

Options for NOAA maintenance of Chesapeake Bay tidal plankton monitoring

DRAFT 11-2-10 for TMAW review on 11-3-10

Background

The Chesapeake Bay Program began working with state partners to monitor plankton in the Bay's tidal waters in 1984. Data collected from the phytoplankton and zooplankton monitoring programs has been used for a variety of management purposes including tracking progress toward water quality targets and developing indices to provide information on the status of fisheries. Funding for phytoplankton monitoring in Maryland has been cut for 2011, and has been significantly curtailed in Virginia. Zooplankton monitoring ceased in 2002 (see more about sampling history at the end of this document). As a result, a Bay wide monitoring program for plankton no longer exists.

The Chesapeake Bay Executive Order (EO 13508) Annual Action Plan calls for the maintenance of the phytoplankton and zooplankton monitoring network, as part of action FW 15. NOAA's primary interest in the data from this network relates to facilitating ecosystem based fisheries management and monitoring water quality in the mainstem of the Bay. The 2011 President's Budget includes an increase in funding for the NOAA Chesapeake Bay Office (NCBO) to help meet the requirements of EO 13508. Some of these funds could be used to support plankton monitoring in the Chesapeake. However, before committing to part or all of the costs associated with the plankton monitoring network, NCBO proposes to work with interested constituents such as representatives from Maryland, Virginia, Chesapeake Research Consortium, Scientific and Technical Advisory Committee, and the Chesapeake Bay Program to reevaluate past monitoring efforts and identify sampling design changes as necessary to ensure relevant data is collected as efficiently and economically as possible.

In order to conduct this reevaluation a clear list of objectives for a baywide plankton monitoring program needs to be developed. Drawing on needs identified in EO 13508 as well as recommendations from previous plankton workshops in the Bay, NCBO has compiled the following initial draft list for review and comment.

Objectives

1. Phytoplankton monitoring objectives
 - a. Provide long-term data sets for use in fisheries management, ecosystem modeling efforts, and in trend analysis (effects of eutrophication, climate change, links between fisheries and water quality, food web shifts, etc.) Note:

phytoplankton data are much more informative than chlorophyll concentration for this analysis.

- b. Continue baywide Index of Biotic Integrity (PIBI) calculation for spring & summer; used in Eco-Check and CBP report cards. PIBI is correlated with water quality.
- c. Support/complement limited HAB detection. Note: specialized methods needed for full HAB detection, and sampling during blooms is needed (these rarely occur at the same places and times as the routine monitoring). Satellite and buoy data may help with HAB forecasting and detection. (Improved HAB detection is an action in MD under WQ 15.)

2. Zooplankton monitoring objectives

- a. Provide long-term data sets for use in fisheries management, ecosystem modeling and in trend analysis (effects of eutrophication, climate change, links between fisheries and water quality, food web shifts, etc.).
- b. Complete Zooplankton Index of Biotic Integrity (Z-IBI) development baywide for both seasons; only have for summer polyhaline now. Could use in report cards if available baywide.
- c. Continue to collect data needed to calculate the Spring Larval Striped Bass Food Availability Index. This index serves as an indicator of habitat suitability for the survival of larval fish, and serves as predictor of the survival of larval striped bass for a given year-class and tributary.

Sampling Design

Once a clear set of objectives has been identified, the design of the plankton monitoring network will be analyzed to determine what changes, if any, need to be made to meet them and at what cost. In considering any sampling design changes, significant thought will be given to maintaining a connection to data collected historically so that future results are comparable with the past. Some potential sampling design options include:

1. Status quo plus zooplankton: restart the zooplankton monitoring the same way it was done in 2002, and continue the current phytoplankton monitoring without changing design or methods. (It is unlikely that we would do this, but it is one option.)
2. Limited revisions to zooplankton monitoring. This could be done by implementing some or all of the recommendations in the report from the 2005 CRC conference, "Zooplankton/Food-Web Monitoring for Adaptive Multi Species Management." These changes could include, for example, varying the sampling stations by season, sampling in

fresher areas in the spring to assess food availability for fish spawning, and in saltier areas in the summer to assess food availability in areas used by summer breeding fishes, juvenile fish, and planktivorous forage fish. This presumably would be cheaper than sampling all the stations in both spring and summer. Other issues that affect costs are the duration of annual sampling (whether to include colder months) and what layers of the water to sample (whether to include lower layers).

