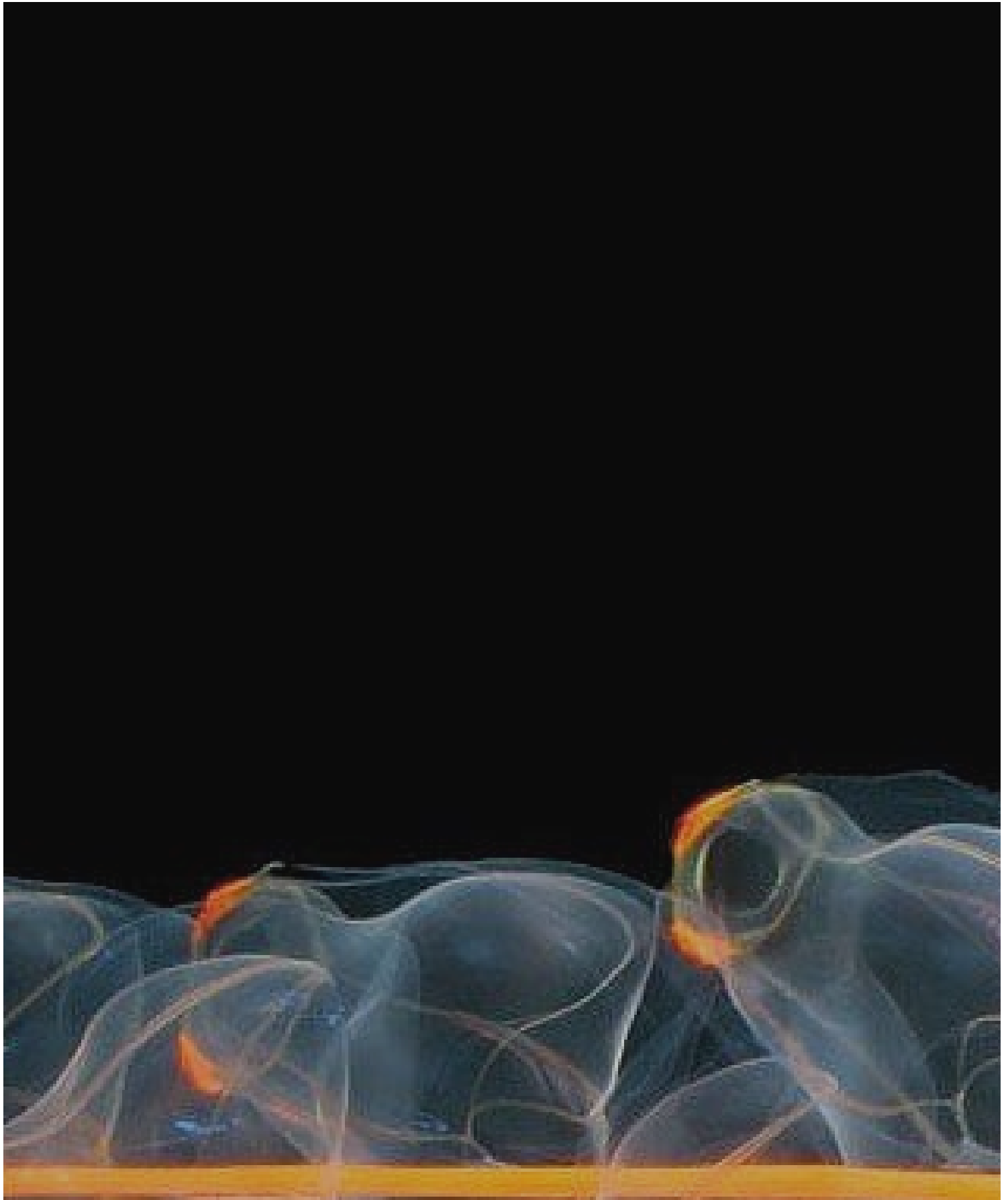




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WORDS BY
DIVA AMON



MY FIRST EXPEDITION TO THE DEEP SEA WAS A BIT SERENDIPITOUS.

