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ANTICIPATE

Advancing Science for Ocean Stewardship

Abstract

The ocean supports all life on Earth, but we've explored only 80% of it and an estimated 91% of ocean species have yet to be classified. It is also changing at unprecedented rates in the face of climate change, pollution and overuse by people. This demands a rapid scale-up in ocean monitoring to understand these changes and to collect valuable data before it disappears. Innovations in sensors and autonomous vehicles are needed to collect that data; new modelling technology will be needed to make sense of it. The benefits will be a wealth of genetic information with applications in pharmaceuticals and biotech as well as a better understanding of ocean ecosystems, their connectivity, and how we can manage these vast resources in a more equitable and sustainable way.

- What do we not know about the ocean that we should know?
- How can we make the best use of the vast amount of genetic data flowing from the oceans?
- How can scientists catch up with the rapidly changing state of the ocean?
- How can we measure the value of the oceans and share those benefits equitably before its resources are irreparably harmed or depleted?

Participants

Moderated by:

Kasmira Jefford, Editor-in-Chief, *Geneva Solutions*, UK

With:

Gerard Barron, CEO & Chairman, The Metals Company, Canada *(remotely)*

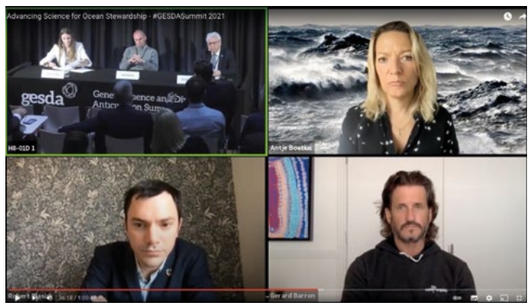
Robert Blasiak, Researcher, Stockholm Resilience Centre, USA *(remotely)*

Antje Boetius, Director, Alfred Wegener Institute; Marine Biologist; Leader, Helmholtz Association, German Research Centres, Germany *(remotely)*

Anders Meibom, Professor, EPFL's Laboratory for Biological Geochemistry; Professor ad personam, Institute of Earth Sciences, University of Lausanne, Denmark

Vladimir Ryabinin, Executive Secretary, Intergovernmental Oceanographic Commission (IOC) of UNESCO, Russia

André Hoffmann, Businessman, Environmentalist, Philanthropist; Vice-Chairman, Hoffmann-La Roche, Switzerland



Highlights

"We have on the one hand, a necessity to understand our ecosystems [starting with the oceans,] at a very deep level if we are going to protect them. On the other hand, we have to have international collaboration, especially when it comes to the oceans, because there are no real boundaries for pollution and the extraction of resources have to be controlled by the international community," said Anders Meibom, a physicist and professor who runs a lab for biological geochemistry at EPFL for biological geochemistry, summing up the challenges facing ocean governance, the main one being to find a right balance between protection to allow scientific exploration and utilization of known oceanic resources for the common needs. Solving this issue is far from simple, as the current frameworks are blurred.

After it came into force in 1994, the UN Convention on the Law of the Sea (UNCLOS) – the main law for managing ocean resources – created three new international organizations: the International Tribunal for the Law of the Sea (ITLOS) in Hamburg, Germany; the International Seabed Authority (ISA) in Kingston, Jamaica; and the Commission on the Limits of the Continental Shelf (CLCS) in the UN's headquarters at New York. The Convention has 167 parties, but not the United States – the only major nation that does not belong. (The United States is party to an extension of UNCLOS, the UN's Straddling Fish Stocks Agreement, which covers species that migrate among or are found in more than one exclusive economic zone.) The ocean and coastal areas cover more than two-thirds of Earth's surface and contain 97% of the planet's water. UNCLOS has no jurisdiction, however, over the high seas – international waters beyond the 370-kilometer jurisdiction of coastal nations. That leaves about 45% of the Earth's surface without laws to protect marine species and minerals. "It's basically more or less a lawless zone. It's a bit like outer space. There's no governance of this," said Meibom, who also founded the Transnational Red Sea Center (TRSC), a Swiss-backed initiative for science diplomacy in the Red Sea region. "We are focusing on the coastal zones. And here we are simply dealing with national interests and trying to organize a cross-nation protection of the system. And this is a situation where the diplomacy is absolutely required. There's no escape from it."

