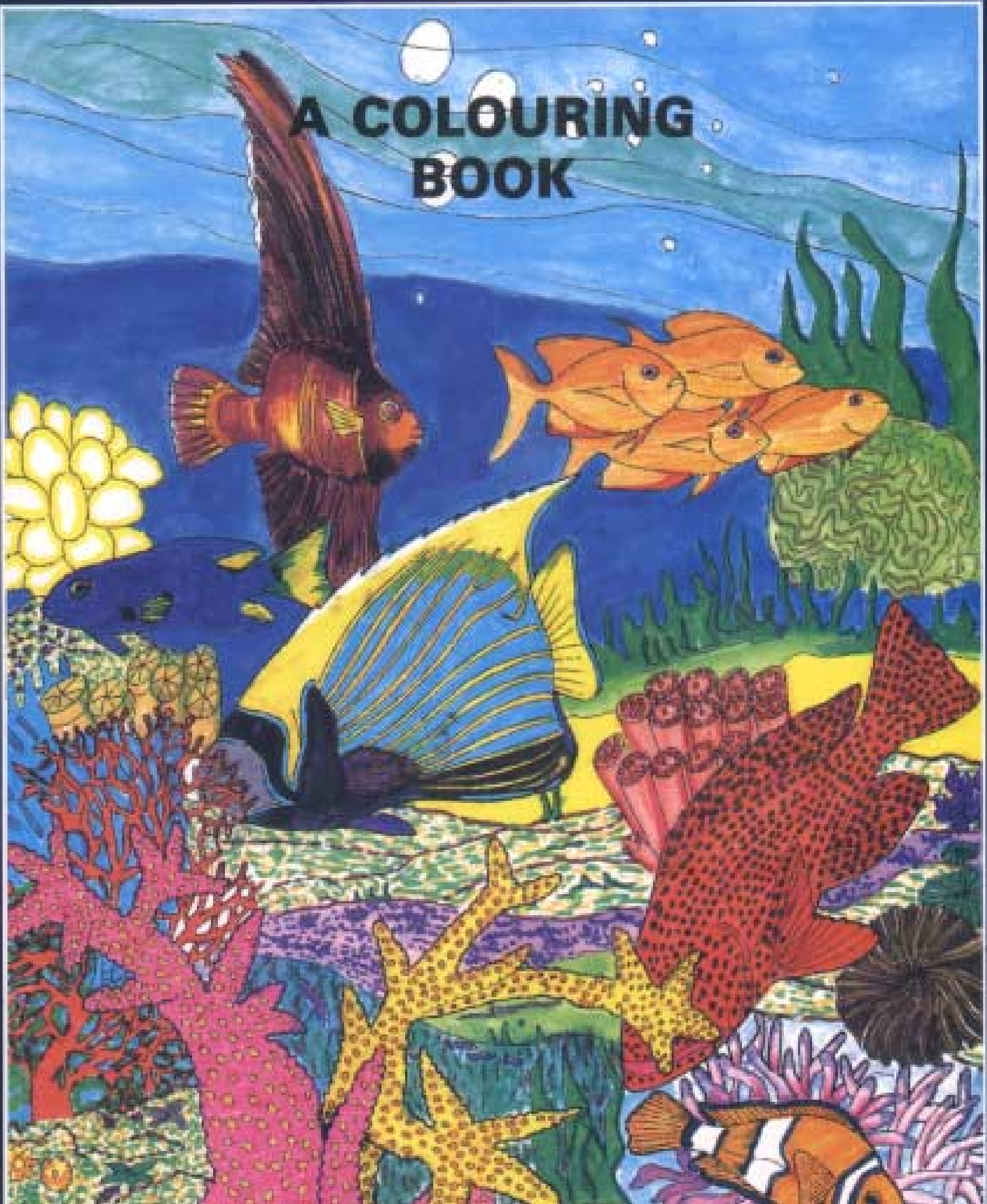
BOBP/MAG/20

LIFE ON OUR REEFS



A COLOURING BOOK

Ministry of Fisheries and Agriculture
Malé, Republic of Maldives

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LIFE ON OUR REEFS

A COLOURING BOOK

Ministry of Fisheries and Agriculture
Maté, Republic of Maldives
&
BOBP For Fisheries Development
BAY OF BENGAL PROGRAMME

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This colouring-cum-information book on coral reefs for schoolchildren evolved out of the effort of the subproject 'Fisheries Extension Services, Maldives (MDV/FES/MDV)'. The focus of the subproject, guided by the fisherfolk, was on building awareness and beginning the consultative processes that would, in time, lead to participatory management of coral reef resources. In doing so, the subproject also reached out to schoolchildren in the islands, the future fisherfolk of the Maldives, through this book. The text, in both Divehi and English, is aimed at primary schoolchildren (6-14 years).

The book is intended to be used as a colouring book as well as a reader. It is written by Mr. N.T. Hasen Didi, former Director in the Ministry of Fisheries and Agriculture (MOFA) and an eminent naturalist and artist, and Ms Sana Mohamed, Reef Biologist, Marine Research Section, MOFA. The book was illustrated by Mr. Hussein Zahir, a Biologist on study leave from the Marine Research Section of MOFA, who is also an artist and an enthusiastic diver.

The fisheries extension services project, and this book, have been sponsored by the Bay of Bengal Programme's 'Small-Scale Fisherfolk Communities in the Bay of Bengal' (GCP/RAS/118/MUL), a project jointly funded by SIDA (Swedish International Development Authority) and DANIDA (Danish International Development Agency) and executed by FAO (Food and Agriculture Organization of the United Nations).

The Bay of Bengal Programme (BOBP) is a multiagency regional fisheries programme which covers seven countries around the Bay of Bengal — Bangladesh, India, Indonesia, Malaysia, Maldives, Shri Lanka and Thailand. The Programme plays a catalytic and consultative role: it develops, demonstrates and promotes new technologies, methodologies and ideas to help improve the conditions of small-scale fisherfolk communities in member countries. The BOBP is sponsored by the governments of Denmark, Sweden and the United Kingdom, and also by UNDP (United Nations Development Programme). The main executing agency is the FAO (Food and Agriculture Organization of the United Nations).

This is a field document and has not been cleared by the FAO.

November 1993

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Divehi Title, coloured by : Ayesha Zayo, Age 9 yrs

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NOTES FOR TEACHERS

* This colouring book should be used in the classroom and outside, as it could be a starting point for further learning through enquiry.

* The children should be divided into groups, and excursions organized to enable them to actually see reef flora and fauna.

* The children should be encouraged to carry the colouring books along with them on their excursion, to shade or colour on the beach while what they have studied of the coral reef is still fresh in their minds. Some geography might be worked into these sessions like, "Where did you see ____________ ?"

* In a later class, they should be encouraged to discuss the text and to colour the pages, one unit at a time, in order to get an understanding of the life forms of the reef.

* Encourage individual students to talk to the class for two or three minutes on topics that they find interesting, like 'The uses of coral' and 'How to conserve coral reefs'.

* After they finish the whole book, encourage the children to trace the pictures they have coloured and make up, piece by piece, a large chart of the reef community.

* Encourage the class to start a Coral Reef Protection Club and learn more by, perhaps, organizing a reef specimen display.

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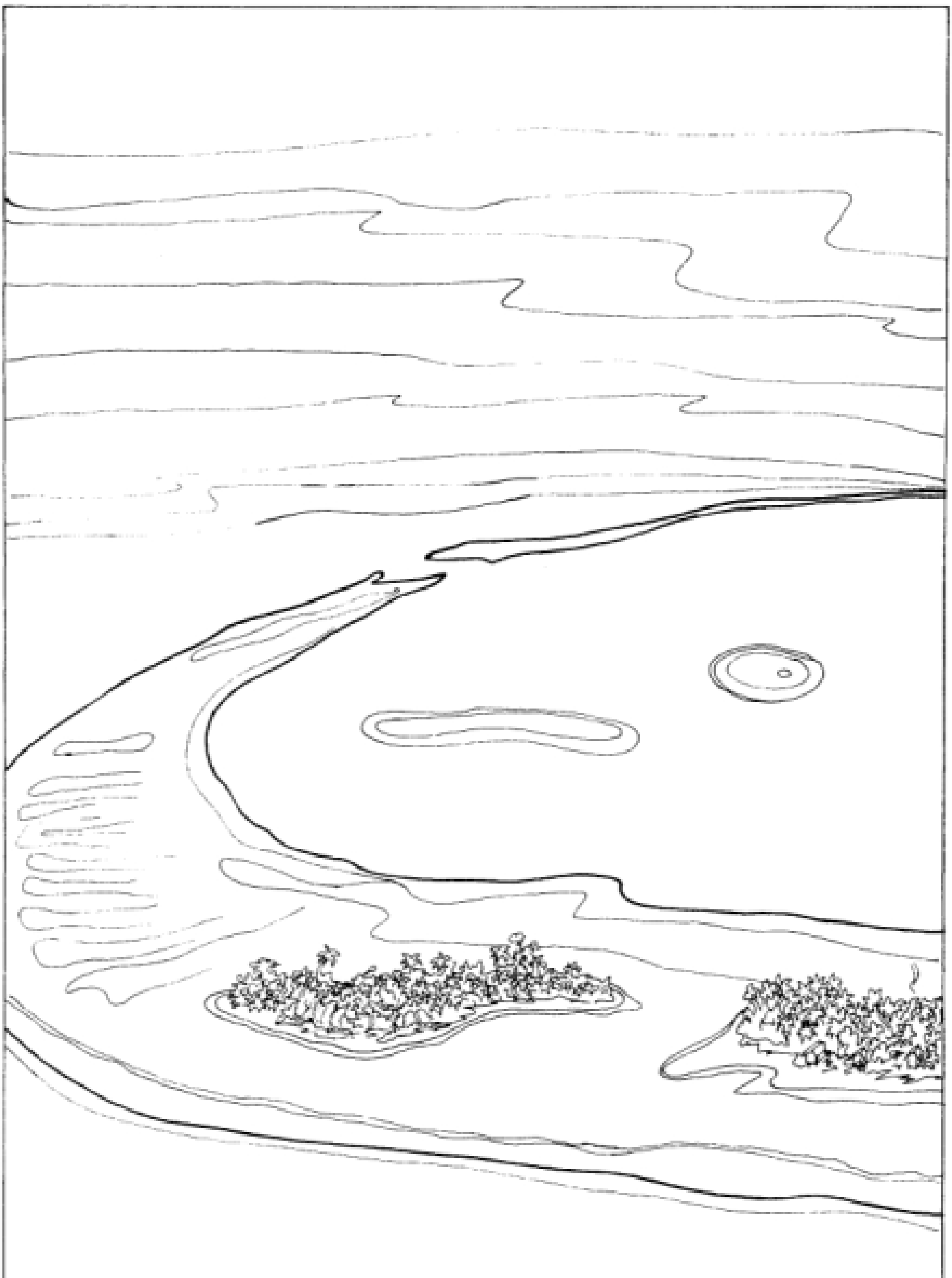

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1. OUR ISLAND HOME

Do you know that our islands are made of a kind of rock called **CORAL** which is nearly 1000 feet thick in some places ? This coral ‘stage’ on which we live is thousands of years old and has been built by billions and billions of little animals. They lived, grew shells and died in this coral forest that is all the time becoming thicker. The corals, the islands on which we live and the reefs on which we depend are very important to us and we must learn to treat them carefully and not harm or overuse them.

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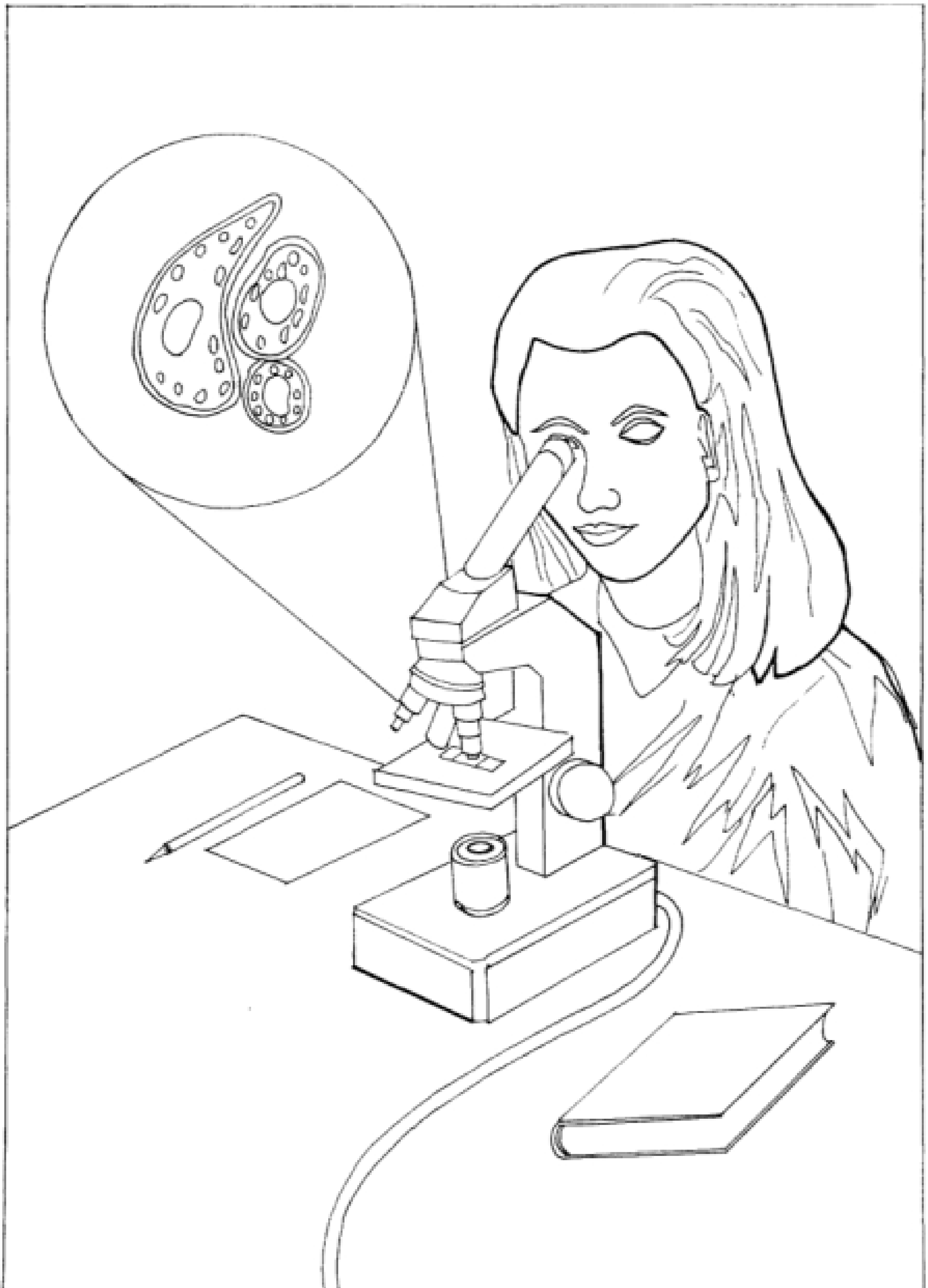

