

# COASTWATCH

Center for Coastal Studies  
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Financial  
Reports



# Letter from the President & CEO



In January 2022, after 15 years at the helm of the Center for Coastal Studies, I will be transitioning to the role of Senior Advisor, paving the way for new leadership at the Center.

My tenure as President of CCS started with the Great Recession of 2007 to 2009 and concluded with the Great Pandemic of 2020 to 2021 - two challenges that we, as an organization, overcame, thanks to an incredibly dedicated, talented and hard-working staff, and your unwavering support and encouragement.

In the intervening years, the Center has expanded and evolved: Our staff has more than doubled in size, from 20 to 43, with 13 adjunct positions in universities and research institutions across the globe. With grants from the National Science Foundation and the Massachusetts Cultural Facilities Fund, and substantial backing from our generous supporters, we completed a green renovation of our headquarters at the Hiebert Marine Laboratory. We embraced renewable energy, installing an array of solar panels on the Lab roof, slashing our carbon footprint. Our soaring atrium houses the skeleton of the well-known humpback whale Spinnaker, and is a gathering space for students, colleagues and our community.

Over time, we evolved two key approaches to our research that distinguish CCS from most of our counterparts. The first is our commitment to a dynamic and flexible research agenda, which allows us to respond quickly to opportunities and challenges as they arise. With space to grow, our researchers have branched out into new areas of study: seafloor mapping and storm tide pathways; marine debris and plastics; benthic, seal and shark ecology. We have adopted new techniques and technologies, such as molecular

genetics, isotope analysis and unmanned aerial systems, to enhance our existing research programs. I am proud to say that we continue to produce top quality, independent research and are recognized far and wide for it.

The second is our strong emphasis on using an integrated ecosystem-based approach to our research, which brings all of our wide-ranging scientific expertise to bear on conducting **“science that matters.”** That more complete understanding of ocean and coastal ecosystems has already helped CCS scientists be more proactive in working with community leaders to support important actions to address water quality issues, save threatened marine mammal populations, help coastal communities prepare for damaging impacts from sea level rise as the planet’s climate rapidly warms, and much more.

I am incredibly proud of all the members of our CCS family whose collective efforts over the last 15 years have made and will continue to make a difference, from our science, rescue and education staff, to the office professionals who direct our financial, administrative and development work, to our dedicated and supportive volunteers, to our Board of Directors and Advisory Council, who have been the best ambassadors for CCS that we could imagine, and to you, our colleagues, members and supporters, who have made all this possible.

Our work is far from done: New challenges, particularly climate change and all that comes with it, loom ahead. As you know, all life is inextricably linked to the ocean, and as it continues to bear the brunt of global warming, the Center’s role in understanding the resulting impacts on the marine ecosystem is becoming ever more critical. I look forward to being a part of those collective efforts in the years ahead!

A handwritten signature in black ink that reads "Richard Delaney".

The Center’s Board of Directors has appointed Dr. Sarah Oktay to be the next Executive Director of the Center for Coastal Studies. Sarah was the Director of Strategic Engagement at the UC Davis John Muir Institute of the Environment; prior to that she was the Director of the UMass Boston Nantucket Field Station, where she collaborated with CCS staff on a number of projects. Sarah is a chemical oceanographer and brings a wealth of experience in coastal and ocean scientific research and educational outreach activities to CCS. We look forward to introducing you to Sarah in January 2022!

As this issue of COASTWATCH goes to press, Rich Delaney is in Glasgow, Scotland at the 2021 United Nations Climate Change Conference, or COP26. He is there as the co-founder and board president of the Global Ocean Forum, a non-governmental organization whose mission is to advance the global ocean agenda toward sustainable development for the well-being of humanity, in the context of climate change. The Global Ocean Forum will present live and virtual Ocean Action Day events to showcase why the ocean matters in climate negotiations. It aims to increase knowledge about the ocean / climate connection, and to secure more ambitious actions by all nations to reduce climate change impacts which increasingly threaten the health of the global oceans and all life on the planet.

# Education & Outreach

By summer 2021, as the world's understanding of COVID-19 transmission evolved and vaccination rates climbed, our public education and outreach efforts transitioned from the predominantly online programming of 2020 back to carefully controlled in-person activities.

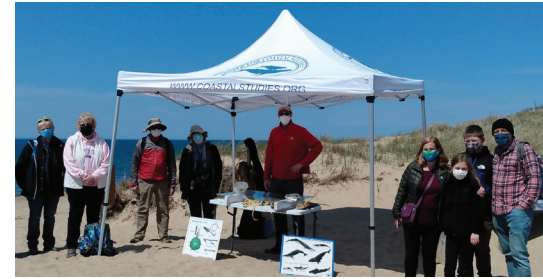
CCS-guided hikes to seal haul-outs and salt marshes were more popular than ever this year, as previously cooped-up Cape residents and visitors cautiously emerged from lockdown. CCS staff and interns 'popped-up' in tents on three local beaches, providing information on seals, sharks and other marine life, and later answering the inevitable and unceasing question, "Can a humpback whale swallow a person?" (The answer, in case you were wondering, is no; their esophagus is too small to swallow a whole human, and they lack teeth to break us down into more manageable pieces.)

