



2019 Annual Report

Downeast Institute Moves Ahead



Introduction

2019 marks the Downeast Institute's first full year of operation as the easternmost marine research and education facility in the United States. We are now in a new era at Downeast Institute (DEI) – an era of increased learning, exploration, and impact.

This year *Maine Magazine* honored Dr. Brian Beal as one of its “50 Mainers making a difference” due to his role in creating DEI and his leadership in conducting applied marine research which has played a pivotal role in enhancing the state's marine economy over the past 30 years. The legacy of Dr. Beal's work continues at DEI as we pursue our vision: *DEI's groundbreaking work will generate new knowledge of the marine ecosystem for all who depend on it.* This document is the report on our progress toward our goals in 2019.

Goals and Progress

A. Create new aquaculture opportunities by discovering successful shellfish hatchery, nursery and grow-out techniques with multiple species, and by producing seed stock at commercial scale.

This year DEI's Center for Shellfish Production and Research spawned and grew eight different species of commercially important shellfish for a variety of stock enhancement, research, and development projects — soft-shell clams, razor clams, Atlantic surf clams, Arctic surf clams, Eastern blue mussels, sea scallops, and European and American oysters.

DEI continues its practice of growing soft-shell clams for public stock enhancement and research. This year DEI grew, placed in the nursery, and is now overwintering over 1.75 million 4mm or larger size clams.

Considerable progress has been made in our work to remove the bottleneck of seed supply in the production of farmed mussels in the northeast. DEI scientists have improved hatchery production to grow juvenile mussels and test methods that allow farmers to grow more than one crop per year. Research takes place in both the Center for Shellfish Production and Research and at a mussel farm in Blue Hill. Our research has led to a process that enables DEI to produce significant numbers of mussels (tens of millions of animals) in a relatively short time (4-5 weeks), at a reasonable price. Using these new methods we successfully grew 7,000 pounds of mussel seed this year which will result in 30,000 pounds of market size mussels in 2020. Plans are underway to transfer this technology to growers in 2021.

In March, DEI achieved a new record for the largest hatchery mussel settlement event to occur on the east coast of North America—18.8 million larval mussels. This eclipses our previous record, accomplished in the same month of the previous year of setting 17.5 million mussels.

DEI is making great progress with our line of golden mussels. By selectively breeding a strain of mussels for a unique light-brown striped shell and high meat content, DEI is creating a product that can command a higher market price. The increased value of the mussels can help farmers offset the cost of seed thus opening the door to new marketing strategies based on sustainable mussel farming. Our mussel work has been funded by the 2017 Sea Grant Aquaculture Initiative: Integrated Projects to Increase Aquaculture Production, Downeast Innovation Fund of the Maine Community Foundation, and Maine EPSCOR's Sustainable Ecological Network (SEANET).

A major breakthrough in our efforts to commercialize a new aquaculture species came at the end of September. Arctic surf clams, *Mactromeris polynyma*, are a high value species that are very vulnerable to predation by green crabs. This year DEI scientist Dr. Brian Beal tried a modified predator protection technique that crabs were not able to penetrate. The Arctic surf clams were able to survive and also grew substantially. This success is a testament to the importance of long-term scientific research. DEI thanks our funders that helped us continue our research these past seven years: the National Science Foundation, the

University of Maine at Machias, the Maine Economic Improvement Fund, National Marine Fisheries Service (NMFS) Saltonstall-Kennedy Grant Program, the United States Department of Agriculture National Institute of Food and Agriculture, and National Sea Grant College Program.

Our research on two species of oyster, Europeans, *Ostrea edulis*, and American, *Crassostrea virginica*, continues in collaboration with our industry partner A.C. Inc. of Beals. In our effort to open the lucrative farmed American oyster industry to the fisheries dependent people of downeast Maine, DEI continued efforts to breed American oysters that are genetically suited to grow in the colder waters of eastern Maine. This year we raised over 150,000 25mm American oysters in our Center for Shellfish Production and Research.

European oysters grow at colder seawater temperatures than American oysters, making them ideal for growing in the colder waters of downeast Maine. However, they are a very tricky species to grow in a hatchery. So difficult, in fact, that no one in Maine has been able to do so in over 30 years. DEI continues to work to find ways to produce this valuable shellfish by investigating ways to condition the broodstock, exploring hatchery culture techniques for rearing larvae at commercial densities, and developing nursery grow-out procedures. Our efforts this year resulted in over 1,200 50mm European oysters. The Maine Economic Improvement Fund Small Campus Initiative (SCI) supports this work as well as our work with razor clams.

