



Volume 20, Number 1, Spring/Summer 2020

WRACKLINES

WHERE CONNECTICUT MEETS THE SOUND

***TOO BIG?
TOO LATE?***

**Acting locally to take
on the world's major
challenges**



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From the EDITOR

Thomas Merton admired the Shakers, whose communities sprang up from New England to his adopted home of Kentucky in the mid-19th century.

A Trappist monk best known for his 1955 book, *No Man is an Island*, Merton was once asked why the Shakers built the best buildings, when they thought the world would end any day.

He replied: "You don't understand. If you know the world could end at any minute, you know there's no need to hurry. You take your time and do the best work you possibly can."

As the coronavirus swept into full pandemic mode in March, production for this issue of *Wrack Lines* was just entering the busiest phase. Writers were sending me the stories I'd assigned weeks ago for editing. Revisions were being made, photos submitted, organized and selected, and our graphic designer, Maxine Marcy, was sorting and arranging all the pieces of the puzzle needed to make a magazine.

As the crisis worsened, I kept asking myself, "Is this work relevant?" But I forged ahead from my home office. I kept hoping for some confirmation for my belief that, yes, articles about people finding their antidote to despair about big global problems by doing what they can could be the salve people need. Still, the doubts lingered. The neighborhood where I live is just four blocks from a hospital where a drive-up virus testing lab is collecting samples. Passing the full parking lot on my daily walks, I could only imagine the courage it took for the nurses and doctors to keep coming to work every day. What was I doing?

Then I came across the Merton quote. In a world suddenly unable to make any plans beyond the next day or two, my job was to call people's attention not to some new immediate crisis, but to the slower moving ones – plastic pollution and climate change. The theme of the issue, "Too Big? Too Late?" was asking readers to care about the future, and try to shape a better one like the people who share their stories in this issue. Looking past the present moment, and deciding that our actions can make a difference – even while so many things are out of our control – is what having hope is all about.

Wherever you are when this issue finds you, know that I and my partners in creating this magazine did the best work we possibly could to bring you something to inspire, challenge and encourage you. You'll read how Elizabeth Ellenwood applies her artistry to raise awareness about plastic, and how a team of UConn scientists parse the details of plastic pollution to figure out which kinds are the most harmful. Tessa Getchis tells the story of five months of teaching marine science at a girls school in the Dominican Republic, learning along with her students how to be part of solutions. Syma Ebbin shares her journey of following her concern for the environment far away then back at home, in her classroom and beyond. And Michael Pascucilla – a local director of health on the front lines of the coronavirus crisis – sets an example for a cleaner future with a solar-electric-powered pump-out boat.

What's your answer to "Too Big? Too Late?" After reading this issue, I hope you'd decide the answer is, "No. It's only too big and too late if we give up. And giving up is no way to live."



Judy Benson, editor
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Above photo: A sign for the drive-through coronavirus testing lab is posted at the entrance to Lawrence + Memorial Hospital in New London in mid-April, as a nurse wearing a face mask walks toward the entrance. Photo: Judy Benson

Cover photo: Photographer Elizabeth Ellenwood collects plastic trash at Napatree Point this spring to use in her cyanotype photographs. Photo: Tim Martin

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About our contributors



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In a paradise threatened, teaching girls to be the change they want to see



By Tessa L. Getchis

Editor’s note: Tessa L. Getchis, aquaculture extension educator and aquaculture extension specialist for Connecticut Sea Grant and UConn Extension for the last 20 years, spent last August through December in the Dominican Republic with her husband Ryan and their two school-aged daughters. While past trips to this island nation had been vacation-length recreational time, this was an extended stay with a decidedly challenging mission. She would be teaching marine science to middle-school aged girls from impoverished families, taking on some big problems while imparting hope and empowerment. The University of Connecticut and Connecticut Sea Grant supported her project there, and Wrack Lines is pleased to publish her inspiring story.

This past fall I had the incredible opportunity to move my family to a Caribbean island, take on a new job as a middle school marine science teacher and be part of an organization that’s cultivating future female leaders in environmental activism.

My family has been traveling to the north shore of the Dominican Republic for more than a decade. This country, which shares the Caribbean island of Hispaniola with its neighbor Haiti, is a place of unimaginable beauty. Palm trees sway over wind-swept beaches, coral reefs span turquoise waters, waterfalls tumble over jagged green mountains and narrow streams meander through grasslands. Its diverse landscapes make it perfect for ecotourism including hiking, diving, surfing, windsurfing, whale watching and more.

Life is also a lot slower. (It’s a stark contrast to living here in the Northeast.) Dominicans are known for their friendly nature, and always greet you with a smile. When they say hello and ask about your day, they really want to know!

We immediately fell in love with the country and its people, but while we were enjoying the sand and sun, we realized they have been dealing with some serious challenges. Most people in this part of the Dominican Republic live in poverty, without sufficient food or clean drinking water.

They lack access to a quality education and some children are forced to sell items on the street or beg for money to support their families. The majority of children attend public schools that are only offered for a half day, and fewer than 20 percent of girls make it past the eighth grade. A rapidly changing climate with extreme flooding followed by drought, and relentlessly rising seas further threaten their personal safety and food and water security.

And then there is the garbage. The country is grappling with the amount of trash, especially plastic, entering its waterways and the looming threat of the microscopic pieces that it will continue to break into for hundreds of years. This plastic problem is so particularly grave here that a documentary *Isla de Plastico* (Cacique Films, 2019) was recently produced to draw attention to the widespread impacts.

It is still paradise – just paradise threatened.

It was difficult to witness such adversity in the midst of what for us was paradise (and what we considered our second “home”). As my husband and I thought about how difficult it would be if our two young daughters had to grow up in these conditions, our hearts sank. They’ve never had an empty belly. They drink from a faucet, never thinking that there might be a limited supply or that the water could make them sick. Our biggest trash problem is when collection day falls on a holiday and we have to store bags in the garage for one extra day. We felt motivated to do something to contribute, but these were huge problems and we were just visitors.

On a recent family trip we visited the Mariposa DR Foundation Center for Girls (www.mariposadrfoundation.org). We learned about the school’s mission to end generational poverty through education and empowerment. It was then we started on the path to finding our unique way to help.

Mariposa — the Spanish word for butterfly — is located in the small, rural community of Cabarete. Mariposa’s focus is on experiential learning and includes traditional classes like math and reading, as well as arts and culture, health and wellness and environmental education and activism. The center was established 10 years ago, and in addition to these

Top: Two 11-year-old students from the Mariposa Foundation Center for Girls help to clean up the waterways in their neighborhood. Photo: Tessa Getchis



Top: While the Dominican Republic is known for its beaches, it also boasts vast mountain ranges and fertile green valleys. Pico Duarte, at 3,098 meters (10,164 feet), is the highest peak in the Caribbean. Photo: Tessa Getchis

Left: A typical home in the Dominican countryside. Photo: Tessa Getchis

Bottom Left: Students learn how waves form during a class at the local surf break, Encuentro Beach. Photo: Alexander De La Cruz

Bottom Right: Seventh grade students enjoy their first snorkeling trip from a boat, in the town of Sosua. Photo: Tessa Getchis



classes, provides two meals a day to nearly 130 girls from ages eight to 18.

Mariposa draws its students from three nearby villages, and the girls chosen to attend for free come from families that are most in need. The neighborhoods they come from are lively with people laughing, dancing to Bachata — the country's unique style of music — and playing dominoes. At a quick glance all might appear well, but behind the cinderblock walls the scene is much different. Many live in extremely crowded conditions, often with no bathroom or running water. They live in sweltering heat. Their homes are often exposed to flooding from land and sea, and are surrounded by litter.

