



California Department of
Fish and Wildlife



Drought Stressor Monitoring: Summary of the California Department of Fish and Wildlife's Statewide Drought Response 2014-2017

August 27, 2019 1:00 p.m. - 3:00 p.m.

Kristine Atkinson

Kristine.Atkinson@water.ca.gov



Contributors (CDFW Regional Staff)

NORTHERN REGION

Seth Ricker
Stacey Alexander
Jason Roberts
Andrew Jensen
Jennifer Bull

Paul Divine
Steve Baumgartner
Mike Dege
Bernard Aguilar
Caitlin Bean
Tom Christy

BAY DELTA REGION

Ryan Watanabe
Derek Acomb
George Neillands
Jennifer Nelson
Michelle Leicester
Jon Jankovitz
George Neillands

CENTRAL REGION

Dennis Michniuk
Matthew Michie
Margaret Paul
Ken Johnson
Eric Guzman
Pat Ferguson
Steve Tsao

NORTH CENTRAL REGION

Tracy McReynolds
Mike Healey
Jeanine Phillips
Colin Purdy
Clint Garman
Kevin Thomas
John Hanson

INLAND DESERTS REGION

Nick Buckmaster
Dawne Emery
Steve Parmenter
Claire Ingel

SOUTH COAST REGION

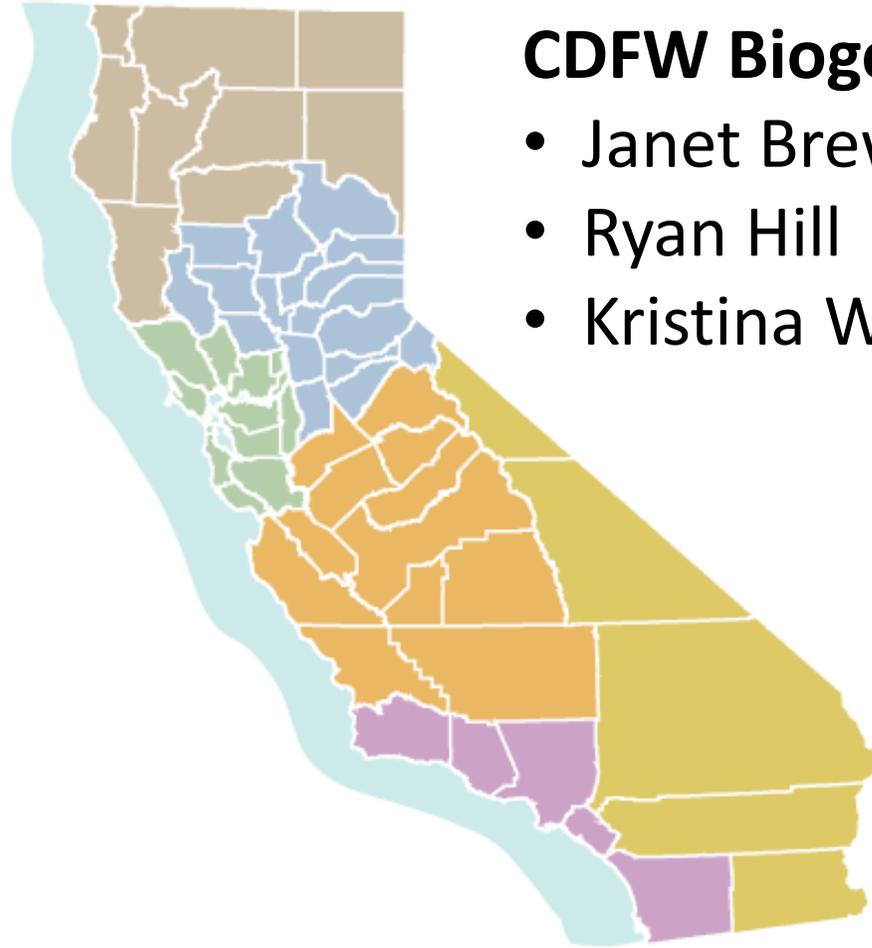
Ben Lakish
Mary Larson
Kyle Evans
Marianne Pelletier
Jennifer Pareti
Tim Hovey
Dylan Nickerson
Russell Barabe
Hans Hansen
John O'Brien



Contributors (CDFW Statewide Staff)

CDFW Fisheries Branch

- Kristine Atkinson
- John Kelly
- Stephen Swales
- Melissa Mandrup
- Patrick Mulcahy
- Lydia Eldridge
- Helen Benson
- Stephanie Hogan

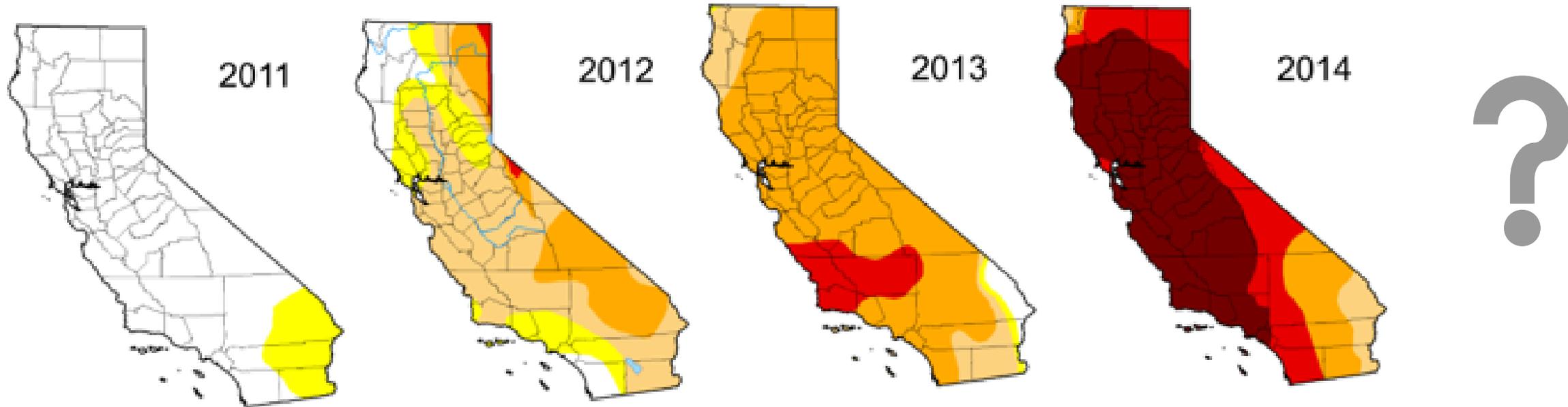


CDFW Biogeographic Data Branch

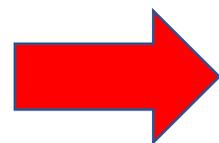
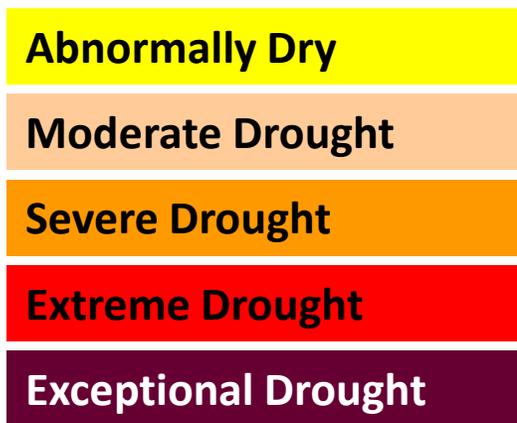
- Janet Brewster
- Ryan Hill
- Kristina White

CDFW Office of Communication and Outreach

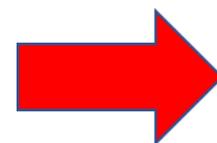
- Meredith Fleener



Intensity:



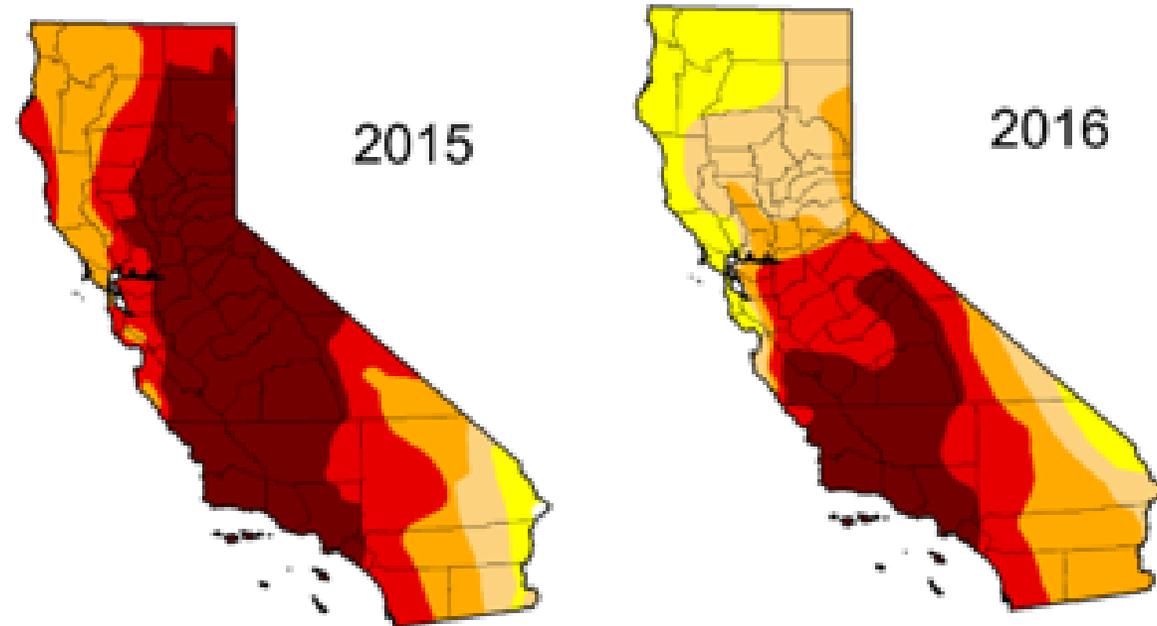
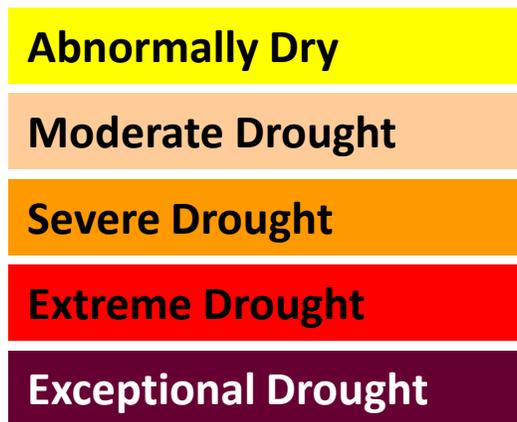
Future Duration???



Intensity???

- The drought lasted for five years: 2012-2016
- California experienced one of the warmest and driest periods on record.

