Plastic Debris and Its Impacts on Marine Mammals

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Learning goals

- Understand plastic pollution problems in our oceans.
- Detect and quantify plastics in our environment and everyday products.
- Obtain knowledge-based ideas to reduce plastic pollution.

1 Introduction

The *United Nations Environment Programme* defines *marine debris* as "any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine and coastal environment." Marine debris consist of many different materials, such as metal, glass, processed wood, and last but not least, plastics. Due to its durability and lightness, plastics make up a large share of all marine debris and can be found also in remote places.

"Plastics" refer to synthetic materials made primarily of crude oil. These materials have many interesting properties, such as lightness and durability. They can be hard, soft, elastic, persistent and formed in any imaginable way. These features make plastics usable almost everywhere. We have a hard time imagining our daily lives without plastics. Plastic materials are used for, for example, clothing and for food packaging and many other products. In the form of nylon, it is also used in fishing nets and fishing lines.

One problem with plastics is that they are not readily *biodegradable*. Together with the large quantities produced, as well as insufficient ways of disposal and recycling, this means that we find plastics everywhere in the environment. In 2020, more than 360 million tonnes of plastics were produced globally. It is estimated that 4-13 million tonnes make their way into the oceans every year. Scientific expeditions have revealed that more than five billion pieces of plastic with a total weight of more than 250,000 tonnes are floating around in our oceans. This enormous amount of plastic has severe consequences for marine life. Animals become entangled in drifting garbage and fishing nets, and they confuse plastic items with food. Plastics which have been ingested by smaller animals is transferred to large animals by predation. Different size classes of plastics cause different threats. For marine mammals, studies of the impact of plastics have so far focused on larger debris causing entanglement or ingestion, whereas information on the impact of small plastic items is scarce.

2 Plastics: A problem with many sources

There are many sources of marine plastic debris. A major input comes from land with rivers and beaches. Plastic waste from agriculture, industrial production, construction sites, or from people carelessly dropping waste accidentally ends up in the environment and is transported to rivers and beaches by wind and rain and end up in the oceans. Interestingly, 70% of global debris entering the oceans originate from only ten larger rivers.

Large amounts of plastic debris are mainly caused by poor waste management. But, even in regions with well-developed waste management, debris ends up in rivers and is then transported to the ocean.

Nearly 2.4 billion people (about 40% of the world's population) live within 100 km from the coast. In many countries, waste is still placed in large waste disposal sites that may be situated close to the sea. Strong winds blow large quantities of waste into the oceans. Many plastic items are only used once and then they are thrown away; this includes bottles, bags, cups, straws, and spoons. These items may end in the environment due to the carelessness of consumers or poor recycling systems or problematic waste disposal sites: Even if they are properly disposed in garbage cans, they may still end up in the oceans.

Every time you wash your clothes, thousands of plastic fibers are released into the wastewater. The fibers are too small to be filtered out of wastewater at treatment facilities and therefore make their direct way to the ocean.

Thousands of ships and boats navigate our seas and rivers. Shipping containers may be lost at sea and—although it is nowadays strictly prohibited—rubbish may be thrown overboard. Sea-based sources, including shipping and offshore industry, contribute with 20% of marine debris. During fishing operations, nylon nets, lines and ropes are accidentally lost or dumped at sea. Abandoned fishing nets may stay active catching fish for a long time period: They are known as *ghost nets*. *Dolly ropes* are orange or blue plastic threads that are used to protect bottom trawling nets against wear and tear. Every year, thousands of kilos of dolly ropes end up in the sea.

3 Where does plastics end up, and what are the consequences for marine life?

Oceanic water is always in motion. Water is transported around by the huge currents that link all ocean basins. Surface and deep ocean currents belong to the same transportation network that work a bit like conveyor belts move water around the world. The atmosphere and the ocean currents influence one another. Some ocean currents form giant gyres spanning several hundred, even thousands of kilometers in diameter. Once entering the oceans, marine debris circulates in these current systems for decades, perhaps even for centuries, and get concentrated within *gyres* created by the currents.

