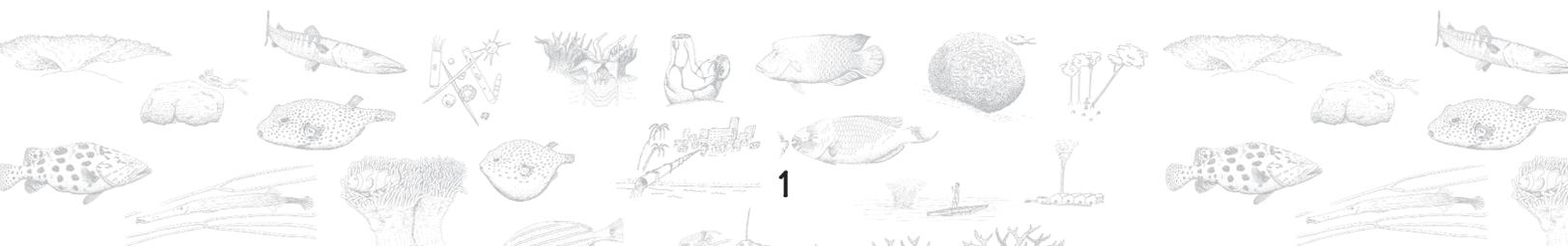


OCEAN WONDERLAND 3D

TEACHER'S RESOURCE GUIDE



Ocean Wonderland 3D is a 3D underwater movie shot in large format on Australia's Great Barrier Reef and in the Bahamas. The film's goal is to underline the crucial ecological role of coral reefs, and the fact that they are endangered. It shows the immense diversity of the marine life on the reefs and the beauty of the many corals living there. It also illustrates the dangers threatening and destroying the world's coral reefs. Shot entirely with natural light, ***Ocean Wonderland 3D*** shows for the first time the underwater world as it exactly is. This is the closest you can get to dive without being there, without getting wet.

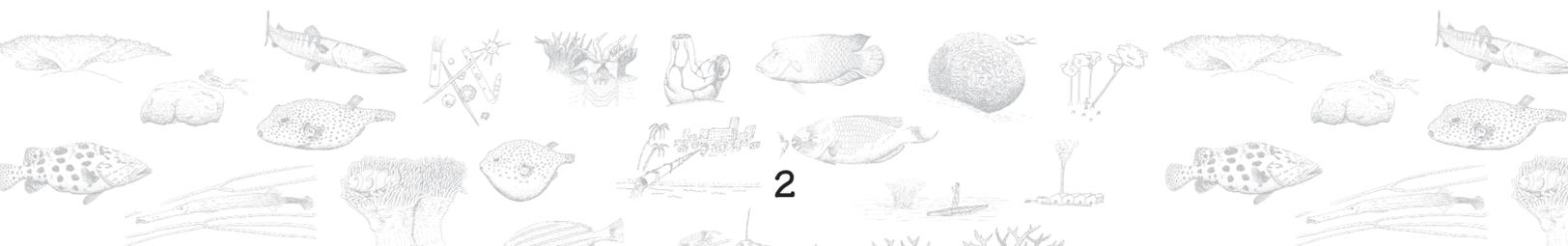
Ocean Wonderland 3D was produced in collaboration with the United Nations Environment Programme (UNEP) with assistance from WWF.

The ***Teacher's Resource Guide*** outlines the main biological features of coral reefs, their formation, and their ecological role for the planet. It describes most of the sea creatures that appear in the movie, and gives some of their main characteristics. It explains how all these creatures belong to and function in a rich but fragile ecosystem that is greatly endangered. It draws attention to the main threats to coral reefs and gives recommendations on how to protect them.

The ***Teacher's Resource Guide*** was prepared by Dr Mark Spalding, a marine biologist who is an expert on coral reefs, with the collaboration of professional educators like your self. It was created to easily adapt to teachers' specific needs and curriculums. Please feel free to modify and duplicate the materials to suit your students' needs.

The ***Teacher's Resource Guide*** is divided into five sections offering information on five different topics. Each sheet provides examples of activities you can do with your students. They can be used alone or with other sheets in the Guide and are meant to enhance the experience of going to the theater and seeing the film. The material in the guide is designed for use with students of elementary age through high school.

Do not hesitate to send your remarks and suggestions to emantello@free.fr



Before Visit:

- **1. Background Knowledge about Coral Reefs** - is both an introduction and a summary of the marine world that your students will discover diving with us, and the dangers threatening it. The activities (Quiz and Worksheet) provided in Sheet 1 should be taken before and after the screening.
- **2. Corals – Block Builders** focuses on coral as an animal (description, location, feeding habits, reproduction).
- **3. Creatures of the coral reefs** describes briefly all the creatures your students will see in the movie. It focuses then on the reef creatures' adaptation to their environment, their type of diet and ways of catching food.

After Visit:

- **4. What is happening to the coral reefs?** introduces students to the crucial role the coral reefs play for all living creatures and the dangers threatening them.
- **5. Help save the reefs!** explains what can be done to stop the destruction of coral reefs.

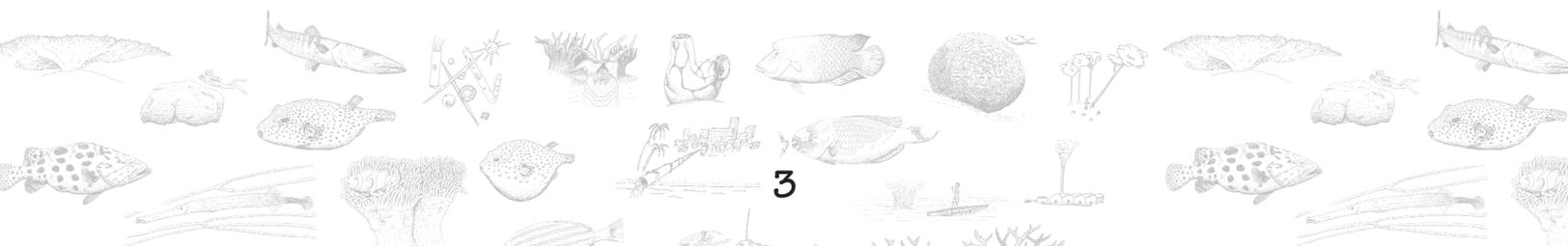
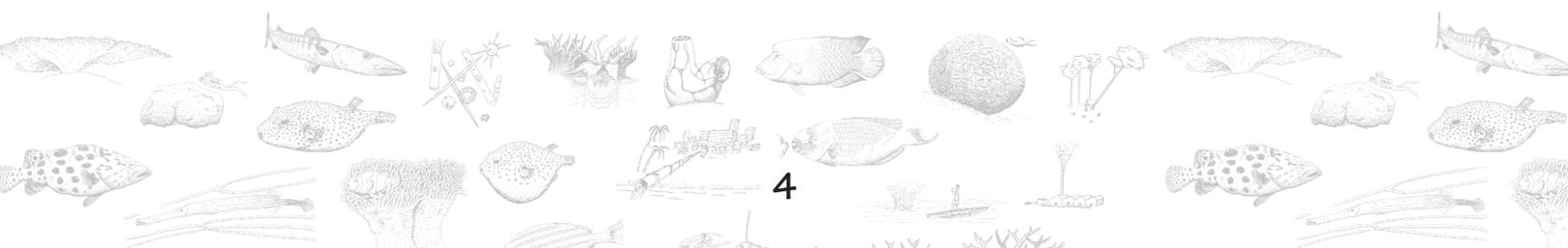


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1. Background Knowledge about Coral Reefs

This chapter can help you familiarize your group with a few facts before watching the film. It is both an introduction and a summary of the marine world that your students will discover diving with us, the dangers threatening it, and the way we might help save the reefs.

I. Where are we going to dive today?

Your students are about to enter another world. Show them on a world map where coral reefs can be found around the world and where the movie *Ocean Wonderland 3D* has been shot.

Corals are sensitive creatures that need warm, clear and shallow waters. They can survive in waters from 64.4 to 84.2°F. They also need sunlight, which means they can only grow in shallow areas. If the water is murky the light often can't get through. The warmest waters in the world are around the tropics.

This map shows clearly that reefs are widely scattered, but individual reefs can be quite isolated. Further more as corals needs shallow waters; most coral reefs are located near coasts.

Coral reefs are found all around the world. The best-known areas for coral reefs are the Pacific Ocean, the Caribbean, the Indian Ocean and the Red Sea. *Ocean Wonderland 3D* was filmed on Australia's Great Barrier Reef and in the Bahamas.