We learned that the school was expanding its environmental education program. The staff wanted the students to better understand the connection between land and sea and help to inspire environmental activism. As we sat together discussing the subject, a light bulb went off. We all saw an opportunity to build a new program that would allow the Mariposas to explore, learn and love the ocean — an experience-based marine science course.

I spent months seeking out advice from science teacher friends and other experts including my colleague Diana Payne, who was a member of the team that created the first marine science education standards for the United States. They helped me to construct lesson plans and hands-on activities for each grade level that I would be teaching. A year later, after brainstorming the entire idea with family, friends and colleagues, I received approval to move forward with the program, and our family started contemplating the reality of packing all our belongings and moving to the island.

Of course there were countless nights that I sat up worrying about what I was dragging myself and my family into. We were going to spend five months in a country that we had only visited as tourists. A colleague wished me luck on our “vacation.” I knew better. I would be teaching middle school students — *in another language*. I would be challenging them to solve complex environmental problems. I would be

asking my husband to take a pay cut from his job and to homeschool our daughters, and asking them to leave their friends, their gymnastics team and the comfort of macaroni and cheese. Would we have enough food and water, would we be safe, would my kids keep up with their education? Was I crazy for even thinking we could pull this off?

It wasn't a small thing to pick up and leave our “normal,” but after finding a place to live, preparing our house to be rented, being trained as lifeguards and brushing up on our Spanish skills, we knew we were on the right path. I made many lists of things to do, things to buy, things to bring. Eventually I had to let go of my need to control everything and be confident that the rest of the details would fall into place. It might not be our usual brands, but my husband assured me that there would be plenty of toothpaste, deodorant and soap in the DR. Besides, it was not going to fit in our suitcases!

After saying goodbye to family, friends and neighbors, we packed our luggage full of clothes, school supplies and the one essential — sunscreen — into the van and headed to the airport. In less than four hours the plane touched down in the city of Puerto Plata with all on board cheering our arrival. As the flight attendant opened the door a wave of warm humid air rushed in and immediately calmed my nerves. Step one — arrival — complete.

Step two was orientation for my new job. I was introduced to my teaching colleagues, my classroom (a large grass covered hut called the “*bobio*”), my students (45 girls ranging from ages 10 to 14) and my schedule (four theory classes, four field classes and lunch duty). The theory classes would focus on the basics of marine science — water, wind, waves, weather, plants and animals. The field classes would be where the action was, involving beachcombing and watersports such as swimming, snorkeling and stand-up paddle boarding.

Though we had originally planned to enroll our daughters in an international school, we ultimately decided to keep them with us during the school day. Their teachers and principals were

confident that as long as they kept up on their reading and math skills, the benefits of this trip would clearly outweigh any catching up they needed to do upon their return. So, on the first day of school all four of us headed out the door and into the unknown.

School began at 8 a.m. with breakfast and opening circle, where we received our welcome and daily news. Immediately after, everyone made their way to their separate classes. Our daughters joined classes with other girls their age learning math, reading, sewing, singing and swimming — all in Spanish. Each day after my theory classes, I jumped in the guagua (the local bus) with Diego (a Spanish teacher from Colorado), Tony and Alex (two local surfers who knew a lot about the local ocean conditions), my husband Ryan (who served as our lifeguard and Mariposa's handyman) and our class of Mariposas to explore a new part of the coast.

We had the extraordinary opportunity to share a lot of “firsts” with our students, many of whom had little or no experience on the water. We swam and snorkeled in the open ocean, paddled in beautiful rivers and lagoons, and took long hikes to caves. Before the “fun” began, we spent time on the mandatory garbage collection that was part of our class. And we collected lots and lots of garbage. We scoured rivers, beaches and neighborhoods, making note of the type of trash — soda bottles, lollipop sticks, plastic utensils, flip flops, shopping bags, cigarette butts, rope, tiny bits of foam containers — and estimated the weight of what we had collected.

I thought about the amount of time I had spent writing lesson plans about the diversity of life, and the excitement I felt about sharing my knowledge with those girls. It was one of the greatest joys of my life when we took them snorkeling and they saw for the first time the beauty of the underwater world. But I felt that we could never escape the reach of the trash. Instead of focusing on the myriad of fish, invertebrates, mammals and birds, our attention was drawn to the contamination and damage caused by the garbage.



We weren't deluded into thinking we could solve the problem. In fact, "hopeless" described our feelings at the time. Garbage disregarded boundaries. The trash swept aimlessly over the land, poured out of the rivers and crept in on the rising tide. No place seemed untouched. We were just a small group of teachers with middle school girls who didn't want to get dirty — and we had a few short months. The problem was too big, and we were too late. Or so it seemed...



Each trip, we reminded our students that they were examples for their friends, siblings, parents and their community. Our message seemed to fall on deaf ears. But then came one miraculous day at the end of the semester. From my seat in the front of the bus on the way to a field site, all I could hear was shouting. Thinking there was a problem, I hurried to the back of the bus to find one of the girls jumping and pointing out the window.



She was talking so fast, shouting, "*El hombre! La basura! La basura!...*" that I couldn't keep up with the translation in my head. Eventually I calmed her to the point that I could understand. She noticed a man collecting trash on the side of the road. But he wasn't just any man. He was the same man that weeks ago had seen her collecting trash and questioned why she would ever bother. She had repeated to him the words that we had said to her each week, "I am an example for my community — I'm trying to make a difference."

And just like that, she had lived up to the school's motto "I am the world's most powerful force for change."

Now, back at home in Connecticut, inspired by our time with the Mariposas, my family and I have a new perspective on life. We are more conscientious about our choices. We are conserving water and reducing food waste, we are walking more and driving less. We have a new relationship with plastic. Even more important, we're now having family conversations, school conversations and community conversations about how we reduce our impact on this planet. That feels good. We are still speaking Spanish, and learning how valuable knowing another language is in this increasingly diverse place we call home.

The Mariposas didn't solve any big environmental problems by collecting garbage. Picking it up was just the conversation-starter. They grappled with all of the typical questions: "Why should I clean up someone else's trash?" "Why isn't anyone else helping us?" "How will we ever make a difference?" They, like us, needed to understand the complexity of the problem.

Ultimately, some good came from having been frustrated, tired, and hopeless. Because then we had to find hope, by making it ourselves. Why give up, when we have the power to make changes, see changes — even small ones — in the communities we love?



Top: The teaching staff for the marine science class, from left, Tony Garcia, Tessa Getchis, Ryan Getchis and Brayden Diego Wilson, share some down time together after class. Photo: Juan Jose Almonte

Second from top: The fifth grade class uses paddleboards for the first time in the open ocean. Photo: Tony Garcia

Third from top: Gathering trash is part of the weekly routine for students in the marine science class. Photo: Tessa Getchis

Left: Litter is scattered in the open space of local barrio. Photo: Tessa Getchis

Excerpts from the Getchis Family Blog

Tessa Getchis and her family shared their experiences in a weekly blog over their five-month stay. Below are some samples:

Sept. 11: *“We have been given this amazing opportunity... For some of the (students) it will be their first opportunity to step foot in salt water.”*

Sept. 18: *“This week we took the girls on their first field trip to the Yasica, a freshwater river that leads to the Atlantic Ocean... This first week was all about exploring nature and getting comfortable in the water. It wasn't without challenges, but there were many smiles and memories made.”*

Oct. 2: *“Estoy emocionada por...” (I'm excited for) was the prompt for our first class this week... they were excited to get out on the water, and also to learn about marine biology. They were also fearful of sharks, eels, crocodiles and urchins.”*

Oct. 9: *“This week the Mariposas learned how to use a stand-up paddle board... Diego and Ryan gave the girls some tips and then we were off to explore the reef. The girls were met by a myriad of fish and invertebrates in every color of the rainbow.”*

