GOALS	RECOMMENDATIONS	Action to Date	Future Action
1. Invest in Maine's Capacity to Monitor and Investigate the Effects of Ocean Acidification and Determine Impacts of Ocean Acidification on Commercially-Important Species and the Mechanisms Behind Those Impacts	*1.1. Enhance monitoring and create a database sufficient to support the development of regulatory and non-regulatory approaches to reduce and limit nutrients and organic carbon from sources that are contributing significantly to acidification of Maine's marine waters. Enhanced monitoring should begin in one or more pilot estuaries where impacts are presently occurring.*	**Enhanced monitoring by establishing a continuous monitoring station to collect data every hour of every day in middle Casco Bay; added parameters specific to OCA and climate change, including direct measurements of the partial pressure of carbon dioxide, and calculations of dissolved inorganic carbon, total alkalinity and omega aragonite saturation. 1.1 -1.3 (the new tool is the creative development of our continuous monitoring station)** **Enhanced staff seasonal monitoring from April through October by expanding season, deploying new data sondes that collect more parameters, and collecting nitrogen samples at over 20 locations; these include nearshore and offshore sites and involve surface sampling at the nearshore sites and surface to bottom profiles at the offshore sites. This monitoring helps inform sources of coastal acidification, impacts of changing storm and weather patterns, and hones in on areas of the Bay exhibiting signs of stress. 1.1-1.2** **Shared and compared data and monitoring methods with other researchers with more frequency and detail, including with UNH, Bigelow, Island Institute, and UM, as we all**	**Add two additional continuous monitoring stations to capture influences and data in eastern Casco Bay and Portland Harbor.** **Continue enhanced staff monitoring which builds upon 27 year data set amassed by FOCB, with occasional adjustments to locations to include areas where we need more data or that are experiencing elevated indicators of stress.** **MOCA method of drawing together existing top researchers in the state to discuss methodology and compare data has worked well; we recommend continuing this.** **Identify data gaps and continuing monitoring needs coast wide; identify consistent funding to support current monitoring and enhanced monitoring to fill data gaps.**

		developed and compared methodology and data on new parameters, especially calculation of omega aragonite saturation. 1.1-1.3 **2019: Added direct measurement of fDOM, turbidity and cyanobacteria. 1.1-1.3** **2016-2019: Assisted DEP with enhanced monitoring and date collection in greater Portland Harbor area with particular focus on sources of nitrogen loading 1.1-1.2** **Created web pages to share data that are updated on a monthly basis** **2018- Launched Water Reporter observing network to engage public in reporting algal blooms, sea level rise, storm surge, and other indicia of climate change.**	
	1.2. Expand monitoring of ocean acidification to establish its natural variability and to detect trends in water chemistry and related biological responses.		
	1.3. Develop new tools with which to assess and understand acidification and its impacts in Maine waters.		

	1.4. Determine the causes and relative importance of acidification in the waters and sediments of Maine.		
	1.5. Identify the impacts of acidified waters and sediments on Maine's commercial species.		

2. Reduce Emissions of Carbon Dioxide	*2.1. Strengthen coordination and continue participation with existing national, state, and regional initiatives regarding the reduction of atmospheric CO_2 levels.*	**Supported RGGI 2.1, 2.2** **Supported Marine Advisory Council and Governor's Climate Council Bill, as well as numerous other state bills designed to preserve home rule and reduce carbon emissions 2.1. 2.2** **Supported NOAA and EPA budgets; wrote comments opposing roll backs in federal environmental laws; support legislation that funds and informs state and local efforts to address OCA and climate change in marine environments 2.1, 2.2** **Support and participate in local efforts to develop fertilizer and pesticide ordinances and to address climate change 2.1, 2.3**	**Support municipal efforts including installation of community solar, and initiatives like Portland/South Portland's One Climate Future.** **Ensure the continued vitality of home rule.** **DEP, at our initial request and now by legislative request, is revising a report on air emissions from marine vessels. The report should be completed by December 2019. That report should be submitted and referenced by the Governor's Climate Council.**
	2.2. Encourage key leaders and policymakers to synchronize in establishing a comprehensive and unified strategy to reduce carbon dioxide emissions.		
	2.3. Expand actions at the state and local levels that may help in reducing CO_2 emissions.		