In 1997, scientists discovered a large area with marine debris in the North Pacific, named the *Great Pacific Garbage Patch*. The total weight of all man-made objects in this area was estimated to be 80,000 tons, or the same weight as 500 jumbo jets.

It may take hundreds of years for plastic to degrade. Plastic items are disintegrated into smaller parts by wind and sun. Older objects become brittle and then fragment into smaller and smaller pieces ending at so-called micro- and nanoplastics. Plastic objects either sink to the seabed or keep floating at the sea surface or within the water column. The weight of floating plastics is enhanced when colonized by small organisms, such as barnacles, mussels, and bacteria. This promotes the sinking process.

The ocean currents transport plastics and its inhabitants over large distances into new regions. Bryozoans, barnacles, hydroids, and molluscs hitch-hike on plastic litter. For *invasive species*, they may reproduce more rapidly in a new area and outcompete native species. This can change the composition of ecosystems and interfere with existing food chains.

During the past decades, scientists have observed impacts of plastic ingestion or entanglement in more than 550 species of marine animals, ranging from invertebrates to mammals. Marine mammals, turtles and seabirds become entangled in discarded fishing gear, restricting the animals in their movements, as well as in feeding or reproduction activities (◘ Figs. 1 and 2). Marine mammals entangled in submerged and anchored "ghost nets" are unable to surface for breathing and drown. A fishing rope tangled at the base of a tail of a whale can cut off blood circulation and eventually the entire tail.

In the North and Baltic Seas, marine debris cause severe health problems for wildlife. Marine mammals such as harbour porpoises, harbor seals and grey seals have shown a variety of impacts associated with entanglement and ingestion. This includes inflammation of organs and suffocation. There has been a drastic rise in the number of reported events during the past decades. Still, there is no satisfactory understanding of the significance of marine debris for marine mammals.

Another problem is that many animals mistake plastic fragments with food. By eating plastic fragments, animals may acquire a full stomach without gaining any nutrients—they can starve. Scientists investigated sperm whales which accidentally ended up in beaches along the North Sea in early 2016. In 9 out of 30 whales, a variety of plastic debris was found in their stomachs. The animals had engulfed nets, ropes, foils, packaging material, and even a large plastic part from a car engine (◘ Fig. 3). One animal was found with 24 kg of marine debris in its stomach.

Fig. 1 A humpback whale caught in a net. The whale was completely covered with the net and one of its pectoral fins was stuck. Several attempts were needed before the whale could be released. Many whales which cannot be helped die—often because they are no longer able to reach the surface to breathe. © Gary Freitag

Fig. 2 Gannets at a breeding colony on the island of Helgoland. Many Gannets are found dead due to entanglement in net fragments. © Abbo van Neer

Fig. 3 (**a**) A fishing net found in a stomach from a sperm whale, stranded in the North Sea. (**b**) The net was 13 m long. Reprinted with permission from: Unger B, EL Bravo Rebolledo, R Deaville, A Gröne, LL IJsseldijk, MF Leopold, U Siebert, J Spitz, P Wohlsein, H Herr 2016. Large amounts of marine debris were found in sperm whales stranded along the North Sea coast in early 2016. Marine Pollution Bulletin 112(1–2): 134–141

In 2018, a dead young male sperm whale was found with 29 kg of plastic trash off the coast of Spain. A necropsy revealed that the animal had ingested, for example, trash bags, polypropylene sacks, ropes, and net segments. Some months later, in 2018, another sperm whale was found washed ashore in Indonesia. Scientists found hundreds of plastic items in its stomach, including cups, bags, and sandals. In 2019, scientists opened the stomach of a young dead whale in Sicily and found many plastic bags inside. In 2019, in the island of Mindanao, Philippines, a young Cuvier's beaked whale was found having 40 kg of plastic bags, including 16 rice sacks, in its stomach.

