Introduction

North Bali Reef Conservation is an NGO working with volunteers and local communities towards the aim of restoring and conserving its coral reef ecosystems. Over the past year, North Bali Reef Conservation has taken great steps towards this aim, including:

- Building and deploying over 3000 artificial reef units
- Highlighting the success of the artificial reefs from a monitoring program
- Starting a community plastic recycling centre
- Running ongoing environmental awareness educational school programs
- Building a turtle conservation area and safely releasing over 400 hatchlings
- Receiving government funding used for program development
Artificial Reef Structures

Over the past year around 3000 artificial reef units have been built and deployed. There are now over 4000 structures deployed across a 200x50m area of previously destroyed reef which borders two healthy coral reefs. Following a visit from Sustainable Oceans International and Dive2U, North Bali Reef Conservation have since been exploring a variety of different artificial reef designs.

- Over the past year, the most common structures built include:
  - Roti buaya; long units with a textured surface and four legs
  - Tripods shaped structure with a hole in the centre for stacking
  - Triangle units with a open middle section, allowing them to fit together
  - Fish domes, with several large holes and an open top.

The structures all have a rough surface, which allows coral larvae to easily attach itself and grow onto the units. Many also have built in caves or tunnels, allowing extra protection for fish and other marine life. The structures are arranged under water by scuba diving volunteers, who stack them on top of each other in random ‘clusters’ across the deployment site. The designs and underwater configuration all focus on increasing protective space, allowing for greater habitat enhancement.

Reef Monitoring

Between July - September, North Bali Reef Conservation ran a 3 month reef monitoring program. This research aimed to provide evidence to support the success of the artificial reefs in terms of enhancing marine biodiversity and abundance. The study used Remote Underwater Video (RUV) in 3 different sites; 1) flat sand bottom (no coral or artificial reef), 2) artificial reef, and 3) coral reef.

Results

Showed that the artificial reef has increased the number of species by 5-6x compared to the flat sand area. They also prove that the artificial reef is statistically similar to the coral reef in terms of biodiversity (see graph).

As well as many coral species, the following are commonly identified living in and around the artificial reef: damselfish, butterflyfish, triggerfish, surgeonfish, nudibranch, mantis shrimp, moray eel and octopus.
Community Plastic Recycling Centre

Since North Bali Conservation founded in 2017, weekly beach cleans were organised. There is no government waste collection scheme in Tianyar and consequently no way to dispose of all the plastic from the beach cleans.

In February 2019, Nowtik, a group of Canadian students kindly donated North Bali Reef Conservation funds which allowed the start up of a community plastic recycling centre. This centre uses a ‘shredding’ machine to shred up the plastic into small pieces. These pieces are put into an ‘injection’ machine, which melts and injects the plastic into moulds, creating useful building materials like bricks and tiles. Each week day, volunteers, local staff and school children help with recycling workshop tasks, such as washing the plastic and operating the machines. The recycling machines can currently use PET (bottles), PP (cups, straws etc) and HDPE (bottle lids, shampoo and oil bottles etc).

Alongside this, a community plastic collection system has been developed. Various collection points around the community area encourage local people to recycle their waste. Without this program, most of the plastic within the community would either be burned or dumped, eventually ending up in the sea. This program is currently operating on a small scale, but is a positive start to the reducing marine pollution in Tianyar. North Bali Reef Conservation has recently set up a fund-raising project to raise income to develop the recycling centre. So far, over $2000 USD has been raised. This money will be used to buy a new injection machine, a faster shredder machine, a plastic cleaning station and new moulds. North Bali Reef Conservation would like to thank everybody who kindly donated money and can guarantee that these funds will greatly improve the recycling facilities.
Educational Programs

Over the past year, volunteers at North Bali Reef Conservation have been running weekly classes at several local schools to over 300 children. The aim of this program is to increase local children's awareness of environmental issues like plastic pollution, as well as other general classes about marine ecology and conservation. These classes are generally taught in a fun and interactive environment, as part of the ongoing English teaching program run by NGO, VolunteerInBali.

