



Here's the Blue Deal

2022



2451 South Signal Street
San Pedro, CA 90731

INTRODUCTION

The following articles are from AltaSea’s series *Here’s the Blue Deal 2022*, one of our web-based ocean education resources.

This year, our articles focus on ocean innovators—AltaSea partners from various disciplines who are solving the challenges facing our ocean and mankind. For the first time, this series also includes pieces by AltaSea’s interns—high school and college students who wrote articles on diverse blue economy topics.

Whether working in regenerative aquaculture, blue technology, or marine science education, the forward-thinkers featured in this e-book are working tirelessly to secure a better future for life on Earth. In doing so, they are also embracing AltaSea’s spirit of collaboration for ocean solutions.



2451 South Signal Street
San Pedro, CA 90731

TABLE OF CONTENTS

MARINE SCIENCE	3
● ACTIONS YOU CAN TAKE ON WORLD OCEAN DAY	3
● TRACKING OCEAN HEALTH WITH MARINE MAMMALS	5
● RESTORING OCEAN LIFE WITH BIVALVE AND KELP AQUACULTURE	7
● THE THREAT OF MICROPLASTICS	9
● THE BENEFITS OF KELP	11
ALTASEA PARTNERS & BLUE ECONOMY SOLUTIONS	12
● AN AQUACULTURE FUTURE	12
● TECHNOLOGIES FOR THE RENEWABLE ENERGY FUTURE: ACCELERATING AND EXPANDING OFFSHORE WIND ENERGY	14
● DIVIROD'S ADVANCEMENTS IN WATER MONITORING SYSTEMS	16
● RISK MANAGEMENT THROUGH BIOMIMICRY: AQUAAI USES NATURE-BASED DESIGNS TO COLLECT UNDERWATER DATA	18
● PACIFIC MARICULTURE FOSTERS BIVALVE AQUACULTURE IN SAN PEDRO	20
● BRAID THEORY AND ALTASEA COLLABORATE TO SUPPORT BLUE TECH STARTUPS	22
● TURNING OCEAN PLASTIC POLLUTION INTO CONSTRUCTION MATERIALS	24
● SMART GREEN SHIPPING'S MISSION TO CURB MARITIME FOSSIL FUEL RELIANCE	26
OCEAN EDUCATION	28
● ALTASEA CELEBRATES OPENING OF SEAWEED LAB AND WELCOMES NEW CEO	28
● UCLA'S INSTITUTE FOR CARBON MANAGEMENT TO DEMONSTRATE CARBON REMOVAL TECHNOLOGIES AT ALTASEA CAMPUS	30
● BRIDGING IN GAPS IN STEM EDUCATION WITH SUSTAINABLE DEVELOPMENT GOALS	32
● INTERDISCIPLINARY APPROACHES TO THE BLUE ECONOMY	34
● WATER-BASED SOLUTIONS FOR A SUSTAINABLE DATA INDUSTRY TO BE INSTALLED AT THE ALTASEA CAMPUS	36



2451 South Signal Street
San Pedro, CA 90731

MARINE SCIENCE

ACTIONS YOU CAN TAKE ON WORLD OCEAN DAY

June 8, 2022

By Emily Vidovich, AltaSea Communications and Development Coordinator

June 8th marks [World Ocean Day](#), the annual day dedicated to collective action in celebration of the oceans that make life on our blue planet possible. As the [threats facing our oceans](#) grow more dire by the year, World Ocean Day presents an important opportunity to reflect on the damage humans have done to our planet, learn about actions to reduce your personal impact, and partake in collective actions that champion ocean solutions.

The United Nations (UN) has established the current decade as the UN Decade of Ocean Science for Sustainable Development, or the Ocean Decade for short. Because the UN's first world ocean assessment concluded that the window of opportunity in which to start managing the oceans sustainably is closing, focusing on solving ocean crises this decade is a necessity.

The goal of the Ocean Decade is to achieve [UN Sustainable Development Goal 14](#), Life Below Water, which encompasses all aspects of ocean sustainability. Because the challenges facing our oceans are diverse and vast, the Ocean Decade has identified several key challenges to address. While many of the focal points rely on effective policy, blue economy innovations, and large-scale societal shifts, there are several decade challenges that individuals can contribute to in their daily lives.

To celebrate World Ocean Day, here are three Ocean Decade challenges that you can contribute to in your personal life:

1. **Understand and beat marine pollution:** reducing your usage of single use plastics is a simple but powerful way to combat marine pollution. Carrying a reusable water bottle and shopping bag, bringing your own thermos for takeout coffees, and asking for no straw in your drink are all actions you can take to combat the accumulation of plastic pollution in our world. By switching to [reusable grocery bags](#), the average American family could save 1,500 single use bags a year. And the benefits of ditching single use plastics reach your wallet as well as the planet; the Earth Day Network calculates that Americans could [save over \\$250 a year](#) by opting for water in a reusable bottle instead of buying plastic water bottles.



2451 South Signal Street
San Pedro, CA 90731

2. **Sustainably feed the global population:** Global trends have made it clear that the status quo of food systems will have to shift in order to feed the growing human population. To relieve the pressure on overfished species, and avoid eating species that are harvested in notoriously destructive ways, use the Monterey Bay Aquarium's [Seafood Watch Guide](#) to help you make sustainable seafood choices. Substituting overfished species like swordfish, halibut, and bluefin tuna for [best choice species](#) like bass, cod, char, and mackerel can ensure that your food choices are contributing to a sustainable seafood industry. Incorporating [sustainably farmed species](#), particularly species that are lower on the food chain like clams and mussels, is another way to make your diet more ocean friendly. Since an estimated [10 percent](#) of plastic pollution in the ocean is abandoned fishing gear, the expansion of sustainable aquaculture could address both plastic pollution and overfishing.
3. **Develop a sustainable and equitable ocean economy & unlock ocean-based solutions to climate change:** Use your right to vote to support candidates that make climate change and ocean protection a top priority. Sign up for updates from conservation organizations such as [Sea Legacy](#) to stay up to date on conservation petitions that you can add your voice to, because elected leaders will only act if they think their constituents care. You can also volunteer your time to your favorite local ocean conservation organizations, or make an annual donation if there aren't volunteer opportunities near you. Finally, stay in touch with us here at AltaSea as we seek to build a hub for the blue economy that will unlock transformative ocean solutions.

TRACKING OCEAN HEALTH WITH MARINE MAMMALS

August 15, 2022

By Jasmine Oropeza, AltaSea College Intern

Marine mammals are important to the marine ecosystem, as over 3 billion people throughout the world depend on [marine biodiversity](#) for their livelihoods. Preserving marine biodiversity is critical to the health of the planet. The United Nations (UN) has [outlined its goals](#) for conserving and sustainably using the ocean and its marine resources, but our oceans are continuing to deteriorate as a result of human activity.

Ocean acidification is the process of our oceans absorbing carbon dioxide, ultimately changing the normal concentrations of the ocean. The burning of fossil fuels, water pollution, and the increase of atmospheric carbon has damaged the health of our marine ecosystem. This decline has only worsened in the recent decades. Since the onset of the Industrial Revolution, [ocean acidification has increased by 25%](#). The rapid rate at which our ocean is deteriorating is challenging for marine life to adapt to. According to a [UN report](#), almost 33% of reef-forming corals and more than a third of all marine mammals are threatened.

Pinnipeds, a group that includes both seals and sea lions, are suffering as a result of ocean acidification and loss of marine life. Exposure to [predation](#), toxins, and change in ocean acidity have affected their reproductive success and survival. [Toxic algae](#) that produces domoic acid has been linked to increased ocean acidification. [Domoic acid](#) causes seizures, loss of pregnancy, and death in sea lions.

