



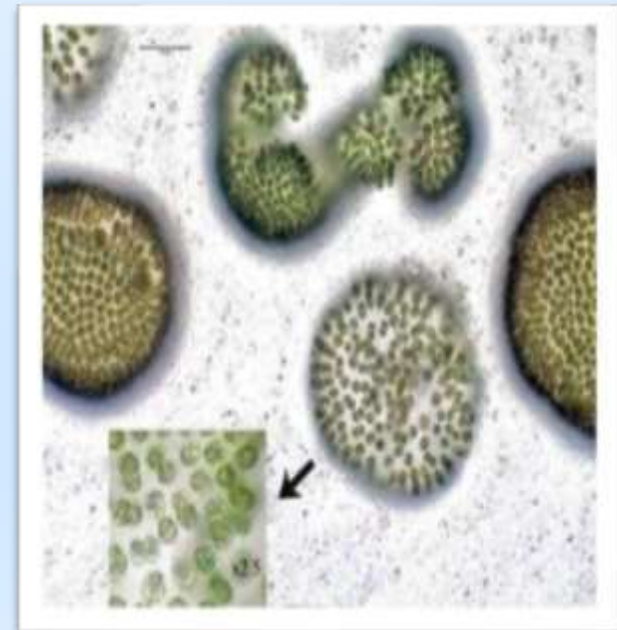
Department of the Environment

Microcystin Testing in Potomac River and Maryland HAB SOP



Cyanobacteria “Blue-green Algae”

- Produces Human and Animal Toxins
- Hypoxia and Fish Kills
- Increased Water Treatment costs
- Aesthetics – clarity and odor
- Quality of Life
 - Recreational
 - Property Values



