Task Force to Study the Impact of Ocean Acidification on State Waters
August 7, 2014 Meeting Minutes

Task Force Members

Present:
Eric Luedke, MD Delegate – via phone
Eric Schwaab, National Aquarium in Baltimore
Bruce Michael, MD Dept. Natural Resources
Matt Stover / proxy for Lee Currey, MD Dept. of the Environment
Tal Petty, Hollywood Oyster Co.
Robert T. Brown, Maryland Waterman's Association – via phone
Tom Miller, UMCES Chesapeake Biological Laboratory
Doug Myers, Chesapeake Bay Foundation

Absent:
Bill Ferguson, MD Senate

Staff:
Marek Topolski, MD Dept. Natural Resources

Guest Presenter

Dwight Gledhill, NOAA Ocean Acidification Program – see Appendix A

Audience

Ryan Ono, Ocean Conservancy
Rich Norling, MD Dept. Natural Resources
Mark Trice, MD Dept. Natural Resources
Nancy Butowski, MD Dept. Natural Resources
April Morton, MD Department of Legislative Services
Eric Weissberger, MD Dept. Natural Resources
Catherine McCall, MD Dept. Natural Resources
Holly Fowler, National Aquarium in Baltimore

Logistics

- Meeting schedule: 2nd Wednesday of each month
- Meetings are public. The meeting schedule will be posted to DNR online calendar
- All pertinent information regarding the OA Task Force will be located on a dedicated website: http://mddnr.chesapeakebay.net/mdoatf/index.cfm

Task Force Charge

House Bill 118: http://mgaleg.maryland.gov/2014RS/bills/hb/hb0118e.pdf

> "The Task Force shall:
> analyze the best available science regarding ocean acidification and the potential effects of acidification on the ecology of State waters and on State fisheries; and make recommendations regarding potential strategies to mitigate the effects of acidification on State waters and on State fisheries."

> "On or before January 1, 2015, the Task Force shall report its findings and recommendations to the Governor and the General Assembly."

Timeline

Meeting 1 (August 7, 2014)

- High level over view and develop a work plan.
- Proposed Broad Categories of Information:
    - Impacts
    - Monitoring
    - Mitigation
    - Science questions
    - Process (includes communication, education, outreach)

Meetings 2 & 3 (September 10 & October 8, 2014)

- Investigate specific areas to consider emphasizing
    - Bring in local experts - invite:
        - Whitman Miller - an overview of the water chemistry monitoring needs.
        - Denise Breitburg - biological response issues/impacts related to pH.
- Dig more deeply into what process was developed in Washington State (process will be more useful than the science because the ecosystems are so different).
- Engage local or non-local industry experts to understand OA issues.
- Review the monitoring programs in the state (what we do and do not have).

Meetings 4 & 5 (November 12 & December 10, 2014)

- Develop report: a significant portion will be about what we do and do not know.
    - Initial thoughts
        - Beginning of report should zero in on primary OA impact issues, issues we are worried about in MD, why we are worried about those issues, and the prioritized recommendations on what should be done.
        - Identify specific technologies currently available and those needed.
        - Recommend where funding should be spent?

Acronyms

- FOARAM Act - Federal Ocean Acidification Research And Monitoring Act of 2008
- IWOGA - Interagency Working Group on Ocean Acidification
- NE-CAN - Northeast Coastal Acidification Network
- NOAA - National Oceanic and Atmospheric Administration
- OA - Ocean Acidification
- SAV - Submerged Aquatic Vegetation

Expectations/Vision

- Create policy framework that proactively prescribes how MD will respond to OA in coastal and Chesapeake Bay waters.
- Develop a list of specific and concrete policy and legislative recommendations
- Improve political interest and pressure to increase legislative funding for research and education (leverage the Federal Ocean Acidification Research And Monitoring Act of

2008 (FOARAM Act) http://www.gpo.gov/fdsys/pkg/BILLS-110hr4174pcs/pdf/BILLS-110hr4174pcs.pdf)

- Use "lessons learned" from west coast and federal efforts to guide development and understanding of local efforts needed to address OA.
- Provide recommendations for research on the biological, ecological, social, and economic responses to OA. Identify where additional monitoring should occur such as areas near shellfish restoration and aquaculture. Resources of particular interest are oysters, clams, fish, and SAV.
- Take advantage of existing monitoring programs and infrastructure as platforms where additional types of data collection for OA can occur. Existing programs and infrastructure include water chemistry monitoring; and biological surveys of oyster, blue crab, and finfish.
- Incorporate recommendations for fishery resources into the fishery management plan process and implementation.
- Provide public education and outreach resources to raise awareness of the broad array of impacts that result from OA.

