CLEAR CREEK SPRING PULSE FLOW & SUMMER TEMPERATURE MANAGEMENT

Agenda

1. Introductions
2. Goals for the meeting
3. Review NMFS Biological Opinion RPA's regarding spring pulse flows and temperature management
4. Review spring Chinook Salmon entry timing and distribution data
5. Review other considerations (e.g. avian nesting, winter run Chinook Salmon behavior at mouth of Clear Creek, ramping rates)
6. Review monitoring needs
7. Develop proposal for 2019 actions

Clear Creek Spring Pulse Flows and Summer Temperature Management 2018

Proposal from the Clear Creek Technical Team
March 25, 2018

Summary of Proposed Actions

- Manage Whiskeytown Dam release to approach but not exceed a 60°F average daily water temperature at Igo (RPA target), following spring reservoir turnover and start of thermal stratification.
- Manage Whiskeytown Dam releases to produce two pulse flows in June, which peak on June 4 and June 18. Attempt to maximize the difference in water temperatures between pulse releases and general base flows.
- Attempt to maintain relatively similar flows between and after pulse flows for consistent monitoring conditions.
- Following pulse flows, manage Whiskeytown Dam releases to approach but not exceed a 60°F mean daily average water temperature at Igo through September 14.
- Manage flows to approach but not exceed a 56°F mean daily average water temperature from September 15 through October 31 (end of RPA criteria period).
- Continue monitoring efforts to inform effectiveness (spring-run Chinook Salmon entry into Clear Creek, spring-run Chinook Salmon distribution in Clear Creek, temperature monitoring).

Action I.1.1. Spring Attraction Flows

Objective: *To encourage spring-run movement to upstream Clear Creek habitat for spawning.*

Action: *Reclamation shall annually conduct at least two pulse flows in Clear Creek in May and June of at least 600 cfs for at least three days for each pulse, to attract adult spring-run holding in the Sacramento River main stem. This may be done in conjunction with channel-maintenance flows (Action I.1.2).*

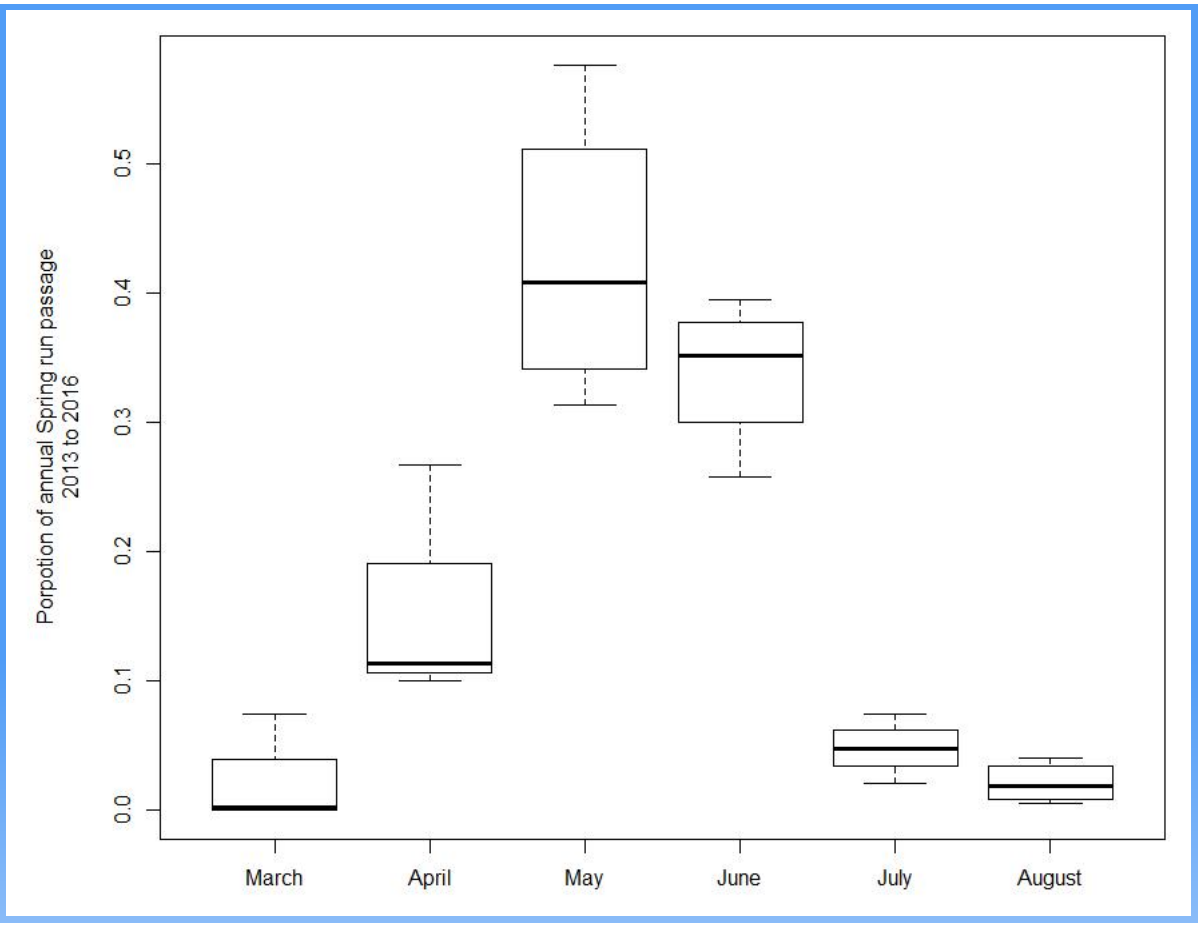
Action I.1.5. Thermal Stress Reduction

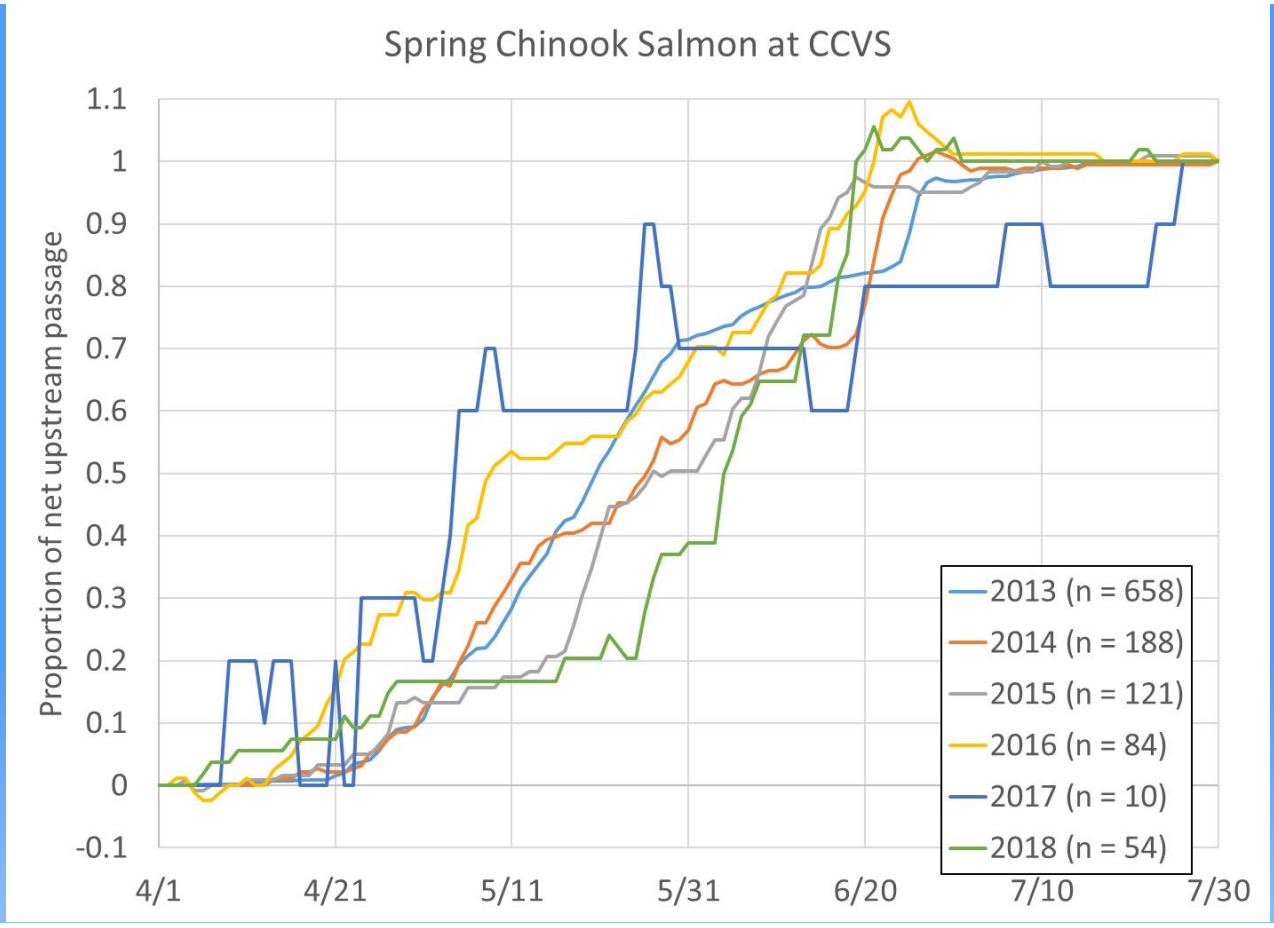
Objective*: To reduce thermal stress to over-summering CCV steelhead and CV spring-run Chinook Salmon during holding, spawning, and embryo incubation.*

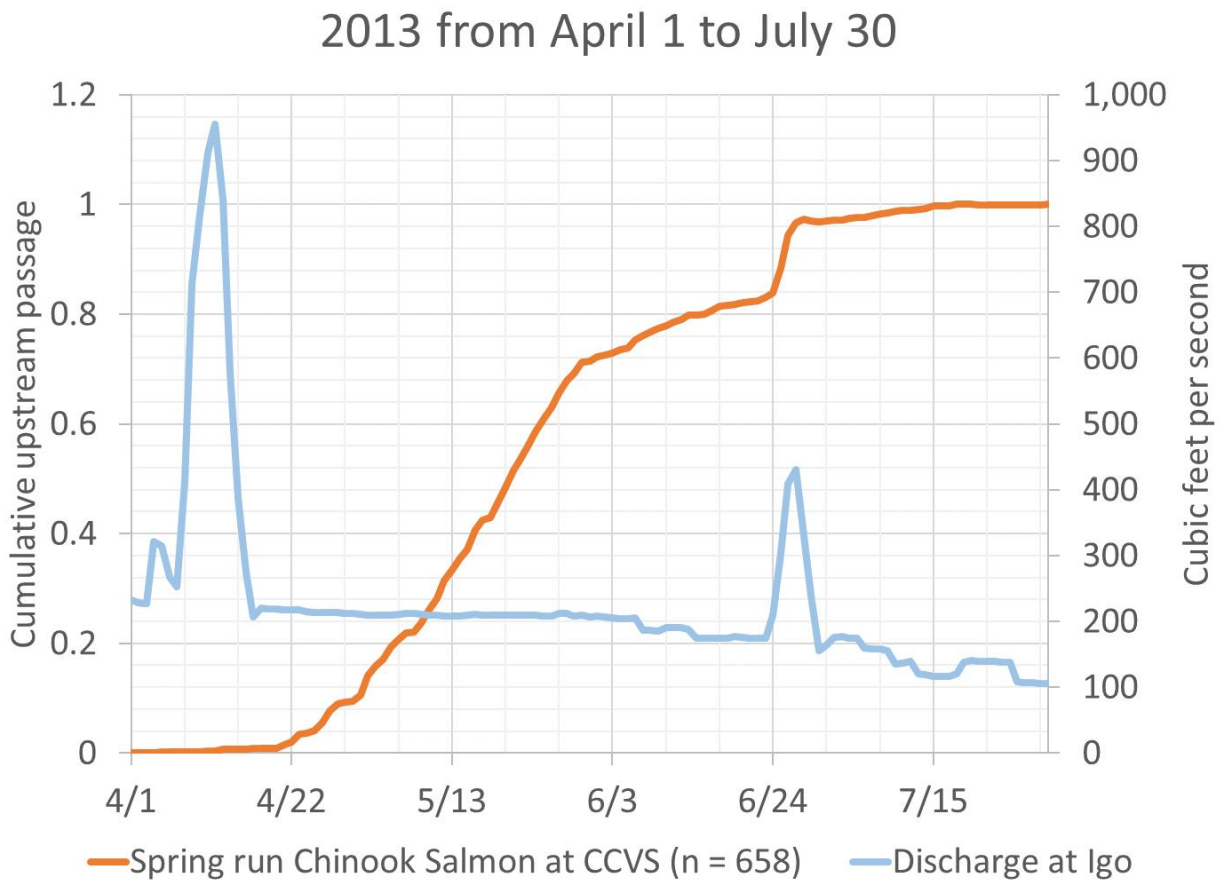
Action: Reclamation shall manage Whiskeytown releases to meet a daily water temperature of:

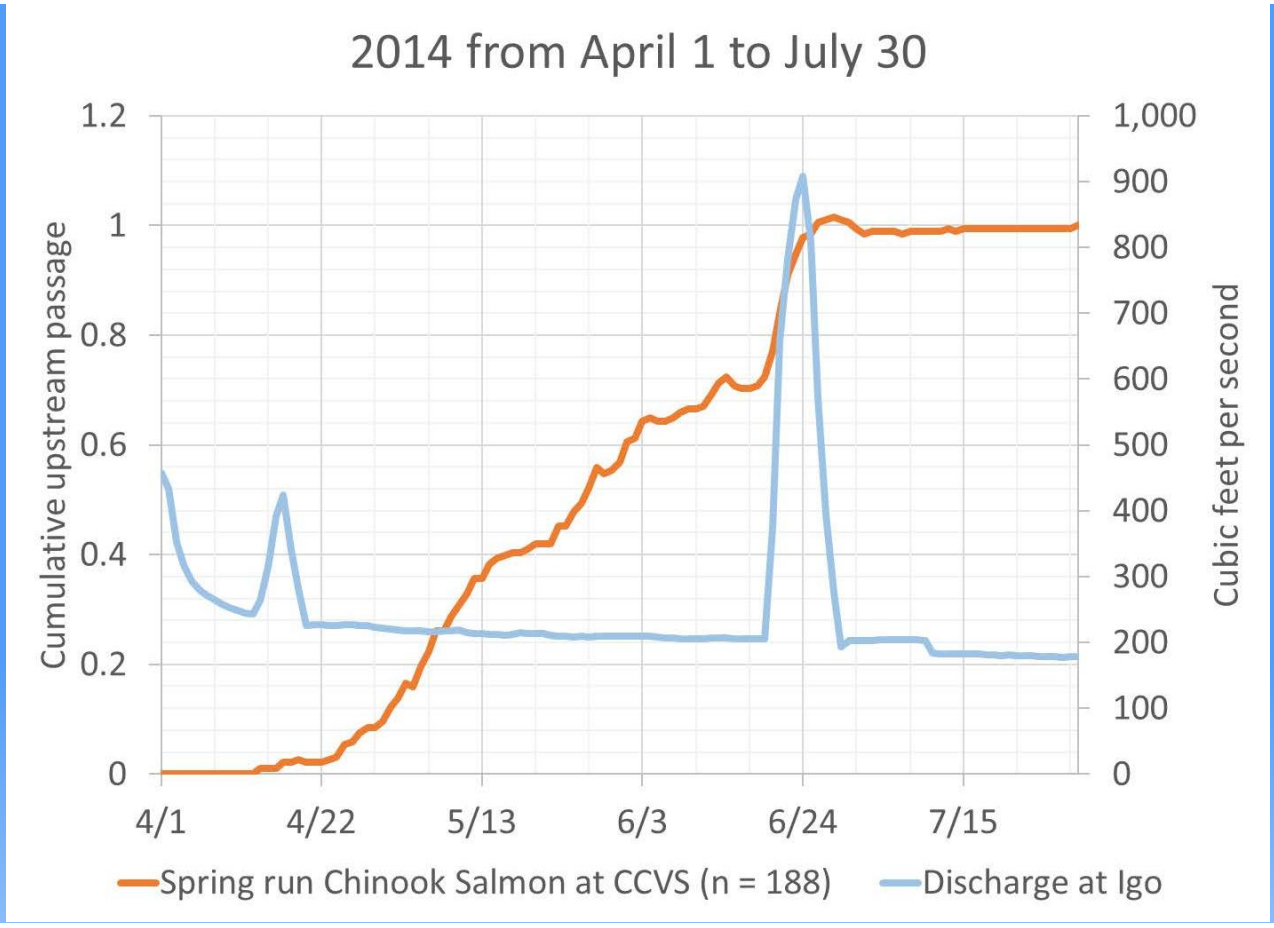
1) 60°F at the Igo gage from June 1 through September 15; and

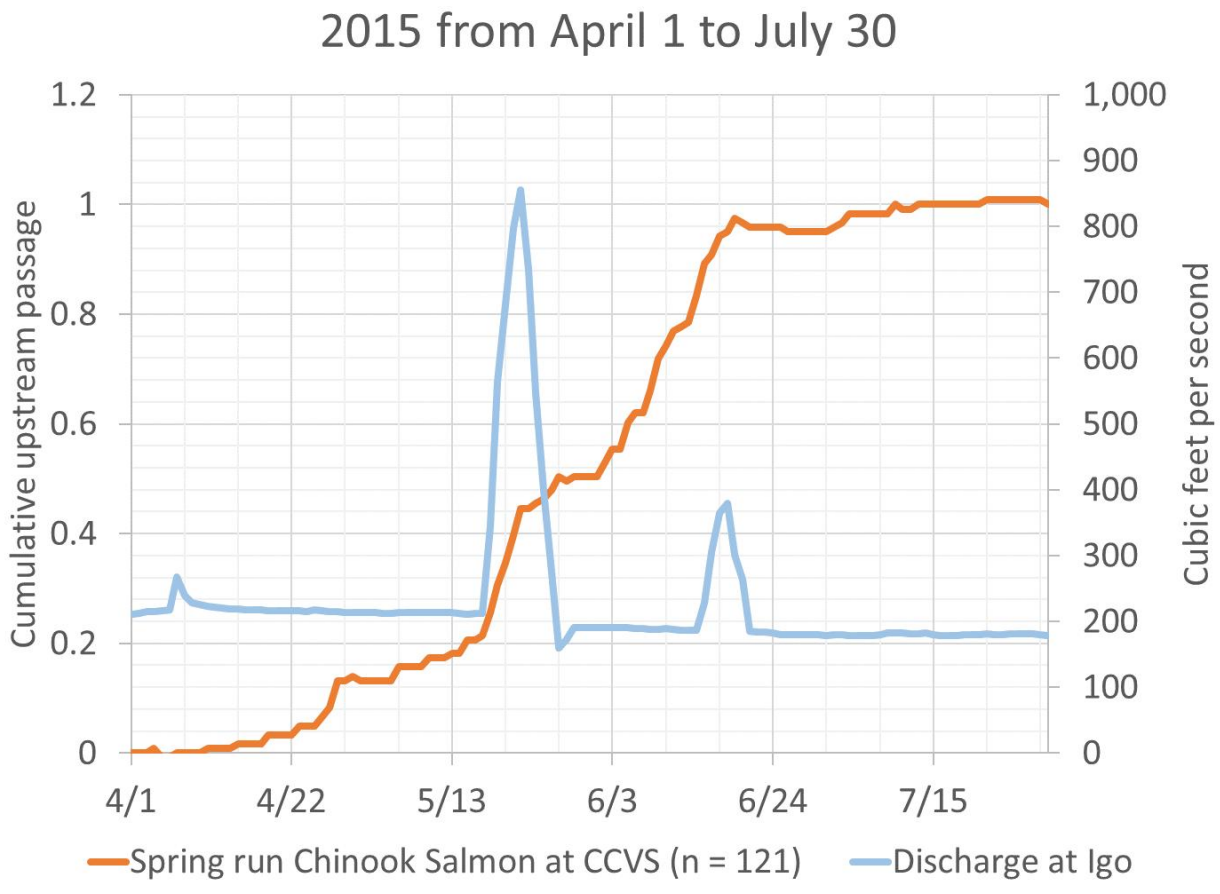
2) 56°F at the Igo gage from September 15 to October 31.

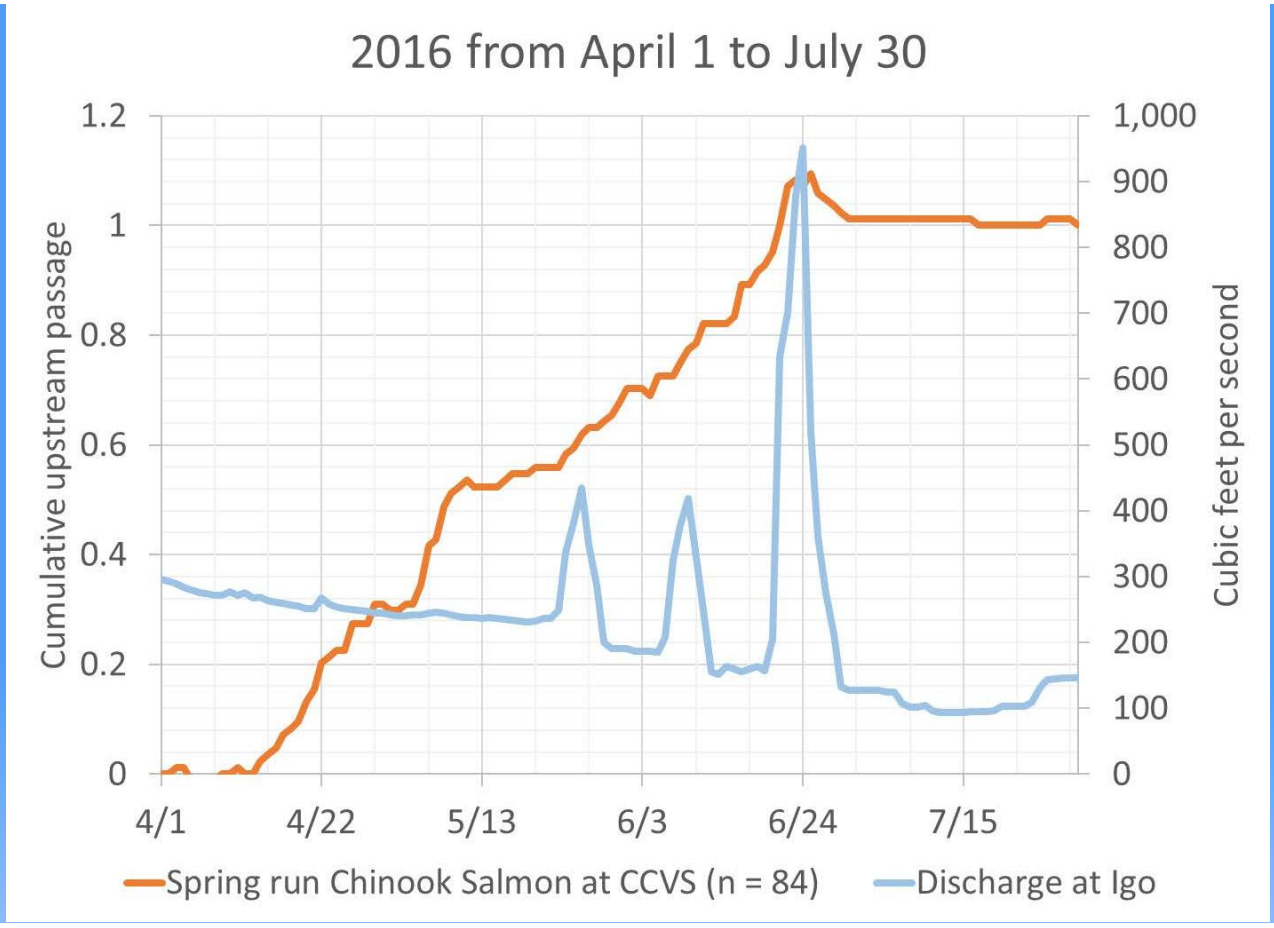

Porpotion of annual Spring run passage
2013 to 2016
0.0
0.1
0.2
0.3
0.4
0.5
March
April
May
June
July
August

