FISHERIES MANAGEMENT

Children seeking to harness the treasures of the oceans

Educational Guide
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CHILDREN SEEKING TO HARNESS
THE TREASURES OF THE OCEANS
FISHERIES MANAGEMENT

An educational guide using a multidisciplinary approach to help children learn about integrated fisheries management in the South Western Indian Ocean region.
INTRODUCTION

The sustainable management of fishery resources is of strategic importance for the economy of the islands of the Indian Ocean Commission (IOC), neighbouring countries and those of the great lakes region in Africa. In fact, fishing is one of the major sources of revenue and a source of protein for a large proportion of the region’s population. However, concerns are increasingly being raised regarding stock depletion and illegal fishing. More than 10 million tonnes of fish of different species are caught in the region per annum, without taking into account wastage due to non-target catches, which are thrown back to sea and post-harvest losses.

The IOC is already implementing several programmes funded by the European Union, concerned with aquatic resource management and protection of the marine environment. However, to provide more coherence to these initiatives and to promote effective and sustainable management of the shared aquatic resources, a regional fishery and aquaculture strategy is being established. Twenty countries are participating in this project and have been engaged in an exercise to consider the future development of their fishery sectors. The aim of this exercise is to establish a sustainable fisheries management strategy for the region. The project is entitled, SmartFish. Students of SmartFish countries, together with their teachers, have been invited to participate in this project with a view to identifying problems associated with their aquatic environment and to propose short- and long-term solutions which will meet the needs of the population whilst preserving fish stocks.

This strategy takes into account the need to have access to pertinent and reliable data on species and ecosystems. This will enable the region to respond to the present incapacity to set up common management strategies and control measures to prevent illegal fishing and the loss of competitive advantages guaranteed by the preferential status of ACP countries. The main objectives of the programme aim to consolidate the traditional fishery sector; promote aquaculture to enable greater added value of catches and to strengthen the food security of the region.

Raising awareness of young people and civil society remains a priority to ensure the protection of aquatic ecosystems and to respond to the concept of sustainable development.

D. Gréboval
SmartFish Team Leader
# CONTENTS

**Introduction** ................................................................................................................................. 3  
**How to use this guide?** ..................................................................................................................... 6  
**Part I** .................................................................................................................................................. 11  
- The region .......................................................................................................................................... 12  
- The environment .............................................................................................................................. 18  
- Biodiversity ....................................................................................................................................... 25  
- Ecosystems .......................................................................................................................................... 29  
- The food chain ................................................................................................................................. 37  
- Threats (erosion, pollution, overfishing and bad practices) ........................................................... 43  
- Overfishing ....................................................................................................................................... 53  
**Part II** ................................................................................................................................................ 56  
- Fisheries Management principles ..................................................................................................... 57  
- Management of aquatic areas - fisheries zones ........................................................................... 63  
- Management of research activities - science and technology ..................................................... 71  
- Management of law enforcement .................................................................................................... 77  
- Management of the fishing gear ....................................................................................................... 82  
- Management of fisheries products ................................................................................................. 93  
- Management of food security ........................................................................................................ 108  
- Management of fishers .................................................................................................................. 115  

**List of Information Sheets**

**Exploring the aquatic environment in the region**
- Information sheet 1 : World map  
- Information sheet 2 : Map of the SmartFish region  
- Information sheet 3 : Climate change  

**Exploring the environment, biodiversity and ecosystems**
- Information sheet 4 : Lakes, swamps, estuaries, lagoons and coral reef environment.  
- Information sheet 5 : Coastal environments (wetlands, mangroves, and coastal forests)  
- Information sheet 6 : Deep water environment (high seas and lakes)  

**Exploring the species and the resources**
- Information sheet 7 : Fish  
- Information sheet 8 : Aquatic mammals  
- Information sheet 9 : Reptiles  
- Information sheet 10 : Molluscs  
- Information sheet 11 : Echinoderms  
- Information sheet 12 : Crustaceans  
- Information sheet 13 : Algae and coastal forests  
- Information sheet 14 : Aquatic birds  

**Understanding the food chain**
- Information sheet 15 : The food chain  
- Information sheet 16 : The story of a small seed  
- Information sheet 17 : Food poisoning  

**Threats to the ecosystems**
- Information sheet 18 : Erosion (the impact on the ecosystems and humans)  
- Information sheet 19 : Pollution (the threats to the environment and the species)  
- Information sheet 20 : Overfishing
Management of the aquatic environment - fishing zones

Information sheet 21 : Fishing zones
Information sheet 22 : Traditional management practices
Information sheet 23 : Fisheries management institutions

Management of fishing equipment

Information sheet 24 : Subsistence fishing gear
Information sheet 25 : Traditional fishing gear
Information sheet 26 : Industrial fishing gear

Management of fishery products

Information sheet 27 : From the sea to the market
Information sheet 28 : Good hygienic practices
Information sheet 29 : Traditional methods of preservation
Information sheet 30 : From the sea to the factory
Information sheet 31 : Marketing and traceability of the products

Food security management

Information sheet 32 : Seaweed culture
Information sheet 33 : The farming of sea cucumbers

Management of fishers

Information sheet 34 : The safety of fishers
Information sheet 35 : Alternative occupations for fishers for the protection of ecosystems

Integrated technical sheets

Technical sheet 1 : Experiment : the greenhouse effect
Technical sheet 2 : Experiment on water evaporation
Technical sheet 3 : Construction of a fish mobile
Technical sheet 4 : Experiment on erosion
Technical sheet 5 : Experiment on photosynthesis
Technical sheet 6 : Experiment on pollution
Technical sheet 7 : How to make fishing knots
Technical sheet 8 : Communicate in Morse Code and by semaphore
Technical sheet 9 : How to weave
Technical sheet 10 : How to write invisible messages
Technical sheet 11 : How to make “papier-maché”
Technical sheet 12 : Building a smoking room
Technical sheet 13 : Experiment with stem cutting

Annex : Technical sheets

Information sheet A1 : Fishing techniques and fishing gear
Information sheet A2 : Good fishing practices
Information sheet A3 : A project conducted by SmartFish: seasonal closure of octopus fishing in Rodrigues
Information sheet A4 : Who is fishing what?
Information sheet A5 : How to prepare an article for the press
How to use this educational guide?

Context

This educational guide has been produced under the framework of the SmartFish project, initiated by the Indian Ocean Commission (IOC) and funded by the European Union.

It follows on from two previous guides produced to raise awareness and enable a better understanding of Integrated Coastal Zone Management issues amongst youths.

To who this educational guide is for?

This educational tool has been designed for teachers and students of primary and secondary schools in the 20 countries involved in the SmartFish project. It is also useful for educators, trainers and NGOs working with fisheries and sustainable development.

The educational approach proposed in this guide addresses sustainable fisheries management, aimed at preserving and conserving marine and lake ecosystems.

What are the objectives of this educational guide?

This educational guide uses an integrated educational approach based on three learning principles namely:

- learning to know
- learning to be
- learning to do

The approach is quite flexible with regard to educational level and school environment. It can be applied to any academic theme including mathematics, science, arts, sports, etc. If properly implemented, it will help bring about appropriate educational outcomes that are in line with the national education context and the needs of the inhabitants, in a dynamic and convivial atmosphere.

Organisation chart

This guide puts forward a new way of learning that is motivating and warrants more reflection, imagination and creativity on behalf of the learner as well as the trainer. Students are gratified with a better quality of learning and additionally learn to derive pleasure from any work they undertake in real life situations.

However, one should keep in mind that this is an educational guide for teachers and trainers working with boys and girls between the ages of 10 and 14 years. Teachers and trainers are free to adapt the material to their personal teaching style.

The educational approach adopted in this guide enables young learners to discover more about fisheries, to identify associated problems and to come up with alternative solutions for sustainable fishing without destroying the planet. The teacher/trainer is responsible for leading the learning process, and should be attentive to the attitudes adopted by individual students and to group dynamics and should organise activities in such a way as to encourage students to take on responsibilities, develop strategies and defend their opinions.

The SmartFish Programme encourages the creation of future projects based on activities at both local and regional levels. An end-of-year project - nurtured throughout the learning programme - is both an assessment of the learning outcomes and a way for students to share their acquired knowledge with their parents and the public.
Countries participating in the project

(See information sheet 4 and student sheet)

Key messages

• Our future depends on the proper management of our aquatic resources.
• Everyone can contribute to the sustainable management of these resources.
• Everyone can carry out simple experiments to enrich our knowledge of our environment.
• Everyone can participate and contribute fruitfully in community projects.

How this guide is structured?

This guide is made up of a teacher’s manual and a student workbook.

The teacher’s manual is made up of two parts:
1. The first part focuses on the acquisition of knowledge about the resources that are being exploited. Support is given in the form of information sheets that focus on the study of the natural environment and biodiversity.
2. The second part deals with fisheries management. The second part should be used once the first part has been completed. A sound knowledge of the nature of resources, as well as those factors threatening them and their environment, is necessary for effective management. This part also enables students to explore the various components that fall under fisheries management (technical, scientific, administrative, legal, commercial and human).

The teacher’s manual is accompanied by educational material in the form of information and technical worksheets.

The student’s workbook should be used as support material. It allows students to visualise and understand notions of biodiversity, ecosystems, fishing techniques and the administrative and legal aspects of fisheries. The worksheets also deal with fisheries products, hygiene and public health, the marketing and traceability of exploited resources, as well as the integrated management of both resources and fishers.
Advice for teachers

Along with the traditional expository teaching, it is important to introduce a strategy where students have recourse to their senses. Light-hearted teaching motivates students to learn and achieves better results. Teachers should capitalise on a child’s natural curiosity to learn without being forced to do so. This can be achieved by using a light-hearted approach: just for fun.

Open discussions: each child should be allowed to express his/her opinion, should listen to others and wait for his/her turn to talk.

Vocabulary: new words should be explained to students.

Lesson Structure

**THEMATIC ICON**

Setting the scene: at the beginning of each lesson there is a short text that the teacher can use as to introduce the subject to be addressed.

**INFORMATION ICON**

Case study: information about the sea or a short story which introduces the lesson (listen, read, understand, report). The information is usually based on real events.

**CHALLENGE ICON**

Presentation: the students share and discuss the information and highlight its accuracy through oral presentations, written documents, group drawings, etc.

**FIND IT OUT ICON**

Observation and investigation for learning: alone or in groups, students collect data and information for analysis in the classroom. These surveys are extremely motivating as they help the students to acquire first-hand information about the environment through group initiatives, where teamwork is essential. This learning process also emphasises the need to politely ask the right questions, in order to understand and learn from the information sheets whilst working as a group.
Activities: outdoor games and manual and artistic activities strengthen the students’ physical development and indirectly enhance understanding.

**DISCOVERY ICON**

Experiments: students carry out simple experiments and discover different scientific concepts through fun activities. These experiments and games enhance the sharing of ideas in a relaxed atmosphere. Mr Joker also presents his crazy ideas.

**ACTIVITY ICON**

**DID YOU KNOW? ICON**

New vocabulary and increased knowledge: at the end of each lesson there is a list of words that the students will have heard. The written work is based on the concepts of the new vocabulary in order to facilitate learning and encourage students to re-use certain words in future activities.

**FUTURE PERSPECTIVES ICON**

Conclusion: the lesson ends with a conclusion and a look at future perspectives.

**THREATS AND OPPORTUNITIES ICON**

In this section threats are identified and alternative solutions proposed.
Part one:

- The region
- The environment
- Biodiversity
- Ecosystems
- The food chain
- Threats (erosion, pollution, overfishing and bad practices)
- Overfishing
Greater knowledge for better management

Discovering more about the aquatic environment in the region

For the sustainable management of aquatic resources, countries participating in the SMARTFISH project should collaborate to develop the best strategies for sustainable fisheries in the region.
Setting the scene

Try to imitate the sounds of the sea (e.g. waves on the beach when the sea is calm, on the reef or on the rocks when it is stormy). Imitate the waves, fish, boats, etc. with body movements.

The main message

A planet devoid of fish is an issue that should be of great concern to everyone and to the youths in particular. Overfishing, together with pollution and climate change, may bring about the extinction of certain aquatic species which are presently being exploited. How will the population feed themselves?

What could happen and how would it happen?

You children who are the adults of tomorrow, will you stay helpless in the face of such a disaster?

Discussion

Free discussion on the content of the message (each student expresses his opinion, listens to others, allows time for questions and answers and respects the right to speak and the right to listen).

It is a good idea for students to participate in the management of local fisheries together with adults. The SmartFish programme enables young people to understand and appreciate the work undertaken by fisheries experts around the world. These experts are working on sustainable exploitation and the preservation of aquatic resources in lakes and oceans to ensure better management of the global food crisis.

What do the students think? Are they concerned about such issues? Initiate a discussion with the students on the need to look at the management of fisheries at the local level.

Group work

Distribute the educational material to the students and give them sufficient time to read it.

Ask the students what they think about what they have just read (subject, content, vocabulary: are the issues appealing? Is it interesting? etc.) The teacher should take notes to evaluate the students’ level of understanding.
**Write a letter**

Write a letter - through the school director - to the appropriate authorities, to inform them of your study project on fisheries management and request permission to carry out some activities such as putting up posters. The students should take the lead and put forward the content of the letter to the teacher. Once written, they should all sign it.

**Spelling**

Write a letter using the model above as a template. The best letter should be sent and the other letters put up on the classroom wall.

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**Mathematical game: Toto’s head**

Using the equation $0+0=0$, draw your portrait and stick it on your identity card.

---

**Thoughts**

What can we do to ensure that the fishery resources will always be available in our region and that we can continue to catch fish for food?

Example:
- Raise awareness for the protection of turtles;
- Carry out an advocacy campaign using posters addressed to the public;
- Help an association of women fishers;
- Create a club for the protection of the aquatic environment;
- Plan an end-of-year exhibition.

---

**Fill in the identity card**

- First name
- Last name
- Age
- Phone number
- Address
- Country
- School
- Class
- Distance from the school to the sea or the lake

---

**0 + 0 = **
**Comprehension**

**Group work - once a group has finished one activity they should move onto the next.**

1. **G1** Write down a list of other words that have the same meaning as ‘manage’.

2. **G2** Set up a role play to illustrate the dialogue between Diego and his father.

3. **G3** Write down how you would answer Diego’s father’s questions. (allow students to answer spontaneously depending on their knowledge level)

**News from the sea**

To pass the time and to enable him to stretch out his legs, Christopher Columbus took his son, Diego, along with him on his mule.

- Diego, explain to me who the ‘customs’ are.
- How do we draw up a budget?
- Father, don’t you think that I am a bit too young to learn all of this?
- On the contrary, my son. I realise now that I started too late. On the routes that I am opening up towards the west, I will discover new territories and I will give you the responsibility of managing them.
- Father, what does ‘manage’ mean?
- You see my son, there’s no time to waste. You lack so much knowledge to become a good manager of the environment and fishery resources.

While trying to find an adequate response, the poor child looked around for someone to come to his rescue.

While trying to respond, the poor child was looking for someone to come to his rescue.

Source: An extract from L’entreprise des Indes, by E. Oresna, a story about Christopher Columbus pp 265-266.

**Discussion**

(Go over the different notions of time: seconds, minutes, hours, days, weeks, months, years, centuries. Ask different questions to elicit answers related to time.)

**Example** : Christopher Columbus was an explorer who discovered America in 1492. How many years ago was this?

**Mr Joker asks himself some questions.**

Like Shakespeare, Mr Joker asks himself: “to fish or not to fish; that is the question!”. Design a tee-shirt that Mr Joker can use when he goes fishing.
Did you know?
In many countries, a fish is the symbol of happiness and wealth. In Poland, for example, it is traditional for all debts to be paid before the 31st of December and then two or three scales are collected from a fish eaten on New Year’s day. These scales are placed in your purse with the hope that money will flow in throughout the year. In Japan, it is thought that removing the backbone of a fish whilst eating it (lifting the tail and pulling it above the head of the fish), may lead to financial setbacks. Therefore, it is better to just turn the fish over on the plate. Do you have any similar traditions concerning fish in your country?

Discovery
Find out the name of a fisheries management project similar to “SmartFish” in your region. Was the project set up by the government, an NGO, or the village? How does the project aim to help fishers and fisheries in general?

Comprehension
Divide the class into three groups and distribute worksheet/information sheet 1, 2 and 3. Each group will work on a different worksheet. (This exercise is aimed at assessing the students’ level of geography.)

Did you know?
Hot and cold water currents circulate continuously throughout the oceans. However, during certain years, these currents travel in the opposite direction. This is a natural oceanic phenomenon that occurs in the Pacific Ocean and is known as El Niño. El Niño has disastrous consequences for fishers of anchovies.
Technical sheet 1: Experiment: The greenhouse effect

What is a greenhouse?
A greenhouse is a glass structure that provides a lot of light. The glass retains heat from the sun. Greenhouses are good for growing plants or vegetables during the winter.

