Update on Cyanobacteria (Blue-Green Algae): A Critical Issue In The North Coast Region

Prepared for: State Water Resources Control Board

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Sacramento, CA

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What is Cyanobacteria

- Commonly called Blue Green Algae
- Essentially a bacteria like organism (prokaryotes) that has chlorophyll and is capable of photosynthesis
- Occurs naturally in most waterbodies (the cockroach of the aquatic world)

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What is Cyanobacteria

- Color is due to the presence of phycobiliproteins
- Occurs singly (unicellular) or in colonies (e.g., filamentous *Anabaena sp.*)
- Some species include heterocysts capable of nitrogen fixation

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Can Form Colonies

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Reservoir–wide Blooms

Source: Thomas B Dunklin Gallery

Comment: Aerial views of algae conditions on the Klamath Reservoirs The colors are real, although the intensity of the neon varies depending on sun angle. These photos were all taken on August 26, 2007.

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Forms blue-green scums during cyanobacterial blooms

Source: Thomas B Dunklin Gallery, http://www.thomasbdunklin.com/gallery/AerialAlgaeDams

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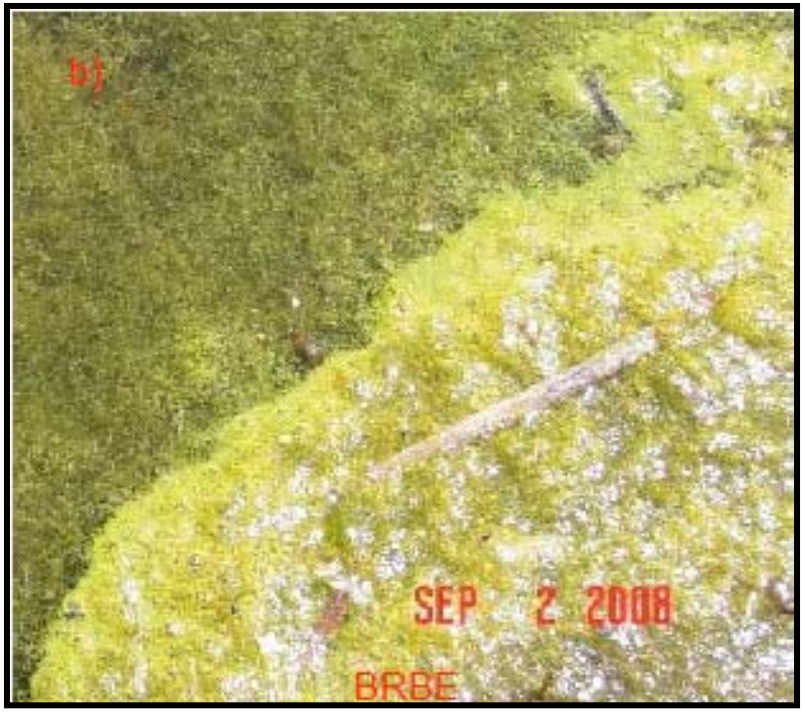
BGA blooms can also occur in rivers.

From: Kann and Corum 2009



Why is it an issue?

- Effects on Water Quality
- Effects on waterbody uses
- Some species produce toxins - cyanotoxins
- Economic impacts

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Bloom Conditions and Timing

- **Conditions / Factors**
  - ✓ **Nutrient rich waters**
  - ✓ **Warm/hot weather and water temps**
  - ✓ **Lakes, reservoirs**
  - ✓ **Streams with low flows, sediment impairments, and diminished riparian cover**
- **Occurrence of Blooms in RB-1**
  - ✓ **Typically start in June/July**
  - ✓ **Last until Oct/November**
    - Die-off with seasonal shift - rains, lake turnover, etc

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Effects on Water Quality & Waterbody Uses

- **Dense blooms have High Biomass**
  - ✓ Causes low DO that can kill fish and other bottom-dwelling organisms
  - ✓ Blocks sunlight penetration, disrupts food webs
- **Cyanotoxins**
  - ✓ Toxic for fish, wildlife, and humans
- **Beneficial Use Impairment**