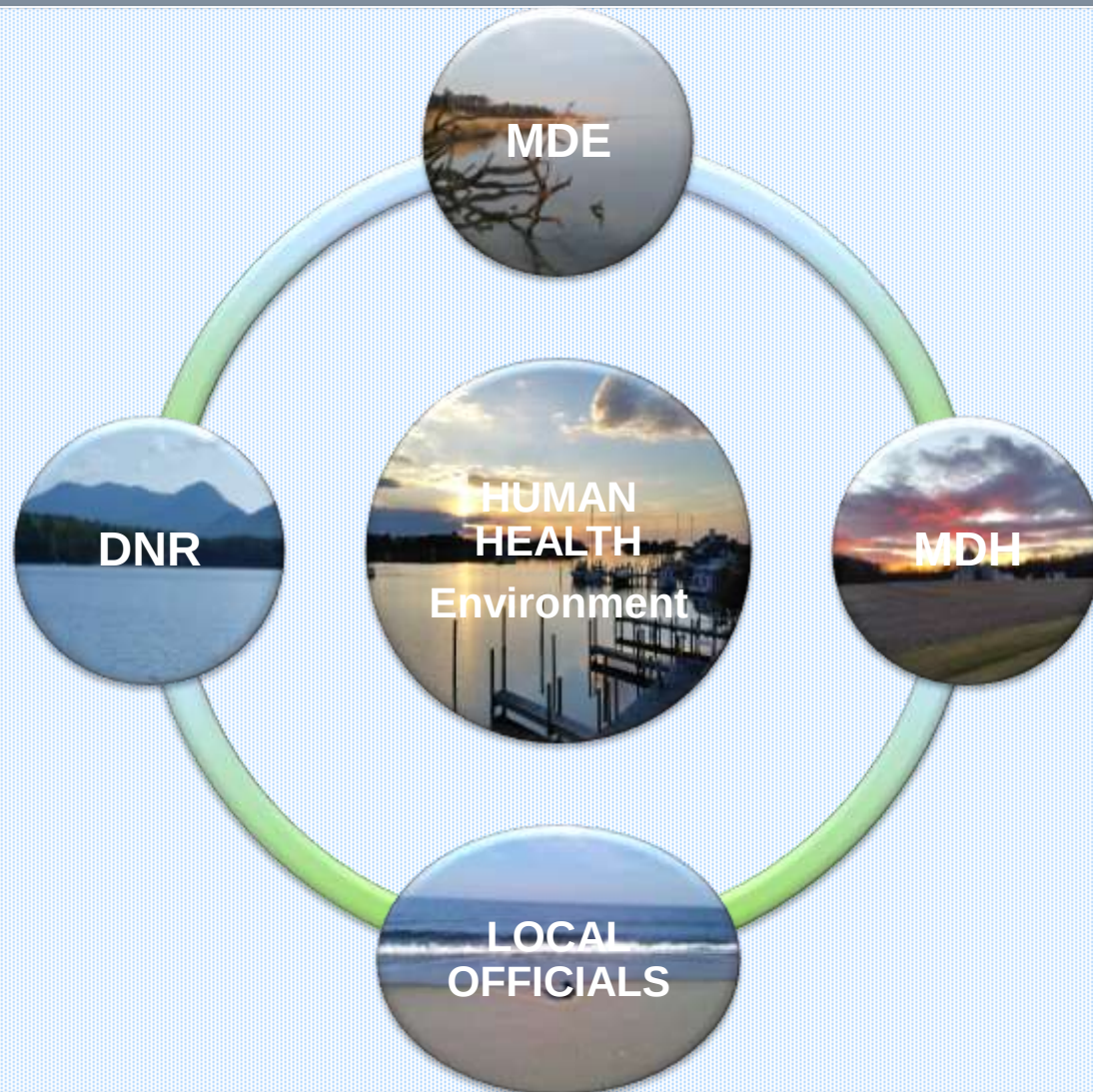
Microcystin producing algae

e.g. *Microcystis aeruginosa*, *M. wesenbergii*,
Woronichinia sp, *Planktothrix rupestris*





HAB Surveillance to Protect Public Health and Environment





HAB Surveillance Program

- 1) Field Response
- 2) Laboratory ID and Analysis
- 3) Management



HAB Surveillance Program

1) Field Response

Bloom Detection- Routine Monitoring

Local Resource Managers

Concerned Citizens



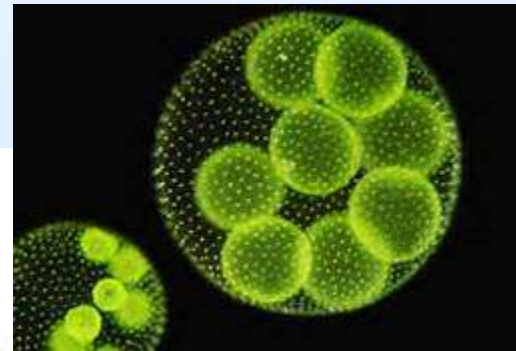
HAB Surveillance Program

2) Laboratory Analysis

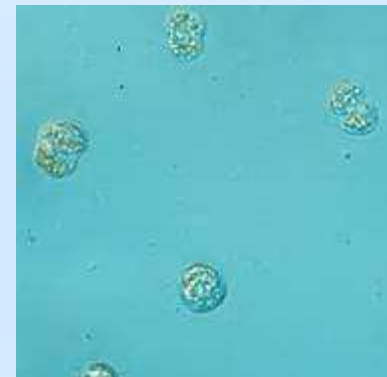
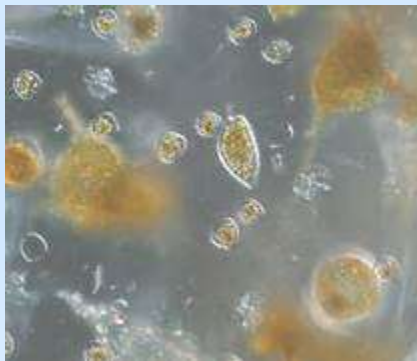
Count and ID Algae Species