Investigating the stomach contents of stranded whales plays a crucial role in understanding the effects of plastic ingestion on cetaceans. However, stranded animals may be diseased and emaciated for other reasons than plastics ingestion and therefore not representative for healthier, free-ranging individuals. Furthermore, animals dying without being washed ashore or investigated, remain unregistered.

4 Microplastics: Small particles with specific problems

Once in the ocean, plastic waste is exposed to waves, salt, abrasion, and sunlight, breaking up larger objects into small pieces. The materials become brittle and break into smaller fragments. The pieces become smaller and smaller, and at some point they are invisible to the naked eye. However, this does not mean they disappear. Experts assign the tiny particles to different categories according to their size and study their effects on wildlife.

Definition

- Microplastics: Plastic fragments smaller than 5 millimeters
- Mesoplastics: Plastic fragments with a size of 5 mm to 2.5 cm
- Macroplastics: Plastic fragments larger than 2.5 cm

There are many ways that plastics end up in nature. Synthetic fibers are released from clothes when being washed. Tiny plastic beads are added to cosmetics in shower- or peeling gel. Large amounts of these small plastic particles may enter the marine environment. The fragments can be sufficiently small to pass filter systems and thus enter the environment. As car traffic increases, there is an inevitable increase in microplastics from tire abrasion ending up in the environment. Scientific studies show that the abrasion of car tires is one of the largest contributions to microplastics. Almost every part of our mobility sector contributes to the microplastic amount that enters the environment.

Similar to macroplastics, microplastics is mistaken for food by smaller animals. Animals filtering water for plankton, such as mussels, consume microplastics and are unable to digest it. Therefore, plastic fragments are deposited inside the body. When the filter feeders are consumed by other animals, the plastic particles are assimilated inside the predators. They are transported higher and higher up the food webs, where they are found in larger and larger concentrations.

Can 5 mm plastic items affect huge filter-feeding baleen whales? In 2012, high concentrations of pollutants and chemicals added during plastics production were detected in Mediterranean fin whales (*Balaenoptera physalus*). Due to the way of feeding, baleen whales are susceptible to high levels of microplastics ingestion and exposed to associated toxic compounds. In addition, microplastic particles have been documented in the feces of northern fur seals (*Callorhinus ursinus*) and in the digestive systems of stranded dolphins and monk seals.

An additional problem is that seawater contains many *persistent organic pollutants* (POPs) such as DDT and PCBs. The POPs enter the sea via rivers and beaches. They are insoluble in water, and microplastic fragments adsorb these pollutants. As a result, plastic fragments become floating pollutant carriers. Once the particles have been ingested by marine organisms, the pollutants can enter tissues. POPs are usually deposited in the fatty tissue of the organism. These toxic substances can affect the hormone and immune systems, as well as cause cancer. In addition, pollutants enter the food web and are transferred from one trophic level to the next.

Around 99% of macroplastics entering the oceans do not reach a plastic gyre. The plastics eventually break down into microplastics and sink to the sediment. Also, the polar ice contains high concentrations of microplastics that will be released by increased melting due to climate change. Macro- and microplastics have even been discovered in the *Challenger Deep of the Mariana Trench*, the deepest part of the world's oceans.

5 Mitigation efforts: What can be done?

Our attention toward the marine debris problem is growing. Projects for raising awareness in the public are essential for reducing usage and thus risk of disposal into the marine environment. It is important that our behavior and habits change rapidly.

Both NGOs (*non-governmental organizations*) and people being part of different social groups and professions are focusing on the impact of the environment and searching for solutions. Currently, many efforts are focusing on getting debris out of the ocean. Technologies that are trying to clean the oceans, using filtering ships or swimming baskets, are developed globally. These technologies focus on removing macroplastics. There is a more difficult task ahead of us: to remove microplastics from the oceans, where it makes up the largest portion of all plastics.

