Winter 2017 Maine Ocean and Coastal Acidification Partnership Meeting
Bigelow Laboratories
December18, 2017

- 1:00—1:15 Welcome and Introductions
  - James McManus of Bigelow Laboratories
  - Esperanza Stancioff
    - Introduction of Steering Committee
      - Susie Arnold
      - Ivy Frignoca
      - Aaron Strong
      - Mick Devin
      - Lydia Bloom
      - Mick Kuhns
      - Richard Nelson
    - Advisory Cmmt. Introduction
- 1:15—1:25 MOCA Business- Overview of MOCA timeline, governance changes and language including policies and discussion-- Susie Arnold, Island Institute
  - Celebrate Successes
    - Holding events since 2013
  - Transitions
    - Susie is stepping down as coordinator; replaced by Ivy Frignoca, the Casco Baykeeper
    - Esperanza Stancioff as assistant coordinator
    - Aaron Strong of UMO as external engagement coordinator
    - Ivy will serve one year; will be replaced by Esperanza
  - Goals
    - Keep steering committee between 5-8 people
    - Wide range of people
      - Industry
      - Looking for aquaculture
      - State Government
    - Advisory Committee overview
  - Overview of new governance documents
  - New policy around external engagement
  - Introduction to new policy for how to comport oneself on Google Group
- 1:25—1:35 MTI update and Ocean Acidification Alliance as an affiliate (non- jurisdictional member), and discussion—Aaron Strong, UMaine
  - International Alliance to Combat Ocean Acidification
    - Formed in 2016 by Governors of CA, OR, WA, and Premier of BC
    - Volunteer partnership
      - Can be business, non-profits, governmental entities
    - Must commit to “taking action” and sharing knowledge
      - What is action

        - Advance scientific understanding of OA
        - Take meaningful actions to reduce the causes of acidification
        - Protect the environment and coastal communities from impacts of changing ocean
        - Expand public awareness and understanding of acidification
        - Build sustained support for addressing this global problem
    - Maine is not a member, but there are affiliates in Maine
        - Work being done to have MOCA join as affiliation member
        - For Maine to join, either an act of legislation or come from Governor's office. No commitment of funds.
    - Qs from Bill Mook of Mook's Sea Farm on how a company joins as affiliate member
  - Overview on Lightning round from Maine Technology Institute
    - How to lead state-wide monitoring program
    - How to prepare for next round
    - Can include both physical things in water and data infrastructure
- 1:35—2:30 Panel: Updates on Casco Bay Monitoring – Mike Doan, Friends of Casco Bay; Nichole Price, Bigelow Laboratory for Ocean Sciences; Joe Salisbury, University of New Hampshire
  - Mike Doan, Friends of Casco Bay
    - Introduction to Friends of Casco Bay
        - Has been monitoring for 26 years through discrete monitoring
        - Monitoring sites throughout Casco Bay
    - Overview of Casco Bay Monitoring
        - First Continuous Monitoring site
            - Wanted Central to the Bay
            - Off a float
            - Sites in 4m of water in high tide
            - Has a transducer
            - PC02 Sensor
        - Learning Curve
            - How to maintain and care
            - Checked every two weeks
            - PC02 sensor maintained once a year
                - When is best in year to send to manufacturer
    - Information Learned So Far
        - Seeing warmer waters later in the year
            - Highs not necessarily higher but lows are not as low
        - Salinity around 30ppt, normal dip in spring with snow melt
        - Dissolved Oxygen
            - Peaks in Spring
            - Falls off Spring and Summer, rebounds in fall
        - Chlorophyll
            - Short spike early, drop off
            - Spike again March and April

        - Drop off April-August
        - Spike again in September and November
    - pH
        - Peak in Spring
        - Fall off in Spring and Summer
    - pCO2
        - Lower in Feb and March
        - Peak in Sept and October
    - Slice: Overview of pH and pCO2
        - Diurnal variability present
        - Biological influences on daily trends
- Questions
    - Ask to see Nitrogen data
        - Not available but usually sees values of .35
    - Any invective phenomenon
        - Still early, more looks at tides, etc.
    - How tight is relationship between pH and PCO2 without time present
        - Very tight.
        - Temperature a driver
    - Bill Mook confirming they are seeing same trends
    - Any of the results related to the late season bloom
        - Yes, and will be looking at it again next year
    - Comment that it might be useful to share learning curve at upcoming workshops to help aid community

- Nicole Price of Bigelow Labs
    - Maine coastline is prone to acidification
    - This is first year there will be multiple year-round observation sites
    - First Observation: Ocean Approved Farm (Seaweed) and study site
        - Off Little Chebeague in Casco Bay
        - Assessment both at kelp farm and at nearby control site
            - Higher Omega level and pH around kelp farm
    - Overview of Halo
        - Allows you to map in real time
        - Challenge: how to drive the boat to get clear real-time data
            - Solution: Use a circular pattern
    - Challenge for upcoming year
        - Disentangling salinity and CO2
    - Questions
        - How long does it take to get sample?
            - Only a few hours but need to ensure that not taking so long that it gets tangled with diurnal data
    - Damariscotta River Projects
        - Rockweed Harvest and CO2 absorption
            - Harvesting may induce, have no effect, or may reduce C02 uptake
            - Harvester came up to Bigelow to do pretend harvester in May

