



OUTER CAPE ENVIRONMENTAL AWARENESS NEWSLETTER



In our very large world, juvenile salmon in the Puget Sound are reminding us that we live in a closed system. Over 80 drugs and health care products have been found in their flesh; a sobering article by Rae Taylor-Burns. We also look at transparent solar cells; and a “Boots on the Ground” first person report from SoCal, where they thought wild fires were the worst of their problems. Coastal Communities share the same challenges and should be sharing solutions. Our article on Living Shorelines introduces a sustainable coastal erosion alternative. You should feel free to share **OCEAN**, this is your Environmental e-Newsletter. Thank you for your support, Gordon Peabody, **OCEAN** Editor.

March 2018 Issue No. 41

LIVING SHORELINES PROTECT U.S. NAVAL BASES

In our last issue of **OCEAN**, we introduced research being conducted on living shorelines on Cape Cod in “Close to Home: ...on the Vineyard” (**OCEAN 40**) by Jessica Hillman. Researchers and the EPA are experimenting with coconut fiber and shell filled bags to protect the Martha’s Vineyard from erosion, by creating Oyster reefs. These Oysters serve as a natural barrier, or speed bump, absorbing the energy of oncoming waves and reducing their impact on erosion. While this project on Martha’s Vineyard is innovative and nearby, it is not the only location using ‘living shorelines’. The U.S. Navy Base in Middletown New Jersey is now using the same method to protect U.S. Navy ships.

A few years ago, Hurricane Sandy struck the Earle Naval Weapons Station, causing around \$50 million of damage. The Navy decided the Fleet needed protection from future storms. They enlisted the help of an environmental group to plant almost a mile strip of Oysters around the shoreline in order to provide a storm buffer and protect the fleet from future damage. While Earle Naval Weapons Station was the first base to use Oysters for natural protection, many others such as, Elgin Air Force Base Reservation in Florida, Naval Station Norfolk in Virginia and USS Laffey museum in South Carolina, are following their lead. These bases are home to expensive weapons and ships that can be greatly damaged by large storms and the Navy feels it is imperative to protect them. “Living shorelines” are able to offer this protection at affordable costs, while being the most environmentally friendly option, especially when compared to steel sea walls or wooden bulkheads, normally used for protection.

LIVING SHORELINES SUPPORT RESILIENT COMMUNITIES

Living shorelines use plants or other natural elements—sometimes in combination with harder shoreline structures—to stabilize estuarine coasts, bays, and tributaries.

- One square mile of salt marsh stores the carbon equivalent of 76,000 gal of gas annually.**
- Marshes trap sediments from tidal waters, allowing them to **grow in elevation** as sea level rises.
- Living shorelines improve **water quality**, provide **fisheries habitat**, increase **biodiversity**, and promote **recreation**.
- Marshes and oyster reefs act as natural **barriers** to waves. 15 ft of marsh can **absorb 50%** of incoming wave energy.
- Living shorelines are **more resilient** against storms than bulkheads.
- 33%** of shorelines in the U.S. will be **hardened** by **2100**, decreasing fisheries habitat and biodiversity.
- Hard shoreline structures like **bulkheads** prevent natural marsh migration and may create seaward **erosion**.

The National Centers for Coastal Ocean Science | coastalscience.noaa.gov

Over the last 100 years the oyster reefs surrounding the coastlines of the U.S. have decreased by as much as 80% due to pollution and overharvesting. Bringing these Oyster habitats back would create a natural boundary providing coastal communities with protection from major storm damage. Further, Oysters have natural water filtering abilities which could help decrease pollution in these waters. They also have low maintenance costs and therefore once the oysters are planted the protection may become sustainable for coastal communities.

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LIVING SHORELINES PROTECT U.S. NAVAL BASES (Cont.)



Photo credit: smithsonianmag.com

This method of shoreline protection has shown so much promise that in December of 2017, U.S. Rep. Frank Pallone Jr. from New Jersey introduced “The Living Shorelines Act” in order to provide coastal communities with \$100 million in Federal grants to build shoreline stabilization and protection projects using natural materials such as oysters. Although the future of this Act remains uncertain we will monitor progress of it as well as track current living shoreline projects implemented around the U.S. coast.