How does it work?

Experiment:
Take two similar glasses containing the same amount of ice. Place both glasses in direct sunlight and cover one of them with a large transparent bowl. You will notice that in the open air, heat is lost and the ice melts slowly. However, the ice in the glass under the bowl melts more rapidly because the heat is trapped under the bowl. This phenomenon is known as the greenhouse effect.

Vocabulary
Aquatic, manage, customs, budget, territory, fisheries, environment

Select one of these words and illustrate it.
Finding out more about the environment

ONE MUST LEARN TO OBSERVE WHAT IS HAPPENING IN THE ENVIRONMENT TO BE ABLE TO APPRECIATE AND PROTECT IT.
The main message

It is important to have a good knowledge of species and ecosystem in which they live to be able to protect them and avoid their depletion.

Think of a species that is currently being exploited in your country and ask the students what they already know about it: its habitat, food, life cycle, the way it is cooked or preserved, etc. Assess the students’ general knowledge.

Learning from nature

The image hunter jumps out of bed early in the morning with his mind cool and fresh. His eyes, like a fishing net, capture the images he sees all around. The first image that he captures is the path from his house to the town. He then takes a picture of the river which shimmers as a fish displays its silvery body. Further along, he discovers the meadows and pastures where the rivers flow and the birds sing. He then goes into the woods where he talks to the trees through the veins of the leaves. He is somewhat scared and follows at a distance when he sees the farmers taking their herds to pasture. At the end of the road, he admires the sun and the clouds in the sky. Finally, back home and before going to sleep, he goes over the beautiful pictures that he has captured as if he was a great photographer.

Setting the scene

Pronunciation exercise: ask the students to say the names of the oceans out loud and compare with them with other words which sound similar. The aim of this exercise is to get the students to listen carefully, to repeat precisely and to spell the words properly. (This exercise can be done each time new words are introduced to strengthen understanding and increase vocabulary.)

Example:

**Ocean:** Asian, motion, nation, notion, potion, commotion

**Indian:** Canadian, Mauritian, Malaysian, Cyprian, meridian

**Artic:** tactic, artist, oceanic, carpet, garbage, market

**Pacific:** horrific, terrific, prolific, scientific, Olympic

**Antartic:** started, target, Atlantic, departed

Outdoor game

Divide the class into two groups. One group represents the countries with an oceanic coast and the other group represents those countries that border lakes. The two groups will carry out a tug-of-war. Any country that has both an oceanic coast and bordering a lake will act as the referee.
Comprehension

(To help the student to realise that the road, the woods, the pastures, the fields, the shepherds and the animals constitute different ecosystems)

What has the image hunter done? What was he looking for? Was he a real photographer? Where was he keeping the images? Does he like the place where he lives?

Group work

(as a group) - Draw the route taken by the image hunter and write all the things that he saw beneath the drawing.

(individually) - Ask the students to close their eyes for a moment and visualise what they think would be an ideal environment. Each student should then describe what he imagined in a short essay.

Ask the students to close their eyes, and imagine that they are a fish, doing all the things that fish do: eating, sleeping and moving around like a fish.
The Environment

The environment can refer to the place where we live. It can mean a family, a school, a rural, urban and terrestrial or a marine environment.

Through questioning, help the students arrive at the definition of the following: a village, a forest, a lagoon, a lake, a wetland, an ocean, etc.

Examples:

• A village is made up of houses, roads, gardens, fountains, shops, etc.
• A forest is made up of trees and other plants, animals including birds, snakes, insects, earthworms, etc.
• The lagoon and the ocean contain fish, algae, marine mammals, corals, turtles, etc.
• Wetlands and lakes contain fish, aquatic plants, crocodiles, and birds such as flamingos, etc.
Discovery

Divide the class into three groups and give one information sheet to each group.

Ask the students to look at the picture, silently read the text on the back and then answer the questions in writing.

Experimental discovery

Divide the class into three groups:

G1

Allow the students to taste some fresh water and some salt water and compare the two.

G2

Set up two bottles, one with fresh water, the other salt water. Drop an object (a seed or an egg) into each of the bottles at the same time and observe the rate at which the objects sink to the bottom.

G3

Carry out the experiment on evaporation according to the technical sheet. Use the experiments to introduce the subject of climate change and its affects on the environment.

Technical sheets

4 Lakes, swamps, estuaries, lagoons and coral reef environments

5 Coastal environments

6 Deep-water environments (high seas and lakes)
Technical sheet 2: Experiments: water evaporation

Experiment 1:
Pour some water into a container. Cover it with a glass lid and place it in direct sunlight. After some time, the glass lid eventually becomes covered inside by a mist. This is due to the processes of evaporation and condensation. Remove the glass lid and place it in a cool place for a few minutes. The mist eventually condenses and if the glass lid is tilted, water droplets will flow.

Experiment 2:
Place some water in a metal container and heat it on a flame. As the water gets warmer, steam starts to rise and the amount of water diminishes as a result of evaporation. If a lid is placed on the container, a mist will form on the lid. This phenomenon is known as condensation. When the lid cools down, water will run off it. This is also known as precipitation, which is the same as rain.

Experiment 3:
Fill a small container with tap water. Fill another container with the same amount of sea water. Place both containers in direct sunlight or heat them on a flame. When all the water has evaporated, traces of salt can be found in the container that had the sea water in.
**Word play**

Match the following words. Which word on the left is connected with a word on the right? Join the words that go together with an arrow.

<table>
<thead>
<tr>
<th>Desert</th>
<th>Islander</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea</td>
<td>Mountainous</td>
</tr>
<tr>
<td>Island</td>
<td>Polar</td>
</tr>
<tr>
<td>Gold</td>
<td>Urban</td>
</tr>
<tr>
<td>Mountain</td>
<td>Lunar</td>
</tr>
<tr>
<td>Pole</td>
<td>Barren</td>
</tr>
<tr>
<td>Town</td>
<td>Gold Ore</td>
</tr>
<tr>
<td>Moon</td>
<td>Maritime</td>
</tr>
</tbody>
</table>

**Art project**

In preparation for the end-of-year project, turn the students into town planners. Ask the students to draw a plan of a coastal village highlighting the buildings with arrows. Get them to organise the village in a manner that promotes sustainable management (include features such as: solar cookers, wind turbines, waste management facilities, compost areas, rainwater harvesting, water-saving features, etc.)

**Outdoor game**

Draw three concentric circles of 1m, 2m and 3m diameter on the ground to represent the beach, the lagoon and the high seas. Shout out the name of a resource and ask a student should throw a small stone in the circle that represents the environment where the resource can be found. Example: crabs, on the beach, whales in the high seas, etc.

**Practical activity**

Find out which directions indicate North, South, East and West and set up a simple sundial. Place a pole in the ground and mark the position of the shadow in the morning and at noon. Note the time on the ground. (Different groups could note a different time of the day.)

**Vocabulary**

Environment, insular, urban, lakeside, veins, contemplate, barren, maritime
3 Discovering more about biodiversity

If biodiversity is threatened, your life will also be threatened as you are part of this biodiversity.
Setting the scene

Poems and nursery rhymes

With fish I swim, with fish I do,
With schools of fish in oceans blue,
They let me swim these fish schools do,
As one of them a fish in school

One, two, three, four, five, once I caught a fish alive; six, seven eight, nine, ten, then I let it go again; why did you let it go? Because it bit my finger so. Which finger did it bite? This little finger on the right.

The main message

When we carefully look at the natural features of the environment around us, we see that there are thousands of living creatures. There is a huge variety of plants and animals including mammals, reptiles, molluscs, fish, birds and insects. All the plants and animals species that live in a region or on the planet make up the earth’s biodiversity.
Learning from nature

A long time ago, in 1882, a small boy called Charles Darwin was born in England. He did not like going to school: he preferred instead to catch and collect kinds of insects. He also liked to going fishing, and wonder about looking at everything in nature. There are so many things to look at! Nevertheless, he managed to learn to read and was fascinated by one particular book entitled “The wonders of nature”. This book was well illustrated, with pictures from faraway places, plants and animals that he had never seen before and of which he dreamed to discover. When he was older, his father allowed him to embark on a ship, the Beagle, on which he made several stopovers in the southern hemisphere: he even got off in Madagascar and Mauritius. He took notes of every living thing that he came across (that is, the biodiversity of these countries). He compared the living things he discovered overseas with those living from home and wondered why some species had disappeared.

Comprehension

How about you? Are you part of the biodiversity? Are you alive? How do you know? (you breathe, you eat, you grow, you can reproduce). Do you look like your friends? (you are a human being) Do you look like a bird or a flower or a fish or a spider?

Did you know?

- There are about one million species of insects in the world. Every year, more species are discovered. Likewise, more than 32,000 species of fish have also been found. There are many more to be discovered: they live in the depths of the oceans, which have not been explored yet.

- The dragonfly lays its eggs in the water of lakes and marshes. As they grow, the larvae come closer to the surface of the water; then they moult and cling on to an aquatic plant. When the small dragonfly eventually emerges at the surface, it flies away to catch and feed on the mosquitoes that live on the riverbanks.

- The water boatman is an insect that glides on the surface of the water. It has a special breathing tube that looks like a snorkel.

Vocabulary

Remember that in the word aquatic we have ‘aqua’ which means water. In the word biodiversity we have ‘bio’ which means living and ‘diversity’ which means a large variety. Biodiversity therefore means a large variety of living things.
Field study

Like Darwin, carry out a field study. Choose a location, in the school yard, near a hedge, a river bank or the water’s edge. Observe and write down the things you see. Make a list of all the living things. Describe those living things that you have never seen before. Put all the new discoveries together on one list.

Drawing exercise

Draw a picture of a colony of ants walking around. To make it easier, each ant can be drawn like the figure 3 lying down.

Mathematics

Write down all the mathematical units you can remember and arrange them in a table (tens, hundreds, etc.) according to size.

Memory game

Hide the list of living things (from the previous activity) and from memory, draw up a new list of all the living things that you found during your observation. Compare your list with those of the other students. The winner is the one who produces the longest list from memory.

Did you know?

Give examples of living things in nature.

Earthworms make their tunnels in the soil by eating their way through them. They evacuate the digested soil in the form of small lumps. 1 m$^3$ of soil may contain about 1,000 hard-working earthworms!

What interesting facts do you know about living things?

Artwork

Cut out the following geometrical figures: a circle, an oval, three triangles and a diamond. Design and decorate a fish, a tree and a child.

Vocabulary

Bit late for resource to maybe crop up only now as it has been used in the other lessons already.
Most living things live in communities where each one has a specific role to play. If one of them cannot play its role properly, all the other living things will be affected and will suffer.
Setting the scene

Pirate game: on-board attack
Divide the class into two groups: each group represents a crew from the two ships. The students face each other in pairs, with their feet locked together. Each pair put their hands together and try to knock each other off balance by using their hands only. The pair that moves their feet first loses the game and their ship sinks together with its treasure.

Allow the students to settle down. The teacher says ‘port’ or ‘starboard’ and the students should raise their left or right hand accordingly. For example if the teacher says ‘feet on the port side’, students should raise their left feet, etc.

The main message

An ecosystem is part of the environment. It includes everything that lives in a small part of a given environment. To manage the exploitable living resources in our lakes and seas, we need to know where these species live, how they feed, who their predators are and the other dangers that threaten them.
News from the sea

The chain of despair

Once upon a time, there was a country where the big predator fish, like the tuna, were being overexploited by the fishers and stocks had almost become depleted.

As these deep-sea fish had become so rare, they could no longer chase the shoals of smaller fish and force them up to the surface. Small fish travel in mid water and are the preferred food of marine birds. Even though the birds can travel long distances without any food, they gradually began to starve as they were not able to find the small fish, flying fish, crabs and shrimp which come to the surface when the tuna hunt.

Before long the fish and other animals became more and more rare in the seas and lakes; only the plankton survived. The water turned pink due to an excess of plankton. When the plankton decayed, the water became polluted and this lead to the death of the many seashells, sea urchins, crabs and corals. This type of pollution is known as a red tide. The fishers and their families could no longer catch anything of value and they were forced to leave for other areas in order to survive.

Among the animals that survived were the jellyfish: they remain small if they do not have much food to eat. They can also change their appearance and reproduce asexually. Many fish and other sea creatures (predators) feed on jellyfish. However, with fewer predators around the number of jellyfish drastically increased. Eventually they started to attack the few fish that were left, but they could not attack the turtles, which were their main predator.

In turn, the turtles became rare as people started to catch them for food and were eating their eggs, even if they were protected by law. As there were less fish available in the sea, the fishers caught more turtles to feed their families and the turtles were caught to the point of extinction. The tragedy continued as marine birds were also affected. As the marine birds became rare, fewer were making their nests on the islets or the cliffs. The insects, lizards and crabs, which depend on the birds for their food, also began to die. In the end, the whole area turned into a desert where nothing could survive, not even human beings.

Comprehension

Could such a thing happen in our country?

This is the worst-case scenario that one could ever imagine. However, if nothing is done to stop pollution, overfishing and wastage, this could very well happen to our country.

To address this problem, we must first understand why various ecosystems are in danger and what are the consequences for other living resources. We all depend on marine resources for our food and other commercial activities.

For more sustainable fishery activities, fishers should develop a good knowledge of the fish and other resources that they catch. This will enable them to adopt a more responsible attitude when they go out to fish. They should pay particular attention to the aspects of reproduction. They should not catch undersized fish or destroy habitats where fish spawn or raise their young.
Poems and songs

A small bird and a small fish are tenderly in love.
But how to express this love when one swims in the sea?
A small bird and a small fish are tenderly in love.
But how to express this love when one lives up in a tree?

The funny ideas of Mr Joker

Did you know that there are fish that can fly and birds that can swim? Flying fish fly and Cormorants dive down under the water to catch fish.

Since fish can fly and birds can swim, why can’t Mr Joker marry the beautiful mermaid who lives in the ocean?
May be he could wear a diving suit or allow scales to grow on his legs to explore the deep sea with her.

Did you know?

Eco’ means home or habitat.
‘Economy’ means managing one’s home or habitat.
‘Ecology’ is the branch of science that studies the relationship between living things and their environment - both animate and inanimate.
Plants, animals and humans living together and supporting each other in a particular area form an association known as an ecosystem.

An ecosystem is a community of living organisms (plants, animals and microbes) living in conjunction with the non-living components of their environment (air, water and mineral soil), interacting as a system. Different ecosystems may exist in the same environment.

All living things depend on one another and on the environment in particular. Each ecosystem depends on neighbouring ecosystems to survive. For example, insects, worms or plants protect each other and allow each other to feed themselves. When a tree is cut on the coast, birds can no longer build their nests and the crabs, which feed on bird excreta, cannot survive.

The reef, the mangrove, the coastal forests and the deep sea are ecosystems that contain several sub-ecosystems.
What is an ecosystem?

Observation exercise

Draw a bird and a fish. Mention the differences between the two: their environment, anatomy (scales, feathers, wings, fins, lungs, gills). What do they have in common? (A tail to allow them to change direction and a sense organ for their orientation).

Game: If I were a ...

Make up a story starting with: If I were a...crab, an octopus, etc.

Discovery

Divide the class into three groups and give each group one of the information sheets. (information sheets 4, 5, 6).

Ask the students to observe the picture and silently read the text on the back. What are the organisms which live in the ecosystems in your sheet?

Based on the information on your sheet, write down a list of the organisms that live in the ecosystem on your sheet and try to draw them.

Once a group has completed a worksheet, it should tackle another one until each group has completed all the worksheets. Display the results in the classroom and conduct a discussion on the work of each group.

Technical sheets

- Fish
- Aquatic mammals
- Reptiles
- Molluscs
- Echinoderms
- Crustaceans
- Algae
- Aquatic birds

Experimenting with our senses

You have five senses to see, smell, touch, hear, and taste. How do you call those five senses? What are the five sense organs? Make a sketch drawing of these organs.

Blindfold the students. Allow them to touch something smooth and rough; to smell different odours; to taste different food; and to guess what it is.

Ask students to listen and identify the sound: when knocking on a glass bottle, on a piece of wood or on a piece of metal.
Construct a table

Using the information from the observation exercise, ask the students to draw up a table with the different species, their characteristics and their way of life.

<table>
<thead>
<tr>
<th>Type of species</th>
<th>Physiological characteristics</th>
<th>Living environment</th>
<th>Birth place and breeding place</th>
<th>Food consumed</th>
<th>Predators</th>
<th>Are they under threat?</th>
</tr>
</thead>
</table>

Drawing

Draw a picture of one animal hunting another (the predator and its prey). There is always a prey - the animal that is caught and eaten, and a predator, the animal that catches and eats the prey, for example a cat and a mouse).