Meibom and other marine experts said they see a need for some kind of "global charter" or, at least, more effective regional laws to protect the ocean. They agree more must be done to achieve one of the UN's 17 Sustainable Development Goals for 2030, which calls for conserving and sustainably using oceans, seas, and marine resources to sustain fishing, shipping, mining and other industries. The only question is at what scale.

Coastal and marine resources provide sustenance, livelihoods and tourism, contributing $28 trillion a year to the global economy in ecosystem services, the UN estimates. Negotiations have been underway at the United Nations towards new international agreements on sustainable uses of the high seas among commercial and national interests: everything from deep-sea mining to new patents, commercial applications and discoveries could be affected. However, wealthier nations have an advantage on monitoring, enforcement, regulation, and marine sciences, which are aided by UNESCO's Intergovernmental Oceanographic Commission (IOC).

"The threats of climate change have increased so dramatically for the ocean, that the race is to protect the ocean species, the network of life in the oceans, the ocean functions," said Antje Boetius, a renowned marine biologist whose research focuses on the impacts of climate change on the Earth's ocean and polar regions, among others on the biodiversity of the deep seas. "There are heat waves that reprogram ocean life so that it becomes pathogenic. We are trusting today that there are almost no marine pathogens, no marine viruses that could be a threat to humans. But we cannot be sure, and we have not the knowledge, not the database, to understand the genetic life of the oceans and what secrets it has."

Even the remote deep seas are harmed by plastic litter, warming of the ocean surface, oil spills and other threats. At least eight million tons a year of plastic wind up in oceans; plastic waste accounts for 80% of all marine debris from surface waters to deep sea sediments, according to the International Union for Conservation of Nature (IUCN), which said plastic pollution is found on the shorelines of all continents and is the most widespread problem affecting marine life. "We have to understand that this is one system," Boetius emphasized. "We count on the ocean as a store of species' DNA. And Earth history shows us that when things have been really bad on land, the life that re-emerged after a catastrophe like vulcanism and meteorites came from the ocean. So, the global-scale solution is a political one. It's one of international cooperation. It's one of enabling, sharing knowledge, and having that right amount of ocean literacy."

In 1903, Prince Albert I of Monaco initiated the General Bathymetric Chart of the Oceans (GEBCO) with the goal of mapping the bathymetry of the ocean's seafloor. The difficulty of mapping through water made progress slow-going. Starting in 2017, the UNESCO-backed Nippon Foundation-GEBCO Seabed 2030 Project accelerated the mapped extent to 20.6% now, more than tripling the mere 6% previously mapped to modern standards. "So, we hope that we will be able to cover 100% of the depths by the year 2030. Very ambitious. And everything is

ambitious here. I think we are now rediscovering the ocean, and the fact that we live on the 'planet ocean', not the planet Earth," said Vladimir Ryabinin, an oceanographer, climatologist and marine engineer who oversees the IOC, the UN body responsible for supporting global ocean science and services. He described the world's agreements on the coastal zones as "actually the largest redistribution of national jurisdiction in the history of humankind" and called for new global governance to protect the ocean and its biodiversity. "There is only one single ocean on this planet. It is connected, and it is not our property," Ryabinin said. "We belong to the ocean. The ocean does not belong to us. And we need to have a global charter."

Adding to the pressure on the ocean, paradoxically, is a vast demand for minerals like cobalt, copper, manganese, nickel and rare earths to facilitate the world's battery-powered transition to electric vehicles and sources of clean energy such as windmills and solar panels. The world will need triple the copper, 21 times the cobalt, eight times the manganese and 19 times the nickel that is used now to produce the clean energy needed to meet the Paris Agreement's climate change goals, the International Energy Agency reported. An abundance of such minerals can be found in potato-sized polymetallic nodules scattered across parts of the seabed. The International Seabed Authority has been drafting rules to mine them. Proponents say their use would protect land from mining. "I think that it's starting to dawn on people just how metal-intensive the green transition is going to be," said Gerard Barron, whose company argues tapping seabed will have the "lightest planetary touch" as the world shifts to a "circular" economy. "We do not dig or tunnel our way to find them. They literally sit there like this," he said at the Summit session, displaying one of the blackish nodules. "Getting off those fossil fuels and not collapsing the world in the process requires the electrification of transportation and energy production, and both of those require a lot of batteries, and that's the raw materials needed to make them. Battery metals are a critical step to a post-carbon and closed-loop world. And so now the question is where are they going to come from?"

