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National Shellfisheries Association Quarterly Newsletter

2019 (3)

President's Message



Greetings everyone! It's that time of the year for us to start focusing on our annual meeting. This coming year the meeting will be in Baltimore, where we can enjoy the Inner Harbor, as well as the meeting itself. An early thank you to session organizers, those who will attend, those supporting others to attend, our sponsors, and conference manager Dr. Sandy Shumway. It's a Herculean effort that's made easy for us because of her skills, and enjoyable through your participation.

For students planning on presenting, be sure to submit the separate form for a travel award. Travel awards will be selected by lottery versus a formal review process. This change came about from student input to the Recruits Co-Chairs who attend the Executive Committee meetings. In addition, there is a special travel competition for minority students supported by the FUCOBI Foundation. Poster and oral presentation awards will still be scored by anonymous senior reviewers. If you can assist with this, please contact Peter Kingsley-Smith to be placed on his list and contacted later when the presentation schedule is finalized.

Students should be developing proposals for the different NSA Grants In Aid for submission by **November 1**. Check the Recruits page on the NSA website. Don't let this chance pass to develop your proposal writing skills and support your own research. These awards are supported by member donations and the Student Endowment Fund that has developed over the decades. Thank you to those that donate to the Fund or to an individual-named award. Some of you add a little extra at membership renewal, some of you during the holiday season, and some of you during the auction at every meeting. No matter how, or how much, you have donated, thank you for investing in our future researchers.

By now you should have received a notice for membership renewal. Our fiscal year runs from October to September, but your membership is calendar year (January to December). Some of you recently received dues notices for 2019 as we found that many forget to renew when we have the Triennial Conference. We appreciate those that recently renewed for 2019 even as we near year's end and anticipate you will renew immediately for 2020. The administrative needs for the Association are supported by membership dues. Renewing or joining early (i.e., Oct-Dec)

assists us overall. The fiscal health of our society is very good, which we would like to maintain.

Noreen Blaschik Favreau and Linda Kallansrude keep things running smoothly for our Association, which includes assisting *JSR* Editor, Dr. Sandra Shumway, by keeping track of manuscripts, invoicing for page charges, and other items that I probably have no idea that they do. Their work has paid off once again as *JSR* received an APEX publication excellence award. Congratulations to the *JSR* production team, including our printer Sheridan Press, and those of you that publish your research findings in our Journal!

Remember to follow the "National Shellfisheries Association" on Facebook and "NationalShellfisheries" on Instagram. Recruits Co-Chair, Erin Roberts, is the primary contact for Instagram posts. I am the primary contact for Facebook posts. Send us photos and a few lines, or links to material, for which our members would have an interest. We'll be posting whatever we can to keep you informed of shellfisheries globally and NSA news.

It may be a bit early, but this is the only chance I have to wish you a happy, healthy, and prosperous 2020. Let us continue to make contributions to shellfisheries and the Association by publishing your research findings in *JSR*, recruiting new members, and assisting the Association in any manner you can. See you in Baltimore!

John Scarpa, President

In this issue:

- ***Carriker Student Research Update***
- ***Blake Endowed Memorial Fellowship***
- ***Oyster Nacre Inspires Scientists***
- ***Award Deadlines***
- ***Reed Mariculture***

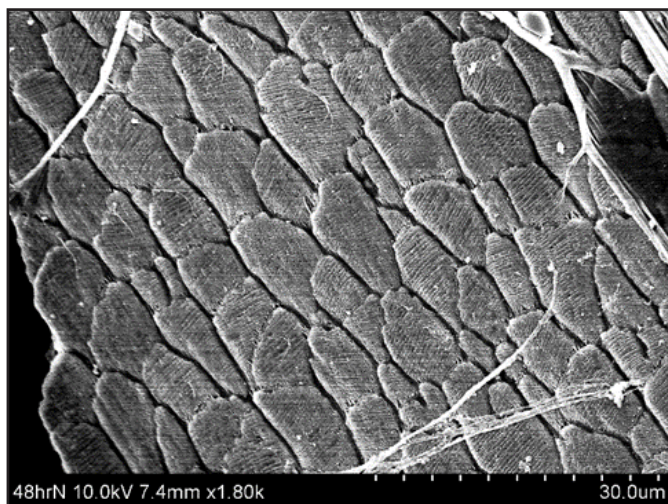
2018 Melbourne R. Carriker Student Research Grant Update

