Juvenile Salmon Vertical Leap Tests August 2018

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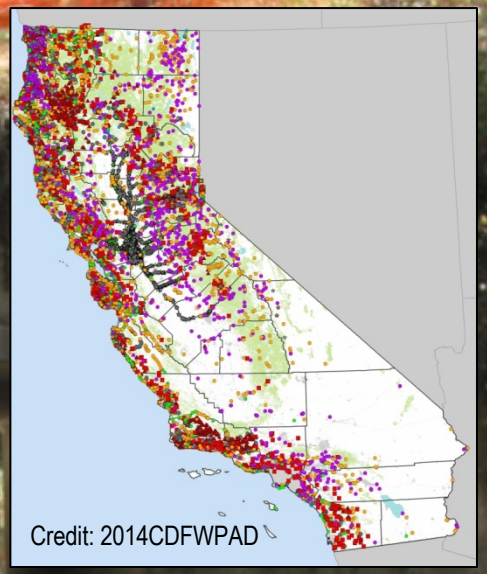
Juvenile salmonids:

- Travel widely*
- Encounter barriers
- Try to jump



Importance:

- 4,000 identified barriers
- Impacts to habitat, $$, projects
- FRGP 2014/2015- $14.5 million
- NMFS jump criteria= 6 inches for boulder weirs, CDFW= 12 inches

Juvenile Fish Jump Test Experimental Flume

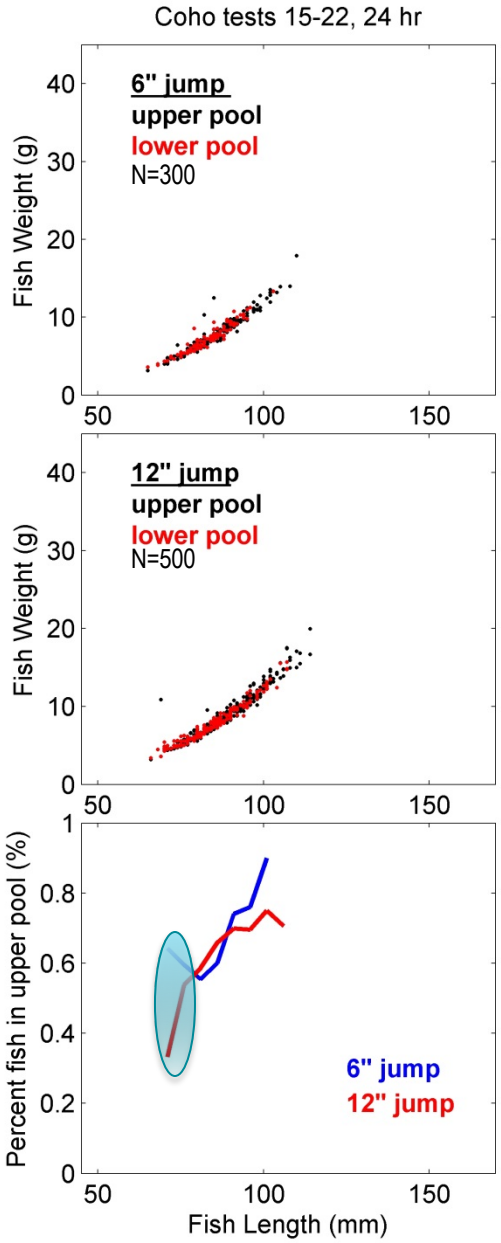
Warm Springs Coho Salmon Fish Hatchery Facility

Geyserville, CA

2016 Results

Test 1: Jumping success over 6in weir vs 12in weir (coho)

