Marine Conservation Program Koh Tao

"Project Report Orientation Internship"

B. Brongers
P. Schalk

University of Applied Sciences
VAN HALL LARENSTEIN
PART OF WAGENINGEN UR

Marine Conservation Program Koh Tao

Internship at The Save Koh Tao Group

Authors B. Brongers (920117001)
P. Schalk (851109002)

Internship 7 February 2011 till 31 May 2011

Companions P.S.Bron
C.Scott
D.Gunsel Zahir

Integrated Coastal Zone Management

University of applied sciences Van Hall Larenstein

July 2011, Leeuwarden

Contact bibi.brongers@wur.nl
peter.schalk@wur.nl

University of Applied Sciences
VAN HALL LARENSTEIN
PART OF WAGENINGEN UR

Preface

For the bachelor Integrated Coastal Zone Management we had the opportunity to do an internship abroad for about two school periods. For this internship we went to Koh Tao, an island in the Gulf Of Thailand, Thailand. At this place we have been working with the Save Koh Tao Group, a small non-profit and non-government organization what is doing marine research and restoration around Koh Tao. We have been involved with several projects to do research, education and restoration.
We would like to thank Chad Scott and Devrim Gunsel Zahir for sharing their knowledge and supervising us during the time in Thailand. Adnan Yanbay and all the other people from New Heaven Dive School for learning us dive. The nice people we met at Koh Tao for the great time and sharing their time and knowledge. And Patrick Bron for supervising us during writing the Project report orientation internship. After reading this report we hope that you get more understanding about the conservation of the coral reefs ecosystem around Koh Tao, Thailand and that you get interested to get involved.

B. Brongers
P. Schalk

Leeuwarden, September 2011

University of Applied Sciences
VAN HALL LARENSTEIN
PART OF WAGENINGEN UR

Index

University of Applied Sciences
VAN HALL LARENSTEIN
PART OF WAGENINGEN UR

1. Introduction

Koh Tao, a beautiful island placed at the east coast of Thailand in the Gulf of Thailand (Figure 1). This small island is well known as a divers paradise. With more than forty dive schools and thousands of tourists visiting the island every year, ~~provides~~ there are signs of a lot of stress on the surrounding reefs. The problems ~~where~~ that The local community group Save Koh Tao Group is fighting against are abundant. From damage and waste on reefs caused by divers, nitrification trough runoff, irresponsible fishing by local people to global warming and ocean acidification. The Save Koh Tao Group tries to fight the negative impact on the reefs with research, restoration and education.

In this report a description of the projects we have been involved in during the internship. First a description of the organization and the coral anatomy, after that the projects and their methods:

- Ecological monitoring program to provide a detailed record of the health, abundance and biodiversity of the coral reefs.
- Coral nursery to give the corals the change to recover and start growing again, by placing coral fragments on a location where the circumstances are better than on the seafloor.
- Biorock to accelerate and improve the health and growth of the coral, by an artificial reef what works on electrical power.

Figure 1 - Location Koh Tao

2. Organization

New Heaven Dive School is very important for the marine conservation of the reefs around Koh Tao. The dive school is doing a great job for the Save Koh Tao Group, which is the main organization on Koh Tao for marine and land conservation. This chapter will give a description of the dive school and the Save Koh Tao Group.

New Heaven Dive School

New Heaven Dive School (Figure 2) opened in 1995 and is owned by Devrim Gunsel Zahir. The dive school is located at Chalok Bay, Koh Tao. The dive school sails out, with the dive boats 'King Kong I' (Figure 3) for marine conservation and 'King Kong II' for fun dives, one time per day to make two dives. To protect the reefs, the dive school reduces the group size. This makes New Heaven a very personal dive school. The main priority of New Heaven Dive School is not to maximize profits but to protect the marine ecosystem and environment, the area which the dive school uses to do their work. The dive school is member of the Save Koh Tao Group, Greenfins, Koh-Taoism and SSI ECOLogical. New Heaven is very active in marine conservation and social projects, like mooring buoy installation, coral restoration, Ecological Monitoring Program and Biorock. Therefore, The New Heaven Reef Conservation Program is the leading center for student training and project assistance in marine research and restoration techniques on the island. (New Heaven Dive School, 2008)

Figure 2 - New Heaven Dive School

Figure 3 - King Kong I

Save Koh Tao Group

The Save Koh Tao Group (Figure 4) is a community group that runs by a coalition between local business owners and residents, both Thai and foreigners, who feel responsible to keep the island and the reefs clean and healthy. This makes sustainable and eco-friendly development of the islands economy possible. The organization exists out of two parts, the land conservation and the marine conservation. The land conservation takes care of all environmental issues that take place on land. This includes projects to fight erosion, improve waste management, beach and land clean-ups, etc. The marine conservation part takes care of research and preservation of the marine environment around Koh Tao. This part of conservation runs by project manager Chad Scott. Projects examples are the Biorock,

Figure 4 - Logo Save Koh Tao Group

Environmental Monitoring Program, Artificial reef construction, Sea turtle and giant clam releases. (New Heaven Dive School, 2008) Once a month a meeting takes place for those interested to talk about the plans for the month and about the problems and the positive developments. The Save Koh Tao Group gets its funding from local business owners; this includes dive schools and resorts, private donations and fund raising events. Students and volunteers that come to work on the island with the Save Koh Tao Group provide income as well. There is no principal where the community is working for, all projects are initiated, funded and performed by the Save Koh Tao Group.

3. Coral Anatomy

The main factor of this internship was all about and in relation to coral reefs. The coral is the base of every coral reef and the life it supports. Before the working methods and projects of the Save Koh Tao Group will be explained, an introduction of the lifecycle of corals will be given.

Lifecycle of corals

The life of a coral starts with a mass spawning when the adult corals release all their eggs and sperm at a certain time. With the *Acrapora* corals is it a special arranged event, with full moon they spawn all at the same time their eggs and sperm, other species of corals follow a different kind of rhythm.
It is a big ocean and releasing their sperm and eggs all at the same time they have the best change of a successful reproduction. When the egg hedge, the newborn coral can swim for a while through currents and tides covering quite some area looking for a suitable place to settle down. In this stage they are ~~fundable~~ susceptible to~~fo~~r predation. One of the projects of the Save Koh Tao group during our internship was to place settlement disks on corals and structures to trap juvenile coral and find out how far these juvenile corals can travel before settling down. This research is still going on.
Another way how corals can reproduce is cloning them on the same way as human cells work; they separate the membrane into two different coral polyps, this way a new polyp arise. (Coral Science, 2009; Scott, C. 2011)
After the swimming polyps settles down at a suitable place, it remains there for the rest of their life. It starts to build a hard calcium skeleton and catch with its tentacles some *zooxanthellea algae* (Figure 5). This is a kind of algae what lives in the water, it can transform sunlight into energy with photosynthesis.
A coral receives energy at two different ways, when coral catch the algae and locked it down in their tissue, it receives energy from the algae and in return the coral protect the algae against predators.
Corals have an ancient way of eating, with their tentacles moving through the current. They catch small plankton and other floating matter. There inner system is not sufficient build, coral need to catch a prey, digest, and excreed it all trough there mouth. This way the flow of energy is not constant and the coral need the algae for extra energy. A continues flow of energy is possible by other animals where the intake and outlet are separated. (Coral Science, 2009)

