



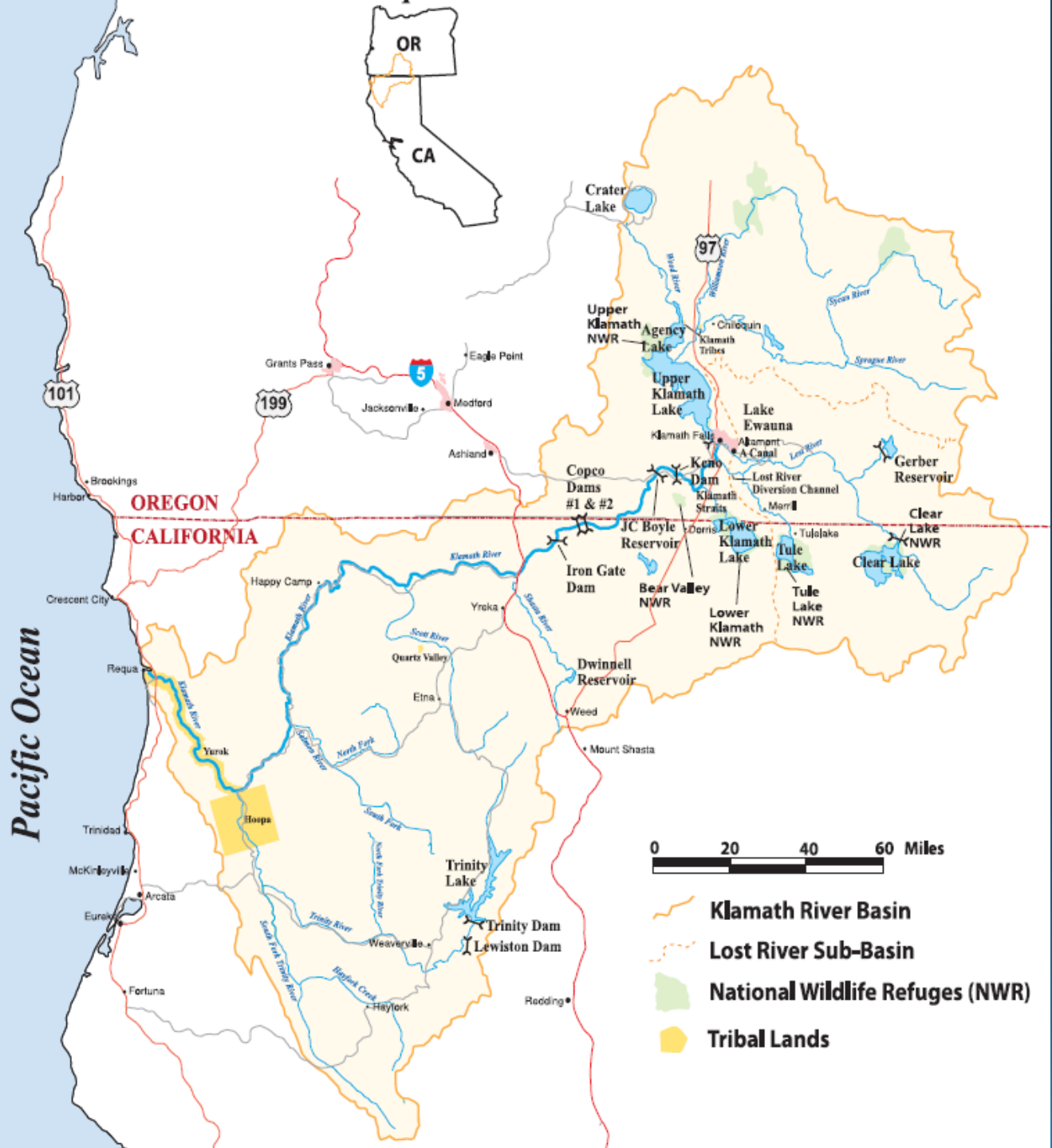
# EPA Collaborations with tribes to address Harmful Algal Blooms (HABs) in the Klamath River Basin

