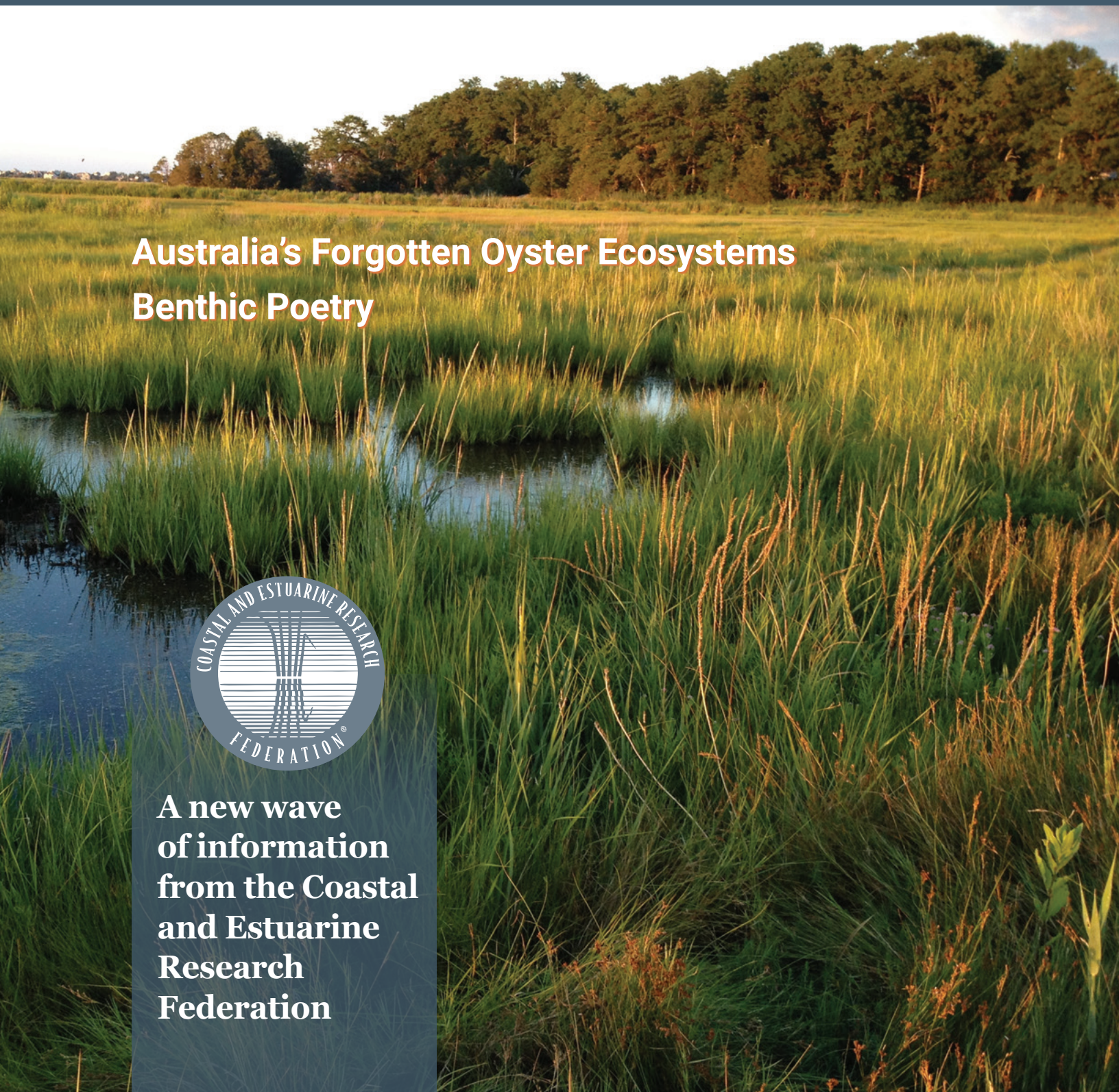
CERF's Up!

Volume 48 • Number 2 • June 2022



Australia's Forgotten Oyster Ecosystems

Benthic Poetry

A new wave of information from the Coastal and Estuarine Research Federation

CERF's Up!

Volume 48 • Number 2 • June 2022

Table of Contents

Editors' Note: *The poems in this issue were contributed from the CERF 2021 conference "Ode to Benthos" sessions, convened by Leila Hamdan, Janet Nestlerode, Elizabeth Hinchey, Kelly Dorgan, and Treda Grayson*

Front Cover: *Salt Marsh, Parker River 2020. Newbury, Massachusetts, USA* Photo: JD Doyle

Back Cover: *Charron Bay in the Sevre Niortaise River Estuary* Photo: Hassan Bensliman

Call for Cover Photos for *CERF's Up!*

Would you like to see your favorite estuary displayed on the cover of *CERF's Up!*? If so, send high-resolution shots showing the natural beauty of the place, along with a short caption and photo credit, to bulletin@cerf.science.

