## Data needs for assessing Chla criteria of the James River

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Major Objectives:

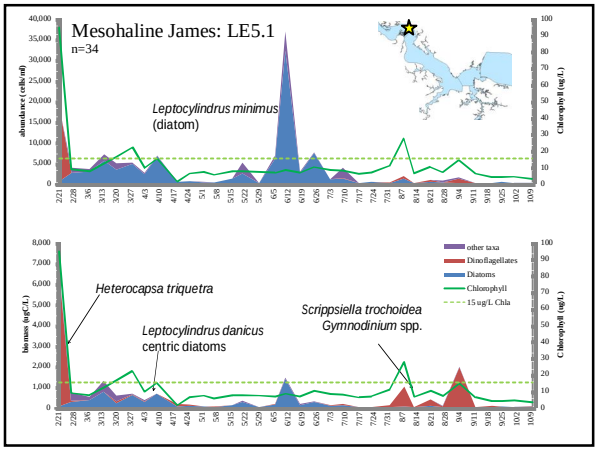
1. Identify phytoplankton composition and abundance of both HAB and non-HAB species contributing to chlorophyll concentrations in the upper and lower James, Elizabeth, and Lafayette rivers throughout the sampling period.

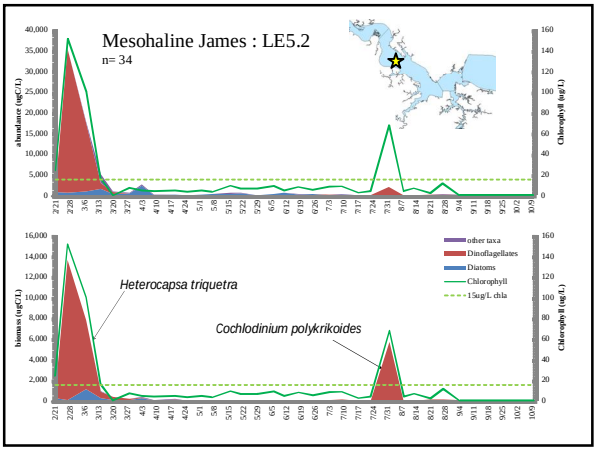
2. Monitor the status of HAB taxa throughout the study period when ever present, and not just during blooms development.

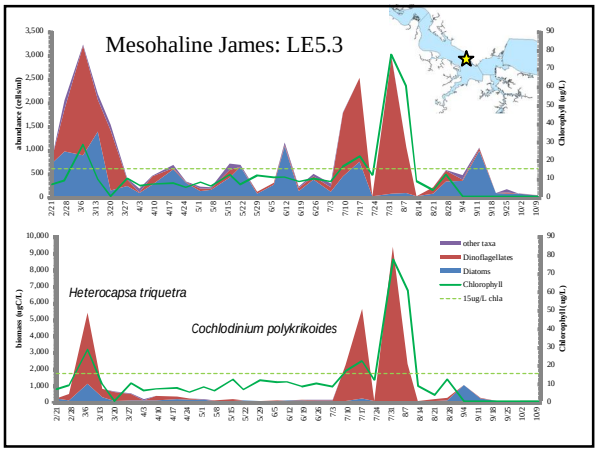
3. Identify river locations containing algal concentrations related to high chlorophyll levels and bloom development.

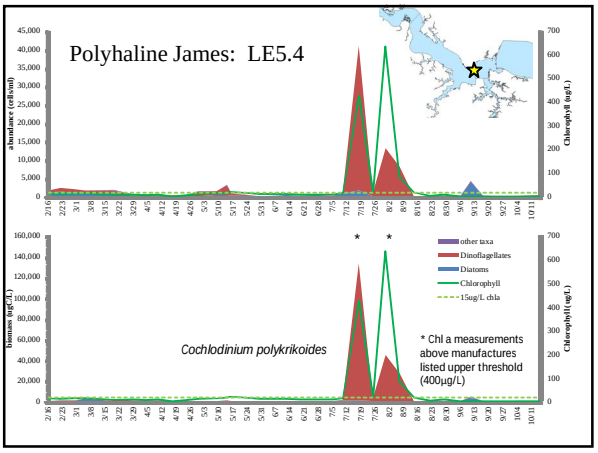
## Results: Objective 1: Phytoplankton composition in relation to chlorophyll

