Phytoplankton Monitoring Network (PMN)

Promoting a better understanding of Cyano Harmful Algal Blooms by way of volunteer monitoring.

Using Citizen Science to Monitor HABs

NOAA Marine Biotoxins Program
Jen Maucher Fuquay, PMN Coordinator
To educate the public on harmful algal blooms (HABs) while expanding the knowledge of phytoplankton that exist in coastal waters through research based monitoring.

- PMN started in 2001 as part of Marine Biotoxins Program in Charleston, SC
- Over 100 active sites in 15 coastal states
Train citizen scientists to:

- Collect samples on weekly or bi-weekly basis
- Identify potential harmful algal species

NOAA scientists can then:

- Analyze water samples for HAB toxins
- Together can identify temporal and geographic HAB trends

To educate the public on harmful algal blooms (HABs) while expanding the knowledge of phytoplankton that exist in coastal waters through research based monitoring.
CyanoHAB monitoring started in 2015 as part of an EPA Office of Water grant

- 25 active sites in 13 states
- EPA Regions 4, 5, 7, & 8 currently represented

Cherry Creek Reservoir, Denver, CO June 2016
Dolichospermum bloom
Why the PMN?

**Problem:** Very few government or private institutions have the capacity or capability to monitor coastlines and thousands of lakes (and reservoirs) annually impacted by HABs.

**Solution:** Engage local citizens in environmental monitoring of potentially harmful cyanobacteria and algae to aid NOAA scientists and others in their research.
Monitoring Benefits

• **Allows for an ‘early warning system’**
  – e.g. Can close shellfish beds/recreational waters and help prevent or reduce exposure and potential illness

• Monitor and maintain an extended survey area along coastal & fresh water bodies throughout the year

• Create a comprehensive list of harmful algal/cyano species inhabiting marine and fresh waters (establish baseline)

• Identify general trends where HABs are more likely to occur

• Promote an increased awareness and education to the public on HABs

• Create a working relationship between volunteers and researchers
Volunteer Equipment (marine)

Volunteers are loaned all sampling equipment except light microscopes for monitoring!

- Refractometer
- 20 um mesh plankton net
- Thermometer
- 5 gridded slides
- Cover slips
- 250 mL bottles
- 1L bottles
- 15mL of Lugol’s solution for preservation
- All shipping materials

*Region specific volunteer manual

*The PMN Manual has data sheets, phytoplankton ID sheets, and HAB information specific to your local coastal waters.

Photo credit: Elizabeth Zerai
Volunteer Equipment
Volunteers are loaned all sampling equipment

- Thermometer
- 5 gridded slides
- Cover slips
- 1L & 125 mL bottles
- 30 mL of Lugol’s solution for sample preservation
- Pre-paid overnight shipping label and shipping envelopes

*Identification sheets for target species
Volunteer Equipment (freshwater)

SWIFT M10 T digital microscope

- Provided to Pilot Program participants
- Volunteers take digital pictures of suspected target species and send to PMN
- Allows for rapid confirmation of tentative ID
- Build virtual archive of organisms observed
- WiFi capable - Great for public demonstrations
Training

- Usually done remotely
- Background of algae/cyanos
- What puts the H in HAB?
- Sampling protocols
- How to ID Target species
Training

• Volunteers must do practice sampling
• IDs are confirmed by PMN staff via photos and/or mailed in samples

Too small to be *Stephanopyxis* and can clearly see lots of thin spines connecting cells. *Stephanopyxis* has thick spines.

Unknown 2
*Triceratium sp.* (pretty!)
Phyto app version 2- coming soon!

- Will include freshwater species!
- More pictures!
- More pronunciations!
- Can enter data from phone or ipad!

[Image of app interface]

http://youtu.be/ltzxoB06De0

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Developed by PMN volunteer Shawn Gano to assist with and improve volunteer’s identification skills of marine algae & cyanos
Phytoplankton Monitoring Network

Volunteer Requirements:

1) **Collect sample** at least once every two weeks during the sampling season
2) **Analyze sample** identifying target algae/cyanos
3) **Take** digital pictures to send into the PMN
4) **Input** data into the PMN database
5) **Ship** sample to PMN as required
DATA ENTRY

• Data entered online for each sample
  – Whether target spp. found or not

• No counting of cells
  No = zip, zilch, zero
  Yes = 0-65% slide coverage
  Elevated = >65% with discoloration

• Final data entered into NCEI BEDI database
When a bloom is reported

Managers
Stakeholders
Phytoplankton Monitoring Network

**Bloom Events from 2001 – 2014**

Volunteer Reported Blooms > 200

- Non-harmful species > 150
- Potentially toxic species = 37
- Confirmed toxic events = 12
  - 9 Domoic Acid
    - Texas = 3
    - Mississippi = 2
    - North Carolina = 2
    - Alaska = 2
  - 1 Okadaic Acid
    - Texas
  - 2 Saxitoxin
    - Alaska

Maps created by NOAA Coastal Data Development Center (NCDDC)
Freshwater Bloom Events 2016

Volunteer Reported Blooms = 7
Potentially toxic species = 4

Confirmed toxic events = 4
- Microcystis (MI/OH, MN)
- Aphanizomenon (ND)
- Dolichospermum (CO)

Non-Toxic blooms
- Anabaena/Dolichospermum
  - MN = 1
  - NC = 1
  - Kansas = 1
  - Utah=1
- Aphanizomenon
  - MN, NC
- Planktothrix/Oscillatoria
  - KS, MN
- Microcystis
  - MN, NC
Target Freshwater Algae

- *Microcystis* spp.
- *Aphanizomenon* spp.
- *Cylindrospermopsis* spp.
- *Dolichospermum* spp. (aka *Anabaena* spp.)
- *Planktothrix* spp. (aka *Oscillatoria* spp.)

Toxic Cyanobacteria in Water: A guide to their public health consequences, monitoring, and management, World Health Organization, 1999
Many thanks to Andrew Chapman at Greenwater Labs for supplying cultures for today's demo.
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