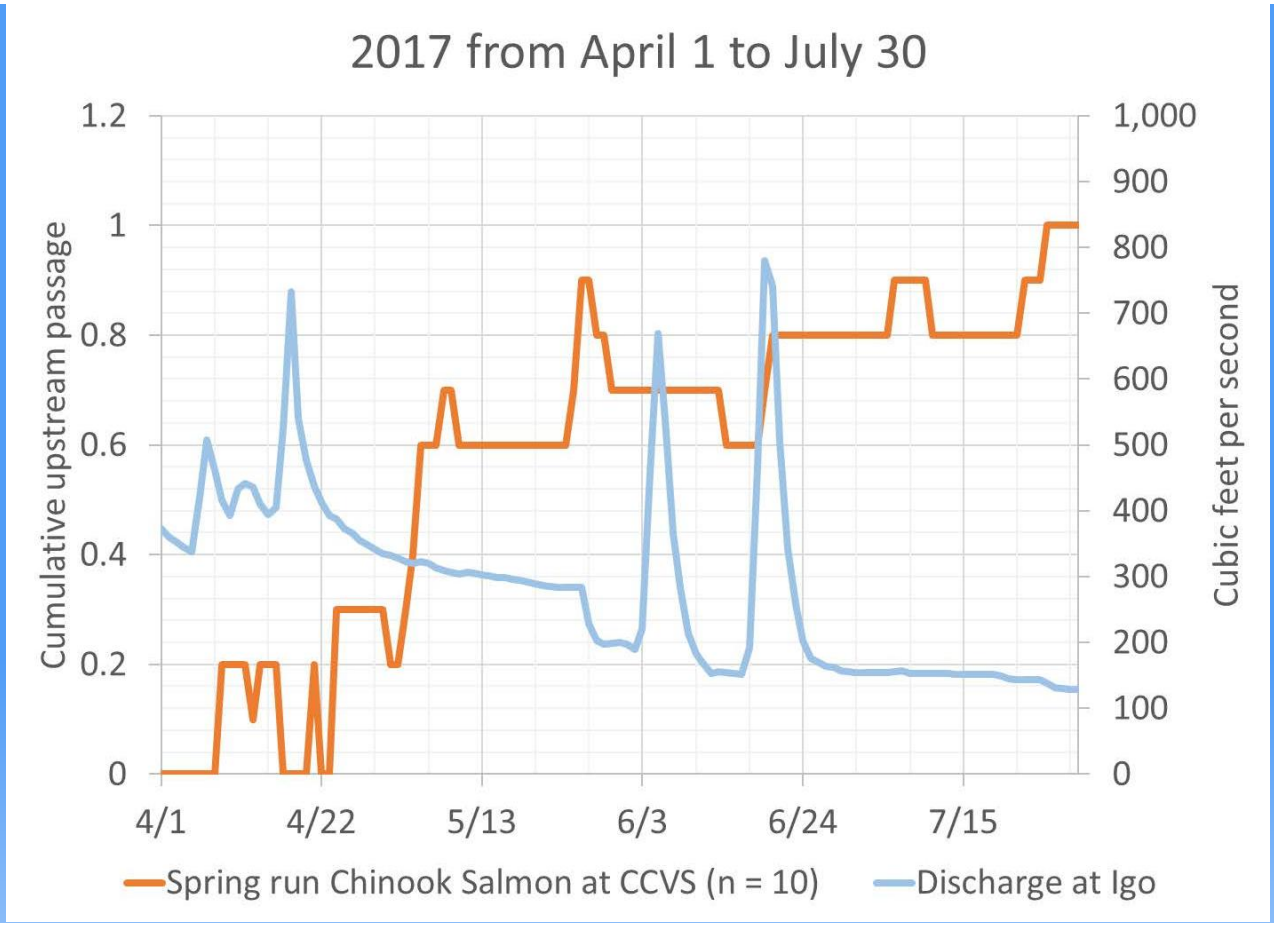

Spring Chinook Salmon at CCVS
Proportion of net upstream passage
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
4/1
4/21
5/11
5/31
6/20
7/10
7/30
2013 (n = 658)
2014 (n = 188)
2015 (n = 121)
2016 (n = 84)
2017 (n = 10)
2018 (n = 54)

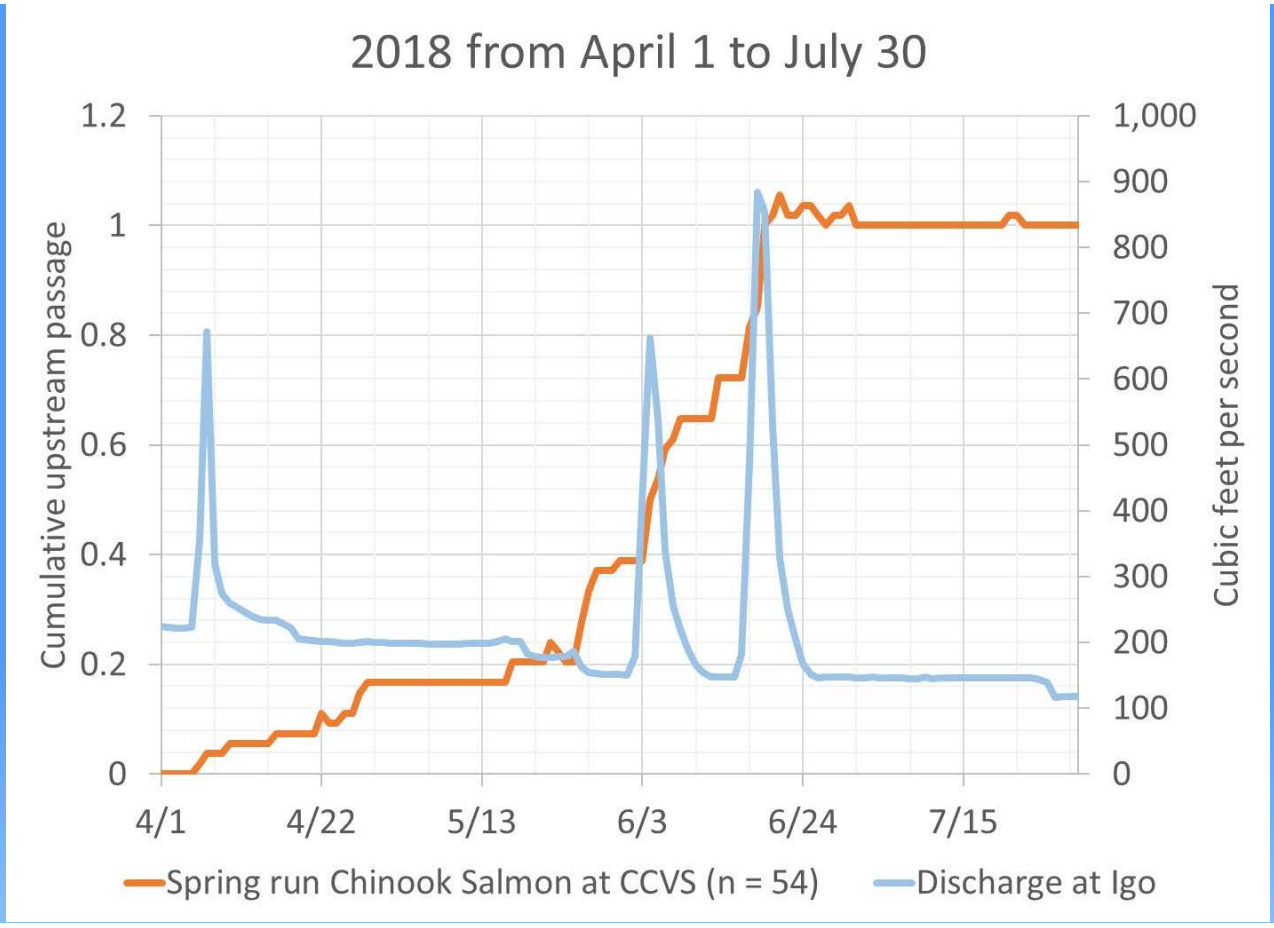

2013 from April 1 to July 30
Cumulative upstream passage
1.2
1
0.8
0.6
0.4
0.2
0
1,000
900
800
700
600
500
400
300
200
100
0
Cubic feet per second
4/1
4/22
5/13
6/3
6/24
7/15
Spring run Chinook Salmon at CCVS (n = 658)
Discharge at Igo

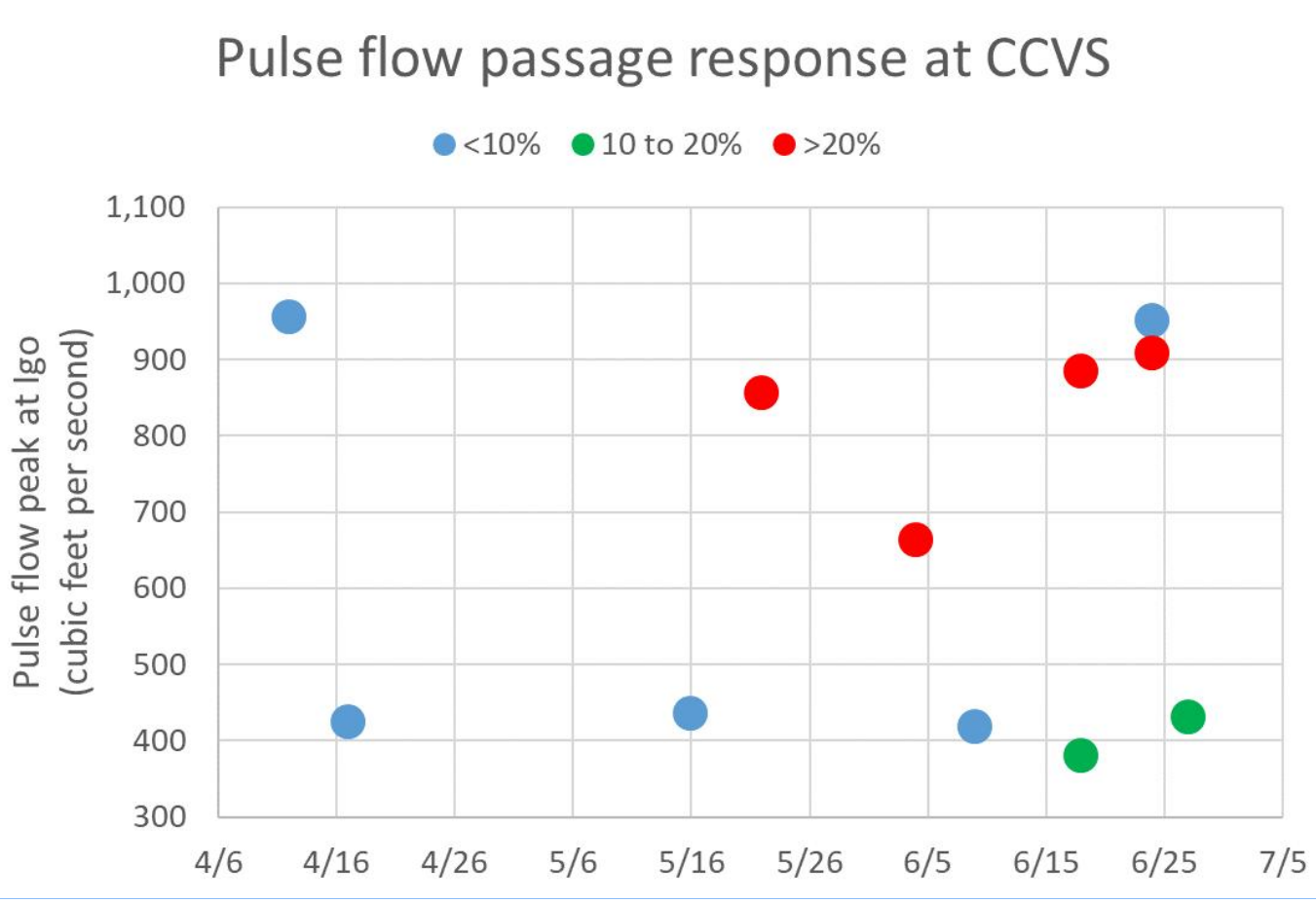

2014 from April 1 to July 30
Cumulative upstream passage
Cubic feet per second
1.2
1
0.8
0.6
0.4
0.2
0
1,000
900
800
700
600
500
400
300
200
100
0
4/1
4/22
5/13
6/3
6/24
7/15
Spring run Chinook Salmon at CCVS (n = 188)
Discharge at Igo

