

# A Coral Reef Monitoring and Mapping System for Western Luzon Philippines Seas

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Through the use of ICT, open source development tools, careful process analysis of the coral reef bleach and status reporting and rapid prototyping, proponents of this project developed a web-based application to support the said activities. The research project is also intended to support the major tasks of Reef Check Philippines, a dedicated NGO formed to keep the coral reefs healthy by monitoring the its conditions. The research project covered the areas of Bataan, Batangas and Mindoro.

Keywords: Coral Reefs, Coral Bleaching, Coral Reef Monitoring and Mapping, Western Luzon Seas

## 1. Introduction

### 1.1. Coral Reefs

Corals are classified into two types; soft corals and hard corals. Hard corals are the building blocks for a reef structure. Soft corals, on the other hand, resemble plants and trees that are colorful. The polyps of soft corals contain tentacles that usually occur in numbers of eight and they look like feathers in the ocean. Coral reefs are formed because of the hard corals' extraction of calcium from the seawater then use them to create a hard structure for the corals' protection and growth. Coral reefs are formed when millions of hard coral polyps form large carbonate structures [1].

### 1.2. Coral Bleaching

Global warming is one of the serious threats that have been affecting coral reefs around the world and this phenomenon causes the coral reefs to bleach. Bleaching is the whitening of coral reefs due to the changing of sea temperature. In response to the bleaching of the coral reefs, different countries from all around the world try to monitor coral bleaching and help these corals recover from the bleaching [2]

Coral reef bleaching usually occurs when the temperature suddenly drops or increases in a matter of 3° to 5° decrease in temperature for 5-10 days during winter and 1° to 2° increase in temperature for 5-10 days during summer [3]. Since it is impossible to spontaneously stop climate change and coral bleaching events, there are still ways that we can do; To control other stressors being caused by human and their activities namely, siltation and sedimentation, due to human activities, nutrient overloading, overexploitation, harmful ways of fishing, and marine based pollution[4].

Monitoring of the coral reefs must be done on a regular basis and on a specified period of time. This entails gathering data and information about the ecosystem of the corals. The main task of monitoring coral reefs is to repeat the initial coral reef surveys.

## 2. Reef Check Philippines

### 2.1. What they are doing

Reef Check Philippines is a non-profit organization that was formed to preserve marine life. They are mainly concentrated on the preservation of the coral reefs. Reef Check is active in more than 80 countries worldwide. They started with the monitoring and protection of the coral reefs in the Philippines in the year 1997.

### 2.2. How they do it

After surveying a sight monitored by Reef Check Philippines, members record the results in data sheets which will then show them a graph of the percentage of the coral cover that they are monitoring. They look at the percentage of the hard corals, soft coral, rubble, sand, silt, rock, nutrient indicator algae, and recently killed corals to determine the condition of a coral reef site. The data sheet will show them these percentages through the use of graphs. The developed system added value to this process by providing them a way to compare previous data with newly recorded data in just a few clicks. Because of the added feature, Reef Check Philippines need not to open different excel files to view the trend of the coral cover.

### 3. The Solution

The goal of this web based system for Reef Check Philippines is to help them in their monitoring efforts by providing a website where they can gather, analyze, compare, and share information they get from the field and from the contributors.

#### 3.1. Conceptual Framework

The system will mainly cover the monitoring of the coral reefs and the areas where coral bleaching occurs. The system aids in the tracking of certain areas and determine if other areas as well need to undergo certain measures. Basically, the system helps in gathering, storing, and graphically presenting the information for the end-users. The system will include of several main modules mostly derived from the processes of monitoring: Bleaching Report, Coral Health Assessment, Mapping Modules, Coral Progress tracking, Coral Data Analysis and Sharing. *Coral Progress Tracking* is one of the additional methods currently not in today’s monitoring processes since currently, there is no tracking of the progress of the coral’s condition from its initial report to its current status. Another additional process is the *Coral Data Analysis and Sharing* module wherein there is the ability to share coral monitoring information since the creation of a centralized repository for these type of information.

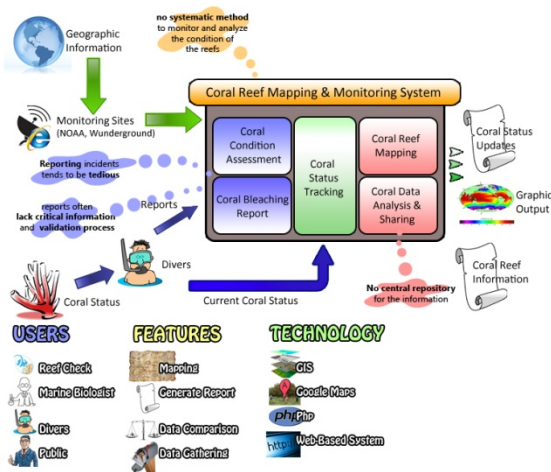


Fig. 1: Shows where data will be from and what technologies were used to develop the system

### 3.2. Benefits Of the Solution

#### 3.2.1. Data Comparison Charts

The information showed in the graphical reports will be from the excel files that are accomplished already and then uploaded by the members to the system. The reports

will be in the form of maps, tables and graphs. These reports aim to help the members monitor the coral reefs by presenting previous data with current data side by side. The report generation can let them choose the starting date and the ending date of the report. The system will then get the values from the database and then show information using graphs to easily understand and interpret that data that will be shown.