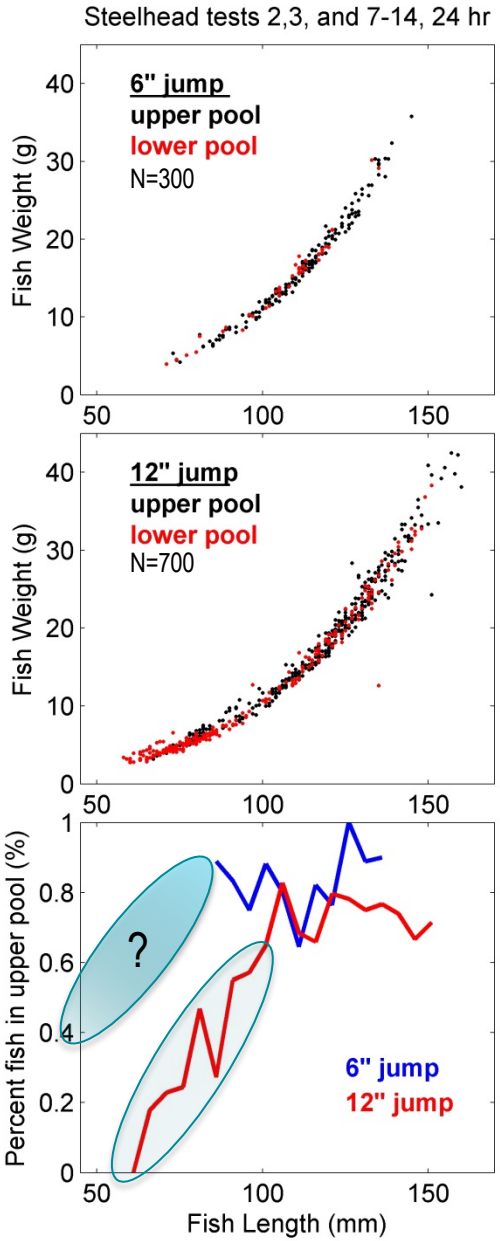
- Jumping success similar over both weirs for 80-90mm fish
- Success about 65%
- Small fish were more successful over 6in weir
- What's going on with large fish?



2016 Results

Test 2: Jumping success over 6in weir vs 12in weir (steelhead)

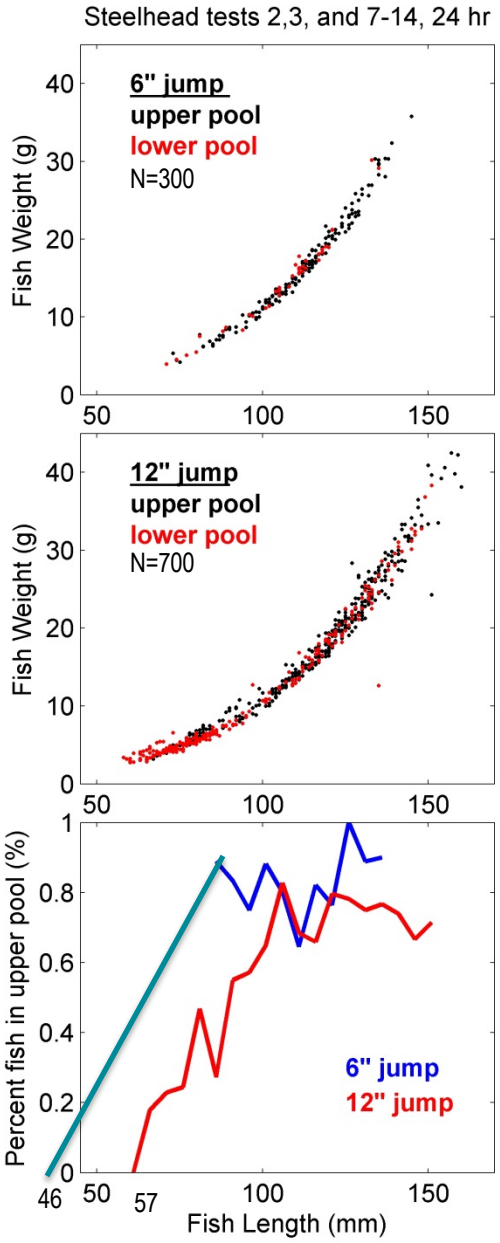
- Jumping success similar over both weirs for 105-125mm fish
- Success about 75%
- Small fish were more successful over 6in weir
- What's going on with large fish?
- No success at 60mm



2017 Results- 6 additional tests

Test: Jumping success over 6in weir vs 12in weir (steelhead)

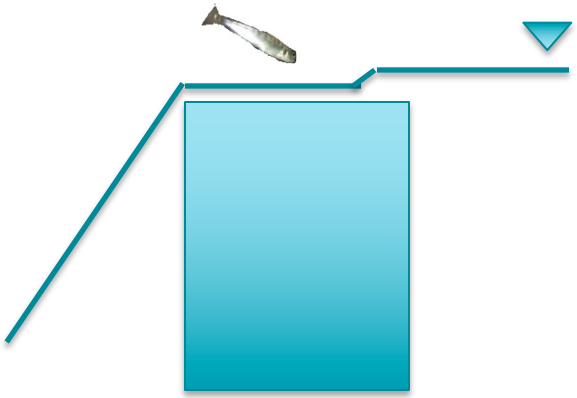
- No fish less than 57mm were successful over 12 inches
- No fish less than 46mm were successful over 6 inches.
- 20-40% more fish jumped 6 inches than 12 inches up to about 110mm, where success for both heights converged at about 75% success.



