PROJECT BOOKLET COASTS AND BEACHES

FOR YOUNG PEOPLE

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BACKGROUND INFO:

PLASTIC PIRATES – GO EUROPE!

Plastic Pirates - Go Europe! is a European citizen science initiative where school classes and youth groups collect plastic samples from streams, rivers and coasts and document their findings. These samples are then analysed by scientists, enabling young Europeans to contribute to research on the state of European waterways and the extent and origins of plastic pollution. The initiative aims to foster scientific cooperation across Europe, encourage citizen science engagement and society's participation in the European Research Area, while raising awareness about environmental responsibility.

The campaign was first developed as Plastic Pirates in Germany in 2016 by the Kiel Science Factory and partners with funding from the German Federal Ministry of Education and Research (BMBF) for the Science Year 2016*17 - Seas and Oceans. Since 2018, it has continued as part of the research focus "Plastics in the Environment". During the German EU Presidency in 2020, the campaign expanded to the Trio Presidency countries – Germany, Portugal, and Slovenia – through a joint effort by their Ministries of Education, Science, and Research from 2020 to 2021.

Since January 2022, the Plastic Pirates – Go Europe! initiative has expanded with the support of the EU Commission and currently involves 13 European countries. Its goal is to raise awareness across Europe about the critical role rivers and coastlines play as lifelines, and to emphasize the importance of protecting natural resources. The initiative also highlights the value of citizen science and the importance of international research collaboration.

A map of all participating countries can be found at **plastic-pirates.eu/en/european-wide-roll-out**

For a list of partner organizations involved in the **Plastic Pirates – Go Europe!** initiative across Europe see **plastic-pirates.eu/en/partners**

THE PROJECT BOOKLET COASTS AND BEACHES PLASTIC PIRATES – GO EUROPE!

This **project booklet** aims to give young people aged between 10 and 16 hands-on experience of the issues related to seas and the ocean, particularly the problem of plastic waste in seas and flowing waterways. The key questions for the Plastic Pirates are as follows: **How bad is plastic waste pollution in flowing waterways and seas in Europe? What kinds of plastic are particularly common in the environment and what impact does this have on our seas and our ocean?**

This project booklet helps young people find their feet during the excursion and serves as a scientific guide to data collection.

The tone of the booklet is aimed at the young people themselves. It has been designed in such a way that they can complete the various steps of the project independently. Help them in your role as an educator.

The project booklet is suitable for use in a group of between six and 30 young people, whether a school class, a work group or a club. Including preparation and follow-up work, the project takes about three days, or six to eight teaching hours, to complete – plus approx. two hours for sampling. As different amounts of time can be allocated to the individual stages, the project booklet is also well suited to integration within a project week.

WHAT TEACHERS AND GROUP LEADERS NEED TO KNOW

A torn plastic bag on the beach or a yoghurt cup floating in the water are symptoms of serious interference with the highly complex system of seas, the ocean and flowing waterways. The **Plastic Pirates – Go Europe!** project focuses on this plastic waste problem and our future handling of it, but aims to familiarise the young people with the general topic of the ocean and water cycles in the process. They will learn what it means to work scientifically – and try their hand at it. Citizen science projects give people interested in science an opportunity to play a hands-on role in the research process. The **Plastic Pirates – Go Europe!** campaign is one such example, contributing to research into the spread of both macroplastic and microplastic in and around European rivers and coasts.

This booklet provides a step-by-step guide to conducting the project (including preparation and follow-up work). The research data collected by many groups throughout Europe will, during the course of the project, be used to create a scientifically sound, digital online map. In a second step, this data will be evaluated by the research partners and then published. The Plastic Pirates team will keep you up to date about the scientific analyses:

https://www.plastic-pirates.eu/en

The teaching materials and worksheets for the Plastic Pirates – Go Europe! youth campaign

Alongside this project booklet, teachers and group leaders at clubs/associations can also access supporting teaching materials and worksheets on the topic of seas and the ocean. These materials are suitable for educational work in both curricular and extracurricular settings. They contain exercises for young people, are structured in a modular way and can be downloaded free of charge at **plastic-pirates.eu/en/material/download**.

FOR YOUNG PEOPLE

This booklet puts you in control. You decide which beach you want to investigate for plastic waste. You take the samples. You measure, collect and enter the data gathered into our map at **https://www.plastic-pirates.eu/en/results/map**. In other words, you don't just 'play' at being scientists – you are a scientist!

This booklet will tell you exactly how it works and what you need to know. It will guide you through the project over the next few pages. Each step is an important building block for scientific study and ensures that your data are reliable and usable when you have finished.

You will use a range of methods to understand the pollution by waste in and around the beach and to record your findings. The booklet contains specific instructions for each method. Split into groups. Different groups will tackle different aspects of the study.

THE POLLUTION OF RIVERS AND SEAS

A BIG PROBLEM

Sadly, we humans don't always look after our rivers and seas properly, leading to many different types of pollution.

The use of too much **fertiliser** in agriculture and therefore excess fertiliser in water run-off

Noise pollution, from ship turbines and offshore industry

Pollution caused by **organic pollutants** and **harmful substances** such as pesticides

Household and industrial **waste**

Pollution caused by **oil** from shipping and the petroleum industry

Some of the waste that we humans produce is transported into seas and the ocean via rivers. This means that the amount of waste in the ocean increases each year. Long-lasting plastic waste that degrades very slowly is a particularly serious threat to marine wildlife and the entire ecosystem.

But how does the waste enter the sea in the first place and how long does it take for plastic bags or fishing lines to degrade? And, of course, how does the issue affect us and how can we help to improve the situation?
Become a researcher and study the plastic waste found in rivers and seas!

Macroplastic

Macroplastic refers to all pieces of plastic that are larger than five millimetres. These include fishing nets, lids of water bottles, cigarette lighters and flip-flops.

Floating macroplastic is dangerous for marine wildlife. On the one hand, it can easily be mistaken for food and swallowed. As it cannot be digested, the animals starve to death as their stomachs are full of plastic. On the other hand, animals such as turtles, seals and whales can become entangled in torn-off nets, known as 'ghost nets', no longer being able to swim. They end up dying in these fishing nets or from other pieces of plastic waste.

Microplastic

Microplastic is smaller than five millimetres. Scientists now split small plastic particles into different categories based on size – for example larger microplastic (one to five millimetres), smaller microplastic (one micrometre to one millimetre) and nanoplastic (smaller than one micrometre), which is even smaller than bacteria. Microplastic is formed, for example, when larger plastic particles in the ocean are broken down into ever smaller parts by the sun's rays, the salt content in the water and the movement of waves.