Swimming Class

In addition to this, volunteers also organise daily swimming classes with children aged from six to fourteen years old. Despite living by the sea, the majority of children in Tianyar village never learn to swim. Teaching children to swim is a great opportunity to encourage them towards a mindset of wanting to protect the marine environment. Now, many of these children are confident swimmers and participate in snorkelling and ocean plastic clean up activities.

Alongside these classes, weekly beach and community plastic clean-ups are organised with local children. This reinforces the message taught in the classroom, aiming to encourage this next generation to be more conscious of their environment. Plastic from the clean ups is taken to the recycling centre, where local children voluntarily help each day with plastic recycling activities.
The fine sand and generally small waves on Tianyar’s 3km beach makes it a great location for turtles to lay their eggs. Between the months of April -August, Olive Ridley turtles migrate to Tianyar beach to nest. Unfortunately, these nests are not always safe and face risks caused by boats, dogs and even local people collecting and eating the eggs. Consequently, North Bali Reef Conservation has started a turtle conservation program, whereby local people collect eggs from nests that may be at risk. These eggs are placed in the sand in the North Bali Reef Conservation turtle sanctuary, where they are monitored for the 50 days before they hatch. Once hatched, volunteers oversee the hatchlings and ensure they are safely released to the sea.

North Bali Reef Conservation released 400 turtle hatchlings in the 2018 nesting season and expects to release many more hatchlings in 2019, due to increased education and awareness. During the nesting season, regular educational sessions are run with local children, teaching them about the importance of conserving turtle populations and why the turtle species in Tianyar are protected.
Funding

Over the past year, North Bali Reef Conservation has been successful in receiving various forms of funding. In December 2018, Pertamina diving club sponsored 12 personalised large fish dome units. These structures were built and deployed by local fishermen. The group these fisherman belong to is called ‘Yowana Bhakti Segara’ (translating to ‘Youth Who Protect Their Ocean’). They work daily with North Bali Reef Conservation, helping to build and deploy artificial reef structures.

Throughout several points during the year, North Bali Reef Conservation and its fishermen group have received Government funding too. This support has come from the Indonesian Department of Sustainable Fisheries (Balai Sumber Daya Pesisir dan Kelautan Denpasar) and also local funding from the head of the village (Pemerintah Desa Tianyar). Part of these grants were used to employ more members of the local fisherman group, allowing more artificial reef structures to be built and deployed. The rest was used to purchase 3 sets of dive equipment, used in activities like artificial reef arrangement and coral transplantation.

Acknowledgements

None of North Bali Reef Conservation’s achievements over the past year would have been possible without both local and international support. We would like to thank all partners, collaborators, local community groups, international volunteers and anybody else who has supported our program.

We are proud to work with the local fisherman group Yowana Bhakti Segara. These fishermen have proved their commitment to a more sustainable future by their endless hard work. Yowana Bhakti Segara work each day building and deploying artificial reef units and we can thank them for the 3000 structures they have helped build over the past year.

The inspirational work of our volunteers has been detrimental to the success of North Bali Reef Conservation over the past year. Some of the recent achievements driven by volunteers include officially starting a plastic recycling centre, releasing 400 turtle hatchlings, successfully teaching many local children to swim and the improvements made to our educational programs.

As North Bali Reef Conservation expands as an organisation, various goals have been set towards achieving our aim of restoring and conserving local coral reef ecosystems. Notable aims include:

- Developing a new artificial reef deployment area in west Tianyar on a nearby reef.
- Increasing plastic recycling production by fundraising to purchase new machines.
- Continuing environmental education and beach cleans with local schools.
- Increasing recruitment of eggs at the turtle sanctuary and release more hatchlings.
- Developing reef monitoring programs by partnering with research organisations.