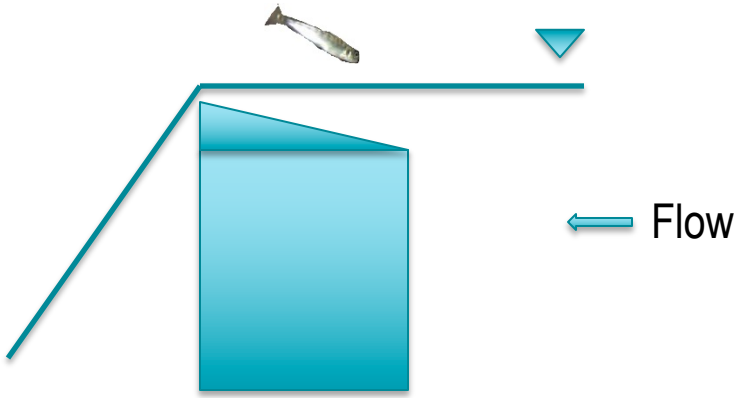
2017-2018 Results

Tests 7-12: Reverse Slope Weir (Caltrans Design)

- 6 inch Flat Crest Weir- 62/100 jumpers
- 6 inch Reverse Slope Weir- 58/100 jumpers
- 12 inch Flat Crest Weir- 13/100 and 12/100 jumpers
- 12 inch Reverse Crest Weir- 27/100 and 20/100 jumpers!



