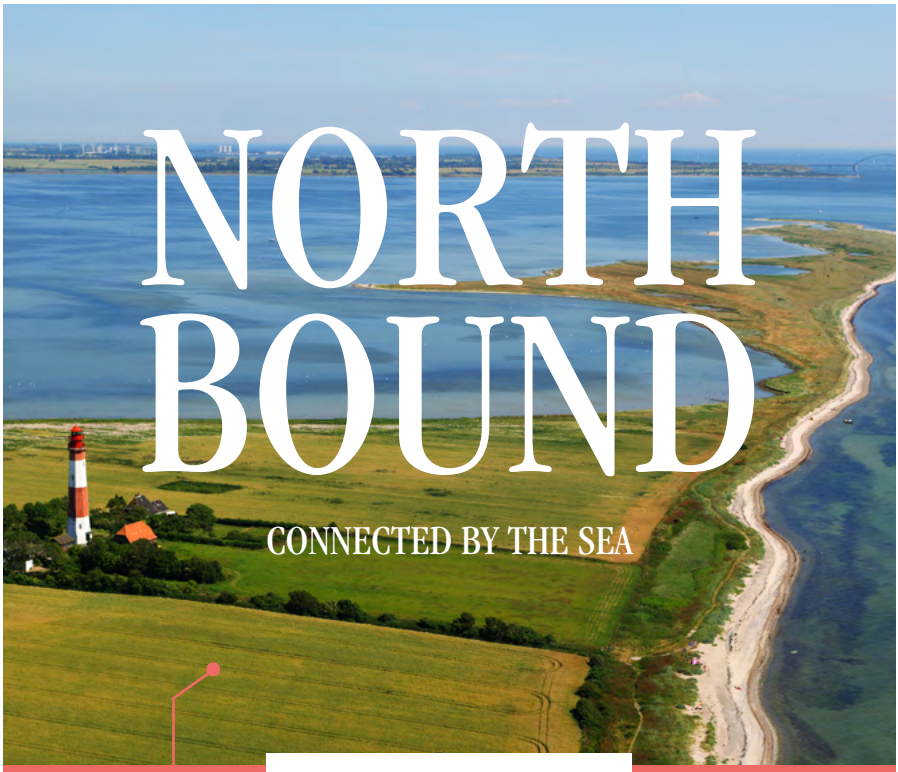

THE NORTH SEA AND THE ARCTIC OCEAN: THREATS AND SOLUTIONS

A seminar for a sustainable ocean

OCEANOGRAPHIC MUSEUM OF MONACO

11 MAY 2022

Summaries

With the support of FERRING PHARMACEUTICALS

Co-organized by museum kunst der westküste

Institut océanographique Fondation Albert Ier, Prince de Monaco

OCEANO

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Northbound, Connected by the Sea,
allowed me to see once again how art can be a catalyst not only for emotional connection and for raising awareness, but also for sparking dialogue around shared concerns while generating the desire to construct concrete solutions to these issues.

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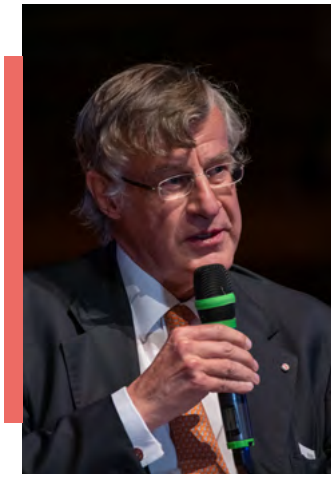
In this sense, this seminar is the logical extension of this exhibition, of a sea that brings people together, beyond continents, latitudes and climates, and connects them with a nature that so badly needs their efforts - our efforts."

HSH Prince Albert II of Monaco



Edito

Prof. Dr. h.c. mult.
Frederik Paulsen,
Founder of the Museum
Kunst der Westküste

From 19 March until 19 June 2022, at the invitation of the Oceanographic Museum of Monaco, the exhibition *Northbound, Connected by the Sea,* revealed the art of the North as far south as the shores of the Mediterranean through an exclusive selection of paintings belonging to the Museum Kunst der Westküste, an exhibition which I hope aroused the enthusiasm of its visitors.

As we had envisioned with Robert Calcagno, Chief Executive Officer of the Oceanographic Institute, during his visit to the island of Föhr in August 2020, we wanted to take advantage of this great opportunity to bring about a meeting which would gather together experts on the North Sea and the Arctic, specialised in various fields such as science, exploration and art, so that we could share their knowledge.

That was the origin of the seminar The North Sea and the Arctic Ocean: Threats and Solutions, organised by the Oceanographic Institute, Prince Albert I of Monaco Foundation and the Museum Kunst der Westküste.

The dynamic dialogue which developed during this seminar enabled us to explore solutions for preserving the extraordinary riches of these interconnected ecosystems, faced with the threat of climate change and the development of anthropic activities.

With the help of scientists, increased cooperation and an ambitious, determined legislation and governance, I think it is now possible to be optimistic about the preservation of the marine ecosystems of the North Sea and near Arctic as well as these of the Mediterranean.

Faced with the pessimism and gloom of an increasingly morose international context, every one of us must, at our own level and within our own means, push political and economic decision makers to become more ambitious in the policies they follow and in the implementation of solutions to bring about ecological and energetic changes which will preserve humanity and biodiversity.

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ABOUT THE SEMINAR

This seminar at the Oceanographic Museum of Monaco was held in the context of the visiting exhibition *Northbound, Connected by the Sea,* from the Museum Kunst der Westküste (MKdW) on the northern German island of Föhr. Hosted by Monaco from 19 March to 19 June 2022, the exhibition showed a selection of historic and contemporary works illustrating the beauty and drama of the North Sea to invite reflection on the importance of preserving this unique coastal and marine environment.

A marginal sea (or epicontinental sea), the North Sea extends over nearly 575,000 km² and links many countries, including the United Kingdom, Sweden, Norway, Denmark, Germany, the Netherlands, Belgium and France. Together with its close neighbor, the Arctic Ocean, the North Sea abounds in extraordinary richness. It is also one of the world's most active regions for the maritime industry, and a particularly dynamic area for leisure and tourism.

Organised by the Oceanographic Institute, Prince Albert I of Monaco Foundation, and the Museum Kunst der Westküste, the seminar gathered North Sea and Arctic experts from science, exploration and art to share their knowledge in a series of presentations and a panel discussion. They engaged in a dynamic dialogue around solutions for preserving the extraordinary richness of these connected ecosystems in response to the challenges of climate change and economic activity.

Discussions highlighted the complementary roles of science and art, and the power of dialogue in driving citizens, decision makers and the private sector towards the protection of the Ocean. They provided inspiration and a basis for collaboration between the North Sea and the Mediterranean Sea, two «laboratory seas» for the preservation of the World Ocean and cultural links between peoples.

video of the seminar

ABOUT THE EXHIBITION *NORTHBOUND, CONNECTED BY THE SEA*

The Museum Kunst der Westküste (MKdW), located on the island of Föhr, in northern Germany, exhibited 24 historical and contemporary artworks, from March 19 to June 19, 2022, at the Oceanographic Museum, as part of the exhibition *Northbound, Connected by the Sea*.

This exhibition - initiated by Prof. Dr. h.c. mult. Frederik Paulsen, Founder of the MKdW – took viewers on a visual journey along the coast and maritime landscapes of the North Sea, from the Netherlands to Germany, Denmark and Norway. It shed light on the role that the North Sea has played, and still plays, in the cultural links between the island of Föhr and these countries.