Nov. 17: *“While I'm concerned about the future that lies ahead for these girls, I still have a great deal of hope. They are paying attention, asking questions and challenging the status quo. They are thoughtful and creative and we just need to give them the tools and resources they need to succeed.”*

Nov. 20: *“We walked along trails through the lush green forest, along lagoons and to hidden caves. The girls shied away from the ice-cold waters but the air thick with mosquitoes was enough to make them jump in. They laughed and played and splashed, and yelled each time they saw a fish... It was a pleasure to see kids just enjoying being kids.”*

Nov. 27: *“Last week in class we learned about marine mammals, and so the girls were thrilled when we came across a small pod of dolphins on our open water (snorkeling) excursions this week.”*

Dec. 16: *“I am feeling so very grateful for this adventure. So many dreams have been fulfilled. We experienced more depth in the beauty, diversity and culture of this country and its people. I started a new job as a marine biology teacher. I was lucky enough to have lots of help from Ryan Getchis...”*



The Getchis family receives a commemorative plaque from the Mariposa DR Foundation. Photo: Miriam Orellana Peña



Tessa Getchis, left, her husband Ryan, center, and another student practice life-guarding skills such as this pool rescue in a class at UConn Avery Point as part of preparations for their trip to the Dominican Republic. Photo: Judy Benson



**'You can see why
an animal might
mistake this
for seaweed.'**

– Elizabeth Ellenwood

As plastic trash fills the ocean, Pawcatuck artist finds a disturbing source of inspiration

By Tom Verde



Top left: Ellenwood shows an anotype photograph she made using fruit and vegetable juices.
Photo: Tim Martin



Top right: Monofilament fishing line is tangled among seaweed found by Ellenwood on one of her beach walks.



Bottom right: Ellenwood is bundled up for a winter walk to collect beach trash.
Photo: Tim Martin

The approximately 17-mile stretch of shoreline from Rhode Island's Charlestown Beach west to the Napatree Point Conservation Area is not quite artist Elizabeth Ellenwood's canvas. Yet it is her source of inspiration, not to mention, in many ways, her actual palette.

"Do you see this?" she asks, reaching down to tug a withered strand of black nylon rope from the sand, during a chilly, winter's morning walk at Napatree. It's just a few miles from her home just over the border in Connecticut, in the Pawcatuck section of Stonington. "You can see why an animal might mistake this for seaweed."

Further down the beach, her eye catches a translucent disc of sea glass, camouflaged among the sea pebbles.

"See? It blends right in," she says, as she picks up the glass and deposits it in her backpack. Even though sea glass may be derived from a natural material, it is not natural to this environment and so does not escape Ellenwood's eye, no matter how well camouflaged.

Pieces of rope, bits of plastic cutlery, tattered Ziploc baggies, strands of Mylar balloon strings: when they end up in the ocean and on beaches, all are worrisome to Ellenwood, 32, a recent University of Connecticut master of fine arts in studio arts graduate.

Yet, true to her profession, she channels that angst into her artwork which features ghostly and granular images of the beach trash she collects — more than 3400 items since she began her beachcombing in June of 2018 — rendered onto paper via historic and modern photographic methods. A driving purpose behind her stunning, even haunting artwork is to underscore the menacing threat of global ocean pollution.

"These objects have this afterlife that affects the water and animals," says Ellenwood. "They have this impact, and that's what I am thinking about."

That impact has been well documented. Each year, 8 million metric tons of plastic ends up in the ocean, according to a 2016 study published by the World Economic Forum. That's the equivalent of dumping a garbage truck full of plastic waste into the ocean every minute.

By 2030, it will be two truckloads, according to the study, and by 2050, startlingly, there will be more plastic waste, by weight, than fish in the sea. And despite alarming photos of such massive accumulations as the Great Pacific Garbage Patch — a 1.6 million-square-kilometer (617,763-square-mile) island of plastic trash seasonally migrating between the waters of Hawaii and California — significant amounts of microplastics pollute the entire world ocean as well.



Ellenwood stands next “Collection #25,” a digital print of plastic trash in a Petri dish. The print was part of the “Among the Tides” exhibit. Photo: Tim Martin

Harmful to much aquatic life, microplastics are bead-like particles of plastic, the size of sesame seeds or smaller. They are the end result of larger pieces of plastic being broken down by the constant corrosive action of waves, water and sunlight. By some estimates, there are currently as many as 180 trillion particles of microplastics in Long Island Sound alone, according to University of Connecticut Marine Sciences Professor J. Evan Ward.

This crisis speaks to Ellenwood’s lifelong love affair with the sea. Born in Westerly, R.I., she spent much of her childhood and early teens in Daytona Beach, Fla., where her father worked as a boat captain. One season, his work took him

and his family to the Bahamas for six months where Ellenwood and her older sister were home schooled, a curriculum which included educational snorkeling trips through the tropical waters.

In Daytona Beach, the water was never very far away, and regular family walks along the shore typically involved “beach cleans” and observation of the maxim to leave the environment cleaner than you found it. Her high school years were spent in Waterford, Conn., where her mother’s artistic talents as a ceramist clearly rubbed off on Ellenwood.

“In high school, I would often just stay in the art room and not go to my other classes, but at least my teachers knew where I was,” she chuckles.

Unlike her mother, working with three dimensional objects did not come as easily as transforming objects themselves into artwork via the medium of photography. It’s a passion Ellenwood pursued as an undergraduate at the New Hampshire Institute of Art (now The Institute of Art & Design at New England College) in Manchester.

It was there that she first encountered and was inspired by the work of 19th century English botanist and early photographer, Anna Atkins. Atkins was an early enthusiast of cyanotypes, a rudimentary photographic process

in which cyan-blue images are created by laying objects on chemically treated paper and exposing them to a source of ultraviolet light, typically sunlight. When natural materials are used — seaweed or algae, such as Atkins favored — the result is a ghostly, blueprint-like (blueprints in fact were made in the same way) image, essentially a negative of the original material.

Another contemporaneous process that appealed to Ellenwood are anotypes. Objects, such as leaves, or photographs printed on transparencies, are placed on a piece of paper coated with a natural emulsion, such as berry juice. (Ellenwood has used blackberry juice or the juice of red cabbages from her mother’s garden.) Exposed to sunlight over extended periods of time, the area of the paper not covered by the object or transparency fades, leaving behind a silhouette-like image of the original object.

To create her cyanotypes, Ellenwood uses the various pieces of beach trash she finds on her walks to create engaging photographic montages of items such as so-called “ghost nets” — abandoned or discarded fishing nets — or tangled snarls of line and Mylar balloon strings. Her anotypes also focus on environmental themes, such as a picture of a coral reef printed on a



Ellenwood hangs a collection of her cyanotype photographs for her “Among the Tides” exhibit at the Alexey von Schlippe Gallery at UConn Avery Point this winter. Photo: Judy Benson

transparency that is laid over blackberry juice stained paper. As the juice pigment breaks down over time, it leaves an impression of the coral image on the strikingly faded paper.

“The plant material, the juice, is sensitive to light, so it starts bleaching out the areas of paper that are exposed,” she says. “When I was thinking about the coral reef bleaching I’m like, ‘Whoa, this process is literally bleaching the print.’ So this is a great representation of what’s happening to the coral reef.”

Ellenwood says she is not the first artist to be influenced by these early photographic methods and Atkins’ pioneering vision. Nor, she is happy to acknowledge, is she the only contemporary artist whose work

focuses on the pressing issue of plastic pollution in the ocean and their threats to the environment. The scientifically informed, environmentally aware work of University of Hartford School of Art trained conceptual artist Mark Dion has been an inspiration. His “New England Cabinet of Marine Debris” – a nod to the Victorian-era “cabinet of curiosities,” filled with wondrous oddities — features a classic New England kitchen sideboard filled with plastic refuse gathered on beaches. It was displayed last year at the Florence Griswold Museum in Old Lyme.

