



Shasta River Watershed Stewardship

Summary of Water Quality Assessment & Planning Efforts

**Karen Mallory
Shasta Valley Resource Conservation District**

**Steve Butkus
North Coast Regional Water Quality Control Board**

**Klamath Basin Monitoring Program
General Membership Meeting
November 5, 2014**



Shasta Stewardship Report Team

- Shasta Valley Resource Conservation District staff
funded by 2013 CWA 319h grant
- North Coast Regional Water Quality Control Board staff
- Klamath Basin Monitoring Program staff
- Input from Partners, to date primarily:
 - CA Dept. Fish and Wildlife
 - US Fish and Wildlife Service



What is the Shasta Stewardship Report?

- Is a non-regulatory document to identify successful completed stewardship actions in the Shasta Basin
- Presents a guideline for future stewardship actions to further improve water quality conditions
- Identifies current water quality monitoring and trends
- Introduces a watershed-scale stewardship-based adaptive management process
- Provides opportunities for direct feedback from local stakeholders and partner organizations



Major Report Components

- Watershed Partners – 31 agencies/groups identified
- Watershed Description
- Water Quality Constituents of Concern
- Water Quality Issues of Concern
- Shasta River Watershed Action Plan:
 - Stewardship Actions
 - Adaptive Management
 - Shasta Watershed Monitoring Plan
- Appendices, including WQ Assessment



Water Temperature Assessments

- Salmonid Species Life Cycle Use Support
 - Chinook Salmon
 - Coho Salmon
 - Steelhead Trout
- Temperature TMDL Target Compliance
- Spatial Trend
- Temporal Trends
- Meteorological Influences on Temporal Trend



Data Sources

Water Temperature Measurements were collected 1991 - 2012 by:

- California Department of Fish and Wildlife
- The Nature Conservancy
- Shasta Valley Resource Conservation District
- Shasta Valley Coordinated Resource Management Planning group
- Montague Water Conservation District
- North Coast Regional Water Quality Control Board
- California Department of Water Resources
- U.S. Geological Survey
- U.S. Fish and Wildlife Service
- Karuk Tribe
- McBain and Trush Consultants
- Various researchers, including the University of California, Davis

Life-Stage Water Temperature Thresholds

Lethal Water Temperature Thresholds

Life Stage	Maximum Daily Water Temperature (°C)		
	Chinook	Coho	Steelhead
Adult Migration	25	25	24
Juvenile Rearing	25	25	24
Spawning, Egg Incubation, Fry Emergence, and Out-migration	20	20	20

Sub-Lethal Water Temperature Thresholds

Life Stage	MWMT (°C)
Adult Migration	20
Juvenile Rearing	18
Spawning, Egg Incubation, Fry Emergence, and Out-migration	13

