

International Rainbow Warrior Divers Association (IRWADA)

Nursery of artificial reefs in Tulamben, northeast Bali

Prologue :

Indonesia has 581 of the world's 793 known reef building coral species, i.e. 73,3% (Veron,2000). At least 66 of the 82 reef building coral genera in Indonesia (80,5%).

Some of Bali's coral reefs have been severely damaged in recent years due to use of bombs and cyanide by fishermen, excessively high water temperatures linked to global warming, and other stresses.

A flood in November 2002 linked to a powerful rainy season, destroyed almost 20% of the corals in Tulamben, one of the richest reefs on the island.

Problems stem from the lack of respect from some dive operators. Their anchor moorings, petrol and oil substances from liveboards including their tenders damage the reef. Irresponsible behavior from under-water photographers also cause damage to the reef.

Following the example of the people of Permuteran (northwest Bali), Tulamben village residents have taken action to prevent use of these destructive methods on their reefs, whether by locals or by outsiders. However, the amount of damage is so great that action is urgently needed to restore reef habitat for tourism and fisheries.

Background :

Because of mounting local concerns about reef deterioration, Yos W.K. Amerta, President of Gahawisri Bali (The Bali Branch of the Indonesian Association of Watersports), invited Tom Goreau (President of Global Coral Reef Alliance), www.globalcoral.org from New York and Dr. Wolf Hilbertz to start restoration projects in Bali, following a workshop in coral reef restoration sponsored by Action Asia Magazine at the Asian Dive Exposition in Bangkok in May 2000. The Workshop was funded by a grant from the Leslie Jones Foundation to the Global Coral Reef Alliance's coral reef restoration program, and donations in kind from Yos Dive Shop and Hotel Pondok Sari.

Result:

Twenty-two Bio-rock coral nursery structures have recently been installed in the Permuteran Village Marine Protected Area in Northwest Bali.

With a total length of 222 meters and situated in an area of 2 hectares, this is the largest Bio-rock coral reef nursery and restoration project ever attempted. It exceeds the sizes of all other ongoing projects in the Pacific, Caribbean and Indian Ocean combined. This project, although still in the early stages, already has the majority of local coral species in cultivation. The corals' enhanced growth rate, their reproduction and their resistance to environmental stress provides a critical reservoir of healthy corals. It is a veritable Noah's Ark to resist future hot periods caused by global warming. This project can restore damaged reefs and vital fishing areas if destructive human practices can be halted.

The Tulamben Project

The new coral nursery structures have been constructed from welded steel bars of from 1 to 1.5 centimeters in diameter. Such structures can be built in a variety of shapes.

The first structure has been constructed on the beach in Tulamben. A flat grid shape was chosen, to fix and stabilize loose stones and rocks in the coral garden. I has dubbed it “The Garden of the Rolling Stones”. The grid shape was chosen to prevent the weight of the coral from over-burdening the structure which could result in a collapse.

After stabilizing the loose and weak underground, different kind of structures such as hubs, tunnels and domes will be connected to the strong frame of steel bars.



The first sequence of this “Bio-Reef” was constructed on the beach in Tulamben. The structure is 10 meters long, 4 meters wide and is flexible, like a carpet. This will guarantee a stable position on the ground to avoid movements linked to currents and heavy wave action.

The Coral Transplantation

Following coral selection for transplantation consisted entirely of naturally broken fragments that were found lying around the reef slopes.

The purpose of choosing these damaged fragments is to rescue corals that would have almost surely died as the result of physical injury and even to avoid damaging healthy corals whenever possible.



The Technology - Simple, easy and cheap !

Coral nurseries built using the Electrolytic Mineral Accretion Technology (Biorock) of Hilbertz and Goreau provide unique advantages for restoring coral reefs. Corals grown on mineral accretion are exceptionally bright colored and rapidly growing, support dense fish populations, and are more resistant to all environmental stresses except bombs and poisons. All structures are charged by power supplies located on the adjacent land. The cathodic structures and anodes are connected to the power supplies by cables which up to about 4,5 kilowatts of power. Many structures receive power through several cables and all are wired to each other so that power is shared throughout, allowing them to continue operating even if their direct power cables are severed. The power supplies are wired in parallel through common buses, so that if one fails the others will take up to load. As a result of this redundant design, the system is highly robust to failure of any particular cable or power supply.

Coral nurseries receiving adequate power quickly turned white as mineral accretion grew on them and began to cement themselves to the reef bedrock.

