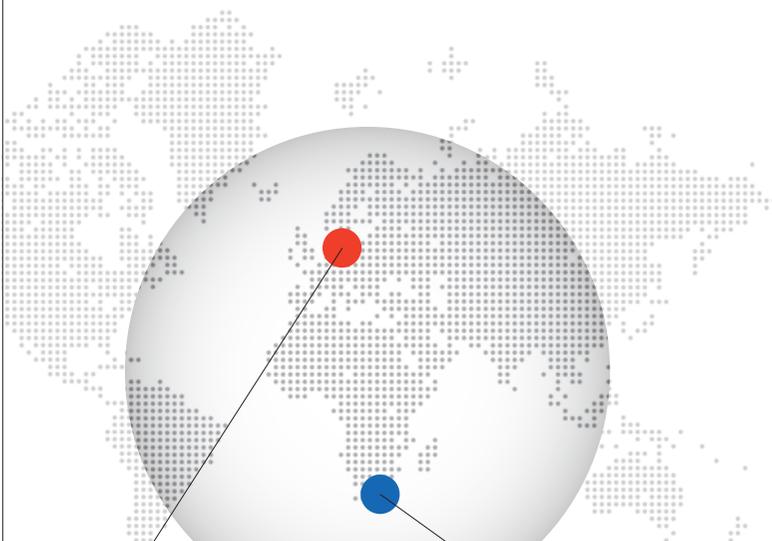


MARINE PLASTIC POLLUTION – RESOURCES FOR EDUCATORS

Bremen Durban Marine Environmental Education Network



MARINE PLASTIC POLLUTION – RESOURCES FOR EDUCATORS

Bremen Durban Marine Environmental
Education Network



Did you know that up to 12.7 million tons of litter¹ enter the ocean every year?

Where does all that litter come from? Where does it go?

Approximately 80% of marine litter comes from land², and coastal zones are especially vulnerable to pollution. Much of it ends up on our beaches, washed in with the waves and tides, much sinks to the seafloor as well, and some is eaten by marine animals mistaking it for food. In the past fifty years, large quantities of litter have accumulated across all parts of our oceans. It is present in all marine habitats, from densely populated regions to remote points far from human activities³, from beaches and shallow waters down to the deep sea⁴.

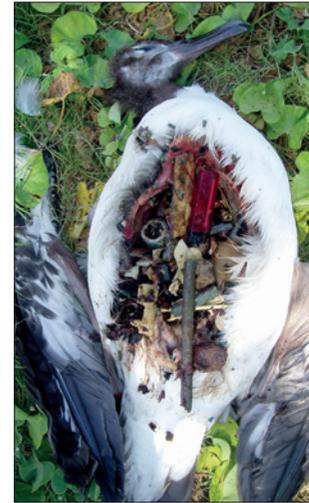
Marine litter comprises any solid material that has found its way into the marine environment – whether via transportation by rivers, drainage overflow and sewage systems, by wind or through deliberate disposal. Marine litter is not simply an aesthetic problem; it has far reaching impacts on the marine environment:

- many marine animals, especially turtles, birds and fish⁵, mistake litter for food and ingest it
- entanglement in derelict fishing gear or beverage holders is also a serious threat, particularly for marine mammals, sea turtles and birds, but also for benthic organisms such as corals⁶
- floating litter facilitates the transfer of alien marine species to new habitats⁷

Although the type of litter found in the world's oceans is highly diverse, plastics are by far the most abundant material recorded⁴.



Source: NOAA (National Oceanic and Atmospheric Administrations US. / Woods Hole Sea Grant, US)



Plastics, which are synthetic polymers, are still one of the most widely used and versatile materials in the world⁸. The global production of plastic in 2013 amounted to 299 million tons⁹. Plastics are light-weight, highly durable, strong and cheap⁶. These properties make them suitable to manufacture a wide range of products⁶, but also particularly problematic. They are not biodegradable. Under the influence of solar UV radiation, however, plastics fragment into small particles, so-called microplastic¹⁴, and thus persist indefinitely, leading to a progressive rise in quantities found in the marine