Do it yourself

Construct a mobile based on the technical sheet.

Outdoor game

In pairs, play the cat and mouse game.

Set up an obstacle course outside (rocks, bushes, chairs, tables, etc.) which the predator and its prey have to run around. The mouse should pass the obstacles by the quickest route possible (over, under, around). The cat has to figure out if it should take a different route to catch the mouse depending on the size of the obstacle. Set up alternative routes, one for the mouse and one for the cat.

Technical sheet 3: Construction of a fish mobile

Draw six fish or other aquatic animals on a piece of cardboard. Colour them in and cut them out. Make a small hole in each fish and thread a piece of string through each one. Take three wooden sticks and tie one fish at each end of the sticks. Tie the three sticks together in the middle so that they balance evenly. The mobile could also be made from objects collected along the shore: shells, dead crabs, etc., or with waste materials found in nature.
Flamingos are pink because they eat a peculiar small shrimp, called the *Artemia salina*, which is a small crustacean living in salty lakes, lagoons, and swamps. This shrimp is usually red, but it may also be pink, green, white or transparent. Thus, the flamingos are pink due to the pigment (red or pink) found in these shrimp.

**The funny ideas of Mr Joker**

How can we get blue or green flamingos? By pouring blue ink or green food colouring into the water where the small crustaceans live, so that they turn blue or green?

**What does living in symbiosis mean?**

Some animals live in symbiosis, that is, in a pairing relationship where both animals benefit from each other. For example, the clown fish and the sea anemone depend on each other to survive. The clown fish rubs itself against the stinging tentacles of the anemone to maintain a gel on its skin which protects it against the poisonous sting from the anemone. The latter is protected from external attack by the clown fish which nourishes the anemone with ammonia that it produces in its gel.

Do you know of other examples of symbiosis?

Examples: birds and crocodiles, remora and sharks, tuna and dolphins.

**Do it yourself**

Make a pair of stilts using empty cans and ropes, to walk like wading birds. Organise an obstacle race.

**Composition**

A dog and its owner or an insect and a flower live in symbiosis. Write a short text to show how each benefits the other.

**Sensory exercise**

Imitate the sounds made by certain animals
For example snap your fingers for a crab, whistle for the dolphin, flap your lips, grind your teeth, whisper, etc. See what it sounds like when everyone makes different sounds at the same time.
Mathematical game

Referring to ‘Did you know’ section, compare the size of the different animals. Take the weight of all the students and find out how many students are needed to reach the weight of a blue whale. Find out the weight of other objects (e.g. a boat) and make similar comparisons. Establish the ratio for the weight of these objects. Repeat the same exercise for other physical characteristics e.g. number of feet. Remind students of the units of length and weight.

Recognition game

Who am I?
Stick the name of an animal on the back (or the forehead) of a student without telling them what it is. The student has to find out which animal it is by asking yes/no questions. The other students are only allowed to answer yes or no until the answer is found.

‘Catch me’ game

Mark out a boundary for the game; place a number on the back of a student. The student picks someone who has to try and read the number on his back by running around him. The student, with the number on his back, tries not to show it to the other person.

Vocabulary

Ecosystem, phytoplankton, zooplankton, invertebrate, molluscs, coral, sponge, echinoderm, crustacean, vertebrate, herbivore, carnivore, detritivore, symbiosis, prey, predator, pigment, size.
If one species in a food chain is removed, all the other species that depend on this food chain will be affected. It is, therefore, important to use all possible means available to protect all food chains and in turn, the environment, ecosystems and biodiversity.
Setting the scene

All the students hold hands. Without releasing their hands, they intertwine with each other by moving under or over each other. When they are tangled up, one student, who has been left out, should try and put them back in order without undoing their hands so as not to break the chain.

The main message

An ecosystem consists of predators and their prey. If the predators are eliminated or the prey cannot feed themselves, the food chain is broken and the equilibrium of the ecosystem is disrupted. Every living thing forms part of an ecosystem. In a food chain, every species depends on another species to survive.

Children song

Sing a round based on a familiar tune (London’s burning), following the steps in the food chain described in the text.

Poem

If everybody in the world
(Paul Fort)

If all the girls in the world were to hold their hands
All around the oceans, they would make a round
If everybody in the world were to be sailors
With their boats, they would make a nice bridge on the waves
Then we would be able to travel around the world.
If everybody in the world were to hold their hands.
News bulletin....

Once upon a time, a small seed fell on the soil that was naturally rich and fertile. It germinated and rapidly grew. A few days later it produced a beautiful yellow flower. All the butterflies, bees and the birds came to admire and taste this fragrant flower.

A small fly tasted some of the flower’s nectar and flew away. On its way home, it stopped near a pond to rest. Suddenly, it was swallowed by a frog. The sated frog looked for a place to rest. While it was resting under a water lily, a snake came along. As the snake was very hungry, it prepared itself for this feast. Without waking the frog up, the snake swallowed him whole.

While digesting the frog, the snake wandered into a neighbouring field. A mongoose living in the field saw the snake in front of its den. As soon as the snake was within reach, the mongoose jumped on it, holding it by the neck. The mongoose held the snake down with its teeth and after a few minutes the snake was dead. The mongoose then took his time to eat the snake.

After his nice meal, the mongoose went for a walk. On the way, the mongoose felt the need to relieve itself. It found a convenient place near the yellow flower, then continued on his way.

A seed from the yellow flower, which was lying in the soil in this particular spot, found this unsolicited meal delicious and welcoming for its growth.

The food chain is thus complete and starts all over again.

Comprehension

Answer the questions on Information Sheet 16.
What are the different stages of this food chain?

What will happen if the frog is removed from the food chain? (The chain is broken, the snake will not find enough food to feed itself and the flies will increase in number as they will no longer be eaten up)

Discovery

Technical sheets

15  The food chain
16  The story of a small seed
17  Food poisoning
Role play

Place the masks on the children: the first child represents an alga; the second child represents a small crab which finds shelter and food around the algae. A third child represents a small fish which tries to catch the crab and a fourth child represents a bigger fish which feeds on the smaller fish. A fifth child represents a fisher who catches the big fish and takes it to the fish market.

Ask the students to carry out the role play. During the role play, take out one element of the food chain to show the consequences.

Try another scenario; starting from the end of the food chain, each one says what it feeds on until we come to the alga which relates that it cannot grow any more.

Writing Exercise

Draw a food chain with one element missing. Explain why this particular element has disappeared from the chain and what will happen if the chain is interrupted.

Manual and artistic exercises

G1 Draw an animal from the food chain given in the text. Cut out the drawing to make a face mask with two holes for the eyes.

G2 Get the students to draw the images that represent the scenario of the role play.

G3 Draw the face masks which will be used during the role play.

Mr Joker performs a trick

The slippery fish

Take a sheet of paper in one hand and hold it high above your head; drop it and ask someone to catch it. You will find that it is more difficult for someone else to catch than yourself.

G1

G2
**Miming game**

All the animals hide when the fishermen come. The teacher has two sets of cards: one for the predator and one for the prey. The predator: fisher using fishing line, shrimp net, harpoon, dynamite, gill net, etc. (consider the different fishing methods) The prey: where will the prey hide so that they are not caught by the fisher?

- An octopus: hides in a hole in the coral and squirts ink if attacked
- A turtle: hides among the sea grasses
- A crab: hides in a hole on the beach
- A seashell: pulls its body into its shell and closes it
- A shoal of fish: they all move as a group in the same direction
- A sea cucumber: pretends to be dead and covers itself with sand
- A ray: lies flat on the sand and changes colour
- A flying fish: flies long distances whilst changing direction

The student who manages to escape is the winner of the round. He chooses a new card and the others have to explain how they will escape. What will happen if the frog is removed from the food chain? (The chain is broken, the snake will not find enough food to feed itself and the flies will increase in number as they will no longer be eaten up) for the future.

**Word games**

Divide the class into three groups:

**G1**

Mr and Mrs X have a child. What is his/her name?

Write some riddles starting from names which are common in the country.

Example: Mr & Mrs Amine has a child, they name him ‘Vit’ and it makes “Vitamin”.

**G2**

Write crossword clues for various aquatic species that you are familiar with e.g. has scales and lives in the water - a fish.

**G3**

Give students a description of animals that form part of the local biodiversity and ask them to guess the names of the animals. Example: They have a tail and several fins; their bodies are covered with scales and they live in water: fish.

**Vocabulary**

Ecosystem, ecological niche, mangrove, sea grass, habitat, migratory bird, algae, indigenous species, endemic species, exotic species, endangered species, extinct species.

**Writing Exercise**

Memorise the vocabulary and and write a short text including as many of the words as possible.
FISHING VESSELS

Place the words from the list in the grid

SAILBOAT

4 Letters
RAFT
DHOW

5 Letters
FERRY

7 Letters
GONDOLA
LOGBOAT
TRAWLER

8 Letters
REEDBOAT

9 Letters
OILTANKER
WE HAVE TO PROTECT THE ECOSYSTEMS. THIS MEANS PROTECTING SPAWNING GROUNDS, HABITATS AND FOOD, WHICH WILL ALLOW THE YOUNG TO GROW AND, IN TIME, REPRODUCE. WE COULD REBUILD THOSE ECOSYSTEMS WHICH ARE DAMAGED, BUT THIS WOULD TAKE YEARS. IN THE MEAN TIME, WE WILL HAVE TO FISH DIFFERENTLY AND THIS MEANS PUTTING A STOP TO BAD PRACTICES.
Join the GREEN FISH MOVEMENT

Be careful, one green fish can hide another!!
Setting the scene

A thunderstorm is brewing. The air is hot. We are sweating profusely and are tired. A light breeze starts blowing, followed by very strong wind. We cover our eyes with our hands to hide from the lightening flashes. We cover our ears so as not to hear the thunder which is coming closer and closer. We tap our fingers, once, twice, thrice etc. to imitate the rain drops coming closer. With our feet, we imitate the thunder. We start all over again using 5 fingers, then 4, then 3, etc. The thunderstorm is over, we are safe. There is no danger any more.

The main message

All forms of life on the planet are interconnected. If life in the aquatic environment is altered in any way, terrestrial life also is affected and we have to pay for the consequences of such alterations.

We must, therefore, refrain from damaging, destroying and assaulting ecosystems.

Such as:
• destroying coastal habitats (mangrove)
• polluting the water (by allowing fresh water containing too much fertiliser or water loaded with sediment to come from deforested river banks) flowing into the sea
• anchoring the boats on corals.
• using dynamite which destroys the sea bed
• overturning stones and corals in lagoons.

We must also avoid all other forms of pollution (chemical products, plastic bags, oil products, factory waste, etc.)
Threats to the biodiversity

News from the sea

When the environment is damaged, living conditions become difficult for living organisms. This may also lead to an ecological disaster. Human beings depend on the natural environment; their population is increasing and they need more food; poverty is increasing and they have to fight for food. This leads to social crisis and war. During wars, people lose their jobs and there are casualties and death. Economic activities slow down and the economy stagnates, leading to an economic crisis. The future of the planet will therefore depend on the relationship between people and the environment. Natural disasters may be partly responsible for these problems but it is mainly bad practices that destroy both our resources and the environment. When we adopt a way of living that does not cause harm or destroy the environment, it is known as sustainable living.
Discovery

Technical sheets

18 Erosion and other natural threats
19 Human threats
20 Overfishing
Essay writing based on three catastrophic scenarios

**G1**
A forest fire.
What happens to the biodiversity when there is a forest fire? Which plants, animals, and insects will die? Which ones will survive? What dangers face the people living near by?

**G2**
Refer to information sheets 18-20 and list the dangers that people face. Explain how each element in the drawing represents a threat and give reasons.

**G3**
Draw a picture to illustrate how pollution affects where you live and write short notes to explain the drawing.

Discussion around the work of the third group

Do you know of any other dangers that are threatening the biodiversity in the area where you live? What are the threats on the lake or the lake side? In the lagoon? On the reef? Out at sea?

Did you know?
The Nile Perch was introduced in Lake Victoria from Ethiopia to help fishers catch bigger fish as it grows quite fast. The problem, however, is that the Nile Perch has eaten all the herbivorous fish in the lake. The latter were not able to defend themselves from this new predator. Thereafter, as there were no herbivorous fish to eat the algae, the algae have overgrown. This continuous overgrowth of algae is choking and polluting the lake.

This phenomenon is known as eutrophication and it is a serious problem. Now everyone is trying to find a way to clean up the lake and at the same time continue to export the Nile Perch.

Technical sheet 4: Experiment on erosion

Make a hole in one side of a plastic tray as shown in the diagram. Half fill the tray with fine sand and level the surface of the sand. Place a wooden wedge under one edge of the tray opposite to the hole. With a watering can or a water hose pour water on the sand on the raised part of the tray for a few minutes. You will notice that the water coming out of the hole contains sand particles. This experiment shows that running surface water on the uplands carries soil particles to the lowland plains and ultimately to the sea.
Technical sheet 5 : Experiment on photosynthesis

How it works

It is difficult to explain to young children the absorption of carbon dioxide by green plants. However, it is easier to demonstrate the need for sunlight. What happens to a plant that is kept in a dark room for a considerable amount of time? How long will it take for the plant to lose its colour (chlorophyll)?

Technical sheet 6 : Experiment on pollution

Leave an open container of water in a corner for a few days. You might notice that mosquito larvae have settled in the water.

Add a couple of drops of used oil to the water. After one or two days you will noticed that the larvae have died. They were asphyxiated (not able to breathe). The mosquitoes will no longer be able to bite you.

Conclusion

The oil acts as a pollutant. The same thing happens when sea creatures find themselves in polluted water. Living creatures are suffocated.
Sometimes whales run aground on the coast and die. Whales communicate amongst themselves in order to remain together in a group. However, when there is too much noise around them, communication breaks down, they lose contact with each other, become disorientated, lose their sense of direction and run aground on the coast.

**Did you know?**

Sometimes whales run aground on the coast and die. Whales communicate amongst themselves in order to remain together in a group. However, when there is too much noise around them, communication breaks down, they lose contact with each other, become disorientated, lose their sense of direction and run aground on the coast.

**Discussion:**

What do we need to do to stop erosion? What do we need to do to avoid the various types of pollution that are destroying our resources?

**Outdoor game**

This game is about using good practices. Set up a zone outside where you are not allowed to walk on certain obstacles in order to protect the ecosystems.

Place a chair (or any other object) in the zone to represent the corals where you are not allowed to walk. You must jump over the coral in order to protect it.

Collect a piece of string and pass it to the person following you, to show that it is not allowed to anchor a boat in this zone.

Highlight certain areas where there is a risk dynamite explosion. Place a cloth on the ground to represent a turtle on which we are not allowed to walk. Go round a stone twice to show that it is a poisonous sea snail, etc.

**Creativity:**

Using different coloured plastic bottles design an aquatic environment (algae, fish, jellyfish, etc.) by cutting up the bottles in different ways and putting them together.

**The funny ideas of Mr Joker**

We should give the whales earplugs or headphones or play them some music through echosounders to keep them away from the big ships.

**Discovery Survey**

Is your coastal area polluted? (Which type of pollution? domestic, agricultural, industrial or linked with tourism). Mention how this has happened and why. Are the habitats of marine species damaged or destroyed (the present state of the mangrove, the corals, the lake side, etc.) and why? Is there deforestation, soil erosion or beach erosion, siting, etc.? Have you ever heard of climate change and erosion? What are the consequences of these two phenomena on the environment and the inhabitants?
Taking action

Design a poster that contains information on endangered marine species and publicise it in the form of a speech, a notice, or a spot announcement which you will disseminate in a busy area, for example:

- Let’s take action against the degradation of the lagoon
- Green ribbon movement to save the algae
- Everyone at sea to save the fish
- Urgent: change our behaviour to save our environment.

How can we help?

Get the whole class involved in writing a code of conduct for the average citizen with regards to the protection of the environment; or a code of good conduct for a model fisher by referring to the information sheet on good fishing practices. Write it up on a large decorated sheet of paper and display it in the classroom, somewhere in the school or in the municipality.

Ask students to take press cuttings from newspapers and magazines on issues linked to fisheries and the environment for a document which will be presented to the public at the end of the year.

Example: refrain from collecting anything from the sea, walking on the reef, cutting down mangrove trees, throwing rubbish in rivers or lagoons and respect public notices.

Role play

Divide the class into three groups:

**G1**

Ask the students to think about different oaths that people take and to come up with a few examples. Ask the children to come up with an oath that would be good for the environment and ask them to commit to it.

