THE GROUNDWATER STEELHEAD

CalTrout Ventura Water Talks

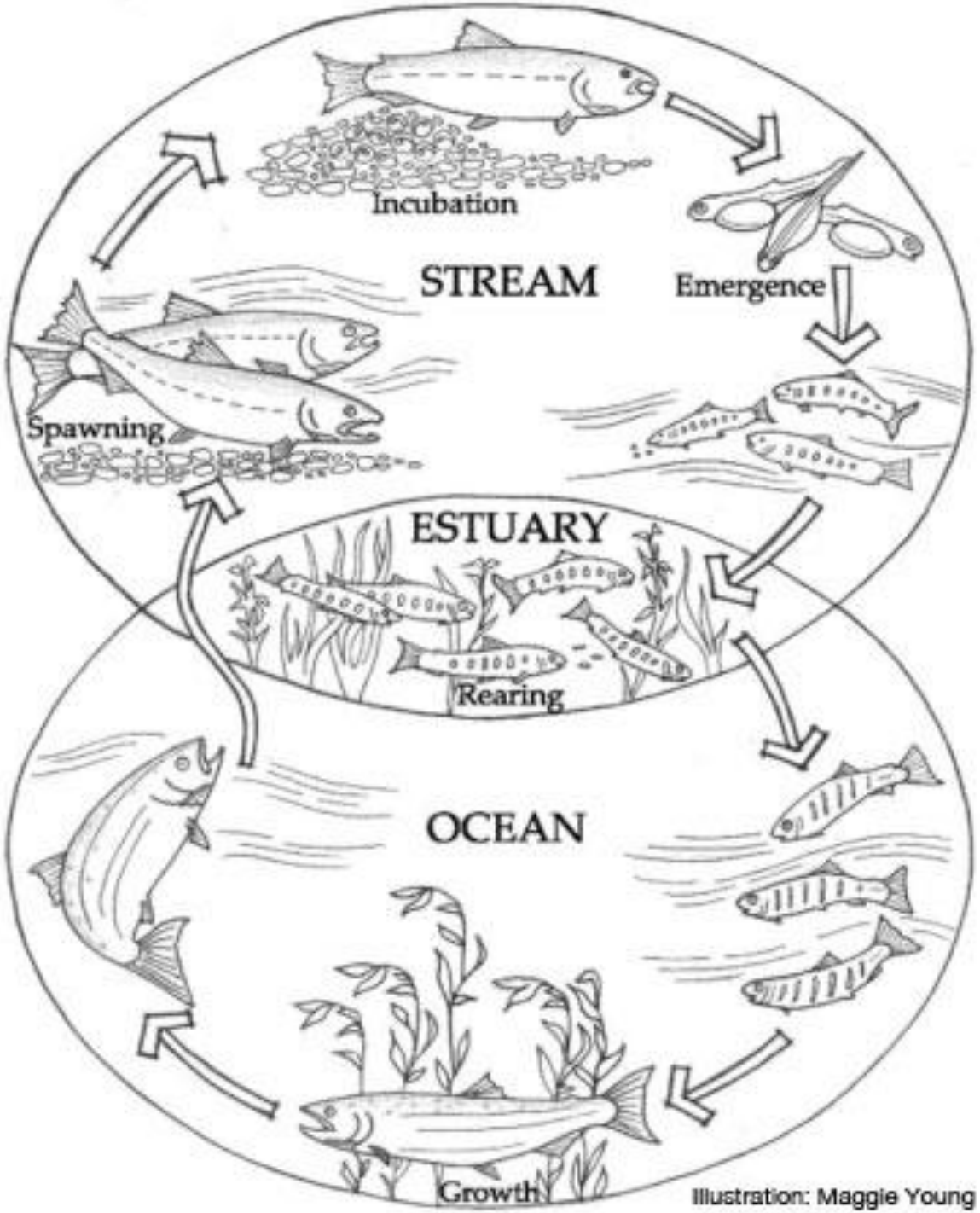
June 29, 2017

Bill Trush Co-Director

Humboldt State University

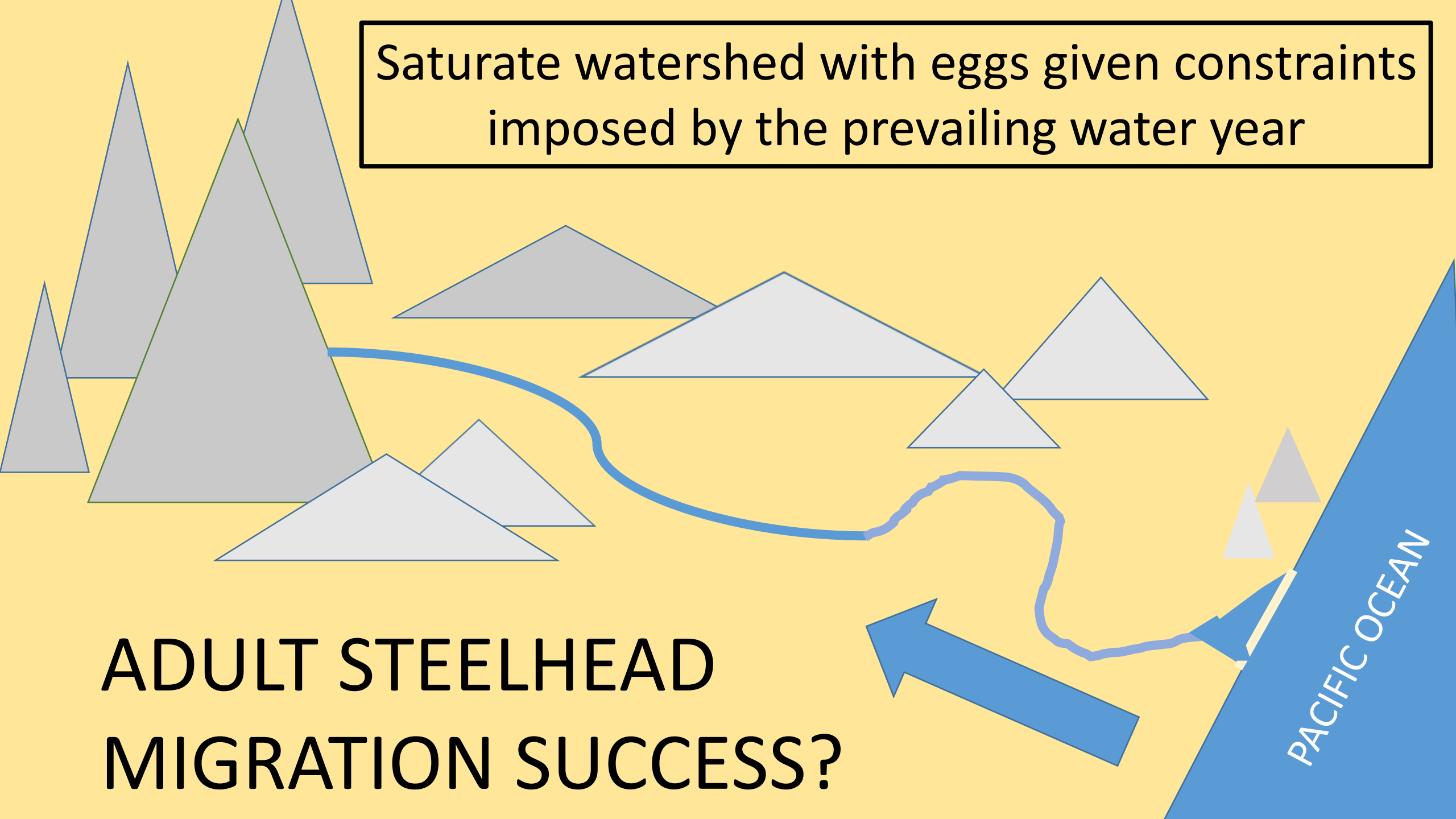
River Institute

Arcata, California



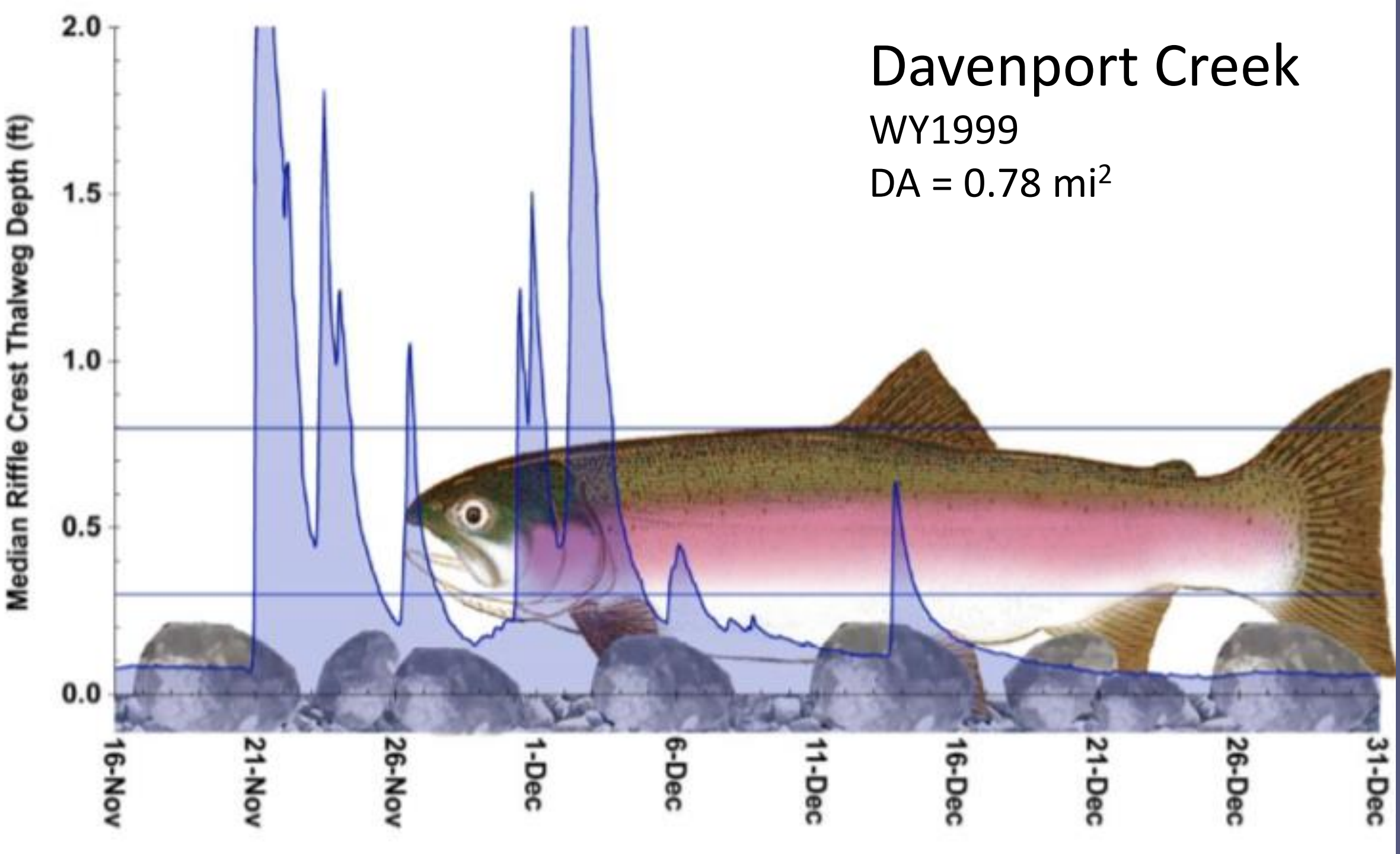
This salmonid was **Federally listed as Threatened and Endangered on August 18 1997** [62 FR 43937] because Southern steelhead have been either ***significantly depleted or extirpated in all rivers and streams in which they historically occurred.***

