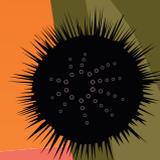




Seashore life

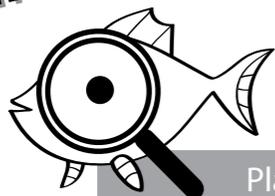




Introduction

At first glance, the sea might seem like a big, monotonous chunk of water, spreading out into the distance until it reaches the horizon. However, if we take a look under the surface of this blue yonder, we are astonished by its depth and fullness of colours. The richness of different forms of life can be compared with the most colourful carnival, exposing the treasures of nature. Actually, nowhere else on Earth can we find so many different animal and plant species interacting and sharing their environment, with humans present only as occasional guests. Looking at the sea and all the life it supports, we can learn about its inhabitants, admire its harmony and compare ourselves to it. We might be tempted to try and learn how to swim like a dolphin or use sound to orient ourselves in the environment. In order to swim faster, we construct swimming suits resembling shark skin. We would like to hold our breath as long as sea turtles. We learn about ways sponges and starfish regenerate parts of their body or how planktonic sea algae create oxygen. People can learn a great deal from the sea, which is why we have to appreciate it and take care of it. Let's dive into the secrets of its inhabitants as real researchers of the marine world! Read the book, and have fun learning and playing!

experiment



Play and learn!

In every chapter you'll find a section called "Play and learn!", with many interesting assignments to complete. These experiments make learning and understanding facts about life on the seashore much easier and more amusing.

contents

Life on the seashore.....	2
Wildlife on the edge of land.....	4
Wonderful world of marine algae..	6
Snails.....	8
Bivalves.....	10
Cnidarians.....	12
Crustaceans.....	14
Echinoderms.....	16
Threats.....	18
Let's clean the beaches.....	20



Life on the coast

To better understand the plants and animals living on marine coasts and in very shallow sea, we should learn something about the environmental conditions in these areas. In order to survive in marine environment, any organism needs some or all of the following: light, warmth, water and energy. Organisms living on the shore have to be well adapted to the ever changing levels of these variables.

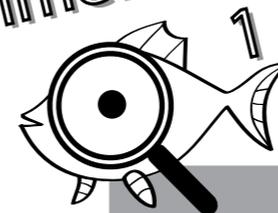
Sunlight is almost always direct and very intense. Therefore, the animals are exposed to high temperatures and solar radiation, which is why they are at risk of drying out. In order to prevent desiccation, these animals developed hard shells and survival techniques such as hiding in rocks or burying in the sand. They wait in the shade until the hottest part of the day is over.

Due to the continuous splashing and movement of seawater, even the land organisms living nearby are influenced by the sea. This is especially true during high and low tides. When flooding commences, the sea level is rising until it reaches high tide, but then drops back to low tide in a process called ebbing. Animals and plants trying to preserve water during sunny days or low tides, find themselves below sea level during high tide or in very windy weather.

All organisms living on the coast are constantly exposed to vast amounts of salt. It can come directly from seawater splashing, get blown off the surface by wind, or come from the ground through plant roots. Adaptations to changing salinity are especially important to coastal marine organisms.

All coasts are not the same. Marine coasts can be rocky, sandy, muddy or made out of pebbles. Some coasts can therefore have a stationary bottom while others move. When the shore is rocky, organisms have many adaptations to attach themselves to the stationary bottom, so the waves and sea currents wouldn't wash them away. When the bottom moves, organisms struggle to stay in one place and have to move really fast or bury themselves in the sand or mud.

Play and learn: experiment



You need to prepare: pencil, paper, meter

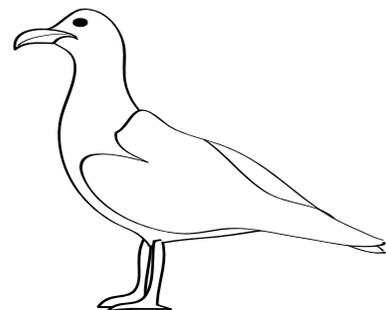
High or low tide?