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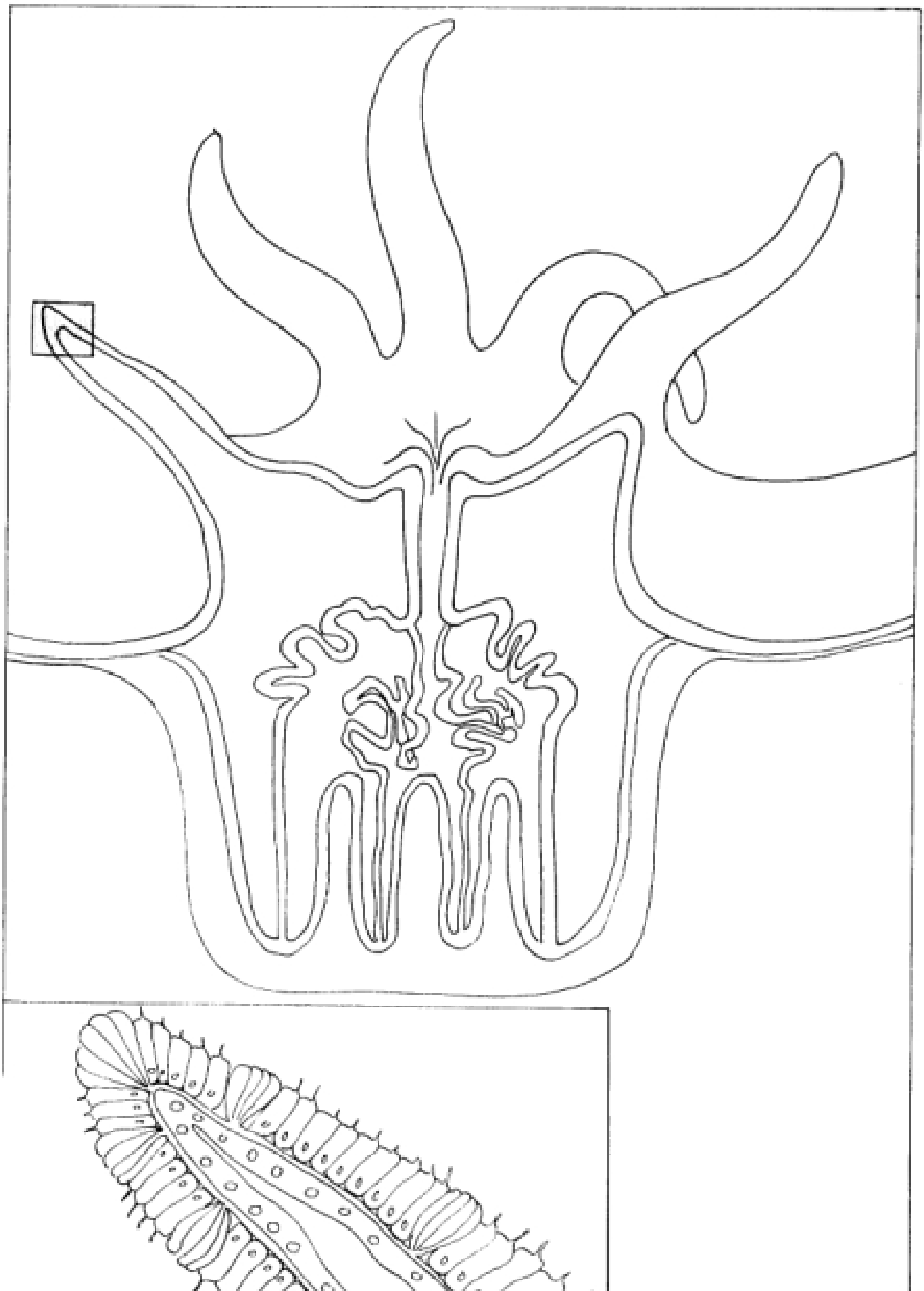
2. THE ANIMAL THAT MAKES CORAL

The very small animal which helps to make the coral rock needs clean sea water and plenty of sunlight to live in.

When this animal is young and very tiny, it is called a **LARVA.** The larva of the animal which makes coral, swims about in the sea looking for a hard rock surface on which to fix itself. Once it attaches itself to the rock, it starts to grow. Let us explore what happens next.



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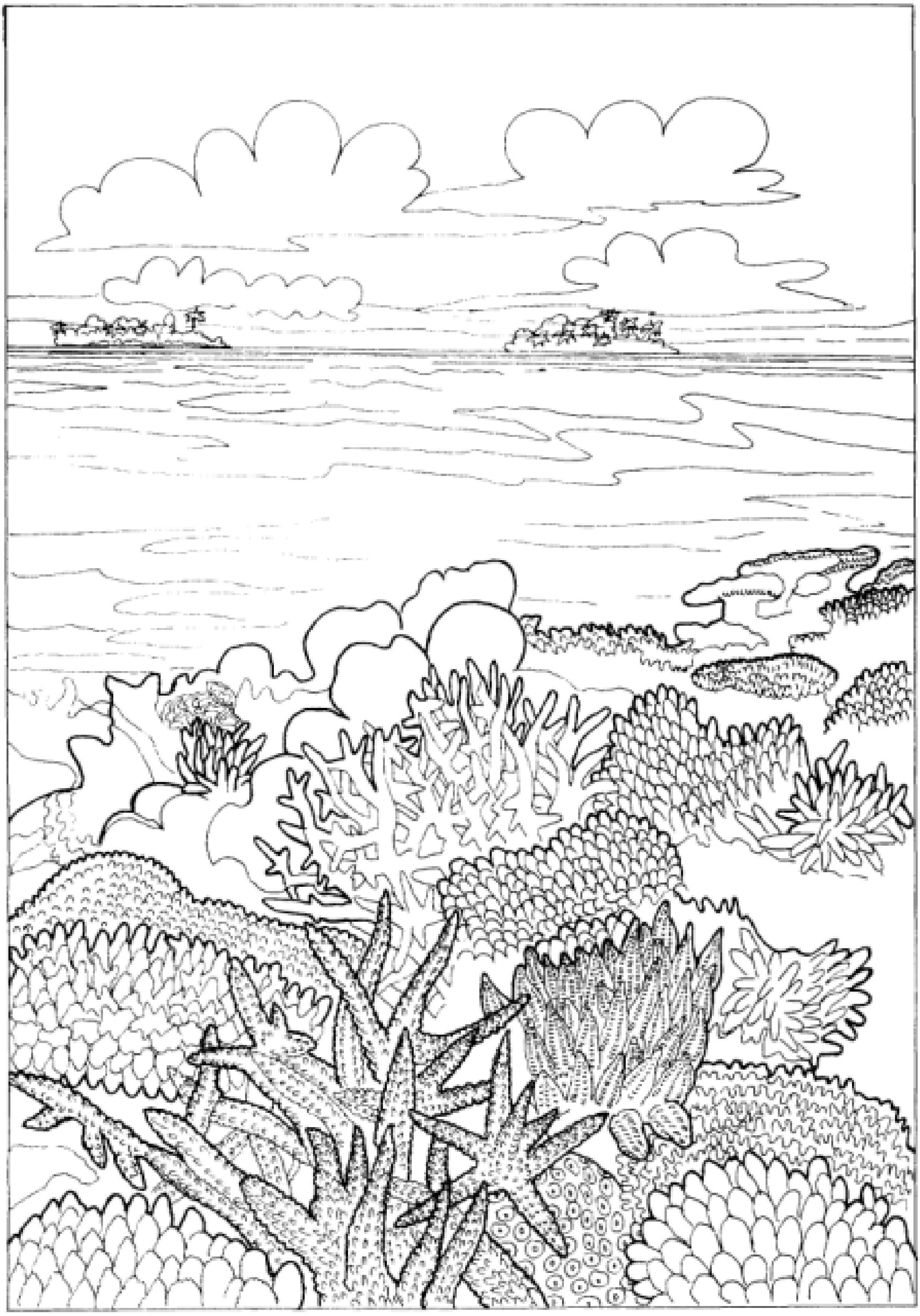
3. THE CORAL POLYP

When a larva grows big, it becomes a **POLYP.** It is then a small, soft tube, and looks like a little tree with its ‘branches’ swaying in the water. The other end of the tube, which is fixed to the rock, is really a ‘mouth’. The long, finger-like ‘branches’ are called **TENTACLES** and they collect food for the polyp.

Many big fish and other animals in the sea attack the polyp. So it has to protect itself. For this, it grows a hard, cup-like shell fixed around its base, or ‘mouth’. These tiny stone cups are made of limestone and are called **CORAL.** When there is danger around, the tentacles quickly fall back into this shell.



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4. OUR CORAL REEFS

Corals grow and branch outwards all the time. Slowly, very slowly, they form an underwater forest of skeletons and living creatures. Over a very long time, overthousands of years, new coral polyps regularly build their colonies layer upon layer on skeletons of the old, forming huge blocks of coral which are called coral reefs.

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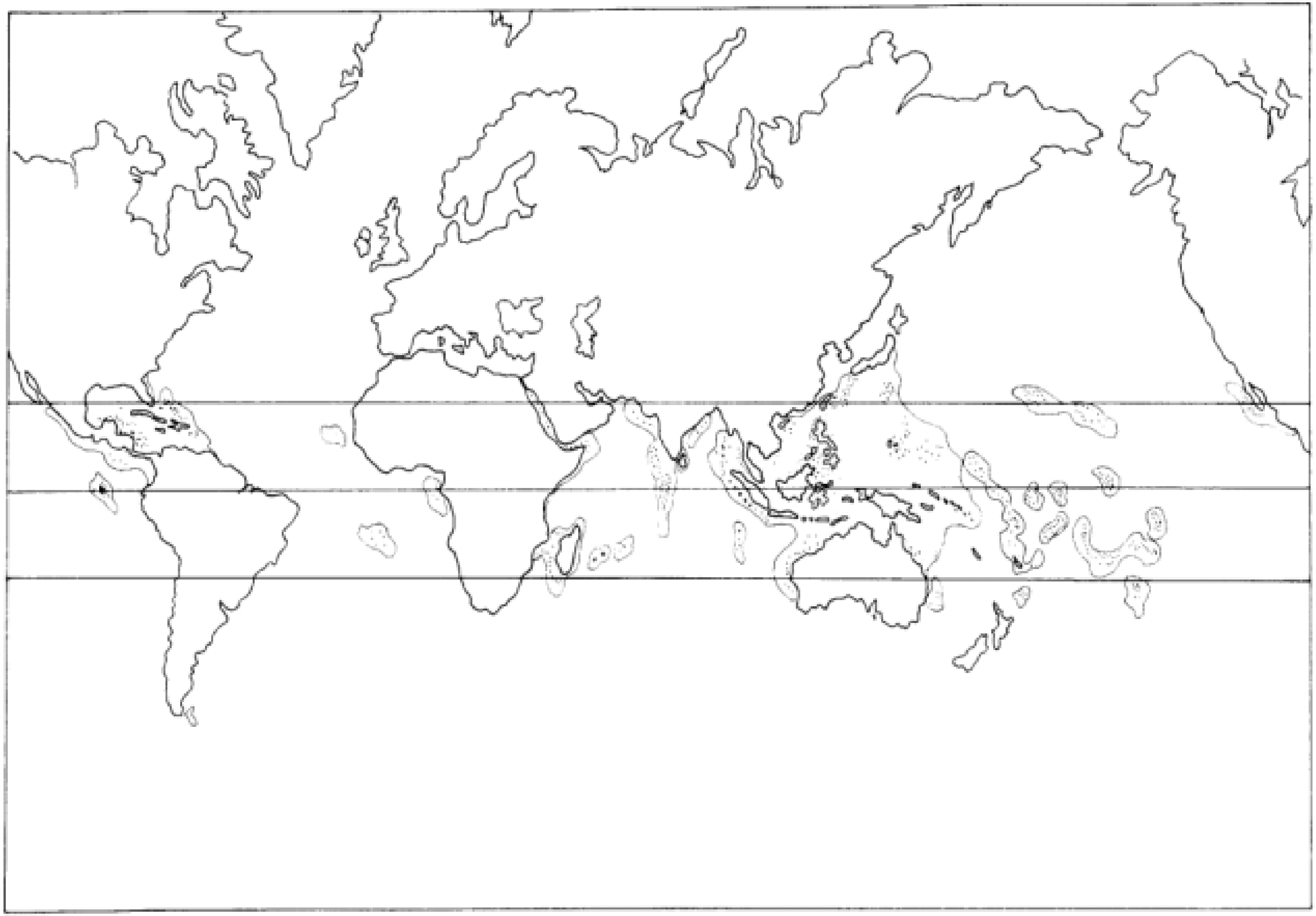

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5. WHERE ARE CORAL REEFS FOUND?

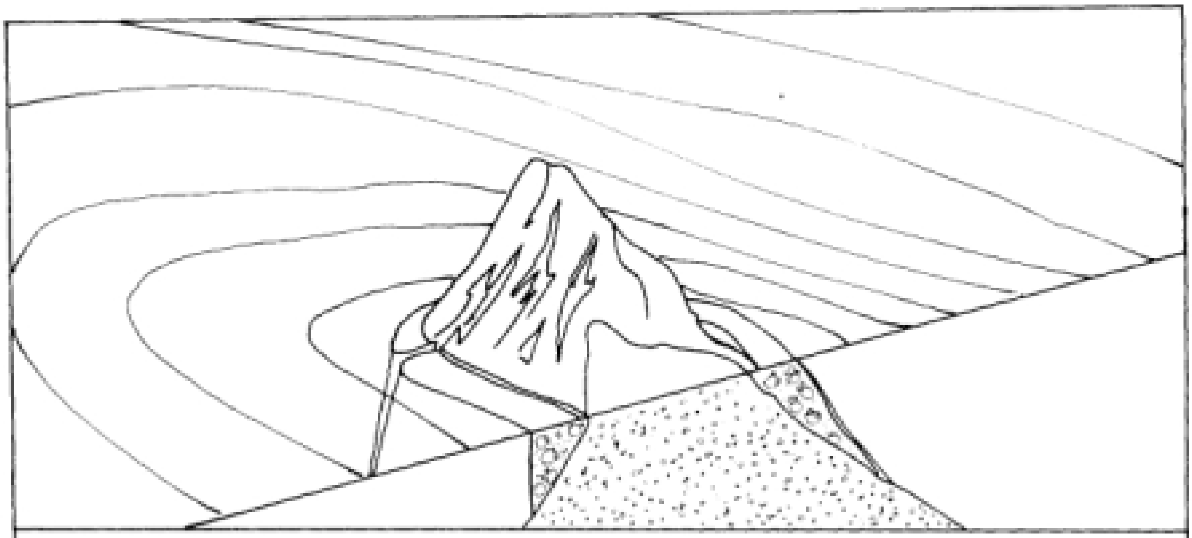
Corals are not found all over the world. They can grow only under certain conditions:

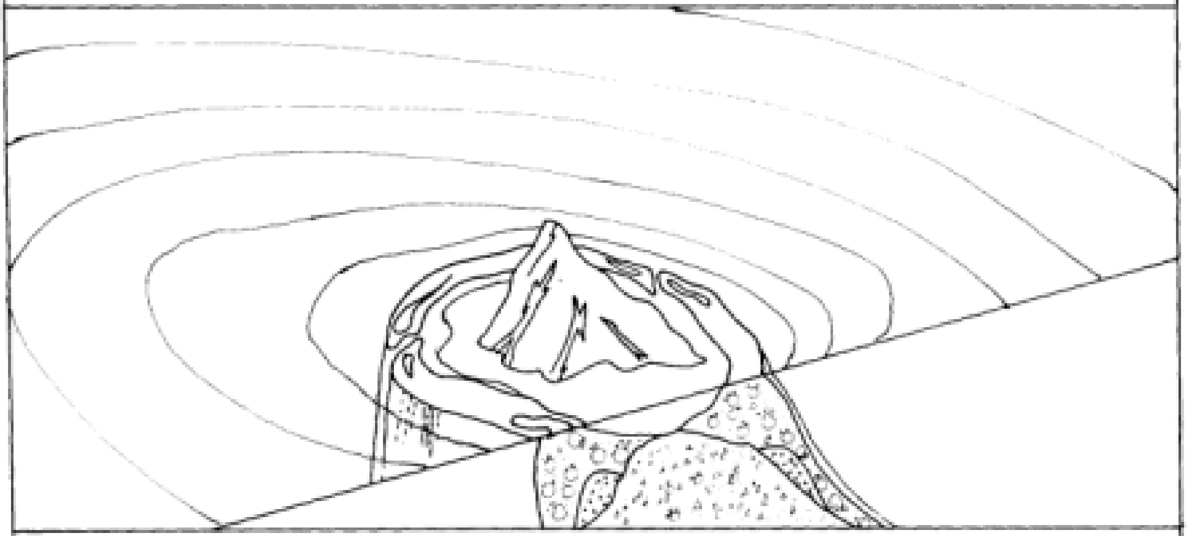
- They need a solid base to attach themselves to.
- The seawater should be warm and not get colder than 20°C.
- The water must be shallow, clear, clean and salty.