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Effects on Water Quality & Waterbody Uses

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Some Cyanobacteria Produce Toxins

- Cyanobacteria can produce various toxins
  - ✓Neurotoxins - extremely fast acting
  - ✓Hepatotoxins (liver) - chronic, with possible food chain effects
  - ✓Dermatotoxins
- Cyanotoxins threaten:
  - ✓Public health
  - ✓Aquatic species - fish, mussels, otters, etc
  - ✓Terrestrial species - cows, dogs, deer, etc
- Known to cause dog/cattle deaths
  - ✓9 associated dog deaths in Northern CA

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Public Health Threats From Uses of Impacted Waters

- **Recreational exposures**
  - ✓ Incidental ingestion while swimming, etc
  - ✓ Suspected aerosol inhalation with jet skiing, etc.
- **Food supply exposures**
  - ✓ Fish, mussels, etc
  - ✓ Suspected in produce irrigated with impacted water
- **Drinking water**
  - ✓ Use of surface waters by campers, etc
  - ✓ Suspected conveyance to shallow groundwaters

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Economic Impacts

- **Esthetic and Recreational Value**
  - ✓ Private property values
  - ✓ Sport fishing, camping, rafting, etc
  - ✓ Use of parks and concessionaire revenues
- **Impacts associated with water use for:**
  - ✓ Drinking water supply
  - ✓ Fisheries and aquaculture
  - ✓ Agriculture

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How to respond to blooms?

- **Draft Statewide BGA Guidance**
  - ✓ **Developed by Statewide BGA Workgroup**
    - **SWRCB – Kim Ward;**
    - **CA DPH – Sandy McNeel and Steve Book;**
    - **OEHHA – Jim Carlisle, Regina Linville, Ned Butler**
    - **Klamath BGA Workgroup**
    - **Others from around the CA**
    - **ODPH cooperative participant**
  - ✓ **Available at SWRCB website:**

    http://www.swrcb.ca.gov/water_issues/programs/bluegreen_algae/docs/bga_vol guidance.pdf

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Statewide Draft Guidance

- **Two-tier approach**
  - ✓ **Informational / educational notices -**
    - Pamphlets at campgrounds and beaches
    - Appropriate in areas of prior blooms or near blooms
  - ✓ **Posting of Advisory / public health warnings**
    - Avoid contact with water and cautions on consumption of fish/mussels
    - Appropriate where blooms are occurring

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Statewide Draft Guidance

- **Document blooms**
  - ✓ **Presence of scums observed**
  - ✓ **Identification of cyanbacteria species in samples above thresholds**
  - ✓ **Cyanotoxins measured in water samples above thresholds**

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North Coast Board Approach

After determining need for informational materials or Public Health posting:

- **Coordinate with local governmental entities**
  - ✓ **local and county public health departments,**
  - ✓ **Land owners - Parks, USFS, etc**
  - ✓ **Tribes**
- **Prepare materials / posting notice**
- **Work with local entities and property owners to distribute materials**
- **Prepare and issue press release**

  (Dave Clegern – SWRCB)