**Susan Keydel, U.S. EPA Region 9, Water Division**  
for EPA Tribal Science Webinar Series, April 11, 2017

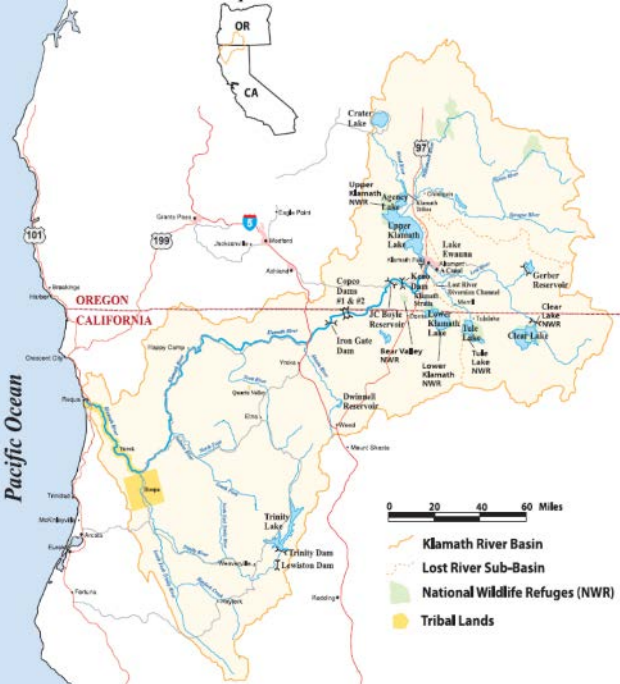
# Klamath River Basin

15,000 sq miles  
2 states  
5 Major Tributaries

6 tribes  
Klamath Tribes  
Quartz Valley Indian Reservation  
Karuk  
Hoopa Valley  
Yurok  
Resighini Rancheria



Numerous complex issues  
**Agriculture and ranching**  
- primarily in upper Basin



# Numerous complex issues

## 6 Dams

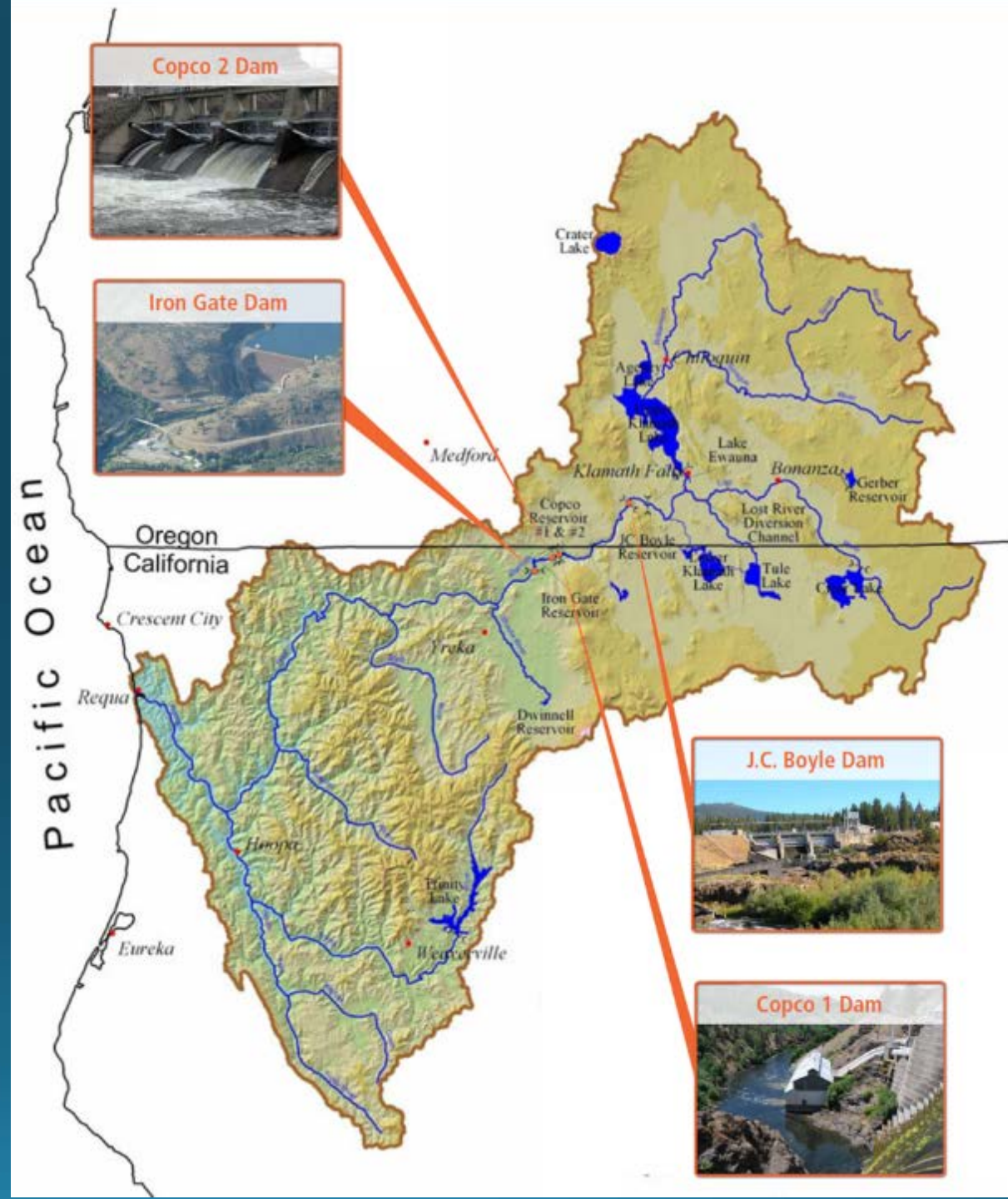
Klamath Project (BoR Irrigation)