Flat Crest Weir

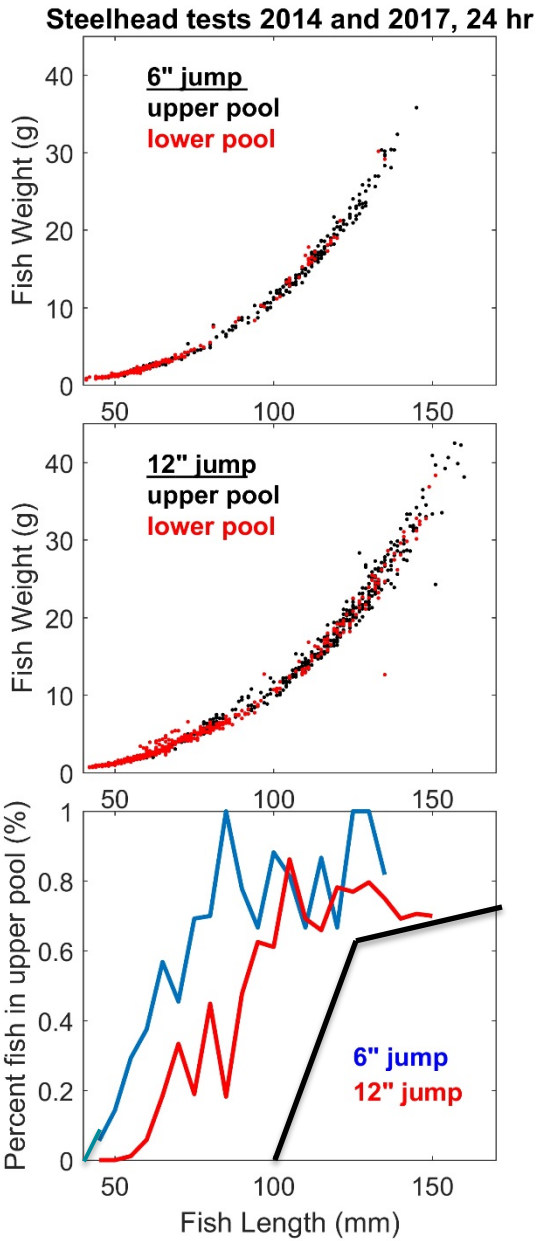


Reverse Crest Weir

2018 Results

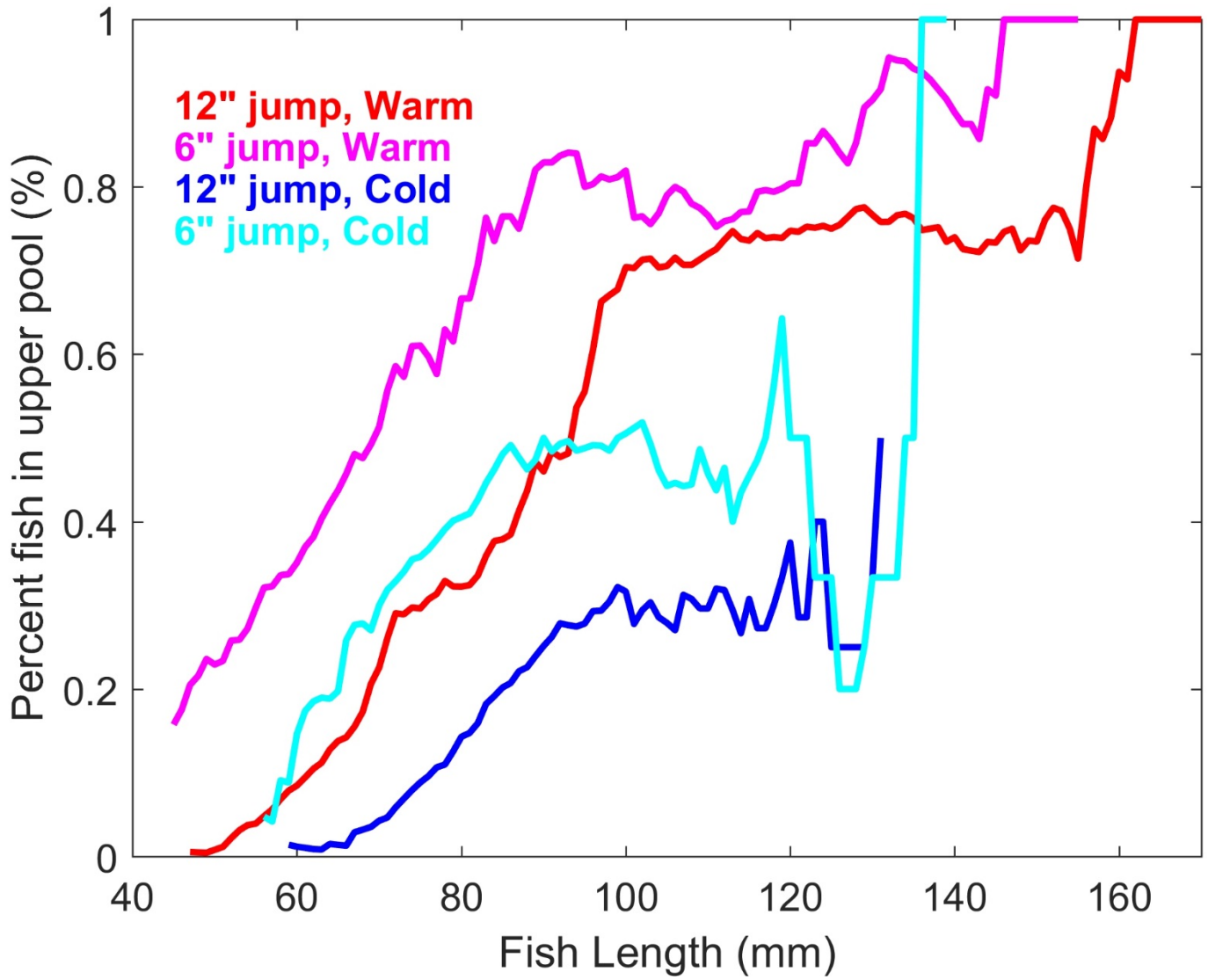
- Fish jump height = 4-6X fish length for small fish
- ≥ 40mm (1.6”) fish jumped 6in weir
- ≥57mm (2”) fish jumped 12in weir
- ≥104mm (4.1”) fish jumped 18in weir (404 fish)
- Small fish were approx. 25% more successful over 6in weir
- Success 66-75%
- Jumping success similar over 6 and 12in weirs for 100-125mm fish

