

GES 4 SEAS



OUR SEAS
OUR STORY
OUR FUTURE

PREFACE

This book is part of the Horizon Europe project, **GES4SEAS**, which was funded to inform and guide marine governance in minimizing human pressures and their impacts on marine biodiversity and ecosystem functioning, while maintaining the sustainable delivery of ecosystem services.

GES4SEAS has developed tools to better assess how human activities and climate change affect marine biodiversity, ecosystems, and the services they provide. Through these innovative tools and knowledge, the project will support policy- and decision-makers in making better decisions for a healthier ocean.

The book aims to increase our understanding on how the ocean influence human societies and how we influence the ocean with our actions, revealing the high complexity these relationships. The story begins with the idea of **Healthy Seas for Healthy Human Societies**, highlighting how an healthy ocean underpins our own well-being (Comic 1). It then explains that this ocean health can be compromised by the multiple **Pressures in the Marine Environment: 1 + 1 Is Not Always 2**, as pressures accumulate and interact in complex ways (Comics 2 and 3). Because of this, we must ensure that, despite these pressures, the marine environment remains in good condition, introducing the concept of **Good Environmental Status and How It Can Affect Your Health and Life** (Comic 4). When ecosystems approach or cross **Tipping Points: Why It Is Best Not to Reach Them** (Comic 5), their stability—and ours—can be put at risk. Managing pressures, avoiding tipping points, and safeguarding environmental status requires an **Ecosystem Based Management: Managing the Whole or the Hole** approach (Comics 6 and 7). Finally, the book reflects on how the GES4SEAS project, through its advances and developed tools for a better

marine management and recovery, offers reasons for **Ocean Optimism: Hope for the Ocean and Societies** (Comics 8, 9 and 10). To bring this comic book to life, real examples from different European regional seas, have been selected to illustrate these concepts and tell this story.

As part of this effort, the project has directly engaged with young people to promote ocean literacy, aiming to encourage more sustainable behaviours toward the ocean. Scientists from the **GES4SEAS** consortium wrote a series of short comics on important marine topics—such as biodiversity, pressures, and management—that were then reviewed by children from different age groups and schools across Europe (Denmark, England, Finland, Greece, Ireland, Portugal, Romania, Spain). Guided by their teachers, the students helped to improve the educational content and layout of the comics to ensure the important messages from **GES4SEAS** are communicated well. Each comic focuses on a different topic and are now compiled into this book, available in multiple languages (Basque, Catalan, Danish, Dutch, English, Finish, French, German, Low German, Greek, Italian, Portuguese, Romanian, Slovenian, Spanish, and Turkish). In addition, the book is also available with blank spaces for completion.

The aim is for this book to serve not only as entertainment but also as an educational resource. Teachers can read it in advance and draw inspiration for explaining key concepts to their students, who can then later create either their own comic or complete the blank version with missing panels, creating their own interpretation of the stories. The official version should be shared with students at the end of the activity.

We hope it inspires you to explore, learn and protect our seas!



Acknowledgments

We thank the students and teachers involved in this activity for their cooperation and contribution to this initiative:

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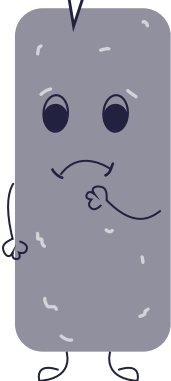
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1

**WHERE DOES YOUR FISH
FINGER COME FROM?**



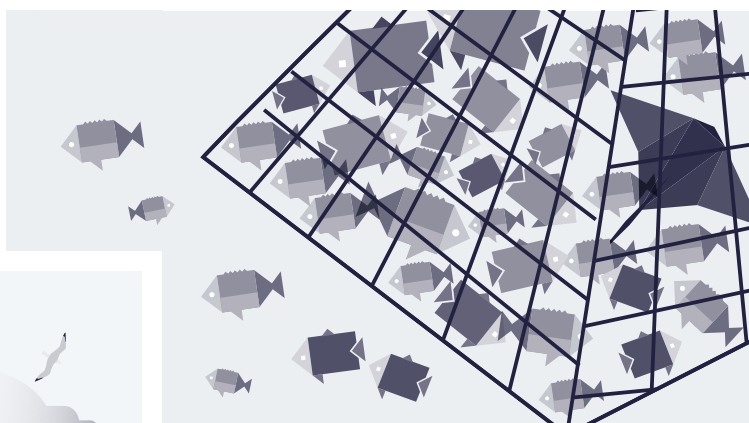
Eating fish is essential for growing, studying, and playing. It is a source of protein, minerals, vitamins, and also essential fats.



There are different types of fishing methods. Some are very harmful to the environment. They damage the seabed and destroy the habitats where many species, fish and others live...



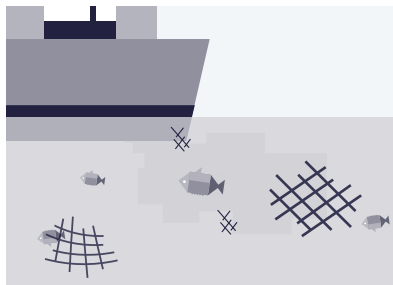
...and they can even catch fish that we won't eat, either because they are too small or because they have a taste we don't like.



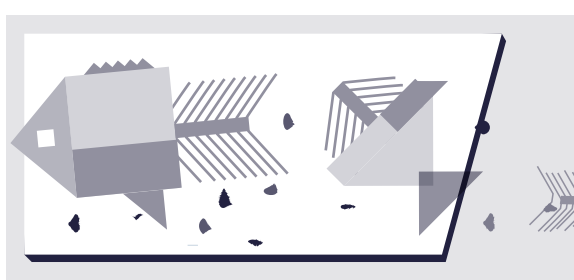
Careless fishing can also pollute the ocean!



But this journey doesn't end when the fish reaches land. Fish fingers can be produced in factories that, just like fishing, can be unsustainable.



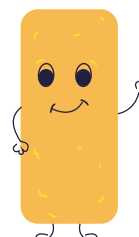
In addition to pollution, which often starts on land and ends up in the sea, we also waste parts of the fish that we're not used to eating.



Garbage

To grow healthy, you need a healthy ocean, where all species live in balance.

yuck



Your decisions when choosing a fish finger can help protect marine ecosystems.

You can, for example, choose fish fingers produced through sustainable fishing and industrial processes. Fishing methods should not destroy habitats...

...and it should be selective, meaning only catching the fish we consume.

In your choice, make sure that the factories producing the fish fingers pollute as little as possible and avoid waste.

How can you do this? Look for sustainability labels on the packaging that indicate respect for the environment, both in fishing and production.

Nowadays, biotechnology allows for new uses of the parts of the fish that are not used in your fish fingers.

We can produce highly nutritious supplements, pharmaceutical products, and even cosmetics!

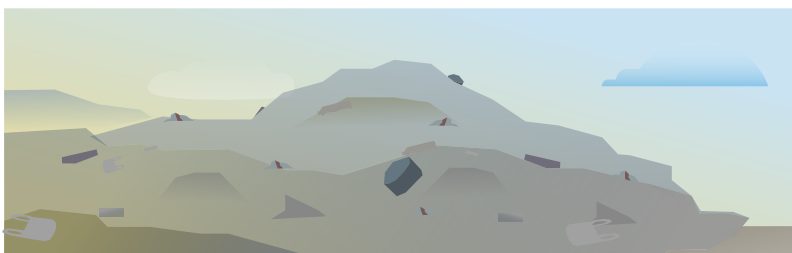
For all these reasons, you, as a consumer, play an important role in ensuring that fishing and the industry follow good environmental practices!

We need a healthy ocean to have a healthy society, but for that, a fish finger must be much more than just a fish finger!

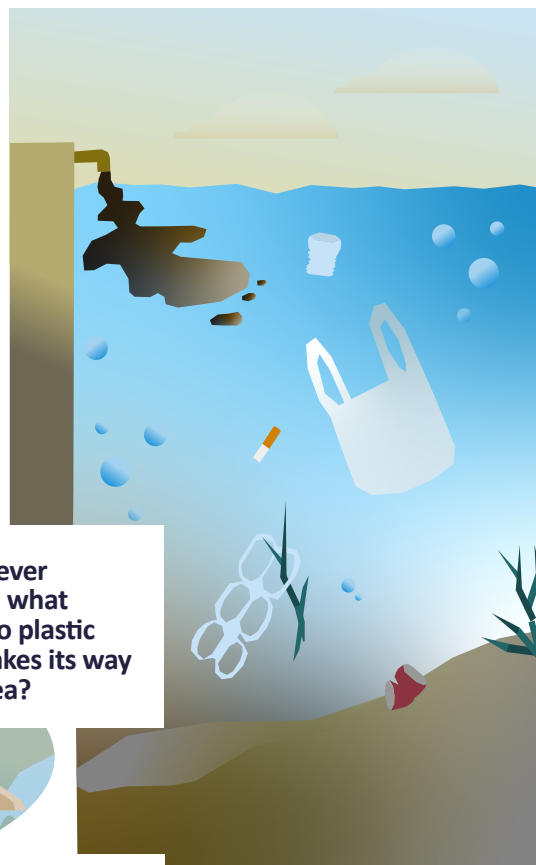
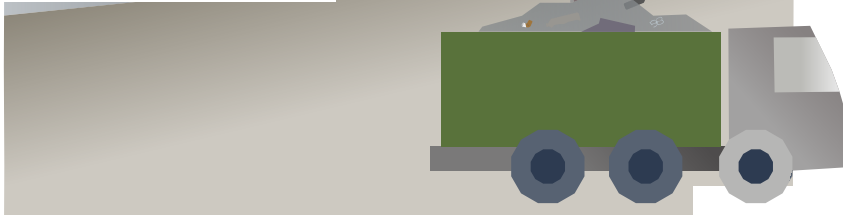
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PLASTICS IN OUR SEA: A GROWING THREAT TO MARINE LIFE!





Where did all this plastic come from?



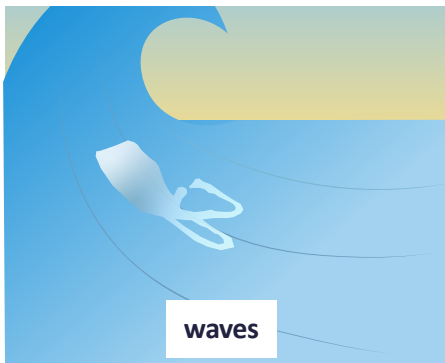
Have you ever wondered what happens to plastic once it makes its way into the sea?



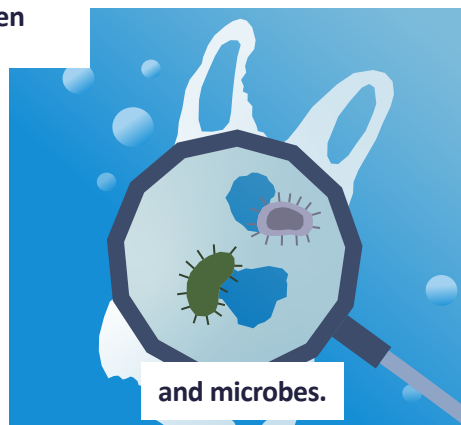
Have you ever thought about how plastic in our oceans can break down into tiny, almost invisible pieces? It's a startling reality! It can be broken down by...



