Marine Recap-VIMS

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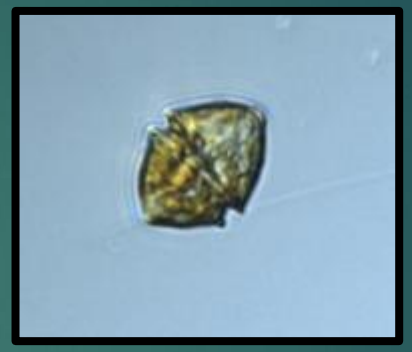
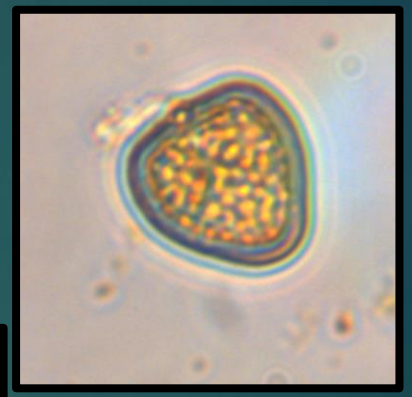
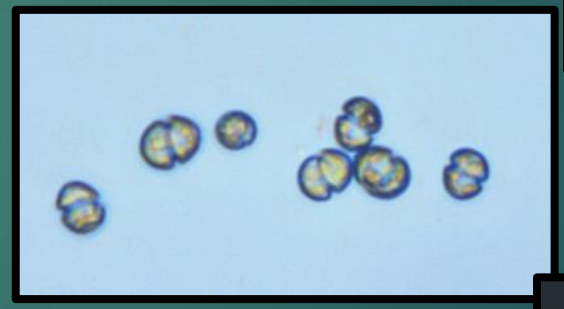
VIMS | William & Mary
Virginia Institute of Marine Science

2019 Blooms: Spring & Early/Mid Summer

- *Heterocapsa triquestra*
- *Prorocentrum mimimum*
- *Karlodinium veneficum*
- *Akashiwo sanguinea*







Date	Site	Bloom species	Cells/ml
2/14/19	YR mouth	*P. minimum*	595
2/14/19	YR north of NWS	*H. triquetra*	4,800
2/26/19	Goodwin Island	*H. triquetra*	11,200
3/27/19	Little Mumfort Island	*H. triquetra*	35,000
4/9/19	LYRE event	*P. minimum*	4,900
4/16/19	Perrin River	*P. minimum*	6,300
4/17/19	Sarah's Creek	*P. minimum*	4,820
4/17/19	Sarah's Creek	*H. triquetra*	1,100
4/17/19	Catlett Island	*P. minimum*	3,280
4/17/19	Catlett Island	*K. veneficum*	8,070
4/17/19	Sarah's Creek	*P. minimum*	42,100
4/22/19	Goodwin Island	*P. minimum*	7,100
4/22/19	Goodwin Island	*K. veneficum*	500
4/22/19	Clay Bank	*P. minimum*	5,300
4/22/19	Clay Bank	*H. triquetra*	7,000
5/2/19	York River Bridge	*P. minimum*	4,300
5/9/19	Coleman Bridge	*K. veneficum*	8,040
5/14/19	VIMS Pier	*P. minimum*	700
7/10/19	York River	*A. sanguinea*	550

York River Samples Dinoflagellate "blooms"

(concentrations >500 cells/ml)

