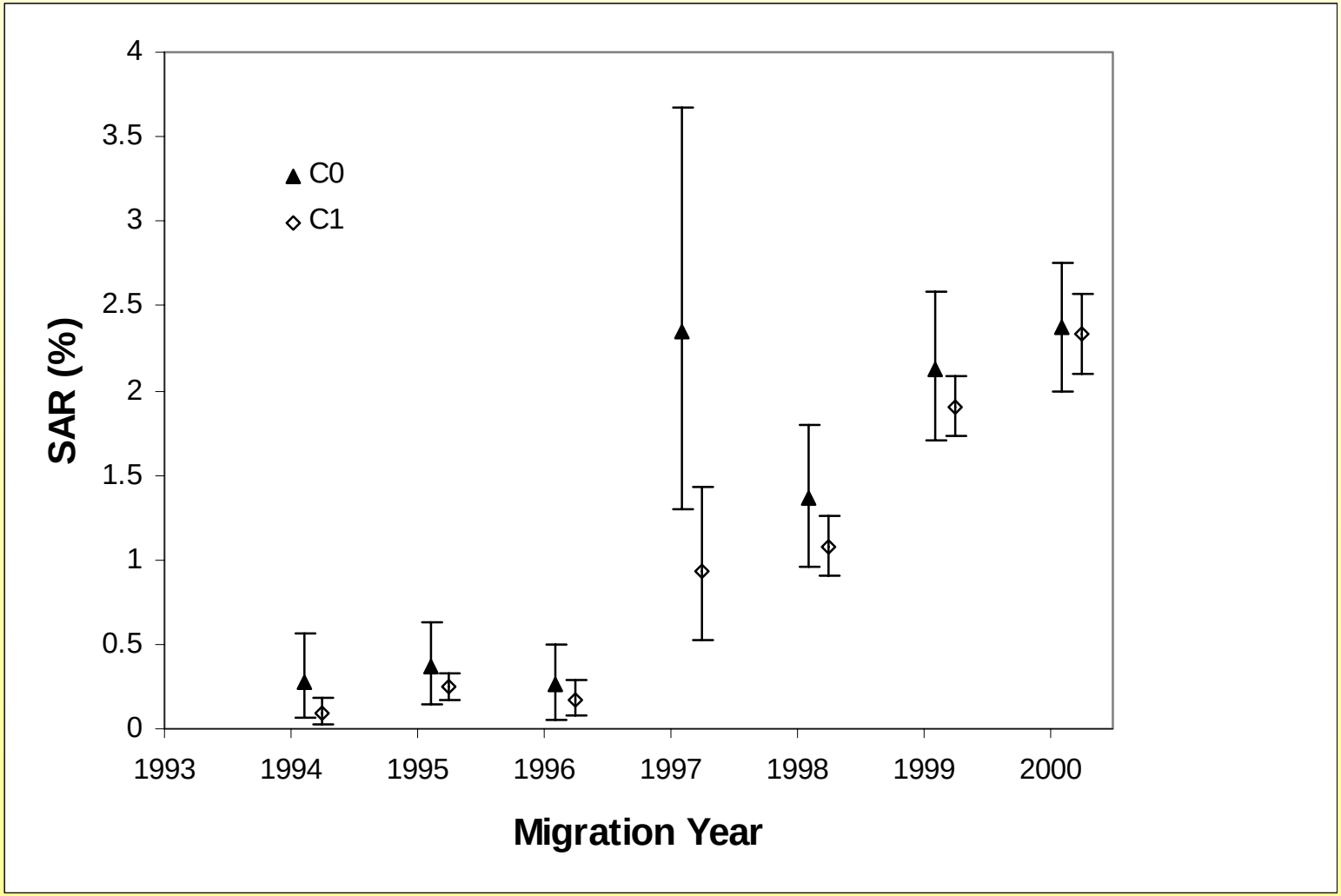
- SAR, T/C, in-river survival, D
  - good estimates for hatchery sp/sum chinook; hatchery SHD could be monitored in CSS but aren't at present; some work by NOAA on SHD
  - opportunistic sampling of wild aggregate sp/sum chinook and wild SHD (low sample sizes)
  - fall chinook not currently monitored; hatchery fall chinook could be PIT-tagged, but env. impact on wild (too small)
- In-river survival rates (reach specific and overall):
  - sp/sum chinook, SHD; fall chinook?