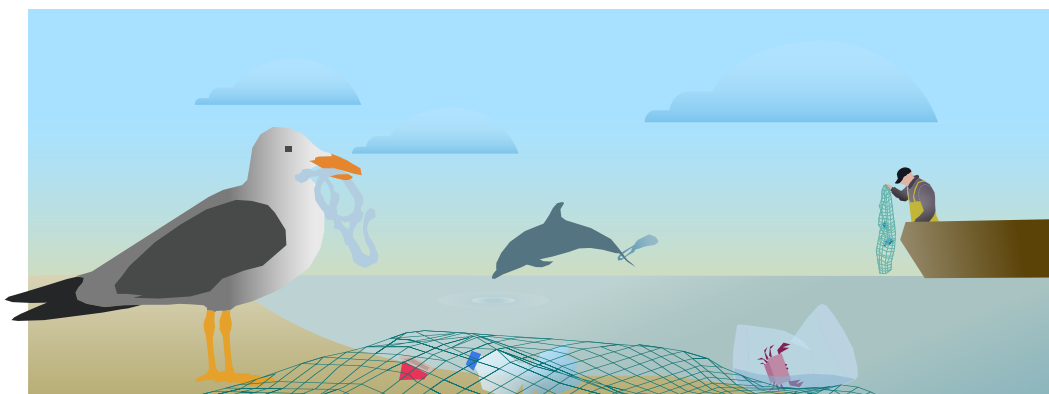
sunlight



waves

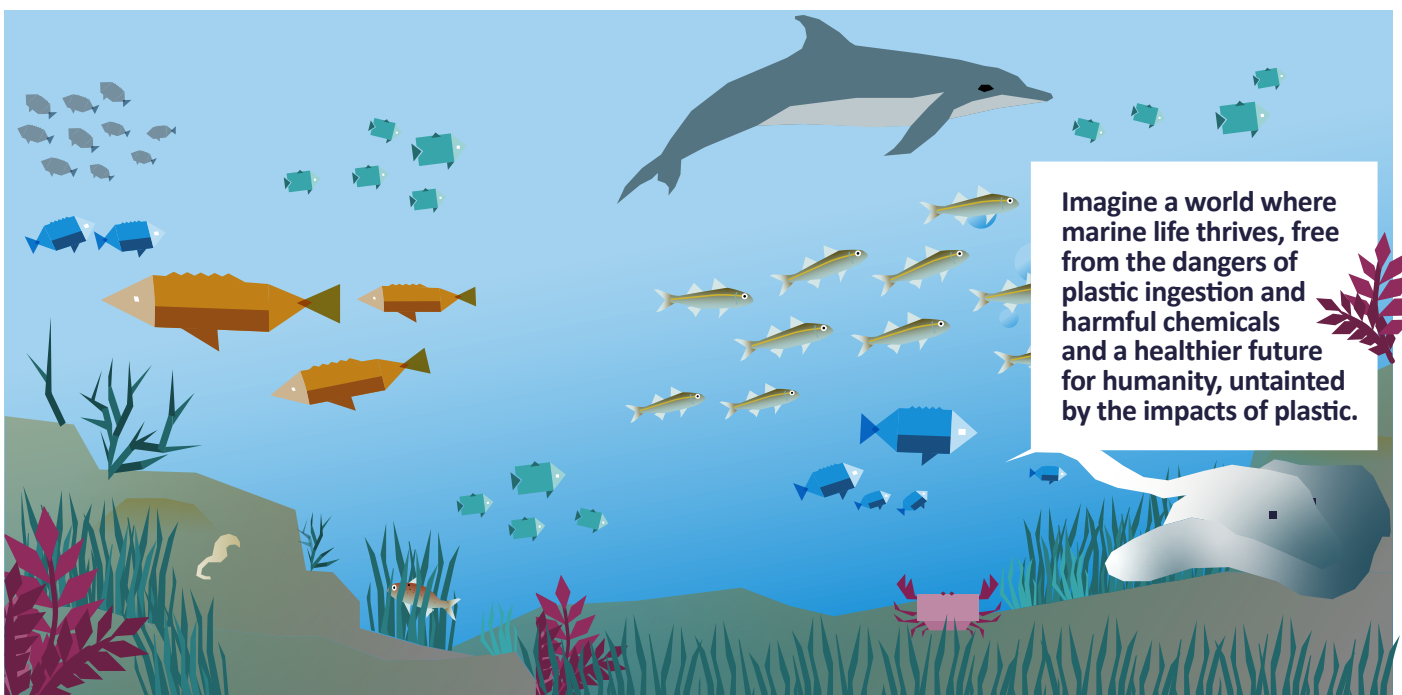
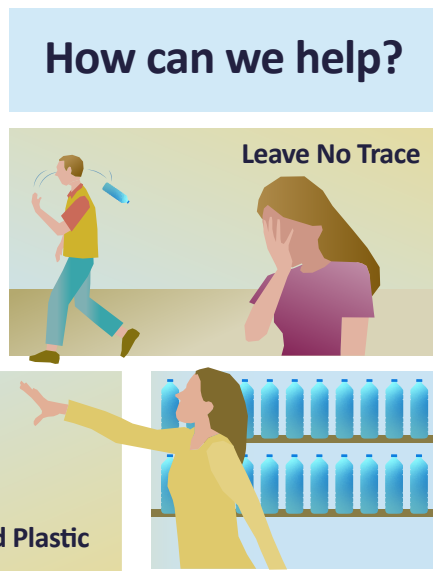
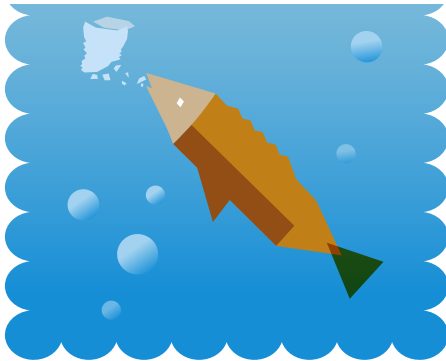


and microbes.



Marine life can be harmed by abandoned fishing nets and plastic debris, often mistaking it for food or ingested directly from the water.

It's a fact that the ingestion of plastics significantly harms marine life, exposing animals to dangerous chemicals. Moreover, this plastic pollution directly impacts humans as well.



Imagine a world where marine life thrives, free from the dangers of plastic ingestion and harmful chemicals and a healthier future for humanity, untainted by the impacts of plastic.

3

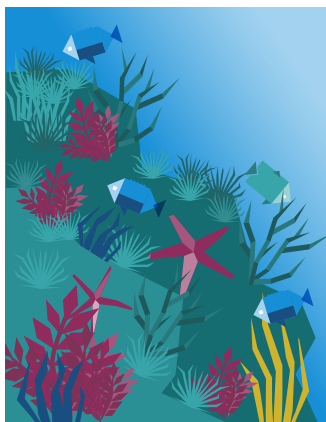
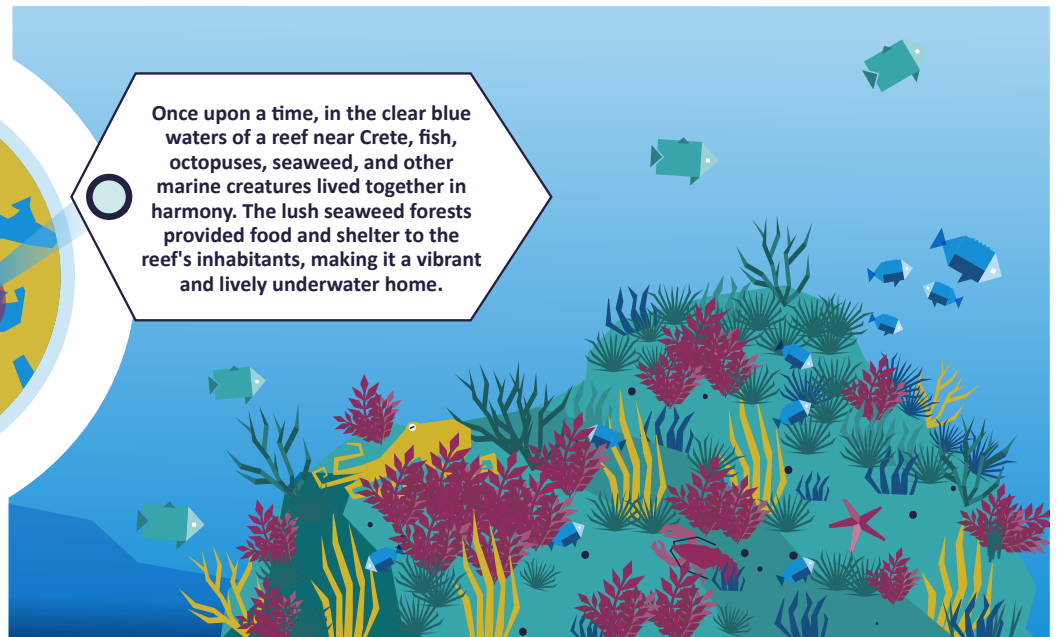
REEFS UNDER THREAT



Mediterranean Sea



Once upon a time, in the clear blue waters of a reef near Crete, fish, octopuses, seaweed, and other marine creatures lived together in harmony. The lush seaweed forests provided food and shelter to the reef's inhabitants, making it a vibrant and lively underwater home.

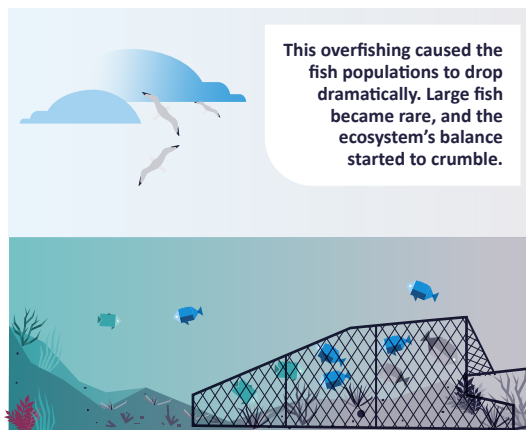


At first, the fishers practiced responsible and sustainable fishing. They took only what they needed without upsetting the delicate balance of the reef. Although their activities reduced the number of fish, there were still plenty left to keep the reef healthy and thriving.



But over time, the fishers grew greedy. They began taking more fish than the reef could replenish.

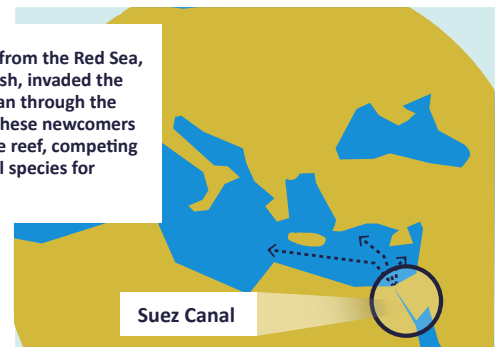
This overfishing caused the fish populations to drop dramatically. Large fish became rare, and the ecosystem's balance started to crumble.

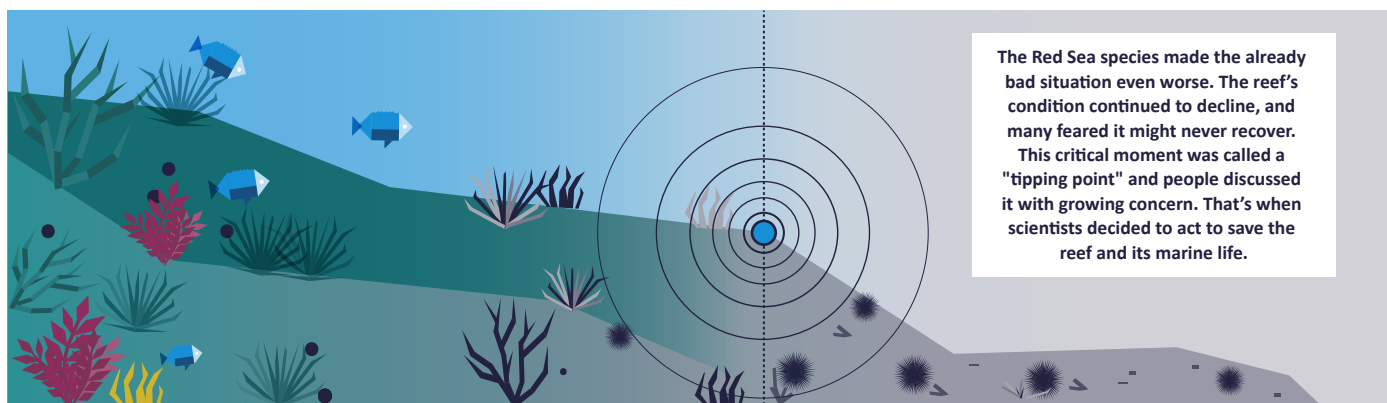


With fewer fish, sea urchin numbers escalated because their predators—large fish—were no longer around. The urchins overgrazed on the seaweed, leaving the rocks bare and damaging the reef's ecosystem.