SPEAKERS

Prof. Dr.
Peter Herzig
former Executive Director, GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany

Prof. Dr.
Tinka Murk
Professor at Wageningen University, the Netherlands

Mr.
Boris Herrmann
Skipper of Team Malizia, Germany

Prof. Dr.
Mojib Latif
Climatologist, Senior Professor at GEOMAR, President of the German Association of the Club of Rome, Germany

Prof. Dr.
Antje Boetius
Director, Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Germany

M.
Arved Fuchs
Explorer, Expedition Leader at Arved Fuchs Expeditionen, Writer, Journalist, Filmmaker, Germany

Prof. Dr. h.c. mult.
Frederik Paulsen
Founder of the Museum Kunst der Westküste, Germany

Prof. Dr.
Ulrike Wolff-Thomsen
Director of the Museum Kunst der Westküste, Germany

The seminar began...

...with a video by Dutch Maritime Productions, which showed how intensive use of the North Sea has turned much of the seabed into a sand desert by destroying its natural reefs. Yet remaining stone fields, shellfish banks, shipwrecks and other manmade structures are full of life, offering hope. The film suggested that offshore renewable energy could provide new opportunities to restore reef biodiversity by protecting the seafloor from damaging activities, using nature-friendly structures based on scientific research.

play now

WELCOME WORDS

Ms Leila Ghandi,
Master of Ceremony

Seminar moderator Leila Ghandi noted that Monaco was a longstanding leader in the fight for ocean protection dating back to Prince Albert I, known as the father of modern oceanography. An Arctic glacier in the Svalbard Islands was named after Monaco following one of his expeditions at the beginning of the 20th century. Carrying on the tradition, Prince Albert II is very active both personally and politically on ocean issues, and is the only head of state to have reached both the North and South Poles.

The latest report from the Intergovernmental Panel on Climate Change tells us "it's now or never": we must take action, Ms. Ghandi said. Global warming is not an abstract and faraway concept. It means direct and concrete effects on our economy, food and water supply, health and lives. This urgency forms the backdrop of today's seminar on action and solutions.

OPENING SPEECH

HSH Prince Albert II of Monaco

Mr. Minister of State,

Excellencies,

Mr. Ambassador of Norway in France,

Ladies and Gentlemen Consuls,

Ladies and Gentlemen,

Dear Friends,

I am very pleased to welcome you today in Monaco, on the occasion of this afternoon of reflection and exchange devoted to the threats facing the North Sea and the Arctic Ocean, and the solutions that exist to meet these challenges.

The idea for this seminar came from the exhibition *Northbound, Connected by the Sea* organized by the Oceanographic Institute, Prince Albert I of Monaco Foundation, and the Museum Kunst der Westküste, which we see on the walls of this room.

I had the pleasure of inaugurating this beautiful exhibition at the end of March, during the Monaco Blue Initiative. As some of you know, this is a forum we have been organizing every year since 2010, to discuss the major issues of the seas and how best to address them.

This inauguration allowed Me to see once again how art can be a catalyst capable not only for emotional connection and for raising awareness, but also for sparking dialogue around shared concerns while generating the desire to construct concrete solutions to these issues.

Today's seminar is thus the logical extension of the exhibition.

I would therefore like to thank the organizers, the Oceanographic Institute and the Museum Kunst der Westküste that I mentioned, but also more particularly Professor Frederik Paulsen and Professor Peter Herzig, without forgetting the teams from GEOMAR Helmholtz Centre for Ocean Research in Kiel and the Alfred Wegener Institute for Polar and Marine Research, as well as all the high-quality speakers we will hear from in a few moments, Professors Antje Boetius, Tinka Murk, Ulrike Wolff-Thomsen, Mojib Latif and Mr. Arved Fuchs, and of course, «our» Mr. Boris Herrmann.

Of course, I would also like to thank all the participants who have honored us with their presence today.

Through our exchanges, through our different points of view and areas of expertise, we will talk about two marine areas, the North Sea and the near Arctic on the one hand, and the Mediterranean Sea on the other. These two areas have much in common, despite the distance that separates them, and we have much to gain by comparing our experiences.

It will then be a question of better understanding the common problems afflicting from which these areas. For these problems often result from the same causes, «our behaviors», the effects of our civilization and our lifestyles.

They include urbanization of the coasts, ever-growing maritime traffic, pollution, and climate change, which always and everywhere have the same consequences, acidification, weakened ecosystems, overexploited resources, damaged seabeds.

Finally, in the face of these problems, it will be necessary to identify solutions together. Solutions that have been tested there and that could also be tested here. Solutions that we have all been able to observe, and for which feedback is particularly valuable.

Because these regions are also solution laboratories.

Men and women are not always destructive, fortunately. We also sometimes try to repair, to protect, to craft beneficial solutions.

One is marine protected areas, for example, which I think we will talk about a lot.

Another is the regulation of maritime traffic, which is gradually developing, both here and there. Management of fishing, too, is progressing little by little.

In light of these solutions and in order to promote them, there is the need for joint action.

I am thinking in particular of the negotiations on climate change or biodiversity. For years, I and others have pushed for the inclusion of maritime issues in international discussions on these subjects.

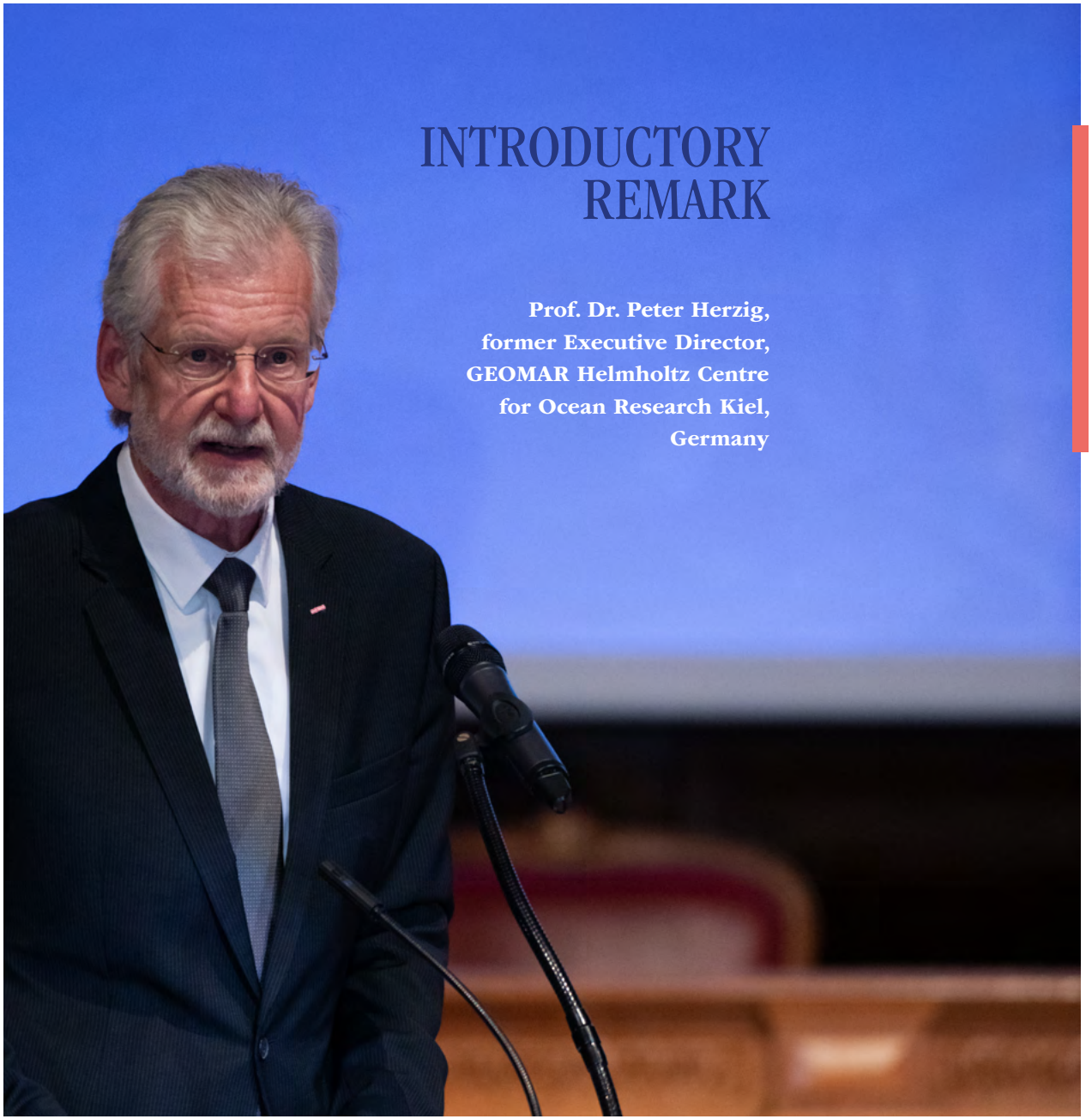
By addressing problems and their solutions, this seminar can enable us to join forces to generate and push proposals.