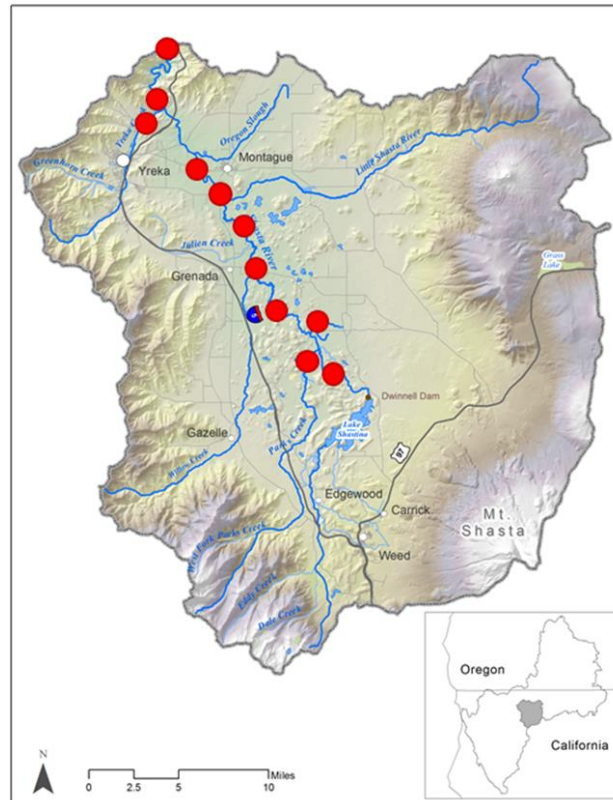
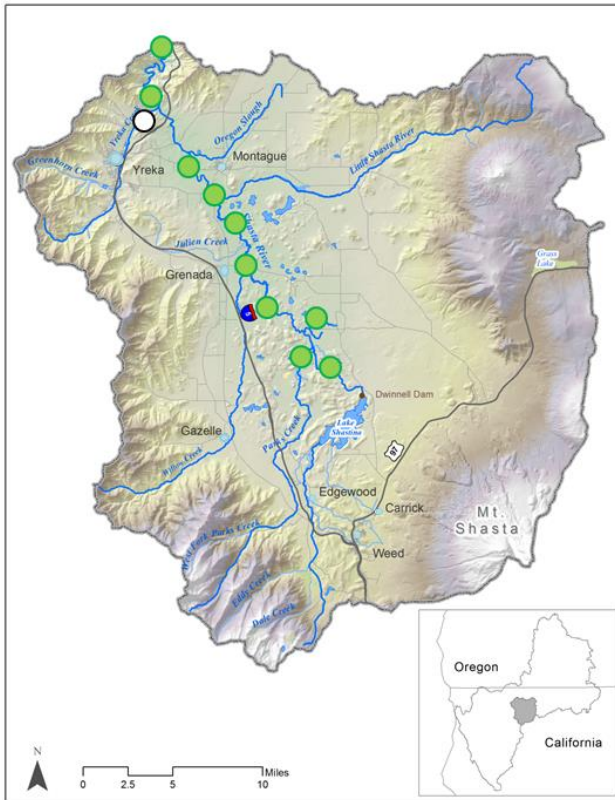
Chinook Salmon – Adult Migration

Lethal Threshold = 25°C

Sublethal Threshold = 20°C

Chinook Salmon
Adult Migration
Periodicity
Sept 1- Nov 30

Data Collected
2010-2013



- Life Stage Supported
Exceed < 10%
- Life Stage Impaired
Exceed \geq 10%
- No Data

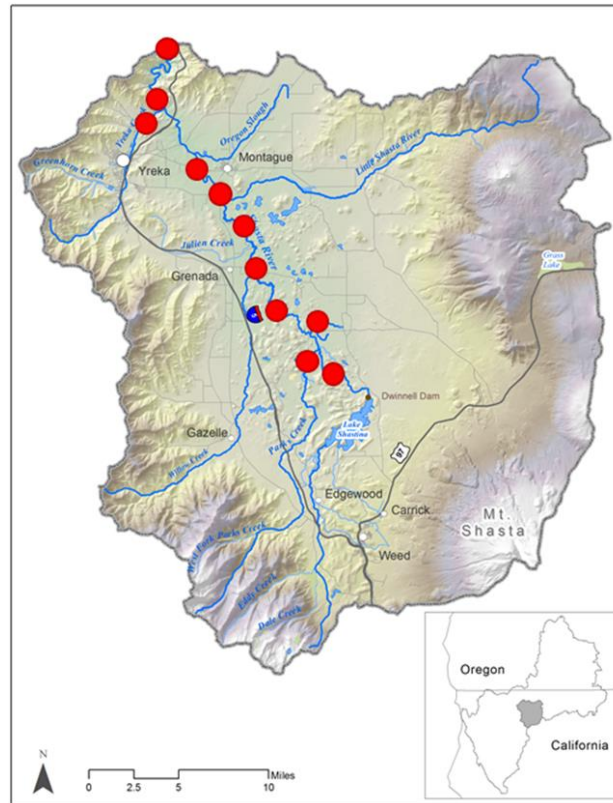
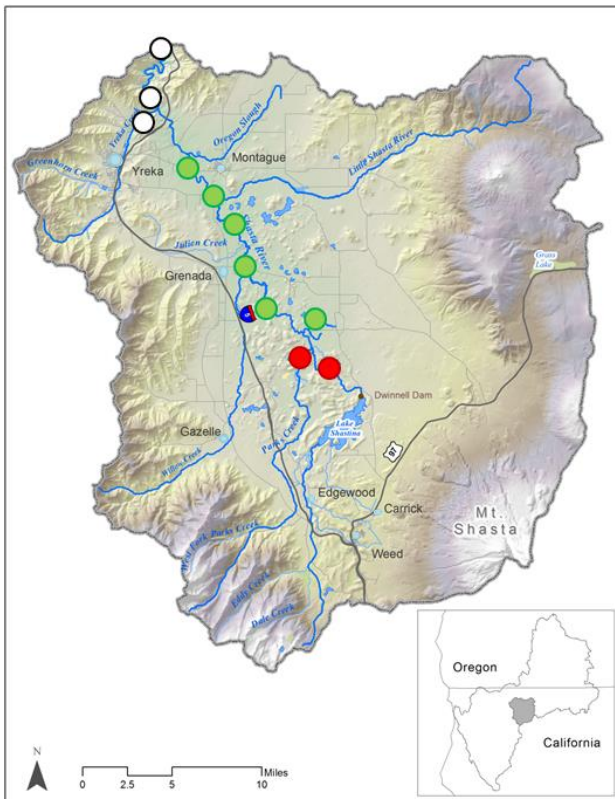
Chinook Salmon – Spawning