New species from the Red Sea, like grazing fish, invaded the Mediterranean through the Suez Canal. These newcomers settled on the reef, competing with the local species for resources.

As if that wasn't enough...



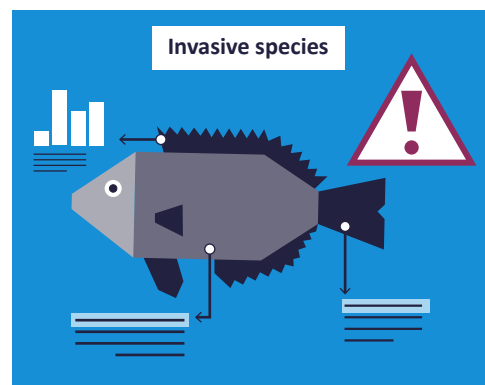


The Red Sea species made the already bad situation even worse. The reef's condition continued to decline, and many feared it might never recover. This critical moment was called a "tipping point" and people discussed it with growing concern. That's when scientists decided to act to save the reef and its marine life.



The scientists worked tirelessly, studying the reef, its changes, and the effects of both invasive species and overfishing. They identified the exact "tipping point" and realized that urgent action was needed to prevent crossing it.

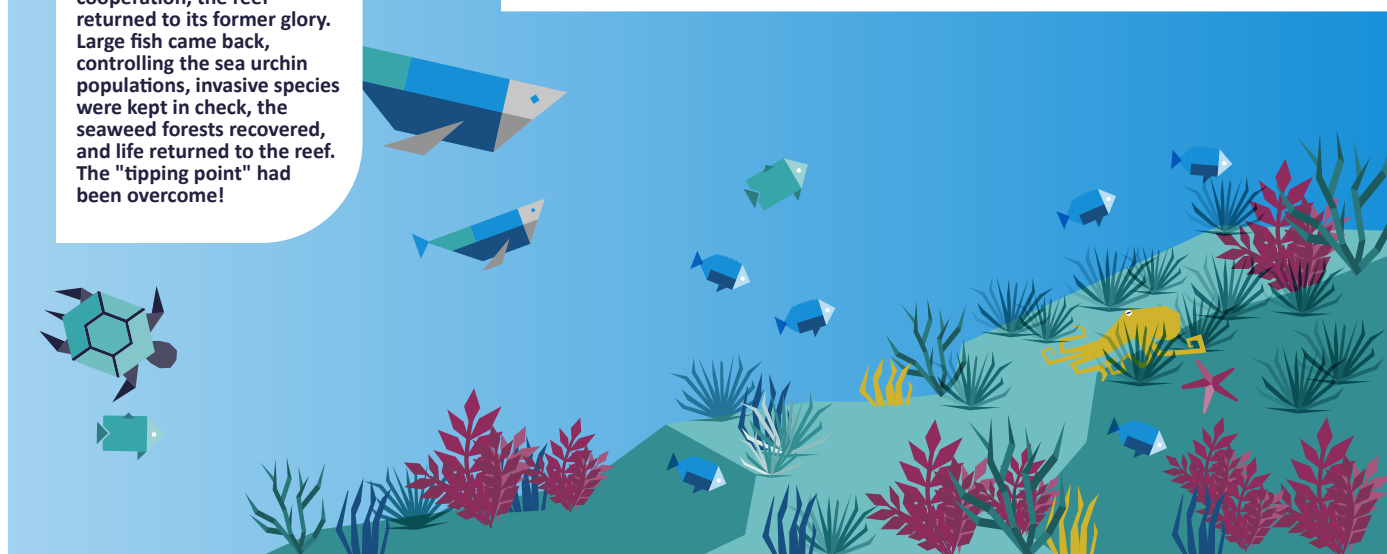
They proposed difficult but necessary measures to restore the reef. Everyone (including scientists, citizens, and fishers) came together and agreed to these measures. They worked to control the invasive species and limited fishing to sustainable levels that would avoid crossing the tipping point.



Invasive species

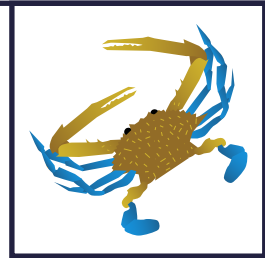
And they succeeded!

With everyone's cooperation, the reef returned to its former glory. Large fish came back, controlling the sea urchin populations, invasive species were kept in check, the seaweed forests recovered, and life returned to the reef. The "tipping point" had been overcome!



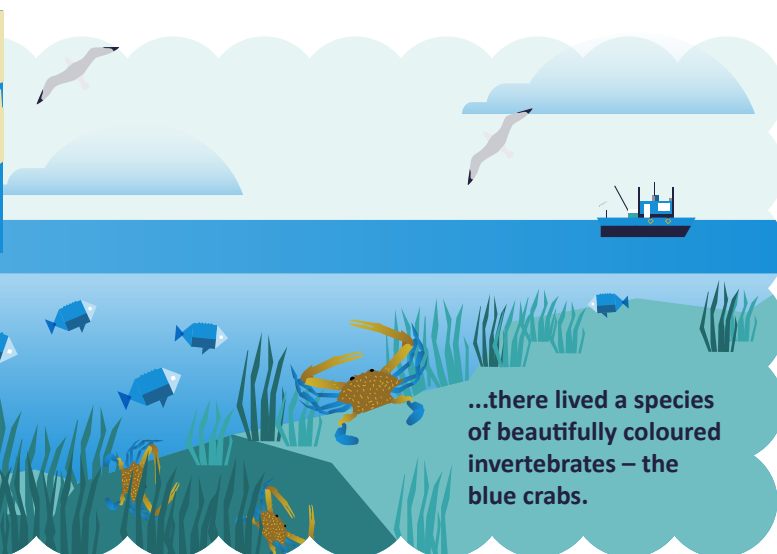
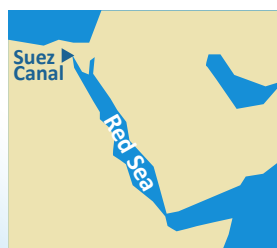
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THE TRAVELS OF THE BLUE CRAB



1800s

In the coastal habitats of tropical seas...



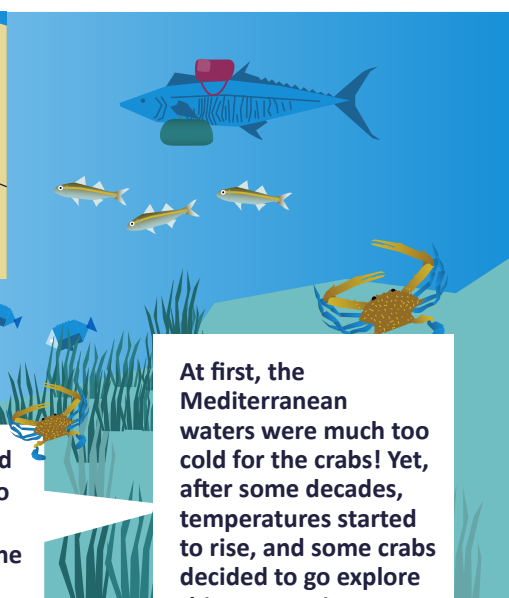
...there lived a species of beautifully coloured invertebrates – the blue crabs.

They really liked it there because of how warm the water was!

1869

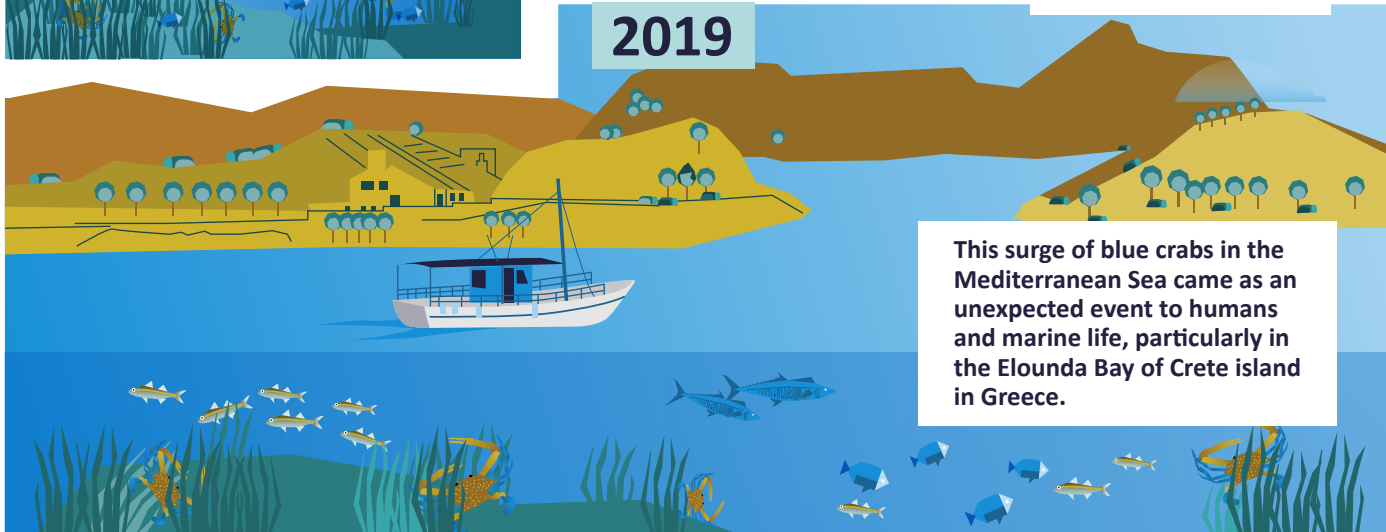


The blue crabs lived happily and solely in tropical seas until the day humans built a new passage – the Suez Canal.

