Upper basin EDT modeling to support the Production Model for Type 1 Fall Chinook

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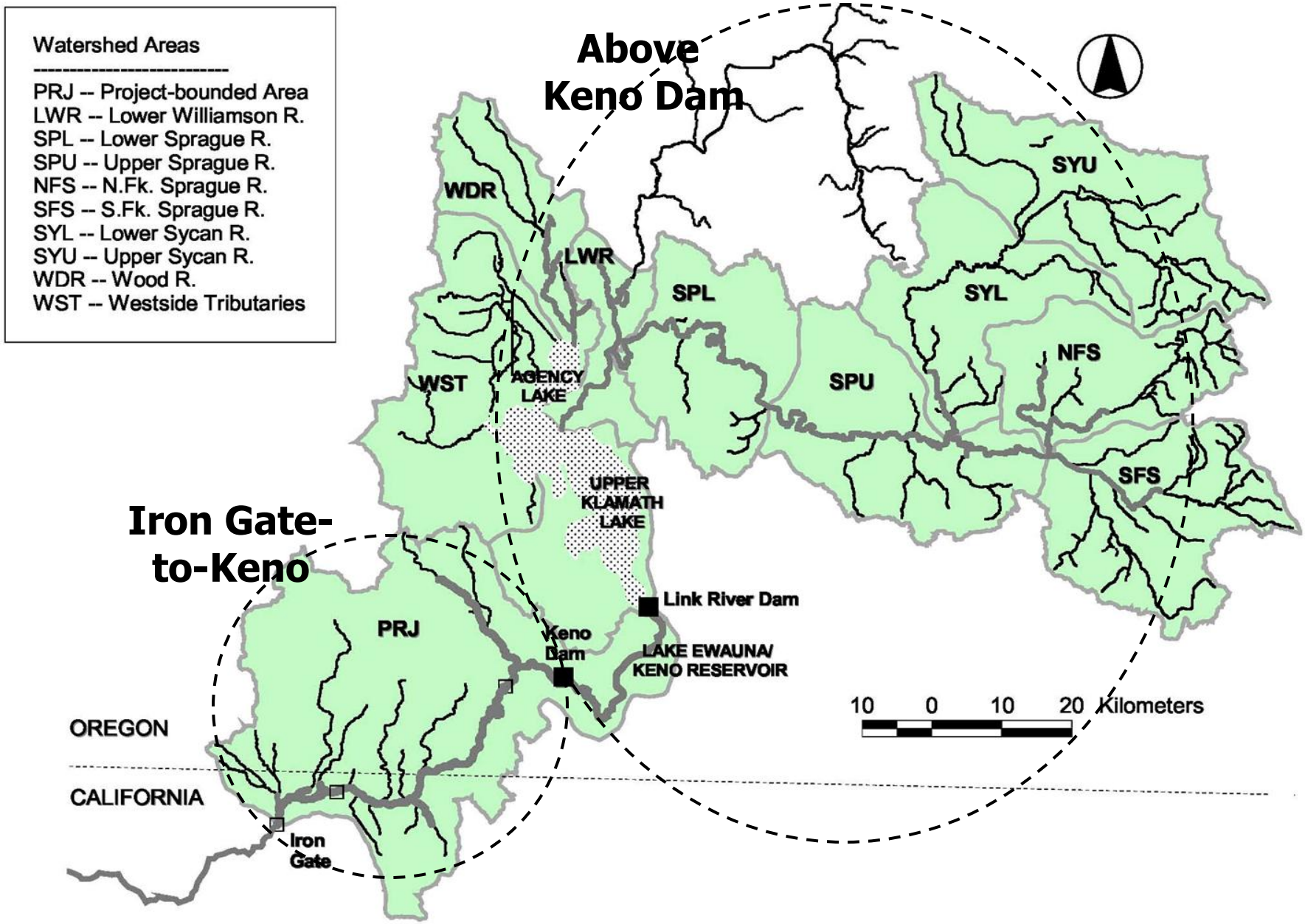

Watershed Areas
PRJ -- Project-bounded Area
LWR -- Lower Williamson R.
SPL -- Lower Sprague R.
SPU -- Upper Sprague R.
NFS -- N.Fk. Sprague R.
SFS -- S.Fk. Sprague R.
SYL -- Lower Sycan R.
SYU -- Upper Sycan R.
WDR -- Wood R.
WST -- Westside Tributaries
Above Keno Dam
Iron Gate-to-Keno
WDR
LWR
SPL
SPU
SYL
SYU
NFS
SFS
WST
AGENCY LAKE
UPPER KLAMATH LAKE
PRJ
Link River Dam
Keno Dam
LAKE EWAUNA/ KENO RESERVOIR
OREGON
CALIFORNIA
Iron Gate
10 0 10 20 Kilometers