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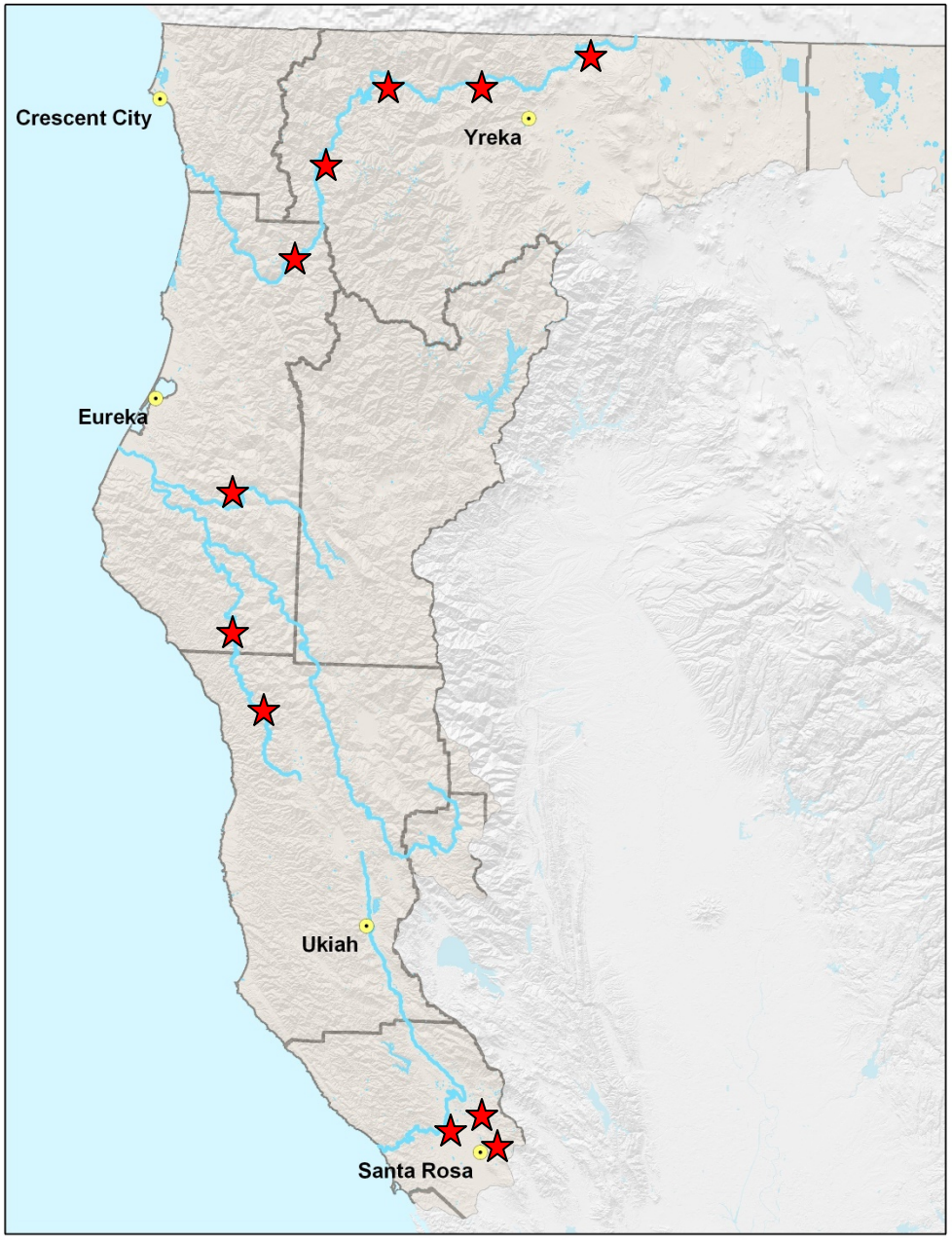

Documented Blooms In RB1

- Klamath River – Reservoirs and downstream river reaches
- Eel River
- Spring Lake
- Van Duzen River
- Private ponds (Sonoma County)
- Russian River (Two ponds)

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Other Western States

- **Washington (3 tiers)**
  - ✓ Informational materials - pamphlets at campgrounds and beaches
  - ✓ Posting Advisory – public health warning regarding contact with water
  - ✓ Full closure of water bodies, with enforcement
- **Oregon (2 tiers)**
  - ✓ Informational materials - pamphlets at campgrounds and beaches
  - ✓ Posting Advisory – public health warning regarding contact with water

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Wrap Up

- RB1 is working with local agencies on education and posting
- Increasing frequency of cyanobacteria blooms and related incidents
- Need to address underlying causes:
  - ✓ nutrient control;
  - ✓ restore and maintain stream integrity; and
  - ✓ regulate flows

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