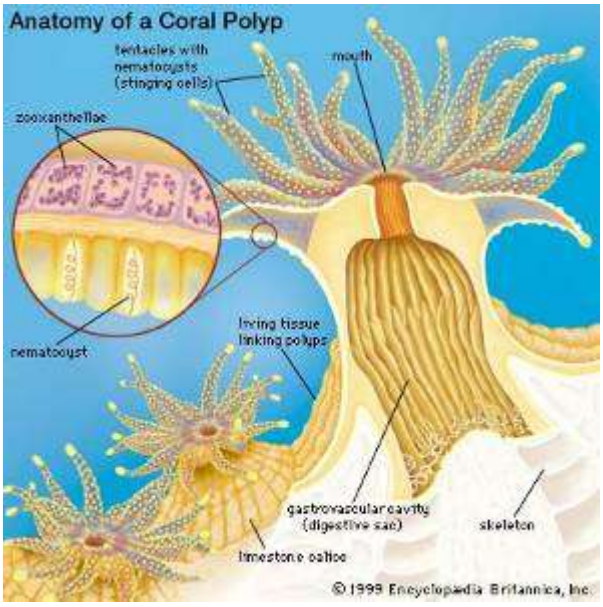

Figure 5 - Anatomy of a Coral Polyp

4. Ecological Monitoring Program

The Ecological Monitoring Program, EMP, is designed to provide a detailed record of the health, abundance and biodiversity of the coral reefs surrounding Koh Tao. The local marine monitoring program is designed specifically for Koh Tao and is based on the standards and techniques of the CPAD Foundation, Reef Watch International and Reef Check. (Scott, C. 2011) This chapter will describe the EMP survey methods and the three different surveys. First a description of the foundations above.

CPAD Foundation, Reef Watch International and Reef Check Foundation.
The CPAD Foundation, Coastal Preservation and Development Foundation, was a non-profit American-Thai company for marine conservation projects. These projects include reef and water quality monitoring and digital mapping of the island, etc. The Foundation forced to stop the work by some financial difficulties, but New Heaven Dive School took over the responsibility to continue the projects CPAD had started. (New Heaven Dive School, 2008)
Reef Watch is a Non Government Organization, to protect the diversity of life on earth. The organization focuses on marine and coastal conservation and environment, doing research in monitoring and documenting changes in coral reef ecosystems. Reef Watch is active in education as well. (Reef Watch Marine Conservation, 2004)
The Reef Check Foundation is an international non-profit organization for the conservation of tropical coral reefs and California rocky reefs. Their goals are to educate about the reef ecosystems, to create a network of volunteer teams trained in Reef Check's scientific methods, to facilitate collaborative use of reef health information and they stimulate locals to protect and rehabilitate reefs worldwide. (Reef Check, 2007)

4.1 EMP Survey Methods

The Ecological Monitoring Program works with the Belt Transect Method. This method provides data which shows the change over time very accurately, besides the data does not need to be averaged to eliminate differences in surveyor opinion. This because of all data is not taken over a set area but along a fixed line. (Scott, C. 2011)

Indicator Species
The Ecological Monitoring Program is divided in three parts; Fish Survey, Invertebrates Survey and Substrate Survey. For the Fish Survey and the Invertebrates Survey the research divers monitor some specific species, so they don't note everything you see. Only the predetermined indicator species are important for the survey, these species are indicators of reef health, biomass abundance and biodiversity. This contents the condition of the reef, the percentage of living organism and the variety and number of different species.
The indicator species are chosen as an indicator because for traits as:

- Feeding Behavior
- Symbiosis
- Abundance/Rarity
- Tropic level
- Susceptibility to human (anthropogenic) threats
- Popularity in Fishing/collection
- Popularity amongst divers.

(Scott, C. 2011)

Location

At Koh Tao there are eight bays (Figure 6) were the EMP are being performed. Each bay has a shallow and a deep location to do the survey. To start the survey, a 100 meter transect line is layed out on the sea floor from known points by coordinates. When the divers have found the starting point, directly follow the diver navigating to the ending point (Figure 7). (Scott, C. 2011)

Figure 6 - Koh Tao

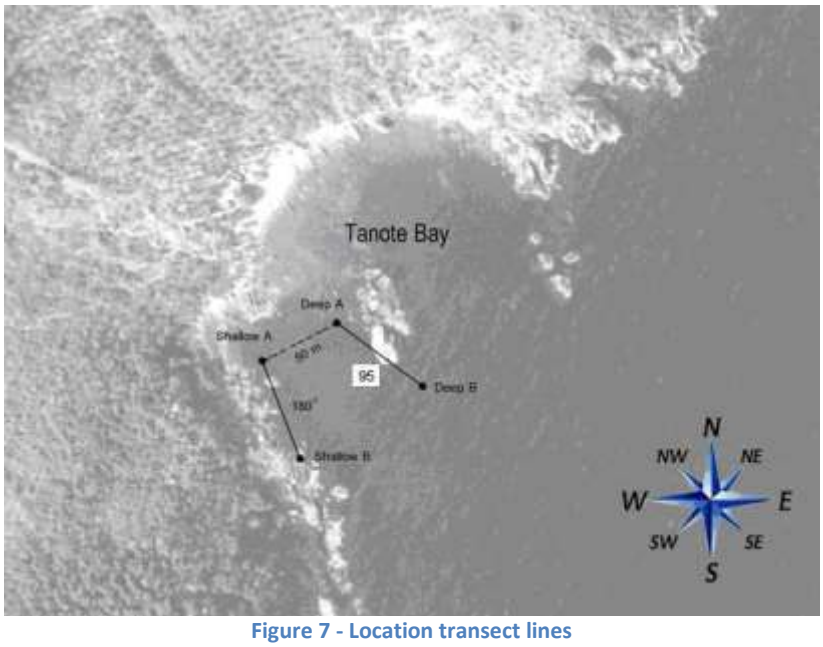

Figure 7 - Location transect lines

The Transect Line

The research divers will create a 100 meter transect line (Figure 8) with the two 50 meter lines. When the divers starts the survey they records data in 20 meter segments, after a 20 meter segment there is a 5 meter section where no data will record. All data is taken in reference to this line, so no organism will be record out of the data collection area.

For the invertebrate survey the divers will zigzag back and forth across the transect line 2.5 meter on either side of the line. The diver records the indicator species in a 20m x 5m rectangular area, that makes the data collection area 4 x 100 square meters. The size of the data collection is for the fish survey is like the invertebrate survey. But for the fish survey the divers swim against the line, just looking 2.5 meters on both side and 5 meters from the bottom. The way of survey is different for the substrate survey, the divers are taking data points every 50 cm directly below the transect line. (Scott, C. 2011)

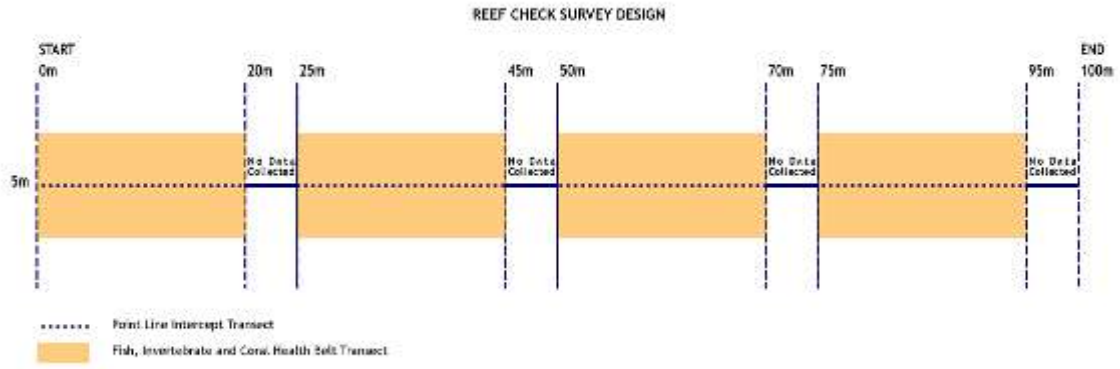

Figure 8 - Transect line

Data Entry

Swimming against the 100 meter survey line the divers notes their findings on a slate which can be written on under water. At the end of the day all data should be entered into the computer ~~at the computer~~**.** (Scott, C. 2011)

4.2 EMP Fish

For the fish survey, the research divers report all vertebrate indicator species. These species will be free swimming, resting on the substrate and under corals. This chapter will give a description of the indicator species of fish.