Many microplastic particles are caused by car tyres wearing down on the roads. These particles then make it to the ocean via sewers and rivers. Microplastic generated by the fragmentation of larger objects is called 'secondary microplastic'. Small plastic pellets produced by industrial companies for the manufacture of larger plastic objects or as additives for other products also make their way into the environment, for example in transport accidents.

This microplastic is referred to as 'primary microplastic'. Like macroplastic, microplastic can also be confused with food by animals, resulting in it entering their bodies and thus becoming part of the food web. To date, only little research has been conducted into how dangerous microplastic can be for animals and humans. Although microplastic is much smaller than macroplastic, it can also pose a significant 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-eaters or other animals, they enter the food chain.

INFO

In this project, you will be investigating microplastic particles that are larger than one millimetre.

WORKING LIKE SCIENTISTS

When you think of scientists, you might have an image in your mind of old men in white coats with crazy hair. The reality is very different.

Researchers don't just work in laboratories all day. For some, their laboratory is even outdoors: at the beach, at a lake, in the forest or at a dune. Scientists also attend specialist conferences, supervise students, produce charts and communicate with colleagues – all as much a part of their day-to-day tasks as performing experiments and gathering data. It's a highly exciting and diverse profession. See for yourself ...

Now that you have learned so much about our ocean and our rivers and have gained important knowledge about the problem of waste, it's time to research the issue more closely. It's time for a scientific study.

You should be clear about three things:

- This is a scientific study in which you are gathering important research data on waste. These data will be published afterwards.
- The study will be carried out by many young people in various countries in Europe, so it is important that everyone sticks to exactly the same method.
- In this project, you are the researchers!

In the next few hours, you should therefore work through the FIVE STEPS of any scientific experiment:

STEP 1: Formulate a research question.
STEP 2: Make hypotheses (before starting their experiments, scientists make predictions about what they expect the results to be; these predictions are then checked).
STEP 3: Plan the research method.
STEP 4: Carry out the experiment and gather data.
STEP 5: Evaluate and compare your results.

On the hunt for waste

It is now time to plan the sampling procedure. We want to gain an insight into the waste at the beach and record it using a variety of methods. Split into groups – with each group concentrating on one aspect of the issue of waste.

Look at the illustration on the next page and read through the research questions for each group (page 10 onwards). Split into groups, with each group selecting an aspect of the study that they will examine in more detail.

Beach sampling – let's go!

Samples are taken from European beaches using a particular scientific method.

As it is not possible to take samples of all beaches in Europe, we will use random sampling. This will give us a large body of data about the prevalence of plastic at European beaches.

The same method will be used at all sampling sites, enabling us to compare the data at a later stage. This is only possible, of course, if everyone sticks to the predefined method.

AN OVERVIEW OF RESEARCH METHODS

Look out for both yourselves, but also for the environment: Follow the rules of conservation areas and respect breeding seasons. Be mindful of the tides and its dangers!

GROUP A

Waste on the Beach
(page 10)

GROUP B

Variety of waste on the beach
(page 12)

GROUP C

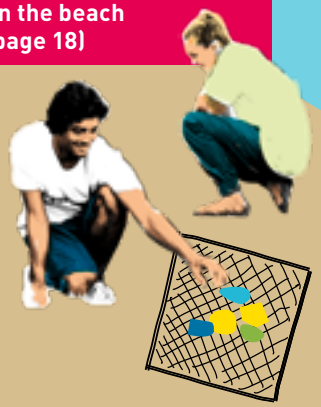
Litter Forensics
(page 14)

GROUP D

Team of reporters
(page 16)

EXTRA GROUP

Microplastic on the beach
(page 18)



Read through the research questions for your group and write them down in your own words.

Group:

Research questions:

1.

2.

3.

GROUP A

WASTE ON THE BEACH

RECOMMENDED GROUP SIZE OF FOUR TO SIX

RESEARCH QUESTIONS

1. How much waste can be found on the beach?
2. What material is the waste made of? Does it float or sink?
3. How likely is it that the waste found on the beach will enter the sea? Where on the beach is the waste found?

METHOD

1. To sample, you need a bit of space on the beach. Look for an easily accessible spot measuring approximately 50 metres along the beach and 20 metres from the beach.

2. Identify three different beach zones:
ZONE A: Intertidal. This zone is in regular (daily) contact with the sea. Here, you can often see the most recent high-water mark.
ZONE B: Supratidal. This zone is in irregular contact with the sea and encompasses the area in between the intertidal and the vegetation zone.
ZONE C: Vegetation zone. This zone is marked by its vegetal cover.

3. Now mark out your first transect. This is an imaginary line that runs from the seaward edge of the intertidal to the back of the beach, so through all three zones. It is important that you place your transect at random – and not at a location where you see a lot or very little waste.

4. Now randomly determine a sampling point in each of the first two beach zones (A, B) and at the start of zone C. At each of these sampling points, trace out a 3 by 3 metre square and use small stones to mark the squares. The distance between the squares should always be more or less the same. Use the illustration overleaf to help you.

5. Now search for waste in the first square and place it on a white cloth next to the square. Only collect waste – no natural objects such as wood or plant remnants. Only collect waste that is at least as large as a cigarette butt (two to three centimetres) and that is actually located within the square, even if other waste is very close by.

6. On a sheet of paper, write down the transect number, the sampling point (e.g. '1A' means transect 1, intertidal sampling point) and the name of your school or club/organisation. Place this sheet of paper next to your cloth and take a photo of the sheet of paper and the waste spread out on the cloth (see photo on page 11). Make sure that the individual pieces of waste are easily visible, that they do not overlap and that there are no other objects on the piece of cloth. Check whether the waste with the sheet of paper can be identified.

Take a photo of each sampling point, even if no waste was found (photo of the sheet of paper with an empty cloth). Otherwise, your results cannot be included in the scientific study.

AIMS OF SAMPLING

- Identify the different beach zones (using the method described)
- Determine sampling points where you can look for waste on the beach
- Sort the waste by material

REQUIRED MATERIALS

- Pebbles or similar objects to mark out a square
- Camera or smartphone
- Paper and a thick felt-tip pen
- A white cloth
- Tape measure
- 9 bags (for gathering the waste if this is to be counted later at the school/in the group's room)
- Work gloves

7. Count out the items of waste and sort them by the various materials. Enter your data in the results table on page 20.

8. Repeat the procedure in the two remaining squares and then mark out a second and third transect. This repetition is important to generate reliable data. Please ensure that your squares are roughly level with those of the first transect. Provided there is enough available space, the distance between the transects should be at least 20 metres.