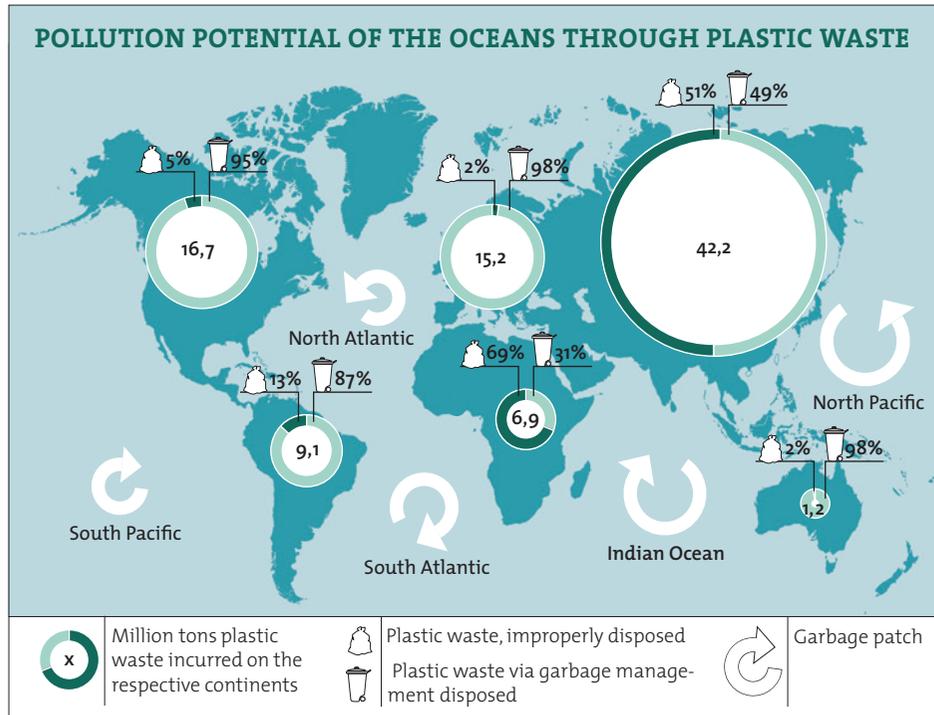
environment. Plastics are a source of toxic chemicals that can be lethal to marine organisms¹⁰, especially when ingested. Marine plastic pollution is therefore one of the most serious emerging threats to the health of oceans¹¹ and is now considered a major hazard to marine life and humankind, whose welfare is closely linked with ocean health¹².

Key types of marine plastic pollution include:

- packaging-related litter
- fishing and shipping-related litter
- sewage-related litter (sanitary items, cotton buds, wet wipes, etc.)
- micro- and nanoplastics (including industrial pellets, fragmented plastics, synthetic clothing fibres and microplastics from personal care products)

Floating marine plastic litter is currently forming five enormous garbage patches in the world oceans¹³.

Because 70% of all plastics are known to eventually sink, it is suspected that ever increasing volumes of plastic items are accumulating in seabed sediments¹⁴.



Source: BMBF (Federal Ministry of Education and Research, Germany)

Scientists currently focus on microplastics more than plastics as they tend to pose a greater threat to marine organisms and are responsible for increasing changes in ecosystems at alarming rate globally¹⁶.

Microplastic is defined as plastic particles in the size range of 1 nm to <5 mm¹⁵. For instance, microplastic ingestion has been recorded in a variety of marine organisms, such as worms, mussels, sea cucumbers and plankton¹⁷, resulting in physiological disorders.

The personal care and cosmetics market is where to date hundreds of products containing microplastics originate. They include facial scrubs,

toothpastes or beauty products. Microplastics are not caught by waste water treatment processes and can thus freely enter the oceans¹⁸. Chemicals from the plastics can then leach into marine organisms and bio-accumulate in the food chain¹⁹. This is a significant issue for the commercial seafood industries and human health as many species consumed have been shown to ingest microplastics²⁰.





In terms of its geography, economy and its culture, the Bremen region is closely tied with the sea.

Owing to its favourable location on the Weser River and North Sea and its long history as a Hanseatic trading power, Bremen has become an important location in both Germany and around the world for the maritime economy and marine sciences.

Scientists and civil society actors address the issue of marine plastic pollution in various ways. The following pages will give an overview on ongoing research and other activities in the Bremen region that contribute to a better understanding of the consequences of marine littering.