Studying the health and geographical locations of marine mammals and other marine life in the ocean is a way to monitor the rapid progression of climate change. Seals are powerful indicators of the declining health of our marine ecosystems. Many programs such as [Wildlife Conservation Society \(WCS\) Marine Program](#) track marine mammal populations in order to protect these species and their habitats. [Research conducted by WCS](#) revealed seasonal



distributions and movement patterns of five species of Arctic marine mammals—bearded seals, beluga whales, bowhead whales, ribbon seals, and walrus—that allows further understanding of sea ice changes and climate change's effect on ocean ecosystems.

Not only do seals provide indicators of the progression of climate change, but they are also important to the health of the ocean. Marine mammals store carbon in their bodies, which they then excrete as waste products that fertilize and protect deep sea marine plants. They also have the

Photo by [Shannon VanDenHeuvel](#) on [Unsplash](#).

ability to counter [ocean stratification](#). As [One Green Planet explains](#), “By diving into deep waters to feed, then rising to the surface of the water to breathe, marine mammals create a ‘biological pump’ which mixes the ocean’s layers.” This biological pump supports the growth of [phytoplankton](#), which provide 50% of the oxygen in the ocean and the base for

the ocean food web. The life processes and bodily mechanics of marine vertebrates are essential for removing carbon from the atmosphere, so preserving their lives and habits is important in the fight against climate change.

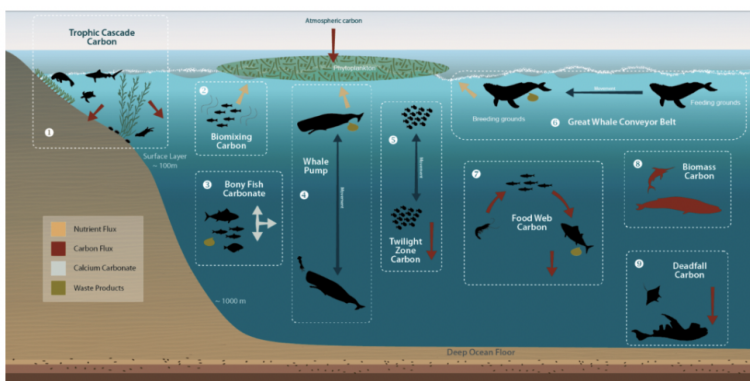


Photo from *Oceanic Blue Carbon*.

Marine mammals allow us the opportunity to monitor fluctuations in ocean acidification and marine ecosystems. Preserving and protecting our current marine life and helping them adapt to the changing environment will help mitigate the environmental changes that are deteriorating the ocean’s health.

About Author: Jasmine Oropeza is a pre-veterinary student at the University of California, Davis studying Animal Science and Public Health. Having more than 4 years of experience with different animal organizations within the Bay Area, she advocates for the importance of climate education, animal welfare, and accessible veterinary care. When not at UC Davis, Jasmine spends time with her pets in San Pablo, CA.

RESTORING OCEAN LIFE WITH BIVALVE AND KELP AQUACULTURE

September 15, 2022

By Jasmine Oropeza, AltaSea College Intern

Human activities—including fossil fuel combustion, fertilizer use, and mining—have upset the balance of the ocean by resulting in excessive amounts of nitrogen and carbon dioxide in the water. The [harmful effects](#) of excess nitrogen—which often enters the ocean via fertilizer-saturated [runoff](#)—include diminished food sources and habitats, increased algae growth, and [decreased oxygen levels](#). In facing [climate change](#), the ocean has absorbed [50 times more carbon dioxide](#) than the atmosphere, rapidly declining its health. Bivalve and kelp aquaculture has emerged as a way to counter these challenges by reducing excessive amounts of carbon dioxide and nitrogen in the ocean.

Bivalves, including shellfish such as mussels and clams, naturally filter nitrogen from the environment by absorbing it into

their shells and tissue as they grow. Bivalves can filter up to 50 gallons of water a day. [A study](#) conducted by the University of Florida revealed that 136 million aquaculture-raised clams were able to remove 25,000 pounds of nitrogen from the coastal environment and store 760,000 pounds of carbon. By filtering nitrogen from the ocean, these shellfish allow aquatic life to flourish in less polluted waters.

Kelp and seaweed also have the capability to filter and remove excess amounts of carbon dioxide in the ocean while producing oxygen through the process of photosynthesis. Dr. Diane Kim—marine

microbiologist, kelp biologist, and founder of [Holdfast Aquaculture](#)—connects the environmental importance of kelp aquaculture to its potential as a sustainable food source.

“Seaweed provides a food source, a habitat, and nursery grounds for so many marine species contributing to a healthy marine ecosystem as they grow. Once they’re grown, they provide a great nutritional benefit for humans.” Dr. Kim explains.

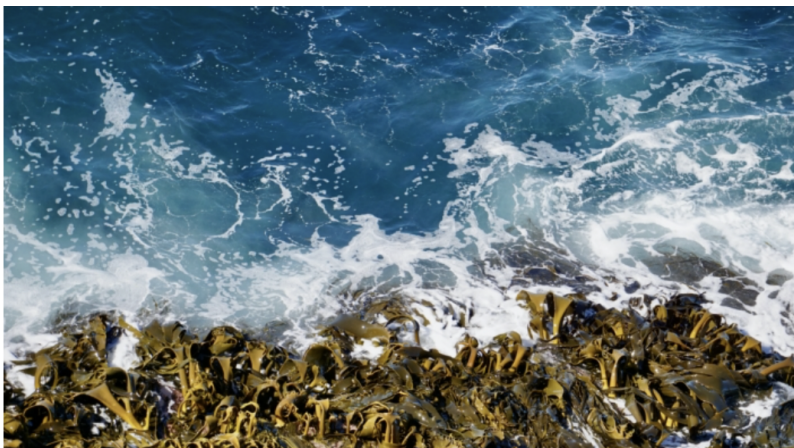


Photo by [Karen Chew](#) on [Unsplash](#)

Kelp [counteracts](#) the negative impacts of ocean acidification—the reduction of the ocean’s pH levels due to excessive absorption of carbon dioxide—on bivalves and improves their growing conditions. When left unchecked, acidification slows the growth of fish and shellfish and can prevent shell formation in bivalve mollusks. Using the symbiotic relationship between bivalves and kelp in aquaculture can help mitigate the impacts of ocean acidification on bivalves

while simultaneously allowing the kelp and bivalves to absorb excess carbon dioxide and nitrogen.



Photo by [EJ Strat](#) on [Unsplash](#)

[Critics](#) of bivalve and kelp aquaculture criticize large-scale aquaculture practices because of their ability to alter population genetics and propagate disease. In response, Dr. Kim says, “We [Holdfast Aquaculture] focus on locally sourced/adapted bivalves and seaweeds. Growing on a large scale in wrongful ways can propagate disease, introduce invasive species, and harm the ecosystem. If you manage it well, you can monitor the operation so that you are making sure that you are indeed having a net positive impact on the environment.”

Holdfast Aquaculture focuses on locally-grown bivalves and has introduced a mussel breeding program that chooses superior mussel genetics for improved genetic pool with more healthy and robust mussels. By growing locally sourced bivalves, Holdfast contributes positively to the environment while feeding the community.

“Aquaculture can be beneficial for the environment, ocean ecosystems and for tackling food insecurity in the world,” Dr. Kim says. “We hope to see an aquaculture industry that is rooted in sustainable community supported models. With kelp and bivalves, we are bringing life back into the ocean.”

About Author: Jasmine Oropeza is a pre-veterinary student at the University of California, Davis studying Animal Science and Public Health. Having more than 4 years of experience with different animal organizations within the Bay Area, she advocates for the importance of climate education, animal welfare, and accessible veterinary care. When not at UC Davis, Jasmine spends time with her pets in San Pablo, CA.