President's Message

Leila Hamdan

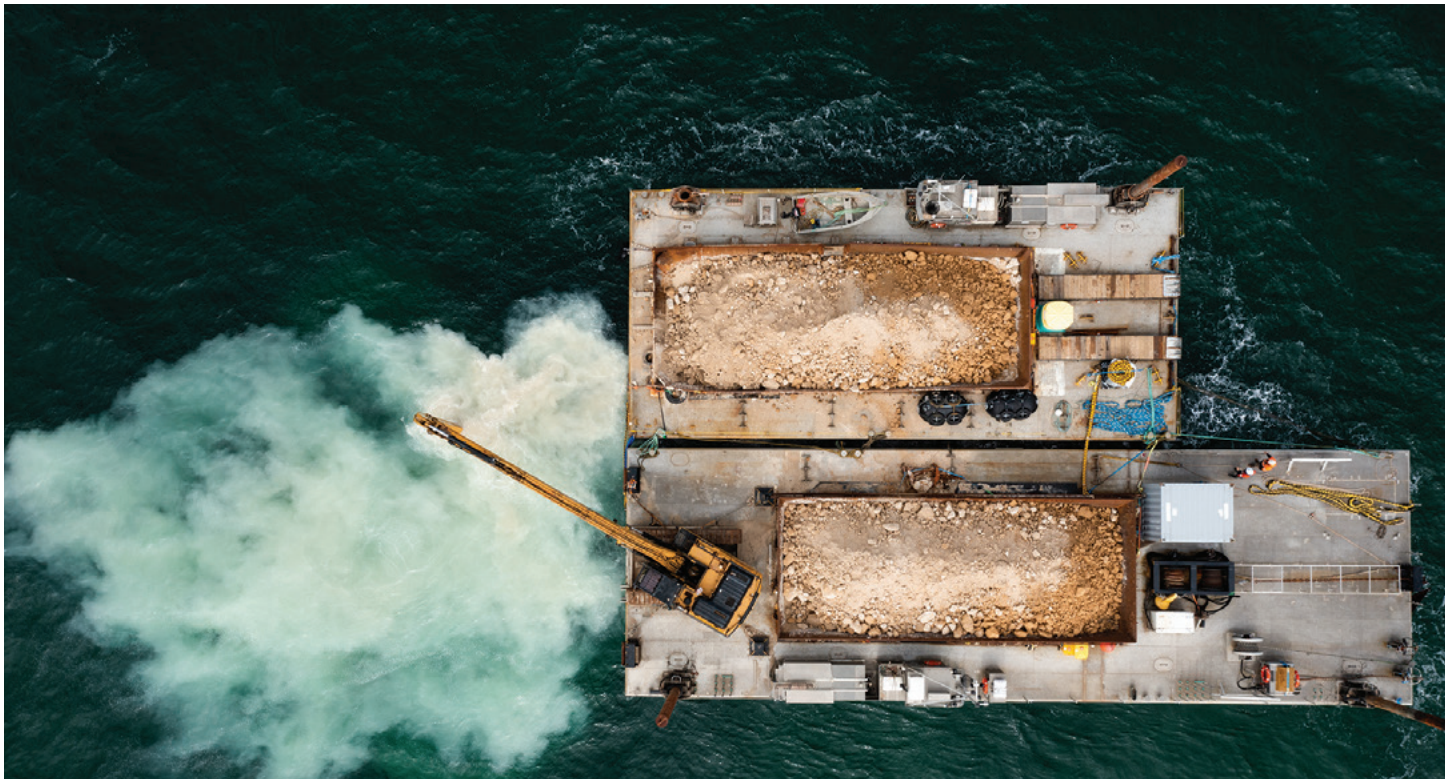
"Well, how did I get here" is the last line of each verse of the song "Once in a Lifetime" by The Talking Heads, released in 1981. It's also a good question to ask throughout our careers. The question can emerge in times boom and bust, when you are overwhelmed with possibilities, or simply overwhelmed. I can track career decisions and figure out how I got here, holding the seat of CERF President for a short time, but the truth of the matter is I got here through networking. My network started with very limited nodes: me, my advisor, a few students, and highly connected edges. The community of CERF changed that for me, and now I have colleagues and collaborators and hundreds of edges between us. A network is not necessary to do science, although it makes interdisciplinary science possible and does some heavy lifting where career advancement is concerned. It is an advantage, and because of that, we should acknowledge it is not shared equally. The CERF Governing Board is working to change that and share the gift of our network across the federation.

CERF has taken seriously the need and obligation to broaden participation in our mission. Rising TIDES (Toward an Inclusive, Diverse, and Enriched Society), an effort championed by the last two governing boards, has made gains in enhancing the diversity and inclusion of our federation and conferences. Since 2017, the Rising TIDES Conference Program has provided programing to students from underrepresented groups in coastal and estuarine science with mentoring, professional skill development, and networking opportunities at our biennial conference. The program envisions ties forged to help students become lifelong members who grow with the federation and shape its future. The program is thriving as a place where networks flourish and diversify. It has taught us we can add capacity to support networks of members at all career stages.

Right now, a group of dedicated CERF members are developing a proposal to grow Rising TIDES, while aligning it with a leadership development program open to all career stages. This program aims to provide skill development for future leaders for CERF and our home institutions. The leadership program could make a strong step towards changing the landscape of leadership to one that is more inclusive, while equitably creating branching networks necessary for advancing institutions, norms, initiatives, disciplines, and careers. The work on these initiatives may answer the question "how did we get here" when we arrive a place where diverse leadership steers us towards new discoveries and practices in coastal and estuarine science. I am excited about the prospect of getting there together.

Building Shellfish Reefs Down Under: What's Happening in Australia?

Simon Branigan
The Nature Conservancy, Melbourne, Victoria, Australia
simon.branigan@tnc.org



Reef building in Port Phillip Bay, Victoria, Australia

Photo: Streamline Media

Australia, like the US and many other regions around the world, has suffered from catastrophic loss of shellfish reef ecosystems. Oyster beds created by the native flat oyster, *Ostrea angasi,* (which is near identical to the European flat oyster), have declined by up to 99 percent since European settlement. Reefs created by the Sydney rock oyster (*Saccostrea glomerata*), a commonly farmed species, have suffered up to 90 percent loss. The wild harvest oyster industry in Australia dried up in the early 1900s after oyster beds of both species collapsed. The oyster industry quickly transited to cultivated oysters (mostly *Crassostrea gigas*) by the 1940s and the industry hasn't looked back. The once prolific wild harvest industry, which at its peak employed thousands of people and harvested in over 200 locations across Australia, soon faded from living memory.

Yet thanks to a dedicated group of conservationists, farmers, and researchers, Australia's "forgotten" oyster ecosystems are making a comeback at a pace and scale few would have thought imaginable. In 2014, The Nature Conservancy launched a program in Australia to recover oyster ecosystems created by the native flat and Sydney rock oysters. Since that time, 20 restoration projects have been completed or are under way, over 50 scientific studies on oyster reefs published (compared to just four prior to 2014), a national restoration strategy (Reef Builder) established, a practitioner network developed,[1] and shell recycling programs became operational in three cities.

The aquaculture industry is benefiting from this surge in restoration through improved knowledge on oyster ecology and husbandry and is a direct financial beneficiary of restoration as projects purchase oysters from farms or commercial hatcheries. The Reef Builder initiative was given a boost in 2021 by the Australian government, which committed AU$20 million towards the recovery of oyster (and blue mussel) reefs at 13 locations around Australia as a COVID-19 economic stimulus response. With a focus on measuring economic as well as environmental benefits, in its first year the investment was able to restore 20 hectares of reef, recycle 250 metric tons of shell, employ 168 people, and engage 71 small to medium enterprises, all while much of the country was in lockdown. The

1 https://www.shellfishrestoration.org.au/

year 2022 is set to be Australia's biggest reef-building year yet with construction under way at a further 10 sites.

