CERF's Up!

Volume 47 • Number 2 • June 2021

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

First Decade of ERF

Freshwater to Marine Continuum

History of Biogeochemistry

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Table of Contents

Editors' Note:
This issue continues the celebration of the 50th anniversary with a look at the first decade of ERF (Williams), two more reflective articles on estuarine disciplines (Paerl, Bianchi), and a 1983 ERF trip to the People's Republic of China (Weis). Thanks to: (1) the Long Island Sound Study for their photo from the waterbody closest to Plainview, Long Island, site of the first ERF meeting in 1971; (2) Merryl Alber for photos from the University of Georgia's Marine Institute in the 1950s; (3) Kent Mountford for the photo from the mid-Atlantic coast in the 1970; and (4) the Oyster Bay National Wildlife Refuge.

Front cover: *Sunrise over Long Island Sound, nearest water body to Plainview, Long Island, site of first ERF meeting in 1971* Photo: Courtesy of Long Island Sound Study

Back cover: *Cold Spring Harbor, Long Island, New York* Photo: Courtesy of Oyster Bay Nationaol Wildlife Refuge

President's Message

Increasing Diversity, Equity, Inclusion, and Justice in CERF and Our Disciplines

Jim Fourqurean

Over the last year, very public examples of the lack of social justice, equity, and inclusion have illuminated structural inequities and systemic racism. Organizations of all kinds, CERF included, rushed to make statements against these pernicious elements of society and in support of the Black Lives Matter movement. But statements alone do not provide solutions to the problems facing us. I'd like to share with you the concrete actions CERF is taking to help build a more diverse, just, and equitable Federation and discipline.

Building a broad, diverse, and inclusive membership in CERF is a key element of the Federation's current strategic plan, "Visions IV: A Strategic Plan for the Coastal and Estuarine Research Federation (2017-2022)" [https://www.cerf.science/assets/docs/2017/CERF_Visions_IV_Brochure_Web.pdf]. In 2017, the CERF Governing Board created the Broadening Participation Council (BPC) to examine all aspects of CERF's activities through a lens of diversity and inclusion. The BPC was tasked to explore ways to make the Federation welcoming and supportive to all and to ensure that the Federation's membership and leadership is reflective of the diversity of the estuarine science and management community.

CERF is particularly proud of one of the flagship activities of the BPC, our Rising TIDES (Toward an Inclusive, Diverse, and Enriched Society) Conference Program (conference.cerf.science/rising-tides-conference-program). The goal of Rising TIDES, funded by CERF and NSF, is to broaden participation of groups underrepresented in our discipline (e.g., Black or African American, Hispanic or Latino, Asian, Indigenous peoples, LGBTQIA+, women, people with disadvantaged socioeconomic backgrounds, people with disabilities). The Rising TIDES CERF 2021 participants—our third cohort—will be funded to attend CERF 2021 and an Affiliate Society meeting in 2022. CERF will provide them with mentors and professional development activities to encourage them to continue in the coastal and estuarine sciences and, we hope, remain members of CERF.

While Rising TIDES is a critical element of our conference experience, the CERF 2021 team has worked to integrate a vision of a just, equitable, inclusive, and diverse meeting throughout its planning process for many more elements of the conference program. These include representation in keynotes and plenaries, special session and workshop topics, the inclusion event, and resources focused to broaden participation. I am sure you will be impressed by these efforts as you participate in all of the programs in the CERF 2021 meeting (conference.cerf.science) this 1–4 and 8–11 November.

In 2019 CERF partnered with institutions from the US Virgin Islands, Puerto Rico, Guam, and other US-affiliated islands to form the SEAS Island Alliance (seasislandsalliance.org), funded by the NSF's Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science program (NSF-INCLUDES). Island communities are strongly linked to the oceans that surround them and are populated by culturally diverse communities. The Alliance's goal is to broaden participation in science, technology, engineering, and math (STEM) education by benefiting from the expertise from US-affiliated islands. The Alliance supports students from groups underrepresented in environmental and ocean sciences, through illuminating a full career pathway and increasing a sense of belonging in STEM by connecting students to each other and to STEM professionals and mentors, across island hubs. SEAS Islands Alliance students will be participating in CERF 2021.

This year, CERF joined forces with Virginia Sea Grant, Georgia Sea Grant, and Oregon Sea Grant on Coastal, Ocean, and Marine Enterprise Inclusion and Network-building

(COME IN), an NSF-INCLUDES planning grant. The project will address challenges of broadening participation across the coastal, ocean, and marine science workforce. The project will bring together scientists, stakeholders, and partners from various coastal science fields to understand the dynamic needs of students from groups underrepresented in our discipline and under-resourced communities; establish a collaborative infrastructure required to enhance and expand internship programs for underrepresented groups; and estimate resource needs to successfully form new and expanded frameworks that will ensure the persistence and success of students underrepresented in our discipline.

Many CERF members have made lasting contributions towards increasing the diversity, equity, and justice in our field. To recognize the importance of this issue, the CERF Governing Board created the new Diversity, Equity, Inclusion, and Justice Award, which will be made for the first time at CERF 2021. This award recognizes the significant contributions of an individual who has worked for these goals in estuarine and coastal science, management, education, and/or stewardship. It honors a person who demonstrates exceptional long-term or emerging leadership and commitment to positive change. We hope that our recognition of excellence in this facet of our profession alongside our recognition of excellence in scientific achievement and environmental stewardship will further encourage our members to work towards justice and equity.

CERF is looking to form partnerships with other groups that share our vision of a more inclusive and diverse field. Most recently we began discussions with minority-led organizations of coastal and estuarine scientists about collaborative ways to provide opportunities for members of such groups to benefit from our programs. We also want to establish more open dialog about how these organizations and CERF can work together to reach our shared goals.

CERF is taking concrete actions to live up to our commitment to diversity, equity, inclusion, and justice in our society. We are assessing progress towards our goal of creating a more diverse and equitable discipline—but we know there is much more work to be done. The Governing Board and I are here to listen to our members for feedback and ideas. And we can do more when our members take an active part to help us achieve our aspirations!

The Searchers: A Short History of the Estuarine Research Federation During Its First Ten Years of Existence

Jerome Williams
Annapolis, Maryland, USA
August 1981

This is an abridged version of the original report, which can be viewed in full on the CERF website https://cerf.memberclicks.net/cerf-s-up--47-2--bulletin---additional-materials with more details on Shakers and Movers, Meetings, and Other Activities.—Ed.

Genesis

In the beginning (1947), there was the Atlantic Estuarine Research Society (AERS), a group of estuarine scientists residing in the central portion of the U.S. Atlantic coast. They gathered together semi-annually for purposes of sharing estuarine information and the need for informality during the sharing process. These two objectives occupied a day and a half (plus an evening) twice a year for over 20 years.

In the late '60's the Atlantic Estuarine Research Society had grown to such a size that the informality was starting to disappear. A disgruntled group from the north, in order to correct this situation, broke off and formed a new society, the New England Estuarine Research Society (NEERS), in December of 1969. The objective was to increase meeting informality by decreasing the size of the group.

It was not too long, however, before the child missed the parent and the time came to renew old acquaintances. Talks were instituted and the concept of a federation loosely joining the two societies generated a great deal of interest. A small steering committee, consisting of Michael Castagna, Richard Whaley, and Jerome Williams drafted a constitution which was circulated among the members of both AERS and NEERS. This constitution, with a few changes, was approved by a mail vote in September of 1971.

Later in 1971, at Plainview, on Long Island in the state of New York, the first meeting of the Estuarine Research Federation (ERF) was held. (*See the Alan Young article in the previous issue –Ed.*). The Atlantic Estuarine Research Society and the New England Estuarine Research Society cooperated in sponsoring a joint meeting November 4-6, 1971. Due to the Spanish motif of the logo appearing on the program cover, this meeting was termed to be an international conference. On Saturday, November 6, 1971, at the combined business meeting of AERS and NEERS, a slate of officers for the new federation was selected and the Estuarine Research Federation was born.

At formation time AERS had 349 members and NEERS had 134, giving a grand total of 483 charter members of the Federation. ERF grew rapidly, and on October 17, 1973, a new society, the Gulf Estuarine Research Society (GERS), was admitted. On May 21, 1974, the South Eastern Estuarine Research Society (SEERS) gained entrance, and on July 25, 1978, east and west coasts joined hands as the Pacific Estuarine Research Society (PERS) became a constituent society of the Federation. From this small nucleus of 483 members in 1971, ERF grew to the point where its total membership was 1,754 by mid-1981.

The Infrastructure

The purposes of the organization as set down in the initial constitution have remained in the forefront through the first decade:

"The objectives shall be to promote research in estuarine and coastal waters, to promote communication between members of affiliated societies, to conduct biennial meetings, and to be available as a source of advice in matters concerning estuaries and the coastal zone."