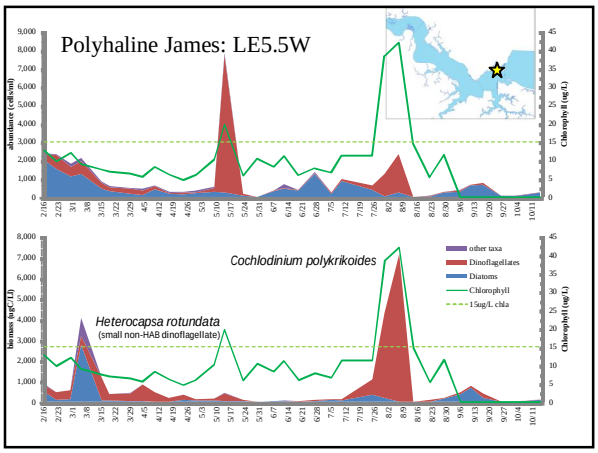
- 523 HRSD samples collected (2/15/12-10/15/12)
- Fixed stations and bloom collections
  - Mesohaline James: 3 stations
  - Polyhaline James: 2 stations
  - Elizabeth River: 1 station
  - Lafayette River: 3 stations
- Compare HRSD dataflow chlorophyll and microscopic phytoplankton composition analysis
- Cell abundance
- Cell biomass, C estimates based on cell biovolume
- Project overview, methods and preliminary results presented at MTS/IEEE Oceans '12 meeting in Virginia Beach 10/18/12
- Provide cell counts and species composition from upper James to Paul Bukaveckas