Intensity:



Preparation for CDFW's drought response

- “All necessary actions” required science-based management
 - fish relocation
 - restoration projects
 - water operations
 - conservation hatcheries, etc.
- What did CDFW do in last major drought?
Unknown statewide efforts
- What were other states doing?
Unknown



Source: <https://realkm.com/2019/03/06/some-misconceptions-of-evidence-based-practice/>

Overview

A) Introduction

B) Methods

C) Results

Question 1: Are streams drying?

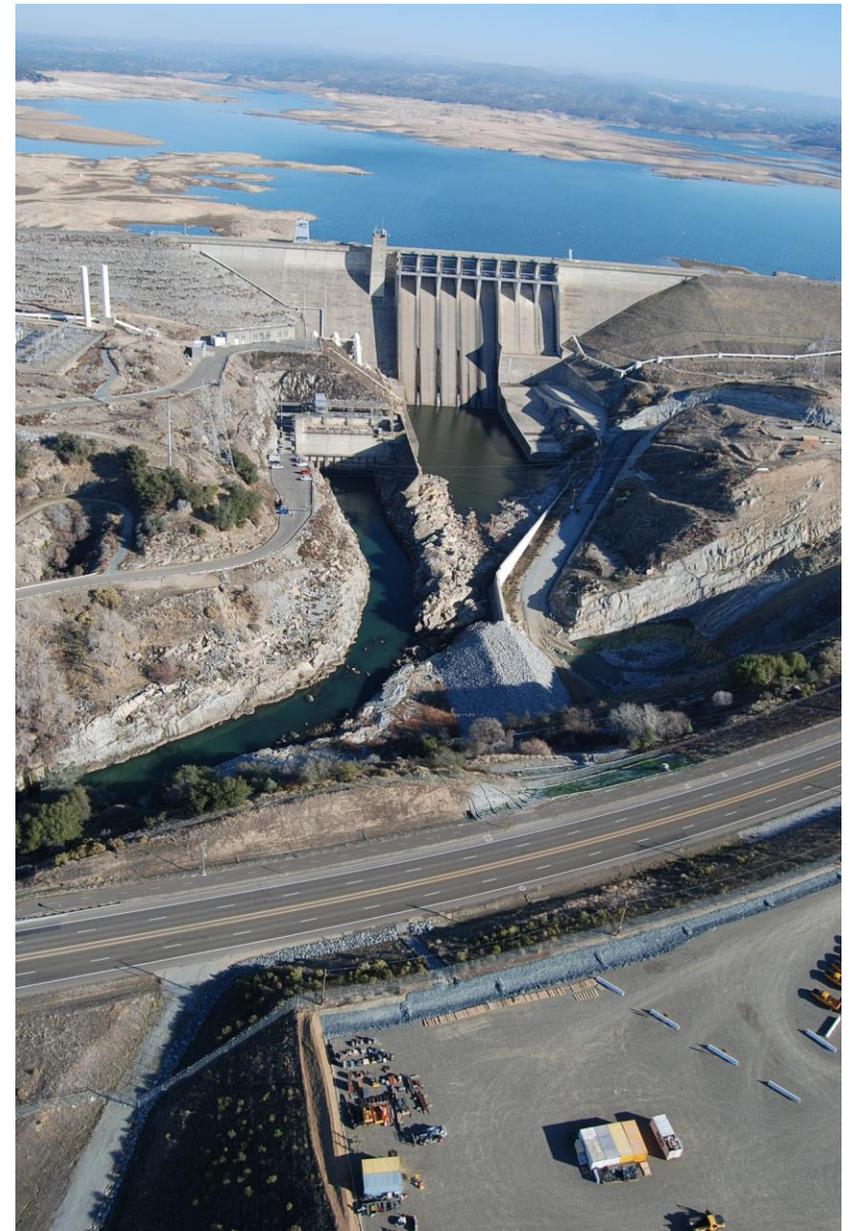
Question 2: Are streams warming?

Question 3: Is the amount dissolved oxygen changing?

Bonus Question: What are effects of drought and mudslides?

D) Discussion

E) Lessons learned / Positioning for the future



**Folsom Lake, January 16, 2014 (Credit: DWR)
(Placer, El Dorado, and Sacramento counties)**

INTRODUCTION



- **Goals:**

- To better understand the threats of drought on aquatic species
- To make science-based management decisions /actions

- **Focus:**

- 17 species (nearly all CESA / ESA or Species of Special Concern)
- 141 watersheds and sub-watersheds, spanning 28 counties statewide

- **Questions**

- Drying? Warming? Changing Dissolved Oxygen? Populations being affected?

METHODS



American River (Sacramento Co.) Redwood Creek (Humboldt Co.) Noyo River (Mendocino Co.) Butte Creek (Butte Co.)

- Implement monitoring in high priority locations for sensitive species (where it didn't exist and augment existing efforts already in place relative to drought.)
- Bi-weekly reporting that reflects CDFW's broad biogeographic ecoregions and regional structure.
- Case Studies on CDFW's website.
- Videos that document the drought's effects on CA's aquatic species.

RESULTS:

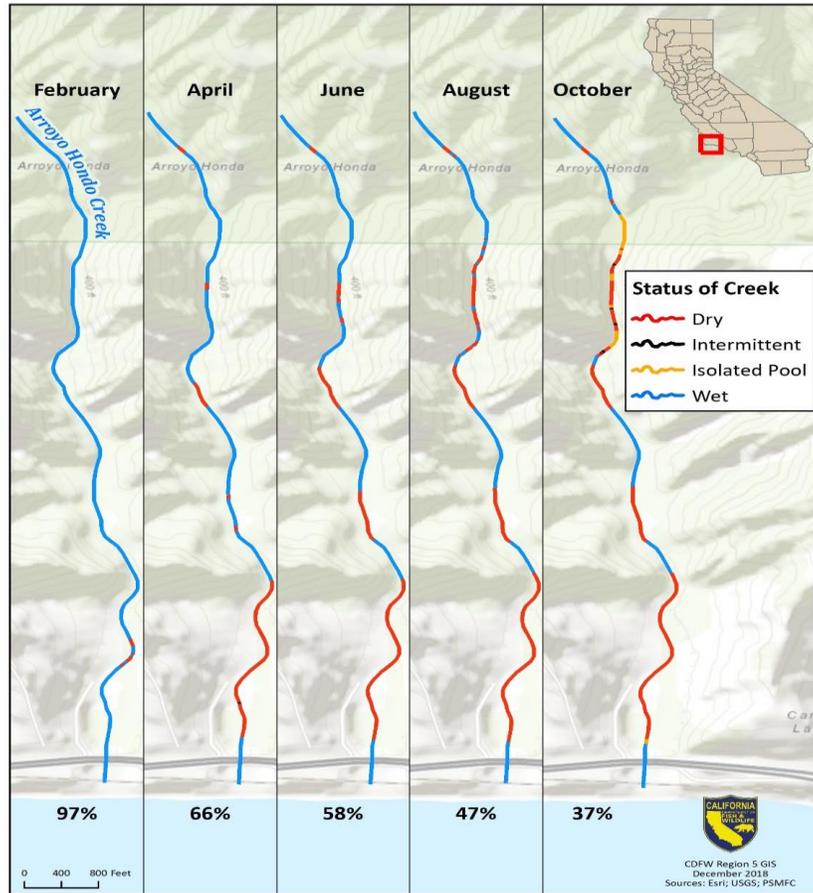
Question 1: Are streams drying? Population effects?



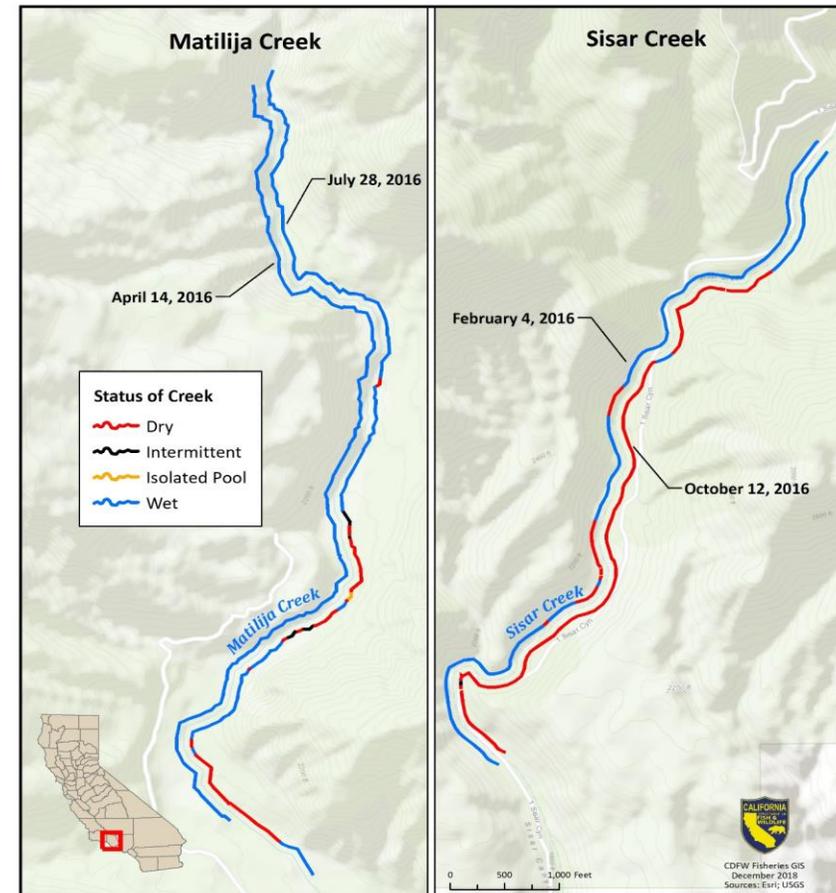
**Ventura River
(Ventura County)
March 2016**

RESULTS:

Question 1: Are streams drying? Population effects? Example: Steelhead in Ventura County



Bimonthly changes in percent of wetted streambed in Arroyo Hondo Creek, Ventura County, in 2015.