Family-friendly edu-tainment was also back on the schedule at SEA Space Marine Discovery Center in downtown Provincetown. Scoop nets in hand, kids paraded down to the water's edge to learn about the creatures great and small that live in the Harbor, and some youngsters took a deeper dive into the world of whales during our two Whale Camps. Educators also traveled farther up Cape to lead children and teens at Pleasant Bay Community Boating and at the Wequassett Resort in explorations of the natural history and ecology of the Bay.

In September, after a hiatus of 18 months, Education Director Jesse Mechling returned to the classroom to resume his decade-long water quality education program for kids in grades 5, 6 and 7. By Spring 2022 he anticipates that he will be teaching in eight participating area schools. Jesse's influence on these local students is lasting; as they continue to study the environment through high school and into college, many recall his lessons as their gateway to a deeper understanding of how their daily decisions impact marine ecosystems and influence climate change.

Beyond the Education Department, CCS staff continued to run the gamut from remote to in-person outreach. In 2021, staff mentored 5th grade students at the Provincetown International Baccalaureate School, taught a two-week field course in Sustainable Fisheries at the Shoals Marine Laboratory in Maine, and participated in numerous community events and speaker series. They presented papers, chaired sessions and co-hosted conferences and training sessions locally, nationally and internationally for the Science in the Seashore Symposium, Northeast Natural History Conference, Northwest Atlantic Seal Research Consortium, New England Estuarine Research Society, Whale Watch Naturalist Workshop, Alaska Eskimo Whaling Commission, Geological Society of America, International Whaling Commission, and many more.

CCS takes great pride in nurturing the next generation of scientists, advocates and policy makers through internships in our marine mammal, fisheries, geology, and marine debris and plastics programs. This spring, former education intern Violet Doucette was awarded the Knauss Marine Policy Fellowship, which matches highly qualified graduate students with hosts in the legislative and executive branch of government located in the Washington, D.C. area, for a one year paid fellowship. This year, CCS research assistants Jenn Tackaberry (Humpback Whale Studies Program) and Sean Terrill (Marine Geology Department), both successfully defended their Master's theses. We wish Violet, Jenn, Sean and all our interns, mentees and student research assistants the very best of luck in their careers.



*Jesse Mechling and whale watchers gather at the pop-up tent on a chilly spring morning.*



*CCS intern Abigail Costigan introduces very junior marine biologists to a horseshoe crab.*

*Owen Nichols, Director of Marine Fisheries Research, working with students at Shoals Marine Lab.*



# Whale Research & Rescue

*Monofilament and wounds on the 2021 calf of Dross. CCS, NOAA permit #18786-05.*

## MARINE ANIMAL ENTANGLEMENT RESPONSE

Entanglement in fishing gear is a well-documented source of injury and mortality to whales. Although Federal efforts continue to try to reduce entanglement risk for large whales, entanglement events continued in 2021. As in past years, the Marine Animal Entanglement Response Team was on call to respond to whale and turtle entanglements every day, at all hours. In addition to responses off New England, they also train and advise teams from elsewhere in the US and internationally.

Two entanglement cases stood out to the team in particular in 2021. The first was humpback whale *Valley*, spotted on June 8 by the Dolphin Fleet Whale Watch towing a heavy line that was lodged in her mouth. The CCS MAER team responded immediately, and despite ever worsening sea conditions they were able to attach a telemetry (tracking) buoy to *Valley's* entanglement before they had to return to port.

That night the whale managed to travel 25 miles north, but sometime in the early morning the satellite track showed that her movements had stalled. She had dragged her entanglement into more fishing gear and had become anchored in place. A lobster vessel found her and reported that she had just enough slack in the line to allow her to swim in small circles at the surface. The CCS team deployed for a second rescue attempt. Carefully approaching in a small inflatable boat, the responders used a hook-shaped knife at the end of a thirty-foot pole to cut the rope that was anchoring *Valley* to the sea floor. They tied large buoys to the rope in her mouth to add drag to the line, and as she moved away the remaining entanglement came free.

Based on *Valley's* poor body condition, the MAER team surmised that she had been entangled for weeks or months. Freeing her from the stress and exhausting effort of dragging the heavy entanglement early in the season gave *Valley* a chance to feed and build resources before winter. The CCS Humpback Whale Studies Program reports that she was sighted regularly off Massachusetts this summer.

Entanglement conjures images of whales wrapped in heavy rope and gear, but monofilament – the thin, almost invisible plastic thread used for longline and rod-and-reel fishing – can also cause stress and injury. The team has been receiving more reports of this type of gear interaction in recent years. Typically, it involves a lure or hook scraping along and often getting caught in their skin, but the monofilament itself can slice into the animal's flesh like a cheese-wire if there is weight or resistance at the other end. Monofilament is also incredibly difficult to see, so it presents a complex set of challenges for rescue teams.

This summer, the 2021 calf of humpback whale *Dross* was reported entangled in monofilament twice. The first time the MAER team was able to remove all but a short length of the line; the second time, the calf shed the gear without intervention. The wounds sustained by the calf and other entangled whales are part of an ongoing study by scientists in the MAER and Humpback Whale Studies programs to better understand the nature and fate of injuries caused by entanglements.