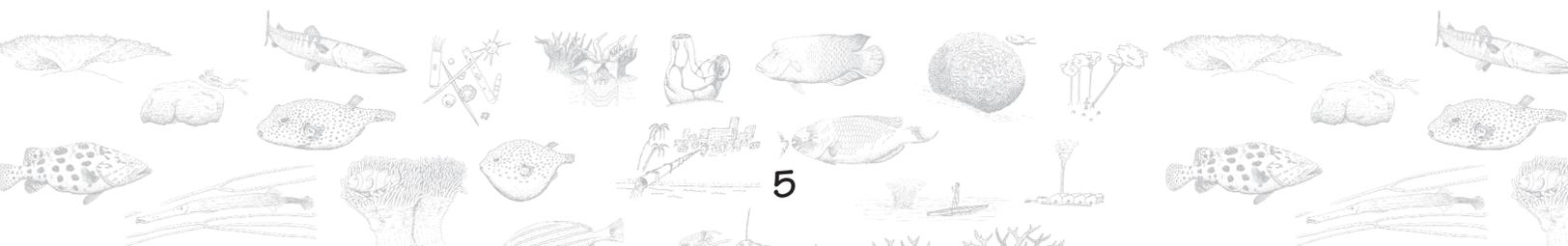
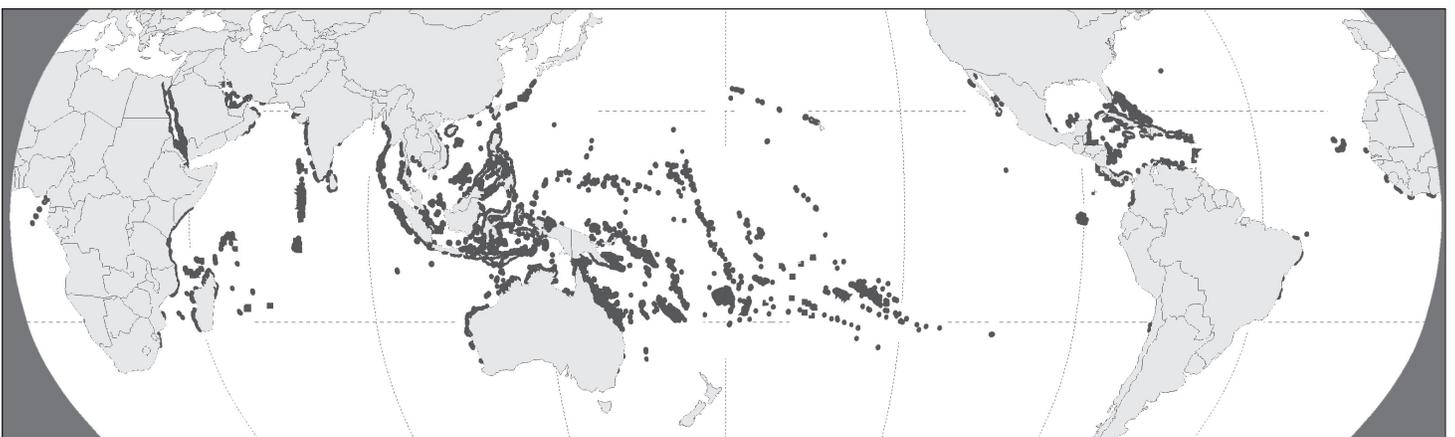
The Great Barrier Reef is the world's largest reef. It is over 1,240 miles long. With its bright colors it is easily visible, even from outer space.

II. Coral reefs and their creatures

During *Ocean Wonderland 3D* your students will see creatures they probably have never seen before. They will be faced with a wall of life in incredible abundance. They will encounter sea turtles, sea stars, sea squirts, yellow snappers, parrotfish, sea anemones, rays, sea snakes, dolphins, groupers, barracuda, trumpet fish, Napoleon wrasse, sharks and more (see Sheet 3).

There are more species in Coral Reefs than anywhere in the world. One of the strangest animals your students will meet during their dive with us is the coral. They will see many different species of corals. Corals come in an

The coral reefs are the darker patches shown on this special map.



incredible diversity of size, color, and form.

Corals are not plants, nor rocks. They are animals. Each coral is actually a colony of tiny animals. Clustered together they build a communal skeleton of limestone. There they sit, unmoved by waves, and unable to move themselves.



Plate coral

Under the right conditions, individual corals can reach tremendous sizes. Over the centuries, skeletons grow upon skeletons, and vast structures of limestone are formed visible even from space. In fact, coral reefs are the only structures built by animals that can be seen from the moon.

The word “reef” means a hard underwater structure that sticks up from the bottom. A coral reef is an underwater hill, or even a mountain, which has been built by corals.

III. Dangers on the Coral reefs

Ask the students to think about the possible dangers they might face while diving on the coral reefs. Introduce them to the predators and the poisonous sea creatures they will discover in *Ocean Wonderland 3D*. (See Sheet 3).

Sharks and other predatory fish such as **groupers**, or **barracuda** are generally quite safe – even big sharks feed on much smaller creatures than us, but they will bite if provoked.

In some cases the poisons are so deadly that they kill the attacker very quickly. Only the fish, which avoid the poisonous ones, survive to breed.

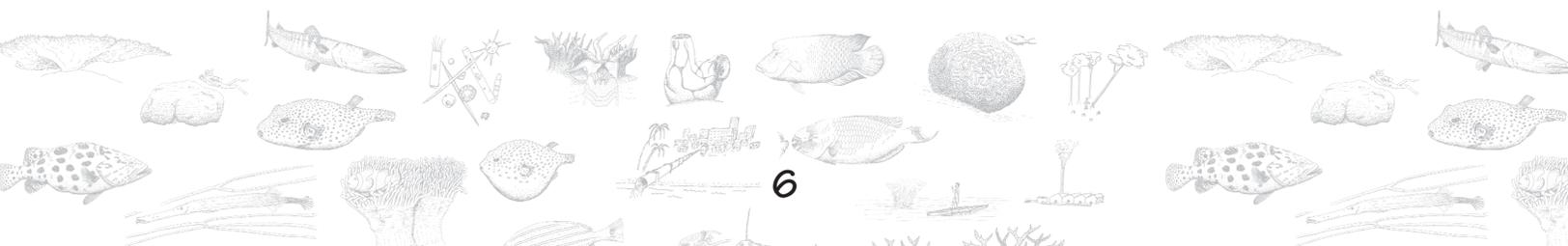
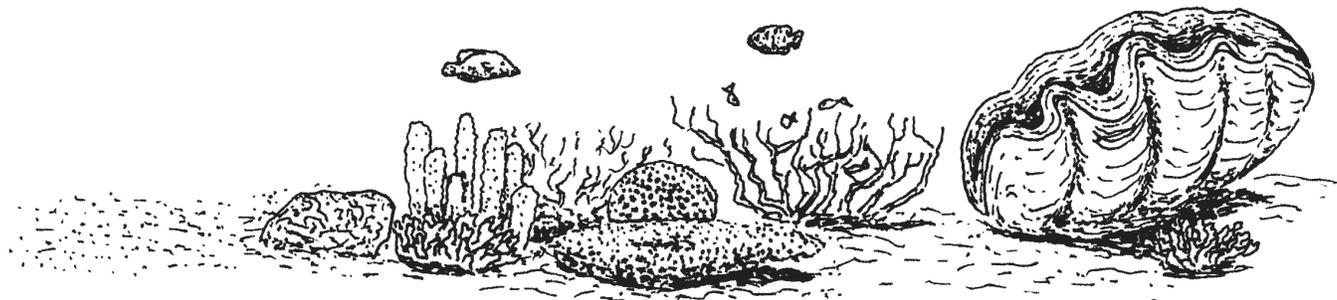
Other animals use poison for attack. **The sea snake** has some of the most powerful venom known, delivering instant death. As such they are one of the deadliest animals on the planet. However, they do not attack humans without a cause. Sea snakes are just curious, as you will see in *Ocean Wonderland 3D!*

The **sea anemones** have stinging tentacles they use to capture small fish and other sea creatures. They are not powerful enough to affect humans. Neither are **corals'** stinging tentacles. Fire coral is the only type of coral which can cause pain or burning sensation when touched.

While diving the safest thing is not to touch anything.

IV. Conservation Issues: Dangers for the Coral Reefs

In order to understand how and why the coral reefs are endangered, students need to get a “bigger” picture. They need to think how humans have been using the sea, how these human activities have been affecting the sea and most specifically the coral reefs' ecosystem. Since they are about to (virtually) dive, ask them also the damages they themselves might cause when visiting the reefs and what they should not do (See Sheet 5).



V. Pre-Knowledge Activities

How much do your students know about life on the Coral Reef?

Before going to see the movie, you might want students to test their own knowledge by doing the following activities and fill out the **Worksheet**.

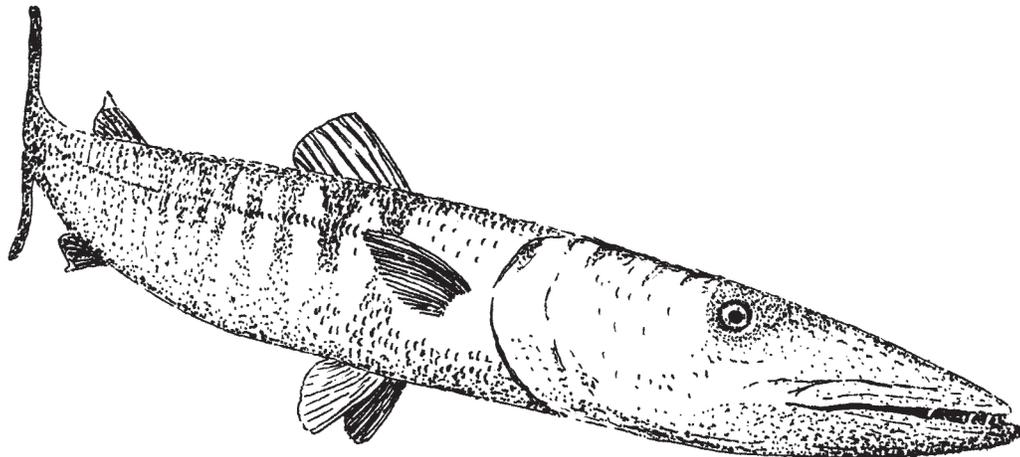
Students should answer questions before and after the screening.

For Activity #2, select some of the questions depending on your class level and the topic(s) you want to focus on.