Another inspiration was the photographic art of Chris Jordan. His arresting images of the plastic waste-filled carcasses of albatrosses on the beaches of the Pacific North West were another motivation for Ellenwood to artistically chronicle the effects of plastic pollution closer to home in New England, as well as Florida where she still visits.

Meanwhile, Connecticut Sea Grant has also long recognized the important role artists can play in raising environmental awareness. Since 2009, under the stewardship of Research Coordinator Syma Ebbin, the program has provided grants to 14 artists, most recently Ellenwood. Her project and exhibition, “Among the Tides,” at the UConn Avery Point campus’ Alexey von Schlippe Gallery last winter were funded, in part, by a Sea Grant arts award. While praising Ellenwood’s “aesthetic transformation” of beach trash into art, Ebbin says she was particularly impressed with the way Ellenwood blends the aesthetic with the scientific.

“In creating her art, Liz works with scientists and integrates understandings gleaned from these experiences into her creative process,” Ebbin says.

Ellenwood’s “Collection #25”, a piece featured in “Among the Tides” is a case in point. The striking 36-by-36-inch image is a full color scan of multiple pieces of plastic beach trash crammed into a Petri dish — a microcosmic examination of a macro-environmental issue.

Ellenwood says the work was inspired by a visit to the lab of

friend and neighbor, Michaela Cashman, a doctoral student at the University of Rhode Island whose research focuses on microplastic detection and isolation in marine sediments.

“I loved the science tools she was using, the Petri dishes, all the labels, the microscopes,” recalls Ellenwood, who was stunned by her first look through one of Cashman’s microscopes at beach sand.

“It’s so beautiful, and made me think that even though I had been focusing on macro-plastics there are a ton of microplastics I probably overlooked while going on beach walks,” says Ellenwood.



Ellenwood examines beach sand and pebbles under a magnifying glass to find plastic shards and records her findings in a small notebook. Photo: Tim Martin

By blowing up the image of bits of beach trash in the Petri dish, she not only gets that notion “right up in the face” (as she puts it) of those looking at her work, the composition of Collection #25 itself renders the art scientific and mimics the experience of viewing sand under the microscope.

Like a scientist, Ellenwood also labels and catalogues her beach finds, photographing and geotagging each bit of trash with her cell phone before bringing it back to what might be described as her studio-lab at the main UConn campus in Storrs. There, she maintains careful records of the action

of sunlight on her anatypes, as well as the impact of light and water on pieces of beach trash she keeps in specimen jars lining a shelf in front of a window.

While her work may drift across boundaries that have conventionally separated art from science and vice-versa, Ellenwood says she is equally happy to have her work viewed on a purely *ars gratia artis* (art for art’s sake) level, or as conveying a deeper social and environmental message.

“Not everyone’s brain works in the same way, and I think there is an opportunity for art to help people understand things,” such as the harmful impact of macro- and microplastics on the world’s oceans and waterways. Art, she concludes, “makes thinking about these things a little more inviting, a little more approachable.”

Editor’s note: In April, Elizabeth Ellenwood received notice that she has been awarded a 2020/2021 Fulbright Research Scholarship and an American Scandinavian Foundation Grant to travel to Norway. There, she will work collaboratively with Hans Peter Arp, an environmental chemist at the Norwegian Geological Institute, and Kaja Fjaertoft, a marine biologist at Passion for Ocean, to produce scientifically informed photographs focusing on ocean pollution. Congratulations, Liz!

See more of Tim Martin’s photos of Elizabeth Ellenwood and her work at: <https://seagrant.uconn.edu/2020/04/28/gallery-of-tim-martins-photos-of-elizabeth-ellenwood/>

Elizabeth Ellenwood’s work is part of a virtual exhibit at The William Benton Museum of Art at UConn. To view the exhibit, visit: <https://benton.uconn.edu/mfa-2020/mfa-2020-studio-art/>

From tiny shards to tons in the sea, plastic pollution presents a challenge to labs, beaches and society

By Judy Benson

Love-hate relationships are tricky. They're vexing. They're complicated.

So it is between humans and plastic. Made primarily from petrochemicals derived from fossil fuels, the various forms of plastic are everywhere in our daily lives. They're in our cars, our schools, our computers, our clothing and the air we breathe as fragments of synthetic fibers go aloft.

"We're not going to get rid of all plastic," said J. Evan Ward, professor and head of the UConn Marine Sciences Department. "Plastics have made our lives better. What we need to do is identify the ones that are most problematic, the ones that have the possibility of being transported up the food chain."

Examples of beneficial plastics leap to mind readily. Think of artificial joints that restore mobility, plumbing pipes that don't corrode, lighter vehicles that reduce fuel consumption and eyeglasses that resist breakage. All have clear advantages over the metal, ceramic and glass counterparts they replaced.

But plastic has a dark side, too, particularly in the marine environment where Ward focuses his research. With an estimated 8 million metric tons of plastic getting dumped into the sea annually, harmful impacts of plastics and its persistence in the environment are becoming ever more apparent. Photos of seals being strangled by monofilament fishing line, a turtle with a straw stuck in its nostril and dead seabirds with stomachs blocked by trash serve as poster children prompting public disgust and action to reduce the use of throwaway plastics. The Ocean Conservancy calculates there are already 150 million metric tons of plastic in the marine environment.

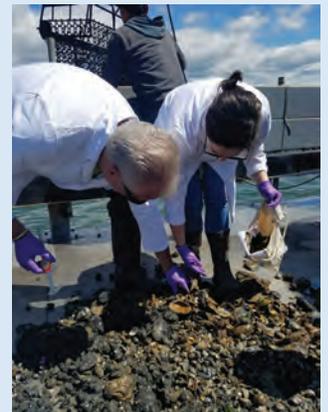
"It's overwhelming for the masses, when you start to look at the



big picture and try to make sense of it," said UConn Marine Sciences Professor Sandra Shumway, now in her third year of collaborating with Ward on research involving plastics. Specifically, their work focuses on microplastics, those microscopic bits frayed from larger pieces, and their effects on shellfish.

"There is nowhere that has escaped the presence of microplastics," she said. "They're even found in caves in the deep ocean, in the Arctic and Antarctic."

Concern about plastics isn't limited to academia, though. As the call from environmental groups to curb single-use plastics became mainstream, a movement to ban plastic shopping bags gained



Top right: UConn Marine Sciences Professor Sandra Shumway, center, checks out mussels growing off the docks at UConn Avery Point with graduate student Hannah Collins. The shellfish will be used as part of a microplastics research project. Photo: Judy Benson

Bottom right: UConn Marine Sciences Professor Evan Ward, left collects oysters with doctoral student Kayla Mladinich for an earlier phase of the microplastics research in 2018. Photo: Jennifer Wozniak

momentum. Last year, Connecticut joined seven other states in enacting it, although the ban was lifted during the pandemic. Individual Connecticut communities have also banned items such as plastic straws, stirrers and take-out containers.

Mystic Aquarium is among the groups supporting these changes. After years of sponsoring beach cleanups and rescuing seals, turtles and other marine animals from entanglement in plastic debris, the aquarium took its campaign to the next level. It set aside part of its exhibit space to further public awareness about the problem. Opened in April 2019, “Plastic Free Seas,” is likely to remain a permanent exhibit, tucked between tanks of blue angel fish, Caribbean blue tang and green moray eel.