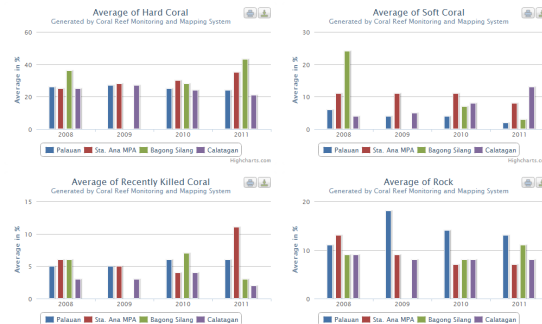


Fig. 2: Shows a sample comparison graph of the coral cover.

#### 3.2.2. Decision Support

The graphs that will be generated by the system can then be used to make status reports for different concerned organizations for decision making. Because of the graphical representation of numerical data bundled with the ability to compare it with previous data, decision making would be easy for organization that does not have an idea of how to interpret the data. At first glance, they can determine if the trend in the coral cover is increasing or decreasing.

The system also accepts reports from sports divers who may submit a sighting report to Reef Check Philippines. A sighting report is like a notification about issues with the coral reefs that currently monitored by reef check Philippines. Moreover, the sighting reports can also be an alert to Reef Check to monitor a certain area if they receive numerous sighting reports that show the same problems. This will enable Reef Check to decide if they need to have a site as a permanent monitoring site.

#### 3.2.3. Central Database

The system will also acts as the main repository of gathered data. Users can access data from the database of the system for analysis and examination. The coral data can be viewed by anyone and can be used as a basis for actions regarding the coral reefs. This will enable Reef Check users to share the data they gathered to other users and other concerned organizations. It is the vision of the developers that the data presented publicly will entice other people to help in the preservation of the coral reefs and also be aware of the things that would damage the reef ecosystem and also help Reef Check users to retrieve the data they need with ease.

Unregistered users can also send reports of coral reefs they observe that they think is in danger.

They can categorize their report as bleaching, COTS, or others. Others is a general term to report incidents such as oil spills, sedimentation and other factors that may affect the health of the coral reefs. Unregistered users will need to fill up a form detailing what they saw and plot it on the map provided for them. Data that are gathered from unregistered users can be used as a status report to government agencies concerned for them to plan necessary actions to help alleviate the stress upon the coral reefs that the damaging factors do to them. Reports of unregistered users of the system are also tagged along with the sites that are monitored by Reef Check Philippines. This feature of the system may help Reef Check when they are notified about the status of the reefs even though they haven't revisited the site to survey it again. The reports are also used to check if the predicted scenarios are true.

#### 4. Conclusion

This thesis entitled Coral Reef Monitoring and Mapping System is made with a vision to help Reef Check Philippines by providing the organization with a website or web portal that would help them easily monitor the changes that are happening to the reefs in the Philippines. With the use of ICT and other technologies like maps, GIS and graphical representation of data, this system is able to help the different stakeholders monitor, diagnose, protect and understand the current state of the corals in the Western Luzon of the Philippines. A significant function of this system helps users in their decision making to declare an area protected or pass new laws that would help lessen the stress on the corals, eventually help preserve the biodiversity in the ocean. As the group envisioned by the use of graphical presentation of old data and new data, users are now able to logically interpret and make a report about the condition of the coral reefs easily with a click of a button.

#### 5. Acknowledgement

This paper would not have been possible without the individuals that, in one way or the other, contributed to its content. The concept behind this paper is the result of cooperation between students and faculty that built on ideas to help to make the preservation of marine resources easier through the use of ICT.

We would like to express our gratitude to Mrs. Ma. Victoria Pineda, our thesis adviser, with whom the idea of the disaster management system for the water resources in Bataan resulted to the development of the system. Also we are thankful to her for supporting us from the very

beginning and having the patience to deal with us. The help of Dr. Wilfredo Licuanan and Mr. Nino Jacinto of Reef Check Philippines, help gave direction to our thesis. They provided information in making our system relevant and suitable for the actual users and for giving their time to accommodate our questions and concerns and to provide not only solutions but to go a step further and give suggestions to make our thesis better.

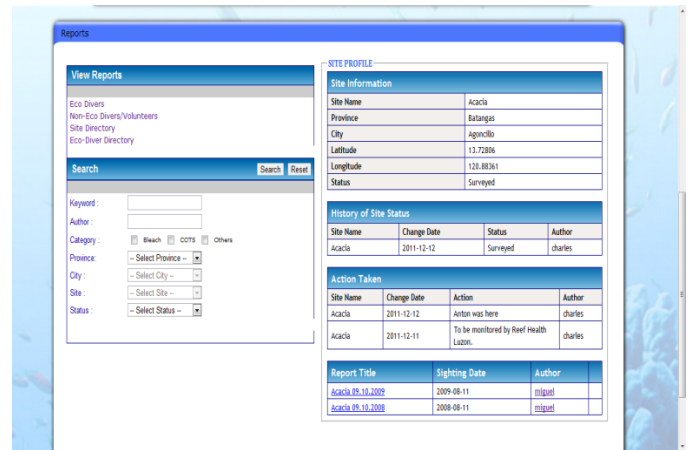


Fig. 3: Shows where users can search reports made by Reef Check users and incident reports submitted by site visitors. A summary of the report is also shown at the side of the page.



Fig. 4: This map located at the homepage of the system shows recent reports made by Reef Check users and site visitors. Data shown in the map can be filtered using the options below it.

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