Butterfly Fish
All Butterfly Fish have a round laterally compressed body shape and a small mouth, where they eat algae and coral polyps with. Because of their food, Butterfly Fish only lives in healthy reef areas. So if there are lots of them, it means it is a healthy coral reef. On Koh Tao the Butterfly Fish are mostly threatened by fishing activities, in many other areas they are prized fish for aquarium trade because of their beautiful bright colors. (Scott, C. 2011)


Figure 9 - Weibels Butterfly Fish

Weibels Butterfly Fish
The Weibels Butterfly Fish (Figure 9) are yellow/orange and the head and back body are black and white. Because they are symmetric, they can entangle their predator. Weibels will mostly be in pairs. (Scott, C. 2011)


Figure 10 - 8-banded Butterfly Fish

8-banded Butterfly Fish
The 8-banded Butterfly Fish (Figure 10) is a small fish, recognizable by their eight bands on a yellow skin.


Figure 11 - Lined Butterfly Fish

Lined Butterfly Fish
The Lined Butterfly Fish (Figure 11) has a white body with vertical black lines. They have a black stripe on their head and the tail is yellow and black.

Figure 12 - Copper Banded Butterfly Fish

Copper Banded Butterfly Fish

The Copper Banded Butterfly Fish (Figure 12) has a white body with wide copper and orange bands. They have a black dot on the back of their body, which looks like an eye to entangle their predator.

Figure 13 - Longfin Banner Fish

Longfin Banner Fish

The Longfin Banner Fish (Figure 13) are recognizable by their white long dorsal fin. They have two black wide bands on their body with a yellow tail.

Figure 14 - Blue spotted stingray

Blue spotted stingray

The blue spotted stingray (Figure 14) is recognizable by his flat body with a long tail (70cm) and the blue spots at the upper body. This ray is top predator of benthic invertebrates, this means he eats sand-dwelling invertebrates which he feeds mostly at night. It forages on the sandy or muddy sea floor, in and outside the coral reefs. (Reef Fish of Thailand, 2004)

Figure 15 - Moray Eel

Moray Eel

The moray eel (Figure 15) feed mostly on small invertebrates and fish, it contains two sets of jaws to facilitate swallowing. On sunny days the eel will be hidden in holes or crevices of rocks and corals reefs, primarily at night he comes out of his place. (Scott, C. 2011) With his head watching out of his shelter, the eel is recognizable by his brown skin and his body shape like a snake.

Figure 16 - Trigger Fish

Trigger Fish

The Trigger Fish (Figure 16) is a top predator of invertebrate species, including COT and is sensitive to changes in the food abundance. It is a big fish with a laterally compressed body and strong teeth. When the Trigger Fish becomes aggressive his first dorsal fin rises and looks like a trigger. The Trigger Fish is a very territorial fish, which protect their nests on the sandy bottom and can be very aggressive towards divers. That is why their nesting areas should be avoided when conducting the EMP. (Scott, C. 2011)

Figure 17 - Red Breasted Wrasse

Red Breasted Wrasse

The Red Breasted Wrasse (Figure 17) feeds on small invertebrates and indicator of reef biodiversity (Scott, C. 2011). They are recognizable on their red breast and the rest of their body is black and white, vaguely striped.

Figure 18 - Grouper

Grouper

Groupers (Figure 18) are top predators and they feed on small fish. They are mainly demersal, so they live near the bottom. They are very sensitive to fishing and habitat destruction. For the EMP the research divers indentify the groupers by size; large groupers are greater than 30cm and small groupers are less than 30cm. Because of the high number of species of the grouper, their appearance can be very different as well. But the main thing to recognize them is their large mouth. (Scott, C. 2011)

Figure 19 - Parrotfish

Parrotfish

Parrotfish (Figure 19) feed on algae and on coral. Sometimes large schools of parrotfish and rabbit fish can be seen feeding on algae in rubble areas. By their feeding behavior the parrotfish influence the reef, by eating algae they preventing the algae from overtaking the coral and by eating coral they create sand, so they are cleaning the coral reefs. Like the Groupers, the parrotfish are indentify by size; large parrotfish are greater than 20cm and small parrotfish are less than 20cm. (Scott, C. 2011). They are recognizable by their bright colors, like green, pink, blue, orange, into each other.

Figure 20 - Rabbit Fish

Rabbit Fish

Rabbit Fish (Figure 20) feeds on algae and assist in coral development. They preventing the algae from overtaking the coral, like the parrotfish does. Rabbit Fish are a prey for larger predators such as sharks. The Rabbit Fish are recognizable on their typical mouth like a rabbit. (Scott, C. 2011)

Figure 21 - Snapper

Snapper

Snappers (Figure 21) feeds on small invertebrates and fish. Their biggest predator are human, because they are a favorite of the fishing industry. (Scott, C. 2011) Snappers are recognizable by the horizontal mostly yellow stripes.

Figure 22 - Surgeon Fish

Surgeon Fish

The Surgeon Fish (Figure 22) have a small row of teeth which they use to graze on algae. They are recognizable by sharp orange, red or yellow spines near their tail. (Scott, C. 2011)

Figure 23 - Sweetlips

Sweetlips

During the day Sweetlips (Figure 23) are mostly inactive, then they can be found in holes or in ledges in the reef. During the EMP should it be noted if a juvenile or an adult was observed. These two look almost nothing alike. (Scott, C. 2011) The juvenile is recognizable by his brown/black skin with big white dots and it looks like the juvenile is dancing around. The adult Sweetlips is recognizable by the small brown dots on their body.

4.3 EMP Invertebrates

Invertebrates are marine animals without a backbone. These species tend to be benthic and they make up the bottom levels of the food chain. To survey the invertebrates the research divers have to look on the bottom and under rocks and coral. This chapter will give a description of the indicator species of the invertebrates.

Clams

Clams influence the reef by filtering the water by inhaling en exhaling water. Clams contain zooxanthellae, these are symbiotic algae that live within the clams. The zooxanthellae give the clams the color, not only do they provide color to the clam but they also provide the clams with sufficient amount of food and energy. (Algone, 2011) Apart from the energy from the zooxanthellae, the clams get there food from small particles that they filter out of the water. Clams with their shells, giant clams, exposed contribute to the reef structure in unlike clams that are imbedded in the reef, boring clams. (Scott, C. 2011)

Figure 24 - Giant Clam

Giant Clam

Giant Clams (Figure 24) have a laterally compressed body compressed body by two shells. They have no head and no radula. The mantle and the shell of the Giant Clams are exposed. (Scott, C. 2011)

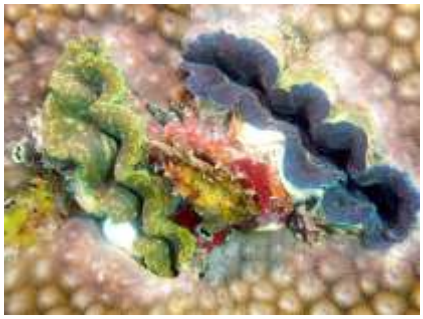

Figure 25 - Boring Clam

Boring Clam

Like Giant Clams, Boring Clams (Figure 25) have a laterally compressed body, no head and no radula. Boring clams have no exposed shell but is imbedded in the reef, only their mantle in exposed. (Scott, C. 2011)