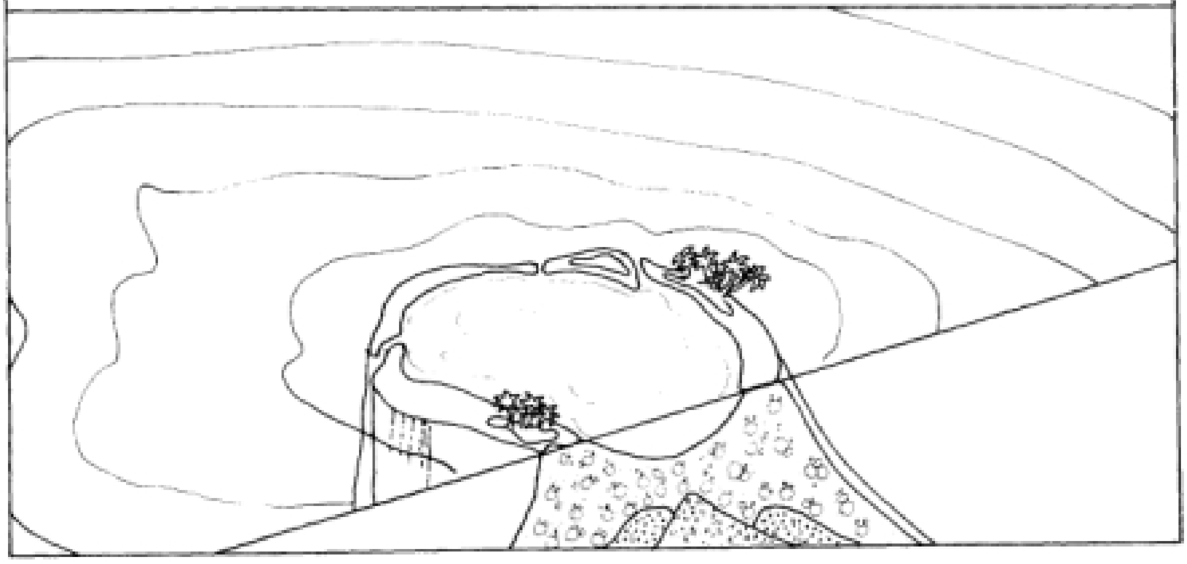
Clear and clean water allows sunlight to pass through it and this helps the food, on which polyps feed, to grow. Only shallow, clear warm waters can give coral polyps the three things they need:

- The plants that live within the coral polyp’s body;
- Plankton to feed on; and
- Calcium carbonate to build their shells.

Such water is found all around the Maldives. We are, thus, lucky to have the conditions which allow coral reefs to grow. And in our coral reefs there are many wonderful things to see.







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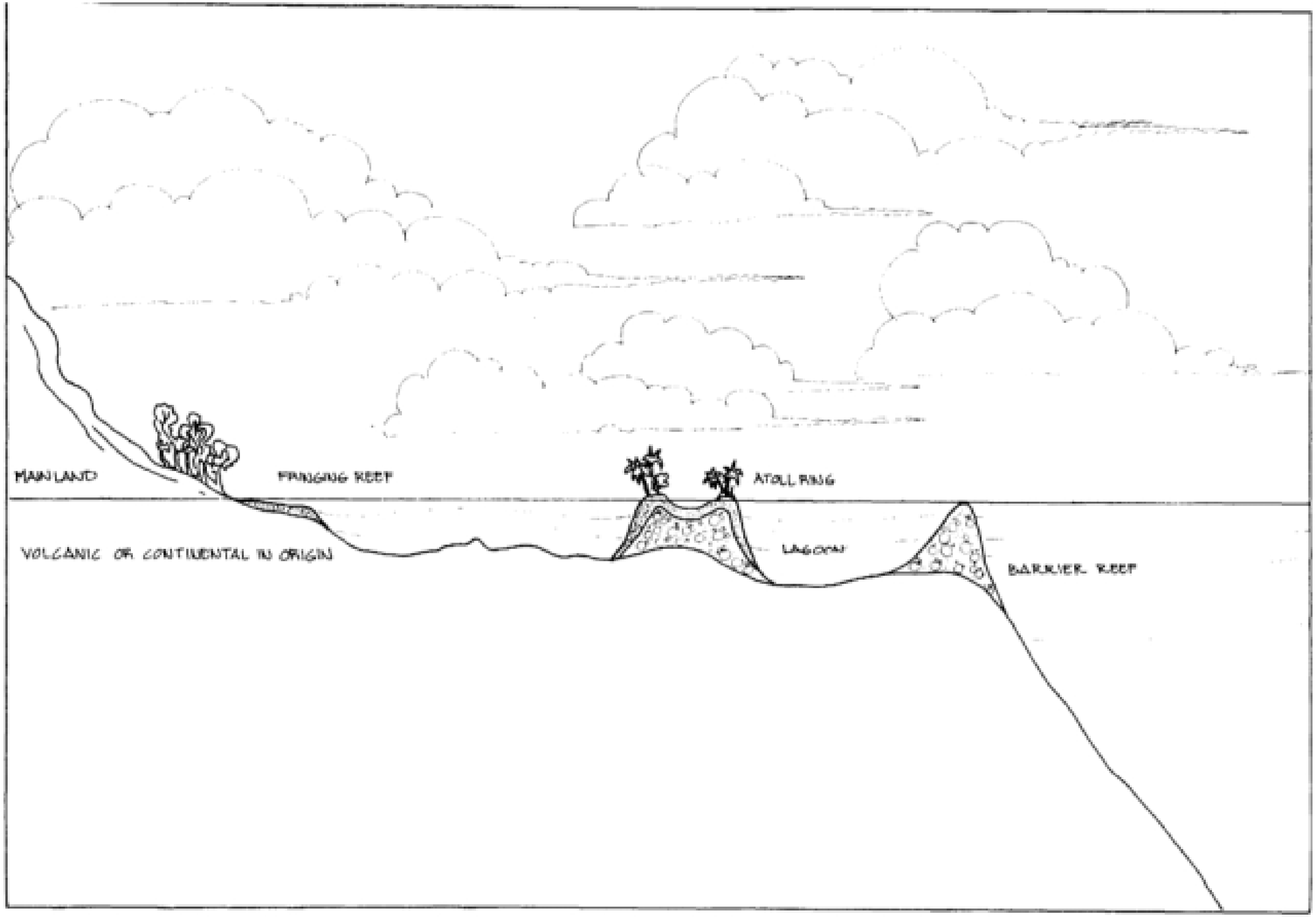
6. THE CORAL RING

Sometimes the coral forms a ring-shaped wall which encloses a pool of water. The wall is called a REEF and the pool is called a LAGOON. A lagoon is protected by living coral reefs and is a very rich fishing ground. This ring of coral and the lagoon within is called an ATOLL. Our country has 26 atolls.

How did atolls form? Many scientists think that, millions of years ago, there were big volcanoes rising from the seabed and their peaks were near the surface of the water. Corals began to grow around these peaks and, over time, circled them almost like a ring around a finger. Gradually, the volcanoes sank back into the sea, leaving behind only the circular ring of coral which then enclosed a shallow lagoon.


MAINLAND
FRINGING REEF
ATOLL RING
VOLCANIC OR CONTINENTAL IN ORIGIN
LAGOON
BARRIER REEF

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7. OTHER TYPES OF REEFS

When corals grow just next to the shoreline and form a fringe along the beach, it is called a **FRINGING REEF.** Shri Lanka, for example, is surrounded by these types of reefs.

Sometimes the hard corals grow quite some distance from the shoreline. But the reef formed still runs in the same direction as the shore – that is, parallel to it. And between such a reef and the shoreline there is a broad, deep stretch of water. The reef, then, is like a wall, or barrier, protecting the shore from the sea, and is called a **BARRIER** REEF. You can find these types of reefs in Australia, for example.

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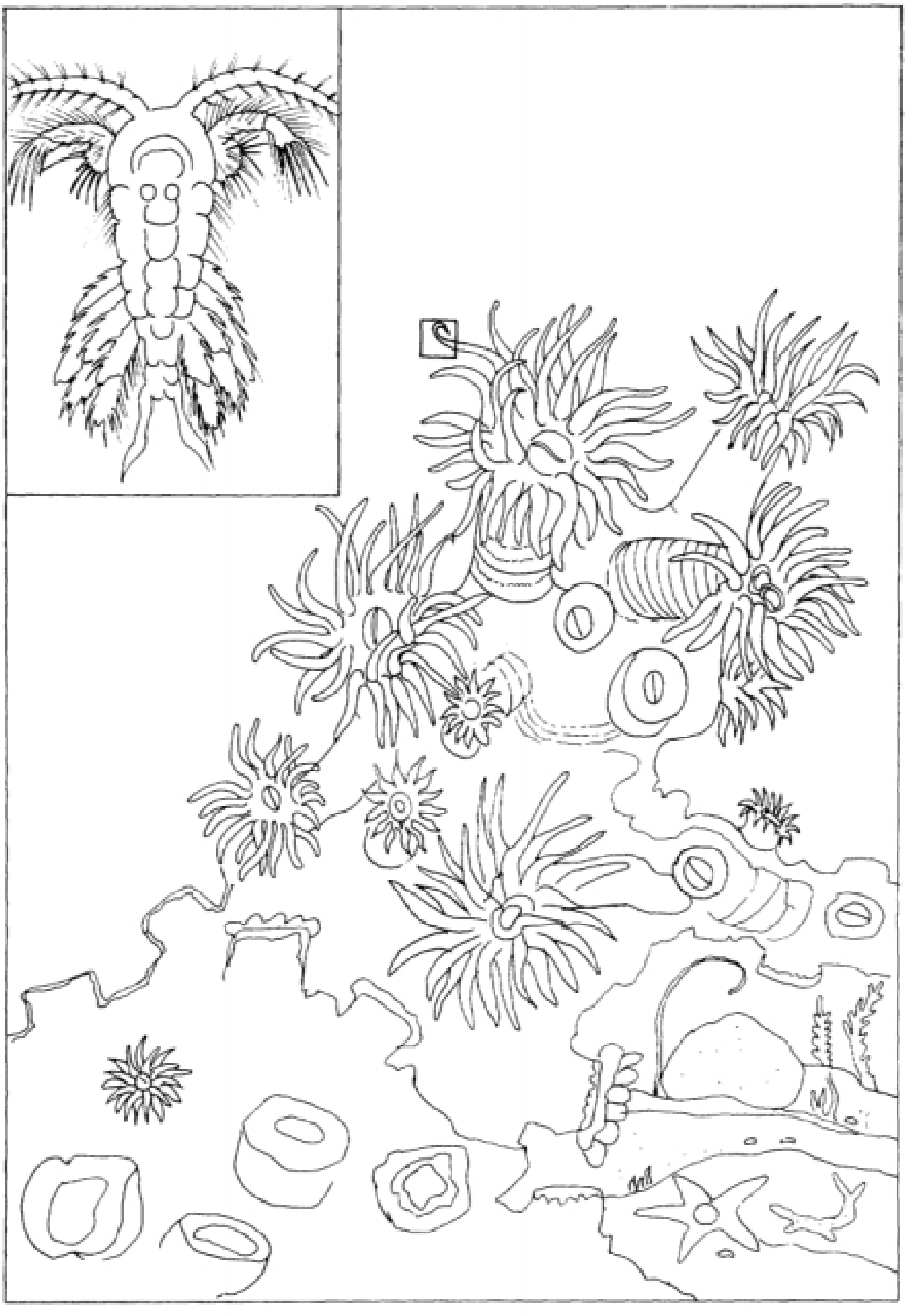

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8. WHAT DO CORAS EAT?

The scientific word for any living creature, plant or animal, is **ORGANISM.** Many thousands of organisms live in the ocean. Most of them are so small you can see them only with an instrument called A MICROSCOPE. Some of them, which float in the upper part of the ocean, are called PLANKTON. The coral polyps eat these. Most polyps come out of their hard shells only at night, because that is when the plankton rise from the seabed to the surface of the sea.

The polyps use their tentacles to catch the tiny plankton that float by. The polyp stings the plankton to stop it moving, and then, very slowly, it uses its tentacles to feed itself.