Discussion

Political & Process

- Identify one or more congressman to take an active interest in east coast OA.
    - A lot of political interest can be driven by local fisheries economies.
        - Example: In Maine, the driving political forces to address OA were its effects on the lobster fishery.
    - Identify the most important social and economic ecosystem services affected by OA: striped bass, blue crab, oyster, aquaculture, human health, other?
    - Do not get hung up on the spatial biology of a species in state vs. federal waters. Err on the side of species inclusion.
- Identify the key questions and issues regarding OA that need to be addressed
- Recommend a policy framework for how to lay out ideas to address the issues in a logical sequence.
    - Recognize that we do not know all the answers as to how OA will impact living resources.
    - These are the questions to be resolved moving forward.
    - Example process model – Washington State
        - Example framework of a process to identify issues and propose future work.
    - Identify human and financial resources needed.
- Recommend establishment of an intellectual infrastructure to move forward on the issue of OA. The endeavor needs to remain a "living" process.
    - Have a committee/advisory group that meets regularly (~quarterly) to evaluate current science regarding OA and recommend directions for future research (over a 5-10 year span) to state and federal funding entities.
- This Task Force has the opportunity to position MD at the forefront of the nearshore/estuarine OA research and management.

    - Any strategic plan put forth should align with strategic plan put forth by the federal Interagency Working Group on Ocean Acidification (IWGOA) http://oceanacidification.noaa.gov/IWGOA.aspx.
        - Alignment would facilitate access in federal resources.
    - Leverage existing MD water chemistry monitoring data with NOAA OA research efforts.
    - Chesapeake Bay could be a national test bed for the effects of estuarine OA and stimulate research to answer key questions.
- Establish mechanisms to disseminate information.
    - Messaging needs to say "Hey, do we have a problem? What is that problem?"
- A legislative budget is needed to accomplish the broad scope of work.

Resources

- Identify existing resources to quantify OA.
    - Evaluate what science is out there and what is needed.
        - There are existing studies that OA affects early life history stages and/or growth rates of some organisms.
        - 2009 Ecosim/Ecopath food web model of Bay
    - Current water chemistry monitoring system is robust for intended parameters.
        - Can existing monitoring infrastructure be modified to include future water chemistry monitoring needs such as the addition of sensors.
    - Academic
        - Scientists at local/regional academic and research institutions that have experience with OA.
            - Monitoring expertise: Mario Tamburri , Whitman Miller
            - Biological response expertise: Denise Breitburg.
        - Several local experts gave talks to the NE-CAN webinar series (http://www.neracoos.org/necan).
        - Because of recent, poor aquaculture oyster survival, a data workshop is being arranged to bring together people who have data which may help figure out what happened: chemical and physical oceanographers, hatchery operators, microbiologists, oyster biologists from up & down east coast. The workshop is scheduled for Sept/Oct and chaired by Mike Roman (UMCES/HPL)
            - Industry has an interest in identification of strains having some resistance to the stresses of OA.
    - Industry experience and physical participation.
- Identify needed resources to quantify OA.
    - Technology specifically designed to measure OA parameters in estuarine system.
        - Be flexible in what parameter(s) can be measured so long as the sensor measures the parameter(s) rate of fluctuation.
        - Vulcan Industries (mining operation in Havre de Grace) was willing to have water monitoring equipment attached to vessels. Money was not available to buy equipment.

