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National Shellfisheries Association Quarterly Newsletter

2022(2)

President's Message



Since I retired, people always ask me if I miss teaching. The answer is usually “not much.” I do wish that I could still teach a summer class at LUMCON, our state marine lab. For many years, Dr. Gary Lafleur and I taught a course entitled Introduction to Marine Zoology. I taught the invertebrates and he handled the vertebrates (from fish to whales). It was an opportunity to keep abreast of the changes in the barrier islands and bays along our coast—mostly they were washing away despite restoration projects. It also kept me current on species names; I now I have to run to a book to remember that the roseate spoonbills we saw on an airboat tour of the Atchafalaya Basin last week with friends from Colorado are *Ajaia ajaja* (I see that the genus is now *Platalea*—these systematics people can never leave well enough alone). The last year that we taught the course, Gary became very frustrated with the students because they would use apps on their smart phones instead of dichotomous keys to identify the fish we collected on field trips. The students missed out on learning the characters that separate families, which is basic to biology. At any rate, I suggest that all students out there learn the animal that they work on, and become competent in the phylum (at least) to which the organism belongs. Don't become a silo scientist.

The aforementioned friends were in town for the Festival International de Louisiane, which, along with Mardi Gras, is one of the best reasons to come to Lafayette. The NSA is also a truly international group. We have members from all over the world, and many of them attend the annual meetings on a regular basis. Several of our international members have also graciously accepted invitations to present plenary lectures at the annual meeting. We are fortunate to have them, and our house organ, *JSR*, is a primary outlet for research from overseas.

It is not too late to organize a paper session for the next meeting in Baltimore. Keep an eye out for items to contribute to the auction for the Student Endowment fund. Sandy can sell just about anything. I brought some laundered (much to my wife's disgust) oyster sacks to an auction some years ago and they went like hotcakes at IHOP. Keep using BioOne to find publications—this is a major source of income for the NSA. Finally, if you are interested in getting more involved with the NSA, make yourself and your interest known to the current officers. We are always looking to recruit new people to run for positions on the Executive Committee.

Lewis Deaton, *President*

115th Annual Meeting

Baltimore Marriott Inner
Harbor at Camden Yards

BALTIMORE, MD

March 26-30, 2023

ABSTRACT DEADLINE

December 15, 2022

(watch www.shellfish.org and email
for more details)

In this issue:

- Annual Meeting Update
- BioOne & the NSA
- Stakeholder Progress Report
- Limpets
- Abbe Student Research Grant Update

2021 George R. Abbe Student Research Grant Update

Awardee: Mingli Zhao

University of Maryland, IMET

“Assessing the potential for interstate blue crab imports to introduce crab pathogens into new ecosystems”

The blue crab, *Callinectes sapidus*, population range extends from Nova Scotia, Canada to northern Argentina. In the Chesapeake Bay, the blue crab is an essential estuarine species that supports the most valuable fishery in Maryland (MD) and a way of life for fishermen and their communities. It is also a key element of the food web where it feeds on a diversity of invertebrates and is a component of the diet of many fish species.

Nationwide, the blue crab commercial fishery is valued at more than \$100 million annually and a recreational fishery that engages tens of thousands of participants from Texas (TX) to Massachusetts (MA). Blue crab landings from the Chesapeake Bay are 55-60 million lbs with a value of \$60-80 million dockside annually. Recreational harvest of blue crabs is estimated to be 3.5-3.9 million lbs per year. As the climate and ocean temperatures have changed, the distribution of blue crab has shifted poleward, and the abundance of blue crab has increased at higher latitudes, evidenced by the frequent reports of the species found in Maine. There is a strong recreational harvest in New York and New Jersey, and as crab numbers increase more, it is inevitable that blue crabs will be fished commercially in these waters and shipped to the Chesapeake area where demand is highest. Changes in regional labor markets can also result in crabs being shipped to Maryland from Gulf states (or the other direction) when H2B visa limits mean that crab picking houses in one region are not able to hire enough workers to meet seasonal harvest peaks.

Fluctuating abundance of blue crab in the Chesapeake Bay draws attention to the role of disease in crab mortality. Many infectious diseases can cause blue crab mortality, including bacteria, eukaryotes, and viruses with both DNA and RNA genomes. This research project focuses on the discovery and characterization of viruses in blue crab by molecular techniques, especially in crabs imported from the Gulf area from the northeast states of the US to Maryland, to assess the potential for these interstate blue crab imports to introduce crab viral pathogens into the Chesapeake Bay.