Saturate watershed with eggs given constraints imposed by the prevailing water year



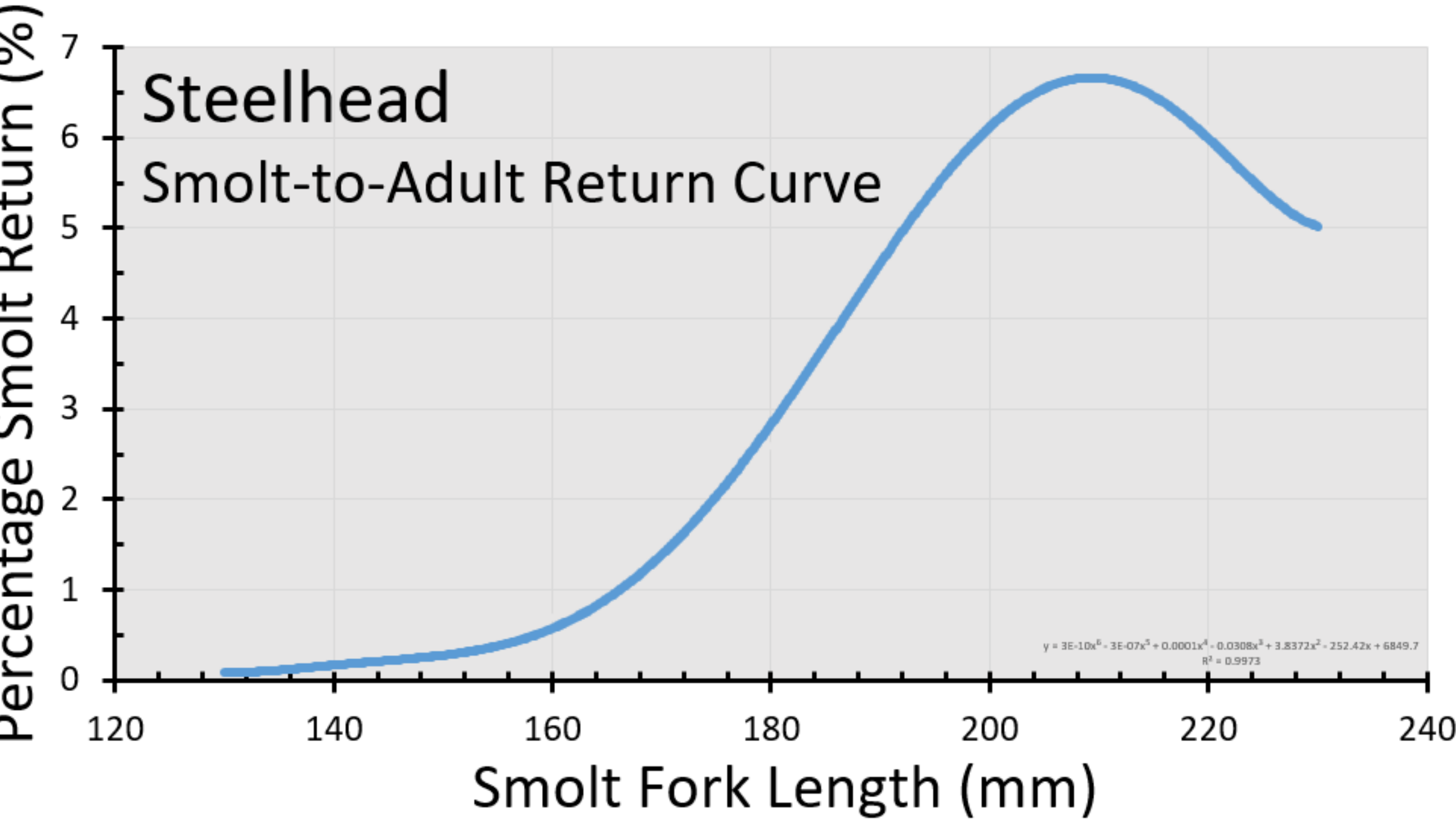
ADULT STEELHEAD MIGRATION SUCCESS?

ADULT STEELHEAD WINTERTIME RACHETING


Davenport Creek
WY1999
DA = 0.78 mi2
Median Riffle Crest Thalweg Depth (ft)
2.0
1.5
1.0
0.5
0.0
16-Nov
21-Nov
26-Nov
1-Dec
6-Dec
11-Dec
16-Dec
21-Dec
26-Dec
31-Dec

Be Healthy, Be Many, and Be Large

STEELHEAD SMOLT MIGRATION SUCCESS

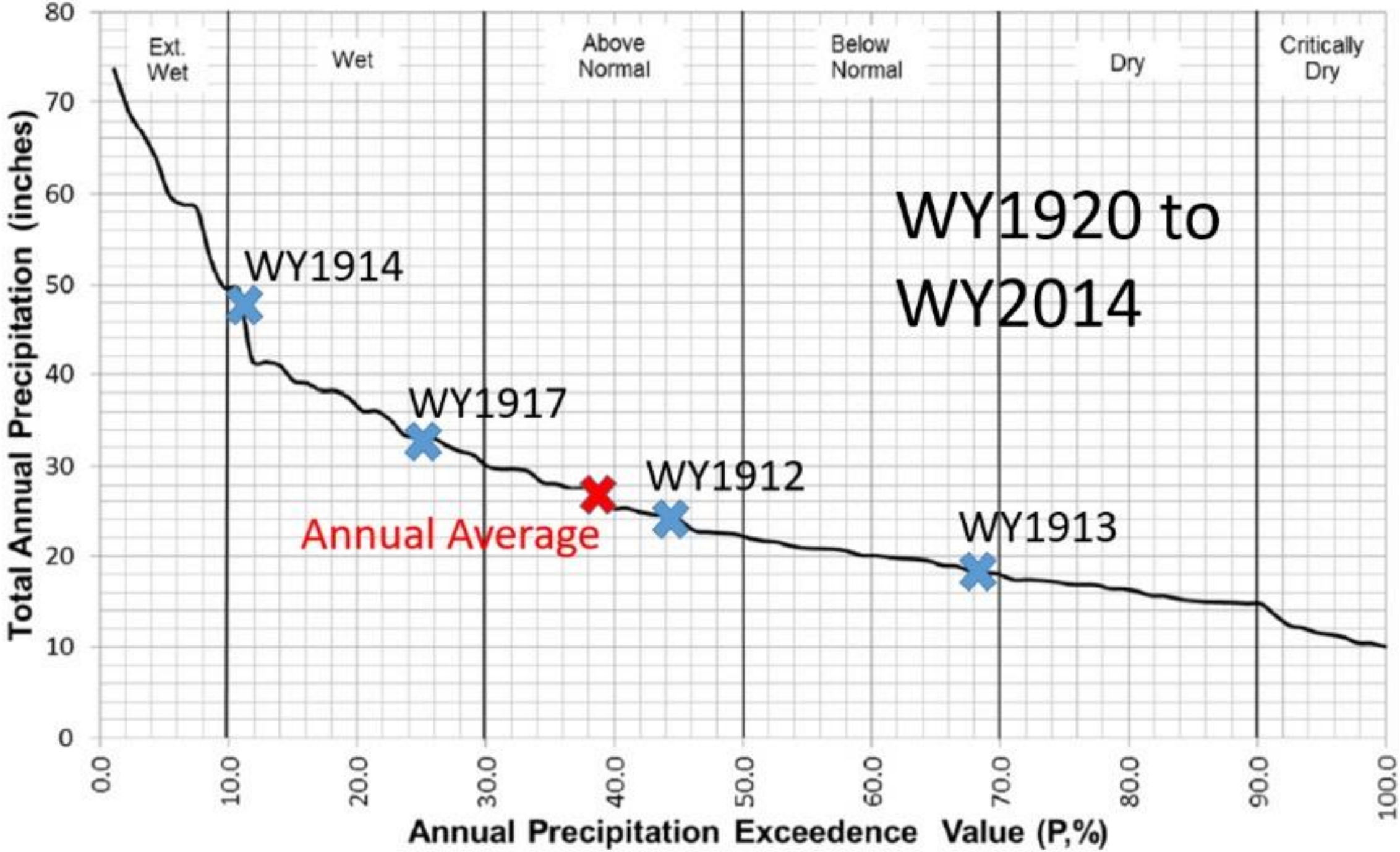

Steelhead
Smolt-to-Adult Return Curve
Percentage Smolt Return (%)
0
1
2
3
4
5
6
7
120
140
160
180
200
220
240
Smolt Fork Length (mm)
y = 3E-10x^6 - 3E-07x^5 + 0.0001x^4 - 0.0308x^3 + 3.8372x^2 - 252.42x + 6849.7
R² = 0.9973