HIGHLIGHTS ON MARINE POLLUTION RESEARCH IN THE FEDERAL STATE OF BREMEN

CAROLIN MÜLLER, LEIBNIZ CENTRE FOR MARINE TROPICAL RESEARCH (ZMT), ECOLOGY DEPARTMENT, WORKING GROUP FISHERIES BIOLOGY

“Although marine plastic pollution nowadays has become the focus of public and scientific attention, thorough assessments of direct or indirect impacts on organisms remain inconsistent. Current studies rarely deal with the effects of marine pollution on early life stages of marine organisms, or the high variability of environmental conditions in coastal ecosystems. Juvenile fish have a high potential to ingest microplastic particles, which in the course may affect them not only mechanically, but may also inhibit crucial physiological processes. Therefore the aim of my research is to investigate the degree and variability of microplastic pollution in juvenile fish in coastal waters off Mauritius and Senegal, along with different habitat quality parameters.”

“I will measure the uptake of microplastics by fish larvae and juvenile fish and evaluate the effects on their survival and growth.”



ROGER SPRANZ, LEIBNIZ CENTRE FOR MARINE TROPICAL RESEARCH, SOCIAL SCIENCES DEPARTMENT, WORKING GROUP INSTITUTIONAL AND BEHAVIOURAL ECONOMICS

Indonesia is the second largest contributor to the plastic waste problem in the oceans after China. Up to 10 million plastic bags are consumed there every day. In 2016, Roger Spranz and his friends founded the “Making Oceans Plastic Free” initiative to help at least stemming the flood of rubbish into the sea. They developed “Tasini”, reusable shopping bags in a container shaped like marine animals that can be easily attached to a key chain.

“Nothing that we use for 5 minutes should pollute our oceans for 500 years.”

“We are therefore convinced that one single of these shopping bags can replace up to 400 plastic bags a year when used regularly. We designed Tasini as marine animals to promote awareness of the ecosystems we want to protect. The holistic approach of the Tasini concept tackles the most crucial factors in breaking the plastic bag habit. Additionally, the fabric for the reusable bags is made from recycled plastic waste, which will help to reduce plastic pollution and increase recycling incentives.”



DAVI CASTRO TAVARES, LEIBNIZ CENTRE FOR MARINE TROPICAL RESEARCH, THEORETICAL ECOLOGY AND MODELLING DEPARTMENT, WORKING GROUP SYSTEMS ECOLOGY

“Me and my colleagues from the Systems Ecology Group (ZMT) analysed carcasses of seabirds, found stranded along the Brazilian coast between 2010 and 2013, for the presence of marine debris²¹.”

“We found ingested plastic particles, including nylon lines, in more than half of the birds that we analysed.”

The incidence of marine litter was higher in birds feeding predominantly at intermediate (3–6 m) and deep (20–100 m) waters than those feeding at surface (<2 m). These results suggest that studying the presence of marine litter in organisms mainly feeding at the ocean surface provides a limited view



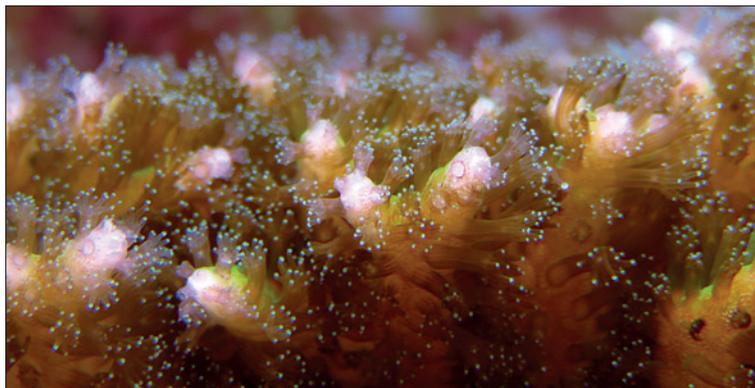


about the risks that this form of pollution has on marine life and highlight the ubiquitous and three-dimensional distribution of plastic in the oceans.”