Awardee: Alyssa Outhwaite

University of Dayton

*“Cracking the shell: an investigation of shell repair
in the oyster, Crassostrea virginica”*

Oysters may look ordinary, but behind the tough shell a host of activities are at play. Perhaps one of the most demanding physiological processes consists of making and maintaining the shell. An array of materials from minerals to proteins must be synthesized, staged, then assembled to construct layers upon layers of hard, fracture-resistant shell. Oysters achieve this feat by acting as tiny masons, assembling slabs of inorganic materials (the bricks) and adhering them together with a suite of matrix organic material (the mortar). The shell formation process is fascinating from many perspectives, but perhaps the most intriguing aspect is that it happens in real time, under ambient temperature and pressure, and in an aqueous environment. Much is known about the pre-cursor materials and the final product, but not so much about how everything is assembled. My research attempted to fill a portion of this knowledge gap by investigating the potential role of hemolymph as a vector for material transport in the eastern oyster, *Crassostrea virginica*.



Attempting to survey all of the individual components involved in shell formation would be impractical for a thesis, therefore, the focus was on the organic material, published literature, and our preliminary results in an effort to identify a biomarker present in putative pre-cursor material. The biomarker selected, catechol amino acid L-3,4-dihydroxyphenylalanine (L-DOPA), is known to be present in proteins involved in the shell insoluble organic matrix formation. By tracking the location and temporal occurrence of L-DOPA-containing proteins, the spatial and temporal mobilization of organic materials mobilized for shell construction were assessed.

To assess shell formation in real time, rapid shell formation was induced by notching the oysters. Hemolymph samples were collected over short- (2 d), medium- (1 week), and long-

term (6 weeks) time intervals. Samples were analyzed to determine total L-DOPA concentrations associated with the stage/age of shell repair. Additionally, mantle tissue and nascent shell were collected to elucidate the distribution of L-DOPA-containing proteins during shell repair. Tissues were stained for catechols (L-DOPA is a catechol) at similar time intervals, while repaired nascent shell was imaged using scanning electron microscopy to characterize the repair structurally.

L-DOPA-containing protein concentrations in hemolymph corresponded with nascent repair shell growth. Low concentrations of L-DOPA signature in hemolymph were seen before the onset of repair, following a spike one week after notching. Levels then dropped, returning to baseline values by six weeks. This indicated that L-DOPA-containing proteins are already present and circulating in the hemolymph, but are accumulated at higher concentrations when repair needs are greater. The drop in L-DOPA signature follows the major completion of repair when the need for those organic matrix proteins is lower. This active aggregation of materials demonstrates the ability of the oyster to sense and respond to the need for shell construction and supply the shell formation front with necessary materials until the notch site is repaired.

Mantle tissues were also examined for the potential presence of L-DOPA. Preliminary staining of mantle tissue sections at 0, 12 and 24 hours showed some indication of the L-DOPA precursor, particularly concentrated in the mantle groove, an area known to function in the secretion of the periostracum. Dense patches of staining were also seen throughout the tissues, indicating channels through which proteins may be shuttled.

The structural changes of repair were also determined through SEM imaging. Though repair material could be seen filling the notched area just 12 hours later, the new shell was not mineralized enough for collection until at least two days after notching. Over the course of repair, the mineral organization of shell layers changed slightly. At two days, the prismatic crystal structures took on a roof tile layout, with overlapping layers apparently orienting away from the mantle towards the shell edge. By four days post notch, the crystals were transitioning to separate non-overlapping structures, with little to no directionality. This pattern continued to hold out to six weeks, with crystals becoming more distinct and showing no directionality. The change in crystal structure appearance is likely a product of how oysters sequentially lay down materials. Oysters under normal growth will push out small quantities of material over a longer amount of time, resulting in defined crystal structure. Under the repair model, a large amount of material is pushed out quickly over a short period of time. That, along with the undulating fashion in which the mantle moves, is likely the source of the overlapping and directional appearance of the repair material.