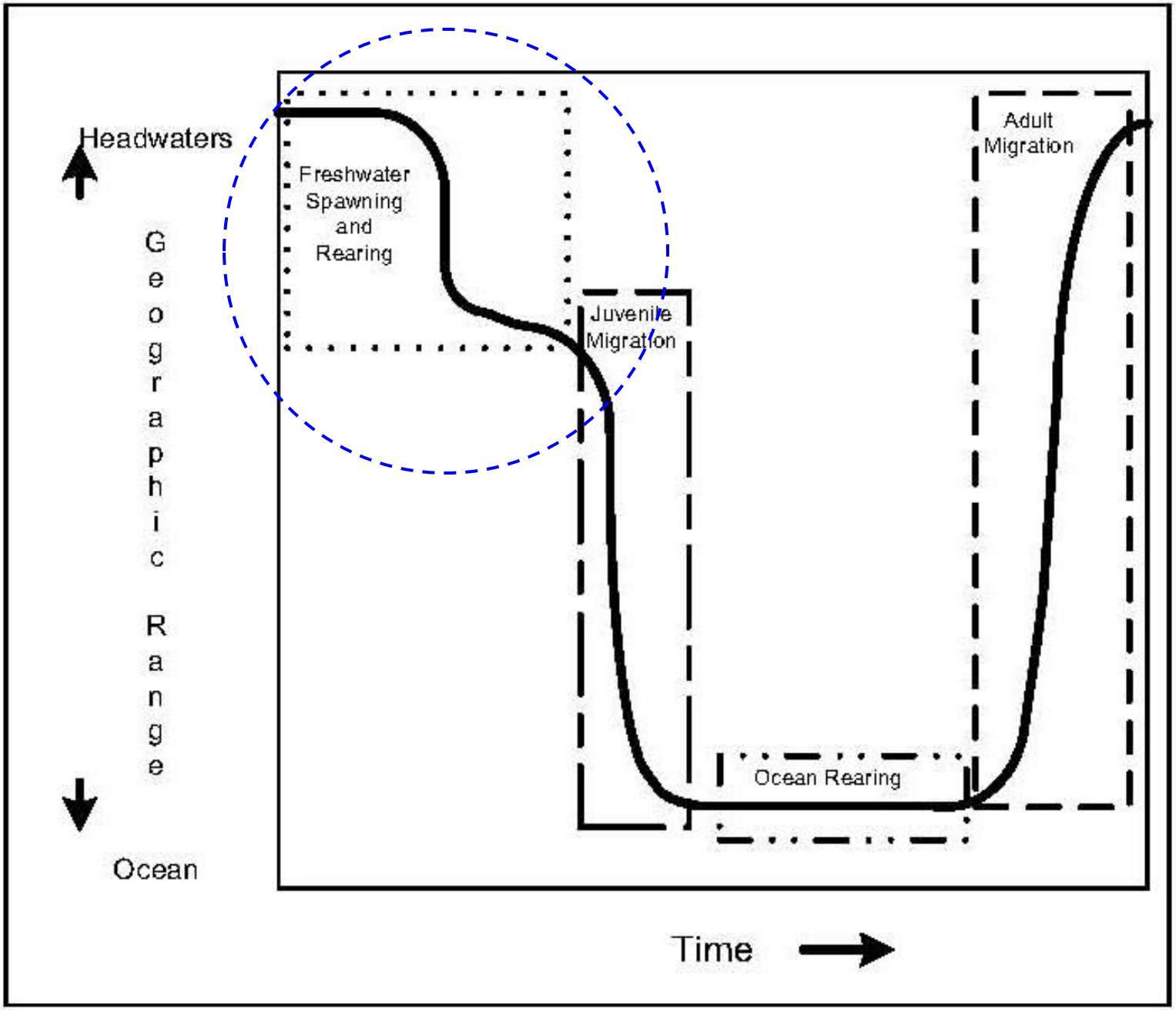
Production Model needs for the KBRA-Dam Removal scenario

- Adult-to-emigrant production functions for Type 1 Fall Chinook in (1) Iron Gate-to-Keno tributaries, and (2) areas above Keno Dam.

- Estimates for the pattern of emigration of young Type 1 Fall Chinook into the mainstem Klamath from each of these two above-dam tributary areas:
    - seasonal timing (by week)
    - weekly proportions of fry versus larger juveniles
    - mean weights of the fry and of juveniles entering each week

Ecosystem Diagnosis and Treatment Model (EDT)

- Habitat-based model structured to account for the effects of environmental conditions as salmon follow variable life-history "trajectories" through space and time to complete their lifecycles.
- EDT was used during the KRHP relicensing process to simulate responses of salmon populations to upper basin habitat and fish passage conditions.
- Portions of the upper basin EDT model for Type 1 Fall Chinook are being revised to approximate habitat conditions at two points in time:
  - Dams-Out (D-O; ~2020)
  - Future (FC; 2052-61)
- Results will inform selection of above-dam tributary production functions and tributary emigration patterns for the Production Model.


Headwaters
Geographic Range
Ocean
Freshwater Spawning and Rearing
Juvenile Migration
Ocean Rearing
Adult Migration
Time

