The Future of the Oceans
Joint research for a healthy marine environment
Our Oceans: Diverse – valuable – at risk

Our oceans are the earth’s largest habitats. Together with the atmosphere, they play a key role in the climate system, are home to a wealth of diverse animal and plant species and contain valuable resources such as oil, natural gas and minerals. Nevertheless, we still know relatively little about the oceans.

The world’s oceans are under threat from pollution and litter. Industrial sewage, household waste, fishing nets, oil spills or agricultural fertilisers – our oceans take up everything that humans produce, consume and, ultimately, dispose of carelessly. At the same time, there is also an increasing global interest in the oceans as a resource, in particular in exploiting valuable mineral deposits on the sea floor, some of which are required for a wide range of modern technologies such as mobile phones or wind turbines. However, the environmental risks of seabed mining remain largely unknown and understudied. It is well known, however, that the ecological self-cleansing capacity of our oceans has long been exhausted.

The pollution of marine habitats with litter and the pressures on the marine environment arising from the increasing use of biological, energetic and mineral resources are challenges that affect us all. Therefore, they require international action. With our research, we are specifically seeking solutions that will enable us to protect the oceans and use their resources in a sustainable and responsible manner.

Prof. Dr. Johanna Wanka
Federal Minister of Education and Research

The Future of the Oceans

Marine waste can also be found in the Polar regions, in deep sea sediments and on beaches all over the world. Most of the plastic particles are washed into the sea through rivers and eventually sink to the ocean floor. Larger plastic particles, so-called macroplastics, disintegrate into smaller fragments as a result of UV radiation and wave action. Particles that are smaller than 5 millimetres are called microplastics. As ingredients in cosmetics and detergents, they are carried into the oceans by wind and sewage waters.

Marine litter is threatening the biodiversity of marine ecosystems. Seals and seabirds get caught in the remains of fishing nets or mistake plastic litter for food and starve to death because the plastic fills their stomachs. Microplastics can already

The problem of plastics has been recognised but has the danger been averted?

It is hard to imagine our everyday lives without plastic products. They are an indispensable feature of our modern society, yet they are also the cause of the growing pollution of the world’s oceans with plastic litter. There are an estimated 13 million tonnes of plastic floating in our oceans today. Huge plastic ‘islands’ gather in large ocean gyres such as the ‘Great Pacific Garbage Patch’, an accumulation of plastics covering an area the size of Central Europe.
be found in nearly all marine food chains. Researchers at the Alfred Wegener Institute have discovered particles in mussels, crabs, shrimps and fish, for example. As it decomposes, plastic litter also releases hormonally active additives, such as plasticisers or UV filters, into the environment and organisms. It is not yet known whether, ultimately, these particles also have adverse effects on human health.

Mineral deposits in the deep ocean – valuable resources in sensitive ecosystems

As global demand for mineral resources, particularly economically strategic elements such as platinum group metals, steel stabilisers, high-tech metals and rare earth elements grows, interest is shifting more and more to the commercial exploitation of deep-sea deposits. The much-coveted precious and non-ferrous metals and rare earths can be found in polymetallic nodules (manganese nodules), cobalt-rich crusts and massive sulphides. Many countries are, therefore, very interested in exploiting the mineral resources of the ocean floor with a view to securing supplies of raw materials and using them in key enabling technologies, such as in the semiconductor industry, in wind turbine generators or in mobile phones. But how can these valuable resources be mined on the ocean floor without putting a strain on the environment?

Vision for seabed mining at depths of 5000m: manganese nodules (pictured left) are collected by robotic systems and lifted by risers to mobile platforms on the surface, where they are prepared for transport to shore for smelting.

Did you know?

• According to the United Nations, the seabed is the common heritage of mankind and enjoys special legal protection.
• Manganese nodules containing a number of different metals are usually found in international waters at depths of over 5000 metres.
• Even today the deep sea is still a great unknown. It includes the completely lightless area of the sea below a depth of 1000 metres and accounts for over 70 percent of the entire ocean.

A few facts and figures!

• Almost 300 million tonnes of plastics were globally produced in 2013, 57 million tonnes thereof in Europe.
• Plastic litter such as PET bottles remains in the sea for up to 450 years and disintegrates into microplastics.
• Microplastics do not disappear and cannot be filtered out of the sea: before decomposing completely, they remain in the water for centuries and are ingested, washed ashore or deposited on the sea bed.
• Marine litter is costly: it poses a threat for marine ecosystems. Moreover, it affects tourism in coastal areas and clean-up measures are costly.
Research as the key: the search for innovations

We are not yet in a position to reliably assess the impact of plastics or the ecological risks of deep-sea mining. Although ocean pollution is globally evident, the environmental consequences have not yet been sufficiently investigated. How big is our 'plastic footprint' on the world’s oceans? And what impact does deep-sea mining have on sensitive ecosystems?

The data and information base on ocean litter is fragmented: there are no reliable data on the quantity, geographical distribution and effects of plastic particles in the oceans and we still lack internationally standardised analytical methods.

Ongoing ecological studies related to future seabed mining are following a precautionary approach. The results will contribute to the elaboration of an international 'Mining Code' to ensure that marine mining operations are carried out in accordance with the best available knowledge and highest environmental standards.

In this context, it is important to develop environmentally friendly processes and equipment for mineral extraction to allow for mining that is both sustainable and responsible.

The BMBF supports solutions

In cooperation with its European partners, the BMBF is playing a pioneering role in research to protect the oceans. Under the umbrella of the ‘Joint Programming Initiative on Healthy and Productive Seas and Oceans’ (JPI Oceans) the following two actions are in progress:

- Germany is coordinating the transnational call for proposals under its ‘Microplastics in Marine Systems’ pilot action. From late 2015, ten countries will provide over 7.5 million Euro to study key research issues regarding marine litter.
- The 'Ecological Aspects of Deep-Sea Mining' pilot action has been coordinating the work of 25 research institutions in eleven European states since January 2015. With a total budget of 9.5 million Euro at their disposal, researchers are studying the possible effects of future deep-sea mining.

Achieving the goal together through global cooperation

The international community has realised that only a joint course of action can help to protect the oceans in light of increasing volumes of litter and increased exploitation of raw materials. A resolute joint effort is now needed to protect the oceans and ensure their sustainable use as a common heritage of mankind. The future of the oceans is, therefore, a priority topic during the German G7 Presidency. For the first time ever, the G7 states have decided to cooperate even more intensively and effectively to combat the growing problem of marine litter and have agreed on a joint action plan.

Contact

Project Management Jülich GmbH
Marine Research, Geosciences, Ship and Marine Technology (PTJ-MGS)
Schweriner Str. 44
18069 Rostock
Dr. Joachim Harms
Phone: +49 (0)381 20356-281
E-Mail: j.harms@fz-juelich.de

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E-mail: publikationen@bundesregierung.de
Internet: http://www.bmbf.de
or by
Phone: +49 30 18 272 272 1
Fax: +49 30 18 10 272 272 1

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Text
Dr. Norbert Blum, Renate Duckat,
Dr. Joachim Harms, Dr. Ulrich Wolf
(Projectträger Jülich)

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