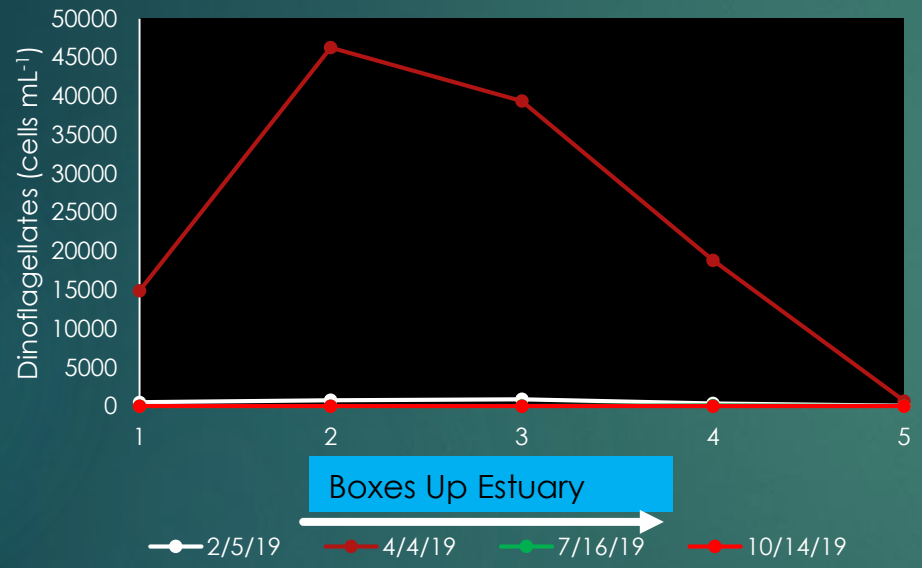
Date Collected	Site	Species	cells/ml
2/14/19 – 4/22/19	York River	***H. triquetra***	1,400 – **54,000** (peak late March/early April)
2/28/19 – 5/2/19	York River	***P. minimum***	1,000 – **70,900** (peak 4/4/19)
2/28/19	York River	*K. veneficum*	1,130
3/11/19	Fort Monroe	*P. minimum*	1,090
3/12/19	Linkhorn Bay	*K. veneficum*	1,660
3/18/19	Salt Ponds Marina	*K. veneficum*	1,450
3/18/19	Broad Bay	*K. veneficum*	1,250
3/18/19	Linkhorn Bay	*K. veneficum*	2,250
4/16/19	Perrin River	*P. minimum*	2,867
4/17/19	Sarah's Creek	*P. minimum*	4,820
4/17/19	York River	***K. veneficum***	**8,070**
4/17/19	Sarah's Creek	*K. veneficum*	3,080
4/17/19	Sarah's Creek	*P. minimum*	21,890
4/1/19	Cherrystone Creek	*P. minimum*	1,100
4/18/19	Lynnhaven River	*P. minimum*	1,300
4/25/19	Sarah's Creek	*K. veneficum*	7,280
5/1/19	Locklies Creek	*P. minimum*	1,100
5/9/19	York River	*K. veneficum*	8,040
5/9/19	Wolfsnare Creek	*Gyrodinium instriatum*	4,300
5/9/19	Keeling Drain	*K. veneficum*	1,160
5/8/19	Rappahannock River	*P. minimum*	2,300
5/2/19	Hampton River	*K. veneficum*	1,740
5/9/19	North River	*K. veneficum*	3,850
7/1/19	York River	*A. sanguinea*	550

Lower CB "Bloom" Samples

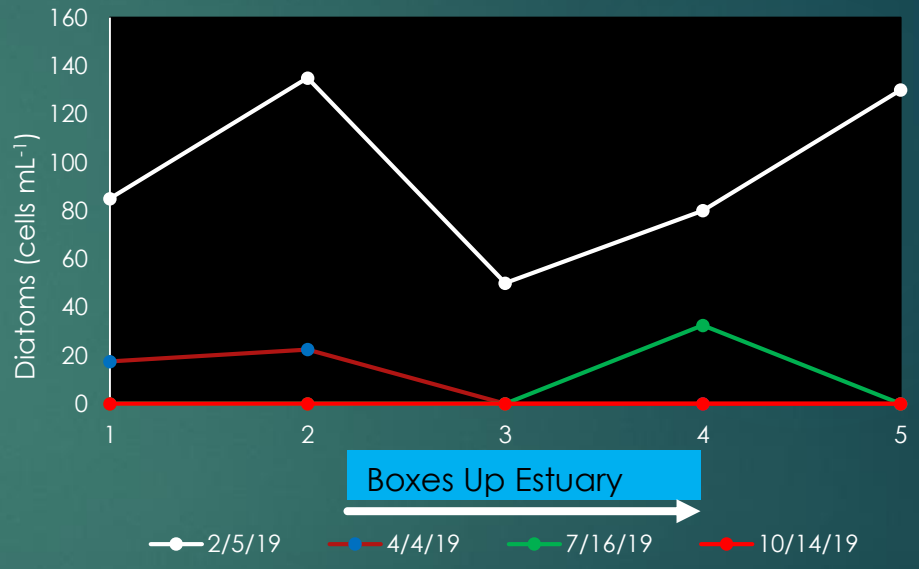
(concentrations >500 cells/ml)