**Any entanglement can be lethal. Boaters are urged to immediately report sightings of entangled whales, sea turtles or other marine animals to the MAER team (1-800-900-3622) or the US Coast Guard on VHF 16, and to stand by the animal at a safe distance until trained responders arrive.**

# Whale Research & Rescue

## NEW PUBLICATION:

### **Up in the air: drone images reveal underestimation of entanglement rates in large rorqual whales.**

This study, co-authored by MAER Director Scott Landry, evaluated the use of images from drones instead of boats to study scarring in species such as fin and blue whales to quantify entanglement rates. The results confirmed that the incidence of entanglement among these difficult-to-study species in the Gulf of St. Lawrence was considerably higher than previously estimated, and therefore more protection from entanglement is warranted. *Scan the QR code to download the paper or visit <https://www.int-res.com/articles/esr2021/44/n044p033.pdf>*



## HUMPBACK WHALE RESEARCH

The MAER team works to disentangle the whales that are seen and reported to the Atlantic Large Whale Disentanglement Network, but what about those that are not witnessed?

CCS scientists previously developed systematic sampling and image analysis protocols to study entanglement injuries on humpback whales as part of normal population research. Thanks to the support of the Massachusetts Environmental Trust, we were able to launch a new project to assess humpback whale entanglement rates through long-term research and community partnerships. This year, our scientists have been analyzing a decade's worth of data and conducting a pilot program to promote the collection of the required data in and around the Stellwagen Bank National Marine Sanctuary going forward.

The pilot program involves some of our long-term collaborators with opportunistic data collection programs in the region: Blue Ocean Society for Marine Conservation, Boston Harbor City Cruises, Dolphin Fleet Whale Watch, and Whale and Dolphin Conservation. You may have even heard about and witnessed this initiative first-hand on whale watching trips off Massachusetts. This project will provide new insights into the latest entanglement trends in the Gulf of Maine as well as contribute to the long-term sustainability of entanglement injury monitoring in the region. It also ties into a larger, multi-species study of the injuries produced by documented entanglements supported by the Marine Mammal Commission.



*Above: A humpback whale entangled in fishing gear.  
CCS, NMFS permit #932-1489.*

*Below: Scars from injuries are used to study unwitnessed entanglements in humpback whales.  
CCS, NMFS permit #21485.*



## MET WHALE PLATE PROGRAM

The Massachusetts Environmental Trust (MET) provides vital funding for the Center's right whale research and rescue work, humpback whale research and water quality monitoring programs through its specialty license plate program. 30,000+ Massachusetts drivers have an MET plate, and all are helping protect our environment while preserving the Bay State's heritage and water resources. Please visit [WhalePlate.org](http://WhalePlate.org) for more information about this innovative grant program.



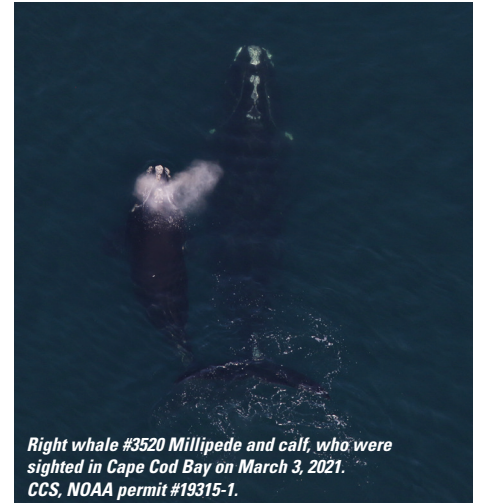
The Humpback Whale Studies Program also worked with its many collaborators to tackle a diverse range of other research topics in 2021, including: estimating population abundance and trends, determining connectivity between the Gulf of Maine and the waters off New York, quantifying the effects of satellite tagging, understanding and predicting humpback whale habitat use, understanding pregnancy rates and stress, and genetic based studies of population structure, viability and climate impacts.

# Right Whale Ecology Program Updates

- The CCS 2021 right whale season launched on December 11, 2020, with the first aerial survey and the first right whale of the season spotted by our observers in Cape Cod Bay. On March 3, 2021, the first mom/calf pair of the season was spotted; theirs is the earliest recorded arrival from the southeast calving grounds in our program's history. When the season officially wrapped up on May 14 the CCS team had documented 13 mom/calf pairs (out of a then-total of 17 - the 18th right whale mom/calf pair of the season was spotted on May 20 off Briar Island, Nova Scotia), and identified 234 individuals – 65% of the entire population.
- Sightings made by the CCS aerial surveillance crew, and data collected by the boat-based habitat monitoring team, contributed to establishing dynamic right whale protections in state and federal waters. Based on real-time evidence of right whale presence, the period for fixed fishing gear closures and vessel speed restrictions in areas around Cape Cod was extended for two weeks in 2021 until surveys established that right whales had departed from the area. Federally, CCS sightings data contributed to establishing five and extending one Dynamic Management Areas (DMAs), voluntary slow-speed zones established by NOAA Fisheries based on visual sightings documenting the presence of three or more right whales within a discrete area.
- Earlier this year NOAA Fisheries announced new regulations designed to reduce right whale entanglement in fixed fishing gear (lobster and Jonah crab traps) by 69%. The regulations, scheduled to go into effect on May 1, 2022, will expand closed fishing areas to reduce the number of buoy lines in the water, weaken the remaining lines so that whales may break free from gear, and improve the gear marking system to better identify the type and source of entanglements and help inform further efforts to reduce entanglement rates. Researchers will be keeping a close eye on the situation to see if and how these changes are reflected in the severity and frequency of entanglements.