1. Is SAR sufficient for NPCC goal & recovery goals?

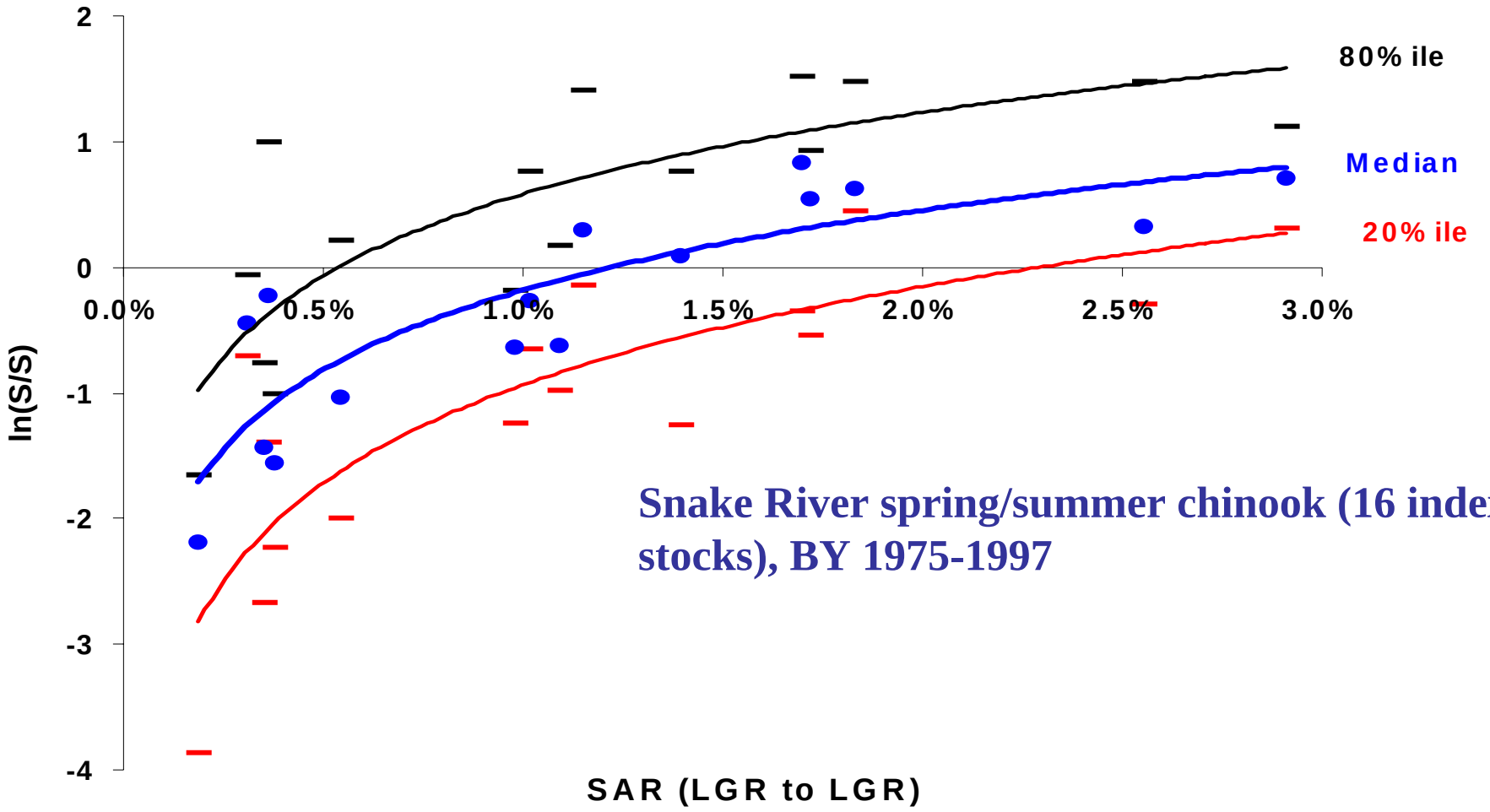
Smolt to Adult Survival Rate (SAR)
NWPCC Interim objective = 2-6%



CSS confidence intervals ‘good enough’ to answer this question (for sp/sum chinook)



What's appropriate SAR for stock persistence & recovery?

