

# Coral builders

**While Asia's reefs face increasing destruction from human activity, experimental regeneration methods are helping to give damaged areas a better chance of survival**

Story by **Alex Frew McMillan**

AS ANYONE WHO HAS DIVED EXTENSIVELY in Asia will tell you, big fish are few and far between, and the situation only seems to be getting worse. It's no different anywhere else on the planet.

The world's coral reefs may account for 25% of total fish life, but they are under siege. We have lost 19% of our coral reefs in recent years, and almost half of the remaining reefs could die in the next 20 to 40 years, according to a report released in 2008 by the Global Coral Reef Monitoring Network.

The loss of coral reefs has huge implications not just on marine ecosystems but on humans, too. More than 450 million people live within 60 kilometres of coral reefs, and the majority of them derive income from the reefs, whether directly or

indirectly, according to the U.S.-based monitoring organisation Reef Check. Properly managed reefs can yield an average of 15 tonnes of seafood per square kilometre per year.

So there is plenty riding on efforts to preserve reefs and protect them from harm. Increasingly, those efforts are being supplemented by local schemes to regenerate reefs that have been destroyed by destructive methods such as blast fishing and cyanide fishing. Globally, the reef-restoration efforts currently under way are small-scale. Reef Check says that the cost effectiveness of efforts to 'farm' corals and then transport them to damaged areas is "debatable" when large areas require restoration.

The costs are also high, with the replacement of 10% of the coral cover in a particular location costing around US\$58,000 per hectare, plus ship time, based on a four-person team of divers placing 500 coral fragments per day.

Though it is too early to say what their full impact will be since most programmes have only been running for a handful of years, recent evidence suggests they can help sustain at-risk reefs and even help repopulate barren sea beds.

There has been something of a seismic shift on the concept of reef regeneration. As recently as five years ago, scientists threw scorn on such attempts. Better to protect what we've already got than attempt to regrow what has been lost.

PHOTO: REEF CHECK MALAYSIA

They have a point, according to Julian Hyde, the general manager of Reef Check Malaysia, the local branch of the monitoring organisation. There's a very limited impact that reef-regeneration programmes can achieve in replicating ecosystems that have developed over millions of years.

"I think natural systems are too complicated for a simple man-made fix," Hyde says. "You can't rebuild a tropical rainforest. It's too complex. You have to leave it alone for 1,000 years and it will become a rainforest again."

## SECOND THOUGHTS

All the same, Hyde has decided to give the approach a chance and Reef Check is currently working with several reef regeneration schemes in Malaysia.

There are two main methods of fostering coral. One concept is to use reef balls, which are concrete domes with a flat bottom that can be shaped to resemble a piece of reef. The reef balls are pitted with holes that can act as hiding places for small fish and that can be stocked with coral buds. Often, PVC tubing is run through the structure to let fish get in and out.

PHOTOS: BIRI INITIATIVE

Reef balls are most suitable for areas that have been heavily bombed and have very little coral left at all, meaning the substrate of the ocean is very unstable. They can help stabilise the environment so whatever is left can make a stand. A variation is being put to work in the Philippines.

Reef Check has focused its attention on another method to encourage existing reefs to expand. It has been supporting schemes to take broken but live corals from reefs to form nubbins that are attached to plastic frames. The frame then forms a nursery to encourage their growth. When the nubbins reach a decent size, the frames are deployed to an area adjacent to an existing reef.

"If you put coral onto a solid surface and leave it, it will grow," Hyde says. "It doesn't need complicated expensive technical solutions. All it needs is for us to leave it alone."

## TRIALS AND TRAVAILS

There has been a lot of trial and error since there's little scientific research on how to regrow coral. An initial attempt to grow coral nubbins near Pangkor Island in Perak failed because the frames kept washing away, leading to a redesign.

A second attempt to deploy coral frames in Tioman Island began in June 2011 and was much more successful, installing 61 frames on the Tekek house reef in front of East Divers Tioman and 79 on the ABC house reef in front of B&J Dive Centre. The frames were raised off the seabed, allowing currents to pass under them, and seeing some of the nubbins survive the rough waters and heavy rains of the monsoon.

But siltation proved a problem, and only 24% of the nubbins survived for a year or more at one site. Another challenge came from an unexpected source: damselfish.

Several of the 321 species in Asian waters depend on algae for their primary source of food. These territorial fish are habitat engineers, farming algae 'yards' on coral and protecting them voraciously from other herbivores. The algae cause corals nubbins to die, and the damselfish also attack divers doing cleaning and maintenance on the frames. So they had to be moved well away from the damsel's territory.

Still, the project was extended in 2012 to two new locations in Tioman, with 40 frames in front of EcoDivers and 60 in front of Nazri Resort. There is also an additional spot chosen on Pulau Perhentian, with 60 frames installed in front of Bubbles Resort and Dive Centre.

The Nazri site was a particular challenge because it is deeper, close to the fresh water of a rivermouth and further from surviving reefs. Construction then started on a nearby resort, and the site was abandoned. Only 28% of the nubbins survived for a year or more.

