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USAID CONSERVATION OF CENTRAL AMERICAN WATERSHEDS PROGRAM (CCAW)

Grant No. 413FO-AP S01-ROAT

FORMALIZATION, FINANCIAL SUSTAINABILITY AND CIVIL SOCIETY MONITORING IN THE SANDY BAY-WEST END MARINE PARK

IMPROVED ENVIRONMENTAL EDUCATION, RECYCLING AND WATER QUALITY MONITORING PROGRAMS

Roatan Marine Park

Roatan, Bay Islands, Honduras

The Author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government

ROATAN MARINE PARK (RMP)
GRANT DELIVERABLE REPORT

Project Deliverable: Improved environmental education, recycling and water quality monitoring programs

Deliverable Goals:

- To increase the number of schools incorporated into the RMP environmental education program.
- To increase the number of children in Roatán educated on coral reef conservation.
- To empower the youth of Roatán to provide marine conservation education to local children.
- To contribute to reduce the amount of plastic bottles consumption among visitors.
- To determine the water quality and estimate adverse impacts of eutrophication within the Sandy Bay-West End Marine Reserve.
- To create and maintain a database for monthly water quality measurements over a long term surveillance

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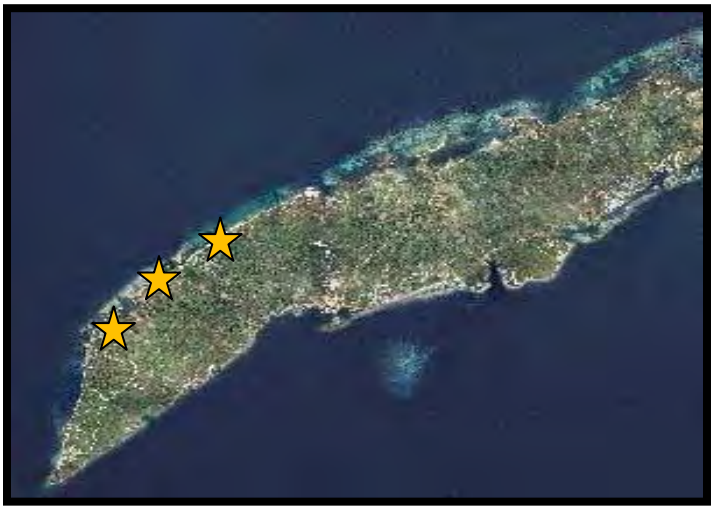
Background:

Founded in 2005, the Roatan Marine Park Association was created in response to concerns about the alarming rate of reef degradation in the Sandy Bay-West End Marine Reserve (SBWEMR). Initial efforts focused on reducing illegal activity within the Reserve, achieved through an alliance with the Honduran National Police. Later, with help from several grants, an extensive marine infrastructure program was implemented, and now over 70 permanent (dive, yacht, and fishing) moorings have been installed and are maintained by the RMP. With more support from the dive industry and other local businesses, an Environmental Education Program was established in 2006 with three target schools: West End's Public School, Sandy Bay's Public School and Sandy Bay Alternative School, all present within the Sandy Bay-West End Marine Reserve. The program consisted at that time of sporadic visits to schools to make lectures regarding reef conservation, followed by visits to the reef in the Glass Bottom Boat.



Location of schools visited by the RMP in 2006.

On the other hand, as human influence continues to ascend, there is an increasing need to monitor the biodiversity, health, and water quality of Roatán. There is a shortage of information available on the true extent of this problem and how it is impacting our coral reefs. Poorly treated sewage and sediment runoff from development are contributing to rapid degradation of Roatán's reef ecosystem. For many time it had been one of the RMP's goals to develop a long-term water quality monitoring program in order to determine the sources and impacts of anthropogenic discharges, and improve our management approaches to this stressor. However, due to a lack of financial resources, logistics and manpower, the Water Quality Monitoring Program established by the organization in 2007 was forced to be on stand-by for more than one year.

Description:

Environmental Education:

Recognizing that long-term resource sustainability can only be achieved through improved education, the RMP has developed an island-wide environmental education program in order to enable children to take responsibility for protection of the reef in the future. The program aims not only to bring marine education to the classroom, but to bring the classroom to the reef, as it is through school marine field trips that children are able to develop deeper understanding of the value of our coral reef and threats to its future survival. In 2008 alone, the RMP continued working with the schools within the Marine Reserve and was able to expand its education program to include one university, one kindergarden, and six more schools, providing education to over 2,000 children in Roatán (table 1).