Klamath Hydroelectric Project (PacifiCorp)

- FERC license expired in 2006

## Water quality effects of Dams

- No fish passage
- Thermal gain in reservoirs
- Seasonal nutrient “sink”
- Cyanobacteria blooms
- Downstream WQ, habitat and flow impacts



# Numerous complex issues

## Fisheries and ESA

Historically, Klamath 3<sup>rd</sup> largest West Coast salmon fishery, supporting tribal, commercial and recreational fisheries

### Threatened and Endangered Fish Species

- Salmon (Coho and Chinook) – NOAA lead
- Sucker (Lost River and shortnose) – USFWS lead

### Impacts -

- Fish growth, spawning, migration (range and timing), disease and mortality
- Significant declines in anadromous fish populations



Coho salmon



Lost River and shortnose sucker

Numerous complex issues

## Drought and Fisheries Crisis of 2001/2002

2001

- ESA flow minimums set
- Ag deliveries cut in Project

2002

- Summer Drought
- Water deliveries resumed
- 33,000-68,000 returning adult chinook salmon died

Beginning 2006

- Closures of commercial fishery for 700 miles of CA & OR coast
- >\$100 million annual lost revenue



# Numerous complex issues

## Harmful Algal Blooms (HABs)

### First detected

- 2005 - Copco reservoir

### Public Health postings

- Reservoirs
- River Below dams
- River downstream to estuary
- 2015 & 2016 – posted from Upper Klamath Lake to estuary