Figure 26 - Crown of Thorns

Crown of Thorns

The Crown of Thorns (Figure 26) is a carnivore and feeds on coral tissue by inverting their stomach. They influence the reef negatively when there is an abundance of the Crown of Thorns, because the tissue of the corals is eaten and when the corals have no tissue, they die. The Crown of Thorns has external gills and pinchers. They have a white, spiked body with up to 19 arms and use their tube feet to locomotion. (Scott, C. 2011)

Figure 27 - Long-Spined Black Sea Urchin

Long-Spined Black Sea Urchin

Long-Spined Black Sea Urchins (Figure 27) are herbivores, who feed on macro algae. Like this they influence the reef by cleaning and preventing the algae from overtaking the coral. As well, they are very important to the top-down control of the tropic structure. Long-Spined Black Sea Urchins are recognizable by their black body with a lot of long black spines. Like the Crown of Thorns, Long-Spined Black Sea Urchins uses their tube feet to locomotion. They have a sophisticated mouth called Aristotle's lantern, the mouth is at the underside of the body like a five-sided set of jaws and teeth (Crown. 2011). (Scott, C. 2011)

Sea Cucumber

Sea Cucumbers influence the reef by cleaning. By their food, micro and macro algae, they preventing the algae from overtaking the coral and they filter toxins like phosphate and nitrate out of the water. No Sea Cucumbers means grey water. (Scott, C. 2011)

Figure 28 - Marmbled Sea Cucumber

Marmbled Sea Cucumber

The Marmbled Sea Cucumber (Figure 28) has a white spotted, elongated body with an oral and aboral end. The front tube feet are adapted for feeding. Tube feet are hollow, muscular projections that are used in locomotion (HowStuffWorks, Inc. 1998-2011). The Marmbled Sea Cucumber feeds on algae from rock and coral surfaces. (Scott, C. 2011)

Figure 29 - Black Sea Cucumber

Black Sea Cucumber

The Black Sea Cucumber (Figure 29) is recognizable by his black elongated body. In their mostly fluid body, they have a microscopic internal skeleton. Unlike the Marmbled Sea Cucumber, the Black Sea Cucumber dependence less on their tube feet. This because the Black Sea Cucumber feeds on organic matter from the sand. (Scott, C. 2011)

Figure 30 - Orange Spiked Sea Cucumber

Orange Spiked Sea Cucumber

The Orange Spiked Sea Cucumber (Figure 30) is recognizable by a black elongated body with spikes, these spikes may or may not have orange on the tops. Like the Black Sea Cucumber, the Orange Spiked Sea Cucumber feeds on organic matter from the sand. (Scott, C. 2011)

Gastropods

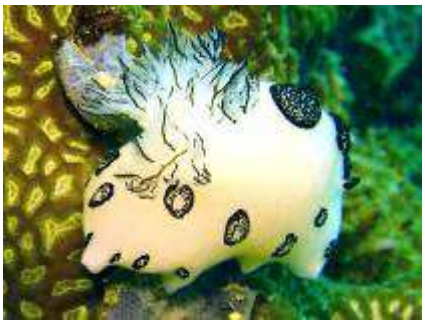

Figure 31 - Nudibranch

Nudibranch

Nudibranches (Figure 31) have an important role in marine food chains as a predator and as a prey, like fish, turtles and sea stars. Nudibranches their self are carnivorous and feed on sponges, coral, eggs, algae, etc. (New World Encyclopedia. 2008) There are thousands of nudibranch species, so there is not one recognizable body shape or color. Nudibranches are hermaphiditic, so they have male and female genitals and do not need congener to propagate. A nudibranch is a snail without a shell and you can see a projection on their backs which are their lungs. Because they have no shell, they have to use chemical defenses against predators. (Scott, C. 2011)

Figure 32 - Flatworm

Flatworm

Like the Nudibranch, Flatworms (Figure 32) are hermaphroditic and carnivorous. The Flatworm is one of the first classes who have a central nervous system, a primitive digestive system, organs and internal tissues. Flatworms are recognizable by their floating flat and bilateral symmetry body shape. (Scott, C. 2011)

Figure 33 - Drupella Snail

Drupella Snail

The Drupella (Figure 33) is a carnivorias snail that feeds on coral tissue. They feed on many coral types, but they like the branching coral the most. An abundance of Drupella Snails influence the reef negatively, like the Crown of Thorns, because the tissue of the corals is eaten and when the corals have no tissue, they will die. Originally the shell of the Drupella Snail is black and white, but mostly the shell is covered in algae and so the Drupella Snail is recognizable by a purple shell. (Scott, C. 2011)

4.4 EMP Substrate

Substrate contents the bottom composition of an area. The divers record the bottom composition of the point using the codes provided. The EMP code has three parts: the substrate type, the substrate species and the coral health by shortcuts. This chapter will describe where the diver is looking for with the substrate survey.

1. **Substrate type**

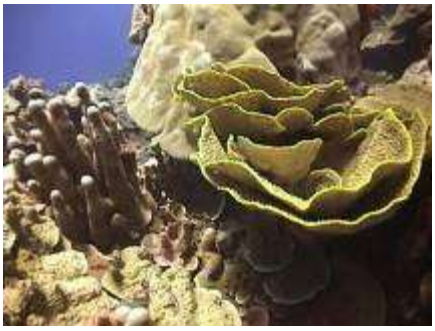

Figure 34 - Hard Coral

HC –Hard Coral

Hard Corals (Figure 34) are the corals that contain hard skeleton made of calcium carbonate. (Scott, C. 2010)

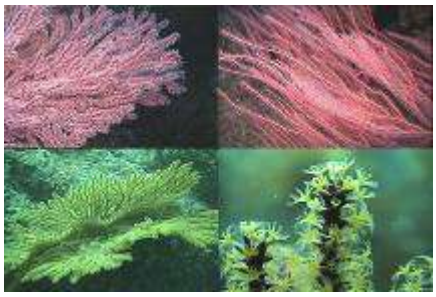

Figure 35 - Soft Coral

SC – Soft Coral

Soft corals (Figure 35) are usually flexible, because these corals have a hydrostatic or protein skeleton. (Scott, C. 2010)

Figure 36 - Sponge

SP – Sponge

Sponges (Figure 36) have thousands of pores which let water flow through it continually and sponges have no tissues. Sponges have different shapes, like tubes, cups and cones. (EnchantedLearning.com, 2010)

Figure 37 - Nutrient indicator algae

NIA – Nutrient indicator algae

Nutrient indicator algae (Figure 37) are the algae prevented by high nutrients and low herbivores. The algae are an important indicator of human action, like pollution. (ReefCheckNews, 2010)

Figure 38 - Silt

SI – Silt

Silt (Figure 38) are small particles with a grain of 0,002 - 0,0063 mm. (Nature information, 2011)

Figure 39 - Sand

SD – Sand

Sand (Figure 39) are small particles with a grain of 0,063 – 2 mm. (Nature information, 2011)

Figure 40 - Rubble

RB – Rubble

Rubble (Figure 40) are pieces of dead coral. (Scott, C. 2011)

Figure 41 - Rock

RC – Rock

Rock (Figure 41) is a very tight and heavy substrate.