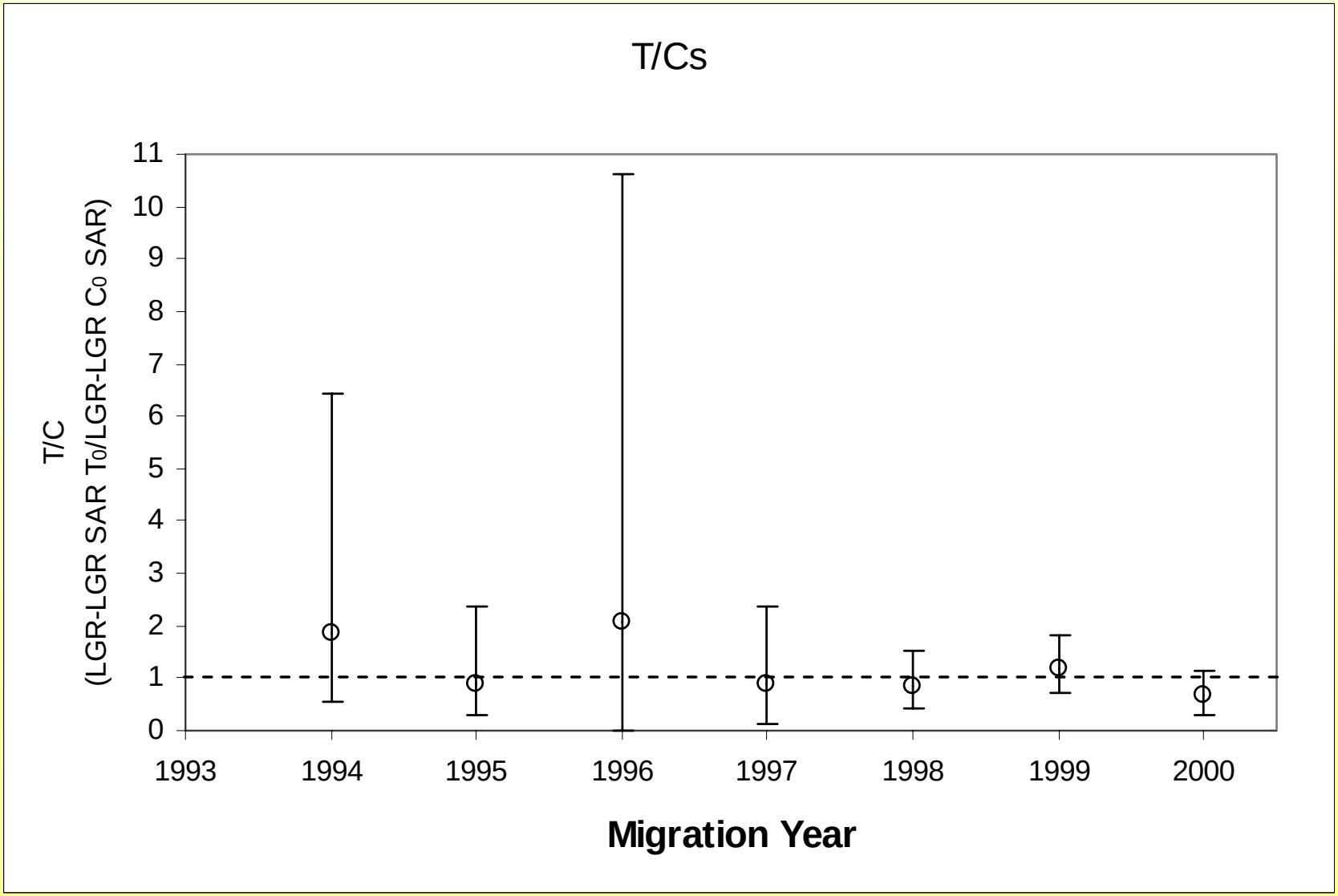


Snake River spring/summer chinook (16 index stocks), BY 1975-1997

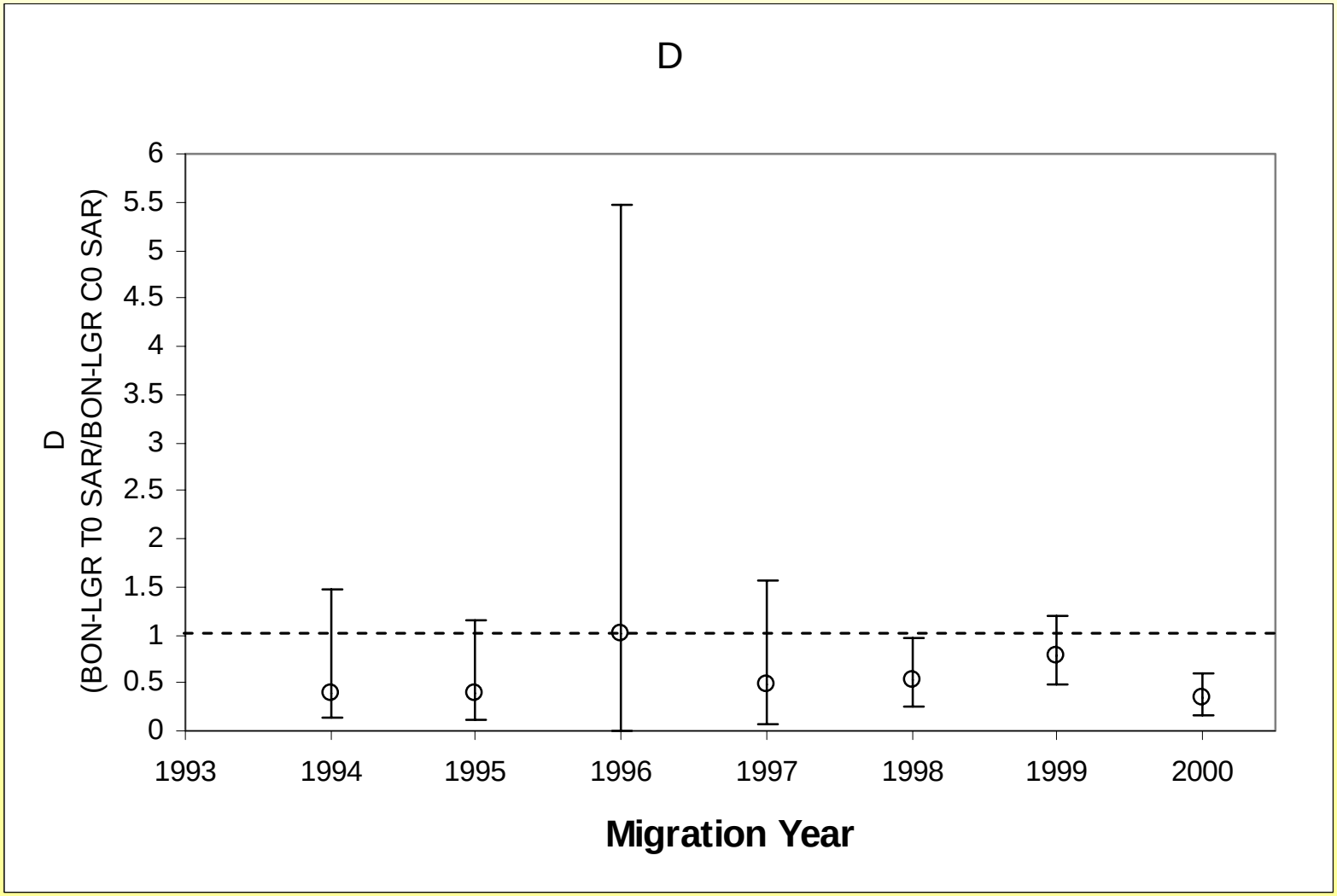
2. Has hydrosystem complied with performance standards set out in 2000 FCRPS BiOp?

- NOAA and Action Agency Hydrosystem RME Plan (2003) provide methods for assessing compliance and progress with 2000 FCRPS BiOp:
  - physical performance standards (flow targets, spill)
  - juvenile in-river survival in FCRPS (per project, system) and combined (including D for transported fish)
  - adult upstream survival, adjusting for fallback, harvest, straying and passage through navigation locks
  - multidimensional decision rule for assessing compliance:
    - slope of SURV trend line > 0; $SURV_{post\text{-}2000} > SURV_{pre\text{-}2000}$; # of SURV values > target; $SURV_{2006\text{-}2010} > SURV_{2001\text{-}2005}$