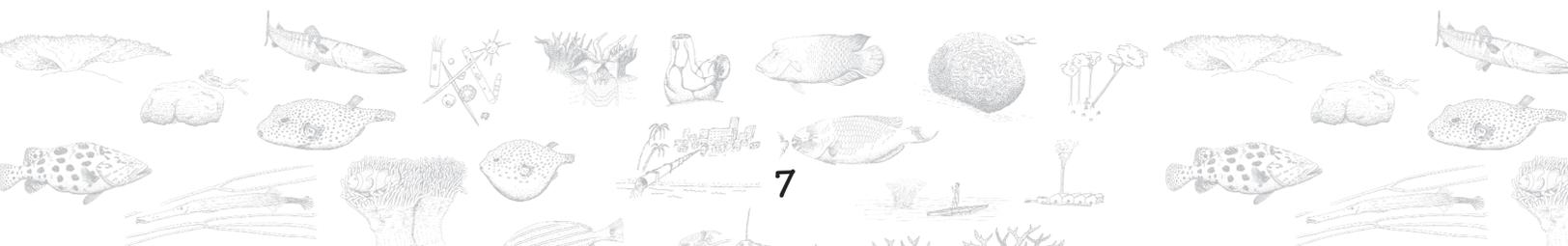
Activity #1

Ocean Wonderland Mini-Quiz. Answer with "True" or "False".

| | True | False |
|---|--------------------------|--------------------------|
| 1. Coral reefs are located in deep warm waters. | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. A coral is a plant. | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Coral reefs provide food resources for both sea creatures and humans. | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. There is less variety of life on coral reefs than anywhere else on land. | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Sharks love to eat human meat. | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Sea anemones are carnivorous animals. | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Sea turtles, sea snakes and dolphins need to surface for air. | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Healthy corals are white. | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Sea anemones are dangerous to humans. | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Sea snakes have one of the most poisonous venom on earth. | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. Corals grow very fast. | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. The dolphin is a carnivorous fish. | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. Men have killed way more sharks than sharks have killed men. | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. Corals are not destroyed when the water warms up: they adapt. | <input type="checkbox"/> | <input type="checkbox"/> |



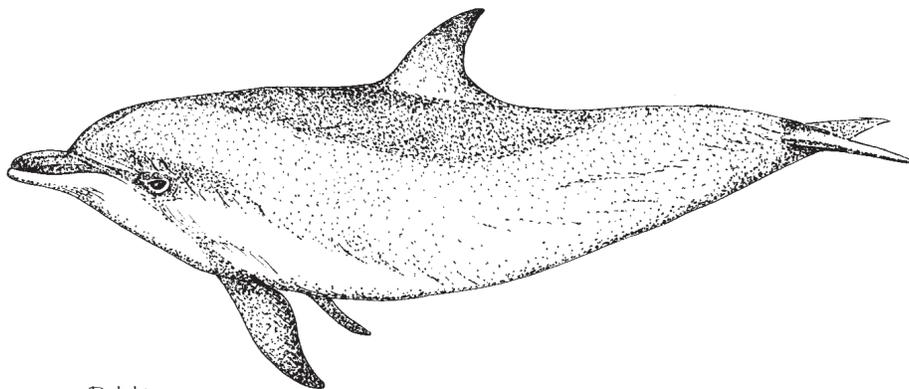
Barracuda



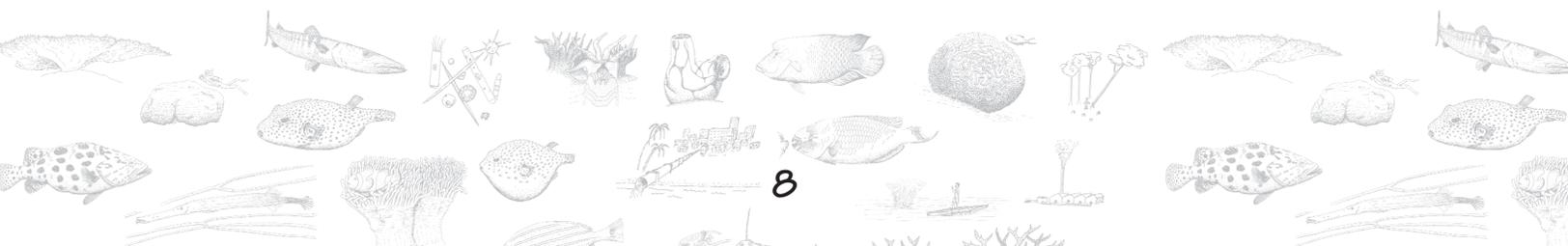
Activity #2

Complete the “K” and “W” parts of this worksheet before the screening of *Ocean Wonderland 3D*. After you have seen the movie, complete the “L” part of the worksheet and check with your students how much they have learned...

1. Can you name the biggest oceans and seas in the world?
2. Do you know in which oceans corals can be found and why?
3. What is a coral?
4. What is the difference between an animal and a plant?
5. How have people always used the sea?
6. How have humans been using corals?
7. Do you think many sea creatures live on the reefs?
8. Can you name three predators that live in the ocean?
9. Can you name at least three poisonous sea creatures?
10. What is the difference between a shark and a dolphin?
11. What is the difference between a turtle and a tortoise?
12. What is an herbivore? Can you name one that lives in the sea?
13. What is a carnivore? Can you name one that lives in the sea?
14. What is an omnivore? Can you name one that lives in the sea?
15. What is a primary producer? Can you name one that lives in the sea?
16. What do sharks eat?
17. What do sea anemones eat?
18. What type of sea creatures do you eat?
19. What is an ecosystem?
20. What is a food chain?
21. What is global warming?
22. What is polluting oceans?
23. How are sea animal endangered by pollution?
24. How is coral endangered?



Dolphin

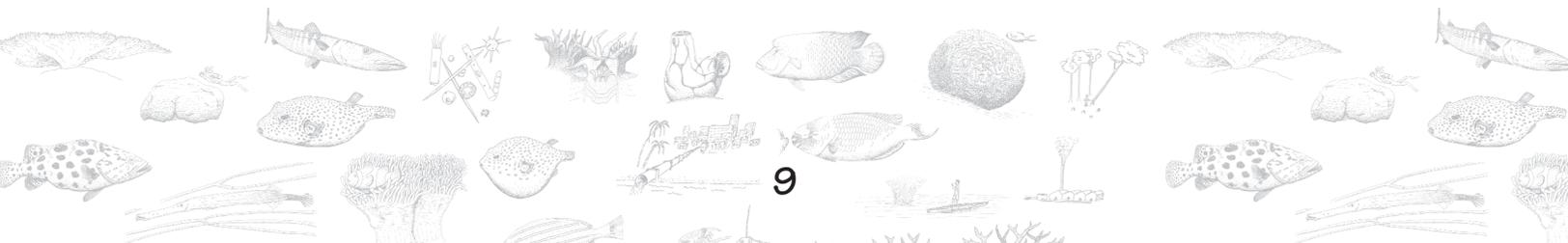


| | | |
|--|--|---|
| <p>Complete the 'K' and 'W' parts of this worksheet before seeing <i>Ocean Wonderland 3D</i></p> | <p>WORKSHEET <i>Ocean Wonderland 3D</i></p> | <p>Complete the 'L' part of this worksheet after having seen <i>Ocean Wonderland 3D</i></p> |
| <p>K</p> <p>What you know.</p> | <p>W</p> <p>What you want to know.</p> | <p>L</p> <p>What you learned.</p> |
| | | |

Activity #3

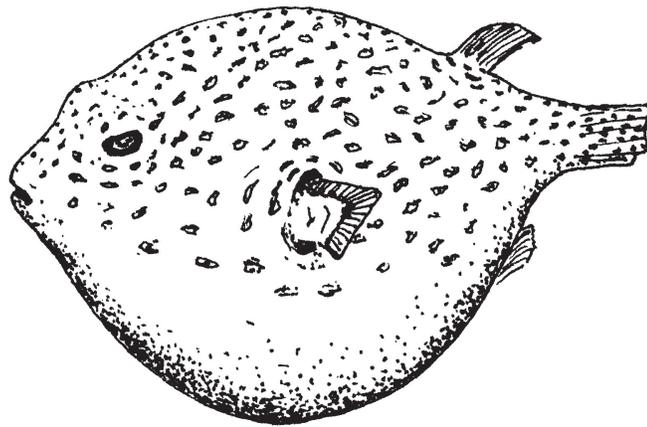
Classroom coral reef

Photocopy the sea creatures in this guide. Blow up the images to life size. Copy the reverse image of each creature. Give each student one reverse image of the creature and a normal image. Have each student color the creature, cut them out and glue or staple the two images together. Stuff before closing with recycled paper. Hang creatures from the ceiling and transform your room into a virtual coral reef.

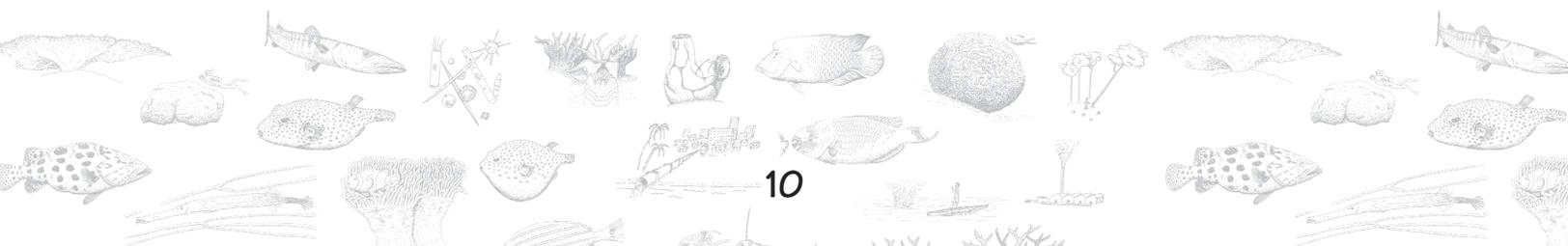


Answers for Activity #1 Ocean Wonderland Mini-Quiz.

1. False. Coral reefs are located in warm **shallow** waters.
2. False. A coral is an **animal**.
3. True.
4. False. There is **more** variety of life on coral reefs than anywhere else on land.
5. False. Though the largest predators in the sea, sharks **do not like** human meat.
6. True.
7. True.
8. False. When they are white, they are **dying**. White corals are called "bleached" corals.
9. False. Sea anemones' stinging tentacles are **not dangerous** to humans.
10. True. But the sea snake is not aggressive towards humans, unless provoked, of course!
11. False. Corals grow **very slowly**. Branching corals can grow up to 4 inches a year, but the round, brain corals may only expand at 0.7 inch a year.
12. False. Dolphins are **mammals**.
13. True. Men have killed way more sharks than sharks have killed men.
14. False. Corals are destroyed if the temperature is too warm...



Pufferfish



2. Corals - Block Builders

I. Fact file

a. What are corals?

Corals are not plants or rocks. They are animals, but pretty strange ones. Each coral is a colony of tiny animals that are called “polyps”. All the corals you saw in *Ocean Wonderland 3D* are in fact made up of hundreds or thousands of these “mini-animals” or polyps.