It's not just The Nature Conservancy involved in reef restoration. Many community groups and recreational fishers, through groups like Ozfish Unlimited, are also getting involved. State government environment agencies are mapping remanent reefs to help identify what's remaining and the Australian government is in the process of listing native flat oyster and Sydney rock oyster reefs and beds on its protected ecological community list, which when completed would result in the highest level of federal protection.

While the oyster restoration movement is rapidly accelerating in Australia, and through the National Shellfish Restoration Network it is also connected to similar movements in New Zealand and Asia, much of this momentum was made possible by the earlier achievements of oyster restoration in the US. Indeed, if we didn't have the successes of oyster initiatives like in the Chesapeake Bay and Gulf of Mexico to point to, many would have been skeptical of the vision for an ecosystem-wide recovery program for shellfish reefs in Australia.

As the world grapples with biodiversity loss, climate change, and food insecurity, oyster growers and restoration practitioners have the opportunity to come together the world over to provide a lighthouse example of how oyster aquaculture and the restoration of wild oyster ecosystems can work hand-in-hand to help solve our global challenges for the benefit of people and nature. Australia, with its growing oyster restoration community and strong aquaculture industry, hopes to be just one example of what can be achieved.

Native flat oysters growing on recycled scallop shell, seeded in the hatchery

Photo: Tayna Sincock

Hatchery brood stock of native flat oysters

Photo: Streamline Media

Linking Bioturbation to Geotechnical Properties of Sediments: A Modeling Approach

Kelly Dorgana[1] and Sanjay Arwadeb[2]
[1]Dauphin Island Sea Lab, University of South Alabama, Dauphin Island, Alabama, USA
[2]University of Massachusetts, Amherst, Massachusetts, USA
kdorgan@disl.org

It's well known that bioturbation differs across functional groups.
Where are they feeding and where are their poops?
But have you thought beyond what the animals do
To the role of cohesion and the organic sediment goo?

Worms extend burrows through muds by crack propagation.
How does this process free particles to be mixed through bioturbation?
To figure this out, what do we need to know?
How much do cracks branch and how straight do they go?

Branching and microcracking free sediment grains
To be transported while their neighbors remain
What causes a crack to branch or to turn?
Is it mud properties or the movement of the worm?

We used finite element modeling to answer these questions,
First varied stiffness and measured crack propagation direction.
A big change in stiffness, like from a fecal pellet or burrow compaction
Bends the crack by a surprisingly small fraction.
Next we varied the forces applied by the worm
And that also did little to make the crack turn!

Two hypotheses down, we turned to fracture toughness.
Could its variability lead to jagged crack roughness?
We varied fracture toughness across different spatial scales
And overlaid crack stresses to see where the mud fails.

Variability on small spatial scales results in a crack that's more jagged,
But an applied stress field can straighten it and make it less ragged.

Next we looked at crack paths made by burrowing worms,
Measured the distance they grew and the angle they turned.
We observed discrete crack growth events,
But even when it appeared that the crack had bent,
We saw sharp angles result from the joining of parallel cracks.
But crack propagation was quite straight, in fact.

Next steps are to put the model and data together
To inform what spatial scales we should measure.
We learned that it's important to know how much the mud is sticky,
But high-resolution measurement of fracture toughness is tricky.
Compared to the high variability model, real cracks go much straighter,
So maybe spatial resolution is a problem we can put off until later?

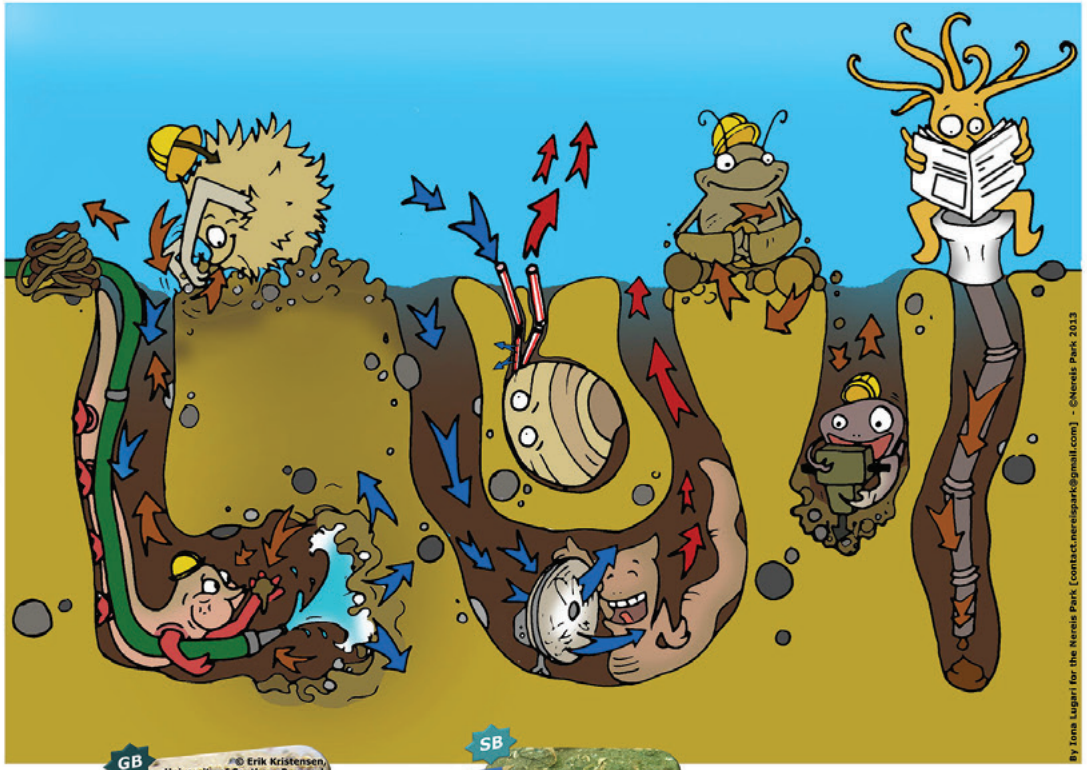
Editors' Note: *The following poster, shown by Kelly in her talk, was created by Iona Lugari, and is reprinted with permission of Nereis Park.*

BIOTURBATION:

The displacement of particles (sediment reworking) and water (ventilation) in sediments due to faunal activities(*).
The actors of bioturbation(#) can be regrouped in different functional groups.