The timing and staging of materials used in shell formation appears to be tightly controlled and is an inducible response. These findings lend support for a mechanism of active materials transport and assembly in the shell formation process. I thank the National Shellfisheries Association for selecting my proposal for a Melbourne R. Carriker Student Research Award.



NSA Colleague Honored with Memorial Fellowship



Benthic Invertebrate Ecology.

On December 26, 2018 many of us lost a friend, mentor, and colleague when Dr. Norman J. Blake passed away following heart surgery. It is not surprising that several of his family, friends, colleagues, and students have come together to honor Norm by establishing the **Norman Blake Endowed Memorial Fellowship in Marine Science**. This endowment will support graduate students in the University of South Florida College of Marine Science, with a preference given to students studying Shellfish Biology, Shellfish Aquaculture, or

The goal is to create a fully-funded endowment of at least \$100,000 which will, in perpetuity, continue the impact of Norm's legacy at the College of Marine Science. In addition, Dean Dixon has committed three years of funding to begin awarding the **Norman Blake Endowed Memorial Fellowship in Marine Science** in the Fall of 2020 as the endowment is established.

Norm was a staunch and silent supporter of NSA students.

If you would like to make a contribution, please make your check payable to the USF Foundation and write "Norman Blake Endowed Memorial Fellowship in Marine Science" on the memo line and mail to USF College of Marine Science, Attn: Renate Jurden, KRC 3114, 140 Seventh Ave. South, St. Petersburg, FL 33701. If you have any questions about this fund, or need any additional information, please contact Laurie Scott at lkscott@usf.edu or call 727-515-7033.

Support NSA by using BioOne

The National Shellfisheries Association (NSA) joined BioOne in 2007. More than 1,500 articles and 14,000 pages from the *Journal* are published in BioOne Complete. This represents over 14 years of content beginning in 2005 with Volume 24(1).

NSA members whose dues are paid can access the BioOne site via the Association website. Please check with your libraries to encourage them to subscribe to BioOne.2 or BioOne Complete for full access via the library portals. "Hits" count when it comes to royalties and these funds are very important to the NSA and support of publication of the JSR. Because BioOne is a non-profit organization, most of the money that it receives from subscriptions and royalties is returned to publishing societies. From 2007 when NSA joined BioOne, through 2015, NSA has earned nearly \$425,000. So, **USE BIOONE OFTEN!**



Award Deadlines

November 1: Nominations for:

- Honored Life Member Award
- David H. Wallace Award
- Neil Bourne - Ken Chew Award
- Paul Galtsoff Industry Award

Student Research Grant Awards:

- Melbourne R. Carriker Award
- Michael Castagna Award
- George R. Abbe Award

December 15: SEF Travel Awards (new lottery system)

Meeting Deadlines

**Abstract Submission:
December 15, 2019**

**Early Bird Registration:
January 18, 2020**

**Hotel Registration Cut-off:
February 28, 2020**

FROM THE EDITOR...

Arnold Frank or Frank Arnold? Chihiro Hayashi or Hayashi Chihiro? Guo Xi or Xi Guo?

REFERENCES AND NAMES MATTER! That means not only taking the time and effort to find and cite the most appropriate papers, but making sure that when you do, you provide all of the relevant bibliographic information so that others can locate the paper. It also means getting the names of the authors correct and in the correct order – a very important consideration on many fronts, but especially in this electronic age when metrics are computed based on numbers of downloads and citations, and authors need and expect to receive recognition for their contributions. This may sound like a pretty straightforward statement, but it takes on a special significance when dealing with foreign names and the associated formats and customs for presentation. It is a common error to find names, especially those from Asia, misrepresented, misspelled, or the worst: backwards, i.e. first name last and surname first, when people don't recognize or understand which is the last name. When this happens, not only is it very difficult to locate the references, but the authors do not get the credit and recognition they deserve.