Polyps

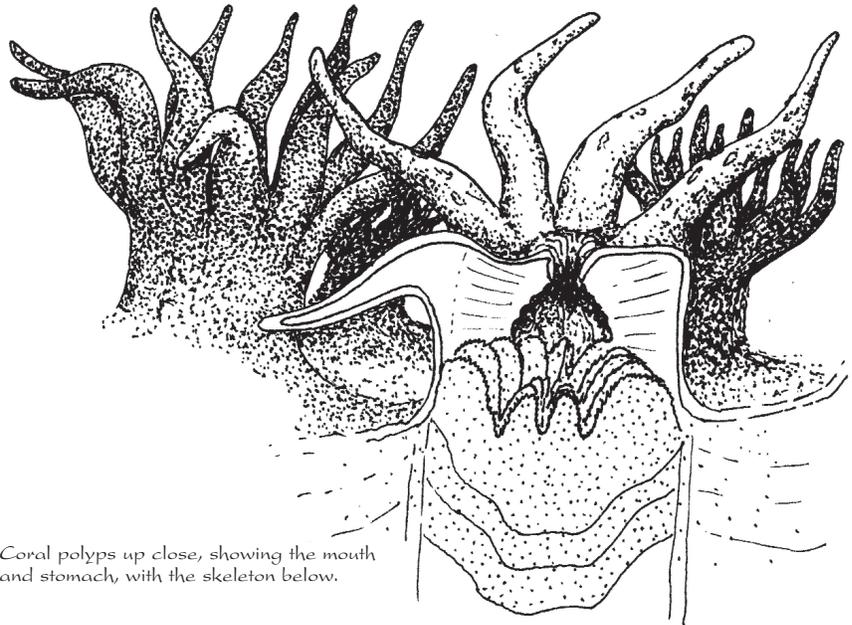
These polyps are like the building blocks of corals. It's a very simple animal, shaped like a cylinder, but with a lot of tentacles around the top. These tentacles wave about in the open ocean and catch tiny animals and scraps of food, which they pass into their central mouth. But hang on! There's only one hole here! Any food that the polyp doesn't like, and all the bits left over once the food has been digested, has to come out the same way.

Polyps don't have a brain. Instead they have a network of nerves able to pass messages from one part of the body to another.

Tiny skeletons

Polyps have a skeleton, which they build by absorbing calcium carbonate dissolved in the seawater. Unlike most other animals each polyp is fixed firmly to the ground, or to a neighboring polyp. This means they can't move around.

As polyps create more polyps their skeletons become joined together and form a colony, a sort of super-

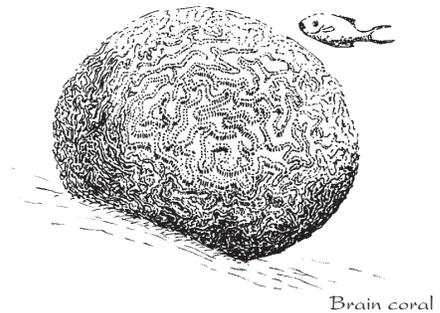


Coral polyps up close, showing the mouth and stomach, with the skeleton below.

animal – and that's a coral. Clustered together they build a communal skeleton of limestone, and there they sit, unable to move themselves.

b. How do corals look like?

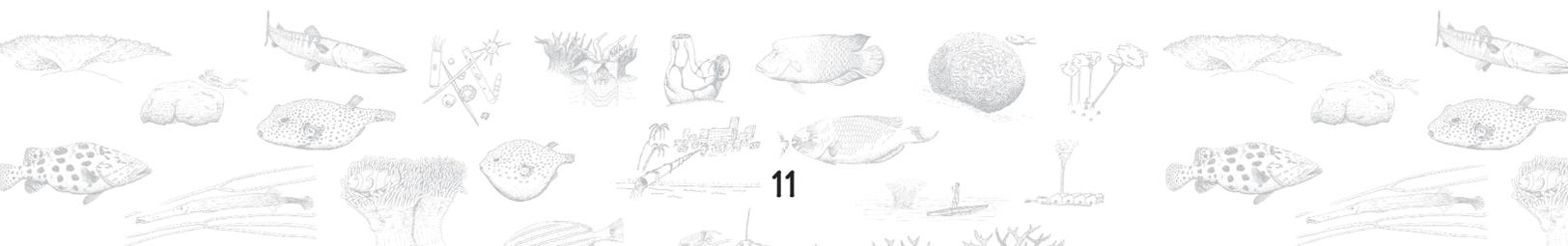
Corals come in all shapes, sizes and colors. Most are hard, some are soft as you will see in the movie. They're not so quick to grow. Think of a branching coral. Typically these can

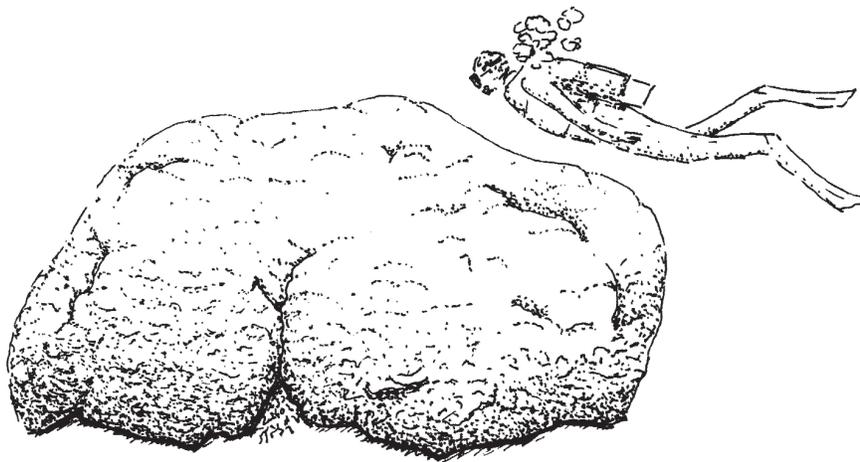


Branching coral, showing growth

grow about 6 inches in a year, and as they grow they also split and form new branches. But the boulder corals

and brain corals grow less than 0.40 inch a year. Without its polyp, the skeleton is entirely white.





Boulder coral

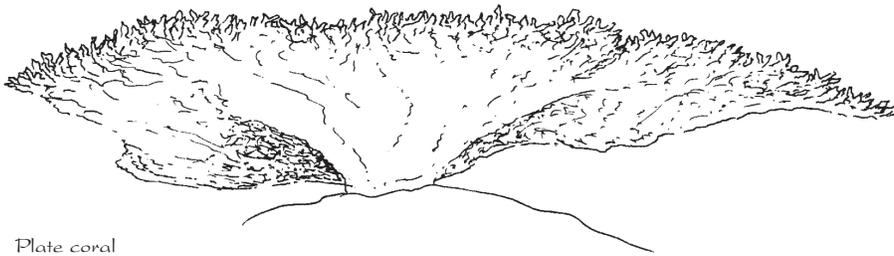


Plate coral

joins here the rest of the plankton. If the coral sperm meets the right egg, they join (fertilization). The egg divides and develops into a small larva, known as a planula. The planula remains in the plankton for up to 30 days and may drift many miles, but eventually it swims down to the bottom where it settles, grows tentacles, and becomes a polyp.

Photosynthesis: A neat double deal!

Algae are a very simple form of plant, and like all other plants, they use the sun, along with water and carbon dioxide to create sugars. This process is called **photosynthesis**. These sugars are the stuff of life. With them the plants are able to make other chemicals, which they use to grow. And all animal life depends on plants to do this.

On land some animals eat the plants, other animals eat the animals that ate the plants and so on. Everything can be traced back to plants. It's the same in the sea, but the plants (algae) are often much smaller than they are on land.

By having algae within their bodies, corals have worked out an amazing partnership. The algae can grow where no one can eat them, but in return they "leak" out some of their sugars, which the corals use as food. Also, when algae photosynthesize they produce oxygen, and corals need oxygen, just like we do, to breathe. When they breathe, the corals produce carbon dioxide, which the algae need to photosynthesize. It's a neat double deal. This sort of joint benefit in nature is known as **symbiosis**.

c. What do they eat?

Each polyp can use its ring of tentacles to capture food as it floats past. But their diet is greatly helped by a strange and invisible collaborator. Millions of tiny microscopic plants, called **algae**, live within the coral's tissues. Although they are too small to be seen it is partly these algae that give corals their bright colors. So what are they doing there?

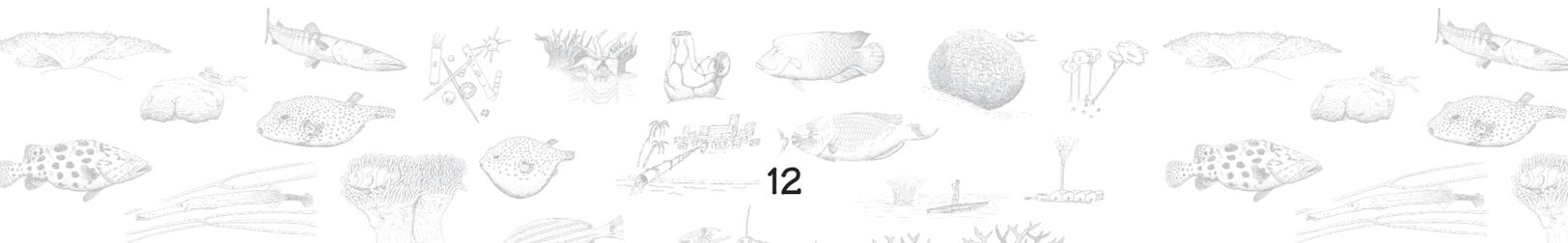
These plants - like all plants - make their own food, using the sun's energy. Inside the corals, algae provide enough food for themselves and their tiny hosts. So the food captured by the corals themselves is rarely more than a top-up.

d. How do they reproduce?

One polyp can survive on its own, but to build a coral it can split into two, and those two can split into two, making four, then eight, then 16, 32, 64, 128, 256, 512, 1024, etc. This splitting into two is known as asexual reproduction. The two first polyps are identical in the same way as identical twins, and there is no genetic difference between them.

Coral polyps can also reproduce sexually. At certain times of year all the corals produce a great mass of eggs and sperm, which they just release into the ocean. This mass

* Plankton is the name given to all the microscopic plants and animals floating or swimming in the ocean.



