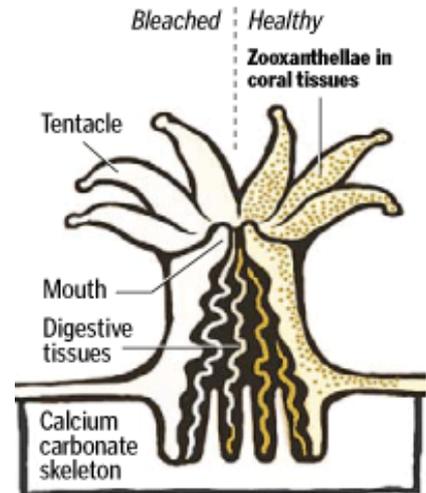


5 Coral Reefs

He raised the *heaven* on high and set the balance of all things, that you might not *transgress* that balance. Give just weight and full measure. (Qur'an 55:1-9)

What is coral?

Coral reefs are one of the most **spectacular** sights in the natural world! In the past, some people thought corals were a kind of rock, but we now know that they are colonies of very tiny animals called **polyps** that have a hard, rock-like outer skeleton. **Polyps** are related to jellyfish and sea anemones, and like them, have stinging tentacles which they use to feed on plankton – tiny plants and animals drifting in the water currents. But corals mainly feed in another, unique way. Inside the cells of the **polyp's** body tissue, there are cells of a very specialised kind of algae, called **zooxanthellae** (pronounced 'zoozanthel'). Like all plants, **zooxanthellae** use sunlight, water and dissolved carbon dioxide gas to produce food (a process called **photosynthesis**). These sugars are then shared with the coral **polyp** host. In return, **polyps** protect **zooxanthellae** from **predators** and provide nutrients and carbon dioxide. The **pigments** inside the algae cells that absorb sunlight are brightly coloured.



Coral **polyp** structure © Patterson Clark / The Washington Post

Most coral **species** grow best where the sea temperature is 23 - 29 °C, and cannot survive in water below 18 °C. They also need clean, clear water that gets a lot of sunlight and has a salt concentration of 3 - 4 %. These specific needs mean most coral **species** and reefs are found in tropical seas at depths of 2 - 30 metres.

What is a coral reef?

The rock-like skeleton of coral **polyps** is made from calcium carbonate (limestone), laid down by the **polyps** as they grow. When **polyps** die, their skeletons remain and new **polyps** grow on top of the old empty skeletons, so only the thin brightly-coloured top layer of the **coral reef** is alive. Over time, the collection of skeletons builds up to form a large rock-like structure called a coral colony. Corals colonies of different **species** grow in a range of shapes: branched like trees, in flat shelves, or round domes. Over centuries, many individual colonies of various sizes, shapes and ages grow together, and this becomes a **coral reef**. Zanzibar has about 90 km² of **coral reef** of three types. **Fringing reefs** border the **shore** with a small channel in-between, **barrier reefs** are separated from the **shore** by a deep **lagoon**, and **patch reefs** are small, isolated reefs in sandy **lagoons**.

Why are coral reefs important?



Chumbe Island Coral Park reef © Oskar Hendrikson

Biodiversity – Coral reefs are one of the most diverse ecosystems on our planet. Worldwide, there are around 845 **species** of reef-building corals, which provide **habitat** for thousands of reef fishes, shellfish, crabs, lobsters, sponges, and algae. Zanzibar's reefs are home to hundreds of coral and reef fish **species**: Chumbe Island Coral Park, a Marine Protected Area just 0.4 km², has over 200 coral and at least 432 reef fish **species**.

Food – Fish provide 60% of the animal protein eaten in Zanzibar, and are therefore a vital part of the islands' food source. Most of these fish need to spend at least part of their lives on a **coral reef**.

Income – Fishing is the main economic activity in coastal villages, with at least 34,000 artisanal fishers in Zanzibar. Zanzibar fishers land approximately 24,000 tones of fish each year.

Natural beauty – The amazing and diverse shapes and colours of the coral reef and reef fish are a powerful attraction for tourists to come to Zanzibar for snorkelling and diving. Tourism provides jobs for at least 100,000 Zanzibaris and generates 20% of Zanzibar's GDP.