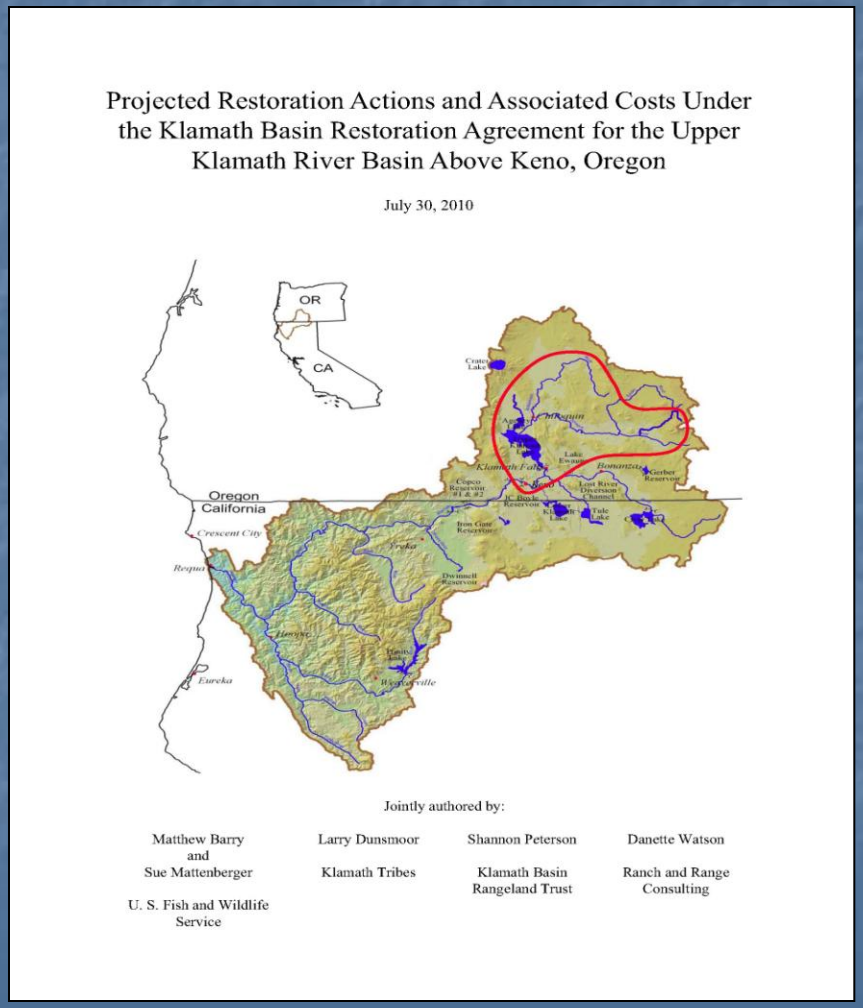
For additional information on EDT

Go to: http://edt.jonesandstokes.com/EBP/Library/Library.aspx

Step 1:
Refine EDT stream reach databases for potential Type 1 Fall Chinook habitat within the two above-dam geographic areas, to represent Dams-Out (D-O) and FC conditions

Bases for estimating D-O and FC habitat conditions

- 2004-2005 EDT models of existing and achievable stream restoration conditions above Keno
- New environmental data
- KBRA documents and an April workgroup session that helped identify adjustments for restoration above Keno (plus Spencer Cr.)
- Modest, clearly beneficial measures identified for Iron Gate-to-Keno tributaries when revising EDT
- Adjustments to account for climate effects (flows and temperatures)



Projected Restoration Actions and Associated Costs Under the Klamath Basin Restoration Agreement for the Upper Klamath River Basin Above Keno, Oregon

July 30, 2010

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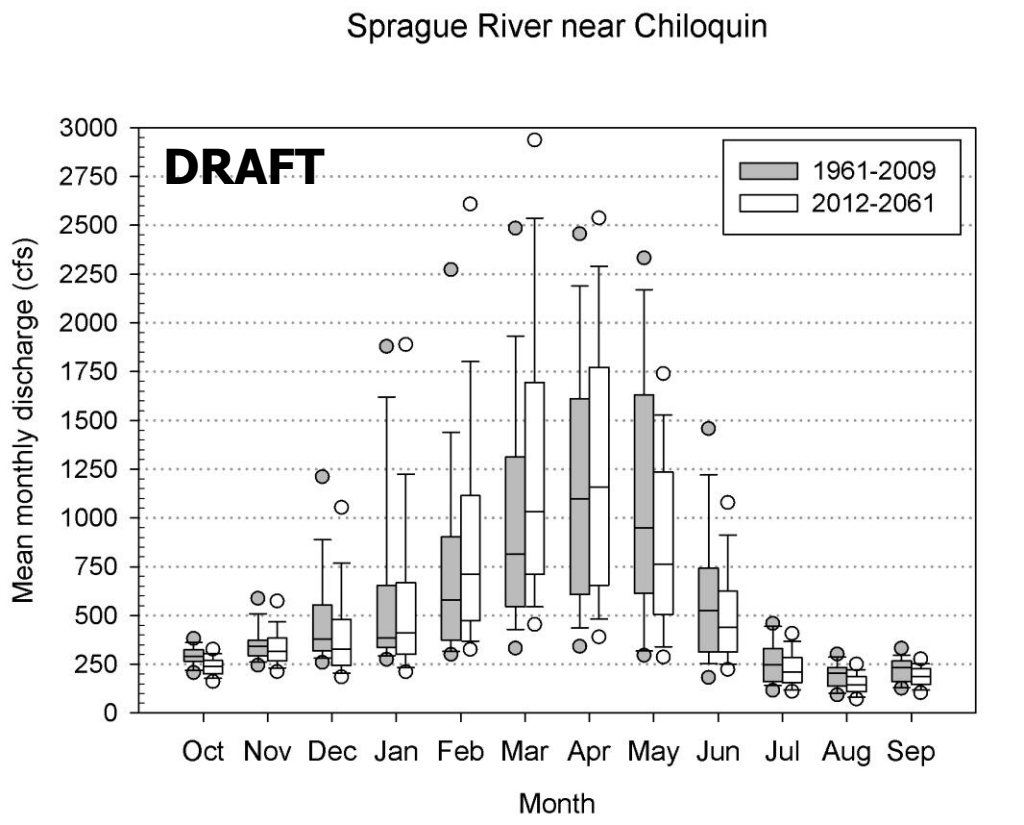
Anticipated KBRA/other actions and their consequences