Most commercial hatcheries focus on the production of the popular American oyster species. This means that aquaculture techniques for growing non-traditional species like Razor clams, *Ensis leei*, need further development and refinement. To fill this knowledge gap, DEI's efforts to produce both of these species continued in 2019. DEI raised over 18,000 juvenile razor clams to a size greater than 4mm in length and continued to test substrates in which to grow them, as well as investigating optimal diet options. Our work in this area will lead to diversification of the shellfish aquaculture industry, and provide additional harvesting options for fishermen.

With support from the Maine Technology Institute, and a donor-advised fund of the Maine Community Foundation, DEI is exploring whether unused lobster pounds in eastern Maine could be repurposed for shellfish aquaculture. We were able to improve one of our own tidal impoundments for testing, and will conduct temperature and other studies.

A. Serve as the Marine Science Field Station for the University of Maine at Machias (UMM), providing a research, educational, and conferencing facility for use by faculty, staff and students.

DEI's 16-acre campus, state of the art facilities, and location on the Downeast coast provide exceptional capacity for researchers from the University of Maine at Machias. This year UMM faculty meetings were held at DEI and incoming and prospective students toured DEI as part of UMM's "Preview Day." Our facilities continue to be available for use by UMM faculty and students.

Early in 2019 DEI finalized a 3-year strategic plan for the Marine Science Field Station (MSFS). This strategic plan was the result of a 2-day planning workshop held the previous fall attended by eight senior marine scientists from public and private field stations of all sizes across the eastern seaboard. Guidance from the workshop participants informed the development of the plan and included considerations such as equipment needs, collaborative research and educational opportunities, communications, data management, physical plant features, and advertising strategies.

DEI joined the Organization of Biological Field Stations, an organization meant to raise the profile of Biological Field Stations and help member stations increase their effectiveness in supporting critical research, education, and outreach programs. We are also a member of the National Association of Marine Laboratories.

Five students from the University of Maine at Machias, Eckerd College, and the University of Massachusetts Amherst gained experience in marine biology, hatchery operations, and aquaculture at DEI this summer. These interns undertook projects to understand the effects of tidal height and individual size on soft-shell clam reproductive capacity. They tested nanobubble technology, examined how diet and environment affect the growth and survival of American oysters, and investigated aquaculture techniques for growing razor clams in the hatchery.

Three of the interns' unusual undergraduate research opportunities came from DEI's partnership with the University of Maine and its collaborative SEA (Science for Economic Impact and Application) Fellows program. DEI partnered with UMaine's Darling Marine Center (DMC) to create the annual SEA Fellows program. In August the Fellows presented their findings at the *Summer Science Symposium* at the DMC.

In addition, an intern from the University of Maine at Machias has been at work outside the marine research discipline, gaining experience in non-profit management and accounting.

C. Provide leadership in helping shellfisheries adapt to a changing marine environment with immediate emphasis on the crises caused by the predatory milky ribbon worm and invasive green crab.

DEI continues with our groundbreaking work to adapt the important soft-shell clam fishery to the effects of warming ocean temperatures. Efforts are being made to share DEI's robust coast-wide long-term data sets to inform regulators, policymakers, members of the media, and clambers about the cause of the decline and possible strategies to sustain the fishery. To this end, DEI staff have presented at Shellfish Committee meetings, the Maine Legislature, the Maine Shellfish Advisory Committee (ShAC), various community events, and scientific and fisheries focused conferences.

In September, Dr. Brian Beal was appointed by Governor Janet Mills to serve on the Science and Technical Subcommittee of the Maine Climate Council. The Science and Technical Subcommittee provides information, backed by data and scientific studies, on the effects of climate change in the State to the Maine Climate Council. This supports the Council's research and consideration of mitigation, adaptation and resilience strategies. Dr. Beal will use this opportunity to highlight the data connecting the decline in commercial clam populations to warming ocean temperatures. He will also contribute his ecological expertise on other marine species.

This year, DEI continued to expand the use of our "Beal boxes" across the coast to measure recruitment and survival of clams, other shellfish, and green crabs. In collaboration with DEI or on their own, shellfish committees, schools, colleges, and community groups deployed the recruitment boxes in locations along the coast. The results from the boxes continue to demonstrate that areas currently devoid of commercial clam populations are still receiving high amounts of clam recruitment, but that the clams are not surviving to commercial sizes. DEI continues to work with students, teachers, and professionals from other organizations to show them how to use Beal boxes and provides help with processing and analysis.

In October, Maine Sea Grant announced that DEI was selected to be one of the recipients of its 2020-2022 biennial funding. The award enables DEI to establish a coast-wide recruitment monitoring program for clams. DEI will deploy Beal boxes in two coves in nine Maine clamming towns. To distribute the experiments geographically, three towns each were selected in the southern, midcoast, and downeast regions. The establishment of monitoring locations will standardize data collection and provide much needed fisheries-independent recruitment and clam survival data. It is our hope to continue these monitoring sites into the future to build a long-term database of recruitment and survival that can inform fisheries management, similar to the American Lobster Settlement Index (ALSI).