TIP

If you find a particularly large amount of waste, you can pack it into bags after the last square and count it at school or in your group's room. Please ensure that each bag is labelled with the number of the transect and sampling point (e.g. '1A') to avoid mixing up waste from different sampling points.

CALCULATING THE AREA OF THE SQUARES

IIn order to work out how much waste there is in one square metre of your beach, we first of all need to know the **area of the square** (A). Use the following formula:

A = a * a
A= 9 m²

a: Side length of the square (= 3m)

Make sure that the pieces of waste are easily visible and that they do not overlap.

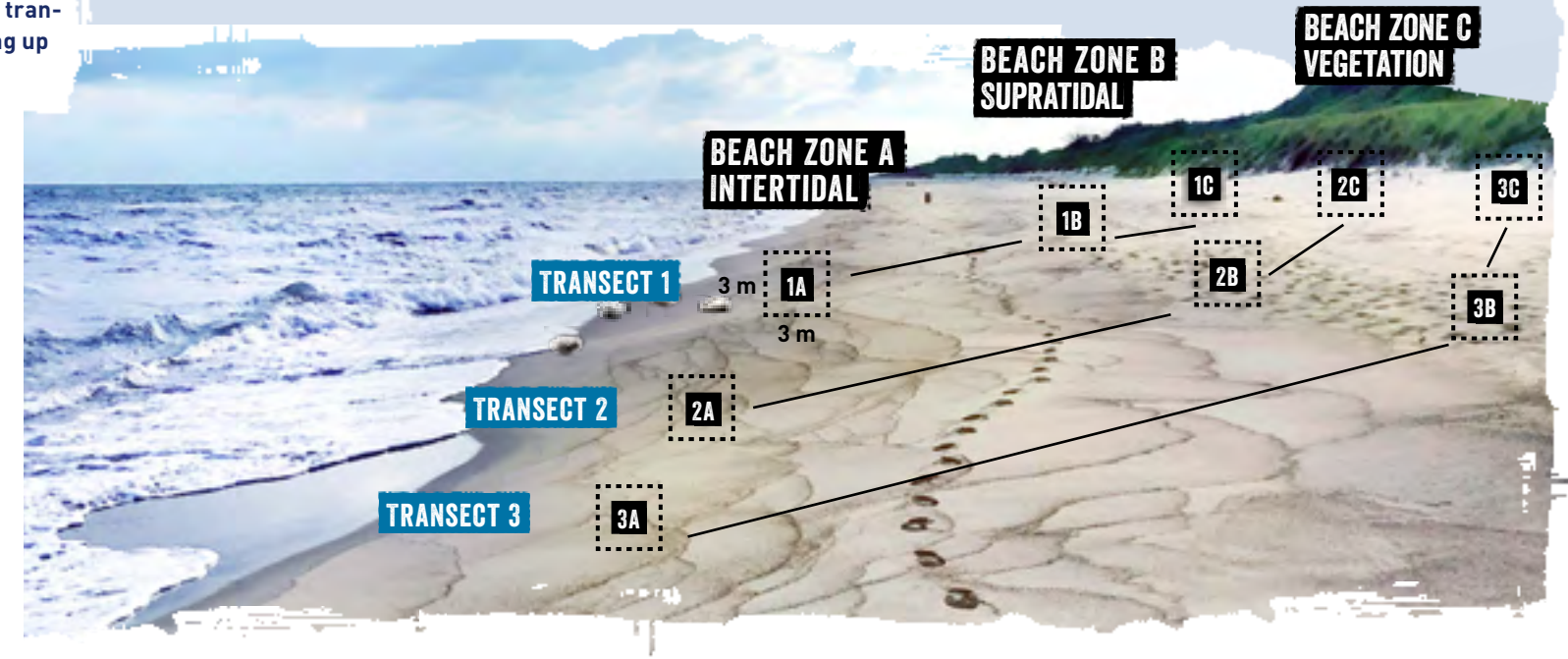
EXAMPLE PHOTO

A transect is an imaginary line that connects two or more sampling points.

Sampling points where data are collected are determined along this line.

RESULTS LOG

Complete the table on page 20!



GROUP B

VARIETY OF WASTE ON THE BEACH

RECOMMENDED GROUP SIZE OF SIX TO EIGHT

RESEARCH QUESTIONS

1. Which category of waste is most represented?
2. Which single-use plastic items were found most often? What is the ratio of single-use plastic waste to other waste?
3. Which (political) measures would lead to less plastic waste on the beach?

METHOD

1. First, find a place to set up a 'waste-sorting station'. It should be at least 50 metres away from the group covering waste on the beach and not be exposed to wind. This is where you will sort, count and document the waste you find. Split yourselves up: at least two participants are responsible for sorting and documentation. More people are needed if a lot of waste is found. The sorters should familiarise themselves with the waste categories (page 13) and set up the station: write the categories on a piece of adhesive tape and stick it to the canvas. Position buckets for the pieces of waste which could easily fly away (plastic packaging and plastic bags) in order to prevent waste already accounted for from mixing with the other waste from the previous group. If you should find a lot if waste that doesn't fit into a category, you can supplement it under the category Local Waste (see 'Results', page 20).
2. The other participants take buckets and look for waste. **Be careful not to search in the area of Group A "Waste on the Beach" (they need an area of approx. 50 metres on the beach)! Additionally, only search for waste at the beach.** Search systematically. For example, walk next to each other along the beach. Doing so will allow you to maintain approximately the same distance from one another.
3. Collect all of the waste you find. **Be careful if you encounter sharp objects and hygiene items – always use work gloves to pick up these items!** Sandy or dirty pieces of waste should be thoroughly shaken out. Once your bucket is full, take it to the sorting station, where the sorting experts will help you separate the waste into the proper categories. Make your way back to the sorting station after 45 minutes at the latest, or as soon as you are unable to find any more waste.
4. Now measure the length and width of the area of the beach you covered. Use the measuring tape or the string to do so or use Google Earth to help you. If you walked quite a distance, you can also measure 50 or 100 metres of string and then simply use the string to measure the distance. Make a note of these values in the data table on page 20.

AIMS OF SAMPLING

- Set up the waste-sorting station
- Categorise the pieces of waste along the beach
- Calculate the proportion of single-use plastic

REQUIRED MATERIALS

- Buckets, bags or other containers for collecting and sorting the waste (the more the better)
- Canvas, approx. 5 m by 2 m
- Fabric adhesive tape and thick felt-tip pen
- String, at least 10 m long, the longer the better (for measuring the area)
- Tape measure
- Camera or smartphone
- Waste bags for removing the waste
- Work gloves
- Scale, ideally a luggage scale

! INFO

Collect and document all waste (not only single-use plastic) in order to generate reliable data about all of the waste.