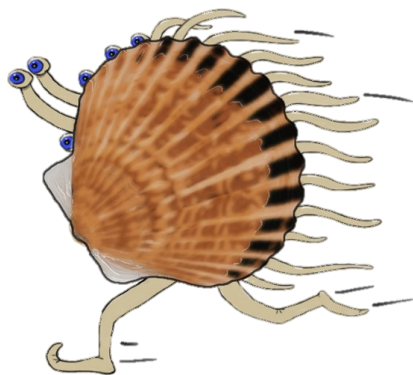
So please take the time to check all of your references and their authors carefully and, if in doubt, ask someone who can provide assistance. To all authors who believe there may be a chance of misunderstanding names and their order: please try to make it as clear as possible to readers how authors should be recognized. This can be done by highlighting or placing surnames (last names) in bold font. Arnold **FRANK**. Or Chihiro **Hayashi**.

Let's try to give everybody the credit they deserve and make it a little easier for everybody to locate those references.

Sandy Shumway

The Scallop Gallop

NSA 5K in Baltimore



Contact Lewis Deaton:
led9784@lousiana.edu

112th Annual Meeting BALTIMORE, MD March 29 – April 2, 2020



Plans are well underway for what looks to be a very exciting meeting! There are currently some 35 special sessions planned, including several newcomers to the NSA. There are four opening speakers covering diverse topics: Evan Ward, João Ferreira, Luz Pérez-Parallé, and Roger Mann. Check the web page (www.shellfish.org) and contact the session organizer if you have questions or want to confirm your participation – there will be something for everyone. Also, take note of our generous sponsors and when you see them during your regular activities, thank them for their support.

All of the usual functions are on the agenda: Sunday evening President's Reception (aka seafood extravaganza), student breakfast (Monday), SEF Auction (Tuesday), Business Luncheon (Wednesday), and the poster sessions and happy hours. Don't forget to start cleaning your office early and bring all of those unwanted treasures to the auction. If you can't make it to the meeting, you can send your auction items to Sandy. You'll also have the opportunity to sample the Baltimore waterfront and local restaurants.

ABSTRACT DEADLINE DECEMBER 15, 2019. Also, make note of all the associated deadlines for award nominations, student research awards, and travel awards. (see Box on Page 3 for easy tracking).

Any questions about the meeting, contact the Conference Manager, Sandy Shumway (sandra.shumway@uconn.edu).

Looking forward to a fun and successful conference – see you in Baltimore!

Sandy Shumway

Recruits' Corner

Fellow Recruits,

Welcome back after another productive and/or restful summer season. We hope you have enjoyed learning about fellow students' research projects featured on Instagram @nationalshellfisheries. Keep an eye on the account for highlights from the PCSGA/NSA-Pacific Coast Section conference in Portland, OR, featuring student presentations and the always raucous fundraising events. As you plan your fall schedule, do not forget about the following opportunities for funding and associated deadlines:

Submit your applications for the NSA research grants by November 1st, 2019. These \$1,250 awards provide flexible funding for those studying general and applied shellfish questions, crustacean biology, and fisheries management. We highly encourage you to apply, and past awardees are still eligible. Don't wait until November 1st - apply now!



The next important date is **December 15th 2019, which is the deadline for SEF travel award applications.** These awards provide travel support for lodging, registration, and travel for students attending the NSA meeting in Baltimore, Maryland, March 29th through April 2nd, 2020. This year the support will be awarded via lottery. To be eligible, you must be a current member of the NSA, be presenting original research, and be the first author of an oral presentation or poster. Current graduate students and former graduate students within one year of graduation can apply.



Do your classmates constantly "borrow" your copies of the *Journal of Shellfish Research*? Do they have brilliant shellfish insights, but have never presented at the annual NSA conference? If so, encourage your classmates to become NSA members! Student members receive hard copies of the *Journal of Shellfish Research*, access to digital copies online, and are eligible

for research and travel grants. Student membership is only \$50 annually, and **those who recruit five people to join NSA receive one year of free membership.**

For details on all happenings, visit the student page on the NSA website (www.shellfish.org/student-members). As always, email Erin (erin_roberts@my.uri.edu) or Laura (lhs3@uw.edu) with any ideas or concerns.