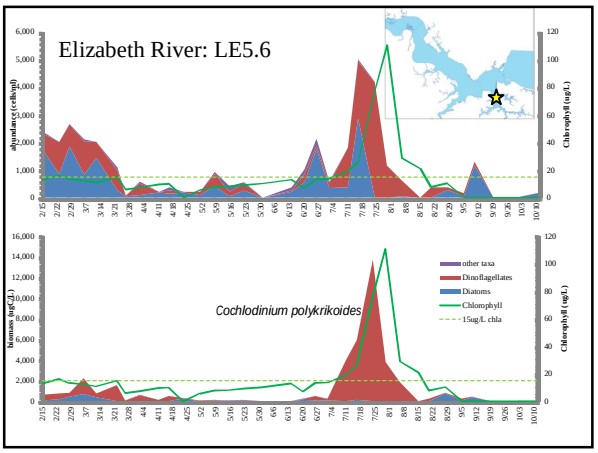


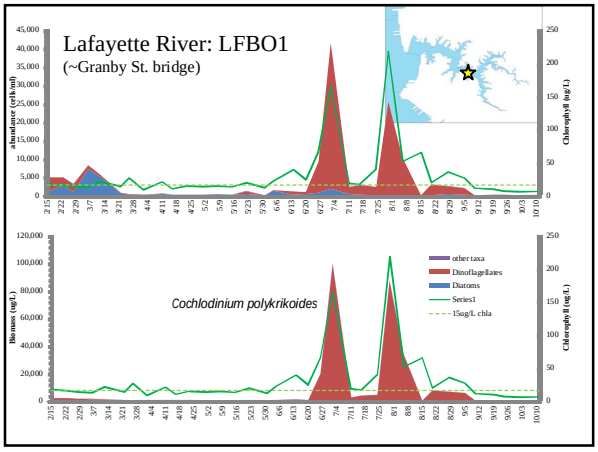



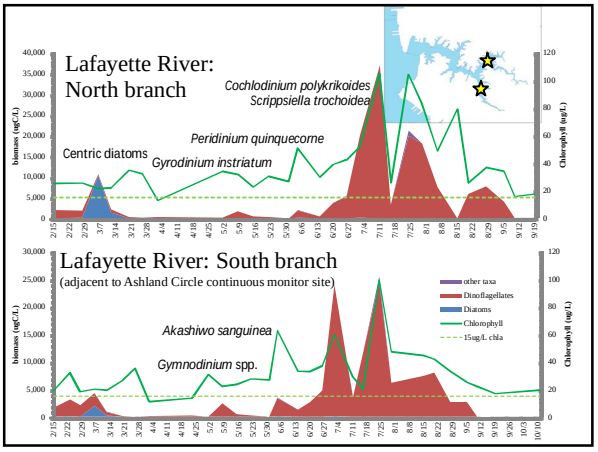





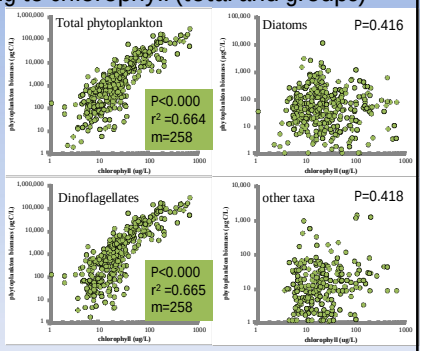




## Objective 1: Phytoplankton composition

- 111 phytoplankton taxa identified
- 35 present in at least 10% of samples
  - Diatoms: 52/17
  - Dinoflagellates: 29/13
  - Chlorophytes: 11/2
  - Cyanobacteria: 9/0
  - Euglenoids: 3/1
  - Cryptomonads: 2/1
  - Silicoflagellates: 2/0
  - Raphidophytes: 2/0
  - Prasinophyte: 1/1

## Objective 1: Phytoplankton composition contributing to chlorophyll (total and groups)

Significant positive linear relationship total phytoplankton and dinoflagellate biomass and chlorophyll



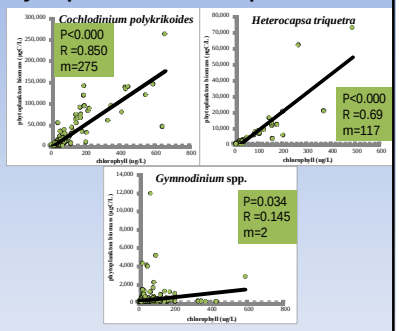
## Objective 1: Phytoplankton composition contributing to chlorophyll (species)

- 35 taxa (≥10% of samples) biomasses compared to chlorophyll concentration
  - Pearson correlation analysis

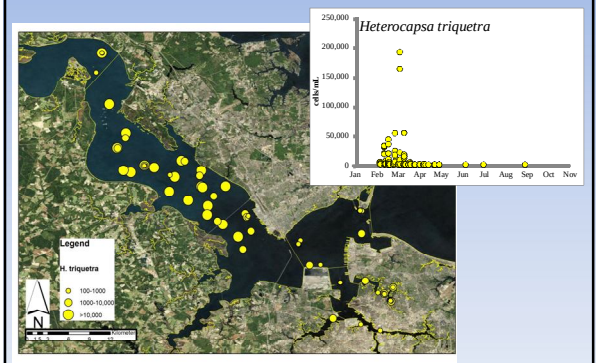
| Phyla | Taxa | p | R |
|---|---|---|---|
| Dino | **HETEROCAPSA TRIQUETRA** | **0** | **0.869** |
| Dino | **COCHLODINIUM POLYKRIKOIDES** | **0** | **0.85** |
| Dino | **GYMNODINIUM spp.** | **0.034** | **0.145** |
| Dino | PROROCENTRUM MICANS | 0.058 | 0.152 |
| Diatom | DACTYLIOSOLEN FRAGILISSIMUS | 0.121 | -0.157 |
| Diatom | CERATAULINA PELAGICA | 0.224 | 0.242 |
| chloro | ANKISTRODESMUS FALCATUS | 0.265 | -0.134 |
| chloro | SCENEDESMUS QUADRICAUDA | 0.282 | 0.253 |
| Dino | SCRIPPSIELLA TROCHOIDEA | 0.288 | 0.081 |
| Diatom | UNID. CENTRICDIATOM 10-30 | 0.313 | -0.054 |
| Diatom | THALASSIONEMA NITZSCHIOIDES | 0.314 | 0.115 |
| Dino | PROROCENTRUM MINIMUM | 0.416 | -0.078 |
| Diatom | CYLINDROTHECA CLOSTERIUM | 0.421 | -0.063 |
| Diatom | SKELETONEMA COSTATUM | 0.426 | -0.051 |
| Diatom | COSCINODISCUS | 0.471 | -0.7 |
| Diatom | CHAETOCEROS | 0.483 | -0.086 |
| Diatom | LEPTOCYLINDRUS MINIMUS | 0.487 | -0.058 |
| Diatom | LEPTOCYLINDRUS DANICUS | 0.505 | -0.163 |
| Diatom | NAVICULA | 0.51 | -0.161 |
| Dino | ALEXANDRIUM MONILATUM | 0.55 | 0.162 |
| Diatom | THALASSIOSIRA | 0.557 | -0.1 |
| prasino | PYRAMIMONAS | 0.561 | -0.122 |
| Diatom | CYCLOTELLA SPP. | 0.629 | -0.085 |
| Dino | PROTOPERIDINIUM | 0.656 | 0.092 |
| Diatom | PLEUROSIGMA | 0.689 | -0.058 |
| Diatom | UNID. PENNIATE DIATOM 10-30 | 0.7 | -0.024 |
| Diatom | GUINARDIA FLACCIDA | 0.75 | -0.07 |
| Dino | HETEROCAPSA ROTUNDATA | 0.757 | -0.034 |
| Dino | GYRODINIUM | 0.772 | 0.04 |
| euglen | EUGLENA | 0.842 | 0.019 |
| Diatom | DITYLUM BRIGHTWELLII | 0.849 | 0.043 |
| crypto | CRYPTOMONAS | 0.88 | -0.1 |
| Dino | AMPHIDINIUM | 0.902 | -0.022 |
| Dino | AKASHIWO SANGUINEA | 0.92 | 0.012 |