EPA involvement

# Water Quality Standards, Assessments and TMDLs

**CA's 2006 303(d) List** - microcystins added for Klamath River reach with reservoirs (2008)

**Hoopa Valley Tribe WQ Standards** - standards for microcystins & *Microcystis* approved (2008)

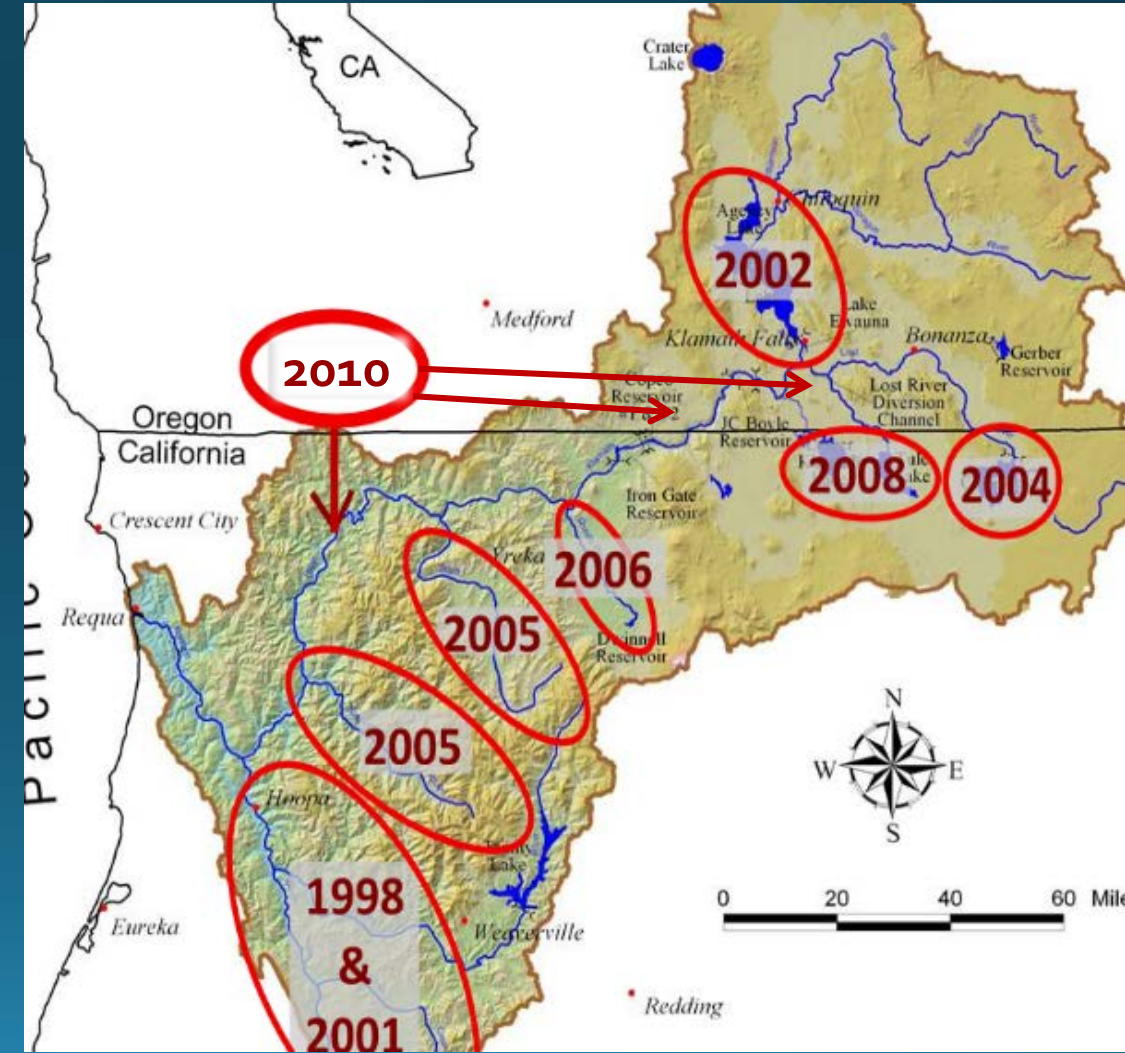
**TMDLs completed / approved**

## Oregon

- Sprague, Williamson, Upper Klamath Lake, 2002 (temp, DO, pH, Chl(a))
- Lost River, 2010 (pH, NH<sub>3</sub>, DO, temp)
- Klamath, 2010 (pH, NH<sub>3</sub>, DO, temp, Chl(a))

## California

- Trinity S. Fork, 1998 (sed);
- Trinity, 2001 (sed)
- Salmon, 2005 (sed, temp)
- Scott, 2005 (sed, temp)
- Shasta, 2006 (DO, temp)
- Lost, 2008 (nutrients, pH)
- Klamath, 2010 (nutrients, temp & organic enrichment /low DO)



# EPA involvement

# Support HABs assessment

## Funding

- Tribal 106
- GAP supplemental funds for tribal WQ consortium

## Microcystins analysis (by ELISA)

- 2005 - present
- Tribal WQ consortium monitoring
- Public health monitoring (settlement)
- Data reported to public list-serve