I had finished my first degree at the University of Southampton in the UK and headed back to my home country of Trinidad and Tobago to fulfil a scholarship obligation. After six months at home, I received an email from my dissertation supervisor and leading deep-sea biologist, Professor Paul Tyler, asking whether I wanted to join a research cruise onboard the RRS *James Cook* to search for hydrothermal vents (a fissure on the ocean floor that issues geothermal-heated water) in the Cayman Trench, which was mobilising in Trinidad and Tobago. It was a no-brainer – I remember running around my house screaming with joy. So, in March 2010, we set sail for more than a month at sea, working with a suite of deep-sea tools to hunt for hydrothermal vents. Deep-sea science is perhaps three parts skill and two parts luck and fortunately, we had all of it.

The moment those vents – gushing black superheated fluid and covered in blind shrimp and anemones – came into view, was pure magic. There were definitely tears that day. Nine years later, Beebe Vent Field is still the deepest in the world, just shy of 5km, and I'm still thrilled to be working to better understand the communities living in our world's deep ocean.

The deep ocean is an extremely dark place and yet, the animals that reside there are the most vibrant purples, reds, pinks, yellows and oranges – it's an amazing place that holds many surprises. For example, there are more species of coral in the deep sea, than in the shallows. One incredible area of study that continues to astound me is that bioluminescence may be the most common form of communication on the planet.

During my first deep-sea biology course, I was shocked to discover that less than 1% of our deep ocean had ever been explored. That is a staggering figure! I think everyone has some inner desire to explore, to see things no one has ever seen, to answer questions that have never been answered and to have experiences that few have ever had. Deep-sea science was my gateway to that excitement of never knowing what I was going to see in an unexplored and ever-changing ocean. I was extremely fortunate to have an undergraduate mentor who believed in me and provided many opportunities. I cannot underscore how important this was and since then, I have continued to be humbled by the number of amazing experts who are willing to share their time and advice. My first dive in a submersible was in 2013, in the Cayman Trench. The *Shinkai6500* took two Japanese pilots and me down to the Von Damm hydrothermal vents at 2.7km depth. Initially I wasn't very comfortable, and I was frightened about having to use the bathroom (as there were none on board) but once we hit the twilight zone and the windows were lit up with bioluminescent fireworks, I quickly forgot about my worries. Being down there gives you a perspective you could not get any other way.

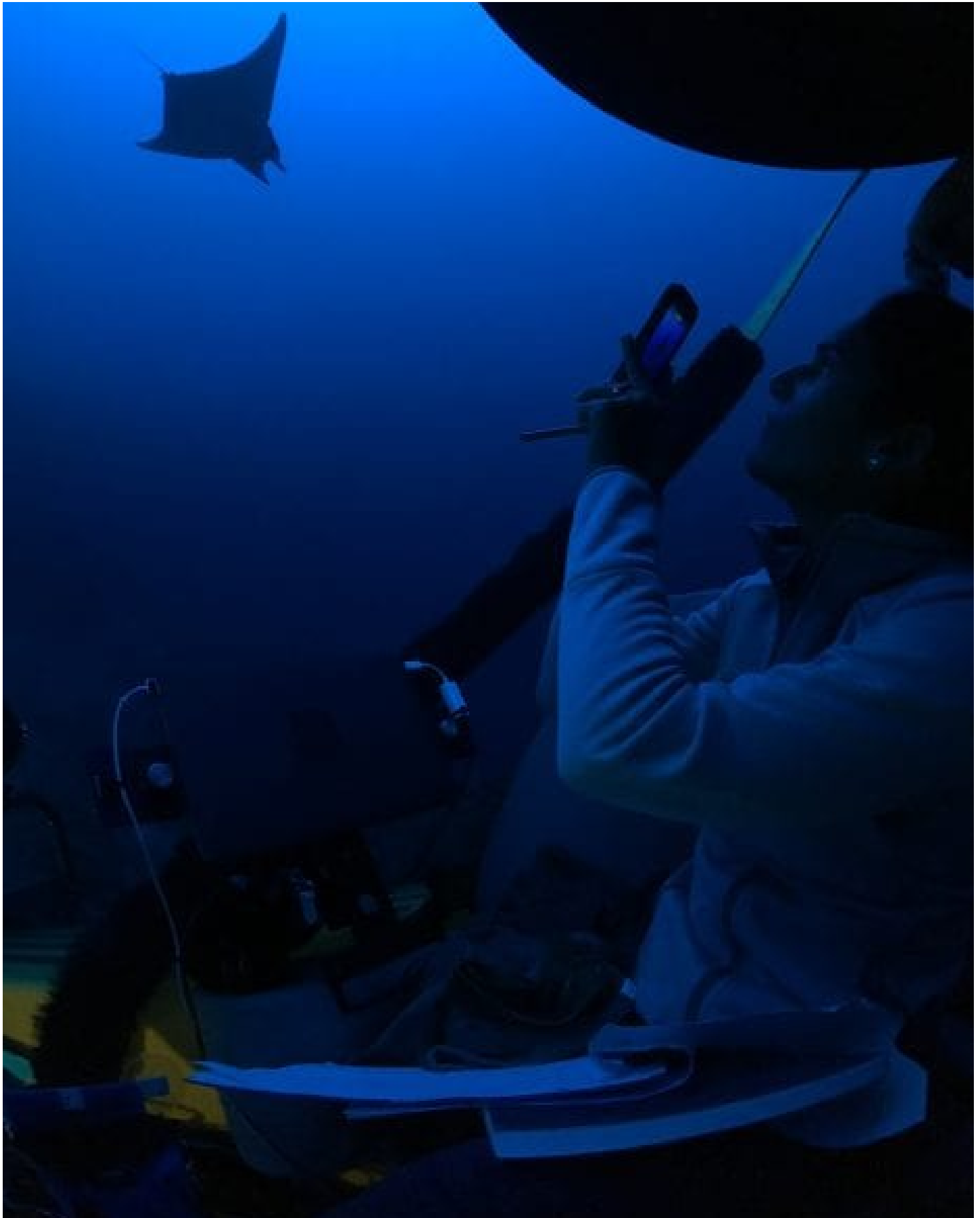
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In 2014, the EV Nautilus operated by the [Ocean Exploration Trust](#) explored the deep ocean around Grenada and Trinidad and Tobago. It was so special to be able to explore the waters off my home country, collaboratively between local and foreign scientists, especially as we as a country don't have the financial, technical or technological capabilities to do so. And what we found was spectacular: methane seeps with giant mussel beds and tubeworms as far as the eye could see, coral and sponge

