CERF's Up!

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Celebrating CERF's 50th Anniversary

COASTAL AND ESTUARINE RESEARCH FEDERATION®

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

CERF's Up!

Volume 47 • Number 1
March 2021

Horseshoe crab at Oyster Bay National Wildlife Refuge, Long Island

Photo: Richard Sack

Table of Contents

Editors' Note:
This issue begins the celebration of CERF's 50th anniversary with an article on the first meeting of CERF in 1971 (when it was known as the Estuarine Research Federation, ERF for short). This is followed by four articles solicited by Bob Christian and Bob Murphy (of the History Committee for the 2021 Conference) on historical developments in estuarine disciplines. Thanks to the USFWS Oyster Bay National Wildlife Refuge (near Plainview, Long Island, site of the first ERF meeting in 1971) for use of their photos.

Front cover: Beach in Oyster Bay National Wildlife Refuge, Long Island, just north of Plainview on Long Island
Photo: Richard Sack

Back cover: Oyster boat in Oyster Bay National Wildlife Refuge
Photo: US Fish & Wildlife Service

President's Message

Jim Fourqurean

The work of CERF scientists has never been more important

As all of us are anticipating a return to normalcy sometime soon from the global pandemic of 2020, the work of CERF members has never been more important. 2020 was the second hottest year, 0.6 °C hotter than the 1981–2010 baseline. The last six years were the hottest six years in history and 2011–2020 was the hottest decade ever recorded. The ecological and societal impacts of this temperature increase are concentrated on our coastlines, where the majority of the earth's human population lives and where sea level rise from a warming earth is threatening our ecosystems and our built environment. CERF members need to lead the way in developing understanding of the causes and consequences of these changes.

Increases in temperatures are primarily being driven by global atmospheric CO_2 concentrations, and despite the global economic slowdown caused by the pandemic that reduced global CO_2 emissions by 7%, there was no respite from rising atmospheric CO_2 levels—which reached a record 413 ppm in May. In addition to causing global heating, atmospheric CO_2 dissolves in our freshwaters, estuaries, and the coastal ocean, driving changes in plant growth and structural formation of many important estuarine and coastal marine species of ecological and economic importance, like oysters and reef corals.

Heating is unequally distributed globally, with the arctic heating over twice as fast as the global average. And recent monitoring programs have indicated that our coastal waters are also warming faster than the open ocean. Warming also changes the distribution of evaporation and rainfall across the earth's surface. This changing distribution not only influences river flow, and therefore salinity, in our coastal ocean, it also causes droughts in historically productive arable land and floods in other places.

The long-term average of sea level rise since the 1960s has increased coastal flooding. Global sea level rise has accelerated to 4.8 mm per year, up from the 3.2 mm per year realized since 1990. And a hotter world produces more, and more powerful, storms and cyclones that threaten our coastlines. 2020 set a new high-water mark for hurricanes in the Atlantic basin, so many that we had to relearn our Greek alphabet to know the name of the next storm to come. Our coastal ecosystems are redistributing in response to changing storms and sea level rise, and therefore the protection that healthy marshes, mangrove forests, barrier islands, estuaries, and coral reefs provide against ocean storms and erosion is being lost.

It is clear that we, the coastal and estuarine scientists and managers in CERF, are needed now more than ever. Never has understanding and managing the coastlines been more important. A healthy and vibrant CERF will also ensure that we continue to develop the next generation of talent in the field that can advance our ability to ameliorate, adapt, and mitigate climate change in the coastal environment!

Jim Fourqurean

The First Meeting (1971) of the Estuarine Research Federation

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The first ERF meeting, as a joint meeting of AERS (meeting #46) and NEERS (meeting #4), was hosted by Adelphi University and held on Long Island at the Holiday Inn in Plainview, New York, 4–6 November 1971.

Holiday Inn in Plainview, New York, 2020

Plainview lies seven km south of Oyster Bay in Long Island Sound. After registration Thursday evening and the traditional Beer Blast, there were 15 paper presentations Friday morning and afternoon, with a banquet Friday evening. Another 4 papers were given Saturday morning followed by a business meeting. An additional 11 stand-by papers were available if needed but records do not indicate if any of them were presented in lieu of scheduled papers. There were 75 participants at the inaugural meeting, 22 of whom were NEERS members so presumably around 50 were members of AERS. I have identified seven extant attendees but there probably are a few more out there. Attendees chose L. Eugene Cronin of the Chesapeake Biological Lab as the first President of ERF; Cronin had been a founder and first President of AERS 22 years earlier.

Were you there in 1971? We are gathering short reminiscences from people who attended the first meeting. Please send to bulletin@cerf.science. –Eds.

(continued)

NEERS returned to Long Island in 2011, 40 years after the first ERF meeting in 1971. The meeting was hosted by Darcy Lonsdale of Stony Brook University (third from left). Sue Adamowicz of the Rachel Carson National Wildlife Refuge (second from right) led a Saturday field trip to the Wertheim National Wildlife Refuge

The First Meeting … *(continued)*

The program from the 1971 meeting:

ESTUARINE RESEARCH FEDERATION

ATLANTIC ESTUARINE RESEARCH SOCIETY

NEW ENGLAND ESTUARINE RESEARCH SOCIETY

PROGRAM

PLAINVIEW, LONG ISLAND, NEW YORK

NOVEMBER 4-6, 1971

The First Meeting …

1971 meeting program[1]; inside:

ESTUARINE RESEARCH FEDERATION
1st Meeting

AERS - 46th Meeting NEERS - 4th Meeting

Hosted by Adelphi University
Holiday Inn, Plainview, Long Island, N. Y. 11803

November 4-6, 1971

SCHEDULE

REGISTRATION -----------Nov. 4, 1600-1900 hrs.
Nov. 5, 0830-1200 hrs.
BEER BLAST -------------Nov. 4, 1900-2300 hrs.
Univ. Center, Room 201, Adelphi Univ.
Nov. 5, 1900-2015 hrs.
Banquet Room, Holiday Inn.
BANQUET ----------------Nov. 5, 2015-
Banquet Room, Holiday Inn.

SESSIONS
Friday Morning, 0900-1200 hrs.

0900 Wolfe, Douglas A. Estuarine Ecosystem Research at the NOAA-NMFS Atlantic Coastal Fisheries Center, Beaufort, N. C. (20 min, 2x2 slides)

0925 Simon, H., A. C. Churchill, and H. W. Moeller. Investigations of the Growth of Codium fragile in Great South Bay. (15 min)

0945 Kerwin, James A. A Study to Determine the Abundance, Composition, and Distribution of Aquatic Vegetation in Chesapeake Bay. (20 min)

1005 Egan, W. G. and J. M. Cassin. Correlation of Bioluminescence and Fluorescence with Biota in the New York Bight. (15 min)

COFFEE BREAK 1025-1050 hrs.

1050 Foerster, John W. The Fate of Freshwater Algae Entering an Estuary. (15 min, 2x2 slides)

1110 Lear, Donald W., Jr., Maria O'Malley, and Susan K. Smith. Observations on Chlorophyll a as a Water Quality Management Parameter in Estuaries. (15 min)

2

1130 Burnett, J. W., and G. J. Calton. Further Studies in the Purification and Physiological Actions of Sea Nettle Nematocyst Toxin. (12 min, 2x2 slides)

1145 Neumann, David A., and David G. Cargo. Consumption Rates of Mnemiopsis leidyi by Chrysaora quinquecirrha under Laboratory Conditions. (10 min, 2x2 slides)

LUNCH BREAK - 1200-1330 hrs.

1330 Michael, Allan D. Species Distribution and Environmental Factors in a Heterogeneous Environment. (25 min, 2x2 slides)

1400 Kollmeyer, Ronald C. Circulation Model Basin Studies of the Niantic River, Connecticut. (30 min, movie - 16 mm.)

1435 Kruczynski, William L. Quantification of Food Uptake by Pea Crabs in Scallops. (10 min, 2x2 slides)

COFFEE BREAK - 1450-1515 hrs.

1515 Welsh, Barbara L. Exploitation of a Stressed Environment by the Grass Shrimp, Palaemonetes pugio. (20 min, 2x2 slides)

1540 Wildox, J. Ross. Feeding and Growth of the Sand Shrimp, Crangon septemspinosa. (15 min)

1600 Tinsman, Jeff, and Don Maurer. The Effect of Thermal Effluent on Oysters in Indian River Bay, Delaware. (20 min, 2x2 slides, opaque projector)

1625 Frenke, Kenneth, and Joseph M. Cassin. Distribution of Fecal Bacteria in New York Bight Sediments. (15 min)

BEER BLAST!!!! BANQUET

Saturday Morning - 0900-1050 hrs.

0900 McErlean, A. J., S. G. O'Connor, and J. A. Mihursky. A Long-Term Study of Estuarine Fish Populations. (20 min, 2x2 slides)

0925 O'Connor, Joseph M. Lethal Effects of Suspended Sediments Upon White Perch, Spot, and Menhaden. (15 min)

0945 Graham, Joseph J., Clarence W. Davis, and Stanley B. Chenoweth. Factors Affecting Larval Herring Catches along the Western Coast of the Gulf of Maine. (15 min, 3x4 slides, blackboard)

3

1005 Peters, David S. The Effect of Temperature, Salinity, and Food Availability on the Feeding and Growth of the Hogchoker, Trinectes maculatus. (15 min, 2x2 slides)

COFFEE BREAK - 1020-1050 hrs.

