

**Task Force to Study the Impact of Ocean Acidification on State Waters  
October 15, 2014 Meeting Minutes**

**Task Force Members**

Present:

Eric Schwaab, National Aquarium in Baltimore  
Bruce Michael, MD Dept. Natural Resources  
Lee Currey, MD Dept. of the Environment  
Tom Miller, UMCES Chesapeake Biological Laboratory – via phone  
Tal Petty, Hollywood Oyster Co.  
Doug Myers, Chesapeake Bay Foundation

Absent:

Bill Ferguson, MD Senate  
Eric Luedke, MD Delegate  
Robert T. Brown, Maryland Waterman's Association

Staff:

Mark Trice, MD Dept. Natural Resources  
Marek Topolski, MD Dept. Natural Resources

**Guest Speakers**

Bob Rheault, Executive Director of East Coast Shellfish Growers Association  
Michael Devin, ME House of Representatives  
Jay Manning, Co-Chair Cascadia Law Group

**Audience**

Matt Stover, MD Dept. of the Environment  
Nancy Butowski, MD Dept. Natural Resources  
Ryan Ono, Ocean Conservancy  
Zoe Johnson, MD Dept. Natural Resources  
Eric Weissberger, MD Dept. Natural Resources  
Catherine McCall, MD Dept. Natural Resources  
Rich Norling, MD Dept. Natural Resources  
April Morton, MD Department of Legislative Services  
Andrew Gray, MD Department of Legislative Services  
Jill Parisi, Oyster Recovery Partnership  
Kara Muzia, Oyster Recovery Partnership

**Logistics**

- Meeting 4: November 17, 2014 from 9 am – 12 pm
- OA Task Force information is available at <http://mddnr.chesapeakebay.net/mdoatf/index.cfm>

**Discussions**

Bay = Chesapeake Bay  
Bay Program = Chesapeake Bay Program

## Shellfish Industry Perspectives and Issues

Tal Petty: Hollywood Oyster Co. – <http://www.hollywoodoyster.com/index.html>

- There is enough industry concern about economic impacts of OA to help push this issue
    - Can data be pulled together for wild and surrounding cultured operations to discuss potential commercial implications?
    - Enable a discussion of various products like clams (bait), oysters, crabs, etc
      - Include maps of resource distribution
      - Discuss implications to existing and future aquaculture: species of interest
  - Concern about summer 2014 poor hatchery spat set– big problem for aquaculture and restoration
    - Affected MD and VA hatcheries including Horn Point and Chesapeake Bay Foundation
    - Cause of spat set failure is uncertain – no current evidence that OA was causative factor
      - Is sufficient data being collected to figure it out?
      - Was this particular spat set failure unique?
    - What data does Horn Point collect?
      - Water quality for in-stream and in-tank water
        - Temperature, salinity, DO, pH? (quality?), fluorometry
        - Disease prevalence: MSX, Dermo, other known diseases
        - Not aware of any new disease present
      - What biological parameters are measured?
        - Parameters depend on research going on – specifics not known
        - Data collection should include both benthic and water column conditions
    - Horn Point will convene a workgroup of Bay oyster hatchery experts/operators
      - Review all possible data sources
      - There should be some factors that can be readily discounted as causes
      - Tom Miller will urge scientists to convene a workshop before end of year
      - Tom Miller is urging Mike Roman (Horn Point Director) to have draft report/findings completed before end of year (November/December)
  - **Action Item: A formal letter will be drafted by Task Force asking Mike Roman if draft findings could be shared with Task Force before the end of December (November/December time frame)**
  - Guidance/assistance is needed from industry
  - Are protocols/infrastructure in place to monitor/identify and share spat set status
    - Current information sharing is ad-hoc and as needed
      - Communication is informal among hatcheries and growers
      - Establish systematic and seamless pathways for exchange of real time information (observations, biological response, water conditions, and problems) between hatcheries and growers
        - Facilitate rapid identification of where/what any problem is
          - Needs to include spatial extent of issue
  - Need to establish threshold conditions that trigger/affect spat set success
    - Need to determine the correct parameters to measure
    - Limited understanding of why poor spat sets occur
      - Premature to develop thresholds at this point of time
    - Who should be responsible for monitoring, threshold development, establishing protocols, and establishing communication pathways?
- How to get more data?
  - Identify monitoring programs that should test for additional parameters
  - MDE collects a lot of water samples across a wide spatial extent
    - Current testing is focused on human health parameters = fecal coliform

- Increase suite of parameters tested for from each of MDE's water samples
  - Some pH has been collected, used to collect nutrient data