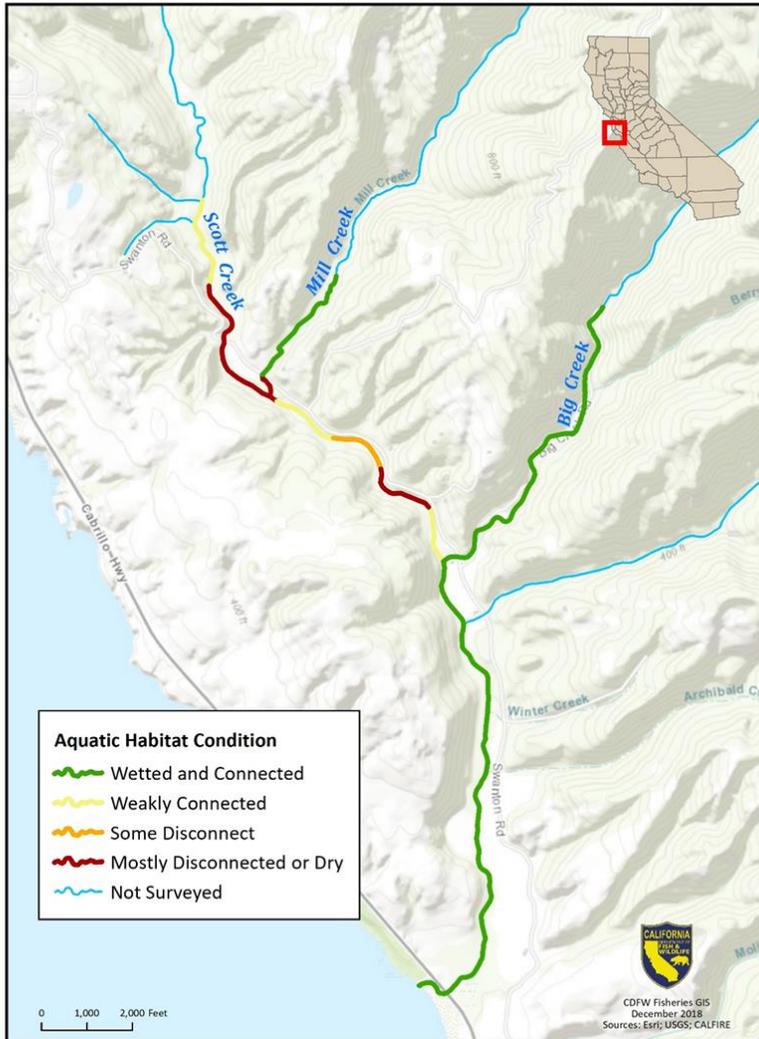


Matilija Creek, tributary of the Ventura River, and Sisar Creek, tributary of the Santa Clara River, in 2016.

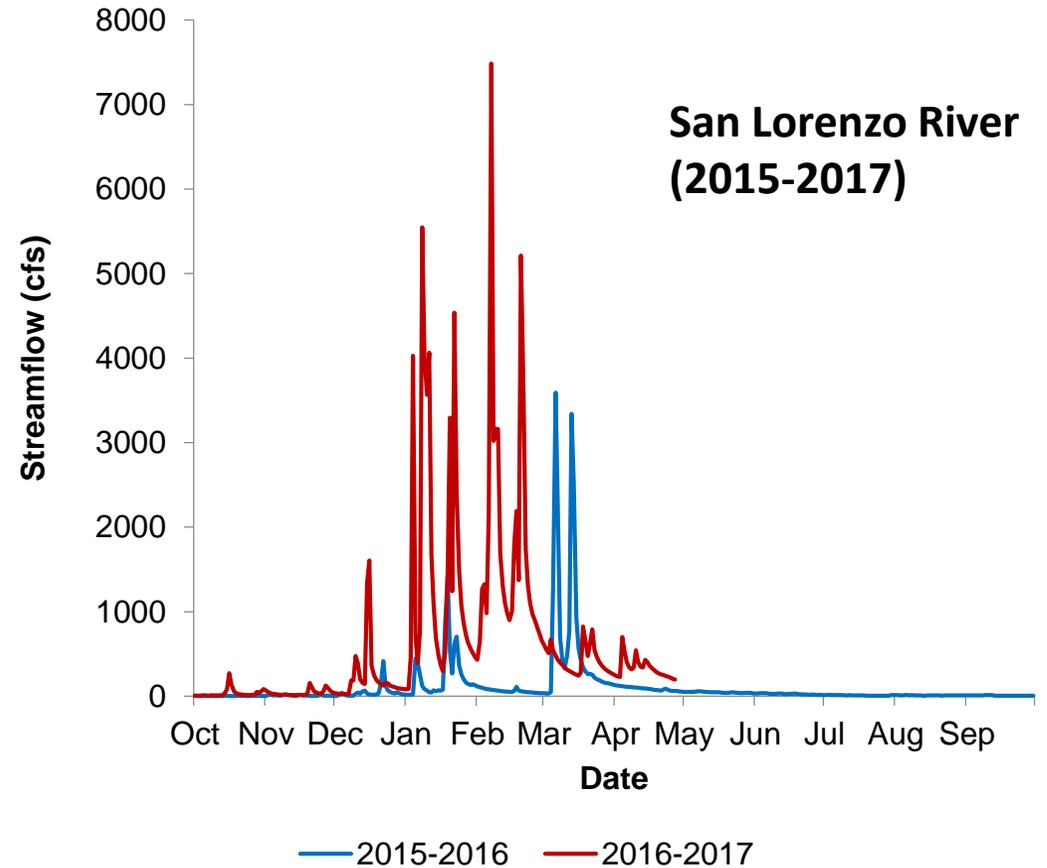
RESULTS:

Question 1: Are streams drying? Population effects?

Example: Santa Cruz County



**Scott Creek
(summer 2015)**



**San Lorenzo River
(2015-2017)**

— 2015-2016 — 2016-2017

RESULTS:

Question 2: Are streams warming? Population effects?



**Noyo River (Mendocino County),
habitat for Coho Salmon and Steelhead**



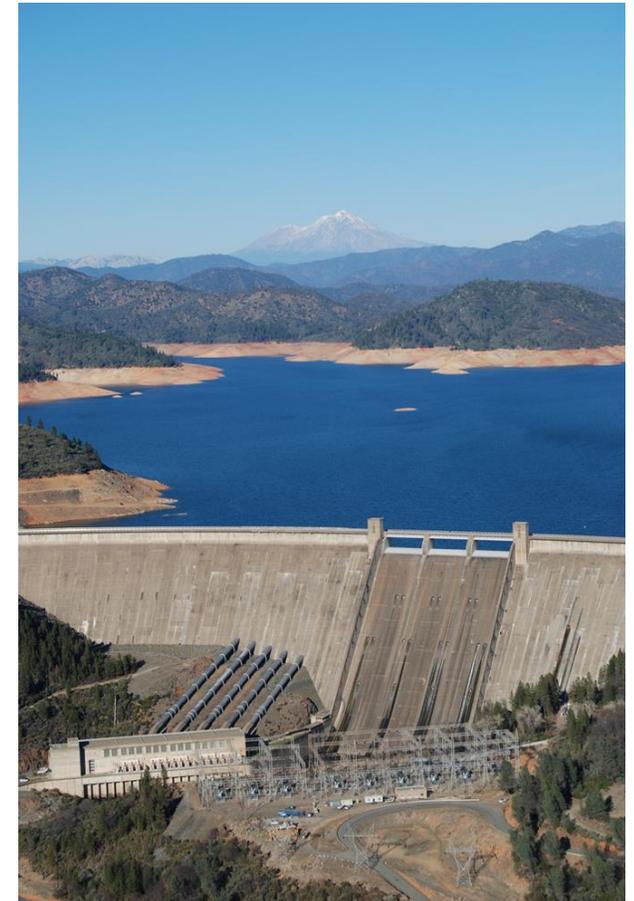
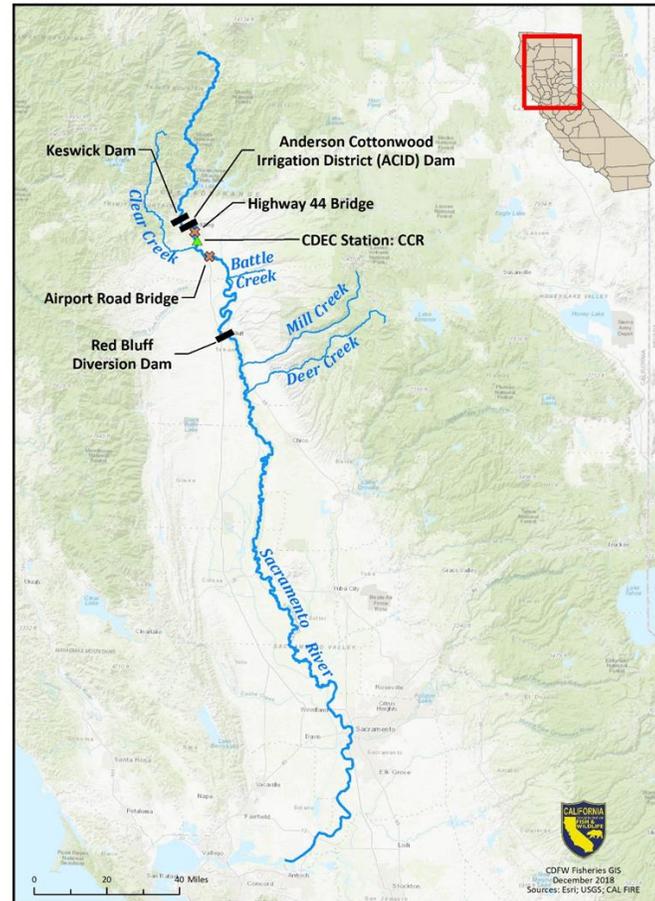
**Salt Creek, tributary of Sacramento River (Shasta County),
habitat for fall-run Chinook Salmon and steelhead**

RESULTS:

Question 2: Are streams warming? Population effects?
Example: winter-run Chinook Salmon (Shasta County)



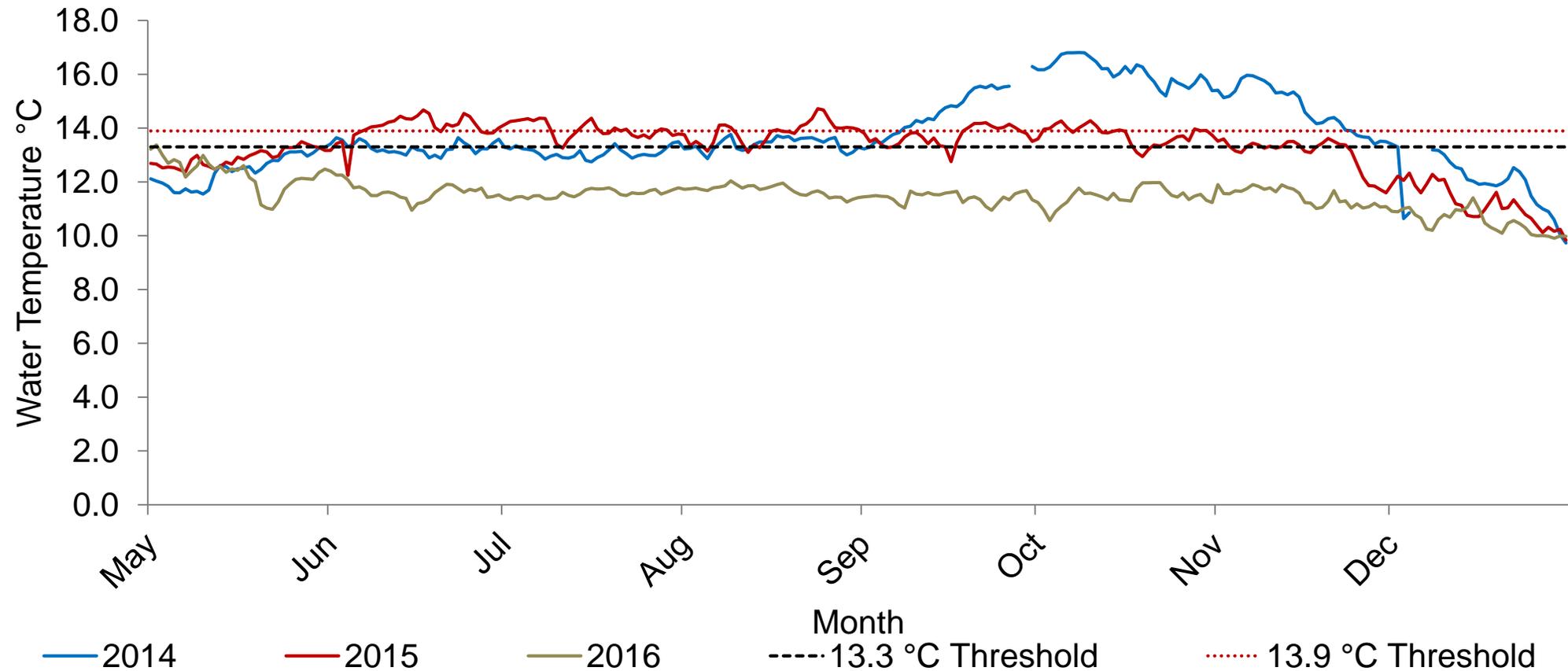
Endangered winter-run
Chinook Salmon



Shasta Lake, January 16, 2014 (Shasta Co.) (Credit: DWR)

