B-C Analyses of the Yakima River Basin Integrated Plan Projects: update

2013 Capital Budget (5035-S.SL) Section 5057

Stephen Katz
School of the Environment
Washington State University

Jonathan Yoder
School of Economic Sciences
State of Washington Water Research Center

Other PIs: Jenny Adam, WSU; Michael Brady, WSU; Joseph Cook, UW; Barb Cosens, U. Idaho.

Project scope

- SWWRC/WSU are to prepare separate benefit-cost analyses for each proposed YBIP project.
- Directed to use existing studies to the extent possible, supplemented by primary research.
- Show contributions of individual projects to:
  - fish populations,
  - irrigation water reliability during severe drought,
  - municipal and domestic water supply.

Basic approach

- Project categories
  - Water storage/conservation
  - Fish habitat
  - Operations
- Accounting for non-separability among projects
- Existing models are the foundation, with modification where deemed appropriate.
  - YAKRW: water supply, conservation, operations
  - Habitat productivity, fish productivity
  - Valuation (ag, muni, fish)

Out-of stream benefits

- Irrigation benefits
  - YAKRW and a modified version of the irrigation benefits spreadsheet model of EcoNorthwest.
  - Developing full water value curves by irrigation district.
  - YAKRW proration estimates and water value curves provide sufficient information to
    - estimate the marginal value of a storage/conservation scenarios relative to baseline/other.
    - Estimate the value of increasing water market activity.
- Municipal benefits
  - Starting point: muni purchase from non-proratables/senior
  - Muni curtailment costs are then the opportunity cost of this water.