Thanks to a Collaborative Action Grant from the Gulf of Maine Research Institute, awarded during the Gulf of Maine 2050 conference, DEI will partner with East Charlotte Waterways Inc. to expand the clam recruitment monitoring network internationally to New Brunswick, Canada next year.

“Brushing” is a technique that is used in many communities to increase commercial clam populations. However, the efficacy of this method has never been tested. This year DEI conducted an examination of the effects of brushing on soft-shell clam recruitment by conducting the first comparative experiment of its kind, designed to allow comparisons between protecting from predators and netting, at three intertidal field sites in downeast (Gouldsboro), midcoast (Bremen), and southern (Harpwell) Maine. With help from clammers and municipal officials, the field tests were deployed in May and sampled in late October. Results will be known this winter and will show the effects of brushing, netting, or doing nothing, and highlight any regional differences. Final results will be presented to Shellfish Committees and at the 2020 Maine Fishermen’s Forum. The Broad Reach Fund of the Maine Community Foundation, Maine Sea Grant, and the Maine Shellfish Restoration and Resilience Fund funded the three study sites.

DEI’s discoveries regarding the importance of protecting clams from predators led several shellfish committees to approach DEI asking for assistance in using predator exclusion methods. Three years ago, these inquiries led to DEI Aquaculture Production and Research Assistant Kyle Pepperman beginning a predator exclusion technology transfer project called Community Clam Culture. This year experiments were deployed in 11 locations in four towns in Washington County to measure clam survival, growth, and rates of recruitment. Shellfish Committee members, including clammers, accompanied occasionally by school groups, assist with deployment, sampling, and processing data. DEI analyzes the data and presents results to the Shellfish Committees and at the Fishermen’s Forum at the end of each year. Over the three years a total of 45 shellfish growing areas in nine communities have been assessed, resulting in a current, comprehensive mudflat productivity profile of an important clamming region. This important work is made possible by the Broad Reach Fund of the Maine Community Foundation.

D. Increase experiential marine science education for regional K-12 students, their teachers and the visiting public.

With support from individual donors, foundations such as the Davis Family Foundation, Steven C. Leuthold Family Foundation, Onion Foundation, Morton-Kelly Charitable Trust, and Margaret E. Burnham Charitable Trust, as well as Bangor Savings Bank, Camden National Bank, and two generous anonymous benefactors, DEI’s marine science educational programming continues to thrive and grow. Students visit DEI to receive marine science education on a casual or intensive basis. Our intensive program is called *Marine Science Days* and its focus is on teaching students how to use the complete scientific method. Classes participate in *Marine Science Days* by coming to DEI on an ongoing basis, often on a weekly, bi-weekly, or monthly schedule. During *Marine Science Days* DEI’s educators lead students through the process of integrating student observations and hypothesis into research questions, conducting experimental studies and interpreting results. Our curriculum is constantly being developed, tried, revised, and tried again, with changes often reflecting discoveries and findings of DEI’s research.

In the spring semester over 500 pre-K- 12th grade students visited DEI for marine science lessons. Of these, 255 students, from five Washington county schools, participated in *Marine Science Days*.

In the fall semester nearly 600 pre-K- 12th grade students came to DEI for marine science instruction. Of these, 264 students, from eight Washington county schools, participated in *Marine Science Days*.

DEI held four sessions of its *Marine Science Summer Camps* for K-12th grade students this summer. Fifty-one students from six counties in Maine participated. Children also traveled from Massachusetts and as far away as Texas to attend. Campers have the opportunity to visit DEI’s rocky shoreline and intertidal areas and immerse themselves in numerous hands-on activities and scientific investigations.

The kick-off four-day retreat for our third *Coastal Science Academy*, a free year-long professional development program for K-12 grade educators, occurred in July. Eleven teachers from five schools, one as far away as Bronx, New York, are participating this year. The initial retreat focuses on demonstrating science experiments and assisting with project planning in order to help educators confidently use

authentic scientific inquiry and methods in their classrooms. Participants who want recurring *Marine Science Days* are required to complete the *Academy*, but it is open to any teacher who wants to leverage their student's natural curiosity to help them learn scientific concepts. The profound impact of *Coastal Science Academy* was expressed by one of this year's participants:

"I have been teaching for 25 years and the Coastal Science Academy was *by far* the most valuable teacher workshop I have ever attended. This academy is a win for teachers and a definite win for students." - Elaine Despres, Freeport Middle School Science Teacher.

We continue to take our portable marine touch tank to schools and community events in Washington and Hancock counties upon request. This year we brought the touch tank to eight different events, enriching over four hundred and twenty-five children with marine science education. AmeriCorps members from Maine Conservation Corps Environmental Stewards led our outreach with the touch tank this year. In total, DEI hosted five AmeriCorps volunteers who helped with outreach, research, and education throughout 2019. The AmeriCorps volunteers were from the Maine Conservation Corps Environmental Stewards program. Their service at DEI was made possible with support from an anonymous foundation and the Broad Reach Fund.