OT – Other

Other includes any substrate which you cannot identify or are unsure of. (Scott, C. 2011)

Growth form corals

Figure 42 - Branching coral

B – Branching

Branching corals (Figure 42) have branches like a tree. (Scott, C. 2010)

Figure 43 - Corymbose coral

C – Corymbose

Corymbose corals (Figure 43) have crazy growing or dense branches. (Scott, C. 2010)

Figure 44 - Digitate coral

D – Digitate

Digitate corals (Figure 44) look like fingers. (Scott, C. 2010)

Figure 45 - Massive coral

M – Massive

Massive corals (Figure 45) are round boulders. (Scott, C. 2010)

Figure 46 - Submassive coral

S – Submassive

Submassive corals (Figure 46) have pillars or columns. (Scott, C. 2010)

Figure 47 - Foliose coral

F – Foliose

Foliose corals (Figure 47) are platy corals, like foliage. (Scott, C. 2010)

Figure 48 - Liminar coral

L – Laiminar

Laiminar corals (Figure 48) have thin sheets. (Scott, C. 2010)

Figure 49 - Tabulate coral

T – Tabulate

Tabulate corals (Figure 49) are growing like a table. (Scott, C. 2010)

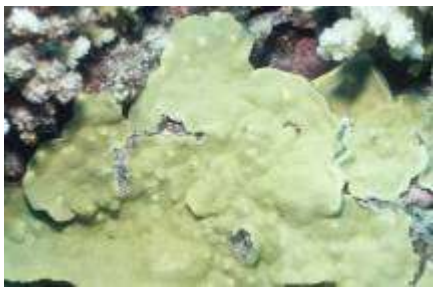

Figure 50 - Encrusting

E – Encrusting

Encrusting (Figure 50) is moss what is growing over existing substrate. (Scott, C. 2010)

Figure 51 - Solitary coral

R – Solitary

Solitary corals (Figure 51) called mushroom corals as well. Free living coral with one big polyp. (Scott, C. 2010)

U – Unknown

Unknown includes any corals which you cannot identify or are unsure of. (Scott, C. 2010)

2. Coral Health

Figure 52 - Healthy coral

H – Healthy coral

Healthy corals (Figure 52) have dark, consistent colors. (Scott, C. 2010)

Figure 53 - Partially bleached coral

PBL – Partially bleached coral

Partially bleached corals (Figure 53) have pale or white patches. (Scott, C. 2010)

Figure 54 - Fully bleached coral

FBL – Fully bleached coral

Fully bleached corals (Figure 54) are still alive, but very unhealthy. They have no color anymore and look white. (Scott, C. 2010)

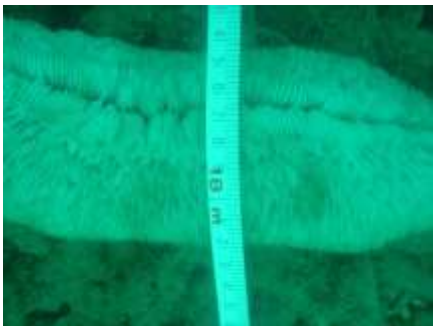

Figure 55 - Recently killed coral

RKC – Recently killed coral

Recently killed corals (Figure 55) have no tissue anymore, but the skeleton is still clean and is white or yellow colored. (Scott, C. 2010)

Figure 56 - Dead coral

DC – Dead coral

Dead coral (Figure 56) have a grey-black skeleton and the growth form is still intact. (Scott, C. 2010)

5. Coral Nursery

One of the projects of The Save Koh Tao Group is coral nurseries. The main idea for a nursery is placing coral fragments on a location where the circumstances are better than on the seafloor, away from predatory animals and rubbing sand. On a nursery the corals get the change to recover and start growing again. While the algae inside the corals are sensitive for light density changes, that means that the algae performs optimum at the depth were it lives. When the algae moves to another water depth with other light density the algae cannot adapt and will die or cannot perform photosynthesis. Therefore there are several types of coral nurseries to be able to rehabilitate all types of coral from various depths. (Scott, C. 2011) This chapter describes the working methods and the different types of coral nurseries.

5.1 Working Methods

Tools:

- Dive gear
- Dive bag for moving fragments and tools
- Nursery, Table/Rope/Bottle or fish
- Rope
- Pincer or hammer for splitting a fragment
- Plastic tubes
- Slate
- Ruler
- Coral health chart

Placing coral fragments on the nurseries

Placing coral fragments on the different types of nurseries works pretty much all at the same way. The coral fragments should contain a bit of living tissue and should not be too large, maximum at 15 cm across. The fragments should be placed in a small plastic tube and then on the nursery, placed in the chicken wire or in a bottle. The fish nursery works the same way as adding coral fragments on the Bio-rock, with a bit of steel wire the fragments is should be wrapped around the steel construction wire. Placing coral fragments on a rope nursery is a bit different, here should the rope be twisted open, the coral fragment should then be placed in the opening, after that the rope should be twisted close.

Research at Nurseries

The research divers have to collect growth data from the tagged corals on nurseries. Using a ruler and coral health chart they measure the coral growth, color, height and diameter. By repeating this overtime, a database of the growth of this specific coral will be created. (Scott, C. 2010)

5.2 Different types of coral nurseries

Figure 57 - Table Nursery

Table Nursery

Table nurseries (Figure 57) just look like a steel table with plastic chicken wire on the top. In the holes of the wire is place for a plastic tube with coral fragments, in a table nursery like this the coral fragment are lifted 1,5 m from the seafloor. Still close to the same light level but away from the sand and predatory animals, here the coral fragments get time to recover and start growing again. When the fragment is large and strong enough, the fragment can be replaced to natural reefs. Normal table nurseries are horizontally built, but some of the table nurseries are built with an angle, this is to research what the best way is to rehabilitate coral fragments, on a flat area or on an area what is built on an angle. (Scott, C. 2011)

Figure 58 - Rope nursery / Midwater nursery

Rope nursery/Midwater nursery

The rope nursery or midwater nursery (Figure 58) is a new type of coral nursery. The rope what is used for this type of nursery is the rope you can twist open. Several strings what are twisted together as one rope. When twisted open there is an opening to put one coral fragment in, then twist close. With this type of nursery you can place in a short time a lot of coral fragments. Possibilities are placement on existing objects or midwater nursery. These are two midwater floating beams where you can hang a rope in between. With rope nurseries it is easy to relocate coral back on a structure or a natural reef. (Scott, C. 2011)

Figure 59 - Fish Nursery

Fish Nursery

The fish nursery (Figure 59) is type of nursery is specially designed to attract fish, the most common nursery is a pyramid shape structure what is made out of steel wire. The structure need to be filled up with dead coral fragments and other sea rubble. When the structure is completed there will be a lot of fish looking for shelter between the rubble and living coral in and around the fish nursery. (Scott, C. 2011)

Bottle nursery

The bottle nursery is a concrete ring where bottles are placed in. Coral fragments are placed in the bottle, an easy way of saving coral. And the bottle nursery straight away offers structure on the seafloor what attracts al type of other marine life. (Scott, C. 2011)

6. Biorock

One of the projects of the Save Koh Tao Group is the Biorock, an artificial reef what works on an electrical power to accelerate and improve the health and growth of the coral. This chapter will describe the working methods and how this artificial reef works.

