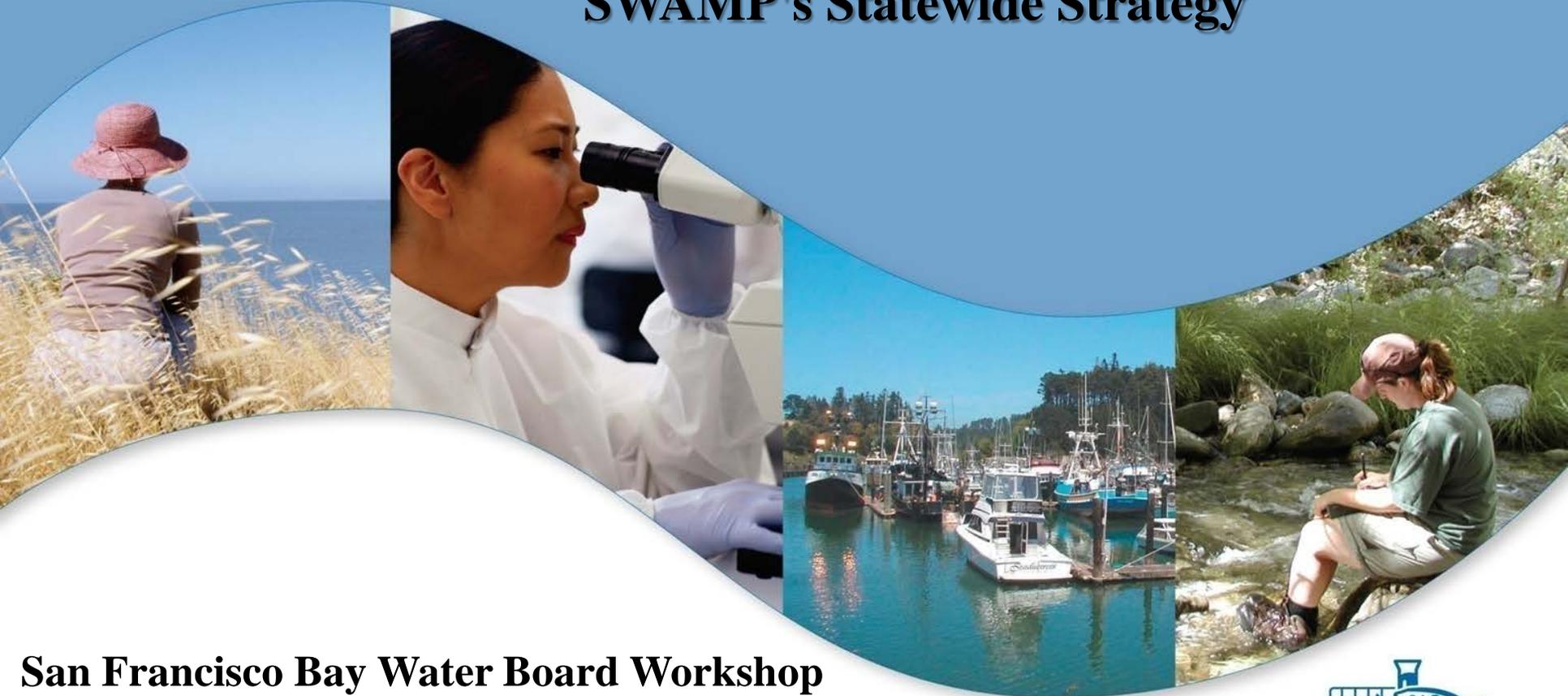


# California's Surface Water Ambient Monitoring Program (SWAMP)

## Freshwater Harmful Algal Blooms (HABs) in California and SWAMP's Statewide Strategy

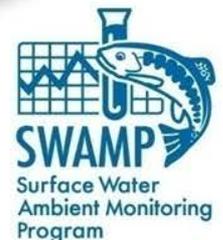


**San Francisco Bay Water Board Workshop**

Beverley Anderson-Abbs

SWAMP – OIMA

[Bev.Anderson-Abbs@waterboards.ca.gov](mailto:Bev.Anderson-Abbs@waterboards.ca.gov)





# Why California needs a Freshwater Harmful Algal Bloom (HAB) Strategy

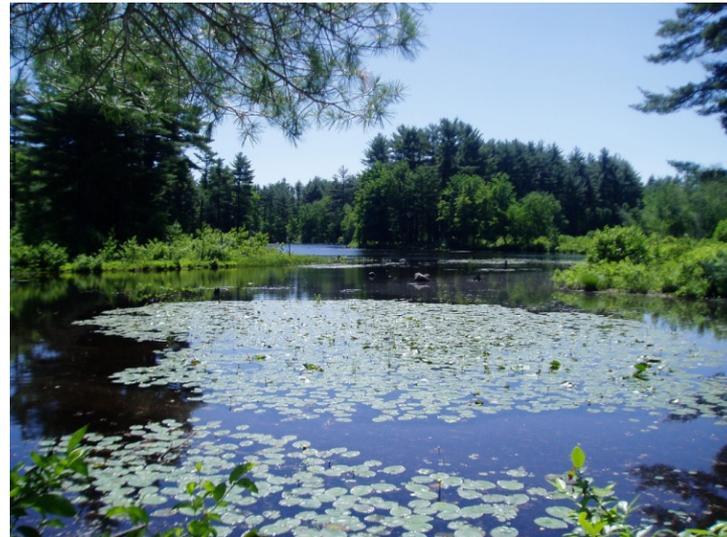
- HABs increasing worldwide and in California
  - Increasing water temperatures
  - High nutrient concentrations
  - Drought – less water, low flows
- HABs create significant water quality issues



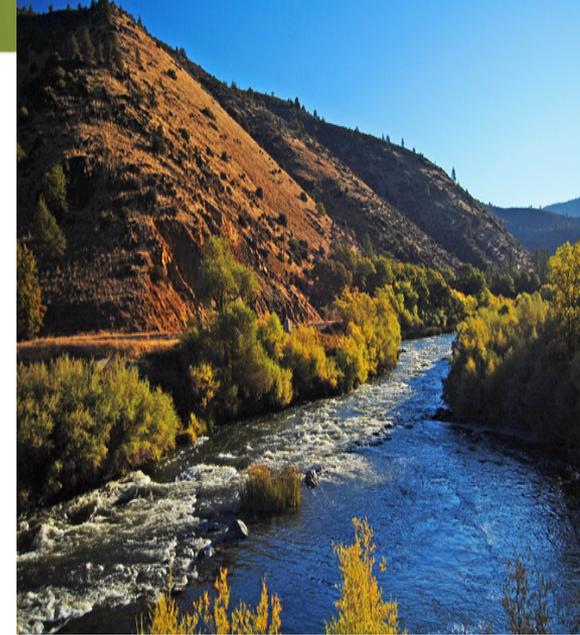


Lakes

# Where are they?



Wetlands



Rivers and streams



Estuaries



Marine waters

# Microcystis

- Most common toxic cyanobacteria
- Produces microcystins
- Microcystin human health thresholds
  - OEHHA recreation = 0.8 ug/L
  - USEPA drinking water = 0.3 ug/L



Toxin	Chemical Class	Action	Effect	Reference	Producing Species
<b>Microcystins</b>	Cyclic heptapeptides; 80 variants; microcystin-LR is most toxic	Serine/threonine protein phosphatase (1 and 2A) inhibitors	Hepatotoxin; damages liver	Mackintosh <i>et al.</i> 1990, Yoshizawa <i>et al.</i> 1990	<b><i>Microcystis aeruginosa</i></b> <i>Planktothrix sp.</i> <i>Phormidium sp.</i> <b><i>Anabaena sp.</i></b> <i>Anabaenopsis sp.</i> <i>Nostoc sp.</i> <i>Oscillatoria limosa</i> <i>Radiocystis sp.</i> <i>Gloeotrichia sp.</i>
<b>Anatoxin-a</b>	Alkaloid	Competitive inhibitor of acetyl choline	Neurotoxins: causes death by respiratory arrest	Devlin <i>et al.</i> 1977, Carmichael <i>et al.</i> 1990, Skulberg <i>et al.</i> 1992	<b><i>Anabaena sp.</i></b> <b><i>Aphanizomenon sp.</i></b> <i>Planktothrix sp.</i> <i>Phormidium sp.</i> <i>Oscillatoria sp.</i> <i>Raphidiopsis sp.</i> <i>Cylindrospermum sp.</i>
<b>Cylindrospermopsin</b>	Cyclic guanidine alkaloid	Protein synthesis inhibitor	Hepatotoxin/ Cytotoxin; affects liver, also kidney, spleen, thymus and heart	Runnegar <i>et al.</i> 1994, Terao <i>et al.</i> 1994, Ohtani <i>et al.</i> 1992	<b><i>Cylindrospermopsis sp.</i></b> <b><i>Anabaena sp.</i></b> <b><i>Aphanizomenon sp.</i></b> <i>Raphidiopsis sp.</i> <i>Umezakia natans</i>