II. Activities for Students

Activity #1

Draw a coral

Draw a **brain coral** starting with a young one 2 inches across, and then draw it after 1, 5 and 10 years. Work out how much it would grow and use a ruler to draw the right size.

Do the same with a branching coral – you'll need a big bit of paper. Don't forget to let it branch.

Activity #2

What is an animal?

Corals don't have brains. They stay in one place all their lives. They even have plants living inside them. What makes them animals?

Activity #3

Types of coral

Corals come in an extraordinary range of shapes and sizes – plates, branches, boulders, brains, lettuces, or mushrooms. Clay or plasticine can be used to build some corals.

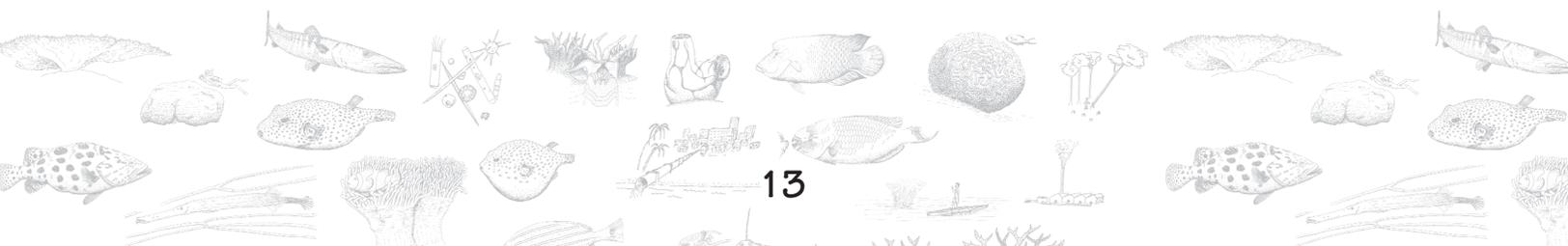
Older classes might rather try to build a polyp, and could then try joining a number of polyps together to build a small coral.

Activity #4

Big numbers

Typically you might expect about 30 polyps per square inch of coral. Imagine that you have a flat, circular plate coral of 3-foot diameter – how many polyps are there?

Develop other questions based on the surface area of spheres (a brain coral is half a sphere), or cylinders (branches), or even an entire reef of given dimensions.



3. Creatures of the Coral Reefs

Coral reefs are full of life, and they provide food and shelter to sea creatures. There are about one million different types of plant and animal on the coral reef. These include almost 5,000 different types of fish – that’s a quarter of the types of fish found in the sea. There are 800 stony corals, but scientists are discovering new species all the time, so the true total might be much higher.

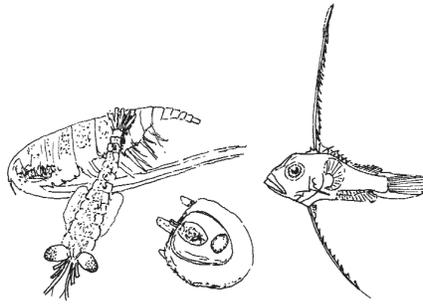
1. Fact file

Here are some of the creatures you will see in *Ocean Wonderland 3D*, with a little information about them all.

a. Corals and Plankton

Like sea anemones and jellyfish, corals belong to a group of marine animals possessing stinging tentacles. They are carnivorous and use their tentacles to catch creatures in the **plankton** (zooplankton). But they also get a free “salad” – corals have lots of **algae** living inside their bodies, which provide them with a majority of food.

Plankton is a term that describes thousands of different types of microscopic creatures that drift in the

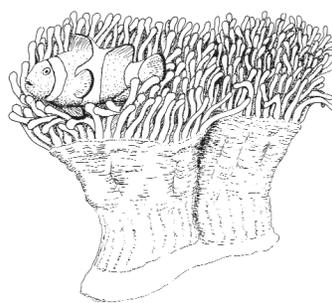


Zooplankton. The creature on the right will grow up to become a large grouper. The long spines are to make it a little more difficult for predators to eat it.

water. It includes some algae, which are plants and use the sun's energy to create food. These are called phytoplankton. It also includes lots of animals, or larvae, which eat the phytoplankton, and even eat each other – these are called zooplankton.

b. Sea anemones

They are a close relative to corals. They attached themselves to corals or rocks and obtain their food by filter feeding. These giant frilly cushions



Anemone with clownfish

are a carpet of death for some creatures. Each of their tentacles has thousands of special stinging cells and they can quickly immobilize a small fish that ventures too close. See below the strange relationship they have with the **clownfish**.

c. Sea squirts

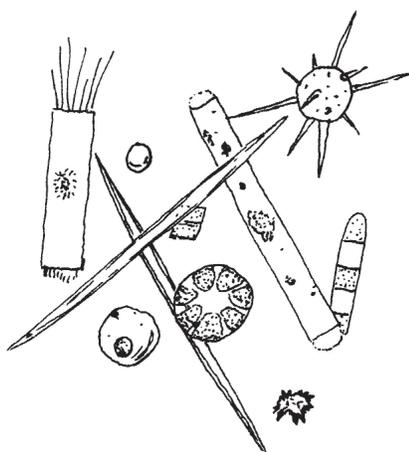
These strange looking animals don't do very much. They are solitary animals. Like quite a lot of other animals they filter water, catching tiny particles and pieces of plankton. Attached to a surface they just sit there and waft a current of water in through one hole and out of the other.



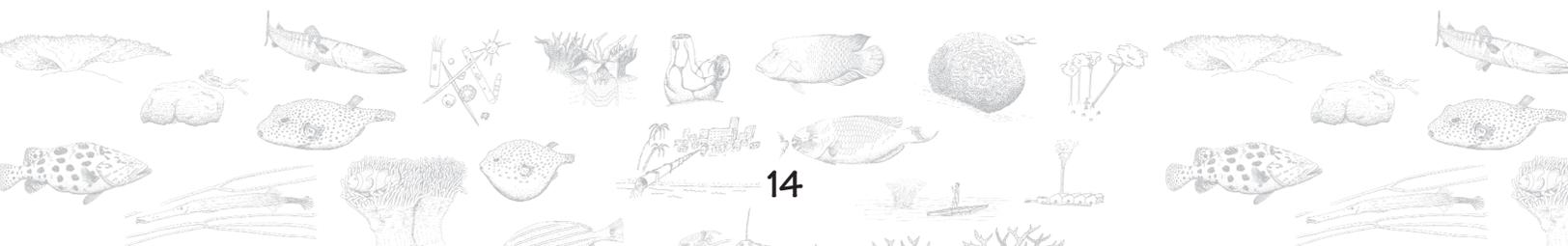
Sea squirt. These simple creatures filter water for food as it flows through their bodies.

d. Sea snake

Sea snakes are true air breathing reptiles. They can hold their breath for very long period of time while hunting and even sleeping, but must



The strange shapes of phytoplankton

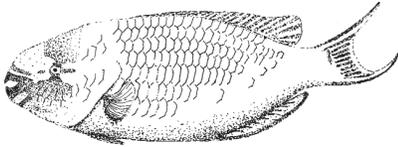


surface for air. They possess one of the most potent poisons known. Just the tiniest drop could kill a human. It sounds a bit extreme for an animal that just eats small fish, but there's a reason. If the fish swims off before it dies, the sea snake can lose its meal, especially if the fish swims into a hole too small for the snake. With a really strong poison the death is instant.

e. Coral Reef Fishes

Parrotfish

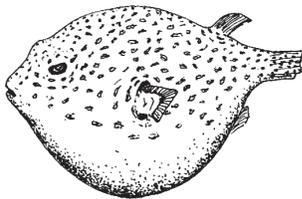
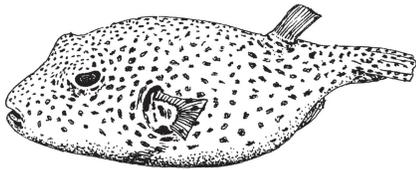
Parrotfish use their strong beaks to crunch through rocks and even coral. They crunch through coral to get at the fine layer of algae on the surface.



Parrotfish, showing the hard "beak".

Puffer fish

Puffer fish are so named because they can puff up their bodies with water until they become round like a soccer ball. This makes an easy

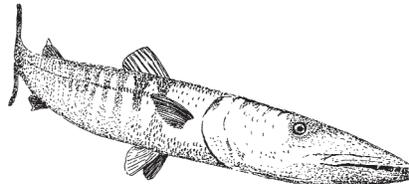


Puffer fish

snack into a much tougher mouthful. Any fish bold enough to try meets a second form of defense. Puffer fish are poisonous, and if a creature bites into one it will learn not to attack them again in the future.

Barracuda

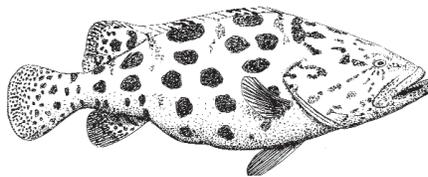
Barracudas are silver bodied predators, shaped like torpedoes, who chase fish. Their mouths are armed with an array of vicious pin-like teeth, making it almost impossible to escape once caught.



Barracuda

Groupers

Groupers are some of the most important predators to be found on the reef. Some can reach spectacular sizes: more than 8 feet in length, and weigh in over 600 pounds. The largest have been known to eat young turtles and small sharks.



Potato grouper

Surgeon fish

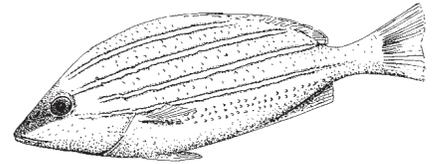
The Surgeon fish owe their name to the knife-like spines near the base of their tail.



Surgeon fish

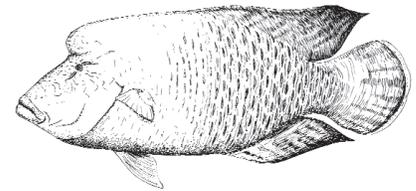
Snappers

In *Ocean Wonderland 3D* we see schools of Yellow snappers. Snappers are carnivorous and feed essentially on crustaceans and fish.