3. Reassessment and revision of the zooplankton and phytoplankton monitoring programs to better meet NOAA's mission/objectives, especially for fisheries management, as well the objectives of constituents located around the Bay.

Regardless of which approach is taken, there are several logistical and strategic issues to consider, including:

1. Funding mechanism (contract or cooperative agreement).
2. Generating comparable results across MD and VA, via consistent methodologies in the field collections, QA, lab assessments and data delivery, with adequate spatial coverage of tidal waters.
3. Timing (aligning the sampling and the budget process effectively).
4. The extent to which we can achieve, within budget constraints, coordinated sampling (in time and space) of water quality, phytoplankton, zooplankton, ichthyoplankton, and prey and predator fish.
5. Prioritizing program objectives (based on the amount of resources available and the objectives, decisions will need to be made on the scope of the program).
6. Data availability (data need to be available quickly).

Recommendations

1. Present this draft options paper and discuss these issues at the TMAW meeting on 11/3/10, and request time for the same purpose on the agendas of the Sustainable Fisheries Goal Implementation Team (GIT) Executive Committee on 11/15, and the CBP Scientific and Technical Analysis and Reporting team (STAR) on 11/23.
2. Some or all of the small group that drafted and/or reviewed this document [Peter Bergstrom, Bruce Vogt, Sean Corson, and Howard Townsend (NOAA), and CBP staff Jackie Johnson (ICPRB), Peter Tango (USGS), and Jeni Keisman (UMCES)] will meet with Maryland & Virginia monitoring staff to refine the objectives and work out more details.
3. A subset of that group will meet with Kevin Sellner and other CRC or STAC staff to determine how best to involve CRC/STAC in identifying objectives, evaluating monitoring designs, and associated costs.
4. Once a renewed monitoring effort is established, a smaller group would meet regularly to review results and decide if any changes to the program were needed.

Past Chesapeake Bay plankton monitoring and data uses

The Chesapeake Bay Water Quality Monitoring Program conducted zooplankton monitoring from 1984-2002, and phytoplankton monitoring from 1984-2010. Zooplankton monitoring was conducted under direct EPA funding. Phytoplankton monitoring was funded by the states of Maryland and Virginia as a match program for the EPA funding they received to do water quality monitoring. Zooplankton and the plankton sampling were usually done on the same boats at the same time as the water quality monitoring. Due to budget issues, zooplankton monitoring was discontinued in 2002 in favor of shallow water monitoring. There was one year of funding available to restart it in 2005. However due to administrative delays, funding was redirected into analyze archived samples instead to better assess methodological difference between historic state programs. Phytoplankton monitoring continued, with some modification, through 2010.

Plankton monitoring is important for making connections between water quality and fisheries. One technique for making these connections is by calculating an “Index of Biotic Integrity” or IBI from plankton data. This index converts the raw data on species presence and abundance from each sampling event to a single number, with higher numbers representing “better” plankton conditions (defined as conditions closer to those found in less-impacted reference areas). IBI calculation and validation has been done for phytoplankton in Chesapeake Bay (see [report](#)), and is partially done for zooplankton in Chesapeake Bay (see [article](#), for summer polyhaline only). Phytoplankton IBI (PIBI) status by Bay region is included in the annual [Eco-Check report card](#), and baywide by year as part of the [CBP annual report card](#). On a baywide scale, the PIBI score as a percent of its goal has fluctuated between about 40-70% with no clear trend. Similar reporting is not available for the zooplankton IBI, because it has not been developed for all seasons and salinity regimes.