**Action Item: Lee Currey will discuss testing for additional parameters with water quality monitoring staff at MDE**

- Does the lack/loss of the benthic calcium sink (shell) in the Bay effect OA?
  - Loss of oyster reef and accumulated in-sediment shell effect on OA and organisms
  - Some OA related issues get categorized under climate change
    - Some pH/CO<sub>2</sub> interactions are incorporated into Bay climate change models
- Report: Economic Activity Associated with Clam Aquaculture in Virginia – 2004
  - Thomas J. Murray, Virginia Sea Grant Marine Advisory Program and James E. Kirkley. 2005. VSG-05-04, VIMS Marine Resource Report No. 2005-5. Department of Fisheries Science, Virginia Institute of Marine Science.  
<http://www.vims.edu/GreyLit/VIMS/mrr05-5.pdf?svr=www>

Bob Rheault: Executive Director of East Coast Shellfish Growers Association – <http://www.ecsga.org/>

- Old deep water upwelling OA should not be confused with coastal OA
- OA is happening, but not as big an issue as being made to be
  - OA is one of many factors affecting shellfish, but it is not the 1° factor
- 1° pressing issue is eutrophication and its effects on mud, benthos, and overlying waters
  - What are nutrient/pH relationships?
    - It is not conclusive what will happen to shellfish when pH changes
      - Daily swing of ~1.5 pH units in a 24 hour cycle in estuaries is common
        - Daily pH high of ~8.5 at noon to low of ~7 in early morning
        - Projected ↓ pH in next 50-100 years of 0.1 - 0.2 units
        - Shellfish populations continue to exist despite daily pH swing
      - Internal pH of shell depositing cells remains ~7.1 regardless of pH swing
        - Easier for cells to maintain internal pH in waters with ↓ pH
          - ↓ pH gradient
        - [Energetically] easier for cell to lay down carbonate
          - Being studied by Carrie Whippers (?) with NOAA
        - Carbon isotope signature in shell is from food (dietary origin) rather than water (dissolved CO<sub>2</sub>)
        - Aragonite saturation coefficient (calcification rate) may not be as important as currently thought
        - pH and aragonite saturation coefficient manipulation, by adding bicarbonate and calcium carbonate, does not eliminate all shellfish production problems
          - Shellfish were disease free without pH improvement
          - Larval shell dissolution is normal unless > 50% of batch
          - First 6-8 hours after hatch is critical
            - They cannot feed and velum has not formed
            - ↑ likelihood of mortality if hatched in evening when ↓ pH
            - ↑ likelihood of survival if hatch is in morning when ↑ pH
              - shell formation energetics has not been studied

Comment [MT1]: I was not able to locate any information.

- George Waldbusser, Oregon State University studies shellfish and OA <http://ceoas.oregonstate.edu/profile/waldbusser/>
- During Carboniferous period, ↑ CO<sub>2</sub> and ↓ pH levels than today
  - Time period when shellfish abundance exploded and radiated
  - Acidic conditions were worse yet shellfish survived and thrived
    - Is genetic information to handle acidic conditions still present?
    - In Australia, *Crasostrea gigus* reared that resist ↓ pH
      - Are genetics for physiological plasticity common?
- OA is different from eutrophication induced acidification
  - Estuaries have acidified mud due to too much nitrate and decomposing algae
    - ↑ localized pCO<sub>2</sub>
    - Shallower/thinner redox zone in sediment over time
  - ↓ abundance of soft shell clam in Chesapeake Bay
    - Probably a sensitivity to acidic mud rather than temperature
  - Clam larvae habitat options: 1) stay on surface of mud and ↑ predation risk or 2) burrow into acidic mud and dissolve
- Some hatchery problems may be nitrate related
  - Water sterilized by chlorination prior to culturing algae (shellfish feed)
    - Chloride ions form nitrosomenes which are toxic to shellfish, ↑ larval mortality
- Insufficient research on synergistic effects of multiple factors
  - Identify research issues of interest to shellfish industry and follow up with studies
    - Do ↓ shell reserves affect depth of redox zone and calcium availability?
      - Areas that accumulate organic material develop black mud (↓ pH)
        - Hatcheries can grow out clams to dime size which can survive on acidified anoxic sediments
        - Larvae will not set on these muds
        - He dumped shell onto black mud areas
          - Had successful, heavy hard clam spat set
        - Shell in sediment appears critical for benthic chemistry and larval survival
      - Need studies for how to remediate anoxic sediment for successful spat set
        - Will crushed shell or pelletized limestone work? If not, what will?
        - Need options to ↑ benthic pH because significant ↓ nitrogen (↓ eutrophication) and induced effects is unlikely in near future
      - Evaluate crushed shell and pelletized limestone effect on benthic habitat
    - Has there been a change in calcareous algae abundance – food quality?