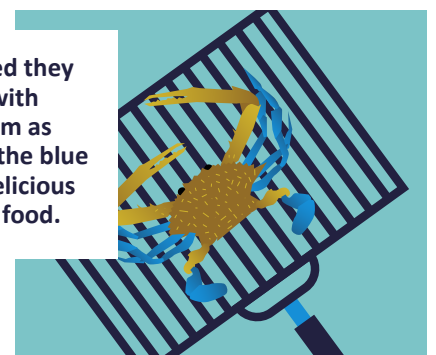
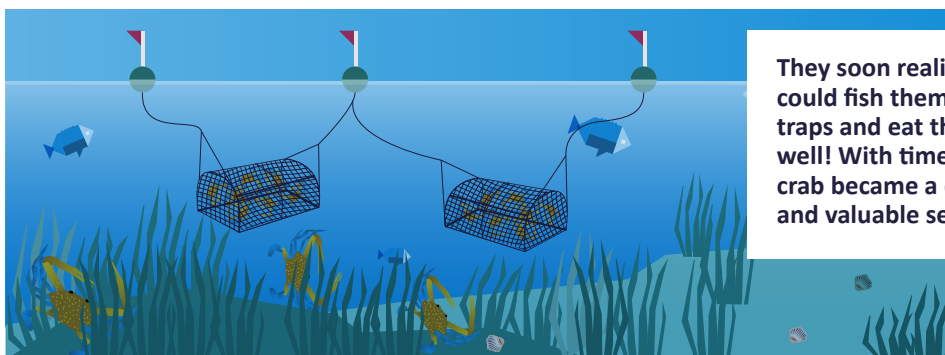
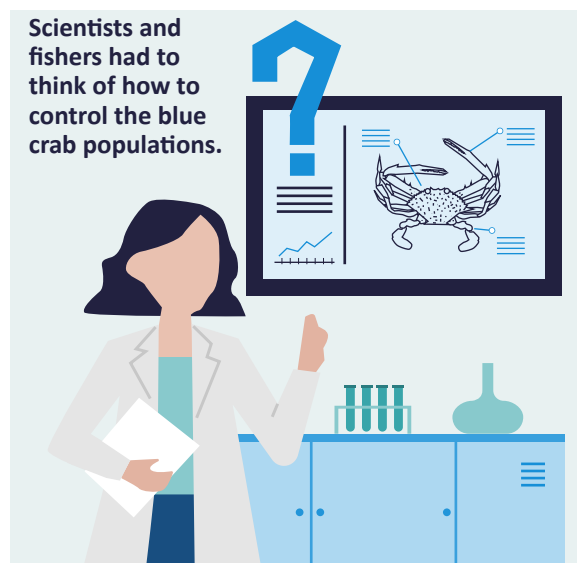
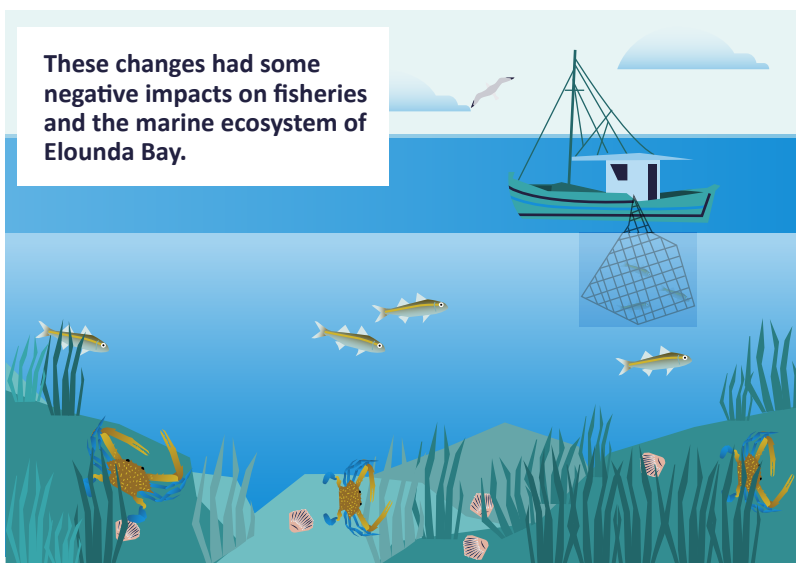


At first, the Mediterranean waters were much too cold for the crabs! Yet, after some decades, temperatures started to rise, and some crabs decided to go explore this new territory.

2019

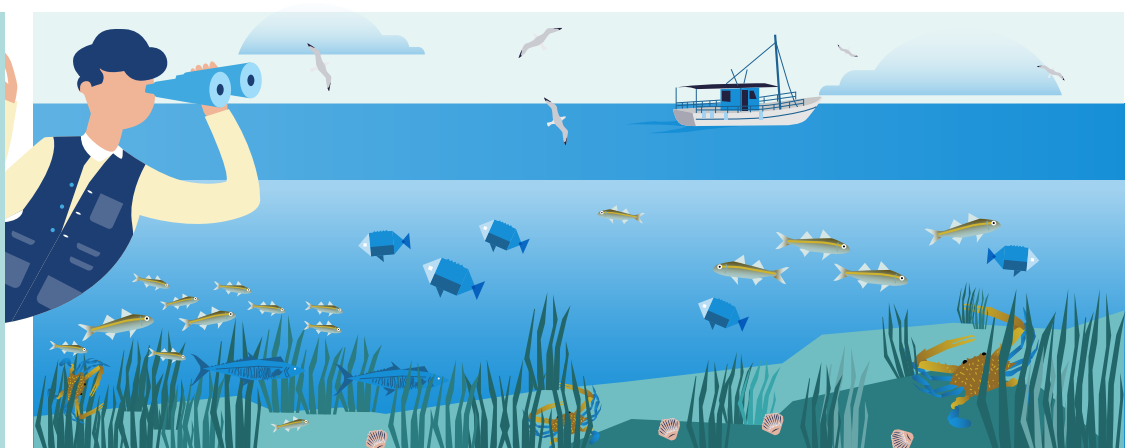


This surge of blue crabs in the Mediterranean Sea came as an unexpected event to humans and marine life, particularly in the Elounda Bay of Crete island in Greece.



Today, scientists are still studying why blue crabs like Mediterranean waters so much.

This is important so we can continue managing their populations and balance the needs of humans without destroying marine ecosystems!



5

**TIPPING POINTS: ONCE YOU FALL,
IT IS VERY HARD TO COME BACK UP**





This is exactly what happens when environmental conditions (friend 2)

take an ecosystem (the backpack)



to a tipping point (the cliff) where one environmental state (the gentle hill)

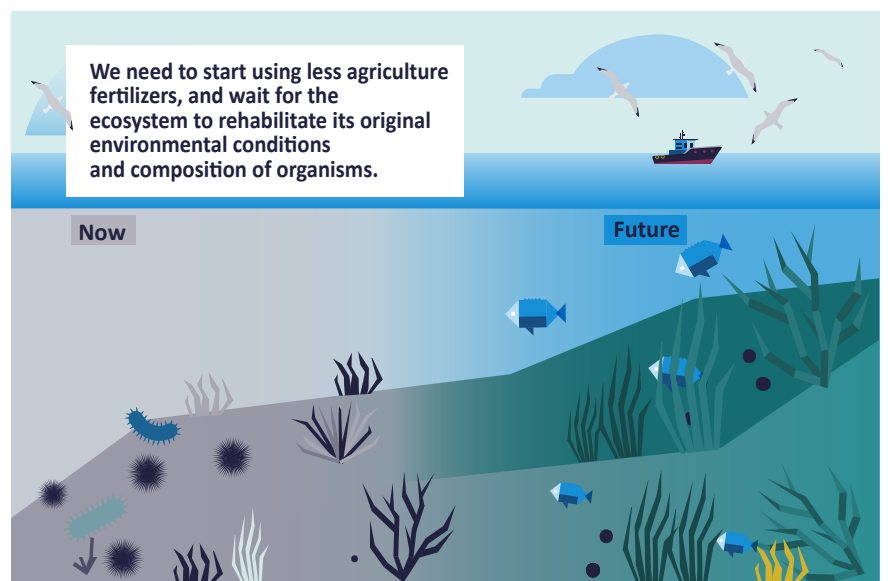
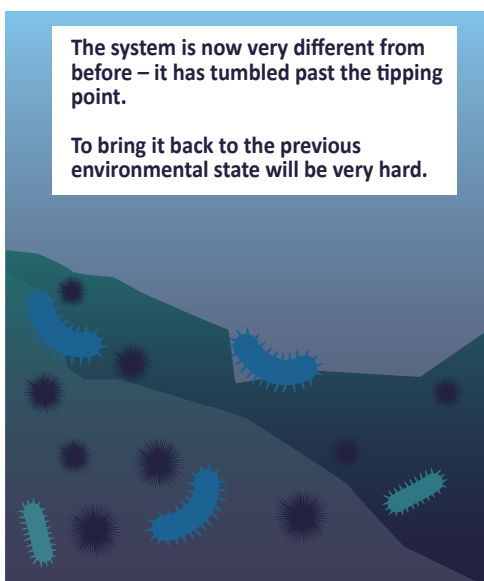
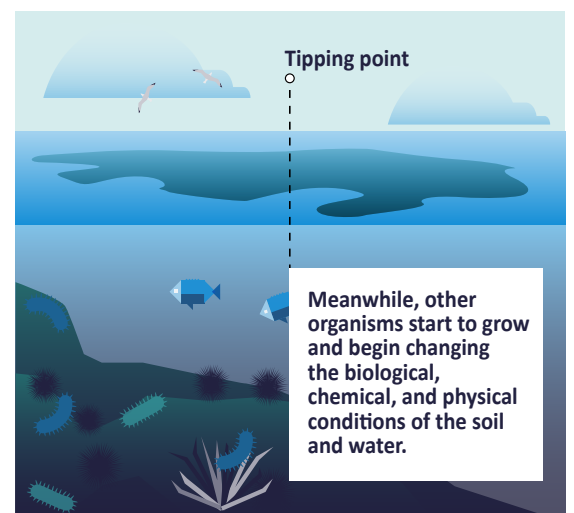
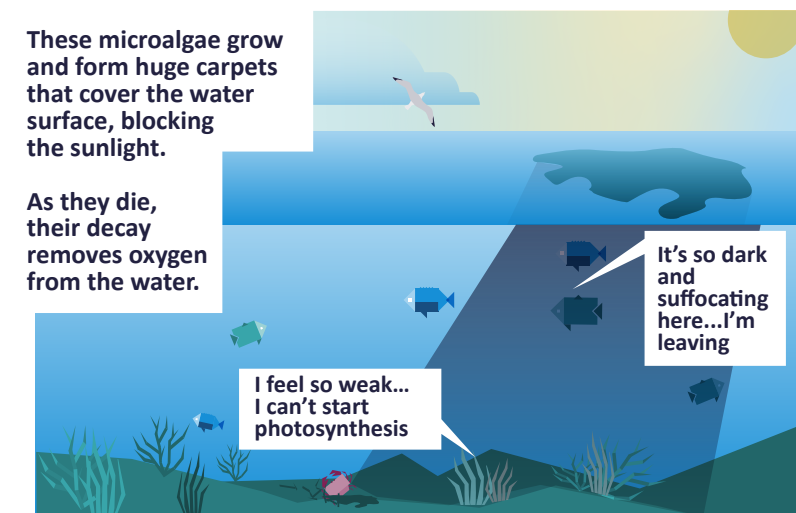
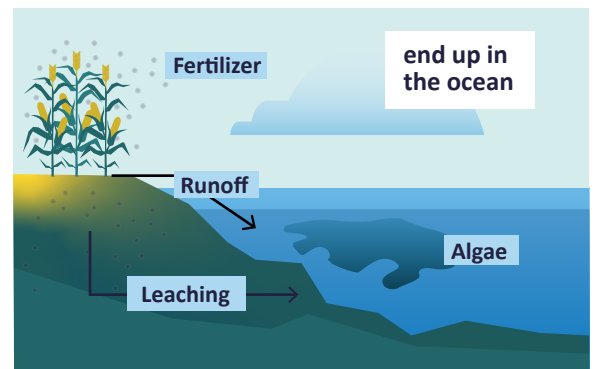
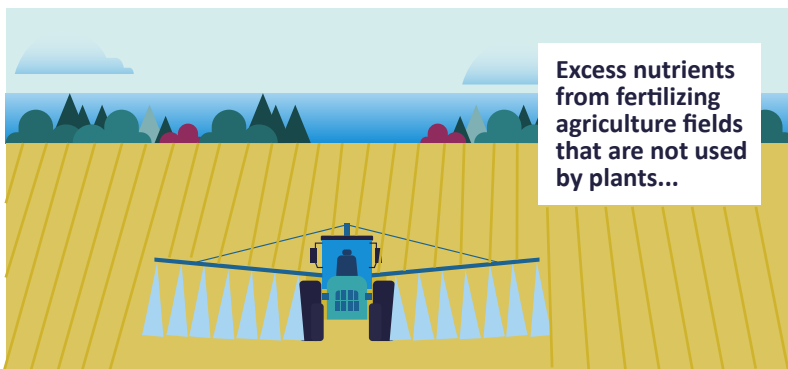


changes suddenly into a different environmental state; (the forest at the bottom)



It becomes very hard to take the backpack (ecosystem) back to the state it was before (the hill).

