Marine scientists have breathed new life into corals that had been lying dead for 10,000 years

CORAL DRAW

(Clockwise from top) ZSI scientist Ch Satyanarayana and world renowned coral expert Carden Wallace study corals in Indian waters; coral which was transplanted in the Gulf of Kutch; expanses of corals that died nearly 10,000 years ago at Kutch. PIX COURTESY ZSI

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Just as a gardener grows a bed of roses from a cutting (twig) taken out of the mother plant, marine scientists of the Zoological Survey of India (ZSI) in Kolkata have restored a portion of the coral reef in the country's first marine national park in the Gulf of Kutch off Gujarat coast. The corals, as it turns out, had been lying dead for the past 10,000 years.

"Coral transplantation and restoration is not new to scientists in India and across the world. But this marks the first time in the world that biologists have managed to restore a reef, which had been lying dead for thousands of years, by bringing in live corals from more than 2000 km away and growing them in turbid waters," Kailash Chandra, director, ZSI, Kolkata told *HT*.

Coral cuttings, just like rose twigs, can survive if transplanted in suitable environments. Scientists took advantage of this aspect. Broken 'twigs' of corals collected from the Gulf of Mannar, off Tamil Nadu coast, were airlifted and flown to Gulf of Kutch covering a distance of more than 2,000 km before they were planted in turbid waters.

Experts called it a big achievement by Indian scientists as corals usually need clear water with lots of sunshine. They cannot withstand murky or muddy water as the sediment clogs the pores and kill them. Transporting corals over such long distances was also a great feat as corals are very sensitive to changes and die under stress.

India has four major reefs — Andaman and Nicobar Islands, Lakshadweep, Gulf of Mannar and Gulf of Kutch. While the reefs in Andaman are considered the richest and most diverse, the ones in Kutch area are at their poorest in terms of survivability. Only 30% of the coral in Kutch area was found to be alive, albeit in a degraded condition.

"Tons of sediment brought down by rivers that once used to flow through the Kutch area in the past had deposited a layer of silt on the coral bed, killing them. Dead remnants of corals could be seen strewn around in all the 46 islands in Kutch," Ch Satyanarayana, a coral scientist at ZSI, Kolkata and principal investigator of the project, told *HT*.

Experts from the Geological Survey of India have been studying the dead corals and some coral fossils for long. They have done carbon dating of the dead corals and the fossils and have found that the corals had died almost 10,000 years ago. Sedimentation was the main culprit. Over the past few years, they have degraded further due to such activities as fishing and pollution from industries. Increasing temperature due to climate change and global warming has also taken a heavy toll. Between 1967 and 2007, Kutch had lost more than 107 sq km of coral reefs.

The three-year project, aimed at transplanting and restoring the dead coral reef in the Gulf of Kutch, was a joint collaboration between the ZSI and Marine National park authorities. It kicked off in 2012 with funds from the World Bank and was supposed to end in December 2015. However, it has since been extended for another two years, to 2017.

"The entire process required meticulous planning at every step because corals are one of the most delicate and sensitive animals and one error could kill them and jeopardise the entire project," Chandra said.

Experts from the Geological Survey of India along with coral expert Carden Wallace were consulted to select the suitable species that could be transplanted. Only those species, which were earlier found in the Kutch region, were selected.

The obvious target was 'Acropora' – a group of branching corals – that grows very fast. They were once found abundantly in Kutch and were the first ones to die when conditions turned unfavorable.

The focus then shifted to sourcing the coral cuttings. Since the corals of Andaman and Lakshadweep grow in the best of conditions and would not have survived the stressful conditions in Kutch, the scientists zeroed in on Mannar where the conditions are largely similar to that of Kutch. They then picked out some sites in Mannar with the help of satellites and a ground report.

"We thought of not disturbing any coral colony by breaking twigs. Instead, we relied on the twigs that had already been broken and were lying on the ocean floor. They are usually called opportunistic species and have better chances of survival," Satyanarayana said. As corals are classed as Scheduled -I animals under the Wildlife Protection Act, they enjoy the highest protection under the law. With Mannar home to a marine national park as well, the team had to exercise extreme caution while sourcing the corals. The specimens, as small as 7 cm, were collected from outside the park with the help of forest department officials in Tamil Nadu.

As the project moved to the transplantation phase, the scientists had to take utmost care. The water's salinity, pH level, temperature and oxygen level had to be perfect. Instead of normal ice, the researchers used 'gel ice' which is normally used to preserve flowers for export. Extreme care had to be taken so that the corals do not suffer any shock on the flight.