- 1 Go to the coast in the morning and try to draw it on a piece of paper. Make sure you mark the sea level carefully.
- 2 In case of a rocky coast, try to find a dark trace on the rocks, just above the sea line. The border between dark and light rock marks the sea level during high tide.
- 3 Measure the distance from the sea level and the border on the rocks. Write down the height.
- 4 Repeat this in the afternoon and write down the new height.
- 5 Calculate the difference in heights between the morning and afternoon measurements. Was high tide in the morning or in the afternoon?
- 6 If you are on a sandy beach, the tidal level can be determined by clusters of algae and seagrass washed ashore. In this case, take the meter and place it on the sand so it touches the water. Then walk to the top of the cluster of algae and measure the distance.



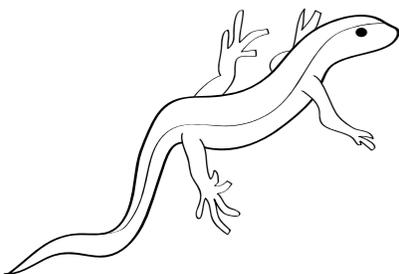
Wildlife on the edge of land

Even though they are not considered marine organisms, plants and animals living next to the sea have many adaptations to counteract the continuous impact of the sea.



Caspian gull

The best known animal we meet on the seashore is the Caspian gull. This bird nests on the shore and feeds on the sea surface, where it is searching for fish. Gulls have well-developed vision, so they can spot fish from high above the surface, and a very sharp beak for catching prey with precision. Their webbed feet make them excellent swimmers. They also have snow white feathers covered in oil, preventing them from getting wet while swimming.

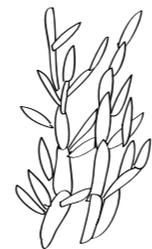


The Italian wall lizard

This small reptile can often be seen running very fast on the shore. It is usually brown-grey or dark brown with green or grey stripes, and can grow up to 15 cm in length. It hides between rocks when the temperature is too high and, if it needs to, runs away to avoid getting splashed by a wave. It can be seen on almost every shore. Its diet consists of spiders, insects and small crabs.

Halophytes

These plants have successfully adapted to living on the seashore, where they are exposed to high salt concentration. The most common halophytes on the Adriatic coast are glasswort, limonium and samphire.



Glasswort stores big amounts of water in its thick, waxy, green stem and thus prevents desiccation. It has a salty taste and is used in cuisine.



Limonium has a thin, grey coloured, reticular stem with thin hairs slowing down evaporation and preventing it from drying out. It blooms with tiny blue flowers.

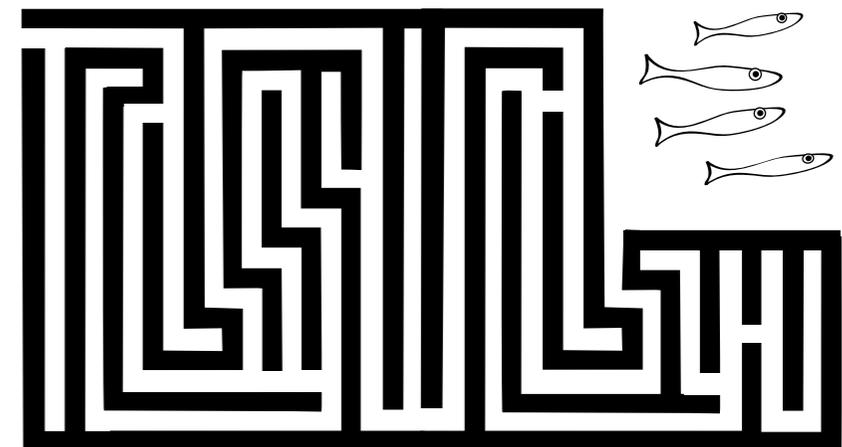


Samphire excretes wax which prevents it from drying out. The leaves are narrow, fleshy and dark green. It is used in cuisine due to its salty aromatic taste and has medicinal properties. In Croatia, there are several names for the plant including motar, petrovac and šćulac.

exercise 1



Help the sea gull find its way through the labyrinth to get the fish!



Wonderful world of algae



Among the wildlife on the seashore, algae are one of the most successful organisms. Algae are plants living in water and lacking plant organs such as the stem, roots, leaves and flowers. Their body is cloth shaped or filamentous, with an irregular shape, and is called a thallus. Algae are very important for life on Earth as they produce huge amounts of oxygen through photosynthesis. They are also food for many marine animals, and can provide shelter when growing densely. We classify algae according to the pigment absorbing sunlight in their cells. There are three different groups: green, brown and red algae.