5. Count up the first pile of waste and write down the result in the data table. If no waste was found in a particular category, enter a zero in the table. Now spread the waste out so that nothing overlaps. Take a photo of the waste together with the category name and then check the quality of the photo. Take several photos if too much waste in one particular category is found.

6. Follow this procedure for all of the waste categories.

7. Now weigh the plastic waste you found. Then weigh all of the waste together, including plastic waste, and enter the results in the table (page 20). You can use a waste bag for weighing purposes. If the plastic waste is wet, take it home and let it dry prior to weighing. Once finished, dispose of the waste properly.

8. Calculate the total number of all types of waste and what percentage each category represents. Use the formula below to calculate the proportion of single-use plastic. Record your results on page 20 and discuss which measures would be effective to reduce the waste in each category (e.g. prohibition of single-use plastic).

WASTE-SORTING STATION

Measure the parts

HOW ARE PIECES OF WASTE COUNTED?

In general, the waste is counted as it is found. Waste items that are only loosely connected or that are found inside other containers are counted individually. For example, a plastic bag that contains other waste must be emptied and each piece must be recorded separately (be careful and wear gloves). Pieces of waste which are firmly connected (e.g. a glass bottle with the lid screwed on) or tightly wrapped objects (e.g. fishing nets) are counted as one piece of waste. The larger object determines the waste category.

Plastic bag with straw and disposable coffee cup = category 'plastic bag' 1×, category 'plastic cutlery and plates' 1×, category 'takeaway packaging' 1×

Glass bottle with a screwed-on metal lid = category 'glass bottle' 1×

RESULTS LOG

Complete the table on page 20!

GROUP C

LITTER FORENSICS

IMPORTANT: As forensic scientists, you have to work closely with your colleagues at the sorting station of the group studying waste variety on the beach. When examining litter items for any signs of information, take great care to put these items back in their respective buckets afterwards.

1. Help your colleagues from the group on the waste variety on the beach in their search for plastic. As soon as you or the others find plastic items with text on them, proceed with the next steps.

2. Screen the incoming and present plastic litter items for objects, that have text on them and set them aside for closer analysis. If you should not be able to fill in all parameters of the next steps in the table on page 21, leave the fields blank.

3. When you find an item with text, take a good photo if it on which you can read all the text. Additionally, shortly describe the item.

4. Then identify the country of origin. Maybe, these questions can help you with that: What language is the text? Is there a place of manufacturing? Is there a currency of a specific country? Is a brand only sold in a specific country? Fill out the table at page 21.

5. Next, note down the brand of this item and try to find information on its manufacturer. The brand name is usually very big (e.g. Chio Chips). The manufacturer name is often written in smaller size. If you need help, ask your teacher or use the internet.

6. Next, record information on the degradation in the table. Levels are as follows:

   a. Low degradation: Items that look like they have been just littered or that are only very slightly pale due to bleaching from the sun.

   b. Moderate degradation: Items that look worn. In thicker items, edges might be rounded or chipped. Bottles are squished or broken. Additionally, items that look very pale but still have readable text on them fall into this category.

   c. High degradation: Items that are very brittle, have deformed or show extensive cracking. If you flex these items, they easily break. Items are strongly bleached and text and colour are hardly or not visible at all.

7. Make sure, that you have taken a good photo of the item and check the according box in the table.

8. If you have recorded all available information of an item, put it back into the category of the waste-sorting station where you have taken it from or ask the sorters of this groups, where you should put it. Continue with the next item and repeat steps 2 to 7 until you have recorded all or at least 10 litter items. Should you find more items, you can continue the table on another sheet. Make sure to take and submit a photo of this continued table.

RECOMMENDED GROUP SIZE OF THREE TO FOUR

RESEARCH QUESTIONS

1. Where might local waste come from?
2. Which brands are most responsible for pollution of this beach?
3. How degraded are litter items?

AIMS OF SAMPLING

- Find litter items with text among the plastic litter collected
- Identify the country of origin from which most of litter originally comes
- Identify brands most responsible for pollution
- Record data on the degradation of plastic litter

REQUIRED MATERIALS

- Magnifying glasses

WHAT ARE FORENSICS?

In forensics, people systematically and scientifically investigate criminal activities.

EXAMPLES

ID	Description	Origin	Hint to origin	Brand/ Manufacturer	Degradation	Photo
1	Food packaging	Germany	German text	Niederegger	No degradation	X
2	Food packaging	Ukraine	Ukrainian brand/ cyrillic labelling	Konti	Low to medium degradation	X
3	Food packaging	Presumably Germany	Presumably Germany	Ricola	Medium degradation	X
4	Food packaging	Germany	German text fragments	Ferrero	High degradation	X

ID:1

ID:2

ID:3

ID:4

GROUP D

TEAM OF REPORTERS

RECOMMENDED GROUP SIZE OF FOUR TO SIX

RESEARCH QUESTION

1. How successful was sampling?
2. What are the possible sources of waste near the beach? Where does the waste come from? Who might be responsible?
3. How could we possibly handle the waste problem?
4. What factors influence plastic deposition?

METHOD

1. Search for possible sources of waste in the surrounding area and take photographic evidence. Consider the following sources of waste: overflowing bins by the beach, overflowing bins near the beach, bulk waste, scrapyards, diverted waste water, gratings, fishing equipment, very light plastic objects (which could be transported by wind). Could a larger one-time event be responsible for the waste (e.g. a storm or a sports event)?
2. As a group, discuss whether there have been any severe weather conditions in recent weeks. If yes, mark the corresponding data fields on page 21.
3. Talk to the other groups and interview them. What methods have they used and what did they aim to research? Were there any major problems? What was their motivation like when taking samples? Complete the results table on page 21.
4. Ask the other groups what waste they have found so far and think about where it might have come from. Take photographic evidence.
5. Now take a group photo including all participants and write the name of your school/organisation and the beach on the photo. With your consent, this photo and your group name will be shown for all to see on the interactive map at: https://www.plastic-pirates.eu/en/results/map.
6. Don't forget to make a note of the date of today's sampling on results page 21. Also note down the coordinates (in decimal degrees) of the sampling location of the group studying microplastics in the sediment (you can use Google Maps for this, for example, and ask your teacher for help if necessary).

AIMS OF SAMPLING

- Document the sampling with photos or a short video
- Seek out and identify sources of waste and estimate the effects of the weather
- Secure data and photographic evidence

REQUIRED MATERIALS

- Camera or smartphone
- A notepad and pen

INFO

Did you see any animals or plants that were affected by the waste? Or have you observed anything else that was interesting? Feel free to send us photos!