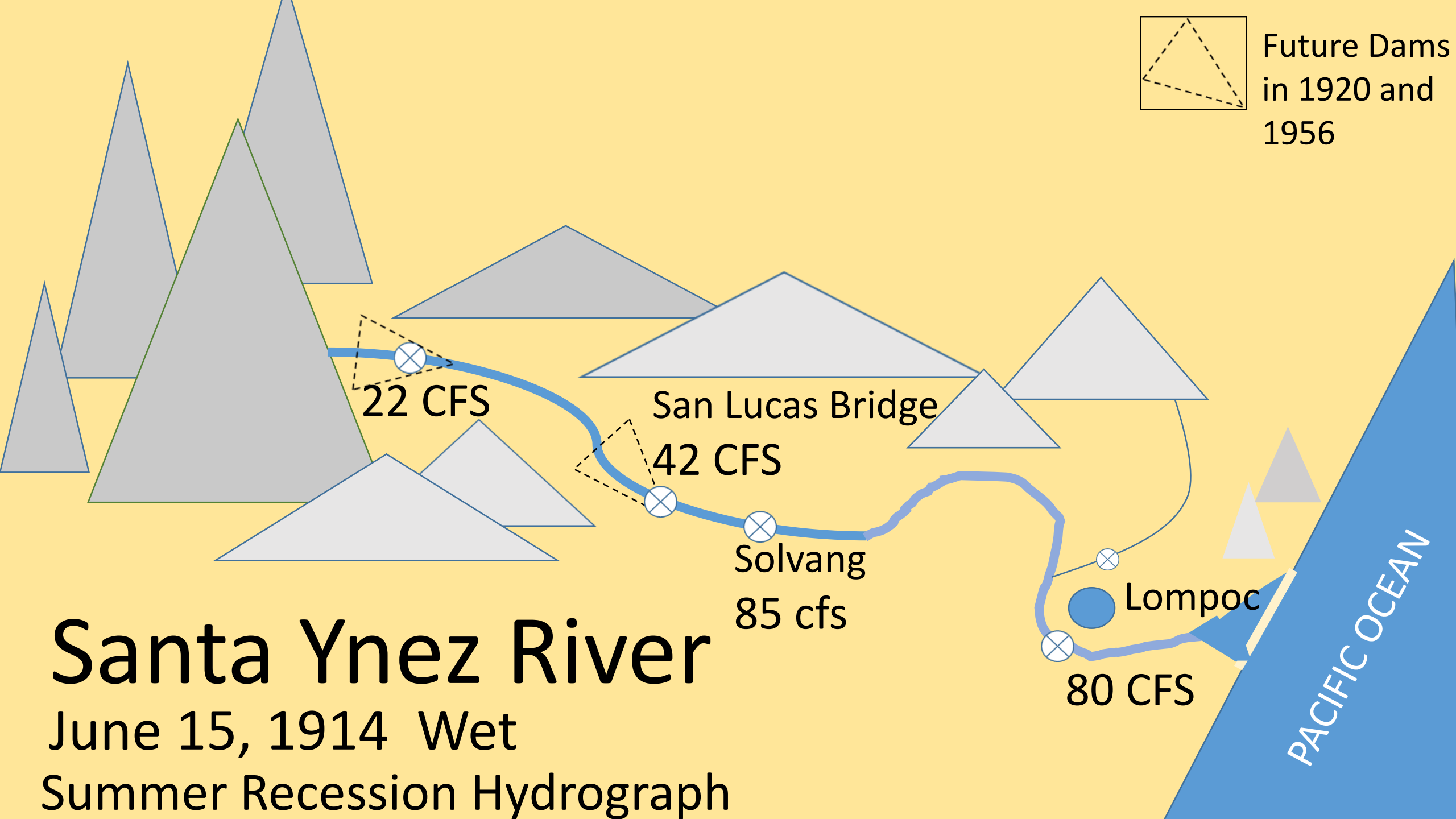
Predicted Adults per 1000 Smolts	
130 mm	1.0
140 mm	1.5
150 mm	2.5
160 mm	7.0
170 mm	14
180 mm	26
190 mm	49

Height=66mm (2.6inch)

Width=156mm (6.1inch)

Predicted 6.5 Adults per 1000 Smolts

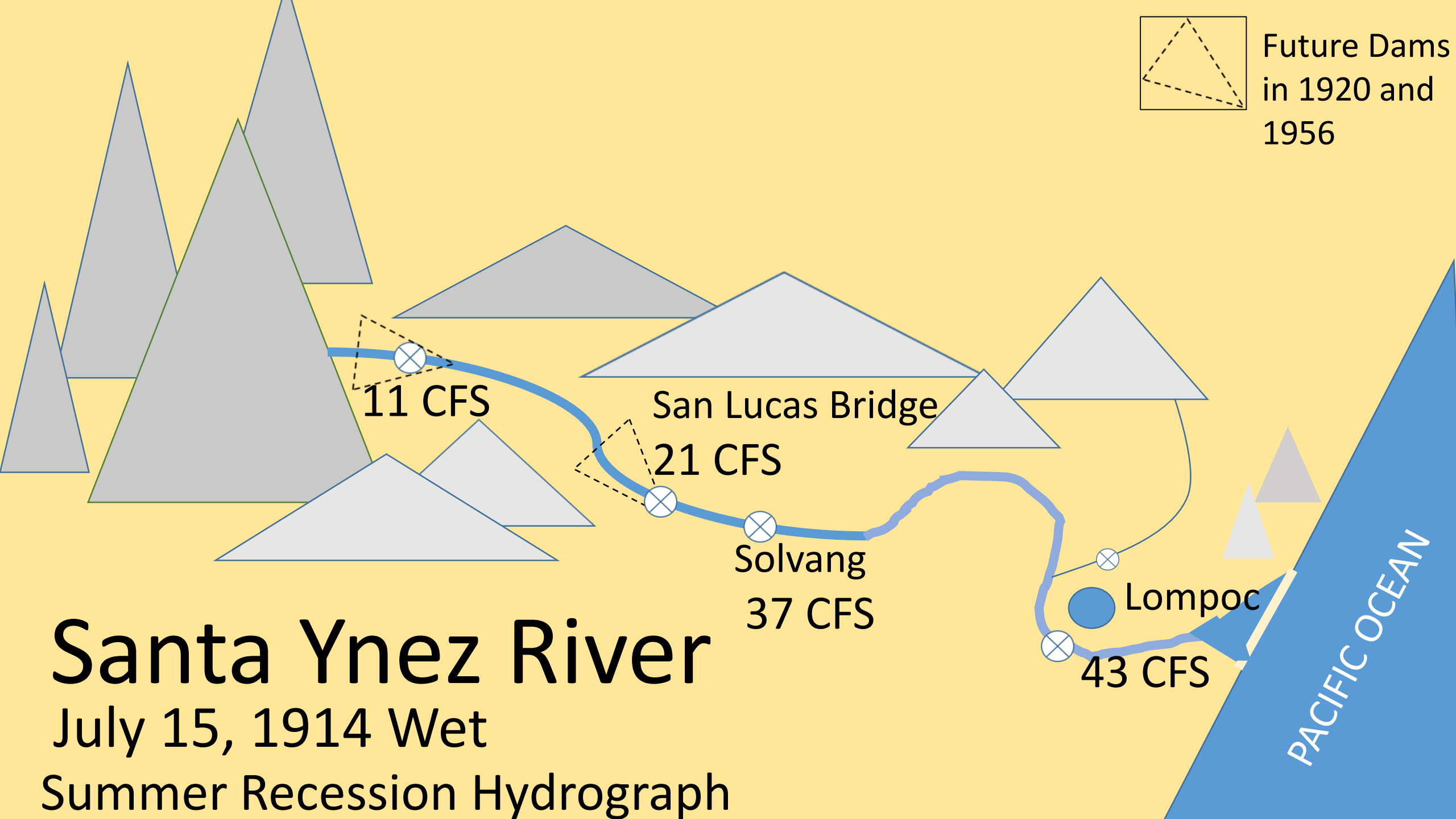

Ext. Wet
Wet
Above Normal
Below Normal
Dry
Critically Dry
WY1920 to WY2014
WY1914
WY1917
WY1912
WY1913
Annual Average
Total Annual Precipitation (inches)
Annual Precipitation Exceedence Value (P,%)
0
10
20
30
40
50
60
70
80
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0



