

METHODOLOGIES AND OBJECTIVES FOR THE 2010 HONDURAN MARINE RESEARCH PROGRAM

Prepared by Dr James Saunders (Operation Wallacea), Dr Paul Bologna (Montclair University), Dr Patrick Scaps (Université des Sciences et Technologies de Lille, France), Dr Kathy Velander (Napier University), Patrick Connelly (Operation Wallacea), Natalie Bown (Newcastle University), Michael Logan (Dartmouth College), Steve Green (University of Kent)

Contents and links

[Introduction](#)

[The Cayos Cochinos - Cayo Menor Research Station](#)

[Reef fish populations](#)

[Queen Conch populations and ecology](#)

[Boa, Ctenosaurs and Anole populations and ecology](#)

[Invertebrates associated with live scleractinian corals](#)

[Utila - Coral View Research Centre](#)

[Assessing anthropogenic impacts on the health and functioning of the mangrove systems](#)

[Assessing mangrove pollution and impacts](#)

[Mangroves and reef fish nurseries](#)

[Colonisation of mangrove roots by epifauna and flora](#)

[Assessing the impact of localised development on the seagrass systems](#)

[Assessing the impact of localised development on the seagrass systems](#)

[Anole Population and Ecology Research](#)

[Rio Esteban](#)

[Mapping and assessing the reefs of Rio Esteban](#)

[North Honduran Shore - Social Science Group](#)

[Ecotourism development on the Northern Honduran Coast](#)

Introduction

The Honduran Marine Program has a number of different research groups operating from the sites on Utila, the Cayos Cochinos and the Honduran North shore. These groups cover a variety of biological and social research topics. The biological research is based on two permanent sites on Utila and the Cayos Cochinos while a mobile social development group moves around the Northern Honduras coast. In addition to this 2010 will be the first year where the biological research moves to the mainland with initial surveys of the reefs around the fishing community of Rio Esteban planned.

Cayos Cochinos - Cayo Menor Research Station

The area around the Cayos Cochinos Archipelago has been established as a Marine Protected Area and a National Monument since 1993. An ongoing monitoring and research program based on the biodiversity within the area is vital to gauge the success of the MPA and the current status of the fauna and flora in the area. This project covers many areas and species within the CCMPA.

Reef fish populations

Fish populations have huge importance to coral reefs, not least around the Cayos Cochinos where the ecological and economic needs of the reefs need to be balanced. For this to happen continuous monitoring of important species of reef fish has been undertaken for several years and this will continue in 2010.

The reefs that will be surveyed include Timon, Pelican, Arena and Chachahuate. In 2009 a total of 10 reefs were surveyed, for 2010 it is expected that 8 reefs will be surveyed with additional reefs added if conditions are favourable. An Underwater Visual Census (UVC) protocol will be employed to survey fish populations and related benthic characteristics. Ecologically and economically important species of reef fish (e.g. Parrotfish and Groupers respectively) and recognised indicator species (e.g. Butterfly fish) will be surveyed along each transect (Table 1). Transects will be laid over 20m and fish populations counted 2.5m either side of the tape and 5m above as divers swam along the transect at a consistent speed. This equates to a surveyed area of 500m³ per transect (n=8). Size of fish will also be recorded for important species such as Grouper and Parrotfish.

Results will give the population levels of each of the fish species and size classes for each. Comparisons of fish number, diversity and community structure will be made between reefs and areas within the MPA, and with previous years data using univariate and multivariate statistical analysis methods.

This work is supervised by Dr James Saunders and Patrick Connelly (Operation Wallacea) and data will be collected by 3 Dissertation Students and a number of research assistants.