Find more information in the links below:

www.smithsonianmag.com/innovation/storms-get-bigger-oyster-reefs-can-help-protect-shorelines-180967774/, <https://www.govtrack.us/congress/bills/115/hr4525>, <http://www.dailymail.co.uk/sciencetech/article-5213285/Military-turns-oyster-reefs-protect-against-storms.html>

Thank you to **OCEAN** Researcher Jessica Hillman

MICROBEADS FINALLY BANNED IN U.K.

Microbeads are the tiny plastic beads incorporated as abrasives, into many modern cosmetics and bath products. They are typically made for specific products such as toothpaste and facial scrubs and often are made of polyethylene or petrochemical plastics. Microbeads are particularly harmful in marine environments, which is a topic we have been monitoring for years. **OCEAN 35** provided an article “Microbead Update” by Erich Dietterle stating that the UK had pledged to follow the US and ban microbeads.

Finally, this January 2018 the official ban of microbeads in the UK was passed. The manufacture of cosmetic and personal care products containing microbeads is now banned in the UK and by July it will be illegal to sell these products in the UK. Banning microbeads is a critical first step to reduce the microplastics that are currently accumulating in our oceans. Because of the small size of the particles, they are easily ingested by fish. Current estimates claim there are over five trillion pieces of plastic currently in the ocean and this is a step in the right direction to prevent further growth.

The UK ban on microbeads will have positive impacts on helping keep the ocean clean but much more must be done, and they don't plan on stopping with just this ban. We will continue to monitor the bans of microplastics and microbeads globally with the hope that we can reduce the amount of plastic ending up in the ocean and are hopeful that the UK will continue implementing policies that protect the ocean. The prime minister, Theresa May, has called for a 5 pence (7 cents) fee for single use plastic items and the environmental audit committee MP has called for a deposit return scheme to recycle more plastics.

Find more information in the links below:

[https://www.theguardian.com/environment/2018/jan/09/plastic-microbeads-ban-enters-force-in-uk?](https://www.theguardian.com/environment/2018/jan/09/plastic-microbeads-ban-enters-force-in-uk?CMP=share_btn_fb)
<https://storyofstuff.org/plastic-microbeads-ban-the-bead/>

Thank you to **OCEAN** Researcher Jessica Hillman



Photo credit: thescienceexplorer.com

OCEAN 2018 ENVIRONMENTAL INNOVATION AWARD: Transparent Solar Panels

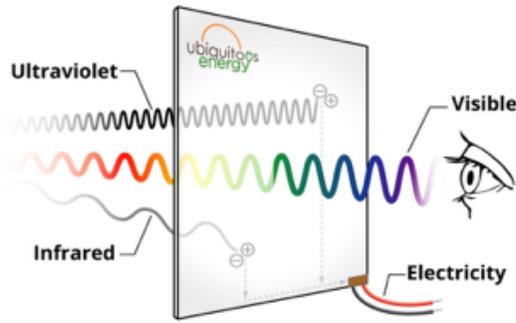


Photo credit: ubiquitous.energy/transparent/

Solar panels provide renewable energy alternative for many households. However, there are still obstacles preventing solar panels from becoming a primary energy source. Some people consider traditional solar panels to be an aesthetic eye sore for home use or public spaces. A team of researchers at Michigan State University, led Richard Lunt, PhD, has now created transparent solar panels that collect as much power as traditional solar panels.

The team has developed a solar concentrator system using organic molecules to absorb sunlight and generate electricity while allowing visible light to pass through, making the surface transparent. These clean, transparent solar cells can be mounted

on windows of any house or car. The efficiency rate of transparent solar panels is lower than the standard rate of about 15-18%, these new solar panels are about a third as efficient at just over 5%. However, they are still very productive and can be applied to many more surfaces making them a good option.