3. Identify and Reduce Local Land-Based Nutrient Loading and, Organic Carbon Contributions to Ocean Acidification and Freshwater Runoff by Strengthening and Augmenting Existing Pollution Reduction Efforts and Making Groundwater Recharge a Land Use Priority.	*3.1. Identify and reduce nutrient loading and organic carbon from point source and nonpoint discharges determined to cause or contribute to ocean acidification.*	**Commented on MEPDES permits for wastewater treatment facilities (WWTFs) that discharge into Casco Bay to ensure all treatment plants monitor their effluent to determine seasonal nitrogen load and that major facilities optimize treatment to reduce nitrogen loadings. This effort led the East End WWTF in Portland to reconfigure its aeration basins and achieve over a 70% reduction in nitrogen over one year.** **Commenting on MS4 permit (general permit for proper operation of municipal separate storm sewer systems) renewal: strongly advocating for addition of monitoring to detect illegal discharges through municipal storm sewer systems; also seeking requirements that municipalities take action to improve water quality of urban impaired streams, including those that show signs of degradation from excess nutrient loading.** **Tracked and observed nuisance algal blooms caused by excess nitrogen loading in coves of Casco Bay. Where possible, identify and rectify cause of excess N loading. For example, eliminating use of lawn fertilizer on adjacent property, asking town to investigate septic systems, or seeking N optimization in MEPDES permits.**	**This model should be expanded to other coastal WWTFs.** **Consider developing a model fertilizer ordinance that can be adapted and tailored at local level or a state fertilizer statute.** **Advocate for expanded septic inspections to all properties; enhance repair and replacement of failed septic systems; explore where to expand sewer lines.** **Advocate for enhanced funding for upgrades to WWTFs, septic systems and overboard discharges (OBDs)..** **Conduct policy reviews of existing laws to strengthen them to address OCA and climate change, for example: identify means to improve water quality in nutrient and urban impaired waters; review 2007 Resolve and stalled work to develop numeric nutrient criteria; determine whether or not to employ RDA to implement IC-TMDL; review whether to recommend revision of water quality standards to consider signs of OCA as an**

		Completed research on and developed chart of strong examples of N fertilizer statutes and ordinances and other materials. Begin distributing these materials in summer 2019; serve on South Portland fertilizer ordinance committee **Supported state legislation to expand septic inspections**	**impairment; advocate for delegated authority to regulate cooling waters in MEPDES permits; contemplate whether temperature and pH regulations need to be modified in consideration of climate change.** **Advocate for revised Chapter 500 stormwater rules to be more proactive and require LID and green infrastructure.** **Review expired Maine Construction General Permit to advocate for tightening requirements to prevent runoff from construction sites. Also contemplate tightening post construction requirements.** **Advocate for implementation 0f policies designed to disconnect impacts of impervious cover and treatment of stormwater before it reaches receiving waters.** **Make entire coast a no discharge zone.**
	3.2. Assess the need for water quality criteria relevant to ocean acidification.	**Participate and coordinate with DEP on relevant water quality monitoring (see section 1 above)**	

	3.3. Ensure that state staff and other practitioners are working with the best information and most effective technology.	**Supported grant to fund purchase of new sonde for DEP**	**Advocate for adequate funding for eelgrass monitoring, and water quality monitoring, especially to identify impairments and set permit limits.**
	3.4. Investigate incentive programs for pollution and freshwater runoff reduction.		
	3.5. Support and reinforce current planning efforts and programs that address the impacts of nutrients and organic carbon and freshwater runoff into coastal waters.		
	3.6. Enhance education and outreach programs that provide landowners with information about best practices for reduction of nutrient pollution.	**Enhanced BayScaping program, see 5.2**	