Almost all live coral fragments were quickly cemented in place by mineral accretion, and proceeded to grow rapidly over it. New coral skeleton growth was clearly visible in just a few days. Because these corals have only recently been transplanted and the power applied, it is too soon to compare detailed differences in growth rates between species, but even in the first few weeks some trends became apparent. The Acroporas and Montiporas seem to be most responsive, quickly overgrowing the mineral accretion, often completely growing around it and rapidly forming dense arrays of new branches. Some Scropora colonies formed hundreds of new branches that grew about a centimeter in less than a month and many corals show clear changes in growth orientation and unusually dense and compact branching after transplantation. These corals are also distinguished by very bright colours but on some structures on which connections failed due to faulty cables, these colours and growth form changes were not apparent until after the cables were replaced and power restored.



The power supply from the Tulamben Project delivers a optimal constant power from 9 Volts and 16 Ampere. This is a very low current and have no danger to any marine life or humans. (on the picture Tom Coreau).

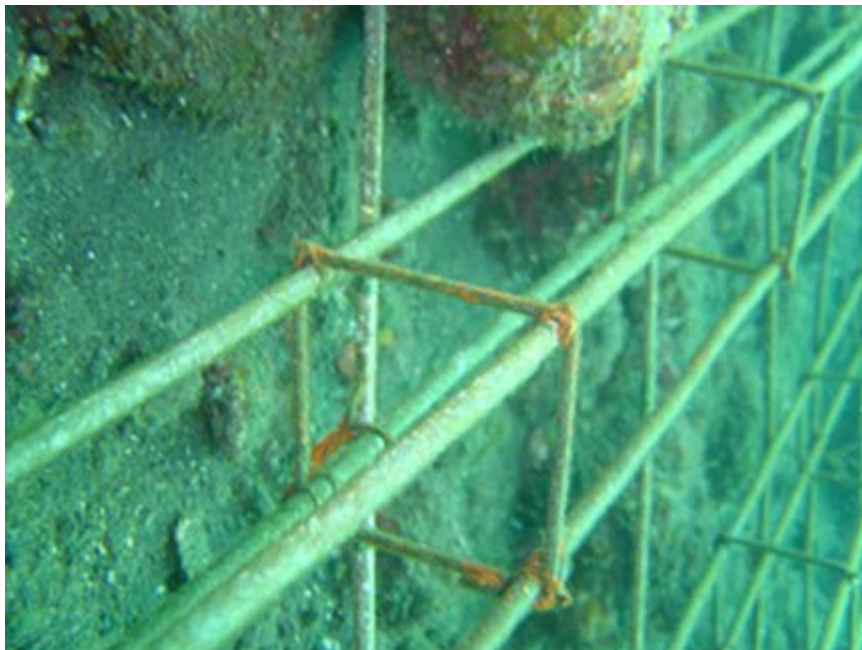
The Team :



picture above from left to right: Komang Astika, Juergen Angele, Herbert Goller, Tom Coreau, Made Baloon, Milan Jeglik
picture below from left to right: Monika Jeglik, Tony Medcraft, Tom Coreau, Komang Astika, Juergen Angele, Herbert Goller

Condition of the structure on :

13. February 2004 :



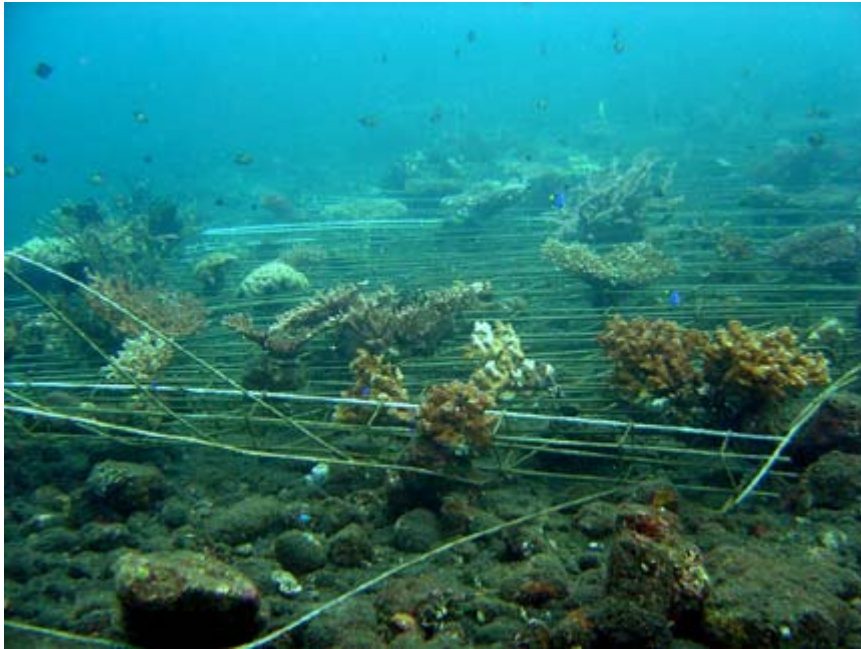
just 4 weeks later :

14. March 2004



Achievement to date :

Finger thick limestone growth all over the structure and it has already attracted several different species of fishes.