3. Is transportation more effective than in-river passage?



5. What is the relative survival of transported fish post-BONN, compared to in-river fish?



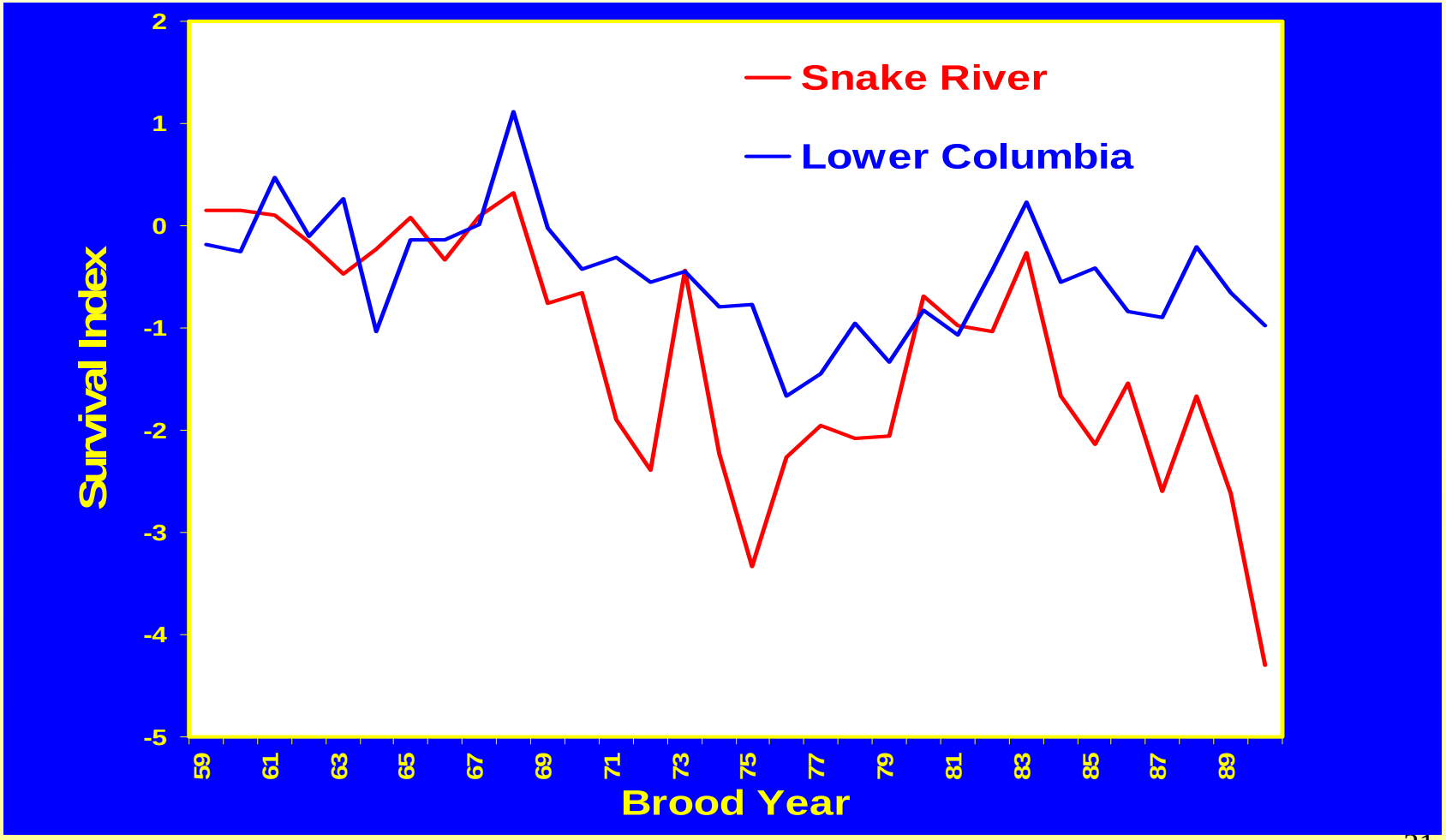
4. What's the incremental mortality of Snake R fish populations (passing 8 dams) as compared to lower Columbia stocks (passing 1-3 dams)?

Can compare R/S (Schaller et al. 2001)