6.1 Biorock Technology

Ocean acidification

As a result of our use of fossil fuels like oil and our high demand for energy we excreed tons of carbon oxide (C02) in the open air. The oceans and air are exchanging gasses what means that when we produce C02 and put it in the air it will mix and dissolve in ocean water. (Figure 60)

For every 100 tons of carbon dioxide what we put into the air, approx. 33 tons ends up in the oceans (Dutch institute of ecology, 2008). Now the oceans are basic, around PH 8. For sea life what use calcium carbonate (CACO3) in there shell and skeleton it is necessary that oceans are basic. In a basic environment the formation of carbon carbonate is a slow process what takes a lot of energy from the organism. But when oceans are getting more acidic the formation of carbon carbonate change in formation of Bi carbonates (HC03) (Figure 61). In this kind of climate it is impossible for marine live to form a skeleton or a shell. For corals it means that with a more acidic ocean they have to put more energy to build a skeleton and have less energy to reproduce, growth and fight diseases and temperature changes. (Scott, C. 2008)

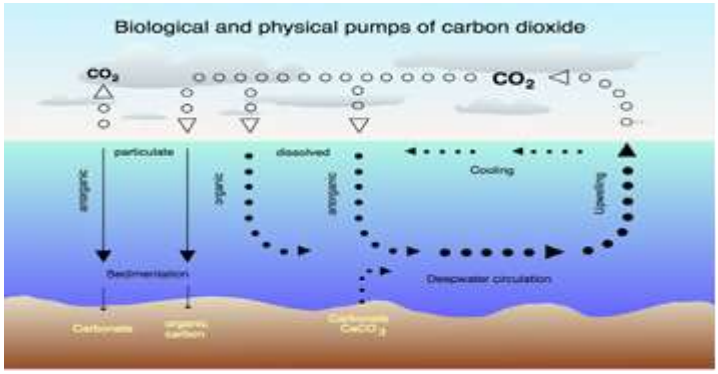

Figure 60 - Biological and physical pumps of carbon dioxide

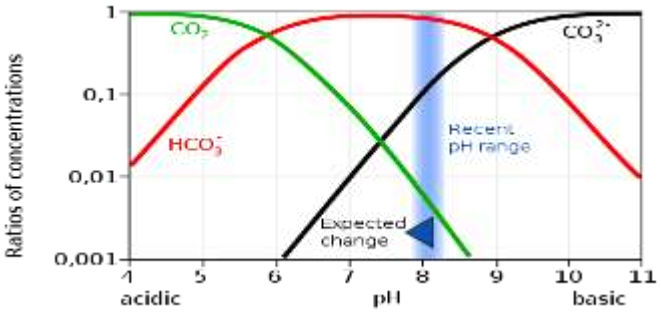

Figure 61 - PH range oceans

Figure 62 - Electric dome Biorock

Fighting acidification with Biorock

The Biorock is an artificial reef what is built out of steel wire, four big domes (electrified) (Figure 62) and one small dome (control dome non electric) has been sunk to the bottom floor. When electricity runs through this steel wire you get electrolysis. In this process water get electrified, hydrogen, oxygen and carbon carbonate are formed (Electrolysis, 2002). The carbon carbonate remains on the steel wire, to protect the steel wire from rust and when corals are attached to the steel structure, the coral can use the carbon carbonate for his skeleton. By reducing the amount of energy what is needed to form a skeleton for the coral, it can put now its energy in reproduction, fighting diseases and ocean warming. Data shown from the Save Koh Tao database indicate that 80% less bleaching accords on the Biorock than on surrounding corals in two major bleaching events. (Scott, C. 2008)

6.2 Biorock Working Methods

Tools:

- Dive gear
- Dive bag for coral fragments
- Steel wire
- Pincers
- Quadrant
- Slate
- Color chart
- Ruler

Placing corals onto the Biorock

Before the divers can start working on the Biorock, they need to find coral fragments. Coral fragments are corals broken from the reef and recognizable by their living tissue. The coral fragments should be no bigger than 15 cm. across for adding onto the Biorock. The found coral fragments could be placed onto the Biorock using steel wire and pincers.

Research at the Biorock

Figure 63 - Quadrant

The research divers are researching the growth coverage of the Biorock, using a quadrant (Figure 63). The quadrant is a framework from one square meter with ropes across, these ropes create boxes from 10 by 10 cm. The diver placed the quadrant on the Biorock and estimates the growth coverage percentage of each box. By repeating this overtime, a database of overall growth will be created.

The research divers have to collect growth data from the tagged corals on the Biorock. Using a ruler they measure the coral growth, height and diameter. By repeating this

overtime, a database of the growth of this specific coral will be created. Research shows a three ~~till~~ to five times faster growth of corals, sponges, clams, etc. (Scott, C. 2008).
The divers performing a coral health check from the tagged corals on the Biorock either. This health check is developed by reef check and is based on the principle of color (Figure 64). By keeping track of the color there are easy changes in the coral health recognizable. For example: when the color of a Massive coral compares with color B6 on the chart, the color code of the Massive coral is B6. When the research divers come back a few weeks later and compare the same Massive coral again and the color code has changed, than there is something going on with the coral. The lighter the coral, the less healthy the coral is.

Figure 64 - Coral health chart

Location
The Biorock is located in the Gulf of Thailand, on the North-West side of Koh Tao, lying in between the small resort island of Koh Nang Yuang and Koh Tao (Figure 65). Biorock is situated on a sandy area around 11 meters deep. The nearest natural reef is situated around 150 meters on the eastside of the dome. All the coral fragments attached to the Biorock are found nearby the Biorock in the sand or the nearby natural reef.

Figure 65 - Location Biorock

References

Algone, (2011). *Zooxanthellae and Corals*. Found: 13-07-2011
www.algone.com/aquarium-articles/saltwater-aquarium/zooxanthellae-and-corals

Coral science, (2009). *Lifecycle of corals*. Found: 31-08-2011
http://www.koraalwetenschap.nl/content/view/171/155/

Crown, (2011). *Sea Urchins.* Found: 21-07-2011
http://www.teara.govt.nz/en/starfish-sea-urchins-and-other-echinoderms/2

Dutch institute of ecology (2008). *Ocean acidification*. Found: 29-08-2011
www.nioo.knaw.nl/content/verzuring-zee-tast-schelpdieren-aan

Electrolysis of water (2002). *Electrolysis.* Found: 12-09-2011
http://www.thuisexperimenteren.nl/science/electrolyse/electrolyse.htm

EnchantedLearning.com, (2010). *Sponges.* Found: 25-07-2011
http://www.enchantedlearning.com/subjects/invertebrates/sponge/

HowStuffWorks, Inc, (2011). *Sea Cucumber*. Found: 20-07-2011
http://animals.howstuffworks.com/marine-life/sea-cucumber-info.htm

Natural historical museum ocean (2011). *About Drupella cornus.* Found: 29-08-2011
www.nhm.ac.uk/nature-online/species-of-the-day/biodiversity/climate-change/drupella-cornus/index.html

Nature information, (2011). *Sand and Silt.* Found: 25-07-2011
http://www.natuurinformatie.nl/ndb.mcp/natuurdatabase.nl/i000650.html

New Heaven Dive School, (2008). *CPAD Foundation.* Found: 14-07-2011
http://www.newheavendiveschool.com/en/marine-conservation/history

New Heaven Dive School, (2008). *New Heaven Dive School.* Found: 25-07-2011
http://www.newheavendiveschool.com/en/home/philosophy
http://www.newheavendiveschool.com/en/marine-conservation/history
http://www.newheavendiveschool.com/en/marine-conservation/current-projects

New Heaven Dive School, (2008). *The Save Koh Tao Group.* Found: 25-07-2011
http://www.newheavendiveschool.com/en/koh-tao/save-koh-tao
http://www.newheavendiveschool.com/en/marine-conservation/current-projects

New World Encyclopedia, (2008). *Nudibranch*. Found: 21-07-2011
http://www.newworldencyclopedia.org/entry/Nudibranch

Reef Check, (2007). *About Reef Check*. Found: 14-07-2011
http://reefcheck.org/about_RC_Reef/about_us.php

ReefCheckNews, (2010). *Nutrient Indicator Algae.* Found: 25-07-2011
http://www.reefcheck.org/news/news_detail.php?id=590

Reef watch Marine Conservation, (2004). *About Reef Watch*. Found: 21-07-2011 http://www.reefwatchindia.org/aboutus.html

Scott, C. (2010), PDF*, Adopt-A-Reef Coral Nursery Project, Methods and Research*. Save Koh Tao Group.