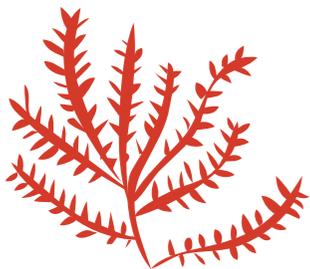
Green algae

Green algae usually grow near the surface of the sea, where there is enough sunlight. We can often find them in shallow water near the shore. The most common green algae on the Adriatic coast is *Ulva*, locally known as sea lettuce. It prefers habitats rich in nutrients, so we can often find it next to harbours or sewage outfalls. It is considered to be a pollution indicator.



Brown algae

Brown algae are the most numerous group of algae in the Adriatic. Many species like Peacock's tail algae, *Fucus* and *Cystoseira* live along shallow rocky shores. *Cystoseira* grows in dense meadows that provide good shelter for animals living in the shallows. The brown algae *Padina* resembles a hand-held fan and can often be found attached to rocks on the shore.



Red algae

Red algae can be found in shallow waters and at greater depths. Unlike green algae, they can only grow in clean and clear water. They are used in the local cuisine of some countries. Their distinct red colour makes the rocky shore appear so much nicer. One of the most common red algae in the Adriatic is *Corallina*, with a coral-like thallus that is best looked at with a magnifier.



Play and learn: experiment



You need to prepare: a pencil, paper, stockings, scissors, an old newspaper, 10 big books and a book with algae descriptions which will help you distinguish the species.

Making a herbarium with algae

- 1 When you go to the shore, bring along old newspapers, paper, stockings, scissors and a pen so you can make your own herbarium.
- 2 Search for any algae and take a small piece of it. Place it carefully on the absorbing paper, and make a note of the date and place where you found it.
- 3 Cut off a piece of the stocking slightly bigger than the piece of algae you collected.
- 4 Cover the detached piece of algae with the stocking and embed it in the newspaper. The stocking will prevent the algae from sticking to the newspaper.
- 5 Repeat the procedure with every algae you find.
- 6 When you return from your outing, place the newspaper with collected algae on a dry and flat surface. Put a dozen heavy books upon it. Their weight will press on the algae, and the newspaper will absorb the extra water.
- 7 During the next two weeks change the newspaper daily.
- 8 When the algae dry out, carefully remove the stocking from the samples. The algae are most probably already attached to the paper because of the moisture. If not, tape them to the paper.
- 9 With your teacher's help, try to find the names of the algae in the book with species descriptions. Do this for every specimen you have. Write them down next to the algae on the papers of your new herbarium.



Sea snails

Snails belong to a group of animals called molluscs. Besides snails, cephalopods and bivalves are also molluscs. All molluscs have a soft body covered with a slimy mantle that, in most species, excretes a shell made out of limestone. Considering snails only, the shell is always made out of one piece.

There are many marine species living in the sea water, or next to it. The most common species found on the shore of the Adriatic are the common periwinkle, turban shell, limpet and green ormer.



Common periwinkle

The periwinkle is a tiny snail that can be found everywhere on the rocky seashore. It spends most of its time on dry land, hiding in cracks and crevices in the rocks next to the sea. Even though it is very small, there are many compartments in its spiral shell which are used for storing water supplies collected during high tide, or when splashed by waves. It has gills for breathing which is why seawater is an irreplaceable resource of oxygen.



Turban shell

Turban shells are snails with thick, colourful shells and can often be found on the rocks in tidal areas. Their favourite food are blue-green algae or cyanobacteria, forming slimy films on the rocks. When the snail dies, its empty shell can sometimes be inhabited by a hermit crab.



Limpet

A limpet has the ability to very firmly attach itself to rocks when it is in danger from being swept away or dried out. It has a flat, irregular shell resembling the shape and colour of the surrounding rocks which enables the limpet to hide from its predators.

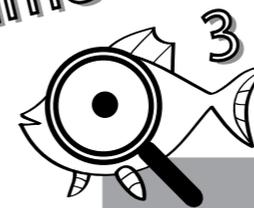


Green ormer

The shell of this snail looks like an earlobe. The inner part of the shell is covered with a thick layer of iridescent nacre, which makes it extremely beautiful. The holes on the shell enable seawater to enter and carry oxygen to the gills.