## Objective 1: Phytoplankton composition

- 32 taxa (≥10% of samples) abundances compared to chlorophyll concentration
  - Pearson correlation analysis
- Taxa with significant relationship
  - *Cochlodinium polykrikoides*
  - *Heterocapsa triquetra*
  - *Gymnodinium* spp.




## Objective 2: Dinoflagellate bloom succession

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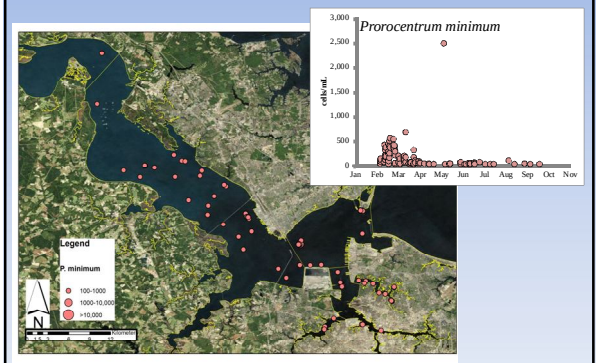


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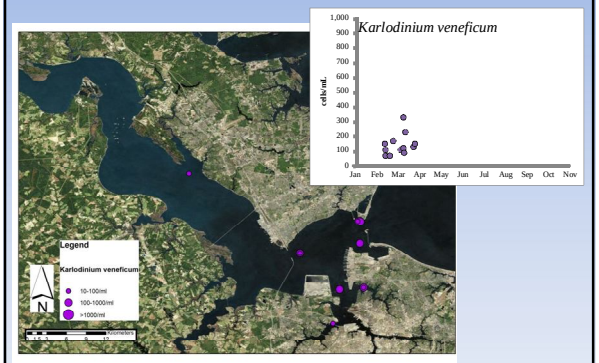


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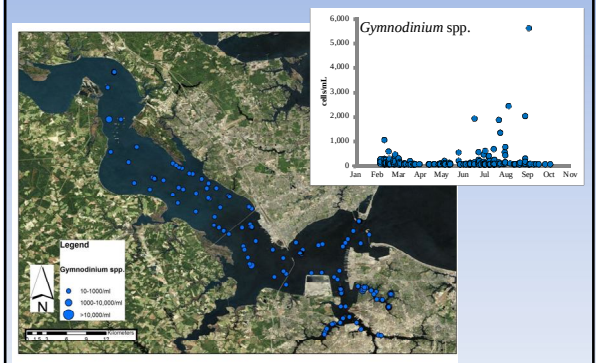

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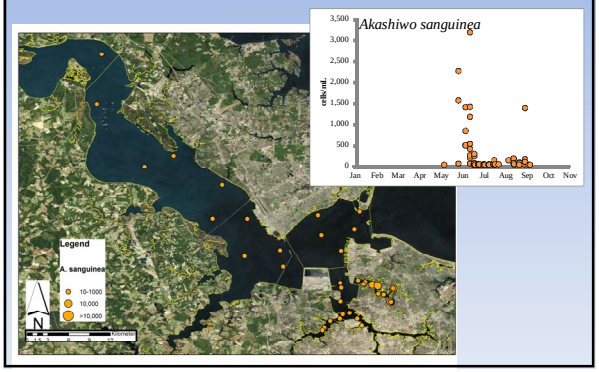