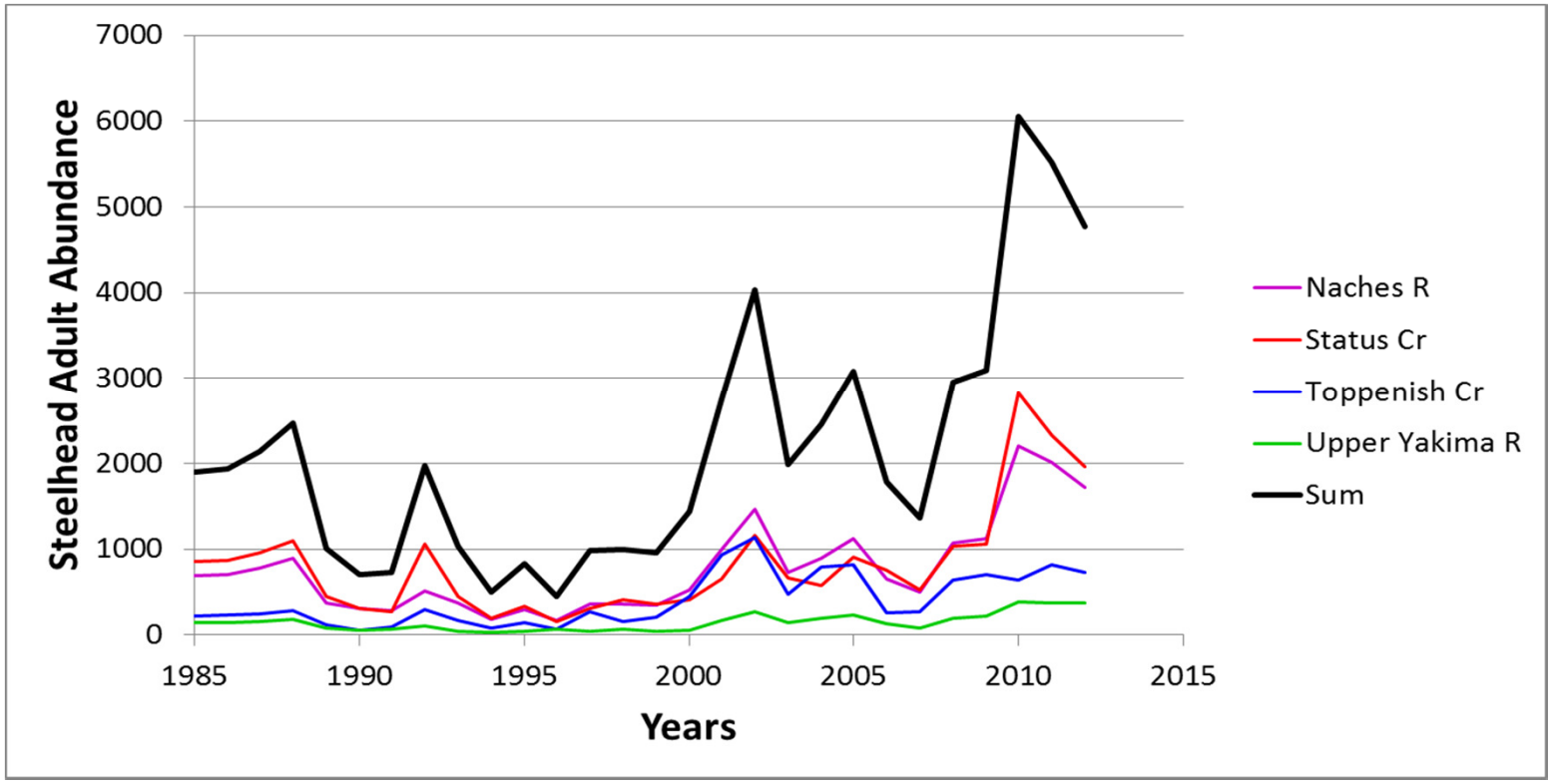
In-stream benefits

- Premise –
  - Do work on habitat (including water quantity & quality, habitat quantity & quality, reducing sources of mortality, etc.)
  - Produce more fish
  - Increase net value of fish in the basin