In this sense, it is the logical extension of this exhibition, of a sea that brings people together, beyond continents, latitudes and climates, and connects them with a nature that so badly needs their efforts - our efforts.

It also perpetuates the strong ties that My great-great-grandfather Prince Albert I was able to establish along the shores of the North Sea, during his numerous trips, whether traveling to Kiel, or stopping over elsewhere on his way to the Arctic Ocean.

For all these reasons, I know that this afternoon will be fruitful, in the service of our seas and for the good of all.

I thank you all.



INTRODUCTORY REMARK

Prof. Dr. Peter Herzig, former Executive Director, GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany

Peter Herzig, former Chief Executive Officer of the GEOMAR Helmholtz Centre for Ocean Research in Kiel, Germany, and former EU maritime ambassador, provided some background. The North Sea is a unique maritime region of the Atlantic Ocean which connects seven European countries: the UK, Norway, Denmark, Germany, the Netherlands, Belgium and France. These countries share a rich marine cultural heritage dating back to pre-Viking times, he said.

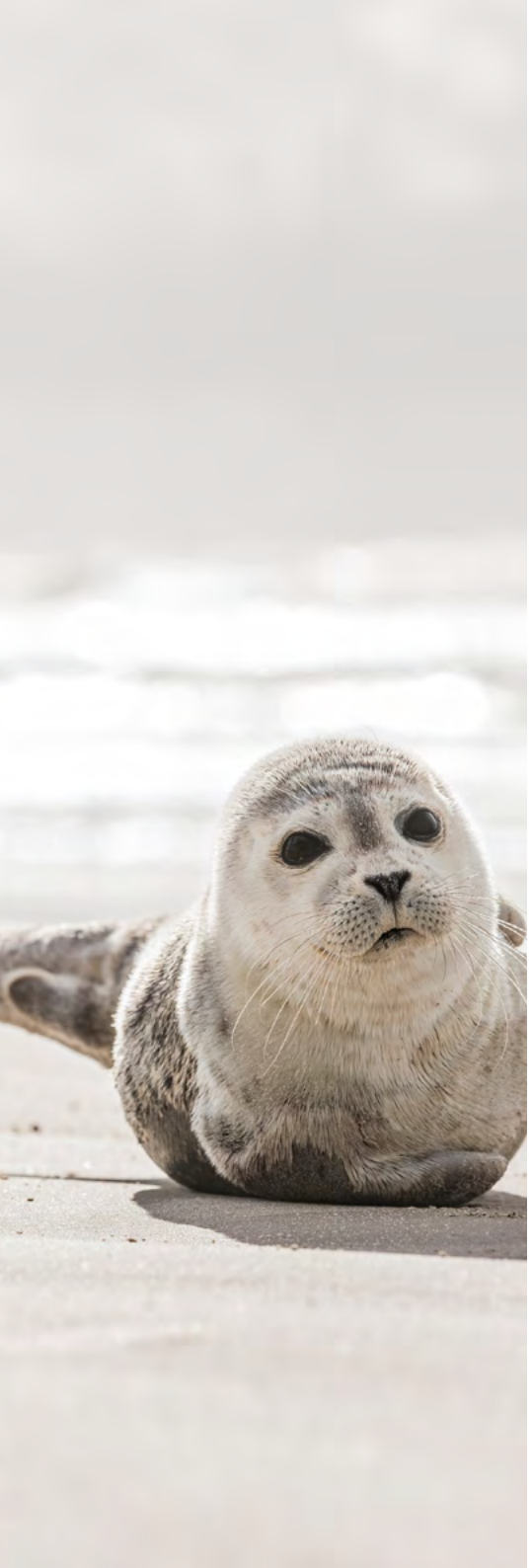
As one of the busiest maritime industry areas in the world and a major area for recreation and tourism, the North Sea needs practical solutions to reconcile economic use and environmental protection in the face of extreme pressure from sea-level rise, overfishing, loss of biodiversity, acidification, decrease of oxygen, plastic and nutrient pollution and global warming.

Solutions include marine protected areas, Marine Spatial Planning, fishing-free wind parks, offshore aquaculture and CO_2-storage beneath the seafloor. While the North Sea has long been known for oil and gas, a shift is underway to exploit the potential of renewables such as large-scale offshore wind farms and wave and tidal energy, Dr. Herzig noted.

Climate change and the permeability between the North Sea and the Arctic have resulted in major biodiversity shifts that could have a significant impact on marine life and the world food supply, he warned. Some fish stocks are moving north towards colder environments and are partly replaced by more southern species.

Sea level rise is also a major threat that could affect some 25 million people living in coastal communities in northern Europe. Discussions are underway on an innovative project to build two dams in the English Channel and between Scotland and Norway in order to protect these populations.

At first glance, the Mediterranean and the North Sea do not appear to have much in common, but the two can share best practices to achieve a balance of sustainable use and protection, both in their regions and beyond.



BIODIVERSITY OF THE NORTH SEA AND THE ARCTIC: SETTING THE SCENE

Prof. Dr. Tinka Murk, professeure à l'université de Wageningen, Pays-Bas

Tinka Murk from Wageningen University set the scene with a presentation on North Sea and Arctic biodiversity in a context of multiple crises, from Covid-19 and economic recession to climate change and the urgent need to reduce fossil energy, exacerbated by the war in Ukraine.

The Netherlands seeks to dramatically increase offshore wind production in its part of the North Sea, which is already very busy and experiencing challenges including overfishing, seabed destruction, pollution, ocean acidification, noise, invasive species and electromagnetic interference from underwater cables.

This ecosystem has also suffered from measures taken to secure the Netherlands' low-lying coast, such as sand mining and the closing off of estuaries that were important migration areas for sturgeon and salmon. Dr. Murk expressed particular concern about biodiversity collapse. Biodiversity helps the environment adapt to climate change – nature can take care of itself if we don't prevent it from doing so, she said.

The Netherlands is undertaking three major transitions in the North Sea: the energy transition to offshore renewables; rehabilitation of the ecosystem to make it productive and resilient; and a food transition away from a hunting-gathering model, which we stopped doing on land thousands of years ago.

All this takes place against the background of climate change, with a warmer, rougher, higher sea, Dr. Murk noted. Neighbouring countries also have plans, and we must address the whole North Sea as an interconnected system. Marine and coastal management is like a puzzle, its pieces being energy, food, ecological stressors, habitat restoration and stakeholders. Spatial planning must be applied, and quickly, given the urgent need for sustainable offshore energy, she said.