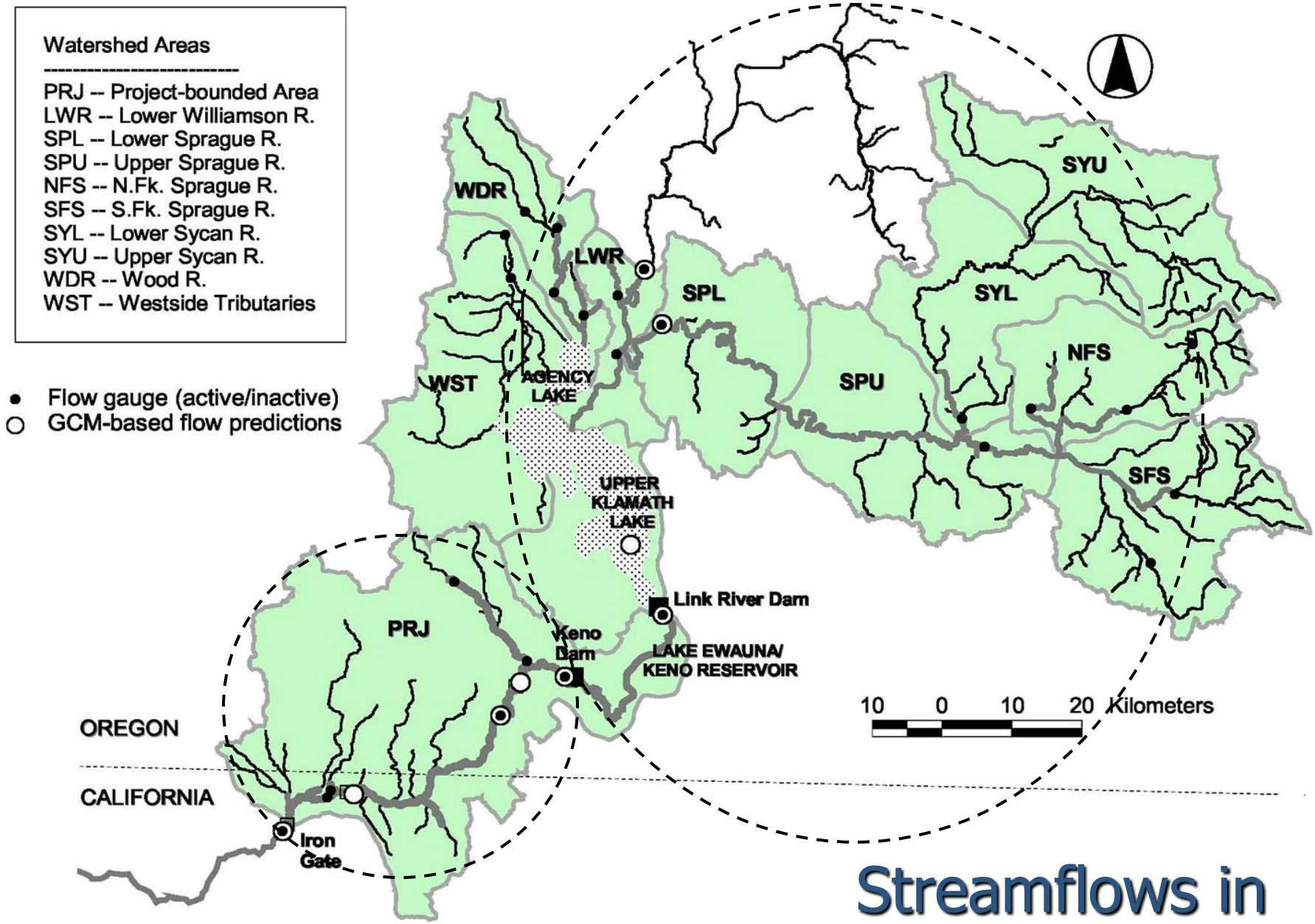
- Dam removal
- Riparian, floodplain, and wetland restoration
- Strategic additions of woody debris and gravel
- Reconnections of groundwater-fed floodplain channels and ponds
- Streamflow augmentation
- Reconstruction of selected stream channels
- Water quality remediation/TMDL implementation
- Fish passage improvements
- Others

- Benefits to include:
  - Immediate habitat responses to certain measures completed prior to dam removal and more incremental responses to others
  - The consequences of non-KBRA measures count too because all upper basin anadromous fish benefits are enabled by dam removal

Inputs to EDT for seasonal flow patterns

- Lacking more resolute data, EDT assumes habitat availability within a stream reach varies in direct proportion to monthly streamflow (within bounds).
- Climate and KBRA-affected flows for the Williamson and lower Sprague systems have been derived from USBOR model outputs.
- Recent flow patterns should be sufficient for modeling key areas of the groundwater-dominated Wood River system (where wetted widths are near-constant).
- Potential revisions to flow patterns for the upper Sprague system and Iron Gate-to-Keno tributaries are in development.