Play and learn:

experiment



You need to prepare: pen, duct tape, glue, white papers, small boxes or bags, book for determination of species, cardboard or styrofoam board (size 1x1 m)

Making your own mollusc collection

- 1 When you go to the shore, bring along papers, boxes or bags, duct tape and a pen. This will allow you to create your very own collection of marine molluscs.
- 2 Search for empty snail shells and bivalves on the beach, and put each in its own box or bag. **MAKE SURE YOU COLLECT EMPTY SHELLS ONLY! YOU DON'T WANT TO HURT ANIMALS!**
- 3 In every sample box put a piece of paper with the date and location of the find.
- 4 If you don't have boxes or bags, collect the shells and tape them to a white piece of paper. Write down the data next to the shells.
- 5 With help from your teacher and using a species identification book, try to identify them and write down their names next to the data you already collected.
- 6 You can glue and sort collected shells on 1x1 m cardboard or a styrofoam board. Glue papers with the species name and collected data next to every specimen and your collection is finished!



Molluscs

Bivalves are molluscs with soft bodies protected by a shell. These are made out of two parts that fit together and can be very tightly closed. Some species move with the aid of a foot sticking out between the two hard shells, but most of them spend their lives in the sand or mud. Among others, you can find mussels, cockles, oysters and date shells on the sea shore.



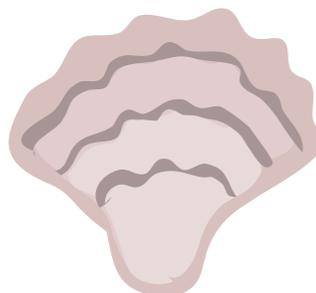
Common cockle

These molluscs dig beneath the surface of sandy bottom with one part of their body usually sticking out. Their Latin name *Cardium* means "heart", and was given to them because they are heart-shaped when looked at from the side. Their shells are ribbed and coloured with white and brown stripes.



Mediterranean mussel

Mediterranean mussels are known for their dark blue shells and good taste. They live in groups attached to rocks or other firm surfaces. Although they are a favourite dish for many people, you must be careful not to eat mussels from polluted areas. They can accumulate toxic substances while filtering seawater.



Oysters

The irregular, layered oyster shells resemble the rocks they are attached to. They are prized and sought after because of their good taste. There are several local names used to identify them in Croatia, including "kamenice" and "oštrige".



Date shells

Date shells are bivalves that use special excretions to drill holes in limestone rocks. Their extremely tasty body almost made them extinct in the Adriatic. Since they grow and develop really slowly, the depleted populations also recover very slowly. To get to these valued molluscs, people need to destroy the rocks they live in. As a result, they demolish the whole shore. This is why the date shell is strictly protected in Croatia and there are big fines for collecting them.

exercise 2

Guess who I am!

Try to find these bivalves in the word search!

O	M	O	O	F	H	D	V	L
Y	U	U	W	B	S	S	L	R
S	A	A	S	H	D	E	J	G
T	Z	I	I	S	H	A	B	F
E	S	B	J	S	E	Y	L	C
R	A	E	E	J	T	L	X	B
N	H	T	N	V	P	Z	B	T
C	A	R	D	I	U	M	P	C
D	T	W	V	Z	M	L	B	R

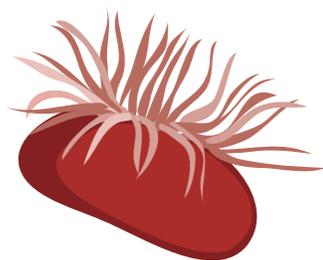
Names:

- CARDIUM
- DATESHELL
- MUSSEL
- OYSTER



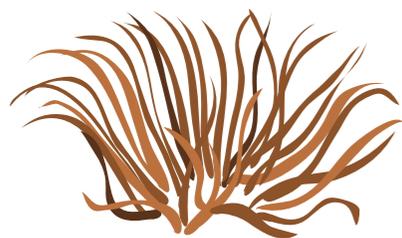
Cnidarians

Cnidarians are animals that have rings of tentacles around their mouth. These tentacles bear venomous cnidocytes, cells containing substances they use to stun their prey or protect themselves from predators. Their venom is mostly harmless to humans, but there are some species you need to look out for, because even the slightest touch can cause burns and pain. Anemones, corals and jellyfish are considered to be cnidarians.