THE THREAT OF MICROPLASTICS

September 30, 2022

By Lorenzo Brown, AltaSea High School Intern

A common misconception is that plastics eventually break down. The truth is that plastic pollution doesn't disappear; it just breaks into smaller pieces that continue to pollute the water forever. Microplastic pollution is one of the most significant threats currently facing the ocean. As of 2022, there are between [50 and 75 trillion microplastics in the ocean](#); that's roughly ten thousand pieces of trash per person in the world.



Microplastics on a beach in Sri Lanka. Photo by [Sören Funk](#) on [Unsplash](#).

Microplastics are defined as plastics that are five millimeters in diameter or less, which can be items the size of a penny or smaller. They can come from common items such as clothing fibers, toothbrushes, and utensils. Large pieces of plastic that pollute the ocean ultimately break apart and become the microplastics of the future. [According to Nathalie Brundell](#), 11% of all plastics in the ocean are microplastics, and that percentage continues to increase.

Microplastics [damage marine life](#) in many ways. When an animal ingests microplastics that they mistake for food, the microplastics go into the animal's intestines and clog up its

digestive system. This prevents the animal's organs from functioning properly, which can lead to death.

Additionally, as bigger species consume smaller organisms that have already ingested microplastics, these plastics make their way up the food chain. This leads to a build up of plastics, as well as the [toxins they absorb](#), in larger organisms. This has consequences for humans as well as marine life.



2451 South Signal Street
San Pedro, CA 90731

As Brundell explains, “Microplastics actually concentrate and absorb other toxins in the oceans. Along with the plastic-polluted fish, these toxins end up on your dinner plate.”

Since fibers from plastic-based materials such as polyester account for [35% of ocean microplastics](#), one thing that individuals can do to help prevent the spread of microplastics is to adopt eco-friendly laundry habits. This includes washing clothes less frequently and on gentle cycles to prevent microfibers from shedding. It is also possible to get [washing machine filters](#) that trap microfibers. Microplastic pollution will be difficult to solve, so every person’s effort matters.

About the Author: Lorenzo Brown is a sophomore at Hyla High School on Bainbridge Island, Washington State.



2451 South Signal Street
San Pedro, CA 90731

THE BENEFITS OF KELP

October 14, 2022

By Asha Reardon, AltaSea High School Intern

In my hometown of Bainbridge Island in the state of Washington, there used to be a kelp forest off of the island's coast. For the past several decades, kelp levels off the coast of Washington have declined by [60 to 80 percent](#). Bainbridge Island's last bed of kelp disappeared in 2017. For the time being, there's no evidence that the kelp will return.

While the full story of the kelp's disappearance is still unclear, Washington's Department of Natural Resources has identified several contributing factors. Kelp has been damaged by oil spills, and as climate change raises ocean temperatures, there has been an uptick in kelp-eating urchins. It is clear that human activities are harming kelp forests, preventing the kelp from providing benefits to the ecosystem.

Kelp benefits the oceans and the planet in many different ways. Kelp forests provide habitat, food, and shelter for [1,000 different species](#), including seals, sea lions, sea otters, invertebrates, fish, sharks, and seabirds. Even gray whales have been seen in kelp forests, most likely using the forest as a cover from orcas. Many of these organisms use the kelp's thick blades as shelter, protecting their young from predators and storms. Kelp is also a [rich source of nutrients](#) required by both animals and humans.

Kelp also benefits the ocean water itself. Through photosynthesis, the kelp absorbs excess carbon dioxide, helping to de-acidify the water. This has the potential to [reverse ocean acidification](#). By keeping the ocean's pH in balance, the kelp helps to ensure that important shell-building species are still able to build their shells. Although climate change is [contributing to kelp die-offs](#) along the West Coast, kelp's natural absorption of carbon dioxide makes it a powerful tool for reducing climate change. In 2021, an [expert panel](#) brought together by the Energy Futures Commission found that human-cultivated kelp has the potential to remove 1 billion to 10 billion tons of carbon dioxide from the atmosphere annually.

I hope that scientists are able to figure out exactly what made Bainbridge Island lose its kelp forest, so that they can find a way to restore the habitat. I personally want to focus on stopping the disappearance of kelp as well, because the ocean depends on the many benefits of kelp.

About the Author: Asha Reardon is a sophomore at Hyla High School on Bainbridge Island, Washington State.

ALTASEA PARTNERS & BLUE ECONOMY SOLUTIONS

AN AQUACULTURE FUTURE

November 15, 2021

By Emily Vidovich, AltaSea Communications and Development Coordinator

Aquaculture is the oceanic counterpart to agriculture—it is the business of cultivating and harvesting aquatic species, including fish, shellfish, and algae, for consumption or commercial use. The United Nations Food and Agriculture Organization [calculates](#) that aquaculture production has risen 527% since 1990, with a majority of yield being finfish.

Cultivation of mollusks, including shellfish such as mussels, clams, and oysters, only constitutes about 20 percent of current global aquaculture. But shellfish production is gaining popularity due to its sustainability. Because shellfish grow quickly and do not require freshwater, land, or fertilizer, they are one of the most sustainable sources of protein available. At AltaSea’s campus in the Port of Los Angeles, [HoldFast Aquaculture](#) is working to develop local shellfish species for aquaculture production.



One of the mussel-based cuisines developed by HoldFast. Credit: HoldFast Aquaculture.

In collaboration with Santa Barbara Mariculture, HoldFast is developing variations of California blue mussels that are optimal for regional aquaculture operations. The company sells shellfish and algae seed from which farmers can grow mussels, oysters, clams, and various seaweeds. HoldFast also has a research and development arm that forwards sustainable aquaculture through its shellfish breeding program, micro and macro-algae aquaculture, and consulting services to farms and hatcheries.

Like AltaSea, HoldFast believes in the importance of science education and outreach. To encourage youth engagement in the blue economy, the company offers free presentations and immersive learning experiences to schools as

well as job training for the aquaculture industry. Due to its multifaceted approach, HoldFast is considered an industry leader in California sustainable aquaculture—a crucial component of the future blue economy.

Sustainable shellfish aquaculture not only minimizes environmental degradation, it actually improves the marine environment. Growing shellfish [creates a structural habitat](#) for other ocean species, bolstering ocean ecosystems. Shellfish beds also stabilize sediment on the seafloor, protecting shorelines from [climate change-fueled erosion](#). Since they are filter feeders, shellfish clean the water by eating micro-sized contaminants. This process removes toxins and prevents harmful algal blooms. The natural filtration provided by shellfish also removes excess nutrients, such as nitrogen from fertilizer runoff, from the ocean. A 2020 study in Greenwich, Connecticut, valued the nitrogen removal services of aquaculture shellfish at [\\$2.3 to \\$5.8 million annually](#).



Mussels growing along the coast. Photo by Peter Secan on Unsplash.

Shellfish production benefits people as well as our planet. Mussels and other shellfish provide various nutrients, vitamins, fatty acids, and minerals essential to a healthy diet. Due to their nutrient-density, rapid maturation, and resiliency against the effects of climate change on their habitat, shellfish are projected to be integral in [achieving food security](#) for the swelling human population.

With this in mind, HoldFast has teamed up with culinary experts to produce diverse and delicious mussel-based products. In doing so, HoldFast hopes to shift the way people think about food and show that shellfish can be both a ubiquitous and refined dietary staple. In this foray, and in all

of its work, HoldFast champions its founding belief—that feeding people nutritious food should not come at the expense of the environment.

TECHNOLOGIES FOR THE RENEWABLE ENERGY FUTURE: ACCELERATING AND EXPANDING OFFSHORE WIND ENERGY

December 15, 2021

By Emily Vidovich, AltaSea Communications and Development Coordinator

To maintain the possibility of limiting global warming to 1.5 degrees Celsius above pre-industrial levels, global emissions must be [reduced by 55 percent by 2030](#). Accelerating the clean energy transition is foundational to limiting global warming, since the [energy sector accounts for 76 percent](#) of global greenhouse gas emissions. Within the energy sector, heat and electricity generation rank as the highest emitting sub-sector at 31.9 percent of global emissions.