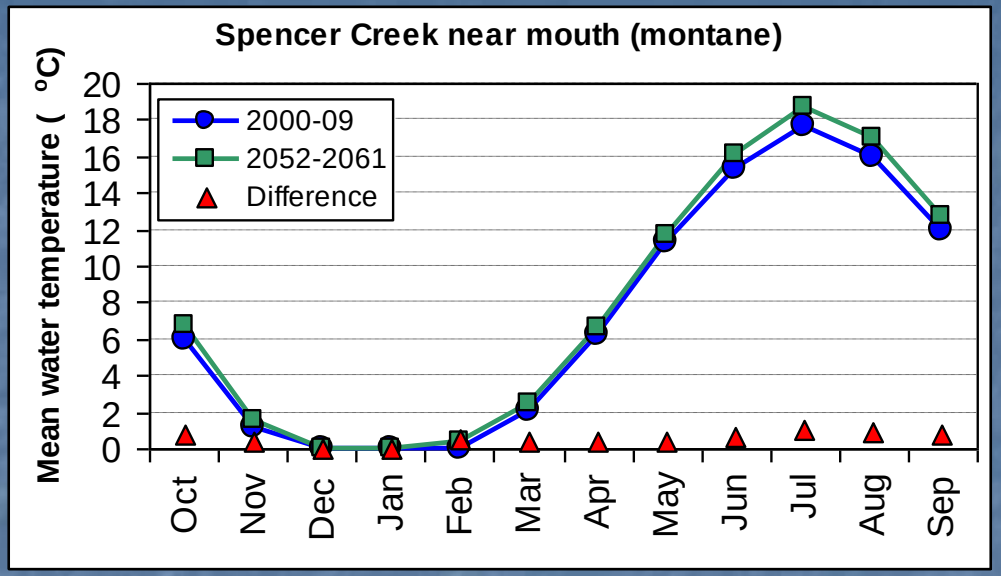


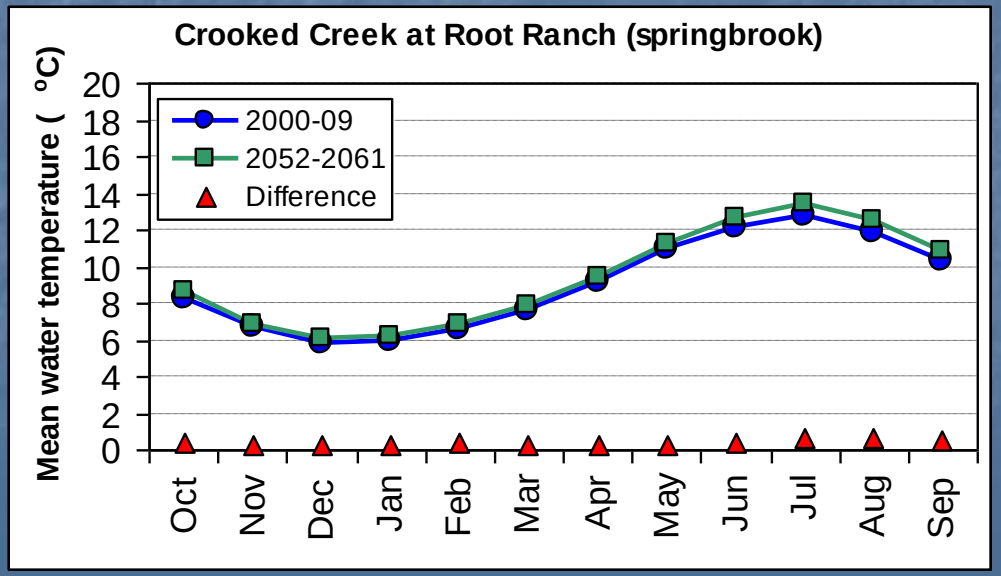


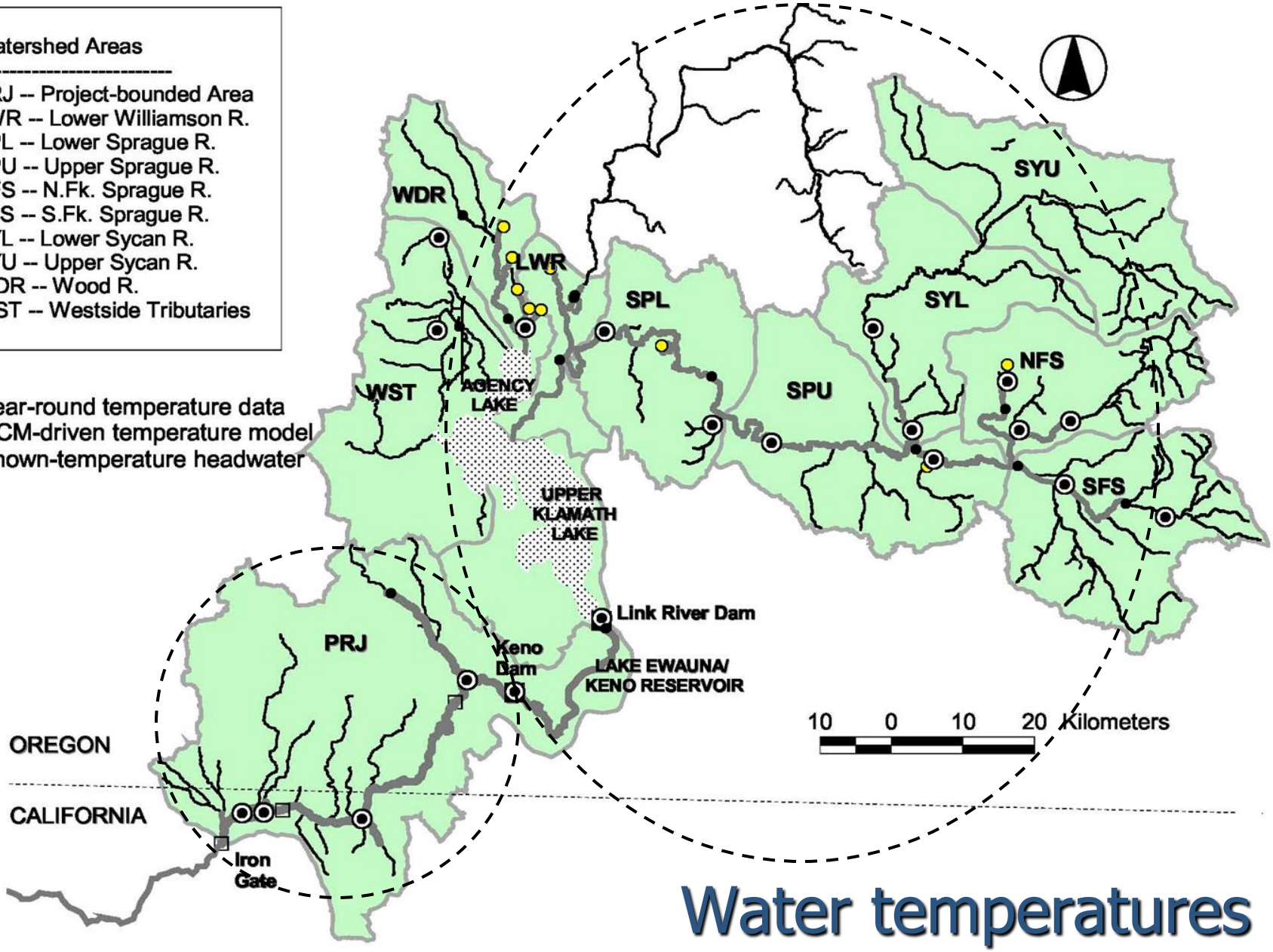
Streamflows in Klamath tributaries

Inputs to EDT for seasonal water temperature patterns

- Climate-based modeling points to modest warming of upper basin salmon habitat in the next 50 yr.
- HEC5Q temperature predictions are being used in EDT for upper basin lakes and Link R (between lakes)
- 16 site-specific tributary models suggest small October-May water temperature increases in potential salmon streams, but these might be offset by restoration or affected by changes in flow.
