

Yakima River Summer Chinook Reintroduction:

Life History Characteristics and the Habitat Potential of the Yakima River

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Presentation Outline

I. Modeling Objectives

II. Background Information

- A. Historical context and extirpation of summer chinook

III. Conceptual overview of Modeling Approach:

- A. The EDT model: Nuts and bolts
- B. Demographics & life history characteristics
- C. Model scenarios and assumptions
- D. Theoretical performance (results)

Modeling Objectives

II. Biological hypothesis

A. Influence of Environmental characteristics:

- i. Viable life history trajectories
- ii. Evolution & local adaptation

III. Adaptive management tool

A. Artificial production

- i. Broodstock management (use of natural & hatchery origin adults)
- ii. Juvenile rearing/release strategies (sub-yearling vs yearling releases)
- iii. Size and duration (#smolts released, adults needed for program)

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Historical Production of Summer Chinook

Abundance Estimates

~86k

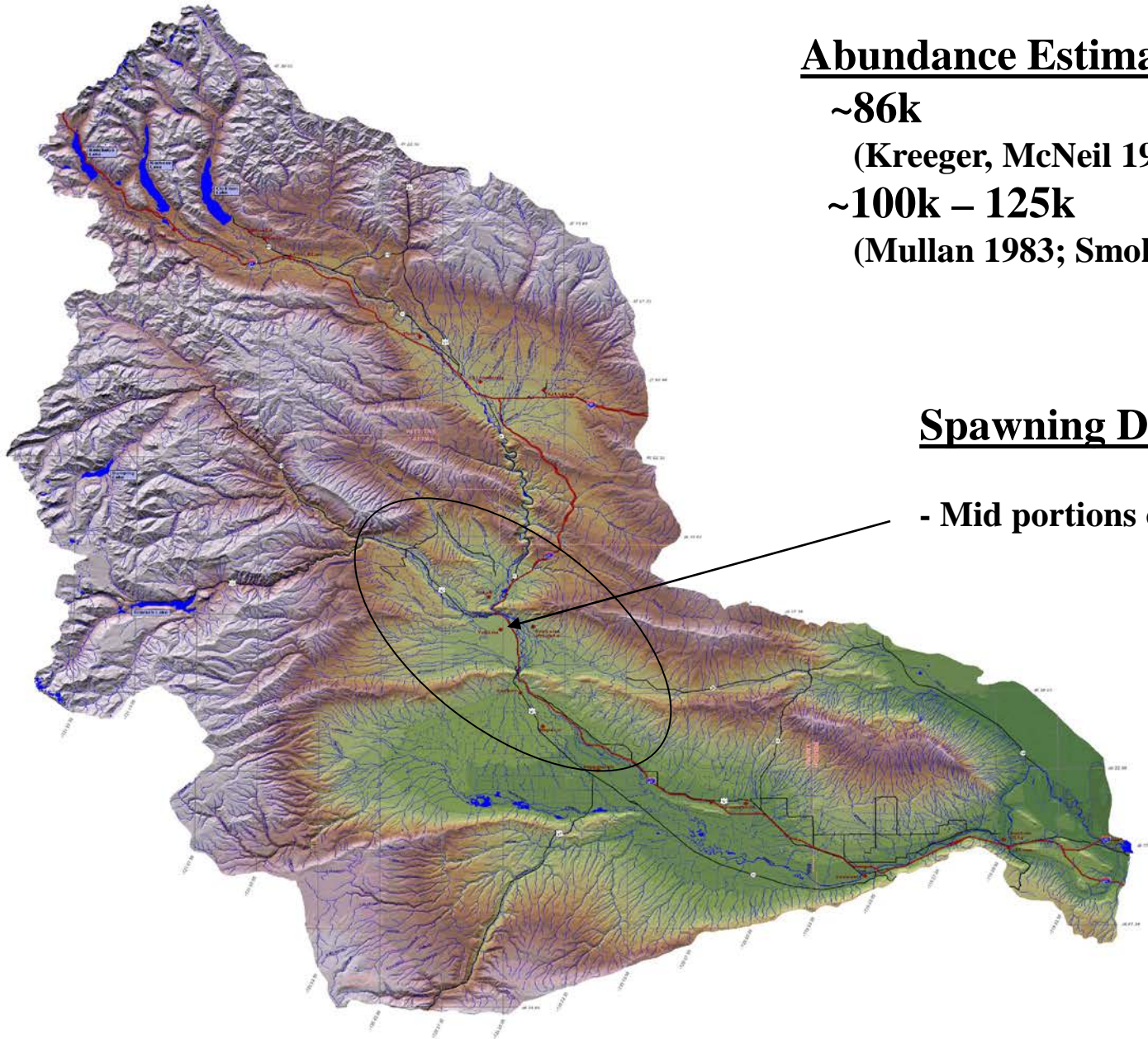
(Kreeger, McNeil 1993)