4. Increase Maine's Capacity to Mitigate, Remediate and Adapt to the Impacts of Ocean Acidification	*4.1. Preserve, enhance and manage a sustainable harvest of kelp, rockweed and native algae in bivalve areas and adjacent shoreline, and preserve and enhance eelgrass beds.*	**Worked with others to create the Maine Ocean and Coastal Acidification (MOCA) partnership when state legislation to create a council failed in 2015.** **Served on MOCA steering committee since 2016 and as coordinator since 2018 to coordinate state OCA research, hold biannual symposia on OA research and policy, publish periodic newsletter, and maintain listserv of over 200 members to share OA related news. Also relates to 5.3** **Serve on NECAN (North East Coastal Acidification Network created and funded by NOAA) policy committee to ensure Maine work is coordinated with regional efforts. Also relates to 5.3** **Supported interstate, regional solutions like RGGI to reduce carbon emissions and networking with other North Atlantic Waterkeepers on issues including stormwater pollution.**	**Transition MOCA into Governor's Climate Council, in particular the science and technical subcommittee and the marine and coastal working group. Identify who will assume role of communications to listserv and periodic symposia or other events to share research and brainstorm solutions.** **Use available science to identify and reduce or eliminate excess sources of nitrogen.** **Identify and support adaptation policies and practices such as multi-species aquaculture. (Experiments to date have shown that growing seaweed with mollusks may create a buffering effect, with higher pH and greater calcium carbonate available to shellfish grown within a seaweed bed. Seaweeds may be used to uptake excess N.)** **Support regional policies to further reduce carbon emissions including from transportation sector. This approach should also include evaluations of the impacts of carbon and other pollutant emissions from marine vessels.**

			Advocate for more nimble fishing regulations to responsibly contemplate fishing of new species moving into the area and multi-species management. For example, rockweed is managed as a fishery but is habitat to many other fisheries. **Inform and support municipal efforts.**
	4.2. Encourage bivalve production to support healthy marine waters.		
	4.3. Spread shells or other forms of calcium carbonate ($CaCO_3$) in bivalve areas to remediate impacts of local acidification.		
	4.4. Increase the capacity of the fishing and aquaculture industries to adapt to ocean acidification.		
	4.5. Identify refuges and acidification hotspots to prioritize protection and remediation efforts.		
	4.6. Encourage the enhancement and creation of research hatcheries.		

5. Inform Stakeholders, the Public, and Decision-Makers about Ocean Acidification in Maine and Empower Them to Take Action.	*5.1. In addition to providing the commission's report, its key findings should be communicated to the Governor, Maine's legislative leaders, Maine's Congressional delegation, the press and the general public in a series of briefings by commission members.*	**See notes on MOCA in Goal 4, science networking under Goal 1, and below.**	
	5.2. Continue efforts to increase the understanding of ocean acidification among key stakeholders, targeted audiences and local communities to help implement the commission's recommendations.	**Revamped BayScaping program to better educate public regarding how N fertilizer use impacts OCA and ocean health.** **2018, commenced use of Water Reporter to develop volunteer network of observers documenting impacts of climate change** **Developing and augmenting web pages and other social media** **Casco Bay Matters lecture series on impacts of climate change** **Revised curricula for grades 3-8 on impacts of climate change, 5.2 and 5.4** **Teacher training on OCA and climate change 5.2 and 5.4**	

		Through MOCA: held 6 symposia, disseminated newsletter and email updates	
	5.3. Enhance the existing communication network of engaged stakeholders, state agency representatives and the research community.	**Helped create and run MOCA, participate in NECAN**	
	5.4. Develop, adapt and use curricula on ocean acidification in K-12 schools and institutes of higher education and increase interdisciplinary university programs to equip young leaders with the skills to find solutions to complex multidisciplinary problems such as ocean acidification.		

6. Maintain a Sustainable and Coordinated Focus on Ocean Acidification.	*6.1. Create an on-going ocean acidification council.*	**Achieved with passage of Governor's Climate Council Bill! We supported this bill as a MOCA and Environmental Priorities Coalition (EPC) priority bill to pass. We organized and led efforts to support the bill and one of its predecessors, the Marine Advisory Council bill. Prior to passage, we helped create and maintain MOCA.**	**FOCB will continue to work within existing and future networks to advance knowledge, engage community, and look for new ideas and informed solutions to impacts of climate change including OCA.**