**Action Item: Locate research articles for issues Bob Rheault raised**

#### Perspectives and Lessons from Other States

Michael Devin: ME House of Representatives - Maine OA Commission –

<http://www.maine.gov/legis/opla/oceanacidificationmtgmatrls.htm>

- Commission had 16 members: 5 legislator, 4 state depts., 1 NGO, 10 industry & science
  - 2 people worked with NE-CAN
  - NE-CAN: The Northeast Coastal Acidification Network – <http://www.neracoos.org/necan>

- Commission obtained funding for three committees to work outside of four formal meetings
  - Data & Modeling
  - Washington State Report
    - All but one recommendation in report were relevant to Maine
  - State of Science
- Report due in December
- Maine is a combination of Washington and Maryland coastlines
  - Upwelling in Gulf of Maine – like Washington
    - Very little control over OA conditions
  - Extensive coastal shoreline – like Maryland
    - Point and non-point sources
    - Riverine pollution input – ↑ freshwater flow input
      - Sediment and nutrient loading
      - Antiquated storm and waste water infrastructure – ↑ upgrade/repair cost
    - Nutrient load and water pH linkage has not been studied or addressed in ME
- What level of engagement with industry?
  - Shellfish industries (clambers, aquaculture, lobster) are primarily concerned/involved
    - Clam industry has concern about impacts not believed to result from green crab
      - Based on farmer/clammer observations
      - Despite more frequent warmer conditions favorable to green crab
      - Benthic water and sediment pH testing indicates acidic conditions
    - Industry is actively engaged with scientific communities
  - Legislative process is focused on jobs and economy
    - Potential for economic impacts by OA created support for Commission formation
      - Commission is trying to keep a focus on economic factors
      - Fishermen are willing to provide observations and information
      - When poor conditions occur they are willing to request site monitoring
      - People are linking OA with warming waters resulting from climate change
        - Asking what other environment issues are related to OA
      - Shows how keeping the discussion economically relevant can work in favor of dealing with OA and climate issues
- Nick Bautista, Island Institute – <http://www.islandinstitute.org/>
  - Recently had a meeting to discuss the potential impacts of OA on coastal committees
- Chellie Pingree, Congresswoman Maine submitted some OA legislation
  - H.R. 4692: Coastal Communities Ocean Acidification Act of 2014  
<http://thomas.loc.gov/cgi-bin/bdquery/D?d113:8:./temp/~bduApN::>
    - Address impacts of OA to commercial fisheries and coastal communities
    - Skepticism as to passage of legislation
    - A coastwide effort to address OA is needed
      - Reach out to neighboring states - cannot rely on a federal level response
      - Unlikely the federal level is able to handle/address a broad issue like OA

Jay Manning: Co-Chair Cascadia Law Group – Washington State Blue Ribbon Panel on Ocean Acidification – <http://www.ecy.wa.gov/water/marine/oceanacidification.html>  
<http://www.ecy.wa.gov/water/marine/oa/2012panel.html>