Table 1 Fish species identified and surveyed on the reefs around both the Cayos Cochinos and Utila

Family	Common name	Latin name
Butterfly	Foureye butterflyfish	<i>Chaetodon capistratus</i>
	Spotfin butterflyfish	<i>Chaetodon ocellatus</i>
	Banded butterflyfish	<i>Chaetodon striatus</i>
Damsel	Sergeant Major	<i>Abudefduf saxatilis</i>
Grouper	Graysby	<i>Cephalopholis cruentatus</i>
	Rock hind	<i>Epinephelus adscensionis</i>
	Nassau Grouper	<i>Epinephelus striatus</i>
	Black Grouper	<i>Mycteroperca bonaci</i>
	Scamp	<i>Mycteroperca phenax</i>
	Tiger grouper	<i>Mycteroperca tigris</i>

Grunt	Caesar grunt	<i>Haemulon carbonarium</i>
	French Grunt	<i>Haemulon flavolineatum</i>
	Spanish Grunt	<i>Haemulon macrostomum</i>
	White Grunt	<i>Haemulon plumieri</i>
	Blue Stripped Grunt	<i>Haemulon sciurus</i>
	Black margate	<i>Anistremus surinamensis</i>
	White margate	<i>Haemulon album</i>
	Porkfish	<i>Anistremus virginicus</i>
Parrotfish	Redband Parrotfish	<i>Sparisoma aurofrenatum</i>
	Redtail Parrotfish	<i>Sparisoma chrysopterygum</i>
	Redfin Parrotfish	<i>Sparisoma rubripinne</i>
	Stoplight Parrotfish	<i>Sparisoma viride</i>
Snapper	School master	<i>Lutjanus apodus</i>
	Yellowtail Snapper	<i>Ocyurus chrysurus</i>
Surgeon	Ocean Surgeon	<i>Acanthurus bahianus</i>
	Blue Tang	<i>Acanthurus coeruleus</i>

Queen Conch populations and ecology

One of the most important species within the MPA is the Queen Conch (*Strombus gigas*). It is very important for both the ecology and economy of the area holding a vital position in the functioning of a healthy and diverse reef system. Unfortunately the conch is also highly commercially important as a food source for the local communities or more often a catch that is sold by local fishermen nationally and internationally. This means that conch populations have become very low on many reefs before they came under the protection of the CCMPA.

A good indication of the success of the CCMPA would be the regrowth of the conch population in the area, therefore a long term monitoring program was initiated in 2007 with conch measured and tagged. This was repeated in 2009 with permanent tags as none of the 2007 tags were evident on conch (it is considered highly unlikely that all tagged conch vanished and instead the very basic tags used in 2007 were inadequate). This will be built upon in 2010. The project will include tagging of more conch while measurements using the old tags will allow measurements of growth, population size, movement and ecology.

Reefs, seagrass and sediment systems (n=5 of each) within the CCMPA will be surveyed for conch populations using a 50m transect (n=4) and any conch located will be tagged from all areas with permanent markers to allow yearly growth rate to be monitored in future years. Both snorkelling and Scuba will be used and all surveys will be located by GPS. Habitat preferences will be analysed through comparisons of sites with ANOVA and possibly PCA analysis.

The project is being supervised by Dr James Saunders and Patrick Connelly (Operation Wallacea) with data collected by two dissertation students, in addition to all Operation Wallacea surveyors will be looking for conch in addition to their normal survey protocols.

Invertebrates associated with live scleractinian corals

Much of the biodiversity of coral reefs, and therefore the functioning and productivity, is due to their complexity and the niches that are created by the scleractinian corals. This complexity is relatively well understood, certainly in comparison the lack of complexity associated with algae dominated reefs. However, the inhabitants of these niches are not well understood, nor are the influences upon them such as anthropogenic variables. This project intends to do an extensive survey of the reefs around the Cayos Cochinos for such corals and associated invertebrates. For the quantitative surveys, the size dimension of each study site will be approximately 50 x 50 m and forty 1m² quadrats will be located haphazardly at each site. In each quadrat, all coral associates will be counted, coral colonies bearing associates will be identified to species and the diameter of each colony will be measured in two perpendicular dimensions. Surface area of a coral colony will be calculated. Coral colonies will be classified into massive, encrusting, foliaceous, branching and ridge-like forms and different conversion factors will be applied for each category. The average of two diameters in perpendicular directions will be used to estimate the surface area of encrusting and foliaceous forms. The surface area of massive corals will be estimated as $2\pi r^2$, where r is the average diameter of a coral colony. For corals of branching and ridge-like forms, the projective area of each colony will be calculated and then multiplied by the conversion factors of 3 and 5.6 respectively to estimate their surface.