<b>Nodularin</b>	Cyclic pentapeptide; only a few variants identified	Serine/threonine protein phosphatase 1 and 2A inhibitor	Hepatotoxin; damages liver	Yoshizawa <i>et al.</i> 1990	<i>Nodularia sp.</i>
<b>Anatoxin-a (S)</b>	Phosphate ester of cyclic N-hydroxyguanine	Anticholin-esterase	Neurotoxins: causes death by respiratory arrest	Carmichael <i>et al.</i> 1990	<b><i>Anabaena sp.</i></b>
<b>Saxitoxins</b>	Carbamate alkaloids	Sodium channels blocker	Neurotoxin; causes death by respiratory arrest	Sivonen and Jones 1999	<b><i>Anabaena sp.</i></b> <b><i>Aphanizomenon sp.</i></b> <b><i>Cylindrospermopsis sp.</i></b> <i>Lyngbya sp.</i> <i>Planktothrix sp.</i>
<b>BMAA</b>	Non-protein amino acid		Neurotoxin: (Parkinson's Dementia Complex)	Cox <i>et al.</i> 2005	All
<b>Dermato-toxins</b>	Aplysiatoxins	Protein kinase C activators	Dermatotoxin: tumor promoters; dermatitis and intestinal inflammations	Mynderse <i>et al.</i> 1977, Fujiki <i>et al.</i> 1990	<i>Lyngbya sp.</i> <i>Oscillatoria sp.</i> <i>Shizothrix sp.</i>

# Areas in California with Recurrent Toxic Algae Blooms

**Klamath Basin**

**Clear Lake**

**San Francisco Bay area/Delta**

**Pinto Lake/Monterey Bay**

**Southern California  
*Prymnesium* “Golden algae”**

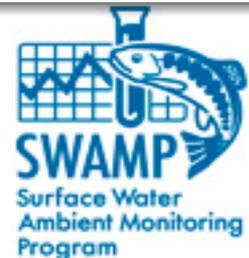
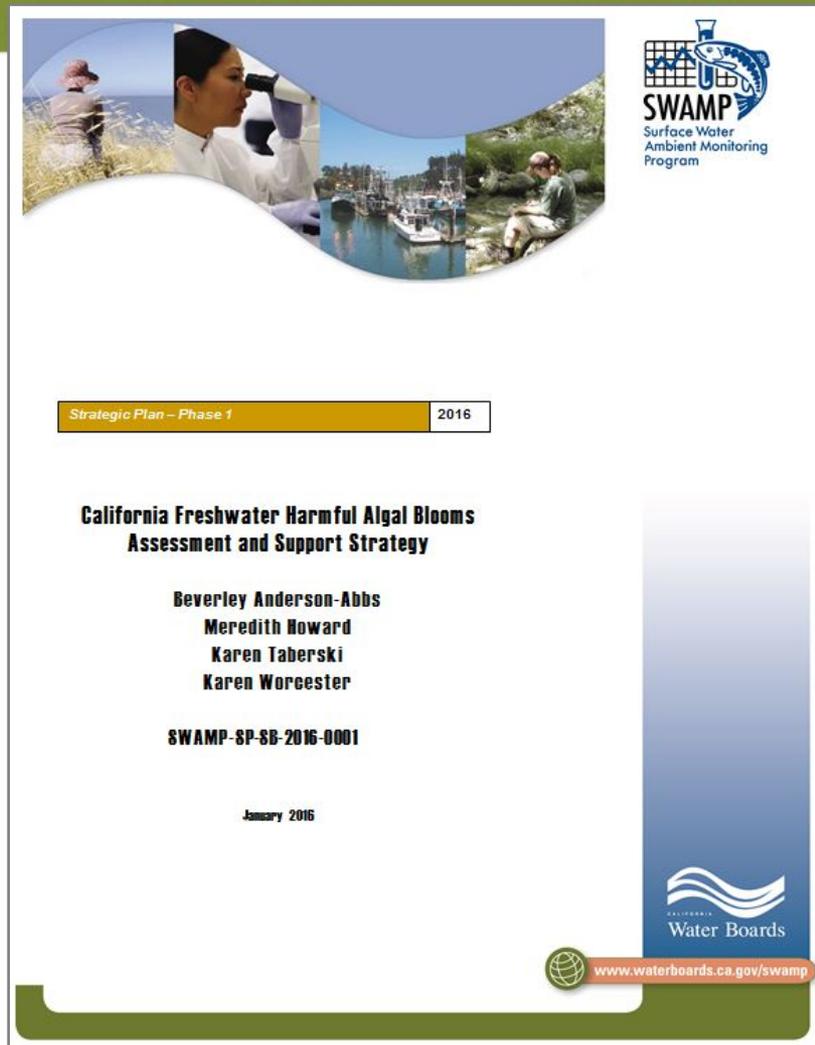


# SWAMPs Freshwater HABs Assessment and Support Strategy

- Goal – articulate a coordinated and widely supported, long-term program to assess, communicate, and manage freshwater HABs