Harnessing energy from offshore wind is essential to achieving a future powered by clean energy. Offshore winds are more powerful, abundant, and blow more consistently than land-based winds. As such, they have incredible potential to power global electricity needs. An assessment of the capacity for offshore wind energy production in U.S. federal and state coastal waters as well as the Great Lakes found that there is potential to generate [2,000 gigawatts](#) of capacity annually. This means that if American offshore wind energy production is maximized, it would create enough energy a year to power almost double the nation's current electricity needs.



The U.S. Department of Energy has set a goal of reaching 30 gigawatts of offshore energy capacity by 2030, enough to power 10 million homes and [reduce greenhouse gas emissions](#) by 78 million metric tons. Reaching this goal would also support [77,000 jobs](#)—employing 44,000 people directly in the offshore wind industry and an additional 33,000 in nearby communities.

But while offshore wind is one of the most promising frontiers in the future of energy, current logistical challenges and high cost of installing

Cover photo: Offshore wind farms have enormous capacity for renewable energy production. Photo by Nicholas Doherty on Unsplash.

and maintaining offshore facilities are significant [barriers](#) to rapid, widespread implementation. A company called RCAM Technologies seeks to address these challenges by combining 3D printing technology and biomimicry to develop technologies that reduce the cost of offshore wind farms and facilitate easier construction.

[RCAM Technologies](#) uses 3D concrete printing to create common components of wind turbines—anchors that hold floating wind turbines in place, fixed bottom foundations for turbines in shallower waters, and turbine towers. RCAM’s



A prototype of RCAM’s energy storage modules. Photo courtesy of RCAM Technologies.

designs can be 3D concrete printed at ports, circumventing the logistical challenges of transporting large pieces of equipment. [The company says](#) that their innovations can lower installation costs by up to 90 percent compared to standard industry practices, while also utilizing domestic materials and local labor. RCAM has also designed long-term energy storage technology that can house the energy made by offshore wind—concrete spheres that [mimic the ability of arthropod shells](#) to withstand pressure. These hollow spheres sit on the seafloor and store energy within them.

Solutions such as these, which reduce costs and solve logistical challenges, could help offshore wind technology become more accessible globally. [Democratizing access to clean energy sources](#) is crucial not only to fulfill the energy needs of high-emitting developed nations, but also to ensure that the growing energy needs of developing nations are met in a sustainable manner. As renewable

technology increasingly [out-competes coal](#) as the cheapest energy option, access to low-cost renewables becomes a mechanism for economic prosperity as well as climate change mitigation. New renewable energy projects added in 2020 are projected to save emerging economies [\\$156 billion](#) over the projects’ lifespans. Innovations like those developed at RCAM Technologies will be crucial to making the offshore wind industry as cost-effective as possible while also streamlining implementation so that offshore wind energy can be a major global player in the clean energy future.

DIVIROD'S ADVANCEMENTS IN WATER MONITORING SYSTEMS

January 15, 2022

By Emily Vidovich, AltaSea Communications and Development Coordinator

[Diviroad](#) is a water risk infrastructure and analytics company that is building a comprehensive and scalable water data network. The company uses a network of data sensors to fill gaps in current water monitoring systems, which they describe on their website as “outdated models” operating within “sparse and disparate monitoring networks.” Diviroad’s innovation enables better measurement of environmental risks and water challenges fueled by climate change.

Diviroad’s technology circumvents limitations of traditional measurement models by deploying small sensors that are installed outside of water, preferably on high-ground features such as poles or rooftops. In a video on the company’s

website, Diviroad founder [Dr. Javier Marti explains](#)

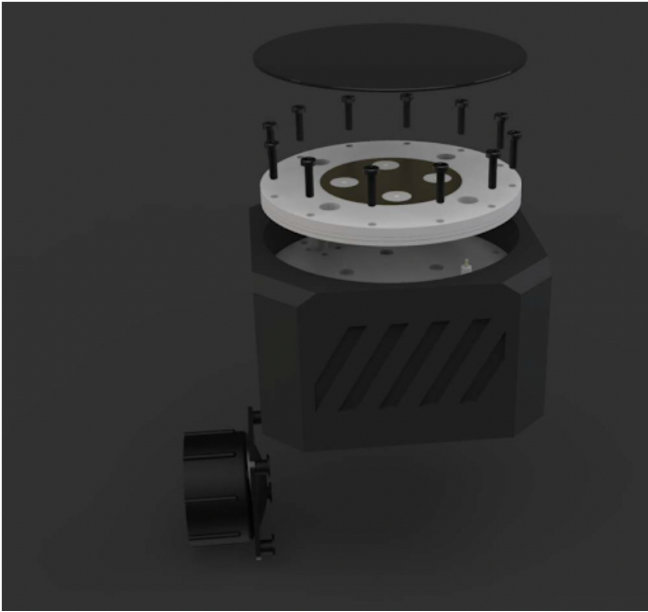
that the key difference between Diviroad’s model and traditional monitoring is that traditional monitors collect data at one fixed point, whereas Diviroad’s sensors cover an entire area. Diviroad claims that just one of their units, “provides an information map equivalent to over 300 traditional sensors.” Their sensors operate nonstop and can cover a range of up to 10 acres.



Accurate water measurement is becoming increasingly critical as climate change worsens and prolongs droughts. Photo by [Mike Erskine](#) on [Unsplash](#)

These sensors partially work by gathering data from the pre-existing satellites that orbit Earth and bounce signals off the planet. Diviroad’s sensors collect previously unused data by measuring how the resonance of satellite signals changes when the signals hit water. The company’s proprietary machine-learning algorithm decodes these signals to create accurate data. By collecting water data from

government and local sources and supplementing it with their own data, Diviroad can precisely map and measure water-affected factors such as water level, snowfall, vegetation, and soil moisture percentage.



3D model showing the interior of Divirod's sensor. Photo courtesy of Divirod.

Once sensors are installed in an area, users can access the data on any smartphone or computer. Divirod says that their sensors can forecast and measure virtually anything related to water, enabling them to be utilized for remote monitoring of environmental risks related to property management, tidal management, and resource management.

In regards to property management data services, Divirod envisions a highly personalized approach for commercial building owners and facility managers to understand and mitigate potential water damage to roofs. Divirod's modular system, box-shaped sensors that can be incorporated into existing infrastructure, enables such tailored data.

When it comes to measuring tides, Divirod claims that its technology is significantly less expensive than pre-existing government monitoring stations and can provide information that is more localized, improving accuracy. Accurate tide

information is crucial for coastal communities seeking to protect property and improve climate resiliency in the face of [sea level rise](#).

[Water supply challenges](#) are projected to be a key feature of the climate change-altered world of the coming decades, particularly in areas like California where changing weather patterns are already [exacerbating droughts](#). Divirod asserts that real-time, precise analysis of measurements such as water level and soil moisture will be critical to optimizing water usage, understanding risks, and preparing for shortages. No matter the application, Divirod hopes to empower its users with accurate, abundant information, so that they are prepared to anticipate, adapt to, and protect against impending water risks.

RISK MANAGEMENT THROUGH BIOMIMICRY: AQUAAI USES NATURE-BASED DESIGNS TO COLLECT UNDERWATER DATA

February 15, 2022

By Emily Vidovich, AltaSea Communications and Development Coordinator

Inventor Simeon Pietrkosky co-founded [Aquaai](#) in 2014 after his young daughter learned about the [crises facing the ocean](#) and asked her father to invent a robot that could help save the seas. Using biomimicry as a design ethos, he created an autonomous underwater vehicle (AUV) that looks, feels, and moves like a fish.