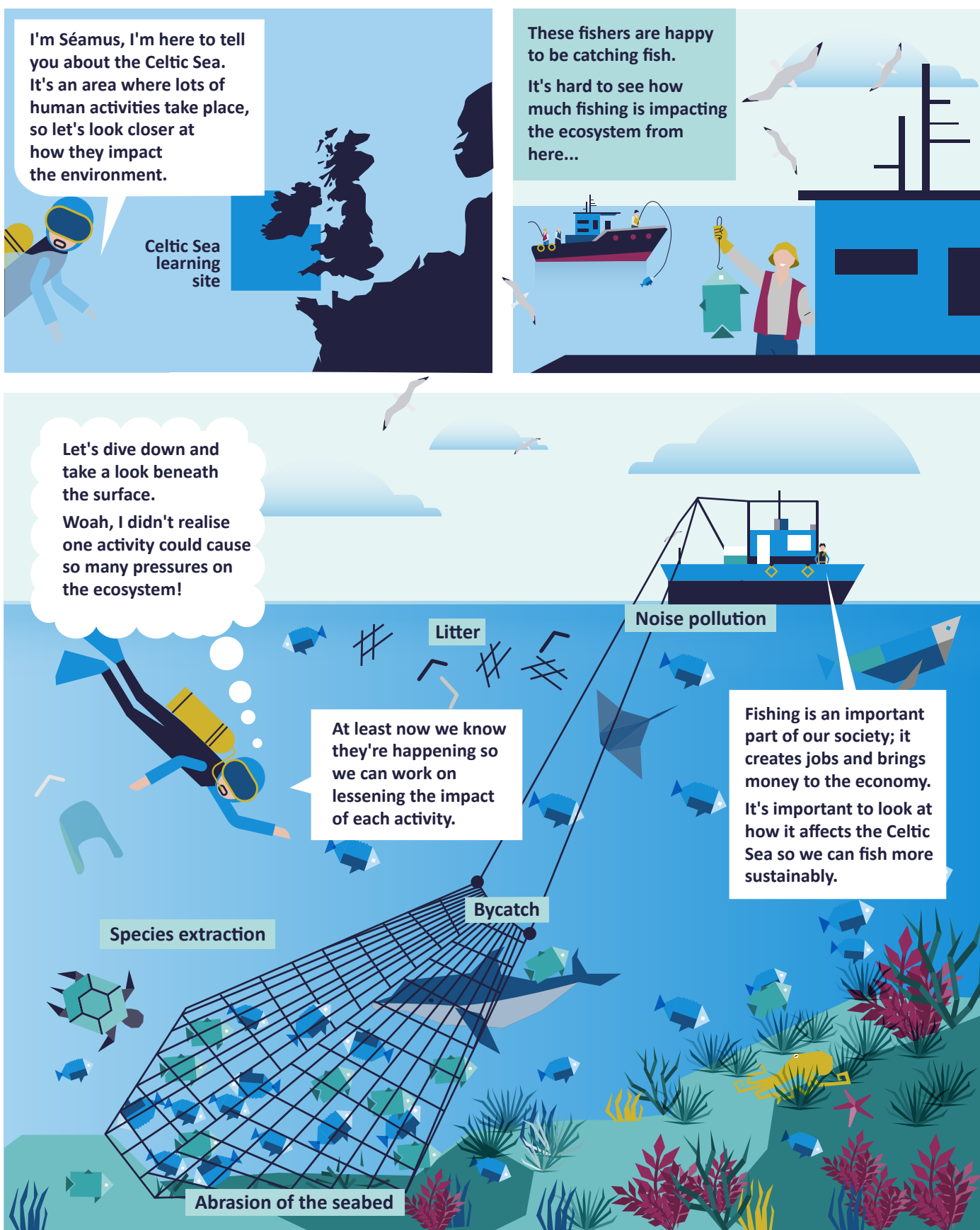
Now, let's look at how this happens in a real ecosystem in Denmark.



6

ECOSYSTEM BASED MANAGEMENT







Not so fast! Gráinne the scientist here. You're forgetting the bigger picture! There are many more human activities happening in the Celtic Sea than just fishing.



In EBM, we must look at the pressures on the ecosystem from all human activities, even those taking place on land, to get a full picture of how to minimise our impact on the ecosystem.



Ecosystem Based Management aims to balance sustainable development of human activities with protecting the biodiversity of our ecosystems.

Wow, I've learned a lot! I got caught up focusing on how to reduce the impacts of just one activity.



Glossary

Ecosystem Based Management (EBM): managing the whole ecosystem, including humans

Human Activities: something humans do that affects the environment, e.g. tourism, oil and gas, agriculture

Bycatch: accidentally catching something you're not fishing for (in the comic, the fishers are trying to catch fish but there is also a dolphin in the net)

Species Extraction: removing species from the environment, e.g. fishing

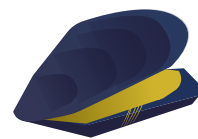
Pressure: stress that a human activity puts on the ecosystem, e.g. noise from drilling, abrasion from fishing

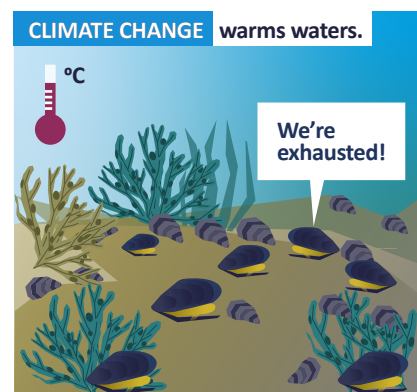
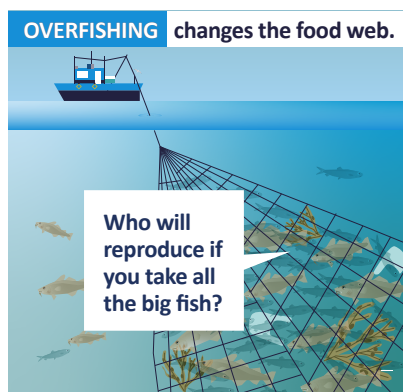
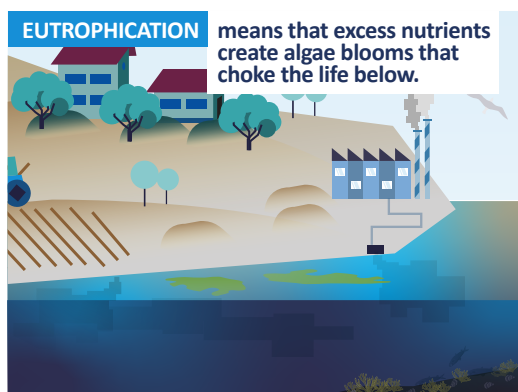
GES (Good Environmental Status): a clean, healthy and productive marine environment that can be used sustainably by current and future generations



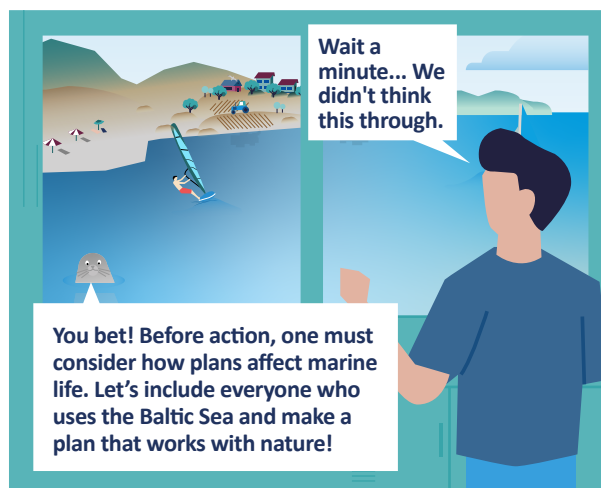
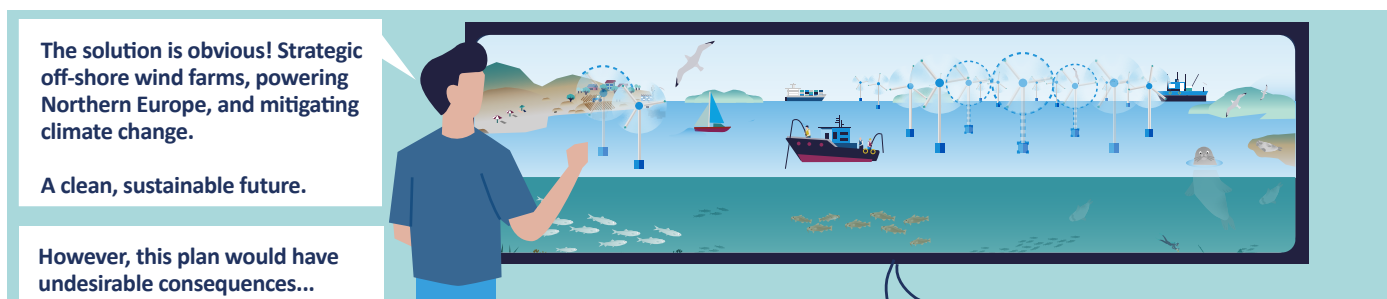
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**BALANCING THE BALTIC SEA -
ECOSYSTEM BASED MANAGEMENT
FOR PROMOTING BIODIVERSITY
AND SUPPORTING LIVELIHOODS**

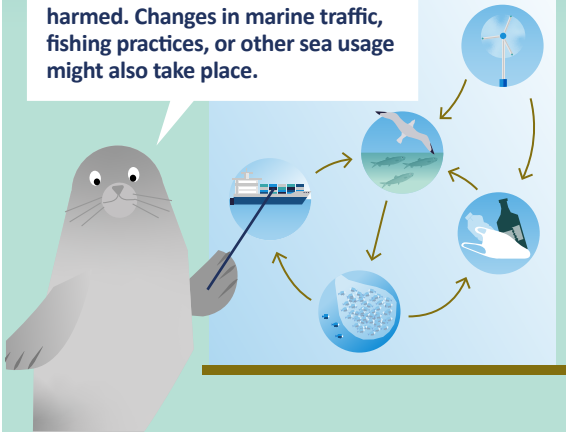




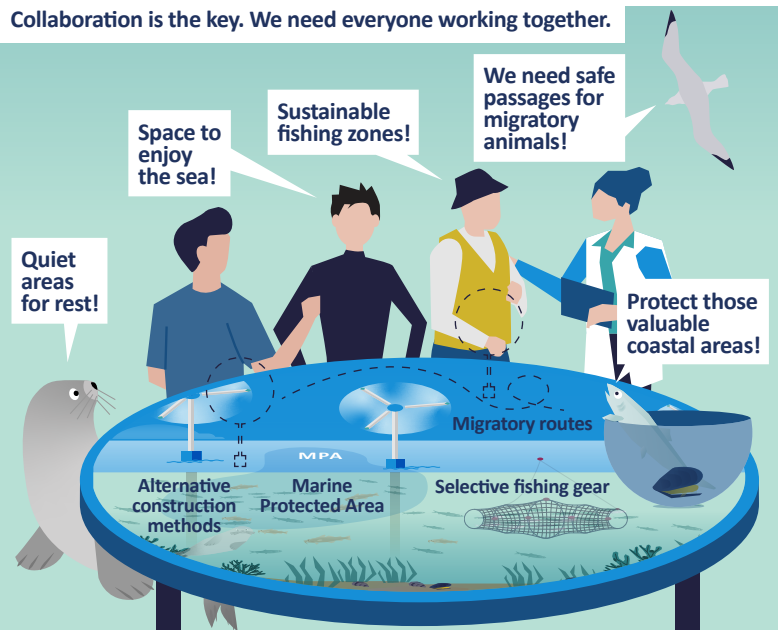
Efforts are being made to alleviate these impacts. Renewable energy, for example, is needed to mitigate climate change.