Scan the QR code for more information about the new regulations or visit <https://www.fisheries.noaa.gov/media-release/noaa-fisheries-announces-new-lobster-and-jonah-crab-fisheries-regulations-help-save>

- Entangled right whale #3560 *Snow Cone*, who was partially disentangled by the CCS MAER team in March 2021, and further aided by Canada's Campobello Whale Rescue Team in May and July, was spotted in the waters southeast of Nantucket in late October 2021. She still has a short length of line wrapped around her baleen but her physical condition has remained consistent since the summer.
- In October 2021, the North Atlantic Right Whale Consortium (of which CCS is a member) announced that the estimated number of North Atlantic right whales left in the world was just 336, down 8% since 2019, and down 30% over the last decade. Of those, fewer than 100 are breeding females. Scientists have no doubt that human impacts – ship strikes and entanglement in particular - are to blame for the plummeting numbers. This estimate does not include data from 2021, during which researchers on the East Coast documented 18 new calves and two mortalities; that of the 2021 calf of #3230 *Infinity*, struck and killed off the Florida coast in February, and #3920 *Cottontail*, an adult who died as a result of a long-term entanglement.



Right whale #3520 *Millipede* and calf, who were sighted in Cape Cod Bay on March 3, 2021. CCS, NOAA permit #19315-1.



Qiyah Williams and Natasha Telschow keep watch for right whales on Cape Cod Bay from the deck of R/V Shearwater.



A spectacular breach from the 2020 calf of right whale #2642 *Echo*. CCS, NOAA permit #19315-1.



## SEAL eDNA

Environmental DNA (eDNA) is the latest cost-effective tool to gather information on individual species and their populations. All living creatures shed DNA, through sloughing of skin or fur, exhaling, sweating, or through their scat. In 2020, a pilot project was conducted to determine whether seal DNA could be detected and quantified in water around seal haul-out sites. CCS collected and filtered water samples from areas adjacent to haul-outs around Cape Cod, and shipped them to collaborators at the School of Marine Sciences at the University of Maine for analysis. That study confirmed that seal DNA was detectable at various distances from the haul-out sites.

Armed with this exciting discovery, and with financial support from the Friends of the Cape Cod National Seashore, CCS Seal Research Manager Lisa Sette and Research Associate Christy Hudak, in conjunction with University of Maine Orono's Dr. Kristina Cammen and graduate student Julia Sunnarborg, have since extended the seal project to establish whether or not eDNA can be used to ascertain the genetic diversity of a population. If they are successful, this will open up a new method of acquiring genetic samples from animals with minimum effort for the scientists or disturbance to the species.

## SEAL RESEARCH AT THE WAVE STATION

One of the best ways to fully understand a place is to make observations over time. CCS is known for its long-term monitoring projects, and the Wave Station at the Highland Center in North Truro has been part of that legacy, beginning with observations by Graham Giese's Coastal Geology team back in 2004.

In the late summer of 2019, the CCS seal program began looking at the feasibility of using the Wave Station location as an observation platform for monitoring seal behavior. The site, which is set on a high coastal bluff overlooking the Atlantic, provides a unique opportunity to observe nearshore seal activity without affecting their behavior. In 2020, the team began weekly field observations from May through December. In 2021, interns and volunteers from UMass Amherst, UMass Boston and Nauset Regional High School assisted with the project, conducting twice-weekly observation sessions to document the presence and behavior of animals (including humans) that moved through the field of view in, on and beside the water.



Gray seal swimming through a dense algal bloom.  
CCS, NEFSC Permit #21719-01.

Preliminary results indicate that fewer seals were observed traveling through the field site in 2021 than in 2020. Additionally, the only fins the team observed during the summer and early fall were those of ocean sunfish (*Mola mola*) and whales in the distance, which is very different from the numerous white sharks sighted the previous year. While the reasons for the decline in sightings have yet to be determined, it should be noted that the viewing conditions in July and August 2021 were challenging, as dense algal blooms and turbidity (lack of water clarity due to suspended particles) made tracking individual animals below the surface quite difficult. Work continues at the Wave Station, and the team is excited to see what the cooler temperatures and changing seasons will bring.

## CCS WAVE STATION: A WINDOW ON THE SEA

*"This small observation shed is our initial opening of a scientific 'Window-on-the-Sea' at Highlands Center - a window through which scientists will observe and better understand the workings of this major component of the Outer Cape Cod environment, from whale migrations to the drifting of coastal algae. As just one example, it will permit geologists such as me to record, moment-to-moment, the processes by which waves, tides and winds take materials that glaciers brought here thousands of years ago and create from them the coastal landscapes that our lives depend upon today."*

Graham Giese, PhD, on the opening of the Wave Station in 2004.



# Marine Fisheries Research

CCS Director of Marine Fisheries Research Owen Nichols, benthic ecologist Agnes Mittermayr, and vessel captain Ted Lucas are wrapping up a year of biological sampling in Town Cove and Nauset Marsh, as part of the multidisciplinary "Nauset Barrier Evolution and Ecosystem Assessment," funded by the Town of Eastham.

Semimonthly surveys were conducted on board the Center's R/V Kingfisher, during which benthic grab and underwater video samples were taken, traps set and retrieved, and dredge and trawl tows were conducted at several stations in the system. Additionally, Nichols and a team of volunteers and students have been conducting seine and trap surveys from shore. Together, all of these data will provide a valuable baseline with which to evaluate natural resource management decisions and develop a framework for long-term monitoring.

Among the highlights of the sampling to date are the presence of several tropical fish species, including crevalle jacks, mangrove snapper, northern sennet, and Atlantic moonfish. Data were collected on the presence and relative abundance of invasive species such as green crabs and European oysters, as well as many species of commercial and recreational importance, such as blue crabs, mussels and American eels.