Multiple novel virus and viral genotypes have been discovered. The *Callinectes sapidus* reovirus 1 (CsRV1) was originally discovered by electron microscopy and termed RLV (reo-like virus). It is associated with captive crab mortality in the 1970s and 1980s, but its prevalence in wild blue crabs and association with soft crab mortality was not appreciated until sensitive molecular tools were available. The virus is present at high prevalence in the majority of soft crab mortalities from Atlantic and Gulf coast estuaries, and injection of CsRV1 causes 100% mortality with enough dose in one to three weeks. Subsequent investigations using quantitative PCR revealed that the virus was present in an average of 20% of wild crabs on the US Atlantic coast. In one of my studies on the genetic variation of CsRV1 across the blue crab range from New England to South America, I found the viral genotypes in the Gulf of Mexico and Caribbean

were distinct from the mid-Atlantic and Chesapeake Bay. Similarly, CsRV1 genotypes from New England were distinct from Chesapeake strains. For instance, CsRV1 genotypes discovered within adjacent water bodies like the northern Atlantic coasts of the US have high nucleotide similarity, while CsRV1 genotypes found in distant locations - western Gulf coasts (Texas, Florida Keys) are more divergent; however, several CsRV1 strains from Louisiana (LA) and TX were very similar to the CsRV1 genotypes found in Maryland and the US Atlantic coast rather than western Gulf states. The similarity between MD and LA CsRV1 genotypes could be a result of rapid movement of CsRV1 by human-mediated transport of blue crabs between MD and LA (either direction).

The investigations of CsRV1 disease ecology and viral disease of blue crabs have revealed yet more viruses infecting the species. 1) *Callinectes sapidus* reovirus 2 (CsRV2) was discovered infecting blue crab in Brazil. The near complete genome sequence of CsRV2 was sequenced and analyzed and was proved to be distantly related to CsRV1. 2) On the northeast Atlantic coast, CsTLV1 and CsTLV2

Callinectes sapidus toti-like viruses) was identified by visualizing their dsRNA genomes and sequencing the viral whole genomes by Next Generation Sequencing from blue crabs collected in Massachusetts (MA), Rhode Island (RI), and New York (NY). The pathogenesis of the totiviruses was revealed on blue crabs with histopathology and the viral particles was observed in muscle, gill and hepatopancreases of the infected crabs under electron microscopy. This study also showed that CsTLV1 and CsTLV2 co-infected blue crabs in MA, RI and NY, but no viral genome was detected in lower latitude states of MD, DE, NC, LA and TX.

These results indicate the importance of monitoring the potential spread of novel viruses and new viral genotypes of known viruses from the northeast states and Gulf of Mexico to the Chesapeake Bay, especially with blue crabs expand their range, and anticipated increased interstate blue crab transports. In the future studies, we will apply metagenomics and metatranscriptomics to identify a larger virome in blue crab. The goal of this study is to investigate both the RNA and DNA viruses in blue crabs imported to MD from the Gulf of Mexico states, such as the TX and LA. Furthermore, experimental transmission studies will be conducted to detect the pathogenicity of newly identified viruses on Chesapeake blue crabs. The growing awareness of the diversity of viruses infecting blue crabs will underscore the need to communicate with blue crab scientists, managers, and industry about disease, imports, and responsible discard of dead crabs.



BALTIMORE 2023!

Plans are well underway for the 115th Annual Meeting to be held in Baltimore, Maryland, March 26 - 30, 2023 at the Marriott Baltimore Inner Harbor. The program is growing fast. There are currently 30 special sessions, and several others being discussed, and the list will be posted soon on the web page. If you have an interest in organizing a session or just have a topic that you think would enhance the meeting, contact us.

New this year will be 'At the Movies' – a dedicated room that will show shellfish-related films continuously throughout the conference. If you have a film that you would like to contribute or have a movie to recommend, please be in touch.

This will be our first time together in person in 4 years and Baltimore is always a great location. Looking forward to seeing everybody there!

(and don't forget to start collecting your auction items)

The Conference Management Team



CALLING ALL UNDERGRADUATES!

The NSA welcomes your participation. This is a great opportunity to present results from your senior theses, REU experiences, summer research projects, and others in a friendly and welcoming environment. Oral and poster presentations (or both) welcome.

The Annual Meeting is a great opportunity to meet with your future colleagues and collaborators.

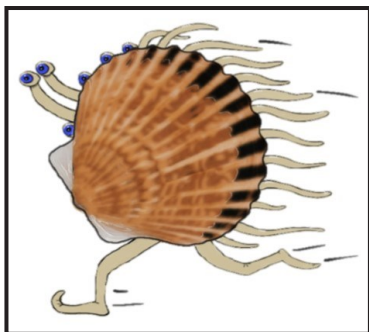
Watch the NSA webpage for deadlines. For questions, contact:

Contact: Ed Catapane (catapane@mec.cuny.edu) or
Margaret Carroll (margie@mec.cuny.edu)

Scallop Gallop

**Run for the ravens while taking in the
Baltimore waterfront**

Watch for more details!



Contact Lewis Deaton:
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THANK YOU TO OUR SPONSORS

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Toxic algae closures: What kinds of predictions are needed?

When I was growing up we had weather forecasts, and it was great. You could either plan your day or just complain about how wrong the weather forecast was (or a bit of both). Now, there are forecasts for almost everything one could monitor, from pollen forecasts to election forecasts to covid forecasts. There is even something called “predictive policing”—a forecast for potential criminal activity before it happens. Artificial intelligence, networked data, and rapidly advancing science has made it tempting to forecast many things and to deliver the predictions on nice websites and “data dashboards”. Harmful and toxic algae are no exception, and as aquaculture becomes more and more essential to feeding the world, forecasts for harmful blooms are poised to have more and more utility.