or

SARs

for different stock groups

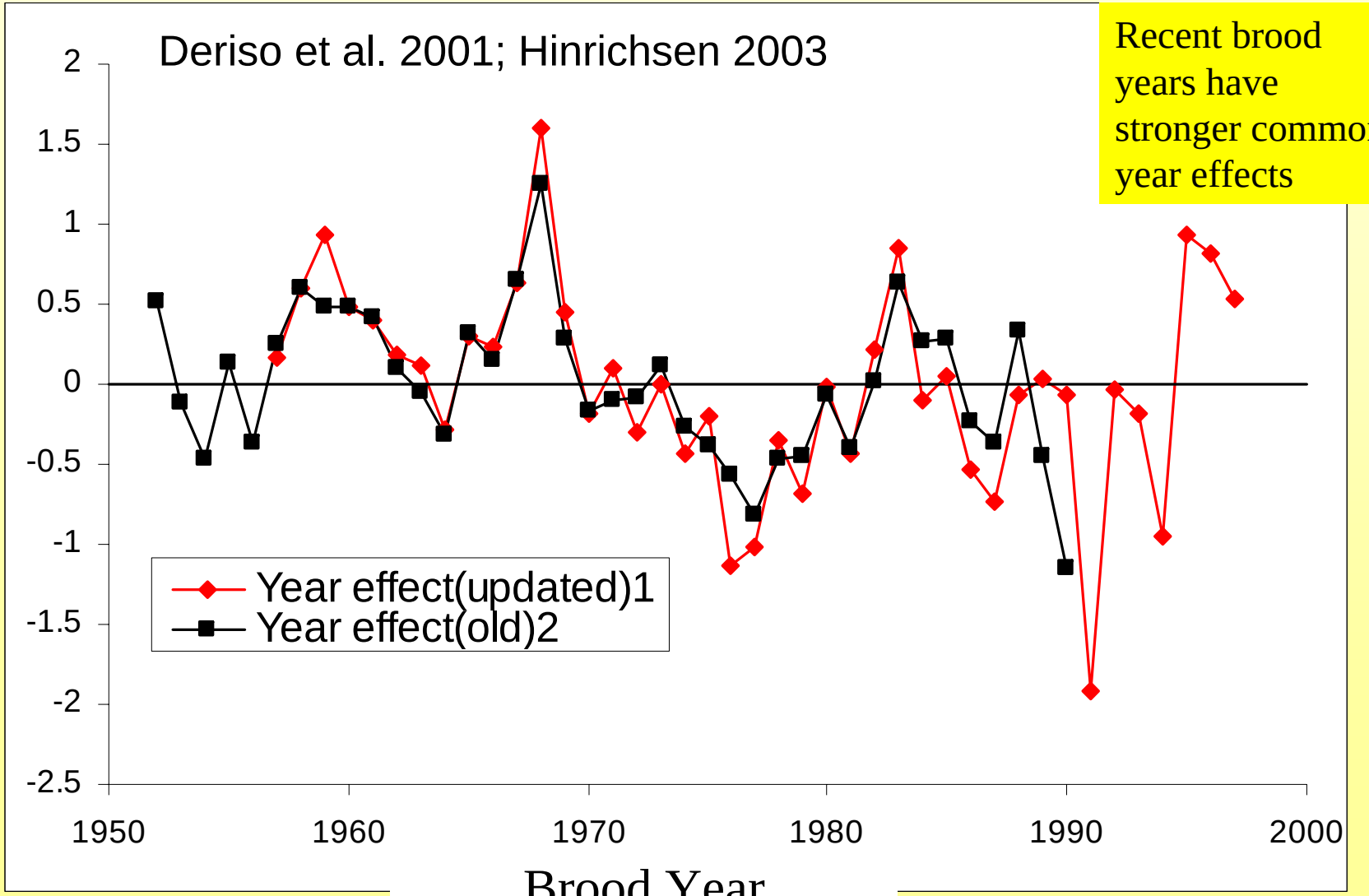


Common Year Effect for Snake River and John Day stocks (δ_t)

$$\ln(R/S)_{i,t} = a_i - b_i S_{i,t} - (X*n + \mu_t) + \delta_t + \varepsilon_{i,t}$$

Above avg. ocean / climate for all stocks

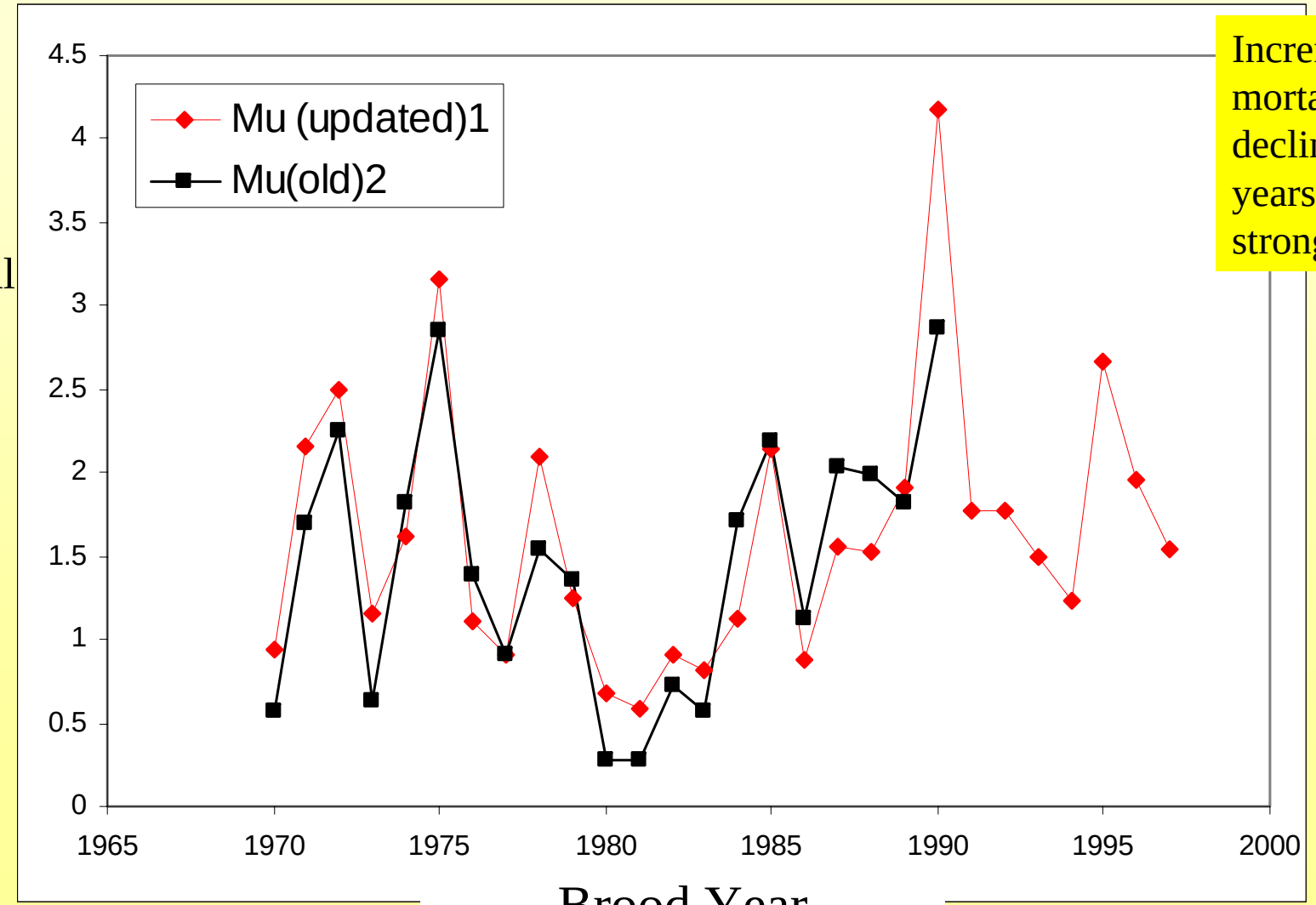
Below avg. ocean / climate for all stocks