RESULTS:

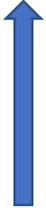
Question 2: Are streams warming? Population effects?
Continued: winter-run Chinook Salmon (Shasta County)



RESULTS:

Question 2: Are streams warming? Population effects? Continued: winter-run Chinook Salmon (Shasta County)

Upstream



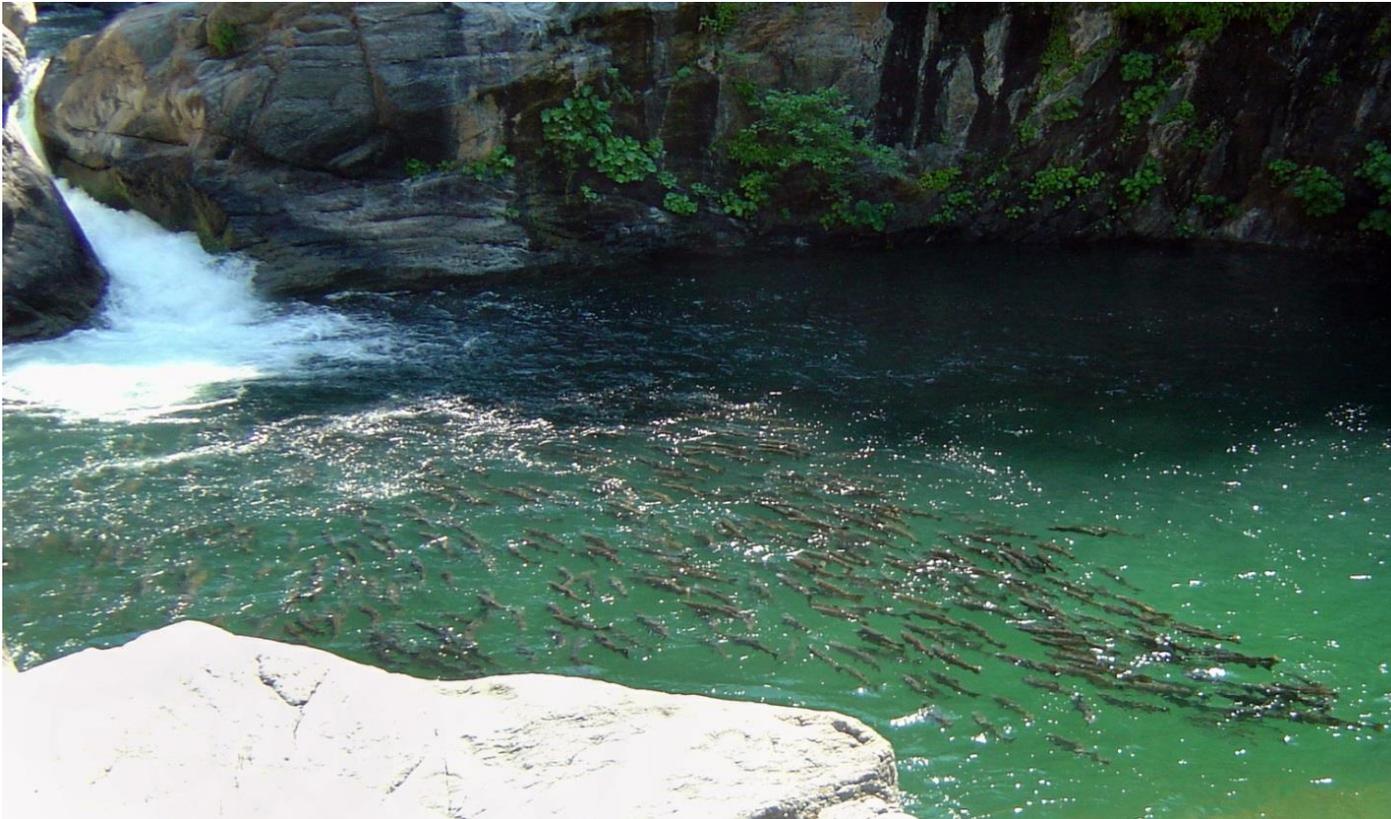
Location	2015	2014	2003-2013 Average
Keswick Dam to A.C.I.D. Dam	38%	56%	43%
A.C.I.D. Dam to Highway 44 Bridge	61%	37%	43%
Highway 44 Bridge to Airport Rd. Bridge	1%	7%	14%

Year	Egg-to-Fry Survival
2003	23.0%
2004	20.9%
2005	18.5%
2006	15.4%
2007	21.1%
2008	17.5%
2009	33.3%
2010	37.5%
2011	48.6%
2012	26.9%
2013	15.1%
2014	5.9%
2015	4.2%
2016	24.0%

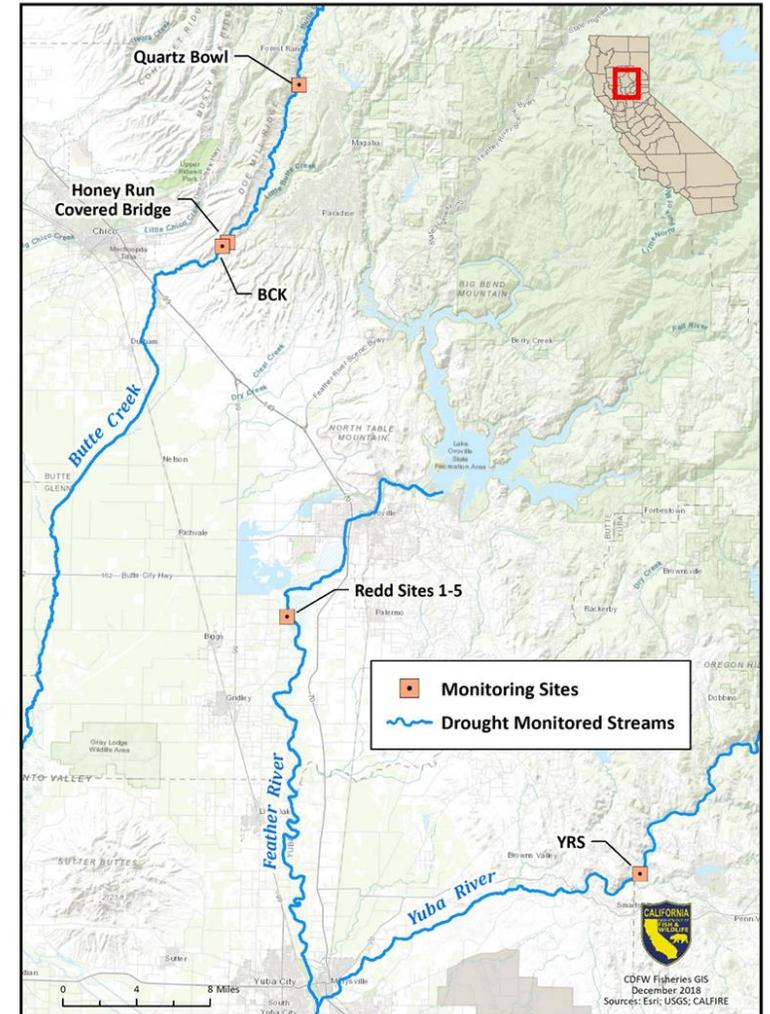


RESULTS:

Question 2: Are streams warming? Population effects?
Example: spring-run Chinook Salmon (Butte County)



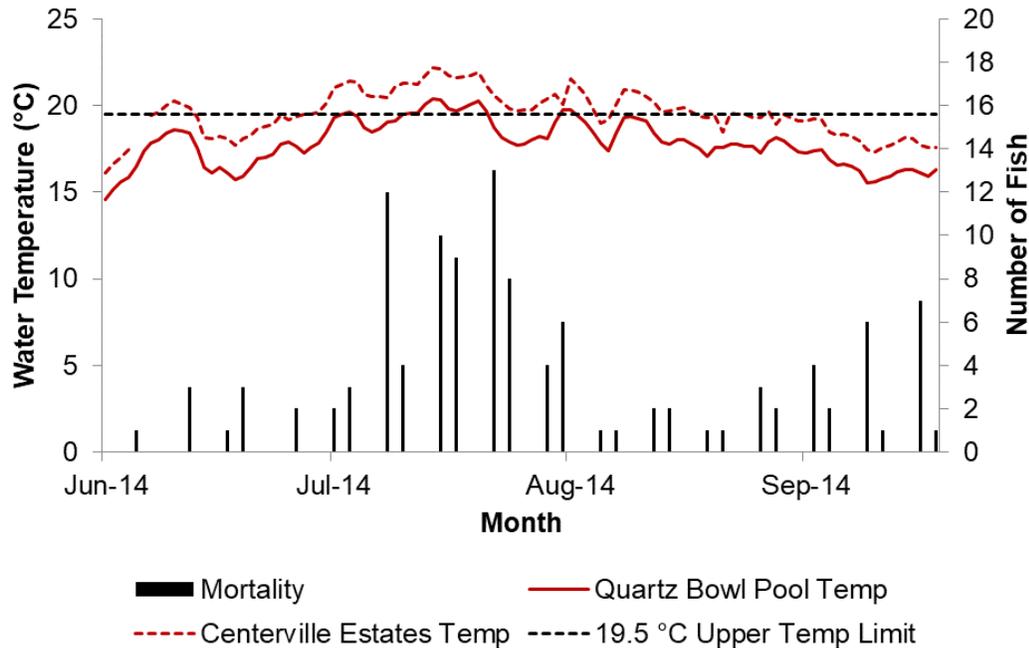
Threatened spring-run Chinook Salmon



RESULTS:

Question 2: Are streams warming? Population effects? *Continued*: spring-run Chinook Salmon (Butte County)