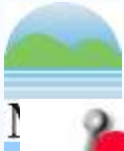
1 Cell



5,000 Cells



1,000,000 Cells



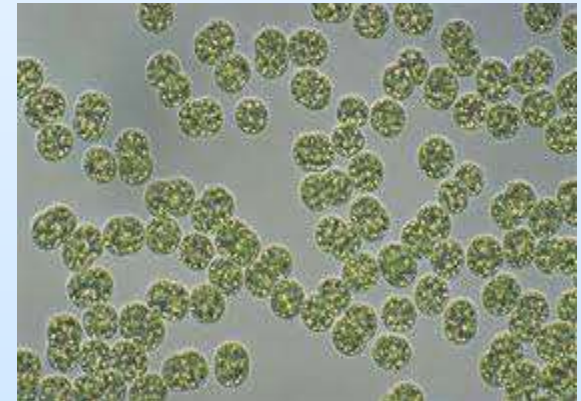
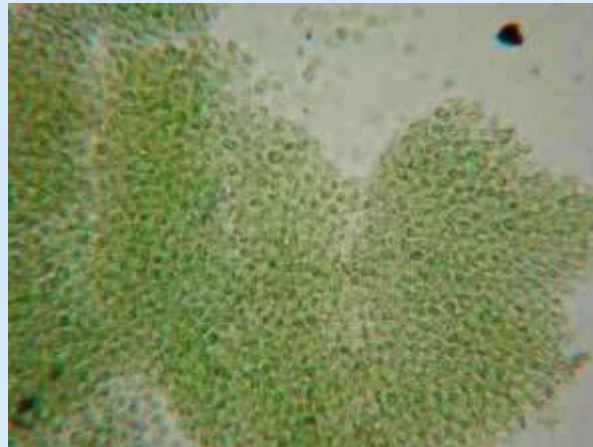
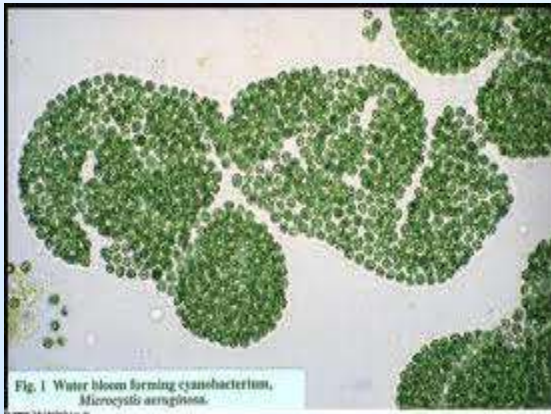
HAB Surveillance Program



Laboratory Analysis



**Microcystis aeruginosa -
Excess of 40,000 cells**



HAB Surveillance Program

Microcystin ELISA



3) Management

- **Communicate with local officials**
 - **Post Advisories**
- **Continue Monitoring**

HAB Surveillance Program

WHO Guidelines for Microcystin Advisories



**Recreational Contact
– 10ppb toxin**

Drinking Water – .3 ppb toxin



HAB Surveillance Program

- US EPA guidelines for recreational contact and drinking water

Microcystin guidelines (parts per billion)

	WHO	*US EPA
Drinking Water	1µg/L	0.3 µg/L infants 1.6 µg/L adults
Contact	10µg/L	8 µg/L

Cylindrospermopsin guidelines (parts per billion)

	Drinking Water
	0.7 µg/L infants 3 µg/L adults

- *MD reviewed past data, staying with WHO for microcystin and water contact



WARNING

HARMFUL ALGAE MAY BE
PRESENT

• *If Algal Blooms are visible:*

- Avoid Swimming.
- Don't drink the water.
- Keep children and pets away.
- Clean fish well and discard guts.
- Avoid areas of algae scum when boating.



Contact your doctor or veterinarian if you, a family member, or a pet experience sudden or unexplained illness that may be a sign of exposure to Harmful Algae.