Santa Ynez River

June 15, 1914 Wet

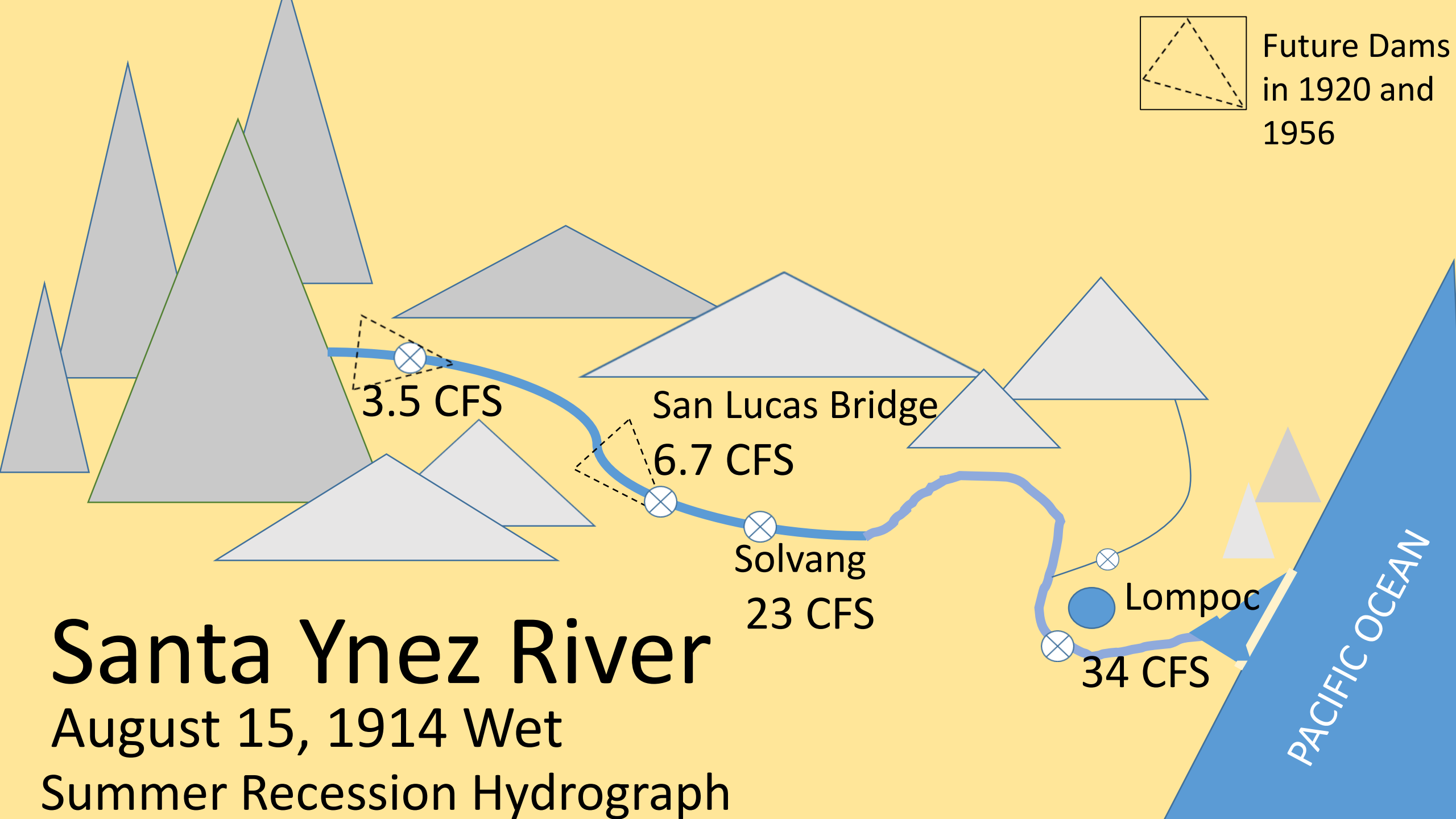
Summer Recession Hydrograph



Santa Ynez River

July 15, 1914 Wet

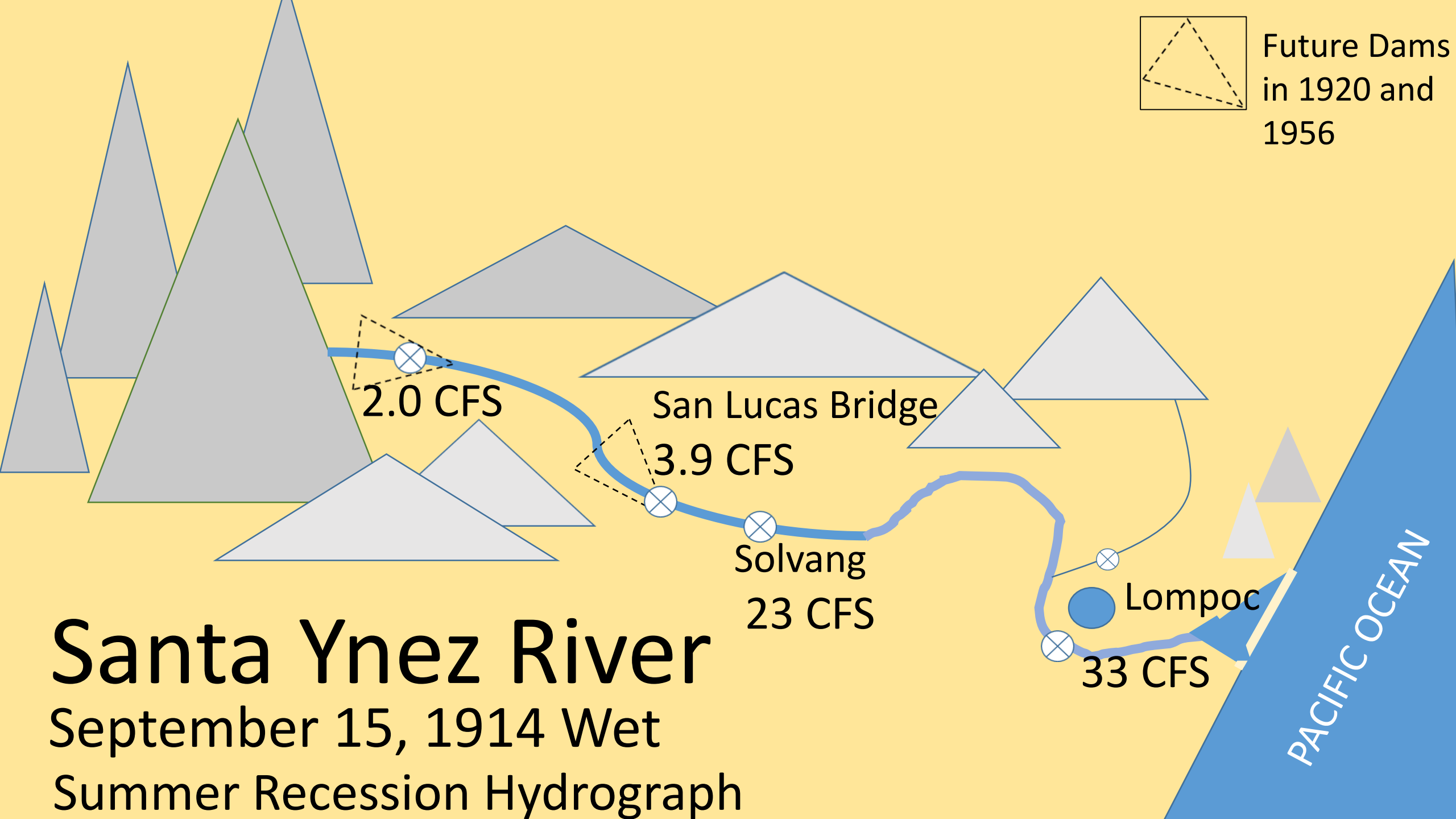
Summer Recession Hydrograph



Santa Ynez River

August 15, 1914 Wet

Summer Recession Hydrograph



Santa Ynez River

September 15, 1914 Wet

Summer Recession Hydrograph

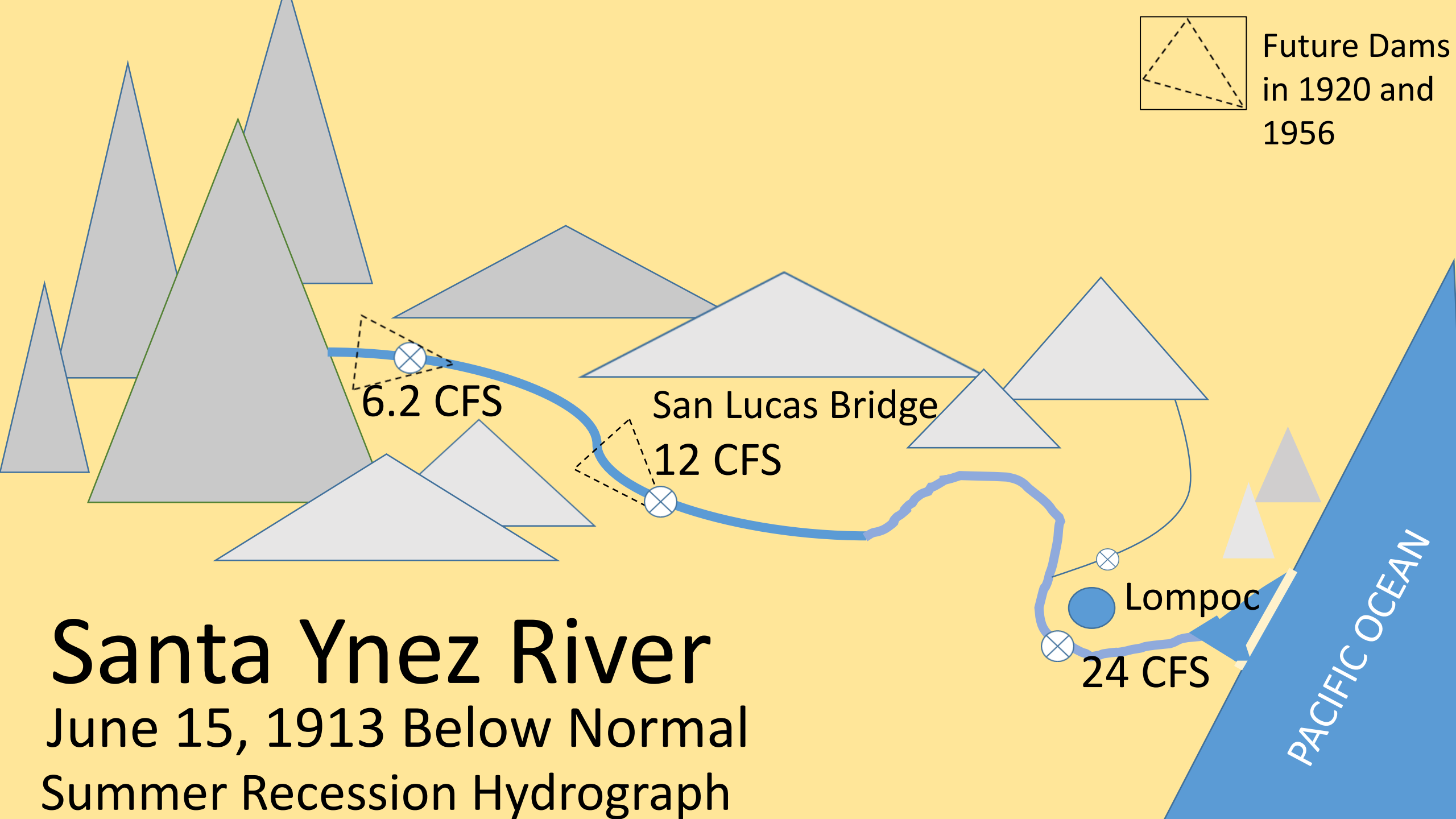
USGS WATER SUPPLY PAPER No. 361

Daily discharge, in second-feet, of Santa Ynez River near Santa Barbara, Cal., for the year ending Sept. 30, 1913.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	0.2	0.4	0.6	1.0	1.4	152	31	18	7.5	3.0	0.8	1.0
2	.2	.4	.6	1.0	1.4	126	31	18	7.0	2.6	.6	.7
3	.2	.4	.6	.9	1.4	102	30	18	7.0	2.4	.6	.7
4	.2	.4	.7	.9	1.4	102	29	18	7.0	2.2	.5	.6
5	.3	.4	.7	1.0	1.4	114	28	17	44	2.0	.5	.4

Daily discharge, in second-feet, of Santa Ynez River near Lompoc, Cal., for the year ending Sept. 30, 1913.