Lethal Threshold = 20°C

Sublethal Threshold = 13°C

Chinook Salmon
Spawning
Periodicity
Sept 15 - Nov 30

Data Collected
2010-2013



● Life Stage
Supported
Exceed < 10%

● Life Stage
Impaired
Exceed ≥ 10%

○ No Data

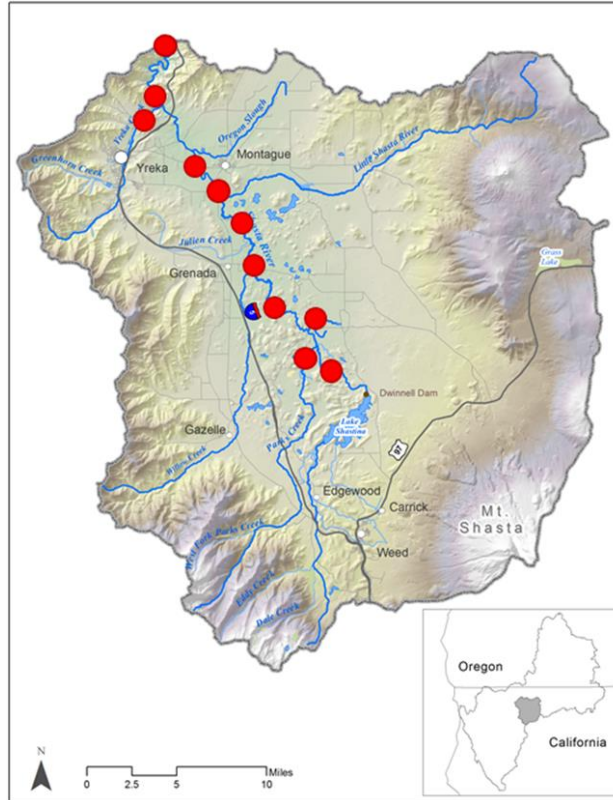
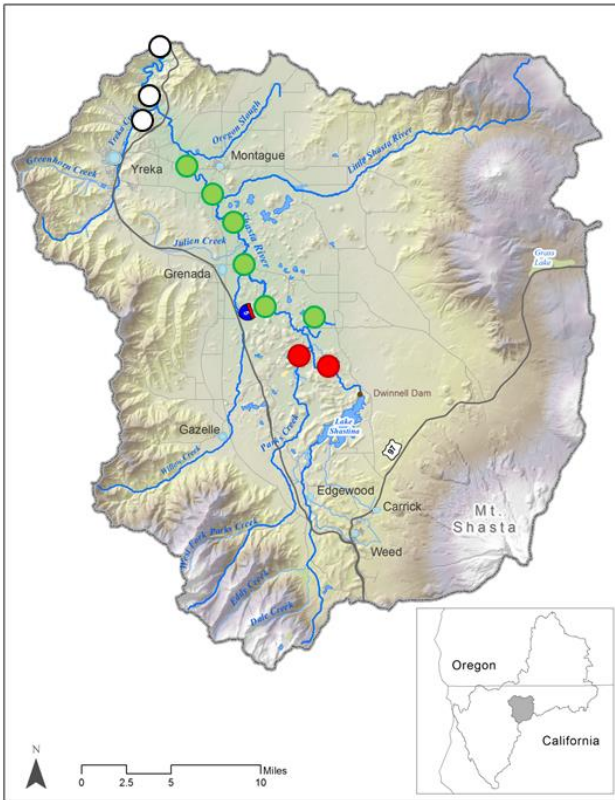
Chinook Salmon – Egg Incubation