**G2**

Set up a club: Each group sets up a club to protect aquatic ecosystems. Each group should come up with a name for the group, design a logo and a scarf. Groups can make a stamp of their logo by sculpting a vegetable. Groups can make and decorate a totem pole and write a song to motivate people and a dance (like the ‘Haka’ of New Zealand).

**G3**

Convince students in other classes to follow the code of conduct written on the totem pole. Visit the different classes to convince them to join the club. Keep the club running throughout the project. Display the names of the clubs, the students and the totems in the classroom.
What is Overfishing?

News bulletin

In mid-February 1690, about thirty ships left the port of St Malo, in France, for Newfoundland where they were to start a new cod fishing season. All the ship owners, the fishers, the traders and the sailors were happy at the idea of a miraculous fishing campaign. Around 200 boys, aged between 12 and 15 years, were among the crew members. For these boys, it was the end of their studies: no more homework, latin, mathematics, etc. Everyone knew that there were plenty of fish where they were going. It was even said that the fish were so numerous that one could jump from fish to fish all the way from Newfoundland to Canada without getting your feet wet. The cod resources seemed to be unlimited.

Yet, three centuries later in 1990, cod fishers who were better equipped and more efficient than their ancestors, had to bow down to the evidence: the stock of cod had been reduced to such an extent that the catch was almost nil. They then decided to catch shrimps with trawling nets, as they were abundant in the region. Unfortunately, these nets also caught any young surviving cod which had not yet reached their reproductive stage. Suddenly everyone realised that the cod species was threatened by extinction.

People all over the world were affected but the message was clear: fish resources are not inexhaustible. Prompt measures have to be taken for the better management of all fish resources: in oceans, lagoons, estuaries and lakes, if not, populations will lack food.
IF RESOURCES ARE SHRINKING IT’S BECAUSE MAN IS OVERFISHING AND USING DESTRUCTIVE TECHNIQUES.
Comprehension

What message does this historical event convey to you? It tells the story of an ecological disaster. What is an ecological disaster?

Which species was fished and in what quantity? A species is endangered. What do we mean by endangered? What would happen if a single species were fished without any control? If all fish species were endangered what would happen? (People would lack food).

When did this event take place? The sailors had little knowledge and were ignorant. Explain the word ignorant. What happened in 1990? What did the fishers do and why? Was it a good idea?

Which animals have become extinct where you live? Why did this happen?

Discussion

Overfishing is excessive fishing of certain fish, crustaceans or molluscs. With the development of large scale industrial fishing, factory ships catch larger amounts of fish in deeper waters away from the coasts. This in turn leads to a marked decline in the stock of some fish species that were previously abundant. They are captured when they are young and before they have had the chance to reproduce.

Survey

Carry out a survey with the older fishermen:
What amount of fish did they used to catch?
Which species did they catch?
Which equipment did they use?
How different is it today?
Are they happy with the current situation?
Report what they have mentioned in writing.

Vocabulary

Biodegradable, symbiosis, erosion, excessive, pollution, eutrophication, greenhouse effect, photosynthesis.

Mr Joker is happy if ecosystems are well protected and well-managed resources enable us to survive. The world will be a better place to live if everyone does what is necessary. This is why Mr Joker has set up the Green Fish Movement, for the proper management of our aquatic resources and to make the red fish and the clown fish jealous.

The Green Fish is moving - join us!
The benefits of protected areas

Exercise: write in the children’s mother tongue what is written in the bubbles.

Hello mister octopus! what do you think of our fight against erosion? Are the corals doing better?

Hi there, yes, it’s working, it’s fantastic, there’s no more pollution! You’ve found the right solution.

Hi Petrel! You seem to be enjoying life since the factory stopped releasing waste into the lagoon.

For sure! Life’s much better now. Look! I can catch plenty of small fish and I’m not scared to play! It’s great!
Part II

Fisheries management
- Management of aquatic areas - fisheries zones
- Management of laws of enforcement
- Management of fishing gear
- Management of fisheries products and captures
- Management of food security
- Management of fishermen
A GOOD DECISION: NEVER CATCH FISH WHICH ARE TOO SMALL AND NEVER DAMAGE THEIR HABITAT.
Setting the scene

Imitate the sounds made when someone is swimming, rowing a boat, fishing, setting up a sail, the whistling of a whale, the engine of a motorboat.

The message

The majority of the fish, octopus, squid, seaweed, sea cucumbers and other sea food that we consume, is predicted to disappear in the next 50 years. It is up to the youth now to ensure that these are protected.

Discovery through discussion

Who is responsible for this situation? What can we do to address this issue? Who is responsible for fisheries and fisher communities? To whom do the fish resources belong? What are sustainable fishing techniques? What does legislation say about sustainable fishing? What are the conditions for maintaining good quality resources? Are fisheries an important component of the local economy? Are fish catches declining? What do the researchers say about this decline? Can we produce these resources in captivity (aquaculture) and allow ecosystems to recuperate?

News from the sea

As soon as he was old enough, Jamie’s father took him along to explore the bay. They would catch fish by hand or with fishing lines, depending on the tide or the season. They often came back home empty handed, but they were happy to have discovered a fascinating environment. Jamie’s great Grandfather was the captain of one of the first trawlers and at that time he could stay out at sea for six consecutive weeks. Income from his fishing activities allowed him to support his family. Jamie was delighted at the idea that his parents have been earning their living from the bay for generations. He caught his first fish in the bay when he was only eight years old. It was a Mako shark and he will never forget its spear-shaped mouth. Nor will he forget the reassuring hands of his father’s on top of his on the fishing rod.

(Excerpt from “Le Bateau” de Nam Le.)
Comprehension and discussion

Have you ever gone out fishing?
What job was Jamie’s great grandfather doing?
How long was he staying out at sea? What was he doing with the money that he was earning?
At what age did Jamie catch his first fish? Was it a big fish?
Would you have liked to be in Jamie’s place? Do you have a parent or an ancestor who is/was a fisher? Have you ever gone out fishing? What is the size of the first fish that you caught?

Essay writing

Give an account of a fishing trip that you went on: Where did it take place? Which fishing methods did you use? Who did you go with? What problems did you encounter (too hot, too many boats, sea sickness)? What did you do with the catch?

Display the final texts (corrected and properly written) in the classroom so that everyone can read them. Select the best text by inviting the class to vote.

Group work

Divide the class into two groups. One group represents fishing with a boat and the other group, without a boat. Draw up a table to show the different fishing methods used by the students.

G1
Fishing without a boat
What species are you fishing? Where are you fishing? Which fishing methods are you using?

G2
Fishing with a boat
What species are you fishing? Where are you fishing? Which fishing methods are you using?

Drawing

Fold a sheet of paper into two and on each half draw animals which have funny names. (clown fish, tiger shark, lute turtle, giraffe crab, parrot fish, butterfly ray, catfish, etc.)

Tie a rope across the classroom and hang the drawings on the rope.
<table>
<thead>
<tr>
<th></th>
<th>Without a boat</th>
<th>With a boat</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What to fish? (species)</strong></td>
<td>Shellfish</td>
<td>Fish</td>
</tr>
<tr>
<td></td>
<td>Octopus</td>
<td>Shrimp</td>
</tr>
<tr>
<td></td>
<td>Sea cucumber</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Crab</td>
<td></td>
</tr>
<tr>
<td><strong>Where to fish? (environment)</strong></td>
<td>Lagoon</td>
<td>Lagoon</td>
</tr>
<tr>
<td></td>
<td>Reef</td>
<td>High seas, shoal</td>
</tr>
<tr>
<td></td>
<td>Beach</td>
<td>Reef, behind the reef</td>
</tr>
<tr>
<td></td>
<td>Mangrove</td>
<td>Lake</td>
</tr>
<tr>
<td></td>
<td>Rocky shore</td>
<td>Pond</td>
</tr>
<tr>
<td></td>
<td>Lake, pool, pond</td>
<td></td>
</tr>
<tr>
<td><strong>Fishing method? (fishing gears)</strong></td>
<td>By hand, with a bucket</td>
<td>Fishing rod with bait and lures,</td>
</tr>
<tr>
<td></td>
<td>Small net</td>
<td>Pole and line</td>
</tr>
<tr>
<td></td>
<td>Fishing line</td>
<td>Fish trap</td>
</tr>
<tr>
<td></td>
<td>Harpoon</td>
<td>Fishing line</td>
</tr>
<tr>
<td></td>
<td>Fish trap</td>
<td>Gill net</td>
</tr>
<tr>
<td></td>
<td>Dynamite</td>
<td>Trawler</td>
</tr>
<tr>
<td></td>
<td>Toxic chemicals</td>
<td>Seine (fishing net)</td>
</tr>
<tr>
<td></td>
<td>Cast net</td>
<td>Long line</td>
</tr>
</tbody>
</table>

**Do-it yourself**

Look at Technical Sheet 7 to learn how to tie fishing knots.

**Vocabulary**

Management, species, environment, fishing gear, fishing techniques.
Read the information about the different types of knots and try to make those that are illustrated. Stick the knots onto a piece of cardboard and display in the classroom.

**Overhand knot:** This knot is one of the most fundamental knots and forms the basis of many others. The overhand knot is very secure and should be used if the knot is to be permanent.

**Half hitch knot:** This is a secure knot and is difficult to undo especially when it is wet.

**Figure of eight hitch knot:** This is a secure knot. It does not tie too tightly and is easy to undo.

**Clove hitch:** This knot is useful when a length of rope needs to be adjustable, it is normally done at the extremity of a rope to tie up something.

**Bowline:** This knot is one of the oldest known. It is both easy to tie and untie and is effective with all types of rope.
What is a fishing zone?

Setting the scene

Movement in space: Stretch out your hands and turn on your heels. Then, place one foot in front and one behind as far apart as possible. Tap the hands of your neighbour and set up a chain by tapping the hands of the friend ahead.

The main message

Different authorities and officials, together with the fishers and the consumers, are responsible for protecting the country’s fishery resources. Such protection is only possible if the fishing zones are well defined.
Laws and regulations must be respected no matter the type of boat.
If countries have difficulty enforcing their fisheries laws, regional or international bodies may come to help them.

For example, the Indian Ocean Tuna Commission, the Lake Victoria Fishing Organisation or the Indian Ocean Commission.
Practical exercises

Measure the different working spaces in your school: the size of the tables, the blackboard, the classroom and the space available for the teacher. Compare them with the overall size of the school.

Vocabulary exercises

What does 'encroaching on the neighbour’s land' mean? Find out the meaning of the following words from a dictionary: registry, boundary, border, boundary stone, public space, lane (e.g. air traffic lane), harbour, port.

Give the students simple mathematical problems that deal with area and perimeter.

Comprehension

What did Mr. Ali Man do? Did he give the shrimps in front of his factory more time to grow and reproduce? Did he protect the shrimps in the zones which he shared with the other fishers? Why did he do this? Did he become richer? How did the other fishers react when everyone was allowed to fish in the same zones at the same time? In these conditions, will the shrimps be smaller? Will they fetch a lower price on the market? Will they have time to lay their eggs and will the young have enough time to grow?

Survey exercise

Who owns the resources in the ocean and the lakes?

Ask the students to carry out a survey with their parents, fishers, local authorities and a tourist to find out who owns the resources in the ocean and the lakes.
Who owns the oceans and the lakes?

Comparing the results

Enter the answers from your survey in the table below.

<table>
<thead>
<tr>
<th>Who owns the oceans and the lakes?</th>
<th>Families</th>
<th>Fishers</th>
<th>Authorities</th>
<th>Tourists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Everyone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The country or the government</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The fishers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nobody</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The fish</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other answers</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Read the following text and discuss

When we first considered the sea as belonging to everyone, no one took responsibility, all the fishermen fished for themselves. They all fished however they wanted without any respect for specific zones or areas. To gain material advantage and gratification however, the fishermen need more money. To get more money they take loans, which need to be repaid. To pay the money back they try to catch more fish, increasing their fishing quota and reducing the number of fish left in the sea. However, when there is a minimum catch or no catch at all, it is the fishermen that are ruined, leaving their villages to source out an alternative incomes.
Fishing zones (Information sheet 21)

The main message

Fishing zones are demarcated and allocated to a particular country or to a group of neighbouring countries: they may however, be left open to all nations which in turn can lead to conflicts. More equitable solutions should be found and this is the responsibility of the governments involved. Each country should sign an agreement for the co-management of shared resources with its neighbours. All countries should agree to share the responsibility for preserving biodiversity, for protecting the environment against pollution and for saving the water of the lakes.

News bulletin...

Iceland is a country of Vikings. It is somewhat special as an island, as it has many volcanoes and glaciers. It has a harsh climate and almost no trees; no cereals grow there. It is a country where children used to eat dried cod as a snack because there was no bread. The inhabitants have put up a fight against foreign fishing vessels to defend their only survival resource which is fish. They have claimed an exclusive fishing zone of 200 nautical miles from their coast. Since then, many other countries have made similar claims.

Written work

Refer to Technical Sheet 21 and the text to answer the following questions:

- Who do fishing zones belong to?
- Who are responsible for the fishing zones?
- What do the fishers do under these conditions?
- Why do fishers borrow money?
- Why is there less and less fish?
- What are the future prospects for fishers?

Vocabulary

Homonyms: look in the dictionary for words that are phonetically similarly to the following: Air, ear, ere, era. Use these words to make sentences.
Silent reading: sustainable management of artisanal fishing

For a long time, maritime laws considered the lakes and oceans as the common heritage of mankind and open to everyone with the exception of a strip of 3 nautical miles around the coast (1 nautical mile is equivalent to 1.852 km). This strip, where the country has full sovereign rights, corresponds with the distance of a traditional canon shot from the shore. In some fisher communities, a common law prevails where the coastal residents are responsible for this strip (lake or sea) in front of their village. The villagers are responsible for the fisheries management of this zone. The state or the government does not intervene. This allows for a better control over the resources. For example, if net fishing is forbidden, the fishers will refrain from using nets. They will enforce their own policing measures to ensure that fishers from adjoining villages do not fish in their waters. This is seen as an efficient management system.

Written exercise

Ask the students to carry out an exercise, similar to the previous one, but based on the mismanagement of the resources.

Indoor game

One, two, three whales: One student stands against a tree or a wall and throws a stone as far away as possible. The distance the stone is thrown represents the country’s fishing zone (like the canon ball). The student represents the villagers in the zone. The other students stand on the other side of the line now marking the zone. They represent fishermen from other regions coming to fish illegally. The first student has to defend his zone. He shuts his eyes and says: one, two, three whales. When he is counting, the illegal fishers have to get as close to him as possible before he opens his eyes. If the first student finds an illegal fisher moving when he opens his eyes that person is eliminated from the game. The illegal fishers have to try and reach the student without being caught to take the place of the legal fisher.
**Written work**

What is the name of the ministry responsible for schools?

What is the name of the ministry responsible for thieves?

What is the name of the ministry responsible for fishing?

Is there a ministry of environment in your country?

If yes, what are its responsibilities? If no, is there a need for such a ministry?

If you were the Minister of Fisheries what would you do to solve the various issues in your country?

Write down the names of the countries involved in fishing activities in the great African lakes.

Apart from fishing, what are the lakes used for? (drinking water, irrigation, power, wildlife reserve)

Which problems threaten the lakes and what are the solutions to these problems?

**Singing**

Teach the students the national anthem or a song commonly sung by the fishers.

**Regional and international management strategies**

Countries around the world are having difficulty enforcing fishing laws on a large scale. Therefore, certain organisations have been set up to assume these responsibilities. These organisations are regional or international commissions. All the countries concerned have taken a common decision about which strategies to adopt. (Indian Ocean Tuna commission - IOTC, and the Lake Victoria Basin Commission - LVBC).
Several organizations are helping countries to better manage their resources, such as FAO, East African Community (EAC), the Southern African Development Community (SADC) or the Indian Ocean Commission (IOC). They create commissions, which require countries to meet certain standards and following specific rules, such as those set out by the IOTC (Tuna Commission in the Indian Ocean) or the Lake Victoria Fisheries Organisation (LVFO).

These regional and international organisations work together with governments but also with the Common Market for Eastern and Southern Africa (COMESA), which manages trade, or CITES, which controls the exploitation of endangered species.

Mr Joker’s idea

Let’s tattoo all the fish with their country’s flag, then everyone will know who they belong to!

Riddle

A dolphin has laid an egg in the lagoon in front of my house. Am I allowed to take the egg? (Answer: No, dolphins do not lay eggs!)

Battleships

Students work in pairs. Each student draws two grids with the letters A-J across the bottom and figures 1-10 down the side. On the top grid each student should draw 6 ships in any direction they like. The ships include: one container ship covering four squares, two cruise ships covering three squares and three fishing boats covering two squares. The other grid will allow him to find out where his opponent has placed his ships.