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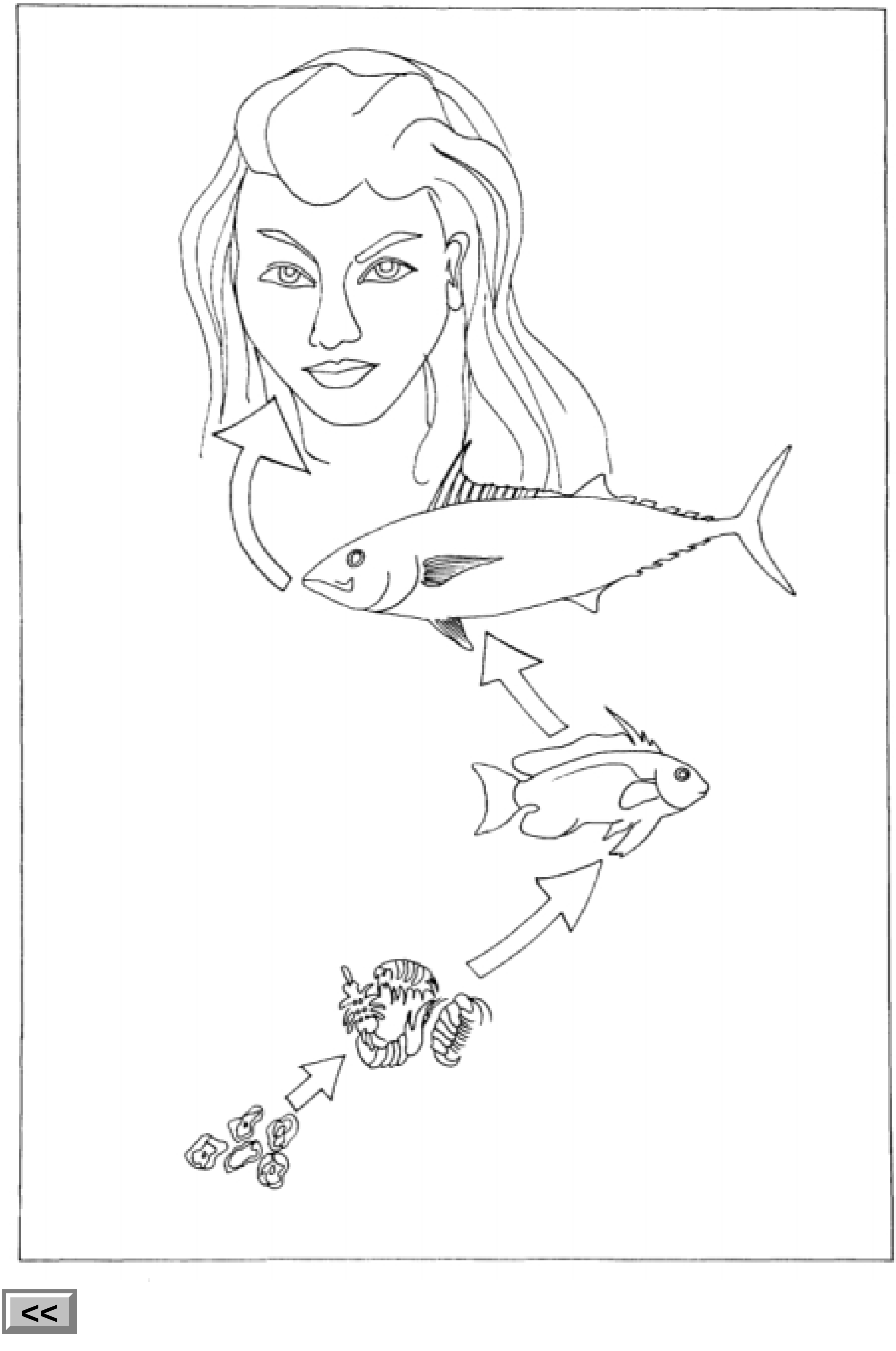

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9. THE FOOD CHAIN

Every creature on Earth is linked like the links of a chain, because it eats other creatures and, in turn, is eaten. It all begins with plants and links upwards through animals, creating a food chain.

Tiny plankton which float freely are the start of the food chain. They provide food for many animals in the sea, from the small coral polyp to the giant Whale Shark. Plant plankton are known as PHYTOPLANKTON, while animal plankton are called **ZOOPLANKTON.** If an animal doesn't feed on plankton directly, there is a good chance the animal that it eats does.

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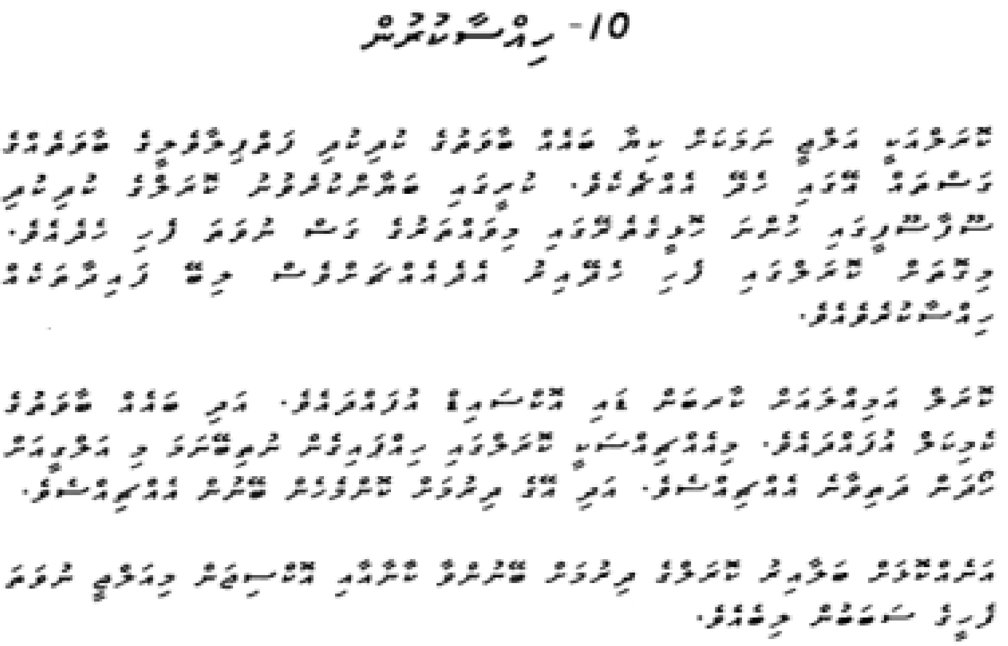

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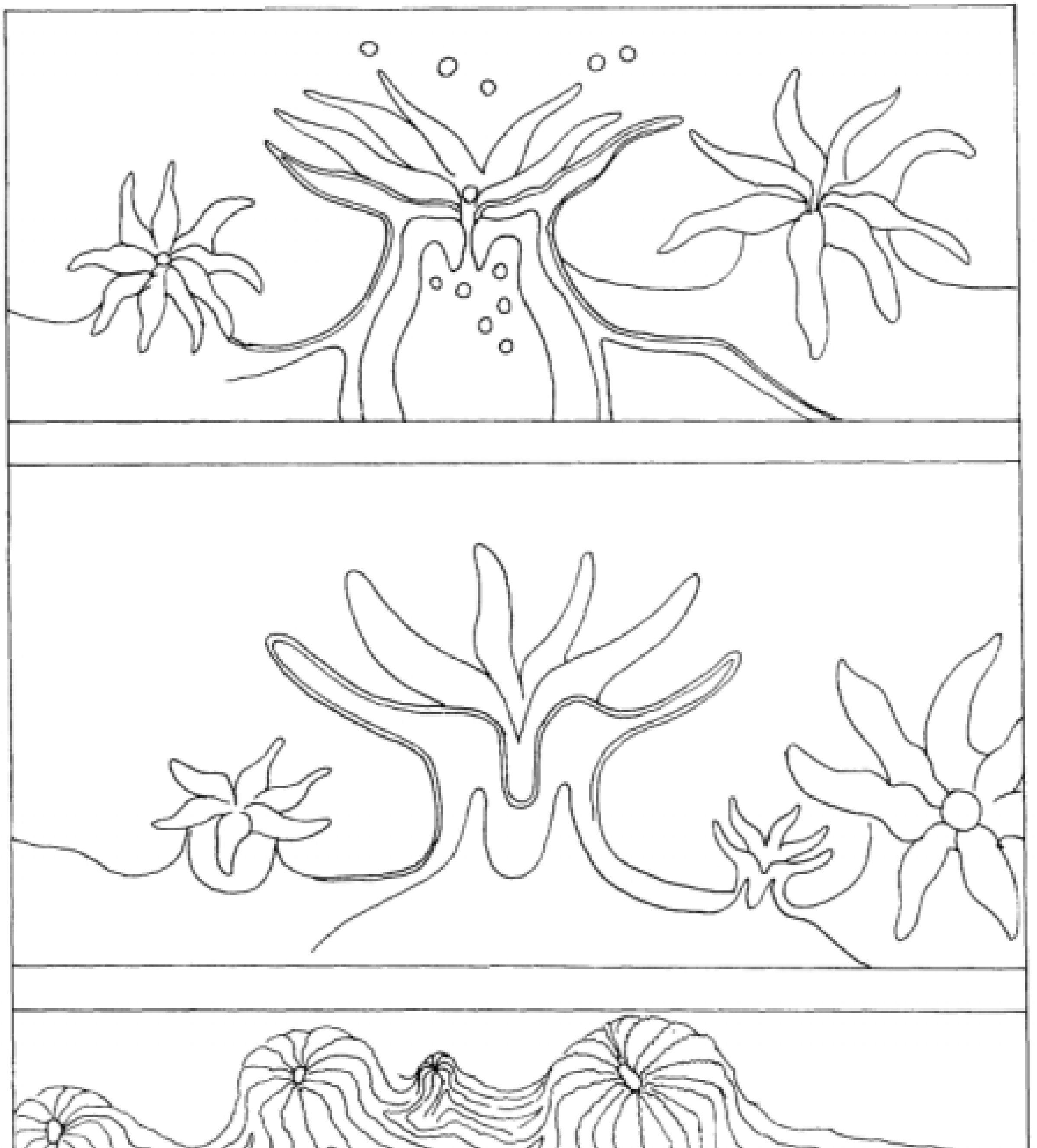
10. SHARING

Corals are also home to some plants. These are tiny plants called **ALGAE** which make their home inside the tube that is the body of the coral animal. They live together in a relationship from which both benefit. The coral produces the carbon dioxide and gives out certain chemical products that these algae need and which they would have difficulty in obtaining if they were free-living. The algae, on the other hand, provide some of the food and oxygen that the corals need.



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11. CORAL GROWTH AND REPRODUCTION

Like all plants and animals, corals also grow and produce new, young corals 'baby' corals (larvae). This is called REPRODUCTION, producing more like themselves. Corals reproduce in two ways:

BY SEXUAL REPRODUCTION: Like human beings, coral polyps produce eggs and sperms. These combine to form small baby corals (larvae). You have already learnt that larvae settle on dead coral or any other hard fixed surface and start to grow,

AND

BY BUDDING: The coral polyp simply divides into two halves, each half forming a new polyp. Or a new polyp grows out of the side of an existing polyp. Each new polyp makes its own limestone cover, This way of growing is called BUDDING, because, like a plant, many buds can form from the same stern.

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12. DIFFERENT TYPES OF CORALS

Some corals can live alone, but most of them live in groups. Scientists call them **SOLITARY and COLONIAL** corals.

Solitary Corals : These corals have a single large polyp. They live by themselves. They form rounded shapes. A good example is the mushroom coral.

Colonial Corals : Most corals live in groups. Many polyps live together in a big family called a **COLONY.** Colonial corals can be either ‘hard’ or ‘soft’ corals. Let us look at them.

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13. HARD AND SOFT CORALS

Corals are of two varieties, hard and soft corals.

HARD CORALS build protective shells of limestone around themselves and, when they die, they leave these ‘skeletons’ behind. Other corals often attach themselves to these hard skeletons. Two examples of hard corals are Brain Coral and Stag Horn Coral.

SOFT **CORALS** can live in much deeper waters than the hard corals. They are not really soft. They look soft and are fleshy, but, if you touch them, they feel like leather. They are also called **FALSE CORALS.**

Soft and false – why? Because they don’t build hard, outer limestone shells. Only hard corals do that. Soft corals grow many thin coloured rods or spines inside to support their soft bodies. When they die, they do not leave behind hard structures upon which other corals can grow. Two examples of soft corals are Sea Fans and Sea Whips.

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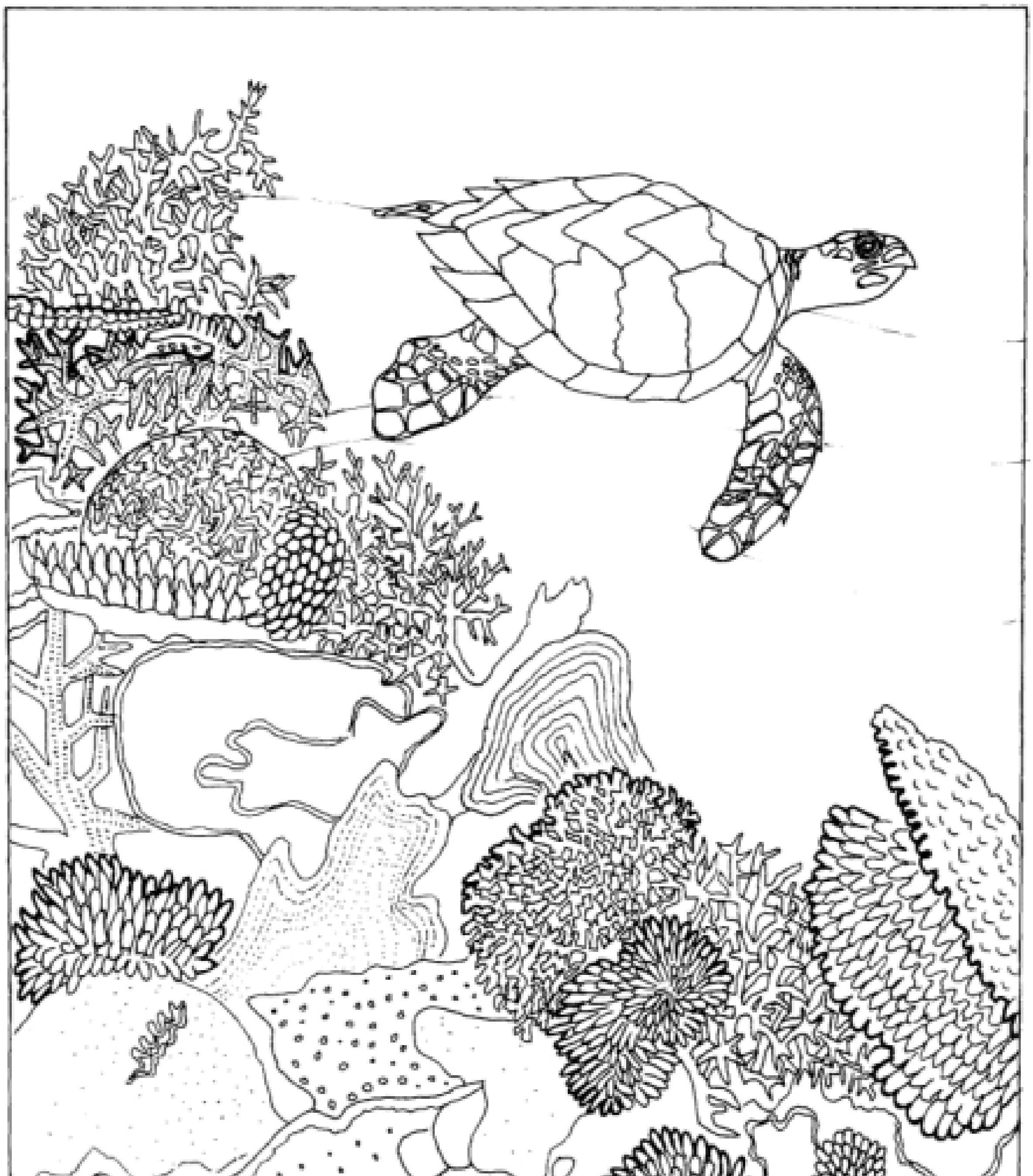

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14. WHERE DO CORALS GET THEIR COLOURS FROM?