Blue-lined snapper

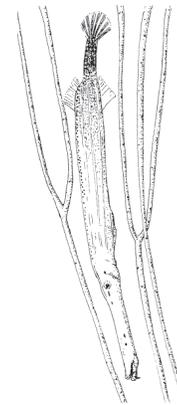
Napoleon wrasse



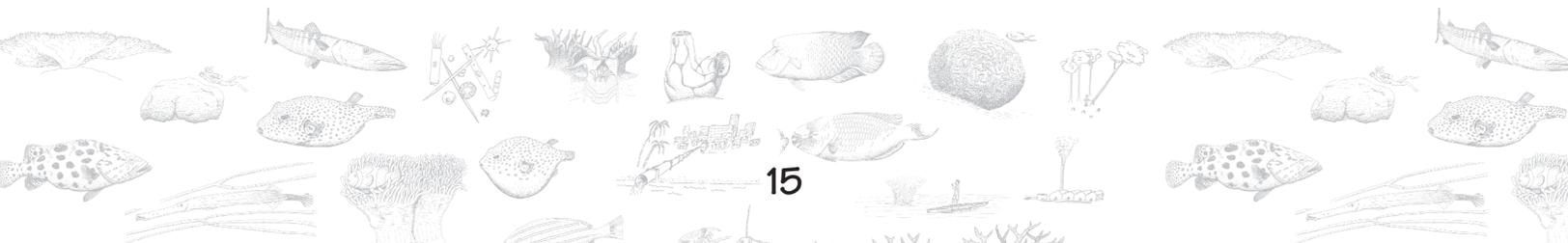
Napoleon wrasse

Trumpet fish

These strange looking creatures are predators. They eat small fish and shrimps, and rely on their deceptively small shape to sneak up on other creatures. In the film you will see them pretend to be a piece of coral or algae until some poor unsuspecting fish swims past. Sometimes they hide behind a larger fish, using it to sneak up and ambush another fish.

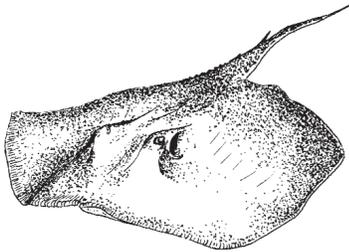


Trumpet fish, hiding amongst whip corals



Rays

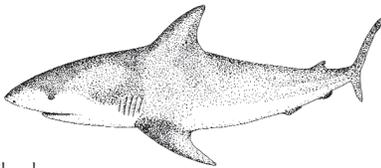
Rays have a flattened body with fins extending the body. Some have a spine on their tail whose sting is very painful. In *Ocean Wonderland 3D*, we see a Stingray and a group of Eagle rays. Rays are experts at digging. Like sharks they have an amazing electrical sense: They know if there is a creature buried in the sand even if they can't see it. They also have awesome jaws that look like two big fists and grind together to crush the hard shells of snails.



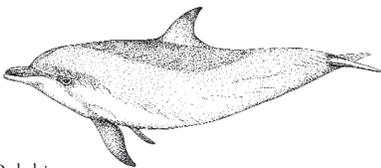
Rays

f. Sharks and Dolphins

Sharks and dolphins are both predators. **Sharks** are top predators – we all know they like eating meat. As well as fish they'll eat crabs and lobsters. The biggest sharks might even eat a grouper, or a turtle, which would be a big meal even for a shark. **Dolphins** eat many small fish as well as crabs, shrimps and squids.



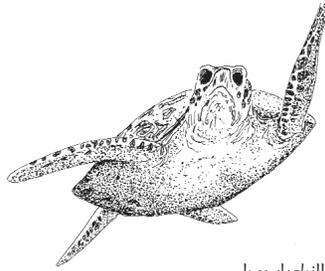
Shark



Dolphin

g. Turtles

Turtles are superbly adapted to life at sea, but still need to return to the surface regularly to breathe. They don't have to worry too much about their food running away as they eat sponges, algae and even sometimes sea squirts. The one you will see in *Ocean Wonderland 3D* is a hawksbill turtle.



hawksbill turtle

II. Strange relationships

When you have all this variety you have lots of "competition". Animals and plants are all competing for space to grow. Many mouths are looking for something to eat, and many creatures are looking for somewhere to hide. In this world it pays to develop a special skill that you can do better than everyone else.

a. Adaptation to the environment

The different creatures in *Ocean Wonderland 3D* are well adapted to where they live.

- The sharks are top predators and have evolved to perfection: big, streamlined, fast... and their teeth are amazing.
- Turtles have relied on their strong shells for millions of years to avoid

being eaten.

- The feeding ray has specialized jaws for crushing prey.
- The strangely shaped trumpet fish hiding among the corals can camouflage easily into the coral. It uses its camouflage to hide from predators and surprise it's prey.
- Many animals use poisons. Some, such as the puffer fish, use poison for defense. Other animals use poison for attacking.

b. Symbiosis: Clownfish and sea anemone

Sea anemones have special cells in their bodies, which can release a barbed sting, full of poison. It's not enough to hurt a person, but can stun or kill a small fish or shrimp.

The clownfish have learned to fool the anemone – they carry a special chemical (a protein) on their skins, which is identical to one in the anemone. The anemone is a very simple creature and recognizes these chemicals and so does not fire off its stinging cells. The little clownfish has a safe home, but in fact the anemone benefits as well. The clownfish defends the anemone from intruders. Sea anemones quickly eat up any scraps that the clownfish drops when feeding. A close relationship between two animals like this is known as **symbiosis**.

DID YOU KNOW?

Everywhere that looks just like rock on a coral reef is actually covered with the thinnest fuzz of algae. This is almost impossible to see, but it's a bit like underwater grass and many other creatures eat it

III. Activities for Students

Activity #1

Adaptation to their environment

Have students think of the different creatures they saw in *Ocean Wonderland 3D* and how well they are adapted to where they live.

Examples:

- The shark that is big, streamlined, fast... and has all those teeth.
- The feeding ray with its specialized jaws for crushing prey.
- The strangely shaped trumpet fish hiding among the corals – they have developed to look like this so they can hide, then lunge out to catch other fish.
- The corals with algae living within their tissues.
- The social collaboration between anemones and clownfish.
- The sea snake and its use of poison giving instant death.
- The first sea snakes came from land. How have they adapted to life in the sea? They need to swim (and have evolved flattened tails). They need to hold their breath (and many can stay below water for up to 60 minutes). They need to lay eggs on land... or do they? (Many sea snakes keep their eggs inside them and give birth to live young.
- Sponges are one of the favorite foods of turtles. To avoid being eaten sponges have developed all sorts of poisons. Turtles have developed the ability to withstand these poisons, but sponges are constantly trying to develop new and more potent poisons.

Activity #2

Types of diet and ways of catching food

Talk about the different types of diet: primary producers, primary consumers or herbivores, omnivores, carnivores. Ask students to assign all the animals to these categories.

Summarize the different ways of catching food such as filtering, digging, chasing, ambush. Assign the animals to these categories.

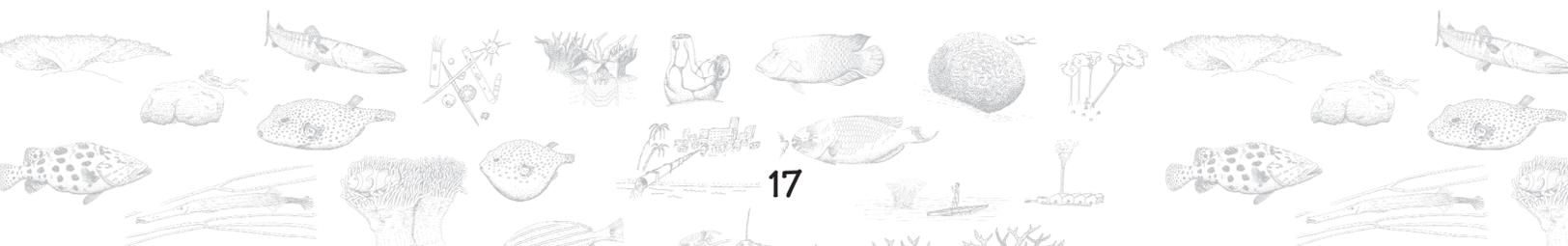
Activity #3

Try and have your students find as many coral creatures in the word find.

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

Creatures of the Coral Reef

- | | |
|----------------|-------------|
| BARRACUDA | RAYS |
| CLOWNFISH | SEAANEMONES |
| CORALS | SEASNAKE |
| DOLPHIN | SEASQUIRTS |
| GROUPE | SHARK |
| NAPOLEONWRASSE | SNAPPER |
| PARROTFISH | TRUMPETFISH |
| PUFFERFISH | TURTLE |



Activity #4

A Pairing activity

Your Answer

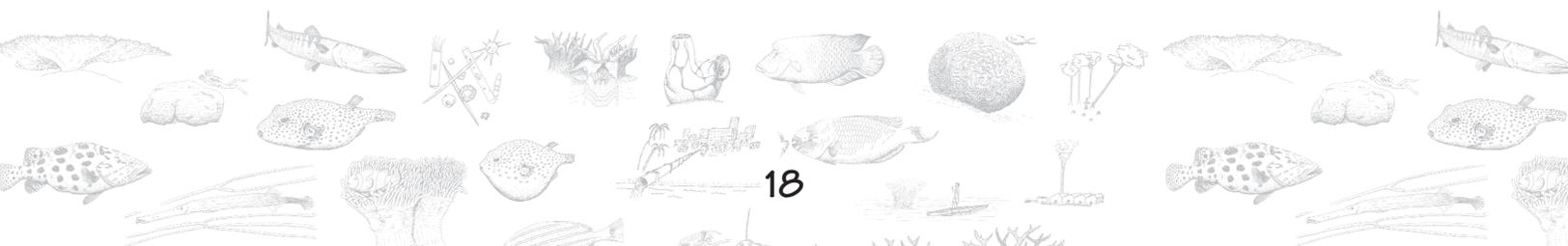
| | |
|------------------|---|
| 1. Shark | i |
| 2. Dolphin | |
| 3. Sea anemone | |
| 4. Corals | |
| 5. Sea Squirts | |
| 6. Turtles | |
| 7. Sea Snakes | |
| 8. Puffer fish | |
| 9. Parrotfish | |
| 10. Barracudas | |
| 11. Groupers | |
| 12. Snappers | |
| 13. Trumpet Fish | |
| 14. Rays | |

| |
|---|
| a. This fish uses its beak to crunch through coral. |
| b. This silver bodied fish is shaped like a torpedo. |
| c. This is a very large fish that can grow to be 8 feet in length and weigh up to 600 pounds. |
| d. This fish is carnivorous and feeds on crustaceans and fish. |
| e. This strange looking fish pretends to be a piece of coral or algae to catch its unsuspecting prey. |
| f. This creature has a flattened body with fins extending from its body. It is an expert digger. |
| g. This fish can puff its body up with water until it is round like a soccer ball. |
| h. This animal needs to return to the surface for air quite regularly. It eats sponges, algae and sea squirts. |
| i. This animal is the top predator of the coral reef. |
| j. This animal is known as a friendly animal towards humans. They eat many small fish, crabs, shrimps and crabs. |
| k. This animal has a lot of living algae living inside its body. |
| l. This animal has a close relationship with clownfish. |
| m. This strange looking animal is a solitary creature who filters water to catch tiny particles and pieces of plankton. |
| n. This animal possesses some of the most potent poison known. |

Activity #5

How have humans adapted to life on earth?