- It's a forecast problem

The question with forecasts is uncertainty

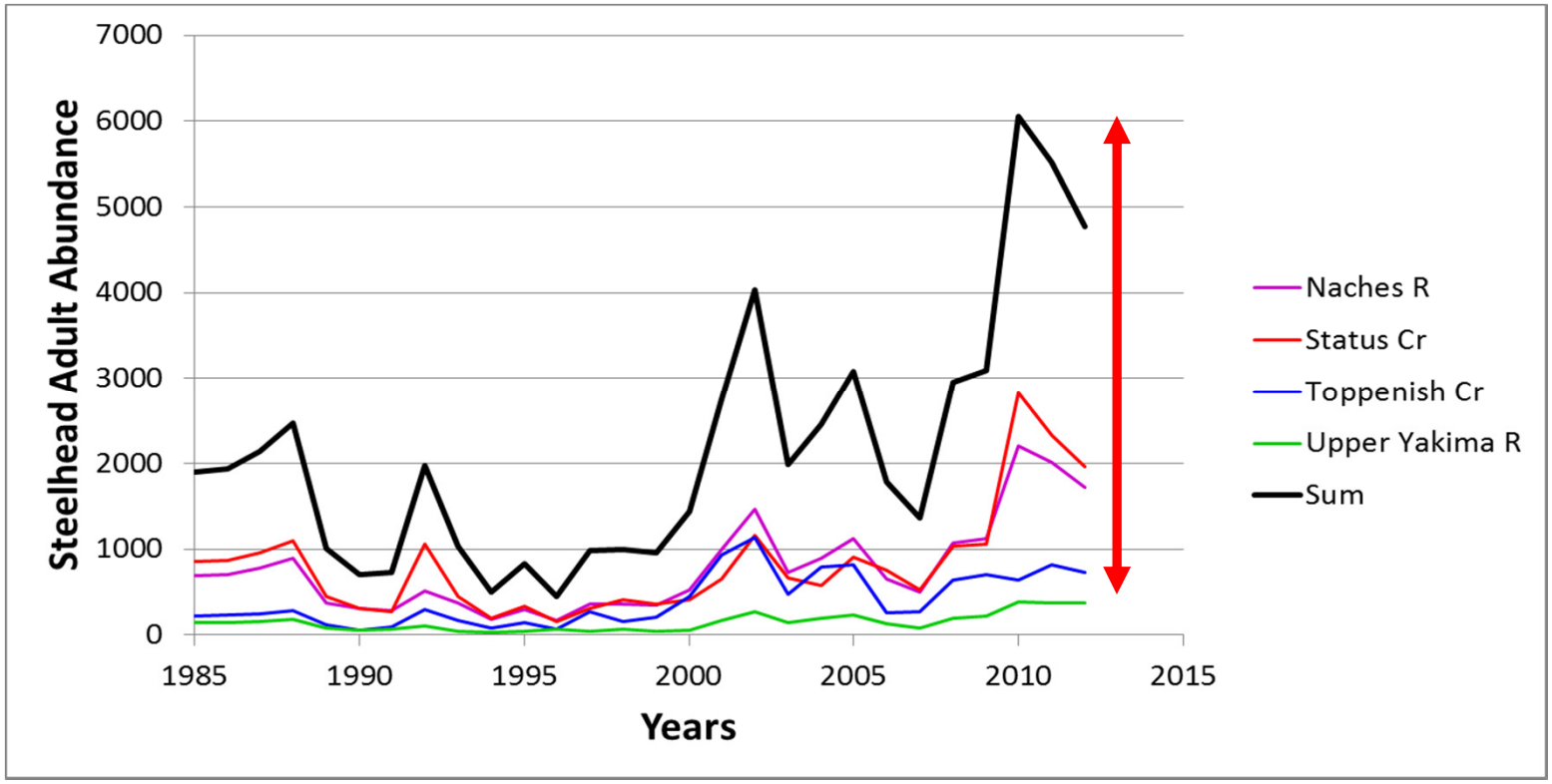
Lots of variance - uncertainty



Looking at Steelhead, because that is where data are at hand

The question with forecasts is uncertainty

Lots of variance - uncertainty

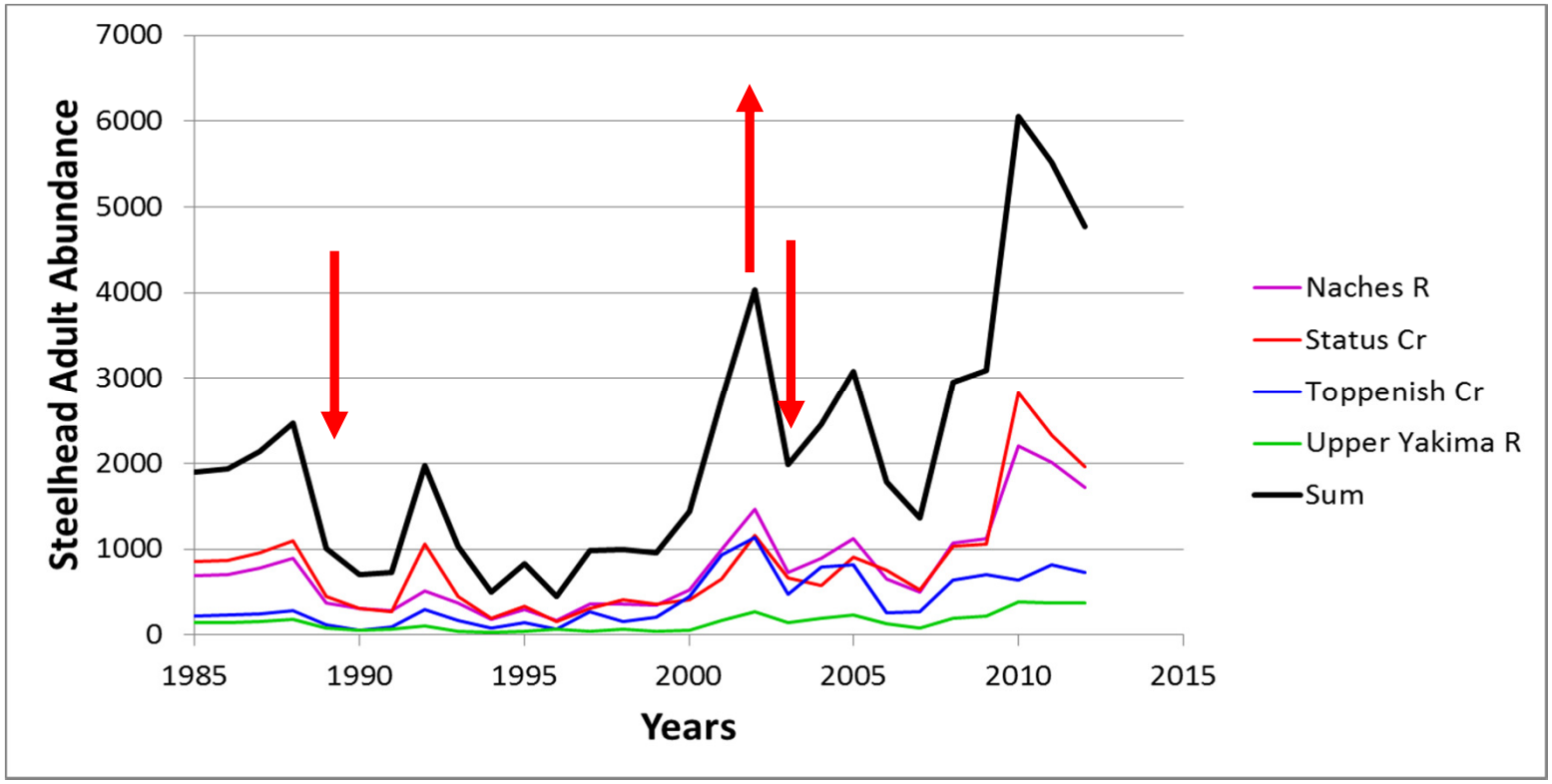


Some of the uncertainty is in wide range of recent abundances