ANNA FEURING AND SONIA BEJARANO, LEIBNIZ CENTRE FOR MARINE TROPICAL RESEARCH (ZMT), ECOLOGY DEPARTMENT, REEF STUDIES WORKING GROUP

“We are starting an experiment to film up close how coral polyps respond to different types of microplastics. With a specially-equipped video camera we will be able to document whether corals ingest or reject the different particles, and how much stress does microplastic pollution cause to healthy and not-so healthy coral colonies.”

“We will experiment with microplastic particles of the size range that are present in e.g. cosmetics, and our findings will help us understand the consequences of overusing microplastics in our everyday lives.”



GUNNAR GERDTS, SHELF SEA SYSTEMS ECOLOGY, ALFRED WEGENER INSTITUTE, HELMHOLTZ CENTRE FOR POLAR AND MARINE RESEARCH (AWI)

Marine littering and microplastic contamination of the North Sea and the Wadden Sea National Park via the Weser River or the port is of great concern.

The new project PLAWES – jointly coordinated by the Alfred Wegener Institute, Helmholtz Centre for Polar and Marine Research (AWI) and the University of Bayreuth – is the first to approach the problem from a holistic perspective. In the model region Weser-Wadden Sea National Park the participating researchers will analyse how microplastics make their way from land to sea, which input and transport routes are involved (and to which extent), and what risks this contamination poses for various ecosystems. The outcomes of the PLAWES project will then provide the basis for strategy recommendations for the government, industry and civil society, and for effective nature conservation and health protection measures, but also for new environmental education concepts.



HIGHLIGHTS OF MARINE POLLUTION AWARENESS RAISING IN THE FEDERAL STATE OF BREMEN

MARUM SCHOOLLAB

MARUM Schoollab is initiated by the research faculty MARUM-Center for Marine Environmental Sciences and the University of Bremen.

Its main focus is the creation of awareness for environmental issues among schoolchildren.

School classes visit MARUM and work just as scientists would do on board of a research vessel, e.g. taking samples, measuring parameters of interest, and logging the results. Afterwards the results are made visible in the so-called scientific graffiti. Student teams of four develop a story and the design of the sprayed picture to illustrate their scientific results. They produce stencils for the main results, arrange them on a canvas or a wall and spray their story about e.g. climate change or marine pollution.

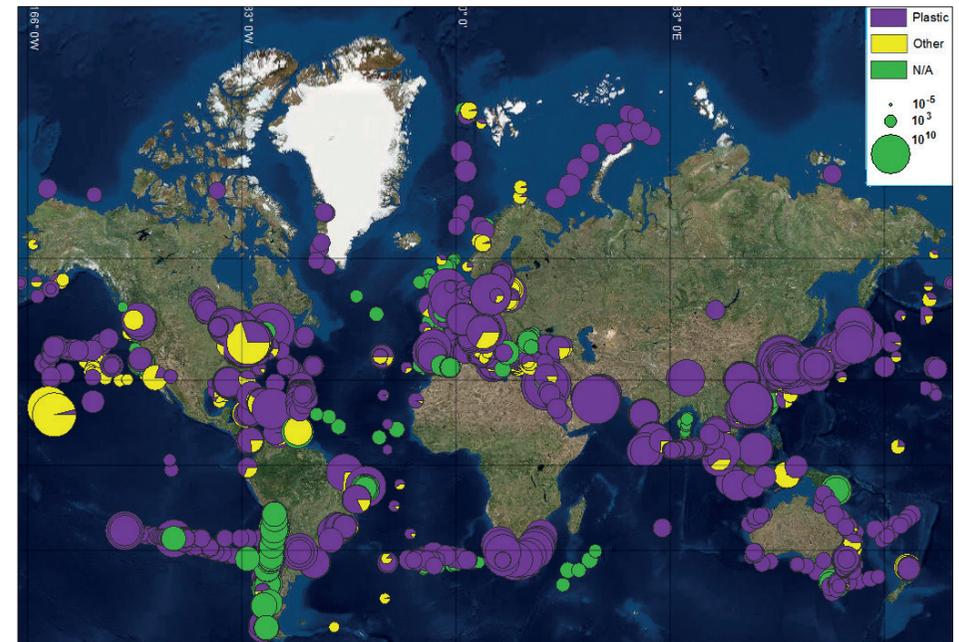


LITTERBASE – ALFRED WEGENER INSTITUTE, HELMHOLTZ CENTRE FOR POLAR AND MARINE RESEARCH (AWI)

The growing research on marine litter has substantially increased our knowledge of the amount and composition of litter as well as its impacts on the marine environment, aquatic life and people. However, the sheer number of studies scattered all around the globe has rendered this topic increasingly intangible making it difficult for policy makers, public authorities, media and the general public to unearth important information needed to address the urgent questions.