Ask your students to think how humans have adapted to live in different areas around the world such as the desert. How has this affected the environment?



4. What is Happening to the Earth's Coral Reefs?

Your students have discovered by diving with us in *Ocean Wonderland 3D*, some of the most beautiful and fascinating natural places on earth: the coral reefs. The reefs play a crucial role not only for all sea creatures living there, but also for all of us humans.

I. Pre-Activity: How have humans used the sea?

Discuss with your students how humans have always used the sea

- **For food:** fishing, salt, shark fin soup (illegal in the US), turtle soup and meat (illegal), ice cream and toothpaste (some use extract of seaweed), oil (whales) etc.
- **For transportation.**
- **For fun:** swimming, diving, sailing, fishing, boating, tourism.
- **For things:** sponges (they are actually animals); jewelry (pearls from oysters, corals, shells); bags, belts, watchband, ashtrays, guitars (turtle skin or shell).
- **For dumping.** Over the last century deforestation and changing farming methods are releasing thousands of tons of silt and pollution into coastal waters, i.e. waters where most coral reefs are located, destroying these sensitive ecosystems.

II. People needs the reefs

Millions of people in the world need coral reefs.

a. Food resources

People use the reefs as a source of food. Humans are part of the natural world, and it's as natural for us to eat fish as it is for a dolphin. Many people have been living in harmony with the coral reefs on their doorsteps for thousands of years. We eat fish and lobsters and lots of other sea creatures. Reefs provide resources for fisheries. Food items include fishes, crustaceans, and mollusks. The problems only come when we take too much food!

b. Protection

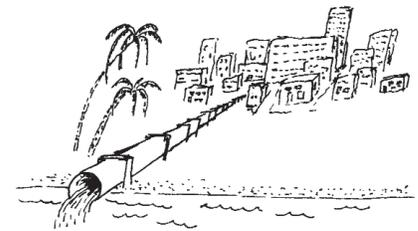
Coral reefs also have a hidden role. Lying next to the land they prevent huge waves from smashing into the beaches during storms. Without even realizing it, many people in coastal towns have been saved from devastation (storms and floods) by the coral reefs just offshore.

c. Leisure and recreation

Over 15 million people are trained as recreational scuba divers, making it probably the world's most popular adventure sport. Millions more have learned to snorkel. Quite apart from the pleasure and educational value of visiting coral reefs, these visitors are bringing jobs and money to coral reef areas around the world.

III. Dangers to the coral reefs

Coral reefs have existed for millions of years. They need specific conditions to survive, and have coped with many natural obstacles such as floods, hurricanes, diseases and changes in currents. But now, there are additional threats from human activities, and the health of coral reefs is rapidly deteriorating.

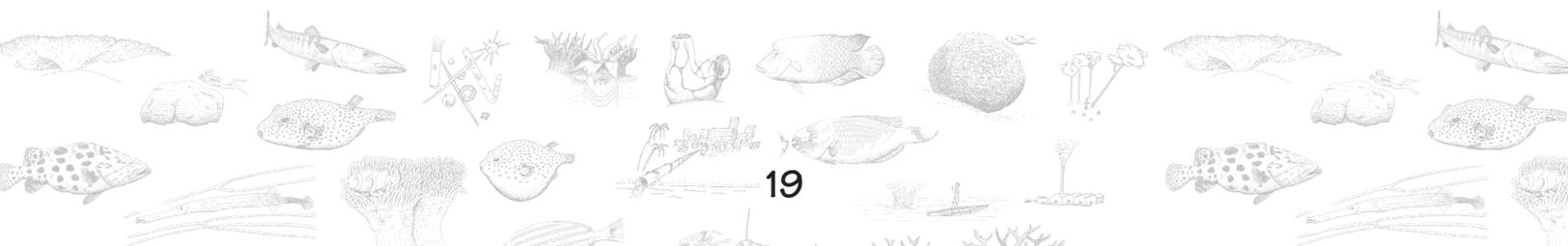


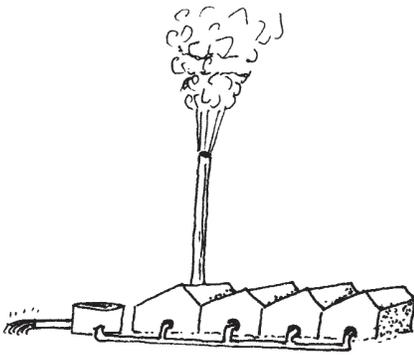
Sewage is often poured directly into the sea, untreated.

a. Pollution

Pollution takes on many forms including **oil slicks, sediments, fertilizers, pesticides, heavy metals, garbage and other chemicals.** Besides **sediments, a much nastier combination of chemicals** is also carried in the rivers and even in pipes, ending up near the coral reefs.

Human sewage is one of the most common problems. As you know





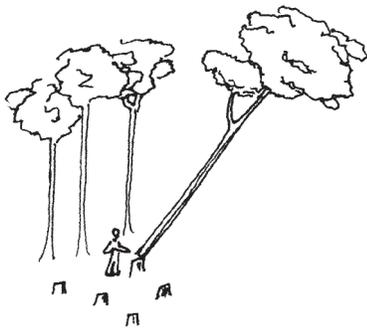
Industry

there's a lot of nasty stuff in sewage, but one of the big issues is that sewage encourages the growth of certain types of large algae or seaweed. These do much better than the corals and can smother them or kill them by shading them out of existence.

We have the technology to clean up our sewage, but in lots of places we don't do it. Even a lot of hotels on the beach just pump untreated sewage into the sea offshore, and quite often the tourists swim nearby!

b. Sedimentation

It might seem odd, but some of the biggest problems facing the reef come from the land. Corals need bright clear waters to get the sun-



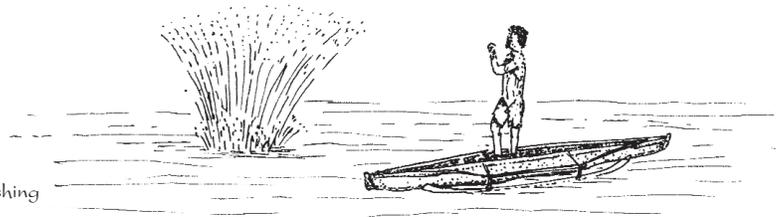
logging - producing sediments which enter rivers and smother the coral

light. They also need hard surfaces to grow on. When there's lots of muck in the water it cuts out the light. It sinks down and creates muddy ooze on the bottom, which stops new corals from growing. And if there are already corals there, the mud can smother and suffocate them.

Where does all this mud or "sediment" come from? We can see a lot of it in rivers. In many parts of the world we are chopping down forests and plowing up the land and this means that lots of soil is being washed off the land, into the rivers and from the rivers to the sea.

c. Over fishing and destructive fishing

The reef is teeming with life. However, there are just too many people trying to fish there. It's per-



Blast fishing

factly possible to catch a few fish and not to make any difference to life on the reef, but once you start taking too many it's possible to upset the entire balance.

Some of the most popular fish to eat are groupers, snappers, jacks and you'd be lucky to see one! In a few places, especially in the Caribbean and Florida, so many fish have been taken that the entire ecosystem is unbalanced.

Some fishermen use explosives to catch fish. By creating a massive

blast they kill all the fish over a wide area. This is terribly wasteful, and the blast also destroys the coral. It will take years for the reef to recover and the fisherman will leave nothing but destruction.

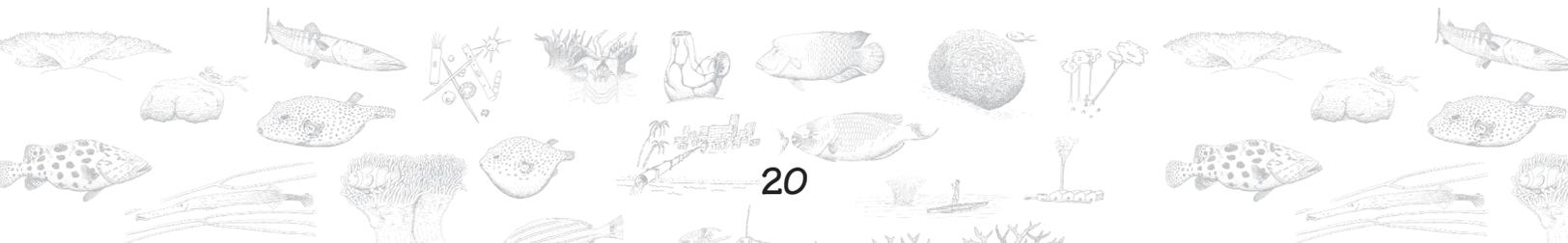
d. Climate change

We keep hearing about climate change. Gradually, as a result of our burning vast amounts of gasoline in our cars and in our power stations (to make electricity) we are adding to certain gases in the atmosphere. These gases are trapping heat inside the planet. It's impossible to notice day by day, but temperatures are already a little warmer than when our grandparents were around.