600-6000 or an order of magnitude in the last 20 years.

The question with forecasts is uncertainty

Lots of variance - uncertainty



Also the variance is correlated among groups of fish that experience different freshwater histories – but common histories outside the basin.

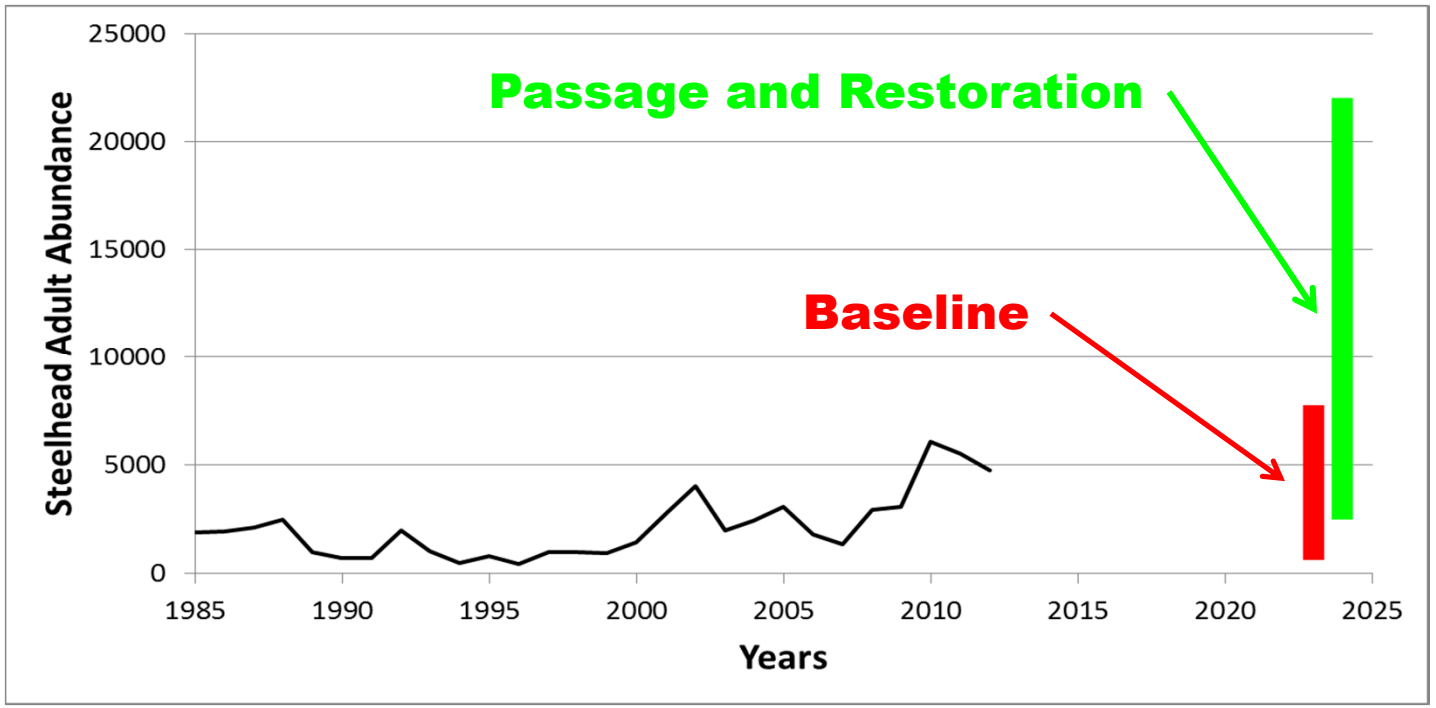
So what happens outside of the basin matters