(*): *the definition is here restricted to aquatic fauna. Soil animals, aquatic and terrestrial plants can also generate bioturbation.*

(#): *only examples of marine macrofaunal species (i.e., organisms retained on a 0.5 mm sieve) are given here.*



Echinocardium cordatum

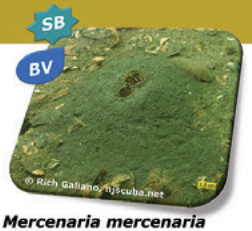
Biodiffusor reworking B
Organisms with activities that mix sediment homogeneously over short distances.
Sub-groups are epifaunal biodiffusors EB, surficial biodiffusors SB and gallery biodiffusers GB.

Upward conveyor reworking UC
Vertically oriented species that feed head-down at depth in the sediment and deposit wastes at the sediment surface.

Arenicola marina

Blind-ended burrow ventilators BV
Organisms positioned in vertical I- or J-shaped burrows. They pump oxygenated water into the burrow for respiratory purpose by body and cilia movements. Bivalve siphons may leak oxygen indirectly into the surroundings.

Hediste diversicolor



Mercenaria mercenaria

Open-ended burrow ventilators OV
Organisms that construct U- or Y-shaped galleries with 2 or more openings. They maintain breathing by circulating oxygenated water from head to tail by body undulations or by beating limbs.

Uca vocans

Scopimera sp.

Downward conveyor reworking DC
Vertically oriented head-up feeders that ingest particles at the surface and egest wastes deep in the sediment.

Cirriformia sp.

Regenerator reworking R
Excavators that dig and maintain burrows in the sediment by transferring sediment from depth to the surface. The excavated sediment is replaced either by surface sediment infilling or by collapse of burrow walls.

A collaborative work coordinated by Franck Gilbert (EcoLab).

http://www.nereispark.org/

This poster is freely inspired by the Kristensen, E., G. Penha-Lopes, M. Delefosse, T. Valdemarsen, C.O. Quintana & G.T. Banta paper: What is bioturbation? The need for a precise definition for fauna in aquatic sciences. Marine Ecology Progress Series (2012) 446: 285-302.

Smothered and Covered: The Paul E. Keet Story

David S. Johnson
Virginia Institute of Marine Science, Gloucester Point, Virginia, USA
dsjohnson@vims.edu

Up on the high marsh,
Where the tides don't often meet,
Lives a carrot-shaped worm named Paul E. Keet.
His other name is *Manyunkia aestuarina*
And he lives happily in the habitat of Spartina,

In the warmer months, Paul likes to eat
Microscopic and single-celled photosynthetic treats,
Like phytoplankton and diatoms.
If you put your ear to the mud,
You can hear his tiny little nom, nom, noms.
He lives in New England and before 2020,
You could hear his cheers of Tom, Tom, Tom!

A storm blew in the winter of 2018,
A storm that was wicked and mean.
It pushed the tides as tall as a ladder,
That lifted giant chunks of ice like they didn't matter.

Ice in New England is nothing new,
Like chowda and leaf peepers and popovers, too.
But this ice was thick and carried a load
Of sediment from the expansive mudflats below.

Up on the high marsh the icy muds landed,
Leaving the ice and mud alone and stranded.
And by the time the ice melted and fans yelled Go Sox!
The marsh looked like it had a bad case of the muddy chicken pox.

But more importantly, Paul and his friends emerged from their deep winter sleep,
To mud piled up three centimeters deep!
Paul and his friends were smothered and covered.
Would Paul and his friends ever recover?

Three months after the ice did redecorate,
There were cores to excavate,
Samples to replicate,
Values to estimate,
Data to cogitate,
Means to investigate,
Thoughts to ruminate,
Colleagues to agitate,
Lives to speculate.
And when we thought the debate
Would not abate,
We set it straight
With this non-chordate
Whose muddy fate
Did decimate his benthic real estate.

Paul's neighborhood was cut in half,
No matter how you did the math.
You could see the marsh had felt the wrath
Of the storm's destructive path.

But before you write an obituary
For this marsh-filled estuary,
Remember that Paul is as tough as Reviewer 3
Who says, it's okay, but I don't see
Any generality
Or any real novelty.

Paul is a hardy New Englander,
Who is quick to give you the finger (if he had one).
He doesn't let a little ice and mud get him down,
Not when he has a beautiful tentacular crown.

So, 18 months after a storm that was wicked and mean,
Paul's neighborhood was back to normal based on the means.
This was true not only for Paul and his annelid crew,
But also for the coffee-bean snails and isopods, too!

Paul and his friends emerged from their muddy quilt,
Settling into a new neighborhood of fine muds and silt,
A fine place for the invertebrates of the marsh to thrive,
A place where Paul E. Keet survived.

[Cue "Survivor" by Destiny's Child]

Marshes are resilient,
What they say is true,
But these ice rafts and muddy blobs didn't come out of the blue.
Climate is changing,
This is also true.
Does that mean more ice and sediment doom?
Paul E. Keet eats diatoms.
Feed a marsh sediment
And it goes nom, nom, nom.
Do rafts of sediment make a marsh grow?
Hey, I'm just a worm guy, what do I know?
I'll leave that to the geomorphologists and their sediment budgets,
Though, frankly, I think they kind of fudge it.
But again, I'm just a worm guy, so who am I to judge it?
In the end you can clearly see,
Invertebrates can make a full recovery,
That after a bath of mud and ice
They return to a saltmarsh paradise.

These are not the only muddy tales this week,
Manisha Pant tells what happened to worms when the *Deepwater Horizon* sprung a leak.
What happens when *Spartina* sees periwinkles and a sprinkle of your tinkle?
Serina Wittyngham will iron out this global-change wrinkle.
What happens to invertebrates when your marsh moves away?
Well, you'll have to see what Emily Goetz has to say.
How many crabs and how many holes?
Find out those answers from Kayla Martinez-Soto.