It turns out that corals are really well adapted to their life in the tropics, but are not prepared for warmer tem-

peratures. When it gets too hot the corals "bleach" - they turn a bright white color, which is a sign of sickness. If it stays hot for too long they die.

In recent years we've had record high temperatures and in some places, including parts of the Great Barrier Reef, lots of the coral has died. Scientists are worried that if the world's temperatures continue to rise we will see lots of the corals sicken and die. It might be worse in those places where the corals are already stressed.



IV. Activities for Students

Activity #1

Discuss how human activities are dangerous for the reefs and their creatures:

- Corals are sensitive and delicate creatures. If we visit a reef we should never stand up on the corals, and even touching them should be avoided as they are easily broken and can be harmed just by being handled.
- If we are going about in a boat we should never throw our anchor on the coral.
- And of course we should never throw litter. Apart from looking horrible it can be dangerous, many turtles die each year from getting tangled in plastic, or choking on trash. Even litter thrown far from the reef can be carried by rivers or the wind, and may drift through the oceans for years.
- Closer to home we cannot buy jewelry or gifts made of coral or shells, thus reducing the demand for it.
- Over fishing near the coast has thrown the sea ecosystems out of balance.
- Lately massive consumption of energy has begun to change the planet's climate. The oceans are warming up and corals are struggling to adapt to the changes. You can help by walking, or riding a bus or bike for transportation.

Activity #2

Creating a Wall Chart to educate people about reefs.

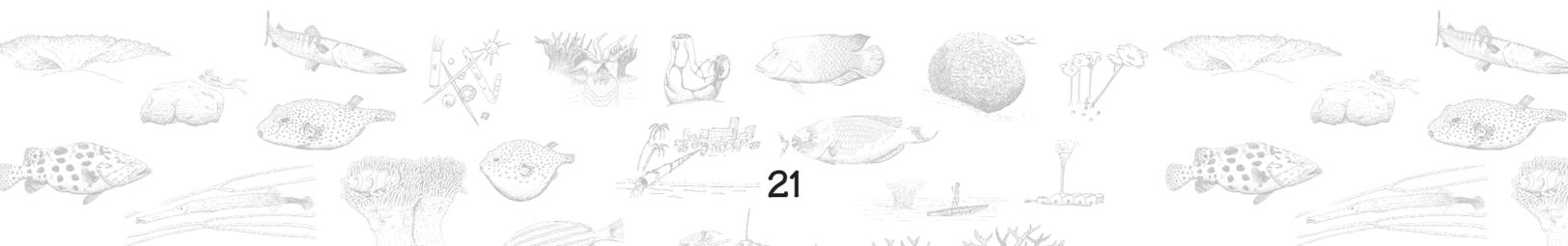
Educating people about the reefs and about the pressures they are under, is critical if we are going to change anything. Because reefs are out of sight, many people don't realize the damage they are doing. Design a model or a large wall-chart, to be put together in groups, or even by the whole class showing how reefs can be damaged. The model or picture should include:

- Hills or mountains with forests/and without
- Rivers carrying sediment to the sea
- Towns and villages with sewage systems/and without
- Factories
- Fishers, using dynamite
- Tourists throwing anchors onto the reef
- Divers touching the coral

Activity #3

Creating a poster to help save the reefs.

Make posters informing people about how the coral reef is being damaged and what they can do to help. Put the posters up around school and the community.



5. Help Save the Reefs!

I. Don't use so much energy!

Climate change is one of the biggest concerns. You've probably read all about it before, but we need to get active in all sorts of ways. Of course we need our leaders to do something, but they won't unless they know people care. So let them know you care. Write letters and tell your family and friends. And put your concerns into action:

- Use a car less – take a school bus or bike to school.
- Turn lights out when you're not in the room.
- If it's cold put another layer of clothes on, don't turn the heating up.
- If it's hot wear less, or use a fan – air-conditioning uses a lot of energy.
- Try to use less disposable packaging. All plastics are made from oil products and their production is adding to the problems. Reuse and recycle plastic bags, paper and glass.

III. Coral reef reserves

We've all heard of national parks, and maybe some of us have visited them. In national parks some of the most beautiful and important natural areas have been protected. People can still visit them, but you can't hunt, or chop down the trees, or pollute the water. We need the same in the oceans.

There are already quite a few marine reserves around the world, and Australia's Great Barrier Reef is the biggest, but many more are needed. Properly designed reserves will ban fishing from certain areas, but still allow fishermen to catch fish elsewhere. In a few places tourists have to pay to visit the reserve. This is a pretty good idea, but only if the money is used to help protect the reserve.

Sadly, one of the biggest problems in the sea is that we can't stop things from being carried in water. For a reserve to work we also have to stop pollution and sediments coming from the land.

II. Support an Organization

Quite a few groups are now doing more to help protect coral reefs. Organizations such as the United Nations Environment Programme, WWF and their partners in the International Coral Reef Action Network (ICRAN), are helping to set up marine reserves. They are teaching fishers about the problems of using explosives to catch fish. They are trying to find alternative employment for people if there are too many trying to live off the reef.

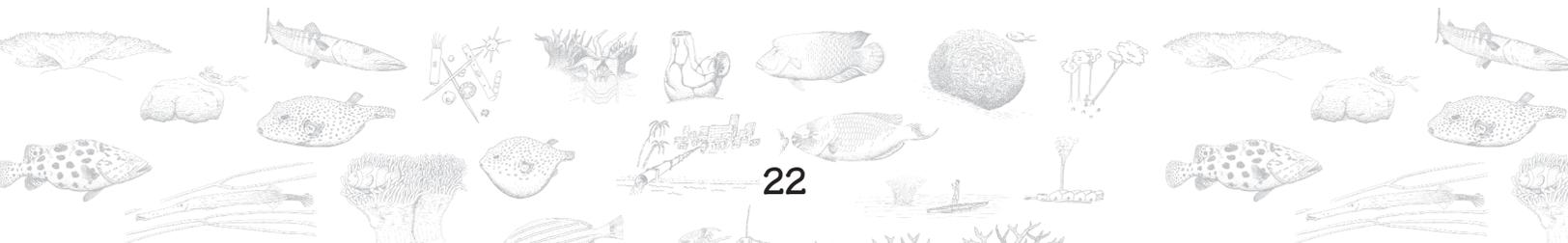
These organizations need supporters, and they need money. By joining them, raising money, by taking part in their campaigns (which might involve writing letters, or even going out to help survey coral reefs) you can really help.

What can we do?

IV. Be a responsible tourist

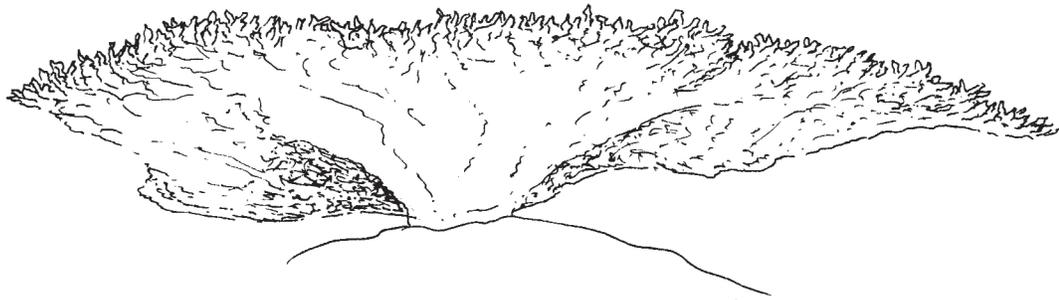
Some people blame tourists for damaging the reefs. The truth is that some tourism can be very bad. Many hotels are responsible for pollution. Sometimes visitors to the reef walk on the corals, or touch them, and people in boats throw their anchors onto them. Cruise ships are some of the worst – the anchor of a cruise ship can destroy an area of reef half the size of a football field every time it is dropped.

But tourists can be good too. They want to see healthy reefs with lots of fish, and are prepared to pay for this. So they give the reef extra value, and they give the fishermen an alternative way of making money. Some of the best marine reserves are paid for by tourism. And the best tourists go home and tell others about the wonders of the reef, so more and more people are concerned to protect them. Even tourism is becoming pretty important for coral reefs. Every year about 1.6 million people visit Australia's Great Barrier Reef, spending about \$600 million! Some of this money is used to help pay for the park rangers who protect the coral reefs.



If you go to a coral reef area:

- *Never touch the coral. Divers and snorklers that stand on, sit on, or handle corals can injure the delicate polyps. Divers should rest by floating or standing on the sandy bottom. They should be very careful not to grab on to any coral formations.*
- *Make sure the person in charge of your boat doesn't drop an anchor on it. Dropped boat anchors can gouge the reef and crush corals. Boaters should be very careful when navigating around the coral reefs. Anchors shouldn't be dropped directly on the reef, but on a near-by sandy area.*
- *Do not collect shells.*
- *Do not leave garbage behind.*
- *Don't buy corals, sponges, seashells or other reef animals from the gift shops. Coral skeletons are used for decoration of aquariums, and fashioned into jewelry and sculptures Excessive collecting decimates reef species and throws the reef ecosystems out of balance. In 1990, the world consumption of corals for the souvenir trade was estimated at 2,200 tons a year.*
- *Petition cruise ships to drop their anchor safely, without damaging coral.*
- *Stay in a hotel that cares for the environment and, don't be shy, ask them about their sewage – it's you who might have to swim in it!*



V. Activities for Students

Activity #1

Design a marine reserve and design a poster and a brochure to attract tourists.

List the activities, which are prohibited, but also list the activities that people can still enjoy – reserves shouldn't just be negative!

Draw a map and create zones where people can do different things

Activity #2

Dangers for the Coral Reefs

In order to understand how and why the coral reefs are endangered, students need to get a “bigger” picture. They need to think how humans have been using the sea, how these human activities have been affecting the sea and most specifically the coral reefs' ecosystem. Since they are about to (virtually) dive, ask them also the damages they themselves might cause when visiting the reefs and what they should not do.