        - Came back in June
        - As harvested Rockweed recovers, becomes more productive than non-harvested area
        - Bigelow plans on continuing to do assays in area
        - Question: On Balance over year, do they take on same amount?
    - Work on Kelp "Seed" and assisted evolution
        - Bigelow Working to do cross-breeding to do find more resilient strains of kelp
    - Ocean Liming
        - Two Questions from Undergrad Intern's Research
            - Are present-day oyster farm conditions corrosive
                - Evidence shows self-limitation
            - Can ocean liming work with this?
        - Takeaway so far
            - PCO2 levels very high in Damariscotta
    - Problems with Shell Waste
        - Legal Issues
            - Maine: Not permitted to deposit or discard any dead marine animal or its parts in intertidal zones, harbors, or rivers
            - CWA: Included in pollutants
    - Liming may work where phytoremediation is not feasible
- Joe Salisbury, UNH
    - Casco Bay Observations
        - Background
            - Shawn Shellito takes care of instruments
            - Chris Hunt is responsible for discrete analyses
            - Melissa Melendez, PhD student applied a 1-d mode to the data
            - Joe Salisbury oversees the project
        - Data
            - Higher in PCo2
            - Seasonal Cycle
            - Similar to other data, but higher with PC02 and lower with pH (proximity to harbor? On the bottom?)
        - Oxygen v. pH
            - Nice linear relationship
            - Usually indicative of system driven by temperature and biology
            - High productivity during stratified conditions
            - VERY low pH during intense rains
        - Other observation
            - Ocean water showing very low pH as well
            - Offshore water coming in and mixing with low pH freshwater
    - Models
        - Higher C02 during high wind periods
        - TA
            - Not many TA measurements in Casco Bay

        - Omega Data
            - Spikes in July
    - Seasonal Ranges from Casco
        - TA: 447
        - Omega: .71
        - DIC: 487
        - O2: 141
        - Temperature: 17
    - Takeaways: Temperature and Salinity are the major drivers during the summer on seasonal variations in PCo2
- Thoughts: Have a cruise where visit multiple sites
    - Measure PC02, alkalinity, pH, oxygen, and others.
    - Will not just be surface, will get data from deeper waters through bilge system
- Question:
    - Aaron Strong: Should we be anticipating lower saturation rates consistently in Spring and Fall?
        - Thermodynamic forcing of Aragonite seems to support that
    - To what extent is inshore collection of organic matter influencing?
        - Organic matter is easy to be thought of as a culprit but also being used as feed
    - Bill Mook: Observation between salinity and temperature.

- 2:30—2:45 Coffee Break
- 2:45—3:45 Panel: Harmful Algal Blooms and potential links to OA- Barney Balch, Bigelow; Bryant Lewis, Department of Marine Resources; Ivy Frignoca, Friends of Casco Bay
    - Barney Balch
        - GNATS transect
            - Runs from Portland and Yarmouth, NS
            - Early bias to late spring to early fall
            - Year round effective as of 2006
            - Use the Hovmoller space-time diagrams
        - Between 2016-2017, HUGE increase in temperature
            - Did not believe at first; must be associated with temperature from ship
        - Salinity
            - Lower salinity observed cross gulf
            - Compare with gulf salinity during wet years (2006-2011)
        - Density
            - Cross gulf lower density
        - Absorption
            - Lower absorption across gulf
                - Compare with high absorption during wet years
        - Temperature Gradients
        - Photosynthesis
            - Productivity dropped by factor of five around 2006

        - Rose against for first time in decade in 2017
    - Silicate
        - Drop recently
    - Nitrate-Silicate
        - Nitrate in excess unless in wet years
    - Alkalinity
        - Low with some exceptions
    - DIC
        - High values in 2015
    - Omega Aragonite
        - Across the gulf of Maine down to sub 1.5
            - Some even below 1
        - Related to temperature and solubility?
    - pH
        - 8.3 in summer months
    - HABS-Alexandrium
- Bryan Lewis, DMR Supervisor for Western Maine
    - HAB trends on the East Coast
        - Florida
            - Gulf Coast is most active but events do occur on the East Coast
            - Year Round Concern
            - Neurotoxic Shellfish Poisoning
                - "Red Tide"
                - Karenia brevis
                - Since 1940s, recurring
            - Paralytic Shellfish Poisoning
                - "Red Tide"
                - Shellfish or pufferfish (all 7 cases)
                - Recurring
            - Amnesic Shellfish Poisoning
                - Pseudo-nitzschia
                - No illness
            - Ciguatera Fish Poisoning
            - Brown Tide
        - Mid-Atlantic
            - Karlodinium veneficum
                - Non toxic, fish kills
            - Brown tide
                - Aureococcus anophagefferens
                - Marine fauna kills
                - First suspected event in 1985
        - Northeast
            - Paralytic Shellfish Poisoning
                - Alexandrium species
                - "Red tide"