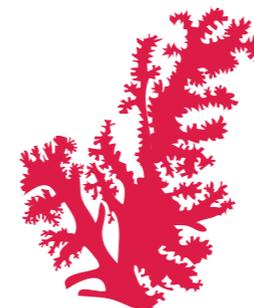
Beadlet anemone

It lives firmly attached to the rocks in the intertidal zone. The bright red colour and beautiful appearance attract attention from far out. It spreads its tentacles to collect food when beneath the surface, during high tide. At this point it looks like a beautiful flower. During low tide, the beadlet anemone retracts its tentacles and shrinks to preserve moisture, resembling a sweet cherry attached to the rocks.



Snakelocks anemone

Snakelocks anemone also live attached to the rocks in shallow water. This is why many people will see it and believe it is an algae. Its long brown tentacles have venomous cells that can cause a stinging sensation on sensitive skin, so try to avoid direct contact with this interesting animal.

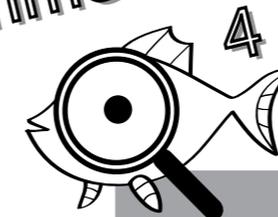


Corals

Corals are small cnidarians that usually live in groups we call colonies. Coral colonies can be made out of millions of tiny animals with their hard skeletons constructing complete shores, reefs or islands. Many corals live in symbiosis with small algae called zooxanthellae, which provide energy in return for nutrients. Corals are very sensitive to temperature changes, sea pollution and physical damage. Almost all coral species are endangered and protected.

Play and learn:

experiment



You need to prepare: pen or a stick

Touch the beadlet anemone!

- 1 When you go to the shore, bring along a pen or a stick, so you can investigate the beadlet anemone's reactions.
- 2 Try to find a beadlet anemone attached to the rocks in the shallows. Some of them will be shrunk and round. Leave these ones alone.
- 3 When you find a beadlet anemone, with its tentacles spread out in the shape of a flower, touch it carefully with a pen or a stick. Try not to harm it.
- 4 Look at what will happen!



Crustaceans

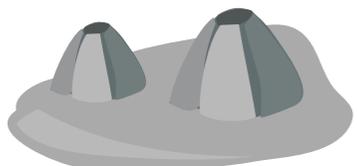
Crustaceans, insects, spiders and centipedes belong to a group of animals known as the arthropods. Their articulated body is the main visible feature and consists of a head, thorax and abdomen. Legs are also segmented. Their body is protected with a hard external skeleton. They mostly live in tidal areas.

Warty crab



It is a beautiful reddish brown coloured crab with an exceptionally hard shell. It has distinctive black pincers you should look out for as they can clamp vigorously. Its speed and agility allow it to escape anyone trying to catch it for its delicious meat.

Barnacles



Barnacles are probably the most common animals found on rocky shores. They are inconspicuous crustaceans with a very hard carapace and are firmly fixed to rocks. If you look carefully at the bumps on submerged rocks at high tide, you will see tiny animals rhythmically waving their feathery legs in search of food.

Hermit crab



Hermit crabs, unlike most other related species, are not completely protected by a hard skeleton which makes them very vulnerable. This is why they have to find empty shells which they can use to take shelter and protect their soft abdomen. The crab will often place a beadlet anemone on the shell and carry it around for protection. This association among different species with mutual benefit is called symbiosis. The hermit crab moves the anemone allowing it to feed easier, while it protects the crab with venomous tentacles.



exercise 3

Look at the adverts of following species and try to find their perfect match!

Pen shell
I have a house to rent
In return I'm looking for someone who will guard in front of the house and warn me when they spot danger

Cleaner fish
I offer teeth and cavity cleaning services
Looking for left overs and someone powerful who will protect me from the attackers

Solitary crab
I'm strong and agile
In need of good protection

Guard crab
I'm fast, skillful and cautious
Looking for an apartment

Beadlet anemone
Attractive appearance, very fast and efficient
venomous cells used in defense
Looking for a moveable partner that will show me the world!