Thank you
Sam, Erin, Caroline, & Leah,
Tiffany, Catherine, Grace, & Linda
For all your help.
I couldn't ask for any better,
And the National Science Foundation
For giving us the cheddar.

A tremendous thanks to my co-authors, Serina, Manisha, and Kayla.
They are real stars of this story.
They did most of the work.

Here I am, taking most of the credit like some kind of . . .
Wait, what rhymes with work?

I hope you enjoyed the tale of Paul E. Keet,
It was one that I found really kind of neat.
And I don't really mean to boast,
But you can find out more in *Estuaries and Coasts*.

References:
Wittyngham, S.S, M. Pant, K. Martínez-Soto, and D.S. Johnson. 2021. Biotic recovery following ice-rafting in a salt marsh. *Estuaries and Coasts*. https://link.springer.com/article/10.1007/s12237-021-01023-z

Mighty Mangroves and Little Micro Machines

Rachel Weisend
Texas A&M University, Corpus Christi, Texas, USA
rweisend@islander.tamucc.edu

In these twisty roots and propagule shoots,
Juvenile fish develop before continuing on their routes.

Mangrove roots bury below deep into the sediment muck,
Keeping these mangroves nice and stuck.

When coastal storms come around,
Coastal developments are kept safe and sound.

For as the waves crash and make impact,
Our coastlines are left intact.

But in this sediment a process is unseen,
Where carbon is stored and used by micro machines.

These micro machines known as microbes will eat
The carbon that is deposited on repeat.

In goes the carbon and out comes methane,
Which is a gas that causes our atmosphere pain.

But this methane is safer in the sediment,
Which makes these ecosystems to be in our benefit.

Mangrove systems are mightier than other systems on land,
Overall giving the atmosphere a helping hand.

Protect these systems for if they break,
It is the methane the atmosphere will take.

This drives the cycle more and more,
Wreaking havoc on every shore.

So when you see these pretty trees,
Give them thanks and let them be.

The mighty mangroves and the little micro machines.

Don't Be Trashy!

Alyssa Quackenbush[1] and Erin Voigt[2]
[1]Galveston Bay Foundation, Kemah, Texas, USA
aquackenbush@galvbay.org
[2]North Carolina State University, Raleigh, North Carolina, USA
epvoigt@ncsu.edu

Marine debris is any manmade product (not just plastics!) that is not supposed to be in a marine environment. This includes processed wood, crab pots, rope, and much more. These are all threats to humans and ecosystems because they can entangle organisms and leach harmful chemicals. While doing fieldwork for a lab project, we noticed the immense amount of debris at remote saltmarsh locations. We began wondering where this debris came from and why it ended up here. The project involved creating maps from drone imagery, so we also wondered if we could see the debris in the maps and what the implications would be if we could. After searching the literature, we found that many studies have focused on debris found in the ocean and on beaches, but few studies examine the amount of debris in other coastal habitats. Thus, this marine debris project was born.

Marshes provide many ecosystem services and are negatively affected by marine debris. Large debris smothers marshes and attempts to remove it can be more damaging due to trampling. Using drones to efficiently locate debris in saltmarsh habitats will minimize trampling and allow us to survey a large area much faster than on foot. Therefore, we tested how effective drones are at locating debris in marshes and for spatiotemporal variation along sites in Pamlico Sound, North Carolina.

We completed synchronous ground and drone surveys of debris over a two-year period at eight sites. A drone survey was completed for all sites in 2019 and 2020. A ground truth survey was completed for all sites in 2020. An efficacy study was completed for four sites in 2020, which allowed us to calculate how ground type and the size and area of debris affected the probability of debris being located by drone surveys. This study revealed that large, brightly colored debris on wrack ground type had the greatest likelihood of being located with the drone. Our other three surveys show that average debris density varied significantly across sites but not across years.

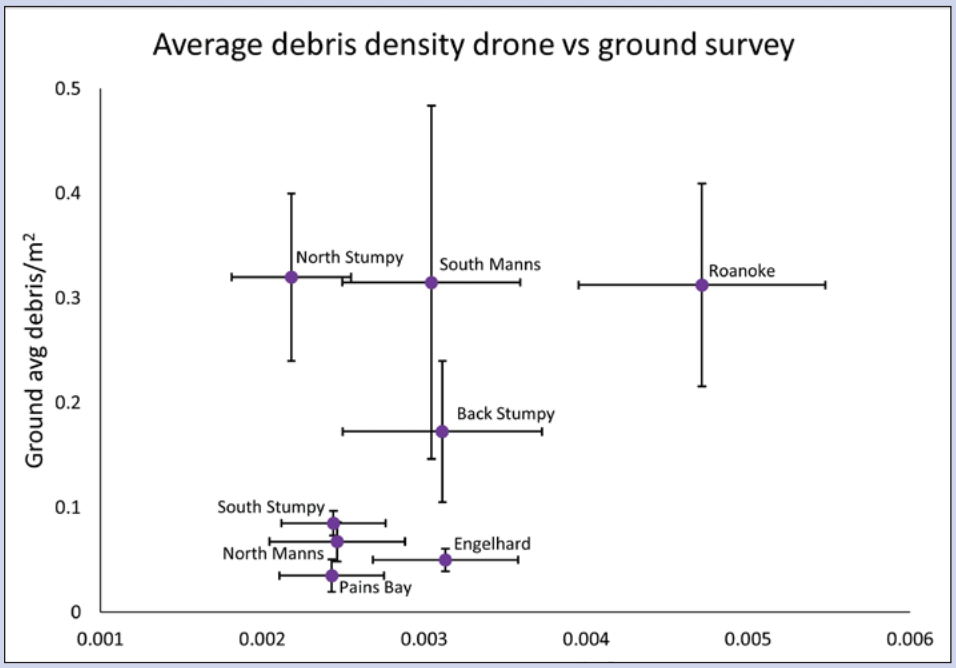


Figure 1. Average debris density for each site in 2020 drone survey and 2020 ground survey. Notice how much larger the ground survey values are than the drone survey values

Despite covering less area, ground surveys produced greater estimates of marine debris density. This is likely due to finding much smaller debris in the ground surveys, while drone surveys mostly captured large debris. Due to the nature of marsh habitat, smaller debris is likely to be buried or concealed by the grass, making it difficult to locate with a drone. Examples of small debris items we found include bottle caps, food wrappers, and shotgun shells. Examples of large debris items we found include wood boards, crab pots, and tires.