- Ca. CyanoHAB Network (CCHAB) anticipated to coordinate/implement strategy



# Freshwater HABs Assessment and Support Strategy Framework

Response to HAB Events

Ambient Monitoring

Risk Assessment

Immediate  
Event  
Response

Long Term  
Event  
Response

Waterbody  
Monitoring

Infrastructure

Monitor at State  
and Regional Scale

Assess Risk at  
all Scales

Waterbody Scale

State & Regional Scale



# Infrastructure

## Satellite Imagery

- Historic trends
- Notifications
- Bulletin and Newsletter
- Temporal trends

Search Query

Find By Location

Map/Layer Options

### FHAB Warning Status

\* Danger

\* Warning

\* Alert

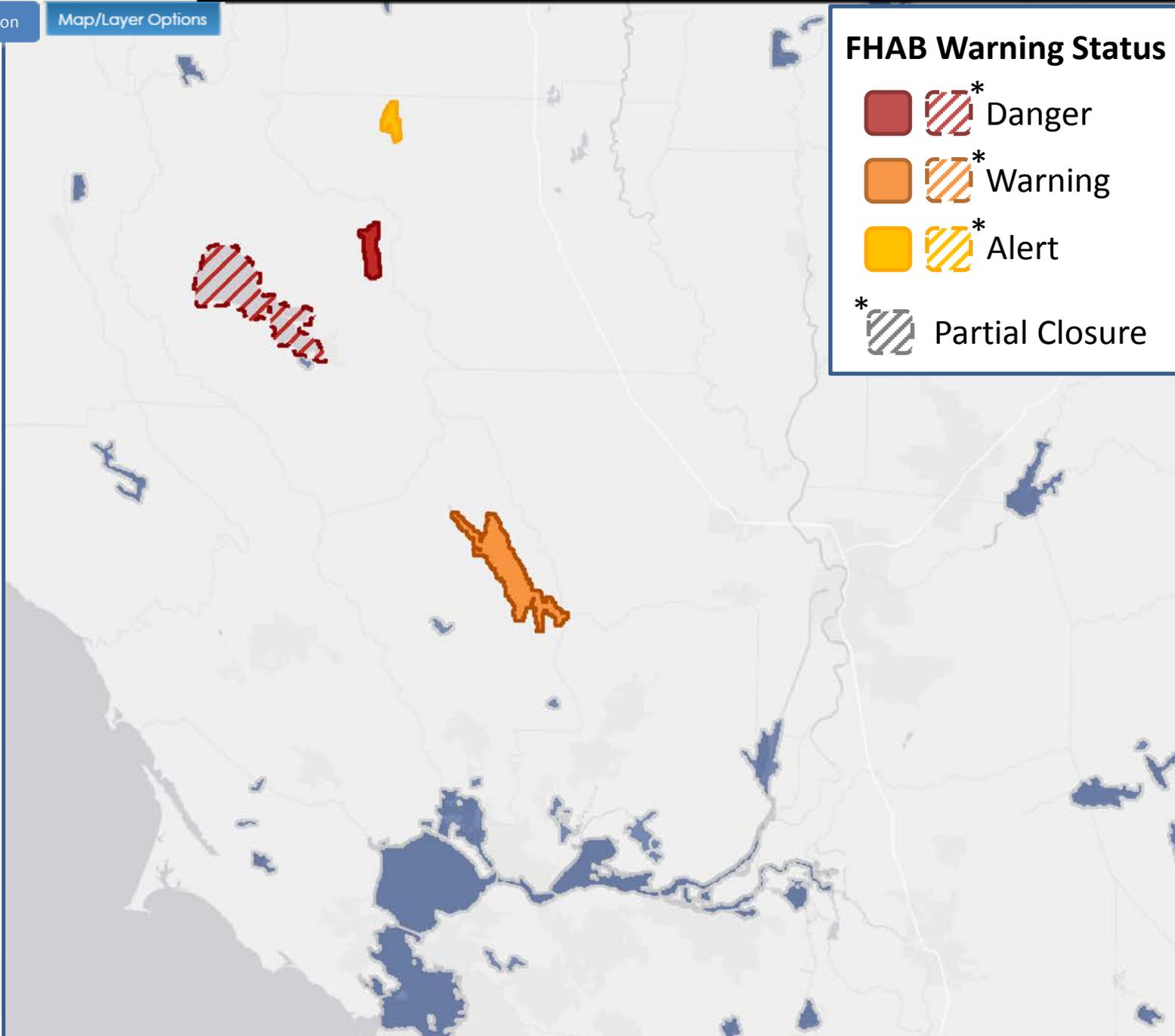
\* Partial Closure

#### Water Board Region 2

- [Anderson Lake](#)
- [Broad Slough](#)
- [Calaveras Reservoir](#)
- [Carquinez Strait](#)
- [Central Bay](#)
- [Laguna Lake](#)
- [Lake Curry](#)
- [Lake del Valle](#)
- [Lake Hennessey](#)
- [Lower South Bay](#)
- [Napa River island slough complex](#)
- [New York Slough](#)
- [Nicasio Reservoir](#)
- [Quarry Lakes](#)
- [Richardson Bay](#)
- [Sacramento River](#)
- [San Antonio Reservoir](#)
- [San Joaquin River](#)
- [San Pablo Bay](#)
- [South Bay](#)
- [Suisun Bay](#)
- [Upper Crystal Springs Reservoir](#)

#### Water Board Region 3

- [San Felipe Lake](#)
- [Hernandez Reservoir](#)
- [Lake San Antonio](#)
- [Nacimiento Reservoir](#)
- [Whale Rock Reservoir](#)
- [Soda Lake](#)
- [Lopez Lake](#)
- [Lake Cachuma](#)



### FHAB Warning Status

 \* Danger

 \* Warning

 \* Alert

\* Partial Closure

**Lake Berryessa**  
Warning Advisory  
In effect

### FHAB Warning Status

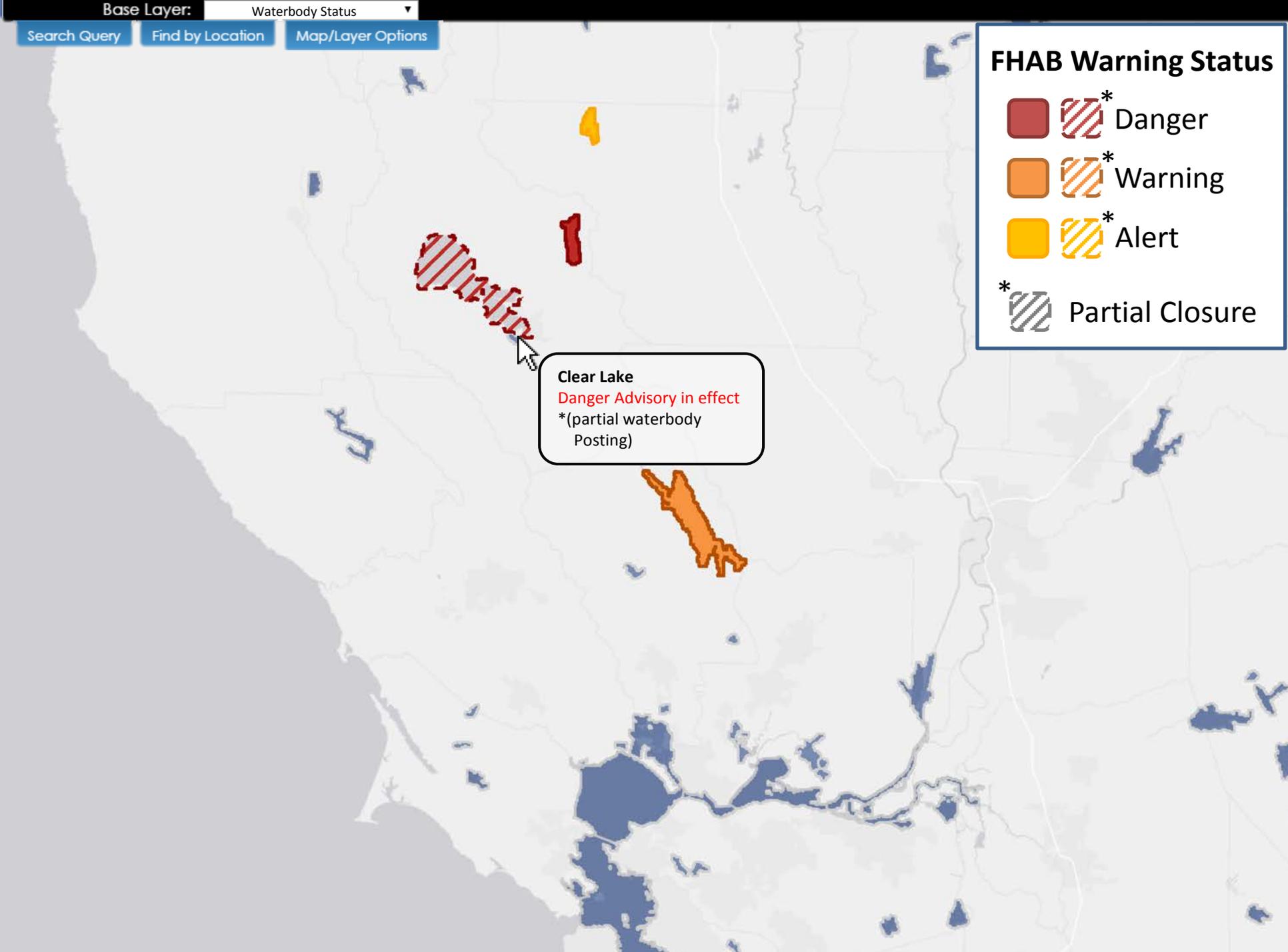
 \* Danger

 \* Warning

 \* Alert

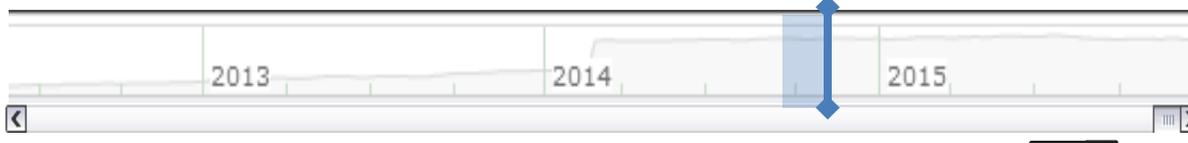
\* Partial Closure

Clear Lake  
Danger Advisory in effect  
\*(partial waterbody Posting)