Zooxantella
I am small and humble, able to produce energy using sunlight
Looking for a safe and peaceful home

Shark
I offer protection from all kinds of predators
Looking for someone who is willing to take care of my astonishing teeth

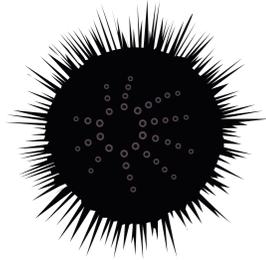
Rocky coral
I offer space for living in a safe and strong colony
Due to energy shortage I'm desperately looking for a partner

Echinoderms

Echinoderms are a group of animals with bodies that can usually be divided in five symmetrical parts. Most of them have spines of some kind, ranging in size. They usually live on the bottom using special water filled legs to move around, which are supported by a water vascular system. Sea urchins, starfish, brittle stars and sea cucumbers are all echinoderms.

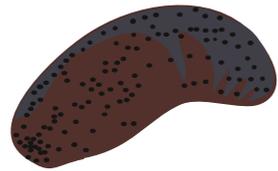
Sea urchins

They are often found on rocky shores with their black, sharp spines threatening swimmers who often step on the urchins. Although we have to take care not to get hurt, these animals are not always to be avoided. They are indicators of clean sea water so when you spot a sea urchin, you can be sure it is as clean as it gets! They are also considered sea bottom cleaners because they feed on damaged algae and other marine organisms.



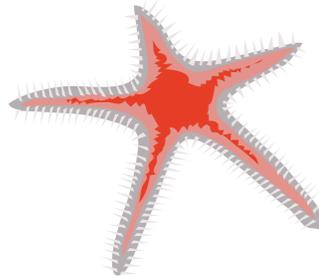
Sea cucumbers

They are named sea cucumbers because of their elongated oval bodies. Their soft body is covered with dark, leathery skin. They will eject their intestines through their mouth in order to deter predators. The intestines will start to regenerate after the danger passes. Sometimes we can find them in very shallow sea.