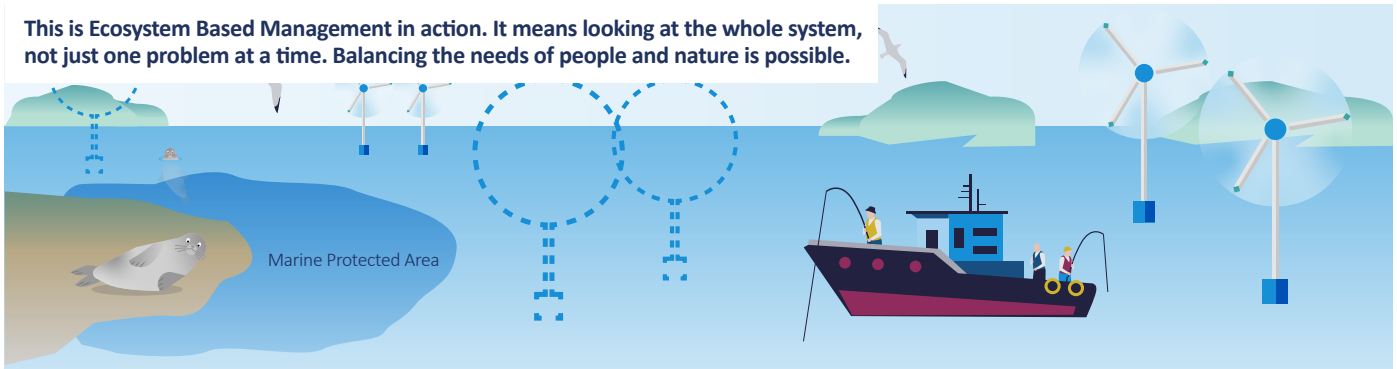
Everything is connected. One piece out of place affects everything else. When new activities like wind farms are planned, we need to consider what's already there and ensure marine life isn't harmed. Changes in marine traffic, fishing practices, or other sea usage might also take place.



Collaboration is the key. We need everyone working together.

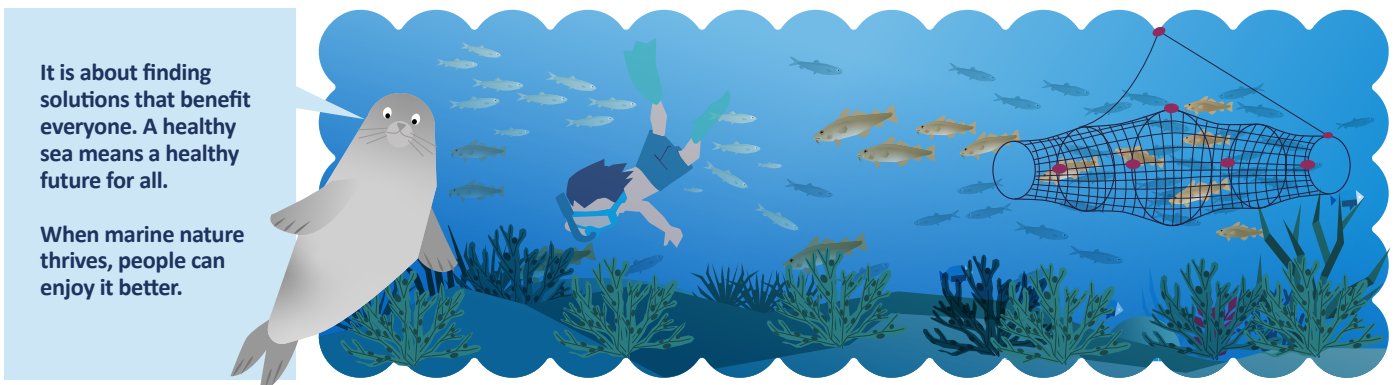


This is Ecosystem Based Management in action. It means looking at the whole system, not just one problem at a time. Balancing the needs of people and nature is possible.



It is about finding solutions that benefit everyone. A healthy sea means a healthy future for all.

When marine nature thrives, people can enjoy it better.



Even small actions add up — recycle, choose sustainable seafood, support clean energy, eat more plants, speak up, and help protect our Baltic Sea!

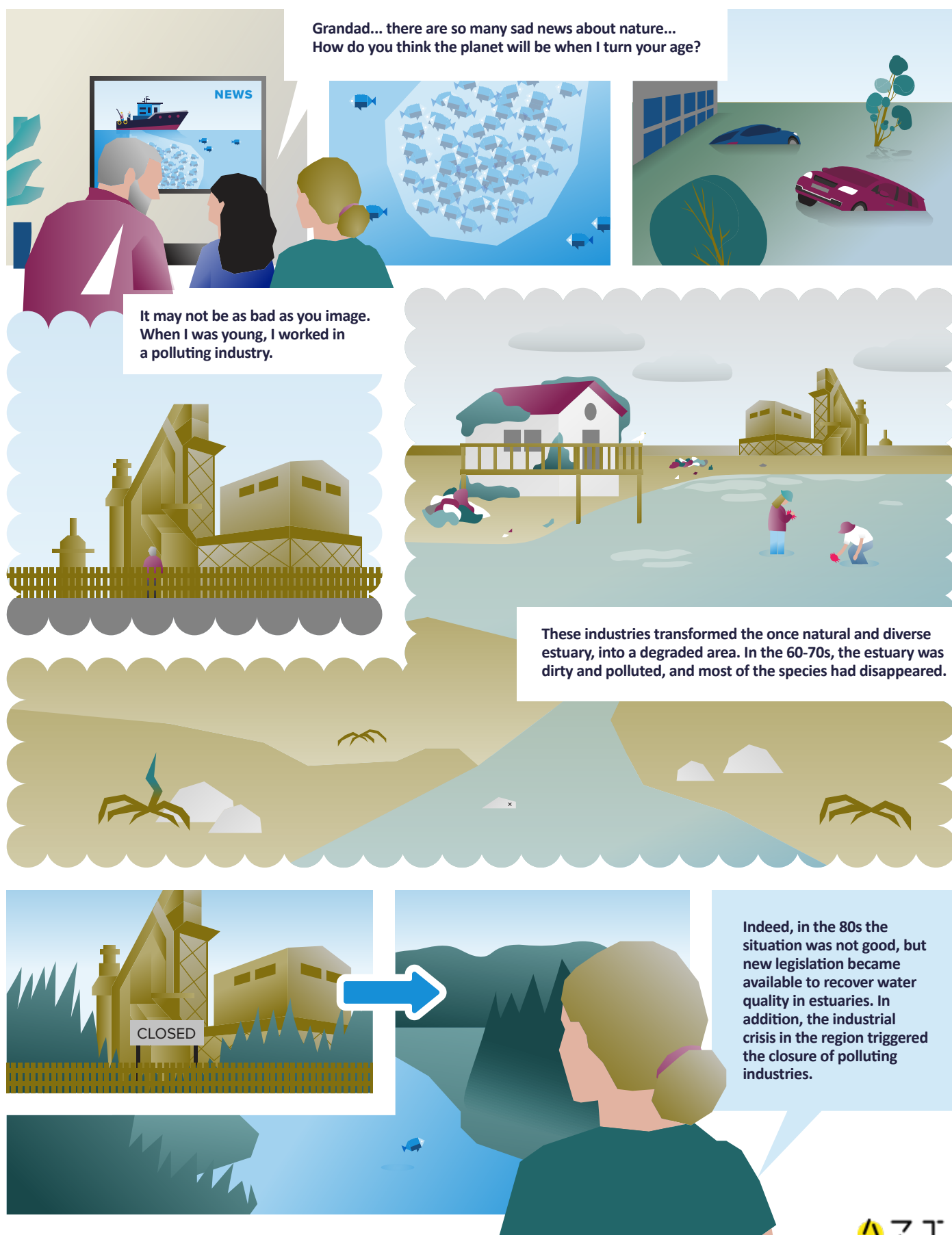
Let's build a better future together!

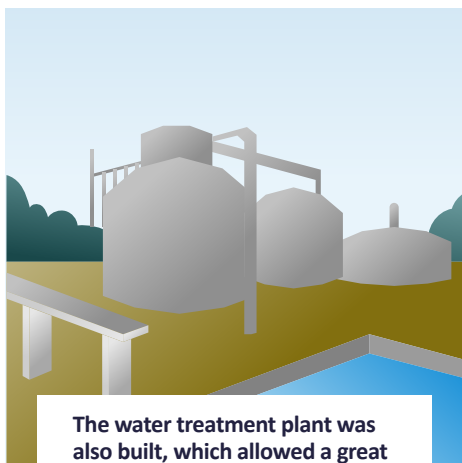


8

THE RECOVERY OF “BILBAO BLUE” COLOUR







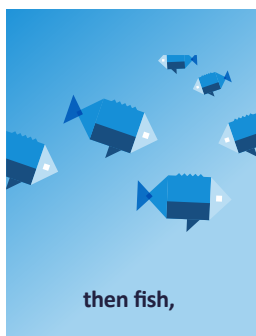
The water treatment plant was also built, which allowed a great improvement in the condition of the sediments and quality of water.



But your mum knows all about this better than me. She has been responsible for the environmental monitoring of the estuary for the last two decades.



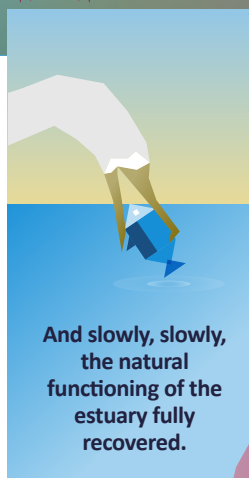
First invertebrates,



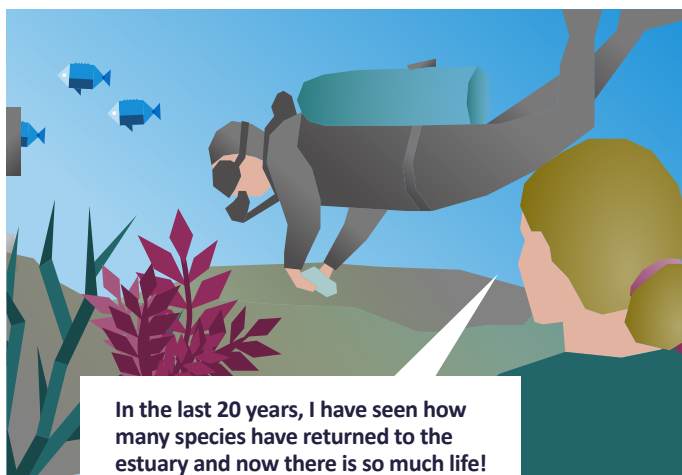
then fish,



birds, and even species that had long been disappeared.



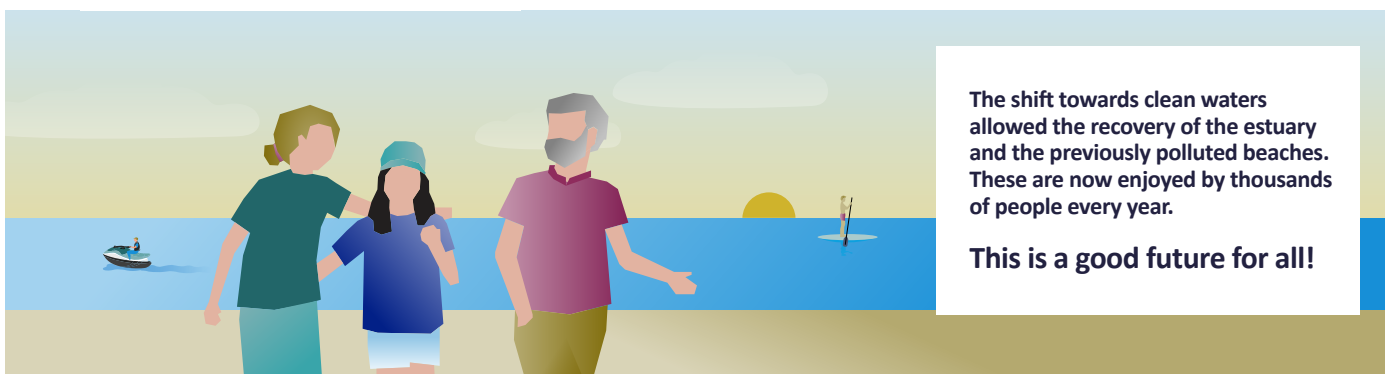
And slowly, slowly, the natural functioning of the estuary fully recovered.



In the last 20 years, I have seen how many species have returned to the estuary and now there is so much life!



Yes, my dear, dirty industries have been replaced by cultural and recreation opportunities. Even your dad works by the estuary, at the Guggenheim museum!

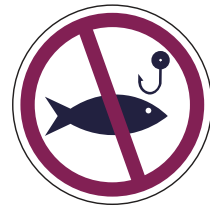


The shift towards clean waters allowed the recovery of the estuary and the previously polluted beaches. These are now enjoyed by thousands of people every year.