For more information call:
DHMH Environmental Help Line: 1-866-703-3266





Microcystin HAB Advisories Issued by Year

YEAR(s)	Number of Advisories Issued
BEFORE 1997	0
1997	1 ****("Pfiesteria")
1997-2008	?
2009	7
2010	7
2011	6 (1) in Potomac R.
2012	5
2013	7
2014	7 (1) in Potomac R.
2015	3
2016	6
2017	2
2018	3

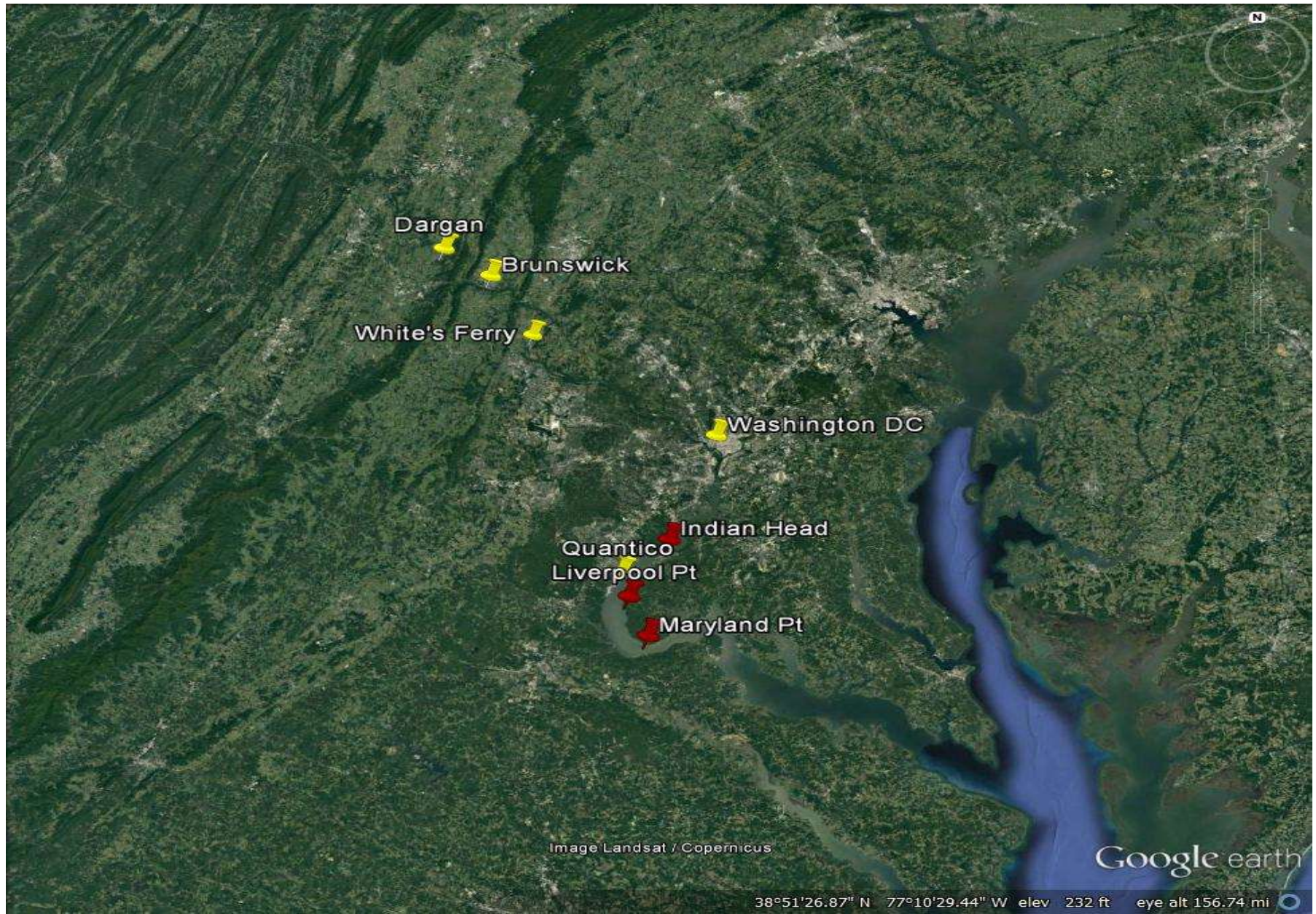
Microcystin

- *Microcystis aeruginosa*, blue green algae, primary Microcystin producer found in Potomac River
- 19 samples, 2010-2014
- 3 samples were greater than WHO guideline, 10 ppb