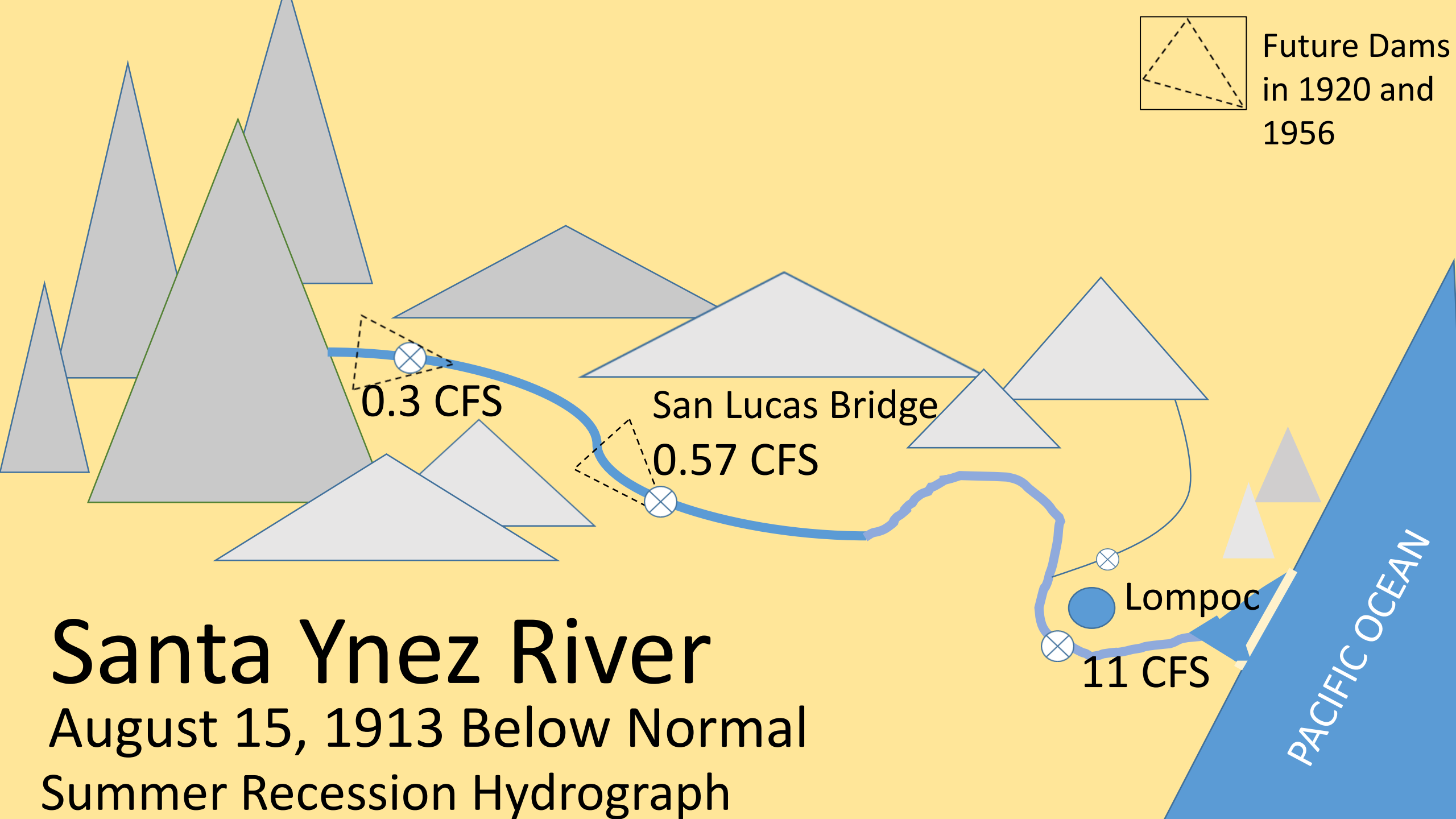
Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	21	23	25	32	37	350	93	47	26	17	11	11
2	21	23	25	33	35	350	90	46	25	17	11	11
3	21	23	25	33	33	350	87	45	25	17	11	11
4	21	24	25	33	31	240	84	44	24	17	11	11
5	21	24	25	33	29	240	81	44	24	17	11	11