ARTICLE ABOUT THE SAMPLING PROCESS

Take a look at your photos and write a short article about your sampling procedure for your school website. It may include the following:

- The jobs done by each group
- How much waste was found by each group, and what kind
- Whether any microplastic was found
- The suspected source of the waste
- How you liked the work and the project
- How waste in the oceans can harm plants, animals and humans
- What we can all do to avoid waste in the seas

PROFILE OF THE BEACH

BEACH TYPE

- [ ] Urban
- [ ] Semi-urban
- [ ] Remote/Natural

BACK OF THE BEACH

- [ ] Cliffs
- [ ] Dunes
- [ ] Rocks
- [ ] Forest
- [ ] Bush
- [ ] Crops
- [ ] Fields
- [ ] Built-up area
- [ ] Road
- [ ] Other

_____

_____

_____

IS THERE ANY DEVELOPMENT BEHIND THE BEACH?

- [ ] Yes
- [ ] No

DESCRIPTION OF THE DEVELOPMENT BEHIND THE BEACH

_____

_____

_____

LOOKING FROM THE BEACH TO SEA, WHAT DIRECTION IS THE BEACH FACING?

- [ ] North
- [ ] East
- [ ] South
- [ ] West

COASTLINE CURVATURE

- [ ] Linear
- [ ] Concave
- [ ] Convex
- [ ] Sinusoidal

COMPOSITION OF THE BEACH SUBSTRATE IN %

____ ... of sand

____ ... of pebbles

____ ... of rocky coast

OBJECTS IN THE SEA THAT INFLUENCE THE CURRENTS (E.G. PIER, REEF, ...)

_____

_____

_____

BEACH SLOPE

- [ ] Gentle slope
- [ ] Moderate slope
- [ ] Average slope
- [ ] Steep slope

BEACH ACCESS

- [ ] Pedestrian
- [ ] Vehicle
- [ ] Boat

What kind of waste is left behind and by whom? Take a look at the table and think about further evidence that may shed some light on the source of the waste.

Source of waste	Evidence
Residents	**Overflowing bins, household waste**
Beach visitors	**'Party waste' (barbecue equipment, empty beer bottles)**
Fly tippers	**Junk**
Industry	**Microplastic pellets**
Agriculture	**Larger plastic films for covering fields, plastic coverings for greenhouses**
Shipping	**Items that are used on board ships: canisters, waterproof clothing**
Fishing	**Nets, fishing lines, salt packs, polystyerene/ styrofoam boxes, other fishing equipment**
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FEEL FREE TO TAKE PICTURES

EXTRA GROUP

MICROPLASTIC ON THE BEACH

RECOMMENDED GROUP SIZE OF FOUR TO SIX

RESEARCH QUESTIONS

1. How much larger microplastic can be found on the beach?
2. Compare the larger microplastic you found on the beach with the plastic shown on page 19 and categorise it.
3. Which category of microplastic is most represented?

1. Identify the high-water mark (the point at which wet and dry sand meet). If you cannot find this line, take samples within the first metre of the beach. Should you be unable to find this line, do the sampling within the first metres of beach.
2. Measure out 50 metres along this line and mark out three random points parallel to the beach that are at least 5 metres apart from one another.
3. Measure out a 1 by 1 metre square at each of these points and mark it out in the sand.
4. Go to the first square. Remove all larger natural objects (e.g. stones, algae, plants, wood). Use a spade to dig about five centimetres into the sand within (!) the square and deposit it on a tray.
5. Filter the sand on the tray with the sampling sieve. Place everything left behind in the sieve onto another tray. If the sand is damp, wash it through the sieve with filtered sea water. To get filtered sea water, pour sea water through the filtering sieve. If big parts of the beach are wet, it makes sense to have a constant supply of filtered water ready.
6. Take a close look at the contents of the tray. Sort larger microplastic into one corner, count the plastic according to the categories and complete the results table on page 21. Page 19 describes how you can recognise larger microplastic.
7. As soon as you have counted all the larger microplastic pieces and entered them into the table on page 21, label a bag (name of your school/ organisation, sampling point number [1, 2, 3]). Pour the entire contents of the tray into the bag, including sand (not only the larger microplastic). Seal the bag.
8. Repeat the procedure with the second and third samples. Note: Please do not mix the samples; instead, pour them into separate labelled bags.

AIMS OF SAMPLING

- Determine the high-water mark and trace a transect along the sandy beach
- Separate microplastic and sand by sieving
- Identify and classify microplastic

REQUIRED MATERIALS

- Sampling sieve, mesh width: 1 mm; find instructions at **plastic-pirates.eu/en/material/download**
- Filtering sieve, mesh width: 100 – 300 microns
- A bucket for filtered sea water
- Tape measure
- Small spade or tub to dig out the sand
- Three sealable bags to hold the samples
- Trays
- Ruler

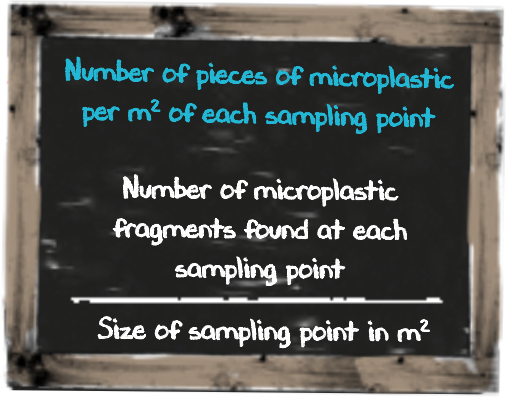
CALCULATING THE SAMPLING AREA

- Work out the size of your sampling squares in m^2: **side a in m × side b in m = … m^2**
- Calculate the number of pieces of larger microplastic for 1 m^2 of each sampling point: number of larger microplastic fragments / area of the sampling point in m^2
- Calculate the average of the three sampling points to determine how much larger microplastic per m^2 of beach you found

A SIEVE
FOR SAMPLING MICROPLASTIC AT THE BEACH

If you wish to take part in sampling of microplastic, you will need a sampling sieve, which you can construct yourselves.