N= 2000, 20 tests*

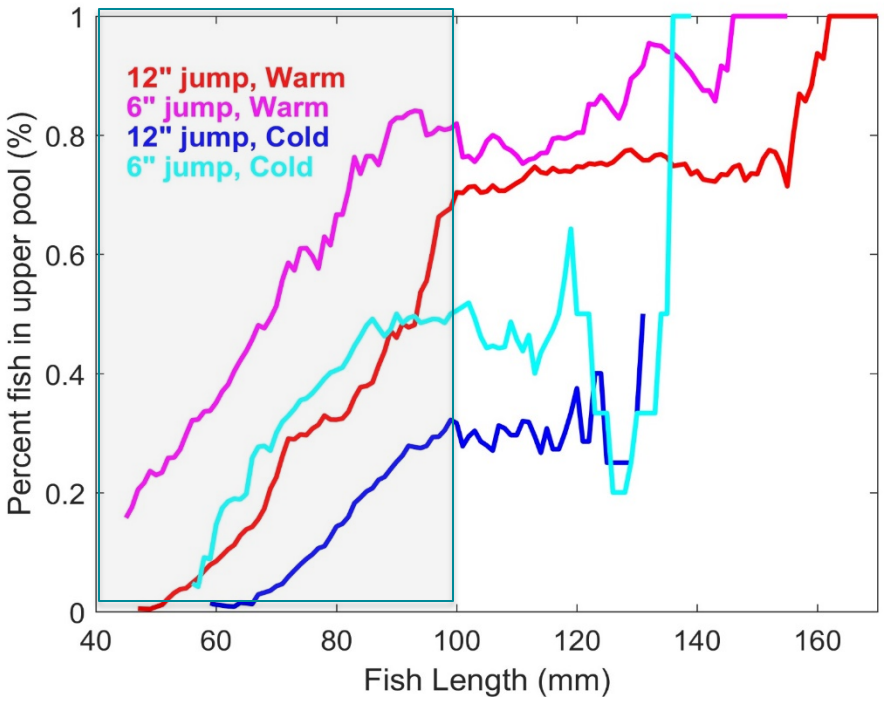


Includes tests 2014 1-3,7-10,12-14; 2017 1-6, 23-26

2018 Results – Temperature Effects



Does Fish Length <100mm Matter?



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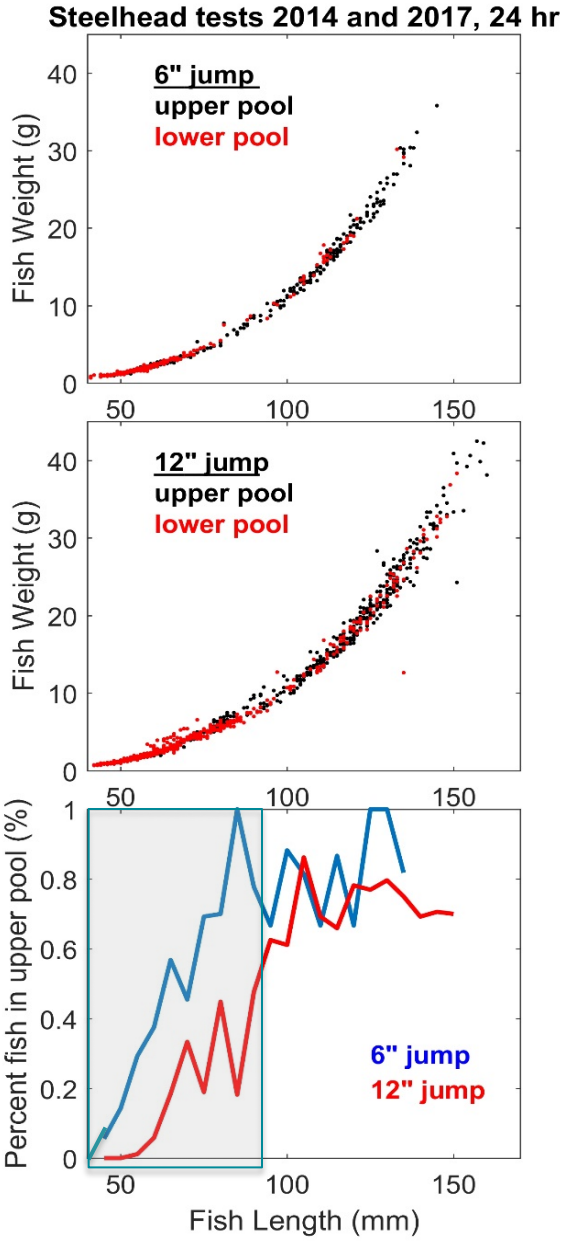