In turn, each player reads out the code of a square (E7 or B9). If a player reads out a square with part of a ship in it, the opponent answers ‘hit’, if there the square is empty, the opponent answers ‘miss’. The two players mark off the squares on their grids based on the answers. When all the squares of a particular boat have been ‘hit’, the opponent says ‘sunk’ to let the other player know which ship it was. The winner is the first player to find out where his opponent placed all his ships.
The Morse Code is a way of sending a message to someone. We can send a message to warn of a danger either by using smoke like the American Indians or by beating a drum as in Africa or Asia or still by switching a torch on and off as the scouts. The Morse Code uses patterns of dots and dashes to represent letters.

Practical experience

With the help of the chart below, write a message in Morse Code (e.g. SOS, danger, Mayday). Using a bottle and a stick, send an SOS message.

Vocabulary

Management, territory, zone, customary, governmental, regional, international, local resident

Communication exercise between the fishing boats.

Write in the Morse code or in semaphore signal by referring to the technical sheet given below.
The availability of reliable statistics for fish stocks is important as it enables the utilisation of sustainable fishing methods and fishing effort for more abundant catches while preserving ecosystems and fish stocks.
Setting the scene

Mime different method of observation: looking through a magnifying glass, a pair of binoculars, a telescope, a microscope, etc.

The main message

It is important to have reliable information on the status of aquatic resources and the dangers that they face. For the sustainable exploitation of a resource, its state must be stable and be thriving in a healthy environment; and fishing methods and efforts should also be sustainable. The availability of statistical data is also important for the sustainable management of stocks to ascertain whether they are depleted, under threat or sustainable.
Without complaining, the sailor tries his best to remember; he presents his logbook and shares the information required by law. However, the situation that he must describe is disturbing. How can you ask him for assurance and more precision? He makes his observation from the top of his ship and this has upset him for weeks now; his sight is reduced by sea spray or mist; he is misled by the tides; he is threatened by giant sea creatures; he is haunted by hallucinations. It will be a miracle if he can provide us with reliable data.

Source: An extract from L’entreprise des Indes, by E. Oresna, a story about Christopher Columbus p. 77.

Comprehension

Effective resource management depends on controlled and reliable observations. What does the sailor note in his logbook? Why does he keep a logbook? Why is it difficult for him to remember everything?

What are statistical data?

Statistical data are data that are collected daily, monthly and yearly over a long period of time. For example, child births, air temperature, rainy days, etc. Statistics refers to the analysis of data collected over a long period of time.

For example, it is important to find out whether the quantity, size and stock of fish are stable or whether stocks have dwindled and are threatened by depletion. Such analyses make it possible to take the appropriate management measures for more sustainable fishing.
Analysis of statistical data

Statistical data about fishery resources are collected by the Ministry of Fisheries. These data are fed into computers. Mathematical models are used to interpret the data, establish the current status and predict the future development of fish stocks.

Statistics are obtained as a result of data analysis which yields written or electronic records of figures on different aspects of fisheries. For example, the amount and weight of fish caught daily, monthly, per boat and per season, number of fishers, number of fishing boats, number of fishing days etc.

Understanding the notions of fish catch and fishing effort

The fish catch refers to the quantity of fish caught. This could be fish caught per day, per fisher or per boat. Whatever the fishing method, a fisher knows how much fish he has caught and has a general idea of fish stocks. If a fisher or a fishing vessel notices that less and less fish are being caught yearly or seasonally, it means that the fish stock is being depleted; the resource is probably being overexploited and his livelihood is at stake.

For example, if a fisher was using 5 fish traps in 2002 to catch 100 kg of fish or crayfish and in 2012 he was catching only 50 kg with the same number of traps, it means that the fish catch is declining and that the fish (or crayfish) resource is shrinking. He must therefore take appropriate management measures with regards to the fishing method and fishing gear or even stop fishing altogether for a brief period or indefinitely. If he needs to catch 100 kg of fish, he would have to use 10 fish traps, that means that he is increasing his fishing effort (number of fish traps) to catch the same quantity of fish.

Team game

Divide the class into three groups.

G1: Play heads or tails with a coin

G2: Throwing dice (made by the pupils during their geometry classes)

G3: Target game: hitting a target with a paper ball or a ball made of rags.

Each game is played in five rounds. Note the scores for each game per team. Calculate the probability for each one of the players to win. These statistics will help you to designate the team that will represent the whole class in an inter-class competition.

Practical exercise

A patient’s temperature report card:

Draw a temperature report card for a patient over five days showing the days (morning and night) horizontally and the temperature vertically on a grid. The minimum temperature is 36°C and the maximum is 40°C. Use the data to make a line graph and analyse the graph.

Solving mathematical problems

Give the students with a mathematical problem at their level, based on the example given above.

For example, in 2009, 3 fishers, each using 5 fish traps, caught 50 kg of fish each daily. In 2012 they catch only 20 kg of fish each daily with the same number of fish traps. How many fish traps must each fisher use in 2012 to catch the same quantity of fish as in 2009? (They must each use 12.5 fish traps to catch 50 kg of fish)
Practical outdoor activity

Ask two teams of students to pick up the litter, including the dead leaves, in the school yard in a set amount of time (10 minutes). The group which collects the most has a better output than the other which was maybe less organised and less motivated. Carry out a discussion around this activity and bring out the idea that some techniques for picking up litter are more efficient and lead to a better output. The exercise could be repeated with shelling beans or ground nuts.

The exercise may be repeated with the shelling of bean or groundnut pods.

Classroom discussion

Organise a discussion on the conclusions drawn from this simulation exercise. Record the results in a table and draw a graph according to the students’ ability.

Discovery

Different statistical methods

Random sampling

The students count the total number of boats that are usually anchored in the port. On one particular day, they count the number of boats that have remained in the port. They can therefore deduce the number of boats that have gone out on that day. Each time a boat returns to the port, the students take the total weight of the catch and the weight by species. Using these data, they can work out the following:

- The fishing effort (the average number of boats which went out fishing during a month and a year); and
- The fish catch (the quantity of fish caught).

This information will allow fishers to know whether the fish resource is stable (same) or declining (less fish). The authorities may then take the appropriate management measures.

Fun learning

A game using seeds

Spread a fair amount of seeds uniformly on the ground (soil or sand).

1. Game 1: Ask ten students to pick up the seeds (that represent fish) with their hands while only one student uses a broom or a shovel to pick up the seeds. Compare the amount of seeds collected by each student manually and with the amount collected by the student with the broom. Look at the impact on the ground in both cases (e.g. where the broom has been used the ground is cleaner but more disturbed).

2. Game 2: This time only one student picks up the seeds manually while ten others pick up the seeds with their brooms. Notice that the seed picking effort is much greater; the manual picker only manages to pick up a few seeds. The rest is swept up by those with the brooms. The surface of the ground looks as if it has been ploughed - the environment has been completely disturbed.

The logbook

To find out which species are endangered due of overfishing, a second statistical method may be used. This method consists of looking at the logbook of each fishing boat. According to the law, all fishing boats are required to maintain a logbook where they note down the number of fishing trips, fishing locations, and the quantity of each species caught for each trip. A fishery officer looks at all the logbooks and calculates
the total quantity of fish and the different species caught yearly. However, the logbooks are not always well kept as we have seen above.

Conducting a Survey

To find out whether the number of students in your school has increased or decreased since 2000, ask the school director for permission to consult the student attendance registers. Insert the data, in terms of the number of students and the year, in a table.

This survey will indicate whether the school should be closed down or if new classrooms should be built and more teachers recruited.

Another technique: Tagging

Another way to collect statistical data is by tagging. Tagging consists of catching some fish without causing any injury to them: they are weighed, then tagged and released into their usual environment as quickly as possible to avoid stress. When they are caught again, it is possible to determine their itinerary from the tag. It is also possible to determine their growth over a given period of time and the size of the stock. It is therefore possible to evaluate the fish stock for a given species and in a specific zone. The results will show whether the stock has decreased due to overfishing or if it is stable and can be further exploited.

Example: 100 fish are caught, tagged and released at sea. Much later, a fishing boat catches 100 fish from the same area. From the number of fish with a tag, among the 100 fish caught, scientists can estimate the size of the fish stock.

Experiment

Mix 10 red bean seeds in with a greater number of white bean seeds. Take a sample of the mixed seeds at random. Count the number of bean seeds of each colour in the sample. Use the proportion to calculate the number of white bean seeds that were initially added to the 10 red bean seeds.

Artistic expression and action

To ensure that fishers bring tagged fish which they have caught to the researchers, they are given a small token of thanks (a bag, a cap, a tee-shirt or money).

Make a picture with a strong message against the IUU (Illegal, Unreported and Unregulated) fishing boats which do not submit their fishing statistics. The best drawing will be printed on a tee-shirt and will be offered as a gift to the fishers.

Vocabulary

Statistics, fish catch, fishing effort, at random, fish tagging.
All countries of the SmartFish region should come together to develop common laws and organise how to enforce them.

If an agreement can be reached, this will prevent conflicts between countries and fishermen, and also protect resources. This will allow future generations, including your own, to fish for much longer without destroying the environment.
Setting the scene

Simon says: The teacher gives orders to the students. If the teacher says ‘Simon says’ before the order, the students should do what he says e.g. Simons says, sit down - all the students sit down. On the other hand, if the teacher says only “sit down” or “stand up” the student should not do it. Students who make a mistake are eliminated.

The main message

Whether at school, at home or on the road, there are things that we are not allowed to do because it can be dangerous for ourselves or for others. This also applies at sea and on lakes. It is important to abide by the laws that protect fishers and the fish resources. For the sustainable management of fishing activities in our region, the same laws should be adopted by all countries involved.

Laws should be enacted for each type of fishing vessel, each species and each country. A common legislation for countries exploiting the same resources and in the same fishing zone, will enable a better control, avoid conflicts and lead to the sustainable exploitation of fishery resources. All the boats which his opponent has hidden on his grids.
Management measures: legislation

Statistical analysis and surveys of fish catch enable us to evaluate the problems of the fish resources. Based on the results, countries should adopt appropriate regulatory measures to oblige fishers and other people to use sustainable fishing methods.

Each country has its own laws with regards to fishing permits and the issuance of fishing licences. Each country enacts laws to protect the fishers, the fishing zones, and the fishery resources. It decides on the restrictions, penalties and sanctions to take when laws are broken. Several people in the Ministry are responsible for law enforcement.

Discussion on the regulations and the laws

When you travel by bus or by train, you must buy a ticket otherwise the inspector will give you a fine. This affects everyone. Everybody should abide by the rules and regulations.

Similarly, according to the legislation in most countries, all children should attend school as it is compulsory.

News bulletin...

The inspector boards the fishing vessel. With his notebook, he goes all over the ship to check if it is abiding by international laws and the laws of the country it is visiting. The inspector must ascertain if the ship has been fishing legally. He inspects the fishing records, the navigation instruments, the fishing zones, the size of the fish caught, the number, types and age of the fishing equipment. He also checks whether the amount caught is in line with authorised quotas and notes the catches of non-target species as well as the catch of under-size fish. He then inspects the logbook and the crew register. He also checks whether the ship is equipped with a Vessel Monitoring System (VMS) - a satellite surveillance system which allows the ship’s route to be tracked - and whether it has fished in the restricted zone.
Practical exercises

G1 Your uncle wants to work as a fisher. You intend to help him in his legal undertaking. Who must he contact to register his boat? Where should he collect an application form for a fishing permit? Where can he find out which fish can be caught legally? Where can he find out in which zone/s and when fishing is authorised?

G2 Carry out a survey with the fishers. Find out which laws and regulations they are aware of. Do they abide by these laws and regulations? Do these laws cause them any problems? What According to them, what might incite them to get involved in illegal fishing activities? Who is responsible for law enforcement in your region? What does ‘breaking the law’ mean? What are the penalties that the fishers fear the most?

G3 Display the information collected on a large display board which will be exhibited at the end of year exhibition. Draw posters to show the restricted fishing zones, reserved zones, zones where it is not allowed to catch undersized fish, etc.

What is a quota?

To protect a resource, scientists recommend a limit on the amount that may be caught without any threat to the resource. The authorities impose fishing quotas, that is the maximum quantity of the resource that each fisher is allowed to catch.

Did you know?

There are also transferable quotas which a fisher can sell or rent if, for example, his vessel has broken down. The problem is that for high value resources, a fishing quota can become very expensive and often it is only the big fishing companies which can afford to buy such quotas.

Some countries have, therefore, imposed taxes on profits. Others have reduced the fishing season limits to the extreme, such as in Alaska where the right to fish a particular species of herring for its roe is authorised for only 15 minutes each year.

Control measures and penalties

Different methods of control exist to enforce the laws, depending on the country. Inspectors may impose a penalty or a ban on pirate ships to use the port’s facilities.

In some cases, inspectors may sail on a ship to ensure that the country’s laws or international norms are strictly respected. A scientific observer may be posted on the ship to collect fishing data by taking samples and analysing the size, stomach content and parasites present in the fish caught without having an enforcement role.

Measures such as seizing boats or sending fishers guilty of infractions to prison should be avoided as they will be incapable to support their families and will not be able to pay the fines. For minor infractions, they may be asked to do community work during their free time.
Outdoor game

In the school yard, mark off an area for a road, a pavement, a parking space and different types of vehicles (represented by the students): cars, carts, bicycles, lorries, ambulance, etc. Each one should try and park his vehicle; a policeman takes down the names of those who break any laws.

Did you know?

Some fishing vessels fish without a fishing permit or a licence and with illegal fishing gear or they fish protected species. Illegal fishing represents about 15% of the world’s fish catch. Only international cooperations can help to effectively fight against illegal fishing. This can be achieved through more inspections at sea, banning the sale of products from illegal fishing and imposing sanctions on countries that do not comply strictly with the laws. If a fishing vessel cannot prove where it has caught the fish that it is trying to sell, it should not be allowed access to the port nor should it be allowed to refuel; no one should buy its fish catch. This is a way to discourage illegal, unregulated and unreported (IUU) fishing.

Sketch

Write a sketch where a person of authority has to deal with a person who acts illegally or who is not in possession of his identity card. For example, between a bus controller and a traveller who has not bought a ticket or who is using an expired ticket.

Artistic activity

Observe a boat carefully (a canoe, a motor boat, a ship) and make a drawing of it. Be sure to include its name, number, flag and other characteristics.

Vocabulary

Individual rights, public affairs, law, offence, sanction, illegal, fine, penalty, transferable individual quota, auction, immersion
MANY FISHING METHODS WHICH USE DESTRUCTIVE EQUIPMENT REPRESENT A DANGER TO RESOURCES, ECOSYSTEMS AND FISHERS. THEREFORE, FOR THE BENEFIT OF EVERYONE AND FOR LONG TERM SUSTAINABLE FISHING, IT IS IMPORTANT TO ADOPT FISHING TECHNIQUES AND FISHING GEAR WHICH DO NOT HARM THE ENVIRONMENT.
Setting the scene

Mime the following: to port, to starboard, to rock, to crawl on the ground, to sink and go up again.

The main message

There are numerous fishing methods and fishing gear. Each fishing method has its advantages and disadvantages; however, there are repercussions on the environment and on the resources depending on the fishing gear used.

News from the sea

At sunrise, the men climb on the deck. Gerard has one eye on the map and the other on the radio receiver ‘Torau’, which indicates his position and guides his ship to the exact location that he has chosen. The trawl is now ready and the men are waiting for Gerard’s signal. As soon as the signal is given, the winch is activated, the gates open and the net sinks in the water. A second signal indicates that the warps have finished unravelling and that they can now drag the trawl net along the sea bed. The men go back to rest. The sun is up and the weather is fine on this summer’s day...the coast is out of sight. There are a large number of trawlers around us. The wind has picked up and the sea while reflecting the blue sky, becomes more agitated; the boat starts rocking and rolling. Three hours later, the trawl is brought in. The contents of this first catch is released on the deck. It is mostly prawns but there is some hake, squid, monkfish, as well as various other species of little value...and a few empty beer bottles.

(Source: extract from “La petite pêche à Groix, chasse marée, n°54” G. Borel.)
Comprehension

What kind of fishing vessel is this? What is it doing? Is Gerard fishing alone on this fishing vessel? What happens when the net is dragged on the sea bed? Find out the meaning of the word warp in the dictionary.

Look at the sheets that show the fishing gear and identify the trawl net. Describe what you see.