With these 'high falutin' purposes in hand, the Board of Governors initiated a request for nonprofit status from the Federal Government on April 3, 1973. After a new constitution was formally adopted by the Federation on October 8, 1975, on November 13, 1975, ERF was granted tax exempt status. Following this, on April 6, 1976, the Estuarine Research Federation was officially incorporated in the state of South Carolina.

Meetings

Themes of subsequent meetings after the founding meeting in 1971 were:

1973: Recent Advances in Estuarine Research, Myrtle Beach, South Carolina

1975: Recent Advances in Estuarine Research: Estuarine Processes, Galveston, Texas

1977: Recent Advances in Estuarine Research: Estuarine Interactions, Mt. Pocono, Pennsylvania

1979: Estuarine Perspectives, Jekyll Island, Georgia

1981: Estuarine Comparisons, Gleneden Beach, Oregon

Publications

In March 1975, Armando de la Cruz was appointed the first editor of the Estuarine Research Federation Newsletter. This was designed to be published somewhere around four times a year to keep the membership

(continued page 6)

Expanding CERF's Horizon: Synthesizing Human and Climatic Drivers of Change along the Freshwater to Marine Continuum

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Anthropogenic and climatic pressures on estuarine and coastal ecosystems are increasing at a dizzying rate[1,2] and the scales linking these pressures to biogeochemical and ecological responses must encompass the entire freshwater to marine continuum.[2-4] While emerging concepts, such as "critical zone science," are progressing an integrated and interdisciplinary approach to studying complex environments, these more holistic concepts have yet to explicitly consider human impacts in coastal systems.[5]

Connectivity

We face multiple climatic stressors that not only impact estuarine and coastal (jointly termed "coastal") ecosystems directly, but are synergistically and antagonistically interacting with human drivers, including nutrient (nitrogen [N], phosphorus [P], trace elements) and organic matter enrichment, sedimentation, and discharge of xenobiotics including industrial, agricultural, and domestic chemicals. More frequent "flashy" intense rainfall events are increasing mobilization and delivery of these substances from coastal (and further inland) watersheds (Fig. 1).[6,7] This enhanced mobility, combined with warming trends and more protracted droughts, increases the potentials for harmful algal blooms to proliferate in receiving waters.[8] Blooms, combined with elevated colored organic matter and sediment loads, increase light attenuation and negatively affect submersed aquatic vegetation, with cascading impacts on critical faunal habitats they provide.[1,9] Increased planktonic primary production combined with elevated organic matter loads and higher freshwater discharge synergistically provides the "fuel" for vertical salinity stratification and expansion of coastal hypoxia worldwide.[2,10]

Impacts of advanced eutrophication can be displaced from the freshwater to coastal components of the continuum due to combined man-induced and climatic pressures, and these spatial shifts are becoming more evident and problematic (Fig. 1). Examples include the encroachment of nutrient-enhanced floodwater-driven harmful cyanobacterial blooms (CyanoHABs) from the Atchafalaya River, Louisiana, into bayous and coastal embayments of the Northern Gulf of Mexico[11] and the tropical cyclone-driven overflow of nutrient- and CyanoHAB-laden freshwater from Lake Okeechobee into Atlantic and Gulf of Mexico estuaries via the Caloosahatchee River system in Florida.[12]

California's San Francisco Bay Delta is experiencing the "flip side," where protracted droughts and increased upstream freshwater withdrawal to support agricultural and urban growth are creating low-flow, long residence time, and nutrient-enriched conditions that support proliferating CyanoHABs (threatening safe water supplies), food web integrity, and fish and shellfish habitat.[13]

Feedbacks

Combined human-climatic induced biogeochemical and trophic changes are often linked back to environmental drivers through complex feedbacks that may not be intuitive. For example, tropical cyclones and fires can rapidly release CO_2 and other greenhouse gases from coastal systems while simultaneously priming more terrestrial carbon for export through the aquatic continuum (Fig. 1).[6,14,15] However, these episodic emis-

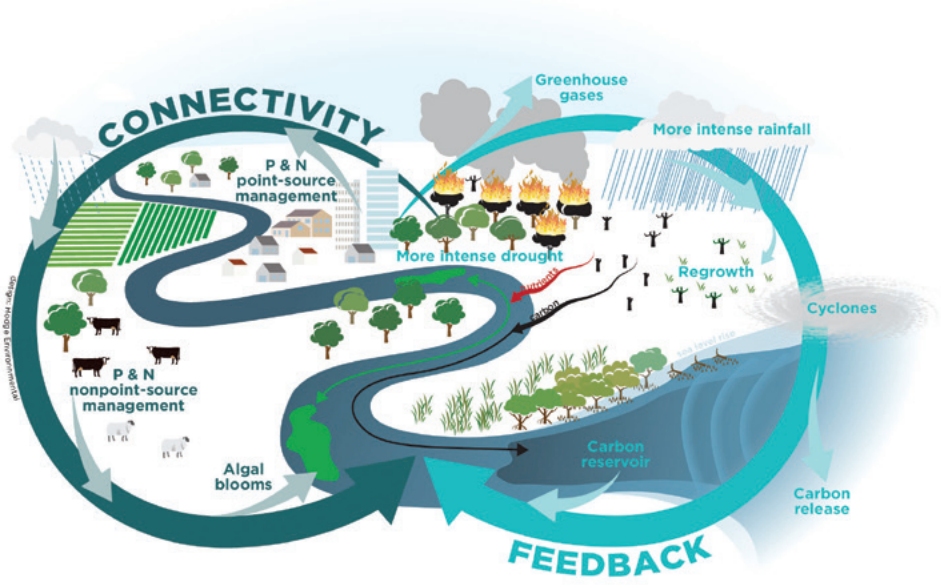

Fig. 1. Conceptual diagram of connectivity along the freshwater to marine continuum and interactions with climatic feedbacks at regional and global scales

sions may be offset to some degree over longer timescales or larger spatial scales, e.g., by vegetation regrowth, transformation of biogenic carbon to more recalcitrant pyrogenic carbon, or enhanced export of terrestrial carbon to more stable oceanic reservoirs.[6,15]

Another product of human intervention in the carbon and nutrient cycles and resultant warming is global sea level rise. In addition to inundating and altering low-lying coastal, estuarine, and shoreline habitats and enhancing erosion (Fig. 1),[2,7] rising sea levels alter salinity regimes, thereby impacting salinity stratification, and consequently the potential for hypoxia and anoxia formation and persistence.[16] Additional feedbacks linked to sea level include increased generation of greenhouse gases, altered nutrient cycling and regeneration, nutrient availability, primary production and harmful algal bloom (HAB) potentials, and altered benthic and planktonic habitats for both sessile and motile biota.

Future challenges

The next challenge in coastal science is recognizing the intricate connectivity and feedbacks that modulate the coastal zone. On the spatial-continuum scale, impacts on upland streams and watersheds can have consequential ramifications downstream. In managing eutrophication, productivity of upland stream, riverine, and lacustrine waters has traditionally been considered to be P limited, while downstream estuarine and coastal waters are frequently N limited.[17] Consequently, point- and non-point source P input controls are typically prescribed for stemming eutrophication of inland waters, while N inputs are the focus for controlling estuarine and coastal eutrophication. However, reducing only P upstream while potentially alleviating eutrophication there, also will reduce the primary producer "filter" for N; as a result, N enrichment may enhance eutrophication downstream.[8] Therefore, a dual N and P reduction strategy is often in order for stemming eutrophication, HABs, and their biogeochemical (e.g., hypoxia) and trophic (e.g., food web disruptions) impacts on the continuum scale (Fig. 1).

On the temporal scale, a broader scope will be required to understand how episodic events combine with cumulative change in diverse coastal settings. Observation and modeling efforts resolving hourly to annual scales will be essential to determine mechanisms of self-limitation for negative feedbacks and thresholds at which positive feedbacks exceed recovery potential and lead to permanent environmental shifts. This challenge becomes ever greater as extreme events become more intense and frequent. As a salient example, Australia's unprecedented 2019–2020 fire season was ultimately ended by an extratropical cyclone that brought some of the most intense regional rainfall on record.[14] The ensuing widespread flooding rapidly exported pyrogenic material through the aquatic continuum, precluding efforts to quantify biogeochemical fluxes associated with these extreme events.