Shellfish Field Day was held on Saturday, August 10. Over 200 people from the local area toured our campus and participated in fun and educational marine science based activities.

E. Complete expansion of vitally needed marine research infrastructure and shellfish hatchery space to meet the demand for DEI's research, education, and aquaculture production capacity.

The second phase of our building expansion was largely completed in 2018, though a few additional elements were added to our 16-acre campus this year. The construction of the Marine Sample Processing Laboratory was completed in September, just in time for the beginning of field sampling season. This indoor heated building overlooks one of DEI's lobster pound mesocosms, and is equipped with sinks and hoses that spray filtered seawater. The addition of this lab to our campus greatly increases our efficiency and capacity to conduct large-scale field research.

A service building to hold and store DEI's equipment was also completed in the summer.

In August, DEI hired a Post-Doctoral researcher, Dr. Robert Holmberg, to assemble DEI's ocean acidification laboratory and conduct research in eastern Maine on the effects of ocean acidification (OA). Dr. Holmberg's PhD was completed at the University of Massachusetts at Boston where he designed and built a scalable ocean acidification laboratory to support his dissertation which investigated the impacts of ocean acidification on biocalcification in coral reef fishes. We are very happy to have Dr. Holmberg's expertise to study how OA might affect Maine's commercially important fisheries.

The name of our residence building, Evelyn Hall, was officially announced during a ceremony at our annual *Shellfish Field Day*. Evelyn Hall was named in honor of Evelyn Offutt, a philanthropist and founder of the Next Generation Foundation of Blue Hill. Guided by the principles of its founder, the Next Generation Foundation made significant grants to improve health, education, and societal support for the most vulnerable populations of Maine. The Foundation provided the seed grant that leveraged significant grants for DEI's Phase 2 expansion. Due to Evelyn Offutt's foresight and generosity, Evelyn Hall now exists to provide accommodations for college students, interns, scientists and teachers working with DEI.

With the Phase 2 expansion complete we also began making adjustments to our Center for Shellfish Production and Research processes in order to increase efficiencies and reduce costs. One major breakthrough was due to Board member Sam Chapman's efforts. Sam built an upweller that utilizes gravity feeding and created a cyclone separation cone system for collecting waste.

F. Attract U.S. and international marine research scientists seeking the pristine conditions and unique oceanographic features at DEI.

In addition to finalizing our Marine Science Field Station Strategic Plan to guide the function, operation and marketing of the Marine Field Station, hiring DEI's first Postdoctoral Research Associate, planning and assembling our new state-of-the art ocean acidification lab, DEI has begun integrating opportunities in marine research and education that foster collaborations among scientists while engaging students.

DEI continued to work to improve our facilities to attract scientists, such as those interested in oceanographic studies. At the end of 2019, DEI, in collaboration with the Washington County Council of Governments, awarded a contract to engineer two key pieces of infrastructure to enhance existing working waterfront amenities on our campus: a boat ramp that can be used in high winds to access our 100-ft x 30-ft pier, especially by smaller vessels, as well as wave attenuation. We will also explore the possibility of using the wave attenuator to generate electricity.

The research of DEI's Senior Scientist, Dr. Philip Yund, is focused on population connectivity in mussels and barnacles. We are also working with a researcher from the University of Maine who has applied for NMFS Saltonstall-Kennedy funds to conduct scallop hatchery trials at DEI. Recently, the Belvedere Natural Resource Preservation Fund of the Maine Community Foundation announced their support of a related scallop hatchery incubator project.

G. Fortify DEI's capabilities to meet the goals of the strategic plan: governance, revenue generation, staffing and communications.

DEI continues to apply to a range of federal and state agencies as well as foundations to fund our research, outreach, education, capacity-building efforts, and to provide operating support. We have also increased efforts to raise funds from individual donors, and held a campaign to assist with DEI's education program that secured almost \$10,000.

DEI communicates our news and updates through our *Village Veliger* newsletter, e-newsletter, website, hand-outs, and social media.

Throughout the year members of the public, as well as organized groups, visit DEI for scheduled or drop-in tours. DEI's current policy is to accommodate all visitors during business hours in order to orient as many people as possible to DEI and the work we do. This year DEI staff, AmeriCorps volunteers and interns gave tours to over 100 people.

DEI hosted a variety of meetings for non-profit organizations and researchers. In addition to taking advantage of our video-conferencing and presentation capabilities, attendees were also exposed to DEI's attractions and features. Most meetings end with a tour of our Center for Shellfish Production and Research. While in the conference room attendees can view our magnificent ocean setting, working fishing boats, active research sites, and enjoy the Jonesport-Beals art collection.