While transparent solar panels are not yet available to purchase. Richard Lunt has cofounded Ubiquitous Energy, which is working towards producing solar cells for widows, mobile devices, and anything that would otherwise need batteries. Ubiquitous Energy has a pilot project and are working on preparations for mass production. This new solar technology will be invisible, efficient, low-cost, and non-toxic, making it a great source of alternative energy.

Find more information in the link below:

<https://eandt.theiet.org/content/articles/2017/10/transparent-solar-panels-could-harvest-as-much-power-as-rooftop-panels-study-suggests/>

Thank you to **OCEAN** Researcher Jessica Hillman

THOUSANDS OF ENDANGERED ANTELOPES MYSTERIOUSLY DIE OFF



Photo credit: www.livescience.com

In 2015 more than 200,000 Endangered, Saiga Antelopes died in Central Asia. This event threatened their entire population. This is not the first incident, similar events occurred in 1981 and 1988. During each of these events accounts of unusually high temperatures and humidity were reported. Recent research shows that this mass-die off was likely due to blood poisoning caused by *Pasteurella multocida* type B bacterium. It is believed that this bacterium was also related to the events in 1981 and 1988. Though this bacterium is normally present in the Saiga Antelopes, the unusually high humidity and temperatures allowed it to grow out of control causing the blood poisoning and eventually leading to the mass die-off.

The warmer than average humidity and temperatures are believed to have been caused by climate change. It has been shown that increases in temperature and humidity are correlated with increased amount *P. multocida* infections in the Saiga Antelope. It is expected that climate change will continue to drive temperatures and humidity levels up in Kazakhstan in the coming years, this means that Saiga Antelope will likely experience another die-off and will likely continue to be at extreme risk of extinction.



Photo credit: www.livescience.com

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THOUSANDS OF ENDANGERED ANTELOPES MYSTERIOUSLY DIE OFF (Cont.)

It is estimated that 100,000 Saiga Antelope remain, there are some populations in Russia as well as Kazakhstan. Because these animals are migratory they are sometimes seen in Uzbekistan and northern Turkmenistan. Since the 2015 event the population has rebounded somewhat but the likelihood of similar, catastrophic events occurring increases, due to the effects of climate change.

Find more information in the links below:

<https://news.nationalgeographic.com/2018/01/saiga-antelope-killed-bacteria-2015-mass-die-off-central-asia-spd/>, <http://www.bbc.com/news/science-environment-42720955>, <http://www.digitaljournal.com/tech-and-science/science/climate-envelope-responsible-for-mass-deaths-of-saiga-antelopes/article/512488>

Thank you to **OCEAN** Researcher Lindsey Stanton

A REVIEW OF "iRecycle" APP

A new app called iRecycle has recently been developed, this app helps users locate local sources to properly dispose of and recycle materials. The app requires no personal information, however for best results allowing it to access your location would be required. After a few weeks of using this app myself I believe that the app is relatively easy to use, there are various sections for plastic, paper, electronics, automotive, and much more. Another great aspect of this app is that it has a section containing numerous environmental articles for individuals who would like more information.

One drawback we have noticed is that some of the more difficult items to recycle such as chip bags currently have only one location for recycling; which in this case is in New Jersey. We have also noticed while returning recyclables and checking this app, that the location where we had been returning recyclables did not appear on the iRecycle app. Overall this seems like a great and easy way to recycle items that many never thought possible. It is apparent that more information needs to be added to the app, just like any other source of information, as time goes on.

Find more information in the link below:

earth911.com/eco-tech/recycling-app

Thank you to **OCEAN** Researcher Lindsey Stanton

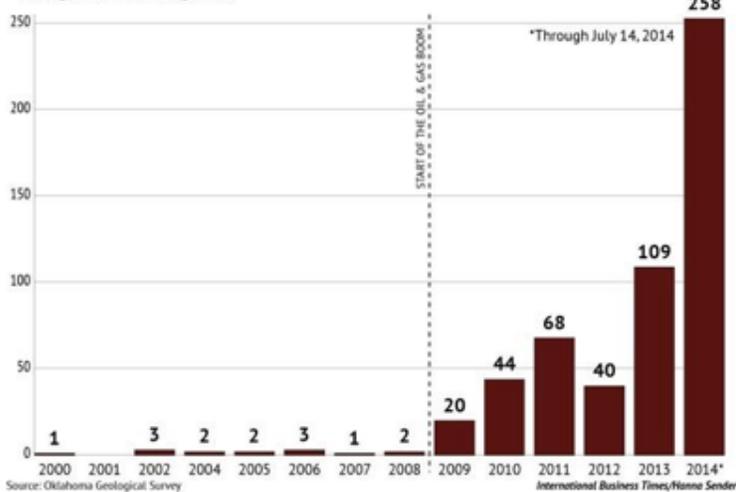


WHAT'S STILL SHAKING IN OKLAHOMA?

Last fall four different earthquakes shook Kingfisher County in Oklahoma within a five-hour period. The first earthquake occurred at 4:50AM and registered as a 4.1 magnitude, followed by a 3.0 magnitude earthquake at 7:20AM and two more at 9:15 both registering as 2.5 earthquake's. Unfortunately, occurrences like these are becoming increasingly frequent. Some argue that these events are caused by fracking, a practice that involves drilling into the Earth and injecting a high pressure mixture of water, sand and other chemicals with the goal of releasing gas or oil. A recent study from the United States Geological Survey shows that fracking is directly causing only a small percentage of earthquakes in the Oklahoma area, however, it is believed that the wastewater associated with the practice is causing the majority of the issues. Basically, fracking is the first step in creating an oil well, and *for every barrel of oil produced this usually results in 10-20 barrels of waste water*. This wastewater is later pumped into a separate underground disposal well which is deeper than the well that the fracking created. This wastewater ultimately results in increased seismic activity.

EARTHQUAKES IN OKLAHOMA

of magnitude 3.0 and greater



that the fracking created. This wastewater ultimately results in increased seismic activity.

It is apparent that fracking can lead to some unintended consequences, but it is important to realize what is actually causing the problem. It is apparent that adjustments must be made in order to create a safer less catastrophic practice. Since fracking began, the state of Oklahoma has seen a spike in seismic activity and this trend is expected to continue, assuming there are no policy changes regarding wastewater disposal. With more stringent policies the amount of earthquakes in the area would like decrease drastically.

Find more information in the links below:

<http://www.news9.com/story/37425984/small-earthquake-shakes-dover-ok>, <http://www.theweek.co.uk/fracking/62121/what-is-fracking-and-why-is-it-so-controversial>, <https://www.marketwatch.com/story/oil-has-made-this-state-the-man-made-earthquake-capital-of-the-world-2016-03-15>

Thank you to **OCEAN** Researcher Lindsey Stanton

CLIMATE CHANGE ALTERING ARCTIC FOOD CHAIN

One of the subtler effects of global warming is the perturbation of food web dynamics. On their own, marine food chains can be complex and sensitive to change, so a rapid increase of ocean temperatures is something that should be of concern in any ecosystem.

An example of this has been documented in the Arctic, where the higher temperatures have caused substantially more sea ice to melt, which in turn exposes shallow regions allowing soil and sediment to flow from thawing permafrost erosion and to be stirred up with less of an impediment into the water column.

The study, which was conducted by collaborating scientists from Woods Hole Oceanographic Institute, MIT, University of South Carolina, and University of Washington, researched this by recording the changes of radium-228 (a naturally occurring isotope) which is present in seawater when organic matter (sediment) is introduced. They showed that not only has this increased significantly over the last decade in the Arctic Ocean, likely from organic matter containing phosphorus and nitrogen originating from the continental shelf, but according to their modeling, nutrients, carbons and metals are all in flux from their average values in the Arctic Ocean. This affects the food web because where there is an abundance of nutrients there are often plankton and algal blooms, which are uncommon in the central Arctic Ocean because of low light and limited nutrients available.



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CLIMATE CHANGE ALTERING ARCTIC FOOD CHAIN (Cont.)