Specially lit tanks illuminate microplastic particles to enable visitors to see them for themselves, allowing them to trap a plastic bag and floating water bottle in a net while the gossamer fragments float free. But rather than focus exclusively on the problem, the exhibit suggests ways people can be part of the solution – switching to non-plastic alternatives, for example, as well as participating in beach cleanups. One panel tells the story of a local woman who’s trained her service dog to pick up plastic when she and her son do beach cleanups. Instead of conveying an oversimplified message that all plastic is bad, it encourages people to differentiate between reusable plastic equipment and throwaway single-use items they could skip altogether.

“It’s a bigger problem than we can solve by just doing beach cleanups,” said Dale Wolbrink, spokeswoman for the aquarium. “It’s about stopping it at the source.”

To spread the word further, the aquarium has taken the message on the road. Dozens of schools, farmers markets, yacht clubs, beach communities and other venues have hosted aquarium educators for lessons about the scope of the plastic problem and ways to curb it.

“We’re focusing on the idea of refuse, reuse and reduce before recycling,” said Mary Ellen Mateleska, director of education and conservation at the aquarium. “We’re trying to get the message out that solving the global problem of plastic pollution can begin with you.”



Top: The “Plastic Free Seas” exhibit at the Mystic Aquarium showcases plastic alternatives as well as the problems created by plastics. Photo: Judy Benson

Second from top: Graduate student Hannah Collins shows the experimental setup in the UConn Avery Point lab where mussels are exposed to microplastics. Photo: Tyler Griffin

Third from top: Doctoral student Kayle Mladinich extracts a sample of shellfish tissue for examination under the microscope in a UConn Avery Point lab this winter. Photo: Judy Benson

Bottom: Ward and Mladinich settle out marine aggregate from samples collected from Long Island Sound in 2018 as part of an earlier phase of research into microplastics and oysters. Photo: Kevin Tallec

In the summers of 2018 and 2019, the aquarium joined the Long Island Sound Study and Connecticut Sea Grant in leading a “Break the Single-Use Plastic Habit” campaign, launched both years with trash pickups at public beaches.

Judy Preston, Long Island Sound outreach coordinator for Sea Grant, said the campaign has effectively used social media – including the hashtag “#DontTrashLISound” – to draw attention to the plastic problem specific to the estuary. Oystercatchers, seals, black fish and other Long Island Sound wildlife are depicted on attractive decals for reusable water bottles and travel mugs given out as part of the effort.

“Bringing attention to the plight of seals, sea birds and even the less familiar terrapin that is threatened from habitat loss and degradation due, in part, to plastic debris, is a way to help people understand that plastic can have a life of its own long after it’s ‘disposed of,’” she said. “Coupled with the International Coastal Cleanup Day in September, the #DontTrashLISound campaign has resulted in the removal of thousands of cigarette butts (the most collected item), food wrappers, plastic caps and bottles, and the often cited plastic straw.”

The groups involved in the campaign hope to continue the momentum around the problem of plastic debris, she said.

“Legislation to ban or curtail its use is hopeful,” she said. “If we can collectively make a difference in this arena, perhaps we can gain momentum for other important sustainability issues to help Long Island Sound, such as reducing our fertilizer use and driving less.”

Ward and Shumway both applaud cleanups of the plastic littering beaches and waterways and efforts to encourage people to use less plastic. In their view, helping to rid the environment of the discarded bags, empty take-out cups and similar large pieces of plastic trash are where the main work of engaging the public about plastic pollution belongs.

“There is definitely good reason to reduce the amount of plastic in the environment,” Ward said. “We should get rid of all nonessential plastics. There are definitely some serious problems with animal health and plastics.”



STUDENTS RELATE TO LESSON IN THE REAL-LIFE PROBLEMS, SOLUTIONS TO TOO MUCH PLASTIC



Top, Niantic Center School students sign a pledge to reduce their plastic use after a lesson from Mary Ellen Mateleska, below left, and Ireland Wilson, both of Mystic Aquarium. Below, Mateleska wraps an elastic band around a student's hand as part of an exercise in understanding how marine wildlife can become entangled in plastic. Photos: Judy Benson

TOO MUCH PLASTIC

East Lyme – Quickly the class of eight- and nine-year-olds rattled off what they'd found on beach clean-ups.

"Dirty diapers in the bushes," said one boy.

"Cigarette butts in the sand," said another.

"A lot of plastic water bottles," added a third.

"And what do you know about plastic?" asked Mary Ellen Mateleska, their guest teacher for the morning lesson.

"It never breaks down," said one girl.

These third graders, gathered in the library and Niantic Center School one day last winter for a traveling program about plastic from Mystic Aquarium, live in a shoreline town where cleanups at local beaches are part of growing up. Clearly they made for a receptive audience for information about how plastics harm turtles, seals and seabirds, and how much is getting into the marine environment.

Mateleska, working with co-teacher Ireland Wilson, listed some of the items most commonly collected in beach clean-ups; plastic bottles, food wrappers, bottle caps, plastic straws and stirrers. After showing a short film of aquarium staff leaning off the edge of a boat to cut a loggerhead turtle free from plastic netting, they taught the students the four R's: Refuse first. Then reduce, reuse and lastly, recycle.

"We could all just make one change and not use so much plastic," she told them. "I'm going to ask you guys to make a pledge to stop using single-use plastic."

But before signing the pledge – a banner the students signed with colored markers and a phrase or picture – they got a hands-on lesson – literally – in what marine animals can experience when they encounter plastic.

Five student volunteers stood in front of the class as Wilson and Mateleska placed a rubber band around their outstretched fingers. They were told to work it off using only that hand, mimicking the predicament of animals with flippers. The students giggled and grimaced as they contorted their bound hands every which way. Only one managed to work off the rubber band.

"This issue is on the minds of kids from elementary school to high school to college," said Mateleska. "It's a hot topic right now, so we've been trying to get out there as much as we can."

– Judy Benson

Acting to reduce plastic use overall, Ward said, is equivalent to first turning off the faucet when the tub overflows, before grabbing a bucket to start bailing. He and Shumway lament that some recently published popular and academic reports have fed generalized anxiety about all plastics that can leave people feeling powerless and directionless about how to effectively respond. Instead, the two researchers are hoping their work will reveal which particular parts of the plastic problem should — and shouldn't — be the focus of concern. Too much emphasis on the wrong area, they fear, will dilute energy from where it's really needed.

"There's no point in upsetting the general public for no good reason," said Shumway.

Volunteers collect trash at Lighthouse Point Park in New Haven as part of the "Break the Single-Use Plastic Habit" campaign by Connecticut Sea Grant and other groups last summer. Photo: Judy Benson



She was referring to concerns being raised that oysters, clams and mussels — shellfish that are commercially important, healthy sources of protein — were ingesting microplastic particles, which would in turn get eaten by humans. With seven decades of work on shellfish between them, she and Ward have a deep understanding of shellfish physiology and good reason to suspect the threat was being overblown.

Working with doctoral student Kayla Mladinich and more recently with graduate student Hannah Collins, the two researchers began the project three years ago by tracing the path of microplastics through the guts of mussels.

This is meticulous work involving



Top: A mussel is immersed in water laden with microplastic particles in a lab at UConn Avery Point. Photo: Tyler Griffin

Below: Mladinich adjusts tubes used to feed microplastics to shellfish in the lab. Photo: Tyler Griffin



some very time-consuming processes to study effects of long-term plastic exposure, and others requiring great precision to gauge short-term impacts. In the earlier field sample collection phase of the project, where sediment, water, oyster tissue and other marine materials are gathered and analyzed, the researchers had to be hypervigilant to prevent samples from getting contaminated with airborne microplastics. The study has also involved the use of a needle-sized endoscope to film the bivalves' internal digestive organs as they were fed plastic particles.

Results thus far show the mussels reject nearly all of the microplastics, either spitting them out as they first enter their systems, ejecting them at their filtering organs, or excreting them in feces.