# Clear Lake, Lake County, CA

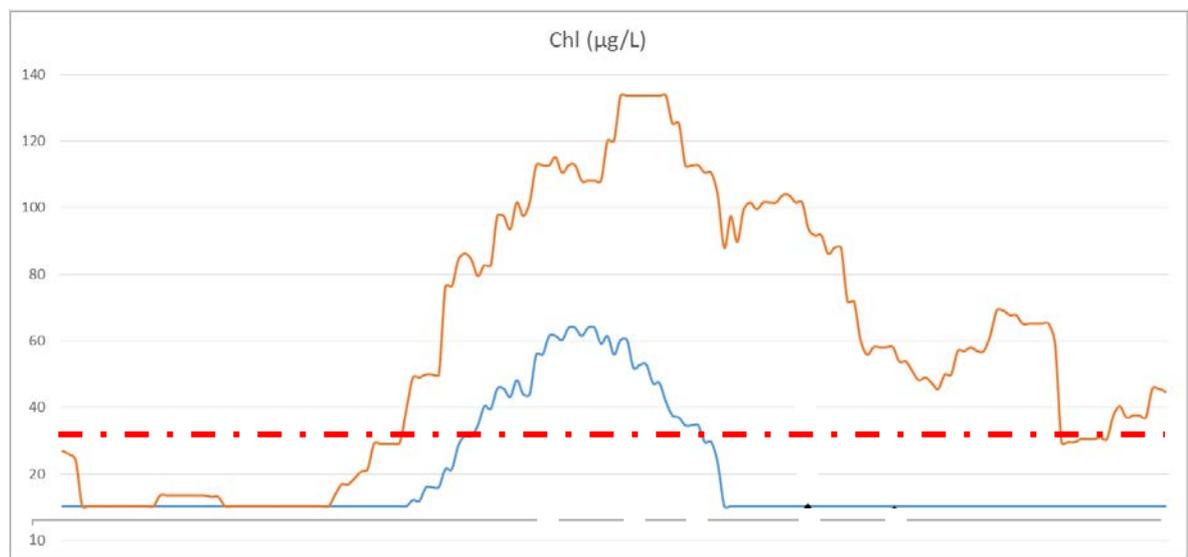
**Current Advisory:** State and county agencies are urging swimmers, boaters and recreational users to avoid contact with blue-green algae now blooming in Clear Lake located in Lake County, CA. The lake has been posted with advisories warning of any contact with the water because of possible toxins associated with the algae. [Read More](#)



Display Last **10** Days

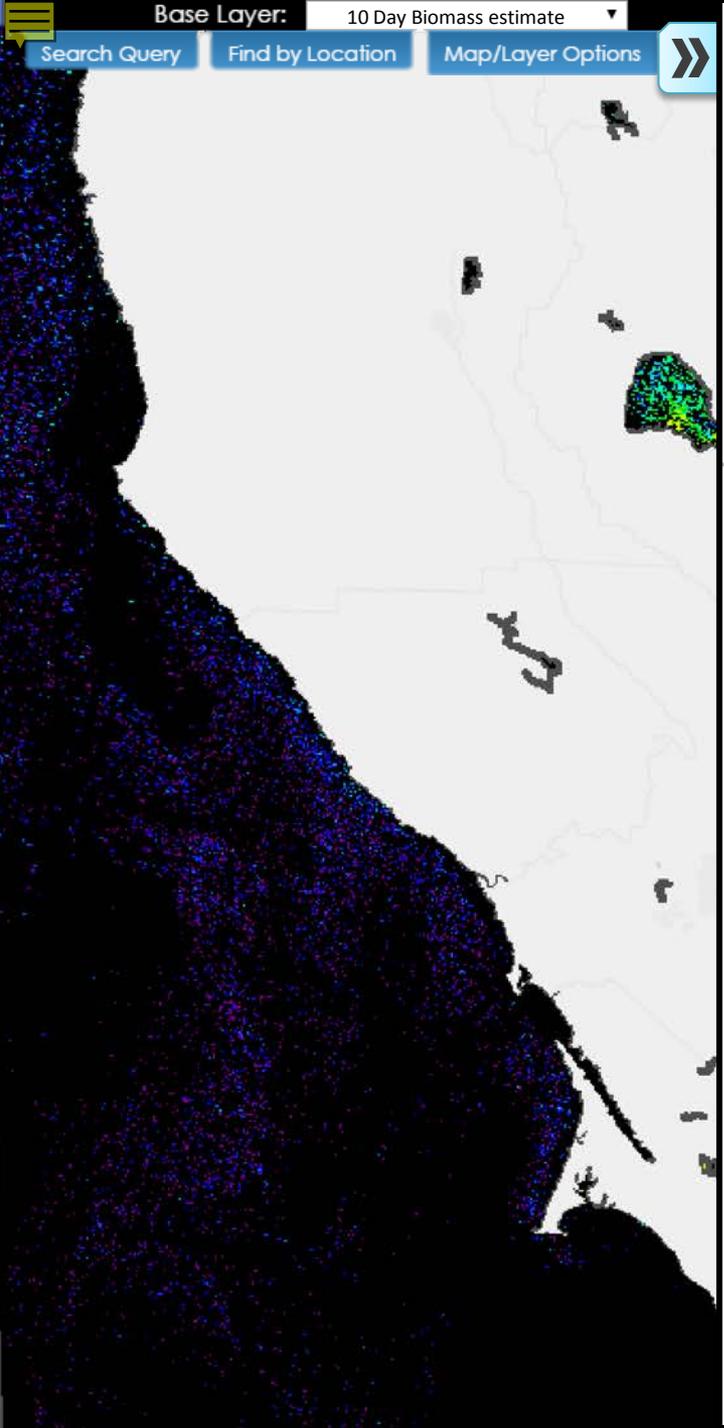
Trends Water Quality Data Table

## Cyanobacteria Estimated Biomass & Toxicity



- . - . Advisory Threshold
- Lake Biomass Mean
- Lake Biomass Median

Clear Lake CEDEN Anilities  Select One



# Clear Lake, Lake County, CA

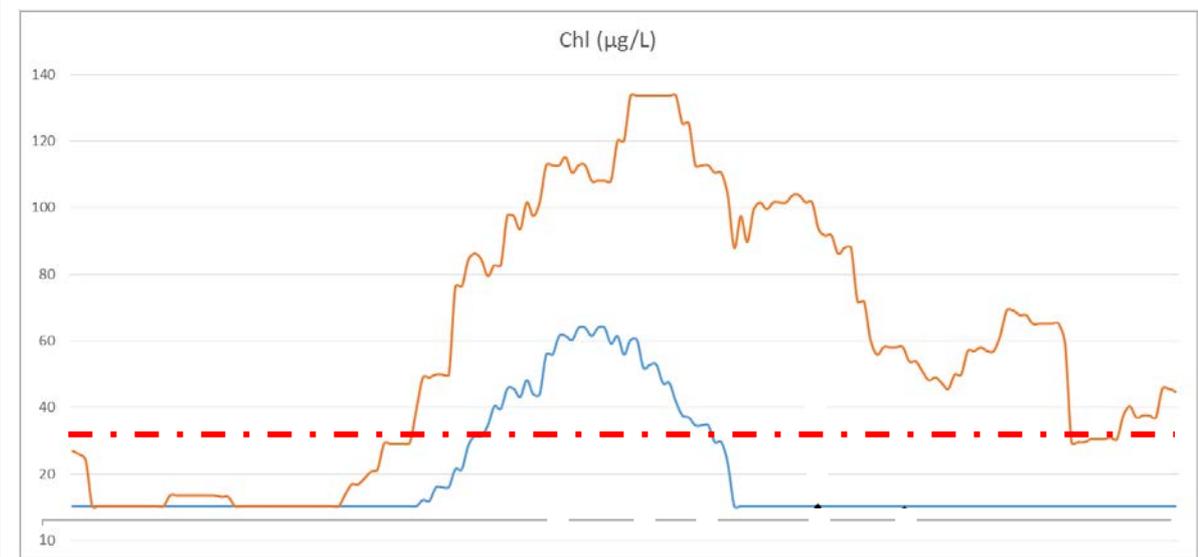
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Display Last **10** Days

Trends Water Quality Data Table

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Clear Lake CEDEN Anilities  
 Select One

# Clear Lake, Lake County, CA

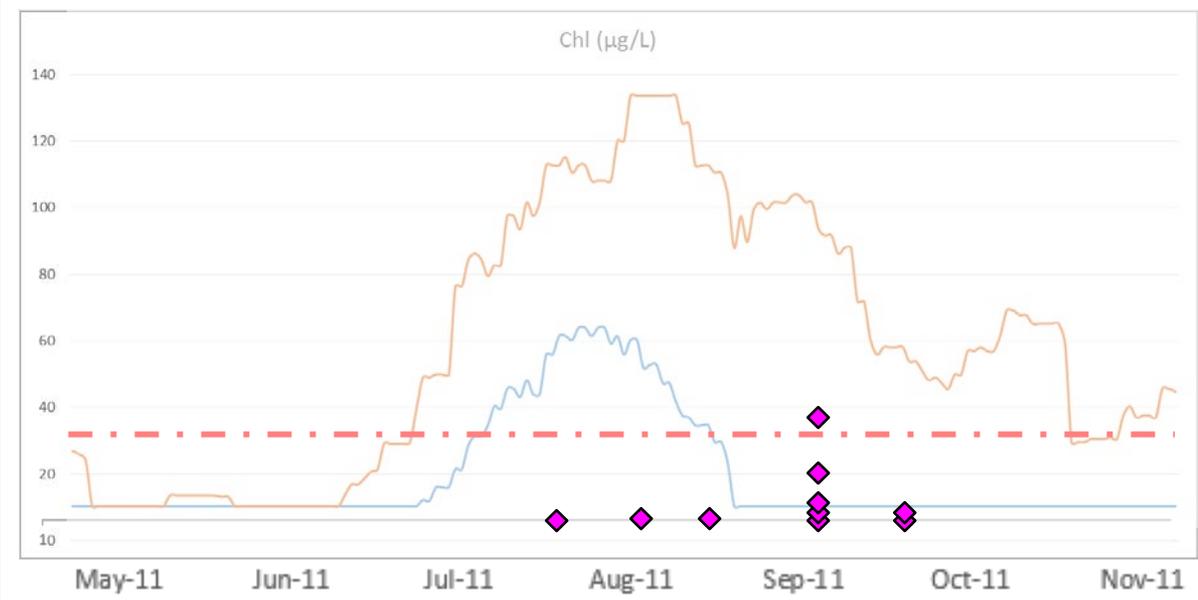
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Display Last **10** Days