Corals grow with the help of several chemicals in the sea around them. Some of these chemicals are coloured and are called **PIGMENTS.** These chemicals give the corals their beautiful, bright colours, which we so enjoy.

The Algae which live with the corals and in them are also coloured and these lend their colour to their **HOSTS.** When you visit the reef, make a list of all the colours that you see.

Hard corals have their pigments in their fleshy parts and not in the shells they build. So when they die, the colours fade and they leave behind white skeletons.

On the other hand, when soft corals die they do not lose their lovely colours (red, orange, yellow, blue), because their colours are part of the skeleton and not the living body.

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15. FISH IN THE UNDERWATER GARDEN

The coral reef is a wonderful garden. No one has really counted the number of sea animals and plants that live in this coral garden.

Reef fish are as bright as the rainbow. Scorpionfish, Goatfish, Parrotfish, Clownfish, Butterflyfish and Damselfish are some of the reef fishes. Amongst them, you also find animals such as sponges, shrimps, barnacles, sea anemones, sea urchins, oysters, sea slugs, flatworms and snails. There are also seaweeds and other plants. They all live and feed in different ways – some by day, some at night.

The reef is the home of animals -that swim, float and creep, of animals that fix themselves firmly on to something else and never move again, and of several plants. That is why it is called a **LIVING REEF.**

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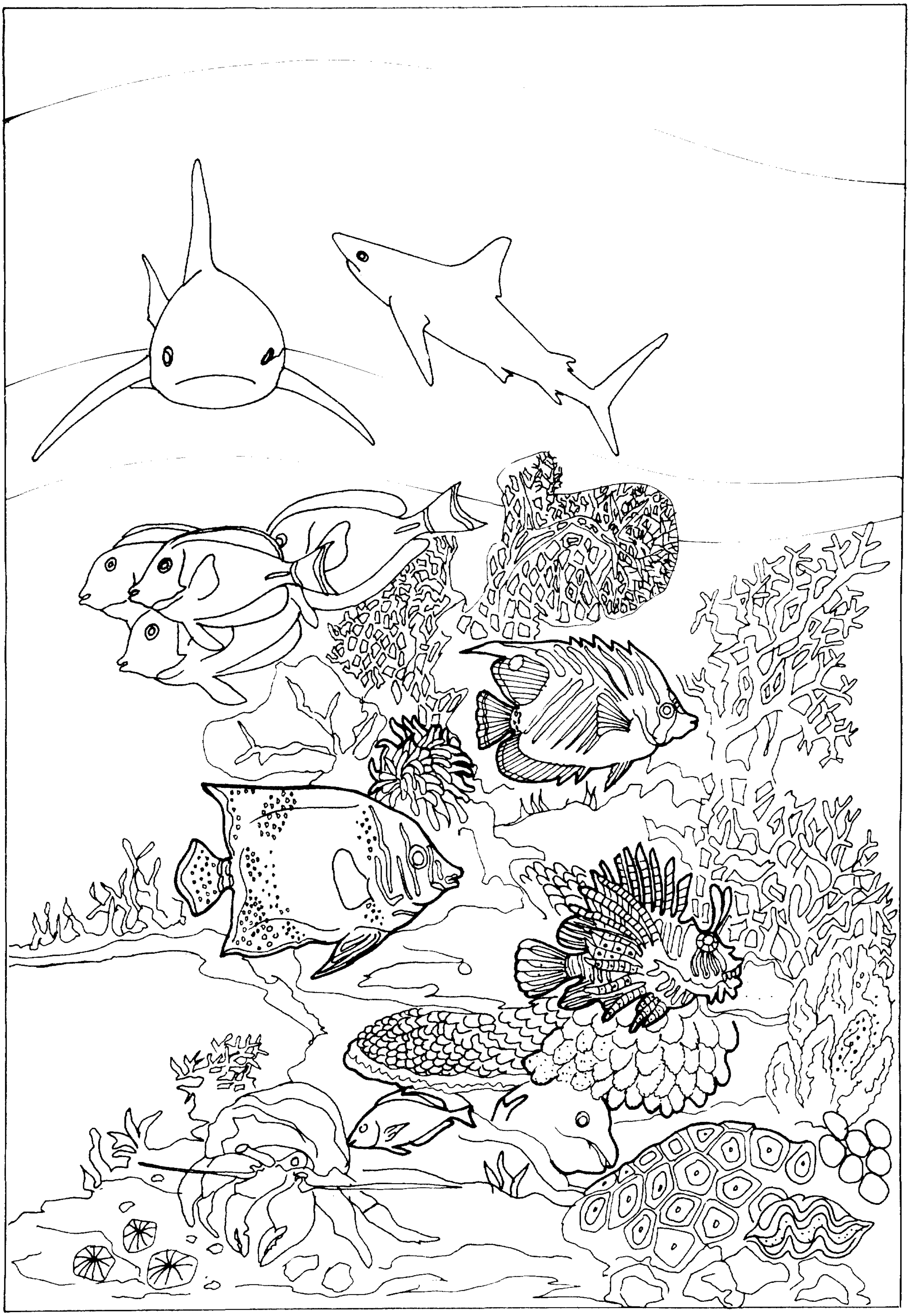

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16. FISH IN THE LIVING REEF

Let us look at the different kinds of fish near our island shores. There are groups of Bannerfish, with fine black and white stripes and trailing long banners. There are brightly coloured Angelfish and the black and yellow Butterflyfish. Much bigger and with shining colours on its back is the Parrotfish. It attacks the coral, and swimmers say that they can even hear the crunch of its powerful jaws as it bites on the hard coral.

Also in this crowded, colourful world is the blue and yellow Surgeonfish. It has strong, small, knife-like spines on each side of its tail. The Lionfish and Turkeyfish look milder, but they are very poisonous.

Another creature which might shock you is the huge Sting Ray hovering on the seabed. Or you might see a Moray Eel with its gaping jaws in the corner of a coral. In deeper waters you will see the Grey Reef Shark.

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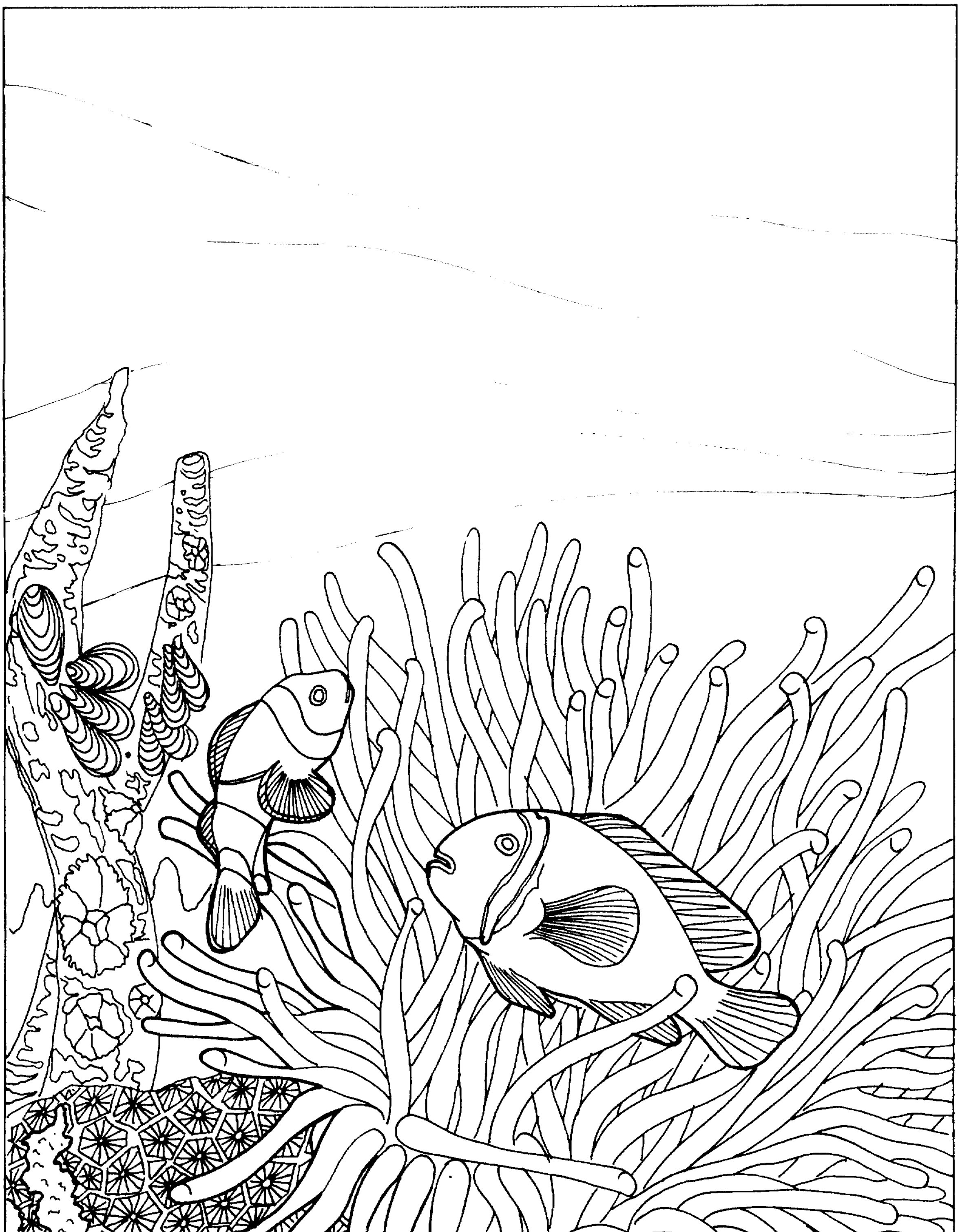

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17. ANIMALS THAT DO NOT MOVE

Some of the animals that live on the reef cannot move about freely. They are fixed to the reef or a rock. So they must trap their food from the seawater around them.

The sponge, the oyster and the barnacle are all such animals. They act like strainers by sucking into their bodies water which is full of bits of food and then letting the water drain out, holding back the food they need.

Sea anemones are like coral polyps, but they don't have a hard shell. They spend their time fixed to rocks or to dead coral or even buried in the sand. Their tentacles search the waters, to trap small passing fish.

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18. CREEPERS AND CRAWLERS

Starfish, sea urchins, snails and various kinds of small crabs crawl about on the coral reef. Among them is also a creature called the Hermit Crab. This animal does not have a shell of its own. So it moves from one empty snail shell to another as it grows. Some animals that live on the reef like to stay hidden by day, and come out only at night to feed.

The most unusual fish you will see in a coral reef is the Sea Horse. It swims upright, very slowly, and moves about hunting shrimps. Its tail is used like an arm, to cling on to something, and the male has a pouch where eggs are fertilized and kept until birth.

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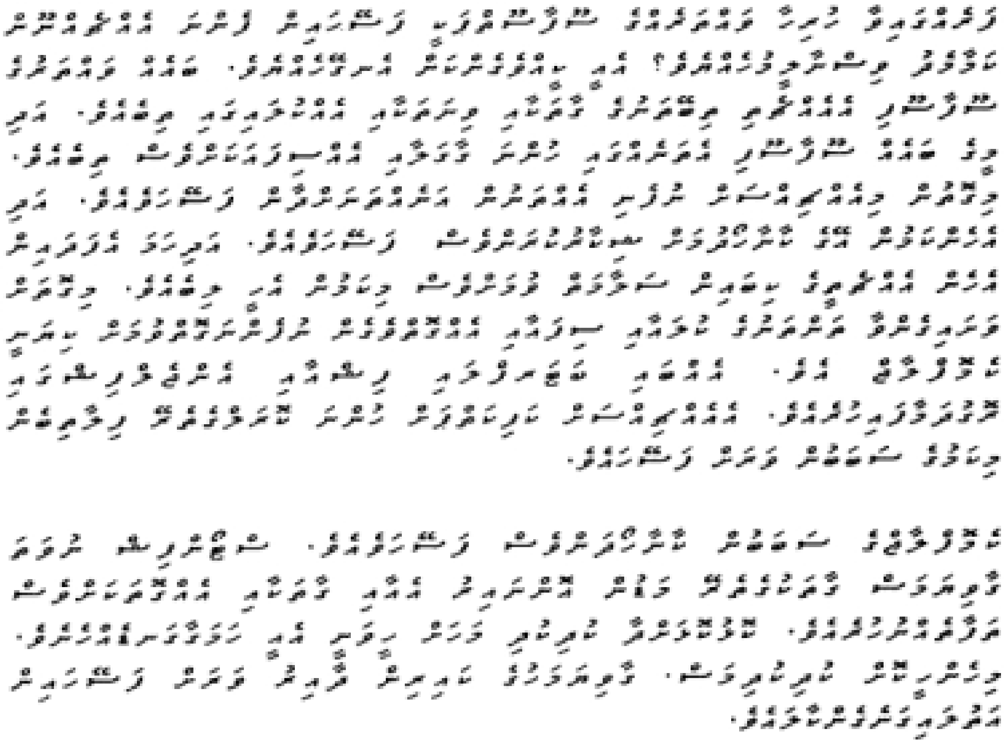
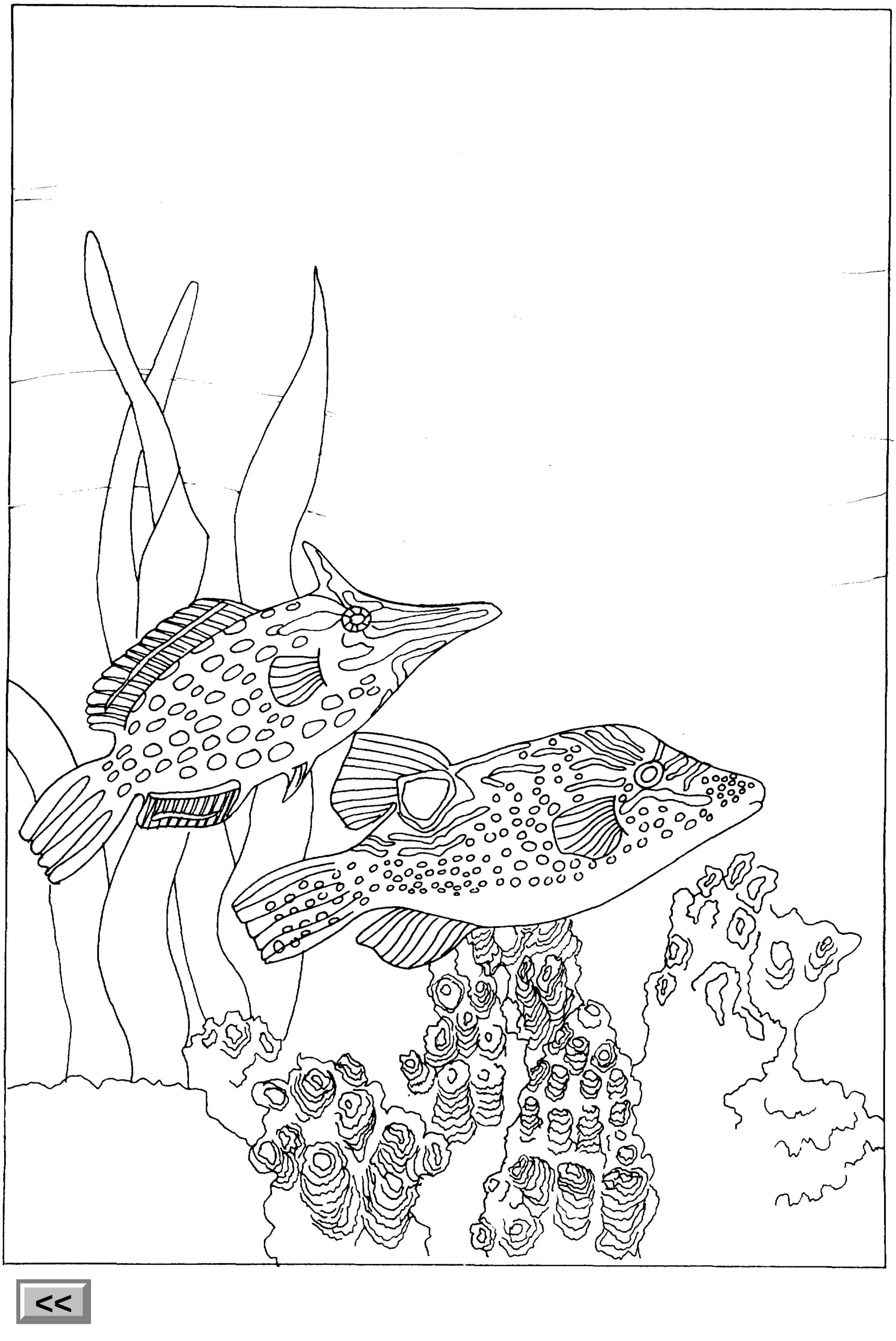