Evelyn Hall housed people from 13 different organizations, businesses, and research institutions throughout the year, enabling people from as far away as England to visit DEI.

To raise our visibility DEI collaborated with a group of eight other environmentally focused eastern Maine non-profits to plan and host a free outdoor Wild & Scenic Film Festival. The festival was held in Ellsworth's Knowlton Park on July 28 and was attended by hundreds of people. DEI also continues to be a partner in the Downeast Fisheries Partnership, a group with representatives from non-profit organizations whose vision for the communities of eastern Maine is for them to sustain themselves by commercial fishing.

In addition to hiring Postdoctoral Associate Dr. Robert Holmberg, DEI welcomed other staff members to

our team: Jeff Balicki, Facility Assistant; Breanna Salter, Production Assistant; Kacey Crowley, Facility Assistant; Kylie Hinkley, Finance Assistant; and Lynn Alley, Education Associate.

Published Research and Reports

Sharing the results of scientific studies is an important step in the scientific process. Publishing research in peer reviewed journals helps verify results and provides information to other scientists so they can evaluate the study themselves and use the information to repeat the experiment or build upon it. Written and oral reports help to disseminate information quickly to scientists, industry, and other stakeholders. DEI scientists published, reported, and presented the following research in 2019:

Published Peer Reviewed Journal Articles

Honig, A., Etter, R., **Pepperman, K.**, Morello, S., Hannigan, R. 2020. Site and age discrimination using trace element fingerprints in the blue T mussel, *Mytilus edulis*. *Journal of Experimental Marine Biology and Ecology* 522: Article 151249. https://downeastinstitute.org/wp-content/uploads/2019/11/honig_mussel2019pepperman.pdf.

Research Reports

Beal, Brian and William Otto. 2019. How acidic sediments and seawater affect interactive effects of predation on survival, growth, and recruitment of wild and cultured soft-shell clams, *Mya arenaria* L., along a tidal gradient at two intertidal sites in eastern Maine. Downeast Institute and University of Maine at Machias, published Feb. 19. https://downeastinstitute.org/wp-content/uploads/2019/03/3_19_2019-final-report.pdf.

Beal, Brian. 2019. Effects of brushing and predator-exclusion netting on soft-shell clam, *Mya arenaria*, recruitment: Intertidal field experiments in Gouldsboro, Bremen, and Harpswell, Maine, Initial Findings Report. Downeast Institute, published May. https://downeastinstitute.org/wp-content/uploads/2019/06/6_03_2019-interim-report-brushing-netting-study.pdf.

Presentations:

Pepperman, K., Beal, B., Maloney, C., Jourdet, C., Ellis, B., Lewis, J. (2019, Jan. 9). "Cost Effective Production of Blue Mussel, *Mytilus edulis*, Seed for Rope Culture: A Hatchery Solution." Presentation during the Emerging Species panel of the *Northeast Aquaculture Conference & Exposition* and 39th *Milford Aquaculture Seminar*, Boston Park Plaza Hotel, Boston, Massachusetts.

Beal, B., Jourdet, C., Ellis, B., & Kadis, B. (2019, Jan. 10). "Atlantic Razor Clams, *Ensis leei*, Field and Laboratory Trials with Cultured Juveniles in Eastern Maine Presentation at the Emerging Aquaculture Species." Presentation during the Emerging Species panel of the *Northeast Aquaculture Conference & Exposition* and 39th *Milford Aquaculture Seminar*, Boston Park Plaza Hotel, Boston, Massachusetts.

Beal, B., Jourdet, C., Ellis, B., Pepperman, K., & Lewis, J. (2019, Jan. 10). "Arctic Surf clams, *Mactromeris Polynyma*: Growth and Survival of Cultured Juveniles Along the Maine Coast." Presentation during the Emerging Species panel of the *Northeast Aquaculture Conference & Exposition* and 39th *Milford Aquaculture Seminar*, Boston Park Plaza Hotel, Boston, Massachusetts.

Beal, B., Randall, S. & Coffin, C. (2019, Jan. 10). "Soft-Shell Clam, *Mya arenaria*, Aquaculture In Maine: Can Barriers Be Overcome To Encourage Farming Enterprises?" Presentation during the Emerging Species panel of the *Northeast Aquaculture Conference & Exposition* and 39th *Milford Aquaculture Seminar*, Boston Park Plaza Hotel, Boston, Massachusetts.

Pepperman, Kyle and **Brian Beal**. (2019, Feb. 7). "Community Clam Culture: 2018 Results: Clam Survival, Growth and Recruitment in Milbridge." Presentation to the Milbridge Shellfish Conservation Committee, Milbridge Town Office, Milbridge, Maine.