Table 1. Schools Visited in 2008

No	**Name of School**	**Number of targeted audience**
1	Roatan Bilingual School	700
2	Children's Palace School	30
3	Punta Gorda School	360
4	Jonesville School	100
5	Camp Bay School	25
6	Colonia Balfate School	350
7	Sandy Bay Public Kindergarden	20
8	UTH (Technological University of Honduras)	50
9	West End Public School	50
10	Sandy Bay Public School	300
11	Sandy Bay Alternative School	50
TOTAL		**2,035**

So far in 2009, three new education centers have been incorporated to the RMP Education Program: SOL Foundation and both e-learning centers in Sandy Bay and French Harbor. Our goal for this year is to include eight more schools:

- Methodist School
- Diamond Rock School
- Church of God Bilingual School
- Bilingual Public School
- Centro Básico Los Fuertes
- Corozal School
- Mud Hole School
- Juan Brooks Public School

Visits to schools are made to give children lectures on coral reef, mangroves and water conservation, recycling and other topics, using mainly power point presentations. As the program is expanding, so was the need for the purchase of new equipment: a projector, a laptop and a photographic camera, as well as materials (crayons, markers, glue, scissors and re usable bags) to enhance hands-on activities.

The marine field trips the RMP develops with schools consist of snorkelling trips, glass-bottom boat rides, beach clean ups, Discover Scuba Diving Experiences and open water courses. These activities provide children the opportunity to get closer to the reef and raise their awareness.

Volunteers have been essential in the development of the education program, especially local young volunteers. The "Education for Kids to Kids" program started by the RMP in 2008 with 9th graders from the Punta Gorda School was re launched in 2009 with the Sandy Bay Alternative School. The program consists of four steps:

1. Encounter with the reef through a field trip in the Glass Bottom Boat.
2. Presentation about Coral Reef Ecology Conservation by the RMP.
3. Training on teaching techniques.
4. Final presentation in schools.

Recycling:

Water dispensers were installed in the RMP eco-friendly store in West End to motivate bottle refill and reduce the purchasing of water in plastic polyethylene terephthalate (PET 1) bottles that end up as rubbish in the ocean. In order to promote water bottle refill among visitors, signs were installed on the RMP store and bulletin board.

Water Quality Monitoring:

Through rigorous data collecting, a thorough monitoring program could aid the preservation of the delicate coral reef ecosystem. An effective monitoring program requires sample collection from strategic sites in and outside the marine park, at regular intervals over a relatively large time scale (> 2 years).

Water quality parameters:

Most nitrogenous materials in natural waters tend to be converted to nitrate, so all sources of combined nitrogen, particularly organic nitrogen and ammonia, should be considered as potential nitrate sources. Primary sources of organic nitrates include human sewage and livestock manure, especially from feedlots. Nitrite usually tends to appear in small concentrations in healthy waters. In eutrophic waters, where low oxygen concentrations or even anoxia occurs, nitrite is created through bacterial reduction of nitrate ions. Nitrite is toxic; the LD_{50} value for fish is 0,01 mg/l. As well as nitrite, human sewage and runoffs from over-fertilized landscapes also produce significant amounts of phosphate. And so, it important to monitor water near these run offs because phosphate is an essential nutrient for primary production and is extremely limiting for algal growth.

Another component which is an essential aspect of water quality is the amount and diversity of coliforms present. Coliforms can serve as an indicator for the presence of waterborne pathogens in fresh water and in marine environments. Discharges of raw or inadequately treated sewage from sewer systems are a common problem in Roatán. Sadly, there are no studies to ensure quantitative information which could give the island an idea of how much sewage is actually going untreated into the water. An important subgroup of this collection is the fecal coliform bacteria, the most common member being *Escherichia coli*. These organisms are associated only with the fecal material of warm-blooded animals. Failing septic systems can cause leaching and/or runoff into the waterways, causing bacterial contamination. Coliforms can cause a variety of diseases in humans and are, therefore, a threat to public health.

The turbidity, or cloudiness, of a fluid is caused by suspended solids with the liquid. The turbidity of the water determines exactly how much light can reach lower depths: The higher the turbidity, the less light reaches lower depths. Light availability is a major factor for coral growth, as the zooxanthellae depend on it for photosynthesis. Increasing turbidity results in declined coral growth.

I. MATERIALS & METHODS

A. Sampling

Water samples were taken from different sites and habitats (e.g. mangrove, sandy patches, seagrass meadows, coral reefs) and collected at the surface.