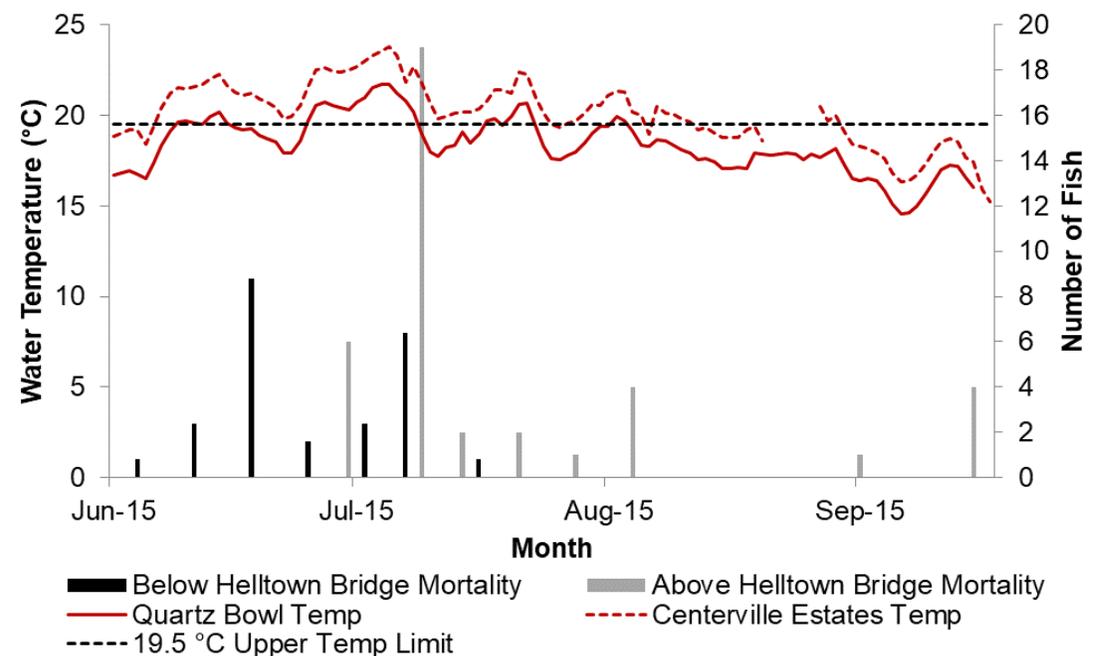
Total Number Pre-Spawn Mortalities: 232



2014

Holding / Spawning Season

Total Number Pre-Spawn Mortalities: 432



2015

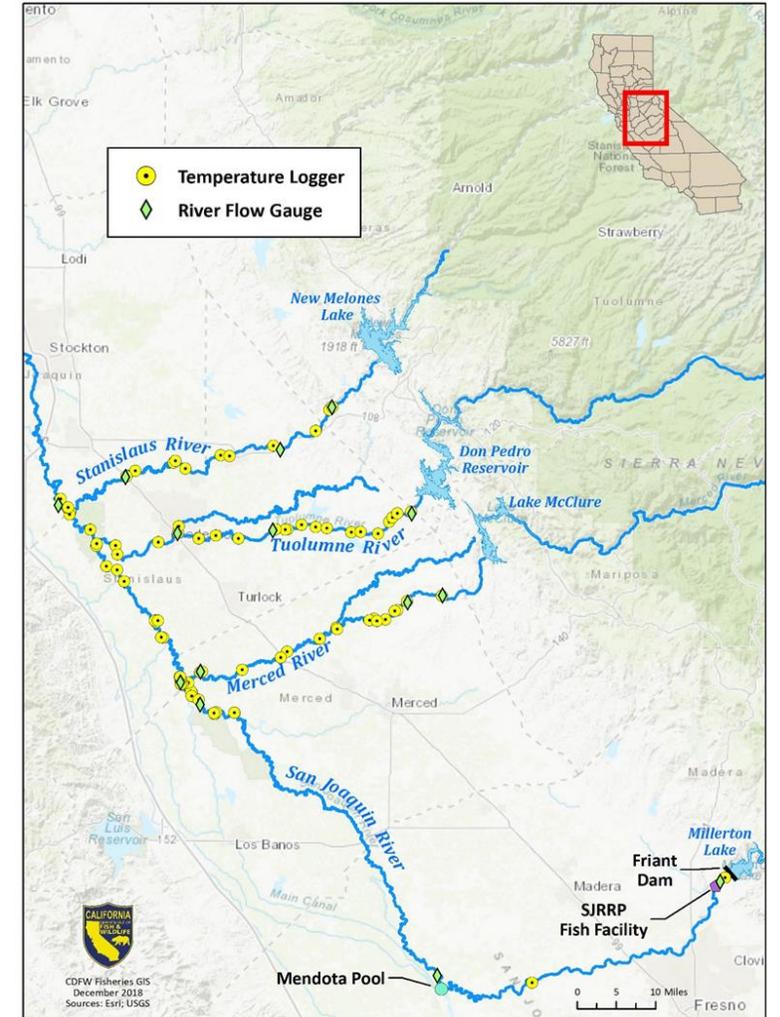
Holding / Spawning Season

RESULTS:

Question 2: Are streams warming? Population effects? Example: San Joaquin River Watershed

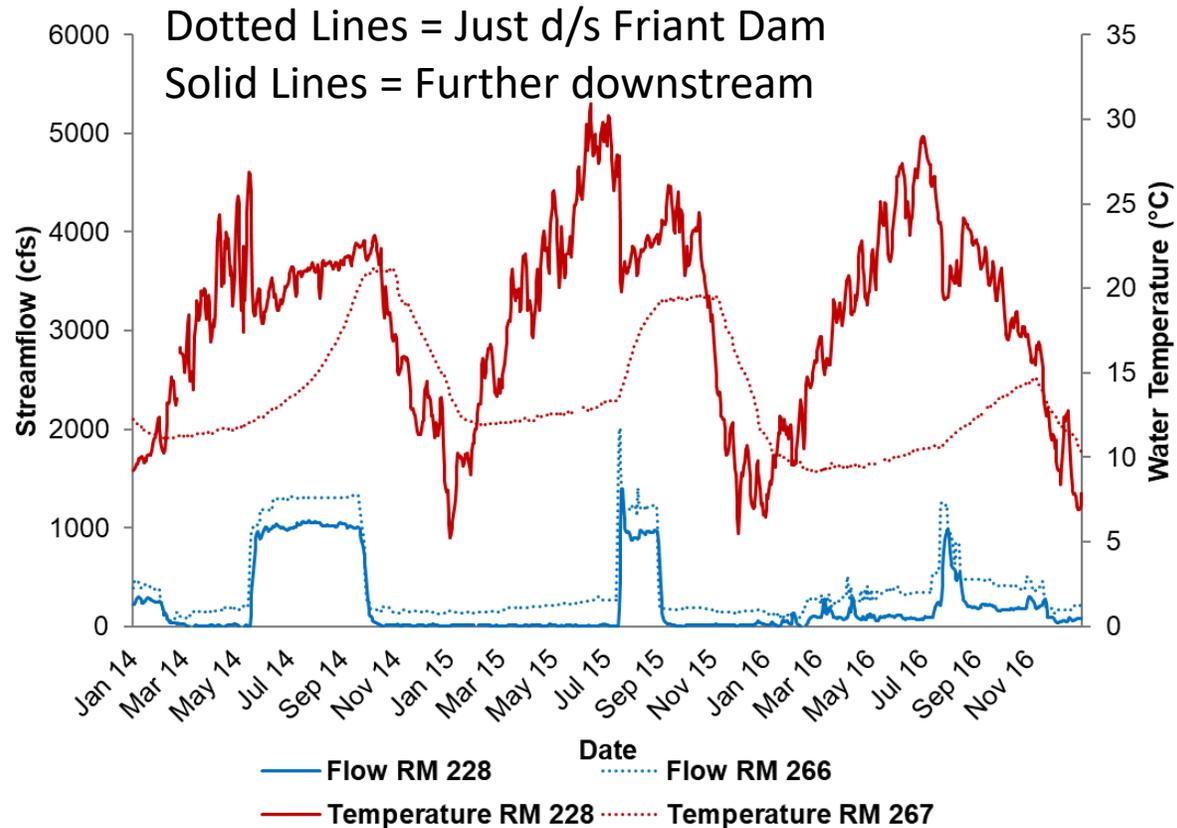


- Fall-run Chinook Salmon,
- Threatened steelhead,
- Threatened spring-run Chinook Salmon (prep work to be re-introduced)

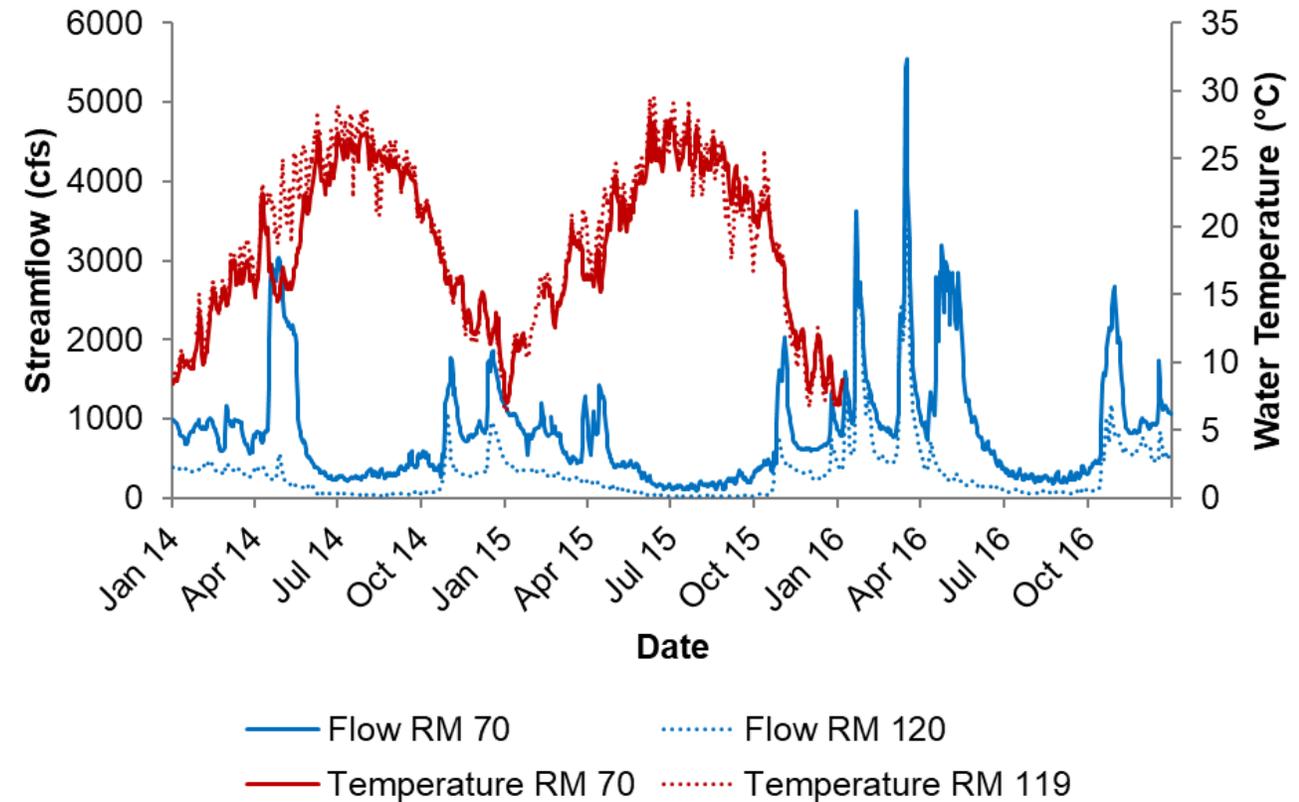


RESULTS:

Question 2: Are streams warming? Population effects? *Continued: San Joaquin River Watershed*



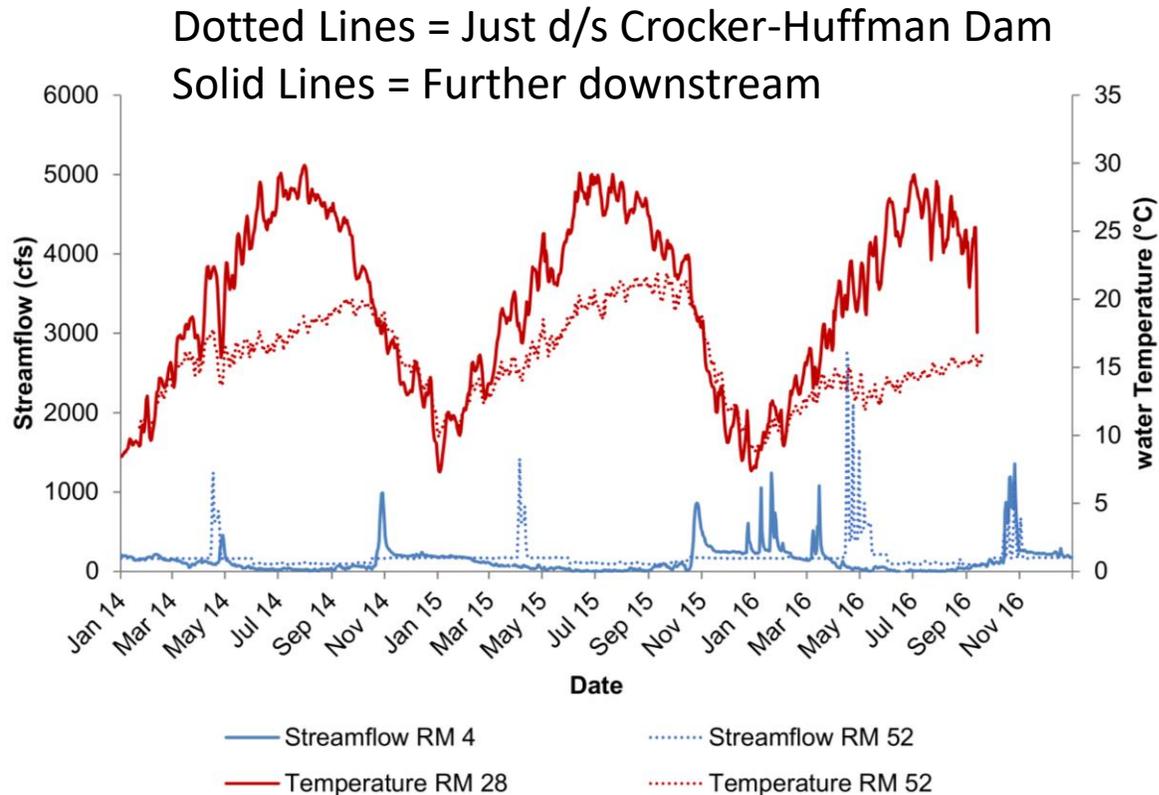
**UPPER San Joaquin River (Below Friant Dam)
(Fresno County)**



LOWER San Joaquin River

RESULTS:

Question 2: Are streams warming? Population effects? *Continued: San Joaquin River Watershed*



Snorkel Survey Counts in 2014:

- 742 adult and juvenile steelhead
- 14 adult Chinook salmon;
- 9,046 juvenile Chinook salmon.

Snorkel Survey Counts in 2015:

- 59 adult and juvenile steelhead
- one adult Chinook salmon
- 34 juvenile Chinook salmon

Merced River, tributary to San Joaquin River (Merced County)

RESULTS:

Question 2: Are streams warming? Population effects?

TOPIC: Freezing an issue in Sierra streams



RESULTS:

Question 2: Are streams warming? Population effects?

TOPIC: Freezing an issue in Sierra streams

Example: California Golden Trout in Tulare County



California Golden Trout (unique genetic strain)



<https://www.youtube.com/watch?v=tacjH47tS2U>

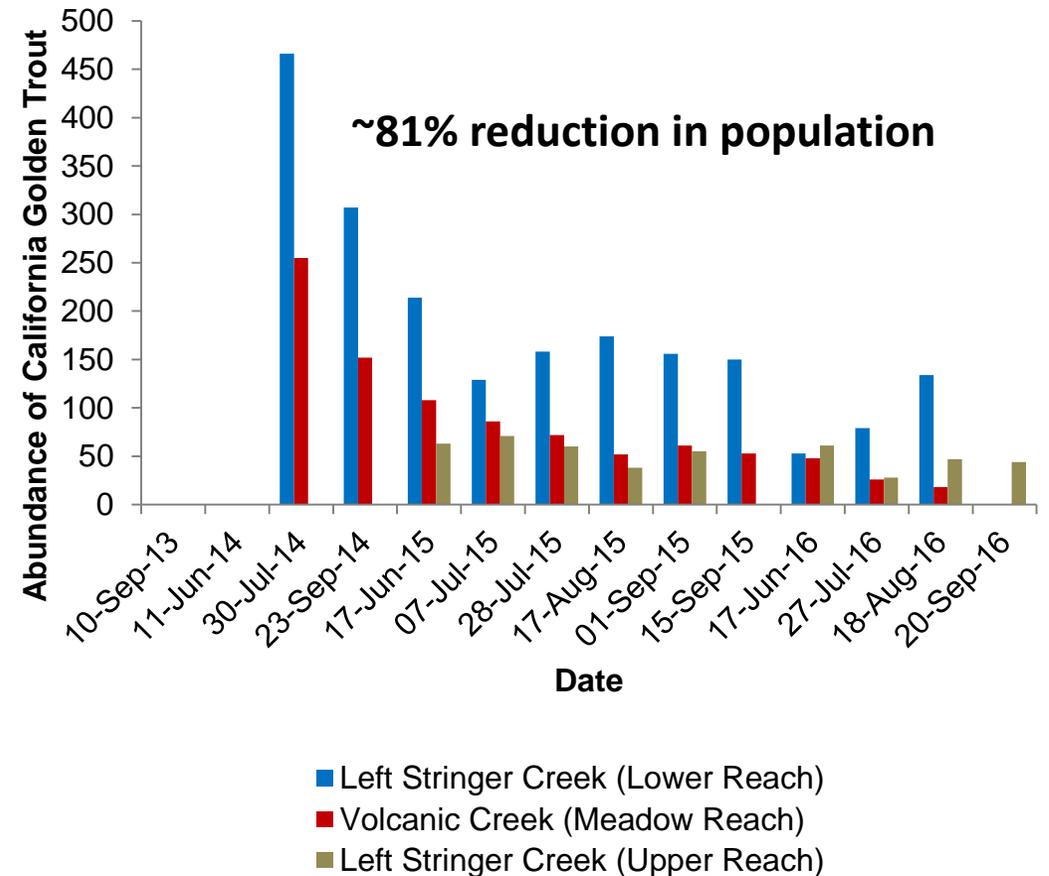
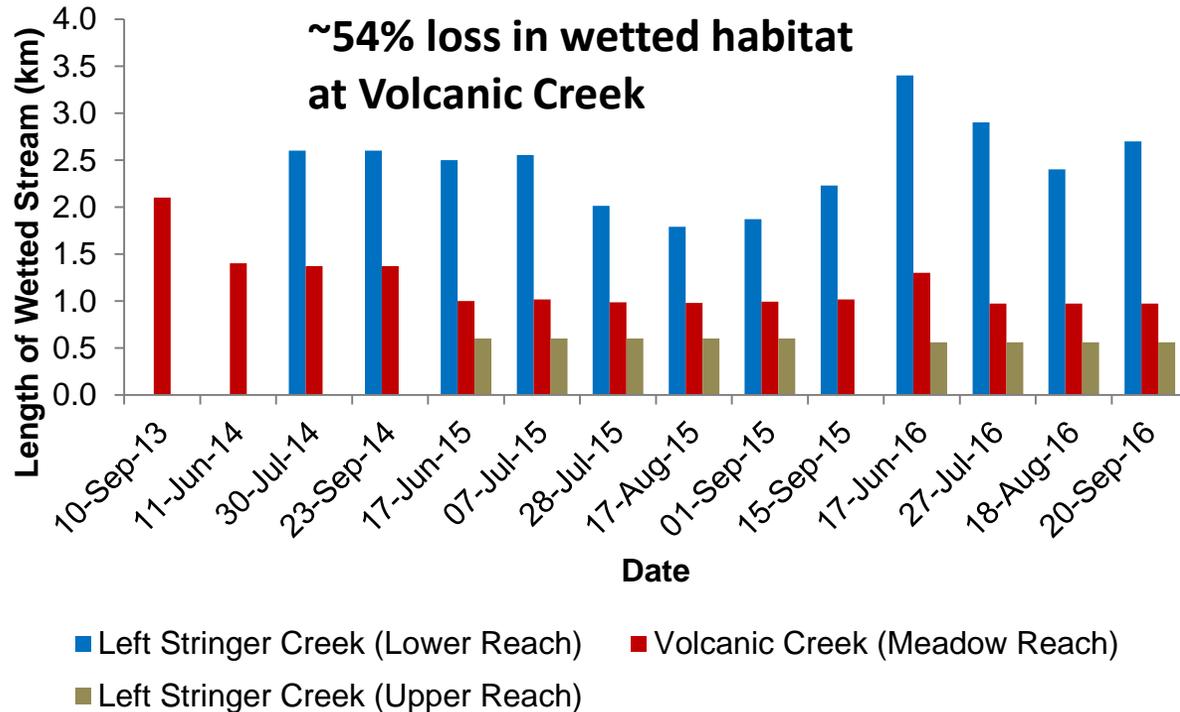
Film credit: CDFW

RESULTS:

Question 2: Are streams warming? Population effects? TOPIC:

TOPIC: Freezing an issue in Sierra streams

Continued: California Golden Trout in Tulare County



RESULTS:

Question 3: Is the amount of dissolved oxygen changing?