Lethal Threshold = 20°C

Sublethal Threshold = 13°C

Chinook Salmon
Egg Incubation
Periodicity
Sept 15 - Feb 28

Data Collected
2010-2013



- Life Stage Supported
Exceed < 10%
- Life Stage Impaired
Exceed ≥ 10%
- No Data

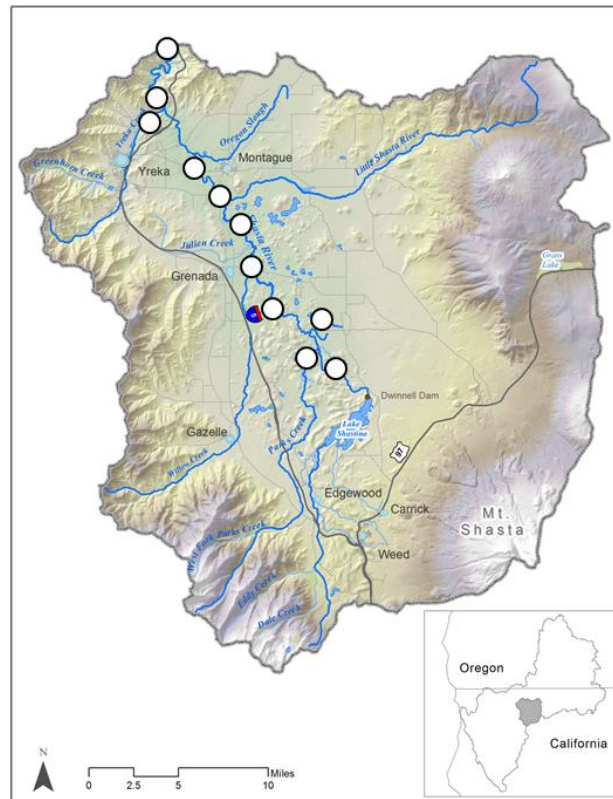
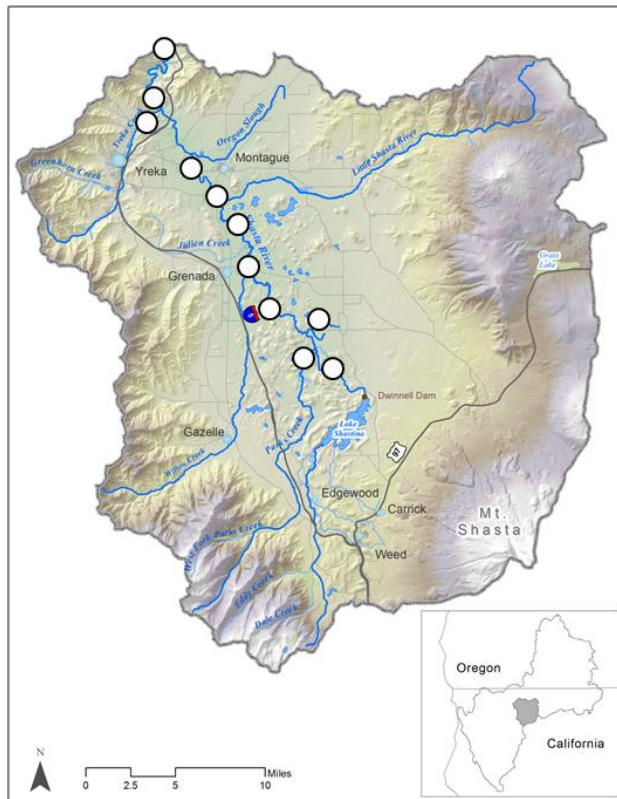
Chinook Salmon – Fry Emergence