Trinidad and Tobago, given our proximity to South America, is so biodiverse, and yet here was 70% of our national area that



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Trinidad and Tobago is ocean, so we all want our biodiversity and the habitats they live in preserved, while dispelling lots of the misinformation floating around. We're just winding up our 'My Deep Sea, My Backyard' project, which has been taking place in the Republic of Kiribati and Trinidad and Tobago over the past year. There are a huge number of nations that have deep-sea environments within their Exclusive Economic Zones, but only 16% of them have the financial capability and resources to explore them. This results in unaware populations and unsuitable marine management decisions. We've been utilising deep sea cameras and ROVs to explore the mesophotic zone and deep ocean areas of these two small island states for the first time. Both technologies collect fascinating imagery but require minimal resources and expertise.

I research human impacts on the deep sea because I want my work to help improve the way we view and treat our oceans. I also try to support this by taking that work, and the work of colleagues and other scientists into the spaces where global ocean regulations are being crafted, such as the [United Nations](#) and the [International Seabed Authority](#) (ISA). The ISA is currently drafting the regulations for the exploitation of mineral resources on the seafloor in international waters. It is crucial that these regulations are environmentally conscious and take precaution, given how limited our knowledge is of the deep-sea environments where mining may take place. I attend on behalf of the [Deep-Ocean Stewardship Initiative](#) (DOSI), an expert group that seeks to integrate science, technology, policy, law and economics to advise on ecosystem-based management of resource use in the deep ocean and strategies to maintain the integrity of deep-ocean ecosystems within and beyond national jurisdiction. I co-lead the Minerals WG, which is responsible for engaging with all stakeholders on matters related to deep-sea mining.

Our deep ocean and its life provide ecosystem services that keep our planet healthy and are integral to our survival. But while we may think that the deep ocean is remote and out of our grasp, it is already changing due to our actions. This is dangerous given that we have little idea what lives in the majority of our deep ocean. We need a baseline in order to measure change and that's mostly missing. So, we're now in a race against time and our increasing use of the deep sea, to categorise what's there, so that we can effectively manage it and don't lose species and communities before we've discovered or understood them and their functions. You can't protect what you don't know, and you can't manage what you don't understand.