Offshore energy should not be restricted to wind, which research indicates may not provide as much energy as was hoped. Wind turbines also have geophysical effects and introduce new stressors: they attract and kill bats and birds, so turbines must be shut down during migrations or deploy deterrents. On the other hand, windfarms can be places free of shipping noise and fishing.

The Netherlands is experimenting with adding floating solar panels to offshore wind parks, and with tidal energy, which has the advantage of being very predictable. The tidal energy platform could also serve as a refuelling station using energy sources such as hydrogen or ammonia, Dr. Murk suggested.

To protect biodiversity and the sea floor requires protected areas free from bottom trawling. Necessary restoration efforts include bringing back hard structures to recreate hotspots for sea life; planting oysters; and making reefs using new bio-inspired materials to replace concrete, which has a very high carbon footprint. Monitoring to track changes, using cameras, water samples and sound sensors, is also key.

Offshore energy presents food production opportunities: mussels can be raised underneath floating solar panels, while North Sea fish could thrive again on the protected seabed. Previously, the law required oil and gas companies to remove structures when they had finished extraction. Instead, we must leave them, Dr. Murk said – they're full of life. Nature will use all opportunities, and doesn't need to be micro-managed. These developments must be discussed with stakeholders, including fishing and shipping companies, and be accompanied by new legislation, but this very complex puzzle can in fact be organised.

She offered guidelines: firstly, not everything can be done everywhere. Activities must be designed and located intelligently, with certain areas left untouched to allow nature to take its course. Secondly, it is important not to base everything on one technology, such as offshore wind, but instead multiply technologies. And finally, we should collaborate more and make use of what is already known, as many other countries and seas face similar challenges.

The recipe for a healthy, productive and resilient marine ecosystem is very simple: ensure a diversity of sufficiently large and healthy habitats; enable connectivity among habitats and target protective measures to allow animals to fulfil life cycles; support full food web functionality by not overfishing top predators; and eliminate chemical, physical, electromagnetic and noise pollution.

Eco-inclusive design and operation must be integrated in development of wind or other energy at the planning stage, not after the fact. Not enough attention is being paid to the socioeconomic transition, as new jobs are created and others lost, nor to governance transitions to ensure development is nature inclusive, restoring seas, coasts and estuaries so that they thrive again and are safe, Dr. Murk said. Lastly, while we should learn from the past, a biodiverse future will be different, so we should embrace the new situation, and marvel at what nature can do.

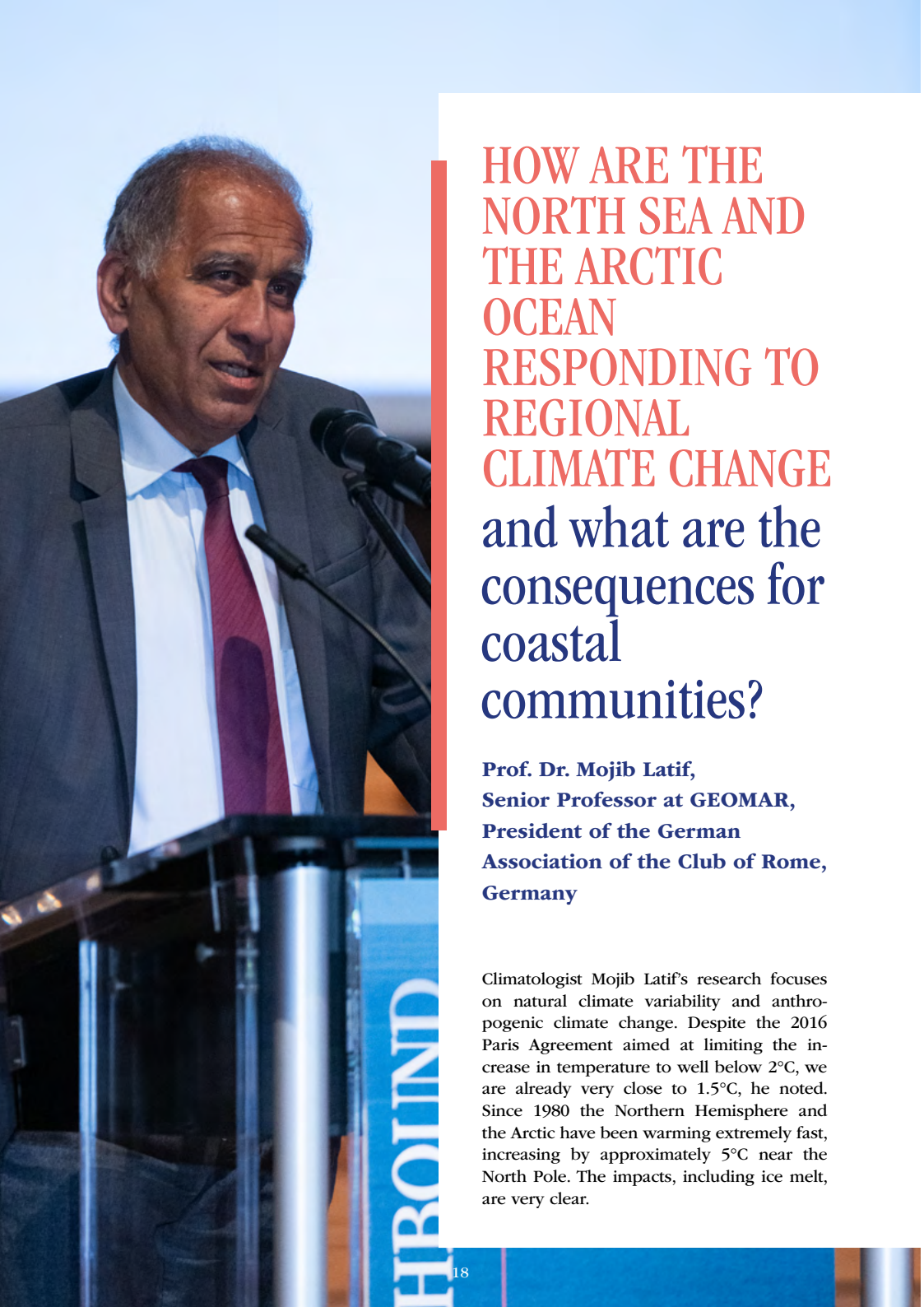
VIDEO MESSAGE

Mr. Boris Herrmann, Skipper of Team Malizia, Germany

In his brief message, the professional sailor and skipper of German-Monegasque racing yacht *Seaexplorer* explained how his ship contributes to ocean science by collecting CO_2, salinity and temperature data in hard-to-reach areas, in collaboration with the Max Planck Institute and GEOMAR. During the last Vendée Globe, it produced one of the longest ocean data tracks ever recorded and the greatest amount of CO_2 data in that time frame.

Oceans regulate the climate and mitigate global warming by absorbing almost one-third of the planet's CO_2 emissions and 90% of the heat energy, Mr. Herrmann recalled. He has experienced climate change impacts first-hand, sailing through the Northeast Passage from Murmansk to the Bering Strait in 2015 without using an engine. Setting a new world record was bittersweet: "The frozen ice should have prevented our passage, yet we hardly even saw ice", he recalled. "It was frightening".

His team is witnessing more and more extreme weather at sea, he said. On a recent crossing to New York they encountered four tropical depressions in two weeks, and thick brown carpets of sargassum stretching all the way to the horizon, which was not the case ten years ago.



HOW ARE THE NORTH SEA AND THE ARCTIC OCEAN RESPONDING TO REGIONAL CLIMATE CHANGE and what are the consequences for coastal communities?