~100k – 125k

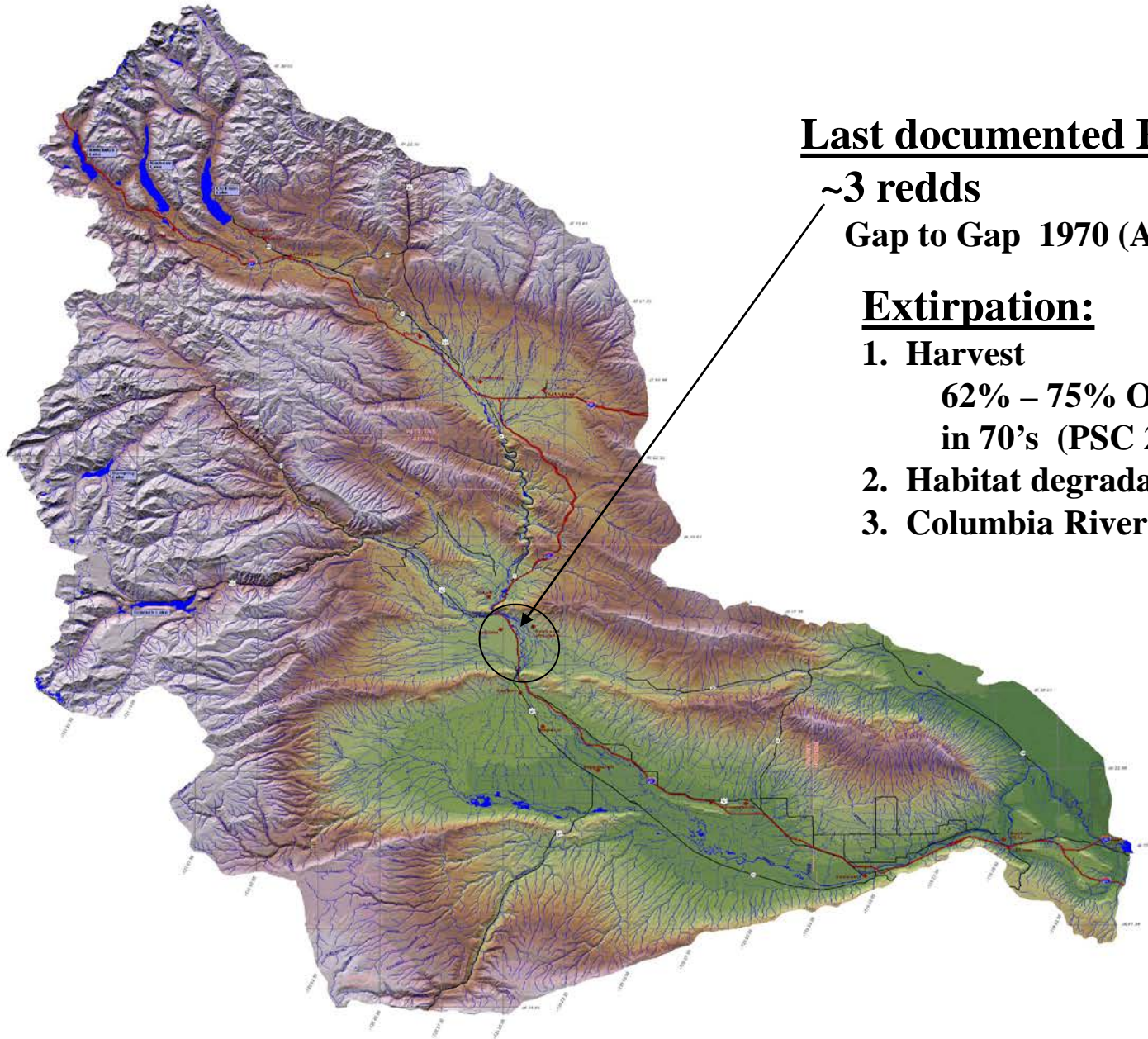
(Mullan 1983; Smoker 1956)

Spawning Distribution

- Mid portions of Yakima River



Extirpation of Summer Chinook



Last documented Redds?