## Anatoxin-a analysis by LC/MS/MS

- for Yurok in 2016 (EPA ORD Las Vegas lab)



## United States Environmental Protection Agency Region 9 Laboratory

1337 S. 46th Street, Building 201, Richmond, CA 94804  
Phone: (510) 412-2300 Fax: (510) 412-2302

<b>Project Manager:</b> Susan Keydel	<b>Standards and TMDL Office</b>	<b>SDG:</b> 13253C
<b>Project Number:</b> R13W04	<b>75 Hawthorne Street</b>	<b>Reported:</b> 09/16/13 12:33
<b>Project:</b> Klamath River 2013	<b>San Francisco CA, 94105</b>	

### Sample Results

Analyte	Reanalysis / Extract	Result	Qualifiers / Comments	Quantitation Limit	Units	Batch	Prepared	Analyzed	Method
Lab ID: 1309006-01 Sample ID: SD090413-SG Microcystin		6.8		1.8	ug/L	B13I075	09/13/13	09/13/13	Water - Sampled: 09/04/13 11:36 Microcystin by ELISA
Lab ID: 1309006-03 Sample ID: HC090413-SG Microcystin		0.64		0.18	ug/L	B13I030	09/06/13	09/06/13	Water - Sampled: 09/04/13 09:31 Microcystin by ELISA
Lab ID: 1309006-04 Sample ID: BB090413-SG Microcystin		2.2		0.18	ug/L	B13I030	09/06/13	09/06/13	Water - Sampled: 09/04/13 10:52 Microcystin by ELISA
Lab ID: 1309006-05 Sample ID: OR090413-SG Microcystin		0.57		0.18	ug/L	B13I030	09/06/13	09/06/13	Water - Sampled: 09/04/13 08:23 Microcystin by ELISA
Lab ID: 1309006-06 Sample ID: SV090413-SG Microcystin		1.0		0.18	ug/L	B13I030	09/06/13	09/06/13	Water - Sampled: 09/04/13 10:17 Microcystin by ELISA
Lab ID: 1309009-01 Sample ID: KR13872 Microcystin		22,000		1,800	ug/L	B13I030	09/06/13	09/06/13	Water - Sampled: 09/02/13 12:30 Microcystin by ELISA
Lab ID: 1309009-02 Sample ID: KR13873 Microcystin		97,000		18,000	ug/L	B13I030	09/06/13	09/06/13	Water - Sampled: 09/02/13 10:40 Microcystin by ELISA
Lab ID: 1309009-03 Sample ID: KR13874 Microcystin		84		18	ug/L	B13I075	09/13/13	09/13/13	Water - Sampled: 09/02/13 11:20 Microcystin by ELISA
Lab ID: 1309009-04 Sample ID: KR13875 Microcystin		1,900		180	ug/L	B13I030	09/06/13	09/06/13	Water - Sampled: 09/02/13 11:40 Microcystin by ELISA
Lab ID: 1309009-05 Sample ID: KR13876 Microcystin		6.9		1.8	ug/L	B13I030	09/06/13	09/06/13	Water - Sampled: 09/02/13 11:50 Microcystin by ELISA

EPA involvement

# Support HABs assessment

## Equipment to characterize HABs

- Where is it? Only at the surface? How thick? Does it move diurnally?
- Can we measure Phycocyanin or Chlorophyll as a surrogate for cell counts or microcystins?

## Sondes with Phycocyanin probes

## Autosamplers for 24-hour collection

## Deployed Bob-e in Iron Gate Reservoir

- one sonde going up and down on a winch.
- profile HABs for depth, temperature, DO, phycocyanin, etc.



# EPA involvement - Support KBMP - meetings, monitoring and Blue-Green algae Tracker

<http://www.kbmp.net/bga>

## Klamath Basin Monitoring Maps

Maps are developed by the Klamath Basin Monitoring Program (KBMP) in partnership with a variety of organizations who collect water quality and related data.