Trends Water Quality Data Table

## Cyanobacteria Estimated Biomass & Toxicity



- - - Advisory Threshold
- Lake Biomass Mean
- Lake Biomass Median

Clear Lake CEDEN Anilities

◆ Microcystin Total (ug/L)

◇ CEDEN Sample Location

MERIS 10-Day Composite Biomass Estimate  
May 20, 2014 – May 30, 2014



# Clear Lake, Lake County, CA

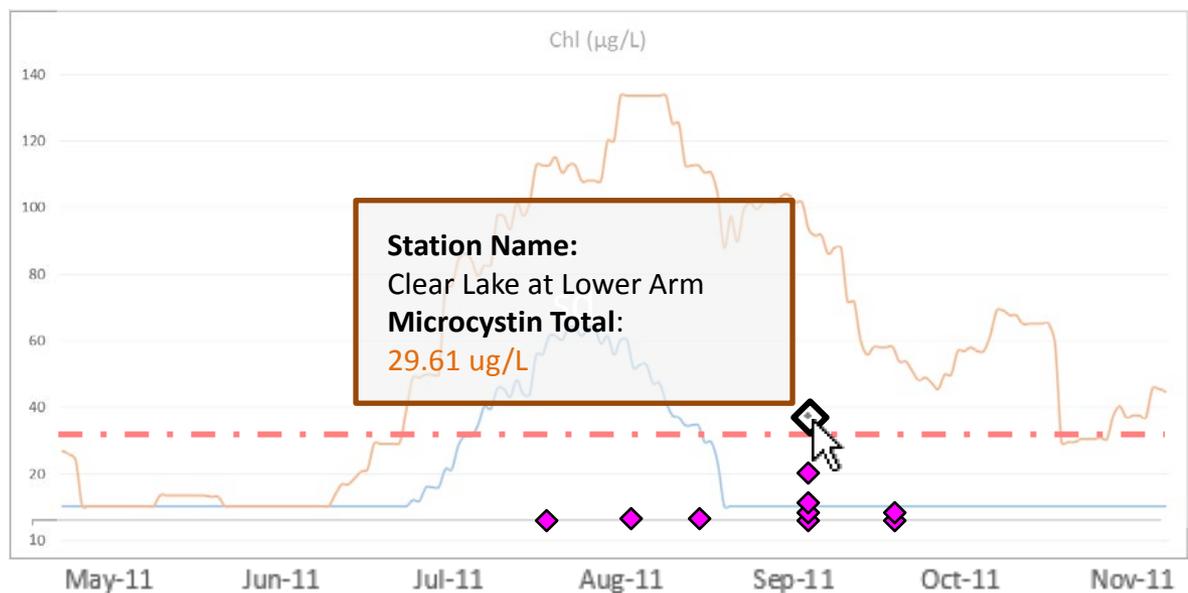
**Current Advisory:** State and county agencies are urging swimmers, boaters and recreational users to avoid contact with blue-green algae now blooming in Clear Lake located in Lake County, CA. The lake has been posted with advisories warning of any contact with the water because of possible toxins associated with the algae. [Read More](#)



Display Last **10** Days

- Trends
- Water Quality
- Data Table

## Cyanobacteria Estimated Biomass & Toxicity



**Station Name:**  
Clear Lake at Lower Arm  
**Microcystin Total:**  
29.61 ug/L

- - - Advisory Threshold
  - Lake Biomass Mean
  - Lake Biomass Median
- Clear Lake CEDEN Anilities
- Microcystin Total (ug/L)

◊ CEDEN Sample Location

MERIS 10-Day Composite Biomass Estimate  
May 20, 2014 – May 30, 2014

# Clear Lake, Lake County, CA

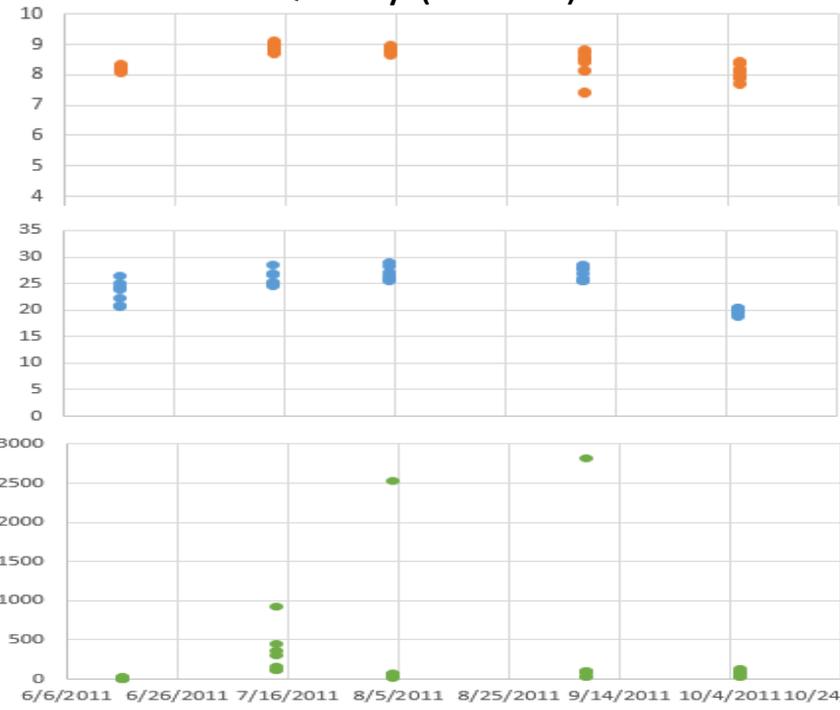
**Current Advisory:** State and county agencies are urging swimmers, boaters and recreational users to avoid contact with blue-green algae now blooming in Spring Lake located in Spring Lake Regional Park in Santa Rosa, CA. The lake has been posted with advisories warning of any contact with the water because of possible toxins associated with the algae. ([Read More](#))



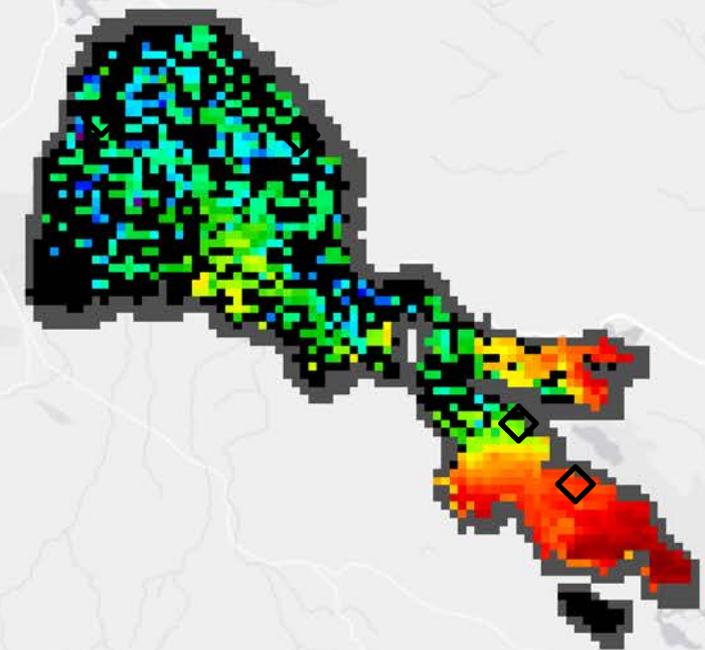
Display Last **10** Days

Trends **Water Quality** Data Table

## Clear Lake Water Quality (CEDEN)



- pH
- Chlorophyll (RFU)
- Temp (C)
- Turbidity
- DO (mg/L)
- SpCond (uS/cm)