~3 redds

Gap to Gap 1970 (Anon 1970)

Extirpation:

1. Harvest

62% – 75% Ocean harvest
in 70's (PSC 2004)

2. Habitat degradation

3. Columbia River Hydro development

Presentation Outline

I. Modeling Objectives

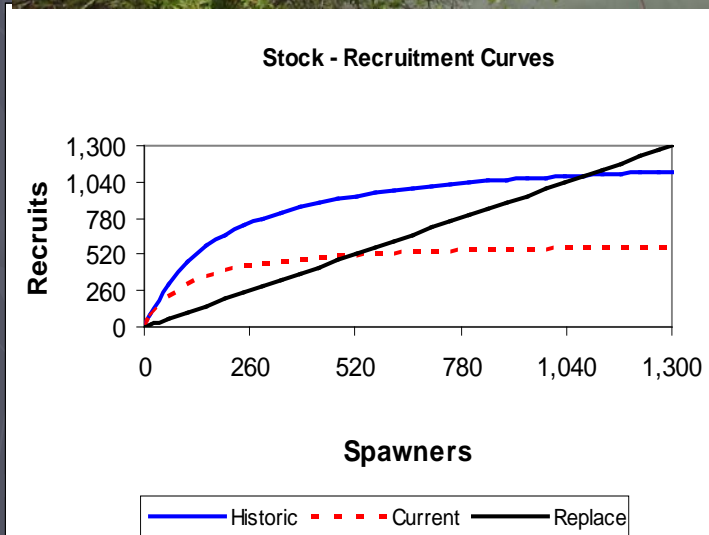
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EDT Nuts & Bolts



- I. Quality and quantity of available habitat
 - A. Numerous abiotic & biotic attributes
 - i. Individual stream reaches
 - a. Homogenous physical characteristics
 - B. Environmental variability
 - i. Monthly time step
 - ii. Primary attributes
 - a. Seasonal variability
 - ★ Spatial and temporal variability
-
- II. Beverton-Holt production function
 - A. Quantify productivity & capacity
 - i. Across life stages & life history trajectories
-
- III. Life history patterns (trajectories)
 - I. User defined

Demographics & Life History Characteristics

I. Simple:

A. Adult age structure

- i. Sex ratios
- ii. Fecundity

B. Spawn timing & distribution

- Good information about donor stock
- Held constant

II. Complex:

} Highly uncertain

A. Juvenile rearing/migration patterns

- i. Stream type
- ii. Ocean type

B. Adult migration & Holding

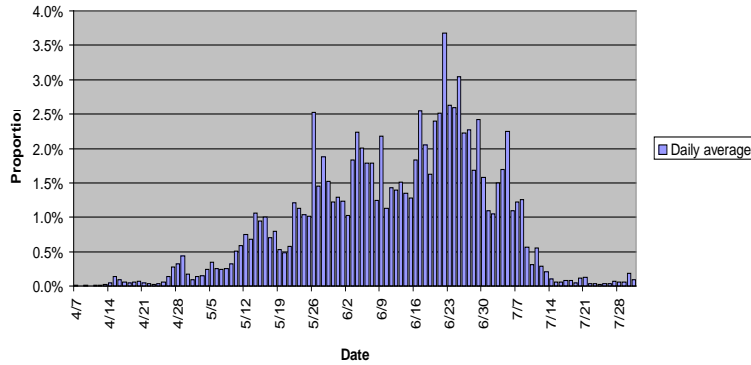
- Significantly influenced by environment
- Impact performance