Potomac River Microcystin Sites





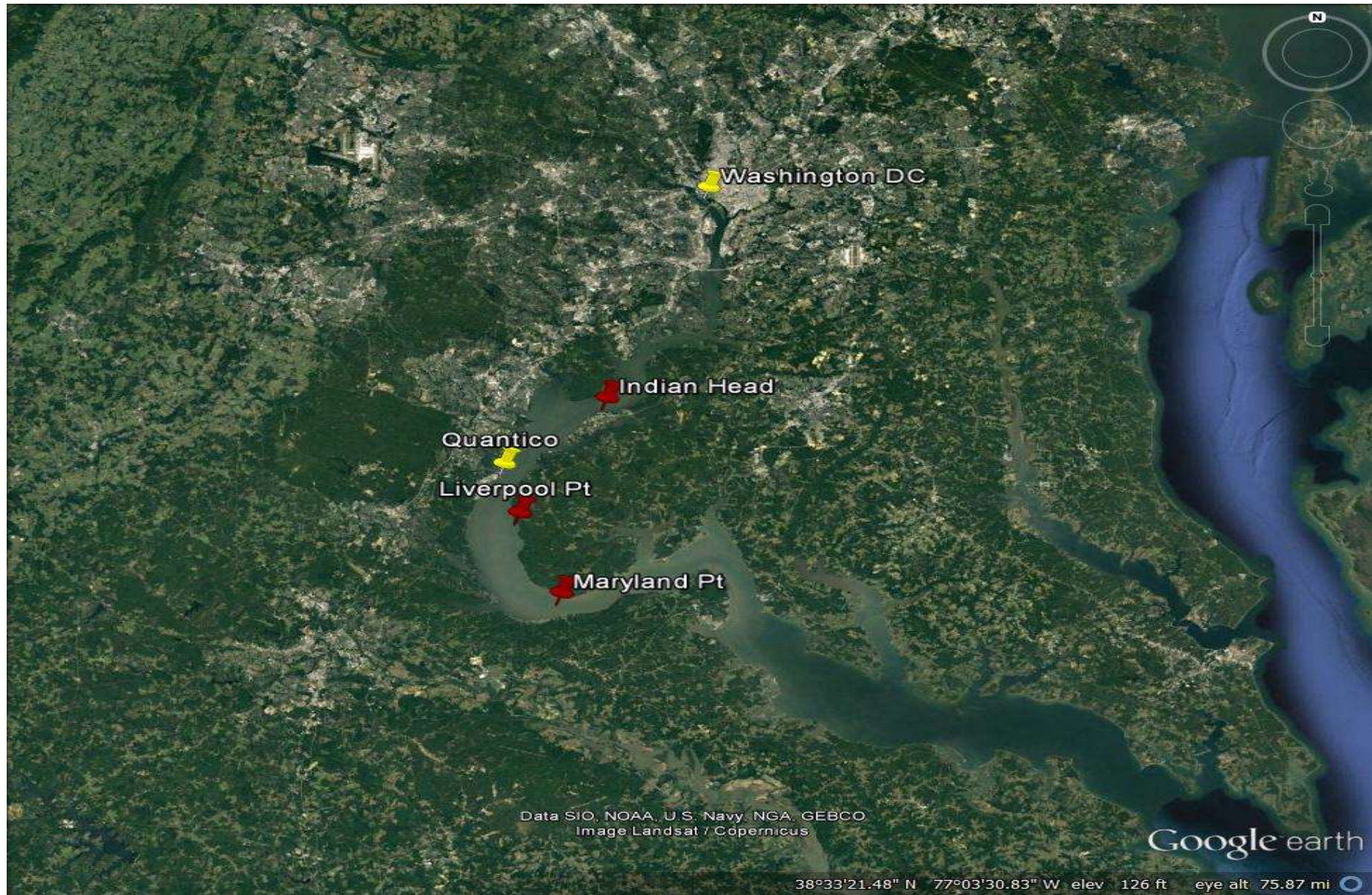
Microcystin 2010, 2012

Date	Location	Cell counts (cells/ml)	Microcystin (ppb)
7/8/2010	Dargan	Planktothrix isothrix	0.7
7/12/2010	White's Ferry	Planktothrix 128K	<0.15

Date	Location	Cell counts (cells/ml)	Microcystin (ppb)
7/11/2012	Brunswick	Planktothrix isothrix	0.75



Microcystin 2011, 2014



Microcystin 2011

Date	Location	Cell counts (cells/ml)	Microcystin (ppb)
7/27/2011	X	M. aeruginosa 290K	6.3
		M. wesenbergii 6K	
	TF 2.3 (Indianhead)	M. aeruginosa 169K	2.1
		M. wesenbergii 3K	
7/28/2011	Mattawoman Crk at Sm	M. aeruginosa 161K	8.2
		M. wesenbergii 4K	
8/1/2011	Potomac above power l	M. aeruginosa 192K	20
		M. wesenbergii 6K	
	TF 2.3 (Indianhead)	M. aeruginosa 42 K	8.1
		M. wesenbergii 0.9K	
	TF2.2	M. aeruginosa 39K	2.8
		M. wesenbergii 4K	
8/10/2011	TF 2.3 (Indianhead)	M. aeruginosa 926K	375
8/15/2011	TF2.4 (Quantico)	M.aeruginosa 7K	3.9
	MAT0016	M.aeruginosa 9K	2.1

Microcystin 2014

Date	Location	Cell counts (cells/ml)	Microcystin (ppb)
8/18/2014	RET 2.1	M.aeruginosa 107K	2.9
	RET 2.2 (Maryland Pt)	M.aeruginosa 159K	11
9/4/2014	Liverpool Pt	M.aeruginosa 50K	50
9/8/2014	TF2.4 (Quantico)	M.aeruginosa 44K	9.5
9/10/2014	MATT 007	M.aeruginosa 147K	0.95