These linkages and feedbacks point to the need to consider the continuum as one integrated, physical-chemical-biotic unit, in which drivers and responses are functionally and structurally connected over multiple timescales. This is highly relevant from the standpoint of water and habitat quality as well as fisheries, extraction, recreation, residential management, and their socio-economic ramifications. The benefits of protecting and preserving estuarine and coastal "health" resources and resiliency clearly go beyond the local horizon, and extend to the watershed/airshed, regional, national, and ultimately global scales. The next generation of coastal researchers, managers, and decision makers must be trained and gain experiential perspectives on at least the aquatic continuum and ultimately broader regional and global scales.

Acknowledgements: The authors thank Kate Hodge for constructing the figure. We appreciate support from US NSF projects OCE 1840715 and DEB 1831096, the US National Institutes of Health project P01ES028939, and the Australian Commonwealth Scientific and Industrial Research Organisation.

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A Short History... *(continued)*

informed of any events of interest. In March 1977 Robert Reimold took over. He was replaced in March 1978 by Robert Radulski. Quinton White took over in June 1979 and served as ERF Newsletter editor through 1981.

The ERF Newsletter has served as a valuable instrument of Federation communication during this period, both as an organ for the Board to communicate policy to the membership, and as a response mechanism for the membership to communicate their feelings back to their governing board.

From the beginning, there had been talk among the Estuarine Research Federation's founders of someday sponsoring a journal. In the early years most of the membership seemed to believe that their needs were being met by other journals, and the expense of sponsoring their own would be too great. Consequently, it was not until 1976 that serious thought was given to the possibility of acquiring a journal, Chesapeake Science, published by the University of Maryland in conjunction with the Chesapeake Biological Laboratory.

In October 1977, a contract was signed with the University of Maryland for them to publish the journal Chesapeake Science (with its name changed to Estuaries) under the sponsorship of the Estuarine Research Federation. The first issue under the new name appeared in March 1978, with Martin Wiley as the editor. He had been editor of Chesapeake Science for 9 years, and it seemed only natural for him to continue during this transition period. Subscriptions for Volume I (1978) totaled 1050, Volume II (1979) 1042, and Volume III (1980) 1069.

In November 1980, the University of Maryland no longer desired the responsibility of publication, and a contract was signed with the Belle W. Baruch Institute for Estuarine and Coastal Studies in South Carolina. Harold Stevenson was appointed as the new editor.

The Origins of Biogeochemistry

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Estuarine science, and its elder "sister" disciplines, oceanography and limnology, are deeply rooted in interdisciplinary origins. Biogeochemistry, one of the many sub-disciplines of the natural/earth sciences, has emerged as a key unifying discipline in the 21st century. While much has been written on future directions in biogeochemistry, little attention has been given to its disparate origins. One rare and notable review on the history of biogeochemistry was written by Eville Gorham,[1] the grandfather of acid rain, who passed away in 2020 at the age of 94. I thought revisiting this topic in the 21st century seemed timely in part as a tribute to Eville, it being 30 years since his publication in the journal *Biogeochemistry*, and with plans for a special issue celebrating the 34th anniversary of the journal, where it was published.[2]

Here, I begin with the post-phlogiston period in the 19th century, where vital connections were being made between weathering, atmospheric chemistry, carbon cycling, and climate change by notable scientists like Svante Arrhenius (1859–1927), Gustav Bischof (1792–1870), Thomas Chrowder Chamberlin (1843–1928), and John Tyndall (1820–1893). In particular, French chemist Jacques-Joseph Ebelmen (1814–1852) proposed that dissolved salts and bicarbonate can be formed from the weathering of rocks—launching us into the modern carbon cycle. Work by Sir Humphry Davy (1778–1829) on weathering and the importance of organisms in the exchange of carbon dioxide between the rocks and the atmosphere provided the foundation for new analytical approaches by Jean-Baptiste Joseph Dieudonné Boussingault (1801–1887). This work allowed Jean-Baptiste Dumas (1800–1884) and Boussingault to make new connections between carbon and nitrogen. The focus on chemistry in understanding soil fertility for agricultural purposes continued with the examination—in large part by Boussingalt, Sir John Bennet Lawes (1814–1900), Justus von Liebig (1803–1873), and Phillip Carl Sprengel (1787–1859)—of phosphorus and nitrogen for crops in a period emphasizing stoichiometry. These are some of the key foundations in early stoichiometric thinking. Remarkably, this leads to the first examples of nitrogen amendments dating as back far as 1856.

The next important stage was establishing how microbes "fit" with what was known about the stoichiometry of soils and plants. Sergei Nikolaievich Winogradsky (1856–1953) "steals the show" with his discoveries of chemolithotrophy and mechanisms of nitrification. Another important development comes, oddly enough, from the work of Charles Robert Darwin (1809–1882) on vegetable mold and worms, which for the first time explored the role of multicellular organisms in soil fertility. These studies linking weathering, elemental cycling, microbes, and beyond, sets the stage for the founding of ecology by Danish botanist Eugenius Warming (1841–1924). Linkages between evolution and biogeography from earlier critical works by Darwin, Alexander von Humboldt (1769–1859),

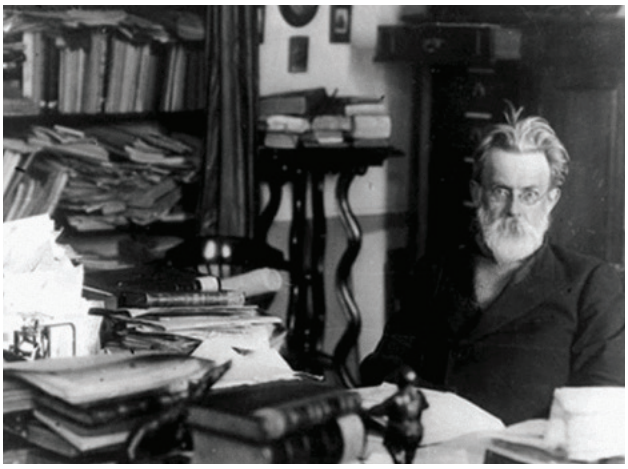

Fig. 1. Vladimir Ivanovich Vernadsky in his office in Petrograd (1921)[2,3]

Alfred Forbes (1815–1854), and Thomas Henry Huxley (1825–1895) set the stage for this development of ecology. As agriculture and industry continue to expand, we also begin to see concerns about the impact of humans on Earth, with notable writings from the American diplomat and philologist George Perkins Marsh (1801–1882).

Geochemist/mineralogist and founder of biogeochemistry Vladimir Ivanovich Vernadsky (1863–1945) (Fig. 1)[2,3] begins the 20th century with his idea about the biosphere and continues with the noosphere (the sphere of human consciousness) as concerns grow about an Anthropocene. The field of biogeochemistry now formally emerges with Vernadsky and George Evelyn Hutchinson (1903–1991) leading the way. New development of disciplines of geochemistry and organic geochemistry, led by Victor Moritz Goldschmidt (1888–1947) and Alfred E. Treibs (1899–1983), respectively, allowed for biogeochemical linkages to be made between the short and long-term carbon cycles. This also allowed for new bridges to be formed whereby chemical proxies can be used to understand

biogeochemical shifts in Earth's 4-billion-year history. Ecology continues to develop with greater linkages to abiotic processes and works on population cycles and trophic webs by Charles Elton (1900–1991) and energetic approaches in systems ecology by Howard T. Odum (1924–2002) and Eugene P. Odum (1913–2000). We see Theodosius Grygorovych Dobzhansky (1900–1975) usher us into the world of evolutionary genetics, which will prove vital in the next century of biochemistry.

In the early 1930s, Alfred C. Redfield (1890–1983) emerges with new ideas on molecular-organismal relationships that sparked a revolution in stoichiometric-based biogeochemistry in the 20th century. These new approaches proved particularly useful in light of the Green Revolution, related to issues concerning human population growth, fertilizer production, eutrophication, just to name a few, which led to widespread environmental decay. Unfortunately, Vernadsky's noosphere had come into full swing and it was Rachel Carson (1907–1964), who famously sounded the warning alarm heard around the world.

In the 21st century, biogeochemistry becomes more entrained in Earth system science with greater focus on global reservoirs and fluxes.[4] The advent of long-term and large-scale experiments begins to help contain the complexity of non-linearity and regional differences in fluxes and rates in biogeochemical work. This leads to more synergy that requires multidisciplinary approaches, beginning more formally ca. 1960s–1970s, which allows biogeochemistry to blossom in the 20th century. This begins a new age of combining molecular approaches (e.g., omics) with large-scale satellite, monitoring, survey, and observatory approaches that ultimately are combined in Earth system models. New molecular approaches with genetic markers allow for advances in biogeography and evolution that require ecological principles (e.g., population dynamics plant succession) to understand organismal distribution, particularly as range expansion begins to occur in a warming climate. These new connections with ecological/evolutional genetics are just a few of the many exciting developments in the ever-changing field of biogeochemistry in the 21st century.