The torpedo-shaped robot, which is partially covered in soft orange “scales,” copies the physics of how fish swim to propel itself through the water—it flexes its body to move its tail back and forth, while the pectoral fins on its sides assist with direction and balance. This fin propulsion design also reduces the amount of energy needed to power the AUV because the robot, like the fish that inspired its design, moves through water with efficiency. Aquaai has built these robot fish in sizes ranging from 30 centimeters to 1.5 meters in length.



Aquaai's proprietary fish-like AUV. Photo Courtesy of Aquaai.

When conceptualizing the design, Pietrkosky hoped to make his AUV unobtrusive so that it could immerse itself in underwater habitats as it collects data. The robot is equipped with cameras and sensors that can relay real-time data and high quality video feeds. Small enough to be deployed by a single person, the robot can be used to [monitor aquaculture fisheries](#) and other underwater industries. The AUV can monitor temperature, water quality, pH, and dissolved oxygen at fisheries—metrics that are crucial to maintaining the health of fish and minimizing negative externalities that can result from poorly managed aquaculture. With [sustainable](#)

[aquaculture](#) playing an increasingly important role in feeding the growing human population while decreasing pressure on overfished wild species so that the ocean can thrive, access to such data is essential.

Aquaai markets its product as, “the easiest, most effective, and least expensive way to access digital and environmental data from the waterways.” In addition to its uses in the aquaculture industry, Aquaai’s technology can be put to use



2451 South Signal Street
San Pedro, CA 90731

monitoring water quality after storms, identifying the source of nutrient pollution from agriculture, and tracking plastic pollution. Its small design means that it is not limited to the open ocean—it can be deployed in aquaculture enclosures, ports, and narrow waterways.

Since finishing extensive trials and fine-tuning their product, Aquaai has been busy preparing its updated AUVs for customers—the company has already received preorders for 86 robots. Aquaai co-founder Liane Thompson sees this as an encouraging first step towards bringing to fruition the company’s mission—using biomimicry to protect waterways from the negative impacts of human activity.

PACIFIC MARICULTURE FOSTERS BIVALVES AQUACULTURE IN SAN PEDRO

April 15, 2022

By Emily Vidovich, AltaSea Communications and Development Coordinator

Off the coast of San Pedro, [Pacific Mariculture](#) is developing the first offshore mussel farm in United States federal waters. The project's goal is to create a sustainable shellfish farm that can increase food security, create local jobs, and reduce reliance on imported seafood.

Bivalves—a class of shelled marine organisms including mussels, clams, oysters, and scallops that are colloquially referred to as shellfish—are unassuming creatures that are getting an increasing amount of attention. As climate change, population growth, and overfishing collide to create a [perfect storm for a food shortage](#) in the coming decades, [scientists and experts are finding that consuming more shellfish](#) and less other animal proteins will be crucial to securing a sustainable future for food. That is because shellfish are both nutritious—they are more protein-dense than many other meats and have high levels of both omega-3 fatty acids and essential micronutrients—and one of the most environmentally friendly foods available.

When farmed, bivalve aquaculture is zero-impact because bivalves require no feeding, antibiotics, or chemicals. Since they are filter feeders, bivalves improve their environment by cleaning the water. Shellfish also provide a [structural](#)



The nutrient density and nonexistent environmental impact of mussels makes them a promising dietary staple for the future. Photo by Andy Castille on Unsplash.

[habitat](#) for other species. These factors make bivalve farming the aquatic archetype of [regenerative agriculture](#). Whether wild caught or farmed, bivalves have notably less environmental impact than other animal proteins, including farmed fish. [Zoologist David Willer](#) attested to this in an interview with BBC, noting, “If just 25% of ‘carnivorous fish’ aquaculture was replaced with an equivalent quantity of protein from bivalve aquaculture, 16.3 million tonnes of CO2 emissions could be saved annually—equivalent to half the annual emissions of New Zealand.”

The various benefits of bivalves as a food source led Pacific Mariculture to focus on mussels, which are native to California. Pacific Mariculture is a subsidiary of [Pacific 6](#), a Long

Beach-based partnership that seeks to invest in and develop projects that positively impact communities, including sustainable aquaculture. Pacific6 believes that, “employing proven science, advanced technology, best industry practices



2451 South Signal Street
San Pedro, CA 90731

and diligent consideration for the environment can create a paradigm shift in domestic seafood production.” In order to realize this vision, Pacific6 works with research institutes, scientists, environmentalists, government agencies, fishermen, and aquafarmers.

At the AltaSea campus in the Port of Los Angeles, along the stretch of coast where the offshore mussel farm is located, Pacific Mariculture and the University of Southern California (USC) have teamed up to train future blue economy professionals. At the [USC labs housed at AltaSea](#), the university and its industry partners—including Pacific Mariculture—provide college students with year-round training in aquaculture practices as well as research and development. Industry experts train students in both established and emerging aquaculture operations, while USC academics train students to properly approach experimental design and data analysis. This two-pronged approach facilitates the development of a well-rounded new generation of blue economy professionals. Through its innovations in mussel farming and contributions to education initiatives, Pacific Mariculture is helping to realize a future based on a sustainable blue economy.

BRAID THEORY AND ALTASEA COLLABORATE TO SUPPORT BLUE TECH STARTUPS

May 15, 2022

By Emily Vidovich, AltaSea Communications and Development Coordinator

[Braid Theory](#), an advisory firm focused on science and engineering-led companies, is in the business of helping blue tech startups thrive. Since 2016, Braid Theory has focused on giving blue economy innovators the multilateral support needed to accelerate environmentally friendly, ocean-based solutions to sustainability issues in industries such as maritime shipping, food systems, and energy generation.

The firm's [space on the AltaSea waterfront campus](#), known as Braid Space, is a cluster of repurposed shipping containers within one of the historic warehouses that make up the AltaSea campus. Braid Theory's aim is to utilize the inherently collaborative nature of AltaSea's campus to expand Los Angeles' Bluetech Innovation Hub and attract new businesses, industries, and technologies to the city.



The unique location and formulation of AltaSea, which brings multisector innovators for ocean solutions together under one roof within the nation's largest port, is foundational to Braid Theory's vision for an expansive and innovative blue tech industry in Los Angeles. By circumventing some of the major logistical challenges facing ocean innovators, including workspace, ocean accessibility, research equipment, and commercialization support, AltaSea and Braid Theory are increasing the accessibility, and consequently the breadth, of blue economy sectors.

AltaSea's Port of Los Angeles campus is one of the only places where such companies can work feet away from the ocean with an affordable rent.

AltaSea's campus includes berths and dedicated waterspace within the port where blue tech can be field tested. At Braid Space, engineers and business advisors provide customized support to assist technology entrepreneurs on their path to commercialization. Thus, the early-stage blue economy companies headquartered at AltaSea benefit not only from an affordable workspace and close proximity to other innovators, but also the tailored support of Braid Theory in achieving growth and market success.



2451 South Signal Street
San Pedro, CA 90731

In addition to these services, Braid Theory offers critical equipment for AltaSea campus tenants. Their facilities at AltaSea's waterfront campus include test-beds, synthetic biology and biochemistry labs, and platforms for ocean observing and robotics. This equipment, while necessary for technology development, can be cost-prohibitive to many small or early-stage companies. Providing communal equipment circumvents a major barrier that typically faces innovators, making AltaSea's Bluetech Innovation Hub an attractive option for luminaries from all disciplines who have the knowledge and ideas necessary to create a sustainable future through blue economy innovations, but lack access to essential facilities.

As such, Braid Theory's multifaceted approach to expanding the blue economy in Los Angeles is primed to not only bring innovation to the city, but also to give groundbreaking blue tech organizations the platform, tools, and support needed to thrive.