B. Turbidity

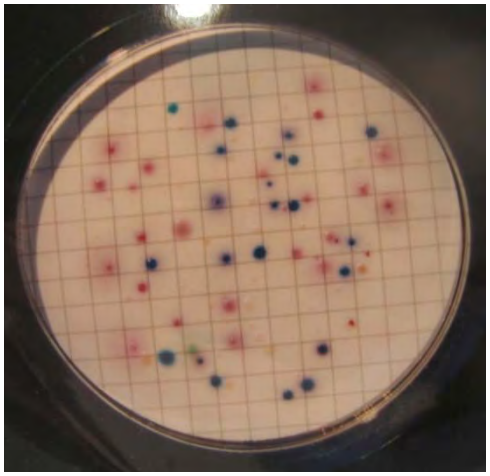
Turbidity measurement was performd via Turbidimeter (LaMotte 2020).

C. Nitrate, Nitrite, Phosphate

Measurements of nitrate, nitrite and phosphate were performed via Colorimeter (Hach).
Chemicals added to samples develop specific colors that indicate the content of nitrate/nitrite/phosphate.

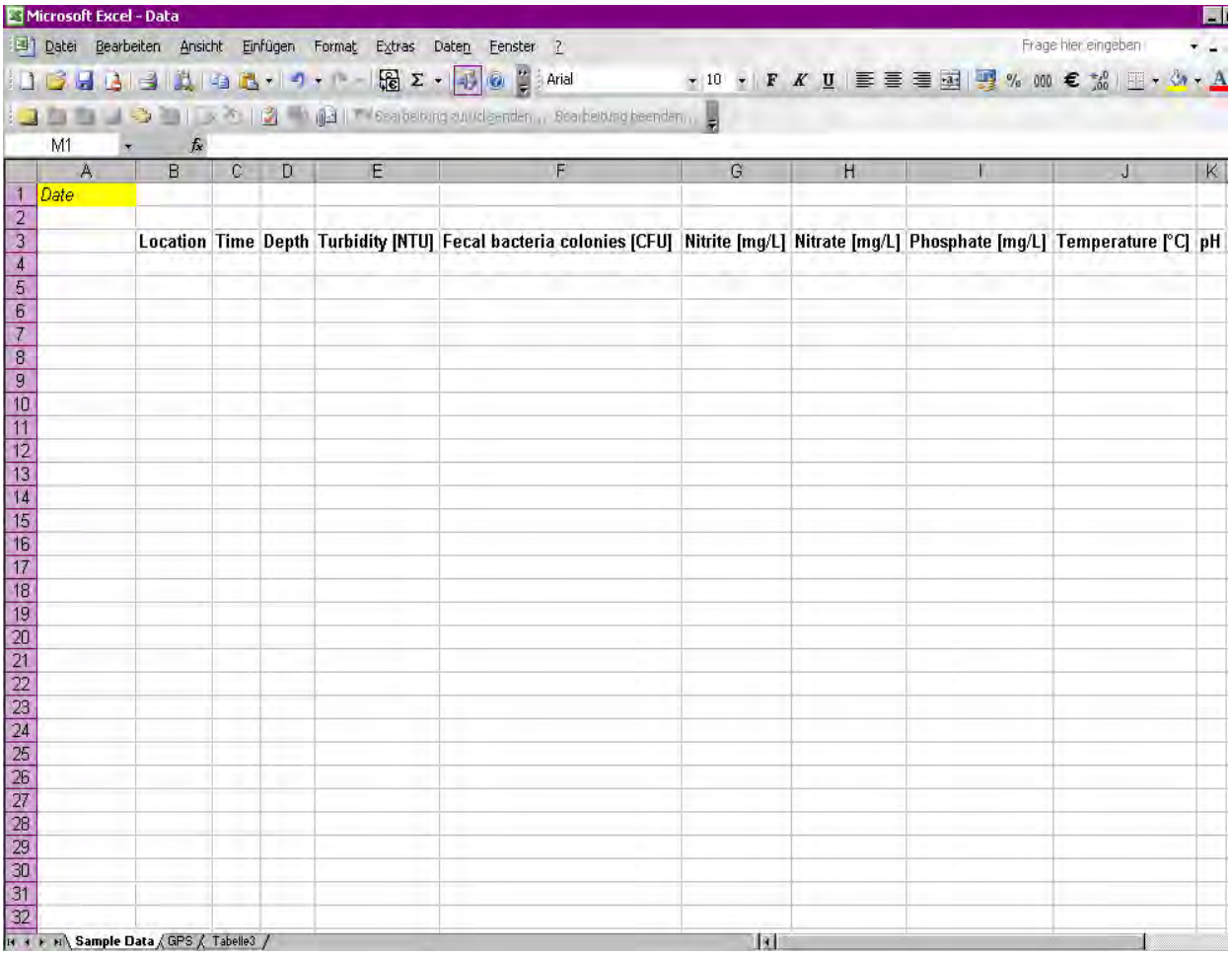
D. Coliform bacteria

For measurement of coliform bacteria, the sample water was poured through a filter apparatus via a syringe depositing microorganisms on a membrane filter. The membrane filter was transferred to a Petri dish containing growth medium and incubated for 24-48hrs. After the incubation period, bacteria could be counted and identified. Blue colonies are identified as *E. coli*, purple colonies as general coliforms. The sum of these two is the total coliform population.