"This shows people that bivalves are not good indicators of microplastics in the environment," Shumway said.

The current phase of the project, funded by Connecticut Sea Grant and the National Oceanic and Atmospheric Administration, is looking at the types of plastic used in the nets, ropes, cages and other equipment of aquaculture farmers. Are shellfish eating particles fraying off the gear and incorporating them into their tissue? If so, which types in particular? A second line of inquiry asks whether the makeup of the bacterial community in shellfish digestive organs is changing in response to plastics.

"What we're trying to figure out is how oysters and mussels exposed to environmentally relevant

microplastics, like nylon and polyester microfibers, select particles for ingestion," Mladinich said. The different shapes, sizes and composition of various particles are all determinants of what happens in shellfish, she said.

With so much attention being paid to plastics these days, she and Collins both feel privileged to be young researchers involved in a project with immediate relevance. But it can also be daunting, considering the global scale of plastics problem.

"Sometimes it does seem overwhelming, when you think of the size of the problem," Collins said. "But even though it feels overwhelming, I appreciate knowing that I'm working on one piece of it."

Ultimately, Ward said, the purpose of the research is to take a mindboggling unknown – the full extent and impact of plastics in the marine environment – and break off one piece into an answerable question.

"We're developing a model to identify which microplastics are ingested by bivalves and which are rejected," he said. "The types are a consequence of the particle size and shape. We'd like to be able to tell managers which types of microplastics are most problematic for bivalve gear" so that shellfish farmers can avoid using it.

Thus far, though, theirs is a "good news story" for the shellfish industry, Ward and Shumway said. While other research may be raising "danger" signs about shellfish safety, their results are showing that people aren't eating plastic when they slurp an oyster at their favorite raw bar.

"There's been some bad science about this," Shumway said. "People have been using this bandwagon to further their own cases to link microplastics to human health issues of eating shellfish, and it's just not right. Shellfish are a good, safe source of protein, they're good for the economy, good for the environment and they're good for you."

A lifelong environmental journey

MY LOVE OF NATURE LED TO THE NEW ENGLAND WOODS, THE PACIFIC NORTHWEST AND A UCONN CLASSROOM

By Syma Ebbin



Top: Syma Ebbin's favorite local hiking spot is the Barn Island Wildlife Management Area in Stonington. Photo: Judy Benson

Center: Ebbin, left, meets with members of the UConn EcoHusky Club at Avery Point that she advises. Photo: Judy Benson



Even as a child, I had the need to be outside, in nature. I grew up in New York City, surrounded by the impervious surfaces and imposing structures of that urban environment. But I spent my summers on the edge of Long Island Sound at my grandfather's house, exploring the wet and permeable surfaces of the surrounding inlets and marshes.

At Stuyvesant High School in Manhattan, my friend Nancy introduced me to backpacking. We hiked Vermont's Long Trail and parts of the Appalachian Trail every chance we got.

Those opportunities propelled me to Williams College in northwestern Massachusetts. There, the forest — specifically the college's old-growth Beinecke Stand — was of paramount importance to me and my research on spring ephemerals, the early-blooming wildflowers that thrive in New England forests. But the joys of walking and cross-country skiing in those woods were undermined by an existential angst that set in while taking Environmental Studies with lawyer and Williams Professor Tom Jorling.

After a semester of learning about the impacts of water and air pollution, population growth and the destruction of critical habitats and endangered species, a soul-killing malaise took hold. I discussed my depression with my roommate whose recommendation was simply, "don't think about it."

For me, this wasn't a viable option; I was ready to get my tubes tied. I didn't see a clear path to creating a bright and healthy future for planet Earth. But Professor Jorling didn't get depressed or at least he didn't let on. Instead he worked down in Washington, D.C., writing and implementing laws including the Clean Air and Clean Water Acts, the Resource Conservation and Recovery Act, and Safe Drinking Water Act. Perhaps he was onto something. Even though you can't solve the whole problem, you do what you can. Action builds hope.

Left: A volunteer carries plastic trash from Griswold Point in Old Lyme during a March clean-up that involved Ebbin and members of the UConn EcoHusky Club working along with the Nature Conservancy's Connecticut chapter. Photo: Judy Benson



Ebbin shows the haul of trash she, her husband and son collected on Earth Day April 22 along Thomas Road in Groton, including the shopping cart pulled out of Birch Plain Creek. Photo: Judy Benson

Forestry and Environmental Studies to learn more about the people part of the equation, studying the human dimensions of the environment with Professor Stephen Kellert.

He gave me the opportunity to help organize a workshop that became the basis for a seminal book edited by Kellert and Harvard's E. O. Wilson: *The Biophilia Hypothesis*. The workshop and book explored Wilson's idea that the very essence of our humanity is in fact derived from our association with other living organisms. In other words, humans need nature to be human. And that dependence extends beyond the material and economic to encompass a suite of aesthetic, cultural, intellectual and spiritual meanings.

After graduating, I migrated across the continent to Alaska to study fisheries management at the University of Alaska's School of Fisheries in Juneau. Fishing commercially for salmon or halibut during my free time, I fell in love with small boat fisheries and the fishermen engaged in them.

I was lucky to receive a Sea Grant Fellowship to work with the North Pacific Fishery Management Council and was introduced to Alaska's large boat fleet at this time: factory trawlers, joint ventures and motherships. It was at the end of the 10-year phase-out of foreign fishing mandated in the Magnuson-Stevens Fishery Conservation and Management Act. This, I realized much later, was an historic and significant moment, and U.S. fishermen were ramping up to fill the impending void.

Then I headed south to Washington state. There I worked with the Northwest Indian Fisheries Commission (a natural resource management support organization comprised of 20 treaty tribes in the Puget Sound and Washington coastal area) and Makah and Squaxin Island tribes. I became immersed in the world of state-tribal fisheries co-management. It was another historic moment in the world of fisheries management, as the fractious past of litigation, confrontation and violence in the Pacific Northwest gave way to a working relationship focused on common goals. And here I realized a critical insight: fisheries managers do not manage fish, they manage people.

And so, like a salmon homing in on its natal stream, I returned to the Atlantic coast. I entered Yale University's School of

My research focused on the people, processes and institutions engaged in the co-management of tribal fisheries in Alaska, specifically the Kuskokwim River, and the Puget Sound region of Washington. I found that the present is a function of many threads stretching back in time, and that to understand these different threads requires insights from many disciplines: law, history, anthropology, political science, economics and sociology, in addition to the natural sciences. My efforts were aimed at understanding how institutions can restructure our relationships with resources and the environment, as well as with other people.

Nowadays I work as Connecticut Sea Grant's research coordinator. In addition, I teach environmental science and policy classes at UConn's Avery Point campus and am faculty advisor to the campus environmental club, the EcoHuskies. I teach my students about climate change, how to calculate their environmental footprints, what comprises them and ways to reduce them. We discuss the IPAT framework – an equation that determines environmental impact based on population, affluence and technology. This concept stimulates thinking about the drivers of environmental impact, what's most important, what's missing, and what can we do to reign our impacts in. We talk about the need to attack the drivers, to change behavior, reduce consumption and the type of consumption.

I try to leave my students with more hope than despair, to end

continued on inside back cover ►

Plying the Sound while preventing pollution in the water and air

ONE-OF-A-KIND SOLAR-ELECTRIC POWERED PUMP-OUT VESSEL HOLDS PROMISE FOR TRANSFORMING BOATING

By Michael A. Pascucilla



Michael A. Pascucilla, director/CEO of the East Shore District Health Department, stands on the bow of the solar-electric pump-out boat. Photo: Peter Hvizdak

Growing up in Connecticut on the coastal waters of Long Island Sound, I have childhood memories of clamming, fishing, crabbing, boating, water skiing and jumping off the jetties and piers with my friends. I truly feel privileged and humbled to have had this special experience. Fondly I remember how my “old school” Italian grandmother would send me to the shore to collect a seafood bouquet of crustaceans to put over a bowl of homemade pasta with garlic bread for our traditional family Sunday dinner. Yummy!