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John Teal (left) and Alfred C. Redfield (right) at the first international salt marsh conference in 1958, which brought together 55 scientists from all over the world. (H.T. Odum is the person just behind them.) The conference was held at the University of Georgia Marine Institute on Sapelo Island Photo: Courtesy of Merryl Alber

An ERF Trip to the People's Republic of China 1983

Judith S. Weis[1], Roger Rulifson[2], Kenneth Beal[3], Charles Simenstad[4], and Quinton White[5]
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At the train station. From left: Virginia Carter, Mark Bundy, Janet Ebaugh, Quinton White, Guide, Judy Weis Photo: Si Simenstad

The goals of the "People to People" 3-week trip were to have professional exchanges between American and Chinese estuarine scientists, with a secondary hope of establishing some collaborative efforts, and for us Americans to have time for sight-seeing. There were about 20 scientists in the ERF delegation, with a few spouses coming along. We visited labs in Beijing, Dalian, Hangzhou, and Quangzhou. Here are the recollections of the five of us *(Judy Weis below; others will be in subsequent issues—Ed.)*.

Judy Weis

When I got the invitation, I didn't think I would be able to go—it seemed very expensive and how could I miss three weeks of classes?? I mentioned that to my colleague in the office next door who said "When will you ever have an opportunity like that again? You can find people to take your classes and find the money. Do it!" So I did. I "passed the hat" to the department head, the Dean of the College, and the Provost of the campus, and managed to scrape up some money to help with the costs. Department members and grad students filled in for me in the classes.

First memory—after changing planes in Dallas or Houston I boarded the plane to Seattle, our meeting place, settled into my window seat and soon two people joined me. I couldn't help but overhear their conversation; they were discussing marine science and China! I interrupted to inquire if they were on the ERF trip, and of course, they were. They were Judy Stout (my roommate for the trip) and Will Schroeder from South Alabama. What unusual luck to get to know them ahead of time! I had some unusual bad luck on the later flight from Japan to Beijing, when for some reason they had one fewer seat reserved than the number of our group. After going through all the names, it turned out my name was missing. What to do??? Jerry's leadership skills came to the fore and he said he would stay behind (my hero!) to straighten things out. They eventually found a (first class!) seat on the flight for me and we all arrived together.

My impression of the meetings with scientists at the universities and laboratories we visited was that the biological estuarine research being done was primarily collecting and identifying the animals. We saw lots of preserved specimens and little about experimental lab studies or field studies. There seemed to be more emphasis on physical oceanography. All the professional meetings were held with a translator, so speaking slowly was essential. We each brought some slides with us to explain some of our studies, so the visuals probably were especially important.

The food was amazing and wonderful, and the banquets impressive. I forget how many pounds I gained from the trip!

On the streets of the cities, we saw thousands of bikes and very few cars; the reverse of the situation today, which produces much more air pollution. We also saw people doing tai chi, which was much less familiar back then. People would often come up to us and engage us in conversation since they were learning English and enjoyed the chance to practice it with us. Those were interesting "people to people" interactions.

Attendees:
Leaders: Jerry Williams, US Naval Academy (and Lee Williams)
Neal Armstrong, University of Texas
Ken Beal, NOAA
Mark Bundy, Maryland DNR
Tony Calabrese, NOAA
Virginia Carter, USGS
David Correll, Smithsonian Environmental Research Center (and Margaret Correll)
Janet Ebaugh, University of Washington
Curtis Ebbesmeyer, Evans-Hamilton Inc.
Tom Hopkins, Maryland DEP
Mike McCormick, Montclair State University
Winston Menzel, Florida State University (and Margaret Menzel)
Sammy Ray, Texas A&M (and Charlotte Ray)
Roger Rulifson, Unity College
Will Schroeder, University of Alabama
Al Sherk, USFWS
Si Simenstad, University of Washington
Judy Stout, University of Southern Alabama
Judy Weis, Rutgers University
Barbara Welsh, University of Connecticut (and Bob Welsh)
Quinton White, Jacksonville University

2021–2023 CERF Governing Board Election

We invite you to make your voice heard in the future of the Federation. Voting is now open for the 2021–2023 CERF Governing Board elections for our next President-elect, Secretary, Member-at-large, International Member-at-large, and Student Member-at-large. Only one individual will be selected for each position. The candidates for office are listed below; their full bios and statements are available online at cerf.science/2021-2023-governing-board-slate. An online voting form was sent to all eligible voting members. Please remember to submit your vote by 8 July 2021.

Our thanks go to the Nominating Committee: Hilary Neckles (chair), Anna Armitage, Justin Campbell, Silvia Newell, and John Rybczyk.

On behalf of the current and future Governing Board members, thank you for participating in this important election.

President-Elect

Linda Blum

Research Associate Professor, University of Virginia

Linda Walters

Pegasus Professor of Biology, University of Central Florida

Secretary

Alice Besterman

Postdoctoral Fellow, Buzzards Bay Coalition and Woodwell Climate Research Center

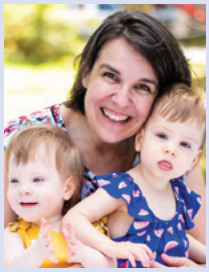
Ryan Davis

Principal Scientist, Anchor QEA

Antonietta Quigg

Senior Associate Vice President for Research and Graduate Studies and Regents Professor in Marine Biology, Texas A&M University at Galveston

Member-at-large



Ayesha Gray

Director, Grand Bay National Estuarine Research Reserve

Treda Grayson

NRDA Program Manager, U.S. Environmental Protection Agency Office of Water

Sydney Nick

Interdisciplinary Geographer/ Geologist, U.S. Geological Survey

Student Member-at-large

Kailani Acosta

PhD student, Columbia University

Sommer Starr

PhD student, Florida State University

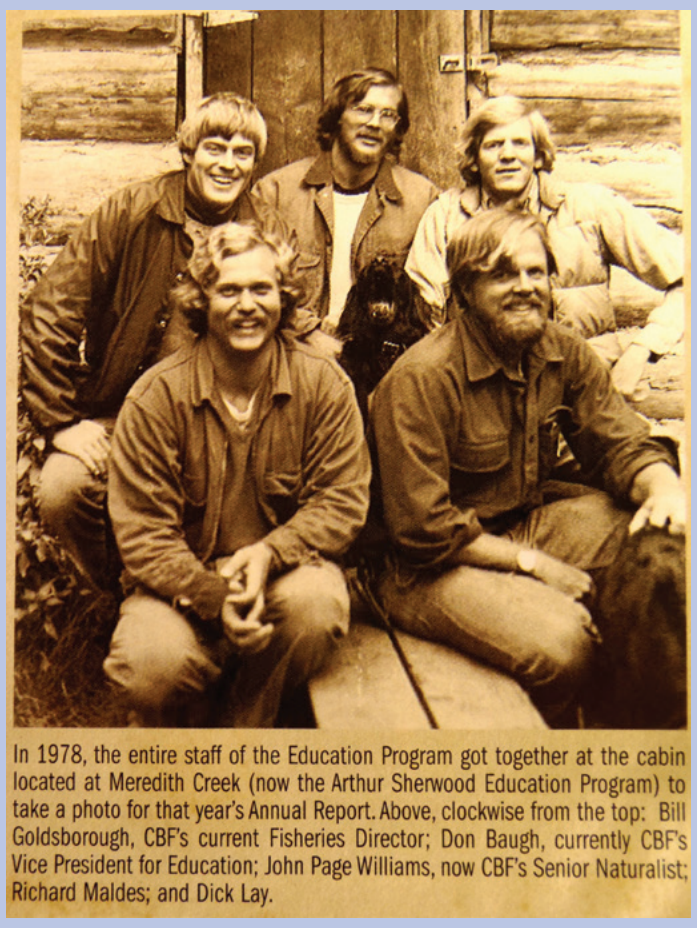
International Member-at-large

Carles Ibáñez

Senior Researcher and Head of the Department of Climate Change, EURECAT

Catherine Lovelock

Professor, University of Queensland



In 1978, the entire staff of the Education Program got together at the cabin located at Meredith Creek (now the Arthur Sherwood Education Program) to take a photo for that year's Annual Report. Above, clockwise from the top: Bill Goldsborough, CBF's current Fisheries Director; Don Baugh, currently CBF's Vice President for Education; John Page Williams, now CBF's Senior Naturalist; Richard Maldes; and Dick Lay.