E. Data collection

Prepared Microsoft Excel sheets are used for data collection:



Microsoft Excel - Data

	A	B	C	D	E	F	G	H	I	J	K
1	Date										
2											
3		Location	Time	Depth	Turbidity [NTU]	Fecal bacteria colonies [CFU]	Nitrite [mg/L]	Nitrate [mg/L]	Phosphate [mg/L]	Temperature [°C]	pH
4											
5											
6											
7											
8											
9											
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Sample Data / GPS / Tabelle3

Microsoft Excel - Data

Site Number	GPS names	Site	Location	Coordinates	Description	Substrate
1						
2						
3						
4						
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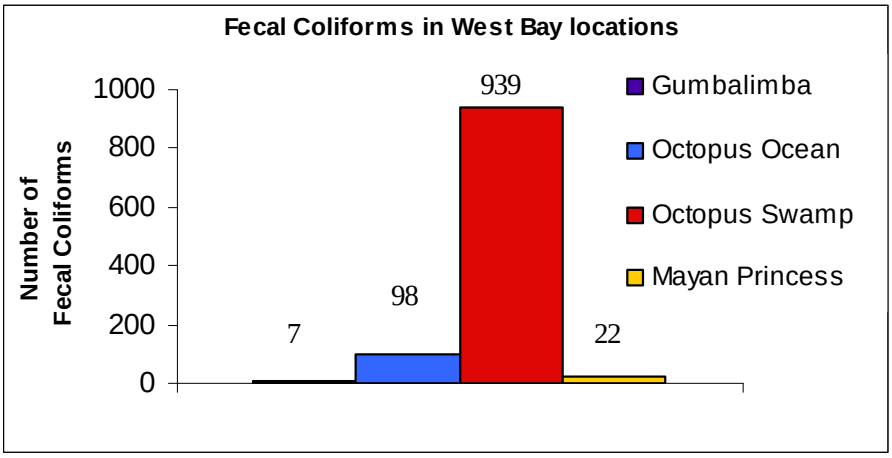
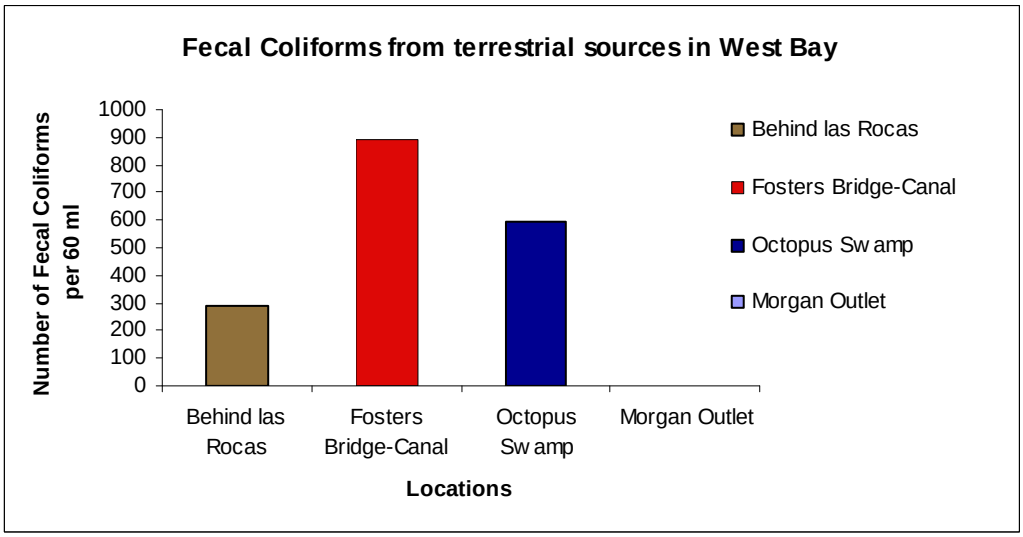
14						

