Technical Memorandum

Re: Highlights from 2018 Shellfish Focus Day at the Maine Fishermen's Forum

To: Coastal municipalities in Maine – Chair, Shellfish Conservation Commissions, Chair, Marine Resource Commissions, Town Managers, Town Clerks

From: Steering Committee for the Shellfish Research Needs Listening Session: *Susie Arnold (Island Institute), Monique Coombs (Maine Coast Fishermen's Association), Bridie McGreavy (University of Maine), Kohl Kanwit (Maine Department of Marine Resources), Amanda Moeser (The Nature Conservancy), Roger Stephenson (Union of Concerned Scientists), Ethel Wilkerson (Manomet), and Jessica Joyce (Tidal Bay Consulting)*

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The purpose of this memo is to provide coastal municipalities in Maine with information and resources to support conservation and management of their soft-shell clam resources and activities with the intertidal zone.

Shellfish Focus Day is typically the first day of the Maine Fishermen's Forum, and this year it occurred on March 1, 2018 in Rockport, Maine. The agenda for Shellfish Focus Day centers around bivalve shellfish, wild and aquaculture, and provides an opportunity for presenters to give updates on the latest in science, management, outreach, and education throughout the state. A copy of the 2018 agenda is available online: http://mainefishermensforum.org/wp-content/uploads/2018/Downloads/2018-Seminar-Descriptions-2.17.18.pdf. In 2019, Shellfish Focus Day is on February 28th.

This event was well attended with more than one hundred audience members from the shellfish industry, Maine Department of Marine Resources (DMR), municipalities, students, researchers, and managers. In an effort to broaden awareness around the information presented during Shellfish Focus Day, the Steering Committee for the Shellfish Listening Session prepared this Technical Memorandum.

All presentations from Shellfish Focus Day were recorded by the Department of Communication and Journalism at the University of Maine and are available on YouTube: https://www.youtube.com/playlist?list=PLMRkRrSVKicotJn_2yeBcV_2N3zsi0sEp

The Steering Committee compiled the following highlights from each of the presentations, most of which are relevant to municipal management of intertidal resources and aquaculture. In addition, members of the Steering Committee compiled a

summary of recent and current shellfish research initiatives throughout the state, which is available online: https://bit.ly/2KtuM0I

We believe that providing municipalities with these resources will help them learn about important and innovative efforts across the state and will help connect available science with shellfish conservation and management.

Presentation Highlights:

1. The Evolution of a Shellfish Farm - Bill Mook (Mook Sea Farms: bill@mookseafarm.net)
   - Bill shared information on the evolution of Mook Sea Farm, which has both an oyster hatchery facility and oyster farm on the Damariscotta River.
   - He emphasized the importance of continually learning and trying new things to grow an adaptable business.

2. Pathways Program – Heidi Leighton (ME DMR: heidi.leighton@maine.gov) & Bill Zoellick (Schoodic Institute: bzoellick@schoodicinstitute.org)
   - This program aims to help towns understand the value of partnering with schools to expand shellfish monitoring and to educate students about shellfish science. Topics of student research include settlement, growth rate, and predation.
   - These tools and curriculum will be developed as templates for other municipalities to utilize. They will be available online in 2018, along with results of past data collection efforts throughout the state.

3. Clam Recruitment Studies – Searsport HS students
   - Searsport students presented results from field experiments they conducted with help from the Downeast Institute that focused on the effect of tidal height (mid vs. low) and predator exclusion on growth and survival of wild and cultured soft-shell clam juveniles. Specifically, they used recruitment boxes (e.g., a rectangular wood frame 1-ft x 2-ft x 3-inches deep with Pet Screen mesh on the top and bottom) to examine wild clam recruitment, and 6-inch plastic flower pots (one-half with flexible, $1/6^{th}$-inch netting, the other half unprotected) to examine growth and survival of cultured soft-shell clam seed. The studies were conducted at three different intertidal areas in the Searsport-Stockton Springs area.
   - Densities of wild clams in recruitment boxes varied between the three sites (average number at each site was 1,250, 565, and 320), but not between tidal heights at each site. Wild clams ranged from $1/8^{th}$ of an inch to $3/4^{th}$ of an inch, with clams in the lower intertidal boxes being about 20% larger than those in the mid-tide boxes. Poor survival of cultured clams occurred in both

protected and unprotected flowerpots, as green crabs and milky ribbon worms were able to penetrate the flexible netting.