Phytoplankton Counts York River 2019

Dinoflagellates

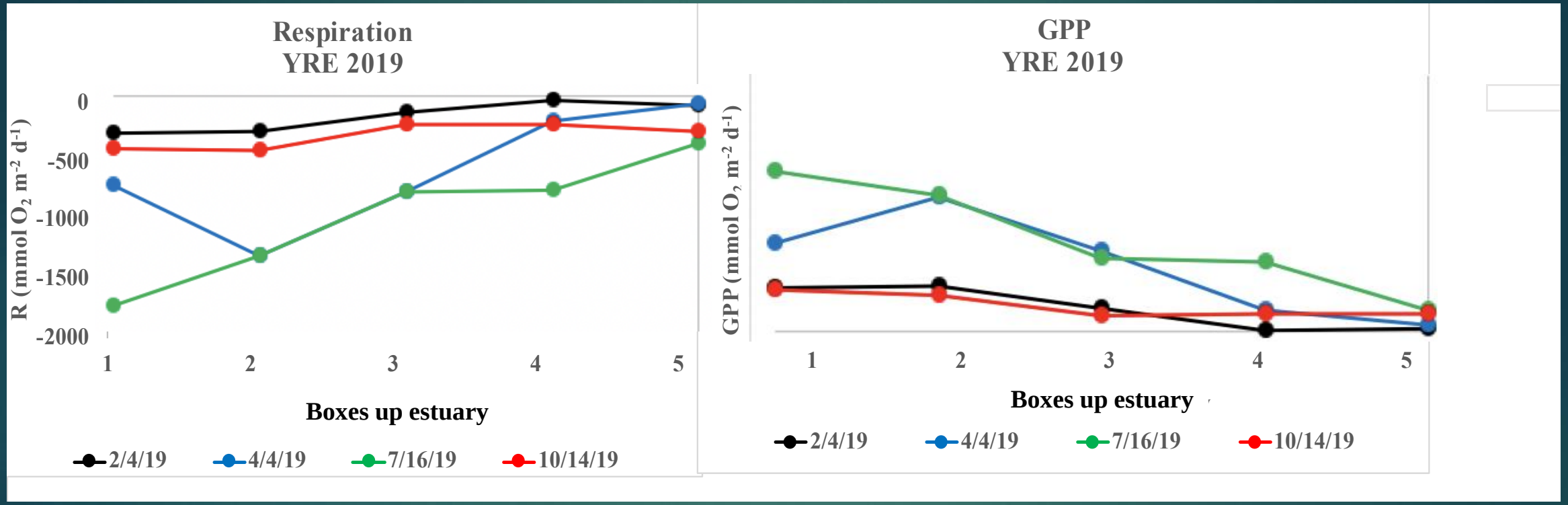


Diatoms



Visual microscopic counts of dinoflagellates and diatoms in surface water column samples taken concurrently with DataFlow sampling.