Agnes Mittermayr with a tenacious blue crab



Above, L-R: Crevalle jacks, Atlantic moonfish, and a female green crab with eggs.



## **NEW PUBLICATION: A Community Science Approach to Conservation Challenges Posed by Rebounding Marine Mammal Populations: Seal-Fishery Interactions in New England**

A two-day workshop to understand seal-fishery interactions brought together fishermen, natural resource managers, marine mammal stranding response personnel, scientists and others to share observations, identify common themes and build collaboration. This paper, co-authored by Owen Nichols, discusses the process, the lessons learned, and the partnerships that grew out of those efforts. Scan the QR code to download the paper or read it at <https://www.frontiersin.org/articles/10.3389/fcosc.2021.696535/full>



# Shark Research

This year the Center received major funding from the National Park Service and the Commonwealth of Massachusetts to formally establish a new Shark Ecology Research Program and extend the geographic range and duration of current white shark studies.

The foundation of the program is CCS seascape ecologist and program manager Bryan Legare's ongoing research into the relationship between white shark behavior and habitat use in the shallow nearshore waters off the Cape Cod National Seashore.

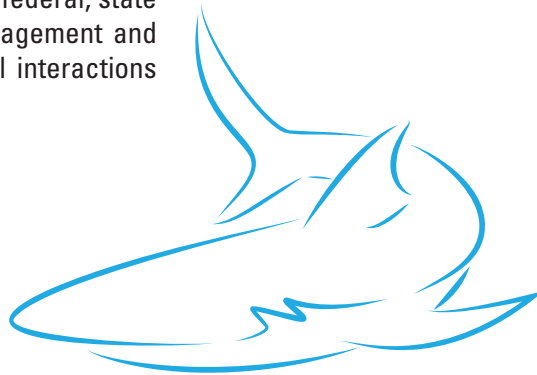
For the last three summers Legare has deployed a dense array of acoustic receivers in a study area at Head of the Meadow beach in North Truro; he added a second array off Nauset Beach in 2020.

The receivers record the acoustic signal of previously-tagged white sharks as they pass through the area, generating unique tracks for each individual shark. Those tracks are then considered in relationship to detailed, 3-dimensional images of the seabed collected during side-scan sonar surveys of the area by the Center's Seafloor Mapping Program, and to oceanographic conditions such as speed and direction of currents, tides, wave state and turbidity.

The study shows that, generally, patterns of presence and absence of white sharks in the shallow water habitats are associated with bathymetry (with banks and troughs on the seafloor determining individual pathways through the study area), changes in oceanographic conditions, and high-energy weather systems. Ultimately, this work will help federal, state and local officials develop science-based management and communication strategies to minimize potential interactions between humans and sharks.