1050 Business Meeting

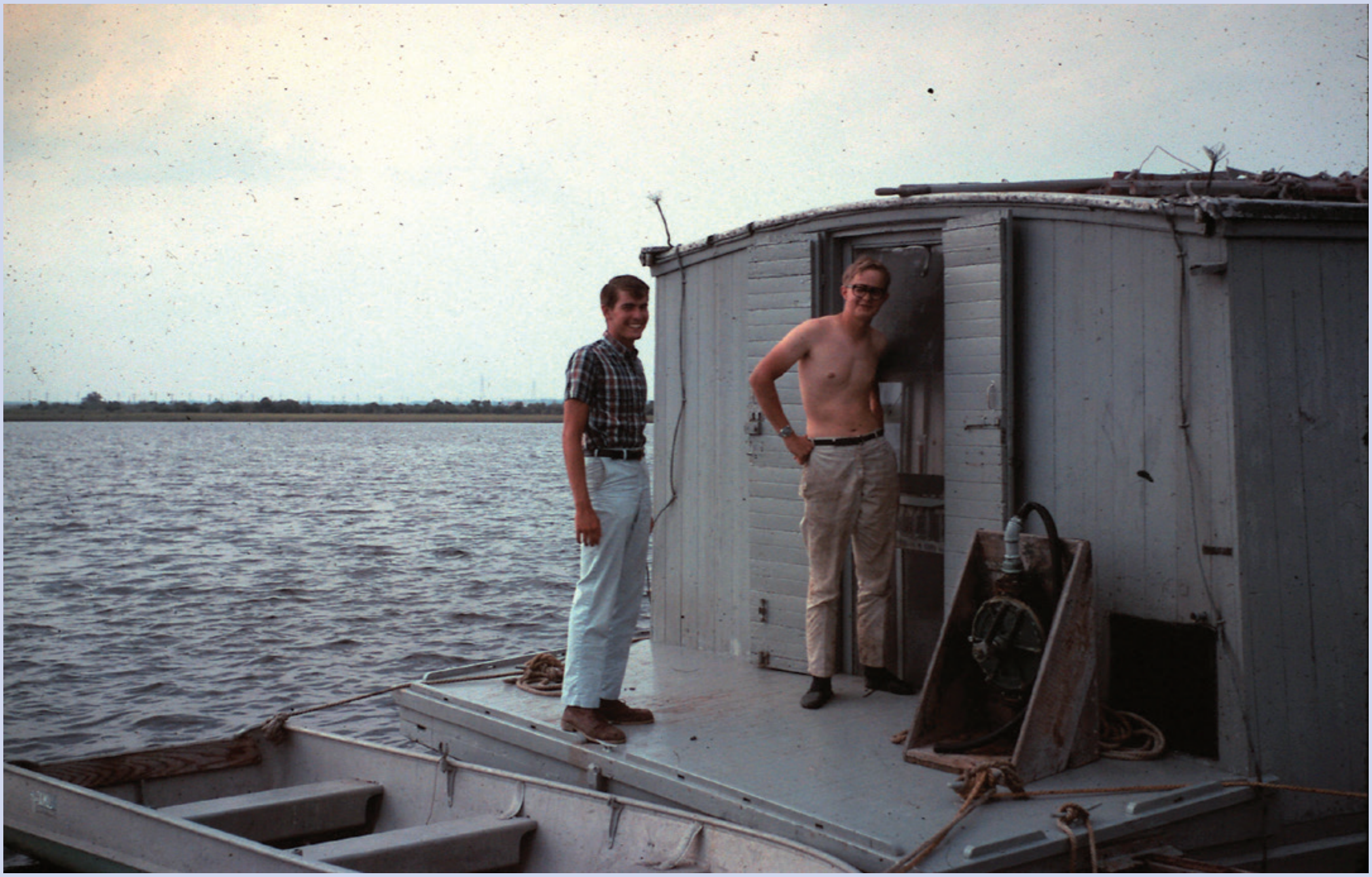
Stand-by Papers

1. Gibson, Charles I., and James S. Young. The Ballad of Boiling Baby Brevoortia or Thermally Troubled Tyrannus. (10 min, 2x2 slides)
2. Loesch, Joseph G., and Dexter S. Haven. Preliminary Estimates of Growth Functions and the Size-Age Relationship for the Hard Clam, Mercenaria mercenaria, in the Lower York River, Virginia. (10 min, 3x4 slides)
3.a. Terretta, Roy Tim and W. A. Van Engel. The Occurrence of Cancer irroratus in Chesapeake Bay, Virginia (During the Winter Blue Crab Dredge Fishery).
b. Shotton, Lewis R., and P. A. Haefner, Jr. Aspects of the Biology of the Rock Crab, Cancer irroratus, in the Coastal Waters of Virginia. (15 min, 2x2 slides)
4. Smith, Kevin P., and Joseph M. Cassin. Implication of Pleasure Craft in the Sanitary Pollution of Estuarine Waters and Shellfish. (10 min)
5. Dietz, Marsha A., and K. L. Webb. An Ultrastructural Study of Strobilation in Chrysaora quinquecirrah with Special Reference to Neurosecretion. (15 min, 2x2 slides)
6. Zubkoff, Paul L., and Jeanne D. Joseph. Comparative Biochemistry of Jellyfish: Component Fatty Acids of the Total Lipids of Aurelia, Chrysaora, and Cyanea. (15 min, 2x2 slides)
7. Keck, Richard T., Robert Malouf, and Don Maurer. Setting Preferences of Larval Hard Clams, Mercenaria mercenaria. (15 min, 2x2 slides)
8. Wang, Johnson C. S. A Study of Fish Fauna in the Chesapeake and Delaware Canal in 1970. (15 min, 2x2 slides)
9. Morales-Alamo, Reinaldo, and Dexter S. Haven. Circular Mouth Shape as a Character Peculiar to the Scyphistoma of Aurelia aurita from Chesapeake Bay. (15 min, 2x2 slides)
10. Grigonis, Dave, and Paul Chanley. Effects of a Vitamin on Bivalve Larvae. (15 min)

1. https://cerf.memberclicks.net/cerf-s-up--47-1--bulletin---additional-materials

Reflections on the CERF 2021 Theme

Bob Christian and Bob Murphy for the CERF 2021 Theme Committee



Bob Christian (left) and Bob Hartwick (right) on deck of Cynthia *near the Great Bay, New Jersey (circa 1967). The houseboat* Cynthia *was owned by Rutgers University. It had been the "home" of numerous estuarine scientists and students (e.g., Thurlow Nelson, Mel Carriker, Bob Loveland) since 1909*

As you know, the CERF 2021 conference theme is "Celebrating our past, charting our future." The celebration is for 50 years as an organization and a longer history of research, education, and management of estuaries and coasts. Successful science and wise management depends on evaluating and translating history to advance understanding and prediction. Numerous activities are planned around the theme, and one is a series of short articles in *CERF's Up!* This issue contains the first group of these articles, and more will appear in subsequent issues.

We invited CERF members to submit manuscripts that captured how past, present, and future hypotheses and research connect to our understanding and management of estuaries. We also directed requests to former CERF officers and award winners. These experts were asked simply to choose a topic within their expertise and run with it. They could address the topic any way they wished, including reviews, personal stories, and opinions. We prompted them with a few possible questions: How has the field changed; how have guiding paradigms come and gone; how has technology and methodology changed; what may the future hold? Then we got out of the way. We hope you find the articles informative and thought-provoking.

Nekton Ecology: Origins, Progress, and Prospects for the Next 50 Years

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*Juvenile silver perch (*Bairdiella chrysoura*) are common among the more than 100 species of fishes comprising the nekton of East and Gulf Coast estuaries*

Photo: D.M. Allen

The first known use of the term nekton was in 1891 by Ernst Haeckel who proposed that it be used to distinguish a group of aquatic animals with an ability to swim from the animals belonging to the plankton. Various definitions exist, but most recognize nekton as animals that can move independently of water currents. In G. Lauff's book *Estuaries* (1967), which was an outcome of the first "Conference on Estuaries" held in 1964, J.L. McHugh[1] acknowledged that it was difficult to characterize the assemblage of organisms comprising the nekton in estuaries. He identified fishes and swimming invertebrates (especially some crabs, shrimps, lobsters, and squids) as secure members, and he recognized many part-time members such as some polychaetes, birds, reptiles, and mammals. In 1997, Aleyev[2] suggested that there was reason to consider the term nekton obsolete because it does not allow for a meaningful quantitative distinction from the term plankton, which most zoologists agree includes the jellyfishes, many of which are large and capable swimmers. Imperfect as the definition might be, those of us who refer to nekton in our research are not likely to give up using the term.