The YBIP forecasts are certainly aware of the presence of significant uncertainty

Yakima River Basin Study

Fish Benefits Analysis
Technical Memorandum

U.S. Bureau of Reclamation
Contract No. 08CA10677A ID/IQ, Plan of Study Task 7



The current estimates are based on expert panel process (EDT) – (except sockeye)

If the whole basin was a big engineered machine one could add up the properties of the parts and forecast the performance of the whole

This is the concept for the expert process

How do changes in habitat change survivorship for species X at life stage Y?

$$N_t = N_0 + \sum^{Life\ Stages} \sum^{Habitat\ issues} f_{LS,\,Loc}(Habitat\ Value)$$

Production and survival

Lots of sources of uncertainty in expert panels generally.

Where to look to reduce some of that uncertainty in our case?

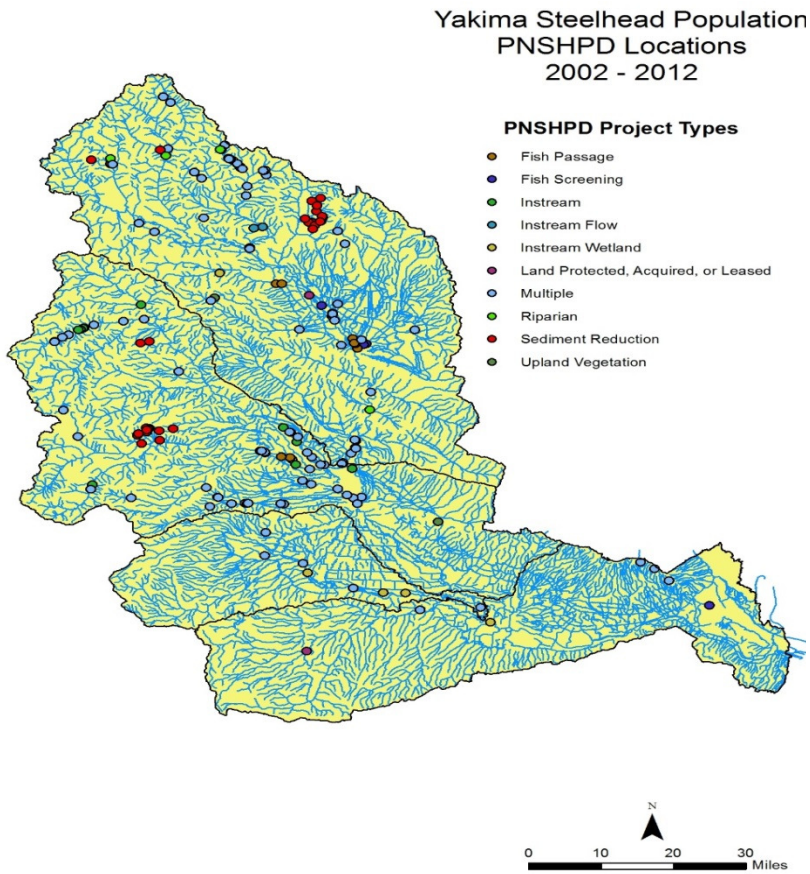
So what are we going to do?

In the short term: The EDT process was done for the CRB Sub-Basin planning process in 2003, and its accessible online.

Also, we have 10 years of monitoring data on: flow, fish, habitat and management actions.

So run the last 10 years over with knowledge of how the management plan really played out.

10 year history of management actions e.g. restoration



Timeline for completion

- Deadline: December 15, 2014
- Hope to have a draft for public comment in early November.

In the longer term: Model ensembles to compare current forecasts with alternatives from multiple Life-Cycle models and juvenile capacity models

This is a much more demanding data management, analysis and research project.

The desired outcome is to have three or four diverse approaches to production estimates

Then allow the model ensemble to indicate the likely range of outcomes for each management scenario.