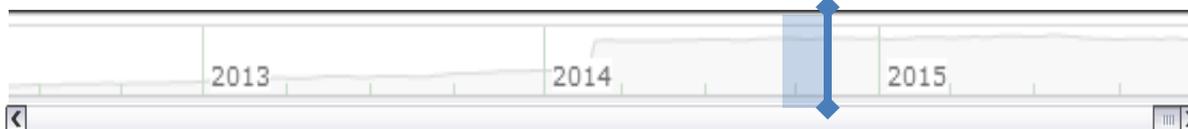


◇ CEDEN Sample Location

MERIS 10-Day Composite Biomass Estimate  
May 20, 2014 – May 30, 2014

# Clear Lake, Lake County, CA

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Trends Water Quality **Data Table**

Select Data for Waterbody x

From Jan 8, 2016 To Feb 8, 2016

Download Table

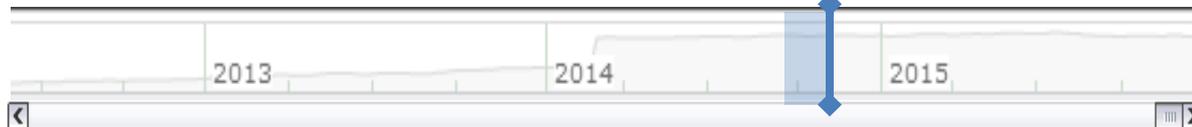
## MERIS Analysis Data

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Pixel Values											ug/L						
2	start_date	end_date	count_1	count_tot	min	max	stdev	median	mean	perc90	var	min	max	stdev	median	mean	perc90	var
3	12/23/2010	1/1/2011	1638	1638	1	176	5	1	1	24	1	10.41	33.02	10.44	10.41	10.41	10.70	10.41
4	12/24/2010	1/2/2011	1638	1638	1	176	5	1	1	24	1	10.41	33.02	10.44	10.41	10.41	10.70	10.41
5	12/25/2010	1/3/2011	1638	1638	1	176	5	1	1	24	1	10.41	33.02	10.44	10.41	10.41	10.70	10.41
6	12/26/2010	1/4/2011	1638	1638	1	176	5	1	1	24	1	10.41	33.02	10.44	10.41	10.41	10.70	10.41
7	12/27/2010	1/5/2011	1638	1638	1	176	5	1	1	24	1	10.41	33.02	10.44	10.41	10.41	10.70	10.41
8	12/28/2010	1/6/2011	1638	1638	1	176	5	1	1	24	1	10.41	33.02	10.44	10.41	10.41	10.70	10.41
9	12/29/2010	1/7/2011	1708	1708	1	176	6	1	1	31	1	10.41	33.02	10.45	10.41	10.41	10.80	10.41
10	12/30/2010	1/8/2011	1708	1708	1	176	6	1	1	31	1	10.41	33.02	10.45	10.41	10.41	10.80	10.41
11	12/31/2010	1/9/2011	1674	1674	1	108	5	1	1	30	1	10.41	14.81	10.45	10.41	10.41	10.80	10.41
12	1/1/2011	1/10/2011	1675	1675	1	123	7	1	1	46	1	10.41	16.79	10.46	10.41	10.41	11.13	10.41
13	1/1/2011	1/11/2011	1675	1675	1	123	7	1	1	46	1	10.41	16.79	10.46	10.41	10.41	11.13	10.41
14	1/2/2011	1/12/2011	1675	1675	1	123	7	1	1	46	1	10.41	16.79	10.46	10.41	10.41	11.13	10.41
15	1/3/2011	1/13/2011	1675	1675	1	123	7	1	1	46	1	10.41	16.79	10.46	10.41	10.41	11.13	10.41
16	1/4/2011	1/14/2011	1675	1675	1	123	7	1	1	46	1	10.41	16.79	10.46	10.41	10.41	11.13	10.41
17	1/5/2011	1/15/2011	1727	1727	1	137	15	1	1	211	3	10.41	19.38	10.55	10.41	10.41	61.53	10.43
18	1/6/2011	1/16/2011	1727	1727	1	137	15	1	1	211	3	10.41	19.38	10.55	10.41	10.41	61.53	10.43
19	1/7/2011	1/17/2011	1727	1727	1	137	15	1	1	211	3	10.41	19.38	10.55	10.41	10.41	61.53	10.43
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21	1/9/2011	1/19/2011	1713	1713	1	147	19	1	1	374	5	10.41	21.80	10.62	10.41	10.41	133.61	10.44
22	1/10/2011	1/20/2011	1698	1698	1	147	19	1	1	368	5	10.41	21.80	10.62	10.41	10.41	133.61	10.44
23	1/11/2011	1/21/2011	1742	1742	1	147	20	1	1	411	6	10.41	21.80	10.63	10.41	10.41	133.61	10.45
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25	1/13/2011	1/23/2011	1746	1746	1	147	21	1	1	431	6	10.41	21.80	10.63	10.41	10.41	133.61	10.45
26	1/14/2011	1/24/2011	1746	1746	1	147	21	1	1	431	6	10.41	21.80	10.63	10.41	10.41	133.61	10.45
27	1/15/2011	1/25/2011	1722	1722	1	147	17	1	1	281	4	10.41	21.80	10.58	10.41	10.41	133.61	10.44
28	1/16/2011	1/26/2011	1731	1731	1	147	24	1	1	562	8	10.41	21.80	10.68	10.41	10.41	133.61	10.47
29	1/17/2011	1/27/2011	1731	1731	1	147	24	1	1	562	8	10.41	21.80	10.68	10.41	10.41	133.61	10.47
30	1/18/2011	1/28/2011	1715	1715	1	146	20	1	1	418	6	10.41	21.54	10.63	10.41	10.41	133.61	10.46
31	1/19/2011	1/29/2011	1715	1715	1	146	20	1	1	418	6	10.41	21.54	10.63	10.41	10.41	133.61	10.46
32	1/20/2011	1/30/2011	1660	1660	1	146	20	1	1	417	6	10.41	21.54	10.63	10.41	10.41	133.61	10.46
33	1/21/2011	1/31/2011	1576	1576	1	146	20	1	1	417	6	10.41	21.54	10.63	10.41	10.41	133.61	10.45