Scraping the ocean seabed for minerals is an idea that worries some conservationists and marine scientists, because polymetallic nodules are a core part of a biome and disturbing them could damage unknown marine life while dramatically worsening climate change by releasing pent-up carbon from the depths. "We are just scratching the surface of the ocean in terms of our understanding. I mean, we know that life has existed in the ocean about 3.7 billion years, around three times as long as life on land. And that means there's tremendous diversity in the ocean and maybe around two million species, complex species. But we've only described about 10% of those," said Robert Blasiak, whose marine research focuses on a nexus between stewardship, sustainable management, and international cooperation.

Some companies have rushed to register patents for marine genetic resources of organisms that can withstand extreme conditions involving high pressure, hot and cold temperatures, and dim light. For entrepreneurs, these deep-sea genomes could have lucrative and beneficial uses for industry and biomedicine. The Nagoya Protocol, which grew from the UN Convention on Biological Diversity, only requires prospectors to share biological resources with researchers or companies in the national jurisdiction where they are found and does not apply to the high seas.

"Stewardship rests on three pillars," said Blasiak. "It needs to have knowledge. You need to know about the system before you can really take responsibility for it. The second is care. Once you have that knowledge, maybe you start to care; maybe you don't need to know that much to already feel a connection with the system and want to do something about it. The third one is agency, being able to actually do something about it. And for much of our existence, a lot of the ocean has been kind of out of reach. We haven't been able to access the deep ocean, the really remote parts of the ocean."

The world faces marine degradation on an unprecedented scale, said André Hoffmann, great-grandson of Roche Holding's founder and a former WWF International vice president. "For the past 250 years, our absolute, relentless pursuit of short-term profit maximization has destroyed the planet. And in particular, it's destroyed part of the planet that we don't even know. So, we don't even know what we are missing," said Hoffmann, adding that the belief in business as a panacea and wealth generator for protecting common interests and the environment "has not worked. And it is exactly the reason why we need things like GESDA, which will help bring us towards diplomacy at that level." Hoffmann said he was encouraged by a vote a day earlier in the UN Human Rights Council at Geneva recognizing for the first time that having a healthy environment is a human right. "The pandemic," he said, "has allowed us to realize that our system is not resilient." For example, 90% of the world's fish stocks is now fully or overfished, according to the Food and Agriculture Organization (FAO). Global fish production is approaching its sustainable limit, FAO said, with a 17% increase in production forecast by 2025. Overfishing more than tripled since the 1970s, and 40% of the most popular species like tuna is caught unsustainably. "When it comes to ocean protection, the marriage between science and diplomacy is absolutely essential," said Meibom. "It is not just that it is a good idea – it is essential. Now that is why, of course, I am a big fan of GESDA."

Takeaway Messages

The ocean and coastal areas cover more than two-thirds of Earth's surface and contain 97% of the planet's water, but 45% of the Earth's surface has no laws to protect marine species and minerals.

Ocean life goes back about 3.7 billion years, but scientists have described only about 10% of it.

Companies rush to register patents for marine genetic resources of organisms that could have lucrative and beneficial uses for industry and biomedicine.

The threat of climate change has increased dramatically for the oceans, creating a race to protect marine species and functions.

Demand for minerals for the world's battery-powered transition to electric vehicles and sources of clean energy has led to prospective mining on the ocean seabed that could spare land from mining but damage unknown marine life and release pent-up carbon from the depths.

Efforts to map the bathymetry of the ocean seafloor are accelerating with international cooperation.

Stewardship rests on three pillars: knowledge, care, and agency. That is why stewardship could be at the core of science and diplomacy actions for ocean protection.

A "global charter" may be needed to fulfil one of the UN's 17 Sustainable Development Goals for 2030 that calls for conserving and sustainably using oceans, seas, and marine resources.

More information

Session recording on YouTube

Related interviews: Anders Meibom & Vladimir Ryabinin

Tweets related to the session

Related content in the 2021 Science Breakthrough Radar®

Ocean Stewardship and related breakthroughs at five, ten and 25 years: Full breakthrough brief, Harnessing Ocean Biodiversity, Transition Ecosystems, Repairing the Ocean, Improved Ocean Observation