Santa Ynez River

June 15, 1913 Below Normal

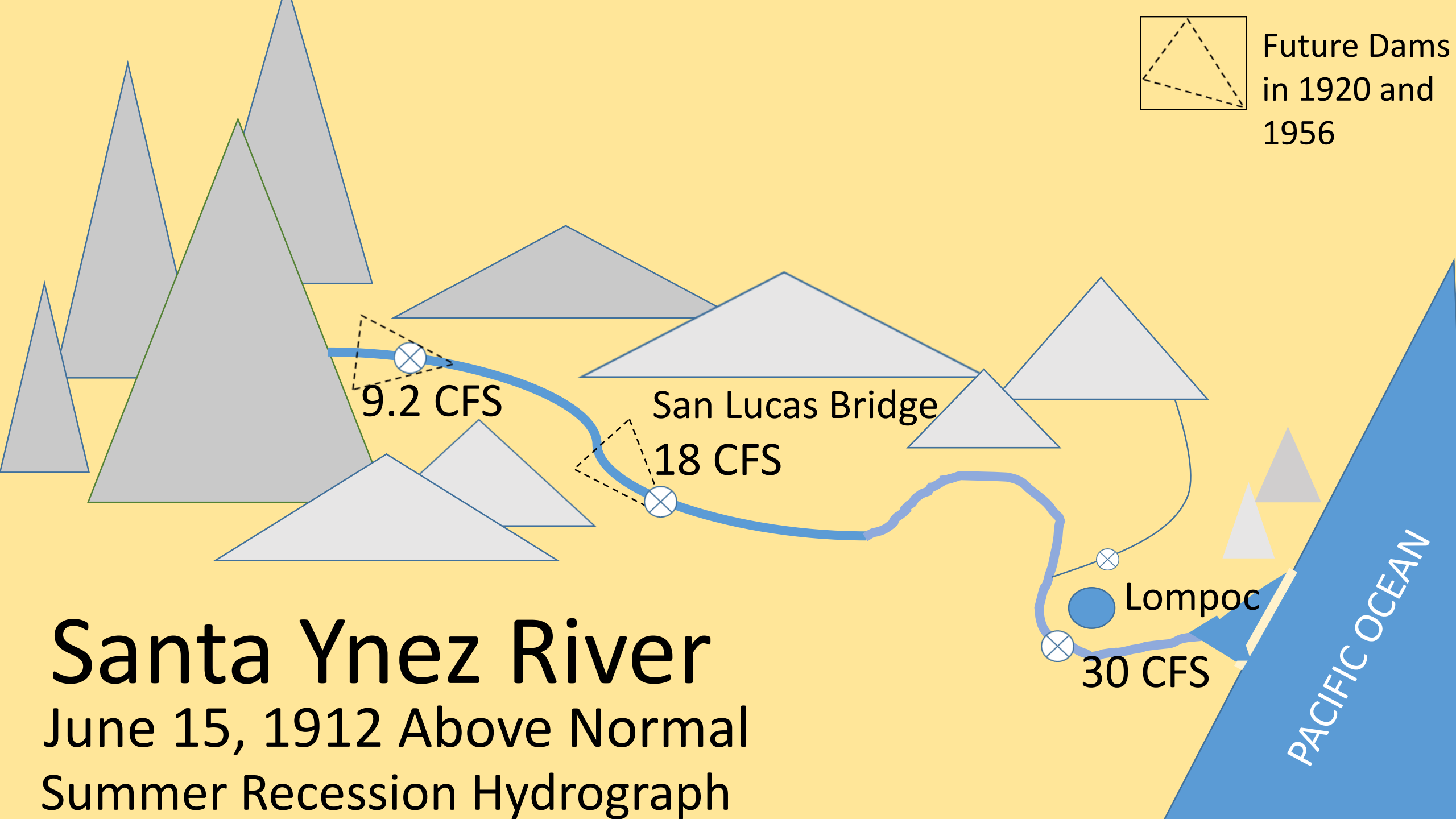
Summer Recession Hydrograph



Santa Ynez River

August 15, 1913 Below Normal

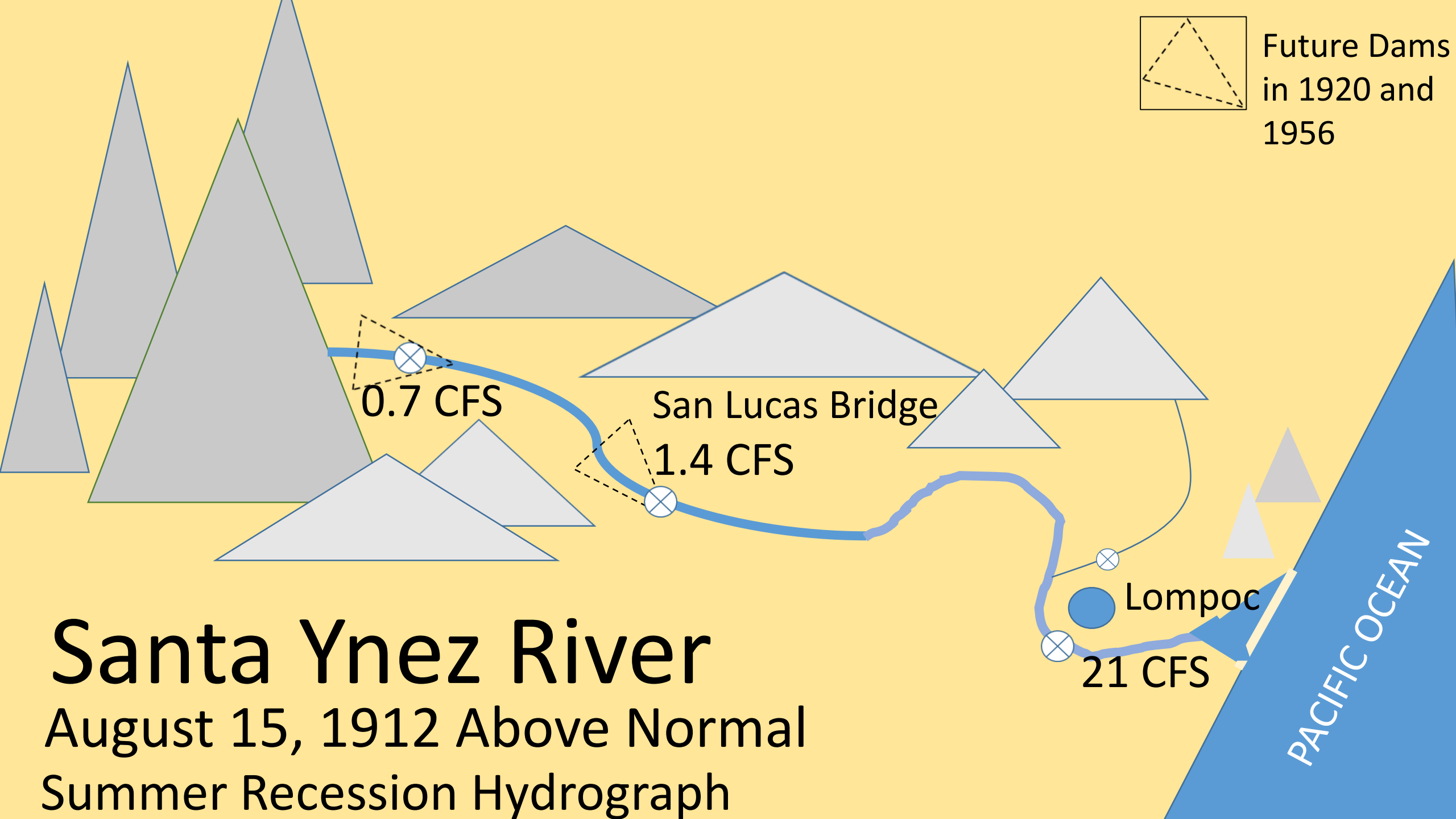
Summer Recession Hydrograph



Santa Ynez River

June 15, 1912 Above Normal

Summer Recession Hydrograph



Santa Ynez River

August 15, 1912 Above Normal

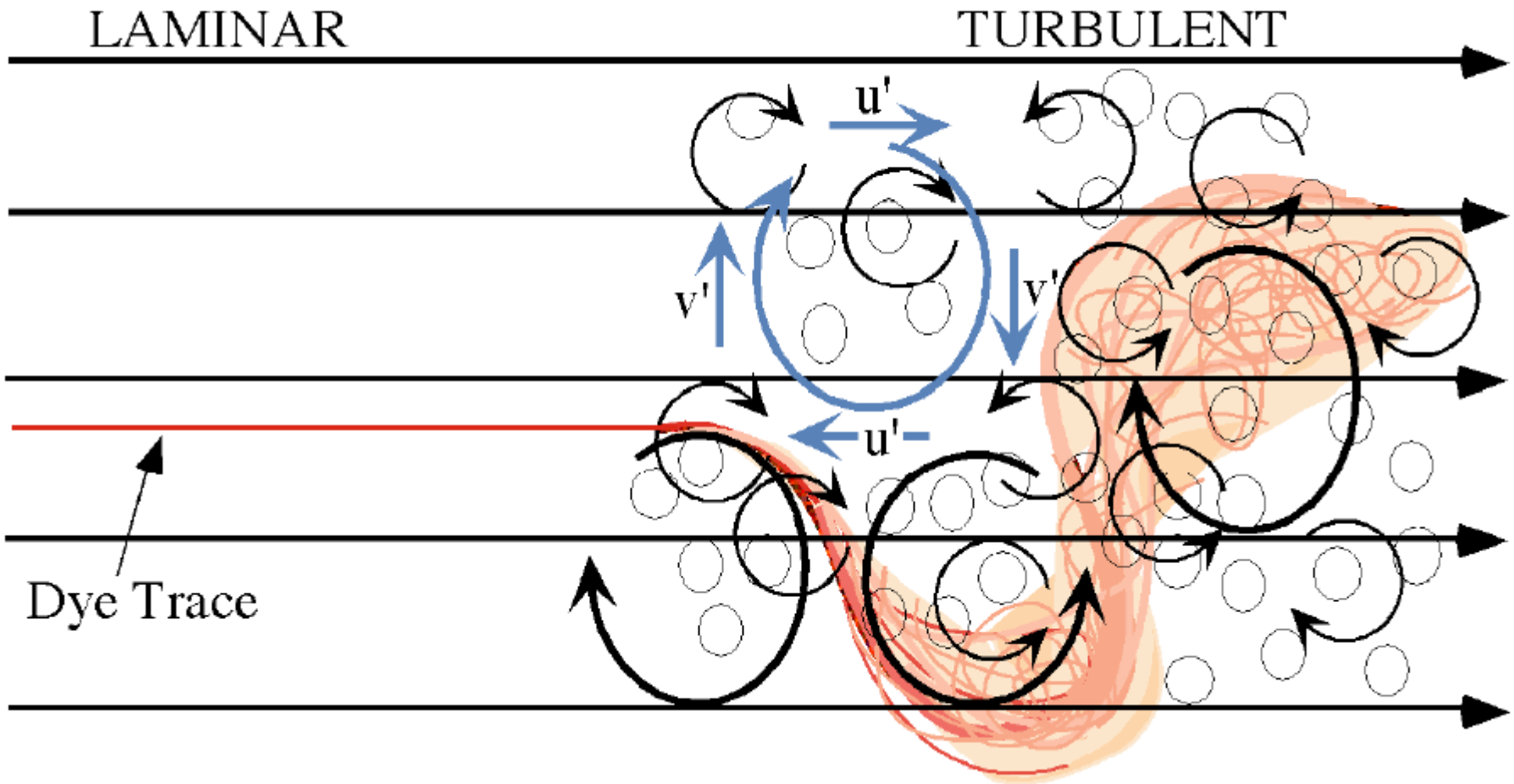
Summer Recession Hydrograph

Daily discharge, in second-feet, of Santa Ynez River near Lompoc, Cal., for 1911–12.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	40	37	37	80	45	45	125	75	70	29	23	21
2	40	37	37	80	45	45	125	75	70	29	23	21
3	40	37	37	80	45	45	125	80	70	29	23	21
4	39	37	37	80	45	95	125	80	70	29	23	21
5	39	37	37	80	45	95	125	85	70	29	23	21
6	39	37	37	80	45	280	125	85	70	28	22	21
7	38	37	67	80	45	350	125	90	70	28	22	21
8	38	37	67	80	45	50	70	90	70	28	22	21
9	38	37	67	80	45	55	70	90	70	28	22	21
10	37	37	67	80	45	185	70	95	70	28	21	21
11	37	37	67	80	45	110	125	95	70	27	21	21
12	37	37	67	80	45	670	540	100	70	27	21	21
13	37	37	67	80	45	560	410	100	70	27	21	21
14	37	37	67	80	45	340	300	100	70	27	21	21
15	37	37	67	80	45	170	205	100	30	27	21	21
16	37	37	67	80	45	185	205	100	30	27	21	21
17	37	37	67	80	45	205	205	100	30	26	21	21
18	37	37	67	80	40	205	205	100	30	26	21	21
19	37	37	67	80	35	205	205	95	30	26	21	21
20	37	37	67	80	32	205	205	95	30	26	21	21