        - Many water chemistry monitoring devices are designed for ocean not estuarine environments, which are highly variable, and do not perform well.
            - This type of technical challenge needs to be identified.
            - Are there existing systems, or will engineering efforts need to be funded?
    - Temporal and spatial intensity and frequency of OA events.
    - Biological response to OA.
        - Deficiency of biological data for comparison with water chemistry to explore biological response
        - Effects of OA on different life history stages of target species (growth rate, reproduction, maturation, etc.).
        - Can data collection be incorporated into existing monitoring programs: finfish, oyster, blue crab, other?
        - A zooplankton monitoring program to understand of food web effects.
        - If there is a response lag, then a monitoring time commitment including funds is necessary.
    - Need for more than one oyster hatchery (Horne Point) to acquire spat.
    - Identify funding
        - Determine how to leverage state and federal funds to meet the objectives.
        - Will industry participate in funding research?

Terminology

- Ocean acidification should be rephrased as coastal acidification
    - Spatial
        - OA does not intuitively include estuarine waters. Maryland state legislators did not realize that OA included the Chesapeake Bay.
        - This is why the phrase “State Waters” was used in House Bill 118.
        - Coastal acidification would intuitively include estuarine as well as ocean waters
    - Jurisdictional
        - OA is under the scope of NOAA. Ocean acidification is typically focused on atmospheric CO^2 inputs.
        - Use of the term coastal acidification incorporates terrestrial inputs of CO^2 which enables inclusion of EPA resources in addition to NOAA resources.
    - Research
        - The OA science community has a disconnect between the data collection challenges in estuarine vs. ocean systems.
        - There are vast chemistry differences between the two systems.

Appendix A

Presentation: audio minutes 29:20 – 1:20:00

Ocean acidification topic has evolved for where carbon comes from:

- v1.0 geochemical (atmospheric carbon only)
- v2.0 deep sea and geochemical
- v3.0 ecosystem interaction, deep sea, geochemical

v1.0:

- Balancing the geochemical carbon budget.
- Human released carbon is stored rapidly/directly in the ocean and atmosphere rather than back to the geochemical system/cycle.
- Dissolving CO^2 into water reacts to form carbonic acid (changes the pH of water).
- Carbonic acid reacts with/consumes carbonate ion.
- Calcium and carbonate ions react forming calcium carbonate.
- Marine organisms use calcium carbonate to build internal and external structures.
- Empirical experiment - measure CO^2 in a beaker & change "atmospheric" CO^2 in contact with it, the water's pH will change.
- At the rate of experimental pH change, the projection will be a precipitous decline of pH to a level only seen in 4 other major acidification events in geologic history.
    - Calcifying organisms are severely affected by the projected low pH.
- OA will cause ocean pH to shift enough that the water becomes corrosive to organisms that have calcium carbide structures.
    - The shell structures will dissolve.
- There are documented examples where some invertebrate and finfish early life history stages are affected by OA.
- SAV response to OA is uncertain.
- Ecosystem interactions need to be considered when planning for mitigation/adaption strategies.
    - How can actions be designed so as to benefit various systems at the same time?

v2.0:

- CO^2 does not come exclusively from atmosphere, but also from deep ocean water.
- Deep oceans are enriched in CO^2.
- Organics (ie: dead organisms) from surface ocean sink to deep water and decay.
- Decay releases CO^2.
- Upwelling brings the CO^2 enriched deep sea water to the surface where the water is already enriched from atmospheric derived CO^2 (anthropogenic sources).
- Areas of upwelling exist on the west coast.

v3.0

- CO^2 is released into water from biological processes.
- CO^2 is interacting/utilized by the biology (SAV, marshes, etc.) which are also interacting/responding to the atmospheric carbon and nutrient enrichment (terrestrial and atmospheric).

Chesapeake Bay

- v1.0 at play.
- v2.0 at play when there is upwelling/turn over.
- v3.0 at play because the CO^2 is also interacting/utilized by the biology (SAV, marshes, etc.) which are also interacting/responding to the atmospheric carbon and nutrient enrichment.
    - Challenge is to understand the carbonate chemistry within the Chesapeake Bay. How it has changed, and how/why it may be continuing to change?
    - Does it mean anything to the biology and reliant economies?

Oyster larvae susceptibility to OA has been studied.

There can be a synergistic effect between hypoxia and OA: the effect is greater than either parameter on their own.