An effective method to alleviate the marine debris problem is to reduce plastic consumption. Large contributors to plastic debris that enters the oceans are part of our everyday use. Different ideas to reduce plastics in our wastewater are attempted. Non-wrapped groceries are introduced, offering reduced prices for bringing reusable cups to coffee shops, as well as utilizing only materials which can also be used for other purposes.

Scientists and engineers around the world investigate potential solutions to the debris problem. One focus is on the main sources of marine debris and its trajectories, on its way to the oceans. Another important part of current research is finding substitutes for plastics, or developing biodegradable forms of plastics while meeting the demands in their usage. However, these substitutes, for example, made from soya or corn, will also generate contamination due to intensive agriculture practices.

Everyone can help to reduce the amount of plastics in the oceans. Use *the three R rules* "Reduce," "Reuse," and "Recycle" to cut down on consumption you don't need. Avoid single-used products like plastic cups or plastic bags. The EU parliament is banning disposable plastic products from 2021, including drinking straws, disposable crockery, and cotton buds. In addition, EU member states are obliged to recycle 90% of all disposable plastic bottles. These rules will give more responsibility to the industry for dealing with plastic waste.

To effectively change attitudes to the use of plastic products, the problem has to be addressed in schools. The issue is already part of the content of a few textbooks, and a larger number of student projects have been established for science competitions that deal with the issue of marine debris. The problems with plastics will last for future generations, which underlines the necessity to educate school children in reducing their plastic consumption.

In recent years, civil engagement in scientific research has become increasingly important in Europe. In citizen science projects, locals have the opportunity to be part of a scientific investigation and to advocate for marine protection. The data collected by the participants are evaluated, either by scientists or together with the citizens. They contribute to steering decision-making processes. Citizen science projects also offer great potential for school education. The students are actively part of the scientific inquiry, deal with a topic and have the opportunity to reflect their own behavior and develop awareness.

One example is a citizen science project dealing with marine debris on the yearly *International Coastal Cleanup Day* (ICC). The ICC day is arranged on the third Saturday in September. On this day, coastal sections of rivers, lakes, and oceans are cleaned of debris. Data are collected at the same time, to be used for scientific purposes.

The ICC day is the largest voluntary marine conservation campaign in the world. For the participating students, it is certainly a positive feeling to be able to contribute to marine conservation. Meanwhile, there is also a smartphone app of the Ocean Conservancy, "Clean Swell," which is currently available in English language only, for the ICC.

Current topics of plastic pollution research

Debris, and especially plastics, have a profound impact on the environment. Many studies have investigated the impact plastic debris has on the marine environment, where organisms of different sizes entangle in debris or ingest it. More recent studies have shown that the majority of debris reaches the oceans by rivers. However, quantities, composition, and sources of debris within rivers or at estuaries have not been well studied and most investigations consider few sampling sites. Sampling a larger area over a longer time span is challenging but may be essential to understanding distribution patterns, transport mechanisms, and sources of riverine debris.

The German citizen science initiative "Plastic Pirates" fills some of these gaps. "Plastic Pirates" involve school children and teachers to sample a river of their choice for different types of debris. The participants use a sampling protocol to document quantities, composition and sources of debris items, and a small net to fish for microplastics. The data is subsequently sent to a team of international experts for analysis.

The analysis of the first dataset revealed that about 33% of the collected debris consisted of plastics, and that another large share of garbage is cigarette butts—with a high potential of polluting freshwater. One principal source of debris is people visiting the riverside to meet for having a barbecue or a picknick. Future sampling campaigns with the "Plastic Pirates" aim at investigations of single-use plastics and continue to sample microplastics to cover a larger time span.

6 Teaching materials

Exercise 4.1: How different debris objects might affect marine mammals

All kinds of plastic items can become marine debris, and later encountered by marine mammals. Some items found in marine mammals are listed in ▫ Table 1.