We hypothesized a strong linear relationship between marine debris density measured in ground surveys and drone surveys because this would mean the drone surveys are a good indication of what debris is actually there. However, there was no linear relationship (R^2 = 0.17) between average marine debris density measured in ground surveys versus drone surveys at the same site (Fig. 1). Overall average ground debris density (0.17 debris/m^2) is significantly larger than average drone debris density (0.0029

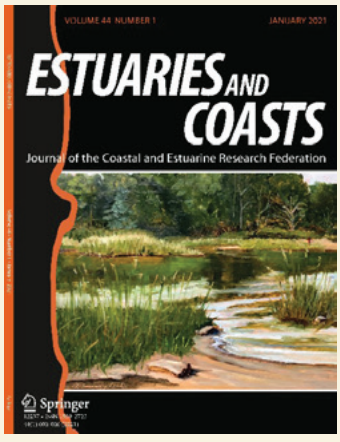
Figure 2. The 1,907 pieces (99kg) of debris we collected from our sites

debris/m^2; $p < 0.01$). Drone surveys may be a good alternative for locating large debris, which is most likely to cause smothering damage, but are not accurate at predicting overall debris density.

We also wanted to know if certain human factors (number of boat ramps, number of beach access points, miles of road, human population size) or natural factors (proportion of land cover types, average wave power, relative wave energy, site heading) influence where debris ends up among our sites. We calculated these eight factors within five miles of our sites and ran a principal component analysis (PCA). This analysis revealed that average debris density for the 2020 drone survey was primarily driven by human factors. No other linear relationships were discovered between the surveys and our eight factors. However, all three surveys' average debris densities have a quadratic relationship with average wave power, meaning sites with high and low wave power have greater marine debris density than medium wave power sites. This trend is likely due to sites with low wave power trapping debris and sites with high wave power gathering debris from a larger area of water due to their large fetch.

These findings should be further tested by flying the drone at different heights and with different camera properties to find the equipment specifications that result in optimal debris sighting. Additionally, drone efficacy is impacted by debris size, color, and ground type. Debris density appears to be influenced by different factors at different times. Lastly, we did not want to leave debris in the marsh just because it was outside of our ground truth areas, so we collected and properly discarded of 1,907 pieces of debris totaling 99 kilograms (Fig. 2)! Almost a third of this debris was plastic, followed by fibers, metal, and wood.

Estuaries and Coasts
Editors' Choice Paper



May 2022

Justić, D. et al. 2022. Transport Processes in the Gulf of Mexico Along the River-Estuary-Shelf-Ocean Continuum: a Review of Research from the Gulf of Mexico Research Initiative. *Estuaries and Coasts* 45 (3): 621–657.

https://rdcu.be/cLGHy

Upcoming Events

GERS 2022 Biennial Meeting
27–29 October 2022
Ocean Springs, Mississippi
https://bit.ly/2022biennialgears

Restore America's Estuaries 2022 Summit
4–8 December 2022
New Orleans, Louisiana
https://raesummit2022.estuaries.org

CERF 2023 Conference
12–16 November 2023
Portland, Oregon
https://bit.ly/cerf2023conf

CERF 2023 Conference Artist

CERF is excited to announce the winner of the CERF 2023 art contest!

Lena Champlin is a doctoral student in Environmental and Earth Science at Drexel University in Philadelphia, where her biogeochemistry research focuses on climate change and water quality, including eutrophication and acidification in estuarine ecosystems. She is a research associate at the Academy of Natural Sciences natural history museum, where she conducts outreach to families about coastal acidification. She is interested in using artwork and visual displays to communicate her science research to students. Lena has worked on several projects that combine art and science including co-authoring and illustrating a children's book, *Coco's Fire*, a story about teaching climate change while addressing climate anxiety. Lena grew up in coastal Maine where she developed her love of being outside, exploring tide pools, and drawing natural landscapes and animals.

Her painting, "Elkhorn Slough Estuary," is a representative piece of this site off Monterey Bay in Central California. The shape of the estuary looks like the antler of an elk in a map view, which is shown by the elk in the painting. Local estuarine animals and plants are also included. Lena has been doing field research at Elkhorn Slough for her doctoral projects and created this painting while studying for her graduate qualifying exams because she was thinking a lot about this system and wanted to use the process of art to feel more connected to her science research site. The picture represents the connectivity of water, plants, animals, and surrounding land use within estuaries.

"Elkhorn Slough Estuary" will be used throughout the CERF 2023 conference branding. CERF is excited to incorporate this beautiful piece into all of our programming.

The Latest *Coastal & Estuarine Sciences News (CESN)*

Merryl Alber, Managing Editor
Janet Fang, Science Writer/Coordinating Editor

CESN is an electronic newsletter that is put out on a bimonthly basis (six issues per year) and serves as a companion to the journal *Estuaries and Coasts*. Each issue of *CESN* provides a summary of four articles from the journal, written for an audience of coastal managers and other interested stakeholders and emphasizing the management applications of scientific findings. Issues are posted online and emailed to subscribers. Go to the *CESN* website at www.cerf.science/cesn to read the full summaries and sign up to have future issues delivered to your email inbox.

APRIL 2022 CESN

Runnels for Restoration
A climate adaptation tool to buy marshes some time

Source: Besterman, A.F. et al. 2022. Buying Time with Runnels: a Climate Adaptation Tool for Salt Marshes. *Estuaries and Coasts.* DOI: 10.1007/s12237-021-01028-8
https://www.cerf.science/cesn-april-2022#Article1

Blue Crabs in a Sea of Grass
Habitat associations shift with reproductive stage

Source: Cheng, S.L. et al. 2022. Coastal Vegetation and Bathymetry Influence Blue Crab Abundance Across Spatial Scales. *Estuaries and Coasts.* DOI: 10.1007/s12237-021-01039-5
https://www.cerf.science/cesn-april-2022#Article2

Tracking Wastewater Contamination at Shellfish Farms
Artificial sweeteners are emerging indicators of human wastewater

Source: Frith, A. et al. 2021. Multiple Indicators of Wastewater Contamination to Shellfish Farms Near a Tidal River. *Estuaries and Coasts.* DOI: 10.1007/s12237-021-01033-x
https://www.cerf.science/cesn-april-2022#Article3