- 28 member Commission – creation was driven by industry

- 12 scientists with OA expertise
- Oyster growers –industry already concluded OA was a significant economic problem that was having an impact prior to Commission’s first meeting – huge benefit
  - Oyster industry leaders were able to get the shellfish industry on the same page
  - The largest shellfish producer was involved and was able to add political pressure
- Legislators and county commissioners
  - Oyster growers were constituents, so they had to listen and pay attention
- One member felt they should have been more engaged with agriculture community
- Report “Scientific Summary of Ocean Acidification in Washington State Marine Waters” released prior to Commission recommendations – [http://westcoastoah.org/wp-content/uploads/2013/12/Scientific-Summary\\_OA-in-WA-waters.pdf](http://westcoastoah.org/wp-content/uploads/2013/12/Scientific-Summary_OA-in-WA-waters.pdf)
- Washington recommendation areas/topics
  - Legislature created the Marine Resources Advisory Council
    - Ensure that Blue Ribbon Panel’s recommendations are implemented
    - Central coordinating entity for all other recommendations
      - Adaptation, source control, public engagement activities
  - Get to root cause of CO<sub>2</sub> emission and loading – identify global vs. local contributions
  - Recognized that global level CO<sub>2</sub> was beyond Washington’s control
    - Upwelling events for example – although they have already had effects
  - There are things Washington state can do to improve CO<sub>2</sub> locally – but be realistic
    - Educate others on OA
    - Commission has pushed/advanced the issue of CO<sub>2</sub> reduction and carbon tax
    - Focus on local areas where actions can have an impact on input control
      - Reduce loading of land based acidifying pollutants
        - Specifically, nutrients and organic carbon
      - Realization of their effect on acidifying the waters
        - Investigate importance of land-based pollutant loads
        - Develop source control solutions
          - Watershed are likely to have differing acidification budgets
          - Control what you can locally
            - Combine local acidification budgets into a “global” Washington state budget
              - Currently being developed to create budgets at various watershed/water body scales
              - This will help develop local source controls
        - Atmospheric contribution of CO<sub>2</sub> in Seattle and effect on water acidity
          - ex: there were water pH dips that correlated with rush hour traffic in Seattle
    - Increase ability to adapt and remediate using shell or plants to mitigate locally the impacts of CO<sub>2</sub>
      - Use of kelp, other seaweeds, eelgrass in areas where they will grow and there are both sensitive species and acidity problems
        - Grow (reduce CO<sub>2</sub> locally) then harvest plants to remove the biomass/carbon then replant
    - Coordinate the effort from top to bottom
      - Establish communication and coordination among federal, state, local, tribal, advocates, researchers, and NGOs
    - Legislature created the Ocean Acidification Center at Univ. Washington

- Responsible for ensuring the research and monitoring side of recommendations actually happen
- They interact with local, state, federal, and tribal entities
- Invest in basic science and monitoring
  - Increase knowledge of how OA works
  - Develop an adequate monitoring program
  - Predictive model development
    - Emphasis on determining effects from acidification events (such as upwelling) in short time span (48 hours)
    - This is to inform hatcheries of when upwelling events occur so they are able to take actions to reduce/eliminate effects
  - Implement mechanisms for restoration/remediation: shell placement, grow and harvest plants
- Engage, motivate, and educate public about OA
- Washington is working on a study of OA carbonate budget
  - Mindy Roberts, Washington Department of Ecology is project lead on budget development, [Mindy.Roberts@ecy.wa.gov](mailto:Mindy.Roberts@ecy.wa.gov)
- Washington is interested in linking up with Atlantic and Gulf coast states to strengthen the network of states addressing OA – they are already engaged with Alaska
- Challenge for MD Task Force
  - Articulate the economic risks of coastal OA in MD
    - Identify economically important species
      - Identify members of industries and get buy in
      - Engage industry of the challenges OA presents to their economy
    - Emphasize the relevance of climate change induced effects on OA
      - i.e.  $\uparrow$  CO<sub>2</sub> causes climate change and also happens to influence OA
      - Political challenge is that politicians will have to acknowledge that climate change is occurring
      - Challenge is to make the connection and articulate the economic risks when the acidification problem has not fully presented itself
  - Bay impacts and concern are less evident
    - Researching species at risk (based on existing data/studies of related/comparable species) that are economically significant to industries in each jurisdiction
      - Engage with fisheries to work together to answer scientific questions about the species
        - The hope is that industry involvement in assessment process will help them come to their own conclusion about OA effects
  - Develop education and outreach initiatives, programs, and efforts
  - There are Bay TMDLs and state partnerships in Bay watershed working on nutrient, eutrophication, and hypoxia
    - TMDL has specific nitrogen, phosphorous, and sediment loads allocated at local and county-by-county level
    - Expand efforts to include carbon input at jurisdictional level
    - MD would like to bring the OA issue into the Bay partnership

#### Task Force Discussion

- Has Bay Program discussed if their infrastructure can respond to OA?