The term nekton has not been as universally accepted as plankton or benthos. A search of CERF's journals (*Chesapeake Science*, 1960–1977; *Estuaries*, 1978–2005; *Estuaries and Coasts*, 2006–2019) identified 317 articles that use the term nekton; those accounted for about 7% of the nearly 4800 articles published. The term fish was found in 64% of all articles. In many of those papers, use of the term nekton would have been appropriate. Nevertheless, there has been about a 10% increase in the use of the term in all articles over the decades. I encourage others to use nekton when referring to assemblages of macroscopic, motile fishes, crustaceans, and mollusks in estuaries, even if the group of interest is only fishes. This would likely enable those most focused on the ecology of fishes, swimming crustaceans, and squids to discover papers from a broader range of topics.

Nekton ecology is basically about relationships among organisms and habitats. It is about how nekton use habitats, how habitats support motile organisms that represent multiple trophic orders, and how those relationships change with environmental conditions. Research has come a long way since the first ERF conference in 1971. It is beyond the scope of this article to review those accomplishments, but perhaps some observations and thoughts about what has transpired since I was a graduate student in the mid-1970s will help spawn some new ideas and approaches.

Early efforts to characterize and quantify nekton relied almost entirely on nets. Fishers and scientists have long recognized the limitations of nets. Avoidance by the targeted animals and size-selective retention in meshes are fundamental problems in every deployment. The extent of avoidance and retention varies greatly due to differences in size and behavior among species and life stages. Furthermore, susceptibility of any organism to capture varies across different environmental settings and conditions. High variability prevails, with repeated net hauls and use of alternate gear and deployment strategies at the same place and time usually yielding different catches. Nekton are patchy in time and space. These obstacles to accurately describing and quantifying assemblages are humbling, but with increasing awareness, mitigation of the sources of variability, and improved statistical procedures, researchers are now better at interpreting the incomplete snapshots obtained in the field.

Seines are frequently used to sample nekton in shallow-water systems. Although their effectiveness might be better in confined areas such as this flooded, intertidal, salt marsh creek than along open shorelines, avoidance (escape) is usually high
Photo: D.M. Allen

Imaging sonar systems provide opportunities to count, measure, and characterize movements of fishes and motile invertebrates (nekton) in turbid waters. Identification to species is not always possible and the field of view is limited; however, deployments in intertidal salt marsh creeks have revealed patterns of tidal movements, feeding behavior, predator-prey interactions, and other activities
Photo: D.M. Allen

Advances in technology have provided new options for answering questions about the occurrence and behavior of nekton in estuaries. Video cameras have enabled researchers to observe behavior and count and measure fishes and invertebrates, especially in clear water. More recent developments of sonar-based imaging instruments have extended that ability in turbid systems. Refinement of that technology and the analysis of the output holds much promise.

The need to understand movements and migrations of nekton species beyond the range of cameras has been enhanced by tag and recapture techniques. Externally visible tags still work; however, electronic tags (some that need to be activated, others that broadcast signals) have expanded options for understanding movements on many scales. The timing and destinations of tidal, diel, seasonal, and annual migrations of many fishes and motile invertebrates continue to be revealed. Tags have also been used to identify home ranges and demonstrate site fidelity for a wide range of species. A tendency for many resident and young transient species to remain in unexpectedly small areas for extended periods has been widely recognized. Coupling this knowledge with a better understanding of how changes in habitat and water quality affect the physiology and behavior of estuarine species will likely improve management on local and broader scales.

Early researchers tended to focus on single species, especially those which supported fisheries. There is a growing recognition that single species cannot be understood or managed without considering all of the other species (including their prey) that share their habitats. An increased appreciation for interdependency among constituents and the complexity of ecosystems has led to better decisions for both estuarine systems and living resources. Just how estuaries function as nurseries remains a critical focus in the study of nekton ecology.[3] Often overlooked is that nekton are more than just users of habitat; most play roles in both maintaining and changing their habitats. In this time of significant challenges imposed by human activities and changing climate, it is more important than ever to direct research towards social behavior, physiology, trophic dynamics, and impacts of fishery harvests as they relate to habitats and food web structure within and between ocean, estuarine, and riverine ecosystems.

(continued)

Sunset at Oyster Bay National Wildlife Refuge, Long Island

Photo: Sheldon Pollack

Nekton Ecology... *(continued)*

To address relationships and processes, researchers in estuaries appear to rely less on the use of manipulative field experiments than our colleagues working in freshwater and terrestrial systems. Recognizing that variability imposed by tides adds another level of complexity in coastal systems, increased uses of experiments could prove valuable in addressing many questions. This is not to say that that the need for descriptive data from field sampling is any less important than it always has been. Long-term collection programs that maintain consistency in methodology are key to documenting and interpreting change in our changing world. For example, our multi-decadal datasets for nekton and zooplankton (including larval invertebrates and fishes) in North Inlet estuary, South Carolina, continue to reveal decreases in abundances in key populations, shifts in the timing of reproduction and migrations, and changes in community structure as water temperature and sea level increase.[4,5] More long-term studies in other estuaries are needed to understand the mechanisms and consequences of climate change and human activities. Experiments and field surveys conducted simultaneously in multiple estuaries representing a wide range of settings and environmental conditions are likely to show important commonalities and differences in relationships and processes. Increased communication and coordination among researchers has been and can be further facilitated through CERF.

The study of estuarine nekton has come a long way, but much remains to be learned. Acquisition of new information and efforts by scientists to assist in the application of existing knowledge has not kept up with the immediate needs of decision-makers who manage shallow-water ecosystems and resources. Improving these endeavors is critical to the well-being of the world's estuaries and the welfare of humans in the next 50 years and beyond.

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Early Efforts to Culture Microscopic Oyster Larvae, 1878–1920

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Larvae of eastern oysters *Crassostrea virginica* grow in about three weeks from a ~60 µm zygote to a ~350 µm larva competent (i.e., ready) to settle as spat. A modern hatchery like that at Horn Point Laboratory on the Choptank River outside Cambridge, Maryland, can produce billions of competent larvae annually, with hundreds of millions settling as spat for use in restoration and research.[1] Such production depends on a sophisticated seawater system that heats or cools estuarine water for holding broodstock, for stimulating spawning, and for culturing algal food for the growing larvae and spat.[2] Culture water is filtered regularly to capture larvae, which are then transferred into clean water and fed on schedules determined by culture conditions and larval age.

Now, flash back 14 decades. Researchers struggled for years in the late 19th century to spawn and keep small numbers of larvae alive in culture for more than a few days. Experiments began in 1878–1879 when Professor W.K. Brooks of Johns Hopkins University, copying fish culturists, mixed gametes stripped from sacrificed oysters to produce larvae. But he could not refresh his cultures by removing the microscopic larvae from their culture vessels (watch glasses, tumblers, beakers), which became depleted of phytoplankton, crowded with other microzooplankton, and contaminated with waste. The metal screens of the time had mesh sizes too large to trap his larvae, which survived for no more than six days.

In 1882, Brooks' assistant H.J. Rice used 8-cm-wide strips of white flannel to wick water away from a culture tumbler, with one end extending about halfway down inside the tumbler and the other hanging over the vessel's lip in the air. Later, to keep larvae from being entangled in the wicks, Rice placed a glass oil-lamp chimney upright near the tumbler's edge, with larvae swimming outside the chimney while the chimney supported the wicks. Another cloth strip hanging from an elevated reservoir wicked clean water down into the tumbler. Rice estimated that he exchanged 8 L per day with this system. To keep culture temperatures steady, he stood the reservoir and tumbler in a stream of water from a fire hydrant, and used a syringe to produce strong currents in the tumbler several times a day. Before his research ended, he was able to keep small numbers of larvae alive for up to 14 days.

From 1880 to 1885, U.S. Fish Commission embryologist John A. Ryder worked incessantly on the problem of separating larvae from old culture water and placing them in new water, as well as rearing larvae in constructed coastal ponds. He built 20 forms of incubating apparatus "… ranging in size from less than a cubic foot to large ponds four feet deep and several hundred square yards in area." In 1882, he modified a glass-jar system used by fish culturists to separate live fish eggs from dead. There were five tiers to his system. The first was an elevated cylindrical reservoir of estuarine water filtered through a large mass of cotton wool. A rubber tube siphoned that water to two culture jars of larvae on the next level, then another tube moved water from the jars to a third-level aquarium containing seagrass to provide O_2 and absorb CO_2. Aquarium water was siphoned to a fourth-level pair of culture jars of larvae, with the water finally siphoned to a cylinder on the floor. The siphons held cotton filters to retain larvae and water baths around the jars dampened temperature fluctuations. Workers dipped water from the floor cylinder to the upper cylinder by day and night. Many experiments with this system did not produce competent larvae. Meanwhile, contemporaneous experiments by Navy Lieutenant Francis Winslow involving tumblers, soup plates, dinner platters, funnels, and bubbled air resulted in small culture systems that did not require filters (Fig 1).[3]

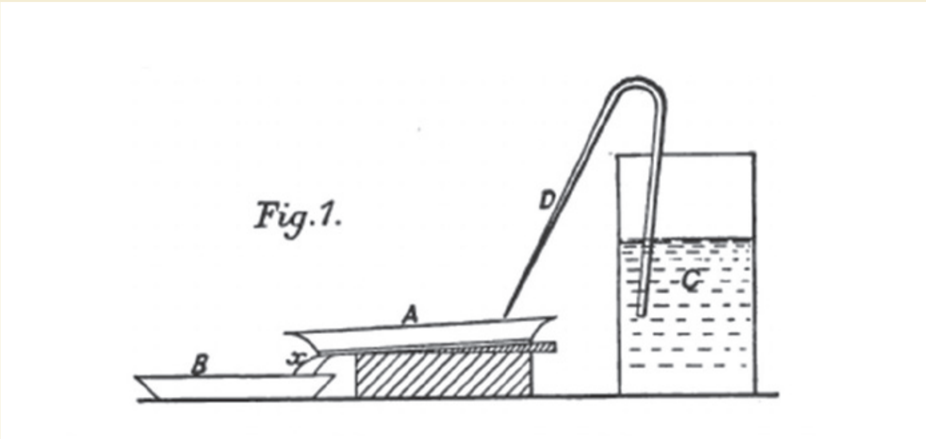

Fig. 1. Francis Winslow's 1884 use of dinner plates by which swimming oyster trochophore larvae in A are washed gently to B by a small amount of water siphoned from C, leaving unfertilized eggs or dead larvae behind

Fig. 2. William Wells with the clarifier he used to separate oyster larvae from old culture water, pictured behind him

Winslow learned of the effects of temperature on early larval development and the deleterious effects of crowded conditions on larval survival but never reared competent larvae in these systems.