This event could benefit some organisms and hurt others. For instance, another paper researched the relationship of polar bear survival to the food web, specifically the link to the web's cornerstone: ice algae. Not only do polar bears need ice physically to effectively hunt, they depend on this bottom trophic level to feed into the chain in a temporal and quantitative degree. Changes in the amounts and timing could affect higher level consumers and influence species that exploit this resource on a seasonal basis. Also, an unexpected complication is that with less sea ice there will likely be an increase in shipping traffic, which could disrupt the ecosystem further by depositing more metals and pollutants into the system. The effects of introduced metals in the ocean are not completely understood at this time.

What we do know is that these changes in sea surface temperatures and receding ice is happening at a fast rate in the Polar Regions in particular, and though it is occurring elsewhere the effects may not be as drastic. Mitigation can only occur through decreasing anthropogenic emissions that are contributing to global warming. The concern about the future without curbing climate change is a valid one, and studies like these are crucial in understanding the progression and impacts it has on various ecosystems.

Find more information in the links below:

<https://www.newsdeeply.com/oceans/articles/2018/01/11/the-unseen-way-in-which-climate-change-is-altering-the-arctic-ocean>, <http://advances.sciencemag.org/content/4/1/eaao1302.full>, <https://psmag.com/environment/climate-change-is-threatens-polar-bear-food-supply>.

Thank you to **OCEAN** Researcher *Brigid McKenna*

EDITOR'S CHOICE: DRUGS FOUND IN SEATTLE SALMON

In the spring of 2016, Puget Sound juvenile salmon and sculpin were found to be on drugs - that is, the *flesh of these fish was found to be contaminated with 81 different types of drugs and personal care chemicals*. The list included Prozac, Advil, Benadryl, Lipitor and cocaine. The discovery was alarming and led to a slew of investigative reports on the reason behind the fish contamination. Several different possible explanations for the fish contamination were presented - was there a failure in wastewater treatment plants? Were septic tanks leaking?

It was found that about 97,000 pounds of chemicals are introduced to Puget Sound every year, and not all these chemicals are monitored in wastewater treatment. Even more concerning is that fact that the toxicity of many of the detected chemicals are poorly understood. Scientists in the region were most concerned with the environmental and ecological impacts of the contamination. Impacts on people were a minimal concern because juvenile salmon and sculpin are not typically eaten as food. However, studies have shown that *fish migrating through Puget Sound's contaminated water die at twice the rate of fish migrating through uncontaminated water*. This could be because of the effects of chemicals on fish growth, immune function and antibiotic resistance.

It is important to note that Puget Sound is home to 106 public wastewater treatment plants, all of which discharge to the Sound. Reports show that effluent from different wastewater treatment displays regional differences in the chemicals present. This could be due to varied drug usage throughout the Sound, but even fish in the Nisqually Estuary, selected as a pristine control area, were observed to have contaminated flesh. This suggests that wastewater treatments plants throughout the region are likely are not effective at removing all chemicals from wastewater.

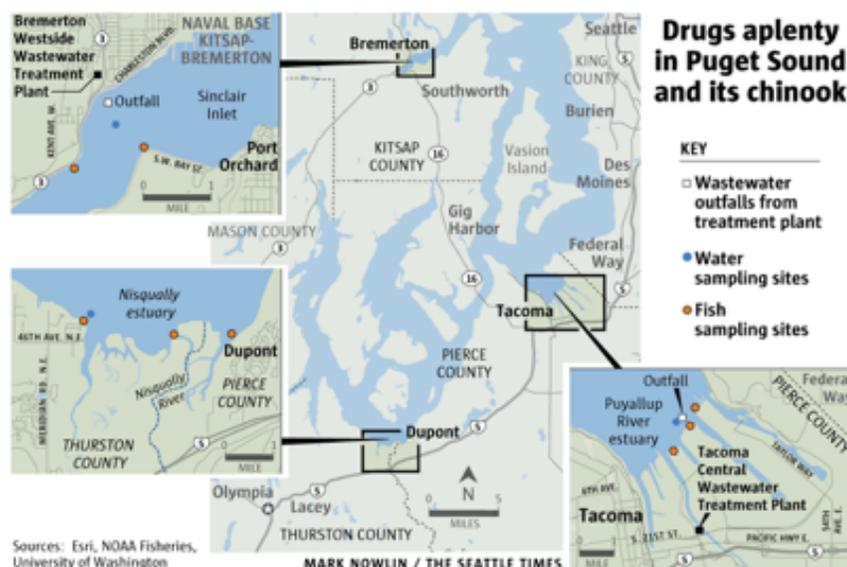


Photo credit: www.seattletimes.com

DRUGS FOUND IN SEATTLE SALMON (Cont.)