- STAC has not weighed in
- Primary workgroup to address OA is Fisheries and secondary is Water Quality
- Bay Program categorizes many OA issues under climate change
  - Determine state of the science, the Bay Model (can and cannot do), tools, and data being used – inventory of where we are
  - Bay Model includes nutrients, sediment, and lag times – needs to:
    - Include additional OA parameters/effects: pH, carbonate, etc.
    - Develop linkage to effects on fisheries (including shellfish) models
- Bay Program has outreach/awareness and science resources to leverage OA education
- Data that is collected is not aggregated and seen at a collective basis
  - Develop overlay maps to visualize data collection, resources, and threats locations
  - It is important to include both the science and economic driver data
    - Data should include economics – economics will drive decisions
    - Present a range (low, medium, high) of costs to collect/develop data
    - ~ 6 months to gather monitoring data – location of some data is not known
- Next steps for the CBAN (Chesapeake Bay Acidification Network)?
  - Incorporate/reference the Washington report's 13 recommendations/findings
  - Use CBAN to move the OA ball forward
    - Prioritize recommendations relevant to OA
    - Link recommendations with specific agencies/groups equipped to implement them
    - Identify existing resources and work with legislature to leverage MD resources as cost sharing to access federal resources (NOAA, USGS, etc.)
- Up-coming conference of relevance to Task Force
  - National Summit: Inspiring Action, Creating Resilience
    - 7<sup>th</sup> National Summit on Coastal and Estuarine Restoration, 24<sup>th</sup> Biennial Meeting of The Coastal Society
    - November 1- 6, 2014, Washington, DC
    - Organized by Restore Americas Estuaries and The Coastal Society
      - [www.estuaries.org/summit](http://www.estuaries.org/summit), <http://www.thecoastalsociety.org/>
  - Panel discussion – Ocean Acidification: The Response of State and Federal Governments
    - Ocean acidification is a growing concern across the U.S. This panel will examine the impacts of this issue on coastal communities, ecosystems, and economies through federal and state perspectives with a focus on WA as a model for other states, such as ME, looking to address ocean acidification.
    - Panelists: Jay Manning, Bill Dewey (Taylor Shellfish Farms), Rep. Mick Devin, Libby Jewett (NOAA)
    - Chair: Julia Roberson (Ocean Conservancy)
    - 3:30, November 5<sup>th</sup>
- What will the Task Force report look like?
  - Next meeting is fleshing out substance of the report
  - Rough draft report by November meeting
    - Flesh out the main ideas, concepts, and substance from previous meetings
    - Develop the report framework and outline
      - Section on Task Force process and materials (minutes, presentations, website)
      - Pull together information to include: background info, what we know, what's available

- DNR take lead to identify and assemble data and monitoring assets and biological resources
    - Create overlay maps of these resources
    - What is the appropriate spatial scale to examine OA
  - What do we know about drivers for action: economic implications, environment, monitoring, and data
  - Different systems: inshore vs estuary (Ches Bay vs Coastal Bays) – characterize types of MD waters affected
  - Review how actions across the six Bay states are affecting OA
    - What is the lag time between action and effect on sediment/water conditions?
  - Ecopath/Ecosym models
    - Link these models to Bay model
    - Carbonate cycle needs to be incorporated into models
      - There is not much carbonate info for bay
      - The biggest challenge has been linking chemistry, eutrophication, cycling between benthos and water models to fisheries models
- Discuss suggested recommendations
  - Engage regionally & nationally
  - Determine how specific the Task Force will be in assigning responsibilities regarding recommendations?
    - What entity is best able to handle a given recommendation?
  - It is important to get state funds which can be leveraged to get additional funds and support from federal agencies
  - What is the potential for legislative action/legislation?
    - What is likelihood of MDE including OA in upcoming climate change report?
    - New ideas and strategies identified by Task Force could be considered for report
- How will the recommendations be presented?
  - What jurisdictional level?
  - Suggest to administration to engage with Bay Program that the OA and resource components be introduced at their level
  - May be structured very explicitly as to who does what or be more general for some topics
    - There are specific programs that exist that are best able to handle various components
    - The recommendations should point to appropriate entities with experience or programs
  - Should the Task Force include implementation time frames and estimated cost for recommendations?
- Suggested Recommendations
  - Establish systematic protocols to monitor/identify and share spat set status between hatcheries and growers.
  - Create a list of parameters related to OA that should be tested for by all monitoring programs regardless of which agency is implementing the program (DNR, MDE, Horn Point, etc.)
  - Link the Bay Model with fisheries models and incorporate OA parameters

- Identify monitoring programs that should expand sampling to include parameters related to OA
- Aggregate monitoring data
- Develop overlay maps to visualize locations of data collection, resources, and threats
- Include both the science and economic driver data
- Identify existing resources and work with legislature to leverage MD resources as cost sharing to access federal resources (NOAA, USGS, etc.)
- Encourage Chesapeake Bay Program's Fisheries Workgroup as primary and Water Quality Workgroup as secondary to address OA
- Recommendations will be tasked to a specific agency, standing commission, etc. to ensure they are being tended to into the future at the state level (administration & general assembly)
- Need a recommendation section to address restoration
- MD and ME work together to involve other states regionally and nationally
  - Use CBAN to help develop communication networks