2014 Monitoring Locations

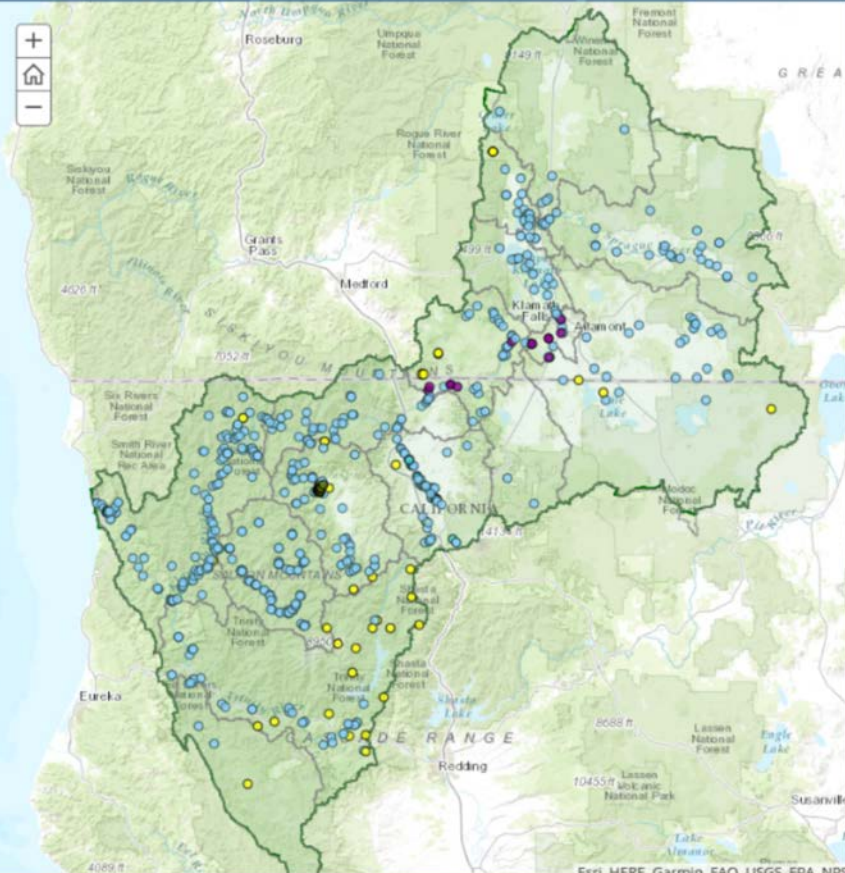
2014 Real-Time Monitoring Locations

Klamath River Blue-Green Algae Tracker

Fish Health Readiness Level (KFHA)

Many KBMP member organizations monitor water quality and environmental conditions on the Klamath River and its tributaries. This map identifies 2014 monitoring locations for our partners within the Klamath Basin. Click on any station to find out what data is being collected and link to each monitoring organizations website.

With a coordinated monitoring network and data sharing, scientists strive to characterize sources of impairment within these watersheds. KBMP monitoring supports the stewardship, protection, and restoration of all beneficial uses within the Klamath River watershed, with the ultimate goal of restoring water quality.