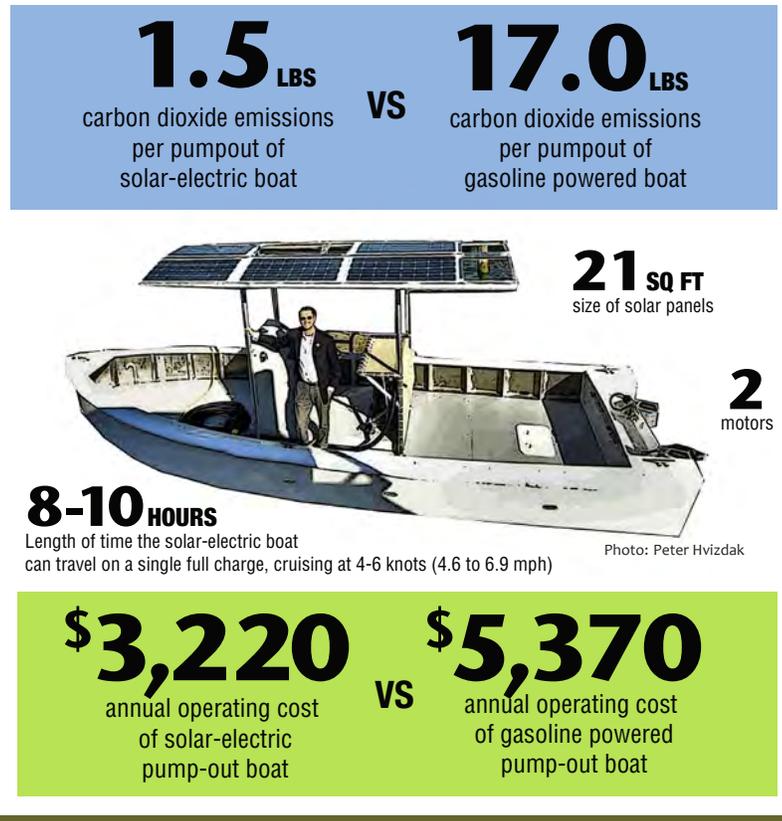
Today, I still enjoy the same activities on the Sound with my wife, children and friends in the eastern Connecticut shoreline town of Guilford. As I am well-traveled, I can say with confidence that we truly have one of the best tidal estuaries in the world. Once called the “American Mediterranean” and more recently described as “The Urban Sea,” Long Island Sound is one of North America’s most developed yet biologically diverse waterways.

As a local director of public health and a professor of public health at Southern Connecticut State University (SCSU) and lecturer of epidemiology at Yale University, the health implications of water quality and climate change — including diseases and natural disasters — are among my top priorities. My staff and I at the East Shore District Health Department, which serves East Haven, Branford and North Branford, work diligently every day to protect our communities and their treasured seashores, as do our colleagues in other shoreline towns. We regularly test the waters of the Sound and collaborate with many partners to ensure the beaches are safe to swim in, and that its prized shellfish, finfish and emerging products such as kelp are safe to eat.

In 2014, our office decided to convert our aging automobile fleet to hybrid and electric vehicles through a Connecticut Department of Energy and Environmental Protection (CT DEEP) grant opportunity. Around the same time, our pump-out boat needed to be replaced. For those unacquainted with the term, a pump-out boat empties human waste out of the holding tanks of recreational vessels, then carries it to shore for treatment so that raw sewage is not discharged into open waters. Pump-out boats provide a vital service for mitigating the environmental impacts of boating by managing the waste generated on recreational vessels. But their operation — just like the operation of any gasoline-powered boat — contributes to climate change, ozone depletion and water pollution.

This presented a conflict – a vessel designed to prevent pollution was itself a contributor. So I pitched a conceptual idea to build a solar-electric powered pump-out boat to our partners at CT DEEP. Kathryn Brown, our state liaison, not only embraced the idea, but championed it to federal funders at the U.S. Fish & Wildlife Service as a potentially groundbreaking project. At the time, only

SOLAR-ELECTRIC PUMP-OUT BOAT BY THE NUMBERS



small, experimental pilot electric pump-out vessels existed. With their support and funding, I worked with my staff on this multi-year project to research, design and build the world’s first full-sized solar-electric pump-out vessel.

We had *lots* of partners! One of the main ones was Pilot’s Point Marina in Westbrook, which assisted in the design and construction of the first-of-its-kind solar-electric pump-out boat. Together with Pilot’s Point, we created a new aluminum boat hull from scratch, intending to maximize energy efficiency and onboard battery capacity without sacrificing maneuverability and ease of use. The result is a vessel that operates just like a gasoline-powered pump-out boat, making the new technology easy to adopt by pump-out boat operators accustomed to gasoline-powered machines.

A CT DEEP Clean Vessel Act grant covered 75 percent of the \$200,000 cost. Our local public health department engaged local businesses and communities to help raise the other \$50,000 as 25 percent matching funds. Undergraduate interns from SCSU assisted in the project, which included community/business fundraisers, working with local community foundations, creating a GoFundMe page and holding raffles. Although this was the first time our local health department hosted fundraisers, the experience was fun and the support and response from our communities was amazing.

To name the boat, we engaged our elementary schools in a boat-naming contest. Students in the winning class took a

field trip to Bruce & Johnson's Marina in Branford to visit the vessel they had named "Solar Shark." They also received a pizza party paid for by the health department.



These students from Grove J. Tuttle Elementary School in East Haven were part of the class that came up with the winning name for the boat, "Solar Shark" as part of a contest for local schools. Photo: Nathan Hughart/The Courier

Since then, we have continued to focus our public health educational efforts with our schools to promote this program and the importance of everybody's role in protecting our water, air and reducing climate change emissions, especially among our children and youth. But marinas, restaurants, grassroots environmental organizations, fisheries and shellfish industries, residents and visitors alike also have an interest in how the solar-electric vessel protects our waterways, so we are working with these groups, too. Our logo sums it up: "Clean water is everyone's business."

What's innovative about our vessel is that it uses ecologically friendly electric motors and solar panels to perform the essential functions of a pump-out boat without the greenhouse gas emissions associated with using a conventional internal fossil fuel combustion engine. In doing so, the East Shore District Health Department

has introduced much-needed technological advancement to the worlds of recreational and commercial boating. There are some 12 million recreational boats in the United States alone, and their combined use emits at least as much carbon dioxide per year as the operation of 1.3 million cars. The health district's new technology is partially autonomous — power generated by the onboard solar panels meets much of the energy needs of the boat. The rest of the electricity is supplied by recharging the battery through a land-based hookup connected to the main power grid.

To understand the environmental impact of the technology it developed, the health district commissioned a study to analyze the carbon dioxide emissions — known as the carbon footprint — of the new solar-electric pump-out boat compared to its gasoline-powered equivalent. The study, conducted in collaboration with Dr. Robert Dubrow and students at the Yale University School of Public Health, tabulated the carbon footprint of different kinds of pump-out boats over the course of their entire lifetimes, from construction to use to disposal and recycling. The students found that a conventional gasoline-powered boat emits about 17 pounds of carbon dioxide for each holding tank it pumps out — about as much carbon dioxide as is released by driving a car with an average fuel efficiency of 25 miles per gallon for 23 miles.

The new solar-electric boat, however, emits as little as 1.5 pounds of carbon dioxide per pump-out. This

is a 90 percent improvement over the conventional standard, a quantum leap in sustainable boating technology that has the potential to help transform recreational and commercial boating into an industry that contributes minimally to climate change. We have just finalized the research study with Yale and plan to submit the manuscript about the findings to an international journal for future publication.