Prof. Dr. Mojib Latif,
Senior Professor at GEOMAR,
President of the German Association of the Club of Rome, Germany

Climatologist Mojib Latif's research focuses on natural climate variability and anthropogenic climate change. Despite the 2016 Paris Agreement aimed at limiting the increase in temperature to well below 2°C, we are already very close to 1.5°C, he noted. Since 1980 the Northern Hemisphere and the Arctic have been warming extremely fast, increasing by approximately 5°C near the North Pole. The impacts, including ice melt, are very clear.

Europe has also warmed a lot over the last five years, and the World Meteorological Organization stated last week there is a 50% chance the annual global temperature will temporarily reach 1.5°C above the pre-industrial level for at least one of the next five years. Time is running out, Dr. Latif warned.

The climate problem is largely a fossil fuel problem. Burning coal, oil and natural gas produces CO_2 responsible for about 60% of global warming. The correlation between CO_2 and rising temperature is not a new revelation – it was demonstrated by computer models, more than 30 years ago, down to the local specifics we're seeing today. It is not a knowledge but an implementation problem. We should apply the precautionary principle and stop before it's too late, he urged.

The Arctic is a key integrating factor for our interconnected world, as strong warming there influences all coastal regions of the globe. A net loss of Greenland ice since 2000 is causing the sea level to rise as meltwater enters the ocean. The same is true of Antarctica. If all of Greenland's ice sheet melted, the sea would rise by an average of 7 metres globally. The loss of Antarctica's ice sheet would cause a rise so great it doesn't bear mentioning, he said.

Europe's sea level rise has accelerated since 1990 and depending on emissions, Europe's seas could rise as much as 2.5 metres by 2150. We can't avoid the future rise but we can still somewhat limit it, yet we haven't even started to take action on global CO_2 emissions since the nice words of the Paris

Agreement, he deplored. The answer is to reduce CO_2 emissions and increase natural carbon sinks. As fossil fuels are the main source, we must not burn them – any child could understand this. The second source is land use, namely deforestation. It doesn't make sense, and must be stopped.

In response to a question about country leaders who refuse to act, Dr. Latif replied that trade should be conditioned on environmental responsibility. We can't have unconditional trade with countries like China, for example, whose country accounts for one-third of global CO_2 emissions, he said.

The environment must take precedence over the economy, which must be regulated. One of the most powerful actions at the global level would be to eliminate fossil-fuel subsidies, which amount to $500-600 billion every year. If you cut the subsidies, sustainable products will prevail, he concluded.

DIALOGUE

with Prof. Dr. Antje Boetius, Director, Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research, Germany, Prof. Dr. h.c. mult. Frederik Paulsen, Sweden, Founder of the Museum Kunst der Westküste and Mr. Arved Fuchs, Explorer, Writer, Journalist, Film-maker, Germany.

CAN SCIENCE - AND EXPLORATION help find solutions to the climate change and the biodiversity problem?

First to speak was Prof. Dr. Antje Boetius, Director of Germany's Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research.

Her research focuses on the effects of climate change on the Arctic Ocean and deep-sea biodiversity, enriched by over 50 expeditions as a polar and deep-sea researcher. Dr. Boetius has family roots in the Frisian Islands where the Museum Kunst der Westküste is based. She believes in the power of combining science, art and exploration to give landscapes, seas, plants and animals a voice.

The North Sea has always seen rising and falling sea levels and temperatures. Her grandfather and father told stories of playing on ice floes in winter on the North Sea, and Dutch grandparents remember endless kilometres of ice skating. Today's North Sea kids have no such memories, she noted.

While admiring Tinka Murk's optimism about nature's adaptability, Dr. Boetius warned this had limits. Temperature, for instance, is a key factor in animal diversification. Having worked for decades on how fish react to higher temperatures, her institute is finding that while adults can adapt and migrate, eggs and larvae are limited by their extreme temperature sensitivity. This research underscores the need to get the full picture of the network of life and how it interacts with humans.

Changes in the North Sea are taking place on an even bigger scale in the Arctic, especially in wintertime. In March 2022 there was an unprecedented heatwave in which temperatures jumped by 40°C. Scientists are now trying to understand what it means; what is known is that this will speed up the loss of ice sheets and hence the rise of the sea level.

Even if we already know enough to act without further delay, science and exploration remain crucial. Scientists estimate that 90% of life on Earth has yet to be named, much less understood, which also holds true for ocean function and interactions with climate, land, biology, and human activity. This knowledge will be key to knowing how to adapt.

Dr. Boetius then showed a short film about the MOSAiC Arctic expedition. The research vessel drifted with the polar ice for a full year, tracking the dynamics at play in the region of the globe most vulnerable to climate change. The samples, observation and data collected provide the scientific knowledge needed to drive political decisions.

Science and exploration also spark citizens' interest, love and advocacy for nature. The MOSAiC film shows the first colour images of wintertime in the Arctic and at the North Pole, which is very important. As we fight for political solutions, we must continue to capture how nature works and give the landscapes and life forms a voice in our negotiations and decisions, she said.

The second panelist was Museum Kunst der Westküste Founder Frederik Paulsen, a businessman, academic and philanthropist with a deep historical and scientific interest in polar exploration and climate change science. He has also participated in many diving and research expeditions.

As we've seen here today, most scientists are doing passive research: probably 80% of all research money is spent is on measuring and trying to understand what's going on, he said.

In his view, researchers should concentrate more on developing solutions, which exist and have been identified. We should not become too pessimistic. The question is how to unite researchers across the world behind solutions, and get politicians to move to implementation. Prof. Paulsen noted as an interesting development Switzerland's recent nomination of an ambassador for science, relating specifically to the environment and to the pursuit of solutions.

He cited a 3-month expedition around Antarctica with 20 research groups, which discovered that albatrosses and whales were coming back, and fish populations increasing, thanks to countries having come together on legislation. But the expedition also observed negative developments, such as microplastic particles in the deep fjords of the eastern Antarctic where no one has ever been. They are everywhere, polluting the whole planet.

With legislation and cooperation, we can find solutions – the relatively quick elimination of the ozone hole thanks to a worldwide ban on freon gas is a positive example – but the political will has to be there, Prof. Paulsen said. He repeated that resources should be allocated to science working on solutions, instead of spending all this money just on studying the changes.

Antje Boetius said that, in her point of view as a science manager, both types of science were needed. Things are not simple and linear but rather a constantly evolving dynamic. For instance, the MOSAiC expedition found that in winter, climate change introduced a coldness in the stratosphere that created a huge new ozone hole, which they spotted just by chance. The serendipity of science and constant observation lead to solutions, and can't always be planned. Most science funding today goes to finding solutions, to applied science, but we don't yet understand our planet fully enough to protect it – you need only see all we've learned about sea level rise in the past decade, she said.

Next to speak was Arved Fuchs, a German explorer, climate activist, writer, journalist and filmmaker.

As shown in a brief video, Mr. Fuchs' 90-year-old traditional wooden sailing vessel *Dagmar Aaen* participates in the Ships of Opportunity (SOOP) project, through which volunteer commercial, leisure and research vessels collect and transmit ocean and climate data as a complement to scientific expeditions and monitoring. Previous speaker Boris Herrmann also contributes to SOOP from his racing yacht Seaexplorer.

Mr. Fuchs has been travelling in polar areas for over four decades, initially living with Indigenous people in the Arctic, who taught him how to survive by observing nature. Travelling by dog team, kayak and skis, one's life depends on recognising fragile ice, or the approach of an Arctic storm, for instance. During the 1989 Ice Walk North Pole expedition, he skated 1,000 km across the frozen ocean. The ozone layer was a big issue at that time but not climate change – it was so cold that the ice was stable and safe. Today, travelling across the frozen ocean is no longer possible, because the ice has become thin and fragile, with a lot of open water in between, he noted.