LITTERBASE, an online portal hosted by the AWI summarises results from more than 1500 scientific studies in comprehensive maps and graphs and opens scientific knowledge on marine litter to the public.



KLIMAHaus® BREMERHAVEN 8°OST

Within the Klimahaus® Bremerhaven exhibition “Alaska“, plastic waste is displayed that has been collected by NABU (Nature and Biodiversity Conservation Union) on the Weser River in Bremen and by BUND – Friends of the Earth Germany at Container Terminal 4 in Bremerhaven. The central element of the exhibit is a whale fluke.

By showing a whale diving in this sea of plastic, we aim to raise the awareness for the issue of marine litter and its impacts on marine wildlife.



Klimahaus® Bremerhaven furthermore cooperates with the Department of Industrial Design of the University of Applied Sciences in Magdeburg-Stendal to jointly conceive the special exhibition “Ocean Plastic“. From collected and remelted marine plastic waste, design objects were produced by students, such as spectacle frames, shoe heels or jewellery.

BUND BREMEN – FRIENDS OF THE EARTH GERMANY

To tackle the issue of marine litter, every individual needs to think about his or her own behaviour

It is time for action and time to reduce the input of plastic into the marine environment drastically. Although there is still a distance of about 100 km from Bremen to the North Sea, there is also litter from Bremen floating off our coast. The Weser River acts as a conveyor belt, and carelessly discarded candy papers and plastics of various sources are transported into the North Sea within a few days. The BUND is active in various districts of Bremen with its



information and networking activities to increase the awareness for this issue. Since a couple of years, a specific campaign within “Bremen Clears Up“ (“Bremen räumt auf“) puts the issue of waterway littering on the agenda. For this we foster public clean-up campaigns, where garbage is collected at the Weser River banks. Beyond that we organize environmental education activities and give talks on marine litter for example in schools to bring across the key message: rethink, reduce, reuse, recycle.





Since 2011, Durban and Bremen are twin towns.

But already since 2010, the two cities have been working on a municipal development partnership for climate and resource protection and are also exchanging ideas at the administrative level, e.g. with activities in the field of environmental education or the activities for adaptation to climate change.

Durban is a pioneer in southern Africa when it comes to projects and concepts for adapting to climate change and youth empowerment. A large number of actors and institutions are involved in other civil society projects.

THE SOUTH AFRICAN ASSOCIATION FOR MARINE BIOLOGICAL RESEARCH (SAAMBR)

SAAMBR, founded in 1951, contributes to the conservation of marine and coastal resources in the Western Indian Ocean by operating three integrally linked divisions:

(i) the Oceanographic Research Institute, a leading marine science research institute in the Western Indian Ocean Region, (ii) uShaka Sea World, Africa's largest world class, conservation-oriented aquarium and (iii) uShaka Sea World Education, a leading marine conservation education centre in Africa. In 2004 SAAMBR became the cornerstone of uShaka Marine World in Durban.



When two ships collided in the Durban Harbour during a major storm in October 2017, releasing approximately 49 tons of plastic pellets into the oceans, the SAAMBR team launched an awareness and action campaign that has prompted one of the largest coastal plastic clean-up efforts in South Africa's history.



It is now apparent that the spill is an unprecedented environmental disaster, with the so-called nurdles still appearing on beaches and estuaries along the entire South African coastline. SAAMBR, together with WILDOCEANS, South Africa's Department of Environmental Affairs and the KwaZulu-Natal Waste Network have joined forces to direct the clean-up efforts that will continue for many more months.



WILDOCEANS

WILDOCEANS is the marine programme of South Africa's leading environmental non-profit organisation, the WILDTRUST. Its conservation, research and socio-economic activities are focussed on building science capacity, creating awareness of threats to the oceans, encouraging citizen science participation, increasing protection of the marine environment, and promoting



sustainable resource use and resilience of coastal communities. One example is the BLUE CREW project that supports a group of female entrepreneurs, based in local communities adjacent to coastal environments.