It’s easy to see the benefits of new forecasting technologies. Harmful algal bloom (HAB) forecasts can help get ahead of possible effects on human health, wildlife, and water quality. But like with any new technology, it’s important to be thinking about potential unintended consequences. The predictive policing example that I mentioned has been shown to be rife with bias and injustices that are embedded in the algorithms. These biases are sometimes unintentional, merely an accidental reflection (or magnification) of biases that exist in the data, model, or assumptions—but with important real-world consequences (Vera et al., 2019).

Environmental forecasters are catching up to other fields now in terms of understanding unintended consequences of data technologies (Grasso et al., 2019). Other ocean forecasting programs have been caught off guard by how their forecasts have been used or interpreted, even when the forecasts were getting it right. For example, forecasts for protected species have been used by poachers; forecasts for fisheries have jolted markets in unexpected ways; and in some cases, forecasts can even reverse the outcome that they were trying to predict (Pershing et al., 2018; Hobday et al., 2019; Record et al., 2021).

As HAB forecasts start to proliferate, it’s a good time to get ahead of potential pitfalls. At the 2021 International Conference on Harmful Algae meeting, an international group of experts presented draft guidance documentation for developing early warning systems and forecasts to meet stakeholder needs. This effort was supported by the Intergovernmental Oceanographic Commission (IOC) Intergovernmental Panel on Harmful Algal Blooms (along with other United Nations agencies, FAO, IAEA), and it will be used to guide the development of HAB forecasts in places around the world. The documentation outlines the wide range of approaches, from monitoring to machine learning technologies, for predicting the staggering variety of harmful algae and toxins that occur. Among the types of guidance provided, there is a strong emphasis on the involvement of stakeholders and users throughout the development process.

To give a bit of background, there are already quite a few HAB early warning systems currently in use. There is a concentration of such programs in European waters, but they’re used in other parts of the world as well, primarily in wealthier countries. Traditionally, warning systems have been designed based on an ecological forecasting paradigm found in the scientific literature. The approach is typically presented

as a cycle that aligns roughly with the scientific method—it begins with hypothesis and model building, along with data analysis, and only includes stakeholders at a later stage when the forecast is being communicated, or in a separate process altogether (Dietze et al., 2018). Using a cycle like this has many benefits, but one drawback is the potential for a mismatch between the forecast design and the stakeholder needs. Indeed, this mismatch is one of the factors that has led to the unintended consequences mentioned earlier.

To help address this problem, the FAO-IAEA-IOC guidance documentation walks through a deliberate process of including stakeholders from the beginning of the forecast development. Rather than starting with a scientific hypothesis or some data mining, the process begins with a series of conversations that include stakeholders—that is, the forecast users. The idea is that having stakeholders engaged from the early design stages can help guide the science so that it benefits the people who need it. Of course, there is always a risk of unintended consequences with the development of any technology, but close collaborations with stakeholders—in this case, members of the aquaculture community—can hopefully reduce that risk.

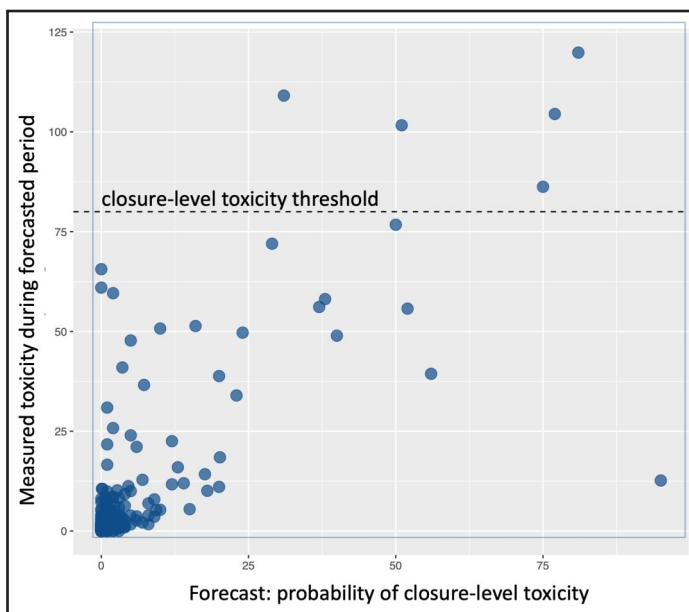


Figure 1: Assessment of the Maine PSP forecast through the 2021 and 2022 seasons thus far, showing the measured toxicity compared to what had been predicted the prior week for the probability of a closure-level toxicity measurement. The dashed line indicates the toxicity level threshold for closure (80 μg per 100 g shellfish).

(continued on page 5)

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In the spirit of open collaboration with stakeholders, we have launched a new initiative, the Tandy Center for Ocean Forecasting, at Bigelow Laboratory in Maine. One of our tenets is that the creation of ocean forecasts, like those used by aquaculture, should be as collaborative as possible. Our first HAB project has been an early warning system for paralytic shellfish toxins in coastal Maine. The project has been a collaboration between growers, the Maine Department of Marine Resources, and Bigelow Analytical Services. The trial system is in its second year and can be viewed at the Maine Department of Marine Resources data site (https://mainedmr.shinyapps.io/bph_phyto/).