Lethal Threshold = 20°C

Sublethal Threshold = 13°C

Chinook Salmon
Fry Emergence
Periodicity
Nov 1- Mar 31

Data Collected
2010-2013



● Life Stage
Supported
Exceed < 10%

● Life Stage
Impaired
Exceed ≥ 10%

○ No Data

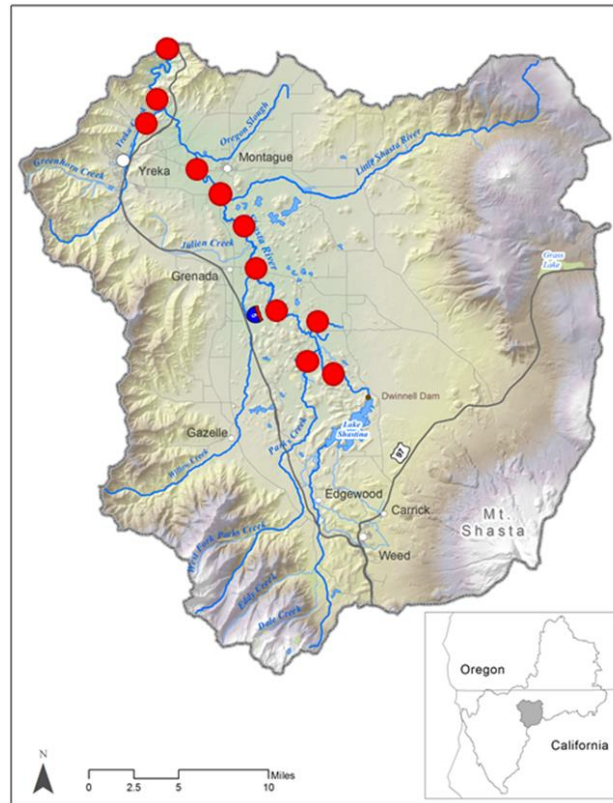
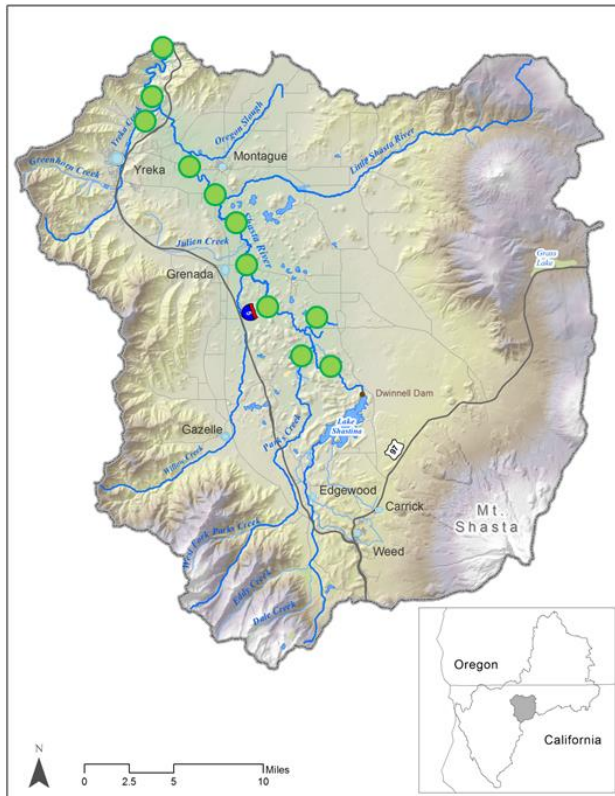
Chinook Salmon – Juvenile Rearing