Recent brood years have stronger common year effects

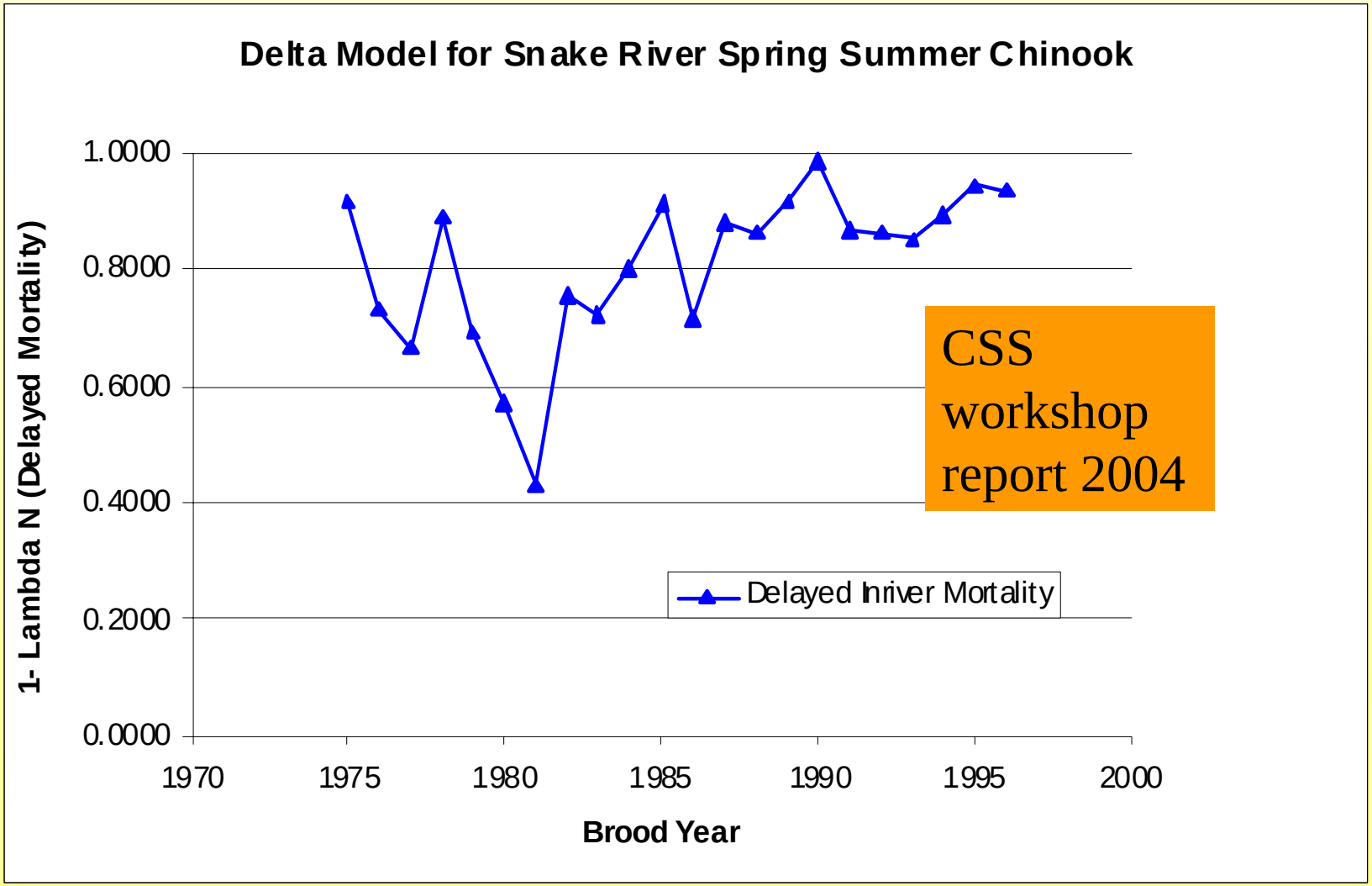
Incremental mortality of Snake R over John Day stocks (μ)

$$\ln(R/S)_{i,t} = a_i - b_i S_{i,t} - (X*n + \mu_t) + \delta_t + \varepsilon_{i,t}$$