4. Mussel Drone Survey in Jordan River – Denis Nault (ME DMR: denis-marc.nault@maine.gov)
    - In 2017, DMR conducted a drone survey in Trenton and Lamoine to determine the effectiveness of drones as a survey tool to supplement hand sampling for mussels.
    - Preliminary results indicate this method may be effective in the intertidal, but not the subtidal, though it holds promise to expedite surveys of intertidal resources when combined with a transect survey and hand sampling.

5. Harmful Algal Blooms in Maine – Bryant Lewis (ME DMR: bryant.j.lewis@maine.gov)
    - Algal blooms are used as indicators of biotoxins. There are several types of biotoxins that occur in the Gulf of Maine, including: Paralytic Shellfish Poisoning (PSP), Amnesic Shellfish Poisoning (ASP), and Diarrhetic Shellfish Poisoning (DSP). A phytoplankton new to the Gulf of Maine was discovered in 2017, *Karenia mikimoto*, which is not a public health risk but does limit the amount of oxygen available to shellfish, causing die-offs.
    - ME DMR regularly tests for biotoxins in shellfish tissue and is updating ASP protocols in 2018 to close an area to harvesting after the first detection of toxin using precautionary closures as needed.

6. Evaluations of the Public Health Bureau – Kohl Kanwit (ME DMR: kohl.kanwit@maine.gov)
    - In 2007, there was an independent review of the State Shellfish Program within Maine DMR that resulted in numerous changes to staffing, governance, industry outreach, and new protocols.
    - The 2011 review reiterated a lot of the problems identified in the 2007 review. It also included one recommendation that the Shellfish Program be transferred out of the Public Health Bureau, though this recommendation was not implemented.

7. Fixing Pollution and Opening Closed Flats – Glen Melvin (Harvester, Waldoboro Shellfish Commission: 4mels@roadrunner.com)
    - The biggest 'employer' in Waldoboro is the shellfish flats (clamming). The flats were closed half of the year due to pollution, so Glen started a collaborative effort (Medomak Task Force) to identify and remedy the pollution sources.
    - After testing, both human and dog waste were identified as contributing pollution sources. The clammers paid to keep a port-a-potty by the landing and worked with the town to ban dogs from this area. Water samples

steadily improved after these changes, and resulted in opening 300 acres of previously closed clam flats.

8. Understanding Tides and Pollution, Medomak River - Gabby Hillyer (Student, University of Maine: gabrielle.hillyer@maine.edu)
    - Bucket drifter tracks are being used to calculate residence time (i.e., time it takes for fresh water to be flushed out by the tides) as well as develop an oceanographic model to examine how pollution travels through the water column and with tides. Rain gauges were also utilized to understand how storms impact river flow.
    - Currently, the drifters show a trend of retention; that is, sediments and nutrients are trapped creating larger and more productive clam flats.

9. Community Clam Culture – Kyle Pepperman (Downeast Institute: kyle.pepperman@downeastinstitute.org)
    - Downeast Institute (DEI) produces seed clams for municipalities to purchase for stock enhancement purposes. Clams average ½-inch length. Successful programs use protective netting to enhance survival.
    - In field trials conducted in Hancock and Washington counties from spring to fall 2017, cultured clam seed averaged 60% survival when protected from predators with flexible netting vs. less than 10% when no protection was used.
    - Both wild and hatchery seed clams displayed site-specific growth and survival. Techniques were discussed that give towns an ability to better understand growth and survival rates on a flat-by-flat basis. This information can be incorporated into their shellfish management program.

10. The Myth of Dead Mud – Sara Randall (Downeast Institute: sara.randall1@maine.edu)
    - Recruitment boxes (similar to those described above for the Searsport HS project) were developed in 2015 and tested on flats in Freeport to determine if the clam decline in northern Casco Bay was due to the lack of clam larvae in the water column. Boxes act as a predator-free 'settlement' site for clam larvae.
    - They are easy and cost effective to make, and may be used to identify locations for communities to obtain wild clam seed. To understand what is taking place in recruitment boxes, core samples should be taken in the areas adjacent to the boxes (in unprotected mud) when deployment occurs (late May to early June), and again when boxes are retrieved in November. Results from core samples should be compared to results from recruitment boxes to assess effects of predators on clam recruitment.