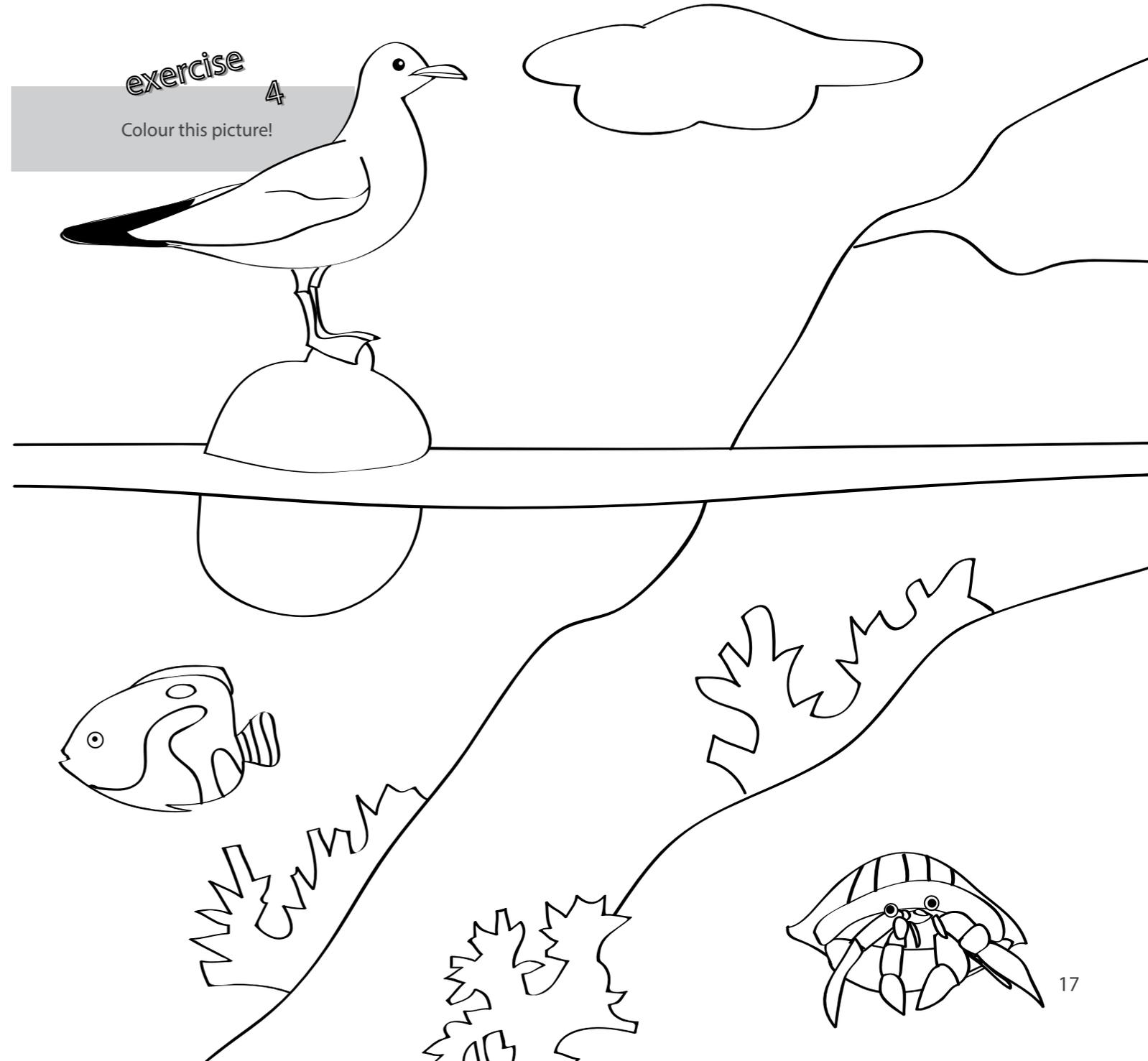
Starfish

Even though they usually live on the bottom and in deeper water, they can sometimes be found in shallow water or washed ashore. They may look harmless, but to many marine animals they are vicious predators. If one of their arms is damaged or detached, they will simply grow another.



exercise 4

Colour this picture!

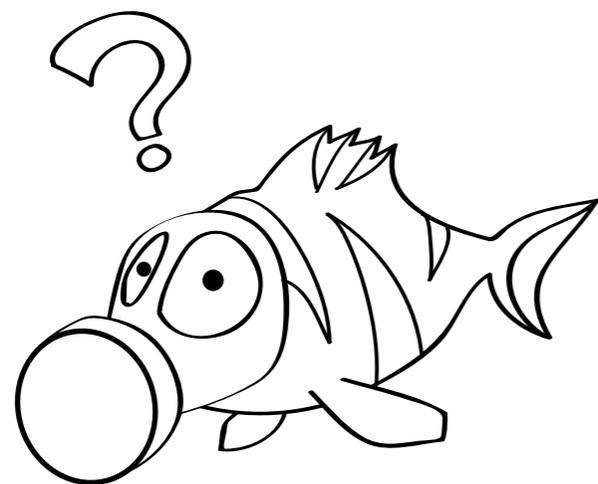




Threats

The biggest threat for plants and animals living on the shore is habitat destruction. There is an increasing number of settlements spreading along the shores of the seas and oceans, taking up more space than ever before. Habitats are lost due to construction of houses, roads, ports and other structures, in turn threatening the survival of many plant and animal species.

Pollution is yet another problem. Many algae and marine animals die due to the presence of deadly chemicals released into the sea. Marine debris can sink to the bottom, but is mostly washed ashore, covering huge areas. In addition to being sore to the eyes, garbage permanently harms the living organisms in the area. In case of naval accidents, the shoreline nearby is covered with a thick layer of tar, suffocating organisms underneath it.



Play and learn:

experiment



You need to prepare: 3 smaller jars with lids, a stick, water, oil, petroleum, vinegar, pen and paper

Oil spills

- 1 Pour water in the jars so that they are half full.
- 2 Pour a spoonfull of cooking oil, petroleum and vinegar in the respective jars.
- 3 Use your stick to stir every jar separately. Look at what will happen and make a note of it!
- 4 Close the jars and shake them up. Watch what will happen and make a note of it!
- 5 How well do liquids from the jars mix with water?
- 6 What do you think happens with oil and petroleum when they spill into the sea?