The toxicity prediction gives a one-week advance notice of the probability of a closure-level measurement for each of a collection of sampling sites all along the coast of Maine (Figure 2). During its first year, the system correctly predicted the times and locations of the two closure events that occurred. We recognize, though, that the system is far from perfect, there are still lots of improvements that can be made, and one of the best guides for improvements are the people who could be using the forecast. That's where you could help us. We are encouraging people to provide us feedback on this effort, or on their hopes for future forecasting programs, including questions, requests, and concerns. Feedback can be sent to our email address at forecast@bigelow.org. Send along an email and join the conversation.

In the long-term, we hope to help bridge the gap between science and stakeholders through a co-development process (Norström et al., 2020). In the end, we will all probably still complain about weather (and other) forecasts, but hopefully we can do so with equitable access to the benefits of those forecasting technologies.

Nicholas R. Record

Johnathan Evanilla

Bigelow Laboratory for Ocean Sciences and the Tandy Center for Ocean Forecasting

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Figure 2: Screenshot of the Maine paralytic shellfish toxin early warning system. The forecast gives the probability of toxicity measurements that exceed the closure threshold. https://mainedmr.shinyapps.io/bph_phyto/



BioOne and the National Shellfisheries Association - why we all need to support the collaboration

You regularly see pleas to ‘support BioOne’ - but what exactly is BioOne and why is strong support from the membership important? BioOne, now BioOne Complete, was founded in 1999. Inclusion in BioOne Complete is competitive, and after careful consideration by the Publications Committee, the NSA joined the group in 2006. Susan Ford spearheaded the effort and became a staunch supporter of the BioOne mission, ultimately becoming a Board Member.

BioOne is a group of 120 active societies, museums, research organizations, and independent presses representing more than 200 subscribed and open access titles in the biological, ecological, and environmental sciences. The group makes primary research available to millions of readers globally by providing libraries with cost-effective access to high-quality, curated research and independent society publishers with a dynamic, community-based platform and global distribution. It brings together nonprofit publishers, authors, professional societies, academic institutions, research libraries, and research funders to access research. Key to their mission is helping participating publishers – such as the NSA – to stay independent, financially sustainable, and empowered to deliver their respective missions. It provides an affordable collection of publications under one umbrella and in these days of constantly shrinking budgets, librarians like that option. BioOne participates in Research4Life which provides nations in the developing world with access to scholarly content, currently serving 2500 institutions from under-resourced economies.

BioOne also saves member organizations considerable expenditures associated with making their publications readily available – they cover all XML conversion charges, DOI registration and deposit, and platform hosting fees for the collection. There are no annual fees or direct costs of any kind for the NSA. Subscriptions to BioOne Complete are available to academic institutions, non-academic organizations, corporations, and government agencies.

BioOne disperses royalties to the partners annually and those royalties are based upon journal usage. BioOne provides society members with free access to the *Journal of Shellfish Research* and other content. The bottom line: Inclusion of the *Journal of Shellfish Research* in BioOne has resulted in financial sustainability and allowed the NSA to continue to maintain control of the Journal in an ever-increasingly competitive publishing market. It has meant that the membership receives the *Journal* at no cost and membership dues can be used to promote other aspects of the society goals.

THIS IS WHERE NSA MEMBERS CAN PLAY A CRUCIAL ROLE IN EXPANDING REVENUES. While you can access BioOne through the NSA member portal, the NSA makes more revenue if you access through your university or other subscribing websites. The NSA receives revenue for every ‘hit’ on a journal article and more for downloads of full articles. Please use the BioOne link as often as possible to access the *JSR*. Share the link with colleagues and, whenever possible, download papers from outside your NSA member profile.

Since joining BioOne, the NSA has received almost \$900,000 in total royalties – in addition to the other benefits noted above. Let’s keep that number growing and the NSA on solid financial footing – Use BioOne often!

2021 MOST ACCESSED ARTICLES PUBLISHED IN THE JOURNAL OF SHELLFISH RESEARCH

Hits are defined as full-text accesses, PDF downloads, and abstract views. (BioOne Publisher Report 2022)