	MAT0016	M.aeruginosa 65K	0.6



Drinking Water Events

- **Broadford Lake, Garrett County, July, 2009**
 - **Beach sample exceeded WHO guidelines for drinking and recreational waters**
 - **Initiative to coordinate with local Health Department and drinking-water plant personnel.**
 - **Advisory for water contact**
 - **Finished water analyzed for MC was below guidelines for drinking water**





2009 Broadford Lake Results

- 7/28 Broadford Lake - Cove - **126 ppb**
- 8/3 Broadford Lake - **14.4 ppb**
- 8/11 Broadford Lake - Beach - 0.785ppb
- 8/11 Broadford Lake - Shallow Intake - 0.80ppb
- 8/11 Broadford Lake - Raw Plant - **1.11 ppb**
- 8/11 Broadford Lake - Finish @ Plant - less than 0.15ppb
- 8/17 Broadford Lake - Beach - 0.38ppb
- 8/17 Broadford Lake - Left Side - 4.05ppb
- 8/17 Broadford Lake - Raw - 0.26
- 8/17 Broadford Lake - Finish - less than 0.15ppb



Additional Microcystin Producers



- **Fountain Rock Quarry, Fred County**
- **March 2010**
- ***Plankothrix rubescens***
- **500 ppb MC**



Microcystin in Lake Anita Louise- Fr. Co

- High levels of the toxic algae *Planktothrix rubescens* detected.
- Required a no contact advisory in January 2016.
- Microcystin levels were as high as 160 ppb during this period.