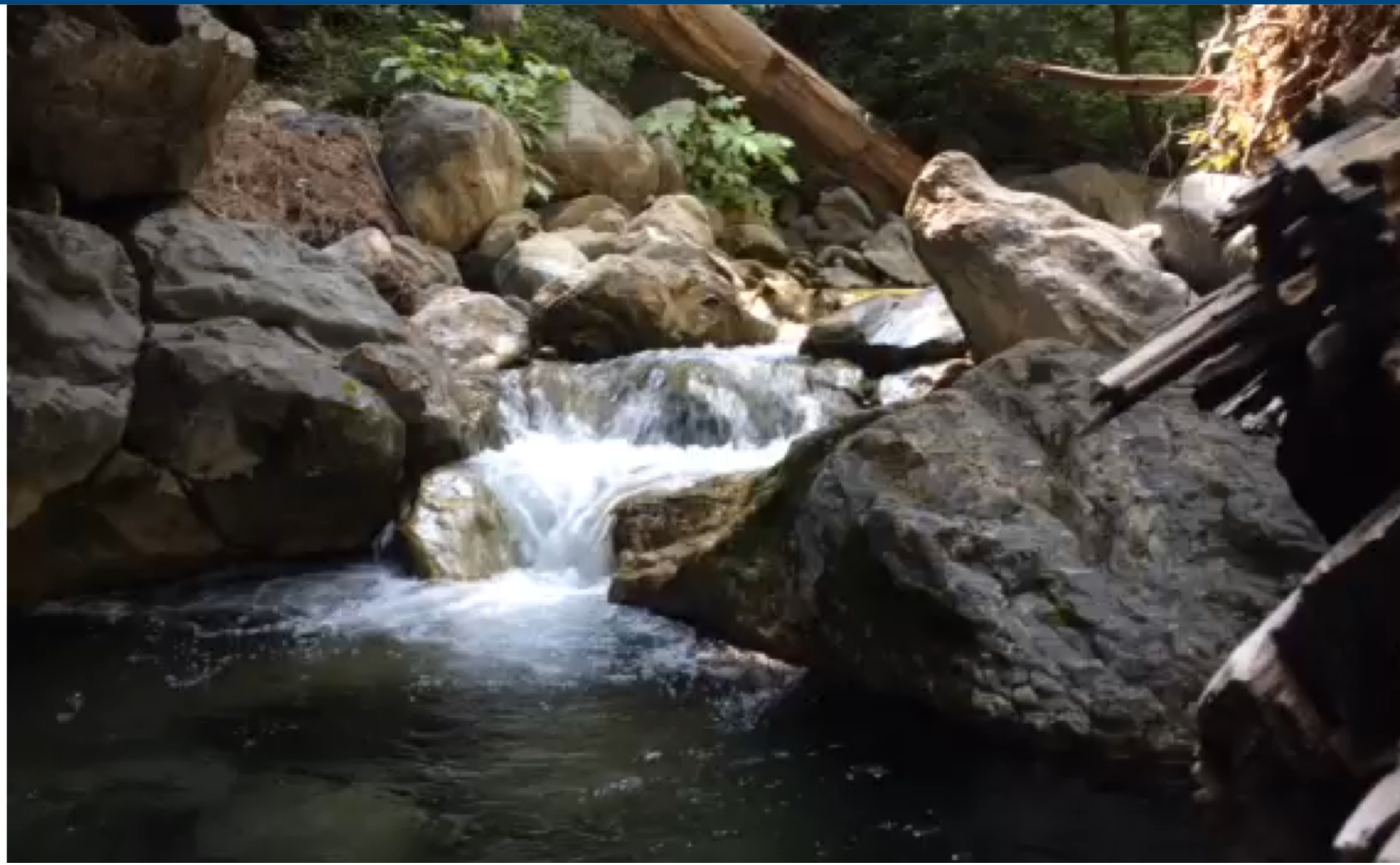

Recommendations

- The NMFS default jump height criterion for boulder weirs be increased from 6 inches to 12 inches.
- Or, specify an acceptable design height range between 6-12” depending on watershed circumstances and species/life stage

- Extenuating circumstances:
  - 6 inch weirs may be necessary if passage of very small fish is needed or if water temperatures are very cold.
- 12in broad-crested weirs include reverse-slope crests.

- Test new configurations including:

(1) simulated rocky crests and cascades

(2) simulated BDA’s