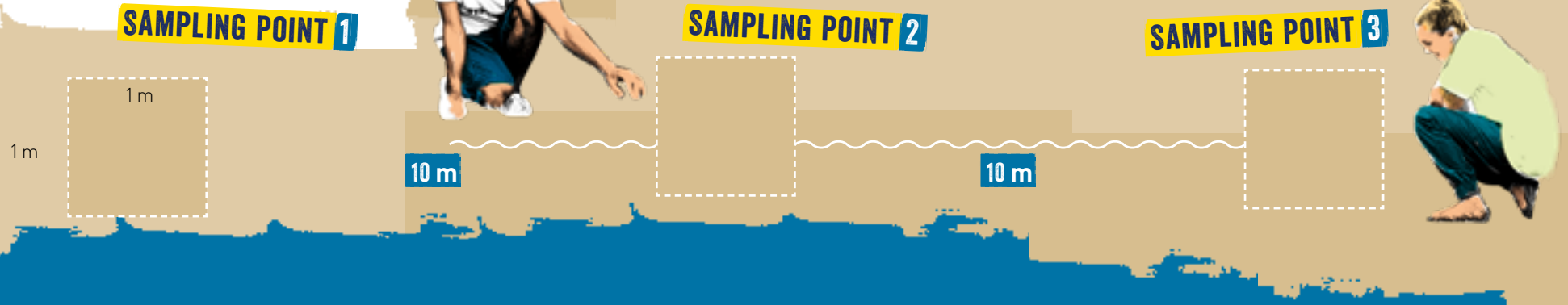
You will find instructions on the website https://www.plastic-pirates.eu/en/material/download.



ANALYSIS OF THE MICROPLASTIC

INFO! IDENTIFYING MICROPLASTIC

It isn't always easy to tell small plastic fragments apart from stones, shards of glass and mussel shells. Take a look at and compare the photos. What are the differences between the four groups? Pay special attention to the differences between white pellets, white fragments and pebbles.



RESULTS

HOW POLLUTED IS OUR BEACH?

Once you have entered your results, ask the other groups to complete the tables. You will then have an insight into your beach and the types of waste present there.

GROUP A

WASTE ON THE BEACH

	Transect 1			Transect 2			Transect 3			
	Sampling point A	Sampling point B	Sampling point C	Sampling point A	Sampling point B	Sampling point C	Sampling point A	Sampling point B	Sampling point C	Total waste types
Paper										
Cigarette butts										
Plastic										
Metal										
Glass										
Food leftovers										
Other waste										
Total of each station										
Per m²										*

* To calculate the total amount of waste per m², divide the total amount of waste by the total area of all stations you have examined. If you have done all 9 stations, then you have to divide the sum of the waste parts of all stations by the total area (81m²).

Average waste per m² in each beach zone:

intertidal

$$\frac{\text{Sum of the waste parts of station A}}{\text{Investigated area of station A}}$$

supratidal

$$\frac{\text{Sum of the waste parts of station B}}{\text{Investigated area of station B}}$$

vegetation

$$\frac{\text{Sum of the waste parts of station C}}{\text{Investigated area of station C}}$$

GROUP B

PLEASE NOTE

If you find a lot of waste which cannot be put into a category, but which is important for your sampling location or for current events, describe it and count it in the field labelled 'Local waste'. This could be, for example, salt packs for fishing, stacks of old newspapers, batteries or face masks and disposable gloves that have accumulated due to the coronavirus pandemic.

VARIETY OF WASTE ON THE BEACH

	Number
Plastic	
Plastic bags	
Plastic bottles for drinks	
Plastic lids of drink bottles	
Takeaway and fast-food packaging, including disposable coffee cups and their lids	
Plastic cutlery and plastic plates (also plastic coffee stirrers and plastic straws)	
Plastic packaging for sweets, biscuits, crisps, etc.	
Cotton buds with plastic sticks ('Q-tips')	
Wet wipes, tampons and sanitary towels	
Polystyrene ('styrofoam')	
Total number of single-use plastic	
Small pieces of plastic less than 2.5 cm	
Other unidentifiable plastic objects	
Metal	
Metal beverage cans	
Bottle caps	
Aluminium foil	
Other unidentifiable metal objects	
Glass	
Glass bottles for drinks	
Glass pieces	
Other unidentifiable glass objects	
Other waste	
Cigarette butts	
Paper	
Textiles (clothing, shoes, textile remnants)	
Rubber (car tyres, rubber bands)	
Balloons	
Other unidentifiable waste	
Local waste:	
Total number (including single-use plastic)	

Share of single-use plastic in the total number of all waste items found: **%**

Length and width of beach searched: L **m** W **m**

Weight of total plastic waste: **kg**

Weigth of all waste including plastic: **kg**

GROUP C
TEAM OF LITTER FORENSICS

ID	Description	Origin	Hint to origin	Brand/Manufac-turer	Degradation	Photo
0	Lays Chips packaging	Germany	German text	Lays, PepsiCo	Medium	x
1						
2						
3						
4						
5						
6						
7						
8						

EXTRA GROUP
MICROPLASTIC ON THE BEACH

Microplastic	Sampling point 1	2	3	Total
Pellets				
Fragments				
Total of each station				
Per m²				

GROUP D
TEAM OF REPORTERS

Sources of waste	Yes	Possibly	No	Evidence
Residents				
Beach visitors				
Fly tippers				
Industry				
Agriculture				
Shipping				
Fishing				

Sampling point coordinates

Latitude: ___ . ___

Longitude: ___ . ___

Sampling date: ___ . ___ . ___

Weather over the last seven days	Yes	No
Heavy rain, flooding		
Storm, strong winds		
Heat, dryness		

Problems during sampling	No problems	Some problems	Lots of problems	The biggest problems
Group A				
Group B				
Group C				
Extra group				

UPLOAD YOUR DATA

Once you have evaluated your findings, you should upload the key data, as well as your photos, to the following website:

https://www.plastic-pirates.eu/en/results/data-upload

Think about a name for your group, which you will use when uploading your results so that other project groups can compare their findings with yours.