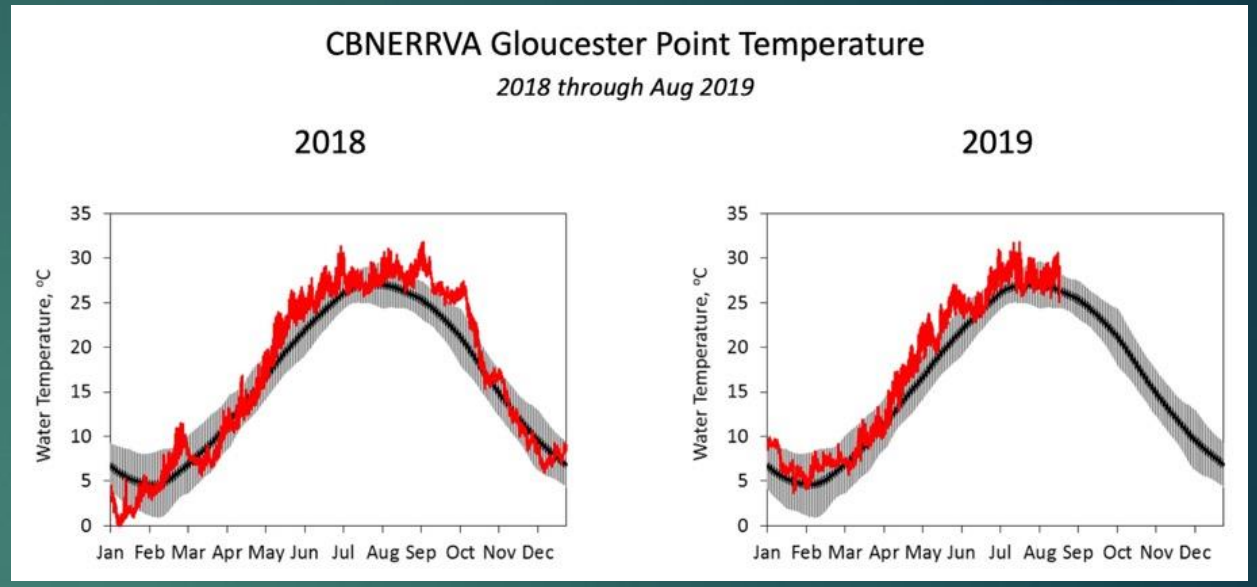
Metabolic parameters

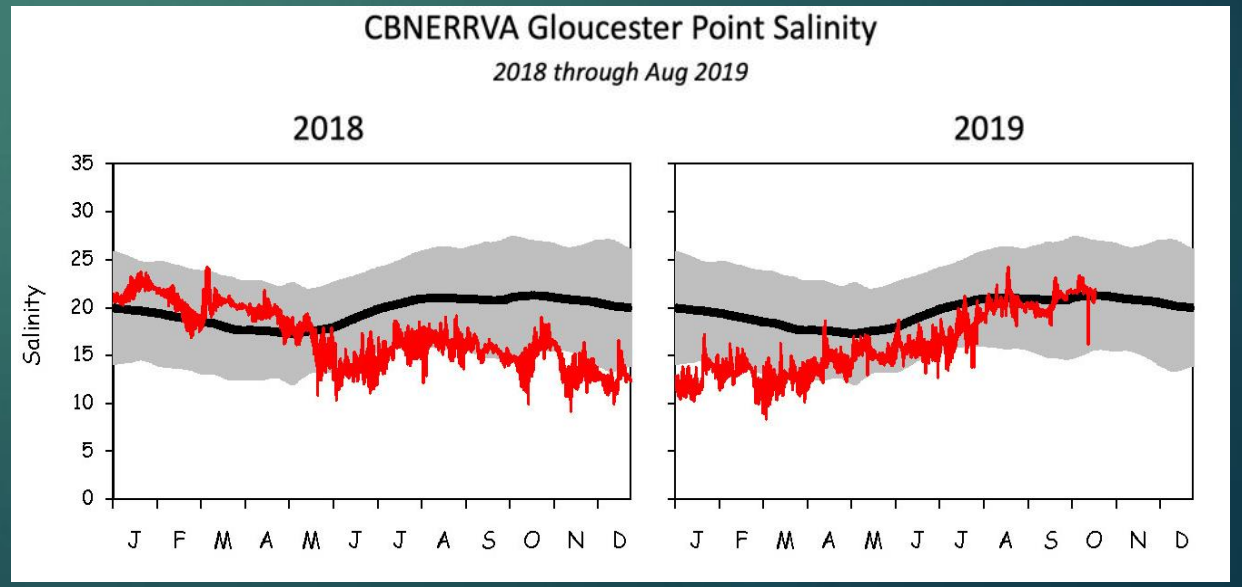


Open water measurements of respiration and gross primary production determined from changes in DO, collected bi-monthly by DataFlow during dawn, dusk, and dawn cruises.

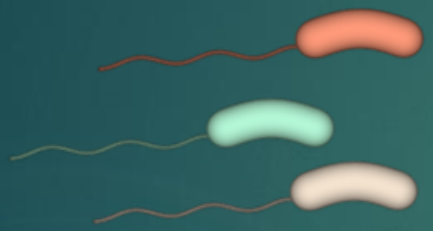
Late Summer Bloom and Non-Bloom Years?