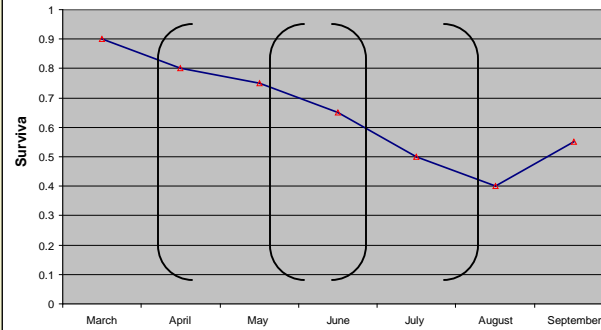
Spatial & Temporal Effects of Environment: Life-stage Productivity

Columbia River

Chinook Sub-Yearling Outmigration (1999-07)



Example: Monthly Survival for Juvenile Migrants



Cumulative survival

Lower Yakima River



Yakima R.-2E

Yakima R.-2D

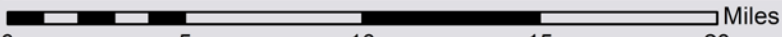
Yakima R.-2C

Yakima R.-2A

Yakima R.-2

Yakima R.-1E

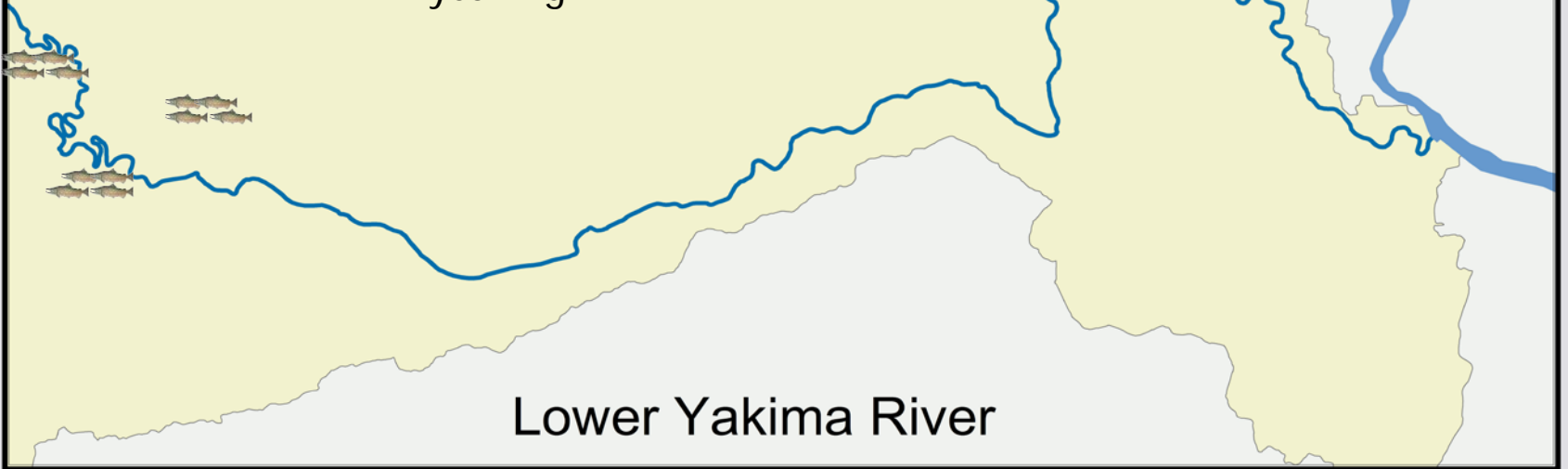
Yakima R.-1B



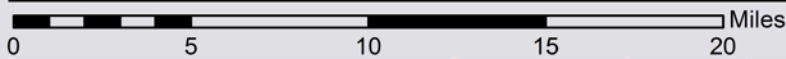


Juvenile rearing/migration patterns:
(Upper Columbia)

1. Ocean type 1 (OT1)- Sub yearling Spring/summer movement to Columbia River with continuous rearing to estuary
2. Ocean type 2 (OT2)- Sub yearling late spring/summer movement to Columbia River for over-wintering
3. Stream type (ST1)- Rear in vicinity of spawning location/emergence, migrate following spring as yearling



Lower Yakima River





Life History Modeling Scenarios

Test viability of juvenile life history pattern:
-Function of habitat

1. 100% Ocean type 1 (OT1)



2. 100% Ocean type 2 (OT2)