"Packed in thermocol boxes, the corals were transferred to the Madurai airport by road. They (the scientists) took a flight to Rajkot via Mumbai from where they had to reach the research site at Kutch by road. Around 950 samples were transported from Mannar to Kutch in four lots," Satyanarayana said.

By the time the specimens reached Kutch, it was almost midnight. The scientists had just 24 hours in hand as that is the ideal length of time by which the corals need to be transplanted. Hence, the operation had to be carried out at midnight. It took 20 hours for the team to complete the project.

"Even though there are several ways in which corals could be transplanted, the ZSI scientists selected a method used successfully in Florida. Called Coral Tree Nursery, the method involves a tree with corals hanging from the branches," Satyanarayana said.

Earlier, efforts by a few other organisations to restore the Kutch coral reef with corals brought from Lakhsadweep had failed. Experts had even tried to transplant the corals by tying them to the sea floor. But the sediment killed them. This time too, the scientists had to contend with two potential stumbling blocks — sediment and some fast growing algae which were competing for space with the corals. The Tree Nursery was chosen to avoid deposition of silt and algae. There are several other threats to the project including zooanthids – a group of colonizing animals — boring sponges and some species of invasive animals.

"Over the years, sedimentation has, to an extent, ceased to be a problem. While on one hand, the tree nursery doesn't allow the sediment to stand on the corals and suffocate them, scientists are constantly monitoring and cleaning the transplanted corals to save them. We are also taking the help of a senior researcher from IIT Chennai to tackle the sedimentation problem," Satyanarayana said. The scientists have been able to restore about 1000 square metre (one square kilometer) of corals. Restoration work is currently in progress in three areas of Kutch – Pirotang, Narara and Mithapur.

"The corals are growing fast and such species as fishes, snakes, star fishes, sea urchins, crabs among others that inhabit the waters and make these reefs their home, have started returning. We are now planning to restore more such areas," Chandra said.

INDIA'S TOP CORAL REEFS

Gulf of Kutch – **352 sq km** (Worst affected)
Gulf of Mannar – **69 sq km**
Andaman and Nicobar Islands – **1021 sq km** (Richest reef)
Lakshadweep Islands – **933 sq km**

OTHER PATCHES OF REEFS

Malvan (Maharashtra)
Palk Bay (Tamil Nadu)
Ratnagiri (Maharashtra)
Rede Port (Maharashtra)

WONDER UNDER WATER

Total area of Coral Reef in India: **5790 sq km**
India ranks **10th** among **100** countries
All three major reef types – Atoll, Fringing and Barrier – occur in India
Around **479 species** of corals recorded in India
Andaman Reefs – Most **diverse** and **richest** reefs in India

HOW TRANSPLANTATION WAS DONE

Site selection in Gulf of Kutch with satellites and ground survey
Helped by Geological Survey of India and renowned coral specialists Carden Wallace
Collecting coral **'twigs'** that had broken off
Packing them in packets filled with **sea water** and **oxygen**
Reach Madurai by road, Madurai to Rajkot by flight, Rajkot to Kutch by road

Time in hand – just **24 hours**
Planted in nurseries at midnight when there was low tide
Coral Tree Nursery – Technique used to plant the corals (used in Florida earlier)
Regular monitoring and cleaning

THE PROJECT

Joint initiative of ZSI and Marine National Park authorities of Kutch
Funded by World Bank – Rs **2.5 crore**
Period: **2012 – 2015 December**
Achievement – One square kilometer of dead coral reef restored
Project extended till **2017**

WORLD

Richest reefs – Indonesia, Malaysia, Philippines, Papua New Guinea and southern Japan
Coral reef area – **2,84,300 sq km** (half the size of Madagascar)
World's largest coral reef – **Great Barrier Reef in Australia**
Coral Reefs – Planet's oldest and largest structures created by living organisms

WHAT IS A CORAL REEF?

Corals are tiny animals about few **millimeters** in size. They secrete calcium carbonate skeleton around them for their protection. They along with other calcium secreting plants and animals form mountain like structures under water called **coral reefs**.

ARE THEY IMPORTANT TO US?

Coral reefs are considered as the rain forests of the sea because of the diversity of animals they harbor. Coral reefs provide us with fishes, support tourism and they are a huge resource for pharmaceutical industry besides being an indicator of climate change and acting as a first line of defence against **cyclones and tsunamis**.

WHAT ARE THE THREATS?

Sedimentation is a big threat as the silt clogs the pores. Other threats include human activities such as fishing and industrial wastes, **over exploitation** and **global warming**, certain invasive species of animals and plants among others.

WHAT IS CORAL BLEACHING?

Warmer water temperatures can result in coral bleaching. When water is too warm, corals will expel the algae (zooxanthellae) living in their tissues causing the coral to turn completely white. This is called **coral bleaching**.