Lake Anita Louise Follow-up

- MDE re-sampled Lake Anita Louise on March 18, 2016.
- Microcystin levels detected at > 100 ppb remained above the World Health Organization threshold of concern (10 ppb).
- The water contact advisory remained in effect.
- Residents used hydrogen peroxide applications the winter of 2017 in an attempt to control future blooms.





Oxygen Depleting Algae Blooms

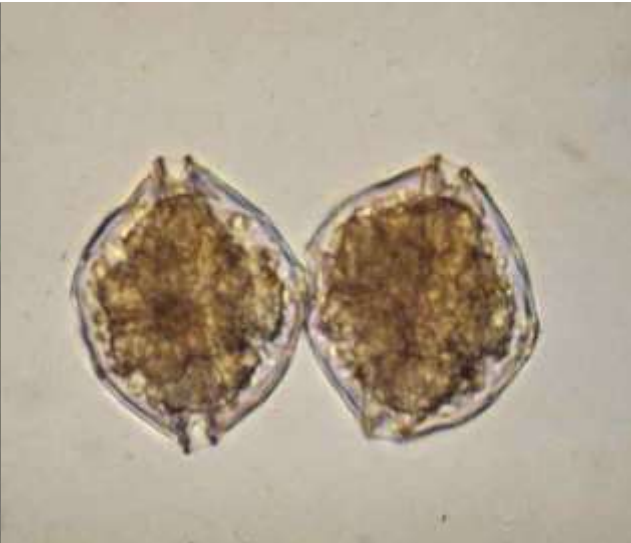
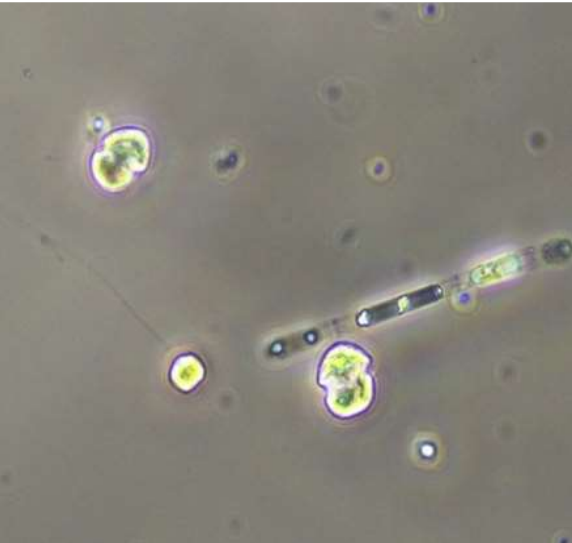