# Clear Lake, Lake County, CA

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Trends

Water Quality

Data Table

Select Data for Waterbody

From Jan 8, 2016

To Feb 8, 2016

Download Table

## Clear Lake CEDEN Data

Station	Sample Date	Collector	Locatic	Coll	Ur	Sa	Cl	Ri	Lab	LabSam	Matrix	Nar	Method	Ni	Analyte	Unit	Result	Observati	MDL	RL	ResultQue	QACode	Batch	Veri	Complian
13LAK0C	9/8/2011	11:25:00	Open	V	0.1	m	Gr	1	1	UCS 110908	sample	Mekebri, †Microcystin-LR, Total	ug/L	29.61	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	9/8/2011	11:25:00	Open	V	0.1	m	Gr	1	1	UCS 110908	sample	Mekebri, †Microcystin-YR, Total	ug/L	11.08	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	9/8/2011	11:25:00	Open	V	0.1	m	Gr	1	1	UCS 110908	sample	Mekebri, †Microcystin-RR, Total	ug/L	3.3	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	10/6/2011	8:56:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-RR, Total	ug/L	2.57	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	10/6/2011	11:50:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-YR, Total	ug/L	2.3	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	10/6/2011	8:56:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-LR, Total	ug/L	2.18	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	10/6/2011	11:50:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-LA, Total	ug/L	2.09	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	10/6/2011	8:56:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-YR, Total	ug/L	1.86	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	10/6/2011	10:39:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-RR, Total	ug/L	1.72	0.2	0.2	0.2	None	VAC,VQI	Qual					
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13LAK0C	10/6/2011	10:39:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-LR, Total	ug/L	1.3	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	10/6/2011	8:56:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-LA, Total	ug/L	1.24	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	9/8/2011	8:40:00	Open	V	0.1	m	Gr	1	1	UCS 110908	sample	Mekebri, †Microcystin-LR, Total	ug/L	1.09	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	9/8/2011	10:10:00	Open	V	0.1	m	Gr	1	1	UCS 110908	sample	Mekebri, †Microcystin-LR, Total	ug/L	0.87	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	10/6/2011	13:05:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-LR, Total	ug/L	0.8	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	10/6/2011	11:50:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-LR, Total	ug/L	0.75	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	9/8/2011	13:30:00	Open	V	0.1	m	Gr	1	1	UCS 110908	sample	Mekebri, †Microcystin-LR, Total	ug/L	0.61	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	8/4/2011	9:00:00	Open	V	0.1	m	Gr	1	1	UCS 110804	sample	Mekebri, †Microcystin-LR, Total	ug/L	0.54	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	8/4/2011	10:11:00	Open	V	0.1	m	Gr	1	1	UCS 110804	sample	Mekebri, †Microcystin-LR, Total	ug/L	0.36	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	10/6/2011	11:50:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-RR, Total	ug/L	0.28	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	8/4/2011	11:13:00	Open	V	0.1	m	Gr	1	1	UCS 110804	sample	Mekebri, †Microcystin-LR, Total	ug/L	0.25	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	6/16/2011	11:05:00	Open	V	0.1	m	Gr	1	1	UCS 110616	sample	Mekebri, †Microcystin-LR, Total	ug/L	0.2	0.2	0.2	0.2	None	VAC,VQI	Qual					
13LAK0C	6/16/2011	15:05:00	Open	V	0.1	m	Gr	1	1	UCS 110616	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	7/14/2011	13:30:00	Open	V	0.1	m	Gr	1	1	UCS 110714	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	8/4/2011	13:50:00	Open	V	0.1	m	Gr	1	1	UCS 110804	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	9/8/2011	14:25:00	Open	V	0.1	m	Gr	1	1	UCS 110908	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	10/6/2011	13:50:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	6/16/2011	11:05:00	Open	V	0.1	m	Gr	1	1	UCS 110616	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	7/14/2011	10:04:00	Open	V	0.1	m	Gr	1	1	UCS 110714	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	8/4/2011	10:11:00	Open	V	0.1	m	Gr	1	1	UCS 110804	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	9/8/2011	10:10:00	Open	V	0.1	m	Gr	1	1	UCS 110908	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	10/6/2011	10:39:00	Open	V	0.1	m	Gr	1	1	UCS 111006	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	6/16/2011	13:56:00	Open	V	0.1	m	Gr	1	1	UCS 110616	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	7/14/2011	12:34:00	Open	V	0.1	m	Gr	1	1	UCS 110714	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	8/4/2011	12:47:00	Open	V	0.1	m	Gr	1	1	UCS 110804	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	9/8/2011	13:30:00	Open	V	0.1	m	Gr	1	1	UCS 110908	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				
13LAK0C	6/16/2011	8:30:00	Open	V	0.1	m	Gr	1	1	UCS 110616	sample	Mekebri, †Microcystin-LA, Total	ug/L	0	0.2	0.2	0.2	ND	None	VAC,VQI	Qual				

◇ CEDEN Sample Location

MERIS 10-Day Composite Biomass Estimate  
May 20, 2014 – May 30, 2014For more advanced CEDEN data downloads visit: <http://ceden.org>

# Infrastructure

## Satellite Imagery

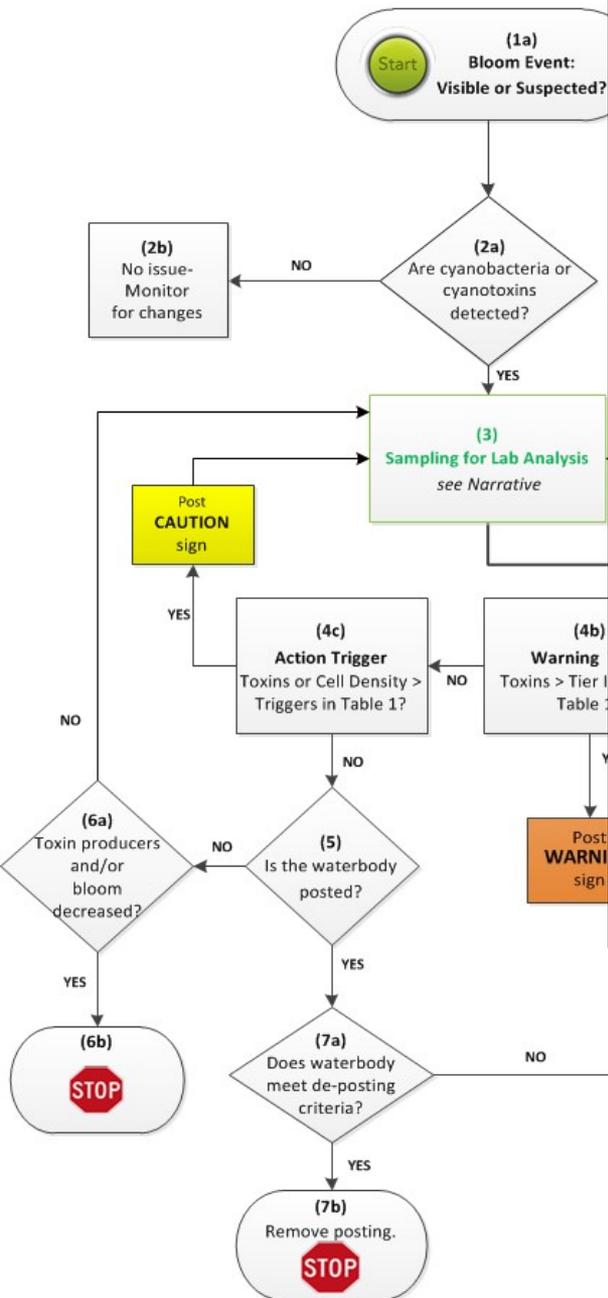
- Historic trends
- Notifications
- Bulletin and Newsletter
- Temporal trends

## Centralized Website and Reporting System

- Data
  - storage
  - visualization
  - access
- CWQMC portal

**Figure 1. Decision Tree for Posting and De-posting Health Advisories for CyanoHABs**

Proposed changes to consider for Voluntary CHAB Guidance (Working Draft)



## Box 2a. Are cyanobacteria or cyanotoxins detected?

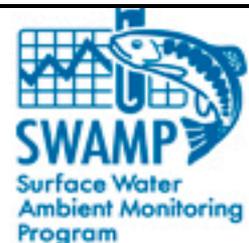
- If No: Proceed to Box (2b), and continue routine monitoring for indicators
- If Yes: Proceed to Box (3)

Box 2a provides an opportunity for initial screening using tools that do not require formal laboratory analysis. In some cases this is not a necessary step for making a management decision.

### Are cyanobacteria detected?

There are a number of methods available for initial determination of cyanobacteria presence including:

- Visual screening for cyanobacteria using field or office-based microscopes, Smartphone tools (<http://cellscope.berkeley.edu/>), [FlowCam](http://www.fluidimaging.com/) (<http://www.fluidimaging.com/>)
- Field sensor or bench top fluorimeter measurements of [phycocyanin](#) pigments
- Stick test and jar tests ([http://www.kdheks.gov/algae-illness/download/Jar\\_Test.pdf](http://www.kdheks.gov/algae-illness/download/Jar_Test.pdf))



# Table 1. CyanoHAB Trigger Levels for Human Health

**DRAFT**

	Caution Action Trigger	Warning TIER I	Danger TIER II
<b>Primary Triggers<sup>a</sup></b>			
<b>Total Microcystins<sup>b</sup></b>	<b>0.8 µg/L</b>	<b>6 µg/L</b>	<b>20 µg/L</b>
<b>Anatoxin-a</b>	<b>Detection<sup>c</sup></b>	<b>20 µg/L</b>	<b>90 µg/L</b>
<b>Cylindrospermopsin</b>	<b>1 µg/L</b>	<b>4 µg/L</b>	<b>17 µg/L</b>
<b>Secondary Triggers</b>			
<b>Cell Density (<i>Toxin producers</i>)</b>	<b>4,000 cells/mL</b>	--	--
<b>Site Specific Indicators of Cyanobacteria</b>	Blooms, scums, mats, etc.	--	--

- a. The primary triggers are met when ANY toxin exceeds criteria
- b. Microcystins refers to the sum of all measured microcystin variants. (See Box 3)
- c. Must use an analytical method that detects  $\leq 1\mu\text{g/L}$  Anatoxin-a

# CAUTION

Harmful algae may be present in these waters.  
For your family's safety:



DO NOT SWIM OR WAD  
near algae or scum



KEEP CHILDREN AWAY  
from algae in the water  
on the shore.