Lethal Threshold = 25°C

Sublethal Threshold = 18°C

Chinook Salmon
Juvenile Rearing
Periodicity
Jan 1- Dec 31

Data Collected
2010-2013



- Life Stage Supported
Exceed < 10%
- Life Stage Impaired
Exceed ≥ 10%
- No Data

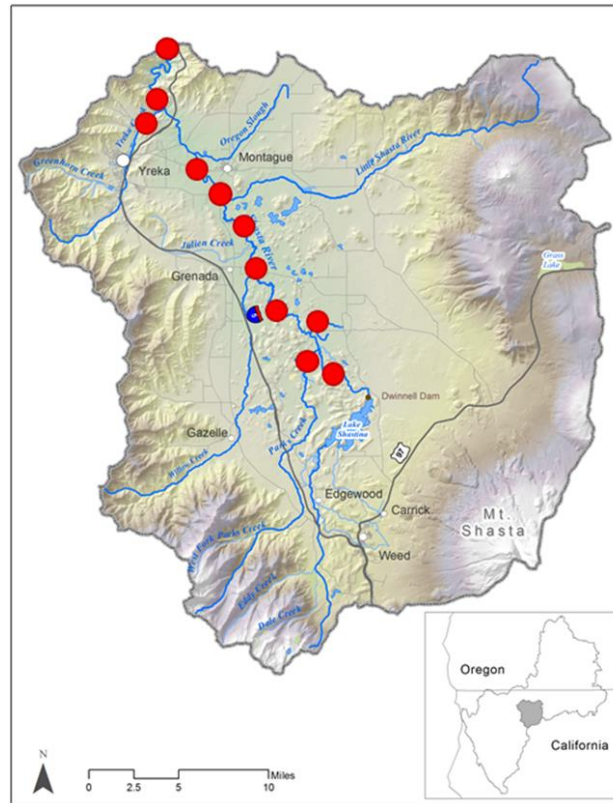
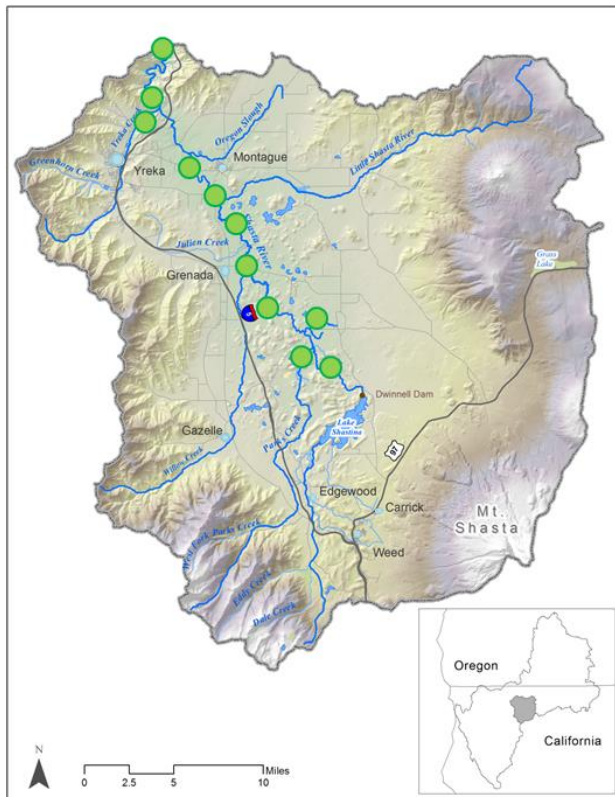
Chinook Salmon – Juvenile Out-migration