Laura & Erin

The *Journal of Shellfish Research* was awarded its 11th APEX Award for Publication Excellence!



NSA Treasurer's Report

The most recent completed fiscal year for NSA was from October 1, 2017 through September 30, 2018. Revenues and expenses were \$372,651.31 and \$366,683.99, respectively, which resulted in a net gain of \$5,967.32. Total end of fiscal year assets were \$595,599.88, which includes \$136,960.66 in the Student Endowment Fund. The



non-SEF assets are above the average annual expenses for the past five years of approximately \$309,000, which the Executive Committee adopted to maintain fiscal security for the society. The Student Endowment Fund raised \$2,260 at the 110th meeting of the society in Seattle, WA. Thank you for your support of NSA and SEF.

Storage of seawater before use can prevent losses by pathogens in shellfish hatcheries

By: Eric Henry, Reed Mariculture Inc.



In recent years there have been anecdotal accounts of reduced *Vibrio* pathogen problems in both shellfish and finfish hatcheries when a diverse bacterial population is allowed to develop. For example, the Auburn University Shellfish Laboratory experienced frequent larviculture failures attributable to *Vibrio* outbreaks after installation of a new seawater system with powerful UV treatment. These failures continued for two years until they adopted the practice of first storing the water for 24 hours before use and stopping UV treatment, whereupon the larviculture failures ceased (see https://www.youtube.com/watch?v=nqerVTlch_w). This contradicts the conventional wisdom that the best defense against *Vibrio* pathogens is stringent sanitary precautions to reduce the numbers of bacteria present, with the hope of preventing invasion by pathogens. But

it can be difficult to impossible to prevent invasion of a hatchery by all pathogenic *Vibrio* spp. because all seawater entering the hatchery must be sanitized, broodstock and algae cultures must be kept free of pathogens, airborne transport of pathogens must be prevented (very difficult in a shoreline location), and all these measures must work perfectly, all the time.

Now there are published experimental studies that demonstrate how water storage can prevent *Vibrio* pathogens from causing problems in hatcheries. The mechanism is the activity of *Vibrio* Predatory Bacteria (VPB), which appear to be ubiquitous in raw seawater. As shown by the very comprehensive study of Richards et al. (2012, Appl. Environ. Microbiol. 78:7455-7466, and more recent studies by this lab), when raw seawater is stored for several days, during the first 24 hours pathogenic *Vibrio* spp. bloom to very high numbers, but by 48 hours VPB bloom and progressively reduce the numbers of pathogenic *Vibrio* spp., until at 72 hours they are virtually undetectable. This phenomenon occurred in seawater samples from multiple sites in Delaware, Alabama, Oregon, and Hawaii.

Only simple and low-cost measures are required for hatcheries to take advantage of this phenomenon.

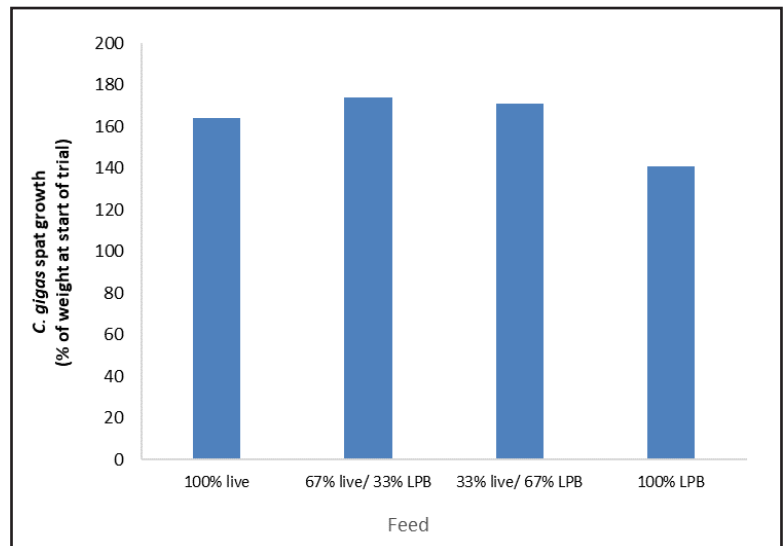
- All seawater entering the hatchery must be stored before use, preferably for 3 days.
- Storage for less than 3 days may be effective, if the storage tank contains a concentrated population of predatory bacteria, created by allowing a residue of settled material to accumulate in the tank. Therefore, the tank should not be completely emptied or cleaned when water is removed.
- Seawater should not be sanitized, e.g. by UV. This can kill *Vibrio* spp., but it also kills predatory bacteria. Storage of seawater establishes active populations of predatory bacteria that may continue to protect larvae and later stages in the facility.
- Broodstock oysters should be vibrio-free, and maintained in stored seawater.
- Water storage for 2-3 days will remove most of the phytoplankton from seawater, so algae must be added to feed broodstock, larval and spat cultures.
- All food algae should be free of *Vibrio* spp., and so must be cultured using only stored seawater, or commercial algae concentrates should be used.