Chesapeake Bay Foundation staff in 1978 at the cabin on Meredith Creek, Maryland. Photo: Courtesy of Kent Mountford

Keynote Speaker: Dr. Ayana Elizabeth Johnson

Photo: Marcus Branch

Dr. Ayana Elizabeth Johnson is a marine biologist, policy expert, writer, and Brooklyn native. She is founder of Urban Ocean Lab, a think tank for coastal cities, and is co-creator and co-host of the Spotify/Gimlet podcast How to Save a Planet. With Dr. Katharine Wilkinson, she co-edited the anthology All We Can Save, and co-founded The All We Can Save Project. Recently, Dr. Johnson co-authored the Blue New Deal, a roadmap for including the ocean in climate policy. Previously, as executive director of the Waitt Institute, she co-founded the Blue Halo Initiative and led the Caribbean's first successful island-wide ocean zoning effort. She also developed ocean policy at the EPA and NOAA, and was a leader of the March for Science.

Dr. Johnson earned a BA from Harvard University in environmental science and public policy, and a Ph.D. from Scripps Institution of Oceanography in marine biology, with a dissertation on the ecology, socio-economics, and policy of sustainably managing coral reefs. The fish trap she invented to reduce bycatch won the first Rare/National Geographic Solution Search.

Her op-eds have been published in The New York Times, Washington Post, Los Angeles Times, and Time, and she blogs on Scientific American. She was named one of Elle's 27 Women Leading on Climate. Outside Magazine called her "the most influential marine biologist of our time."

Dr. Johnson serves on the board of directors for the Billion Oyster Project, GreenWave, World Surf League's PURE, on the advisory boards of Environmental Voter Project, Oceanic, and Scientific American, and as a fellow at The Explorers Club. Her mission is to build community around solutions for our climate crisis. Find her @ayanaeliza.

Inclusion Event

Our CERF 2021 planning committee invites you to this year's Inclusion Event. Join our speakers, Nancy Rabalais and Johnny Quispe, in discussing careers in coastal and estuarine science and celebrating the 50th anniversary of CERF. The theme of this year's event is "Celebrating Our Past, Charting Our Future." The Inclusion Event is welcome to any and all CERF members.

As we reach this major milestone, we are taking a moment to consider the evolution of our organization, including both progress and challenges. During this reflection, we also invite you to bring a piece of yourself and embrace your own evolution. Moving into the next 50 years, we will examine how CERF can continue to change and develop a more inclusive environment for all members. For new CERF members, you will have a chance to learn about different career paths and opportunities for your own future. Together, we will map the next 50 years of the CERF community.

Look for more details about CERF 2021's Inclusion Event on social media, on the website, and in upcoming emails.

CERF 2021 FILM FESTIVAL

A new CERF event showcasing short films made by CERF members

Enter your own work and view other member-made films during the Film Festival event at CERF 2021! A panel of judges will award the best film in each category.

Learn more at https://conference.cerf.science/film-festival

Career Networking Event

Join us for this popular networking event!

Photo: Sandra Huynh

Are you a student, recent graduate, or just looking to explore different careers? Have you established yourself in the field and want to share your story with other CERF attendees? Do you have a job opportunity you would like share?

If the answer is "Yes!", or even a tentative "Maybe???", please join the Career Networking Event at CERF 2021. We are looking for Featured Speakers (folks willing to share their careers with an audience) and Guests (students or professionals looking to learn about different careers).

We have reinvented this popular event to be fully virtual. Each Feature will be stationed in a small breakout-style room. Guests will have the opportunity to chat with Featured Speakers from various coastal and estuarine science and management positions. Then, after a set amount of time, Guests will switch rooms to interact with a new Featured Speaker. This will allow Guests to have conversations with several people from the varied career paths in estuarine science, as well as interactions with peers!

Guests (students and those looking to change careers): Please sign up to attend when you complete your registration for the conference online. Be sure to prepare some questions! Stay tuned for a list of Featured Speakers in attendance.

Featured Speakers (established-career individuals): Please consider signing up to be a Featured Speaker at this event when you register for the conference. Share your knowledge of careers, agencies, and institutions with tomorrow's leaders of the coastal and estuarine science and management community. Whether it is just for the evening of the function or for the duration of the conference, we encourage you to adopt the CERF tradition of volunteerism and commitment to education. Who knows, you may end up meeting a future collaborator in the process!

If you have any questions about being a Guest or a Feature, drop us an email at cerf.cne@gmail.com.

Students, early career individuals, and established individuals from a range of career disciplines who would like to participate in the Career Networking Event, please indicate your interest when registering for CERF 2021. If you have already registered and did not sign up for the event, please send your name, institution, and career level to cerf.cne@gmail.com.

Workshops

Are you looking for a way to further enhance your CERF 2021 experience? Consider signing up for a workshop! We will be offering a diverse program of 16 workshops throughout the conference. These workshops represent an opportunity to receive valuable training in topics ranging from effective communications to technical web-based software.

- Benthic Biophysics in Coastal Ocean Models
- Increasing Collecting Impact: Bridging Coastal Networks and Enhancing Collaborative Science
- Exploring Emerging Technologies through the SAV Community of Practice
- Open Science: Core Concepts for Impactful Research and Resource Management
- Monitoring Changing Shores: Methods, Management, and Data for the Future
- Stories and Science: Blending Complementary Ways of Knowing Enhances Results
- Use R to Manipulate and Visualize Environmental Data I (Introductory Level)
- Job/Fellowship Application Development for Early Career Professional
- Connecting Land, Sea and Sky: A Virtual Birding Workshop
- Marine Spatial Data Mapping and Modelling in R
- Addressing Implicit Bias to Promote Equity in CERF Science Disciplines
- How to Use Field Sketchbooks to Realistically Record Scientific Observations
- Brainwaves - Engaging Stakeholders to Co-Design Waterway Health Report Cards
- Flow-Through Microscopy (FlowCam®) for Estuarine Research and HAB Monitoring
- Use R to Manipulate and Visualize Environmental Data II (Intermediate Level)
- The Coastal and Marine Ecological Classification Standard: A Technological Approach

CERF 2021 Conference Art

Elizabeth Lacey[1] and Emily Boone[2]
[1]Stockton University, Galloway, New Jersey, USA; [2]University of Richmond, Richmond, Virginia, USA
Elizabeth.Lacey@stockton.edu

Sunset James Island*, 2002, oil on linen, 12"x16", James Island, South Carolina. Painted by CERF 2021 Conference Artist Alice McEnerney Cook.* http://mcenerneycook.com/

The CERF 2021 conference will feature work by conference artist Alice McEnerney Cook. Each *CERF's Up!* bulletin leading up to the virtual conference is featuring estuaries from Alice's collection with perspective from CERF members as they reflect on the estuary's past and its chart towards the future.

The Charleston Harbor watershed along the coast of South Carolina encompasses 3,626 km^2 (1,400 mi^2) of coastal plain habitat that includes 21 unique habitats, species, and species aggregations. Bordering the James Island Creek just before it joins the Ashley River and across from the historic Charleston waterfront, the marsh on James Island is one of a complex series of tidal marshes in this watershed. While the marsh itself is part of a public trust managed by the state, the surrounding land is private. Numerous piers jutting out across the marsh provide recreational access to its meandering waterways and make this area a touchstone of the James Island community. James Island, like many of the sea islands in this region, has a long and rich history that continues to influence this estuary. Land once altered to control the flow of water on plantations where slaves hauled marsh mud to use as fertilizer for cotton crops has continued to be filled with soil and sand, compacting the marsh edge above flood elevation to meet the needs of intense development pressure. The marsh system is boxed in with no space to migrate upland as sea level rises. Moreover, the Port of Charleston plans to deepen its harbor, increasing the threat of flooding. While this tidal creek has consistently failed to meet water quality standards, recent prioritization under the state's clean water act hints at a promise of solutions to come.

Silent Auction/Artist Store/Affiliate Swag

Photo: Sandra Huynh

The CERF 2021 Silent Auction is virtual this year and will raise funds for the CERF Odum/Nixon Fund to support CERF student participation as well as professional development activities. A variety of items will be on virtual display through our BiddingOwl auction site. A variety of items will be available for bidding including original artwork, books, scientific instrumentation, crafted sea creatures, pottery, home decor, and CERF memorabilia donated by members. Join us for a good cause and great deals on highly prized items!

How can I donate an item for the silent auction?
If you will be donating an item for the silent auction, indicate so on your conference registration form. If it's after you have completed your online registration, contact the CERF office for assistance in adding your item for donation.

You may also download and complete the CERF 2021 Silent Auction Donation form and return to Cassondra Armstrong (pastpresident@seers.org) or Jessica Reichmuth (presidentelect@seers.org). Completed forms are due by Wednesday, 27 October 2021. Donation forms: https://forms.gle/yVf8GVsUfEZKHZpc8

Other important donation information:
Shipping prices should be included in the suggested bid amount since the donor will be shipping the item to the winning bidder

Please provide up to three pictures of the donated item as well as a brief description of the item so we can post this on our auction site (there is a place for this on the form)

When will the auction take place?
The auction will open at noon Sunday, 31 October and close at 8:00 PM on Wednesday, 10 November. All bids must be placed prior to the close of the auction. Bids will take place using a third-party site, BiddingOwl. More info is forthcoming!