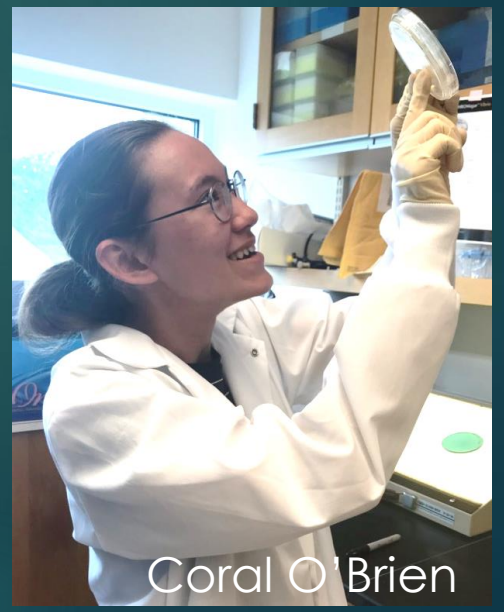
- Heavy blooms in:
2012, 2013, 2015, 2016
  - Expansion throughout lower Bay
- No blooms in the York:
2014, 2018 or 2019
- Blooms in the York: 2017
- Blooms only in the southernmost Bay tribs: 2018



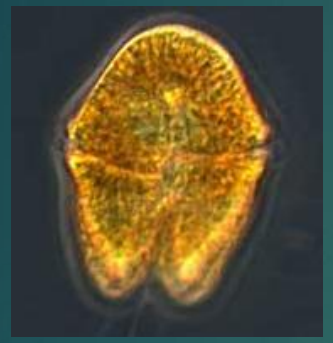