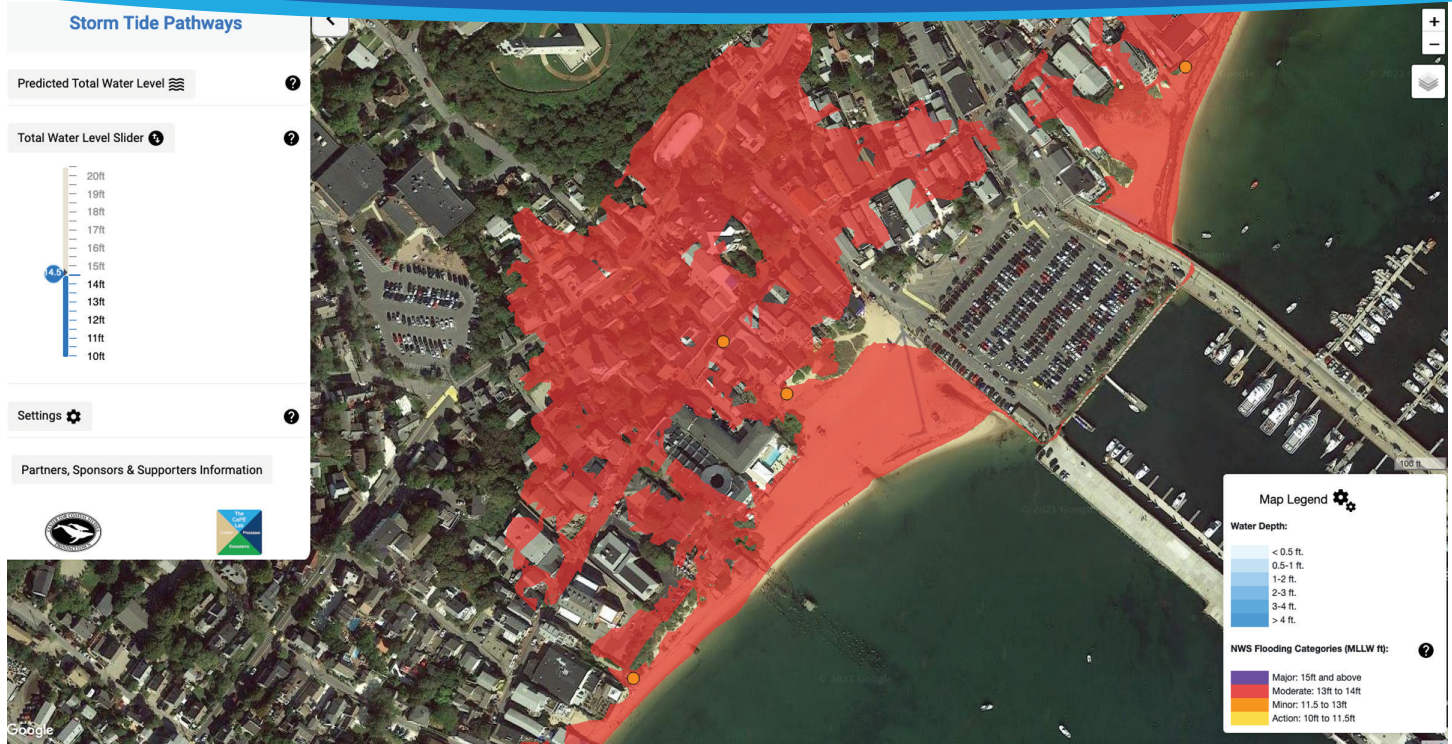


*Shark Ecology Research Program manager Bryan Legare deploys acoustic receivers and monitoring equipment off Head of the Meadow beach in Truro.*



**The Center for Coastal Studies is a founding member of the “New England White Shark Research Consortium” (NEWSRC), a multi-agency collaboration that will facilitate coordinated efforts to understand the biology, ecology and behavior of white sharks in the region, and provide unbiased, science-based information to resource managers, policy makers and coastal communities. NEWSRC partners include scientists and researchers from federal, state and regional organizations, universities, and NGOs, as well as Fisheries and Oceans Canada.**

# Marine Geology



The Department of Marine Geology has expanded and improved a website that provides public data on storm tide pathways for several towns on Cape Cod. *Stormtides.org* is an interactive app that illustrates the precise path and extent of flooding in Provincetown (pictured), Dennis and Nantucket under various tidal conditions. These data have already helped the towns better prepare for coming storms by, for example, building beach berms, sandbagging areas of ingress, and alerting residents living in flood-prone areas of impending inundation events. The team is working on two new storm tide pathways projects; one on the south coast of the Cape, from Chatham to Barnstable, and one on Martha's Vineyard. Both projects will be completed and uploaded to the website in 2022.

Researchers are also finalizing a benthic habitat map of Barnstable Harbor, the sixth such map they've developed on the Cape since 2014 (Pleasant Bay, Nauset Marsh, Wellfleet Harbor, Herring Cove, East Harbor). These maps provide a unique dataset that gives a snapshot of ecosystem health against which to measure future environmental changes.

The Marine Geology Department has now identified 300,000+ individual invertebrates belonging to 414 different species. A team of incredible volunteers picked the amphipods (like *Lysianopsis alba*, pictured), worms, gastropods, bivalves and other tiny critters out of sediment samples collected for various projects all around Cape Cod over the past 4 years. Based on these data, CCS benthic ecologist Agnes Mittermayr has calculated there are 61,961,210 invertebrates in every acre of seafloor along the Cape Cod coastline!



The Department's new Coastal Geographic Research and Applied Sciences (CGRASS) Program led by Steve Mague and Assistant Director Samantha McFarland was launched in December 2020. The program condenses scientific and coastal resource mapping into a single resource that helps towns, resource managers and the public understand and address the public safety and economic impacts associated with climate change and sea level rise. Currently the CGRASS team is working on a project that will enable the four Outer Cape towns (Provincetown, Truro, Wellfleet and Eastham) to address issues in their shared coastal zones as one entity, thereby managing this vital resource by natural boundaries, rather than geo-political ones, and increasing efficiency. This is the first such project in Massachusetts.

# Water Quality Monitoring Program



*(Above) Research assistant Troy Wood processing samples in the CCS water quality monitoring laboratory.*

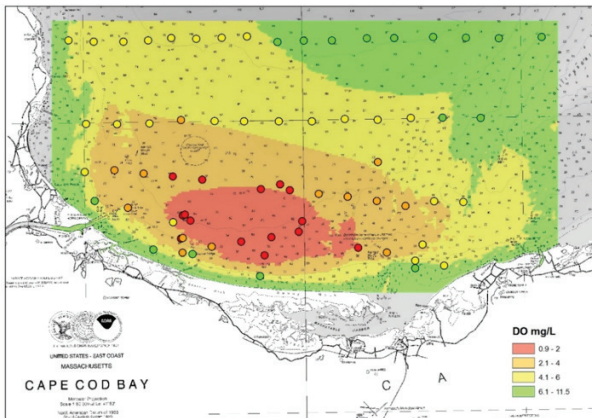
*(Left) Jenny Burkhardt, Research assistant for the CCS Water Quality Monitoring program, sampling with the Barnstable Clean Water Coalition in Three Bays.*

The impacts of climate change on water quality have played a big role in structuring water quality monitoring research initiatives at CCS these past few years.

In September 2019, lobster fishers working in the southwest region of Cape Cod Bay started finding dead lobsters in their traps. Investigations revealed that the waters in that part of the Bay were critically low in dissolved oxygen (DO), causing the trapped animals to suffocate.

This year was the second and final year of a collaborative research project with the Massachusetts Division of Marine Fisheries (MA DMF) and the Woods Hole Oceanographic Institution (WHOI) to investigate the factors contributing to the formation of those hypoxic bottom waters. The team conducted weekly, high-resolution surveys from late July into October to document the evolution of the physical, chemical, and biological conditions in the area. Hydrographic profiles were done at all stations, and water samples for nutrient and phytoplankton analysis were collected. One of the goals of this work is to develop a predictive understanding of oxygen dynamics in Cape Cod Bay to enable us to forewarn commercial lobster fishers of future hypoxic events, giving them time to move their gear and avoid unnecessary mortality in their catch.