- Water pH in portions of Long Island Sound have been documented to drop below 7 becoming acidic.
    - Caused by nutrient enrichment.
        - Nutrients increase the amount of organic material in the water.
        - The organic material then decays and increases respiration.
        - Increased respiration releases CO^2 forming excess carbonic acid.
- Acidic event (pH change) will persist longer than a hypoxia event (reduced oxygen).
    - CO^2 slowly exchanges between water and air.
    - Oxygen rapidly exchanges between water and air.

Federal Programs related to OA

- FOARMA – Federal Ocean Acidification Research and Monitoring Act (http://oceanacidification.noaa.gov/AboutUs/FOARAMAct.aspx).
    - Hope to modify language to rephrase OA as Coastal Acidification.
- IWGOA – Interagency Working Group on Ocean Acidification (http://oceanacidification.noaa.gov/IWGOA.aspx).
    - Developed a strategic plan to address OA: research and monitoring needs over next 5-10 years: monitoring, technology, response resources, data management, modeling, etc.
- OAP – Ocean Acidification Program (http://oceanacidification.noaa.gov/Home.aspx).
    - Significant investment in ocean monitoring and biological response.
- Current Chesapeake Bay monitoring needs to go beyond pH.
    - The current suite of monitoring programs may not be as robust as it needs to be largely due to a lack of biological response data/monitoring.
- In-house NOAA & academic biological studies: ecosystem function, wild catch, managed resources, important ecological linkages, aquaculture.
- Monitoring resources are limited and state funding will be necessary.
- Federal resources that are available: hydrographic ships, observing vessels (merchant) outfitted with monitoring equipment, fixed observing systems, coral reef monitoring stations to collect biological/ecosystem data/indices (more than a monitoring buoy).
- SECOORA - Southeast Coastal Ocean Observing Regional Association (http://secoora.org)
- NE-CAN - Northeast Coastal Acidification Network (http://www.neracoos.org/necan)

- Create ways for stakeholders to communicate with scientists to identify and resolve research problems to address on the ground issues with the ecosystem.

Review of West Coast OA initiatives.

Chesapeake Bay primary scientific concern is the extensive and diverse input of fresh water impacts on Bay chemistry (v1.0 issue).

- Salinity gradients correlate with buffering capacity of water.
  - Fresh water is subject to greater chemistry fluctuations from CO^2.
    - More dynamic
    - pCO^2 levels can be exceptionally high
- There are data points of sustained CO^2 time series data collection: SERC, CBL, Eyes on the Bay.

West Coast:

- During upwelling events, carbonate ion saturation states collapsed and hatcheries had major failures.
- Monitoring the upwelling allowed for advanced warning to hatcheries allowing them to turn off intakes until favorable conditions returned.

Libby Jewett's comments provided to the Maine OA Task Force

- Have scientists, policy makers, and managers work together on everything <u>but</u> technical science documents.
- Be careful of the scope of what the task force thinks they can deliver.
- Focus on setting the groundwork for the future – what do we really need to move forward to get a handle of this in a meaningful timeframe.
- Healthy ecosystems and food webs are vital for maintaining wild harvest industries and most aquaculture operations – many systems interact with the benthic ecosystem.
- As much as possible, emphasize how to slot OA activities into existing efforts in management frameworks.

Presentation time end - 1:20:00

Q & A: time 1:21:48 – 1:27:36

R. Brown -

- Q: Does increased precipitation alter OA and affect oyster larvae?
  - A: It may. Freshwater input will reduce salinity and dilute carbonate and calcium concentrations. This could negatively affect organisms that are sensitive to the concentration state of calcium and carbonate.

E. Leukte -

- Statement: Part of the report should outline where we are lacking in science and what the state can do to support some of the basic questions. What are the unanswered questions?
- Q: Knowledge on the effect to oysters is becoming fairly well understood, but what about other species such as rock fish and other major fisheries in the state?
- Q: Are Chesapeake Bay and Atlantic waters susceptible to upwelling events?
  - A: not as likely, and if it does happen then not to the extent as on the west coast.

- Q: Has Washington State had success with implementation of Task Force report recommendations? Have they [state] been able to build an ongoing relationship with watermen and aquaculture operators and scientific community?
    - A: Yes, Washington State has provided resources to directly carryout research and monitoring. They have directly engaged with impacted industries; established a program to develop technologies explicitly tailored to industry applications in OA.