Going to such remote areas is a privilege that gives you a responsibility to raise awareness. This is Mr. Fuchs' focus today, through the Ocean Change programme, which combines highly sophisticated science and technology to collect and transmit data directly to GEOMAR in Kiel by satellite. While scientists analyse the data, we do the media work to inform people and take them on a virtual trip along the coast and fjord of Greenland to show them what we will lose if we don't act, he explained.

As Dr. Latif said, we have no time to spare. Politicians have known for decades what is going on, but aren't solving the problem, and corporate CEOs are more worried about their jobs and shareholder value than about the environment. This is why we need to keep the population involved, without moralizing and telling them what to do. Mr. Fuchs tells people he is part of the problem, and must change his habits like anybody else, by reducing meat consumption and driving and flying less, for instance.

He agreed with previous speakers about the need to act on trade. In Brazil, the tropical rain forest is being burned for wood and cattle to export to Europe, which is also bad for Indigenous people. To prevent this, we have to stop trading with Brazil and stop buying these products, he said.

European countries have long known about the risk of dependency on Russian oil and gas. Only now are we changing, and suddenly, under pressure, it works out. In Germany there are many plans to build hydrogen factories, including offshore ones in the North Sea. A few years ago, hydrogen was seen as unfeasible because it required so much energy but now it's viewed as a feasible solution because it provides storage for energy to be burned later, Mr. Fuchs noted.

…the importance of continuing scientific study and data collection…

Antje Boetius cited biodiversity talks to adopt protection of 30% of nature by 2030 as a further example of the importance of continuing scientific study and data collection. To achieve this ambitious goal takes a tremendous amount of quality data, measurement and knowledge, including Indigenous knowledge. One of the most important tasks is to establish a massive Arctic marine protected area to limit fishing and other extractive activities. Citizen science and the kind of data Arved Fuchs collects and transmits from his ship can be critical to effective implementation of a marine protected area. Knowing that one can participate is an important part of the solution, she said.

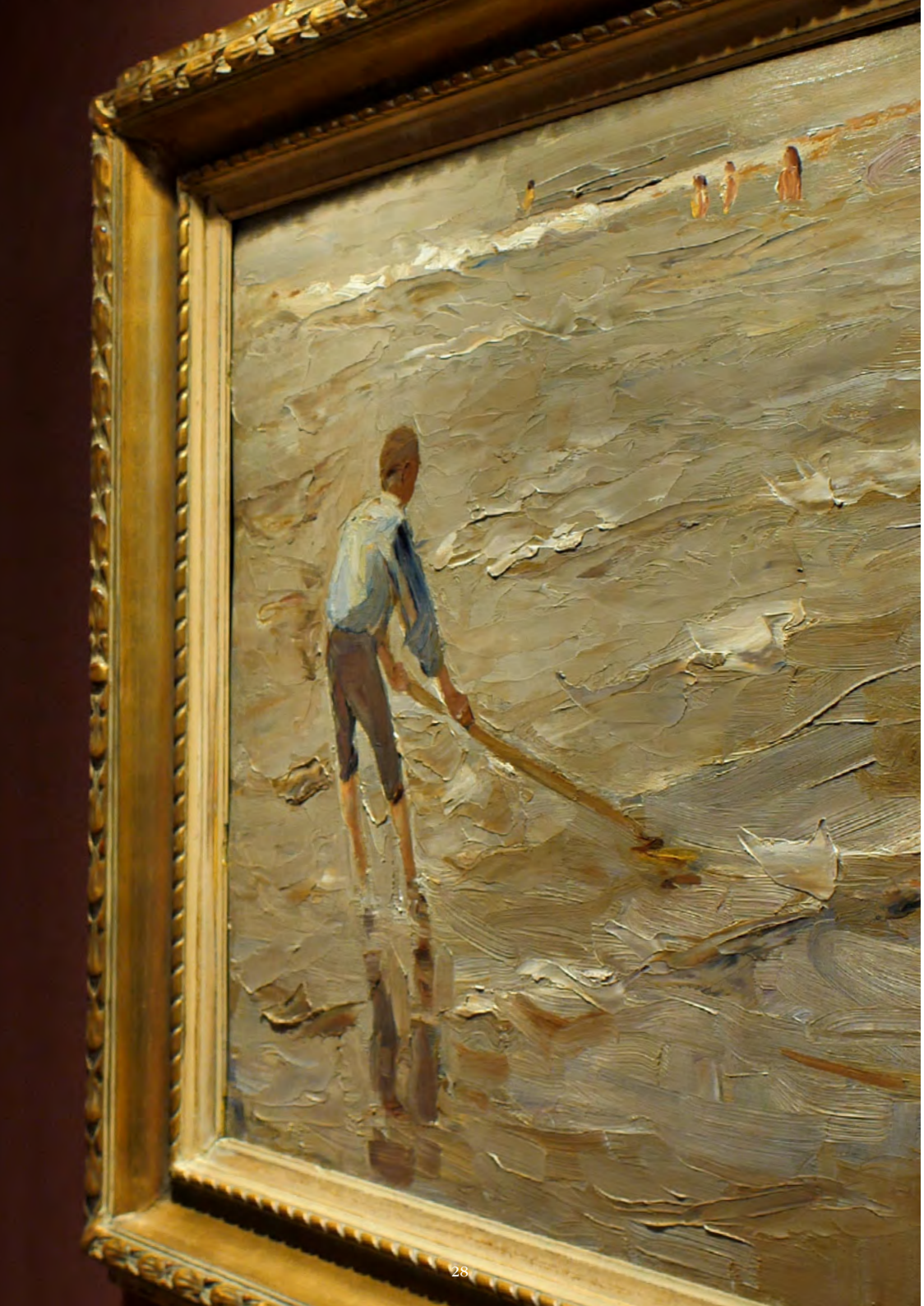
Dr. Boetius noted ongoing European negotiations towards an economic model that rewards activities that protect and restore nature and the atmosphere, and not activities that harm them. This would be a huge switch and create an essential framework for controlling CO_2 emissions by making it more costly to put carbon into the atmosphere than to develop renewables. Laws and frameworks are key to behaviour change, and reflect the will of the people, she said.

Arved Fuchs agreed that although change was too slow, awareness and the acceptance of shifts, like buying electric cars and reducing meat consumption were increasing.

Frederik Paulsen commented that one of the greatest dangers is despair and pessimism – we have to do a better job of explaining that there are solutions.

The panel then took questions. **A member of the audience** asked why the ozone layer problem was solved so quickly, and what could be learned from that positive example. Regulation did it, **Prof. Paulsen** replied. While difficult for him to accept as a businessman who wanted as little government involvement as possible, it took strong government to do this, he said. The ozone hole was solved when most countries in the world recognised that certain common industrial chemicals were causing this problem, got together, and agreed to phase them out within a few years.

In response to a question about how to better incorporate Indigenous knowledge, **Arved Fuchs** noted that this knowledge and history had not been written down, being transmitted orally. We are in great danger of losing it as Indigenous lifestyles change, he warned. In Greenland, where he spends a lot of time, everyone now acknowledges global warming but some think it's good because it means a longer tourist season, a longer fishing season and new types of fish. Other people live in a more traditional way, going out with their dog teams to hunt walruses or seals. This is splitting up society in Greenland, and the traditional hunters are the losers, because politicians aren't listening to them, Mr. Fuchs said. They implicitly pressure people to move South by suggesting they'll have a better life there, which means a loss of culture, knowledge and respect for nature and what nature means to them.



FROM THE MUSEUM KUNST DER WESTKÜSTE PERSPECTIVE, can art be part of the solution for a better known, loved and protected Ocean?