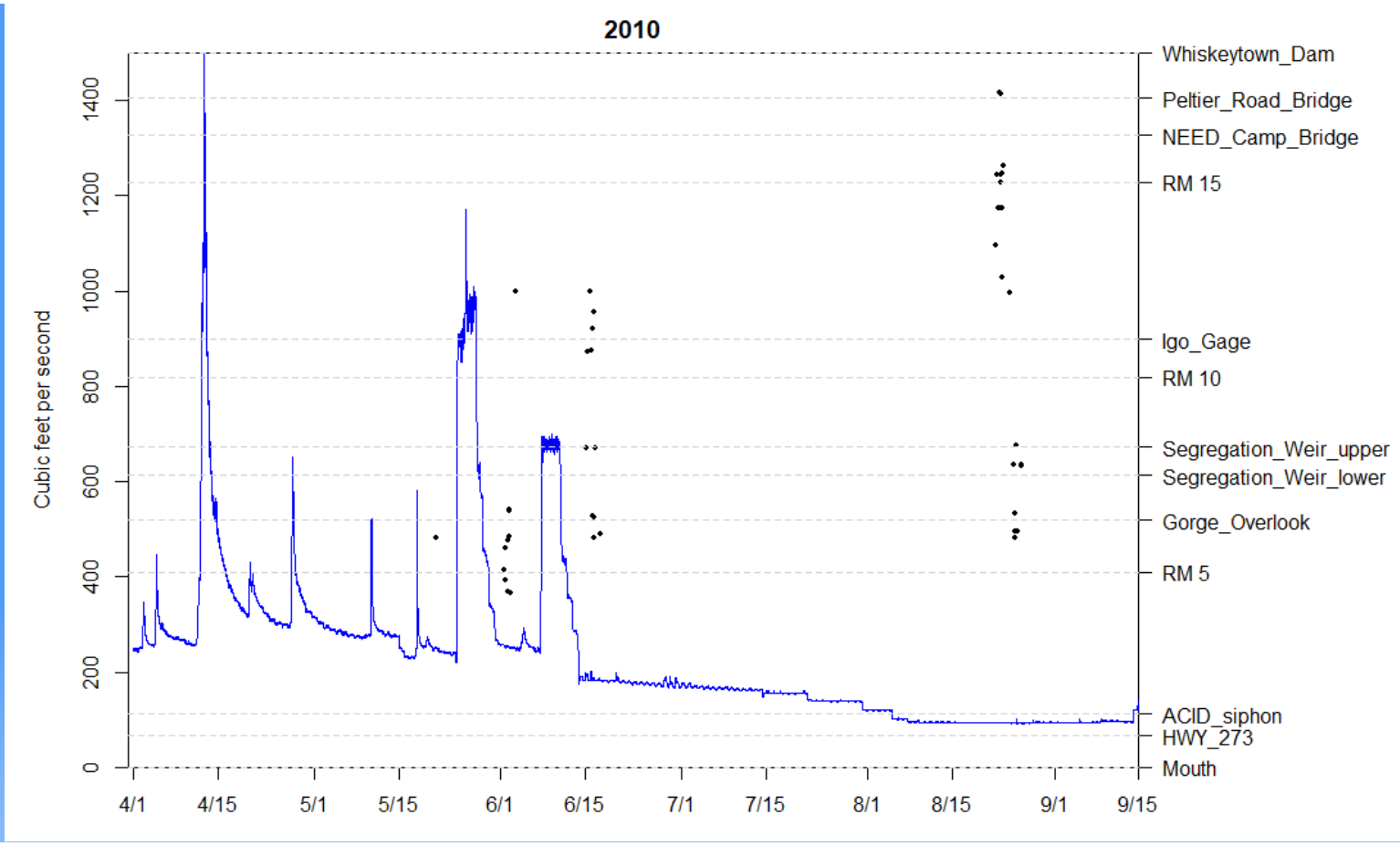

2015 from April 1 to July 30
Cumulative upstream passage
Cubic feet per second
1.2
1
0.8
0.6
0.4
0.2
0
1,000
900
800
700
600
500
400
300
200
100
0
4/1
4/22
5/13
6/3
6/24
7/15
Spring run Chinook Salmon at CCVS (n = 121)
Discharge at Igo

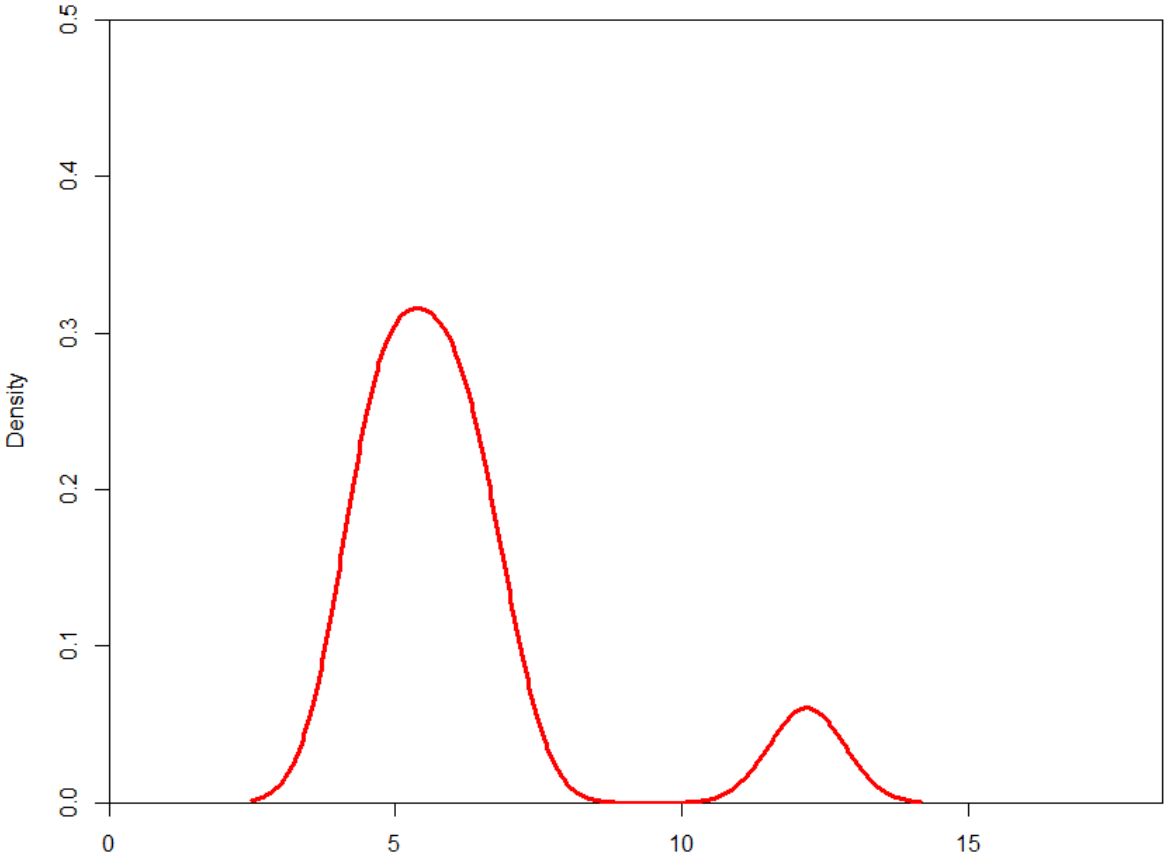

2016 from April 1 to July 30
Cumulative upstream passage
Cubic feet per second
1.2
1
0.8
0.6
0.4
0.2
0
1,000
900
800
700
600
500
400
300
200
100
0
4/1
4/22
5/13
6/3
6/24
7/15
Spring run Chinook Salmon at CCVS (n = 84)
Discharge at Igo

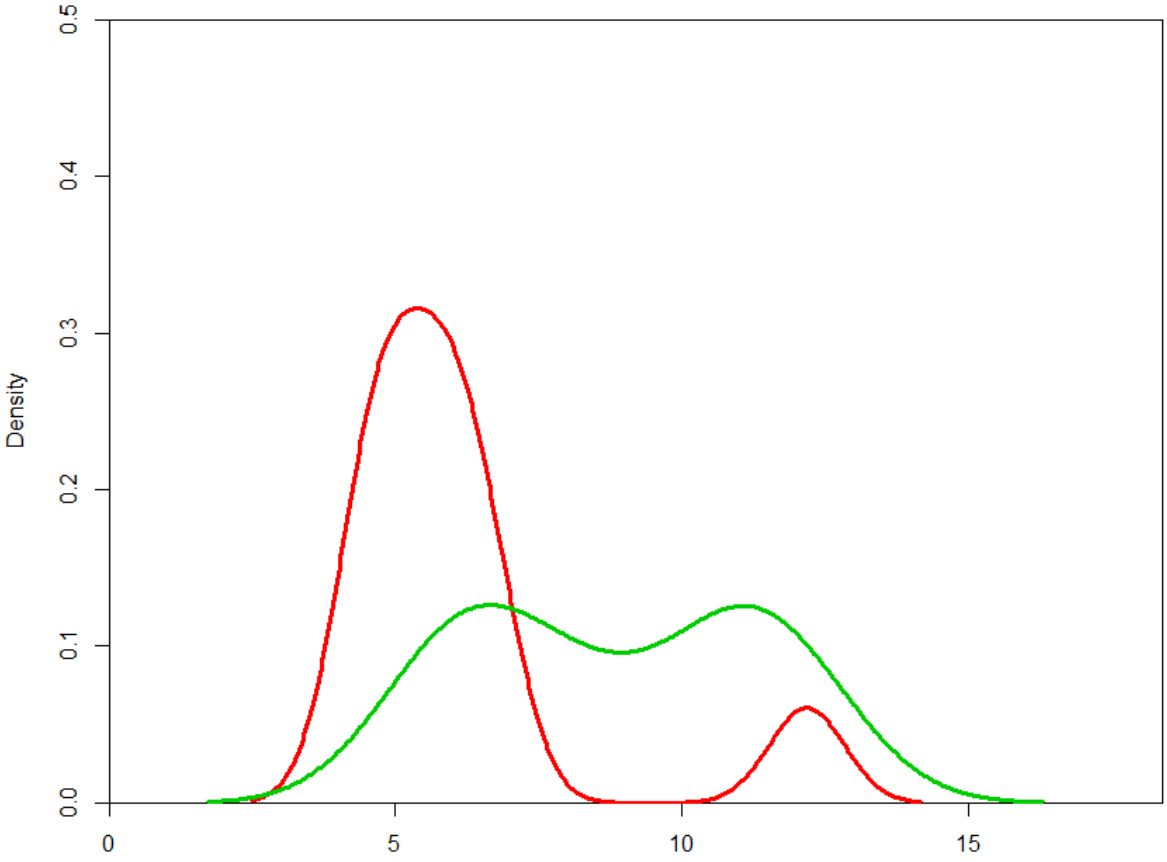

2017 from April 1 to July 30
Cumulative upstream passage
Cubic feet per second
1.2
1
0.8
0.6
0.4
0.2
0
1,000
900
800
700
600
500
400
300
200
100
0
4/1
4/22
5/13
6/3
6/24
7/15
Spring run Chinook Salmon at CCVS (n = 10)
Discharge at Igo


2018 from April 1 to July 30
Cumulative upstream passage
Cubic feet per second
1.2
1
0.8
0.6
0.4
0.2
0
1,000
900
800
700
600
500
400
300
200
100
0
4/1
4/22
5/13
6/3
6/24
7/15
Spring run Chinook Salmon at CCVS (n = 54)
Discharge at Igo


Pulse flow passage response at CCVS
<10%
10 to 20%
>20%
Pulse flow peak at Igo
(cubic feet per second)
1,100
1,000
900
800
700
600
500
400
300
4/6
4/16
4/26
5/6
5/16
5/26
6/5
6/15
6/25
7/5


2010
Cubic feet per second
0
200
400
600
800
1000
1200
1400
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
8/1
8/15
9/1
9/15
Whiskeytown_Dam
Peltier_Road_Bridge
NEED_Camp_Bridge
RM 15
Igo_Gage
RM 10
Segregation_Weir_upper
Segregation_Weir_lower
Gorge_Overlook
RM 5
ACID_siphon
HWY_273
Mouth