DO NOT drink this water  
use it for cooking.

Call your doctor or veterinarian if you or your pet get sick after going in the water.  
For more information, contact:

# WARNING

Toxins from algae in these waters can  
harm people and kill pets and livestock



NO SWIMMING



STAY AWAY from scum, and  
cloudy or discolored water



DO NOT use these waters for  
drinking or cooking.  
Boiling or filtering will not  
make the water safe.

For people, the toxins can cause:

- Skin rashes, eye irritation
- Diarrhea, vomiting

Call your doctor or veterinarian if you or your pet get sick after going in the water.  
For more information, contact:

# DANGER

Toxins from algae in these waters can  
harm people and kill pets and livestock



STAY OUT OF THE WATER UNTIL  
FURTHER NOTICE. Do not touch scum  
in the water or on shoreline.



DO NOT let pets or livestock drink or go into the water or  
go near the scum.



DO NOT eat fish or shellfish from these waters.



DO NOT use these waters for drinking or cooking.  
Boiling or filtering will not make the water safe.

For people, the toxins can cause:

- Skin rashes, eye irritation
- Diarrhea, vomiting

For animals, the toxins can cause:

- Diarrhea, vomiting
- Convulsions and death

Call your doctor or veterinarian if you or your pet get sick after going in the water.  
For more information, contact:

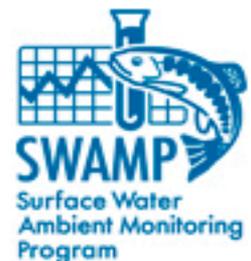
March 2016 - DRAFT

***Standard Operating Procedures  
And  
Health and Safety Protocols  
– For –  
Sampling and Monitoring of  
Freshwater Cyanobacterial Harmful  
Algal Blooms and Other Nuisance  
Blooms in California***



Prepared for:

California State Water Resources Control Board



# Infrastructure

## Satellite Imagery

- Historic trends
- Notifications
- Bulletin and Newsletter
- Temporal trends

## Centralized Website and Reporting System

- Data
  - storage
  - visualization
  - access
- CWQMC portal

## Event Response Guidance Documents

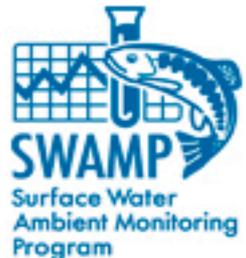
- CCHAB Guidance
- Sampling and analysis
- Management and remediation

## Laboratory Resources

- Chemical analysis of toxins
- Taxonomic identification

## 2016 CyanoHAB Workshops

- June 8 – CSU San Marcos
- June 14 – UC Davis
- June 20 – CSU Humboldt
- June 23 – CSU Santa Cruz



## Field and Laboratory Guide to Freshwater Cyanobacteria Harmful Algal Blooms for Native American and Alaska Native Communities

<http://pubs.usgs.gov/of/2015/1164/ofr20151164.pdf>



Open-File Report 2015–1164

U.S. Department of the Interior  
U.S. Geological Survey

➤ <http://www.inaturalist.org/projects/cyanoscope>

**iNaturalist.org** Observations ▾ Species ▾ Projects ▾ Places Guides People Log in or Sign up

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# cyanoScope

MAPPING CYANOBACTERIA ONE SLIDE AT A TIME

**ADD OBSERVATIONS**

## cyanoScope

### Stats

Totals	Most Observations	Most Species	Most Observed Species
<b>65</b> Observations »	<b>willbmised</b> 37 observations	<b>karolina</b> 4 species	<b>Anabaena</b> 5 observations
<b>14</b> Species »	<b>karolina</b> 9 observations	<b>willbmised</b> 1 species	<b>Gloeotrichia</b> 5 observations
<b>11</b> People »	<b>naturalist39</b> 4 observations		<b>Diatoms</b> 2 observations
	<b>sharpthorn</b> 3 observations		<b>Chroococcus turgidus</b> 2 observations
	<b>sonyacarlson</b> 3 observations		<b>Star jelly</b> 1 observation



## DRAFT- Colorado Guidance for Monitoring Harmful Algal Blooms

<p><b>Step 1: Observe and prepare</b></p>	<p>Visually inspect source waters for algae bloom (at least weekly during bloom season). Taste and odor events, shorter filter runs, changes in source water quality may indicate presence of a bloom. If source waters are susceptible to algae blooms, be prepared and order toxin field tests before bloom season starts.</p> <p><i>*If bloom observed near intake continue to step 2</i></p>	<p>Resources: CLRMA (<a href="http://www.clrma.org">www.clrma.org</a>) can assist with bloom identification</p>
<p><b>Step 2: Blue-green algae identification</b></p>	<p>Use bottle test, microscopic identification, or Hach BART test to identify presence of blue-green algae in bloom (immediately after observing bloom and then at least weekly during presence of bloom).</p> <p><i>*If blue-green algae are present continue to step 3</i></p>	<p>Resources: CLRMA (<a href="http://www.clrma.org">www.clrma.org</a>) can assist with algae identification</p>
<p><b>Step 3: Toxin presence in raw water</b></p>	<p>Monitor raw water at intake for presence of microcystins using a field test such as Abraxis Microcystins Strip Test for source drinking water (immediately after identifying blue-green algae and then at least weekly during presence of blue-green algae). Make treatment adjustments. Be prepared and identify and contact lab in advance about sampling procedures and sample turnaround time in case toxins are detected in finished water.</p> <p><i>*If microcystins are present in raw water continue to step 4</i></p>	<p>Resources: CDPHE (1-877-518-5608) can assist with toxin sampling in raw water and treatment strategies</p>
<p><b>Step 4: Toxin presence in finished water</b></p>	<p>Monitor finished water at entry point for presence of microcystins using a field test such as Abraxis Microcystins Strip Test for finished drinking water (immediately after detecting presence of microcystins in raw water and then at least weekly during presence of microcystins in raw water). Make treatment adjustments.</p> <p><i>*If microcystins are present in finished water continue to step 5</i></p>	<p>Resources: CDPHE (1-877-518-5608) can assist with toxin sampling in finished water and treatment strategies</p>
<p><b>Step 5: Quantitative lab analysis of finished water</b></p>	<p>Send finished water sample to lab for microcystin and cylindrospermopsin quantification (immediately after detecting presence of microcystins in finished water and then at least weekly during presence of microcystins in finished water). Make treatment adjustments.</p> <p><i>*If microcystin values are above 0.3 ug/L and/or cylindrospermopsin values are above 0.7 ug/L (EPA's health advisory values) take a confirmation sample of the finished water within 24 hours and send to lab. If confirmation sample results are above health advisory values consult CDPHE (1-877-518-5608). Consider monitoring for toxins at various points throughout distribution to look for toxin degradation and extent of impacted area using a field test such as Abraxis Microcystins Strip Test for finished drinking water.</i></p>	

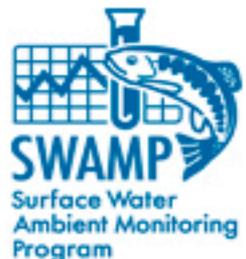
# Additional Resources

- CyanoHAB Laboratory List

[http://www.mywaterquality.ca.gov/monitoring\\_council/cyano\\_hab\\_network/docs/cyano\\_handout.pdf](http://www.mywaterquality.ca.gov/monitoring_council/cyano_hab_network/docs/cyano_handout.pdf)

- 3-18-2016 Freshwater Algae in Northwest Washington, Volume I, Cyanobacteria

<http://cedar.wvu.edu/cgi/viewcontent.cgi?article=1005&context=cedarbooks>



# The End



## NOTICE

**Blue Green Algae is Present  
in Lake Del Valle**



During summer and fall, the presence of blue green algae in lakes can result in a buildup of toxins. While near-water activities such as picnicking, biking, and hiking are safe, take the following precautions to help protect yourself, your family (including pets), and your friends:

- **No bodily contact with the water. Supervise children and pets at all times—they are particularly vulnerable.**
- **Keep pets, especially dogs, out of the water.**
- **Skin in contact with blue green algae should be rinsed with tap water.**
- **Fish may be consumed after removing guts and liver, and rinsing fillets in tap water.**

For more information, contact East Bay Regional Park District at (510) 544-2328 or visit the California Department of Public Health online [www.cdph.ca.gov/healthinfo/environmentalhealth/water/Pages/bluegreenalgae.aspx](http://www.cdph.ca.gov/healthinfo/environmentalhealth/water/Pages/bluegreenalgae.aspx)