This was also the second and final year of a study funded by Massachusetts Bays National Estuary Partnership to begin to monitor coastal acidification in the waters surrounding Cape Cod. The CCS team focused on Provincetown, Wellfleet and Duxbury during this study, and hopes to expand it to other coastal areas on Cape Cod that are vulnerable to the impacts of coastal acidification. Their work was presented as part of the MassBays Science Walk and displayed in several towns in Massachusetts.



*Modeled extent of DO conditions during the 2019 sampling time-period based on recorded observations and water depth (courtesy of M. Dean, MADMF).*



Scan the QR code to download the CCS information station and view the entire Science Walk poster series.

**To learn more about the health of the coastal waters in your neighborhood, visit the Center's water quality monitoring data website: [capecodbay-monitor.org](http://capecodbay-monitor.org)**

# Marine Debris & Plastics

Program Manager Laura Ludwig knows only too well that clearing plastics from our coasts and mining the debris for data is a year-round collaborative effort on land and sea and in the community. Here's her account of what the CCS Debris Brigade achieved in 2021:

February is a cold month, but plastic pollution knows no season - so a dozen intrepid Brigade volunteers bundled up and collected 1,266 items during the annual "Have a Heart for Hatches" cleanup to celebrate Valentine's Day.

March ushered in the field work portion of the annual Ghost Gear Removal project, supported in 2021 by the National Fish & Wildlife Foundation, to remove lost, abandoned or discarded fishing gear from the bottom of Cape Cod Bay. Side-scan sonar surveys were conducted by the busy CCS geology team to confirm locations of lost gear. Rope, traps, net, cable and other debris were then grappled up by the fishing vessels Miss Lilly, Adventure, Kestrel and Resolve throughout the bay. In a new initiative, we enlisted the dragger F/V Donna Marie to bring in the debris they encountered. In all, 14 tons of fishing gear were removed, inventoried and disposed of properly.

April marked the commencement of the Potter Marine Debris Internship, a new initiative which brought Truro native and recent Massachusetts Maritime Academy graduate Caitlin Townsend to our team for a six-month part-time internship.

On May 1st we conducted our first annual Rip-rap Cleanup in Provincetown, and on June 8th we held our annual World Ocean Day cleanup at Beach Point. Over 30 volunteers cleared items like an unopened plastic-wrapped bundle of kindling, 150+ pieces of rope, a toothbrush and about a

thousand other plastic items from two miles of beachfront.

In July, we continued our monthly Marine Debris Monitoring & Assessment project on two very different sections of beach in Provincetown. Data from the Race Point and Ryder Beach transects are uploaded to a federal database where they contribute to a national snapshot of plastic marine debris on our shores.

In August, we welcomed Natalie MacDonald, the Global Ghost Gear Initiative's 2021 Joanna Toole Intern, a six-month position shared between CCS and the Ocean Conservancy. Her first month included the Wood End cleanup, where we removed a ping pong table from the clam flats (among other things).

September is the month of shoreline cleanups in the name of Big Data. Long Point benefited from 34 volunteers clearing plastic trash for the annual Coastsweep, with all data submitted to the International Coastal Cleanup. And at the Outer Cape Cleanup, a 4-day, 28-mile marathon, the National Seashore breathed a sigh of relief after many hardy souls removed and then tallied all its trash: 24,860 items weighed in at 1,960 lbs.



*Outer Cape Cleanup Crew, Day 2 (L-R): Dave Nixon, Marjorie Kehne, Rebecca Arnold, Anthony Daley, Hilary Klein, Caitlin Townsend, Laura Ludwig, Natalie MacDonald, and the photographer's sons Koa and Kane. Image courtesy of Rachael Finn.*

# THANK YOU, VOLUNTEERS!

Even as COVID-19 kept the Hiebert Marine Laboratory closed in 2021 to all but CCS staff members, our incredibly dedicated volunteers remained active in the field and in our community, giving generously of their time and wisdom to several of our research and outreach programs, as well as to beach cleanups and the upkeep of the CCS campus. We greatly appreciate everything these wonderful people do for us, and for our coasts and oceans.

Fran Adams	Mark Dubois	Katie Ledoux	Rosie Puffer
Lin Allgeier	Joanne Duros	Zoë Lewis	Anne Puzzo
Carly Amarant	Alexander Dutoit	Sandy Longley	Jill Rosa
Laurie Appleby	Joann Figueras	Corrine Losch	Robert Ross
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Christine Barker	Larry Franke	Mattie Mailer	Michelle Sgarlat
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Max Dio	Jean Ledoux	Sarah Priestman	

## IN MEMORIAM

*We extend our deepest sympathy to the loved ones of our friends who passed away this year: Carol Phillips Green, a member of the CCS Board of Directors and great advocate for her community; John Lippincott, a Red Sox fan, gifted gardener, and former CCS Board Member; Mark Barry, who loved spending time on the ocean; Sylvia Campbell Skinner, an outdoor enthusiast and talented artist and photographer; Stephen Ryan, an avid beachcomber who always found beauty there; and Jennifer Robbin Larkin, who was never happier than when she was with her family.*

# Staff Updates

This year we bid a very fond farewell to some of our most beloved and long-standing colleagues as they move on to exciting new endeavors: HR Manager Stephanie Richardson has provided us with wise counsel and calming words for 15 years. She is stepping away from CCS to spend more time with her young family. Janet Young, who has occupied virtually every role at CCS during her 20+ year tenure, and has filled every day with light and laughter, is retiring this year. Rich Delaney is changing roles but definitely not retiring! We look forward to working with him in his capacity as Senior Advisor. MAER's Maria Harvey left this summer to fulfill her dream of hiking the John Muir Trail. Sean Terrill successfully defend his Master's thesis and now works for the Army Corps of Engineers.