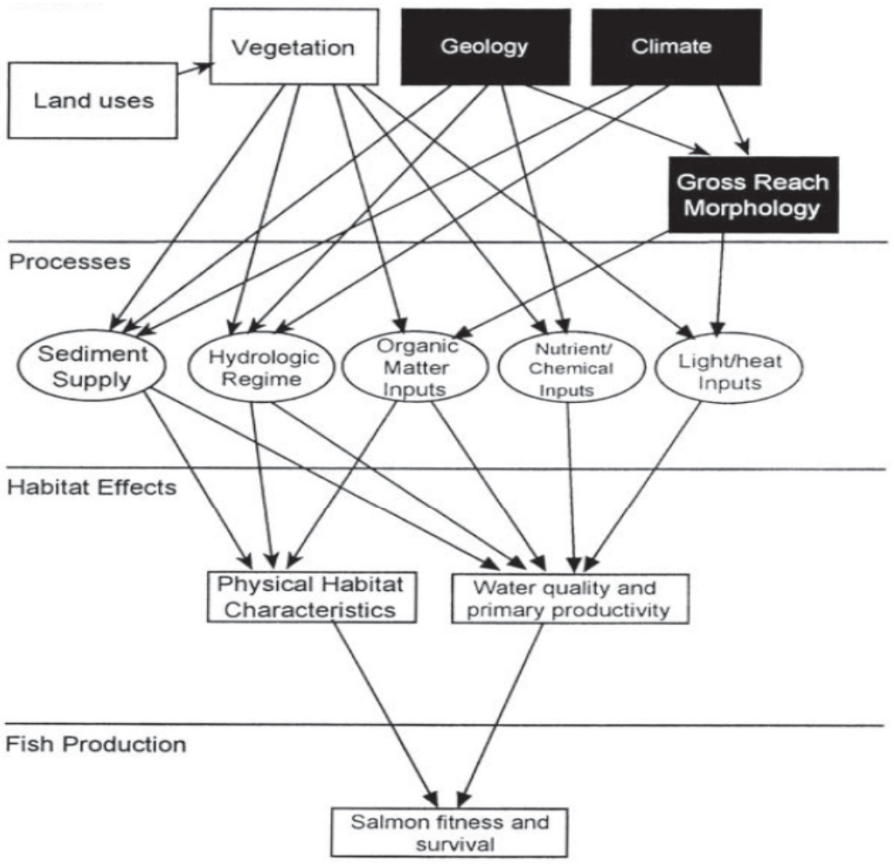


Figure 5. Schematic diagram of relationships between controls on watershed processes, effects on habitat conditions, and salmon survival and fitness (adapted from Beechie and Bolton 1999). Dark boxes in upper row are ultimate controls; light boxes are proximate controls.

TABLE 1. Parameters in the Ecosystem Diagnosis and Treatment (EDT) model.

Parameter and subparameter groups	User access	No. individual parameters
Habitat attributes		
Habitat attributes	accessible	thousands
Habitat types	accessible	hundreds to thousands
Gradient	accessible	tens to low hundreds
Off-channel factor	accessible	tens to low hundreds
Channel length	accessible	tens to low hundreds
Width minimum and maximum	accessible	tens to hundreds
Benchmarks		
Productivity	Mobrand	~10
Density	Mobrand	~10
Life stage duration	Mobrand	low tens
Growth factor	Mobrand	low tens
Rules		
Key habitat weights	Mobrand	high hundreds to thousands
g value	Mobrand	1
Factor	Mobrand	thousands
Exponent	Mobrand	thousands
Month weights	accessible	hundreds to thousands
Food multiplier curve	Mobrand	low tens
Fraction of life history types	accessible	<10
Reach data global		
Length	database	tens
Gradient	database	tens
Month weights	database	tens to low hundreds
Width minimum and maximum	database	tens
Adult age		
Ocean survival multiplier	database	<10
Ocean age	database	<10
Fecundity	database	<10
Sex ratio	database	<10
Juvenile age (steelhead only)		
Marine survival multiplier	database	<10
Proportion smolt	database	<10
Life stage pattern and population description		
Spawn window	accessible	tens
Life stage window	accessible	tens to low hundreds
Life stage duration	accessible	tens to low hundreds
Smolt migration	Mobrand	<10
Transitional season	Mobrand	1
Integration method		
Productivity	database	2
Capacity	database	2
Trajectory seed	Mobrand	1

McElhaney et al., (2010) Ecol. App.20(2):465-482

For what parts does some monitoring data exist?

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Unifying in-stream and out-of-stream uses