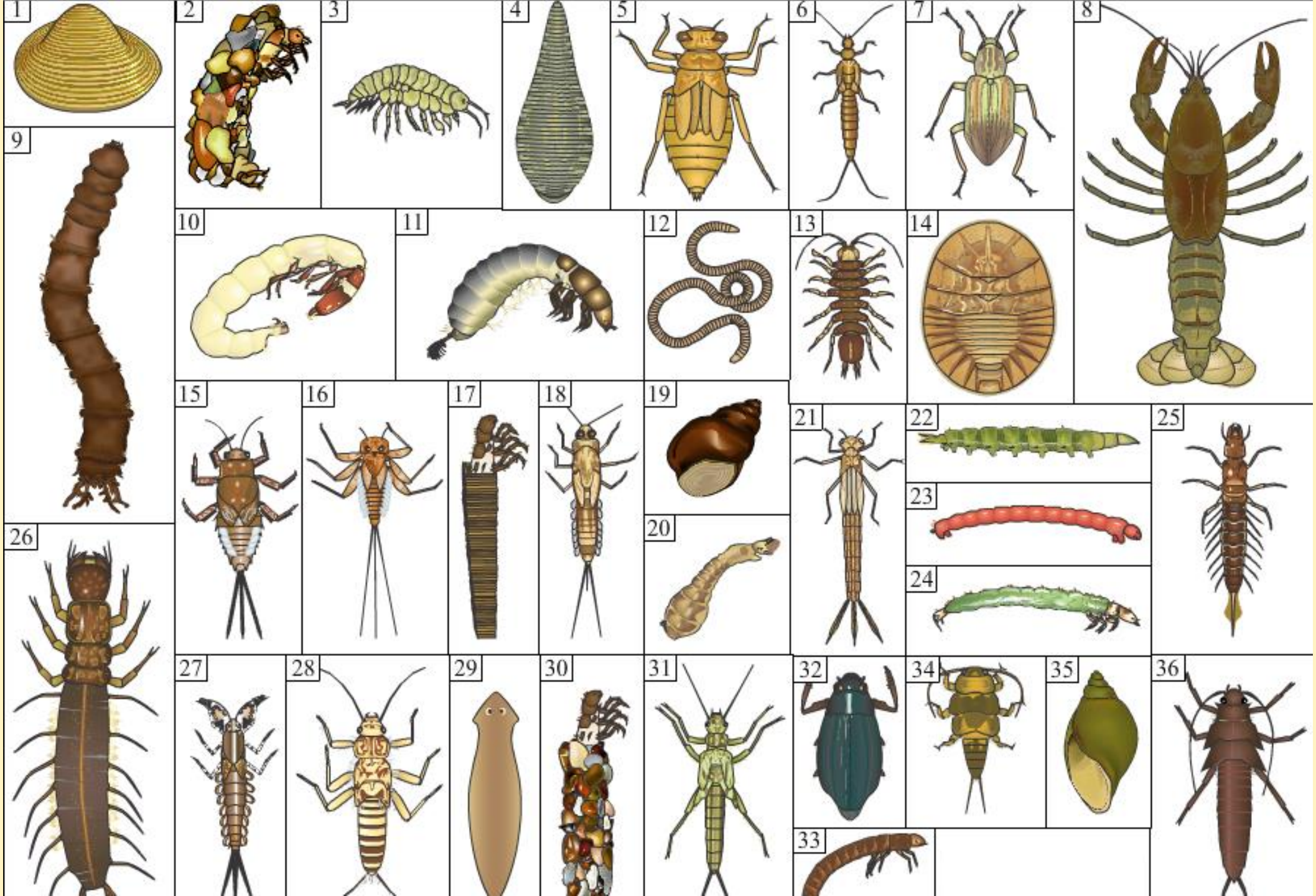
GROUNDWATER Recharge

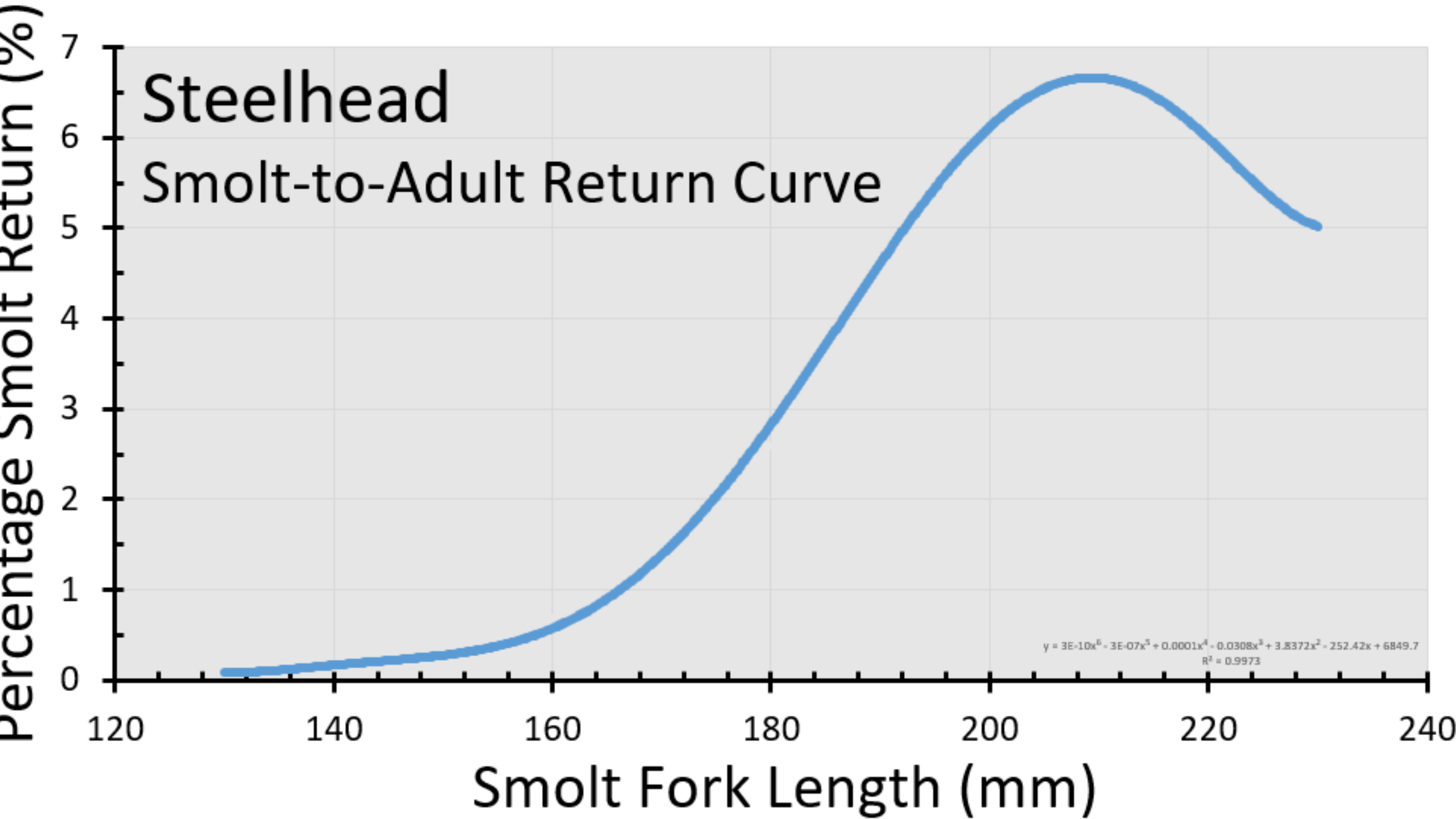
WHAT IS THE CRITICAL PHYSICAL PROCESS?



http://www.mit.edu/course/1/1.061/www/dream/


GROWTH




Steelhead
Smolt-to-Adult Return Curve
Percentage Smolt Return (%)
0
1
2
3
4
5
6
7
120
140
160
180
200
220
240
Smolt Fork Length (mm)
y = 3E-10x^6 - 3E-07x^5 + 0.0001x^4 - 0.0308x^3 + 3.8372x^2 - 252.42x + 6849.7
R² = 0.9973