Protection – Coral reefs provide a natural barrier in the sea that protects coastal communities and beaches in Zanzibar from erosion and flooding from wave action and storms.

Carbon 'fixing' – Coral polyps make their limestone skeleton from calcium ions and carbon dioxide dissolved in seawater. This process, known as carbon fixing, helps reduce the amount of carbon dioxide in the atmosphere and thus helps slow down climate change.

Threats to the coral reefs of Zanzibar

Coral reefs face a variety of threats, mainly resulting from human activities.

Overfishing and destructive fishing methods – Demand for fish is rising due to both population growth and increasing tourist numbers. Overharvesting of fish, octopus, crabs and lobster is becoming a concern. In some areas of Zanzibar, populations of commercial fish and shellfish species are so low that fishers cannot find them any more. This creates further problems. For example, parrotfish eat corals, which they grind up in their teeth and release sand from their faeces which contributes to sand building. Also, some fishing methods are extremely damaging to coral, such as dynamite, poisoning, and 'kigumi' fishing where fishers use poles to break off coral colonies and drive out fish. These methods are illegal: they destroy large areas of reef and kill all the fish present, not just the fish targeted. Fishing nets dragged over the reef are very damaging, as they drag over the coral, catch on it, and break pieces off. Around Zanzibar, many large nets have got stuck on coral heads and been abandoned.



Scuba divers removing an abandoned net from a coral reef in Zanzibar. © Anne Tarvainen



Crown of thorns starfish, and a crown-of-thorns outbreak on a Pemba reef © Chris Bartlett

Crown-of-thorns starfish – These large, many-armed starfish eat coral polyps. Normally, predators, such as shellfish called tritons, eat them, and keep their numbers down, but triton shells are very popular with shell collectors, so they have been wiped out in many areas by the ornamental shell trade. Without predators, major outbreaks of crown-of-thorns starfish now occur, during which thousands cover reefs and cause extensive damage.

Snorkelling and diving – Coral polyps are very sensitive to touch, and if you touch a coral colony, even lightly, the polyps die after a few days. Careless snorkellers and divers kick up sand, smothering the polyps, and worse damage happens when they kick the coral or stand on it. It is also possible that peeing in the water and sunscreen have a negative impact on coral reefs that large numbers of tourists visit.

Boats – When boats run aground on reefs, they break and kill coral when the boat moves in the waves. Anchoring on a reef is also very damaging, because not only does the anchor itself break coral, but also the chain, when the boat swings around. Boaters walking on coral kill it too.

Coral mining and lime production – Live coral is mined, and turned into lime for construction. This is a very destructive activity, destroying vital reef habitat which take decades to recover. An

Ujikua unajua...?

- Most living coral reefs today are between 6,000 and 9,000 years old!
- Most corals feed on plankton at night, and keep their tentacles hidden during the day to stop them from being eaten by fish or shading the zooxanthellae from the sunlight they need for photosynthesis!
- Although coral reefs only occupy 1% of the world's surface, they provide a home for one quarter (25%) of all marine fish species!
- The global economic value of coral reefs is around US\$ 30 billion!
- One third (33%) of coral species around the world are listed as threatened on the IUCN Red List of Threatened Species.

additional problem is that the kilns used to turn the coral into lime are typically heated by burning mangrove charcoal, causing further destruction of Zanzibar's coastal natural resources.

Siltation – As more and more land and mangrove is cleared to make way for housing, hotels and agriculture, more and more soil runs off the land into the ocean during heavy rains and smothers local coral reefs. **Dredging** also leads to siltation because it stirs up lots of soft sediment.

Pollution – As the population of Zanzibar and the number of tourists visiting increase, so does the amount of sewage, oil, chemical waste and rubbish entering the sea. These all damage coral and other marine life.

Coral bleaching and climate change – Climate change has many effects on coral reefs. Not only is seawater getting warmer, but extreme weather events are happening more often. For example, there are more

big storms – which break off coral fragments, stir up mud

and sand, and reduce salt levels. When the water gets too warm, coral polyps eject the algae in their cells. Living corals get their vivid colours from these algae, so after they are ejected the coral becomes bright white. This event is called **bleaching**. **Bleaching** is very bad for corals because they get 90% of their food from the algae. As long as the water cools down soon, they can take in algae again, but if the water stays warm, the polyps soon die. **Coral bleaching** events are becoming more frequent, and are affecting larger areas and deeper reefs each time. Coral disease also increases in some corals with warmer temperatures.