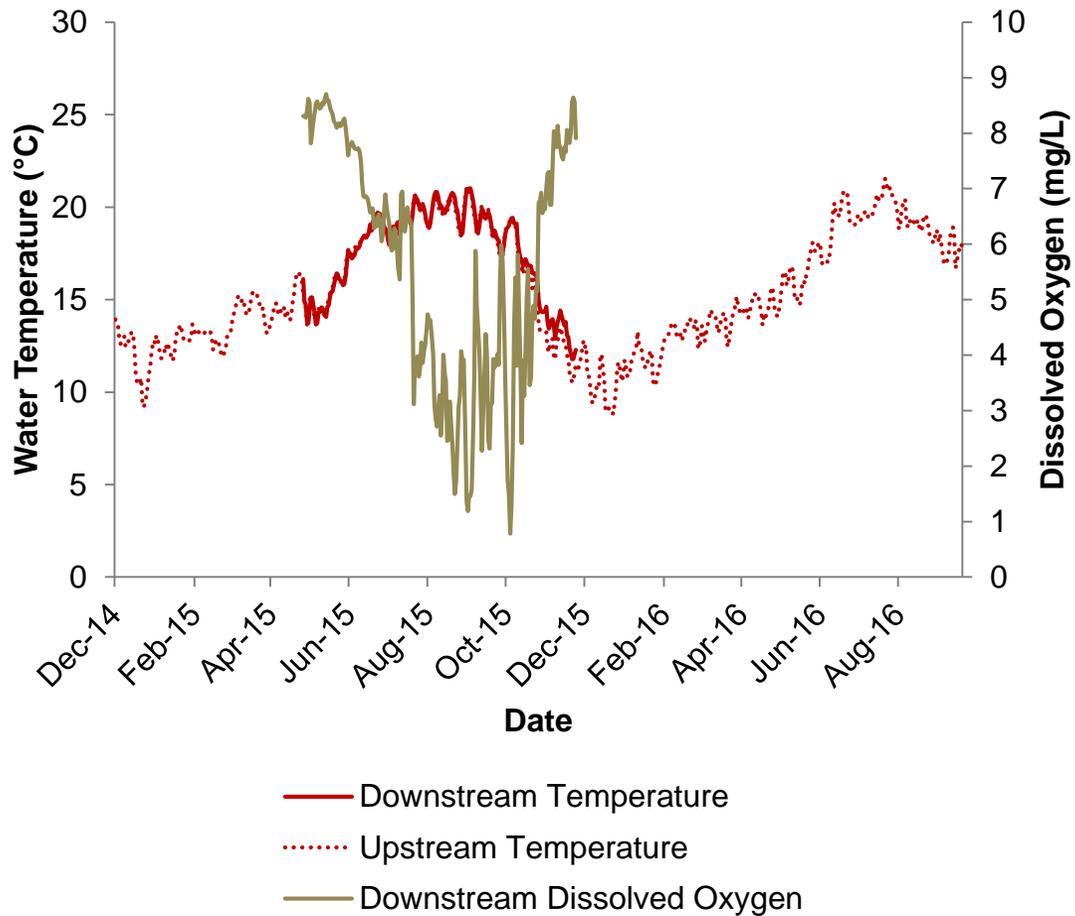
Santa Clara Watershed (Ventura County)



Coldwater Canyon Creek (Riverside County)

RESULTS:

Question 3: Is the amount of dissolved oxygen changing?
EXAMPLE: Coldwater Canyon Creek (Riverside County)



RESULTS:

Question 3B: Are both the dissolved oxygen and temperature changing?

TOPIC: Drought effects on estuaries / bar-built lagoons



Pescadero Creek lagoon (San Mateo County)



Humboldt Bay Estuary
(Humboldt County)



RESULTS:

Question 3B: Are both the dissolved oxygen and temperature changing?

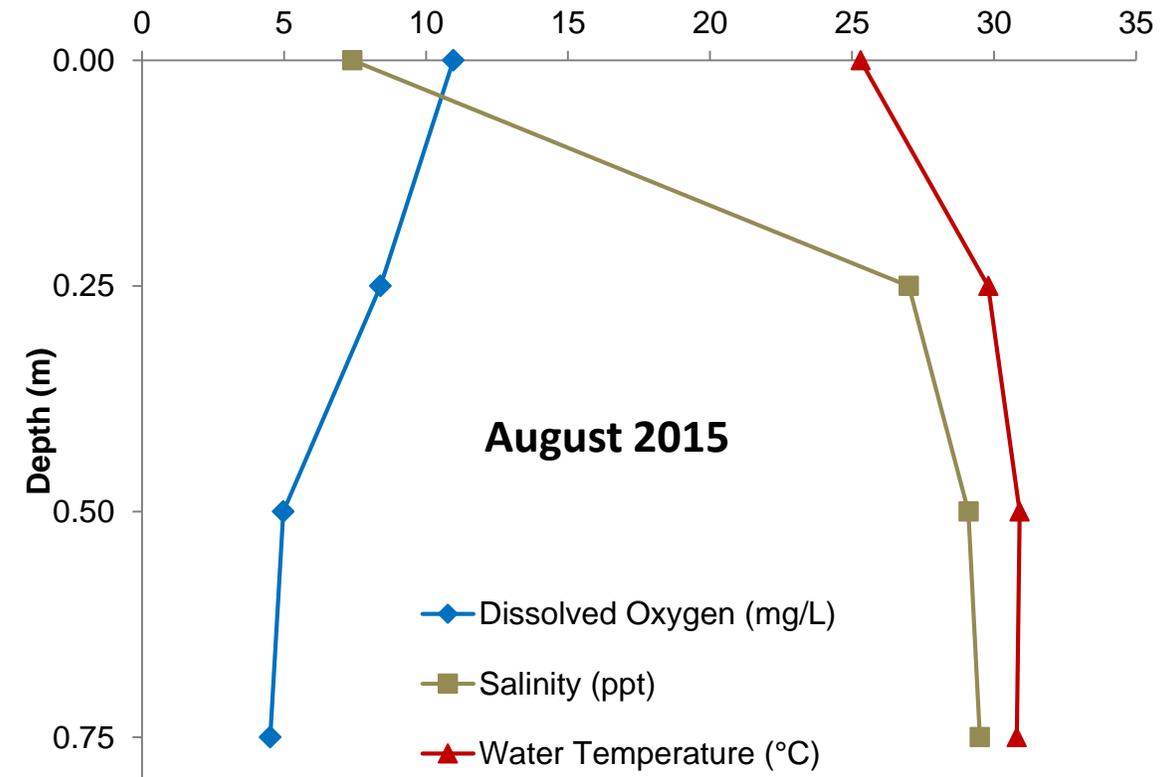
Examples: Bar-Built Lagoons in Central and South Central California coasts



Pescadero Creek Lagoon (San Mateo County)

ESTIMATES of # Steelhead:

- July 2015: 2,345 (95% CI 1,841 to 3,478).
- October 2015: no steelhead were detected in the lagoon.
- In July 2016: 4,064 (95% CI 3,035 to 5,312)
- October 2016: 1,577 (95% CI 1,162 to 2,325).



RESULTS:

Bonus Question: What are the effects of drought and mudslides?



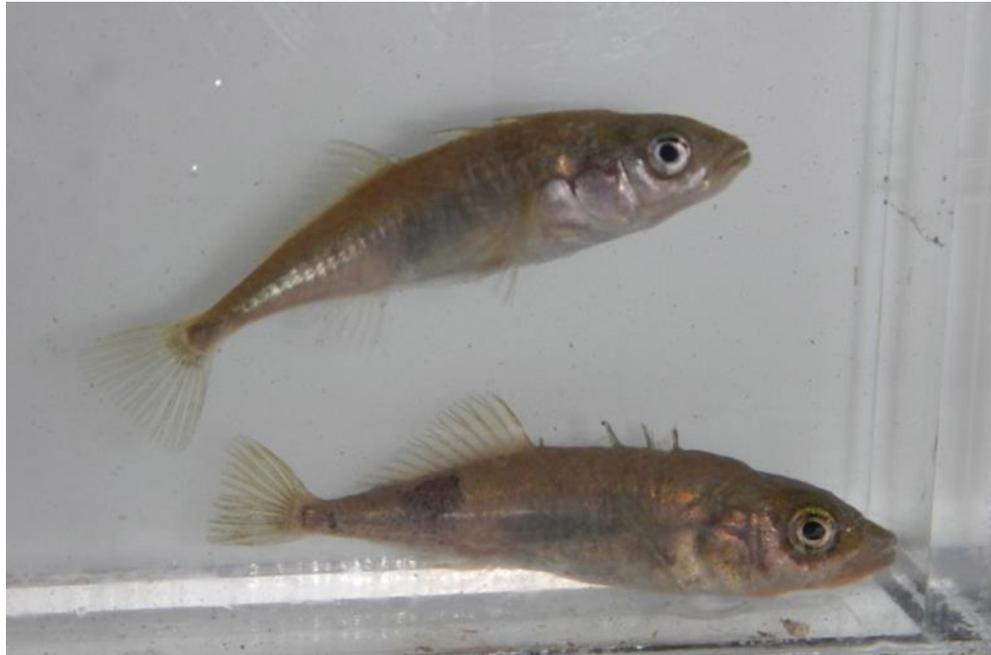
Montecito Creek, Montecito 2018 (Santa Barbara County)

Credit: <https://www.dogonews.com/2018/1/17/fire-ravaged-santa-barbara-now-grapples-with-devastating-mudslides>

RESULTS:

Bonus Question: What are effects of drought and mudslides?

Example: Unarmored Stickleback in Santa Clara River Watershed (Los Angeles County)



**Endangered and Fully-Protected
Unarmored Threespine Stickleback**

RESULTS:

Bonus Question: What are effects of drought and mudslides?

Continued: Unarmored Stickleback in Santa Clara River watershed



- July 2016: Sand Fire puts population at risk due to possible sedimentation.
- October 2016: Rescued and temporarily held at Fillmore Hatchery.
- January 2017: Heavy rains buried the collection site under seven feet of ash and sediment.
- Later 2017: Re-Introduced to suitable habitat within the watershed.

DISCUSSION: Summary

- 2012-2016 showed record-breaking drought in California, especially in the southern Central Valley and coastal areas
- Monitoring was integral to understanding the effects of drought on aquatic species and for determining management actions (e.g. fish rescue).
- Patterns recorded that often-affected fish survival:
 - 1) streams dried earlier and longer;
 - 2) estuaries and bar-built lagoons exhibited degraded water quality,
 - 3) water temperatures sometimes rose to critical levels;
 - 4) wild trout populations in high elevation streams threatened winter anchor ice;
 - 5) fish were often stranded by low streamflow and adversely affected by poor water quality.

DISCUSSION: Lessons Learned

- Long term monitoring keeps us prepared to deal with drought.
- Long term monitoring shows important context.
- Monitoring helps forecast for future scenarios (e.g. water management)
- Linking monitoring with management improves balance of resources (e.g. fish rescue, fish rescue, etc.)
- Extreme drought provided insight about key habitat that remains wetted. These “sanctuary” habitats and access by aquatic species need to be protected.
- Altered habitat from extreme drought has already begun to show us new threats to fish and habitat we need to be prepared to address:
 - Wildfires
 - Mud slides
 - Flash flooding and debris flows

Positioning for the Future

We now have:

- 1) monitoring baseline
 - 2) better understanding of refugia
 - 3) a forecast of most at-risk populations
- Need for building resiliency.