In order to link the different assemblages of organisms inhabiting coral colonies with the status of the reef, the coral cover at the selected sites will be estimated. To describe the cover of the major functional groups and dominant coral taxa, a point-intercept counts will be used on the same quadrats as the macrofaunal surveys. Each 1 m² quadrat will be divided by string so that 25 intersection points will be contained within the quadrat. The type of bottom cover under each point will be identified as sediment, bare hard bottom, algae, sponges, scleractinian corals, octocorals and other benthic cnidarians. This project will be run by Dr Patrick Scaps from Lille University.

Boa and Ctenosaurs populations and ecology

As with previous years focus of the research will be driven largely by the need to estimate the current population status of *Boa constrictor* on the islands, and the importance of understanding its habitat use and thermal ecology of the boas. This has been achieved through the initiation of a long-term mark-recapture study, and by the implantation of temperature-sensitive radio-transmitters into a number of boas, which are then subsequently monitored throughout the Operation Wallacea season. These two central themes will continue throughout 2010 season and daily visual encounter surveys (VES) will be conducted alongside radio-tracking.

In addition to VES and radiotracking, the 2010 season will see the start of new research into assessing general health of boas based on their blood chemistry. Blood samples will be collected from boas to examine hormone levels, assessing the effects of ectoparasites (ticks) on health. Tissue samples will also be collected from boas to add to the ongoing genetic analysis being carried out by the group.

The project will be run by Steve Green (Kent University) with data collected by a number of Research Assistants.

Utila - Coral View Research Centre

Utila is one of the most prosperous parts of Honduras, with an economy that has grown dramatically based on a thriving dive tourist industry that has developed in the last 15 years. This industry has resulted in huge growth in the population of the island and the development of hotels, restaurants and associated business and housing for people employed in the industry. The development and growth has been almost completely unregulated or done with little or no consideration to the marine environment around the island, including the reefs that support the dive industry. As a result there are large number of pressures on the reefs, in addition to which the reefs are still fished by artisanal fishermen, further increasing the pressures on the marine environment. The work conducted at the Coral View Research Centre is primarily focused on assessing the impact on the marine environment of the development on the island and producing data that can be used to promote sustainable development and ongoing use of the reefs for the dive industry. This work covers many research topics.

Assessing anthropogenic impacts on the health and functioning of the mangrove systems

Utila is dominated by mangrove systems, with 70% of the island covered in mangroves or associated wetlands. These systems are an integral part of the marine ecosystem, performing functions such as reef fish nurseries, sequestering pollution, stabilising sediment and preventing coastal erosion. However the mangrove systems are being severely impacted by the development on the island, especially with large areas being destroyed to make way for building hotels and housing.

A large volume of work has been done comparing the functioning of healthy mangrove systems with areas where mangroves have been destroyed, however, very little work has been done at looking at the impact of sub lethal disturbance on mangroves and its effects on their functioning as a system. Given that it is important that Utila continues to develop and that this will inevitably impact mangrove system health, it is highly important to assess how much damage can be done to a system before its important functions are disturbed. This leads to several projects assessing the functioning of the systems, however, overarching all of these is a large scale survey project of the levels of pollution and disturbance in the mangrove systems and the related health of the mangrove trees. All projects are being supervised by Dr James Saunders (Operation Wallacea) with individual projects having special supervision detailed within.