Prof. Dr. Ulrike Wolff-Thomsen, Director of the Museum Kunst der Westküste, Germany

The seminar's next session offered the perspective of Prof. Dr. Ulrike Wolff-Thomsen, Director of the Museum Kunst der Westküste where the *Northbound* exhibition originated. The Museum was founded in 2009 on the North Frisian island of Föhr to showcase art created along the west coast of the four North Sea states of Norway, Denmark, Germany and the Netherlands.

The collection of over 1,000 works by such renowned artists as Edvard Munch, Piet Mondrian, and Max Liebermann depicts the changing west coast landscape as a living and working space, but also, since the late 19th century, a leisure and tourist space. The Museum's other focus is on contemporary international issues, such as climate change, migration and mass tourism. It perpetuates regional historical ties through collaboration with other North Sea countries' museums and an artist-in-residence programme.

The MKdW's mission is to explore social and ecological questions concerning the sea, to use art to heighten sensitivity to changes in nature and the perception of nature, but also to pose questions about origin, homeland and cultural identity, Dr. Wolff-Thomsen said.

Naufrage sur la côte du Finnmark
Johan Christian Dahl,
1847

Monk by the Sea
Caspar David Friedrich
1808-1810, oil on canvas, 110 x 171,5 cm,
Nationalgalerie, Staatliche Museen zu Berlin

Works from the first half of the 19th century tended to depict a struggle with the element, as in the famous Caspar David Friedrich painting *Monk by the Sea*, in which Friedrich saw the sea as a metaphor for life, a mirror of individual engagement with being, and a symbol of a metaphysical world order encompassing man and nature, she said.

His friend the Norwegian landscape painter Johan Christian Dahl took a more realistic view. His 1847 painting *Shipwreck on the Coast of Finnmark,* depicts the dramatic events surrounding a ship that has crashed on the rugged rocks of a fjord. As a symbol of man's powerlessness confronted with the forces of nature, the sea exerted a great fascination on the art public of that time.

In the second half of the 19th century, the sea and the beach became increasingly perceived as leisure and recreational space. Norwegian painter Peder Severin Krøyer's work from 1883 thus shows not the hazardous work of fishermen, but their enjoyment of an evening at the beach. In the 1896 painting by Dutch artist Philip Sadée, fishermen's wives and children look tranquilly out to sea, confidently awaiting the return of their loved ones.

Fascination with the sea transcend borders and continents, Dr. Wolff-Thomsen noted. She illustrated this with an excerpt from Swiss conceptual artist Sophie Calle's video work, *Voir la Mer* in which Calle invited people from Istanbul who had never seen the sea to travel with her to the coast, capturing these moments on film. One sequence shows an older man filmed from behind, looking out at the sea. He turns around very slowly to face the camera, and wipes his eyes. Dr. Wolff-Thomsen interpreted his strong emotion as a response to seeing, smelling, tasting and hearing this huge, natural space for the first time. Perhaps he had also become aware not just of the sea's beauty but of its supra-temporality, and of his own limited time, she suggested.

Humans' relationship with the sea is deeply anchored in our unconscious, a view supported by brain research. This emotional power should be better exploited to rally support for environmental protection, she said. Bringing climate science together with the more emotional language of art is a way to reach the widest possible audience, including people less interested in this topic or already resigned to it.

She gave the example of a 2012 project involving the Museum Kunst der Westküste. Australian twin sisters Christine and Margaret Wertheim created a cooperative international art project called The Crochet Coral Reef to draw attention to these endangered marine ecosystems.

One part was a crowd-sourced crochet Föhr Reef created at MKdW, for which over 750 people crocheted corals using models provided by the artists, freely choosing size, shape and colour. Teams met regularly to crochet together at the museum and at the Danish Museum Sønderjylland in Tønder. This resulted in a 20-square-metre three-dimensional woollen coral reef, as well as smaller sculptures made of plastic threads to draw attention to the problem of microplastic pollution.

The larger, ongoing project has already involved more than 20,000 people in fifty cities and countries. A new reef with 40,000 individual corals crocheted by over 4,000 people can be seen currently at the Frieder Burda Museum in Baden-Baden. These reefs are a pointed ecological statement and weave together cooperative, figurative, material, conceptual, artistic, scientific and playful aspects, Dr. Wolff-Thomsen noted.

The visual, emotional, tactile and participatory components of art can be tools to win over broad circles of society and decision-makers, and initiate impulses and action to save the oceans. Sustainability requires that people be touched emotionally, so we should use the power of art more in our joint efforts, she concluded.

The Crochet Coral Reef
Christine and Margret Wertheim
and 750 participants
2012

AUDIENCE QUESTIONS

Norwegian ambassador to France and Monaco, **H.E. Mr. Niels Engelschiøn** asked about balancing Ocean use and conservation in the context of Norway's recently adopted the goal of 30 gigawatts of offshore wind energy by 2040, which means 1,500 installations. The first to complain are fishermen, and second are those who say it doesn't go far enough, he said.

Tinka Murk called for a change in thinking about how we fish. Research has shown local biomass around shipwrecks is 300-500 times greater per square metre. A sea ranching system where you allowed full ecosystem development and harvested a mix of species all along the food web could easily yield ten times more per hectare than existing fishing practices, she affirmed.

This would also bring new jobs. If you're producing ten times more food in one spot, you can set aside other ecologically key areas for nature protection. While it requires work and science, this could be done faster than we think, she said.

A student from Sciences Po University asked whether CO_2 recapture technology was really nature-friendly, given that producing the machines to absorb CO_2 emissions itself generated massive emissions. She also asked about the relevance of political power versus individual or grassroots action.

Antje Boetius replied that both individual and state solutions were needed, and that politicians must be convinced people want change. Individual action isn't just reducing your carbon footprint, but using your voice to have an impact at the political level, demanding new laws, or better application of existing laws, she said, citing the example of a girl from the Frisian island of Pellworm who rallied other youth to jointly sue for their islands' protection.

Regarding technology to remove greenhouse gases from the atmosphere, **Mojib Latif** argued against huge financial investments to keep fossil fuels alive. Do we want to build a whole new infrastructure to take CO_2 out of the atmosphere, or do we want to spend the money to develop renewable energy? I would argue for the second, he said. The issue is political will, not money – when billions become available overnight to finance war, no one can say there isn't enough money. Lastly, we need to change our lifestyle, and the formula is very simple: "less is more", Prof. Latif concluded.

CLOSING WORDS

Prof. Dr. Peter Herzig, former Executive Director, GEOMAR Helmholtz Centre for Ocean Research Kiel, Germany

In his closing remarks, Peter Herzig said the seminar had shown how much we could do, but also how much remained to be done to save our seas and oceans and to achieve the necessary balance between economic use and protection.

Art and science can work together to raise awareness of ocean issues – this is why the Oceanographic Museum was founded here in 1910 by Prince Albert I. Dr. Herzig expressed hope that the seminar would spark dialogue between North Sea and Arctic specialists and those from the Mediterranean, while encouraging the public to increase support for the Oceanographic Institute's activities in favour of the ocean.

He mentioned the Oceanographic Museum's new exhibition *Polar Mission*, which invites visitors to discover the poles in a new way and to follow in the footsteps of the great polar explorers, including Prince Albert I, who led four expeditions to Svalbard around the turn of the 20th century. It illustrates the richness and fragility of polar environments, extending today's discussions. The exhibition will also feature a recently donated collection from anthropologist and explorer Jean Malaurie that brings to life the impact of environmental imbalances on Indigenous people.

Closing the seminar, moderator Leila Ghandi summarised the main points that emerged from the day's discussions. Firstly, existing data shows we must act now. We should not be pessimistic, but focus instead on solutions. These exist, but require political will and stronger legislation, and perhaps a reallocation of funds towards solutions-oriented research.