Incremental mortality has not declined in recent years, despite stronger returns

6. What's the inferred delayed mortality of both in-river and transported fish?



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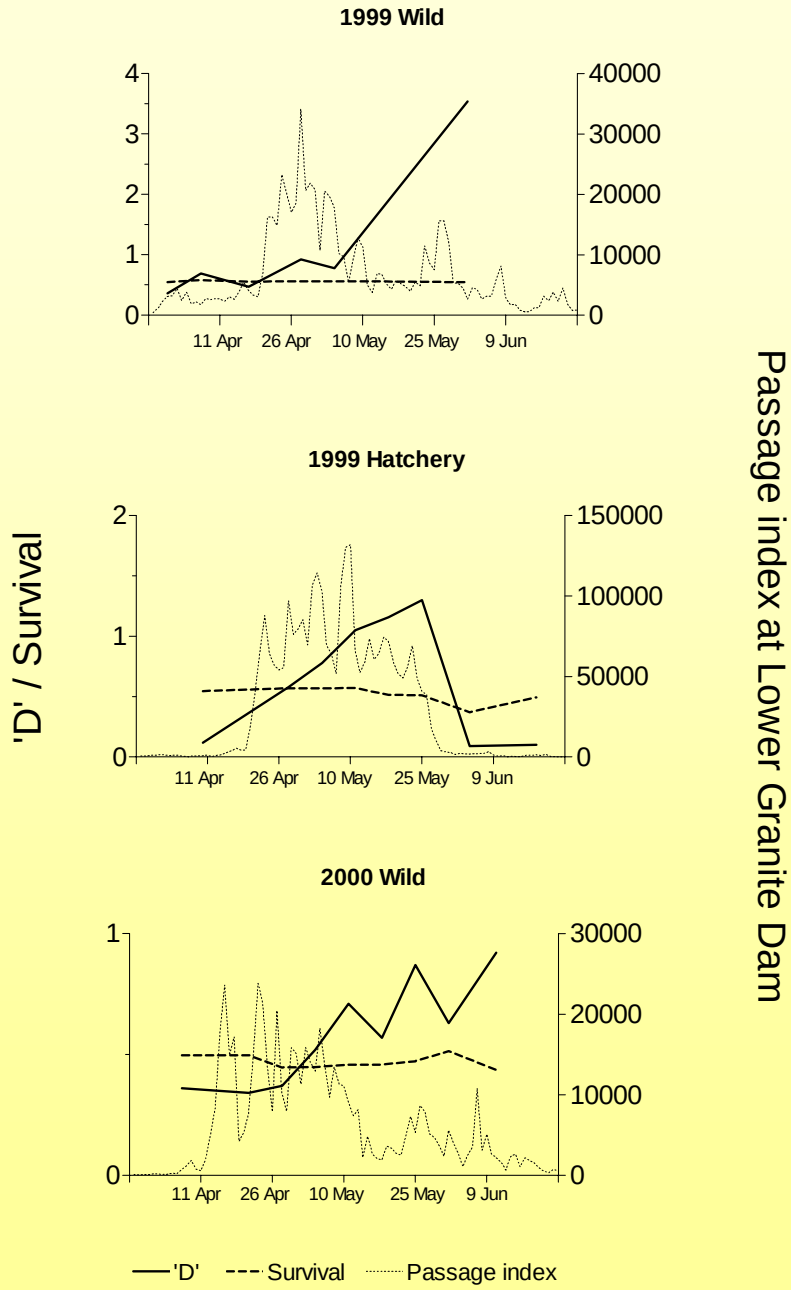
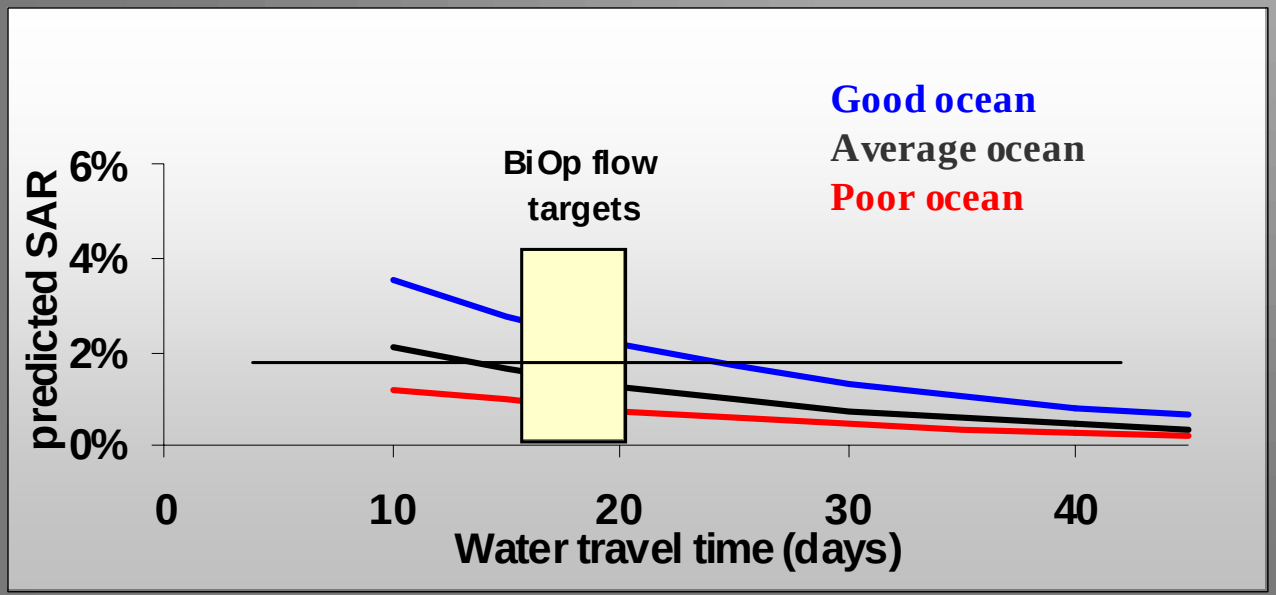


8. What is the effect of different flow/spill management actions in the hydrosystem on a) SAR and Sp/Sp ratios and b) in-river survival?

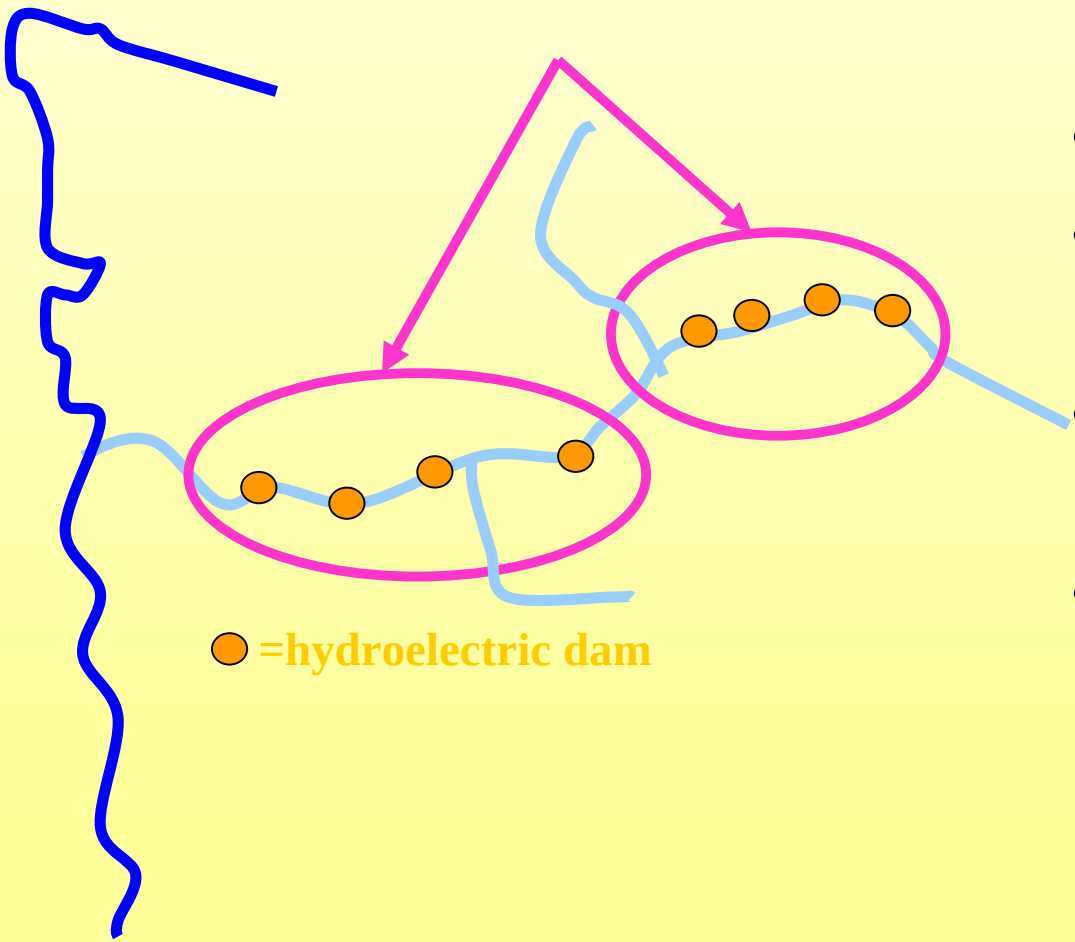
Influence of Water Travel Time and Climate Effect on Spring/Summer Chinook SAR (predicted)