Scott, C. (2011), PDF, *Coral Anatomy and Ecosystems.* Save Koh Tao Group.

Scott, C. (2008), PDF, *Koh Tao Biorock 2008 project*. Save Koh Tao Group.

Scott, C. (2011), PDF, *Koh Tao Ecological Monitoring Program, Fish Survey.* Save Koh Tao Group.

Scott, C. (2011), PDF, *Koh Tao Ecological Monitoring Program, Invertebrate Survey.* Save Koh Tao Group.

Scott, C. (2011), PDF, *Koh Tao Ecological Monitoring Program, Substrate Survey.* Save Koh Tao Group.

Thamrongnawasawat, T., Saisaeng, A., et al., (2004),
'Reef Fish of Thailand, The essential guide to indentity and behavior'

Reverences figures

Title page
http://woodlawnvillas.com/thailand-travel-tips/save-koh-tao-festival-2011

Figure 1 - Location Koh Tao
http://hapworkingtheworld.com/2009/03/02/where-am-i-thailand-map/

Figure 2 - *New heaven dive school*
Brongers, B.

Figure 3 - *King Kong I*
Leuba, C. Save Koh Toa Group

Figure 4 - *Logo Save Koh Tao Group*
http://woodlawnvillas.com/thailand-travel-tips/save-koh-tao-festival-2011

Figure 5 - *Anatomy of a Coral Polyp*
http://www.britannica.com/EBchecked/media/19644/Cross-section-of-a-generalized-coral-polyp

Figure 6 - *Koh Tao*
Scott, C. (2011), PDF, *Koh Tao Ecological Monitoring Program, Invertebrate Survey.* Save Koh Tao Group.

Figure 7 - *Location transect lines*
Scott, C. (2011), PDF, *Koh Tao Ecological Monitoring Program, Invertebrate Survey.* Save Koh Tao Group.

Figure 8 - *Transect line*
http://members.reefcheckaustralia.org/research/index.cfm

Figure 9 - *Weibels Butterfly Fish.*
http://www.easydivers-thailand.com/treasure.html

Figure 10 - *8-banded Butterfly Fish.*
http://www.bottlemuseumshop.com/product.detail_727970_en_3585815

Figure 11 - *Lined Butterfly Fish.*
http://kohalacoastweb.blogspot.com/2007/10/tips-for-snorkeling-and-diving-in.html

Figure 12 - *Copper Banded Butterfly Fish*
http://www.mericakvaryum.com/site/baliklar.php?show=1&id=40

Figure 13 - *Longfin Banner Fish*
http://www.easydivers-thailand.com/treasure.html

Figure 14 - *Blue spotted stingray*
http://www.diverosa.com/categories/Sharks&rays.htm

Figure 15 - *Moray Eel*
Scott, C. Save Koh Tao Group

Figure 16 - *Triggerfish*
http://picasaweb.google.com/Rodney.Willett/CastawayIslandDivingFiji#

Figure 17 - *Red Breasted Wrasse*
http://www.pa-divingidc.com/2010/05/padi-specialty-of-month-may-2010-dup.html

Figure 18 - *Grouper*
http://photocompetition.upclive.com/seo/photo/269505/suger_grouper/red_see.html

Figure 19 - *Parrotfish*
http://www.scubadiverinfo.com/images/gallery_little_cayman/Image24.html

Figure 20 - *Rabbit Fish*
http://www.reefhotspot.com/store/popup_image.php?pID=739&osCsid=9fae657cef12c725a68b952191c20625

Figure 21 - *Snapper*
http://www.poppe-images.com/?t=23&diveid=985&p=2

Figure 22 - *Surgeon Fish*
Scott, C. Save Koh Tao Group

Figure 23 - *Sweetlips*
http://www.diverosa.com/Sipadan/MSI-11%20Harlequin%20sweetlips,%20Plectorhinchus%20chaetodonoides.html

Figure 24 - *Giant Clam*
http://www.airliebeach.sailing-whitsundays.com/Airlie-Beach-Marine-Life/Giant-Clams.php

Figure 25 - *Boring Clam*

Scott, C. Save Koh Tao Group

Figure 26 - *Crown of Thorns*
http://www.eoearth.org/article/Crown-of-thorn_sea_star?topic=49513

Figure 27 - *Long-Spined Black Sea Urchin*
http://wildshores.blogspot.com/2011/07/curry-puff-crab-on-terumbu-raya.html

Figure 28 - *Marmbled Sea Cucumber*
http://www.flickr.com/photos/7755656@N04/5350091990/

Figure 29 - *Black Sea Cucumber*
http://www.scuba-equipment-usa.com/marine/AUG06/Black_Sea_Cucumber%28Holothuria_atra%292.html

Figure 30 - *Orange Spiked Sea Cucumber*
Scott, C. Save Koh Tao Group

Figure 31 - *Nudibranch*
http://www.taatohdivers.com/divstmaps/lighthouse/JorunnaFunbrisNudiBranch.html

Figure 32 - *Flatworm*
http://www.underwater.org/mermaid/tanzania/underwater2.html

Figure 33 - *Drupella Snail*
http://www.ala.org.au/north-west-shelf-marine-environment/

Figure 34 - *Hard coral*
http://www.jetsettersmagazine.com/archive/jetezine/sports02/scuba02/pacific/kosrae/diving.html

Figure 35 - *Soft coral*
http://www.starthrower.org/products/DDDB/DDDB_000-049/DDDB_040%20soft%20corals.htm

Figure 36 - *Sponge*
http://www.flickr.com/photos/merang_uk/4997985522/

Figure 37 - *NIA*
Scott, C. Save Koh Tao Group

Figure 38 - *Silt*
Scott, C. Save Koh Tao Group

Figure 39 - *Sand*
http://gallery.hd.org/_c/natural-science/_more2004/_more02/sand-and-foam-from-wave-at-Praia-do-Faro-Algarve-Portugal-DHD.jpg.html

Figure 40 - *Rubble*
http://www.livefishonline.com.au/item.mibiznez?id=45

Figure 41 - *Rock*
Scott, C. Save Koh Tao Group

Figure 42 - *Branching Coral*
http://factoidz.com/corals-wonders-of-the-sea/

Figure 43 - *Corymbose Coral*
Scott, C. Save Koh Tao Group

Figure 44 - *Digitate Coral*
Scott, C. Save Koh Tao Group

Figure 45 - *Massive Coral*
http://www.fantasea.com.au/page/fantaseafoundation/coralreefinformation/index.html

Figure 46 - *Submassive Coral*
Scott, C. Save Koh Tao Group

Figure 47 - *Foliose Coral*
http://factoidz.com/corals-wonders-of-the-sea/

Figure 48 - *Laminar Coral*
Scott, C. Save Koh Tao Group

Figure 49 - *Tabulate Coral*
Scott, C. Save Koh Tao Group

Figure 50 - *Encrusting Coral*
http://directsealife.com/shop/index.php?cPath=81_1201

Figure 51 - *Solitary Coral*
http://www.messersmith.name/wordpress/tag/solitary-coral/page/2/

Figure 52 - *Healthy Coral*
Scott, C. Save Koh Tao Group

Figure 53 - *Partially Bleached Coral*
Scott, C. Save Koh Tao Group

Figure 54 - *Fully Bleached Coral*
http://www.coralcoe.org.au/news_stories/sundried/imagegallery.html