Table 1 (▸ Exercise 4.1) Possible threats of marine debris

Debris item occurring in the ocean	Possible origin	Possible threatened marine mammal species	Possible encounter	Possible impact on marine mammal species
Plastic coverage of a car engine (size: 30 × 20 cm)	*Landfill*	*Sperm whale*	*Mistaken for food*	*Internal injuries such as perforations of gastrointestinal tract due to sharp edges, blockage of digestive tract leading to starvation*
Gillnet anchored at seafloor				
Net floating at surface				
Microplastic fragments				
Food wrappings				
Broken bucket				
Ropes				
Tires				
Flip-flops				

Tasks

1: Fill in Table 1. How might plastic debris items have entered the oceans? Which marine mammal species could be most affected, and why? What are the possible consequences for the species?

Exercise 4.2: Searching for microplastics in everyday products

Plastic microbeads are added to many cosmetic and personal hygiene products. The aim is to improve the cleansing effect of, for example, facial scrubs. Although they are very small, microbeads pose a risk to marine wildlife. Due to chemical properties, harmful organic substances can attach themselves to these tiny particles. If they are then mistaken for prey and eaten by plankton-feeders or other animals, they can be absorbed by the organism and in this way enter the food chain.

Required materials

- Round microsieve (100 or 300 µm mesh size or coffee filter)
- Petri dish
- Water tanks (plastic aquarium, bucket around 10 L)
- Cosmetic products (body peeling, shower gel)
- Wash bottle
- Binocular microscope

Tasks

1. Put a small quantity of the cosmetic product into the microsieve.
2. Rinse the sample in the microsieve. For this, put the microsieve in the water tank and use your fingers. It should be rinsed until the sample no longer foams up.
3. Using the wash bottle, transfer the rinsed samples to a clean Petri dish. Observe the samples with the binocular microscope.
4. Repeat the process with various cosmetic products.

   Possible extension:

5. Download the smartphone app "Beat the microbead" or "Codecheck" on your smartphone. Scan your cosmetic products

at home and in your local supermarket for microplastics ingredients.

6. Write a request and send it per email to the costumer services of the producing companies.

Exercise 4.3: How long does it take for plastic bags or fishing lines to degrade?

We hardly ever question the fact that we use plastics. Plastic is a synthetic material that nowadays comes in many different forms with all kinds of properties. What all plastics have in common is that they are made primarily using crude oil. Plastics have many practical properties. Plastics have become a daily essential material present in a wide range of products due to several outstanding characteristics. They are malleable, hard, elastic, not very breakable, long-lasting, and can be changed in almost any way. As they can also be produced relatively cheap, they are found all around the globe.

- **Required materials**
  - Degradation timescale (Fig. 4)
  - Various items (aluminum can, plastic bottle, paper towels, newspaper, fishing line, cotton rope, wool socks, cardboard box, plywood, Styrofoam plastic cup, milk carton)
  - Arrange before, who is bringing along which of the listed materials