From 2013 to 2016, I worked on the ABYSSLINE Project, which conducted baseline surveys in the Clarion-Clipperton Zone, an abyssal area of the East Pacific Ocean where deep-sea mining may occur in the near future and which had never been explored. The results from my speciality, the megafauna – animals over 1cm in size, were not at all what we were expecting. There were more megafauna species observed than in any other abyssal habitat. Over half of those megafauna that were collected were species that had been never seen before highlighting how poorly known this area is. But most importantly, more than 50% of the megafauna relied on the polymetallic nodules, the resource that will be removed during mining, for attachment surfaces. If mining moves forward, humankind needs to think very carefully about how to do it responsibly.

WHILE WE MAY THINK THAT THE DEEP OCEAN IS REMOTE AND OUT OF OUR GRASP, IT IS ALREADY CHANGING DUE TO OUR ACTIONS.





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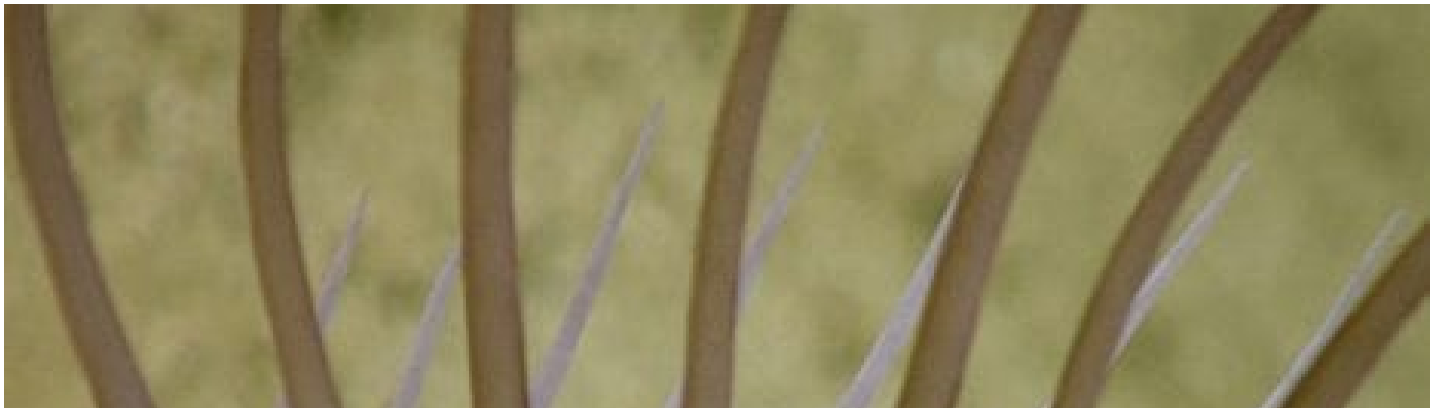
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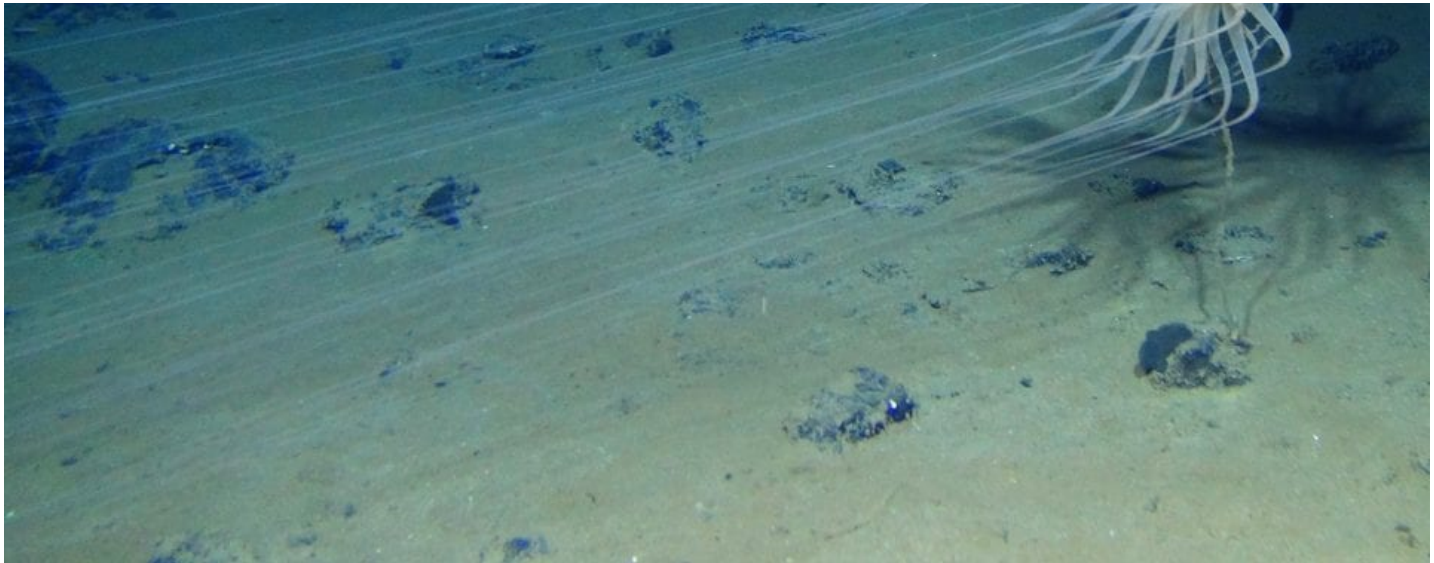