Randall, Sara. (2019, Feb. 26). "Casco Bay Clam Decline: Results from Large-Scale Marine Research." Presentation to the Harpswell Marine Resources Committee, Harpswell Town Office, Harpswell, Maine.

- Pepperman, K., Beal, B., & Kadis, B.** (2019, Feb. 28). "Community Clam Culture: 2018 Results of Clam Survival & Growth Studies on flats in Perry, Pembroke, Trescott, Edmunds, Machiasport, Milbridge, & Gouldsboro." Presentation at the 2019 *Maine Fishermen's Forum*, Samoset Hotel, Rockport, Maine. <https://youtu.be/eJyQPem8OTM>.
- Beal, B.,** Otto, W., Chandler, K., & Wegner, H. (2019, Feb. 28). "Effect of Tidal Height, Predator Exclusion, and Sediment Chemistry on Growth and Survival of Cultured Soft-Shell Clams and on Recruitment of Wild Clams." Presentation at the 2019 *Maine Fishermen's Forum*, Samoset Hotel, Rockport, Maine. <https://youtu.be/-SZCUxL5HRo>.
- Yund, Philip** and **Skylar Bayer.** (2019, Feb. 28). "Where do mussel seed come from and go to in Eastern Maine?". Presentation at the 2019 *Maine Fishermen's Forum*, Samoset Hotel, Rockport, Maine.
- Pepperman, K.** and Evan Young. (2019, Feb. 28). "Cost effective production of blue mussel, *Mytilus edulis*, seed for rope culture." Presentation at the 2019 *Maine Fishermen's Forum*, Samoset Hotel, Rockport, Maine.
- Beal, Brian.** (2019, Mar. 7). "Examining the Effectiveness of Methods to Enhance Soft-Shell Clam Recruitment Along the Maine Coast: Brushing Study Proposal." Presentation to the Bremen Shellfish Conservation Committee, Town Hall, Bremen, Maine.
- Beal, Brian.** (2019, Mar. 20). "Examining the Effectiveness of Methods to Enhance Soft-Shell Clam Recruitment Along the Maine Coast: Brushing Study Proposal." Presentation to the Gouldsboro Shellfish Committee, Gouldsboro Town Office, Gouldsboro, Maine.
- Randall, Sara** (2019, Mar. 26). "Examining the Effectiveness of Methods to Enhance Soft-Shell Clam Recruitment Along the Maine Coast: Brushing Study Proposal." Presentation to the Harpswell Marine Resources Committee, Harpswell Town Office, Harpswell, Maine.
- Pepperman, Kyle.** (2019, Mar. 27). "Community Clam Culture: 2018 Perry & Pembroke Results." Presentation to the Perry & Pembroke Shellfish Committee, Pembroke Town Office, Pembroke, Maine.
- Randall, Sara** and Chad Coffin. (2019, Mar. 28). "Effects of Predation on Casco Bay Shellfish Populations". Presentation to the Phippsburg Shellfish Commission, Phippsburg Town Office, Phippsburg, Maine.
- Yund, Philip.** (2019, April 6). "Regional scale connectivity among barnacles in the Gulf of Maine inferred from the phenology of larval release and settlement". Presentation at the 48th *Benthic Ecology Meeting*, Sheraton Hotel Newfoundland, St. Johns, Newfoundland, Canada. <https://www.bemsociety.org/bem-2019-program.html>.
- Randall, Sara.** (2019, Apr. 9). "Effects of Predation and Climate Change on Clam Populations". Presentation to the Scarborough Shellfish Conservation Commission, Scarborough Municipal Building, Scarborough, Maine.
- Pepperman, Kyle.** (2019, Apr. 30). "Community Clam Culture: 2018 Clam Survival, Recruitment & Growth in Trescott and Edmunds". Presentation to the Unorganized Townships of Washington County Shellfish Committee, Edmunds Consolidated School, Edmunds, Maine.
- Yund, Philip.** (2019, May). "Lessons from Mark: An example on the biology/physics interface". Presentation at the retirement symposium to honor Dr. Mark Bertness, Brown University, Providence, Rhode Island.
- Yund, Philip.** (2019, Jun. 18). "Coastal Circulation of Eastern Maine". Presentation during the Nearshore panel of the *Eastern Maine Coastal Current Collaborative (EM3C): State of the Science Conference*, University of Maine at Machias, Machias, Maine. <http://stateofthescienceconference.org/wp-content/uploads/2019/09/Nearshore-Resource-Units-System-and-Actors-WilsonYundGuenther.pdf>.
- Yund, Philip.** (2019, Aug.) "Dispersal of mussels and population connectivity in eastern Maine". Presentation at the *Research Coordination Network - Evolution in Changing Seas*, Shoals Marine Lab, Isle of Shoals, Maine.
- McGreavy, B., Melvin, G., McMahan, M., & **Beal, B.** (2019, Sep. 12). "Maine's Clam Harvest: What is Being Done to Improve the Health of Maine's Clam Population?" Guest on *Maine Calling*, Public Radio.