Traditional subsistence fishing

There are different forms of artisanal fishing that are less intensive than industrial and commercial fishing. They provide employment and are a means of subsistence for many families. These methods are characterised by the use of different fishing techniques and fishing equipment. This kind of fishing is practised on foot or in small or medium boats; it is practised close to the coast or out at high sea and may last from a few hours to a few days. Fishing boats are equipped with oars, sails or low power engines. The traditional knowledge of fishers about tides, the moon, etc. should be respected.

Practical activities

G1 Draw a boat and label its different parts and the fishing equipment (hull, sail, etc.)

G2 Ask the students to do some manual weaving work using coconut leaves, strips of paper (old magazines) or plastic (old plastic bag). Invite a local fisher or an artisan to give a demonstration in the classroom.

G3 Carry out a survey with the local fishers about their traditional knowledge of the moon, the tides, the colour of the sea, signs announcing a storm, favourable days for fishing according to the local calendar.
Industrial fisheries

The main message

Explain and compare industrial fisheries with artisanal fisheries.

News bulletin...

Industrial fishing has greatly evolved and new technologies have helped increase the fish catch and fishing yield. However, the new fishing techniques are so effective that they often lead to overfishing. Industrial fishing provides employment for many people. The products of industrial fishing are of higher quality because they are better processed. They fetch a higher price when exported and are beneficial for the national economy and for the people of the region. The products of industrial fishing constitute the bulk of the exports of all marine resources including fish and other marine species. In certain countries industrial fishing is carried out essentially by boats 30-50 metres long over periods ranging from 10 to 15 days with 10-15 fishers per boat. Trawling is practised on the high seas and the trips may last for months with trawlers that are up to 110 metres long and a crew of up to 60 people. The large factory ships are equipped with refrigeration systems for processing and conserving the products.

Comprehension

What is an industry?

An industry refers to a place where many people work together, usually with machines, to produce a large amount of a given commodity in a short amount of time. For example, a car factory, a canning factory, a paint factory, a textile factory, etc.

Are there any factories in your region? What do they produce? Are there any fish or shrimp processing factories? Where do the raw materials come from? Where are the products sold?

If possible, organise a visit or carry out a survey in a factory. Ask the students to take notes and photos during the visit. After the visit, ask the students to produce a collective report supported by their diagrams and photos.

What type of fishing are you familiar with? What impact does it have on the environment?

Allow the students to respond spontaneously.

What is the meaning of import and export?
Games

**Game 1**: Miming a repetitive movement
Working on an assembly line.
Divide the class into three groups and decide on what kind of assembly line it is. All the students in the same group will do the same repetitive movement and at the same pace. Change the pace by clapping hands.
Example:

- **G1**: Take a bottle cap and screw it on a bottle.
- **G2**: Place a nail on a piece of wood and hit it with a hammer.
- **G3**: Place a sheet of paper in an envelope and seal it.

While one group is miming, the other groups observe what they are doing and clap their hands to provide a rhythm that they should work to.

**Game 2**: Ask the students to sit in a circle and get them to pass three objects round the circle all at the same time. Anyone who drops an object for any reason is eliminated.

Discovery and comprehension

Working in groups and referring to the information sheets, fill in the table below considering the different types of fishing methods, their negative impacts and possible solutions.

<table>
<thead>
<tr>
<th>Type of fishing</th>
<th>Fishing gear</th>
<th>Bad practices</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subsistence fishing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial fishing</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Technical sheet

- **24**: Equipment for subsistence fishing
- **25**: Equipment for traditional fishing
- **26**: Equipment for industrial fishing
Did you know?

Tuna fish are exploited by either long liners with deep-freezing facilities which target the sashimi market or by purse seiners, which are larger in size and capacity; these target smaller tuna for the canning industry.

Written exercise: Personality quiz

1. What type of fisher are you?
   a. You have always been a traditional fisher
   b. You would like to be a famous pirate looking for hidden treasures
   c. You suffer from sea sickness; you prefer to look at the ships rather than travel on them

2. When you see a fish, you prefer to:
   a. leave it in its natural environment
   b. eat it
   c. catch it and put it in an aquarium

3. When you go for a picnic at the beach with your family, what do you do with your litter?
   a. You look for a garbage bin and if there isn’t one you take it back home with you.
   b. You drop it on the ground
   c. You bury it in the sand

4. When you go in the sea, you like to:
   a. Snorkel, looking at the sea life and corals
   b. Walk around and avoid swimming
   c. collect live seashells and corals to take home

5. If you were the owner of a boat you would prefer it to be:
   a. a traditional sailing boat which does not pollute the environment
   b. a boat with a powerful engine to travel very fast
   c. You would prefer a pedalo

Results of the Quiz

If your answers were mainly (a):
You have adopted good practices that will help protect our environment and preserve our biodiversity. You could be a good fisher who shows respect for the environment.

If your answers were mainly (b):
You have rather bad reactions with regard to the environment and biodiversity. If all fishers behaved like you, there would be more pollution and less fish to eat. If your answers were mainly (c):

You should learn to develop better practices. You do not seem to possess the spirit and vision of a good seaman; water is certainly not for you.

A solution for our region

In Kenya, small boats go out to the trawlers to collect their by-catch which they will sell on the local market. Unfortunately, this solution is not applicable everywhere. In Madagascar, transport is expensive to reach profitable markets. In many countries, there are laws which prohibit fishers to discard their non-target catch at sea, as the chance of survival is very low. Also, the non-target catch is not recorded and therefore is not included in
Did you know?
Sharks are sensitive to magnetic fields. A magnetic hook has been invented which repels the sharks. It is a means to protect them.

Discovery and comprehension

Divide the class into three groups to work on the following information sheets:

Information sheet

- Fishing with dynamite
- Trawler fishing
- Rejecting non-target catches

Drawing exercise

Ask the students to make posters that illustrate bad fishing practices, using the information sheets as models. Display the posters that the students like best in the classroom.

The funny ideas of Mr Joker

- Give squids invisible ink that makes them invisible
- Give corals umbrellas to prevent them from whitening as a result of climate change
- Give turtles diving tanks so they can stay under water for longer and avoid fishers
- Place something to scare away the birds along the fishing lines to prevent them from being caught on the lines or in the nets
Technical sheet 10: Writing invisible messages

This experiment makes it possible to write an invisible (not visible to the naked eye) message. This writing technique has long been used by spies and secret services to send highly secret information.

Take a piece of white paper, one lemon, small container, a pointed stick and a candle. Cut the lemon in half and squeeze the juice out of it into the small container.

Take the stick and place the pointed end into the lemon juice and use it to write a secret message on the paper. Let the paper dry and the writing disappears!

Light candle and hold the paper above it, making sure that it does not get too close to the flame and catch fire. The secret message turns brown. The messages can be read out to the class. Students can guess who wrote them.

This same experiment can also be done with milk, onion juice or baking powder.

Endangered species

Do you know of any endangered species? Are there any endangered species in your region? Name those you know and write down their habitat, feeding habits, the dangers that they face and any proposed solutions to save them. Why are they threatened? Read the information sheets.

Are fisheries products exported in your region? Are there any local species that are overexploited? Are there any species that have been introduced in your country that represent a danger for local species? Which fishing gears are used to catch these species? Do they represent a danger for the ecosystems?

Come up with an original method that may be adopted to protect a plant or a domestic animal whilst it is still young. (for example: place a wire netting around a plant to prevent it from being eaten by animals; watering it and protecting it from strong wind or sunlight, etc.)
Conducting a survey and writing a report.

Write a short text on an endangered species due to bad fishing techniques giving three examples of bad fishing practices. Explain why these fishing practices are harmful.

**Did you know?**

Illnesses are caused by toxins that attack the nervous system and can often be deadly. Some species are not toxic themselves, but have become so through the food chain. One of the causes is consumption of blue-green algae which grow on corals killed by sedimentation, heat or an excess of fresh water. These algae are eaten by herbivorous fish which are then eaten by predators, and finally by humans.

**G1**

Fishing with dynamite
Fishing with dynamite is a danger both for the fisher and fish stocks. It kills more fish than needed. It is a terrible waste; the dead fish are spread all over the area; the fisher also runs the risk of being killed or losing a limb.

**G2**

Picking up turtles' eggs
This animal is on the brink of disappearing because less than 1% of the young turtles that hatch manage to survive to adulthood.

**G3**

Shark fishing
Are shark fins consumed in your region? Are sharks consumed in your village or are they thrown back to sea after their fins have been removed? This is extremely cruel.

Each group should identify a reporter to read the text to the whole class. The texts are then displayed in the classroom so that the students may ask the other groups questions.

Twisted words

What do we build on the sand? A sand hat or a sand castle?
He leaves the port in his trawler. Is he a sailor or a fisher?
A vessel designed to travel under water is a subway or a submarine?
Does the sea make caves or waves?
It shows that swimming is allowed. Is it a green toad or a green flag?

Song competition

Have fun with a ‘Save our Seas’ themed rap competition, split the class into groups of four and judge the best song based on both lyrics and melody.
Did you know?

There is a fish that can walk along the sea bed as if it has feet instead of fins. Scientists have long believed that the coelacanth fish, which was abundant in oceans when the dinosaurs were still around, belonged to a species which became extinct 80 million years ago. However, in December 1983, a fisher caught a strange fish by chance, that was metallic blue, in the Mozambique Channel. For the scientists, this fish was definitely a coelacanth. This living fossil, which can grow up to 2 metres in length, is found in the sea around the Comoros islands.

Artistic activity

Using clay soil, moist sand or dough, make models of different types of fish.

Outdoor game

In an open space, one student represents a boat fishing a target species. This student shouts out a colour. The other students (who represent the fish) are in an area separated by a line which they must cross over. Only those who have the colour announced by the fishing boat can cross the line. The others should try to cross the line without being caught by the boat. If they are caught, they must join the crew on the ship and help them catch the remaining fish.

How we can help

Public information and education campaign: Now that I am aware, I should create awareness among others. Based on the texts, design posters, illustrated with text and images, to be displayed at school, at the fisher’s cooperative or as an end-of-year project.

What can I do at the level of my club to help stop fishers using bad fishing practices? What alternative methods may be suggested to them?

Example of a project for the protection of a species by SmartFish

Read the technical sheet about SmartFish.

Information sheet

A project undertaken by SmartFish: Closure of the octopus fishing season in Rodrigues.
Reflecting on fisheries in the region

What should be done to protect endangered or overexploited species in the region?

What is a marine park or a marine reserve? Do you know of such parks or reserves in your region? Are coastal forests and mangroves being replanted? Are the regulations to protect the environment respected? Are there regulations concerning the size of fish that may be caught or closed seasons for fishing and are they respected?

Discussion on the solutions which may be proposed to help the fishers

Solution 1: One of the solutions is to create marine protected areas. Marine protected areas (MPA) are areas where the plants and animals are protected by law. No one is allowed to fish in such zones; but certain activities are allowed to provide jobs for the fishers. They can replant mangroves, keep watch over illegal fishing, educate young people, take tourists around or carry out other activities. Such measures are implemented in zones with particularly rich biodiversity, zones which serve as nurseries or where the biodiversity is particularly threatened.

Solution 2: Another solution is to demarcate zones to protect specific species during certain seasons, hereby restocking the zone whilst allowing juvenile pelagic fish the freedom to access to the deep ocean.

Solution 3: The organisation of regular controls in the zone to discourage illegal fishing: The VMS system reduces control costs and makes implementation of legislations and the protection of the fishers more effective.

Solution 4: The creation of artificial habitats to rehabilitate damaged ecosystems: replanting mangroves, establishing artificial reefs and protecting spawning grounds.

Information sheet

Protected marine areas

Vocabulary

Fossil, subsistence, overfishing, non-target catch, longline, trawler, threatened, extinction
If all stakeholders concerned with fisheries undertake to protect aquatic ecosystems and their resources and if they respect the rules and regulations, if they avoid unnecessary waste and process their products properly, they are participating in the sustainable management of food reserves for future generations.
Processing and commercialisation
Setting the scene

Flying pigeon:
The teacher mentions the name of an animal or an object and the students raise their hands at the same time as saying ‘fly’ if that animal or object flies (example: airplane, fly). If a student raises his hand for an animal that does not fly, he is eliminated.
Example: If the teacher says cow and the student raises his hand and says ‘fly, he is eliminated because a cow does not fly.

Once the students have settled down, ask them to use their hands to imitate the different ways in which certain birds fly. Example: A pigeon, a cockerel, an eagle, a kingfisher etc.

The main message

Fisheries and aquaculture products play an essential role in the human diet. They also represent an important economic resource both for the fishers and for a country’s economy. Therefore, it is important to set quality and price controls on these products. Measures should be taken to safeguard resources, ecosystems and the overall environment, as well as public health.

News bulletin...

Mr Mascarin was a very important person in the region. All the fishers used to beg him to buy whatever they had caught during the day, hoping that their catch was of good enough quality to convince him to part with his money. The problem was that sometimes the fishers had to come from far away on their bicycles under the midday sun. Mr Mascarin was very demanding. He gave a good price but sometimes he would refuse to buy the fisher’s products. Over time, most of the women in the region stopped fishing for crabs, seashells and octopuses as these resources had become scarce; they preferred to work in Mr Mascarin’s factory, where they knew they could be paid a decent salary and where they enjoyed working, as the temperature was always around 60°C.

Comprehension

Who was Mr Mascarin? Which problem did the fishers face? Why were the women satisfied? What were they doing before they ended up working in the factory? Why have the resources which they were catching before, become rare?
Information sheet 27: From the sea to the market

Essay writing based on the observations made by the students in the market, at the fish landing station, on a fishing boat

If a fisher wants to sell his catch to Mr Mascarin, what should he do to keep his fish in good condition? (keep it in the shade, on ice, in a clean boat, etc.)

Mathematics exercises

G1 One kilo of fish costs Rs 10. A lady buys 35 (of your current money) of fish. How many kilos of fish has she bought? Another lady buys two slices of fish weighing 100 gm. How much has she paid? (Use the local currency).

G2 A fisher goes out 3km to sea to fish; he brings his catch back to the fish landing station. The fishmonger buys the fish and takes it on his motorcycle to the market 15 kilometres away. Mrs Unohu buys the fish and takes it home. She lives 3.5 km from the market. How far has the fish travelled from its natural habitat?

G3 A fishmonger with no access to water must wash the fish, the market stall and his hands. He goes to the village fountain 1 km away to fetch water in two jerry cans, each of 4.5 litres capacity. He must undertake six trips during the day, filling both jerry cans on each trip. He also fills two bottles of water, of 1 litre each, for drinking. How much water has the fishmonger used during the day?

Information sheet 28: Hygiene

The main message

Fresh fish is a food commodity that is highly perishable. It spoils quickly once caught. With high temperatures in the tropics, fish turn bad in less than 12 hours. However, good fishing techniques (which do not wound the fish) and refrigeration or the use of ice, help extend the conservation period of fresh fish. However, small boats rarely have refrigeration facilities or ice on board, mainly due to the high cost. Nevertheless, hygiene is key to maintain fish quality.

Exercises

Look up the meaning of the following words in a dictionary: hygiene, sanitary, epidemic, toxic.

G1 Each student draws a cartoon to illustrate one good sanitary practice.

G2 Using Information sheet 28, list the sanitary practices that a fisher should observe take into consideration.
Good practices for good fishermen

There are sanitary hygiene standards in the processing of seafood; however, they are not often followed. These good hygiene practices should be observed across all stages: from of the processing chain: landing the fish on the docks, transportation and storage to manufacturing and freezing.
How to choose a good quality fish?

- **SMELL IT**: It should not have a bad smell.
- **OPEN THE GILLS**: The gills should be red and clean with almost no slime.
- **SCRATCH THE SCALE**: The scales should not be easy to remove from the skin.
- **CHECK THE EYES**: The eyes should be firm, clear and sticking out.
- **OBSERVE THE STOMACH**: It should not have a sunken, soft and mushy or burst stomach.
- **CHECK THE SKIN**: The skin should always be glossy and moist.
- **PRESS THE FLESH WITH A FINGER**: The flesh should not be soft and should not leave the mark of your finger where you pressed.
- **CHECK HOW THE SELLER IS KEEPING THE FISH**: The fish should always be kept under the shade and chilled with clean ice in a clean container.
Here are some general rules of hygiene:

- Wash hands thoroughly with soap and water after using the toilet, before and after handling cuts and infections, after a messy job and before touching food.
- Change clothes frequently and regularly wash clothes.
- Place fish and meat on easily washable surfaces (e.g. a plank of hardwood, tile, stone).
- Regularly wash instruments: knives, bowls, buckets, baskets, refrigerators or the ship's hold.
- Cover food that will be used later in the day.
- Make sure pests cannot access foodstuffs (places in boxes to protect against rats and insects).
- Do not keep leftovers at room temperature.
- Use clean water. If necessary, boil water or use a piece of clean material as a filter.
- To avoid the growth of bacteria in the intestines, liver, gills and skin, keep fish in the shade, in a clean boat and if possible transport with ice.