How do I collect my winning bid?
All payments will be collected through our BiddingOwl silent auction website. Winners will be notified by email and/or text by BiddingOwl at the end of the auction. All payments must be received by 5:00 PM on Thursday, 11 November. If payment is not received at that time, items will automatically be awarded to the next highest bidder, who will be immediately contacted.

Artist Store
Thanks to our CERF 2021 artist, Alice McEnerney Cook, original art will be available to purchase. She has travelled to a few estuaries along the Atlantic seaboard to capture what we as scientists see every day in the field.

Affiliate Swag (tentative)
Purchase Affiliate gear this year at CERF and represent your group at the next face-to-face meeting.

Estuaries and Coasts Now a Transformative Journal

Paul A. Montagna, Co-Editor in Chief, Estuaries and Coasts
Janet Slobodien, Executive Editor, Springer Nature
Paul.Montagna@tamucc.edu

The publishing industry is going through another major transformation to manage open access (OA) (Ogden 2020). Some of you may remember the first transformation: moving from print to electronic distribution. *Estuaries and Coasts* (ESCO) first went online in 1999. Starting with the 2007 issue, ESCO offered authors an immediate OA option for an article processing charge (APC) (Threkeld 2007). The initial OA fees were $285/page for non-society members and $95/page for full society members. If the fee was not paid, then articles became available to all viewers for free after a 5-year embargo period. Today, ESCO is still using a hybrid approach, where authors choose to publish via the subscription model (for free) or via Gold OA (with an APC). No author is prevented from publishing due to an inability to pay the APC.

Then came Plan S, which is an initiative by cOAlition S to promote OA publishing (https://www.coalition-s.org/). Plan S requires that research funded by its members must be published in OA journals. cOAlition S consists primarily of European funding agencies, but includes private foundations in the US, such as the Hughes and Gates foundations. Plan S went into effect on 1 January 2021, and any researcher with coalition funding could no longer publish in ESCO as a hybrid journal.

Recently, however, the cOAlition S consortium has created an opportunity to cover OA for hybrid journals through 2024 if they agree to be "transformative" (Else 2019). A transformative journal is one that is committed to transition to OA on a defined timescale, while actively promoting the benefits of OA and providing greater transparency with pricing, performance, and metrics. This change is very important to ESCO, and if you look at the journal description https://www.springer.com/journal/12237, you will see that Springer Nature has labeled ESCO a "Hybrid (Transformative Journal)." This means that Springer Nature and ESCO continue to offer a publishing choice, but proactively promote the benefits of OA to authors, and commit to increasing OA uptake and ultimately transitioning to full OA for primary research articles (SN 2021a). In this way, the ultimate transition to open access is supported while also protecting the hybrid/subscription publishing model for those unable to pay APCs.

So, what is the recent OA uptake rate in ESCO? It appears the OA uptake rate has been increasing over the last 5 years (Figure 1). The year 2018 was high because an entire special issue, "Impacts of Coastal Land Use and Shoreline Armoring on Estuarine Ecosystems" (41:S1), was OA. If that special issue were removed, then only 10% of articles would have been published as OA, and 2018 would have been like 2019, and fit well with the increasing trend over time. Assuming this trend continues, ESCO can safely be designated a transformative journal. Importantly, Springer Nature, the publisher of ESCO since 2008, has included ESCO as one of its Transformative Journals, and thus ESCO is Plan S-compliant under option 2.

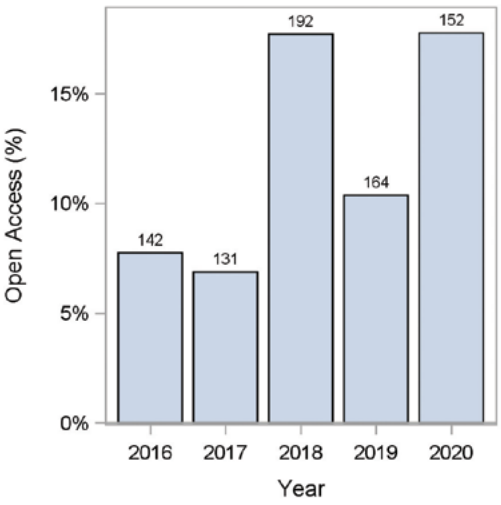


Fig 1. Percent of open access articles published in Estuaries and Coasts. *Data label is total number of articles published each year.*

The current APC for ESCO is $3,280 (€ 2,590 or £2,180) per article. However, Springer Nature also has a generous self-archiving policy, the SharedIt service can be used at any point, and posting preprints is also acceptable. See the access policy at https://www.springer.com/gp/open-access/publication-policies/self-archiving-policy. The current APC is less than the original 2007 fee of $3,990 for a 14-page article (which is the average paper length in ESCO from 2014 to 2020).

There are certainly benefits to authors choosing OA. OA promotes diversifying readership because access is granted to scientists with limited resources (Ozaygen et al. 2020). On average, OA books have 10 times more downloads and 2.4 times more citations than non-OA books. For articles, there is a lot of variability in the magnitude of the OA citation advantage based on the discipline and subfield, but an advantage does exist (Tennant et al. 2016), and Springer Nature reports that there are 4 times more downloads and 1.6 times more citations than non-OA articles across all subjects.

New publishing models are likely to arise in the future. Many university libraries believe that OA fees are simply a double-billing if they subscribe to the journal. They already have access via their subscription fee, so why should they also pay an OA APC

to publish? This is leading to negotiations for over transformative agreements or "read and publish" deals, where libraries pay subscriptions for access to paywalled articles, but their researchers can also publish under OA terms so that anyone can read their work for free (Else 2018). APCs are covered centrally by funders or research institutions. Some of these agreements already exist among publishers and large library systems, and many more will come in the future. For example, Springer Nature has an agreement with the University of California (UC) system libraries where the first $1,000 of each APC is covered for UC-affiliated authors (SN 2021b).

References:

Else, H. 2018. Europe's open-access drive escalates as university stand-offs spread. *Nature* 557:479-480. https://doi.org/10.1038/d41586-018-05191-0

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Ozaygen, A., Montgomery, L., Neylon, C., et al. 2020. More readers in more places: The benefits of open access for scholarly books. *Springer Nature Preprint*. https://doi.org/10.5281/zenodo.4014905

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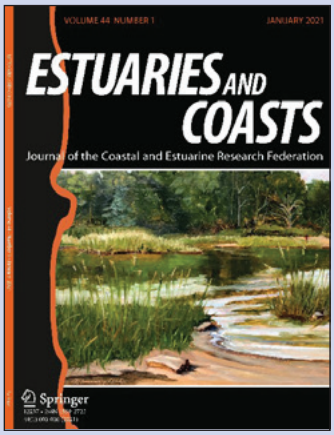
SN (Springer Nature). 2021b. Open access agreement for the University of California. Accessed 1 March 2021: https://www.springernature.com/gp/open-research/institutional-agreements/oaforcalifornia

Tennant J.P., Waldner F., Jacques D.C., et al. 2016. The academic, economic and societal impacts of Open Access: an evidence-based review [version 3; peer review: 4 approved, 1 approved with reservations]. F1000Research 2016, 5:632 https://doi.org/10.12688/f1000research.8460.3

Threlkeld, S. 2007. Author-supported open access in *Estuaries and Coasts*. *Estuaries and Coasts* 30:1-2. https://doi.org/10.1007/BF02782961



Estuaries and Coasts Editor's Choice

March 2021 Special Issue

Orth, R.J., and K.L. Heck. 2021. Seagrasses—a tribute to Dr. Susan Williams. *Estuaries and Coasts* 44: 303. https://rdcu.be/ciLKV

May 2021

Kincaid, E.S., and C.E. de Rivera. Predators associated with marinas consume indigenous over non-indigenous ascidians. *Estuaries and Coasts* 44: 579–588. https://rdcu.be/ciLKX

Ed Kuensler and John Day, University of Georgia Marine Institute, ca. 1950s

Photo: Courtesy of Merryl Alber

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 (6 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.

January 2021

Invasive Seaweed May Benefit Juvenile Salmon

Habitat diversity enhances nursery grounds

Source: Hughes, B.B. et al. 2020. Native and Invasive Macrophytes Differ in Their Effectiveness as Nurseries for Juvenile Endangered Salmon. *Estuaries and Coasts*. DOI: 10.1007/s12237-020-00845-7
https://cerf.memberclicks.net/cesn-january-2021#Article1

How Many Herbivores Can a Turtlegrass Meadow Support?