TURNING OCEAN PLASTIC INTO CONSTRUCTION MATERIALS

November 15, 2022

By Emily Vidovich, AltaSea Communications and Development Coordinator

In 2020, [Ocean Voyages Institute](#) (OVI) embarked on a two-month expedition to clean up the Great Pacific Garbage Patch—an [accumulation of trash](#) in the Pacific Ocean that is [twice the size of Texas](#). The organization ultimately pulled over 100 tons of plastic, mainly fishing nets, from the ocean. This plastic was then given to partner organizations to be repurposed.

One of OVI's off-take partners, [ByFusion](#), is a manufacturing company with a non-traditional recycling method that can be applied to all kinds of plastic waste. ByFusion ultimately turned 20 tons of the collected ocean waste into a large-scale building material called a [ByBlock](#), which according to the company is roughly equivalent in size and construction application to the ubiquitous concrete masonry unit. According to a press release, the plastic waste from the ocean cleanup was converted into 4,000 construction-grade building blocks. ByFusion released this product to market at the end of 2020.

ByFusion's product not only diverts plastic waste from landfill and gives it a functional, long-term use, it also provides a climate-friendly alternative to concrete. Thanks to its durability and versatility, concrete is the most commonly used

building material in the world. One of concrete's key ingredients is cement—over [70 percent](#) of cement used in the United States in 2021 went into concrete mixtures. This is the source of concrete's carbon-intensivity—the cement industry is one of the leading drivers of climate change, accounting for [8 percent](#) of manmade greenhouse gas emissions.

Due to concrete's essential nature and dearth of fully-developed alternatives, [decarbonizing](#) the cement industry is one of the most difficult challenges in meeting [climate goals](#) for the coming decades. If products like the ByBlock are marketed at scale, they could serve as part of the solution to

this challenge by providing an alternative to concrete in some applications, ultimately reducing the demand for this carbon-intensive product.





2451 South Signal Street
San Pedro, CA 90731

ByFusion remains optimistic that its product will be able to do just that. In a press release, the company stated that its partnership with OVI, “[closes] the loop on the largest ocean clean up in history by not only removing plastic waste from our oceans but giving it a permanent purpose by converting it to a building material that can be used for modular structures, landscaping, sheds, outdoor spaces, and a number of other applications.”

SMART GREEN SHIPPING'S MISSION TO CURB MARITIME FOSSIL FUEL RELIANCE

November 29, 2022

By Emily Vidovich, AltaSea Communications and Development Coordinator

Maritime shipping transports approximately [11 billion tons](#) of goods annually, facilitating the global economy and providing people worldwide with diverse materials and necessities. In the process, the shipping sector produces [nearly three percent](#) of manmade emissions.

At the latest [United Nations](#) climate conference, COP27, global leaders sought to address the shipping industry's status as one of the [top ten contributors to climate change](#) through the [Green Shipping Challenge](#).

At the challenge's launch on November 7, according to a press release from the [U.S. Department of State](#), "countries, ports, and companies made more than 40 major announcements on issues such as innovations for ships, expansion in low or zero-emission fuels, and policies to help promote the uptake of next-generation vessels."

One of AltaSea's blue economy partner organizations, [Smart Green Shipping](#), has been at the forefront of developing technologies that address all three of the Green Shipping Challenge's focal points. Smart Green Shipping seeks to enable the global shipping fleet to take advantage of wind energy—a free, abundant, and renewable resource. It does this by retrofitting existing cargo ships with wingsails as well as designing 100% renewable newly built ships.

To enable existing ships to harness wind power, the company designed sails that can be installed onto the empty deck space of commercial vessels. This technology requires no additional crew members or portside maintenance, further

increasing the feasibility of its installation. The company estimates that there are [40,000 existing ships](#) that could be transitioned into hybrid sailing vessels through this retrofit. With United Nations [climate experts warning](#) that greenhouse gas emissions must no longer increase after 2025 if the world is to avoid catastrophic consequences from climate change, Smart Green Shipping's technology for retrofitting existing ships is a practical way to reduce the shipping sector's emissions as rapidly as possible.



An artist's impression of a Drax panamax ship retrofitted with Smart Green Shipping's sails.
Image courtesy of Smart Green Shipping.



2451 South Signal Street
San Pedro, CA 90731

Smart Green Shipping also optimizes the operation of both retrofitted and newly built wind-powered ships by monitoring and predicting winds through its proprietary [data analysis tool](#). As explained in [Business & Innovation Magazine](#), this technology is essentially a, “sophisticated analysis system that can accurately calculate the available wind to any ship, across any trade route at different speeds.”

Through the combination of innovative systems design and strategic use of technology, Smart Green Shipping’s retrofit of existing cargo ships has proven itself capable of decreasing a vessel’s annual emissions by [20 percent](#). For the company, the 20 percent emissions reduction is just a starting point as it continues to pursue greater optimization of equipment and technology in order to accelerate the shipping industry’s green transition.

OCEAN EDUCATION

ALTASEA CELEBRATES OPENING OF SEAWEED LAB AND WELCOMES NEW CEO

March 15, 2022

By Emily Vidovich, AltaSea Communications and Development Coordinator

This past week, AltaSea and its partners at the University of Southern California (USC) officially opened a seaweed lab on the AltaSea campus. The 6,000 square foot lab will conduct research on regenerative aquaculture as well as aquafarming technologies.

The opening of the lab, known officially as the Nuzhdin Research Laboratory, marks the beginning of a [promising partnership](#) between the nonprofit and USC's Dr. Sergey Nuzhdin. With the support of NOAA Sea Grant and the USDA, Dr. Nuzhdin and his team will be investigating ways to sustainably expand aquaculture, particularly the cultivation of bivalves and kelp, in the United States. Part of this research involves improving the commercial production of seaweeds through establishing best practices in breeding and cultivation, in order to protect the genetic diversity of kelp.



Over 150 guests were in attendance to celebrate the opening and listen to a panel discussion between AltaSea CEO Terry Tamminen, USC President Carol L. Folt, and philanthropist Dr. Melanie Lundquist. Former Governor Arnold Schwarzenegger also made a virtual appearance to extend his congratulations.

The ribbon-cutting event for the seaweed lab was one of the first that AltaSea's new CEO Terry Tamminen, who began his tenure at the start of 2022, has been able to oversee.

Prior to joining AltaSea, Tamminen's [diverse career](#) spanned oceanic research, successful private sector endeavors, and notable accomplishments in both public service and nonprofits. In 1993, he founded the Santa Monica Bay Keeper, now known as the Los Angeles Waterkeeper, and co-founded waterkeeper programs in five additional California Watersheds. He later served as the executive director of the Environment Now Foundation and co-founded the Frank G. Wells Environmental Law Clinic at the University of



2451 South Signal Street
San Pedro, CA 90731

California Los Angeles (UCLA) School of Law, which was recently renamed the Emmett Institute for Climate Policy at UCLA Law.

In 2003, Tamminen was appointed as secretary of the California Environmental Protection Agency under the Schwarzenegger administration. He was later appointed cabinet secretary and chief policy advisor to the governor. During his tenure, Tamminen developed several groundbreaking environmental policies, including the Global Warming Solutions Act of 2006, the Hydrogen Highway Network, and the Million Solar Roofs initiative. After leaving state government in 2006, Tamminen founded [Seventh Generation Advisors](#) (SGA), which encourages a “bottom up” approach to adopting clean energy and climate policy. He currently serves as SGA’s president in addition to his new role as AltaSea’s president and CEO.

At the opening of the USC seaweed lab, Tamminen stressed the importance of the work being done at AltaSea, “We’ve profoundly damaged the ocean, our home, making it a dumping ground for plastic and oil and so much carbon pollution that we’ve changed the PH, the very chemistry of the ocean. We must reverse those trends in our oceans and AltaSea is the best place to discover and scale up those solutions to the challenges.”