The other sites fared better, and the survival rate improved with each iteration of the programme. The EcoDivers site got another 40 frames in March 2013, and the early evidence show it is faring the best – 94% of the corals survived the initial months after the installation.

What's more, after a year of monitoring, the nurseries installed back in 2011 in front of East Divers and B&J Dive Centre were in good enough shape to be transplanted to their final rehabilitation sites on degraded reefs in early 2013. The sites are now being monitored over the next two years to see how they fare.

Reef Check admits there have been plenty of lessons to learn. Avoid areas prone to sediment, strong currents – and damselfish! Broken

## MANUFACTURED REEFS

Reefbuds are made from a mixture of concrete and organic material, while plastic frames also provide a foundation for coral regrowth (facing page).





#### A HELPING HAND

Above and facing page: Sinking reefbuds to the sea floor is a delicate process, but once in place these encourage fish life. Left: Nubbins of broken, live coral can be collected and grown in nurseries.

'opportunity' corals from the reefs surrounding the nursery are the best to use, with any dead parts of the broken fragments removed.

The nurseries need twice-weekly maintenance for at least the first two months, and at least a weekly going over after that, to remove silt, bivalves and algae, among other hindrances.

But reef rehabilitation appears to work. "When we started, the attitude among scientists was that you shouldn't waste your time on this – all you're going to do is produce a very shallow copy of a reef," Hyde says. "People's management thinking has moved on. There's been so much reef damaged that we're into repairing it as much as we can."

There hasn't really been much of a technological innovation, just better use of the existing resources. Plastic frames are "dirt cheap and easy to move around," Hyde says, and are

therefore ideal for restoring troubled areas of otherwise functioning reefs. "It gives the reef a bit of a kick start for regeneration."

#### IMPROVING THE REEF BALL

In the Philippines, there are six sites where something called a reefbud has been deployed. They say their version is better than a basic reef ball because it uses beach sand and pebbles besides concrete, and because 25 percent of the material is organic. That helps with the calcification process as the reefbud reacts with seawater. It also makes them more porous.

The reefbuds were first put in place in Rosario, on Luzon, with 1,165 installed between 2007 and 2012 thanks to backing from sponsors spearheaded by oil company Petron. Based on their success, Boracay launched its own scheme in 2012, putting in 5,000 reefbuds off the famous White Beach. They have succeeded in encouraging fish life – unfortunately so much so that the areas are once again attracting illegal fishing.

Reefbuds have now been installed at Sabang Beach in Puerto Galera, as well as in Anilao in

southern Luzon, in Camiguin off the north coast of Mindanao in the south of the country, with plans to put them in Biri Island near Samar in the eastern Philippines.

Richard Ewen, a native of Aberdeen, Scotland who has lived in the Philippines for 15 years, is championing the Biri Initiative from his property, the Biri Resort & Dive Center. He and the operator of Puerto Galera's Big Apple Resort, Jonathan Thorp, first installed large 450-kilogram reefbuds in Puerto Galera in October 2013.

Now, having developed a more portable 150-kilogram version, they hope to expand their reach. One of the key problems with the big reefbuds is that they are extremely heavy and hard to deploy. The smaller version can be carried in an outrigger canoe, and costs US\$300 compared to US\$800 for the large version.

Ewen hopes that, while it is likely too early to raise much outside money at this point, sponsorship might start backing the project in around two years. "We have got to watch the growth on the reefs before anybody gets excited about things," he says.

Ewen has gone so far as to put his resort up for sale, asking 25 million pesos (US\$560,000), and he hopes to devote himself to the Biri Initiative. "I want to use the money for it to fund that project," he says, adding that he has his eye on a nearby piece of land that he could convert into a centre for the reefbud nonprofit. He is also looking to combat the Crown of Thorns starfish, seed giant clams, and install holy crosses and statues of Jesus that have been blessed by a priest in local waters to deter blast fishermen.

He notes that the politics of getting approval to install reefbuds are always complicated. Anilao was intended to be the first site for their installation, but the project switched to Rosario because of foot dragging by the local government. But he hopes the Filipino Department of Environment and Natural Resources will get behind the initiative, and notes that The Explorers Club based in New York City is considering sponsorship.

"They came across us, fortunately, which is a stroke of luck," Ewen says. "One thing leads to another, and word of mouth gets around so things should move forward."

Reefbuds and the like are more problematic and expensive to install but can potentially help bring back to life areas that have been wiped out. Still, different levels of destruction often require different approaches.

"In East Malaysia, I have seen some areas where there's been so much damage from fish bombing or storms that there's nothing left," Hyde says. "There's no solid substrate. I just look at these areas and wonder if they are ever going to regenerate, absent someone doing something to tie the substrate back together again."

Reef Check believes there is no way reef protection can work in a systematic way without government support. Although the private sector has an incentive to protect reefs to generate tourism, other considerations all too often trump any altruistic motives.

"Whenever there's a decision that pits conservation against making money, conservation is always going to lose," Hyde says. Reef degradation "is terribly important and needs more attention. I just don't know how to get people to pay attention." **AA**



PHOTOS: BIRI INITIATIVE X2, REEF CHECK MALAYSIA