Figure 55 - *Recently Killed Coral*
Scott, C. Save Koh Tao Group

Figure 56 - *Dead Coral*
Scott, C. Save Koh Tao Group

Figure 57 - *Table nursery*
Leuba, C. Save Koh Toa Group

Figure 58 - *Rope nursery / midwater nursery*
Leuba, C. Save Koh Toa Group

Figure 59 - *Fish nursery*
Leuba, C. Save Koh Toa Group

Figure 60 - *Biological and physical pumps of carbon dioxide*
http://en.wikipedia.org/wiki/Ocean_acidification

Figure 61 - *PH range oceans*
http://en.wikipedia.org/wiki/Ocean_acidification

Figure 62 - *Electric dome Biorock*
Leuba, C. Save Koh Toa Group

Figure 63 - *Quadrant*
Leuba, C. Save Koh Toa Group

Figure 64 - *Coral health chart*
http://www.coralwatch.org/web/guest/coral-health-chart;jsessionid=7DB3F364741C9DC842409FA06BDE8470

Figure 65 - *Location Biorock*
Scott, C. (2008), PDF, *Koh Tao Biorock 2008 project*. Save Koh Tao Group.

Appendix I – Logbook

Day 1 / 07-02-'11 Monday
Open water diver course

Day 2 / 08-02-'11 Tuesday
Open water diver course

Day 3 / 09-02-'11 Wednesday
Open water diver course

Day 4 / 10-02-'11 Thursday
Advanced diver course

Day 5 / 11-02-'11 Friday
Advanced diver course

Day 6 / 13-02-'11 Sunday
EMP Drupella

Day 7 / 14-02-'11 Monday
EMP invertebrate

Day 8 / 15-02-'11 Tuesday
Bio Rock

Day 9 / 16-02-'11 Wednesday
Coral and fish nursery

Day 10 / 17-02-'11 Thursday
EMP fish

Day 11 / 18-02-'11 Friday
Coral nursery

Day 12 / 21-02-'11 Monday
EMP substrate

Day 13 / 22-02-'11 Tuesday
Deep dive wreck

Day 14 / 23-02-'11 Wednesday
Bio Rock

Day 15 / 24-02-'11 Thursday
EMP drupella
Denselfish

Day 16 / 25-02-'11 Friday
Settlement plates

Day 17 / 26-02-'11 Saturday
Beach and under water cleanup

Day 18 / 28-02-'11 Monday
EMP substrate

Day 19 / 01-02-'11 Tuesday
Bio Rock

Day 20 / 02-03-'11 Wednesday
Coral Nursery

Day 21 / 03-03-'11 Thursday
Coral Nursery

Day 22 / 04-03-'11 Friday
Coral Nursery

Day 23 / 07-03-'11 Monday
Coral settlement plates

Day 24 / 08-03-'11 Tuesday
Coral settlement plates

Day 25 / 09-03-'11 Wednesday
Coral settlement plates

Day 26 / 10-03-'11 Thursday
Bio Rock

Day 27 / 11-03-'11 Friday
Coral Nursery

Day 28 / 13-03-'11 Sunday
Koh Tao Festival built up

Day 29 / 14-03-'11 Monday
Koh Tao Festival built up

Day 30 / 15-03-'11 Tuesday
Koh Tao Festival built up

Day 31 / 16-03-'11 Wednesday
Koh Tao Festival built up

Day 32 / 17-03-'11 Thursday
Fundive

Day 33 / 18-03-'11 Friday
Koh Tao Festival built up

Day 34 / 19-03-'11 Saturday
Koh Tao Festival built up

Day 35 / 21-03-'11 Monday
Koh Tao Festival built up

Day 36 / 22-03-'11 Tuesday
Koh Tao Festival built up

Day 37 / 23-03-'11 Wednesday
Koh Tao Festival built up

Day 38 / 24-03-'11 Thursday
Giant Clam Release

Day 39 / 25-03-'11 Friday
Koh Tao Festival

Day 40 / 26-03-'11 Saturday
Koh Tao Festival

Day 41 / 27-03-'11 Sunday
Koh Tao Festival Clean up

Day 42 / 28-03-'11 Monday
Storm – not able to dive

Day 43 / 29-03-'11 Tuesday
Storm – not able to dive

Day 44 / 30-03-'11 Wednesday
Storm – not able to dive

Day 45 / 31 – 03-'11 Thursday
Storm – not able to dive

Day 46 / 01-04-'11 Friday
Koh Tao Festival clean up

Day 47 / 02-04-'11 Saturday
Giant Clam release

Day 48 / 03-04-'11 Sunday
Bio Rock

Day 49 / 04-04-'11 Monday
Fundive

Day 50 / 05-04-'11 Tuesday
Bio Rock

Day 51 / 06-04-'11 Wednesday
EMP Substrate

Day 52 / 07-04-'11 Thursday
Coral nursery

Day 53 / 08-04-'11 Friday
Fundive

Day 54 / 11-04-'11 Monday
Fundive

Day 55 / 12-04-'11 Tuesday
Fundive

Day 56 / 13-04-'11 Wednesday
Fundive

Day 57 / 14-04-'11 Thursday
Fundive

Day 58 / 15-04-'11 Friday
Assessment damage storm

Day 59 / 16-04-'11 Saturday
Building coral/fish nursery

Day 60 / 17-04-'11 Sunday
Building coral/fish nursery

Day 61 / 18-04-'11 Monday
EMP substrate

Day 62 / 19-04-'11 Tuesday
Bio Rock

Day 63 / 20-04-'11 Wednesday
Coral/Fish nursery

Day 64 / 21-04-'11 Thursday
Mooring and boys lines

Day 65 / 22-04-'11 Friday
Under water clean up

Day 66 / 23-04-'11 Saturday
Fish/ Coral nursery

Day 67 / 25-04-'11 Monday
EMP substrate

Day 68 / 26-04-'11 Tuesday
Bio Rock

Day 69 / 27-04-'11 Wednesday
Wreck dive
Fish/Coral nursery

Day 70 / 28-04-'11 Thursday
EMP substrate
Giant Clam Check

Day 71 / 29-04-'11 Friday
Wreck dive
Coral nursery

Day 72 / 30-04-'11 Saturday
Fundive

Day 73 / 03-05-'11 Tuesday
Bio Rock

Day 74 / 04-05-'11 Wednesday
EMP fish / invertebrate

Day 75 / 05-05-'11 Thursday
Coral nursery / drupella snails

Day 76 / 06-05-'11 Friday
Artificial reef dive

Day 77 / 07-05-'11 Saturday
Data entry

Day 78 / 09-05-'11 Monday
EMP fish + invertebrate

Day 79 / 10-05-'11 Tuesday
Coral nursery

Day 80 / 11-05-'11 Wednesday
Coral nursery

Day 81 / 12-05-'11 Thursday
Bio Rock

Day 82 / 13-05-'11 Friday
Coral nursery

Day 83 / 16-05-'11 Monday
Boyancy World

Day 84 / 17-05-'11 Tuesday
EMP Substrate

Day 85 / 18-05-'11 Wednesday
Giant Clams Check /
Drupella Snails

Day 86 / 19-05-'11 Thursday
EMP Fish / Drupella Snails

Day 87 / 20-05-'11 Friday
EMP Fish

Day 88 / 23-05-'11 Monday
EMP Drupella

Day 89 / 24-05-'11 Tuesday
Bio Rock

Day 90 / 25-05-'11 Wednesday
Coral nursery

Day 91 / 26-05-'11 Thursday
Crown of Thorns

Day 92 / 31-05-'11 Tuesday
Bio Rock