We extend a warm welcome to Doug Sandilands and Jenn Tackaberry, who recently rejoined the MAER team and Humpback Whale Studies Program; Valerie Daniels, our new HR Manager; Ted Lucas, Marine Operations Manager; and last but by no means least, our new Executive Director, Dr. Sarah Oktay, who will be taking the helm on January 1, 2022.

## BOARD OF DIRECTORS, 2021

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Sue Nickerson, Development Director

Stephanie Richardson, HR Manager

Kathy Shorr, Development Officer

Laura Stinson, Development Assistant

Jan Young, Volunteers & Outreach, Accounts Payable

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Jenn Tackaberry, Research Associate

Paulette Durazo, Research Assistant

Emily Kelly, Research Assistant

Martine Bérubé, PhD, Adjunct Scientist

Alex Hill, Adjunct Scientist

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Mason Weinrich, Adjunct Scientist

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#### *Land & Sea Interaction Program*

Graham Giese, PhD, Director, Scientist Emeritus

Katherine Castagno, PhD, Post-Doctoral Researcher

Patrick Barger, Research Assistant

#### *Seafloor Mapping Program*

Mark Borrelli, PhD, Director, Coastal Geologist

Bryan Legare, Manager, Shark Ecology Research

Michael Low, Graduate Research Assistant

Bryan McCormack, CaPE Lab Manager

Agnes Mittermayr, PhD, Marine Ecologist

Dan Solazzo, Marine Researcher

Sean Terrill, Graduate Research Assistant

#### *Coastal Geographic Research and Applied Sciences Program*

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Sam McFarland, Assistant Director

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Laura Ludwig, Program Manager

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Ryan Schosberg, Aerial Observer

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Maria Harvey, Rescue Assistant

Bob Lynch, Operations Manager

David Mattila, Coordinator, Global Whale Entanglement Response Network

Doug Sandilands, Rescue Assistant

Michelle Silva, Rescue Apprentice

Jennifer Tackaberry, Rescue Assistant

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### MARINE OPERATIONS

Ted Lucas, Marine Operations Manager

Marc Costa, Captain

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Moncrieff Cochran, PhD, Adjunct Educator

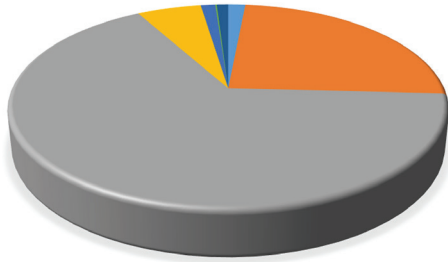
Stephen DeVincent, DVM, Adjunct Scientist

Benjamin Giese, PhD, Adjunct Scientist

The late Carole Carlson, PhD, former Adjunct Scientist

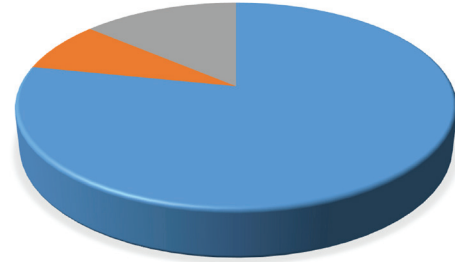
# Financial Report

## FY2020 Source and Use of Funds Summary\*



Revenue 2020

- Membership
- Contributions
- Grants and Contracts
- Events
- Merchandise/Tools
- Other earned income
- Other revenue



Expenses 2020

- Program Services
- General and Administrative
- Fundraising

### REVENUE

(restricted and unrestricted)	<u>2019</u>	<u>2020</u>
Membership	73,211	68,299
Contributions	1,309,441	1,106,859
Grants & Contracts	2,385,992	3,013,312
Events	253,745	255,844
Merchandise/Tools	278,235	58,172
Other earned income	26,598	5,842
Other revenue	35,777	-45,665
<b>Total</b>	<b>\$4,362,999</b>	<b>\$4,462,663</b>

### EXPENSES

	<u>2019</u>	<u>2020</u>
Program Services	3,262,146	3,396,969
General & Administrative	376,403	348,511
Fundraising	484,147	597,563
<b>Total</b>	<b>\$4,122,696</b>	<b>\$4,343,043</b>
<b>Net</b>	<b>\$240,303</b>	<b>\$119,620</b>

\*A copy of our audited Financial Statements is available on our website.

# Center for Coastal Studies Donors, 2020

CCS wishes to thank the many individuals, businesses, organizations, academic institutions, foundations, corporations, and government agencies that provided gifts, grants, and in-kind support in 2020.

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 Captain Deb Ridings  
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 The scientists and researchers out on the  
 water, flying overhead and in the lab.  
 Nancy Scott  
 Lisa Sette and Elizabeth Bradfield  
 Jim and Mary Sexton  
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 Jaime Sweany  
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