Ryder experimented with bolting cloth, filter paper, and cotton wool pads as filters for retaining larvae in 17 of his lab-based systems. By 1887, he concluded that "The trouble with filters, of any form whatsoever, is that they soon clog and become useless. They can never be successfully used in any practical system of propagation." He gave up on laboratory systems and focused on using estuarine ponds. Coastal ponds holding a variety of settlement material (tree branches, cement-coated tiles and slates, shells) for larvae of the flat oyster *Ostrea edulis* had been used in Europe since Roman times. For about a decade, Ryder released young artificially fertilized larvae into ponds he built near the Potomac River, near Chincoteague Bay, and in New Jersey. He tested numerous types of spat collectors and developed three systems of "condensed spat-culture" involving ponds, tidewater ditches, or inclined troughs holding oyster shell as settlement material before finishing his work inconclusively around 1891. Other investigators continued similar experiments in Maryland and New York into the early 20th century, also with limited settlement success.

In 1920, a technological breakthrough finally allowed mass culture of bivalve larvae. William Wells used a milk clarifier (a centrifuge that removes particles from milk) to separate oyster larvae from old culture water (Fig. 2).[4] Ryder had earlier found that larvae that passed through pumps were not injured, so being whirled in a clarifier was tolerable. Concentrated larvae from within the clarifier could be transferred to new water. Wells centrifuged developing larvae daily, providing new water and eventually settlement material when larvae became competent. In this way he grew thousands of larvae to settlement (Fig. 3).[5] In later years, nylon screens of different mesh sizes replaced the use of clarifiers. Subsequent research elucidated optimal spawning and growing conditions and developed algal strains as larval food, leading to today's highly mechanized and productive hatcheries.

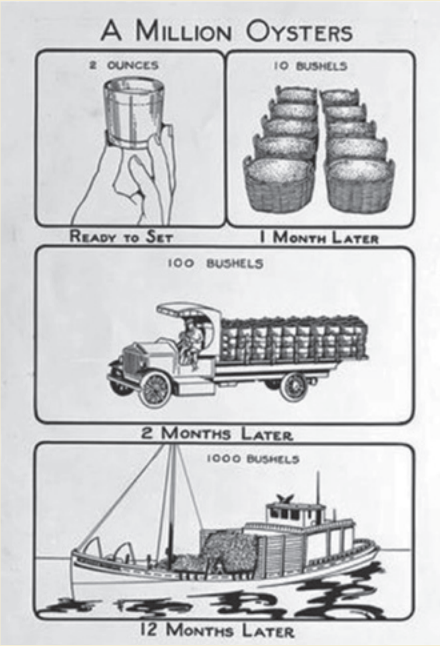

Fig. 3. William Wells' 1922 diagram of how competent oyster larvae can yield spat for oyster bed restoration

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Note: More details and illustrative figures are in V.S. Kennedy. *2014. Technological constraints during the first 40 years of eastern oyster* Crassostrea virginica *aquaculture.* Reviews in Fishery Science and Aquaculture *22:55–72.*

Seagrasses: A Half Century of Progress and a Look to the Future

Bob Orth[1], Ken Heck[2], Jon Lefcheck[3], and Jessie Jarvis[4]

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Seagrasses are well-known to be extraordinarily productive habitat-forming foundation species that have successfully colonized all shallow estuarine and coastal regions of the world except for the most polar seas. We now understand that seagrasses are critically important coastal habitats that provide numerous ecosystem services, including provision of nursery habitat, carbon sequestration, increased water quality, reduced human pathogens, enhanced local biodiversity, and a food source for threatened mega-herbivores.

Like many other ecosystems, seagrasses face many emerging challenges associated with global environmental change, including warming temperatures, increasing runoff and eutrophication, decreasing pH and dissolved oxygen concentrations, and tropicalization of herbivorous fishes and invertebrates. Because seagrasses have the highest light requirements of any plant on Earth, they are particularly sensitive to these changes and therefore serve as sentinel species and harbingers of declining conditions.

Early seagrass ecology focused on establishing a baseline for the biology and ecology of these underwater plants. Seminal articles from the late 1800s through 1970s demonstrated how the distribution of seagrasses was declining due to widespread wasting disease and other disturbances, such as hurricanes. At the same time, scientists also documented the reproductive biology and ecology of seagrasses, including the identification of hydrophilic pollination, which became one of the defining characteristics for this broad ecological grouping of plants.

These early studies set the stage for future work seeking to expand on these topics and, critically, link them to management outcomes. Long-term mapping and monitoring programs in places like Chesapeake and Tampa Bays allowed for large-scale assessments of nutrient mitigation practices leading to unprecedented resurgence of grasses in these regions, validating multi-decadal efforts to curb nutrient pollution.[1, 2] An improved understanding of seed ecology has led to increased restoration success.[3] Hundreds of studies have now established that dense and extensive seagrass meadows are vital habitats that increase faunal density and diversity,[4] particularly of juveniles and of commercially important and threatened species.[5]

We now know much more about the roles small invertebrates play in plant production by removing epiphytes and their importance in top-down control of seagrass health versus traditional bottom up influences.[6] Mesocosm experiments in the early 2000s were also some of the first to link this increased biodiversity to the delivery of ecosystem services such as production and nutrient cycling, helping to cement biodiversity conservation as a cornerstone of sustainable management.[7] Increases in the use of 'omics' since the 2010s have provided a greater understanding of the evolution and adaptation of seagrasses to life in the marine environment, results that provide a greater understanding of angiosperm response to climate related stressors.[8] Finally, comparative analysis revealed that seagrasses can sequester carbon in sediments, sometimes as much per unit area as prominent terrestrial systems such as temperate forests. It has been suggested that 10–20% of all ocean's carbon is somehow bound by seagrasses.[9]

Emerging technologies have also increased our capacity to solve new mysteries about seagrass systems. Genetic tools have permitted finer delineation of evolutionary relationships leading to species reclassifications, which are currently being used to revisit IUCN Red List classifications for all current seagrass species, and a better understanding of the phylogeography of this clade.[10] These tools have also allowed us to evaluate the spatial extent of seagrass clones and the relative importance of sexual reproduction in determining the size of seagrass populations.[11] They also help to understand the role intraspecific genetic diversity plays in mediating response to disturbance[12] and in promoting restoration success.[13] Increased availability of high-resolution satellite imagery has vastly increased our ability to remotely map and monitor seagrasses, particularly in tropical areas with good water quality (such as the Mediterranean and Australian waters).[14, 15] Finally, coordinated experiments have increased both the reach and impact of seagrass science through organizations like SeagrassNet, Seagrass

Watch and the Zostera and Thalassia Experimental Networks. These programs provide a global baseline for gauging change and can further validate and generalize long-standing principles in the field.

Nevertheless, challenges exist. A major issue facing all scientific fields is inclusivity, both geographically and otherwise. Most published seagrass work has occurred in North America, Europe, and Australia,[16] while research in areas such as the Indo-West Pacific, a hotspot of seagrass biodiversity, is under-represented in the literature.[17] The lack of up-to-date information on seagrass status and condition over large geographic regions, including most of Africa and deep-water meadows in the Indian Ocean, are due in a large part to a want of resources necessary to access technologies to reliably detect seagrass habitats.[18] This results in low awareness of the societal importance of seagrasses, leading to increased local stressors, ineffective management, and a reduction in the success of regional seagrass conservation efforts.[19] As stressed in a recent UN report highlighting the importance of seagrasses globally, including, supporting, and championing the seagrass research in geographic regions currently under-represented at scientific meetings and in the literature is essential to ensure a better understanding of the world's seagrass ecosystems.[20]

Further interesting questions include the integration of seagrasses into seascape ecology, particularly with respect to the movement of individuals among habitats throughout their life histories, and what this means for the recruitment of these organisms to adult populations.[21] Similarly, the co-benefits that arise from rhizome-associated lucinid bivalves or nitrogen-fixing bacteria are relatively unexplored, but exciting new evidence suggests these mutualisms can improve local abiotic conditions and relieve anoxic stress.[22] Herbivorous fauna will also garner more attention as they expand into novel seagrass habitats with climate change and directly consume seagrass, as has now been observed in western Australia.[23] Megaherbivores, in particular, may introduce dramatic changes as they alter the three-dimensional structure, and therefore habitat value, in places where they have not been observed before, or in places where their populations have recovered substantially, such as sea turtles in Bermuda.[24] Finally, seagrasses could play a more prominent role in marine spatial planning, such as the recent establishment of the Nature Coast Aquatic Preserve on the Gulf Coast of Florida, and in international management plans, such as their inclusion in carbon budgets under the Nationally Determined Contributions mandated by the Paris Agreement.