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2014 Monitoring Locations

2014 Real-Time Monitoring Locations

Klamath River Blue-Green Algae Tracker

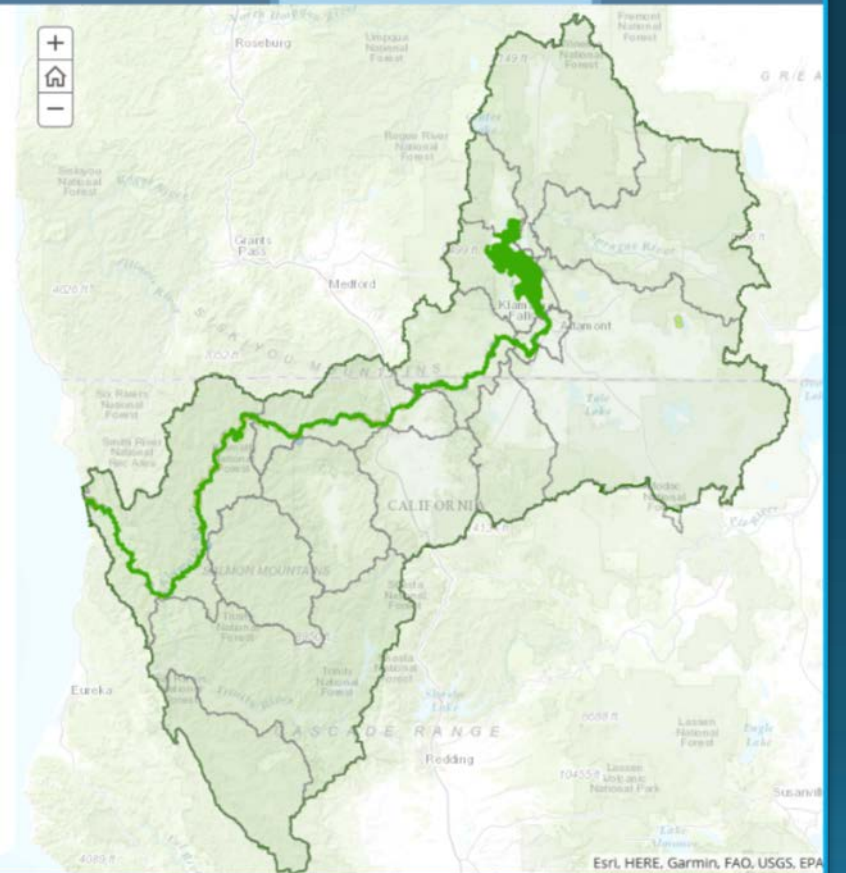
Fish Health Readiness Level (KFHA)

The Blue-Green Algae Tracker was built to inform the public and research community regarding river conditions.

The Tracker utilizes current information to track and map the blue-green algae blooms throughout the Klamath Basin.

The Blue-Green Algae Tracker identifies blue-green algae public health threats (i.e. exceeds health thresholds identified by state or tribal voluntary guidelines) by river segments bounded by public health monitoring locations. River reaches which exceed California, Oregon, or Yurok Tribe criteria for public health are highlighted in RED, ORANGE, or YELLOW. Reaches that do not exceed state or tribal criteria are GREEN.

Click on the links below to learn more about [Blue-Green Algae](#) or see the latest [Blue-Green Algae Public Health memos](#).



EPA involvement –

## Trinity River bloom → threat to Hoopa Valley Drinking Water

- Bloom producing anatoxin and microcystins upstream of DW system intake → source water contamination
- Threat of DW treatment system breakthrough to distribution system.
- EPA provided Drinking Water Tribal Set-Aside funds to improve the system
  - \$371,700 grant
  - UV and hydrogen peroxide proposed



# EPA involvement – Yurok STAR Grants → Science to Achieve Results

• July 2008 - December 2013

• April 2014 - March 2017

## Understanding the Cumulative Affects of Environmental and Psycho-Social Stressors that Threaten the *Pohlik-lah* and *Ner-er-ner* Lifeway: The Yurok Tribe's Approach

**EPA Grant Number:** R833708

**Title:** Understanding the Cumulative Affects of Environmental and Psycho-Social Stressors that Threaten the *Pohlik-lah* and *Ner-er-ner* Lifeway: The Yurok Tribe's Approach

**Investigators:** [Sloan, Kathleen](#)

**Current Investigators:** [Sloan, Kathleen](#), [Fluharty, Suzanne](#), [Steinberg, Steven J.](#), [Steinberg, Sheila](#)

**Institution:** [Yurok Tribe Environmental Program](#)

**Current Institution:** [Yurok Tribe Environmental Program](#), [Humboldt State University](#)

**EPA Project Officer:** [McOliver, Cynthia](#)

**Project Period:** July 1, 2008 through December 31, 2012 (Extended to December 31, 2013)

**Project Amount:** \$974,389

**RFA:** Issues in Tribal Environmental Research and Health Promotion: Novel Approaches for Assessing and Managing Cumulative Risks and Impacts of Global Climate Change (2007) [RFA Text](#) | [Recipients Lists](#)