Calculating the carrying capacity of a Florida Bay

Source: Rodriguez, A.R., and K.L. Heck Jr. 2020. Approaching a Tipping Point? Herbivore-Carrying Capacity Estimates in a Rapidly Changing, Seagrass-Dominated Florida Bay. *Estuaries and Coasts*. DOI: 10.1007/s12237-020-00866-2
https://cerf.memberclicks.net/cesn-january-2021#Article2

The Resilience of Texas Estuaries to Hurricane Harvey

Effects on water quality were short-lived

Source: Walker, L.M. et al. 2020. Timescales and Magnitude of Water Quality Change in Three Texas Estuaries Induced by Passage of Hurricane Harvey. *Estuaries and Coasts*. DOI: 10.1007/s12237-020-00846-6
https://cerf.memberclicks.net/cesn-january-2021#Article3

Predicting the Future of Seagrass Ecosystems in a Warmer World

A mechanistic understanding of climate change effects on seagrass performance

Source: Zimmerman, R.C. 2020. Scaling up: Predicting the Impacts of Climate Change on Seagrass Ecosystems. *Estuaries and Coasts*. DOI: 10.1007/s12237-020-00837-7 https://cerf.memberclicks.net/cesn-january-2021#Article4

March 2021

Managed Ponds Offer Ample Zooplankton for Juvenile Salmon

Chinook salmon grew quickly in San Francisco's highly modified wetlands

Source: Aha, N.M. et al. 2021. Managed Wetlands Can Benefit Juvenile Chinook Salmon in a Tidal Marsh. *Estuaries and Coasts*. DOI: 10.1007/s12237-020-00880-4
https://cerf.memberclicks.net/cesn-march-2021#Article1

Has Nutrient Loading to Chesapeake Bay Decreased?

N and P reductions from wastewater and the atmosphere were overwhelmed by increases in agricultural loads

Source: Fisher, T.R. et al. 2021. Localized Water Quality Improvement in the Choptank Estuary, a Tributary of Chesapeake Bay. *Estuaries and Coasts*. DOI: 10.1007/s12237-020-00872-4 https://cerf.memberclicks.net/cesn-march-2021#Article2

Shorebirds Eat at Night, Too

Godwits wintering in France forage whenever mudflats are available

Source: Jourdan, C. et al. 2021. Nycthemeral Movements of Wintering Shorebirds Reveal Important Differences in Habitat Uses of Feeding Areas and Roosts. *Estuaries and Coasts*. https://cerf.memberclicks.net-cesn-march-2021#Article3

Tracking Seagrass Survival in Virginia's Long-Running Restoration Efforts

Short water residence time is the best predictor of eelgrass success

Source: Oreska, M.P.J. et al. 2021. Defining the Zostera marina (Eelgrass) Niche from Long-Term Success of Restored and Naturally Colonized Meadows: Implications for Seagrass Restoration. *Estuaries and Coasts*. DOI: 10.1007/s12237-020-00881-3
https://cerf.memberclicks.net/cesn-march-2021#Article4

The Coastal Society and CERF Team Up for a Career Workshop

Tom Bigford, The Coastal Society
tebigford@gmail.com

The Coastal Society (TCS) (thecoastalsociety.org) received a $500 grant in June 2020 in response to a "Request for Proposals: CERF-facilitated Local Networking and Professional Development." The funds were provided to support a career development workshop to benefit members of CERF and TCS plus others with academic or professional interests in a coastal or estuarine career. A primary objective was to connect people of color with coastal or ocean interests who continue to be under-represented in school and the marketplace. The 4 November 2020 virtual event, organized in partnership with the Atlantic Estuarine Research Society (AERS) and Southeastern Estuarine Research Society (SEERS), satisfied the need to host a career workshop and provided some insights into tackling the issues of under-representation.

The common interests of TCS and CERF made for smooth planning and a lively event, with keen interest from leadership in both affiliates. Buoyed by tremendous technical support from East Carolina University's Office of Continuing Education, TCS was able to focus on the diversity challenges that were central to the request for proposals. TCS approached the issues from multiple fronts.

Connecting with Our Target Audiences

The TCS/AERS/SEERS team had mixed success on this front. The experience offered several solid lessons for future efforts. Our marketing focused on contact with the two CERF affiliates and at Historically Black Colleges and Universities (HBCUs) in AERS and SEERS states, including the University of Maryland Eastern Shore, Hampton University, and Savannah State University. Reaching out to other schools (Delaware State University, Elizabeth State University, and Florida A&M University, among others) should be a next step for TCS and the East Coast CERF affiliates. Another "must" is to get on the calendar of groups that cater to under-represented audiences.

Seek Speakers with Diverse Backgrounds

Speakers represented a very diverse array of subject-matter specialists from academia, private industry, non-profits, and state and federal government. Attendees greatly appreciated hearing from the wind-power, mining, teaching, environmental, and research sectors. Of the 10 primary speakers, 4 were female. We failed to attract speakers or mentors of color, which was disappointing since TCS often reaches 30-40% for its workshops.

Learn from Our Evaluations

An online evaluation was provided to all 38 participants in a post-event email. TCS received responses from 9 of 26 students.

- Most found the workshop very useful, were very happy they attended, enjoyed the entire experience, and would like to attend future TCS workshops.
- Most said the nominal registration fees were appropriate (CERF grant covered affiliate member attendees; $15 for TCS members, $30 for unaffiliated participants).
- Most "really liked" the program and speakers but two people with an academic focus on water resources were hoping for more insights across the broader environmental fields.
- One postgraduate now working as a NOAA Coastal Management Fellow "really appreciated the honesty of all speakers [who] didn't leave out the exciting details."
- A NOAA Sea Grant Fellow "enjoyed the breakout sessions and the opportunity to talk in depth with the presenters."
- One SEERS member studying water resources was definitely inspired by the workshop program but was hoping for "more discussion of leadership and management across different environmental fields."

TCS sees a still-untapped audience of young talent enrolled at HBCUs, MSIs, and other colleges. We also recognize the need to reach high schoolers and early undergraduates who might not be aware of the scientific opportunities along our coasts and in our oceans. Our societies need to attack these challenges in the near future.

TCS appreciates this opportunity to partner with CERF. That relationship started with a similar career workshop at the May 2019 AERS meeting and again at the joint AERS-NEERS meeting in April 2021. We hope future partnerships will yield more progress across the spectrum of diversity, equity, and inclusion.

Coastal and Estuarine Studies Lab Builds Resilience in Students

Shannon Pelkey, Mariko Polk, and Devon Eulie
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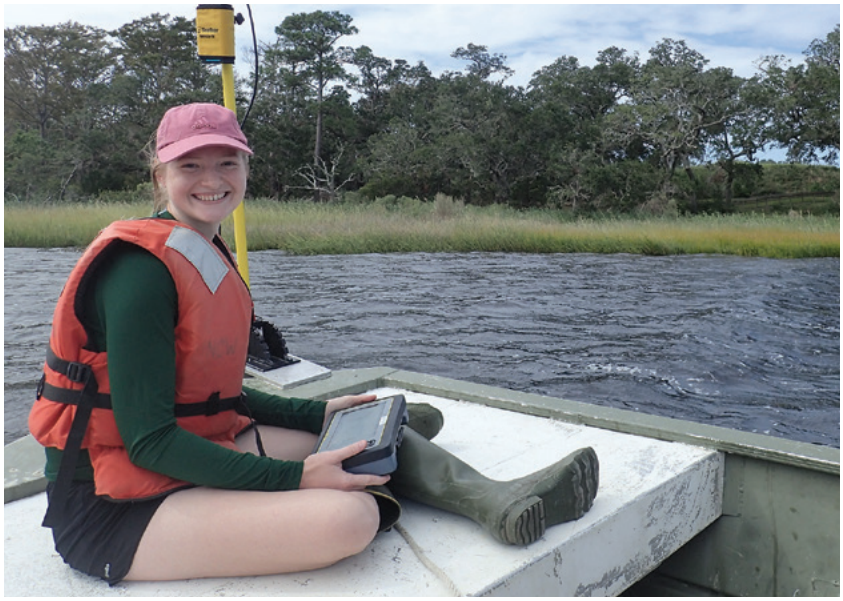
In coastal science, resilience is the ability to bounce back after a disruptive event. Among coastal communities, having resilience to the impacts of events like hurricanes and flooding is critical to reducing the likelihood that short-term events do not become long-term, persistent issues. Likewise, in education, resilience is the ability of students to bounce back in the wake of adversity. In both instances, resilience can be built by supplying communities and students with skills to address the challenges at hand. Devon Eulie, of the Department of Environmental Sciences and the Center for Marine Sciences at the University of North Carolina Wilmington, prioritizes empowering students in her Coastal and Estuarine Studies (CES) Lab.[1] In the wake of Hurricane Florence (2018), Hurricane Dorian (2019), and COVID-19, researchers in this lab are no strangers to adversity.

