Response of *O. mykiss* to removal of San Clemente Dam on the Carmel River, California: results to date and managing expectations

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Overview of presentation:

• What, when, where, how – San Clemente Dam removal
• Stream response and fish response
• Restoration of dynamic processes
• Expectations
Collaborators:

• Amy East (USGS)
• David Boughton (NMFS-SWFSC)
• Dave Rundio (NMFS-SWFSC)
• Nate Mantua (NMFS-SWFSC)
• Lee Harrison (NMFS-SWFSC)
• Doug Smith (CSU – Monterey Bay)
• Lots of others assisting with fieldwork, access, etc
• Assistance from Kevan Urquhart and staff (Monterey Peninsula Water Mgt. District)
"The Carmel is a lovely little river. It isn't very long but in its course it has everything a river should have."

John Steinbeck, Cannery Row, 1945
• Steelhead ESA-listed as threatened (1997)
• South-Central California Coast DPS
• DPS extends from Pajaro River south to Santa Maria River
• From 1960s and early 1970s estimates of over 1,300 adult steelhead
• Counts at SCD ladder from 1993 to 2014 averaged ~ 380 adults
Number counted at San Clemente Dam ladder

Year


0 100 200 300 400 500 600 700 800 900 1000
• 650 km² watershed
• Maximum elevation 1,540 m
• Most of watershed steep, fractured slopes, weathered granitic substrate and talus, chaparral vegetation
• Mediterranean climate

• San Clemente Dam built in early 1920s (rkm 31)
• 32 m high
• One of three dams that existed, Los Padres Dam remains (rkm 42), built in 1948
• SCD removed Fall 2015
• Involved re-route channel

Images from CalAM
- 95% water storage capacity lost
- ~ 1.7 million m³ of sand and gravel
- Little to no water storage
- Mediterranean climate, flow varies more than three orders of magnitude seasonally
2014-17: exceptionally warm years for California

- Surface air temperature record for July 2014-June 2015 was almost off the charts, ~1 °C warmer than the previous record
- 2015 Western Snow Drought came with record high temperatures for the entire west coast
- The “hot drought” was amplified ~30% by high temperatures
- 2016 and 2017 a bit cooler than 2014
Expectations – time and events

To be viable (i.e., persist) – fish need to be able to track changes in the environment

- Individuals
- Populations
- Biogeographic groups
- Species
Natural disturbance events that influence salmonid populations throughout their range include:

- fires
- landslides
- glaciers
- earthquakes
- volcanic eruptions
- floods
Anthropogenic constraints that can influence the ability of salmonid populations to track changes in environmental conditions include:

• urbanization
• land management activities (e.g., timber, agriculture)
• fire (magnitude, frequency)
• flooding (magnitude, frequency)
• barriers
• Viable and persistent populations are found in dynamic environments
• Diversity of ecological processes and habitat features allow for the expression of life-history diversity
• Fish need to be able to track changes in the environment to be viable/persist
Frequency

Life history characteristic, habitat use curve, etc.