Interactions between *Vibrio* bacteria and phytoplankton species

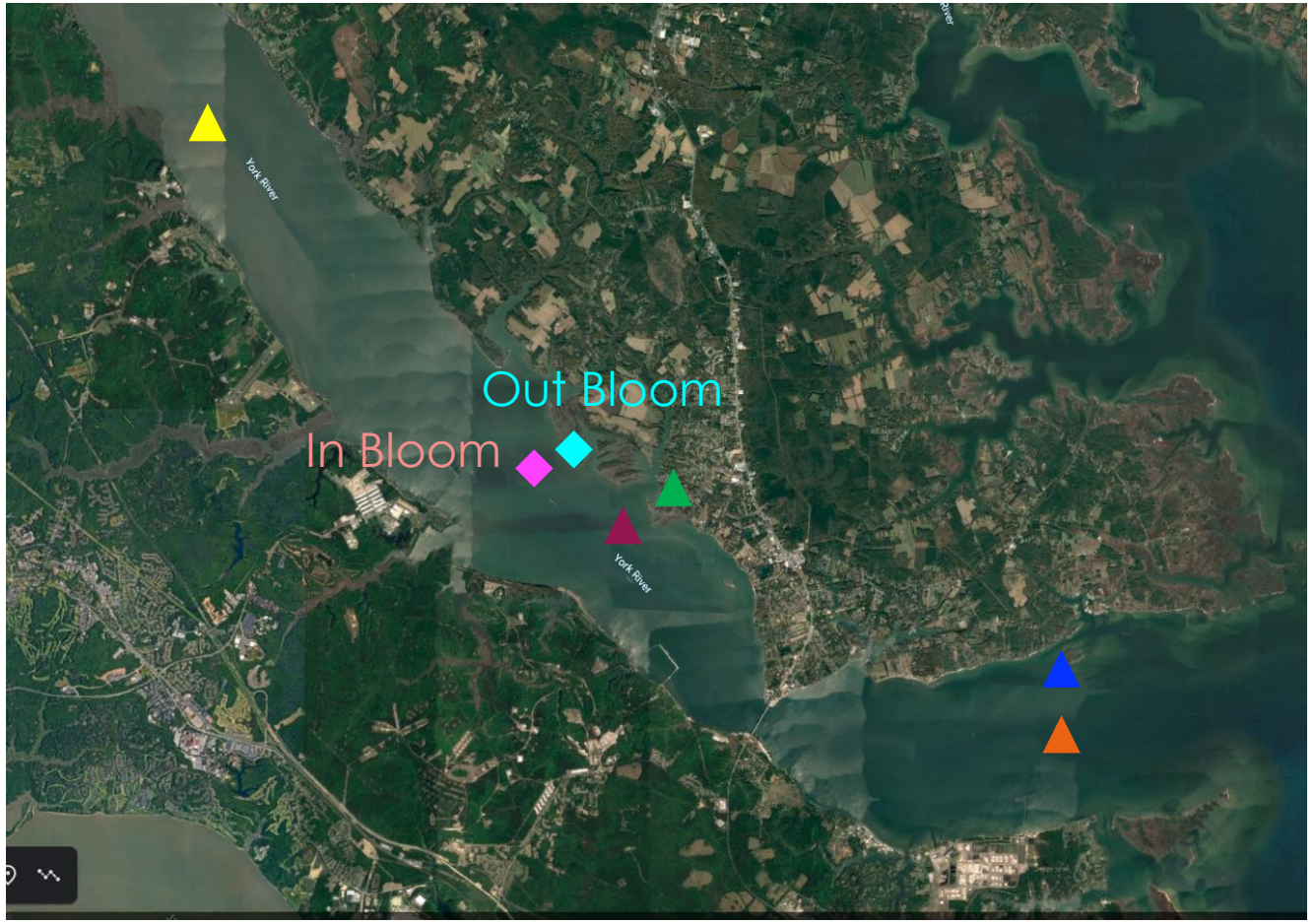




Akashiwo sanguinea bloom sample



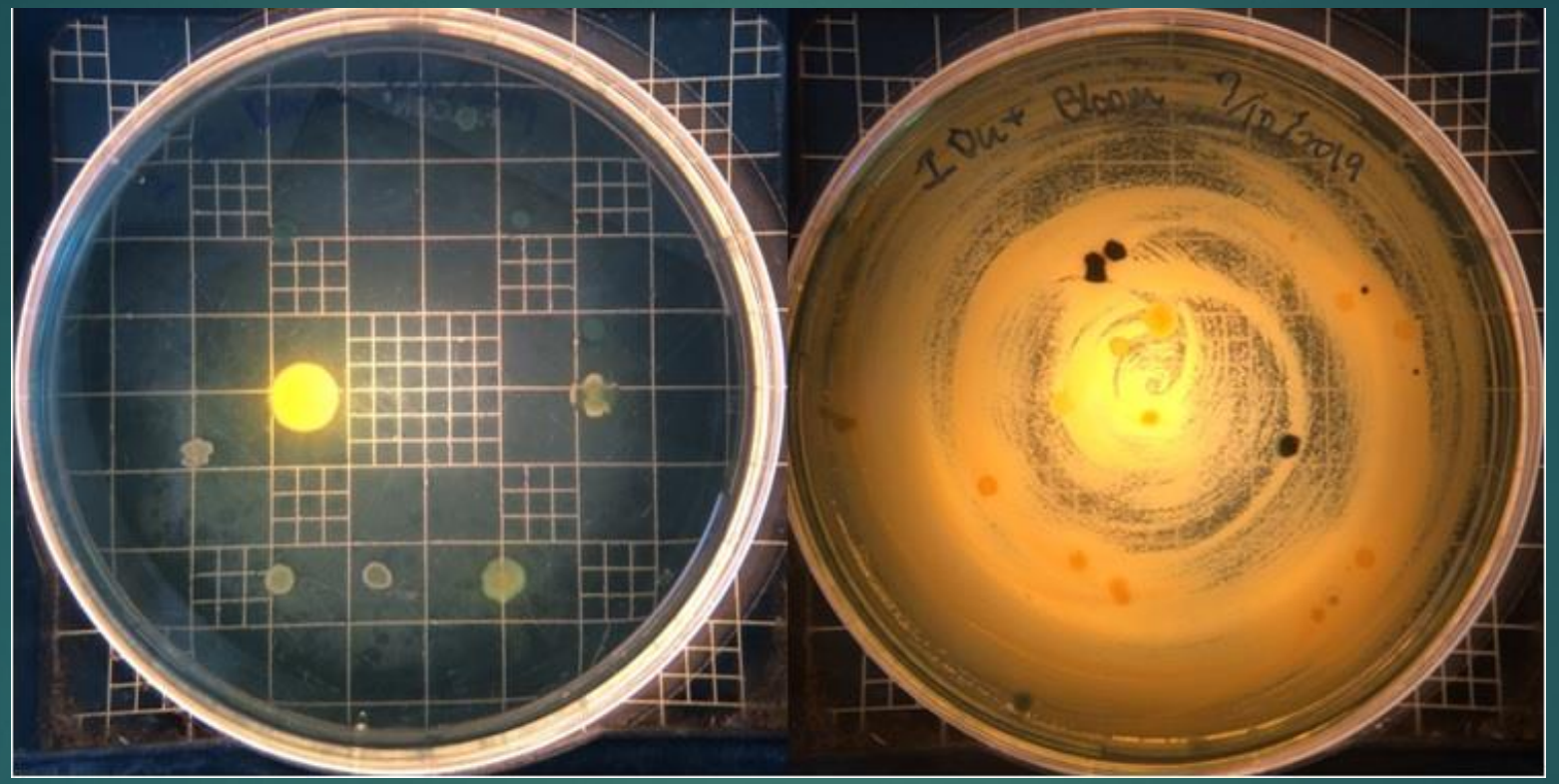
- Bloom sample collected 7/10/2019 (~600 cells/ml)
- Water samples from inside (n=2) and outside (n=1) the bloom