This is a good future for all!

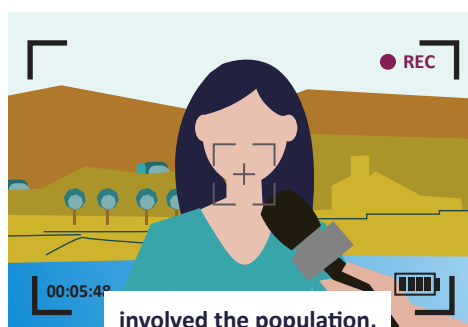
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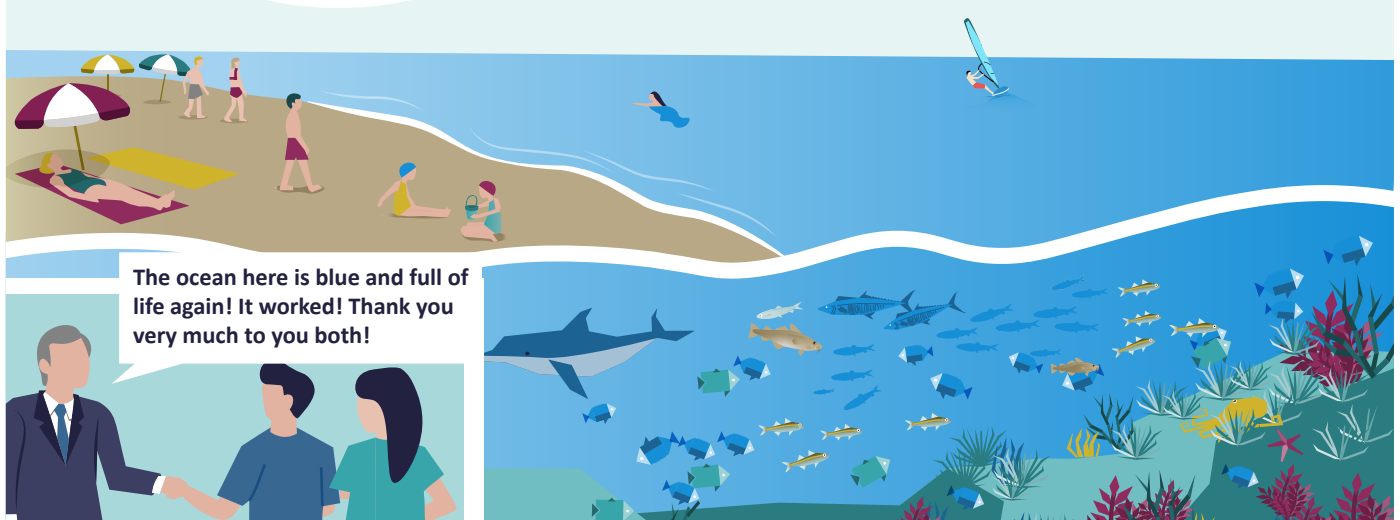
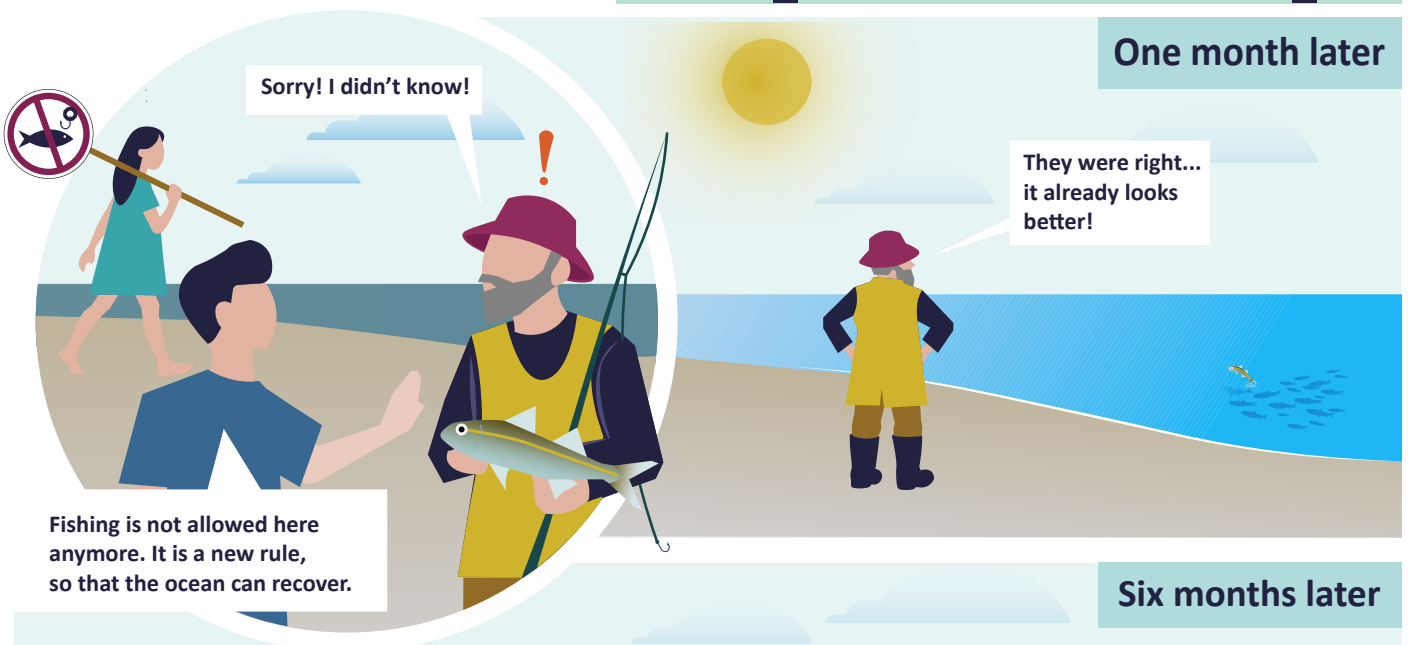
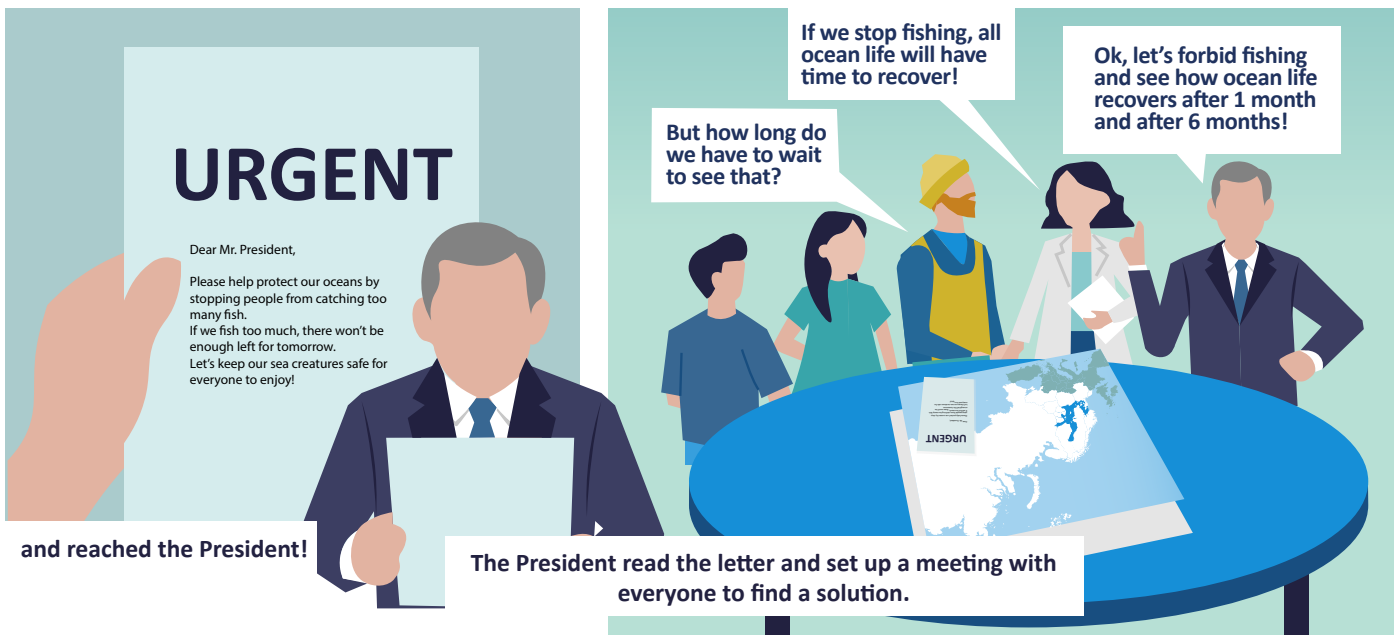
THE POWER OF THE OCEAN





Marine life keeps the ocean full of color, movement, and life.






10

WAVES OF OPTIMISM







And over to our weather presenter for the forecast...

GOOD NEWS Doom & Gloom raincloud · Doom & Gloom raincloud ·


Doom and Gloom raincloud




Over exploitation of species



Habitat and species damage



Climate change

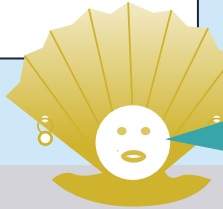



Marine litter

Well enough of that 'Doom & Gloom'. We know that European marine waters have their problems but there are many positive stories to share of Ocean Optimism

So here are our top 4 'good news' stories today

Going live to our first on the shore reporter **Pearl the native Oyster**






SCOTLAND
Firth of Forth
EDINBURGH

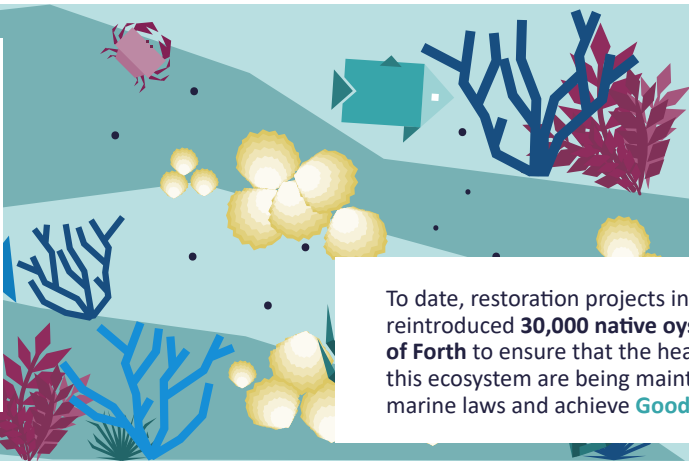
Good morning viewers. Here is a pearl of wisdom from the Firth of Forth Estuary in Scotland, UK.


Habitat Restoration



The Firth of Forth was once home to one of the largest native European oyster reefs.

But sadly due to overfishing a complete collapse of the reefs occurred, and by the beginning of the 1900s the oysters had been fished to local extinction!






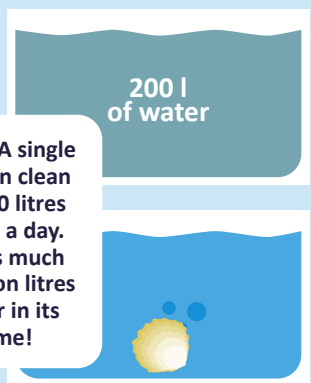
30,000

To date, restoration projects in the estuary have reintroduced **30,000 native oysters** around the **Firth of Forth** to ensure that the health and resilience of this ecosystem are being maintained in order to meet marine laws and achieve **Good Environmental Status (GES)**.