Did you know?

How do you know if a fish is not fresh? It has sunken and deep-set eyes; on pressing its body, a finger penetrates into the flesh and the gills are brown in colour.

In the past, young boys working on tuna fishing boats had to wash the fish eyes to keep them looking fresh when they reached the port.

Did you know?

There are about 500 species of poisonous fish worldwide which are dangerous for human consumption. That is why we must know what we fish. The crab with eleven spots in Mauritius, the hawksbill turtle that lives around Madagascar and in the Mozambique Channel or the Diodontidae bouletang, are all toxic species. If a person is affected by any of these species they must seek the appropriate treatment. Other species are not toxic, but have become toxic due to the food chain. Chemicals, erosion or pollution contaminate the water and algae, this in turn contaminates herbivorous fish which contaminates carnivorous species and this is eventually passed on to humans.

Outdoor game

Sweep the classroom or pick up waste in the school yard and carry them away on rolling sticks in the same way that boats are hauled up the beach for cleaning.
A visit to the fish market

Take your students to a fish market or to a fish landing station. Divide the class into three groups and ask each group to prepare a questionnaire.

G1: What they see.

G2: Ask the Fish buyers questions.

G3: The students look at the hygienic conditions prevailing.

Survey

G1: Observation: Observe the names of the different species on the stalls, their sizes and prices. Are the prices displayed? Which fish are in greater demand? Which fish are in larger supply? Are there species that are prohibited for sale or which are endangered? Are there species which are earmarked for exportation?

G2: Questions for the clients: What are they here to buy? What do they like? How do they find the prices? Can they negotiate the price? Do they often buy the same thing? Do they often eat of seafood? Which kind? Which format do they buy the seafood (already cleaned, dried, salted, etc.)?

G3: Prevailing hygienic conditions: Interview the seller whilst noting the conditions of the stall, the material of which it is are made, the display, the level of hygiene, the freshness of the fish (sunken eyes, presence of flies, products kept on ice or left on the ground), availability and accessibility of water. Has the fish been eviscerated and cleaned? How was the fish transported? Was the fish caught on the same day? Where was it caught? Some species caught locally are not offered for sale in the market. What are the reasons for this?

If there is no landing stage or market nearby, go to a supermarket and have a look at the products (fresh and frozen), date of the product, country of origin, weight, price, which one is the most expensive and which one is the cheapest, type of packaging, presentation, etc.
**Back in the classroom**

Everyone washes their hands. Follow up with a relaxation exercise.

**Sharing of information**

Write up the information collected in the form of tables as shown below:

**G1**  
Findings on the species available

<table>
<thead>
<tr>
<th>Species</th>
<th>Sale prohibited</th>
<th>Fishing method / mode</th>
<th>Endangered</th>
<th>Fish size</th>
</tr>
</thead>
</table>

**G2**  
Findings from the clients

<table>
<thead>
<tr>
<th>Favourite species</th>
<th>Comparative prices among the species</th>
<th>Packaging (whole, scaled, fillet etc.)</th>
<th>Processing (fresh, smoked, salted etc.)</th>
</tr>
</thead>
</table>

**G3**  
Findings about hygienic conditions

<table>
<thead>
<tr>
<th>Hygienic conditions of the stalls</th>
<th>Is water available to hand?</th>
<th>Is there ice?</th>
<th>Is the market open or roofed?</th>
<th>Are there flies around?</th>
<th>Are there prohibited fish for sale (toxic fish)?</th>
</tr>
</thead>
</table>

Once completed, display the tables in the classroom and hold an open discussion on the observations made.

**Information sheet 29: Processing and preservation**

**Discovery visit**

Arrange for a visit to a place where fish is processed to find out about the processing and preservation methods. Alternatively, invite a person who is involved in fish processing to come and give a talk to the class.

Allow the students to taste pieces of fish preserved by different methods.
News bulletin...

As soon as the fish reaches Mr Mascarin’s factory, it is inspected before it is processed. Processing consists of removing the skin, the bones and any brown flesh (part of the muscles rich in haemoglobin). The factory is equipped to respond to the demand for various types of products: fish steaks, fish fillets, fish fingers and fish slices. The chunks of fish go through another visual control before being validated by veterinary services.

At this point, the factory receives the approval, in the form of a certificate, to export its products. The weight is then controlled automatically. The factory can make different types of packaging (bulk, vacuum packed, in bags, in metal cans or carton boxes). The final steps are mostly automated; each product travels on a conveyor belt. Next, the different products are stored, either fresh, chilled, deep-frozen or canned. Each batch is identifiable by a bar code, which can be decoded in retail shops.

Finally, the batches, except for the metal cans, go through a metal detector before they are automatically packed and sent to the port in containers to countries in Africa, Europe, and even America. At this point, Mr Mascarin is very pleased; he looks at the lorries leaving the factory loaded with his products and rubs his hands.

Comprehension

What similarities and differences can be identified in the fish processing system as shown on information sheet 28? Why is ice necessary? Why should ice be made with clean water? Can ice be re-used? Why should fish not be placed on top of each other?

The funny ideas of Mr Joker

Come up with a funny idea to prevent fish from being damaged from exposure to sunlight when in the boat or on the way to the market. Either draw your idea or write it down.
Information sheet 30
From the sea to the factory

Circulate information sheets 30 and 31 and answer the questions in writing.

Classroom discussion

A processed product can be traced from the instant it is caught to the moment it is sold e.g. canned tuna. This is called traceability. It should be noted that there is no wastage in the processing plant, everything is used and nothing is discarded.

Traceability:
Information sheet 31

The traceability of a product refers to the path followed by that product from the sea to the dining table. It comprises the production and distribution chains, from its origin to its final destination. Normally, the traceability code of a product is written on its container.

The traceability of processed food, particularly fish products, is a priority for the inspection authorities and fishing industries the world over. It aims to provide a guarantee for sanitary norms, as well as for the product quality. It is also a means to fight against illegal fishing. Traceability is thus involved with improving the management of the entire fishing industry.

Exercise on traceability.

Find out the itinerary of an imported product that the students normally consume at home (processed cereal, cheese, etc.).
What is wastage?

- All the fish discarded at sea (non-target catch) represent wastage.
- When fish are kept on the boat in direct sunlight, it will have spoiled by the time it reaches the fish landing station. It must therefore be discarded as it will be unfit for human consumption. This is a great waste.
- When fish is not properly dried or smoked, it spoils more quickly and must be discarded. Moreover, when fish is spoilt, it loses its nutritional value, and is not good for health. Local authorities often do not have sufficient personnel to ensure that the laws are enforced.
- Receiving a loan to buy a boat or a motor to catch an already over exploited species is a waste of money.
- When collecting the eggs of sea- and lake birds for food, the “old” eggs are destroyed to ensure that only the freshly laid (same day) eggs are collected. This is a double wastage.
- Catching fish and octopus when they are too small is a waste.
- Small fish treatment plants do not have the capacity to use all the waste generated by processing (heads, skin, scales, carcasses, etc.). They are compelled to throw them away. This is a waste.
- Artisanal subsistence fishers do not produce any waste. Either they eat or sell all their catch or they use it for bait (except for poisonous fish, which should be thrown away at sea).
- Large factories use fish skins to make leather; oil contained in fish eyes is used to produce medical or cosmetic products, the bones are used to make bone flour which is mixed with wheat flour to produce protein rich bread. When there is too much waste, it can be transformed into feed for aquaculture fish and can also be used as fertilisers in agriculture. Nothing is wasted.

Observation exercise

When do we waste water? How can we to save water? Draw your answer and write captions under the drawings.

In your country, which products do you use that have no waste, such as coconuts or sugarcane where everything is used?

In some countries, people make their own fish sauce. In your country, do you cook with it too? How do you make it?

Can we put fish intestines in the compost to fertilise the garden? The skin of crocodiles, eels and the Nile Perch is used for cooking in some countries. How do you process the horns and skins of goats and cattle in your country?

Practical Exercise

Take a whole fish, remove the head, guts, tail, fins and calculate its gross and net weight. Calculate the weight of the fish parts that are not used and that could be wasted.
What is recycling?

Observation exercise

Have a look at a can of tuna or sardines. What is written on the can? See if you can identify the codes which indicate when the fish was caught and where.

Is there an eco-label on the can? What does an eco-label mean?

This label means that the product has been caught by a method which does not cause harm to the environment, to endangered species (e.g. dolphins) and to ecosystems. It is also a guarantee of the quality of the product. It shows that the factory is in conformity with the hygienic norms. This label is necessary for the export of a product to a foreign country.

How can empty cans be recycled? How can packaging material made of paper, cardboard, metal and plastic be recycled? What dangers do waste materials represent for the environment? What would it be best to do? (recycle)

Manual activities

Design a label for a canned fish that has been caught in your country.

Produce a set of postage stamps representing items linked with fisheries (fish, boat, coral) and propose them as models to the postal services of your country.

Game

Ecological disaster game:
Build a wall with a large number of food cans and throw a ball from a distance at the wall to cause the largest number of cans to fall on the ground.

Experimenting with mathematics

Calculating gross weight and net weight:

Weigh a fish can when it is full and when it is empty. Calculate the weight of the content only.

Weigh a one litre bottle filled with water and the same bottle when it is empty. Find the weight of 1 litre of water. (It should be around 1 kg)

Manual activities

G1 Make some papier-maché using leaves or used egg boxes. Use it to make a 3D model of an aquatic animal.

G2 Make an imprint of a fish (like Japanese art, Gyotaku) on tissue paper. Cover the fish with a thin layer of ink or paint. Place the paper on the fish and press it lightly with the hand (like taking an imprint of a leaf)

G3 Make imprints of the different coins used in your country by placing a sheet of paper on the coin and rubbing over the coin with a pencil.
Making papier-maché is not expensive because it uses mainly waste material. No glue needs to be added if it is made with egg containers which already contain glue.

Tear the egg container into pieces. Place them in a bucket partly filled with water. Leave the pieces in the water for one or two days. Mash up the pieces in the water to make a light paste. Take a sieve and spread the paste on the sieve. The water will drain through and the paper paste will remain on the sieve. Put it outside in the sun to dry.

Another way to make papier-maché is by using newspapers and glue. Start by preparing a skeleton (with metal wires, a ball, etc.) depending on the shape you want. Cut the newspaper into strips, 1 to 2 cm in width. Dip the paper in the glue and allow the surplus to drain off. Place the strips on the skeleton laying it out smoothly with your fingers. Place more and more paper on the form to raise the surface where necessary. Allow it to dry. The time it will take to dry will vary according to the thickness of the paper strips. It may take 1 or 2 days. It can then be painted.

Papier-maché may also be made with leaves, cardboard, etc.

Mathematics exercises

1. In Kenya, fish skin is used to make leather. Mrs Nana, who is a fishmonger is invited to a fishers’ ball. To be the most elegant, she wants to make a dress out of fish skin. If each fish provides a piece of skin of 50 cm by 10 cm on each side, and that she normally needs 2 m by 1 m of material for her dress, how many fish would she need to make her dress?
Technical sheet 12: Building a smoking oven

Materials needed: wooden planks of 150 by 50 cm, nails, wide metallic pipe, old cooking pot, wood shavings, aluminium foil.

Join the planks of wood together with the nails to make a box. Make a hole at the bottom of the box to fit the metallic pipe. Place one end of the metallic pipe in the hole and connect the other end to the cooking pot. Place the wood shavings in the cooking utensil and cover it with the aluminium foil. Light a fire with the wood shavings in the cooking pot. After 2 to 3 minutes, smoke will start to accumulate in the box. The wood shavings should take about 1 hour to burn completely. Place the food for smoking, already salted, in the box. The smoking time required is according to taste. Smoking can take 4 to 8 hours for a fish of 3 to 4 kg. The temperature in the smoking oven should not be above 25°C, otherwise the fish will be cooked. For this reason, the wood shavings should be kept at least 1.5m from the smoking oven, to allow the smoke to cool down.

Civic involvement

Design a plan for a smoking oven and propose it to the authorities and the villagers to help them build their own smoking oven.

How to get involved?

Write a letter to alert the authorities, if the students have noticed that many endangered species or under-sized fish are being sold or if there is a lack of hygiene at the market. Draw posters on hygiene and wastage; display them in the food shops or in health care centres. Offer your help to clean up the market place or lobby the authorities to install a water supply there.

Organise a clean-up campaign at school, on the beach, in a park or on a river bank.

Vocabulary

Hygiene, traceability, ecolabel, wastage, recycling, contaminate.
Aquaculture plays an important role: it provides food, employment and income for the population. Governments of the countries in the region should be encouraged to develop aquaculture further as it contributes to economic development and more importantly, permits to rebuild ecosystems and protect the planet biodiversity.
News bulletin...

Save the sea cucumbers! Swimmers from western countries are repelled when they come across a sea cucumber. Yet, these are fascinating animals. They have the capacity to increase their fluidity at will and to squeeze themselves in narrow crevices. On the other hand, they are extremely slow when they move. They are often caught by divers and end up, after drying and smoking, in soups and stews or fried with garlic on the dining table of Chinese gourmets. They have been so overexploited that they are now threatened with extinction. What a shame for the sea cucumbers!

The main message

Fish and other aquatic resources represent an important source of protein for our nutrition. They are indispensable for our health. The nutritional value of these products is the major reason for intensive fishing all over the world. The overexploitation of fish and other aquatic resources has led to shortages. Fish products are becoming rare and more expensive. If things continue like this and more control are not placed on certain fishing methods, people will lack food from aquatic sources in the future.

Setting the scene: facial expressions

Use your five senses to act out the following scenarios:
- you hear the word dust, you sneeze
- you hear the word vinegar, you say yuck
- you hold your nose
- you smell a fragrant flower, you like the smell and your eyes grow larger
- in front of decaying fish you try not to be sick and show disgust
- when you touch a snail your fingers become sticky
- when you touch a silky cloth you feel like wrapping yourself up in it
- you touch a sea urchin
- you hear a loud sound and cover your ears etc.

Understanding the text

Refer to the technical sheet on the specificities and the roles of detritivores.

Which detritivores live in your region? Are they useful? If yes, why? Are they collected for food? Are they threatened? If so, which measures can be adopted to save them?
Aquaculture

Several countries in the region have been looking for an alternative way to reduce overfishing and in turn reduce the overexploitation of natural resources to allow the ecosystem to recuperate. To satisfy the demand for aquatic food and to ensure food security for the world’s population, the present solution is fish farming or aquaculture. It is equally a solution to the unemployment problem of fishers as they can find a job without having to leave their village.

Aquaculture is similar to raising livestock and poultry, where the animals are domesticated. It consists of breeding fish (pisciculture), shrimps (peneiculture), algae (algoculture) or other species. It takes place in lakes or in the sea in closed cages or in artificial ponds on the land. Like traders or farmers, fish breeders should have a good knowledge of the species being reared and potential diseases. They should also know how to process the products for the local market or for export.

Traditional aquaculture has existed for a long time. Fish farming was commonly practised in Europe in the middle ages to provide fish for the priests and population during festivities. The breeding of Carp was practised in China some 2000 years ago. Today, traditional fish farming is practised in countries with an abundance of lakes and rivers. In Asia, fish are reared in cages under floating houses in which the fisher’s family lives.

In recent years, fish farming has become more intensive. At present, fish farming is regarded as one of the means to satisfy the strong demand for fish while preventing overfishing and the depletion of aquatic resources.

Aquaculture is also used to produce fingerlings to restock rivers and ponds. It is also used to reintroduce species which had disappeared due to over-exploitation or other causes (pollution, natural disasters, etc.)

Information sheets 32 and 33 and answer the questions.

32
Aquaculture and pisciculture

33
Advantages and disadvantages of aquaculture

Exploration and discovery

Are there seaweed farms, fish farms or shrimp ponds in your region? If so, organise a visit or ask an official from the farm to present their project to the class.

Write a letter requesting a visit or inviting an official for a talk. Prepare a set of questions for the visit or the talk and produce a collective report in the form of a summary table:

<table>
<thead>
<tr>
<th>Species reared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place and rearing method</td>
</tr>
<tr>
<td>Origin and price of fingerlings</td>
</tr>
<tr>
<td>Growth period</td>
</tr>
<tr>
<td>Number of workers employed</td>
</tr>
<tr>
<td>Sale outlet</td>
</tr>
<tr>
<td>Sale Price</td>
</tr>
<tr>
<td>Diseases</td>
</tr>
<tr>
<td>Threat to the other species</td>
</tr>
</tbody>
</table>
Experiment

Refer to the technical sheet on stem cutting and prepare cuttings of one or more food crops (water cress, ginger, thyme, cassava, sugar cane, etc.). Observe the rate of growth of the cuttings and prepare a growth chart up to the harvest period. Point out the constraints encountered such as too much sun, no watering during the holidays etc.