Lethal Threshold = 20°C

Sublethal Threshold = 13°C

Chinook Salmon
Juvenile
Out-migration
Periodicity
Feb 1 – July 15

Data Collected
2010-2013



- Life Stage Supported
Exceed < 10%
- Life Stage Impaired
Exceed ≥ 10%
- No Data

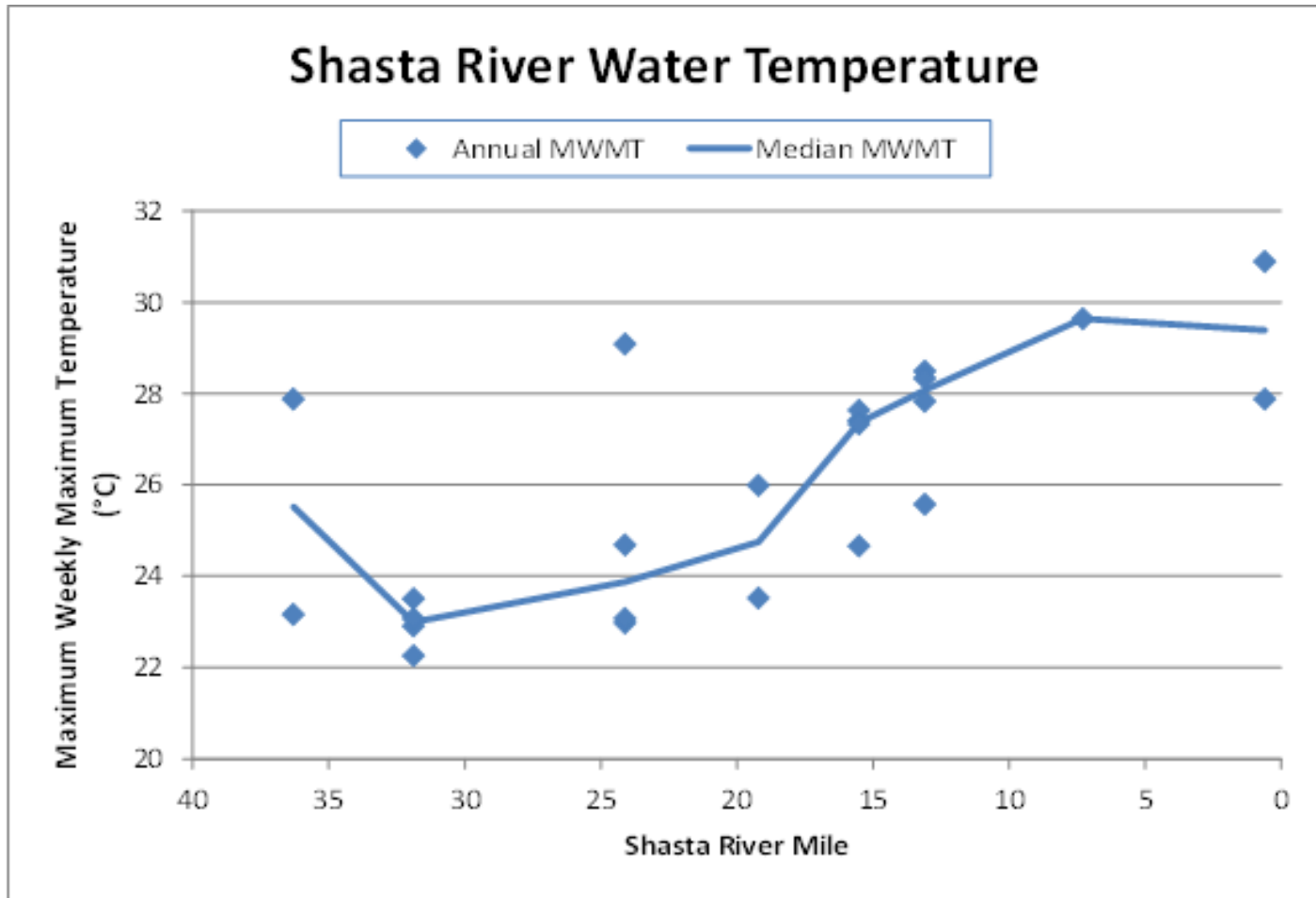
TMDL Targets

Compliance Locations	TMDL Target 5-day Mean of Daily Maximum Temperatures (°C)	Year	Percentage of Measurements that Exceed the TMDL Target
Shasta River Mile 15.5	17.49	2007	85%
		2008	91%
		2009	85%
		2010	64%
		2011	88%
		2012	90%
		2013	94%
Shasta River Mile 24.1	16.71	2010	66%
		2011	88%
		2012	100%
		2013	95%