<https://www.mainepublic.org/post/maines-clam-harvest-what-being-done-improve-health-maines-clam-population>.

Beal, Brian. (2019, Aug. 11). "Downeast Institute: Marine Lab, Clam Recruitment, and Recent Results of Experiments". Presentation to the Isleboro Forum, Isleboro Community Center, Isleboro, Maine. <http://islesboroforum.org/>.

Randall, S., Beal, B., Coffin, C., Goodenow, C. (2019, Nov. 6). "Effects of Sediment Buffering and Predator Exclusion on Soft-Shell Clams". Plenary presentation to the *Gulf of Maine 2050 International Symposium*, Westin Hotel, Portland, Maine. <https://www.gulfofmaine2050.org/>.

Beal, Brian. (2019, Nov. 13). "Success with Arctic surf clams". Presentation at *Aquaculture isn't Scary, It's Necessary* for New England Ocean Cluster's Entrepreneurship in the Blue Economy series, Rising Tide Brewing Company, Portland, Maine.

Randall, Sara. (2019, Dec. 10). "Downeast Institute: Innovations in Wild and Cultures Fisheries". Presentation at *Blue Economy Innovation* panel at the New England Ocean Cluster's Entrepreneurship in the Blue Economy series, Rising Tide Brewing Company, Portland, Maine.

Funding

DEI relies on state and federal research grants, as well as support from private foundations, and donations from corporations and individuals. Our role as UMM's Marine Science Field Station gives us access to research and operating funds unavailable to us on our own. The budget for 2019 was \$1,193,862.

Board of Directors

DEI's Board of Directors is a diverse cross section of individuals with experience in science education, biology, academic and applied research, industry, and fisheries management and sanitation.

As the year ends we thank departing Board of Directors member Dr. Wesley Hedlund for his nine years of service and the invaluable expertise and experience he provided to DEI. Thank you Wes!

As we look forward to 2020 we are happy to announce that Dr. Gayle Kraus will be joining the Board of Directors. Dr. Kraus is a professor of Marine Ecology at the University of Maine at Machias.

2019 Board of Directors

Lynn Alley, Jonesport (Chair)

Lynn is a founding Board member of DEI and has helped lead the organization for 22 years. She was a local educator for 35 years, and completed a research fellowship at Jackson Laboratory in Bar Harbor in 2000.

Dr. Sherrie Sprangers, East Machias (Vice Chair)

Dr. Sprangers graduated from University of Wisconsin – River Falls with a B.S. in Chemistry, followed by a Ph.D. in Reproductive Endocrinology from Marquette University. She moved to Maine in 1990 to begin a career as part of the biology faculty at the University of Maine at Machias. As is typical at a small university Sherrie teaches a wide array of courses in the Biology, Marine Biology, and Environmental Studies programs. Dr. Sprangers joined the board of the Downeast Institute in 2003. Her professional interests are focused on diadromous fish and their freshwater habitats.

Jane Hinson, Machias (Clerk & Treasurer)

Jane is retired from a long time position at UMM leading their Office of Special Programs. In this capacity, she edited and polished the first grant that funded DEI's work (then BIRSH). She was a founding board member of DEI, and has used her wealth of experience from a career in media, industry and higher education to champion DEI's mission.

Jonathan Alley, Addison

Jonathan graduated from the University of Maine in 2010 with a Bachelor's degree in Business Management. He worked at a local elementary school before joining Machias Savings Bank in 2011. In 2015, Jonathan was promoted to branch manager, being the youngest employee in that role at the time. Originally from Beals, he was happy to take

on a leadership role at DEI because of his interest in our education program, both as a former educator and a dad of two.

Jason Alley, Jonesport

Jason is a local clam harvester and lobster fisherman. He began fishing at the tender age of 8. After obtaining a marine engineering degree from Maine Maritime Academy and gaining experience as a merchant mariner, he has invested in sustaining the fishing industry. He volunteered for a position on DEI's board after his children attended our summer camps. Besides being a patient and active board member, Jason contributes to our research and education efforts in many ways, including giving up work days to help collect experiments with his boat, and bringing us touch tank critters.

Christopher Bartlett, Eastport

Chris has served the Maine Sea Grant College Program and University of Maine Cooperative Extension since 1995. He works as a conduit between coastal community members, researchers, and resource managers on issues pertaining to the wise use of marine resources with an emphasis on commercial fisheries and aquaculture. He also collaborates with local schools to engage students in applied marine research and monitoring programs. Chris has been a DEI Board member since 1998 and served as Chair from 2006-2011.