Gyrodinium instriatum, *Cochlodinium polykrikoides*, *Prorocentrum minimum*



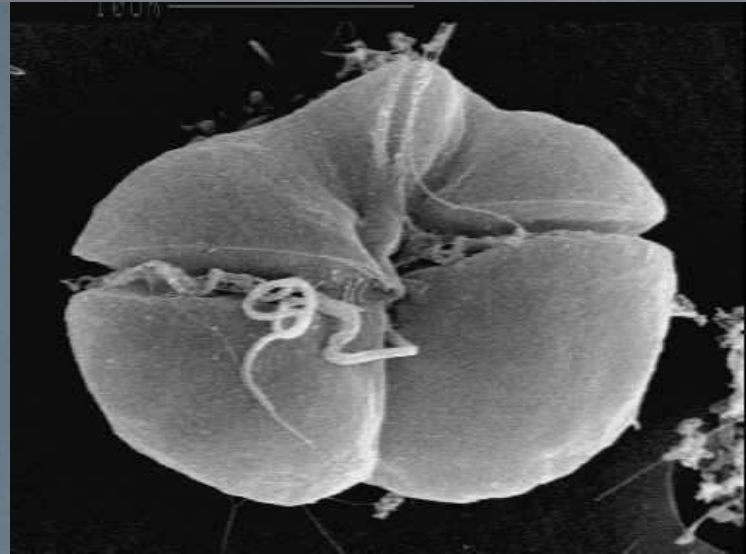
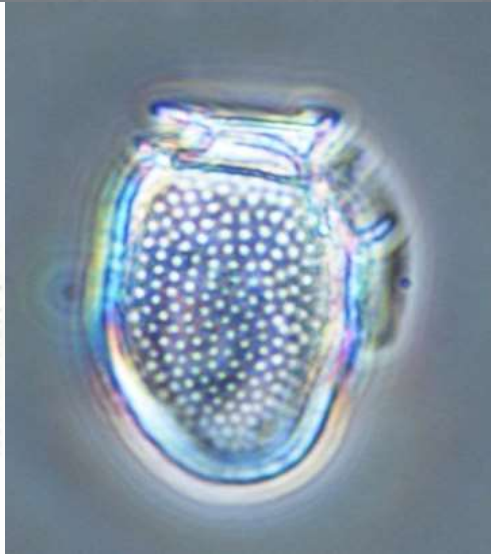
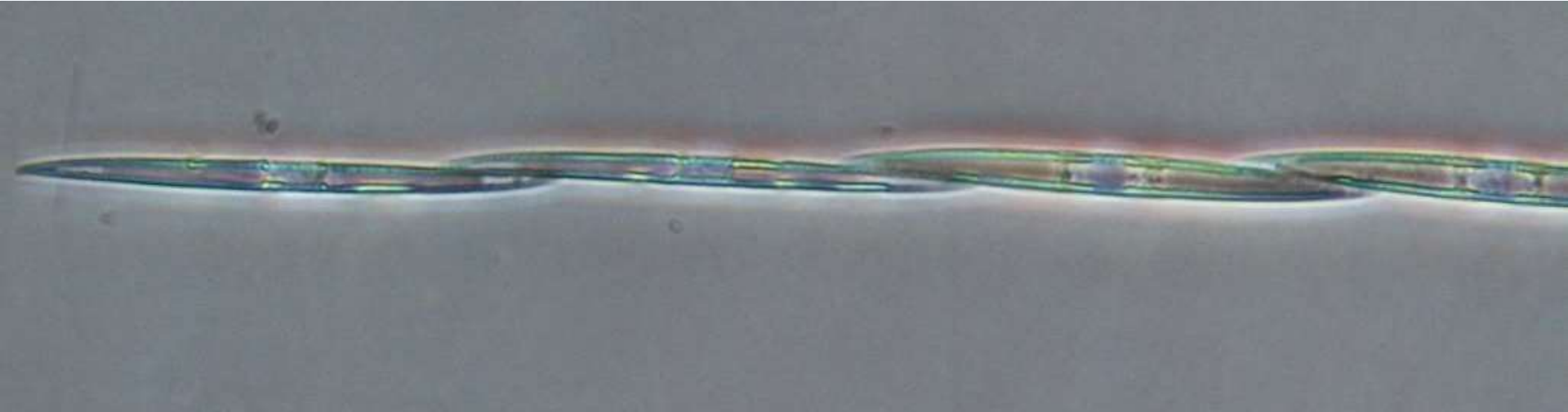
Icthyotoxic Blooms

Karlodinium veneficum, Alexandrium monilatum, Karenia brevis,
Alexandrium monilatum, *Chattonella subsalsa*



Bioaccumulation of Algal Toxins in Shellfish

***Pseudo-nitzschia spp*, *Dinophysis acuminata*, *Karenia brevis*,**



Nuisance Algae

Ulva sp. (Sea Lettuce)



Environmental Hotlines

- Chesapeake Bay Safety and Environmental Hotline (1-877-224-7229) or the Maryland
- Emergency Management 24 hour number 1-866-633-4686





Maryland Department of the Environment

Water and Science Administration

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