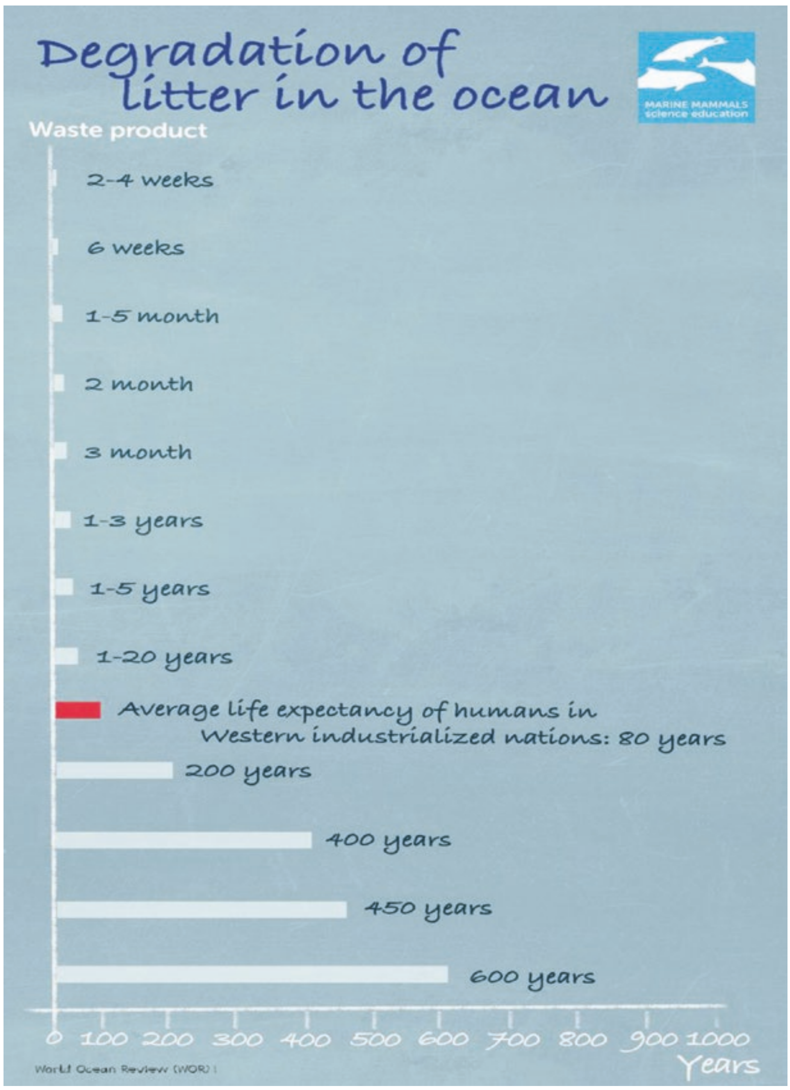

Fig. 4 (▸ Exercise 4.3) Estimated timescales for degradation time of different debris items: aluminum can, plastic bottle, paper towels, newspaper, fishing line, cotton rope, wool socks, cardboard box, plywood, Styrofoam plastic cup, milk carton. Try to fill in which debris belongs to which degradation time, from your readings on the internet © Adapted from: World Ocean Review

Tasks

1. Estimate with the diagram on the poster how many years it takes for the items inside to degrade in the ocean.
2. Find the data on the internet—if data vary between sources, discuss why this might be the case.
3. Discuss consequences concerning the different duration of degradation of litter debris in the ocean.

Exercise 4.4: Floating plastic

We will now study the behavior of plastic waste in seawater. This knowledge is essential to find out where plastic waste may cause significant problems to gray seals in the area. A key question is how plastic waste is spread. Alongside the different types of plastics, its form and density play an important role for its "behavior." This determines whether a plastic object floats on the surface, drifts within the water column, or sinks to the seabed.

Tasks

1. Collect three items of plastic waste each. Choose the three plastic objects that you find most often in your household waste or recycling bin.
2. Consider the factors that may determine the floatability of the plastics.
3. Develop a series of experiments that you can use to study this property. You can use entire plastic objects or cut out small samples. You can investigate the following questions:

   What items float in the water and how do they behave in water?
   - Closed bottles with a lid and open bottles without a lid
   - Closed and filled bottles
   - Bottles with different volumes (e.g., 250 ml, 500 ml, and 1000 ml)
   - Bottles colonized by species such as barnacles (can be simulated using organic modeling plasticine)
   - Bottles made from different types of plastic (e.g., drinking and shampoo bottles)
4. Carry out the experiments with other plastic types (e.g., plastic bags or yogurt pots).
5. Which marine organisms are affected by floating and sinking plastics? Find examples on internet.

Exercise 4.5: Mystery game

Situation: In 2016, 30 sperm whales stranded at various North Sea locations. All individuals were young bulls (males) around the same age. Several research groups from the countries being involved are trying to explain the strandings (Fig. 5).

Fig. 5 Uwe Piatkowski from GEOMAR and Ursula Siebert from the University of Veterinary Medicine Hannover investigating the stranded sperm whales' unfortunate deaths.