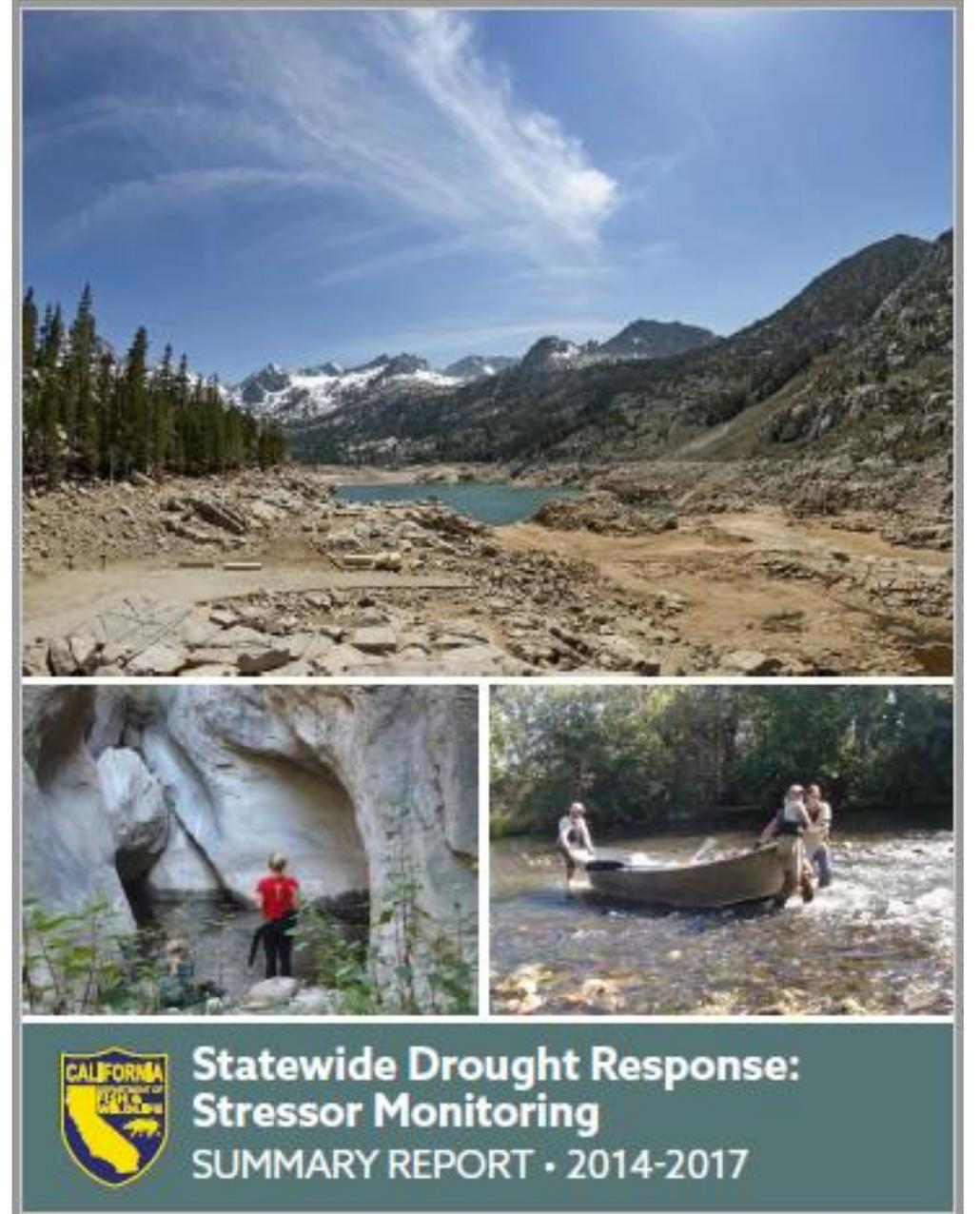
Recommendations for the future

- Monitoring over the long term
- Transparency in results
- Standardizing methods
- Partnerships
- Resiliency
- Innovation



Final Report:

<http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=168170>



**Statewide Drought Response:
Stressor Monitoring**
SUMMARY REPORT • 2014-2017

CDFW Case Studies:

<https://www.wildlife.ca.gov/Drought/Projects>

The screenshot displays the website for the California Department of Fish and Wildlife, specifically the 'Drought Response Projects' page. The browser address bar shows the URL <https://www.wildlife.ca.gov/Drought/Projects>. The website header includes the CA.gov logo, navigation links for Home, Fishing, Hunting, Licensing, Conservation, and Learning, and a search bar. The main content area features a breadcrumb trail: Home | Drought | Projects. The title 'Drought Response Projects' is prominently displayed. Below the title, a paragraph states: *Since January 2014, the Department has conducted stream and wildlife population monitoring, fish rescues, restoration projects, and many other actions to protect native fish and wildlife threatened or impacted by the statewide drought. These reports reflect efforts at various locations along the coast, the Central Valley, mountains, and deserts of California. Periodically, new reports and updates will be posted to keep the public informed on continued efforts during the drought.*

The page is organized into four columns, each with a title and a list of project links:

- Central Valley Drought Projects**
 - Battle Creek Reintroduction Plan for Chinook Salmon
 - Central Valley PIT tagging Study
 - Central Valley Steelhead (2016 update)
 - Eagle Canyon Fish Passage Design Project
 - Knight's Landing Juvenile Sturgeon
 - Upper Sacramento River Adult Sturgeon
 - White Sturgeon Population Ecology
- Drought Response Rescues**
 - Stanislaus River Salmonid Stranding Survey and Rescue
 - By-Day Creek Lahontan Cutthroat Trout
 - Russian River Coho Salmon
 - Jewel Lake Sacramento Perch (with 2015 update)
 - Merced River Steelhead / Rainbow Trout (with 2016 update)
 - Goose Lake Redband Trout (with 2017 update)
 - McCloud Redband Trout (with 2016 update)
 - Redwood Creek Coho Salmon (with ...)
- Drought Stressor Monitoring**
 - Amargosa Basin Vole
 - American River Steelhead
 - Austin Meadow Creek Lahontan Cutthroat Trout
 - Butte Creek Spring-run Chinook Salmon
 - 2017 update
 - 2016 update
 - Central Coast Steelhead
 - 2016 update
 - Coldwater Creek Native Trout
 - 2016 update
 - Cottonwood Creek Paiute Cutthroat Trout
- Restoration Drought Projects**
 - Mattole River Water Conservation Programs
 - Supply Creek Instream Habitat Restoration Project
 - Drought Busters: Water Conservation and Salmonid Education in a Drought Environment

The bottom of the screenshot shows the Windows taskbar with the search bar and system tray, indicating the time is 10:57 AM on 8/11/2019.

Videos of CDFW's Drought Efforts



McCloud River
Redband Rescue
and Recovery

California Trout

Vimeo - Oct 22, 2016



California Golden
Trout Rescue
Project

CDFW

YouTube - Dec 22, 2016



California Golden
Trout's Long
Journey Home

CDFW

YouTube - Aug 23, 2017

<https://vimeo.com/188421508>

Film credit: Caltrout

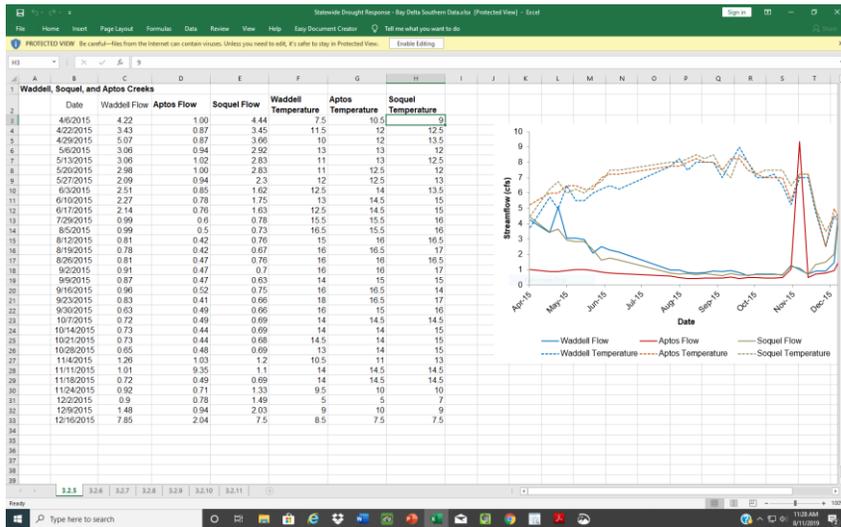
<https://www.youtube.com/watch?v=tacjH47tS2U>

Film credit: CDFW

<https://www.youtube.com/watch?v=tvHZzq-h3FE>

Film credit: CDFW

Raw data available at CDFW's BIOS website



Science Institute News | CDFW ... Drought Response Projects ... Native Fishes Drought Resp... x nrm.dfg.ca.gov

Amazon.com - Online Sh... Priceline.com TripAdvisor Google Suggested Sites Yahoo!

CDFW Open Data Home

Native Fishes Drought Response Stressor Monitoring - 2014 to 2017 [ds2820]

Last updated last month | 15 Records

Search data and map

- https://nrm.dfg.ca.gov/FileHandler.a...
- https://nrm.dfg.ca.gov/FileHandler.a...
- https://nrm.dfg.ca.gov/FileHandler.a...
- https://nrm.dfg.ca.gov/FileHandler.a...
- https://nrm.dfg.ca.gov/FileHandler.a...
- Other

Overview Data API Explorer

6/27/2019 Feature Layer No license specified Download APIs

Showing 1 to 10 of 15 Hint: Click on ▼ to filter columns.

OBJECTID	REGION	NAME	Data	Label	Report	Shape_Area	Shape
1	1	Northern Region Central Valley	https://nrm.dfg.ca.gov/FileHandl...	R1 Central Valley		11445923984.707	608543.3
2	2	North Central Region Inland		R2 Inland		22173746963.6602	817965.5
3	3	Bay Delta Region South	https://nrm.dfg.ca.gov/FileHandl...	R3 South		17884787502.7734	713422.6
4	4	Central Region Coastal	https://nrm.dfg.ca.gov/FileHandl...	R4 Coastal		30291912726.1758	1381678.

Do you want to open or save Statewide Drought Response - Introductory Data.xlsx (263 KB) from nrm.dfg.ca.gov? Open Save Cancel

<https://www.wildlife.ca.gov/Data/BIOS>

ACKNOWLEDGEMENTS

State and Federal agencies, local agencies, non-profit organizations, private landowners, and...



California Department of
Fish and Wildlife



CALIFORNIA DEPARTMENT OF
WATER RESOURCES



QUESTIONS?