But we are not 'shellfish' enough to keep all the good restoration projects to this area. There are many other restoration projects in the UK and Europe wide to reestablish habitats and species in the marine environment

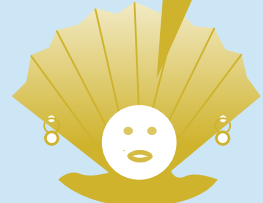


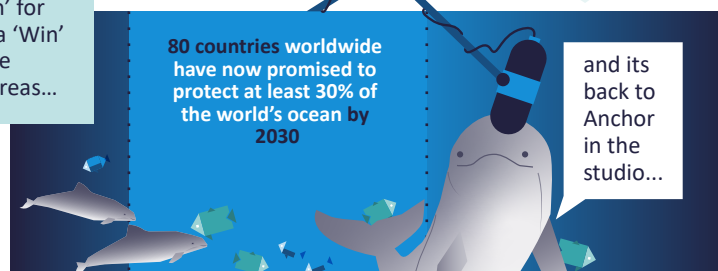
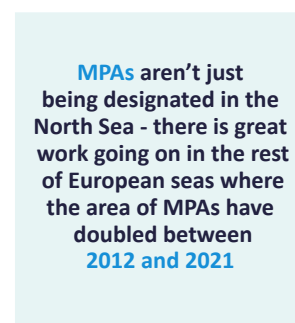
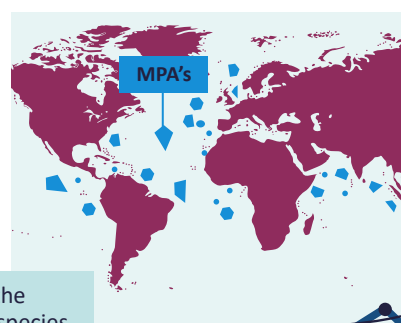
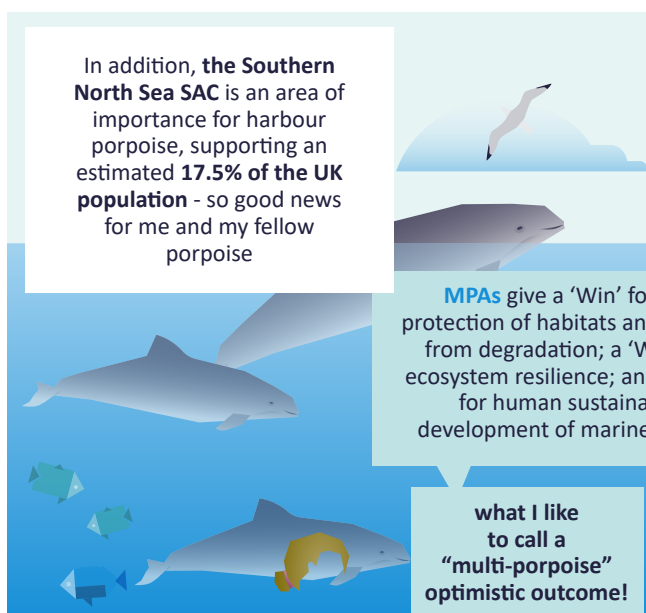
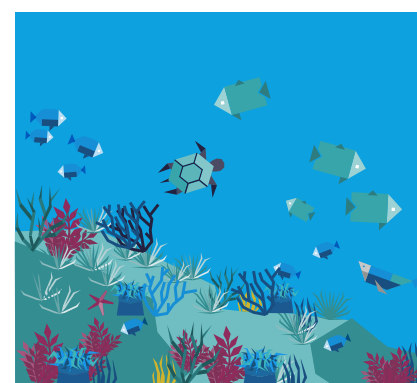
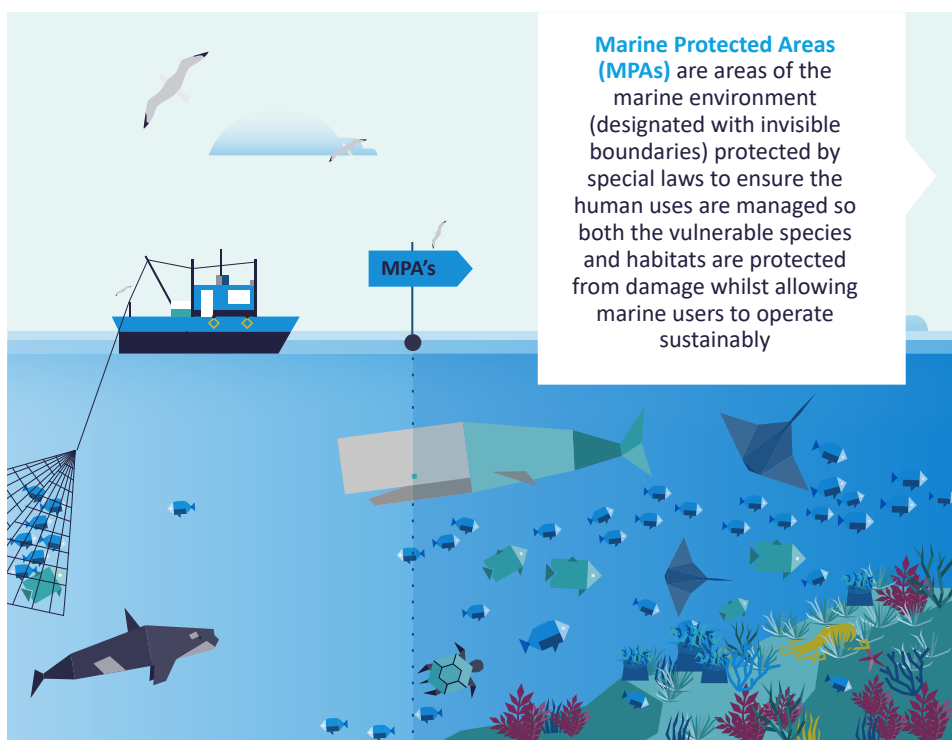
Fun fact: A single oyster can clean up to 200 litres of water a day. That's as much as a million litres of water in its lifetime!



200 l of water

Let's 'shell-ebrate' this good news! Back to the studio.....







I'm feeling lighter already.....so for our **3rd Good News story** we join our eye in the sky reporter **Cliff the Puffin** off the coast of **Flamborough Head, UK.**

GOOD NEWS renewable energy · renewable en




Renewable Energy

Good afternoon...I'm here reporting about offshore renewable energy which has a big role in the North Sea.



ONSHORE

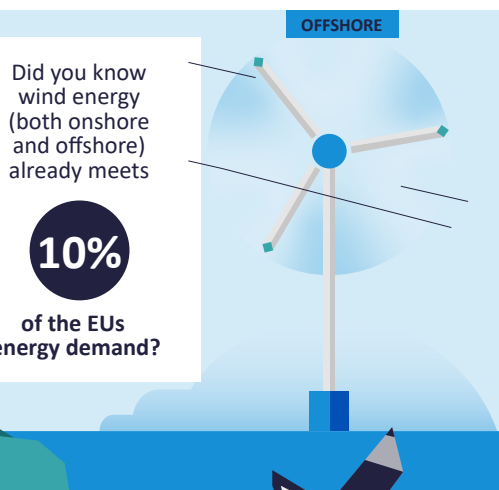


Did you know wind energy (both onshore and offshore) already meets


10%

of the EU's energy demand?

OFFSHORE



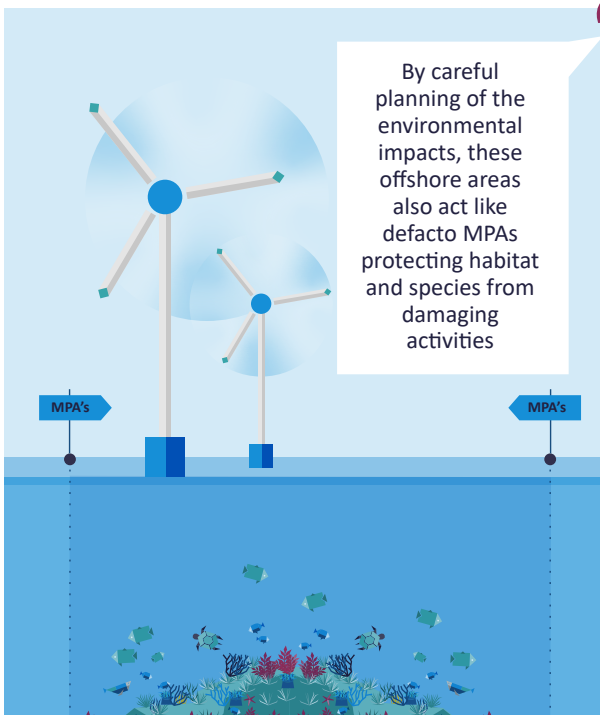
Many countries are now investing in offshore wind energy to meet net zero targets by 2030. By adding offshore wind to the UK's energy mix, we can shift towards clean energy and reduce our reliance on damaging fossil fuels which accelerate global warming and CO₂ emissions



The **NORTH SEA** provides

40%

of all offshore wind energy production in Europe



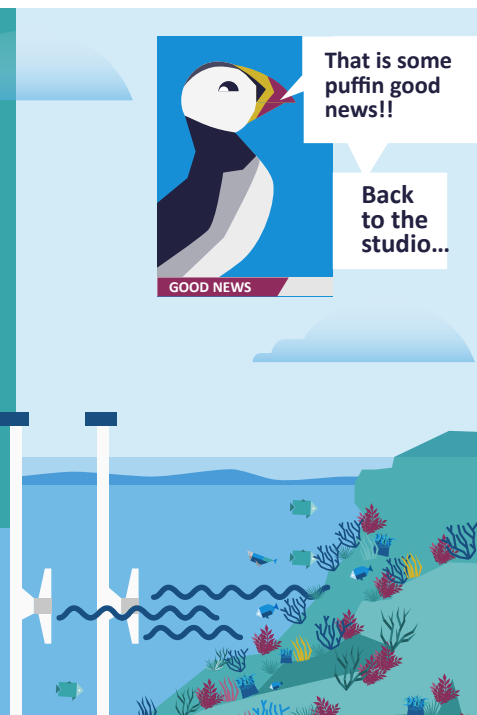
By careful planning of the environmental impacts, these offshore areas also act like defacto MPAs protecting habitat and species from damaging activities

MPA's

MPA's



With new technologies emerging which aim to harness the power of waves and tides, it is not just good news for the North Sea, but a good impact globally as we are contributing to the solutions and fight against climate change



That is some puffin good news!!

Back to the studio...

GOOD NEWS

I'm weighed down with all this good news... so for our final good news story of the day, we side step to Claudia the Crab in Norfolk, UK

Norfolk, UK

I'm reporting live from **Cromer beach in Norfolk, UK** where many volunteers are gathered to assist the organised beach cleanup to remove litter from our coastline

GOOD NEWS Marine Litter · ocean citizens · beach clean-up · Marine Litter

There are so many good initiatives around to clean up our shorelines from the good old-fashioned clean-ups to the invaluable monitoring carried out by volunteer citizen scientists

Technology also plays an increasingly important role in tackling this problem, including remote sensing using satellites and newly designed marine litter collection technologies helping to fix some of the damage already done

Laws and strategies are also being put in place such as the **MSFD and Single-Use Plastic Directive** to curb the problem

Marine Strategy Framework Directive (MSFD)

wet wipes containing plastic

Cotton buds

straws

microbeads

The EU has also implemented a total ban for single-use plastic items for example cotton buds, cutlery, plates, straws and drink stirrers.

The UK banned microbeads in 2017 and in newly proposed legislation, will ban the sale of wet wipes containing plastic

This is such good news you will have to pinch yourself!

There is so much evidence of people coming together to tackle the problems that face our marine environment.

Today's good news stories remind us that beneath the surface of our oceans is resilience and hope. So until next time, keep riding the waves of Ocean Optimism

GOOD NEWS resilience and hope beneath the ocean surface · ocean optimism · protect our seas ·

GES4SEAS



Horizon Europe Grant Agreement 101059877
U.K. Research and Innovation Project Reference
10040226

GES4SEAS project has been approved under
HORIZON-CL6-2021-BIODIV-01-04 call: "Assess
and predict integrated impacts of cumulative
direct and indirect stressors on coastal and
marine biodiversity, ecosystems and their
services".

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