Dr. Brian Beal, Machiasport

Dr. Beal is a professor of marine ecology and director of the Marine Science Field Station at the University of Maine at Machias (UMM). A native of Jonesport, Dr. Beal graduated from UMM in 1979 with a B.S. degree in biology and went on to earn an M.S. degree in Marine Sciences from the University of North Carolina at Chapel Hill. He obtained his Ph.D. in Marine Bio-Resources from the University of Maine, Orono.

Dr. Beal helped create the public clam hatchery in 1987 known as the Beals Island Regional Shellfish Hatchery, as well as the first public lobster hatchery in Cutler in 1986. He was a 2000-2001 Fulbright scholar at the National University of Ireland, Galway where he worked with Irish fishermen and researchers on ocean-based lobster nurseries.

His published research most often appears in the *Journal of Shellfish Research*, the scientific journal of the National Shellfisheries Association, which presented him with the first ever Bourne-Chew award in 2015, in recognition of outstanding contributions to education, outreach, extension, aquaculture or shellfisheries.

Wendy Beal, Jonesport

Wendy has managed the local branch of Camden National Bank for 32 years and was another founding board member of DEI. She started her banking career at CNB in 1977 as a teller after attending the University of Maine at Machias studying business administration and is the residential, consumer, and commercial loan officer. She has graduated from the Williams School of Banking at Williamstown, Massachusetts and the Northern New England School of Banking at The New England Center for Continuing Education, Durham, New Hampshire.

Wendell Bradford, Jonesport

Wendell serves the shellfish industry as a quality control officer at AC Inc., a local shellfish distributor with 31 employees. He graduated from the University of Maine with a degree in Zoology, and began his career at the U.S. Army Research Institute of Environmental Medicine where he authored several scientific papers. He followed that with a career in forestry before moving to Beals upon his "retirement".

Samuel Chapman, Waldoboro

Sam Chapman is widely regarded as one of the leading experts in hatchery shellfish culture in the state of Maine. He ran the Aquaculture Development Laboratory and shellfish hatchery at the University of Maine's Darling Marine Center for 20 years, helped establish hatcheries in Maine, Massachusetts, Connecticut, and Washington, and helped design seven marine laboratories in Maine and New Hampshire. Sam was responsible for the early research and organizing that resulted in Dr. Beal's first BIRSH research effort. Another founding board member, his passion for shellfish aquaculture is unrelenting, and the expertise he generously shares with DEI has contributed to our success.

Peter Greene, Addison

Peter is in his 37th year as a Maine banker. His career has focused on technology and operations at Union Trust Company, Camden National Bank and now in Downeast Maine at Machias Savings Bank. Peter has led numerous large teams advancing projects such as systems conversions and the operational aspects of bank acquisitions. Prior to

his time in banking, Peter dug soft shell clams and worked on fishing boats. This experience coupled with his banking expertise gives him a unique outlook and perspective as a DEI board member.

Dr. Wesley Hedlund, Newburg

A retired science teacher, Wes became interested in DEI's work through his ties with many esteemed scientists around Maine. His teaching background spans 30 years, and he is still excited about science. He holds a B.A degree in Zoology and a masters and doctoral degree in combined studies in science education and marine sciences from the University of Maine and the Darling Center. He has attended National Science Foundation Institutes at Bowdoin, Bates, and the Blood Research Foundation. He has taught College Biology, Advanced Placement, Human Anatomy, UMO Biology, Marine Biology, and Aviation to Bangor High students for 41 years. He has been an adjunct graduate faculty member in College of Education and College of Engineering at UMO. He has directed and taught marine science summer academies for students and teachers at UMO, Eastern Maine Community College, University of Maine Machias, and Washington County Community College. Wes has been President of the Maine Science Teachers Association and the Gulf of Maine Marine Education Association. His interests in teaching the sciences, Boating, SCUBA and underwater photography has led to many different assignment across institutions and the globe. Wes was the first recipient of The Presidential Award in Science Teaching for the state of Maine and one of the Maine finalists for The Teacher in Space Program.

Ralph Smith, Jonesport

Ralph is a long time fisherman, entrepreneur, and local official in the town of Jonesport. His devotion to his fishing community has led him to be one of the most active, passionate, and innovative participants in wild fisheries, and a staunch supporter of applied research to help wild fisheries adapt and overcome challenges.

Kohl Kanwit, Boothbay Harbor

Kohl is an "ex-officio" member designated by the Commissioner of the Maine Department of Marine Resources to help DEI continue to work in strong partnership with that agency. Kohl is the Director of DMR's Bureau of Public Health, which oversees the states shellfish sanitation and management programs, on which all shellfish commerce in Maine relies. She received her Bachelor's degree from McGill University and her MS from the University of Maine. She has worked with the DMR for 17 years, primarily on fisheries research and management.

For more information visit our website, follow us on , or make an appointment to tour our facility.

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