The USC seaweed lab joins aquaculture innovators Holdfast Aquaculture and Carlsbad Aquafarms at AltaSea. Housing organization’s from the same sector in one facility will enable the sharing of knowledge as well as cooperative efforts on engaging local youth, training future sustainable aquafarmers, and developing mentorship programs for student researchers. This spirit of scientific collaboration is at the root of AltaSea’s mission to connect diverse ocean experts in order to accelerate the creation of the blue economy.



2451 South Signal Street
San Pedro, CA 90731

UCLA'S INSTITUTE FOR CARBON MANAGEMENT TO DEMONSTRATE CARBON REMOVAL TECHNOLOGIES AT ALTASEA CAMPUS

June 30, 2022

By Emily Vidovich, AltaSea Communications and Development Coordinator

A recent [report on climate change mitigation](#) from the Intergovernmental Panel on Climate Change (IPCC) delineated seven pathways that humanity could follow in order to avoid unchecked, catastrophic global warming. Four of those pathways would limit global warming to 1.5 degrees Celsius above pre-industrial levels, and three would halt warming at 2 degrees Celsius. In six of those seven scenarios, the IPCC found that carbon capture was a necessary part of the solution.

[Carbon capture](#) refers to technology that can filter emitted carbon out of the atmosphere and store it underground, where it cannot warm the planet. There are two variations—carbon capture refers to grabbing emissions as they come out of a high-emitting source such as a power plant, while carbon removal sucks carbon out of the air without targeting a particular emissions source.

As climate solutions, carbon capture is promising for industries that will be the most challenging to decarbonize—such as steel and concrete—while carbon removal can help draw down past emissions in order to rectify past harms. Because of this, carbon capture can be seen as a way to buy much needed time to design solutions for the most challenging aspects of the fossil fuel-free future, and carbon removal presents a way to help turn back the clock and retroactively address [climate inaction](#). While neither should be used as a substitute for decarbonization, the IPCC mitigation report makes it clear that both technologies are necessary in order to have a fighting chance at stopping climate change.

Because of the importance of carbon removal to a sustainable future, AltaSea has partnered with the Institute for Carbon Management (ICM) at the University of California Los Angeles Samueli School of Engineering to demonstrate carbon removal technologies at the AltaSea campus. ICM's innovative technology focuses on marine-based carbon removal—removing excess carbon dioxide (CO₂) from the ocean instead of from the air. The process involves using renewable energy to trap carbon dioxide by transforming it into solid [carbonates](#).

Removing excess CO₂ from the ocean has the significant co-benefit of counteracting [ocean acidification](#), the phenomenon that describes the decrease of the ocean's pH as seawater absorbs the CO₂ emitted from burning fossil fuels. The ocean has become 30 percent more acidic since the beginning of the industrial revolution, negatively impacting marine ecosystems and shell-building organisms. By addressing excess CO₂ in the ocean, ICM's technology could both address climate change and restore balance to ocean ecosystems.

In a press release, AltaSea CEO Terry Tamminen applauded the new partnership.



2451 South Signal Street
San Pedro, CA 90731

“AltaSea’s mission is to convene the best and brightest that are fighting climate change through innovative technology, and ICM’s carbon removal technology is a gamechanger in our global fight against climate change,” he said, “We are excited to have them on board and be able to help foster the development and growth of breakthrough technologies that can have positive, impactful change on our planet.”

BRIDGING IN GAPS IN STEM EDUCATION WITH SUSTAINABLE DEVELOPMENT GOALS (SDGS)

August 3, 2022

By Audrey Xu, AltaSea College Intern

According to the [Institute for STEM Education and Research](#), in the past decade, STEM education has become one of the largest reform movements in K-12 education. Many people think STEM education is effective in improving student's education performance and outcome.

A meta-analysis paper from [Turkish Online Journal of Educational Technology](#) concluded that there are 56 quantitative studies that took place during 2014-2021 that showed the association of STEM education to students' academic success was statistically high. In addition, students can also improve their critical thinking with STEM education based on a study from [Journal of Education in Science, Environment and Health](#). They conducted a case study where they implemented two STEM activities to 30 7th graders in Istanbul province for 20 course hours over 5 weeks. Quantitative data was measured through the California Critical Thinking Disposition Inventory (CCTDI) and the STEM Perception Test before and after the activities. Furthermore, qualitative data was collected through semi-structured interviews. By the end of this case study, researchers found the students had increased critical thinking and STEM perceptions as well as better [career awareness](#). In addition, many STEM curriculum involve project-based learning, which is proven to help students master their [problem-solving](#), [spatial thinking](#), [geographic skill](#), math performance, and [self-efficiency](#). Moreover, based on a [study](#) from Journal of the Washington Academy of Sciences, STEM project-based learning also fosters student's interest and resilience in their education and careers.



AltaSea at the Port of Los Angeles recently sponsored a 10-week aquaculture course at the Oscar de la Hoya Animo Charter High School to get students interested in learning more about this field and enable them to practically apply what they have learned in the classroom into real life. This charter school is located in the Boyle Heights neighborhood of Los Angeles. The high school is composed of 98% Latino students, over 90% of which are low-income. A typical student from an underserved school like Oscar de la Hoya Animo can be at risk for [limited resources](#) or [lower quality of education](#); the aquaculture program allowed students who face these barriers to still engage in STEM education.



2451 South Signal Street
San Pedro, CA 90731

Alan Hill, AltaSea’s Education Manager who has been a school teacher and outdoor science instructor for 30 years, expressed that STEM education can help further the [United Nations Sustainable Development Goals \(SDGs\)](#). An [article in Global Governance Forum](#) indicated that education is key for sustainable development goals. According to the [Education Policy Commons](#), the SDGs, which work to “address the global challenges we face, including poverty, inequality, climate change, environmental degradation, peace and justice,” are proven to be effective in terms of sustainability. Teaching STEM advances progress towards the SDGs while also equipping students with the soft and hard skills needed to succeed in the world.

When it comes to [implementing SDGs through STEM education](#), there are [challenges and benefits](#) to consider. Hill stated that the benefit of STEM education can not only improve student’s school performance, but also cultivate their interests, help them have a stable career as well as contribute to the blue economy and conservations out there. Hill also believes that such STEM education can be closely tied to the student’s future success since it can help the cyclic poverty cycle when their classroom knowledge can be applied to their job. To further SDGs via STEM education, AltaSea is excited to continue to help implement programs and curriculums in its local K-12 schools and community college.

About the Author: Audrey Xu is a senior at Stanford University studying Human Biology. She is passionate about writing and learning about issues in education, environmental science, and health through an equity lens. Although she did not come from a journalism background, she had exposed and witnessed many events by living in the San Francisco Bay Area. She loves to spend time outdoors. Before writing for AltaSea, she had written articles for AcclimateWest on youth engagement, environmental justice and climate change.

INTERDISCIPLINARY APPROACHES TO THE BLUE ECONOMY

August 31, 2022

By Audrey Xu, AltaSea College Intern

There are many health and economic benefits of the [blue economy](#). According to the [World Economic Forum](#), the blue economy is a solution to “climate change, equity and biodiversity loss.” [Human health](#) is closely related to ocean health. Water covers approximately [70% of our planet](#), providing us the resources and energy that we consume daily. [62 million Americans](#) swim in coastal waters annually and can be at risk for infections. Infections by pathogens like [V. vulnificus](#) that are commonly contracted by humans in [warm coastal waters](#) have a fatality rate of 50% and cause approximately [80,000 cases](#) yearly, proving that human health can be closely related to oceans.

There is an emerging field of study called [Oceans and Human Health \(OHH\)](#). This field is composed of “oceanography, marine biology, ecology, biomedical science, environmental health science, medicine, public health, social sciences, economics, and communication science.” This field had evolved over years, from focusing on the illness directly related to exposure to only water bodies like ocean, Great Lakes, and coasts to covering freshwater bodies and their health-promoting effect. According to [Environmental Health](#), the need to approach the [connections between human health and the ocean](#) through an interdisciplinary approach has been increasing.