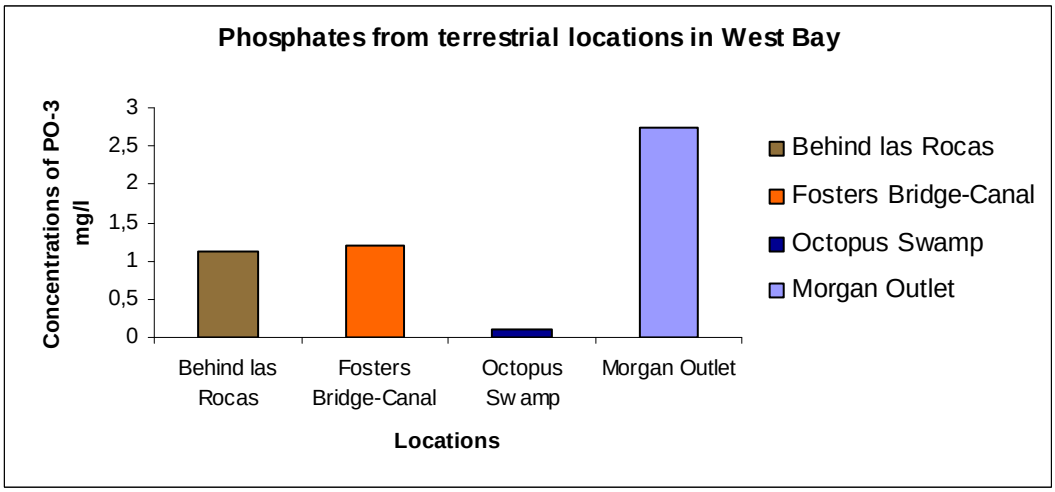
Sample Data | GPS | Tabelle3

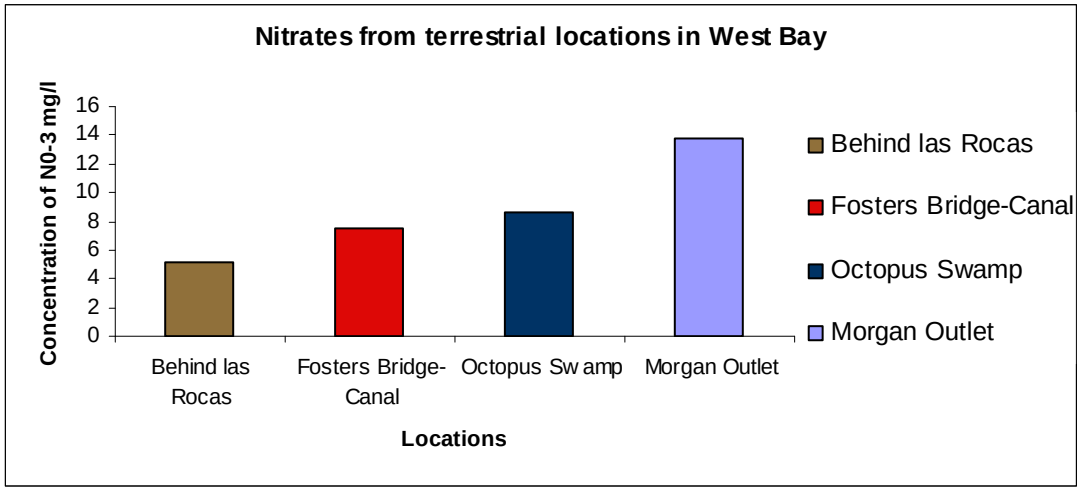
II. RESULTS

Results from 2007









Results from 2009

Half Moon Bay	**17.02.2009**			
	Location	**Depth**	**Turbidity [NTU]**	**Fecal bacteria colonies**
	Sandy Patch	Surface	0,38	19
	Sandy Patch	Bottom	0,11	
	Seagrass	Surface	0	
	Seagrass	Bottom	0	
	Reef	Surface	0	
	Reef	Bottom	0	47
	Tap Water			7

Mangrove Bight	**19.02.2009**			
	Location	**Depth**	**Turbidity [NTU]**	**Fecal bacteria colonies**
	Away from Shore	Surface	0,88	0
	Mangroves 1	Surface	0,92	2
	Mangroves 2	Surface	14,6	300+
	BLANK			0