Rank	Article	Hits
1	Davis, M., and Cassar, V. 2020. Queen Conch Aquaculture: Hatchery and Nursery Phases. <i>Journal of Shellfish Research</i> , 39(3): 731-810. https://doi.org/10.2983/035.039.0319	5,565
2	Tremblay, I., and Guderley, H.E. 2017. Possible Prediction of Scallop Swimming Styles from Shell and Adductor Muscle Morphology. <i>Journal of Shellfish Research</i> , 36(1): 17-30. https://doi.org/10.2983/035.036.0104	2,928
3	Cook, P.A. 2019. Worldwide Abalone Production Statistics. <i>Journal of Shellfish Research</i> , 38(2): 401-404. https://doi.org/10.2983/035.038.0222	2,614
4	Parker, M., and Bricker, S. 2020. Sustainable Oyster Aquaculture, Water Quality Improvement, and Ecosystem Service Value Potential in Maryland Chesapeake Bay. <i>Journal of Shellfish Research</i> , 39(2): 269-281. https://doi.org/10.2983/035.039.0208	2,587
5	Goelz, T., Vogt, B., and Hartley, T. 2020. Alternative Substrates Used for Oyster Reef Restoration: A Review. <i>Journal of Shellfish Research</i> , 39(1): 1-12. https://doi.org/10.2983/035.039.0101	2,555
6	Herrmann, M., Carstensen, D., Fischer, S., Laudien, J., Penchaszadeh, P.E., and Arntz, W.E. 2009. Population Structure, Growth, and Production of the Wedge Clam <i>Donax hanleyanus</i> (Bivalvia: Donacidae) from Northern Argentinean Beaches. <i>Journal of Shellfish Research</i> , 28(3): 511-526. https://doi.org/10.2983/035.028.0313	2,499
7	Wright, A.C., Fan, Y., and Baker, G.L. 2018. Nutritional Value and Food Safety of Bivalve Molluscan Shellfish. <i>Journal of Shellfish Research</i> , 37(4): 695-708. https://doi.org/10.2983/035.037.0403	2,444
8	Cameron, L.P., Reymond, C.E., Muller-Ludin, F., Westfield, I., Grabowski, J.H., Westphal, H., and Ries, J.B. 2019. Effects of Temperature and Ocean Acidification on the Extrapallial Fluid pH, Calcification Rate, and Condition Factor of the King Scallop <i>Pecten maximus</i> . <i>Journal of Shellfish Research</i> , 38(3): 763-777. https://doi.org/10.2983/035.038.0327	2,278
9	Waldbusser, G.G., Steenson, R.A., and Green, M.A. 2011. Oyster Shell Dissolution Rates in Estuarine Waters: Effects of pH and Shell Legacy. <i>Journal of Shellfish Research</i> , 30(3): 659-669. https://doi.org/10.2983/035.030.0308	1,908
10	Gordon, H.R., and Cook, P.A. 2013. World Abalone Supply, Markets, and Pricing: 2011 Update. <i>Journal of Shellfish Research</i> , 32(1): 5-7. https://doi.org/10.2983/35.032.0102	1,677

What have limpets ever done for us?



The common limpet, *Patella vulgata* L. 1758, at Port St. Mary Ledges, Isle of Man. Photo credit: L. Firth

Almost everyone knows what a limpet is, but few of us appreciate its importance in coastal food, culture, and heritage. I worked on limpets during my PhD. On telling people about my project, many people reminisced about kicking limpets off the rocks as children and laughed about having to get them first or they would clamp down. I remember one person being disappointed that I wasn't working on whales or sharks, asking me why on earth I would spend three years working on such 'boring animals'.

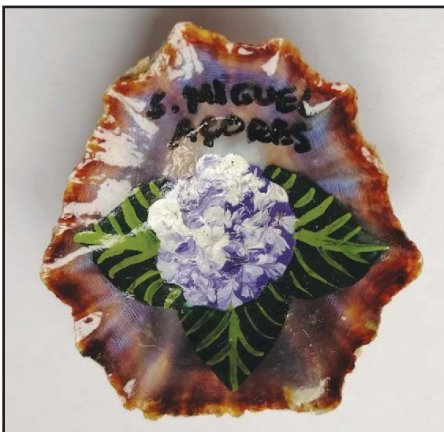
In comparison to other molluscs like oysters, mussels, and cowries, which are renowned for their gastronomic, economic, or aesthetic value, the 'drab' limpet does not win any prizes. In Ireland, where I am from, they are often referred to as 'poor food' ('bia bocht' in Irish) or 'famine food'. This is captured by two old Irish proverbs: 'Seachain an teach tabhairne no bairnigh is beatha duit [beware of the public house or limpets will be your life] and 'Bia ri isea duilicini ach bia tuathaigh isea bairnigh' [mussels are the food of kings, limpets are the food of peasants]. Recognizing that they don't get the respect they deserve, I felt that it was high time that someone 'flew the flag' for limpets to celebrate their past and present importance for humans.

As limpets are abundant and easy to collect when the tide is out, they have long been subjected to human exploitation. Archaeological research on coastal middens revealed that stone tools, 'limpet hammers', were used to knock limpets from the rocks. They were extracted from their shells by stone 'limpet scoops' and either eaten as food or used as bait for fishing. Not only were limpets the dominant shellfish in diets of early modern humans, but in modern times they sustained the poor during periods of famine and destitution. Today, they are considered a delicacy in many cultures. Whilst there is some evidence to suggest that limpets were used as mineral resources for construction materials and animal fodder, they were much more important as food and, to a lesser degree, medicine, tools, and implements.



Distress in the west of Ireland: collecting seaweed and limpets for food in Inisbofin Island. Credit: Illustrated London News (1886).