Density
0.0
0.1
0.2
0.3
0.4
0.5
0
5
10
15

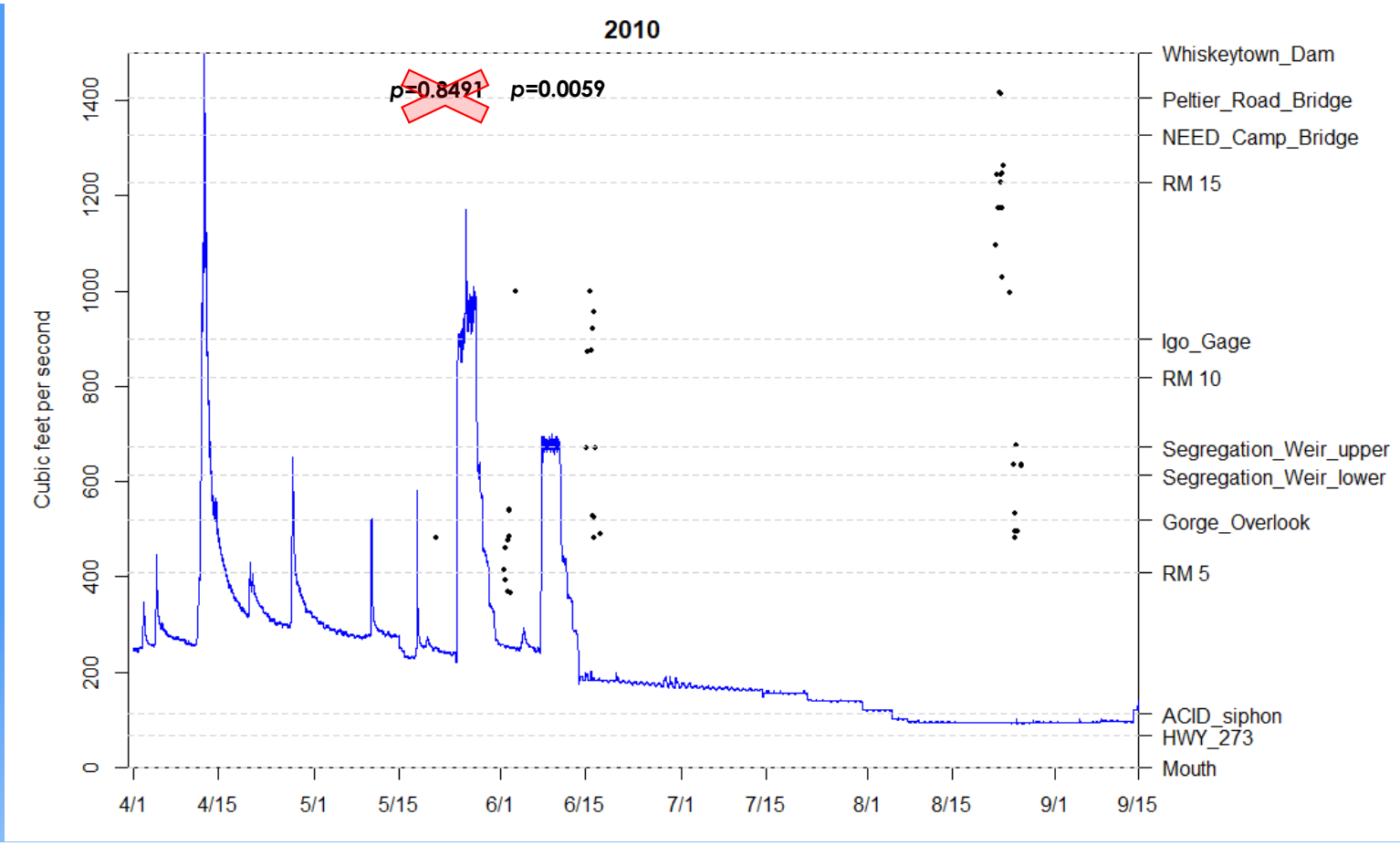

Density
0.0
0.1
0.2
0.3
0.4
0.5
0
5
10
15

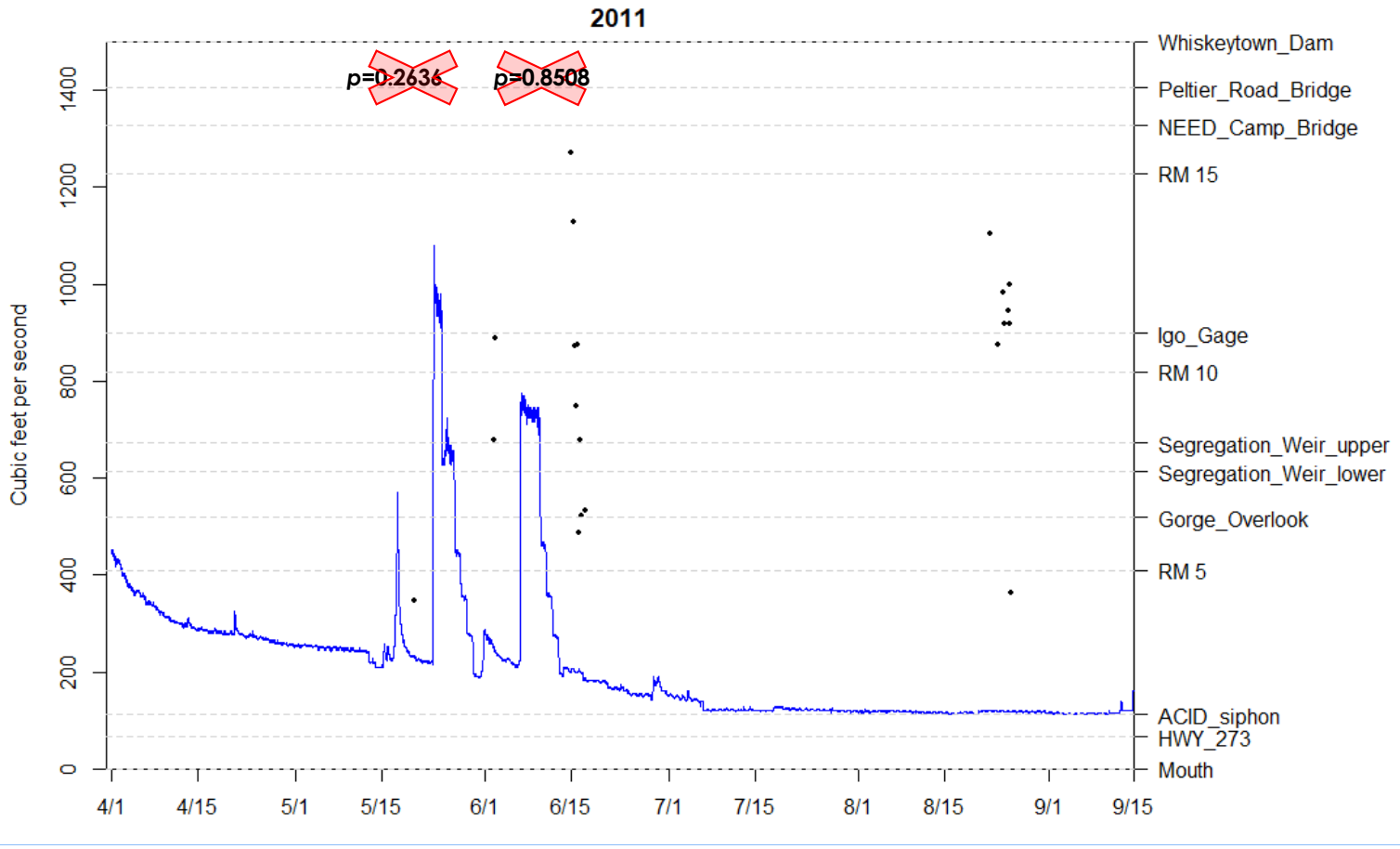
IS THE DISTRIBUTION FROM POST-PULSE SHIFTED UPSTREAM?

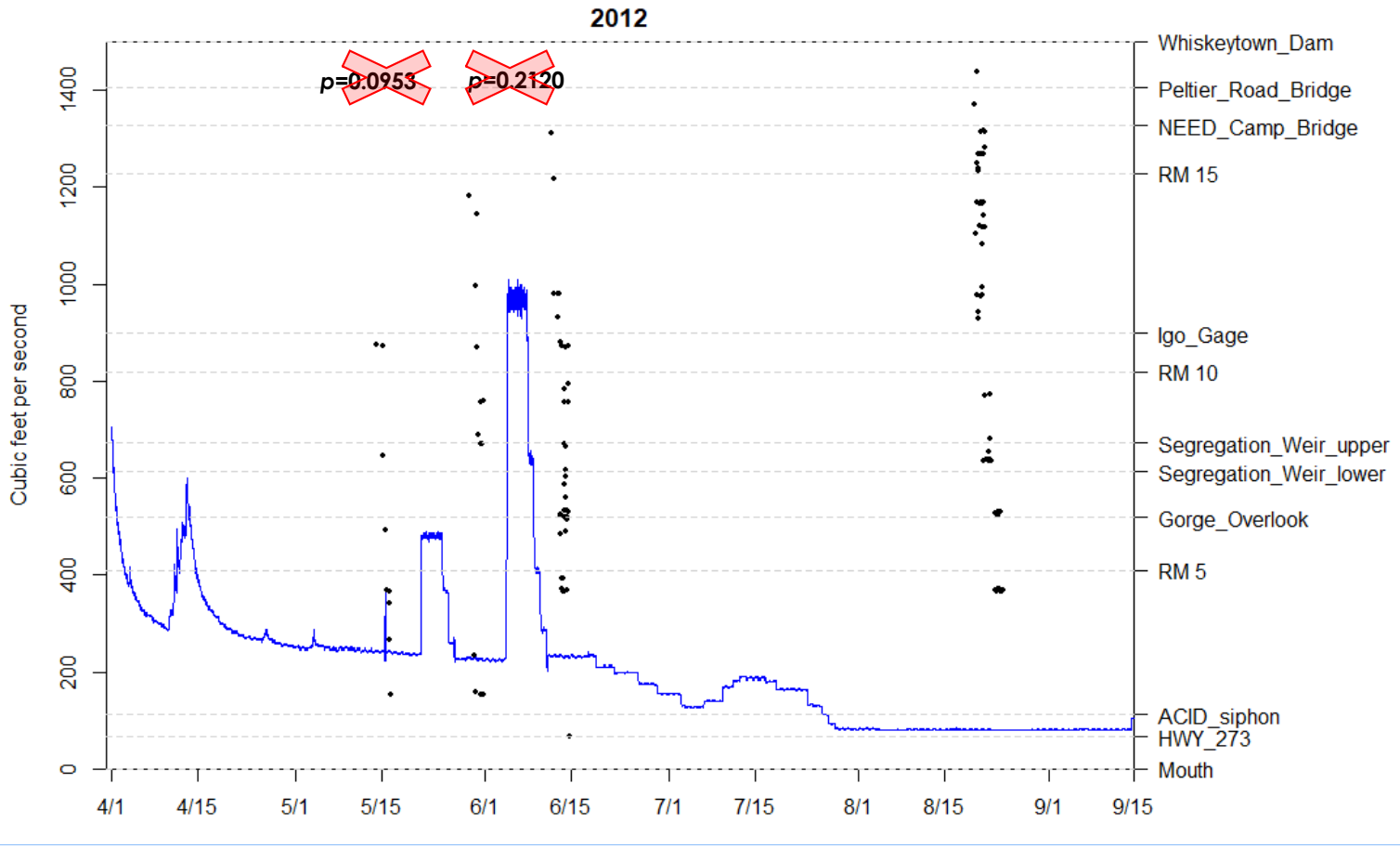
Two-sample Kolmogorov-Smirnov test

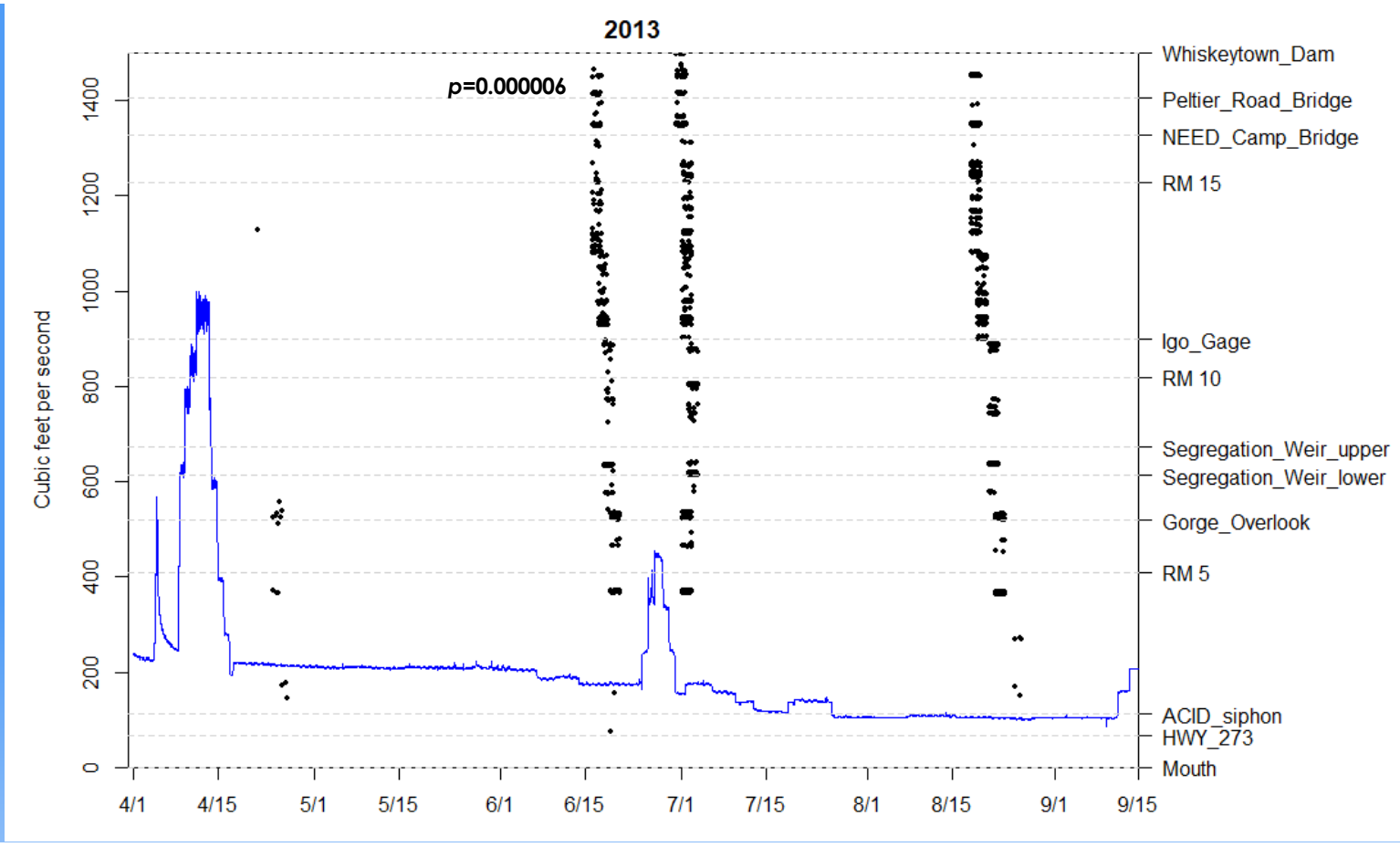
Snorkel data:

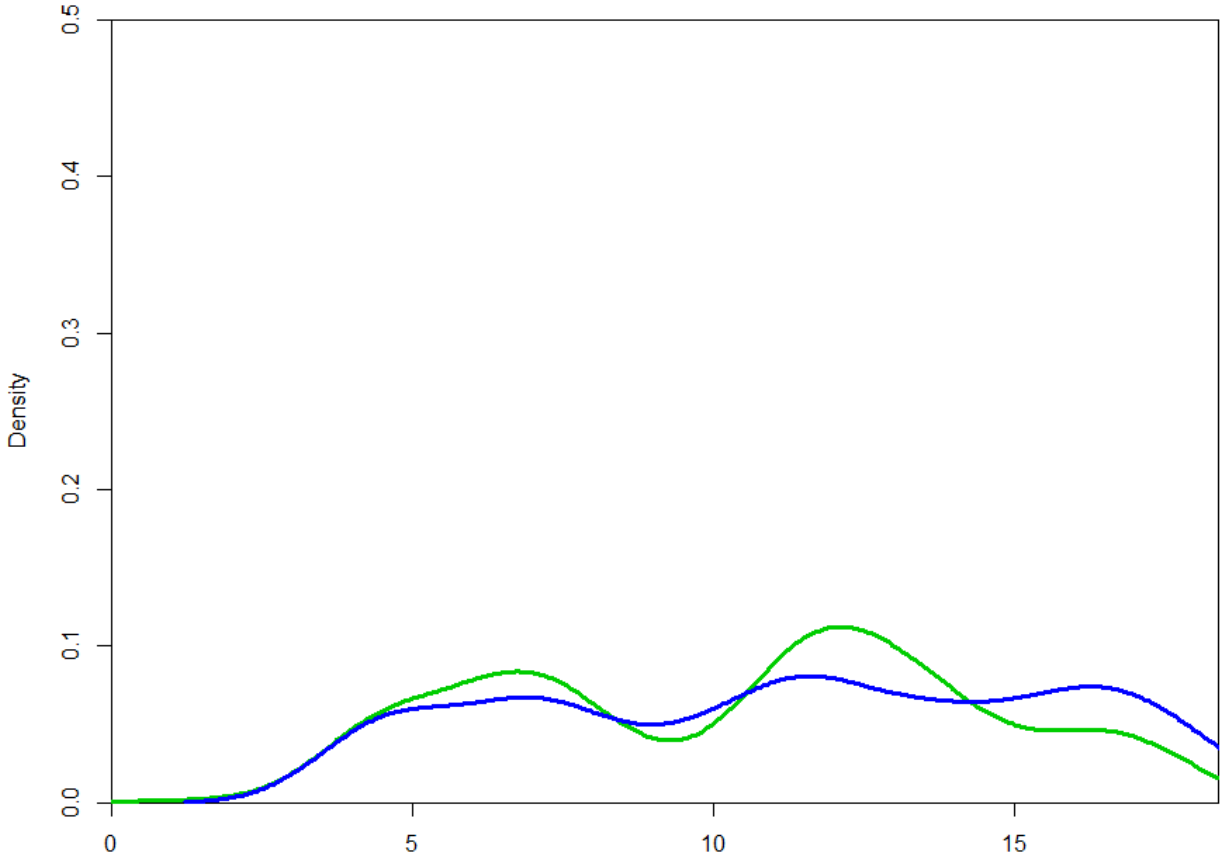
- River mile from pre-pulse
- vs
- River mile from post-pulse

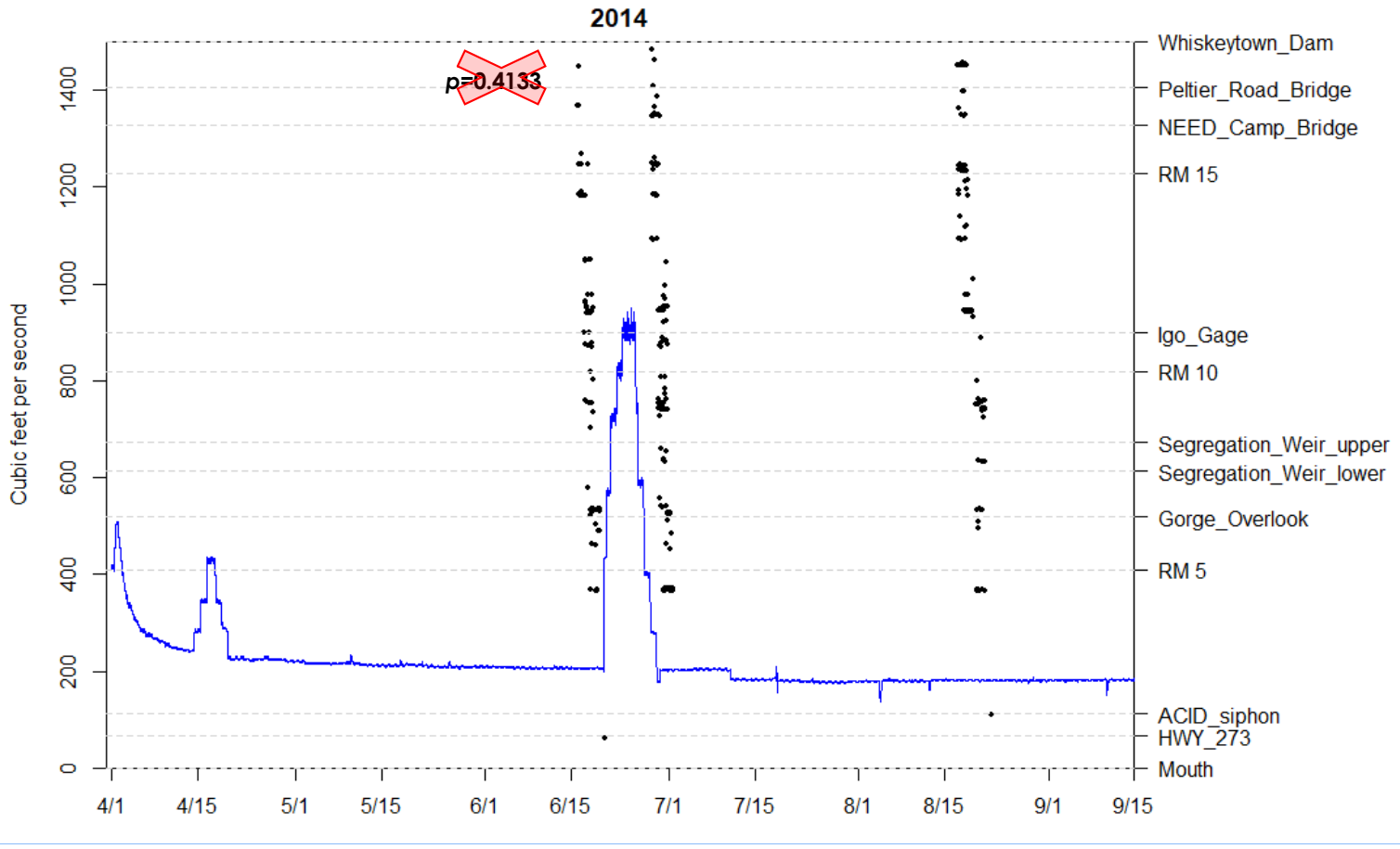

2010
p=0.8491
p=0.0059
Cubic feet per second
0
200
400
600
800
1000
1200
1400
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
8/1
8/15
9/1
9/15
Whiskeytown_Dam
Peltier_Road_Bridge
NEED_Camp_Bridge
RM 15
Igo_Gage
RM 10
Segregation_Weir_upper
Segregation_Weir_lower
Gorge_Overlook
RM 5
ACID_siphon
HWY_273
Mouth

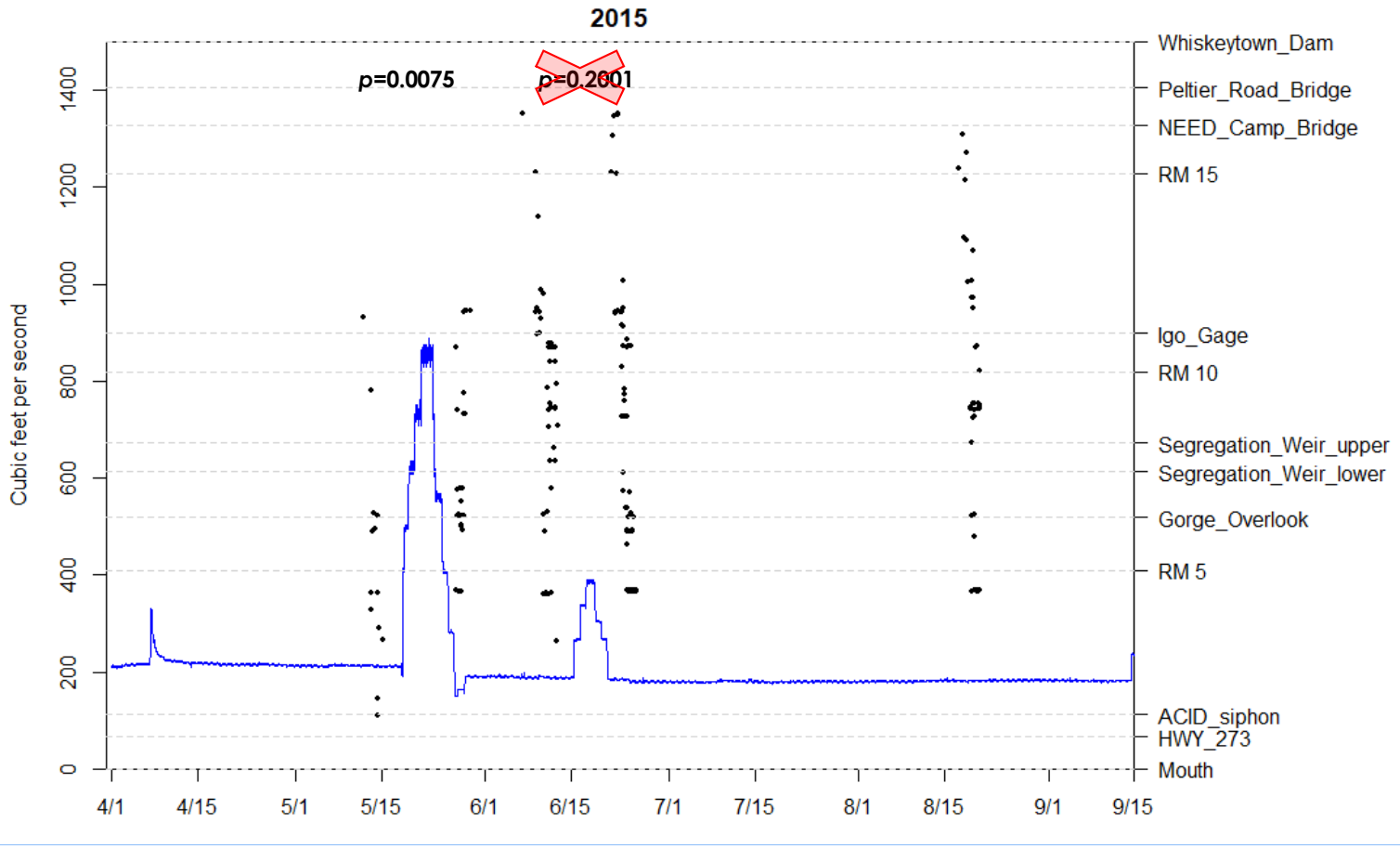

2011
p=0.2636
p=0.8508
Cubic feet per second
0
200
400
600
800
1000
1200
1400
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
8/1
8/15
9/1
9/15
Whiskeytown_Dam
Peltier_Road_Bridge
NEED_Camp_Bridge
RM 15
Igo_Gage
RM 10
Segregation_Weir_upper
Segregation_Weir_lower
Gorge_Overlook
RM 5
ACID_siphon
HWY_273
Mouth