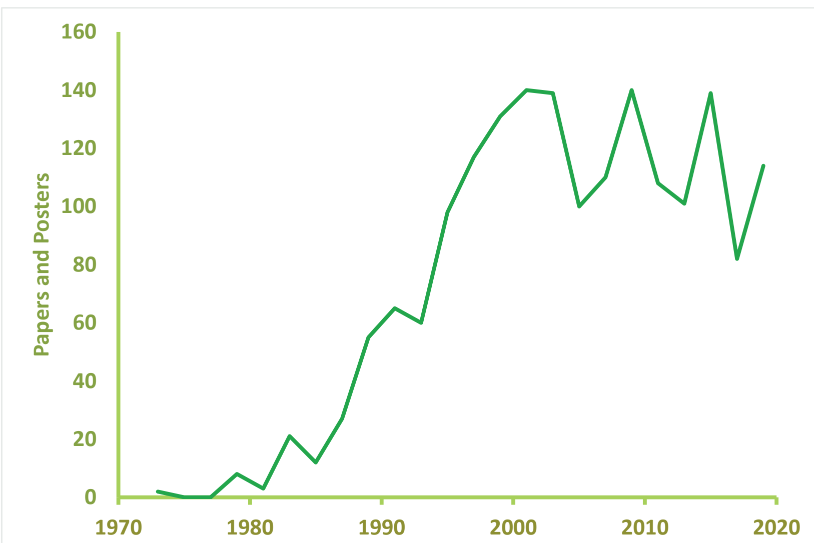

Fig. 1. Number of seagrass papers and posters presented at CERF conferences by year

The CERF biennial meetings have served as an important vehicle in advancing seagrass research, paralleling the increasing interest in seagrasses worldwide. From very few papers on seagrasses in the early days of the meetings to today, where over 100 papers and posters are presented on all different aspects of seagrass from mapping and monitoring, to modelling, physiology, faunal interactions, to tropicalization (Fig. 1). These papers and posters are being presented by many young students and faculty from an ever-growing number of countries who represent the future of seagrass science. Our hope is that CERF will continue to be open to the diversity of ongoing seagrass research worldwide and be a place that fosters the interactions among scientists and managers that results in better conservation and management of this very important but threatened habitat.

Note: References for this article can be found at https://www.cerf.science/cerf-s-up--47-1--bulletin---additional-materials

Diagnostic Timescales: Old Concepts, New Methods, and the Ageless Power of Simplification

Lisa V. Lucas[1] and Eric Deleersnijder[2]
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Don't throw the past away
You might need it some rainy day
Dreams can come true again
When everything old is new again

"Everything Old is New Again"
–Peter Allen and Carole Bayer Sager

The theory underlying the well-known diagnostic timescale "residence time" dates back more than a century to its genesis in chemical engineering.[1,2] Other physical and biological timescales commonly used in the natural sciences and engineering—such as flushing time,[3] water age,[3] turnover time,[4,5] e-folding time,[6] and doubling time[7,8]—were implemented at least as early as the 1920s–1950s. Prior to the era of computational numerical modeling, assessment of such timescales relied upon experimentation, observation, and/or analytical derivation. These timescales were used (1) to characterize or condense experimental or observational data,[3,5] and (2) to convey, in a simple manner, information about the state or functioning of a system.[2,3,8]

Through subsequent decades, diagnostic timescales have helped us distill complexity into intuitively meaningful metrics[9-12] and have aided us in making sense of natural or anthropogenic phenomena.[13-18] For example, a long hydraulic residence time—which encapsulates the overall retentive effect of potentially complex, three-dimensional hydrodynamic processes—might help explain algal biomass build-up or nutrient depletion in an estuary. It can be argued that in the environmental sciences such simplification and distillation power is now needed more than ever, given the daunting volumes of data generated by in situ, vessel-based, and remote observing platforms, as well as by high-resolution, multi-dimensional computer models. Giga-, tera-, and petabytes of data are, after all, not very useful unless meaningful information (such as the identification of key processes or causal relationships) can be extracted from them.[19,20]

Diagnostic timescales—parameters that estimate how long processes take—represent an old tool for tackling this relatively new problem of "too much data."[19-21] They can provide an approximate means of extracting the essence from large, detailed datasets[22] (e.g., the amount of time for which an estuary is exposed to an imported contaminant before it is lost to the sea). A timescale can also convert a primitive variable (e.g., velocity) into a more meaningful number[20] conveying the material effect of the variable in the context of the specific problem under study (e.g., the time for planktonic food subsidies to advect from a productive source region to an unproductive area).[22] In addition, because they all carry the same units (time), timescales describing different biological, geochemical, or physical phenomena can be directly compared to each other, thus bridging disciplinary divides and providing a simple way to identify the fastest, and sometimes dominant, process(es).[18,22,23] Furthermore, diagnostic timescales can prove useful in spatial or temporal system comparisons,[24-26] in the development of simple algebraic "pencil and paper" models,[27,28] and in quantifying connectivity between regions.[12,29,30]

Technological advances leading to our current data boom have thus produced a distillation challenge to which simplification tools like timescales may lend a hand. In parallel, technology and advanced mathematical methods have also led to increasingly powerful approaches for quantifying timescales, with greater temporal and spatial resolution than ever before. For example, high-resolution, multi-dimensional numerical models, in which virtual particles or tracers are transported by computed velocities and diffusivities, are now commonly used to calculate transport timescales such as water age[31,32] (elapsed time since entering[33-35]), exposure time[12,32,36] (time that will be spent in the domain), or residence time[32,37,38] (a variant of the exposure time[22,39]; Fig. 1). Reactions can also be accounted for alongside transport,[40] resulting in timescales that are "holistic", i.e., capturing the influence of a broad collection of processes in a single parameter.[22] Usually, computation-based timescales are obtained via forward schemes,[37,41,42] which involve running a transport model in the usual way: forward in time. Such approaches traditionally have required multiple simulations if one wished to quantify a timescale as a function of time. Advanced methods developed over the last couple of decades, however, provide an antidote to that requirement, allowing for the computation of spatially and temporally variable timescales with a single simulation.[43-45] These approaches include: (1) forward methods for water age that require

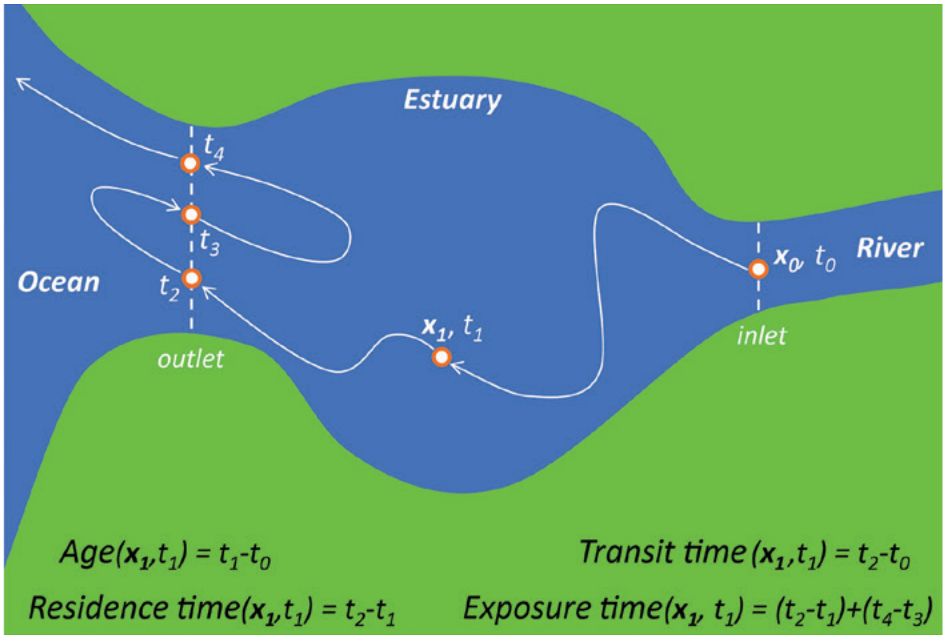


Fig. 1. Schematic describing relationships between core transport timescales: water age, residence time, transit time, and exposure time, following Zimmerman,[35] Delhez,[39] and many others. Reprinted from Lucas and Deleersnijder[22]

solution of an evolution equation for the "age concentration,"[29,43,44] and (2) adjoint methods for residence time and exposure time, which involve running a numerical transport model in reverse.[36,45] These newer approaches can be applied not only to water and tracers, but also to particulate matter and substances adsorbed onto sediment particles.[46-50] Their application is becoming increasingly common for the world's coastal systems.[51-55]