Through the collection of recyclable material washed up on beaches, and in mangroves and estuaries, these teams are able to generate revenue for themselves and their teams of assistants.

The recyclable material is traded through the WILDLANDS' Recycling for Life programme, thus generating revenue through the cleaning of these critical ecosystems. Awareness of environmental pollution is built into the programme to ensure that an understanding of coastal ecosystems and their associated benefits is developed. This is combined with basic business training to ensure a strong understanding of the model leading to improved sustainability of the teams.



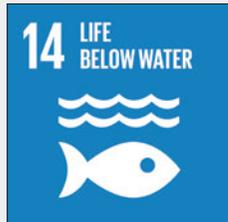
BREMEN DURBAN MARINE ENVIRONMENTAL EDUCATION NETWORK



In 2018, the Free Hanseatic City of Bremen launched a new project on marine conservation as part of the long-term climate partnership between Bremen and the South African city of Durban. The aim of the current project “Bremen-Durban Network for Marine Environmental Education” is to provide students and teachers with comprehensive knowledge on the subject of marine pollution.

The “Bremen-Durban Network for Marine Environmental Education” focuses in particular on marine pollution caused by plastic waste and the input of nutrients and pollutants. Only by raising awareness for the importance of oceans and coasts for human wellbeing, sustainable environmental protection and use of resources will be achieved.

The United Nation’s Sustainable Development Goals (SDGs) for the improvement of people’s living conditions and the protection of the Earth serve as a guideline to this program: SDG 4 “Quality Education” is the basis for improving people’s lives and sustainable development. SDG 14 “Life below water” includes, inter alia, the reduction of marine pollution. SDG 17 “Partnerships for the Goals” focuses on global co-operation to promote sustainable development.



AND WHAT COULD YOU DO?

REDUCE YOUR USE OF SINGLE-USE PLASTICS:

Single-use plastics include plastic bags, water bottles, straws, cups, utensils, dry cleaning bags, take-away containers, and any other plastic items that are used once and then discarded. Refuse any single-use plastics that you do not need, and carry with you reusable shopping bags, coffee cups, bottles, food containers etc.

RECYCLE:

When using single-use (and other) plastics that can be recycled, always be sure to recycle them. This helps keep them out of the ocean and reduces the amount of “new” plastic in circulation.

AVOID MICROBEADS:

Tiny plastic particles, called “microbeads,” have become a growing source of ocean plastic pollution in recent years. Microbeads are found in some face scrubs, toothpastes, and body washes, and they readily enter our oceans and waterways through our sewage systems, and affect hundreds of marine species. Avoid products containing plastic microbeads by looking for “polyethylene” and “polypropylene” on the ingredient labels of your cosmetic products.

PARTICIPATE IN A BEACH OR RIVER CLEAN-UP:

Help remove plastics from the ocean and prevent them from getting there in the first place by participating in, or organising, a clean-up of your local beach or river. This is one of the most direct and rewarding ways to fight ocean plastic pollution.

SPREAD THE WORD:

Stay informed on issues related to plastic pollution and help make others aware of the problem. Tell your friends and family about how they can be part of the solution.

SUPPORT BANS:

Many municipalities around the world have enacted bans on single use plastic bags, takeout containers, and bottles. You can support the adoption of such policies in your community.