Snake R. spring/summer chinook

Questions???

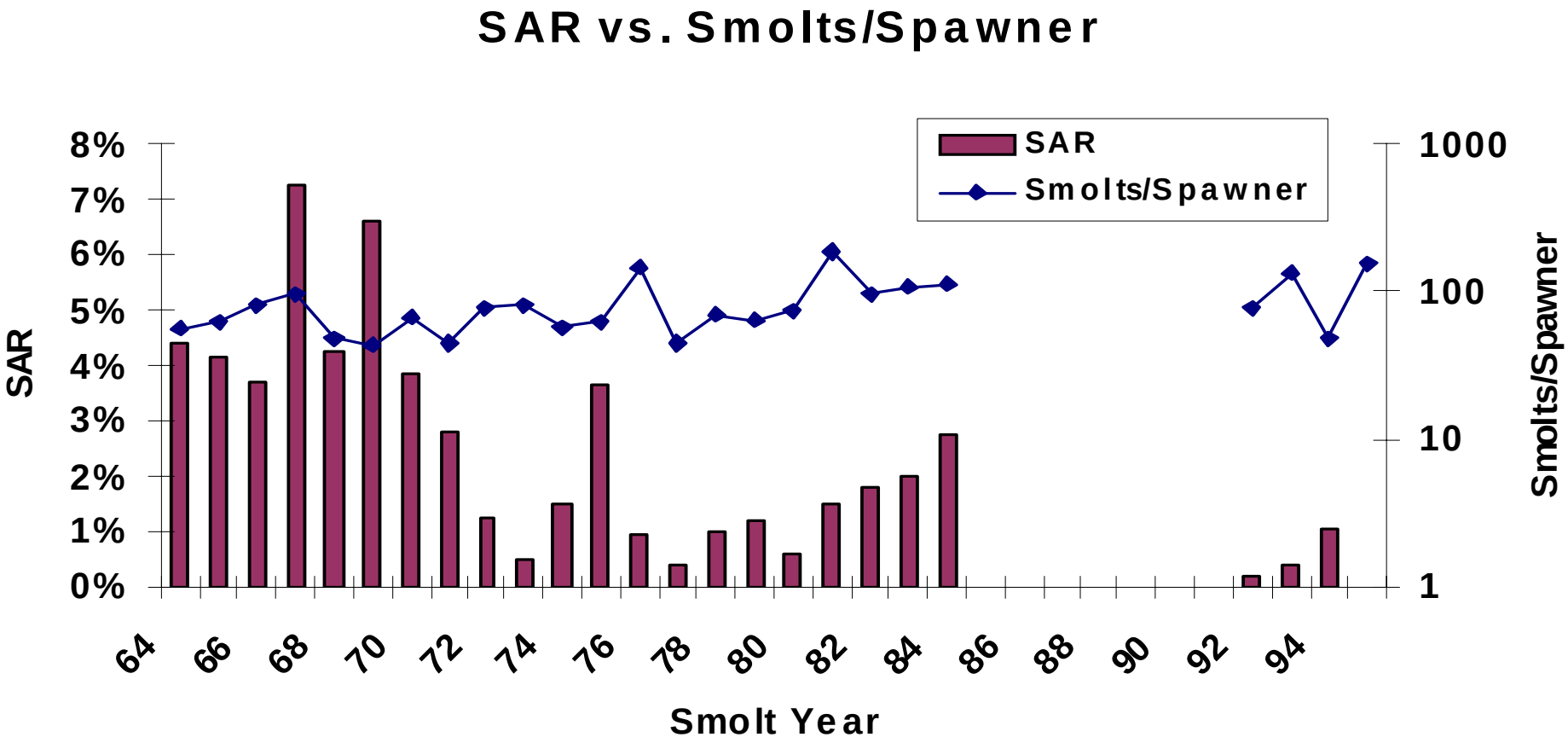
Example of Spatial Comparisons



Compare Snake R. to L. Columbia stocks:

- 1-4 dams vs. 8 dams
- Same species (similar genetically)
- Similar life history and run timing
- Share common estuary and early ocean environment

Graphical Comparisons:
SAR vs. Smolts/Spawner (at LGR; Petrosky et al. 2001)



Log-linear models

Ln (survival rate index) = F(stock productivity, stock size, 'treatment' index, covariates)

- need contrasts over space and time in the treatment (habitat, hatchery, and/or hydrosystem actions); BACI-type 'design'
- need covariates to explain away variation that adds noise to the treatment signals (e.g. climate / ocean conditions)

Example (Deriso et al. 2001):

$$\ln(R/S)_{i,t} = a_i - b_i S_{i,t} - (X*n + \mu_t) + \delta_t + \varepsilon_{i,t}$$

Conclusions

- PIT-tag data, other survival indices permit inferences on relative effects of different actions at different life stages
- Such data are not available for all sub-basins; sample sizes may be constraining for certain hypotheses
- Combining multiple treatments and locations may offer insights provided that treatments are not confounded
- Plan ahead…
  - explore what kinds of inferences are possible now;
  - what would be of interest in the future;
  - what ancillary data need to be collected