The shells of limpets have been put to a wide variety of uses, including tools, currency, offerings, traditional medicine, jewellery, and artwork. Originating in Barbados in the 1830s, the 'sailor's valentine' is a form of shell craft; a type of souvenir, or a sentimental gift made from large numbers of small seashells, with limpets being a prominent feature. Limpet shells have important spiritual and religious relevance, featuring in a myriad of traditions, superstitions, and folklore. For instance, in Hawaii, limpet shells were placed on shrines, and certain families revere limpets as their ancestral spirits or 'aumakua'. It is thought that limpets were part of the ritual of pagan human sacrifice in the Iron Age in eastern Scotland. For Christians, there is a strong tradition of eating limpets on Good Friday, particularly around the United Kingdom, Ireland, and the Azores.



A painted limpet from the Azores. Photo credit: L. Firth

If you want to find out more about the relationship between humans and limpets, please check out the paper below, which has just been published in *International Reviews in Environmental History*. The paper does away with the limpet's reputation as 'famine food' and attests to the important role that it has played in past and present coastal cultural heritage and food culture.

Louise Firth
University of Plymouth

[Firth, L.B., 2021. What have limpets ever done for us?: On the past and present provisioning and cultural services of limpets. *International Review of Environmental History*, 7\(2\): 5-45.](#)

2022 Mollusc of the Year



Photo credit: Bernardo Reyes Tur

The finalists for the “Mollusc of the Year 2022” were three snail species, one mussel species and a tusk shell or scaphopod. A committee of researchers from the organizing institutions selected these top five from among 50 nominations for the 2022 competition. Then open to public voting, the Cuban painted snail received the most votes by a large margin – it was chosen by 10,092 participants of over 16,000 total votes cast. As a “reward” for winning, its entire genome will now be sequenced via the LOEWE Centre TBG.

Check out the top five nominees at: <https://tbg.senckenberg.de/molluscoftheyear-2022/>

NSA AT THE MOVIES



Do you have a shellfish-related video/movie you would like to share? Contact Sandy (Sandra.shumway@uconn.edu)

Movies will be playing on a loop throughout the day, pop in when you have time.

Freeing Oysters from a Parasite's Hold By: Karen Pinchin, Hakai Magazine

On the muddy bottom of Bras d'Or Lake, Nova Scotia, *Crassostrea virginica* once grew as big as brunch plates, with frilly shells and deep, round cups: qualities prized by oyster connoisseurs. For decades, the Bras d'Or oyster industry blended wild-caught harvest and aquaculture; locals picked oysters from public beds while commercial growers cultivated the shellfish in vast beds on the lake's bottom and transferred them onto floating rafts to await packing and shipping.

Many harvesting families, are Mi'kmaq, and have lived near the Bras d'Or—which they call Pitu'paq, or “to which all things flow”—for thousands of years. While never a staple, oysters are a fundamental part of Mi'kmaw food traditions and philosophy, with many families harvesting them year-round for personal consumption. So when the commercial oyster industry took off in the 1950s, many were well-positioned to sell oysters for a living. At the industry's peak, more than 100 Cape Breton license holders—commercial and recreational, Mi'kmaq and non-Indigenous—had millions of oysters on their farms, collectively worth millions of dollars. Then it fell apart.

In the summer of 2002, a mysterious and deadly invasive parasite called multinucleated sphere unknown, or MSX, flattened Cape Breton's oyster industry. Within months, millions of oysters died, their internal organs devoured by the parasite. Mortality of infected oysters hovered around 90 percent.

Cape Breton oysters are no longer sold commercially, and the industry has been essentially dead for nearly two decades. Now, in a last-gasp effort to revive commercial oyster growing in the Bras d'Or, a makeshift team of scientists, community members, and oyster harvesters is fighting to understand and evade MSX. Coordinated by Cape Breton University assistant professor Rod Beresford, theirs is a supergroup of sorts, relying on high-tech devices, traditional knowledge, and elbow grease.

As Beresford pondered the puzzle of the Bras d'Or oysters, eventually connecting with Indigenous knowledge holders including, he formulated his theory: perhaps the lake's muddy substrate is exactly where MSX lurks. And perhaps certain specific salinity levels and temperatures, which vary as wildly as the lake's diverse bays and inlets, either help or hinder the parasite. If he could keep oysters alive just below the lake's surface, he speculated, maybe he could prevent them from catching the parasite in the first place and eventually revive the region's oyster industry.

With cooperation from leaseholders, who had held onto decades-old government plots, Beresford and his team chose a dozen test sites across the Bras d'Or. The team packed cages with 500 oysters each, zip-tied temperature and salinity loggers resembling large black glow sticks to each one, and then sank two to the muddy bottom and floated the other two near the surface at each test site. Then they waited.

The team is behind on analyzing tissue samples, the testing facilities are currently backed up due to COVID-19, Beresford is optimistic that he's close to pinning down the sweet spot of temperature, salinity, and depth that would protect oysters from MSX. He believes oysters grown near the surface, where temperature and salinity varies, will have the best chance at survival. Other areas hard hit by MSX, including parts of the United States, could then use the findings to revive their own industries.