19. HIDING

Have you noticed that ALL the creatures on a coral reef are not easy to spot? Why is this? You must have seen that many fish are almost the same colour as the corals and plants amongst which they live. Some of them are even shaped like coral. This helps them to move about without being seen, and, in turn, helps them to hide and hunt more easily. It also helps them to hide from their hunters. Taking on the surrounding colours and shapes to be able to hide better is called **CAMOUFLAGE.** Many Butterflyfish and Angelfish are striped. The lines help them to hide in branching corals.

Here is how camouflage also helps a fish to catch its food. The Stonefish lies so still amidst coral of nearly its colour that many tiny animals think it is a clump of coral. When these creatures swim close to the Stonefish, it traps them quite easily.



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20. PRETENDING

MIMICRY is copying or pretending to be something else. This is a clever way for a fish to escape from a hunter.

To understand it, let us look at a clever pair of fish. One is called the Filefish, the other is called the Sharpnose Pufferfish. They look a lot alike and are usually found in the same places.

The Filefish is chased because it is a good meal. But no creature hunts the Sharpnose Puffer because it is poisonous. So how does the Filefish escape? Because its enemy THINKS it is the Sharpnose Puffer and leaves it alone.

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21. GUARDING THEIR HOME

Most reef fish often look upon a particular part of the coral reef as ‘belonging’ to them. They move about freely, looking for food, in a fixed area around this piece of coral. It, thus, over a period of time, becomes their home. They do not let any other fish or creature enter their home. This is particularly so when they are reproducing; that is when they most want to prevent any other fish from coming into their home.

Look for the Damselfish and see how they behave, Even though they are tiny, an army of them will attack a much larger creature if it enters their home area.

Silver-coloured Barracuda turn dark when other fish enter their territory. Their jaws begin to snap, they shake their heads and charge the ‘visitor’. In this way they try to frighten the ‘visitor’.

This behaviour is very common amongst reef fish. It is known as **TERRITORIALITY.**

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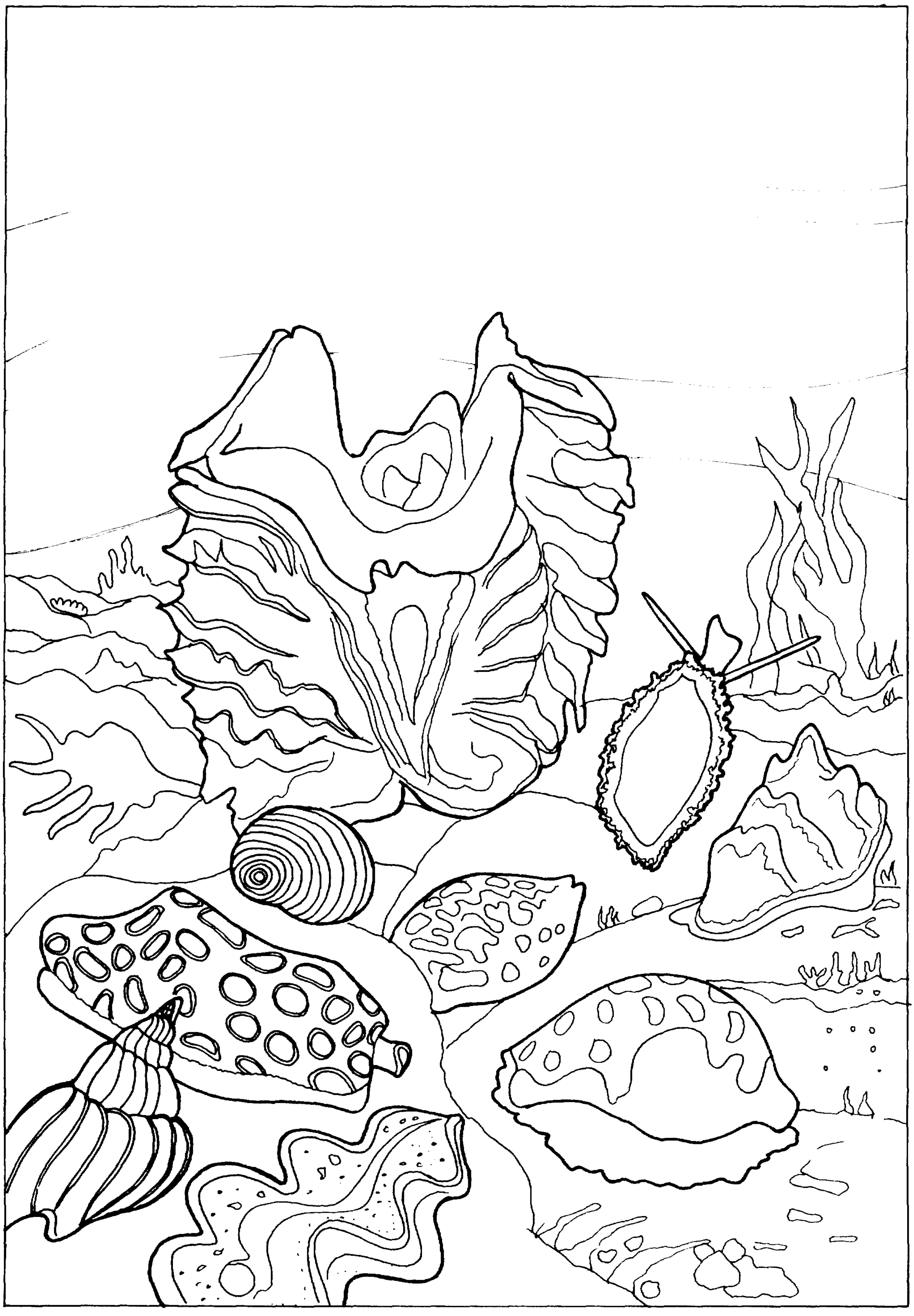

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22. NATURE'S ARMOUR

The shells on our beaches were all once the homes of soft-bodied animals. Shells protect the soft bodies of the animals from harm; they are like armour.

We call the rather small animals that have shells, that serve as their homes as well as their armour, **MOLLUSCS.** The mollusc's shell grows as the animal inside it grows. A special part of its shell is called its **GLAND.** These glands also produce the wonderful colours the shells have.

Turtles also have shells for protection, but a turtle is not a mollusc.

Shells come in strange and beautiful shapes. That is why shell-collecting is a popular hobby. There are many valuable private collections. Some countries have shell museums as well.

Some kinds of cowrie shells were once used as money in the South Pacific, parts of Africa and even in the Maldives.

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23. SNAILS AND SLUGS

Though snails are found on land as well as in water, the snails of the coral reefs are the most beautiful. They have brightly coloured shells (yellow, blue, pink, brown, black and purple). These shells are used to make jewellery, curios, ornamental items and buttons. Some of these beautiful items are sold to foreign countries. In some countries they even eat certain snails.

Sea slugs are like snails – but do not have shells. They too come in beautiful colours. In the underwater world, such bright colours are often a signal. Such creatures may not be safe to eat. They may not taste good. So colours are a warning to other animals not to eat them.

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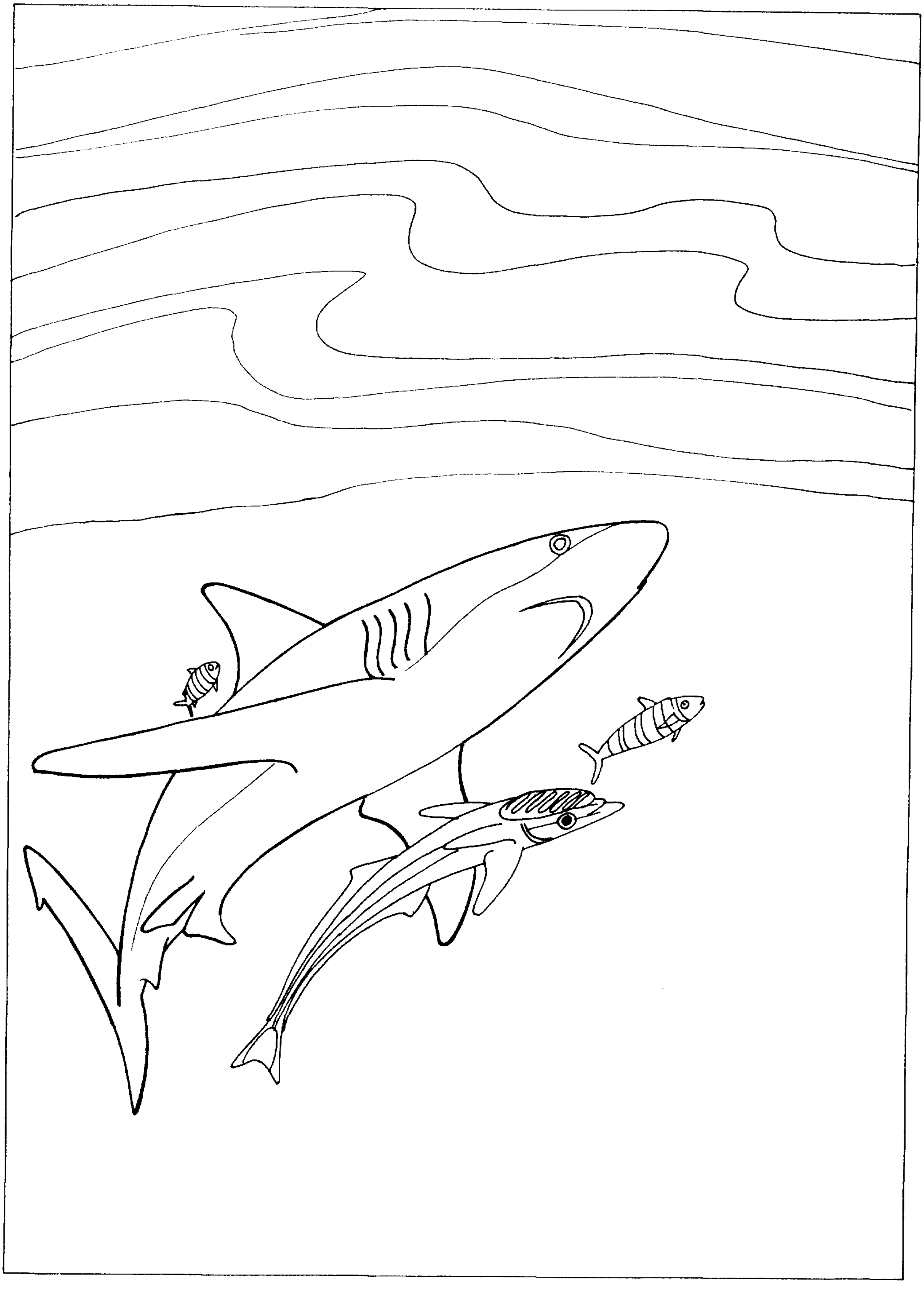

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24. COMMENSALISM

Most organisms live within groups of their own kind. But some plants and animals live with organisms that are not from their own group or family.

If such a relationship helps only one organism, while the other is not harmed, then the organism helped is called a **COMMENSAL.** The relationship is known as **COMMENSALISM.** The word comes from the Greek language and means ‘eating at the same table’. So we know that commensalism has something to do with food.

Is there commensalism in the Maldivian coral reefs? Yes. Let’s look at the Sharksuckers and sharks. The Sharksucker sticks to the shark. It gets a ‘free ride’ and saves energy. At the same time, it gets all the left-overs from the shark’s meals. Does the shark gain in any way? No. Is it harmed? No. This is commensalism. The Sharksucker is a commensal.