11. Where'd the Clams Go? – Bailey Bowden (Harvester, from Penobscot: clamchair@gmail.com)
    - In 2011-2012, the town utilized lobster traps and Astroturf or netting to see if they would attract clam seed. While some seed was collected, there was 100% mortality due to moon snails.
    - Recruitment boxes (as described above) were deployed in late May 2017 and retrieved a few months later in November. An average of approximately 200 clams were found in each box with an average size slightly smaller than ½-inch. The study showed that the lack of a large commercial population of clams in Northern Bay was not due to the lack of clam larvae in the water column, as had been the previous hypothesis, but predators.
    - Management of shellfish is based on a risk assessment model (Public Health), which is the priority rather than researching and growing shellfish.

12. Temporal variation in soft-shell clam and green crab recruitment – Brian Beal (UMM & Downeast Institute: bbeal@maine.edu)
    - In 2017, a field experiment was conducted on the east side of the Harraseeket River (Freeport) using recruitment boxes to examine the timing of clam and green crab recruitment. Boxes were deployed every two weeks from May 5th to September 21st.
    - Most soft-shell clams recruited to boxes prior to June 1st; however, core samples taken on each deployment date showed that the majority of these clams fall victim to predators. Clams that make it to the commercial fishery settle and recruit in low densities from mid-July through the end of September.
    - Green crab recruitment paralleled clam recruitment peaking in early June, but extending through mid-September.
    - Because clam recruitment is not very successful in light of the high densities of predators, the state should consider implementing an upper size limit of 3.5-inches for soft-shell clams to enhance density of recruits that may act to swamp out predation.
    - Utilize an Adaptive Ecosystem-Based Fisheries Management approach to address predation.
        - Another approach to create more clam juveniles would be to institute regional clam spawning closures that would allow soft-shell clams in a given region to spawn successfully prior to harvest each spring. When seawater temperatures approach 50^{o}F clams begin to spawn. A region could be closed for 1-2 weeks each year beginning in the southwestern portion of the state in mid-May and end in eastern Maine by the end of June.
    - Other recommendations include increasing local capacity through expanding beyond the passive enforcement management approach to an active management approach.

Listening Session Highlights:

Following the presentations, attendees were encouraged to break into four small groups to discuss research priorities and projects to address these needs. The **goal** of this Session was to identify needs in the shellfish fishery and facilitate a collaborative approach to research between the shellfish industry and the research and management community. In all, over 30 people participated in the groups, with a range of 4 to 13 attendees per group. The key points and recommendations presented in this section reflect the information shared by the individuals in that particular group. Therefore, the views and ideas presented in this summary are not intended to be representative.

1. Conservation and Management
    - Communicating with municipalities about how to monitor and conserve shellfish resources, and conduct scientific research will help inform their efforts to manage their intertidal resources (primarily soft-shell clams).
    - Scarborough is collaborating with University of New England on ribbon worm predation on their flats, and trying to determine how to adjust license numbers (or effort) based on the impacts to the clam population.
    - Several discussions inquired about the feasibility of growing clam seed to size in recruitment boxes or in scallop bags or oyster cages that collect spat. Another group had a similar conversation about growing soft-shell clams in baskets, though they conceded that until there is a higher value for clams, this option is not economically feasible.
    - Wardens can offer training to volunteers on how to seed and net.
    - There was a recommendation to hold regional or a statewide meetings to bring harvesters, researchers, and managers together to discuss conservation and co-management.
    - There was a recommendation to integrate clam landings data with aggregate harvester data from dealers to understand the per-unit effort of landings. This data would then help inform allocation of licenses based on available resources.

2. Health and Economic Resilience
    - The industry should collaborate to identify funding sources and overcome obstacles to provide better shellfish processing and depuration infrastructure in Maine.
    - There is interest in using technology to better monitor the location of shellfish resources, in an effort to contribute to resource surveys and distribute harvesting effort.

3. Public Health
    - There was a recommendation to increase public opportunities for input into the Limited-Purpose Aquaculture (LPA) license approval process, perhaps through holding public hearings (*which currently are only required for standard leases).*
    - There was a recommendation for DMR to make public information about water pollution/testing more accessible.
    - There was a recommendation to increase the p90 (fecal coliform, *e.Coli*) testing regime, particularly because of new challenges presenting with climate change.

4. Environmental Change
    - Ongoing research is examining whether co-locating kelp and mussel aquaculture, referred to as multi-trophic aquaculture, has the potential to remediate ocean acidification and enhance growing conditions for co-located mussels.
    - There was a recommendation to work with high school or college students to research and monitor the impacts of ocean acidification on intertidal shellfish resources by testing for pH levels over time.