Assessing mangrove pollution and impacts

This project will sample three lagoon systems around Utila, all heavily colonised by mangroves. Of these, Big Bite Pond is behind the town of Utila and is subjected to high organic pollution from “slum” developments. The second lagoon, Oyster Bed Lagoon, is situated just outside the town of Utila and does not have the organic pollution levels of Big Bite Pond, but instead is under increased pressure from high end tourist development which brings high levels of physical impacts from dredging and boat traffic. The third lagoon, on the north shore of the island,

called Rock Harbour, is relatively untouched by human impacts. 21 sites will be selected from these three lagoons, 7 in each, based on data from a large scale survey conducted in 2008 and 2009. At these sites pollution will be measured through levels of pH and salinity, while sediment characteristics will be measured including water content and sediment deposition rate. The health of the mangrove trees will be recorded through measurements of root structure and canopy properties (n=8 for all measurements per site).

Site comparisons of pollution, disturbance and tree health will be made between and within the lagoons using univariate and multivariate statistical methods. The data will be represented in a GIS application and made available to all other mangrove projects as a basis of their work.

Mangroves and reef fish nurseries

The complex 3D nature of mangrove roots provide an ideal environment for juvenile reef fish to develop before migrating onto the reefs. The mangroves provide shelter from predation in addition to a large supply of food for juvenile fish. Experimentally quantifying the role of the mangroves is very hard without removing the plants themselves. Instead this project will create artificial mangrove root systems (n=3) that will be placed in three locations within Oyster Bed Lagoon with different environmental variables. The colonisation of these “roots” by fish and invertebrates will be monitored for several weeks before the roots are removed and monitoring continues to assess the impact.

An additional element to the project is to survey the adult fish populations on the reefs around Utila (n=6), this will survey a variety of fish species (Table 1) using UVC detailed earlier. Of these species several are known to use mangroves as fish nurseries while others are known not to, a comparison of these will indicate the use of mangroves as nurseries in the area.

Colonisation of mangrove roots by epifauna and flora

One of the most important elements in a mangrove system is the community of colonising animals and plants that grow on the submerged roots of the mangrove trees. These provide a food source for juvenile fish that use the mangroves as a nursery, while the rate and species colonising the roots has a large impact on the health of the roots and as a result the health of the trees and mangrove system. This can include burrowing isopods that can destroy the roots, epiphytic algae that may smother the roots and promote colonisation by epifauna that may “protect” the root from colonisation by harmful invertebrates. Coupled with the survey of the pollution in the lagoons a project will survey the colonisation of the mangrove roots at the same locations by algae, diatoms, and epifauna and compare this epibiotic community to the pollution and disturbance levels experienced by the mangroves. Again, between and within lagoon comparisons will highlight the potential drivers of any variation in community.

Assessing the impact of localised development on the seagrass systems

In a similar way to mangroves, seagrass systems are an integral component of the marine environment and perform many functions that directly benefit adjacent reefs. Utila has extensive seagrass systems and although they are not physically destroyed in the same fashion as mangroves by the development they are subjected to pollution and sedimentation disturbance. A preliminary study is planned to survey three areas around Utila, one with high expected pollution, one medium and one pristine. Samples of seagrass will be taken from a 1m x1m quadrat (n=10) from shallow areas of these seagrass beds and the properties of the seagrass measured (leaf number, length, plant density) and compared through univariate

analysis in addition to recording the associated epifloral and faunal communities which will be compared through univariate analysis and correlated with seagrass properties and expected disturbance levels.

The project will be supervised by Dr Paul Bologna (Montclair University) and several Research Assistants.

Microscale patterns of sedimentation on reefs

Deposition of sediment onto a coral reef is one of the main stressors of corals and as such has a large influence on structuring reef biodiversity. Many studies have included sedimentation on a reef as a measurement of stress, however these have been basic and included limited replication on temporal and spatial scales. Therefore this study will study sedimentation extensively on a single reef, assessing patterns of change in both time and location. The reef outside the Coral View Research Centre is ideal for this with the opening of a lagoon next to the reef expected to supply a natural gradient of sedimentation over a small distance.