The next step :

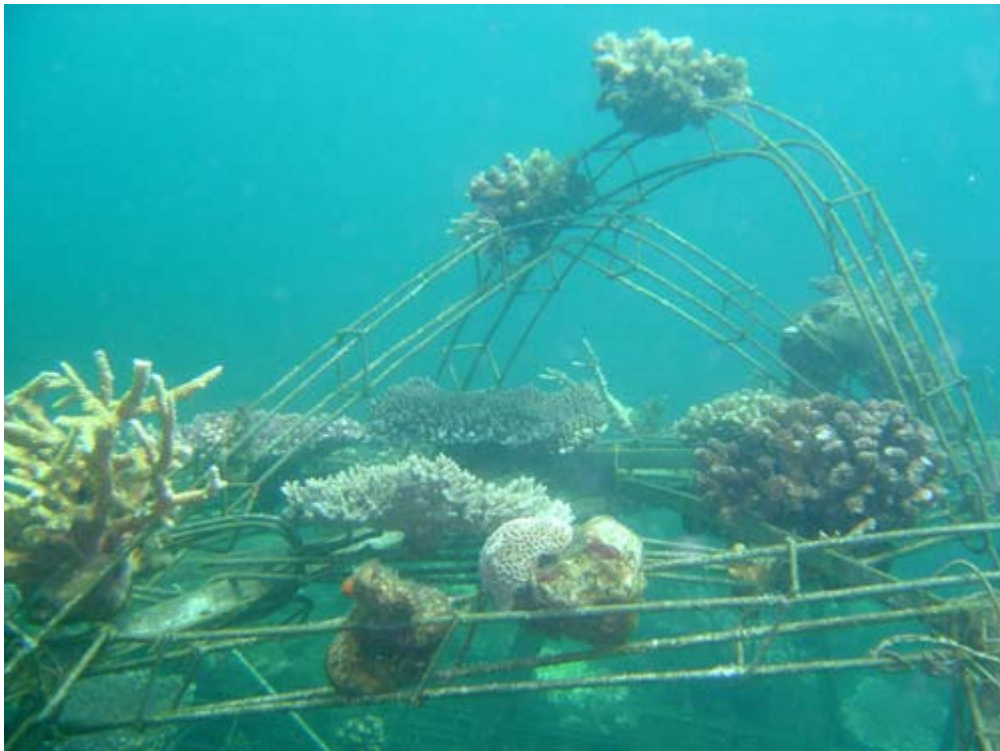
Members of IRWADA and the Tulamben Project expanded the Bioriff with a new structure.



From left to right: Dieter Walter, Monika Jeglik, Juergen Angele, Milan Jeglik, Ralf Möller, Rudi Nöthe, Swantje Geinitz

A kind of rondel with a small hub on the top being fixed to the first structure.







The Aim :

For the next couple of month there are several different projects planned in the Tulamben area and the reefs around. The success of this structure in stimulating rapid coral growth within months, hopefully leads to requests to greatly expand the project.

The Dive operators around Tulamben donated further funds to support the construction of new projects beginning in March 2004.

Our aim is to cover the coral garden areas in the Tulamben bay completely with mesh to stabilize and fix the “rolling stones“ to avoid further coral damage.

A further plan includes the idea of stopping the corrosion process on the USS Liberty Ship Wreck. This project will need bigger support from the many people who use this very rich and valued dive site, which is considered by many to be one of the best shore dives in the world.

Thanks to all of those who financially supported “ The Tulamben Project “ :

Joe`s Diving Bali, Paradies Dive Center, Deep Blue Studio, Tulamben Wreck Divers, Mimpri Resort, Emerald Resort, Bali Coral , Blue Water, TT, Puri Madha, Scuba Seraja, Herbert Goller, Ralf Möller, Rudi Nöthe, Swantje Geinitz, Uschi Kölzer, Dieter Walter

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Tom Coreau (President of Global Coral Reef Alliance), www.globalcoral.org

Yos Amerta (President of Gahawisri)

Cody Shwaiko (GCRA)

If you have any questions or need more information please don`t hesitate to contact me on :

Mail : Joe@Joesdivingbali.com

Mobile : (0062)-(0)8174737953

Live and let dive

Jürgen Stefan Angele

President IRWADA (International Rainbow Warrior Divers Association)