Similar advances have occurred in field instrumentation, allowing for more detailed assessments of field-based transport timescales than was possible several decades ago. For example, drifters—Lagrangian devices released into a water body to follow water parcels and often used to quantify transport time[56-58]—are now frequently GPS-equipped, eliminating the need to physically follow their trajectories (by vessel) and making it possible to track hundreds of drifters and collect thousands of drifter-days of data in a single study.[59] Methods for conducting field studies with natural or artificial tracers have also improved over time. For example, modern vessel-based instrumentation permits high-frequency measurement of stable isotopes and other water quality parameters along a high-speed boat track, allowing for the spatial mapping of water age and potentially related variables such as chlorophyll a or nutrient concentrations.[60]

Diverse diagnostic timescales—such as those for algal growth, oxygen consumption, nutrient uptake, advective or diffusive transport, or sedimentation of particles—can be compared with each other to discern the fastest process(es) operating in a system or influencing a constituent of interest.[22,28] They can also form the basis of very simple (e.g., box, steady state) mathematical models that, despite their simplicity, can perform well quantitatively.[16,27] In some cases, the timescale comparison (i.e., their ratio) essentially is a model, with that ratio representing the balance between two critical processes and serving as an indicator of likely ecosystem response. (For example, the ratio of an oxygen consumption timescale to a residence time has been shown to be a useful indicator of hypoxia occurrence.)[10] Such simple, timescale-based models offer a useful counterbalance to (and intuitive, back-of-the-envelope check on) more complex numerical models, which (1) tend to be computationally demanding,[22] (2) may be difficult to use, and (3) are not available to every scientist or resource manager desiring a quick, approximate answer to a question.

Diagnostic timescale estimation, a century-old scientific and engineering approach, has arguably never been more useful than it is today for integrating physical, biological, and geochemical processes and distilling large amounts of data. Timescale evaluation complements the analysis of primitive variables[20] and, in the process, helps shed new light on the functioning of complex systems. Moreover, diagnostic timescales can form the foundation of simple mathematical models[16,27,61] that provide a convenient and accessible alternative—or companion—to computationally demanding expert models.[22] Despite being old in concept, the usefulness of diagnostic timescales has only expanded, and in recent decades their methods of estimation have significantly improved in terms of resolution.[43-45,59,60] Perhaps their most enduring value to estuarine and coastal science, specifically, is their utility in encapsulating the complexity of real ecosystems—helping us identify the essential components of our conceptual models and attaching approximate values to them. Diagnostic timescales demonstrate that the power of simplification never gets old.

Note: References for this article can be found at cerf.science/cerf-s-up-47-1--bulletin---additional-materials. *If the reader wishes to learn more about diagnostic timescale definitions, methods, and applications in the coastal zone, they are encouraged to check out the authors' recent review paper on the topic at* Lucas and Deleersnijder 2020.

In light of the continuing COVID-19 pandemic and uncertainty about when it will once again be safe to travel and congregate in large groups, the CERF Governing Board has made the difficult decision to hold the CERF 2021 conference virtually. This decision was made after a great deal of analysis at the latest point possible in the meeting planning process. The decision to hold CERF 2021 virtually reflects the need to protect the health and safety of all attendees while still serving our mission.

The conference planning committee has been working for many months to produce an exciting meeting that showcases our science and its application to management of our coastlines, provides opportunities to network, and celebrates the 50th anniversary of the Federation. While we lament the loss of coming together in person for CERF 2021, we recognize a virtual format offers us exciting new opportunities for innovation. We anticipate an inclusive conference, enhanced international participation, and new ways to present exciting ideas, all while reducing our carbon footprint. Expect to see more about the conference format, including the call for abstracts, in the coming months.

Call for Photos Celebrating CERF's 50th Anniversary

We are gathering photos from CERF's past 50 years to use in the *CERF's Up!* bulletin this anniversary year. If you have historical photos showing field studies, lab work, people, or meetings, please send them to bulletin@cerf.science. Photos taken at the same spot in the 1970s and again recently that show change would be fun. Please send as jpg files, high resolution if possible, and include a caption and photo credit.

Save the Dates!

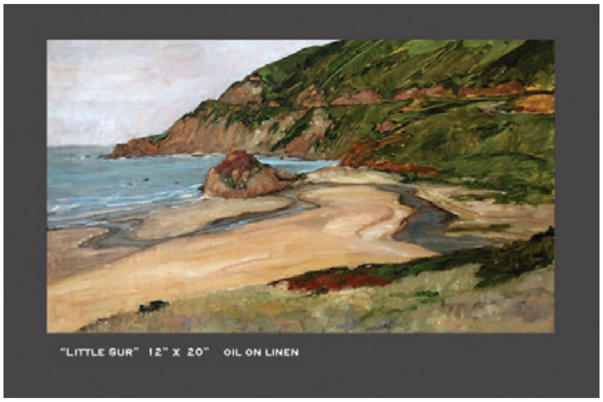
The CERF 2021 virtual conference will be held 1-4 and 8-11 November. Based on feedback from our members, we have decided to spread the conference over two weeks with shorter days. We look forward to having you join us in November!

CERF 2021 Conference Art: Little Sur—From Past to Future

Elizabeth Lacey, Associate Professor of Marine Science, Stockton University, Galloway, New Jersey, USA

The CERF 2021 "Celebrating our Past, Charting Our Future" virtual meeting will feature work by conference artist Alice McEnerney Cook. In each bulletin leading up to the virtual conference, an estuary from Alice's collection will be featured and perspective shared from CERF members as they reflect on the estuary's past and its chart towards the future.

Little Sur estuary lies along the Central California coast and receives waters from the Ventana Wilderness at the base of the Santa Lucia Mountains. The region has been identified as a coastal resource of national significance; it is home to important fish spawning grounds and rare and endangered plants and wildlife (e.g., California condor, steelhead, Santa Lucia fir). Habitats within the Little Sur estuary include some of the largest sand dunes along the Big Sur Coast and large stands of pristine redwood forests. The estuary's habitats and resources as well as much of its watershed are privately owned and therefore public access is limited. For many researchers, the struggle for access to the estuary as a result of the political conflicts has limited their ability to track the status of the estuary and its resources. Regional state, county, and nonprofit agencies continue to work with private landowners on land use practices and water rights to reduce environmental impacts from ranch and tourism developments. Despite these challenges from the Little Sur past, the chart for the future shows promise after a July 2020 announcement that 486 ha (1,200 acres) of



Little Sur along the California coastline. Oil on linen. 12" x 20". Painted in 2000 by CERF 2021 Conference Artist Alice McEnerney Cook. http://mcenerneycook.com/

land along the north side of the river would be repatriated to the Esselen Tribe of Monterey County. As climate journalist Eric Holthaus states, "One of the best climate solutions is giving Indigenous people their land back." For researchers, there remains a continued interest in studying the impacts of both development and natural processes in the understudied region. As many CERF members can attest, ecological research goals often intersect with sociological perspectives on land and water rights. Learn more about the Esselen Tribe at esselentribe.org.

CERF 2021

26TH BIENNIAL CONFERENCE

CERF AT 50: CELEBRATING OUR PAST, CHARTING OUR FUTURE

1–4 and 8–11 November 2021

2021 CERF 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

Mill Neck Bay at Oyster Bay National Wildlife Refuge, just north of Plainview on Long Island (site of first Estuarine Research Federation meeting in 1971)

Photo: Sheldon Pollack

CERF's Rising TIDES Conference Program Continues to Grow

CERF's Rising TIDES (Toward an Inclusive, Diverse, and Enriched Society) Conference Program (RTCP) will expand, substantially, in 2021 thanks to a new $99,999 grant from the National Science Foundation (NSF, Award No. 2036515) through the Geoscience Opportunities for Leadership in Diversity—Expanding the Network (GOLD—EN) program. This is the third grant awarded by the NSF to support the program that began in 2017. The new award is led by Principal Investigator (PI) and CERF Executive Director Susan Park and Co-PIs Treda Grayson and Kristin Wilson Grimes (CERF's Broadening Participation Council Co-Chairs), and Hilary Neckles (CERF Past President).

RTCP 2021 will include diversity, equity, and inclusion (DEI) efforts at CERF's 2021 Biennial Conference and at regional Affiliate Society meetings that follow. Specifically, these efforts will (1) enhance professional and leadership development for students from groups underrepresented in science, technology, engineering, and mathematics (STEM) through workshops, scientific sessions, and other conference and post-conference activities, (2) build the capacity of CERF to achieve DEI objectives through an inclusion-focused workshop open to all attendees of the CERF Conference and through additional learning opportunities, and (3) ensure broad reach to the CERF community by infusing DEI conversations throughout the CERF Conference and the Federation. The 2021 program will welcome 16 new students and 10 RTCP student alumni as participants, providing new networking, training, and tools to help them achieve career goals; provide training and support to six new mentors to increase mentorship capacity; provide implicit bias training to an estimated 50 individuals through a pre-conference workshop; and support other DEI initiatives within the conference. New this year, the 2021 RTCP students will be supported to attend Affiliate Society meetings in their region following CERF's biennial meeting. New also will be an external evaluation of all RTCP activities.