Scientific approach

In addition to experimenting and searching for answers to scientific questions, the publication of results in specialist journals on the scientific process and the presentation of the results at conferences are also essential. This step is important to make information accessible globally and to find solutions together. In many cases, it is also possible that several research groups are conducting research on the same problem. Every team, of course, wants to be the first to publish their findings.

Required materials

- Mystery game cards

Tasks

1. You are one of the research groups from Germany, the Netherlands, France, and the United Kingdom. You and your colleagues will try to find a plausible explanation for the stranding in the North Sea by using the cards. Create a logical sequence of incidents, explaining the phenomenon.

   Start with card number 7 and use at least five more. If you find a plausible explanation for the strandings, you can publish it.
2. All mystery game cards are available as online supplementary date file: ▶ pdf chapter4 Nov 2022.pdf
3. Read all the Mystery game cards and group them in categories. Sort the cards in a logic sequence and eliminate cards that are not relevant for the stranding of sperm whales. Look for similarities and differences and try to find relationships between the cards.

Exercise 4.6: Microplastics beach sampling

Plastics are currently accumulating on beaches worldwide and can pose a risk for many animals. How much microplastic can be found on sandy beaches?

Required materials

- Sieve (mesh size 1 mm)
- Tray
- Rope (20 m long)
- Mini-shovel

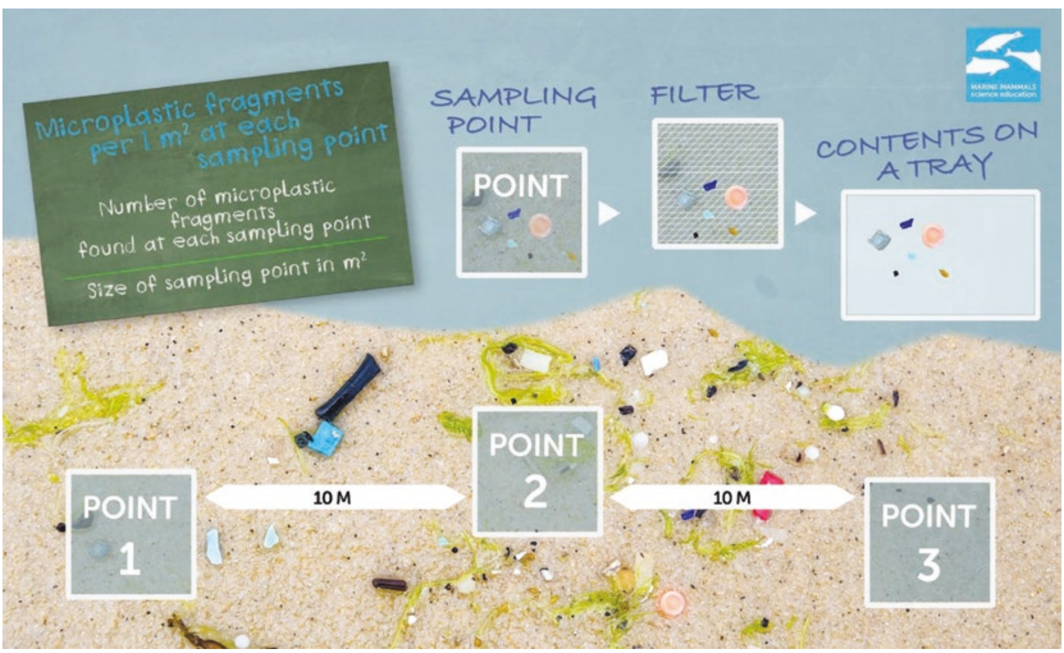

Fig. 6. (▶ Exercise 4.5) Overview sampling points to quantify microplastic fragments on beaches.