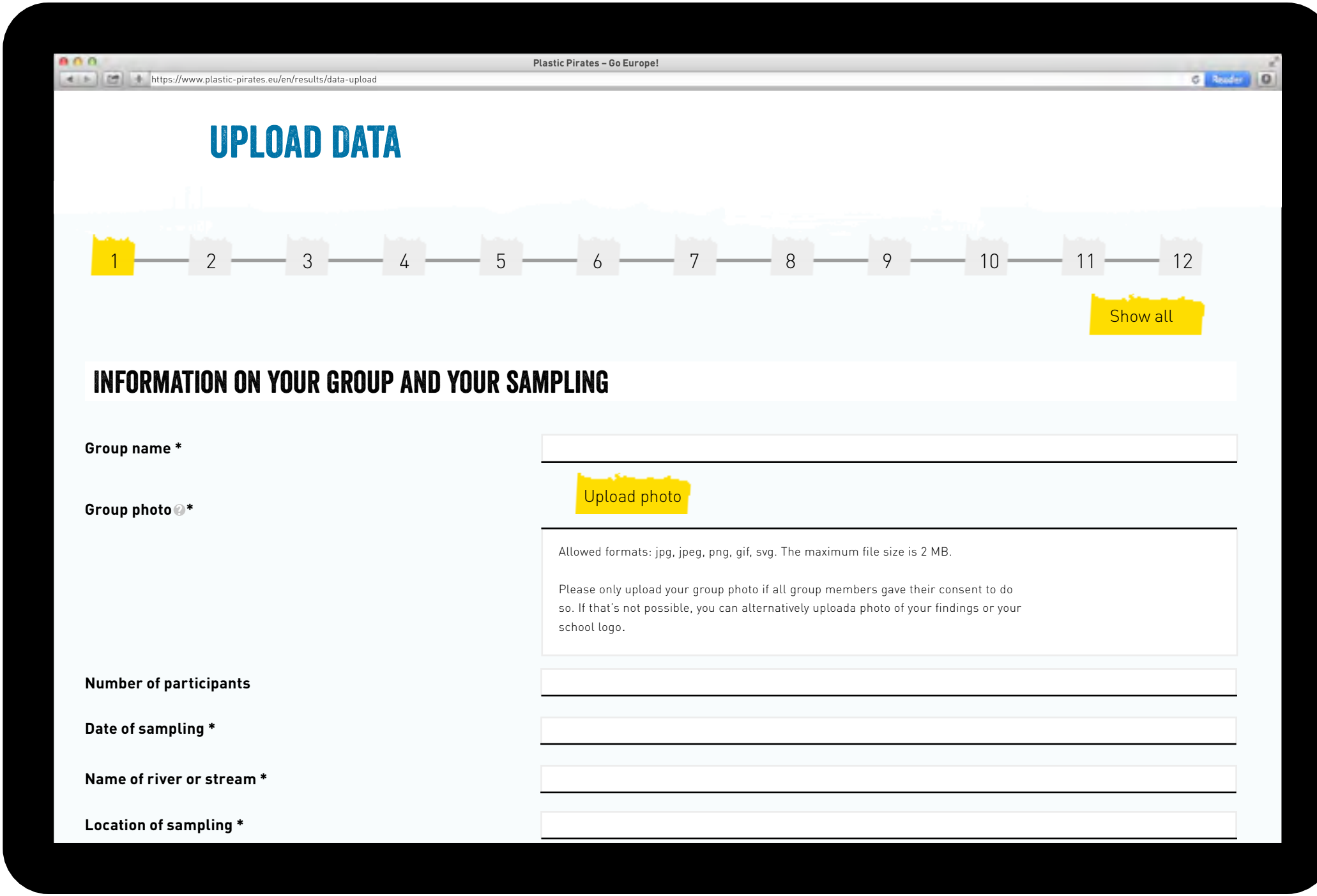
To do this, open the website and fill out the fields. The reporter team takes on this task together with the teacher. For the scientific evaluation and interpretation, the scientists also need your original data.

Please therefore also upload a scan or photo of the completed results pages (20 and 21). Enter your data two weeks after the end of the campaign period at the latest.

Your data are online – what happens now?

You've done your part – and it's now time for others to get to work. It all lies in the hands of the research partners, who will scientifically evaluate the data submitted by all project groups. As this is such a large-scale study, it will take a bit of time to make everything absolutely watertight in line with scientific standards. We will keep you up to date via social media about the scientific evaluation:
https://www.plastic-pirates.eu/en

You can find results from previous counting periods here:
plastic-pirates.eu/en/results/analysis


Plastic Pirates – Go Europe!
https://www.plastic-pirates.eu/en/results/data-upload
UPLOAD DATA
1
2
3
4
5
6
7
8
9
10
11
12
Show all
INFORMATION ON YOUR GROUP AND YOUR SAMPLING
Group name *
Group photo *
Upload photo
Allowed formats: jpg, jpeg, png, gif, svg. The maximum file size is 2 MB.
Please only upload your group photo if all group members gave their consent to do so. If that's not possible, you can alternatively uploada photo of your findings or your school logo.
Number of participants
Date of sampling *
Name of river or stream *
Location of sampling *

COMPARISON OF WASTE IN EUROPE

Now you can go to **plastic-pirates.eu/en/results/map** to compare your data with other project groups. Complete the table and answer the questions in the box.

COMPARISON OF RESULTS:

	Your results	Average in your country	Average in Europe
Items of waste per m² of beach			
Proportion of single-use plastic in %			
Brand of which items were most abundant			
Microplastic per m² of beach sediment			

What is your view of waste pollution at your beach?

SCALE

1	2	3	4	5	6
☐	☐	☐	☐	☐	☐

No pollution ⟷ Severe pollution

Find answers to the following questions:

- Did other project groups find more or less waste than you?
- Is there anywhere in your country where a lot of waste was found?
- What is the situation in other countries?
- What might the reasons be?
- What material is the waste in European beaches principally made of?
- Are your samples different in any way?
- Where do you think the waste in the various countries comes from?
- At which beaches did groups find a lot of waste? What could be reasons for this (e.g. exposition of the beach, main wind direction, close to cities or trading routes)?

EVALUATION AND FOLLOW-UP WORK

Group

You have entered your results. Now it's time to answer your group's research questions.

Answer to research question 1:

Answer to research question 2:

Answer to research question 3:

HAVE ANY NEW RESEARCH QUESTIONS CROPPED UP?

WHAT MAKES ME THINK – AND INSPIRES ME TO ACT

QUESTIONS THAT TAKE YOU FURTHER

What do you regard as the greatest challenge?

Who would you like to tell about the project, and why?

How has the campaign changed your view of the issue of plastic waste?

What have you learned about yourself throughout the project?

What did you find particularly surprising during the programme?

How has your understanding of the term ‘science’ changed over the course of the project?

OVER TO YOU ...

After researching the waste pollution of your beach, you should now think about how you can approach the problem of plastic waste in your environment. Form groups, choose a topic from the double-sided page and develop your own project on the subject. The questions should serve as inspiration for coming up with and implementing your ideas.

REDUCE
YOUR OWN ATTEMPT TO REDUCE YOUR PLASTIC WASTE

Think about how you, maybe even together with your friends or family, can avoid producing waste in your everyday lives.

- During which activities or on which days of the week in particular is a lot of waste produced?
- What material is the waste made of?
- What alternatives are there and how difficult would it be to use them in your everyday life?
- How much waste would that save?