Finally, individuals have a role to play by adopting more sustainable lifestyles but also by making their voices heard. Highlighting the importance of dialogue, Ms. Ghandi urged participants to keep the discussion alive online on social media and the Oceanographic Institute website.

SPEAKER BIOGRAPHIES

Prof. Dr. Antje Boetius

is a polar and deep-sea researcher and director of the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research in Germany. Professor of Geomicrobiology and Head of the Joint Research Group for Deep-Sea Ecology and Technology at the Max Planck Institute for Marine Microbiology, she is also involved in the MARUM Cluster of Excellence at the University of Bremen. Her recent research focuses on the effects of climate change on the Arctic Ocean and deep-sea biodiversity. Her many awards include the Communicator Prize of the German Research Foundation (DFG). She collaborates with the arts, theatre, film and music with a focus on the relationship between humanity and nature.

Art and science can work together...

Mr. Arved Fuchs

is an explorer, expedition leader, writer, journalist, and filmmaker. Fascinated with polar research at a very early age, he apprenticed with the merchant navy and then studied marine engineering. Beginning in 1977, his expeditions to the extreme Arctic and Antarctic included sailing across the Atlantic, crossing Greenland with a dogsled and undertaking the first winter rounding of Cape Horn in a faltboat. In 1989 he was the first person to reach both the North and South Poles on skis. Since then, he has covered over 300,000 sea miles on his restored traditional sailing ship *Dagmar Aaen*, crossing the Northwest and Northeast Passages alongside expeditions to the Antarctic. A prize-winning environmental advocate and acute climate change observer, Fuchs and his crew have documented ice changes on the western and eastern coasts of Greenland, tracked waste, and visited exemplary fossil-free energy production sites. Fuchs' ongoing "Ocean Change" expedition studies the effects of climate change, overfishing and pollution on the oceans. Arved Fuchs has written 20 books and organizes International "Climate Camps" to give young people a direct opportunity to experience the effects of global warming.

Leila Ghandi (Master of Ceremony)

is an award-winning Monegasque journalist and filmmaker committed to the protection of the environment. Her work as a documentary filmmaker has won international awards including the Anna Lindh Euro-Mediterranean Journalist Award. Her book Chroniques de Chine won the US Agency for International Development Literary Award. She is a graduate of Sciences Po Paris and the Harvard Women and Power Executive Program.

Mr. Boris Herrmann

Skipper of Team Malizia, Germany is a professional offshore sailor, circumnavigating the world four times since 2001. In 2015 Boris sailed through the Northeast Passage around the Arctic Circle to highlight the melting ice caps and need for action, and sailed climate activist Greta Thunberg to New York in 2019 with Pierre Casiraghi under his slogan A Race We Must Win – Climate Action. Under the Monaco flag, in 2020 Herrmann became the first German to compete in the round-the-world Vendee Globe race, completing a lap of Antarctica and finishing in 5th place. His vessel Malizia-Seaexplorer carries an ocean sensor to measure ocean CO_2, salinity and temperatue, in partnership with the Max Planck institute, GEOMAR and Ifremer. This data is used around the world.

Prof. Dr. Peter Herzig

is an economic geologist and marine scientist. He was the Executive Director of GEOMAR Helmholtz Centre for Ocean Research in Kiel, Germany, from 2004 to 2020, and has served as Maritime Coordinator of the Federal State of Schleswig-Holstein and Maritime Ambassador of the European Union. Senior Advisor to the Oceanographic Institute, Prince Albert I of Monaco Foundation, Professor Herzig is a member of numerous national and international scientific boards and committees. The recipient of many awards, he is a member of the German National Academy of Science and Engineering, and now works as a maritime consultant.

...to raise awareness of ocean issues.

Prof. Dr. Mojib Latif

is Climatologist, Full Senior Professor at Kiel University, working at the GEOMAR Helmholtz Centre for Ocean Research. Born in Hamburg, Germany in 1954, Dr. Latif studied Meteorology and Oceanography, receiving both his PhD and his habilitation from the University of Hamburg. The main topics of his research are natural climate variability and anthropogenic climate change. He is President of the Academy of Sciences in Hamburg and of the German Association of the Club of Rome, and the recipient of numerous prizes and honours including the Sverdrup Gold Medal of the American Meteorological Society.

Prof. Dr. Tinka Murk

is full professor of Marine Animal Ecology at Wageningen University (the Netherlands), a European registered toxicologist, and chair of the scientific advisory boards of the Dutch North Sea Foundation and of the REEFolution foundation. She developed and led the TripleP@Sea innovation programme at Wageningen and led the Dutch team on an 8-year project within the C-IMAGE consortium following the Deepwater Horizon oil disaster in the Gulf of Mexico. Dr. Murk has published over 250 scientific papers and book chapters and supervised more than 50 PhD students.

Prof. Dr. h.c. mult. Frederik Paulsen,

Founder of the Museum Kunst der Westküste, is a businessman, academic, philanthropist and explorer. During his 30-year period as Chairman of Ferring Pharmaceuticals, founded by his family in 1950, the company grew and expanded into new markets in almost 60 countries. Alongside business interests, Prof. Paulsen is passionately engaged in polar exploration and climate change science. As one of the few people to have stood on all eight of the Earth's poles, Prof. Paulsen is a founding member of the Swiss Polar Institute. A recipient of numerous national and international awards and honours, he studied chemistry and Business Administration in Germany and Sweden respectively, and holds a PhD from the École des hautes études en sciences sociales in Paris.

Prof. Dr. Ulrike Wolff-Thomsen

is an art historian and Director of the Museum Kunst der Westküste on the German North Sea island of Föhr, Germany. She received her PhD and habilitation in art history in 1992 and 2003 respectively, from the University of Kiel. Since 1995 she has worked as art exhibition curator for many projects in Germany and abroad and published hundreds of scientific papers, books and art catalogues. From 1997 to 2007 she was Junior Professor and since 2007 is Senior professor at the Institute of Art History at Kiel University, also serving as managing director and board member of the Museum Kunst der Westküste since 2013.

ACKNOWLEDGMENTS

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ORGANIZERS

Institut océanographique
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The Oceanographic Institute is committed to increasing awareness of the riches and fragility of the Ocean, and to promoting its sustainable management and rational and effective protection. To achieve this, it acts as mediator between, on the one hand, scientific and socioeconomic players, and, on the other hand, the general public and political decisionmakers. It implements this mission highlighting the exceptional heritage of Prince Albert I and the exemplary commitment of HSH Prince Albert II of Monaco to "Promote knowledge, love and protection of the Ocean".

oceano.org

museum
kunst der westküste

In 2009 the non-profit Museum Kunst der Westküste (MKdW) was endowed by entrepreneur Prof. Dr. mult. h.c. Frederik Paulsen, whose family is from Alkersum on the island of Föhr. Centrally located in the village of Alkersum, it builds on the history of Grethjens Gasthof, the former village inn already frequented by artists from Germany and Denmark as well as islanders in the 19th century. The idea of bringing this social and artistic gathering place to life again was behind the founding of the museum and the construction of the present-day museum and restaurant. The MKdW makes the high-quality West Coast Art Collection accessible to the public, while at the same time providing an attractive architectural setting for the presentation of selected loans from Germany and abroad. The museum collects, researches, exhibits and promotes learning about art reflecting on the themes of the sea and coast. Its focus is on art of the 19th to the early 20th century from the west coast countries of the Netherlands, Germany, Denmark and Norway, regularly placing these works in a fruitful dialogue with international contemporary art. As a result of its ambitious exhibition programme, the museum has quickly developed into a cultural beacon with international reach.

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