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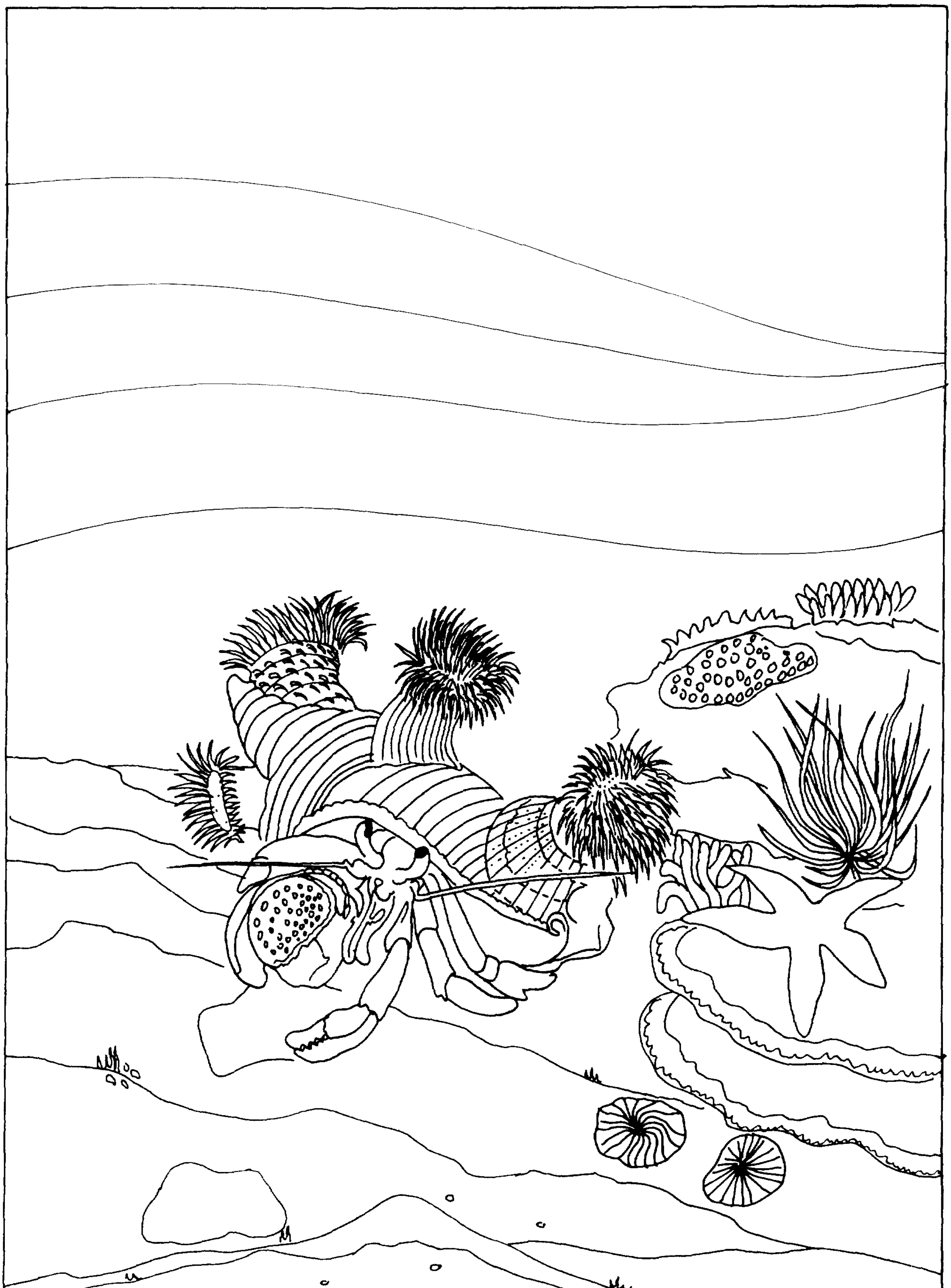

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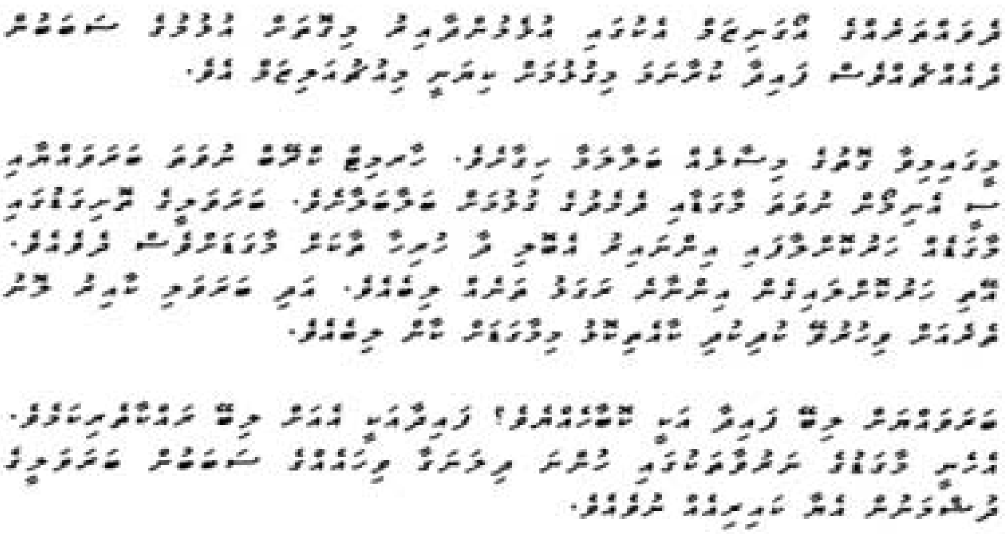

25. MUTUALISM

When two organisms live closely together and they both gain, the relationship is called **MUTUALISM.**

Again, let us look at an example.

There is a mutualism between the Hermit Crab and the Sea Anemone. As the Hermit Crab moves from one empty shell to another, the Sea Anemone (which lives on top of the same shell) moves with it. The Sea Anemone gets a firm base on which to live. As the crab feeds, some bits of food will float up and make a meal for the Sea Anemone.

How does the crab gain? It gets some protection, because the Sea Anemone's stinging tentacles keep away the crab's enemies.

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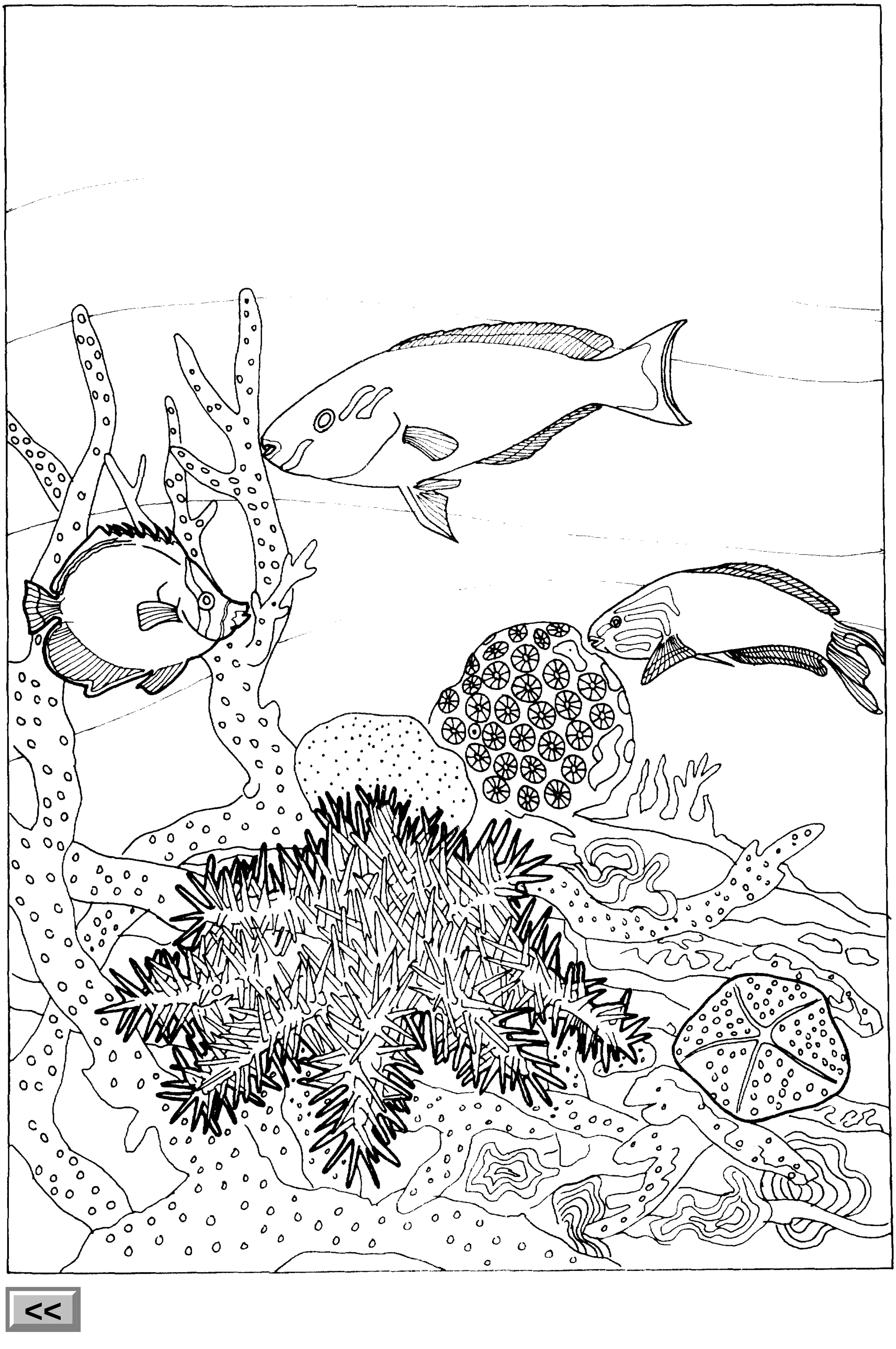

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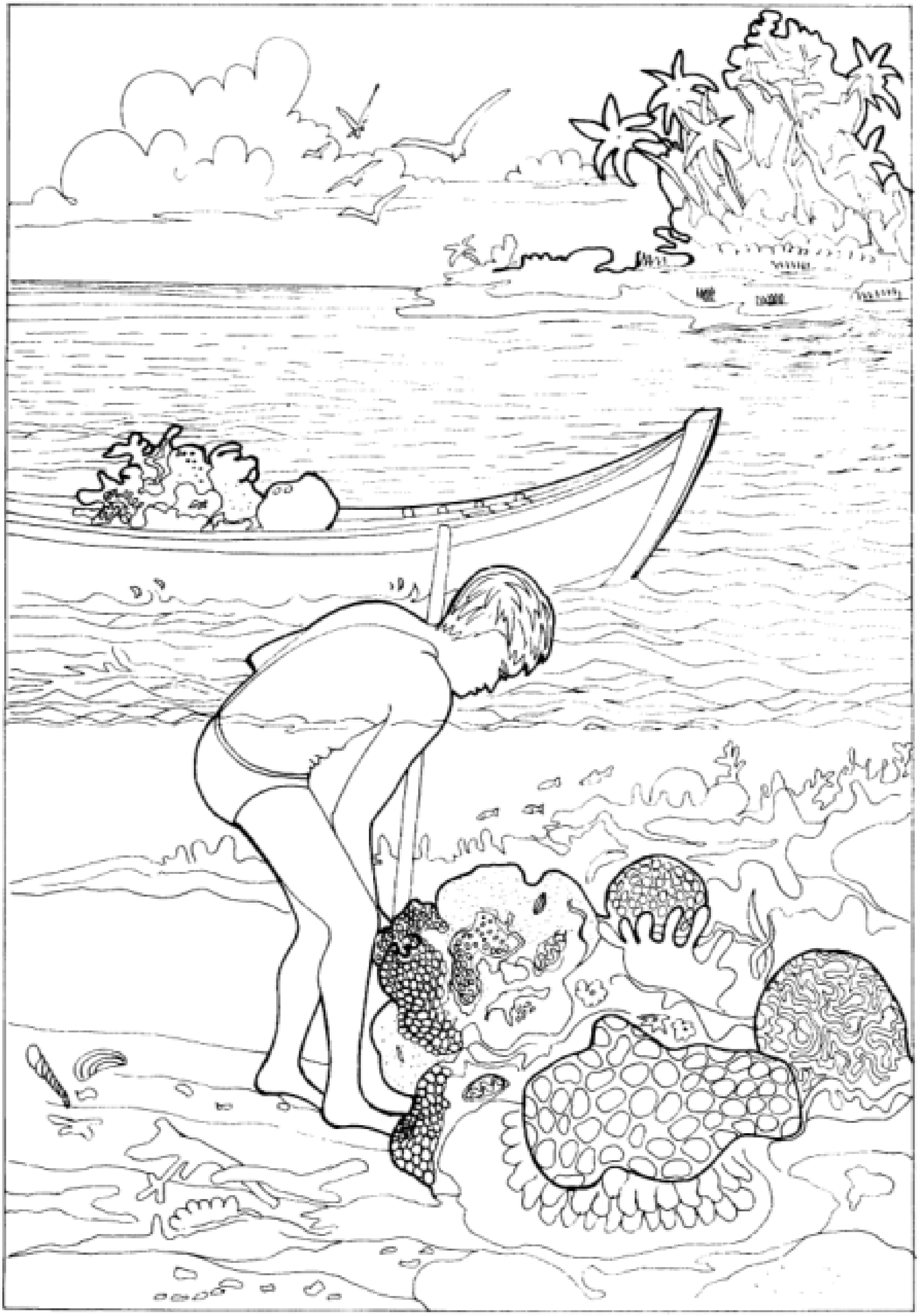
26. HOW NATURE DAMAGES REEFS?

This exciting world of animals and plants that we have learnt about can easily be destroyed.

Both Nature and Man damage coral reefs. Can a damaged reef recover? Yes, if it is not badly damaged, it can repair itself – but only very slowly. It takes about forty years for a reef to recover, if you leave it alone. Destruction on a big scale, however, can be very serious and the reef may die.

There are many ways in which nature can damage a reef. Here are some

- Heavy storms break up certain kinds of delicate corals, like the branching corals.
- The Crown of Thorns (COT), a very large purple starfish, eats the living coral polyps. So colony-building slows down.
- Certain kinds of fish, such as the Parrotfish and Angelfish, eat into the face of the live coral. They have long, tubelike mouths which they use to bite off coral polyps.



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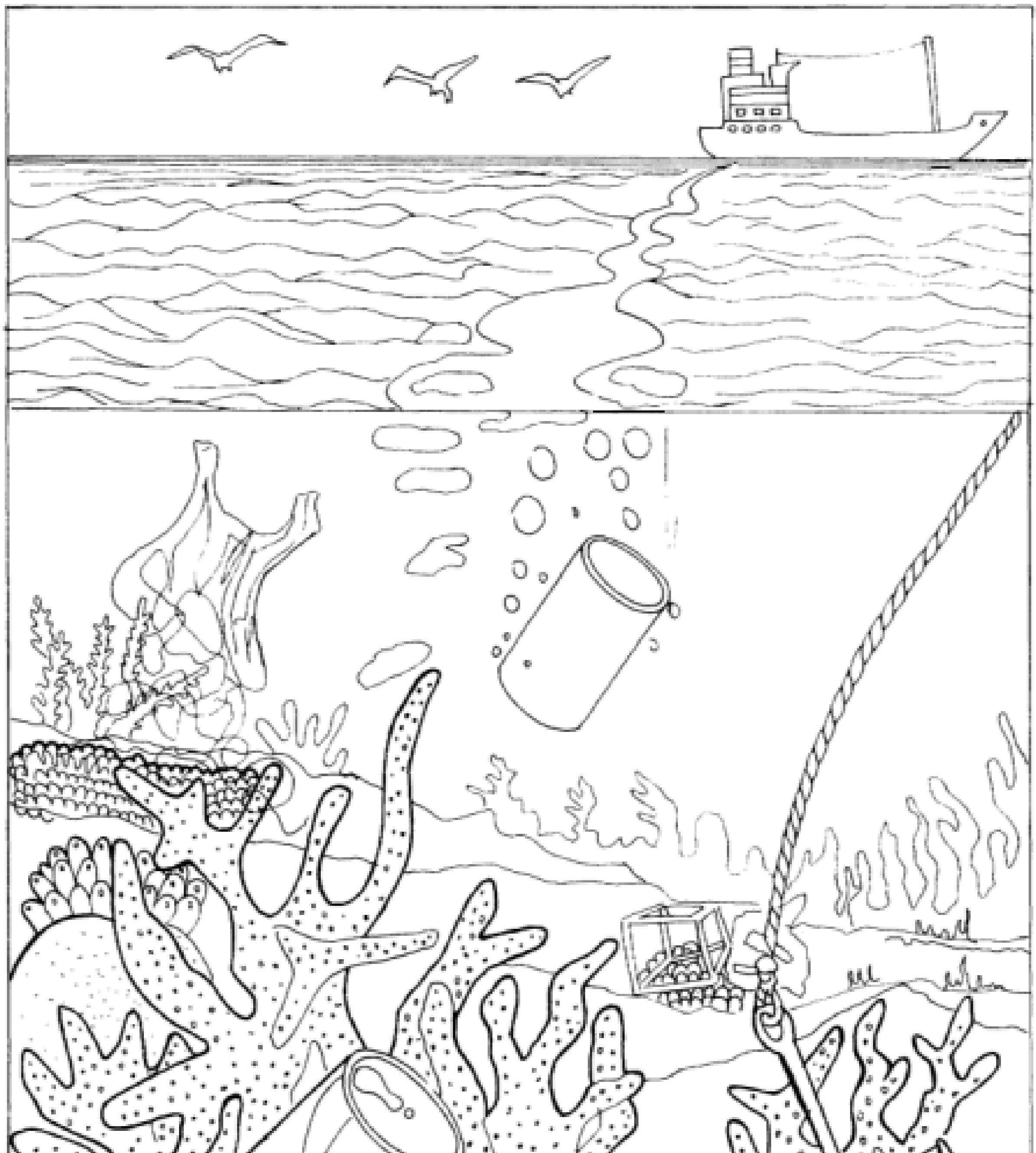

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27. HOW MAN DAMAGES REEFS?