Abstracted from Hakai Magazine, June 15, 2021. This article is also available in audio format via the “Hakai Magazine Audio Edition” podcast.

Recruits Corner

Fellow Recruits,

We hope you've had an enjoyable spring and are looking forward to summer and future NSA meetings!

First, we are excited to announce that Fiona Boardman has officially stepped into the NSA Recruits Co-Chair position. Fiona is a PhD candidate with Dr. Jennifer Ruesink at the University of Washington in Seattle. She studies the effects of oyster culture methods on intertidal communities in Willapa Bay, WA. Feel free to connect with Fiona if you have any questions or just want to say hi!



Once again, it was a pleasure seeing many of you at our Triennial meeting this past March in San Diego. It is time to put next year's NSA meeting on your calendars! **Save the date for the 115th NSA Annual Meeting**, which will be held in Baltimore, Maryland, from March 26 to 30, 2023.

More details about the 2023 meeting are available at <https://shellfish.memberclicks.net/annual-meeting>.

We'd also like to remind students to **apply for the NSA student grant awards** (Carriker, Castagna, and Abbe awards). These awards provide \$1,250 for research. This is a considerable amount of money and the application process is very straightforward. Applications for these awards have been low in recent years, and we highly encourage all students to apply for these grants. The annual deadline for these awards is **November 1st** and students can apply for multiple awards. More information about the awards can be found on the NSA student members page at <https://www.shellfish.org/grants-and-awards>.

Finally, we'd like to remind students to join the Recruits Facebook page ("NSA Students") and follow NSA on Instagram, @nationalshellfisheries. This is a great way to stay up-to-date on important announcements and information about conferences!



As always, email your recruit co-chairs Hannah (hannah.i.collins@uconn.edu) or Fiona (fcboard@uw.edu) with any questions, ideas, or concerns.

Enjoy your summer!

Hannah and Fiona

NSA Pacific Coast Section News

Greetings from the Pacific Coast!

Things are starting to buzz as spring is coming to the Pacific Northwest. Lots of field time with the low tides, doing surveys, harvests, and research. We are preparing for our 76th Annual Shellfish Conference and Tradeshow with the Pacific Coast Shellfish Growers Association (PCSGA). This year we will finally be in person at the Wenatchee Conference Center, Wenatchee, WA. The conference is scheduled for September 20-22, 2022. The keynote speaker is Dr. Yoshitaka Ota, from the University of Washington, who will inspire us "To protect the oceans and protect those that live within nature, now and into the future". The lunch time speaker is David Williams author of "Home waters; A human and natural history of Puget Sound." The Planning Committee is still ironing out the entertainment for the conference, and we are open to any suggestions. The Conference Committee invites both undergraduate and graduate students to submit their abstracts. The call for abstracts is out now with full abstracts deadline of July 15, 2022. **Submit abstract here:** <http://pcsga.org/annual-conferences/abstract-login/>. The NSA-PCS will once again present an award for best student presentation at the meeting. Financial assistance is available to students for conference registration. Questions regarding financial assistance may be directed to the NSA-PCS Treasurer, Laura Butler (lbutler@agr.wa.gov). If you need any more information on the conference please contact the NSA-PCS Chair, Sandy Zeiner (szeiner@nwifc.org).

The NSA-PCS Twitter feed and Facebook page are your best resources for news and information about the Pacific Coast Section and our events and annual meetings. Please join our community online. You can follow NSA-PCS on Twitter: @nsapcs. You can like NSA-PCS on Facebook: <https://www.facebook.com/pages/Pacific-Coast-Section-of-the-National-Shellfisheries-Association/1438569826443936>.



I look forward to seeing you in Wenatchee, WA. Have a fun and safe summer.

Sandy Zeiner
Chair, Pacific Coast Section

SAVE THE DATES

115th NSA Annual Meeting: March 26 -30, 2023, Baltimore, Maryland

116th NSA Annual Meeting: March 22 –26, 2024, Charlotte, North Carolina

117th NSA Annual Meeting (Triennial): To Be Determined

YOUR SESSION COULD BE HERE!

The following is a preliminary list of sessions planned for the 115th Annual Meeting. If you want further information on any of the sessions listed, contact the organizer(s) directly. If you would like to organize a session, contact Sandy Shumway.