CONNECTIVITY

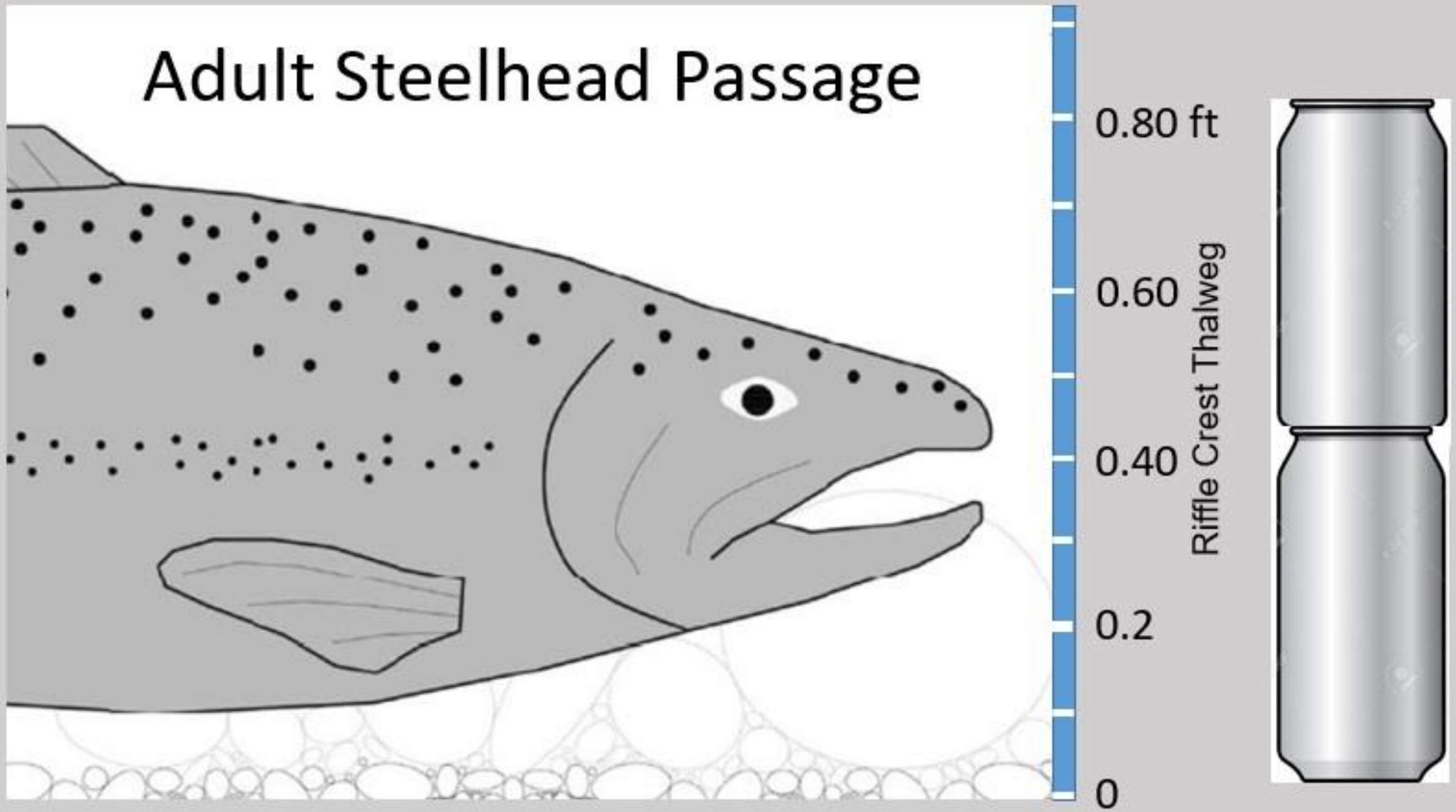
Upstream and Downstream

Spatial and Temporal

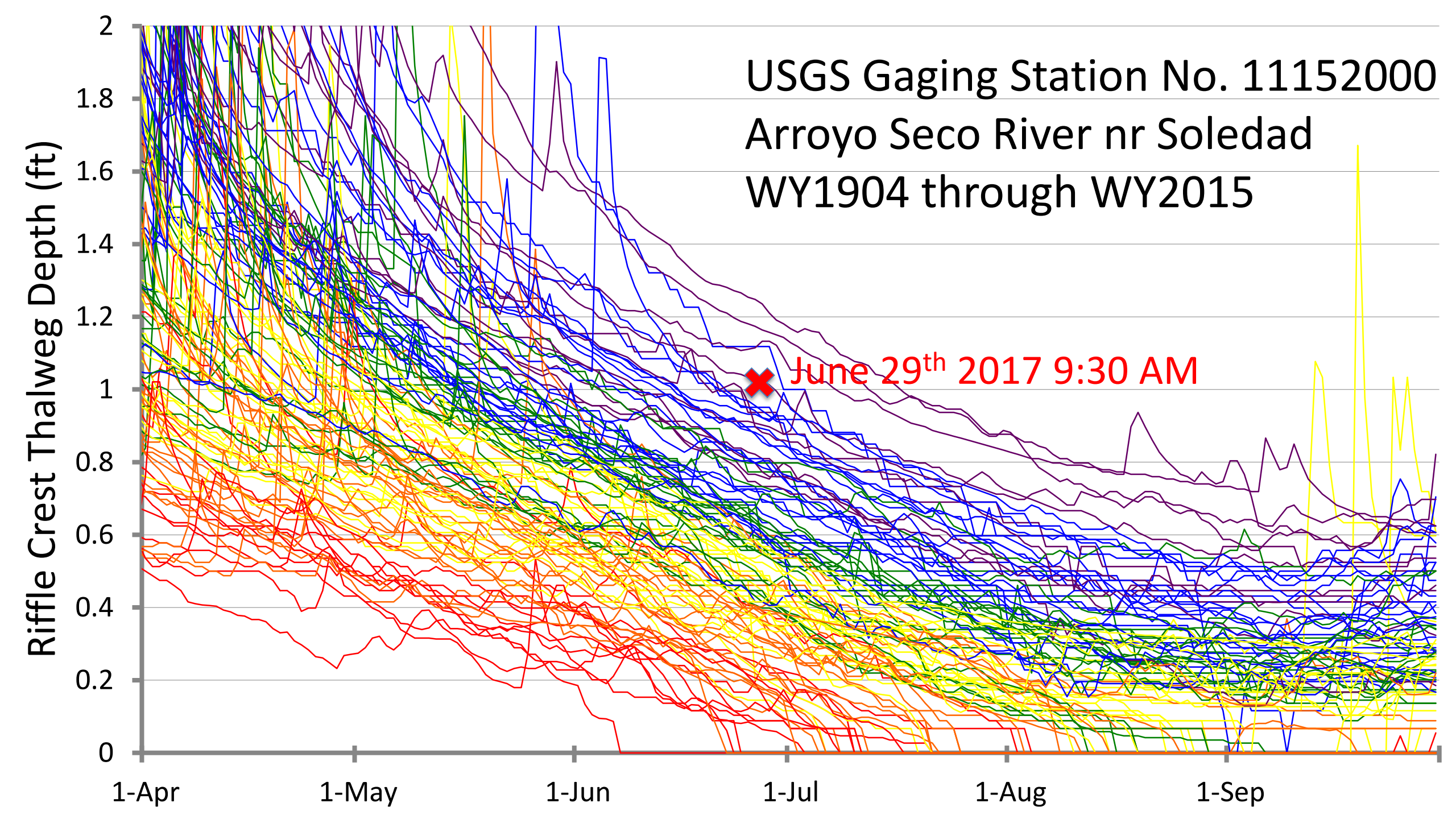
Physical and Biological

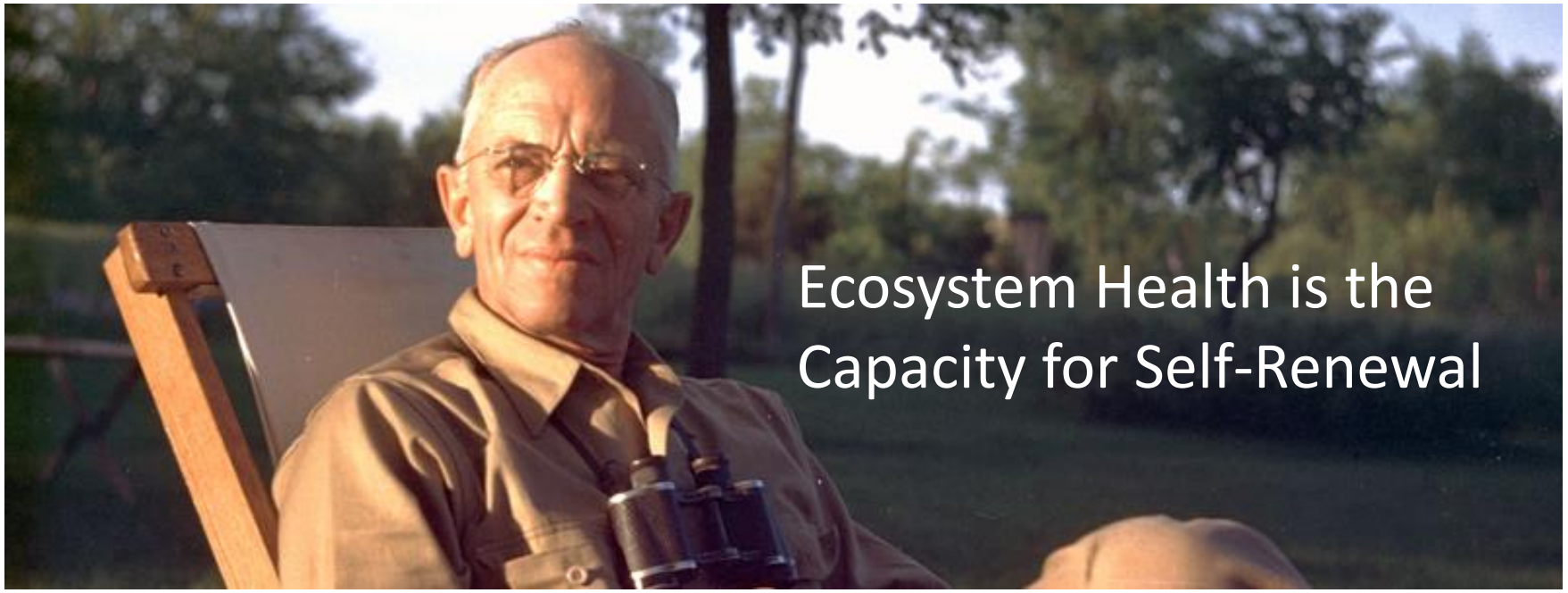
PASSAGE vs MIGRATION

http://www.abbylaux.com/wp-content/uploads/2013/03/mountain_stream_1.jpg


Adult Steelhead Passage
0.80 ft
0.60
0.40
0.2
0
Riffle Crest Thalweg


What I ‘SEE’ ……


USGS Gaging Station No. 11152000
Arroyo Seco River nr Soledad
WY1904 through WY2015
June 29th 2017 9:30 AM
Riffle Crest Thalweg Depth (ft)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep



[T]he health of the land as a whole, rather than the supply of its constituent "resources", is what needs conserving. Land, like other things, has the capacity for self-renewal (i.e. for permanent productivity) only when its natural parts are present, and functional. It is a dangerous fallacy to assume that we are free to discard or change any part of the land we do not find "useful" (such as flood plains, marshes, and wild floras and faunas).[50]

Leopold's Presidential Conservation Platform For John Dewey 1946

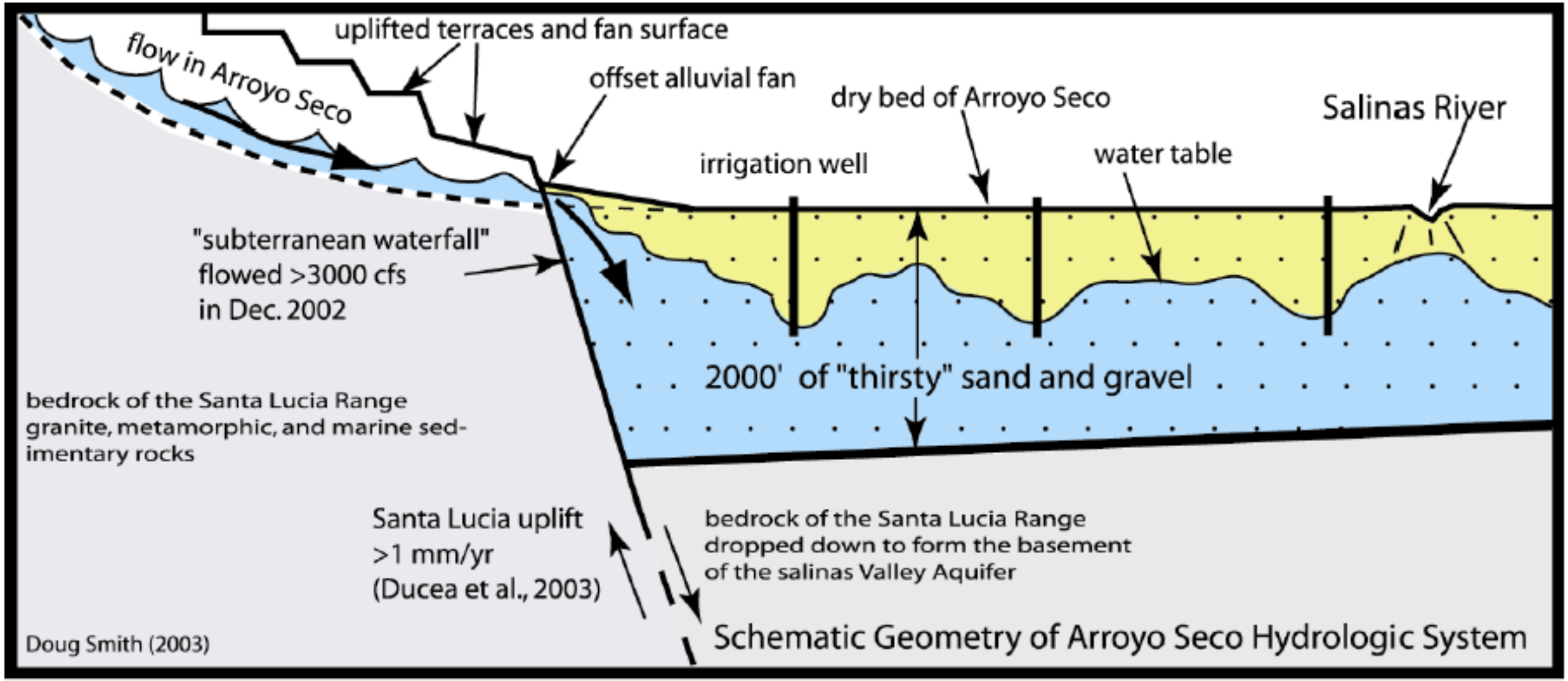


Figure 4.9. Schematic diagram of percolation of the Arroyo Seco River into the aquifer system of the Salinas Valley.