The project will distribute sediment traps over the reef collect deposited sediment and weekly measurements of sediment volume in each trap will allow the sedimentation rate to be determined. Patterns will be assessed through univariate statistics with some possible use of GIS.

The project will be supervised by Dr James Saunders (Operation Wallacea) with data collected by two dissertation students.

Anole Thermal Ecology Research

Starting in 2010 Operation Wallacea will be studying the thermal ecology of Anole lizards on the islands of Utila and Cayo Menor in the Islas de la Bahia. On Utila, two species are endemic and are considered to be at significant risk. Studies will concentrate on developing models to predict the location, timing, and magnitude of range shifts expected to occur due to global warming. Because of potential differences in the thermal biology of species in each community, these range shifts are predicted to cause competitive exclusion of endemic species by non-endemics. Data types being collected on both islands include: (1) operative temperature distributions with copper-plated temperature-logging models, (2) internal body temperatures of free-ranging individuals, (3) thermal performance curves from sprint speed data, and (4) upper thermal tolerance from "panting temperatures."

The project is being supervised by Michael Logan (Dartmouth College) with data being collected by several undergraduate and masters level dissertation students.

Rio Esteban

Assessing reef health and status

Rio Esteban is a small fishing community on the northern Honduran Coast that lost a large portion of its fishing grounds through the establishment of the MPA around the Cayos Cochinos. Rio Esteban is in the process of developing a small ecotourism industry, partly assisted by the

Social Development Groups research (below). Funding has been secured for the development of a dive centre in the community. To aid with its development and ensure it is run in a sustainable way Operation Wallacea will be conducting reef surveys in the area. These are the first dives ever on these reefs so are highly important and the ability to have baseline data from the start of the diving operation will be invaluable for protecting the reefs.

The reefs will be surveyed in the same way as those on Utila and the Cayos Cochinos and will therefore allow comparison of the reefs health between the sites.

The project will be run by Dr James Saunders (Operation Wallacea) and data will be collected by three dissertation Students and several research assistants.

Social Development Group

The Social Development group works with communities on the northern Honduran shore that have been impacted by the loss of fishing grounds by the establishment of the CCMPA. The group is responsible for working with local organisations such as GAD and researching and implementing new income sources for these communities, in particular those of Neuva Armenia and Rio Esteban on the mainland and their satellite communities of Chachahuat and East End respectively within the CCMPA. Two main projects are being run in 2009.

Ecotourism development on the Northern Honduran Coast

One of the most obvious routes to generate income through the sustainable use of the environments is through ecotourism. This has been attempted independently in other communities off the north shore such as Utila and Roatan, however the speed and volume of development has resulted in a high level of natural impact associated with the industry, leaving a large tourist industry, but one that cannot in any way be considered as ecotourism given its environmental impact. Little tourism exists within the CCMPA, or in the communities on the northern Honduran shore associated with the Cayos Cochinos. This project will assess potential routes of development for ecotourism in the area by assessing the opinions of local people and tourists in Utila and La Ceiba to potential businesses and also their feasibility, advertisement, pricing and appeal. Data from the communities of Rio Esteban and those within the CCMPA will mostly be collected through questionnaires targeting the home owners as well as interviews of key local figures and focus group discussions with fishers designed to gauge their opinions and levels of enthusiasm and readiness for new development. Questionnaires of tourists in La Ceiba and Utila will assess the appeal of certain tourist ventures (e.g horse back riding, nature walks) and how they may be advertised and priced to attract such tourists. Results from the project will be used to shape and promote the tourist industry in the communities affected by the CCMPA. In particular, the data will further identify present barriers to ecotourism success in each community, and potential mechanisms by which to overcome these barriers. The analysis will be community specific to accommodate for the individual trends and activities available to each coastal and island community that would be conducive to successful ecotourism.

The project is being supervised by Natalie Bown (Newcastle University) and Dr Kathy Velandar (Napier University) with data being collected by two dissertation students.