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REGULATIONS MUST BE GROUNDED IN RIGOROUS SCIENCE.

The deep ocean is the closest ecosystem on the planet to one that is pristine, and yet, it is not. Fishing and pollution have caused damage for decades, climate change is already wreaking havoc, and as many of our resources such as minerals, oil and gas, and medicine, are dwindling on land and in shallow waters, we are now looking to our deep sea. This is a major concern because very little of our deep ocean has been explored, and even the areas which have been, we do not understand fully. We also know that life in the deep ocean tends to be slow, with animals growing and reproducing gradually. For example, a Greenland shark doesn't become sexually mature for 150 years, while some deep-sea corals live for over 4,000 years. For most deep-sea animals, we have little to no idea. What we do know is that these animals do not cope well with change and don't recover quickly, so we have to be extremely careful moving forward. We have a brilliant opportunity to understand what exists prior to most exploitation, so that we can better value and manage unlike most ecosystems on land and in shallows that we were exploiting for millennia. We have an opportunity to do it right. We need to keep exploring to understand it better. That will allow us to craft, implement and enforce the most effective regulations to allow the conservation and sustainable use of biodiversity. Regulations must be grounded in rigorous science.

When looking at the big picture of the future of the oceans, it is very hard to be hopeful. They are facing more human pressure than ever. In 2017, I was part of a team on board the NOAA Ship Okeanos Explorer exploring the Gulf of Mexico. We had identified a sonar target that looked like a shipwreck in over 1.5 km of water. Before the ROV dive, everyone on board was extremely excited. As we approached with the ROV, you could hear a pin drop – everyone was waiting with baited breath. It didn't take us long to realise that it was not a shipwreck, but a 40ft shipping container that had been ripped open to spill out chest freezers, washing machines, fridges and other household appliances. It was an incredibly sad moment driving the ROV through this unexplored area of the ocean that was already littered with our trash.

However, on a smaller scale, there are stories to give us hope: since the banning of whaling, most cetacean numbers are bouncing back, we are turning around our reliance on plastics, and MPAs are increasing worldwide. And returning to the global picture, our knowledge is increasing alongside our communication of this knowledge, which is leading to much more informed citizens, policymakers and stakeholders who are galvanising change.



other stories to members of the public, industry and policymakers. To me, it is imperative that we create a more ocean literate



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The deep sea and the life that exists there is out of sight and out of mind. Most people are disconnected and as a result, unfamiliar. This disconnectedness also means that most of humankind doesn't think the deep ocean world is relevant to their daily lives or the functioning of the planet. And unfortunately, most people don't think of deep-sea creatures as cute and cuddly – but it's all relative, right? Dumbo octopus are pretty adorable.

Something that has surprised me, and that I think the majority of humankind is unaware of, is the interconnectedness of our planet. The deep ocean provides more than 95% of all habitable space and is inherently connected with the shallow seas, the atmosphere and the land. This means our actions have big repercussions and can impact even the “remote” deep sea. We are only now beginning to understand this, and it means our management actions need to be holistic.

Photographs courtesy of: [National Oceanic and Atmospheric Administration](#) (NOAA) OER, Craig Smith and Diva Amon – [ABYSSLINE Project](#), [Novus Select](#), NOAA Okeanos Explorer Program and Kevin Raskoff.