Will Genetic-Based Restoration Strategies Work for SAVs?
Dispersal distances can determine transplant success

Source: Marsden, B.W. et al. 2021. Assessing the Potential to Extrapolate GeneticBased Restoration Strategies Between Ecologically Similar but Geographically Separate Locations of the Foundation Species Vallisneria americana Michx. *Estuaries and Coasts.* DOI: 10.1007/s12237-021-01031-z
https://www.cerf.science/cesn-april-2022#Article4

FEBRUARY 2022 CESN

What Factors Boost Oyster Filtration Services?
Eastern oysters can filter 60% of an estuary's volume

Source: Gray, M.W. et al. 2021. Beyond Residence Time: Quantifying Factors that Drive the Spatially Explicit Filtration Services of an Abundant Native Oyster Population. *Estuaries and Coasts*. DOI: 10.1007/s12237-021-01017-x
https://www.cerf.science/cesn-february-2022#Article1

Modeling Transport in the Gulf of Mexico
Hindcasting the spread of oil from the Deepwater Horizon spill

Source: Justić, D. et al. 2021. Transport Processes in the Gulf of Mexico Along the River-Estuary-Shelf-Ocean Continuum: a Review of Research from the Gulf of Mexico Research Initiative. *Estuaries and Coasts.* DOI: 10.1007/s12237-021-01005-1
https://www.cerf.science/cesn-february-2022#Article2

What's Up, Dock?
How to minimize the cumulative impacts of docks

Source: Logan, J.M. et al. 2021. A Review of Habitat Impacts from Residential Docks and Recommended Best Management Practices with an Emphasis on the Northeastern United States. *Estuaries and Coasts.* DOI: 10.1007/s12237-021-01006-0
https://www.cerf.science/cesn-february-2022#Article3

Getting to the Bottom of Hypoxia
Managing low dissolved oxygen in China's Pearl River Estuary

Source: Zhang, Z. et al. 2021. On the Intra-annual Variation of Dissolved Oxygen Dynamics and Hypoxia Development in the Pearl River Estuary. *Estuaries and Coasts.* DOI: 10.1007/s12237-021-01022-0
https://www.cerf.science/cesn-february-2022#Article4

Gulf of Mexico Sea-Level Rise Workshop at the Gulf of Mexico Conference

Ashley R Booth
Louisiana State University, Baton Rouge, Louisiana, USA
www.ashleyrbooth.com

As butter melted in the cast-iron skillet, I added in a teaspoon of flour at a time and stirred. "How long do I have to stir?" I asked. This was my first roux—my first Louisiana gumbo—and in response my friend just laughed and said, "until it looks right." Following the recipe for seafood gumbo was a challenge but ultimately yielded a delicious, steamy bowl of Louisiana magic. Sometimes science can be like cooking—if you follow the right recipe, you may end up with useful (and often unexpectedly good) results. But science isn't just about following a recipe to learn about the world. Often, science means creating a recipe or set of methods to get the results you're looking for. Writing that recipe was the premise of the recent Development of Future Scenarios for Gulf of Mexico Sea-Level Rise Workshop at the 2022 Gulf of Mexico Conference.

Hosting the event were the Gulf Estuarine Research Society (GERS) and partners from Coastal Protection and Restoration Authority and the Program for Local Adaptation to Climate Effects: Sea Level Rise (PLACE:SLR), with Regional Workshop funding provided by CERF. The workshop was an opportunity for scientists, resource managers, and federal and state stakeholders to collaborate in developing a "recipe" or tool for projecting sea-level rise in the northern Gulf of Mexico. That meant deciding what ingredients or components need to be in it, how they should be combined, and what the final product should look like. Once complete, the tool will allow researchers, managers, and policymakers who are less experienced in modeling sea-level rise to use existing data and create sea-level rise projections unique to their area.

Creating a standard tool for projecting sea-level rise in the northern Gulf of Mexico is complicated by variability in ocean dynamics and coastal geomorphology. Decadal and multidecadal oscillations in ocean processes complicate understanding of current rates of sea-level rise in the Gulf. These Gulf-wide changes in ocean processes are influenced at a smaller scale by variations in soil subsidence, subsurface compaction, sedimentation, and landscape morphology along the coast. All this variability means that using global rates of sea-level rise to infer change in the Gulf may yield inaccurate (and often significantly lower) projections. For the Gulf, models based on past trends show that sea-level rise is accelerating faster than the global mean and is likely to continue along this trajectory. In response, researchers are developing higher-resolution simulations and projections for coastal stakeholders with funding from the National Academy of Science's Gulf Research Program.

Left to right are GERS Participation Grant recipients Antonio Cantú de Leija, Ashley Booth, Adam Murray, and Nicole Powers
Photo: Megan LaPeyre

To address this Gulf-specific variability, selected ingredients for the Gulf sea-level rise projection tool include tide gauge standards, satellite data, a best-fit curve for historical data, lower and upper bounds for projected sea-level rise based on historical data and process-based modeling (respectively), the CMIP5 global climate change models, and an opportunity for component-based adjustment. Based on discussions and novel data presented in the 2022 workshop, components for the sea-level rise projection tool were refined to incorporate higher-resolution sea-level rise simulations, ocean variability in process-based modeling, individual tidal-gauge variability over the entire range of available data, and low-confidence processes that may significantly alter the range of sea-level rise projections. Once fully developed, this recipe for projecting sea-level rise in the northern Gulf of Mexico will serve as an iterative tool that allows Gulf Coast stakeholders to create and update location-specific projections for sea-level rise and incorporate those projections in their planning processes.

Along with furthering development of sea-level rise projections, the workshop served as an opportunity for graduate students and early-career scientists to collaborate with experts in the field. Participation grants were awarded to Ashley Booth (PhD Candidate in the School of Renewable Natural Resources at Louisiana State University), Antonio Cantú de Leija (PhD student in the Harte Research Institute of Texas A&M University - Corpus Christi), Adam Murray (MS student in the School of Ocean Science and Engineering at The University of Southern Mississippi), and Nicole Powers (post-doctoral research associate at Texas A&M University - Corpus Christi).