FURTHER INFORMATION AND RESOURCES

EDUCATIONAL MATERIAL IN ENGLISH

- Marine Debris Toolkit for Educators (NOAA Marine Debris Program): <https://marinedebris.noaa.gov/curricula/marine-debris-monitoring-toolkit-educators>
- Marine Pollution - Coastcare Series, 2F (South African Association of Marine Biological Research): <https://www.saambr.org.za/education/>
- Educational curricula, media and quick tools (Plastic Pollution Coalition): <https://plasticpollutioncoalition.zendesk.com/hc/en-us/categories/202673118-Education>
- Talking Trash & Taking Action: outreach and education material by The Ocean Conservancy in collaboration with NOAA Marine Debris Program: <https://oceanconservancy.org/trash-free-seas/outreach-education/>
- Plastics in the Water Column (Monterey Bay Aquarium Foundation): <http://www.montereybayaquarium.org/-/m/pdf/education/curriculum/aquarium-6-8-plastics-in-thewater-column.pdf>
- Plastics: Reduce Use or Recycle? (Monterey Bay Aquarium Foundation): <http://www.montereybayaquarium.org/-/m/pdf/education/curriculum/aquarium-6-8-plastics-reduce-use-recycle-ngss.pdf>
- Plastics Use Audit (Monterey Bay Aquarium Foundation): <http://www.montereybayaquarium.org/-/m/pdf/education/curriculum/aquarium-6-12-plastic-use-audit-ngss.pdf>
- Be a scientist (Monterey Bay Aquarium Foundation): <http://www.montereybayaquarium.org/-/m/pdf/education/curriculum/aquarium-6-12-be-a-scientist.pdf>
- Plastic Free Curriculum: <https://www.plasticfreecurriculum.org/>

EDUCATIONAL MATERIAL IN GERMAN

- Marine Litter for teaching primary school level (Greenpeace): <https://www.greenpeace.de/bildungsmaterialien/ergaenzungsblatt-plastik-muell-im-meer>
- PlasticSchool (IOW and Deutsches Meeresmuseum): <https://plasticschool.de/>
- Piwi und die Plastiksuppe (Project Blue Sea): <http://www.piwipedia.de/index.html>

- Plastic – it's not fantastic... (BUND): <https://www.bund.net/service/publikationen/detail/publication/plastic-its-not-fantastic/>
- Cluster of Excellence Future Ocean: Expedition Boxes are available for teachers and can be borrowed free of charge for project work for marine biology, marine chemistry and physics: <http://www.futureocean.org/en/schulprogramme/expeditionskisten.php>
- Handreichung für Lehrerinnen und Lehrer zum Thema Meeresschutz (BUND Bremen): <https://www.bund-bremen.net/meere-schuetzen/>

INSPIRING PROJECTS:

- Last Straw Project, South Africa: <http://www.laststrawproject.com/>
- Litterbase, online portal: <http://litterbase.awi.de/>
- Making Ocean Plastic Free, Indonesia: <https://makingoceansplasticfree.com/>
- Ocean Sole, Kenya: <http://oceansole.co.ke/>

SMARTPHONE APPS:



Marine Debris Tracker (NOAA and SEA-MDI): <http://www.marinedebris.engr.uga.edu/>



Marine Litter Watch (European Environment Agency): <https://www.eea.europa.eu/mobile/apps#marine-litter-watch>



Beat the Microbeads: <http://www.beatthemicrobead.org/>



My little plastic footprint (Plastic Soup Foundation): <https://www.plasticsoupfoundation.org/en/psf-in-action/plastic-footprint-2/>



Clean Swell (Ocean Conservancy): <https://oceanconservancy.org/trash-free-seas/international-coastal-cleanup/cleanswell/>



Dive against Debris™ (PADI Project Aware), available in English and German: <https://www.projectaware.org/diveagainstdebris>



Beach Explorer (Schutzstation Wattenmeer), available in English and German, including educational material: <https://www.beachexplorer.org/en/>

DOCUMENTARIES

- Bag it – is your life too plastic? (2010):
Where do the bags and other plastics end up, and at what cost to our environment, marine life and human health? *Bag It* follows “everyman” Jeb Berrier as he navigates our plastic world. Award-winning documentary, educational material available at http://www.bagitmovie.com/for_educators.html
- A Plastic Ocean (2017):
An international team of scientists and activists set off on an expedition around the world to learn about marine plastic pollution. Award-winning documentary, available on Netflix / Amazon; with educational supplement available at <https://www.plasticoceans.org/resources/>

FURTHER RESOURCES:

- Clean Seas: <http://www.cleanseas.org/>
- African Waste Network: <https://africanwastenetwork.org.za/>
- Marine Litter Solutions: <https://www.marinelittersolutions.com/>
- Durbanites against Plastic Pollution: <http://www.dpapp.org/>
- International Wadden Sea School: <http://www.iwss.org/>

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ZMT  **LEIBNIZ CENTRE**
for Tropical Marine Research

 **Free
Hanseatic City
of Bremen**

**ENGAGEMENT
GLOBAL** 
Service für Entwicklungsinitiativen

SERVICE AGENCY 
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