More information, including the application process, is available at https://conference.cerf.science/2021-rising-tides-conference-program.

New CERF Award Recognizes Contributions to Diversity, Equity, Inclusion, and Justice

CERF has a new scientific award that recognizes the significant contributions of an individual who has worked for greater diversity, equity, inclusion, and justice (DEIJ) in estuarine and coastal science, management, education, and/or stewardship.

CERF's Broadening Participation Council created the award in response to the events of 2020, including the Black Lives Matter movement, and in recognition that DEIJ efforts often go unrecognized and unrewarded by organizations and academic institutions through standard review processes. Yet, DEIJ efforts are fundamental to broadening participation in STEM to improve science and strengthen management decisions.

The new award honors an individual who demonstrates exceptional long-term or emerging leadership and commitment to positive change in DEIJ and is open to individuals in any career stage. The award received unanimous support from CERF's Governing Board at the Fall 2020 meeting.

CERF's Broadening Participation Council Co-Chair, Kristin Wilson Grimes, observes, "CERF is a leader among professional societies by creating an award that recognizes the efforts of individuals committed to greater DEIJ within our professions. CERF's Broadening Participation Council is proud to have created this new award to recognize the importance of this work and the value it brings to CERF, science, and society." Co-Chair Treda Grayson adds, "DEIJ work requires dedication and is often not easy, and I am pleased that CERF can now honor individuals who go above and beyond—sometimes unnoticed—to ensure that our field embraces and accepts all."

Scientific Awards

Submit a Nomination for the 2021 Scientific Awards

We invite and urge you to nominate a colleague, mentor, and/or former student for a prestigious Coastal and Estuarine Research Federation Scientific Award. The awards nominations deadline is 7 April 2021. Recipients will be selected in May and announced on the website soon after.

How to Nominate

Each award accepts nominations differently. Visit conference.cerf.science/cerf-2021-scientific-awards to read more in-depth about each award and its nomination procedures.

If you have questions regarding the awards procedure or nominations, please contact the CERF Scientific Awards Committee Chair Robert Orth (jjorth@vims.edu), or consult with the chair of the specific award subcommittee.

Student/Early Career Participation Award

Thinking about attending CERF 2021? Need assistance with participation? Apply for a Student/Early Career Participation Award!

CERF provides participation awards to support student and early career members attending and virtually presenting at CERF 2021. Students and early career professionals in need of financial assistance to attend the 2021 conference may request support from CERF's William E. Odum/Scott Nixon Memorial Fund for Student Activities. Awards typically range from $150 to $300 per person. Student/Early Career Participation Awards are strictly to offset CERF 2021 expenses such as registration, technology/equipment, and/or childcare for virtual attendance. Students can use this award as leverage to gain additional support from their academic department or employer.

To apply for Student/Early Career Participation Awards, please fill out our Google form [https://forms.gle/fEsH26ftpUvDWMKN6]. If you are an early career professional accepting a Participation award, you agree to volunteer as a student judge, and someone from that committee will reach out to you directly to coordinate your role as a judge. If you have any questions before applying, please email CERF2021StudentTravel@gmail.com.
– Emily Rivest & Chellby Kilheffer, Chairs.

Photo credit: Sandra Huynh

Virtual Meeting Mentorship Program

Wanted! Experienced CERF attendees and first-timers at any point in their career: Be a mentor or a mentee at CERF 2021.

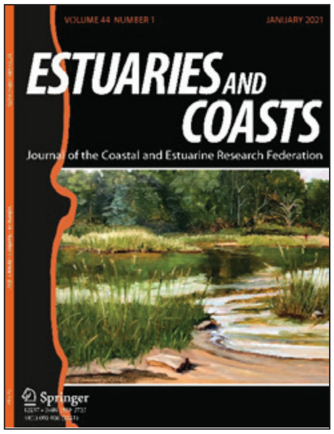
The CERF 2021 organizing committee invites you to participate in the Virtual Meeting Mentoring Program. Anyone attending the meeting has potential to participate in the program. You are never too young to be a mentor. Good mentors can be senior graduate students, post-doctoral fellows, and venerable clams (long-time ERF-CERF members); the only requirement to be a mentor is that you have attended previous CERF meetings, have experience in an area of estuarine or coastal science, are an excellent listener, and have a genuine interest in helping other meeting attendees develop personally and professionally. You are never too old to be mentored. First-time and international attendees especially are encouraged to sign up for the mentoring program.

Mentors and mentees should sign up when registering for the meeting. They will be paired by the mentoring program and are then responsible to exchange emails with one another prior to the meeting (or communicate in some other way), and be available to meet (virtually) on an ad-hoc basis prior to and during the meeting as suits each mentor-mentee pair.

For more information about the Virtual Meeting Mentoring Program, please visit https://conference.cerf.science/mentorship-program, or contact Mike Allen (mallen@mdsg.umd.edu) or Christina Bonsell (cebonsell@gmail.com). Look for more details on the CERF registration form and in upcoming articles in CERF bulletins.

Estuaries and Coasts Update

Paul Montagna and Charles (Si) Simenstad, Co-Editors-in-Chief; Ken Heck, Reviews Editor; and Taylor Bowen, Managing Editor



A new cover image is selected for *Estuaries and Coasts* (ESCO) each year. Anticipating CERF 2021, the journal cover will feature original artwork from Alice McEnerney Cook, the conference artist. The painting is of Indian Field Creek marsh, located at the confluence with the York River near Yorktown, Virginia, USA. Other paintings by Cook will be exhibited at the CERF 2021 Conference and examples of her work can be seen at http://www.mcenerneycook.com. This is the first time the ESCO cover will feature original art.

Retiring ESCO Editorial Board members

We wish to acknowledge the contributions of Associate Editors (AEs) who have devotedly served their terms and have retired from the Editorial Board:

- *Nancy Jackson*, New Jersey Institute of Technology, USA (20 years)
- *Marianne Holmer,* Southern Danish University, Denmark (11 years)
- *Carolyn Currin*, NOAA National Centers for Coastal Ocean Science, USA (10 years)
- *Deana Erdner,* University of Texas at Austin, USA (8 years)
- *William Boicourt*, University of Maryland Horn Point Lab, USA (7 years)
- *Reide Corbett*, East Carolina University, USA (5 years)

New ESCO Editorial Board members

New AEs have also joined the Editorial Board with a four-year term commitment:

- *Ronald Baker,* University of South Alabama, Dauphin Island Sea Lab, USA
- *Kevin Boswell,* Institute of the Environment, Florida International University, USA
- *Nathan Geraldi,* King Abdullah University of Science and Technology, Saudi Arabia
- *Holly Greening*, CoastWise Partners, USA
- *Jill Olin*, Great Lakes Research Station, Michigan Technological University, USA
- *Eric Powell*, Gulf Coast Research Laboratory, University of Southern Mississippi, USA
- *Eduardo Siegle,* Oceanographic Institute, University of São Paulo, Brazil

Submissions and Review Process

Amazingly, submissions continue linear growth over the last 15 years (Fig. 1). The submissions have increased by an average of 17 new and 17 revised manuscripts every year since 2004, or a total growth rate of 7% per year. We have handled over 700 total manuscripts per year since 2017.

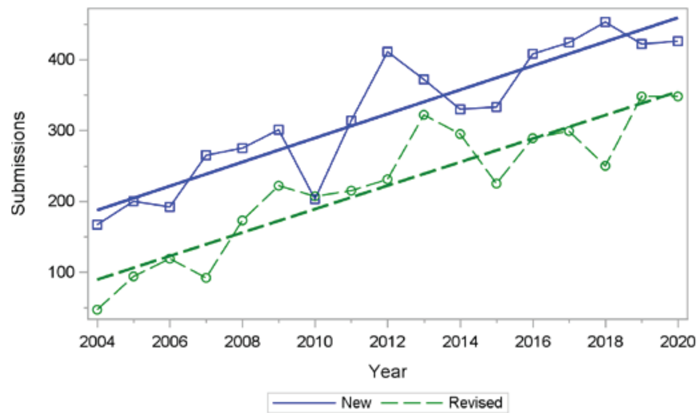


Figure 1. Trends in number of new submissions (top, blue) and revisions (bottom, green) submitted to Estuaries and Coasts *2004–2020*

However, the more notable trend is that our average time to first decision this year-to-date is only 41 days, continuing a downward trend since 2012 (Fig. 2). This average rate falls into what is considered a "fast review time" for publishing in conservation biology journals. We trust you will consider this remarkable performance by the ESCO review process when deciding where to submit your next manuscript!