Photo by [RephiLe water](#) on [Unsplash](#)

With such demand for interdisciplinary studies, the [National Institute of Environmental Health Sciences](#) has granted many Oceans and Human Health centers and research projects. Some of the projects funded include “[Incorporating the Microbiome into DR2 Activities to Inform Health Outcomes](#)” led by Joseph Petrosino, Ph.D. at Baylor College of Medicine focusing on disaster, “[Environmental Influences on Pregnancy Outcomes After Hurricane Michael](#)” led by Emily Harville, Ph.D. at the Tulane University of Louisiana focusing on chemical pollutant, algae blooms, and disaster, and “[Molecular Mechanisms of Marine Organohalogen Bioaccumulation and Neurotoxicity](#)” led by Amro Hamdoun, Ph.D. at the

University of California, San Diego focusing on chemical pollutants.

According to [ScienceDirect](#), OHH programs have been contributing to the blue economy. One instance would be that the United Nations announced a 2021-2030 plan named [Decade of Ocean Science for Sustainable Development](#) that incorporates medical and public health experts into the field of ocean health. They already have many publications in the past two years. This [development plan](#) will continue to facilitate the innovation of science-based strategies and responses for ocean sustainability and management.

Many studies focus solely either on blue economy or [United Nations Sustainable Development Goals \(SDGs\)](#), when in fact these two goals are interdependent and have overlapping challenges in terms of stakeholders and actors. As indicated by the [United Nations](#), there are still financial barriers at various organization and community levels, issues regarding equity in land and resources, and unknown socioeconomic aspects of the blue economy to be resolved.

However, there is evidence suggesting promoting the blue economy supports both environmental sustainability and economic wellbeing. America's marine economy created 2.3 million jobs in 2018, based on information provided by the Consortium for Ocean Leadership. Companies in the blue economy field also earned more than 1 billion in 2018. Therefore, one can be hopeful that as more work is being put into the blue economy, more challenges can be overcome in the process itself.

About the Author: Audrey Xu is a senior at Stanford University studying Human Biology. She is passionate about writing and learning about issues in education, environmental science, and health through an equity lens. Although she did not come from a journalism background, she had exposed and witnessed many events by living in the San Francisco Bay Area. She loves to spend time outdoors. Before writing for AltaSea, she had written articles for AcclimateWest on youth engagement, environmental justice and climate change.

WATER-BASED SOLUTIONS FOR A SUSTAINABLE DATA INDUSTRY TO BE INSTALLED AT THE ALTASEA CAMPUS

December 15, 2022

By Emily Vidovich, AltaSea Communications and Development Coordinator

[Nautilus Data Technologies](#) recently [announced](#) adding Los Angeles to its site portfolio, with the ability to accommodate a 7.5 megawatt floating data center at the AltaSea campus in the Port of Los Angeles. The high performance data center is planned to be moored at one of AltaSea's berths.

In a press release, AltaSea president and CEO Terry Tamminen welcomed the opportunities made possible by bringing Nautilus to AltaSea's waterfront facility. "Nautilus will be an integral part of our mission to demonstrate and commercialize marine-related technology in the most sustainable way possible," he said. "We're happy to have a data center that is at the forefront of blue economy innovation in our area."

The U.S. data center cooling market is projected [to be worth \\$3.5 billion](#) by 2025. Installing a Nautilus data center, which utilizes sustainable cooling technology, at AltaSea will allow the port to showcase an innovative solution to the data industry's climate impact.

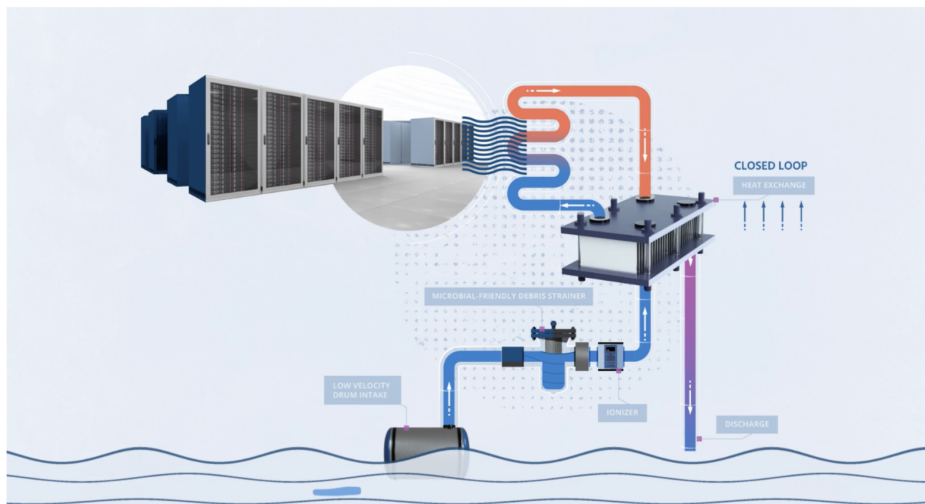


An illustration of the recently announced Nautilus floating data center at the AltaSea campus

While digital data is intangible, it is only able to power the modern age thanks to [data centers](#)—physical locations with networks of computers and other IT infrastructure where data is computed and stored. According to a [report by the International Energy Agency](#), the electricity required by data centers accounts for 1 to 1.5 percent of global electricity usage. This number, which excludes the electricity required to power [cryptocurrency mining](#), will only continue to [grow](#) in an increasingly digitized world.

Almost [40 percent](#) of the electricity used by data centers is used to keep the centers cool—IT equipment doesn’t function well when exposed to high temperatures, but produces a significant amount of heat while it operates. As a result, cooling systems are required to remove the generated heat and replace it with cooler air. Faced with the realities of climate change and rising energy costs, Nautilus [designed](#) a cooling system that uses the natural properties of water to cool its data centers more efficiently, resulting in a significant decrease in electricity usage.

Nautilus’ cooling system starts by intaking cool water and filtering it. Thanks to the multi-step, chemical-free filtration process, water from natural sources—such as oceans and lakes—can be utilized. After being filtered, the cool water absorbs heat via a [heat plate exchanger](#) and is then discharged back to the source. Because it absorbs heat generated by the data center, the water is discharged with a four degree Fahrenheit change in temperature. From intake to discharge, the water circles through the system in less than 15 seconds.



Nautilus’ water-based cooling system. Photo courtesy of Nautilus Data Technologies.

Nautilus has received regulatory approval from multiple state and federal agencies for meeting standards for protecting endangered species, habitat, and water quality—including a 160-page analysis under the California Environmental Quality Act that found no adverse environmental impact.

While Nautilus can utilize its proprietary cooling system at data centers located near bodies of water, its most forward-thinking innovation is its fully water-based solution—[floating](#)

[data centers](#) that are ready to be deployed on any body of water. This is the type of facility planned for placement at AltaSea’s campus. Data center customers at this site will have the added benefit of access to the nearby [One Wilshire Data Center](#), the endpoint for numerous undersea trans-Pacific cables.

As Nautilus CEO and President Rob Pflieger [explained](#), Nautilus sees its floating data centers as a way to maximize its sustainable water cooling technology while circumventing significant challenges to data center site selection—the rising price and dwindling availability of suitable land. Pflieger also argued that, in comparison to the technology industry norm of vying for spots in expensive real estate markets, Nautilus’ decision to incorporate data centers into industrial zones is more economical.



2451 South Signal Street
San Pedro, CA 90731

Cooling data centers with Nautilus' technology reduces a data center's power consumption by [30 percent](#), and the water-based system can absorb heat more effectively than the methods used in traditional cooling systems. The result is a reduction of the climate impact of data centers that also makes them more [resilient](#) to climate change-induced heat waves. Nautilus' innovative approach is a testament to the diverse industries that could benefit from a sustainable [blue economy](#).