Tasks

1. Go to a beach and identify the high-water line (the point at which wet and dry sand meet). If you cannot find this line, take samples within the first meter of the beach from the waterline.
2. Put a 20-meter-long rope along this line and mark out three points (POINT 1, 2 and 3 in Fig. 6)—at the start, middle, and end of the length of the rope.
3. Measure a 50 × 50 cm square at each of these points in the sand.
4. Go to the first square. Remove all larger natural objects (e.g., stones, algae, plants, wood). Use a mini-shovel to dig about 2 cm into the sand within the square and deposit it on a tray.
5. Filter the sand on the tray with the sieve. If the sand is wet, do not sieve it on the beach, but let it dry. Label the bag with the number of the sampling point (1, 2, or 3), close it tight, and take it with you back to your school/group room to dry your sand in an appropriately labeled tray and filter it as soon as it is dry.
6. Now study the contents of the tray carefully. Sort microplastic into one corner of the tray; count the plastic fragments and pellets.
7. Calculate the size of your sampling squares in square meters:
8. Side a in meters × side b in meters = ... m^2
9. Calculate the number of microplastic fragments per square meter at each sampling point: Number of microplastic fragments per square meter found at each sampling point.

Exercise 4.7: Plastic waste diary

You are familiar with various plastic products. It is hard to imagine everyday life without them. An average European, for example, uses more than 100 kilograms of plastic each year. The global increase in the consumption of plastic materials has given rise to huge quantities of waste. Think about how much plastic you use and dispose of every day.

Table 2 (▶ Exercise 4.7) Plastic diary: Do you know how much plastic you use every day?

Day of the week	Number of plastic waste items	Type of plastic waste items
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		
Sunday		

Tasks

1. Keep a plastic waste diary for 1 week. Note the quantities of plastic waste that you personally generate each day. Make a list of all the plastic items that you throw away (Table 2). Ask your parents to do the same for 1 week.
2. What do you notice? Compare your results with others.
3. Now try to reduce your plastic waste for a whole day. Count it again. What has changed? What can you do differently in the future to reduce your plastic waste further?

Exercise 4.8: What can I do?

Humans have been using rivers, lakes, and oceans since the beginning of mankind. These habitats give us a great deal of resources. But instead of caring for them, we pollute and exploit them. Fortunately, there are also people and organizations who actively campaign to protect the planet. There are many ways of protecting the environments and its inhabitants. Each and every one of us can contribute to that. In order to reduce plastic consumption, you can apply to one or even more of the three R rules.

1. Reduce

   Here, the aim is to cut down on things that you do not actually need. Do you really need the latest smartphone or yet another pair of shoes? If you are now thinking about throwing away everything that is surplus to requirements, then this would be the wrong approach. You can get rid of unnecessary items in other ways, such as by getting them to places where they can still be used. Therefore, you should sell, give away, donate, or swap your items instead.

2. Reuse

   Before buying something new, why not use something that you already have and spend your money on things that you will use more often? One example would be shopping bags that can be reused many times. If you think carefully on a day-to-day basis, you will find all kinds of disposable items that can be replaced with alternatives.

3. Recycle

   Separating waste is essential when it comes to recycling. Not all rubbish items can be recycled. In some countries, container deposit schemes, where the consumer pays a small deposit for items such as bottled drinks, which they then get back upon returning the bottles, are an example of where recycling works well.

Tasks

1. Find at least one other example for each R. Furthermore, search for other R words to add the list above and find examples for them.
2. How could you change your everyday routine in order to produce less plastic waste?
3. Think about ways in which you could raise public awareness of the problem of plastic waste pollution in the oceans so that more people are informed. What initiatives could you carry out so that lots of people get involved? What can people who do not live in coastal areas do to help protect seas and oceans?

   You may find the following questions useful:

   Who produces a lot of waste in your area?

   Who is still not aware of the waste problem?

   How can we present the results?
4. Put the project into practice and document every step with photos.
5. Inform the local press or the city administration about your project.
6. Start to investigate the waste problem in your school life. How can you create less waste in your school? What is done in your school to contribute to a more sustainable development towards plastic consumption? What are ideas from other schools? What are the pupils' opinion toward plastic consumption? What could be improved?

   Develop a small survey for your school and start to initiate changes to show other pupils that everyone can improve something.

Home Pages

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