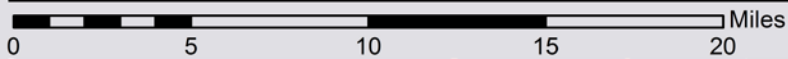
3. 100% Stream type (ST1)



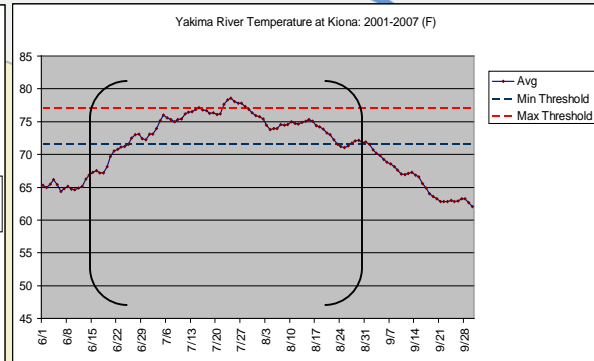
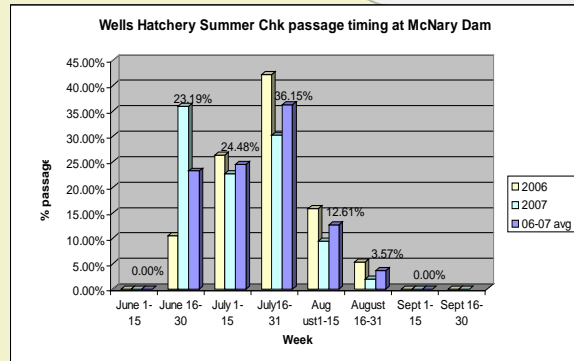
4. Composite (75%,20%,5%)