This regional contamination of salmon serves as a reality check that our chemical inputs to the environment have real effects on ecology. The incident was isolated to one year in one region, but the drugs found in the salmon are not regularly tested in water quality sampling. This means similar situations could be developing in other places into the future, but without testing and sampling, we will not know.

Find more information in the links below:

<http://econewsmedia.com/2017/07/28/seattle-caught-salmon-found-contain-cocaine-antidepressants-pain-relievers/>,
<https://www.seattletimes.com/seattle-news/environment/drugs-flooding-into-puget-sound-and-its-salmon/>

Thank you to **OCEAN** Researcher Rae Taylor-Burns

WARMER SEAS TURN GREEN SEA TURTLES FEMALE

Research from NOAA in 2018 shows that a population of green sea turtles on Raine Island in the Great Barrier Reef Ecosystem is overwhelmingly female: 99.1% juveniles, 99.8% sub-adults and 86.8% of adults are female. In 2016, scientists discovered that some species of turtles have a “thermometer gene”, which means that the temperature inside an egg influences the sex of the turtle embryo. It has been observed in snapping turtles and green sea turtles that higher temperatures cause hatchlings to develop as female, and the difference between a 100% male population and a 100% female population is only a few degrees. For green sea turtles, the tipping point is 29.3 degrees Celsius. Scientists are not certain why this phenomenon exists in green sea turtles, but one hypothesis has been developed: turtles that grow in colder places grow larger than those that grow in warmer places, and it benefits a species if larger individuals are males.



Photo credit: nationalgeographic.com

This is the reason for the nearly entirely female population at Raine Island. Other green sea turtle populations throughout the Great Barrier Reef exhibit different sex ratios, populations near the southern end of the reef have a 2:1 female to male ratio, which is far more balanced than the 116:1 female to male ratio at Raine Island. The sex ratio is concerning because scientists do not yet know the long-term impacts of heavily female populations. However, it is known that male sea turtles mate more frequently than females, so in the words of a NOAA researcher, “a few males can go a really long way”. This bodes well for the future of the population; the imbalanced sex ratio is not a huge problem just yet.

We can expect temperatures to increase in the coming years, leading to even more females. However, colder years will still bring males into the populations to maintain reproductive viability of the species. Other solutions have also been presented. Sea turtles lay their eggs on sandy beaches, and so by shading sandy beaches on Raine Island or wetting sand to cool nesting areas the presence of males in the Raine Island green sea turtle population can be increased.

Find more information in the links below:

<http://www.bbc.com/news/av/science-environment-42626574/great-barrier-reef-warmer-seas-turning-turtles-female>, https://www.washingtonpost.com/news/speaking-of-science/wp/2018/01/08/climate-change-is-turning-99-percent-of-these-baby-sea-turtles-female/?utm_term=.256cac23c1b3, <https://www.theguardian.com/environment/2018/jan/08/great-barrier-reef-rising-temperatures-turning-green-sea-turtles-female>

Thank you to **OCEAN** Researcher Rae Taylor-Burns



Photo credit: nationalgeographic.com

BOOTS ON THE GROUND: A scary visit to CA

Southern California is considered by many to be paradise. Warm weather, beautiful landscapes and a laid-back lifestyle. My experience with Southern California comes mostly from my time living in Santa Barbara where there is almost an arrogant air of perfection, it's a place where nothing bad ever happens.

I left California about a year ago and since then the state saw its largest wildfire in recorded history. The "Thomas Fire" burned 281,893 acres of land in Santa Barbara and Ventura County. There were enormous structural losses: 1,063 structures were destroyed, and 280 structures were damaged. Over 104,607 residents were forced to evacuate and at its height 8,500 firefighters were battling the fire.