- Recent October-May temperature patterns measured in the tributaries, possibly with adjustments per the site-specific models, will be used in EDT.





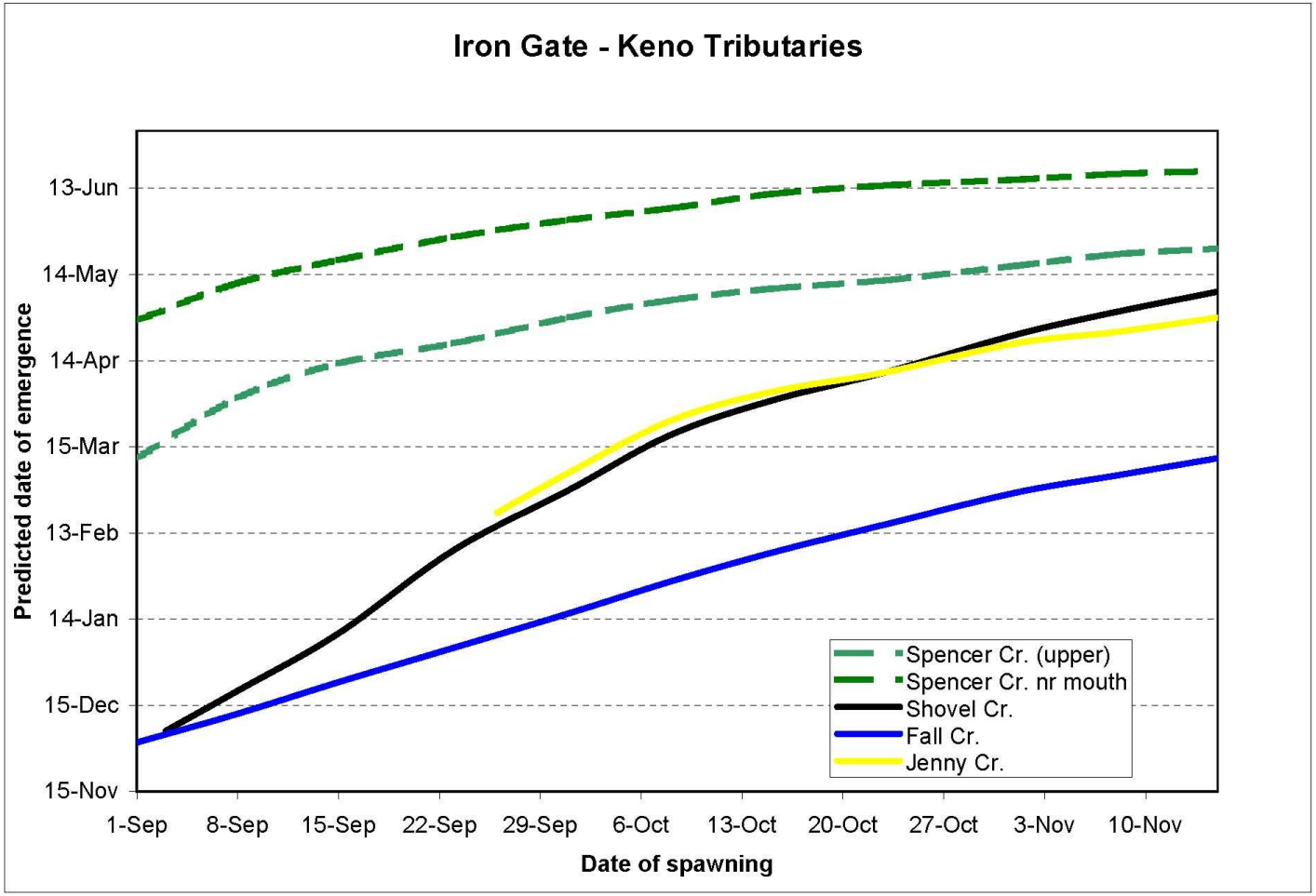


Water temperatures in Klamath tributaries

Step 2:
Life-history refinements to the EDT model(s)

- Stream or reach-specific fry emergence timing for Type 1 Fall Chinook
  - considered adult migration, spawn timing (tentatively beginning in early October and extending into November), and incubation temperatures
  - available temperature data for some tributaries are at best ambiguous about the potential for expression of the life history being modeled

Incubation and emergence timing



Life-history refinements to the EDT model(s)