Technical worksheet 13 : Stem cutting

Stem cutting is a method of propagation used for certain plants: part of the mother plant is used to obtain a new plant of the same species.

The geranium plant can easily be propagated using the stem cutting method. Select a shoot about 10 cm long and cut it just below a node as this is where the roots will emerge. Remove the leaves at the bottom of the shoot. Plant the cutting in a flower pot. Water the pot regularly. After 30 to 40 days the roots should appear. In certain plants, the cuttings should not be placed directly in the soil as with geranium. It should be placed in a glass of water. At the end of 2 to 3 weeks the roots will start to appear. Wait for another 20 days for the roots to be sufficiently strong to plant the cutting in the soil.

The funny ideas of Mr Joker

When Mr Joker heard about the leaf fish he had a bright idea: to grow a forest of edible leaf fish trees. People could pick up the leaves, which taste like fish, in autumn when the other trees are losing their leaves and making a mess!
Did you know?

Seaweed culture has assumed great importance as it is used in the manufacture of food products such as yoghurt, sushi, desserts etc. Seaweed is rich in minerals (iodine, calcium) and vitamins (A, C, E). It is also used to produce veterinary, pharmaceutical and cosmetic (beauty) products as well as fertilisers and bio-fuel. The latter is used as an alternative to oil and coal, which are highly pollutant and which are becoming more expensive as stocks diminish.

Manual Artwork

Make a model of the fish leaf tree proposed by Mr Joker. Use a dead branch to represent the trunk. Draw the leaves in the form of a fish on recycled paper; cut them out with a pair of scissors and fix them to the branch.

Suggest some recipes for leaf fish.

Aquaculture practised in the region

The main message

Seaweed culture, fish farming in ponds and farming of crustaceans have greatly developed in the region over the past decade. For example, about 15,000 tonnes of dried seaweed, from two species, is produced yearly in the region, generating an income of around US 20 million for the coastal populations.

Data analysis in groups

Distribute the technical sheets: “Who is catching what?” among three groups of students.

Technical sheet 4: Who is fishing what?

Fill in the table below with figures of aquaculture in your region.

<table>
<thead>
<tr>
<th>Country</th>
<th>Aquaculture</th>
<th>In the sea, in lakes, in ponds</th>
</tr>
</thead>
</table>

Seaweed culture, fish farming in ponds and farming of crustaceans have greatly developed in the region over the past decade. For example, about 15,000 tonnes of dried seaweed, from two species, is produced yearly in the region, generating an income of around US 20 million for the coastal populations.
Moreover, aquaculture has negative impacts on
the environment. As all types of intensive farming,
it has many inconveniences:
• The nutritive value of farmed fish is sometimes
  less than that from natural stocks.
• Feeding the fish: At present, most of the fish
  reared in fish farms in developed countries are
carnivorous. About 2 kg of fish from the natural
stock are needed to produce 1 kg of fish on a
fish farm. This is not a solution for food security.
Hence, the fish which is used to manufacture
fish feed should be produced by aquaculture
so as not to damage the natural food chains.
• The introduction of exotic species: Local fish
  species are often unsuitable for fish farming;
exotic species have to be introduced. This
is the case with the Nile perch which were
introduced in Lake Victoria and has become
an invasive species to the detriment of the
indigenous Tilapia. It is important to adopt laws
regulating the introduction of exotic species.
The latter may destroy the local resources if
they has no predators or if they introduces
exotic parasites or diseases.
• Escaped fish: Sometimes, the fish in captivity
  escape from the fish cages or farms to the
surrounding water. These exotic species
represent a danger for the native species. They
may transmit parasites or diseases. They also
represent a source of genetic pollution if they
are genetically modified or selected; they may
lead to a reduction of genetic diversity.
• Increased risk of diseases: The high density
  of fish in a restricted area increases the risk
  of epidemics and forces breeders to use
medicines and antibiotics which may affect
the health of consumers. Intensive use of
medicines as well as the wastes generated by
intensive farming are a source of pollution to
the surrounding waters and represent a risk for
native fish species.
• Pollution: Aquaculture produces a lot of waste.
The high density of fish which characterises
most fish farms is also a source of marine
or fresh water pollution downstream. This
pollution is caused by faeces, left over feed, the
antibiotics and medicines carried away by the
water.
• Destruction of the ecosystem: In the tropical
  zones, the high concentration of fish farms is
detrimental to coastal ecosystems; they have
been particularly destructive for mangroves
and wetlands. Also, fish farming cages at sea
are a hindrance to the tourism industry.

Vocabulary

Over-exploit, protein, alternative, domesticate,
exotic, native (indigenous), invasive.
FOR SUSTAINABLE FISHING, FISH RESOURCES AND THE ECOSYSTEMS SHOULD BE PROTECTED; LEGISLATIONS AND LAWS SHOULD BE RESPECTED, AND THE QUALITY OF LIFE OF THE FISHERS AND THEIR FAMILIES SHOULD BE IMPROVED.
Setting the scene:

Try to mime the following short story:

Get the students to act out specific emotions without talking. Whenever the teacher mentions how Mrs or Mr Zozo are feeling, the students should express these emotions through appropriate expressions on their faces.

Example:
Mrs Zozo is extremely angry for having eaten earthworms and her husband for having eaten maggots.
Be quiet, Mrs Zozo, have a rest. Resting!

When Mrs Zozo is resting, the students move quietly around the classroom. The teacher adds a new feeling to the story (anger, shame, joy, pride, sadness) and once they hear which emotion to mime, the students stay still, like a statue with an expression of that particular feeling on their faces. Allow the students time to have fun.

The main message

Surely the ideal solution is a total ban on fishing activities in those zones where ecosystems are threatened and where fishing is less and less profitable? This appears to be a good idea, but if fishing is banned, the fishers and their families will find it difficult to survive. What should be done, therefore, to help the fishers?
The relation between trades

In those days, cod fishing was meeting the needs of everyone in the town: the ordinary citizens, with their fair share of the catches, the more affluent with their fishing gear as well as all the other craftsmen and businessmen: carpenters and cabinet makers, blacksmiths and caulkers, sail makers and cutlers, dealers in fishing equipment, tar and vinegar suppliers, salt workers, victuallers (who provided the crew with food for the 6 months campaign) and even the notaries who drew up the contracts and the wax traders who were making wax candles which were burnt in oratories to protect the sailors from storms.

Understanding the text

It is apparent from the text that many trades and businesses were relying on the fishing industry to subsist. Explain the dependence of these trades and businesses on the fishing industry. Which trades and businesses are familiar to you? Look up words that you are not familiar with a dictionary.

If we put an end to the fishing industry, all the traders and businessmen will be out of job. They will be unemployed. Unemployment means that no jobs available.

Do you know of anyone who is unemployed? Do you know why some fishers work only part of the year? What do the fishers do when they cannot go out fishing? How about those people who depend on the fishers for their trades and businesses? Which is the worst season for fishing? What do the fishers do during this season?

Did you know?

The fishing industry provides food and employment to millions of people. In Africa, fishing is a means of subsistence for about 10 million people and it provides food to another 200 million people.

What is the current situation in your region?

Survey with the fishers

Carry out a survey with the fishers in your locality. Be polite when you address adults. Introduce yourself and explain the objectives of the survey.

Types of questionnaires:

Which precautions do you take before you go out fishing? Are there times when there are shortages of fish, crabs, shrimps and other species which you normally catch? Are there periods of abundance? (When you catch too much, you are not able to market your catch and must resort to conservation). What are the beliefs and traditions which you take into consideration before going out fishing and which do you obliged to comply with (phases of the moon, specific days etc.)? Do you have a good knowledge of the species which you are fishing? (life cycle, reproduction, etc.). Have you noticed changes in the quality or size of the species which you have been fishing over the past few years? If yes, do you know why this would be?
Prepare a questionnaire with the students of group 2 and group 3 on the following themes:

**G2** Profit and cost: What are the costs of the fishing equipment, fuel, fishing permits, insurance, the boat, etc? Are there other expenses? Do you have access to bank credit? Is there a fishers' cooperative or a fishers' association? Is there a community savings system? Can you borrow money easily? What is your average fish catch in kilos per day? How many days a month do you go out fishing? At what price do you sell the fish? What is your average income per year? Has the present fishing season been fruitful? Have you made a profit or a loss? Have you borrowed money? If yes, from whom?

**G3** Fishers’ opinion: Are the fishers satisfied with their job? If not, which problems do they encounter? For example, they cannot earn their living; their fish catch has gone down; the price of fish has dropped; the price of fishing equipment has gone up; they are short of fishing equipment; the laws are too strict; government procedures are cumbersome; fuel is too expensive; fishing zones are too far away etc. Have you heard about aquaculture, seaweed farming, fish farming, and reforestation of wetlands or surveillance of protected zones? Do you know of anybody who works in a marine park or an aquaculture station? What does that person think of his new job?

**Information sharing**

Each group should prepare a data sheet based on the findings of the survey. One reporter from each group shares the findings; the data sheets are displayed in the classroom and will be used for the end-of-year project.

**Mathematical problems**

Calculate the investment cost for a one day fishing trip. Calculate the profit or the loss. Present the data in a table for ease of comparison.

<table>
<thead>
<tr>
<th></th>
<th>Line fishing</th>
<th>Fishing with fish traps</th>
<th>Dragnet fishing</th>
<th>Long line fishing</th>
<th>Other technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs / expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue/ income</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profit/loss</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Discussion

Summarise the results of the survey. Allow the students to express themselves (the findings are different depending on the context: existence of a factory, fishers’ cooperative, fishers’ association and existing infrastructure: road, water, electricity, etc.)

Bring together all the survey data by category and use it for the end-of-year project or submit it to a local or international association.

Problems and solutions

Make a list of the problems encountered by the fishers and discuss possible solutions.

Example of problems:
• The price of fuel.
• Lack and cost of fishing equipment.
• Refund of loans used to buy new fishing equipment.
• Difficult access to credit.
• Difficult to obtain fishing license.
• Lack of training.
• Poor management of the fishing port.
• Poor organisation and lack of training for members of fishers’ cooperatives and associations.
• Lack of infrastructure for preserving seafood (no cold rooms or ice on the quay.)
• Absence of properly equipped quays in some region and narrowness of the unloading areas.
• The price of fish imposed by the retailer.
• Absence or lack of repair workshops for engines.
• Lack of carpenters for building and boat repairs.
• Abusive use of destructive fishing techniques by industrial ships which sweep the sea bed.
• Reduction in fish stocks.
• Increase in the number of accidents at sea because of the depletion of the resources and hence the need to explore fishing zones which are further away.
• Poor knowledge of navigation rules by fishers who ignore international regulations.
• Absence of security equipment for high sea fishing.
• Imprudence due to bad practices.
• Absence of compensation during the closed season for fishing.
Chant fishers’ problems rhythmically.

Song, rap or slam

Compose a song based on a local tune linked to fishing.

What are the solutions to these problems?

The rules and regulations put in place by governments for the protection of the environment and aquatic ecosystem do not always have the interests of the fishers in mind. Some accompanying measures should be attached to these regulations.

For example, if the fishing season or the number of fishing days per month is controlled, consideration should be given to those fishers who do not have any other revenue during the period of inactivity. Their boats also stay idle during this period. They should be consulted when such decisions are taken. They might be provided with an alternative occupation to allow them to have an income during this period. For example, improving their agricultural techniques, as many fishers involved in subsistence fishing are also farmers. They could also take tourists around in their boat or follow a training programme etc.

Technical sheet 34: Fishers’ security

Divide the class into three groups and ask each group to consider a particular problem and to present it to the class in form of a role play highlighting the problems and the solutions. It could also be presented during the end-of-year activities.
Problem 1
The fishers depend on the fishmonger or fish factory to buy their fish catch. The retailers lend them money for family festivities. The fishmongers are often the owners of the boats and engines.

First solution: The boats should remain the property of the government or cooperatives until they are fully paid for by the fishers. The fisher should not be allowed to sell the equipment he has received to another fisher simply to get money and remain idle.

A better solution would be to give the money allocated to buy fishing equipment or a boat to the village authority who can then put pressure on the fisher to pay the money back.

Second solution: The taxes paid by the factories should be used to set up the necessary infrastructures for the fishers (water, electricity, cold rooms, smoking rooms, etc.). These infrastructures could then be managed by the village council.

Each country and every fisher community should obtain an equitable part of the income generated by the fishing industry. Fishers should have access to new infrastructure, credit facilities, enterprises involved with aquaculture and receive help with investment plans.

Problem 2
Government institutions or banks give money on loan to fishers and investors who intend to exploit the aquatic resources of their countries. The problem is that these fishers use the money to increase the fishing effort even when fish resources are declining. This leads to the impoverishment of the fisher’s family.

Solution: Confronted with these problems, fishers have grouped themselves into cooperatives or associations to better administer funds and solicit aid.

Problem 3
The problem with a cooperative is that professional administrators are needed to manage them, because very often the fishers have never been to school and are not able to manage an account book or a budget.

It is difficult to find solutions to the problems of small traditional fishers as often they do not have other resources to explore. They practice subsistence fishing and not high-tech fishing as is the case with industrial fishing.

The fishers should abide by the laws and the regulations. Failure to do so can lead to severe penalties. For example: the sale of toxic fish is illegal but some fishers remove the skin of the fish so that the buyer is unable to recognise the fish. People who buy and consume such fish could die.
Alternative employment

Alternative employment possibilities should be identified for the fishers, such as guards for marine parks, marine tourist guides, workers in aquaculture farms, etc. During the closed season, for example, training sessions such as literacy programmes, budget management courses, use of new technologies, etc. could be organised.

Information sheet

Fishers’ security

34

Alternative occupation to fishing in the context of ecosystem protection

35

Organising a talk at school or with a cooperative

Invite a fisher and a local environmental NGO to give a talk on the local aquatic resources and on the living conditions of the fishers. Encourage a free discussion from their point of view and allow the students to ask questions.

The funny ideas of Mr Joker

In some countries, some people breed worms for their eggs which are sold as a substitute for fish eggs. Mr Joker proposes to import fountain trees which grow in the Canary Islands. He intends to breed the fish in a fountain tree and use the bottle palm tree to make it easier to export them!

Vocabulary

Debt, cooperative, unemployment, protest actions
Assessment of the proposed solutions and elaboration of the end-of-year project.

Despite the pessimistic assessment of the world’s fisheries, it is still possible to rehabilitate fish stocks and ensure the sustainable exploitation of the oceans. Together we can save our aquatic resources if we act immediately.

Assessment of the types of management addressed in this guide

• Management of the ecosystems and the fishing zones
• Management of research and fisheries statistics
• Management of fisheries laws
• Management of fishing methods and fishing gear
• Management of fisheries’ products
• Management of food security and aquaculture
• Management of the fishers and the well being of the fishing community

Group exercise

During the present academic year, together with your club, you have participated in the SmartFish project for better fisheries management. Make a summary assessment of all the types of management studied for your region.

• What impact has the project had on you?
• What have you learnt from the project?
• What measures have been taken at the level of your village or region to strengthen the protection of ecosystems and biodiversity?
• What will happen in your region if no corrective actions are taken?
End-of-year project

Present the project outcome in the form of an activity or an end-of-year community project.

Example of projects

• Organise a role play: involve all the members of the club. Prepare a budget and look for sponsors; write the scenario and select the actors; set up the decorations and select the music; prepare the costumes and organise the rehearsals; finally, prepare a programme for the shows (invitations, programme, press communiqué, radio announcement). Introduce the club and the war dance to the audience.
• Spread the message, through a role play, a poster or a song, of the need to protect ecosystems and coastal habitats for the preservation of species, food chains and the restocking of fishing grounds and also that all fishing activities should be strictly controlled.
• Set up an exhibition with the posters and other materials produced by the students during the project.
• Display the code of conduct and illustrate it with a drawing showing a little man holding a flower where each petal has a rule of good conduct on it.
• Prepare a large poster, to be displayed in the classroom, showing good and bad fishing practices.
• Display the drawings of the bad practices at the community centre and the fish landing station.
• Exhibit Mr Joker’s fish leaf tree.
• … and any other original ideas.
SmartFish is a regional fisheries project managed by the Indian Ocean Commission, funded by the European Union and co-implemented by the Food and Agriculture Organization of the United Nations. SmartFish, which operates in twenty countries throughout the East and Southern Africa - Indian Ocean region, focuses on fisheries governance, management, monitoring, control and surveillance, trade, and food security.

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