Man damages coral reefs in many ways

- People dump their garbage and waste (sewage) into the ocean. The water becomes so dirty that sunlight can no longer pass through the water. When plants cannot get sunlight, they die and the coral polyps stop growing.

- Oil spills from ships and *dhonis* pollute the water and can kill the reefs.

- When harbours are dredged, the waters become very dirty. Mud covers the tiny coral polyps so they cannot breathe or feed.

- By operating nets and traps to catch bait fish, reef fish and lobster, the reefs get damaged. Even the capture of some ornamental fish for export and the collection of seashells can cause damage to the reefs.

- You have learnt about the food chain. If any one organism is caught (fished) too often, it upsets the way of life in the reefs.

- More and more corals are mined to get the material needed for our houses and for our roads.

- Underwater explosives are used to break the coral and make harbours. This blasts away the work of a thousand years.

- And when *dhonis* drop anchor, the anchors hammer the reef and break it up.

All of us must be very careful about what we do to coral.

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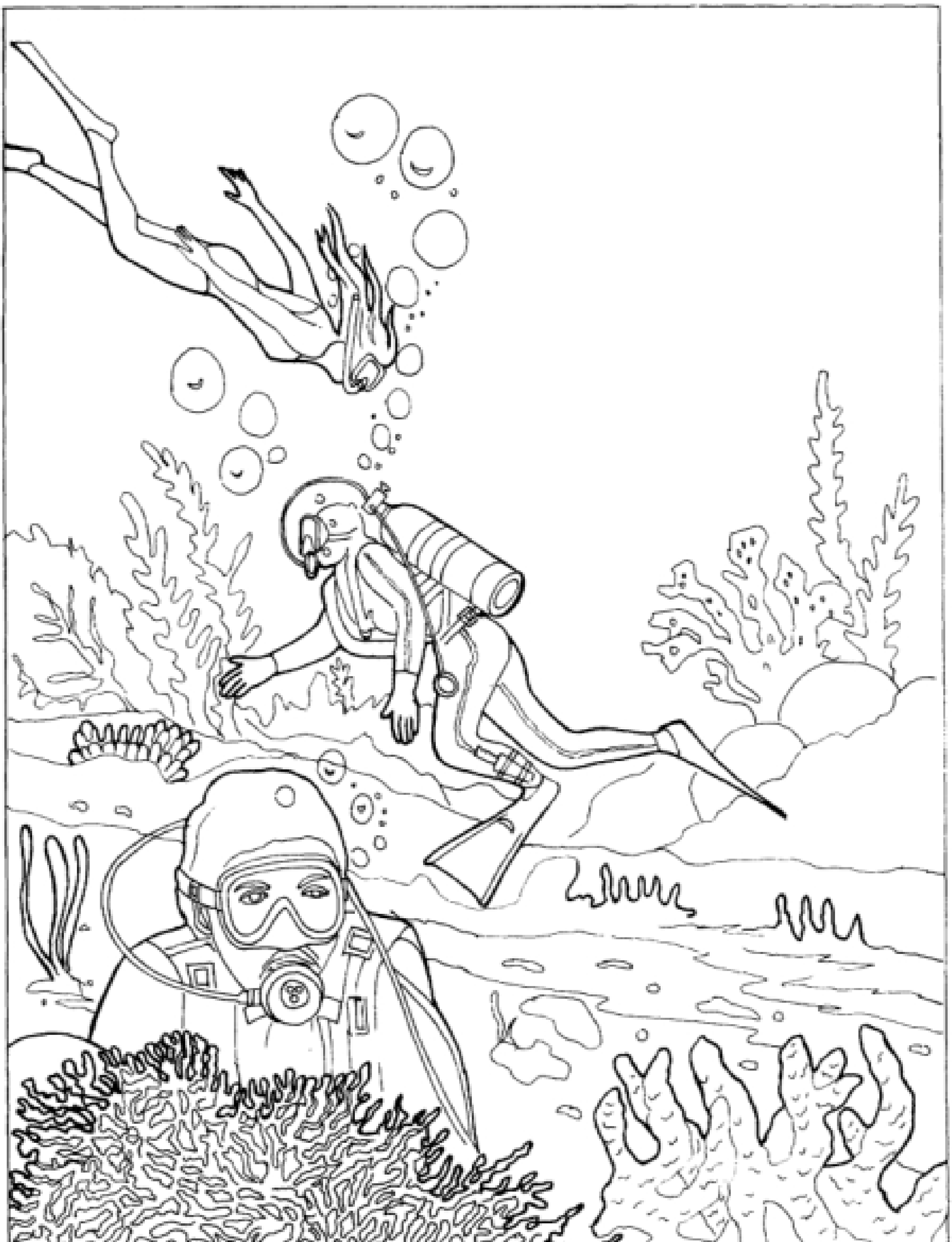

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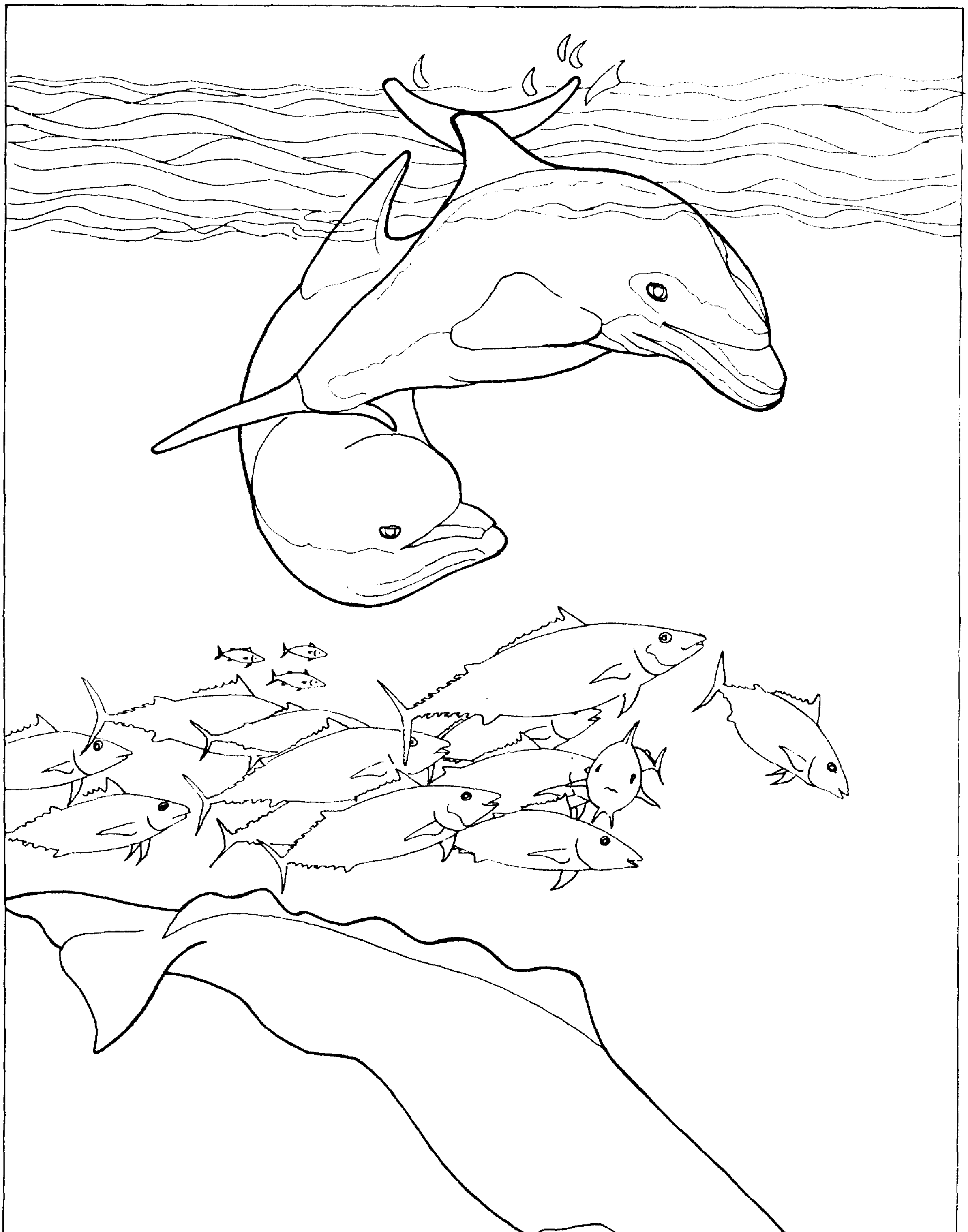

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28. WHY ARE CORAL REEFS IMPORTANT?

- When strong ocean waves and storms hit our lovely island beaches, they cause the land to slowly reduce. This is called **EROSION.** The coral reefs act as a barrier and provide protection. The waves hit the reefs and slow down before they reach the shore.

- **Corals built** the reefs that make up the Maldives. They also give us the materials to build our houses. But we must be careful about how much coral we take for house-building.

- The **LIVING REEFS** attract tourists from all over the world. These visitors go diving and snorkelling. Maldivians are needed as guides and to run hotels for them. So, many jobs depend on tourism.

- Coral reefs provide us with reef fish for food and for sale to other countries. They also give us the bait necessary for tuna fishing. Vividly coloured coral reef fishes are kept in aquariums all over the world.

- Some corals are so exquisite that they can be used as jewellery or as decoration in. people's homes.

- Chemicals from sponges are used to treat cancer. Poisons produced by coral reef animals and plants are used to fight human disease. Coral skeletons are used in bone surgeries.

As you can see from some of these examples, the reefs can earn money for us because they produce things that we can sell. They also bring tourists, who enjoy coming to see the living reefs.

SO REMEMBER: Damage caused by nature cannot be helped. But damage and overuse caused by people can be stopped. Every one of us must help to look after our coral reefs. Why not get together with your friends in school and form a **Coral Reef Protection Club?**

Help our country to protect its reefs.

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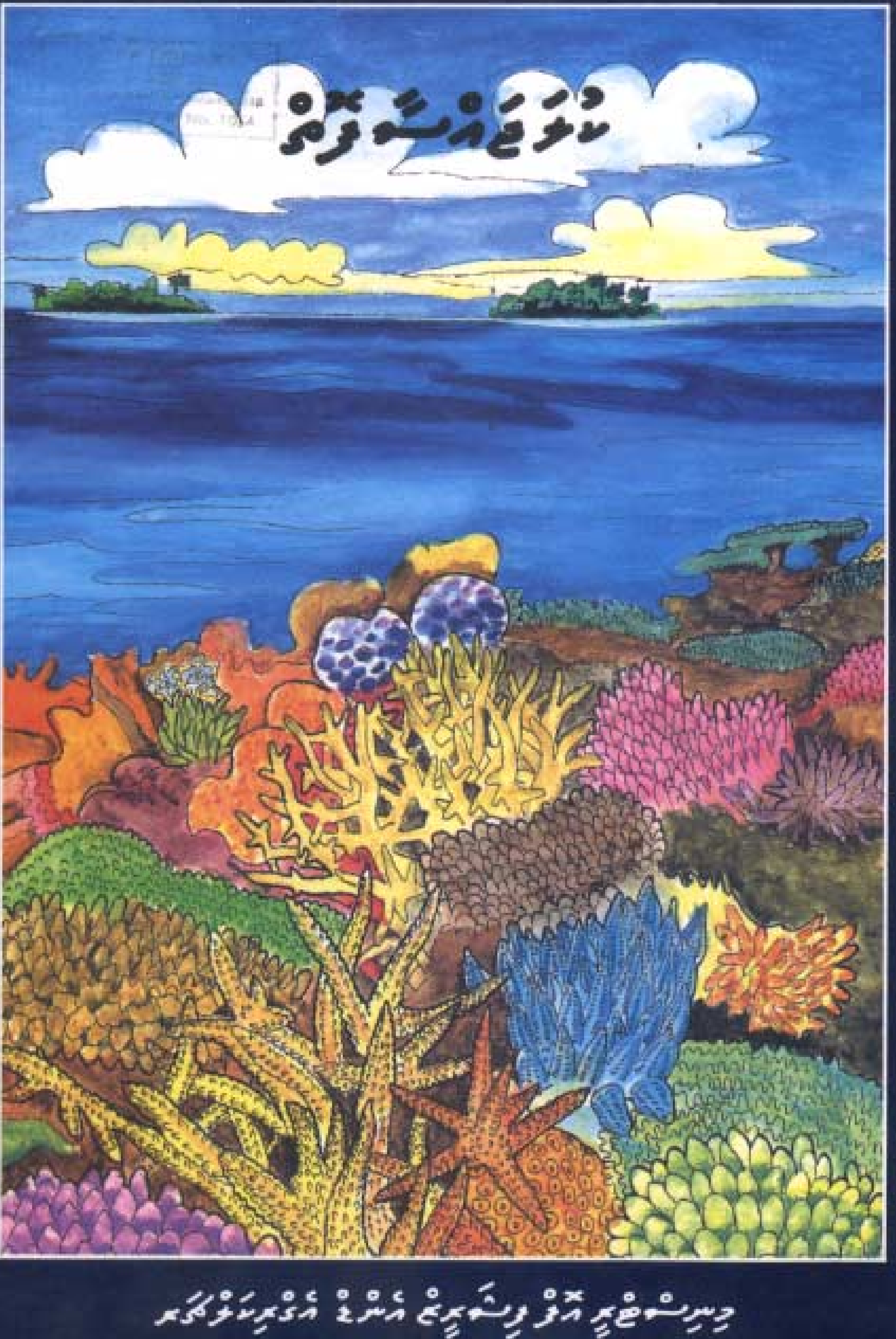

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