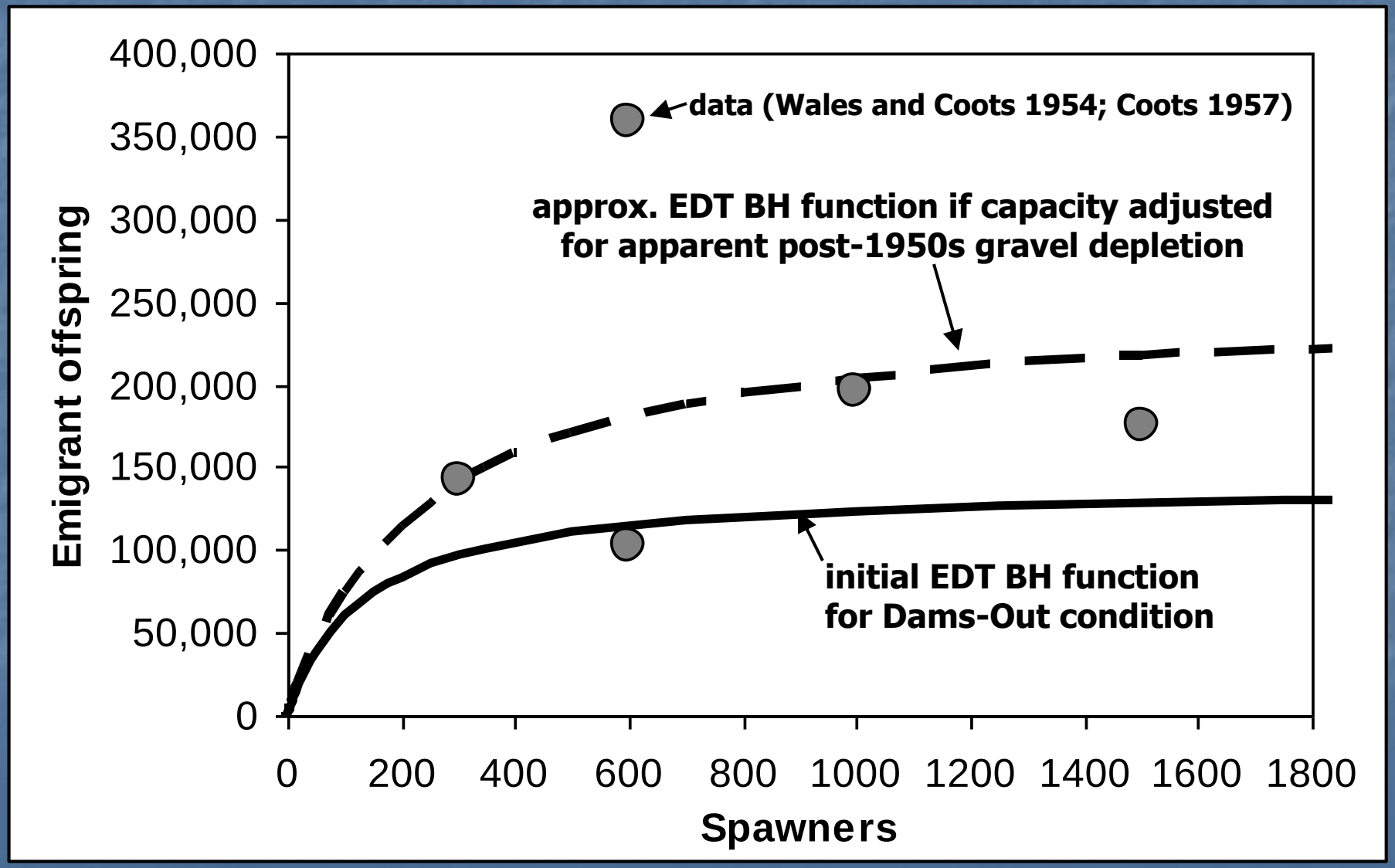
- Juvenile survival and growth prior to entering the Klamath
  - *C. shasta* and lake migration mortality above Keno minimized in EDT to allow external treatment of these factors
  - added attention to rearing trajectories, particularly those that might be lake-based
  - adjustment of fish sensitivities to warming waters in the lakes during spring, to account for abundant food resources

Step 3:
Run EDT to produce adult-to-emigrant production parameters (capacity and productivity) for Type 1 Fall Chinook

- Sample of **exploratory results** emphasizing rapid Klamath River entry from tributaries following emergence (**under revision**):

	BH Capacity (max. emigrants)	BH Productivity (max. emigrants/adult)
Iron Gate-to-Keno		
D-O Jenny Creek, CA	144,700	908
D-O Fall Creek, CA	139,200	1,055
D-O Shovel Creek, CA	248,700	778
D-O Spencer Creek, OR	510,400	589

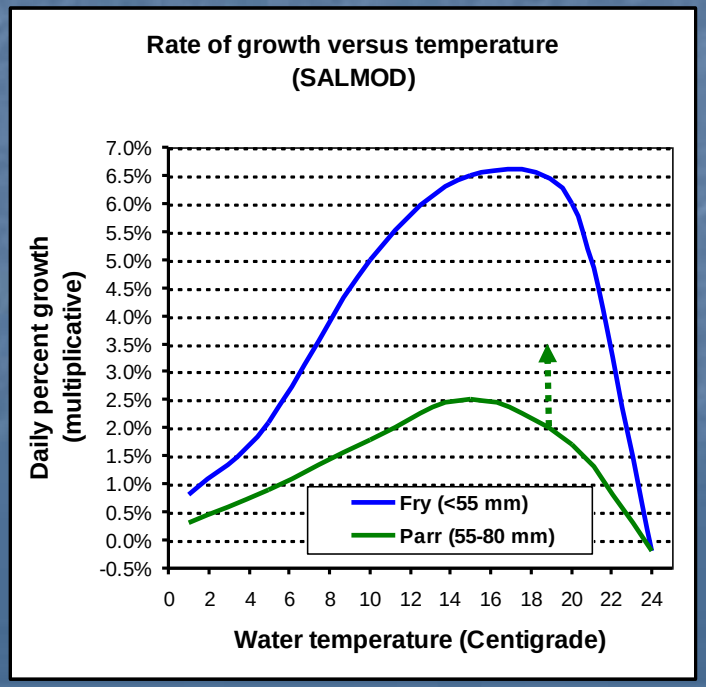
EDT v. 1950s CDFG studies of Fall Creek Chinook