Session	Organizers	Contact information
Blue Crabs	Rom Lipcius Rochelle Seitz	rom@vims.edu seitz@vims.edu
Blue Crabs Biosecurity	Eric Schott	schott@umces.edu
Blue Crab Genomics and Transcriptomics: the Progress of the Blue Crab Genome Project	J. Sook Chung	chung@umces.edu
Birds and Shellfish Sanitation	Bob Rheault	bob@ecsga.org
Cephalopods	Camino Gestal	cgestal@iim.csic.es
Clams	Brian Beal John Kraeuter	bbeal@maine.edu kraeuter@hsrl.rutgers.edu
Commercial Fisheries	Kevin Stokesbury David Rudders	kstokesbury@umassd.edu rudders@vims.edu
Disease	Ryan Carnegie	carnegie@vims.edu
Down on the Farm	Bill Walton Leslie Sturmer	walton@vims.edu Lnst@ufl.edu
Echinoderms	Chris Pearce Andrew Suhrbier	Chris.Pearce@dfo-mpo.gc.ca suhrbier@pacshell.org
Ecosystem Services	Suzanne Bricker Matt Parker	suzanne.bricker@noaa.gov mparke@umd.edu
Contaminants	Evan Ward Kayla Mladinich	Evan.ward@uconn.edu kayla.mladinich@uconn.edu
Freshwater Mussels/Living Shorelines	Dee Kreeger	dkreeger@delawareestuary.org
Genetics/Genomics	Louis Plough	lplough@umces.edu
Green Crabs	Brian Beal	bbeal@maine.edu
Hatcheries	Don Webster	dwebster@umd.edu
Harmful Algal Blooms	Albert Choi Steve Morton	skchoi@jejunu.ac.kr steve.morton@noaa.gov
Horseshoe Crabs	Elizabeth Bouchard Daniel Sasson	Ehb52@hsrl.rutgers.edu sassond@dnr.sc.gov
IMTA/Macroalgae-Shellfish Co-Culture	Michael Doall	michael.doall@stonybrook.edu
Modeling & Climate Change	Eric Powell & colleagues	Eric.N.Powell@usm.edu
Mussels	Luc Comeau	Luc.Comeau@dfo-mpo.gc.ca
Nutrients and Shellfish	Lisa Kellogg	lkellogg@vims.edu
Offshore Aquaculture	Chris Mckindsey	Chris.mckindsey@dfo-mpo.gc.ca
ONE HEALTH Epigenomics	Acacia Alcivar-Warren	environmentalgenomics.warren@gmail.com
OsHv1 (Summer Mortality or Norovirus)	Tim Green	Timothy.Green@viu.ca
Oysters	Bill Fisher	fisher.william@epa.gov
Regulations	Tessa Getchis Christopher Schillaci	tessa.getchis@uconn.edu christopher.schillaci@noaa.gov
Remote Sensing & Shellfish	Michelle Tomlinson	michelle.tomlinson@noaa.gov
Scallops	Steve Geiger	Stephen.Geiger@MyFWC.com
Seagrass Bivalve Interactions	Brett Dumbauld Kay McGraw	Brett.Dumbauld@ARS.USDA.GOV kmcgraw5@earthlink.net
Shellfish Restoration and Conservation	Peter Kingsley-Smith	KingsleySmithP@dnr.sc.gov
Robotics & Emerging Technology	Yang Tao Miao Yu Allen Patillo	ytao@umd.edu mmyu@umd.edu dapatt@umd.edu
Undergraduate Research Colloquium	Ed Catapane Margaret Carroll	catapane@mec.cuny.edu margie@mec.cuny.edu
<i>Vibrio</i>	Steve Jones	stephen.jones@unh.edu
Writing/Publishing Workshop for Students	Sam DuPont	Sam.dupont@bioenv.gu.se
Hard Clam Selective Breeding Workshop	Antoinette Clemetson	Aoc5@cornell.edu
Diversity & Inclusion	Angela Caporelli Aswani Volety	Angela.caporelli@ky.gov avolety@elon.edu
Film Festival	Eric Heupel	eric@heupel.com
Socioecological Approach to Management of Shellfish	Under development	
Spatial Planning	Under development	
Meet the Agencies	Under development	
Best Management Practices	Under development	
Shellfish Aquaculture Business & Economics	Under development	
General Contributed Papers		
Marine Field Stations (POSTER SESSION)	Dianna Padilla Brian Beal	dianna.padilla@stonybrook.edu Bbeal@maine.edu

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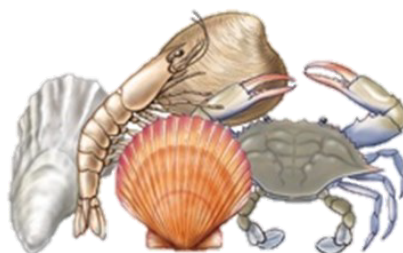
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Upcoming Events

Aquaculture Canada/WAS North America 2022: Aug. 15-18, 2022. St. John's, Newfoundland, Canada. For more information: www.was.org

Aquaculture America 2023: Feb. 19-22, 2023. New Orleans, Louisiana. For more information: www.was.org

11th International Abalone Symposium: Feb. 27-Mar. 2, 2023. For more information: <https://www.internationalabalonesociety.net/>

115th NSA Annual Meeting: Mar. 26-30, 2023. Baltimore, Maryland. For more information: www.shellfish.org

23rd International Pectinid Workshop: Apr. 19-25, 2023. Douglas, Isle of Man. For more information: www.internationalpectinidworkshop.org

116th NSA Annual Meeting: Mar. 22-26, 2024. Charlotte, North Carolina. For more information: www.shellfish.org

If you would like to announce a meeting, conference, workshop, or publication of interest to NSA members, please contact the *QNL* Editor, Steven Allen (sallen@bowdoin.edu).