*Invertebrates compose a vast majority of biodiversity in estuarine and coastal habitats and contribute to ecosystem functioning from a number of avenues, including biological, ecological, physical, and chemical. While invertebrates' functions can be drastically different from one species to the next, all play important structuring roles in coastal and estuarine systems. For example, this charismatic rock crab (*Cancer irroratus*) from the northern coast of New Brunswick, Canada, is an important predator in coastal systems of the northwestern Atlantic coast.* Photo: Jeff Clements

HOBO®
by Onset

Data You Can Trust

HOBO Water Quality Monitoring

For 40 years, Onset HOBO data loggers have set the standard for reliable and accurate water quality monitoring at affordable prices.

- Quick and simple deployment
- Bluetooth, web-based, & optical-to-USB options
- Rugged design for freshwater and saltwater
- Conductivity, pH, salinity, DO, temp, level

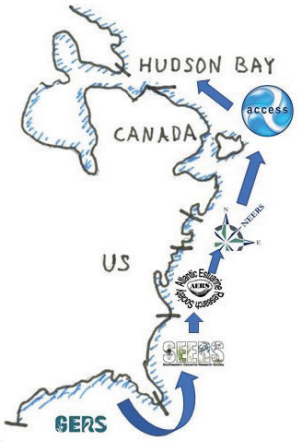
Visit on.onsetcomp.com/resources
Call 1-508-759-9500
Email sales@onsetcomp.com

Free on-line resources:
webinars, white papers, product info and more!

ONSET 40th ANNIVERSARY

Good Things about Climate Change for Estuaries and Coasts

Stephen S. Hale
stephenshale@gmail.com



We hear lots of doom and gloom about human-driven climate change—global warming, rising sea levels, deoxygenating and acidifying waters, more frequent and intense storms, more droughts and flooding, land and marine heat waves, species' poleward range shifts, food chain mismatches from changing phenology, etc., etc., etc. But let's keep in mind some of the good things that will happen for estuaries and coasts and the people that study and manage them, using the US and Canadian Atlantic coast as an example.

1. Sea level rise will provide more ocean for oceanographers to study!

2. Salt marshes migrating inland (where possible) will save money no longer needed for salt marsh restoration projects.

3. Rising sea levels and more intense storms and hurricanes will knock out some coastal development, getting us closer to the "30X30" pledge to protect 30 percent of global lands and waters by 2030.

4. Monomoy Island off Cape Cod will shrink, reducing seal haul-out space, thus reducing seal populations, which draw great white sharks that occasionally bite people and cause a cut in tourism revenue (reference: the movie *Jaws*).

5. Sure, some islands will go under, but new ones will appear; e.g., Block Island off mainland Rhode Island could become two islands.

6. Certain seaside marine labs will need and may get brand-new facilities.

7. There will be more continental shelf space for offshore wind farms.

8. People living inland will have shorter drives to their summer beach vacations.

9. Although there's little hope for the Great Lakes to acquire some *real* estuaries, Lake Champlain just might.

10. Increased extent, duration, and intensity of hypoxia will favor anaerobic organisms. (We owe these anaerobes a lot—our very lives in fact—because they were the ones that started this thing called life in the first place.)

11. Shifting baselines. Fishermen will briefly mourn the loss of historic species but can look forward to exciting new species coming from the south; for example, southern New Englanders will soon forget about the cod and lobsters that they've been catching, like, *forever*.

12. The CERF SEERS affiliate will take on the current climate and ecosystems of GERS; AERS becomes SEERS; NEERS becomes AERS, and ACCESS becomes NEERS (see figure). A new CERF affiliate will spring up around Hudson Bay in Quebec, Ontario, Manitoba, and the Nunavut Territories, spreading CERF's territory and influence poleward.

13. If all Earth's glaciers and ice caps melted, the planet would spin more slowly, causing longer day length, which would be good for those people who never seem to have enough time in one day to get done what they want to.

14. Scientists will have ample opportunities to say "We told you so."

CERF 2021–2023 GOVERNING BOARD

President
Leila Hamdan
University of Southern Mississippi

Past President
Jim Fourqurean
Florida International University

President-Elect
Linda Blum
University of Virginia

Secretary
Alice Besterman
Buzzards Bay Coalition and Woodwell Climate Research Center

Treasurer
Erik Smith
University of South Carolina

Members at Large

2019-2023
Jennifer Beseres Pollack
Harte Research Institute
Texas A&M University-Corpus Christi

2019-2023
Kristin Wilson Grimes
University of the Virgin Islands

2021-2025
Treda Grayson
U.S. Environmental Protection Agency

International Member at Large 2021-2025
Catherine Lovelock
University of Queensland

Student Member at Large 2021-2023
Kailani Acosta
Columbia University

Affiliate Society Representatives

ACCESS
Jeff Clements
Fisheries and Oceans Canada

AERS
Shelley Katsuki
Virginia Institute of Marine Science

CAERS
Steven Litvin
Monterey Bay Aquarium Research Institute

GERS
Kelly Darnell
University of Southern Mississippi

NEERS
Courtney Schmidt
Narragansett Bay Estuary Program

PERS
Liz Perotti
National Oceanic and Atmospheric Administration

SEERS
Jessica Reichmuth
Augusta University

Journal Officials

Co-Editors in Chief
Paul Montagna
Texas A&M University-Corpus Christi

Linda Deegan
Woodwell Climate Research Center

Managing Editor
Taylor Bowen

Reviews Editor
Ken Heck
Dauphin Island Sea Lab

***CESN* Managing Editor**
Merryl Alber
University of Georgia

***CESN* Science Writer/Coordinating Editor**
Janet Fang

Contact Information

Coastal & Estuarine Research Federation
2150 North 107th Street, Suite 205
Seattle, WA 98133-9009
(206) 209-5262
info@cerf.science

Executive Director
Susan Park
(804) 381-6658
spark@cerf.science

Chief Operating Officer
Louise S. Miller
info@cerf.science

CERF's Up! Bulletin

Editor	Allison Fitzgerald
Associate Editor	Stephen Hale
Managing Editor	Connor Blair Pfandler
Copy Editor	Ariel Hansen
Layout Editor	Rhonda Cole

Comments or questions regarding this issue? Email bulletin@cerf.science

COASTAL & ESTUARINE RESEARCH FEDERATION
2150 N 107th St, Ste 205
Seattle, WA 98133
Phone: (206) 209-5262
Website: www.cerf.science
Email: info@cerf.science