Lower Yakima River



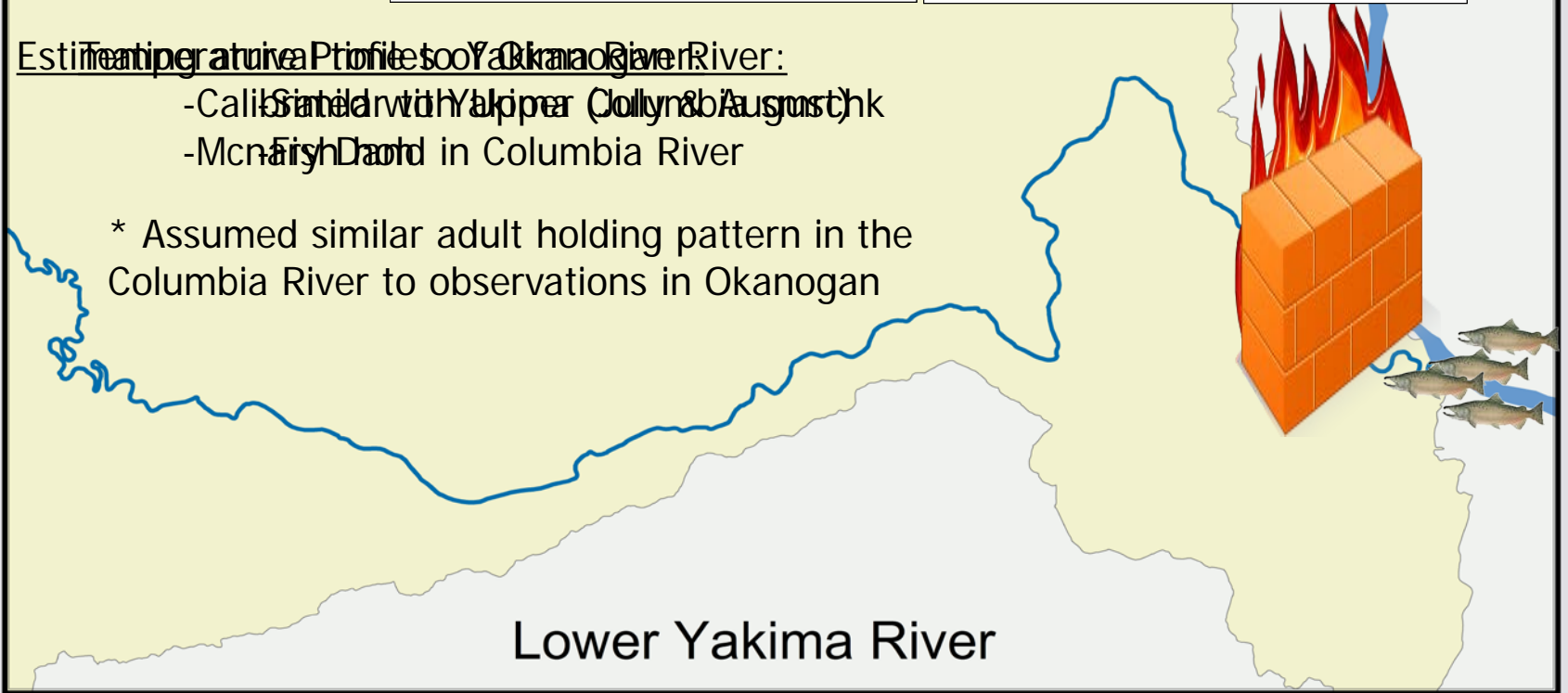
Adult Migration & Holding



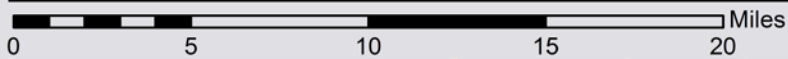
Temperature Profile for Yakima River:

- Calibrated with Upper (July & August) Chk
- McNary Dam in Columbia River

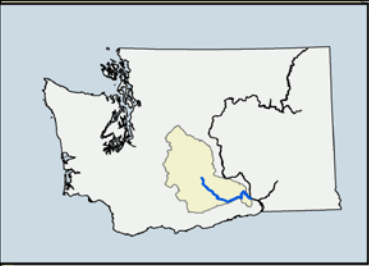
* Assumed similar adult holding pattern in the Columbia River to observations in Okanogan



Lower Yakima River

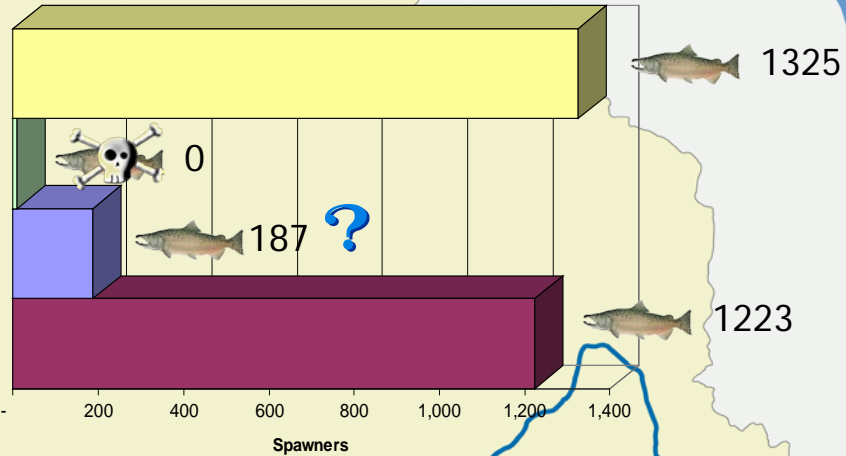


Life History Scenarios Results



Summer Chinook Population Performance

- 1. 100% Ocean type 1 (OT1)
- 2. 100% Ocean type 2 (OT2)
- 3. 100% Stream type (ST1)
- 4. Composite (75%,20%,5%)



Other model assumptions:

- Include current harvest regime
- Assume fully adapted and unsupplemented population

Lower Yakima River



Initial Conclusions

1. Given the model assumptions.....

- Yakima River could support a viable population
- Habitat characteristics favor Ocean Type 1

2. Additional work and model refinement

- Adult migration timing
- Temperature effects on:

- | | |
|---------------------|--|
| 1. Spawn timing | } Migration timing and
juvenile life history
type? |
| 2. Emergence timing | |

Food for thought:

What are the biological trade offs of the different juvenile life history types?

Reduction in productivity vs. increase in life history diversity?

Acknowledgements:

- Yakama Nation Biologists and staff
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- Greg Blair (Mobrand Jones & Stokes)
- Joel Hubble (BOR)
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Questions?