After storage has allowed VPB to eliminate *Vibrio* spp., the seawater can be filtered (commonly to 5 or 1 micron) to remove larger organisms (zooplankton) and used for culture of larvae, spat, or broodstock. Storage of seawater before use has been shown to also provide reliable protection against infection by Oyster Herpesvirus (Whittington et al. 2015, Aquaculture 437:10-20). Although Oyster Herpesvirus has not yet proved to be a significant concern to most North American bivalve hatcheries, it is important to consider that this virus was not a significant problem for *C. gigas* until relatively recently, when it struck whole production regions in distant parts of the world. It appears that all kinds of bivalves are susceptible to infection by herpesviruses, so the potential for a newly-virulent strain to arise and spread worldwide should remain a concern for all shellfish producers.

When seawater is stored and even relatively coarsely filtered before use, most of the resident plankton will be removed, requiring that hatcheries and nurseries add algae to the water to feed their animals. Fortunately, it is no longer necessary for shellfish producers to make the substantial investments in infrastructure, personnel training, labor, and energy costs required to produce large amounts of algae themselves. Reed Mariculture's Instant Algae® concentrates are effective for both supplementing or complete replacement of natural phytoplankton or algae cultured on-site, eliminating the risk of toxic phytoplankton blooms or algae culture crashes. Reed Mariculture now offers LPB Frozen Shellfish Diet, formulated with a larger cell-size distribution than Shellfish Diet 1800, for more efficient feeding by larger larvae and spat. Results from this feed trial demonstrate the efficacy of LPB with spat of *Crassostrea gigas*.

Contact Reed Mariculture at:

techsupport@reedmariculture.com



*Carlsbad Aquafarms (August 13, 2019 to Sept 3, 2019). Fed 0.15mL/gram per day.

* Live feed: Isochrysis/Pavlova mix

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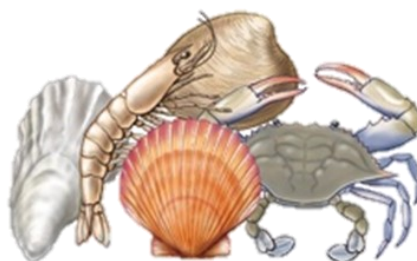
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Upcoming Events

Aquaculture Europe 2019, "Our Future - Growing From Water". Oct. 7-10, 2019. Berlin, Germany.
For more information: <https://www.aller-aqua.com/events>

112th Annual NSA Meeting: Mar. 29 - Apr. 2, 2020.
Crowne Plaza Hotel Baltimore Downtown-Inner Harbor. For more information: www.shellfish.org

For more information on these conferences:
www.was.org

Aquaculture 2020: Feb 9-12. Honolulu, Hawaii
USA

Aquaculture Canada/WAS North America 2020:
Aug 30-Sept 2. St. John's, Newfoundland, Canada

Aquaculture 2022: Feb 27-Mar 3. San Diego,
California, USA

Aquaculture America 2023: Feb 19-22. New
Orleans, Louisiana, USA

If you would like to announce a meeting, conference, workshop, or publication that might be of interest to NSA members, please contact the *QNL* Editor, LeRoy Creswell (creswell@ufl.edu).