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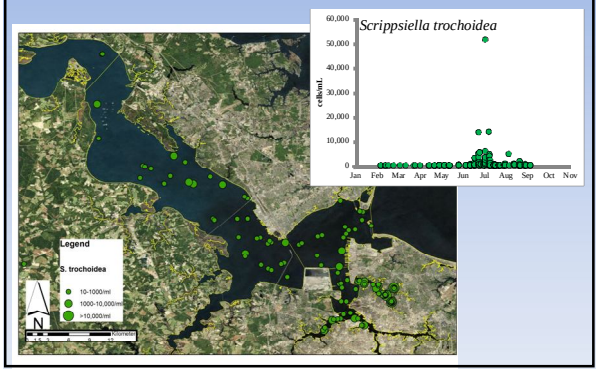


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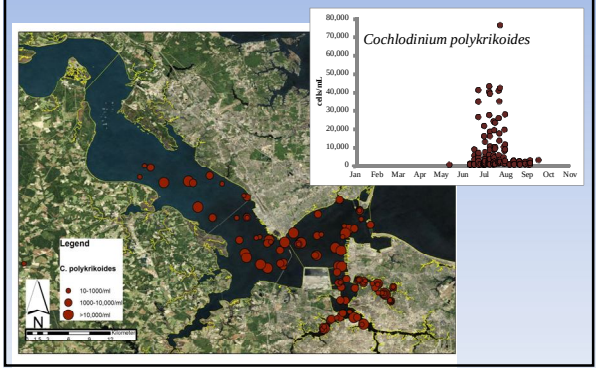


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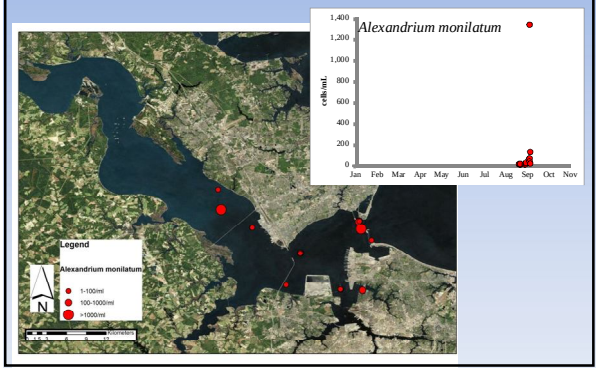
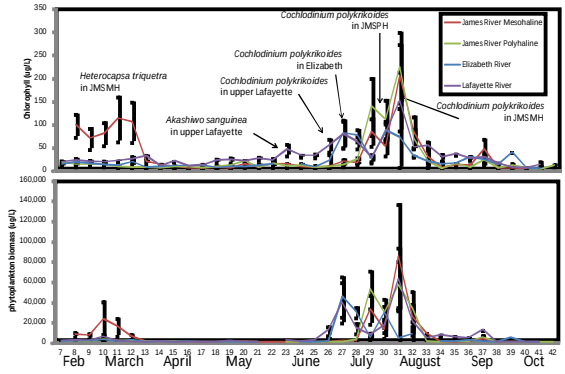



## Results: Objective 3: Hotspots/transport




## 2012 Summary

Spring Bloom: *Heterocapsa triquetra*

- initiation appears to be mesohaline James
- Max Chla: 481* µg/L (2011 max: 367 µg/L)
- Max density: 195,000 cells/ml (2011 max: 65,000 µg/L)

Summer/Autumn bloom: *Cochlodinium polykrikoides*

- initiation appears to be upper Lafayette River
- Max Chla: 649* µg/L (2011 max: 253 µg/L)
- Max density: 75,780 cells/ml (2011 max: 4350 µg/L)

## Summary

- 442/523 HRSD, 33/70 VCU and 4/4 Hopewell samples analyzed (479/597)
- Consistent data comparability between microscopic biomass analysis and chlorophyll fluorescence
- Dinoflagellates are largest contributor of biomass (avg. 71%) in lower James River, followed by diatoms (avg. 25%)
- Lower James River contains several dinoflagellate species which form successive blooms lasting weeks to months, most predominantly *Heterocapsa triquetra* and *Cochlodinium polykrikoides*

## Summary

- Earlier initiation and greater abundance of both spring and autumn dinoflagellate blooms during 2012 than 2011
- *Karlodinium veneficum* and especially *Alexandrium monilatum* and possible other HABs or *Alexandrium* species represent emerging potential health concerns for lower James River
- Continued focus on bloom initiation sites, including upper branches of Lafayette River- *2013: CONMON/Daily sampling*
- Concern of establishment of *Alexandrium* spp. cyst beds within tributaries