Step 4:
Reprocess records of the EDT trajectories from Step 3 to estimate emigrant timing and size at entry to the Klamath

EDT Reach	Julian Week																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Spring Cr. 1A	7	7	7	7	7	7	7	7	7	7	7	7												
Williamson R 5												7												
Williamson R 4												7												
Williamson R 3												7												
Williamson R 2												7												
Williamson R 1												7												
Upper Klamath Lake												8	8	8	10	10	12	14	14	17	17			
Link River																					17			
Lk Ewauna/Keno Res.																					17			
Klamath at Keno Dam																					17			

New calculator “grows” young fish that follow each of thousands of trajectories generated by EDT, using temperature-driven functions and reach-specific estimates of mean weekly water temperatures.

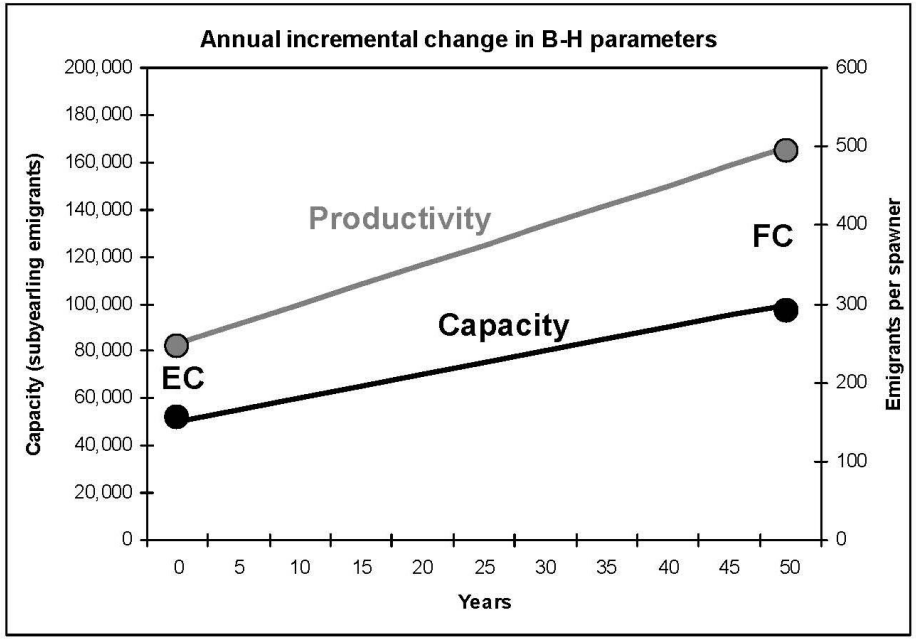
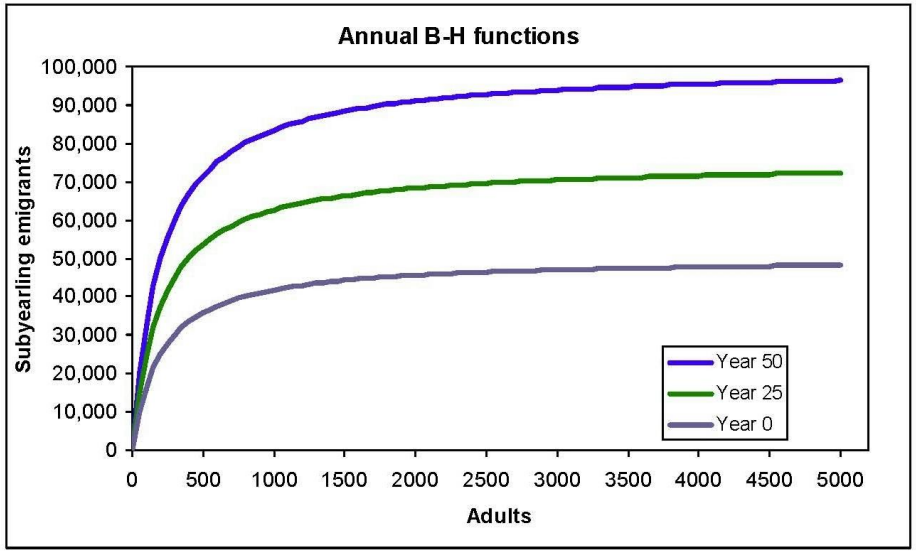


EDT-based Emigrant Timing and Size Estimates

D-O Williamson R emigrants at Keno (before lake-reared trajectories refined)

	Fry		Larger juveniles	
Wk	Pct. of all emigrants	Mean weight (g)	Pct. of all emigrants	Mean weight (g)
12	0%	---	0%	---
13	0%	---	0%	---
14	0%	---	0%	---
15	0%	---	0%	---
16	8%	[illegible]	0%	---
17	27%	[illegible]	0%	---
18	20%	1.36	2%	2.20
19	7%	1.63	9%	2.22
20	1%	1.70	14%	2.42
21	0%	---	10%	2.83
22	[illegible]	---	2%	3.19
23	0%	---	0%	---
24	0%	---	0%	---
25	0%	---	0%	---

OUTDATED

END

Beverton-Holt (BH) parameters/production functions