Summary of 2013 Work

- Algal characterization
  - Fixed Station in TF
  - DATAFLOW lower estuary
  - Top-down controls in TF

- Algal Bloom Triggers
  - Daily and diel monitoring
  - Storm events
  - SONE
  - Nutrients

- Potential Impacts to Aquatic Life
  - Invertebrates (zooplankton & shellfish including oysters)
  - Fish
Algal Characterization
Tidal Freshwater

- Weekly monitoring from May – October
- Water samples analyzed for CHLa, nutrients, and microcystin
- Samples for phytoplankton enumeration will be obtained from 2 sites
Algal Characterization

Oligohaline

- **DATAFLOW - OH**
  - Weekly during spring bloom
  - Monthly until October
  - Cruises increased during summer bloom

- **ConMon - MH**
  - Feb – Oct

http://www3.vims.edu/vecos/
Algal Characterization
Mesohaline, Polyhaline, Elizabeth River, LaFayette River

DATAFLOW by HRSD with ODU
Feb – Nov
Algal Bloom Triggers

Environmental triggers

Daily & Diel Sampling

- Identify daily changes relative to precipitation, tides and nutrient loadings
- Determine vertical movement of algae and obtain estimates of community metabolism on daily timescales
- Storm events
Algal Bloom Triggers
SONE Studies

- **Goal:** study the dynamics of nutrients to estuary bottom and impacts to local water quality
- Data collected in August 2012 and April 2013 at 6 sites
- Supports JR modeling and potential triggers
Impacts to Aquatic Life
Spatial extent of microcystin during bloom

- Spatial extent of microcystin
- Water
- Comparative study of toxin levels in Tidal FW and OH
  - 3 sites (red dots)
  - 4-5 dominant fish species
  - Data from lower site used to gauge toxin export from TF into OH
Impacts to Aquatic Life
Effects of microcystin on invertebrates

- Dose-response relationships
- Exposure to dissolved microcystin in water
- Microcystin diet
Impacts to Aquatic Life

Effects of microcystin on Fish

- **Chronic effects**
  - Gizzard shad juveniles
    - Daily growth rates

- **Acute effects**
  - Gizzard shad
    - Survivorship
  - Atlantic sturgeon juveniles (from Canadian sources)
    - Survivorship, histopathology
Deployed in April
During blooms 5-10 oysters collected for histological analysis
Dose Response Bioassays

- **Toxicity species**
  - Cochlodinium polykrikoides
  - Prorocentrum minimum
  - Gymnodinium spp.
  - Karlodinium veneficium
  - Microcystis aeruginosa

- **Test organisms**
  - Crassostrea virginica
  - Bosmina
  - Cyprinodon variegates
<table>
<thead>
<tr>
<th>Year</th>
<th>Description</th>
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<tbody>
<tr>
<td>2011</td>
<td>Workplan Developed</td>
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<tr>
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<td>Notice of Intended Regulatory Action (NOIRA)</td>
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<td>2012</td>
<td>Workplan Implementation</td>
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<td>2012-14</td>
<td>Monitoring and Modeling</td>
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<td><strong>2015</strong></td>
<td>Assessment Review and Science Panel Recommendations</td>
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<td>2016</td>
<td>Develop Regulatory Proposal (if appropriate)</td>
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<td>2017</td>
<td>Complete Regulatory Review &amp; WIP III</td>
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CEC Model Timeline

- Task 1 – Data Inventory and Integration
- Task 2 – Empirical Data Analysis
- Task 3 – Model Review and Selection
- Task 4 – Model Calibration/Verification
- Task 5 – Sensitivity and Uncertainty Analysis
- Task 6 – Scenario Development and Implementation
- Task 7 – Alternative Criteria Assessment
- Task 8 – Communication with the Scientific Advisory Panel
- Task 9 – Modeling Report
- Semi Annual SAP Meeting
Proposal to extend model calibration to include 2011-13

Potentially Modified Schedule - Modeling

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<tr>
<th>Task</th>
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<th>2013</th>
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