Vertical distribution of Chla (Research update)

CAP – August 12, 2015

Will Hunley (HRSD)

Vertical patterns

- Perspectives on this issue are limited to the lower James River only
- Tributary Chla samples are commonly collected at the surface only. Dataflow monitoring is ideally suited to surface conditions since data can be collected at cruising speed
- Existing Chla assessment methods consider only surface measurements (this is consistent with data collection). This seems to assume that either (a) conditions are well mixed, or (b) reasonably representative of the water column
- There are some recent data and studies that tend to question these assumptions

Chlorophyll a depth profiles – examples

3-19-13 JMSMH
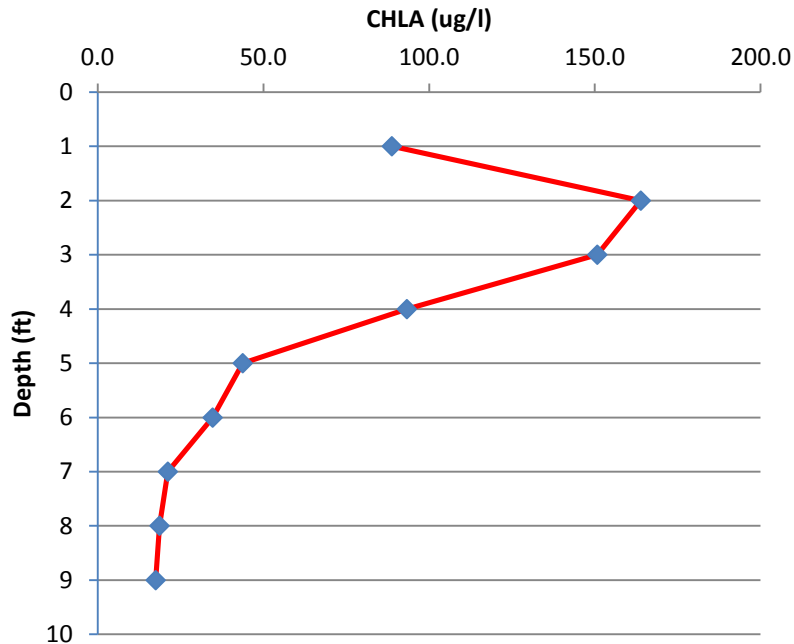
8-09-13 LAFMH
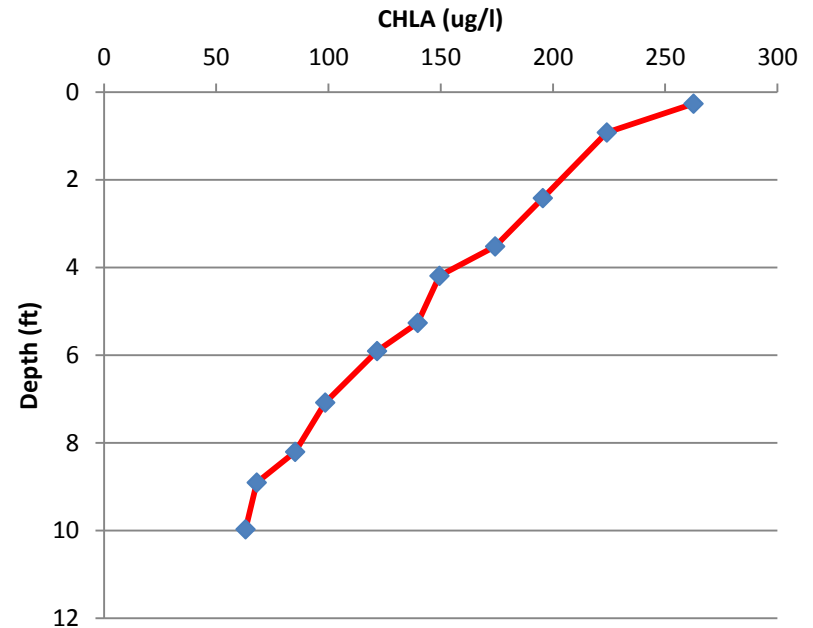
These were collected during late morning hours. The reverse may occur at night?

CHLA is uncorrected YSI result

Vertical patterns

- Park et al. (2001) and Kudela et al. (2008) found that that *Cochlodinium* can migrate vertically on a diel cycle
- Vertical migration may provide surface photosynthetic advantage during the day and access to deeper nutrient pools at night
- Vertical structure seems important because exposure / effects on organisms to elevated Chla would vary accordingly
- Existing surface samples might over or under estimate volumetric conditions
- HRSD and ODU have been conducting further research since 2014 to gain a better understanding of the dynamics
- There was a lack of algal blooms in 2014 which was a limitation. However, there were blooms to study in June-July 2015. August has been low to moderate so far.

Elements of the research

HRSD

- Vertical Chla profiling at fixed sites during weekly DFLO cruises (James and Elizabeth)
  - 3 cruises per week (JMSMH, JMSPH, LAFMH and ELIPH)
  - 5 sites per cruise = about 15 profiles per week
  - Target blooms when they are present
- Surface and bottom CONMON by HRSD in the Elizabeth River (mouth of LAFMH at NYCC)

Elements of the research

ODU

- CONMON at headwaters of LAFMH (Ashland Circle)
- Additional vertical profiles at 5 fixed sites – and on the R/V Slover
- Diurnal (12 and 24 hour) profiles / studies at some of these sites
- Profiles and diurnal studies also involve nutrient sampling and phytoplankton ID and counts
- Rain water nutrient sampling (role in stratification or bloom triggers)
- Data analysis
- Algorithm development
  - Goal: Estimate vertical structure with available monitoring data and prevailing conditions

Drivers being considered in analysis

- Freshwater input – stratification
- Tidal stage and currents
- Wind speed and direction
- Time of day
- Vertical migration by dinoflagellates

Future considerations

- Should future Chla monitoring involve routine vertical profiling and other considerations?

- Should future Chla assessments continue to be surface area only or consider vertical structure?

- If vertical structure is considered:
  - Evaluate volumetrically like DO?
  - Or, perhaps something simpler like vertically average the results and continue to assess by area?
  - Vertical averaging might "correct" surface data?

Next Steps

- Compile and evaluate the data

- Some preliminary results are becoming available

- Could provide a results oriented presentation in a month or two