Diva will be speaking at the 2019 [Jackson Wild Summit](#), running September 21st-27th, which will have a conservation focus of 'Living Oceans'. She will be a part of the 'Into the Abyss: Exploring Earth's Final Frontier' series, talking all things deep sea. [Click here](#) to register to attend the summit.

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Shallow waters

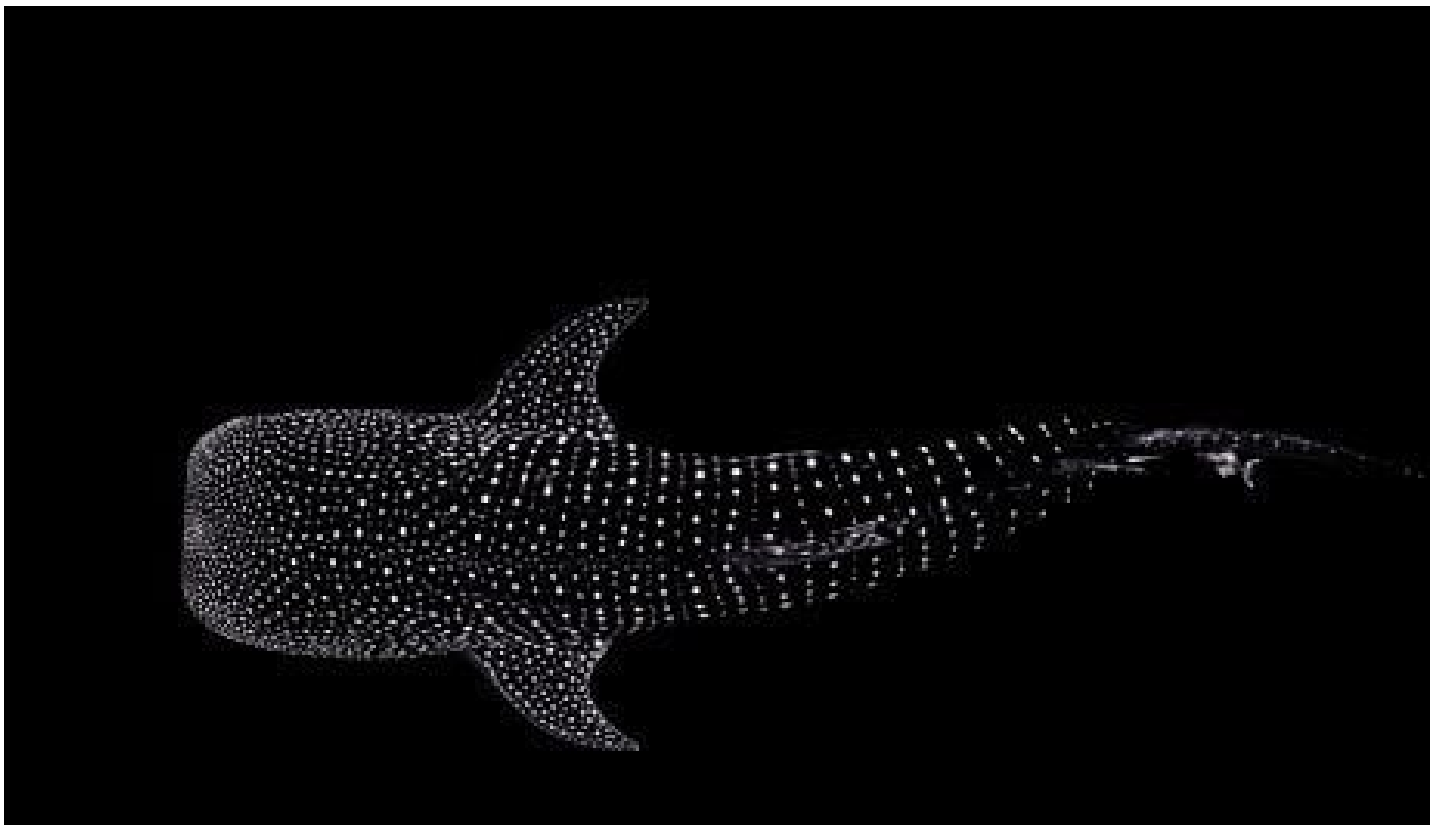
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