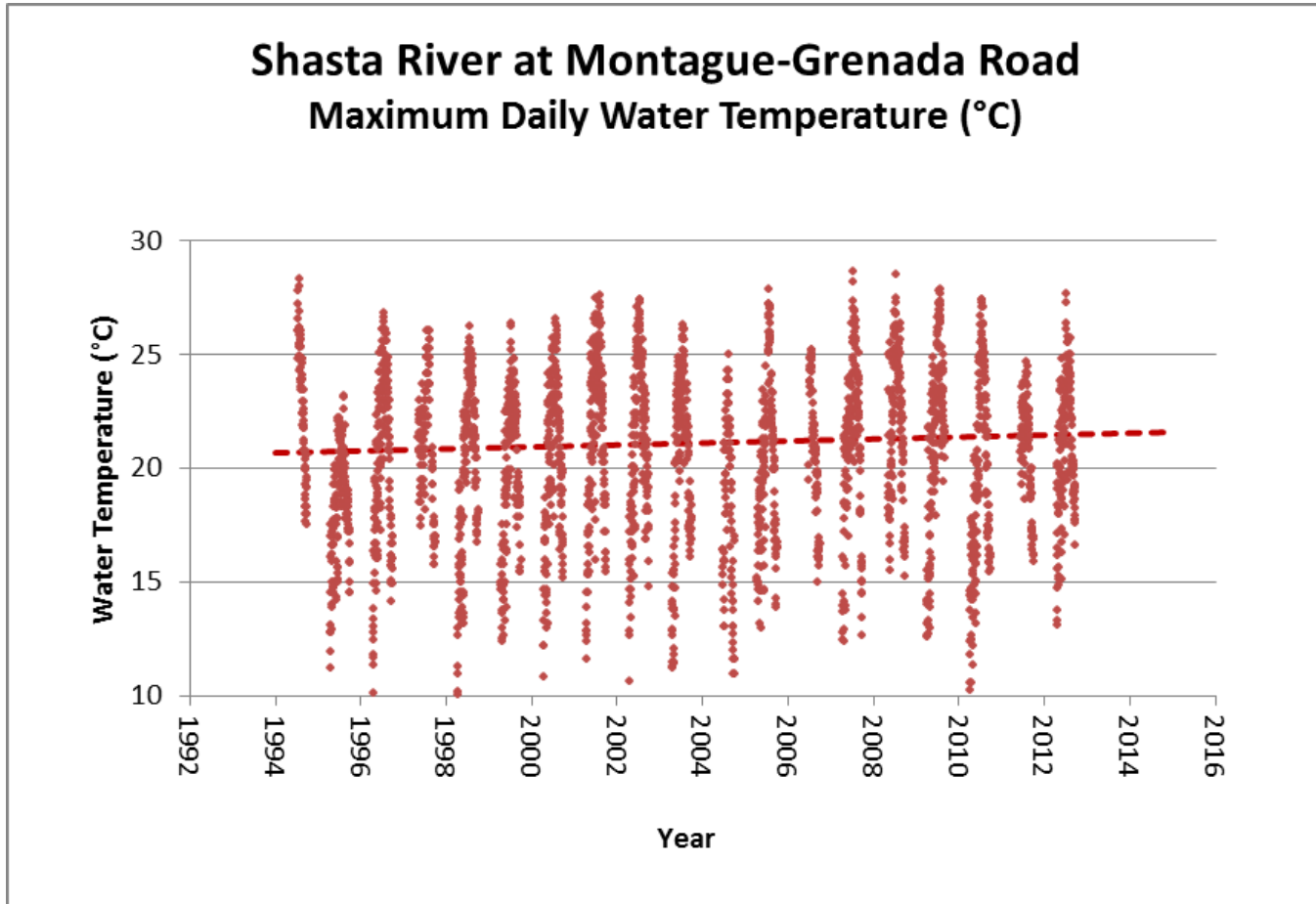
TMDL Targets are Modeled Estimates needed to meet the Narrative Objective of Basin Plan

“Natural receiving water temperatures shall not be altered”

Spatial Trend



Temporal Trend





Temporal Trend

Seasonal-Kendall Trend Test

- Nonparametric - Distribution Free
- Accounts for seasonal changes in temperature
- Significance Threshold: $p \leq 0.05$

Meteorological Influences

- Removed effect of any meteorological trends
 - For example, increasing trend in air temperature may hide improvements resulting from implementation activities
- Applied trend tests to residuals of multivariate nonlinear regressions using meteorological measurements
- Air Temperature was the meteorological variable that most influenced water temperatures.

Temporal Trend

No Statistically Significant Trends were Observed

Shasta River Mile	Probability of a Trend		
	Ambient Measurements		Normalized for Meteorological Influence
	Daily Maximum Water Temperature	MWMT	Daily Maximum Water Temperature
0.6	0.17	0.07	0.76
13.1	0.99	0.23	0.71
15.5	0.64	0.36	0.91
0.7	0.54	0.73	0.48
24.1	0.17	0.12	0.17
31.9	0.44	0.45	0.08

Trends are statistically significant if probability value are less than or equal to 0.05



Summary

- **Conducted an exploratory analysis of existing data**
- **Results advised development of a status and trend Monitoring Plan for the watershed**
- **Assessment identified the clear need to establish and maintain a basin-wide water quality monitoring network**
- **Monitoring elements in a phased approach**
 - **Builds in flexibility while maintaining a consistent long-term network in an intermittent funding climate**



Contact Information

For more information or to participate on document review team:

Karen Mallory

Shasta Valley Resource Conservation District

mnkmallory@sbcglobal.net

(530) 598-1458

Steve Butkus

North Coast Regional Water Quality Control Board

sbutkus@waterboards.ca.gov

(707) 576-2834