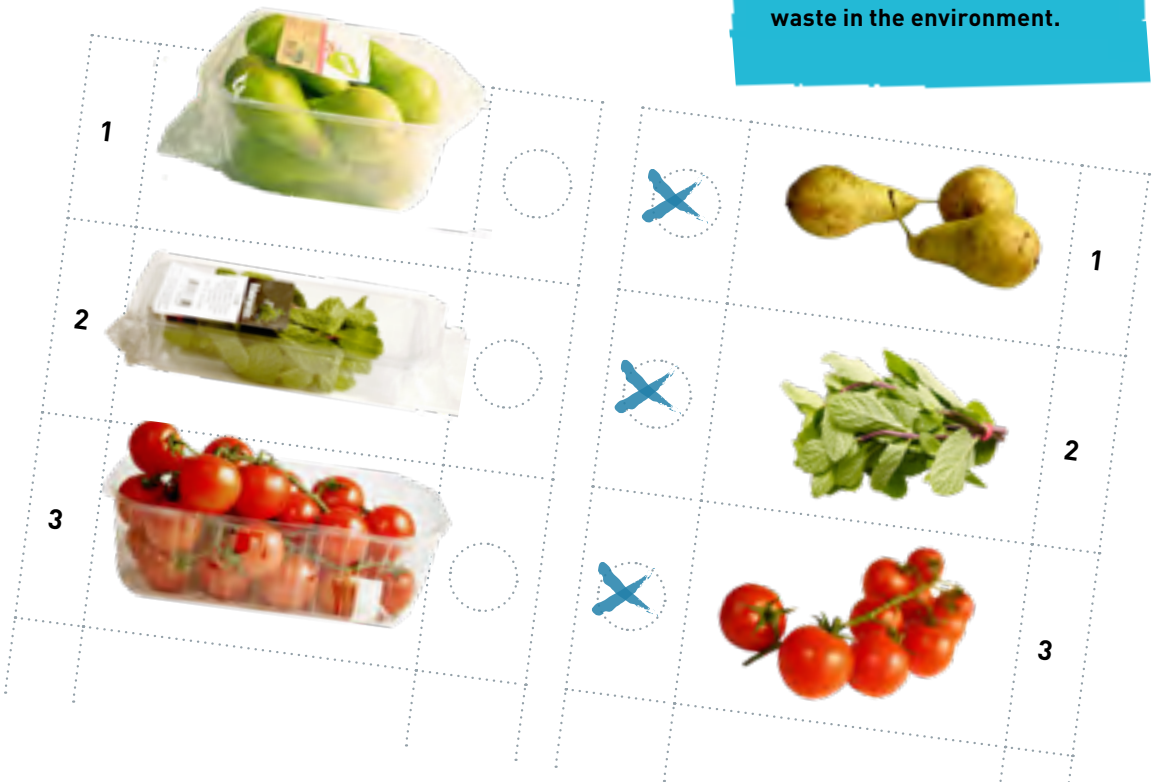
PLASTIC-FREE
CASTING YOUR VOTE WHEN SHOPPING: THE CHOICE IS YOURS!

Each time we buy a product, we are casting a vote and letting the manufacturer or retailer know that we would like to buy more of that product. Find out how your shopping could involve less packaging.

- What is important to customers when shopping?
- Would they be prepared to pay more for items with less packaging?
- What are some of the hurdles to shopping at the farmer's market or in packaging-free shops?

INFO

Not all single-use plastics are bad! It is logical to make certain products out of plastic and to only use them once. Some of these include items in hospitals which are contaminated after use. These items are very helpful, but it must be ensured that they are disposed of properly and that they do not end up as waste in the environment.



UPCYCLING
AS GOOD AS NEW!

Upcycling means that waste products are given a new function and thus once again have value.

- Which waste is generated in your area that is not reused in other ways?
- How could the waste be transformed into a new product with new value?
- Who might need the product?
- Are there negative or positive side effects (e.g. on the environment)?

Have you carried out a project or otherwise been engaged the topic of plastic waste? Then feel free to share your pictures and videos with us on our Social Media channels.

@plasticpiratesgoeurope

Plastic Pirates - Go Europe

under the hashtag #PlasticPiratesEU

For further questions you can also contact us by e-mail: plastic-pirates@dlr.de

OUTREACH
RETHINKING AND CHANGING

You can only make changes if you make others aware of the problem.

- How could you raise awareness for an environmental topic of your choosing (e.g. writing an article, making a stop-motion film)?
- Which target group do you hope to reach and what is the message you want to get across?
- Who are the decision makers (e.g. from the worlds of politics, industry, trade) and how are measures implemented by them?

MORE INFORMATION CAN ALSO BE FOUND IN THE 'OVER TO YOU' CHAPTER OF THE TEACHING MATERIALS AND WORKSHEETS.

LIST OF MATERIALS

NEEDED TO PARTICIPATE IN THE ACTION

WASTE ON THE BEACH

- [ ] Small stones or similar to mark a square
- [ ] Camera or smartphone
- [ ] Paper and thick felt-tip pen to label the 9 stations 1A - 3C
- [ ] White cloth
- [ ] Measuring tape
- [ ] 9 bags to collect the litter, if you plan to count it later on
- [ ] Work gloves

VARIETY OF WASTE ON THE BEACH

- [ ] Buckets, bags or other containers for collecting and sorting the rubbish (the more the better)
- [ ] Tarpaulin, about 5x2m (an old tablecloth will also do, for example)
- [ ] Fabric tape and thick felt-tip pen
- [ ] String, at least 10m long, better longer (to measure the area)
- [ ] Measuring tape
- [ ] Camera or smartphone
- [ ] Bin liners to transport the litter
- [ ] Work gloves
- [ ] Scales (preferably a suitcase scale)

LITTER FORENSICS

- [ ] Magnifying glasses

MICROPLASTIC ON THE BEACH

- [ ] Sampling sieve, mesh size 1 mm (you can make that yourself, for instructions see: plastic-pirates.eu/en/material/download)
- [ ] Filtering sieve, mesh size 100 – 300 microns
- [ ] Bucket for filtered sea-water
- [ ] Measuring tape
- [ ] Small shovel or cup for scooping the sand
- [ ] Three well-sealable bags for the samples
- [ ] Flat dishes
- [ ] Ruler for measuring the sampling depth

TEAM OF REPORTERS

- [ ] Camera or smartphone
- [ ] Paper and pen

Legal notice

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Plastic Pirates – Go Europe! is a European citizen science campaign with the aim of strengthening scientific cooperation in Europe, promoting citizen science engagement and society's participation in the European Research Area, and raising awareness for a conscious and careful approach to the environment. During the German EU Presidency in 2020, the campaign was extended to the countries of the Trio Presidency and became a joint action of the Federal Ministry of Education and Research (BMBF) with the Portuguese Ministry of Science, Technology and Higher Education and the Slovenian Ministry of Education, Science and Sport for the period 2020 to 2021. Since January 2022, the action has been extended to other EU Member States with the support of the EU Commission.