Ocean acidification – The increased carbon dioxide in the atmosphere that causes climate change is also absorbed by the ocean, where it reacts with dissolved salts and makes the sea acidic. It then dissolves the calcium carbonate (limestone) skeleton of corals and makes it harder for corals to build their skeletons at all. Reef breakdown due to acidification is very worrying.

How can we protect our coral reefs?

As we have seen, coral reefs are a critical part of our environment. We depend on them for many things: food, protection from storms, hundreds of thousands of jobs for Zanzibaris in fisheries and tourism. Corals are essential but also very fragile and vulnerable to destruction. We must therefore all do what we can and work together to protect them.

Tembea ujionee!

- Visit a Marine Protected Area in Zanzibar. Many have education programmes for schools, communities, tourists and others.
- Walk to a rocky seashore at low tide – you can see small corals growing in rock pools.
- Talk to local fishers about where the reefs are and how the fish catches have changed over time.

Swimmers, divers and snorkellers should be very careful not to touch coral, and never to stand on the reef! It is important to stay a safe distance from the coral, and be alert so fins don't kick the coral or stir up sand.

Boaters should stay in deep channels, not over shallow reefs, and should either anchor on sand, or use a fixed mooring buoy.

Fishers must avoid fishing methods which damage coral reefs: if they are destroyed, the fish will disappear. Fishers should work with others in the community to manage resources co-operatively, for example by establishing community-based protected areas to protect fish stocks.

Kitunze kidumu – Marine Protected Areas (MPAs) are zones where marine natural resources are protected from damaging activities. Measures taken to protect MPAs may include banning destructive fishing methods or even all fishing, or limiting the number of tourists allowed to snorkel or dive, in order to safeguard the **fragile** coral and other sensitive marine **habitats**. In turn, this gives fish a **refuge** where they can grow fast and breed. This actually benefits fishers because it also increases fish stocks in neighbouring fished areas up to 500 m from the MPA, because of migration! Coral and fish populations in MPAs are usually monitored, and crown-of-thorns starfish removed during outbreaks. There are currently six MPAs in Zanzibar: Chumbe Island Coral Park (established 1994, 0.4 km²), Mnemba-Chwaka Bay (which includes Mnemba Island Conservation Area) (1997, 0.15 km²), Menai Bay Conservation Area (1995; 467 km²), Changuu-Bawe Marine Conservation Area (2010), Tumbatu Island Conservation Area (2010), and Pemba Channel Conservation Area (which includes Misali Island Conservation Area) (1998, 23 km²). Good MPAs raise awareness within local communities that depend on **coral reefs**, and how we can protect them effectively.

We can also protect coral through activities **onshore**. Don't buy or sell coral or large shells as **souvenirs** – many large shell **species** are already endangered animals, and the triton shell has a crucial job in protecting the coral from crown-of-thorns starfish!



Marine Protected Areas in Zanzibar © Nell Hamilton

Forests, mangrove and seagrass all make sand, mud and soil more stable, so we should protect these **habitats** to stop sediment from washing on to the coral and smothering it, for example by replanting trees cut for firewood and not cutting down mangrove.

Kitunze kidumu!

- Never stand on coral reefs!
- Don't throw rubbish in the ocean or onto the beach, dispose of rubbish properly: reduce, reuse, recycle.
- Don't use damaging fishing methods or buy fish caught by **dynamite** or poison fishing, or other destructive methods.
- Avoid buying lime produced by burning live coral – use alternative constructive materials such as mud-bricks, sustainable wood, or lime made from fossilized coral collected inland.
- Tell family, friends and others in your local community how important coral reefs are, and let them know how they can avoid activities that damage your local coral reefs.
- Report illegal destructive fishing activities to the relevant authorities. Destroying coral destroys Zanzibari people's livelihoods, now and in the future.
- **Lobby** the authorities for greater protection of your local reef.