Photo credit: Tehachapi Life Photography

The scope of this fire was enormous in terms of how it affected people. During a recent trip to the fire area, I heard about people's experiences during the fire. Not unexpectedly, people were shaken up. Nearly every person I interacted with expressed their disbelief and sadness. I listened to accounts of how enormous and deafening it was, their evacuation stories, who they knew that lost their home. However, shaken up became an understatement only two days later when a rainfall brought down the hillside above Montecito, swallowing up homes and businesses in the early morning hours. Suddenly a feeling even heavier than before loomed over the area, there was an anxiety, and grief in the air. The fire had claimed only two lives during its burn, which lasted over a month, while the death toll attributed to the mudslide is at least 20 with 3 people still missing as of 1/16/17.

This was a Santa Barbara I had never experienced, instead of feeling safe where they lived, people now felt vulnerable and afraid. Their beautiful landscapes had turned on them. The mudslide was a direct result of the raging fires, and the raging fires a direct result of a critically warm, dry and drought-ridden environment. Guilt set in, was there something that could have prevented this? Or was Southern California just one of the many victims of climate change? Unfortunately, answers to questions like these do not reverse the social and economic impacts caused by such deadly and unprecedented weather events. It will take years and millions of dollars for Southern California to recover from both the fire and mudslide, hopefully its residents can heal in the meantime.

Thank you to **OCEAN** Researcher Kristyna Smith



Environmental Interns on Cape Cod

Safe Harbor is a small Environmental Consulting Group in Wellfleet, on Cape Cod. Safe Harbor Director Gordon Peabody created their intern program fifteen years ago and feels the program has generated benefits on all sides. “We wanted to develop pathways for young people to gain experience in the environmental field. Our program has been successful by integrating field and office work with continuing education and mentorship.”



Winter intern Rosie Lamadrid planting Beach Grass during a snow squall

Safe Harbor Internships are usually part time and often reflect school calendars. Interns with other commitments, such as part time jobs or classes are provided with flexible schedules. Interns are chosen from applicants from High Schools, undergraduate or graduate backgrounds. Safe Harbor has an Intern Partnership with Cape Cod Community College, providing opportunities for college credit. We also have a partnership with Provincetown’s Center for Coastal Studies Right Whale Intern Program, providing additional support for their Interns.

Summer Intern Jon Bruce shared a few thoughts with us. “The internship program has a heavy focus on education, so although the work was challenging and physical, I was constantly learning new things, so each day was unlike the last. My internship with Safe Harbor Environmental has proven to be one of the pivotal experiences in my college career and has given me a clear direction of the kind of work I want to be involved in when I enter the professional world.”

Kristyna Smith, Safe Harbor Project Coordinator, previously worked as Intern Coordinator and offers some advice. “Interns need to be able to communicate; have some flexibility and be able to track complicated projects. You will always have the support of your co-workers but should not be afraid to ask questions.”



Summer interns Sarah Beaulieu and Jonathan Bruce, stabilizing a slope

To learn more visit our Intern Program page: <https://www.safeharborenv.com/who-we-are-2/intern-program/>



OCEAN supports the restoration of Cape Cod's wetland resources. Healthy natural resources protect coastal communities, ecologically, socially and financially. Restorations also provide educational opportunities and we recommend the following link for an easy to read update on the Restoration of the Herring River: <http://conta.cc/2FX53z2>

Our next issue, **OCEAN 42**: New ideas are critical links to the future of our coastal economy. We will share our recent trip to Martha’s Vineyard, visiting some innovative farmers growing Sugar Kelp. An innovative modification of solar cells can produce electricity from rain drops. We will be looking at some local models of “Living Shorelines” and how is it possible that small lizards are showing up in Maine salads?



This issue of **OCEAN** would not be possible without the special efforts of our Associate Editor Samantha Thywissen and Research Coordinator Jessica Hillman.

Thank you, Gordon Peabody, Editor.



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