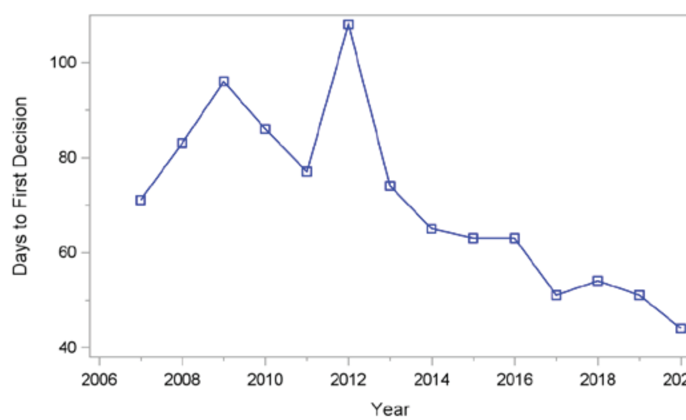


Figure 2. Average time (days) to first review decision in Estuaries and Coasts editorial process

Despite the low average time-to-first-decision, we still have some papers that can languish for months. This is always because many folks are not willing to provide reviews, and reviews are often late. On average 51% of all

Estuaries and Coasts Update…

days late. Everyone is busy, but please do your part and pay it forward. Remember, every time you submit a paper for publication, at least four people work on it: Editor in Chief, AE, and two reviewers. Therefore, you should feel that you owe the scientific enterprise four reviews for every paper you submit.

Estuaries and Coasts Metrics for 2019

Total downloads from SpringerLink: 278,031
5-year Impact Factor: 2.576
Google Scholar h5 index: 35
Total SharedIt shares: 2,631

Estuaries and Coasts Editors' Choice Papers

January 2021
Jäntti, H., S.L. Aalto, and H.W. Paerl. 2021.
Effects of Ferrous Iron and Hydrogen Sulfide on Nitrate Reduction in the Sediments of an Estuary Experiencing Hypoxia.
Estuaries and Coasts 44: 1–12. https://rdcu.be/cdsmC

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

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.

November 2020

Derelict Crab Traps Continue to Kill for Years
The benefits of removing unused traps from the Gulf of Mexico

Source: Arthur, C. et al. 2020. Estimating the Benefits of Derelict Crab Trap Removal in the Gulf of Mexico. *Estuaries and Coasts*. DOI: 10.1007/s12237-020-00812-2
https://cerf.memberclicks.net/cesn-november-2020#Article1

How Plants Influence the Resilience of Wetlands to Sea Level Rise
Salt marshes and mangrove forests trap sediment and contribute organic matter

Source: Cahoon, D.R. et al. 2020. How Plants Influence Resilience of Salt Marsh and Mangrove Wetlands to Sea-Level Rise. *Estuaries and Coasts*. DOI: 10.1007/s12237-020-00834-w https://cerf.memberclicks.net/cesn-november-2020#Article2

10 Questions to Ask About the Future of Tidal Marshes
How does the combination of climate change and urbanization affect marsh function?

Source: Gilby, B.L. et al. 2020. Human Actions Alter Tidal Marsh Seascapes and the Provision of Ecosystem Services. *Estuaries and Coasts*. DOI: 10.1007/s12237-020-00830-0 https://cerf.memberclicks.net/cesn-november-2020#Article3

A New Technique for Mapping Hard-Bottom Habits
Mapping glacial moraine deposits aids in studying the effects of offshore wind farms

Source: Guarinello, M.L. and D.A. Carey. 2020. Multimodal Approach for Benthic Impact Assessments in Moraine Habitats: a Case Study at the Block Island Wind Farm. *Estuaries and Coasts*. DOI: 10.1007/s12237-020-00818-w https://cerf.memberclicks.net/cesn-november-2020#Article4

Angels and Sustainers 2020

Angels

From 1 January to 31 December 2020, the following Federation members donated to the William E. Odum Fund, Scott W. Nixon Fund, Donald W. Pritchard Fund, CERF Enhancement Fund, and/or the CERF Legacy Fund.

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Sustainers

Many thanks to the members who joined or renewed at the Sustaining Member level in 2020. Your extra efforts on behalf of CERF will ensure the future of the Federation.

Merryl Alber
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Camm Swift
John Tanacredi
Robert Twilley
Cynthia Venn
Dara Wilber
Gary Williams
David Yoskowitz

Results from *CERF's Up!* Survey

CERF conducted a survey of members in December 2020 to see if the *CERF's Up!* bulletin is providing what they want, to find out what parts people read, how often, and if there is anything we can do to make it better.

1. Over half the respondents read every issue and another quarter read most issues.

2. Most respondents (85%) read the online version; 17% read the printed version.

3. The most widely read sections were science articles (94% of respondents), *Estuaries and Coasts* Editors' Choice papers, conference information, President's Message, and *CESN* articles.

4. The length of each issue is about right.

5. Respondents would like to see more of other types of articles (new methods, results from recent workshops, viewpoint pieces, new policy or management approaches, communicating science).

6. A few respondents plan to write an article for the bulletin; even more said they would if they had time.

7. Respondents had positive comments about the content and tone of the expanded bulletin. They liked personal stories and pictures from meetings. They would like to see more international articles. Also, more stories on new scientists, how scientists are helping with STEM programs, ways to get involved, and information on threats to specific estuaries.

Thanks to all the respondents for helping to shape our plans to make the bulletin as engaging and relevant as possible.

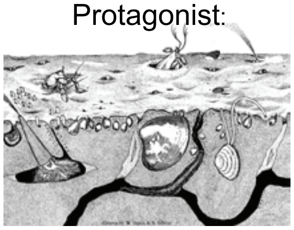
Mill Neck Creek at Oyster Bay National Wildlife Refuge, Long Island Photo: Richard Sack

A Historical Tale of Narragansett Bay Benthos

Stephen S. Hale
stephenshale@gmail.com

Characters

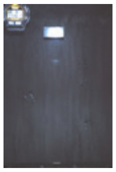
Protagonist:



W. Davis & S. Silvia

Benthos

Antagonist:



Sediment core by G.Ciccehetti

Eutrophication and hypoxia

Frenemies:

Google Earth

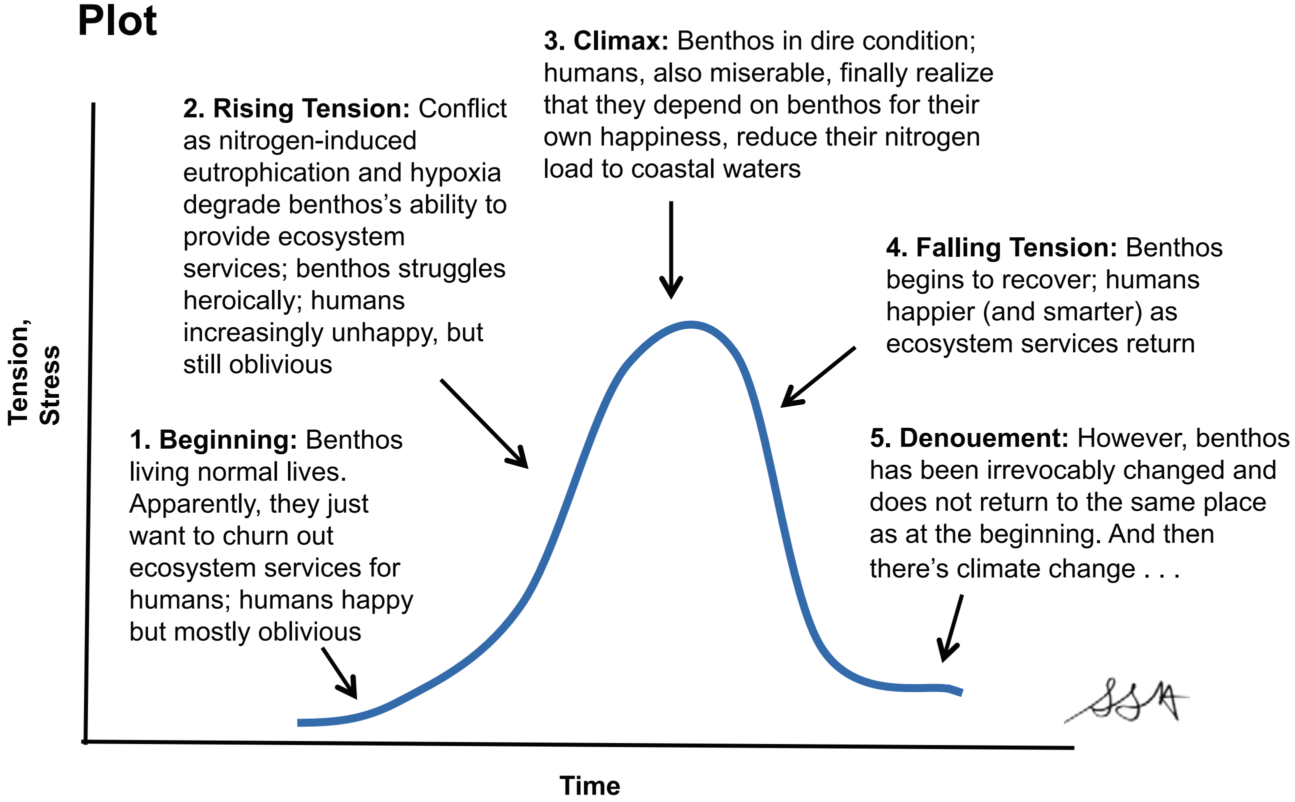
Humans

Setting

NarrBay.org

Narragansett Bay, Rhode Island

Plot



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