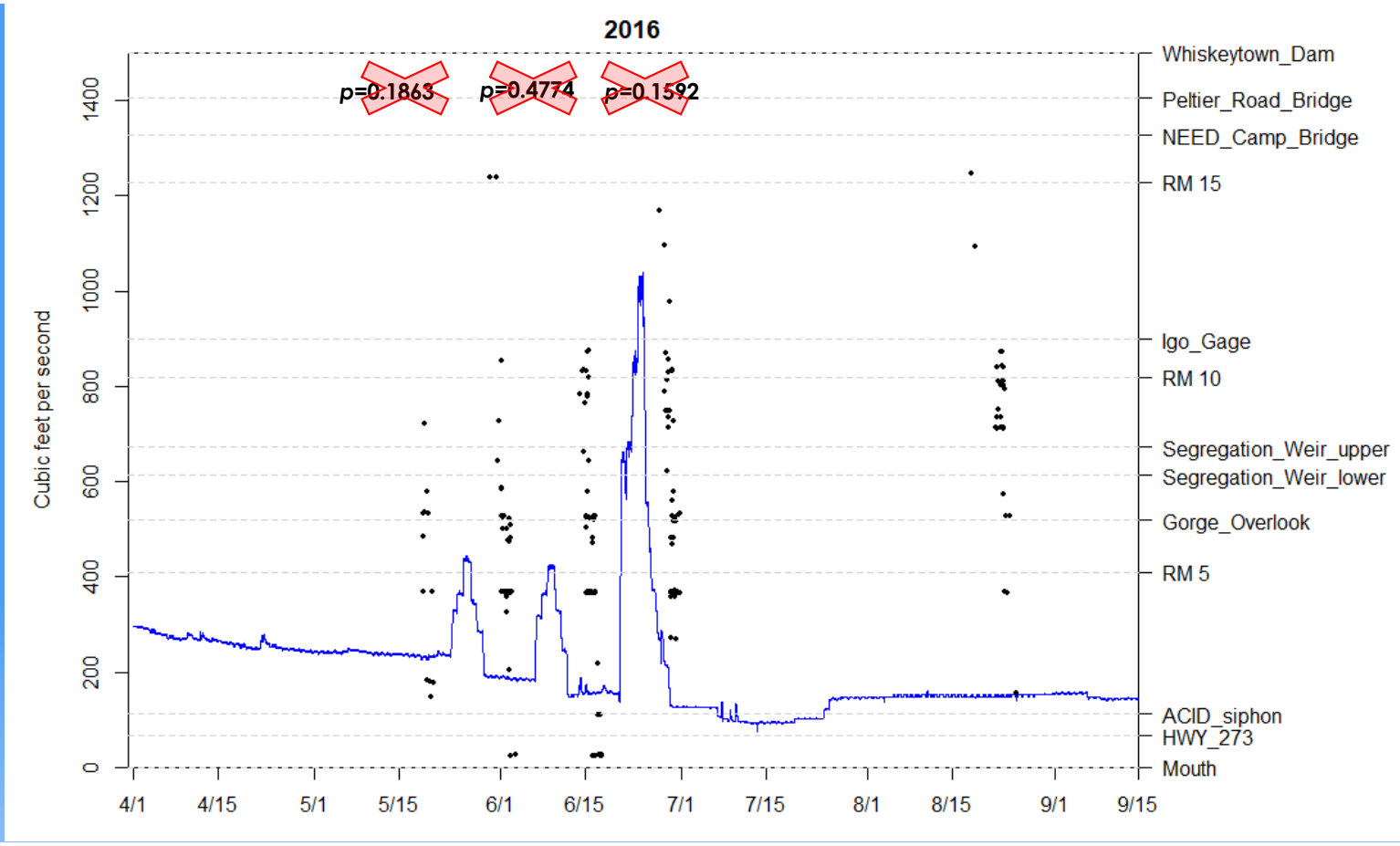

2012
p=0.0953
p=0.2120
Cubic feet per second
0
200
400
600
800
1000
1200
1400
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
8/1
8/15
9/1
9/15
Whiskeytown_Dam
Peltier_Road_Bridge
NEED_Camp_Bridge
RM 15
Igo_Gage
RM 10
Segregation_Weir_upper
Segregation_Weir_lower
Gorge_Overlook
RM 5
ACID_siphon
HWY_273
Mouth

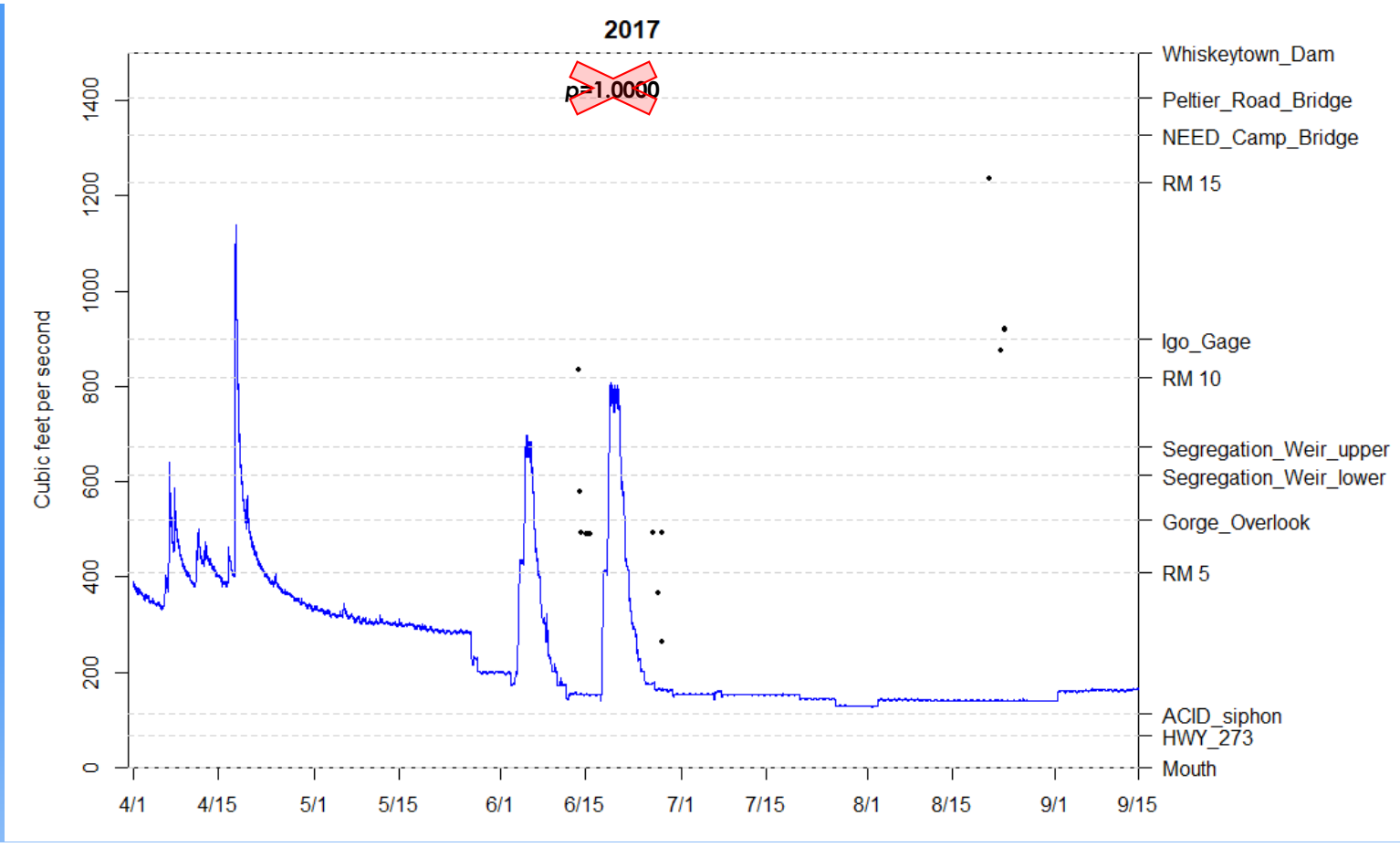

2013
p=0.000006
Cubic feet per second
0
200
400
600
800
1000
1200
1400
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
8/1
8/15
9/1
9/15
Whiskeytown_Dam
Peltier_Road_Bridge
NEED_Camp_Bridge
RM 15
Igo_Gage
RM 10
Segregation_Weir_upper
Segregation_Weir_lower
Gorge_Overlook
RM 5
ACID_siphon
HWY_273
Mouth