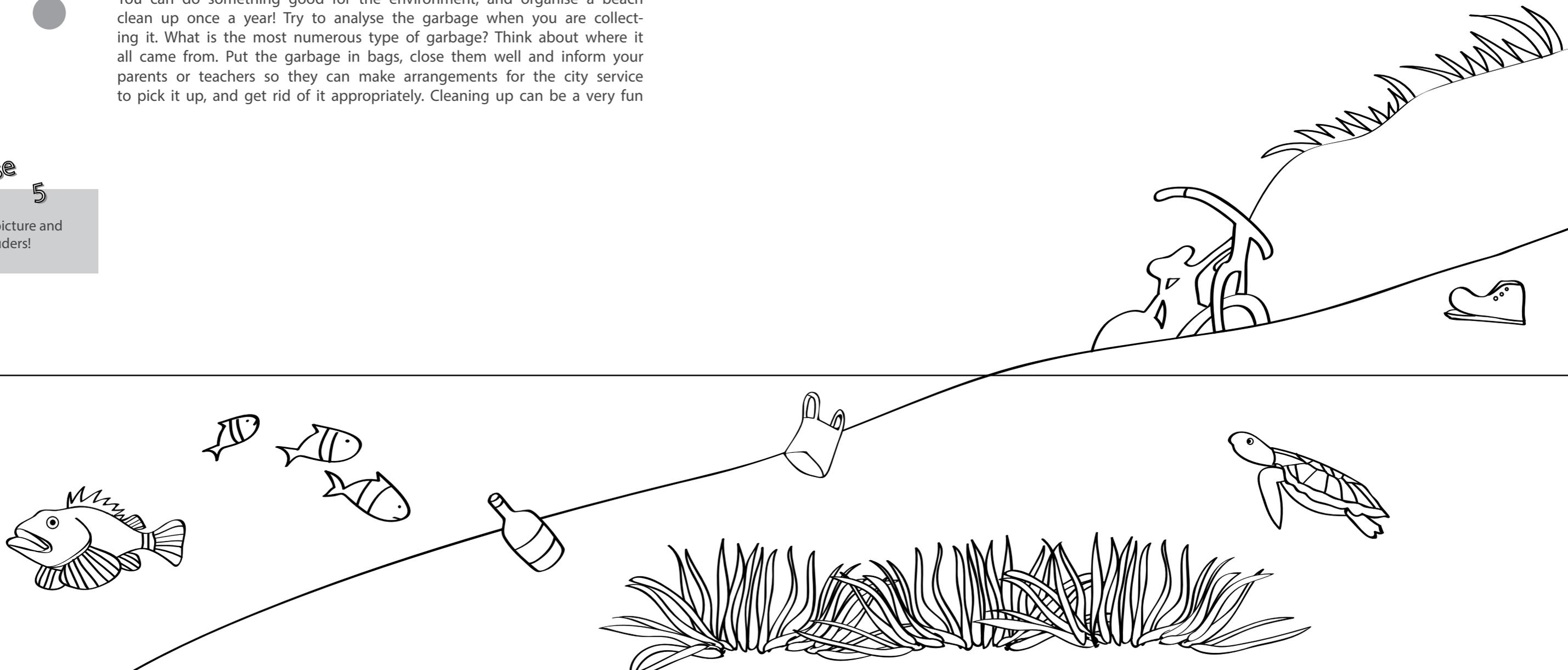
Let's clean up the beaches!

In order to protect the shore as best as we can, people first have to start behaving responsibly. Garbage doesn't belong in the sea, so make sure you warn people not to throw it away when you see them behaving recklessly. In windy weather the floating debris will wash up on the shore. You can do something good for the environment, and organise a beach clean up once a year! Try to analyse the garbage when you are collecting it. What is the most numerous type of garbage? Think about where it all came from. Put the garbage in bags, close them well and inform your parents or teachers so they can make arrangements for the city service to pick it up, and get rid of it appropriately. Cleaning up can be a very fun

activity that will make your town look more beautiful and give you personal satisfaction. You can now look for algae, shells, crabs and interesting inhabitants on the clean beach.

exercise 5

Look at the picture and find the intruders!





National
Foundation
for Civil
Society
Development



Printing of this publication was funded by the National Foundation for Civil Society Development. The contents of this publication are the sole responsibility of the authors and do not necessarily express the opinion of the National Foundation.

Publisher: Blue World Institute of Marine Research and Conservation, Veli Lošinj, 2013.

www.plavi-svijet.org

Design and illustration: Anton Horvatović

Copyright © Plavi svijet, 2013.