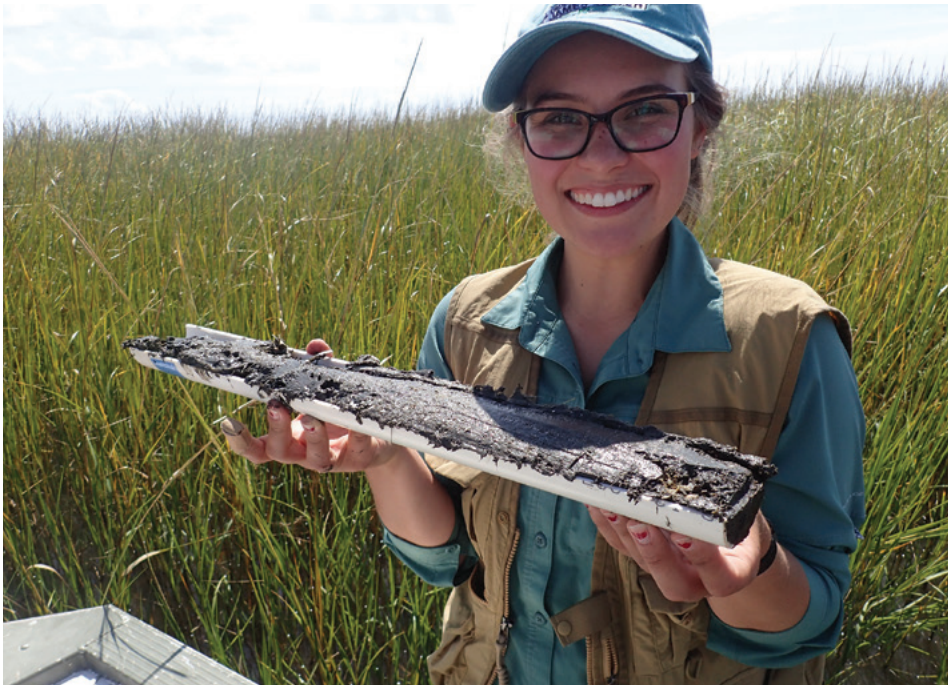
Flooding and damages to the region from the two hurricanes resulted in CES Lab students not being able to return for weeks, loss of a research season, loss of refrigerated samples from power outages, damages to students' homes, and even complete displacement of some students. The impacts of COVID-19 brought university-wide closure and research activity to a grinding halt for over half a year, impacting seasonally dependent research. CES Lab students faced incredible hardships related to these events, yet they were resilient, in small part because of the relationships they built in the lab and support provided by Eulie. Her guidance allowed multiple students to navigate substantial external roadblocks to the completion of thesis and capstone projects.

CES Lab focuses on coastal science and management research by using innovative field and remote sensing methods with a multidisciplinary perspective. Student researchers[2] collaborate on research on coastal topics ranging from erosion of beaches and inlets to local resilience to sea-level rise to coastal blue carbon research. Some of their most exciting work has been on expanding research on living shorelines. As a part of research funded by the US Coastal Research Program,[3] Eulie and PhD student Mariko Polk are exploring the ecosystem service benefits of natural and nature-based management techniques over large spatial and time scales. They recently found that sites with living shorelines experienced less lateral erosion during Hurricane Florence than unprotected natural sites in North Carolina.



UNC Wilmington graduate student Sarah Ashley uses a real-time kinematic (RTK)-GPS enabled echosounder to collect bathymetry data along North Carolina State Historic Site Brunswick Town Photo: S. Pelkey

Other ongoing research in the lab includes work by Master's degree student Sarah Ashley (Fig. 1), who is the lead student on a long-standing, multi-year research collaboration with North Carolina State Historic Site Brunswick Town to monitor shore zone stabilization strategies. The site contains a trove of natural and cultural resources that are at risk due to rapid erosion of the shore zone. Ashley is using biological and physical methods, ranging from benthic cores to drones and LiDAR stations, to understand changes in the shore zone. Another Master's



UNC Wilmington graduate student Mackenzie Taggert shows one of her sediment cores taken in the marshes of the Cape Fear River that will be used to understand blue carbon sequestration Photo: S. Pelkey

student, Mackenzie Taggert (Fig. 2), is researching how much and where blue carbon is stored in Cape Fear River wetlands. She uses stable isotopes and radioisotopes to determine the vulnerability of the wetlands to sea-level rise and other effects of climate change. Research by the lab students always has the overarching objective that it will provide valuable insight to growing coastal resilience, while the students grow themselves as resilient scientists.

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Affiliate News: An Update from CAERS

California Estuarine Research Society (CAERS)
Steven Y. Litvin
President, CAERS

Like scientists across the world, March 2020 saw the field research of CAERS members, from Humboldt County in northern California to Baja California Sur, Mexico, come to a screeching halt. It has been a long and trying year for everyone, but with fastidious planning, new protocols and lots of masks, 2021 has brought a return to the field. We wanted to share a couple of snapshots from our members' renewed fieldwork and we look forward to hearing about yours at the 2021 CERF biennial meeting.

Sofia, Crystal, Avery, Mia (L to R), UC San Diego and U. of San Diego students, work together with California Sea Grant on a native species aquaculture project in San Diego.

Theresa Talley (California Sea Grant): After working out protocols to safely conduct research during the COVID-19 pandemic, we got back out to the field to do some broodstock collections for our research exploring the use of native clams in aquaculture in southern California. Grad student Avery (middle) is also looking at the effectiveness of growing seaweed and sea cucumbers with the clams!

Janet Walker (Southern California Coastal Water Research Project): In March, the Estuary Marine Protected Area (EMPA) Project launched the testing of protocols and standard procedures to monitor and assess fifteen estuaries along the coast of California. The main goal of this study is to establish a monitoring framework, including data collection, analysis, synthesis, and reporting to determine the efficacy of MPA designations in estuaries. A key element is the development of a standardized monitoring protocol that can be used not only by the MPA program, but by any program aimed at assessing estuary function, condition, or health, and provide data that can be easily compared across systems and between programs

The Estuary Marine Protected Area southern California regional team is all smiles (behind the masks of course!) at Batiquitos Lagoon, San Diego County, finishing their last sampling day after a grueling 5-week sampling campaign

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ONSET 40th ANNIVERSARY

In Five Decades of Marine Benthic Ecology. . .

Stephen S. Hale
stephenshale@gmail.com

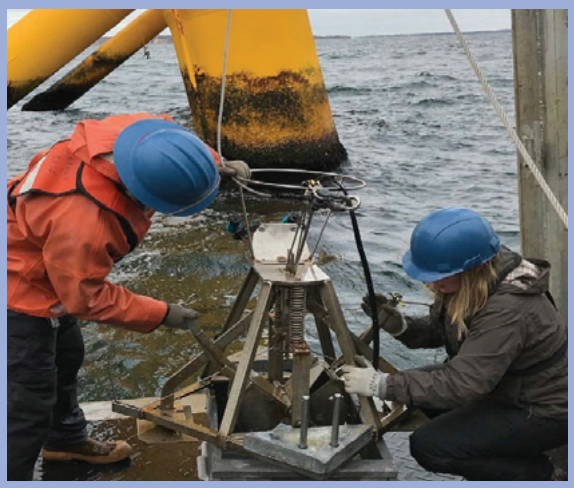
Some things change: *Measuring sediment-water nutrient fluxes, important in estuarine nutrient budgets and biogeochemical cycles.*

Benthic chambers used in Narragansett Bay in early 1970s
Photo: Stephen Hale

In situ and lab devices used in Rhode Island waters in 2015
Photo: Courtesy of Wally Fulweiler

Some things don't: *Sampling benthic macroinvertebrate community species composition, which is needed to assess changes of biodiversity.*

Smith-McIntyre benthic grab used for sampling benthic communities of Narragansett Bay in early 1970s
Photo: Stephen Hale



Smith-McIntyre benthic grab used for sampling benthic communities at the Block Island Wind Farm (the first offshore wind farm in the US) in 2019
Photo: Courtesy of Zoë Hutchinson

But maybe someday: *We still need to get a grab of the bottom sediments but DNA metabarcoding has the potential to ease the job of sorting and identifying species solely by morphological characteristics. There are still some technical issues to resolve in using this method with a community containing the majority of animal phyla on the planet.*

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