Plating on TCBS media

In the bloom

Out of the bloom



Akashiwo sanguinea preying on or inhibiting growth of *Vibrio* spp.?

Looking for the Toxin Producers

- Azaspiracids

Table I: Sequences of primers and probes for Amphidoma languida *(this study), the general Amphidomataceae assay and other* Azadinium *species from the literature*

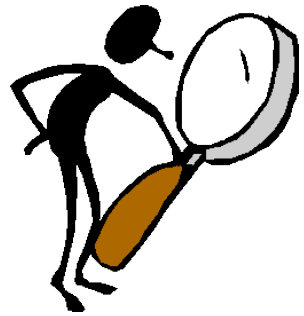
Target species	Target gene	Oligonucleotide type	Sequence (5′-3′)	Product size (bp)	Reference
Amphidoma languida	LSU				
Alan509F		F-Primer	CGGTTCACAGGCGAGGAT	60	This study
Alan569R		R-Primer	GACATTCACACCTCCGTGGAA		
Alan528		TaqMan MGB probe	6FAM-CTTCTGAGGACATGGTAAC-MGB		
Azadinium* and *Amphidoma* *genera	ITS				
Amp240F		F-Primer	CAACTTTCAGCGACGGATGTCTCG	179	Smith *et al.* (2016)
Amp418R		R-Primer	AAGCYRCWGGCATKAGAAGGTAGWGGC		
Azadinium spinosum	LSU				
Asp48F		F-Primer	TCGTCTTTGTGTCAGGGAGATG	72	Toebe *et al.* (2013)
Asp120R		R-Primer	GGAAACTCCTGAAGGGCTTGT		
Aspin77T		TaqMan MGB probe	6FAM-CGCCCAAAAGGACTCCT-MGB		
Azadinium poporum	LSU				
Apop62F		F-Primer	GATGCTCAAGGTGCCTAGAAAGTC	68	Toebe *et al.* (2013)
Apop148R		R-Primer	CCTGCGTGTCTGGTTGCA		
Apop112		TaqMan MGB probe	6FAM-TTCCAGACGACTCAAA-MGB		

PCR amplified, cloned and currently sequencing from Michelle's 2017 and 2018 samples

From Wietkamp et al. 2019, J. Plankton Res.

Looking for the Toxin Producers

- Okadaic Acid (OA and DTXs)

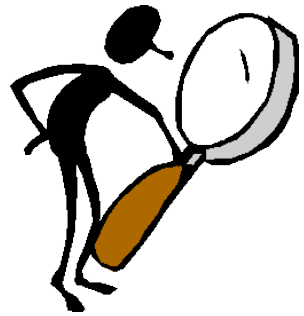


Dinophysis spp.

- Many different species
- Low concentrations in the field, difficult to get obtain all possible CB species for differential molecular assays
- Prey complicates development of molecular assays

Looking for the Toxin Producers

- Domoic Acid



Pseudo-nitzschia spp.

- Many different potential CB species
- PCR assays often must be combined with melting curve analyses to determine if target has been amplified.
- PCR, cloning and sequencing to determine species from 2019 Potomac bloom

Summary

- Blooms of *Heterocapsa*, *Prorocentrum*, *Karlodinium* and *Akashiwo* earlier in the year, but no late summer blooms of *Margalefidinium (Cochlodinium)* or *Alexandium*.
- *Akashiwo sanguinea* seems to prey on or inhibit vibrio growth.
- Using molecular tools (PCR and sequencing) to identify toxin formers and will develop targeted molecular assays.