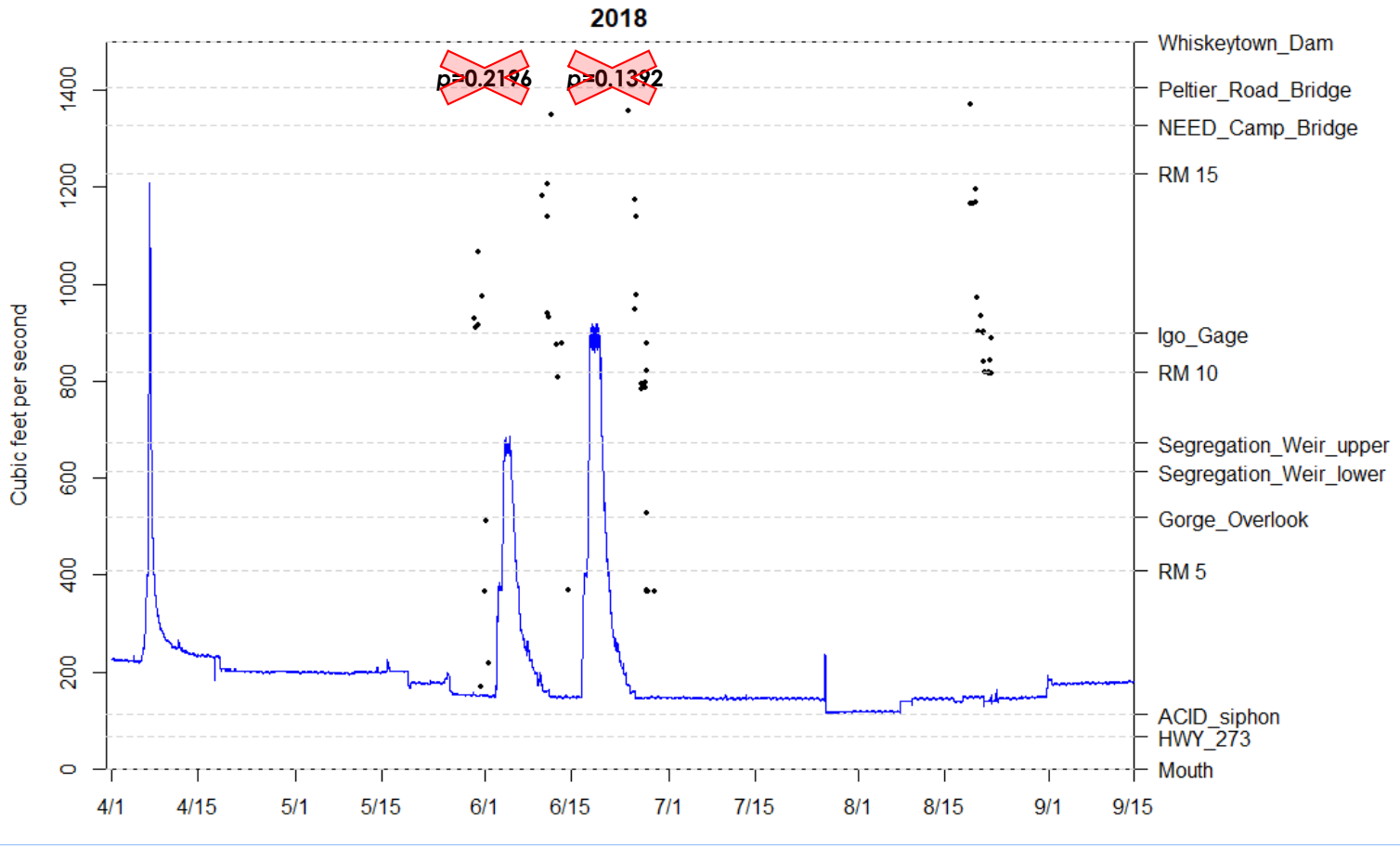

Density
0.0
0.1
0.2
0.3
0.4
0.5
0
5
10
15

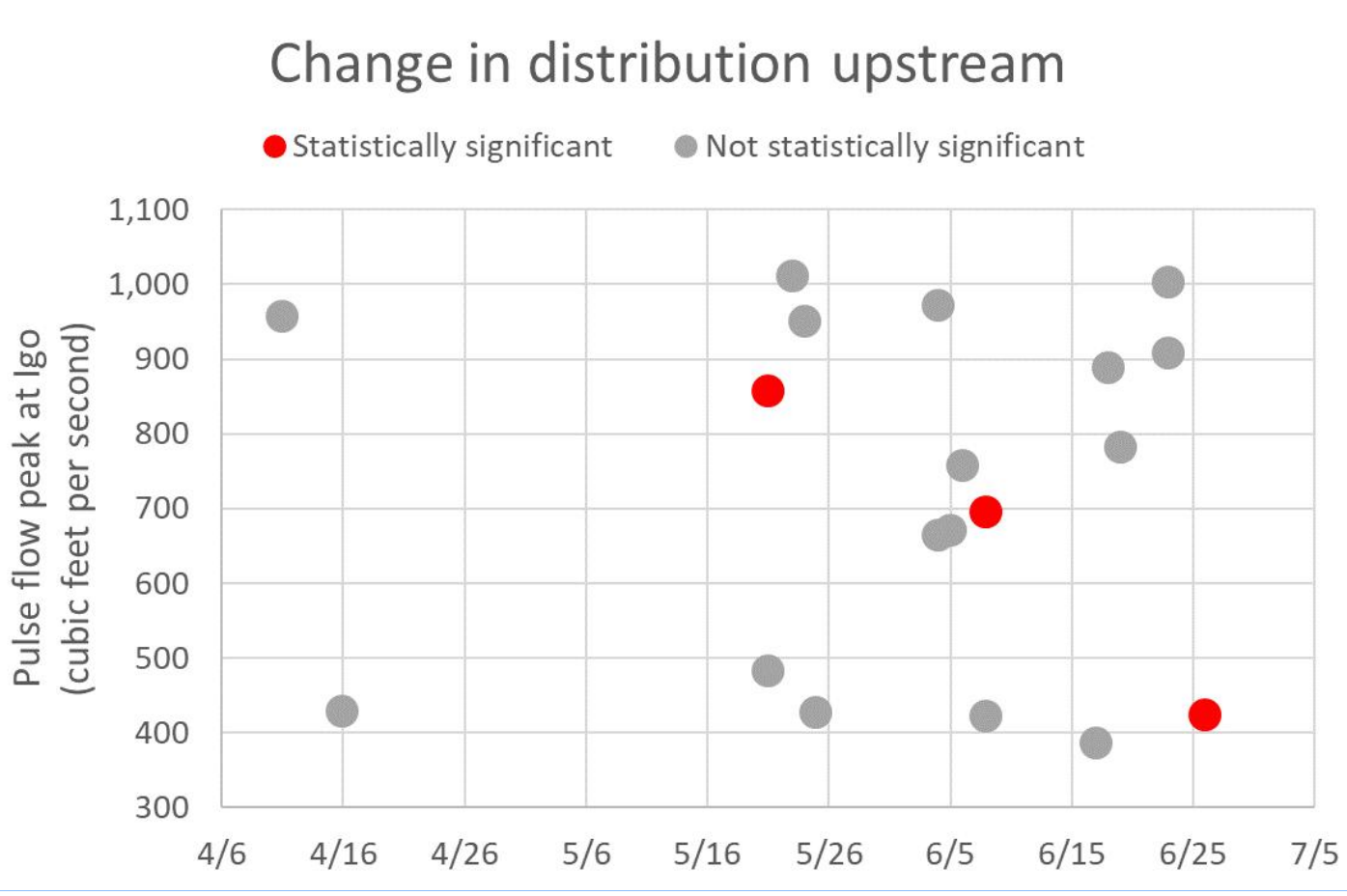

2014
p=0.4133
Cubic feet per second
0
200
400
600
800
1000
1200
1400
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
8/1
8/15
9/1
9/15
Whiskeytown_Dam
Peltier_Road_Bridge
NEED_Camp_Bridge
RM 15
Igo_Gage
RM 10
Segregation_Weir_upper
Segregation_Weir_lower
Gorge_Overlook
RM 5
ACID_siphon
HWY_273
Mouth


2015
p=0.0075
p=0.2601
Cubic feet per second
0
200
400
600
800
1000
1200
1400
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
8/1
8/15
9/1
9/15
Whiskeytown_Dam
Peltier_Road_Bridge
NEED_Camp_Bridge
RM 15
Igo_Gage
RM 10
Segregation_Weir_upper
Segregation_Weir_lower
Gorge_Overlook
RM 5
ACID_siphon
HWY_273
Mouth


2016
p=0.1863
p=0.4774
p=0.1592
Cubic feet per second
0
200
400
600
800
1000
1200
1400
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
8/1
8/15
9/1
9/15
Whiskeytown_Dam
Peltier_Road_Bridge
NEED_Camp_Bridge
RM 15
Igo_Gage
RM 10
Segregation_Weir_upper
Segregation_Weir_lower
Gorge_Overlook
RM 5
ACID_siphon
HWY_273
Mouth


2017
p=1.0000
Cubic feet per second
0
200
400
600
800
1000
1200
1400
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
8/1
8/15
9/1
9/15
Whiskeytown_Dam
Peltier_Road_Bridge
NEED_Camp_Bridge
RM 15
Igo_Gage
RM 10
Segregation_Weir_upper
Segregation_Weir_lower
Gorge_Overlook
RM 5
ACID_siphon
HWY_273
Mouth


2018
p=0.2196
p=0.1392
Cubic feet per second
0
200
400
600
800
1000
1200
1400
4/1
4/15
5/1
5/15
6/1
6/15
7/1
7/15
8/1
8/15
9/1
9/15
Whiskeytown_Dam
Peltier_Road_Bridge
NEED_Camp_Bridge
RM 15
Igo_Gage
RM 10
Segregation_Weir_upper
Segregation_Weir_lower
Gorge_Overlook
RM 5
ACID_siphon
HWY_273
Mouth


Change in distribution upstream
Statistically significant
Not statistically significant
Pulse flow peak at Igo (cubic feet per second)
1,100
1,000
900
800
700
600
500
400
300
4/6
4/16
4/26
5/6
5/16
5/26
6/5
6/15
6/25
7/5

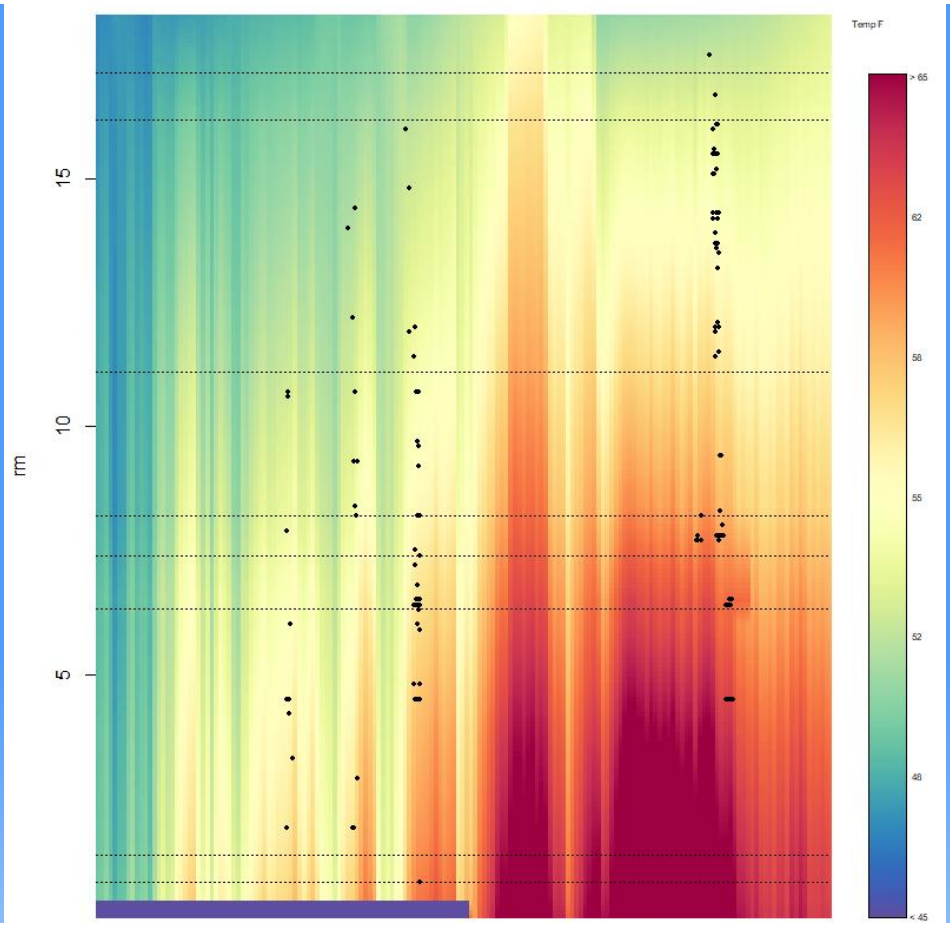
Action I.1.5. Thermal Stress Reduction

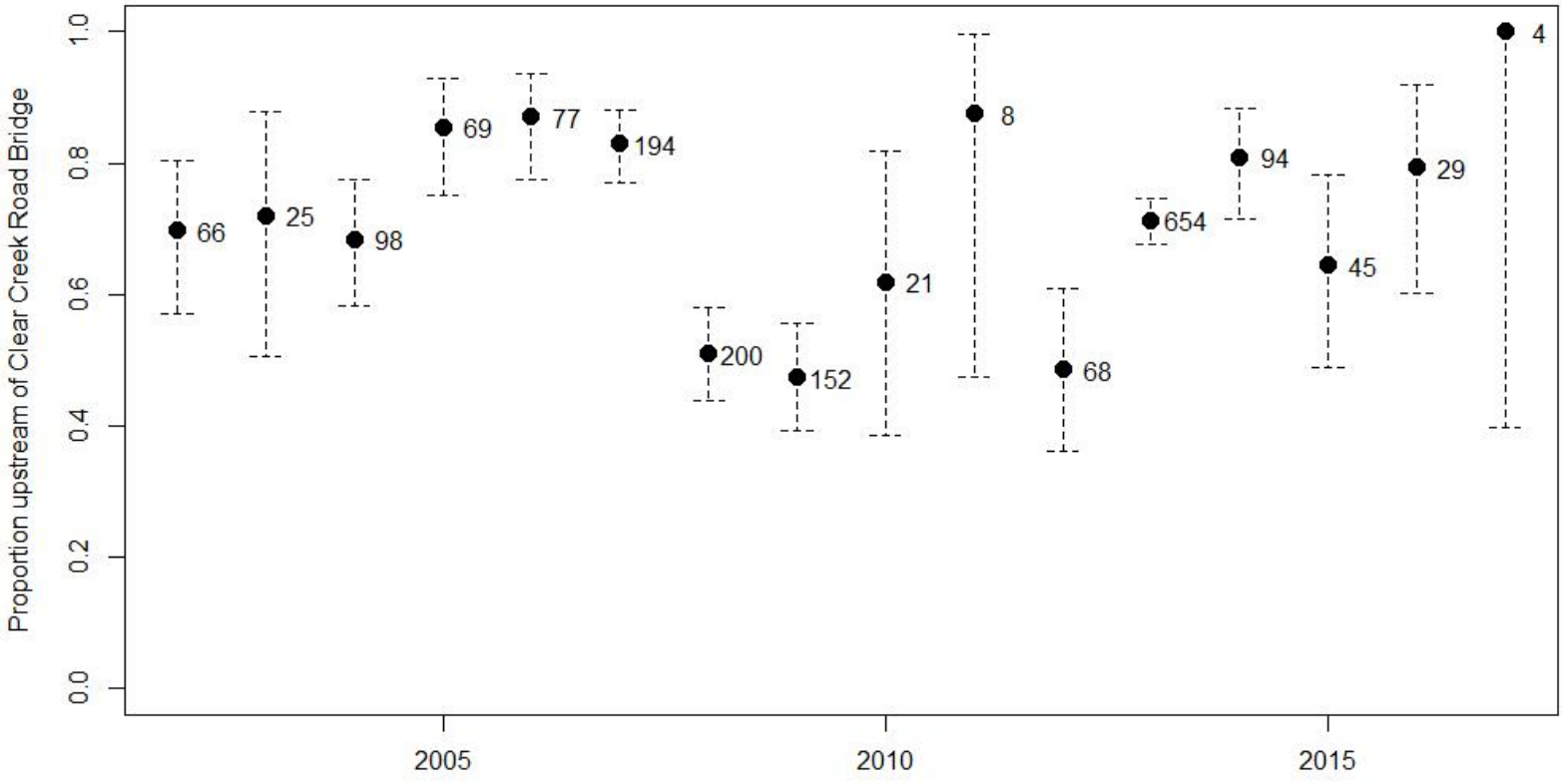
Objective*: To reduce thermal stress to over-summering CCV steelhead and CV spring-run Chinook Salmon during holding, spawning, and embryo incubation.*

Action: Reclamation shall manage Whiskeytown releases to meet a daily water temperature of:

1) 60°F at the Igo gage from June 1 through September 15; and

2) 56°F at the Igo gage from September 15 to October 31.


rm
5
10
15
Temp F
> 65
62
58
55
52
48
< 45


Proportion upstream of Clear Creek Road Bridge
0.0
0.2
0.4
0.6
0.8
1.0
2005
2010
2015
66
25
98
69
77
194
200
152
21
8
68
654
94
45
29
4

Next steps:

Draft 2019 proposal
Subgroup review
CCTT presentation March 21
NMFS review
Finalize
Submit to Reclamation CVO