        - Recurring, most common
    - Amnesic Shellfish Poisoning
        - Pseudo-nitzschia
    - Diarrhetic Shellfish Poisoning
        - Dinophysis species, prorocentrum lima
    - Karania mikimotoi
    - Brown Tide
        - Non-toxic to humans
        - Mid-Atlantic through LIS recurring
    - Rust Tide
- DMR's HAB monitoring
    - Since 1996: Phytoplankton used as early warning for shellfish biotoxins
        - Phytoplankton thresholds trigger shellfish collection
    - DMR staff & Citizen Scientist collaboration
        - 81 stations in 2017
    - PSP monitoring
        - Yearly regional closures (high risk, low value species)
        - March-September phytoplankton observed
        - 150/218 shellfish above regulatory (80ug/100g) from Casco Bay
        - First time all bivalve shellfish species closed for harvest (Casco Bay)
            - Closures: May 2nd-July 27
        - Cyst beds cause some predictability
    - DSP monitoring
        - Shellfish sampling based on phytoplankton
            - 2,000 cells/ L Dinophysis or P. lima
        - Shellfish sampling occurred in August
            - No toxin detected
        - 2016 shellfish tested with 2 methods
            - PP2A kit had numerous positives, LCMS had non
            - Possible unknown okadaic acid
        - Casco Bay and MDI had highest counts
        - No closures in 2017
    - ASP Monitoring
        - Shellfish sampling based on phytoplankton
        - 2,000 cells/ L Pseudo-nitzschia
        - Phytoplankton bloom observed May to present
    - Closures
        - Blue Hill Bay, Frenchman's Bay, near Machias Bay, Cobscook Bay: Sept-December
        - Casco Bay and portions of New Meadows-December
    - ASP monitoring advances
        - Within days of first observed pseudo-nitzschia samples, having toxins in shellfish
    - Emerging threats
        - Cochlodinium polykrikoides

        - Maine's first observation in Casco Bay region
        - Warm water, causes low DO and animal toxins
        - Numerous kill observations
- Steve Archer, Bigelow
    - Bigelow's Analytical Services: Toxin analyses/OA/MOCA
        - HPLC
            - High Performance Liquid Chromatography
            - Introduced to help DMR
            - Bigelow only lab in USA that is FDA approved for PSP analyses
    - Saxitoxin
        - Responsible for the PSP
        - Very toxic
    - Other countries
        - CEFAS in UK
            - 3k analyses from Scotland to Dover
        - Netherlands
        - New Zealand
        - Canada
            - CFIA-ACIA
    - Possible new pseudonitzschia species in the GOM?
- Ivy Frignoca, Casco Baykeeper
    - Casco Bay Algal Blooms (2016-2017)
        - Nitrogen Concentration in Casco Bay
            - Highest in New Meadows and Portland
        - 2016
            - Thick mats in three locations
                - Mill Cove (SoPo)
                - Back Cove
                - Pleasantdale Cove
            - Under algae, pH 7.16 to 6.4 in a week
            - Clams stressed in first week, dead in the second
        - 2017
            - Nuisance blooms started earlier, grew larger, lasted longer
            - Algal mats can:
                - Prevent juvenile clam settling
                - Suffocate animals under mat
                - Change sediment pH
                - Change diversity
            - Back Cove Bloom stayed until October
        - Other observed algal mats
            - Basin Cove Harpswell
                - Algal mat so thick that juvenile clams could not settle
        - Summary
            - Notable increase in productivity, more phytoplankton, more nuisance algae

        - Higher water temps
        - Drought like conditions second summer in a row
    - Action
        - Casco Bay Estuary Partnership and MOCA partnership
        - Clean Water Act permits
        - Support budget and policy that protects science and acknowledges climate change
        - Legislation- local, state, and federal
        - Life style choices- reduce/eliminate lawn fertilizers; pet waste; carbon footprint
- 3:45—4:15 Keynote: Regional Greenhouse Gas Initiative (RGGI) updates-- Kathleen Meil, Policy Advocate, Acadia Center (non-profit, research and advocacy org committed to advancing the clean energy future)
    - State and Regional Action on Carbon Markets
        - RGGI
            - 2003: NY initiates RGGI process
            - 2005: Seven state MOU
            - 2007: MA, MD, RI join
            - 2011: NJ withdrawals
        - Overview
            - Market based
            - Emissions cap is negotiated by states
            - Covers electric generating units over 25 MW
            - Initial Cap set at 2005 levels with 2.5% annual declines to 2020
            - New cap trajectory: additional 30% reduction by 2030
            - Power generators purchase one allowance/ton C02
            - In Maine, bulk of RGGI funds go to Efficiency Maine
        - Why RGGI
            - Economic growth, public health, market benefits, environmental benefits can all go together
        - RGGI & Public Health
            - Reforms to strengthen RGGI through 2030 will deliver additional health benefits
            - The proposed policy scenario is projected to result in 1.28 billion in savings
            -
- 4:15—4:20 COP23 Update—Aaron Strong, UMaine
- 4:20—4:30 Next steps, ideas for future meeting