**Research Category:** [Environmental Justice](#), [Global Climate Change](#), [Tribal Environmental Health Research](#), [Health](#), [Climate Change](#)

### Objective:

1. Identify the chemical stressors associated with coastal & river subsistence resources
2. Identify the common mechanism groups (CMG) pathways & routes of exposure
3. Evaluate potential links between a focal CMG and Yurok Tribal Members' health
4. Develop measures and policies to reduce contributions of chemical stressors from identifiable sources and decrease exposures that are not related to subsistence activities

### Approach:

The Tribe is requesting phased support of this proposal, with the first year of funding to support the scoping, planning and preliminary

### Project Research Results

- [Final Report](#)
- [2013 Progress Report](#)
- [2012 Progress Report](#)
- [2011 Progress Report](#)
- [2010 Progress Report](#)
- [2009 Progress Report](#)
- [2008 Progress Report](#)

[17 publications for this project](#)

### Related Information

- [Research Grants](#)
- [P3: Student Design Competition](#)
- [Research Fellowships](#)
- [Small Business Innovation Research \(SBIR\)](#)
- [Grantee Research Project Results Search](#)

## Identifying, Assessing and Adapting to Climate Change Impacts to Yurok Water and Aquatic Resources, Food Security and Tribal Health

**EPA Grant Number:** R835604

**Title:** Identifying, Assessing and Adapting to Climate Change Impacts to Yurok Water and Aquatic Resources, Food Security and Tribal Health

**Investigators:** [Fluharty, Suzanne](#), [Cozzetto, Karen](#)

**Institution:** [Yurok Tribe Environmental Program](#), [Northern Arizona University](#)

**EPA Project Officer:** [McOliver, Cynthia](#)

**Project Period:** July 1, 2014 through June 30, 2017

**Project Amount:** \$908,965

**RFA:** Science for Sustainable and Healthy Tribes (2013) [RFA Text](#) | [Recipients Lists](#)

**Research Category:** [Tribal Environmental Health Research](#), [Health](#)

### Objective:

The Yurok Tribe is extremely vulnerable to hydrologic changes resulting from climate change due to their geographic location and continued reliance on surface waters and aquatic resources by tribal members. The study will identify areas of water resource vulnerability and resiliency, assess impacts on Yurok food security and tribal health, and will increase the Tribe's adaptive capacity to prepare and respond to climate change.

### Approach:

The proposed project will conduct a baseline assessment (temperature and flows) of Yurok Reservation surface waters, develop GIS models to identify probable scenarios of future hydrological change impacts in Yurok Ancestral Territory, monitor for climate-related water-borne pathogens and toxins in surface water sources and shellfish, assess impacts on key subsistence resources, food security and tribal member health, develop of a Yurok Climate Change Adaptation Plan for Water and Aquatic Resources, and create a web-based climate change monitoring network design to inform and engage the tribal community in tracking climate-related events that could impact tribal and community health.

### Expected Results:

Expected outputs include: an expanded YTEP water quality and public health monitoring network, GIS layers and maps modeling a range of

### Project Research Results

- [2016 Progress Report](#)
- [2015 Progress Report](#)

[7 publications for this project](#)

### Related Information

- [Research Grants](#)
- [P3: Student Design Competition](#)
- [Research Fellowships](#)
- [Small Business Innovation Research \(SBIR\)](#)
- [Grantee Research Project Results Search](#)

# EPA R9 involvement in Klamath Basin

- Klamath tribes are leaders in addressing the numerous issues in the Basin
- EPA involvement at request of tribes
- EPA Activities
  - Address EPA's mission- Protect human health and environment, Tribal Trust responsibilities
  - Support EPA R9 Priorities and Priority Watersheds
  - Facilitate coordination with federal agencies (e.g. US Forest Service on postings on FS lands)
- EPA has worked to carve out resources to provide technical assistance, analytical and monitoring support, and other support for tribal work.

EPA R9 has similarly carved out support to tribes in other Priority Watersheds:

- Clear Lake – technical assistance; analytical support of Microcystins, facilitate coordination with other federal programs
- CRIT and Chemehuevi – support with installing Floating Islands to address nutrient and HAB impacts

# Thank you *Questions?*

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