Since Connecticut began making pump-out boats a regular part of life on the Sound in 2000, more than 8 million gallons have been extracted from recreational vessels and kept out of the estuary. In its 2019 inaugural boating season, the solar electric pump-out boat was used for 1,023 pump-outs keeping 19,956 gallons of marine waste out of the Sound. Its performance has exceeded our expectations. Getting recharged by the solar panels while underway, the electric motor rarely drops below 75 percent to 50 percent full power.

Recreational boating is not an activity that many individuals might think about when they consider how to reduce worldwide greenhouse gas emissions. Nonetheless, the boating industry has a considerable impact on climate change, and directly impacts the world's fragile and valuable marine ecosystems. The health district's projects in sustainable pump-out boat technology represent outstanding examples of the creative and multifaceted approach that future leaders need to take when combatting climate change.

The solutions that the agency has developed — including the research it led with Yale, the unique academic-public-private partnerships it formed

with Pilot's Point Marina and other organizations, and the solar-electric boating technology it engineered — have the potential to



Left, the pump-out boat is lowered into the water at Bruce & Johnson's Marina in Branford on May 5 for the start of the boating season. Right, vessel operator Vinny Suppa steers the vessel towards the dock after its launch. Photos: Judy Benson

impact not just the pump-out boating community, but the entire world of recreational and commercial boating.

Innovations that will have a lasting impact on combatting global climate change need to meet a number of critical requirements. They need to involve technologies that have demonstrably lower emissions than the conventional standard and are economical. Those technologies need to be brought to scale through multifaceted collaborations, partnerships and policy actions. And finally, they need to engage relevant stakeholders to address concerns and to coordinate future action. The East Shore Health District's projects in solar-electric pump-out boat technology satisfy these needs and more, and show the promise of innovations that successfully reduce emissions for the benefit of the environment and of human health.

In partnership with Torqeedo, a partner and the electric motor manufacturer, we are taking the project to the next step by studying the noise level of a traditional gasoline-powered engine compared to an electric-powered one. We are also measuring noise levels and their impacts on marine life working with Professor Sean Grace, co-director of the Werth Center for Coastal and Marine Studies at SCSU.

As a local health department, we understand that combatting climate change means getting future generations to take the lead on important environmental issues. The Sound has suffered — and will continue to suffer — from the effects of anthropogenic climate change, with long-term consequences on the ecological and economic well-being of the region. While the East Shore Health District has shown that solar-electric boat technology is a viable and sustainable option for recreational and commercial boating, this is only one example. If we are to truly address climate change, we all must change our ways to protect our planet, our communities and its gems like Long Island Sound.



To see “*Climate, Health and Cost of Solar-Electric Pump-out Boats*,” poster from research project with the Yale School of Public Health and the Yale Climate Change and Health Initiative, visit: <https://seagrant.uconn.edu/?p=6406>

Vessel operator Vinny Suppa, at wheel, and Michael A. Pascucilla, director/CEO of the East Shore District Health Department, ride the boat from the launch ramp to the dock at Bruce & Johnson's Marina in Branford on May 5. Photo: Judy Benson



With this issue, *Wrack Lines* launches the new “Sharing Our Stories” feature.

In each issue, a member of our staff, a researcher or partner we work with will tell how and why they got into their field, or about a specific aspect of their career.

See stories beginning on pages 4 and 17.

CLICK THE OYSTER!

Do you like a fun challenge and the chance to win a prize?



Go to: seagrant.uconn.edu and click on the link underneath the oyster image in the upper right-hand corner of the home page. This will take you to the new **Wrack Lines Quiz**, a set of multiple choice questions about the articles in this issue.

Copy and paste the questions with your answers into an email and send them to: judy.benson@uconn.edu with your name and age by Aug. 1, 2020. Submissions with all correct answers will be entered into a prize drawing for an attractive mug or handy canvas bag with the Connecticut Sea Grant logo.

Three winners will be randomly selected by Aug. 15, one per category: ages 18 and under; 19 to 25; and 26 and up. **Good luck!**

on trajectories that look forward towards sustainable solutions and futures. We discuss the inherent tradeoffs involved in simply being alive, eating food, using energy, inhabiting a home.

I tell my students that my generation is leaving the world in their hands. They will need to make the decisions regarding how it is used, abused or nurtured. Their task will be to understand and compare the costs involved in their decisions, to take charge and steer a course into the future.

Since joining Sea Grant and UConn, my role in this larger-than-life race to preserve the planet's habitability for future human beings — my three children, my students, my EcoHuskies — has been to educate. All any of us can do is leave this world a little better off. My contribution is to facilitate the critical process of self-awareness, to invite students to reflect on sustainable futures and encourage thoughtful behavior among a few of my fellow travelers perched on this blue marble hurtling through space.

Lately, though, since the coronavirus pandemic, some of my earliest impulses towards nature and the environment have taken on new relevance that I hope to share with my students. Prolonged time in our homes has made it obvious that our built environments can only sustain us for so long.

We are animals, domesticated to an extent, but still in need of wildness on occasion. Throughout the days of confinement, brief but regular escapes from my house showed me that many of my neighbors feel the same. They walked and biked along wooded trails, beaches and empty roads — at least six feet apart, of course — but still rejoicing in being outside.

The need I recognized as a child to be outside, to embrace nature, is universal and essential to all humans. It's a need I can help my students understand, appreciate and nurture and could make the societal changes required to grapple with the hard challenges of climate change and building a sustainable future a bit easier to bear.

A quote from the poet Maya Angelou guides my outlook: *"Hope and fear cannot occupy the same space. Invite one to stay."*

DON'T MISS AN ISSUE!

Wrack Lines is available online at: <https://seagrant.uconn.edu/publications/wrack-lines/>

To join our list serve to receive notifications when the electronic version of the new issue is posted, send an email to: judy.benson@uconn.edu.

To join our mailing list for a free print copy, send an email with your address to: judy.benson@uconn.edu.



A closeup of the wrackline at Waterford Town Beach shows a colorful mix of red and green seaweeds brightly contrasting the pale gray sand. Photo: Judy Benson

What's in our names?

What are wrack lines? The word wrack is a term for various kinds of seaweed, and wrack lines are the collections of organic matter (sea grass, shells, feathers, seaweed and other debris) that are deposited on shore by high tides. More generally, wrack lines are where the sea meets the land.

With our magazine Wrack Lines, we tell stories about the intersection of the land, sea and Connecticut Sea Grant. So what is Connecticut Sea Grant? One of 34 Sea Grant programs across the country, it helps residents make the most of our coastal resources and inland waterways.

It addresses the challenges that come with living by the water or within a Long Island Sound watershed, in a state with 332 miles of shoreline and three major tidal rivers. This NOAA-state partnership based at UConn's Avery Point campus works with aquaculture farmers, fishermen and seafood purveyors to help their businesses prosper.

It funds research essential to understanding and managing our changing coastal and inland environments. It provides communities and local leaders with the information they need to make better land and shoreline decisions that result in more resilient communities and healthier watersheds. It educates students as well as teachers and adults of all ages about the marine environment.

Connected to experts and residents who live, work and recreate in the Sound and its watershed, it brings diverse interests together around a common purpose of working for mutually beneficial solutions to problems.

Small in staff but big in impact, Connecticut Sea Grant is like a pilot boat that navigates the way for large vessels toward safe harbors. Since 1988, Connecticut Sea Grant has supported "Science Serving the Connecticut Coast."

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Photo: Photographer Elizabeth Ellenwood heads to the walkway over the dunes at Napatree Point this spring following an afternoon of trash collection. Photo: Tim Martin



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