James River CHLa Study

Evaluate existing numeric CHLa criteria for the James. Are they protective of designated uses?

Assess modeling framework: watershed loads, hydrodynamics, and water quality.

Data Collection:
- When, where, why of algal blooms.
- Effects on water quality, human health and aquatic life resources.

Modeling: James-specific linkages between nutrient inputs to the estuary and CHLa in the estuary.
Data Collection Team (PIs)
- Iris Anderson (VIMS)
- Paul Bukaveckas (VCU)
- Harold Marshall (ODU)
- Ken Moore (VIMS)
- Margie Mulholland (ODU)
- Kim Reece (VIMS)

Modeling Team (PIs)
- Jim Fitzpatrick (HydroQual)
- David Jasinski (CEC)
- Andrew Parker (TetraTech)
- Jian Shen (VIMS)
- Harry Wang (VIMS)

Science Advisory Panel
- Clifton Bell (MPI)
- Claire Buchanan (ICPRB)
- Greg Garman (VCU)
- Will Hunley (HRSD)
- Winston Lung (UVA)
- Kenneth Moore (VIMS)
- Kimberly Reece (VIMS)
- Harry V. Wang (VIMS)
- Brian Benham (VPI)
- Paul Bukaveckas (VCU)
- Eileen E. Hoffman (ODU)
- Rebecca LePrell (VDH)
- Harold G. Marshall (ODU)
- Margaret Mulholland (ODU)
- Peter Tango (USGS)

DEQ
Arthur Butt, Anne Schlegel

DEQ prioritizes funding allocated to projects based on recommendations in SAP Workplan.

DEQ approves reports on data collection & modeling activities submitted by PIs.

Synthesis products developed for SAP by Bukaveckas, Butt and Schlegel.
Project Status

DEQ

establish panel & leadership

Workplan developed

Science Advisory Panel

award contracts

Data Collection Team: VCU, VIMS, ODU

2012 Data Collection Completed

2012 Reporting in Progress

2013 Proposals in Review

Modeling Team: CEC, Tetra Tech, HydroQual, VIMS

Phase 2 Report Completed (under review)
SAP Priorities: Spring 2013

- Evaluate results from 2012 data collection
- Assess 2013 data collection activities
- Evaluate progress in modeling effort
Today’s Meeting

10:00 am  Opening Remarks by Paul Bukaveckas
10:15    Highlights of Year-1 Findings (P. Bukaveckas)
11:00    Panel Discussion of Year-1 Results
11:15    Year 2 Data Collection Activities (Anne Schlegel)
11:45    Panel Discussion of Year-2 Activities
12:00    Lunch Break
12:30    Primer on the Phytoplankton Model (Jim Fitzpatrick)
1:15     Overview of Modeling Report (Dave Jasinski)
1:30     Watershed Inputs and Critical Conditions (Andrew Parker)
2:15     Historical Water Quality Data Analysis (Jian Shen & Harry Wang)
3:00     Reference Curves (Jim Fitzpatrick)
3:30     Panel Discussion of Modeling Report
4:00     Wrap-Up & Adjourn Meeting
Data Collection and Modeling Framework

External Drivers

- Watershed Runoff
- Point Sources
  - Nutrient Load

System Response

- Hydrodynamics (WRT, transport)
- TN, TP, DIN, SRP
- CHLa

A. Nutrients, bioavailability & algal uptake
B. Magnitude, duration of blooms
C. HABs & CHLa
D. HABs & living resources

1° Consumers

HABs

2° Consumers
**Nutrients, bioavailability & uptake**

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Results from algal bioassay experiments performed at JMS75 in 1989-1994 (Fisher et al. 1999) and 2012 (this study).
Urea and NH4+ were the dominant forms of N taken up (e.g., ~90% of total N uptake during *Cochlodinium* bloom). These results suggest that wastewater (tf) and regenerated N were important for fueling phytoplankton growth.
Magnitude, duration & extent of blooms

Tidal fresh
- Bloom lasting 183 days (CHLα > 20 µg/L) comprised of diatoms (76%), chlorophytes (16%) and cyanobacteria (6%).

Mesohaline
- Spring bloom by the non-HAB dinoflagellate Heterocapsa triquetra (> 190,000 cells/ml; CHLα >300 µg/L).

Polyhaline
- Summer bloom of Cochlodinium polykrikoides (up to 75,000 cells/ml; CHLα >300 µg/L). Bloom appears in headwaters of the Lafayette River and moved to the mouth of the river at the end of June. In situ N regeneration appeared to be the dominant process contributing to bloom sustainability.
Magnitude, duration & extent of blooms

James Polyhaline 2012
Summer (July 1-Sep 30)

Cochlodinium
CHLa & HABs

- Meso- and poly-haline: significant positive relationship between CHLa and dinoflagellate biomass.
- Tidal-fresh: significant relationships between CHLa and Microcystin.
Detected in 104 of 105 water samples during May through October.

Detected in 11 of 60 sediment samples during same period.

Detected in 254 of 379 (67%) individuals for fish and shellfish. Highest incidence of Microcystin contamination in blue crabs (viscera = 100%; muscle = 64%). Microcystin in blue crab tissues exceeded WHO safety guidelines in August.
Microcystin concentrations in water and fish tissues.

YOY gs = 0.98

Microcystin (µg/g DW Liver)

Water Column Microcystin (µg/L)

- Threadfin Shad
- Gizzard Shad
- Gizzard Shad YOY
- Water Column
A. salina / Elizabeth Rr. C. polykrikoides Bloom Event
02 July 2012

A. salina / Hampton Roads NSN Pier C. polykrikoides
Bloom Event 10 July 2012

CHLα = 154 µg/L, 17,000 cells/ml

CHLα = 116 µg/L, 6,000 cells/ml
Three Key Objectives

A. Linking nutrient loads to bioavailability & algal uptake

B. Linking HABs to CHLa

C. Linking HABs to effects on living resources