Project Utila is dedicated to the memory of Mark Smith whose inspiration and enthusiasm in initiating the project made it all possible.

Acknowledgements

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Section 1

INTRODUCTION

Project Utila is a monitoring programme for the marine ecosystems of Utila. The project was devised and conducted by students of ecology and marine biology from British and Honduran universities.

The project was initiated in 1995 with a three month period of field work from July - September, during which baseline data were gathered for three main areas of study:

- an assessment of the impact of recreational diving on the coral reefs;
- an assessment of the diversity of corals and fishes in Turtle Harbour Marine Reserve and the proposed reserve at Raggedy Cay;
- an assessment of the extent of sea turtle nesting around the island.

The project continued this year with students from Edinburgh, Newcastle and North London Universities in the U.K. and a group of biology students from Universidad Nacional de Honduras who assisted with the field work for a three week period. The specific objectives of the field work were:

- to repeat the diver impact surveys at the same sites established in 1995;
- to map the underwater habitats at Turtle Harbour and Raggedy Cay;
- to estimate the abundance of conchs and lobsters at selected sites within Turtle Harbour and around Raggedy Cay;
- to commence monitoring the incidence of black band disease at a site in Turtle Harbour with a view to setting up a permanent monitoring programme in 1997.

Most of the three month stay on Utila was spent concentrating on the field work with the last week left to write up the preliminary report. The purpose of this report is to provide the reader with an overview of the aims and achievements of Project Utila-96 and to present the initial results of the survey work. A final report with fully analysed data will be completed in 1997.

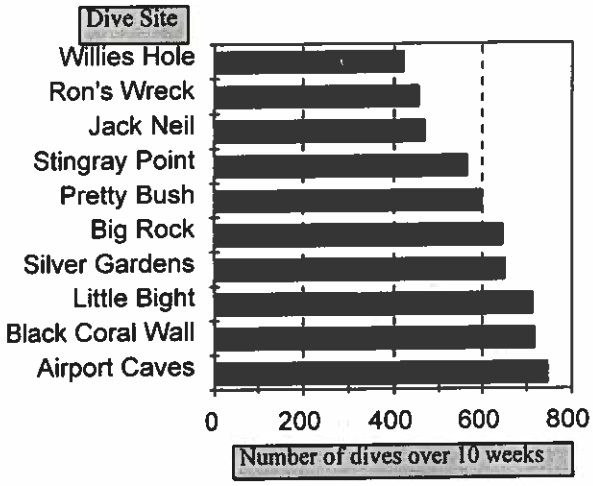
Section 2

DIVER IMPACT STUDY

2.1 Dive School Survey

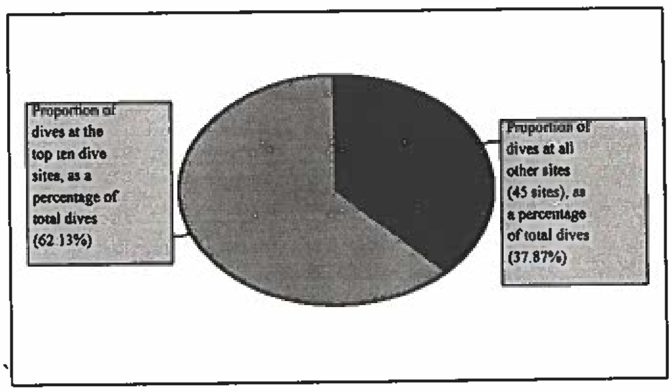
To make an assessment of the diving intensity on Utila's reefs, the dive schools were asked if they would be willing to keep a record of their diving, for a period of ten weeks, coinciding with our stay on Utila. The schools were provided with forms and asked to record each day which dive sites were visited and the total number of divers put down. They were also asked to record the number of Open Water Students on each visit as this category of divers has least experience in buoyancy control and may, as a result, be more likely to damage the reef.

Of the thirteen dive schools on Utila, ten completed and returned the forms. It is important to note that a significant number of dives, carried out by dive schools not participating in the survey, by resorts and privately were not accounted for. As a result the figures produced here should be considered a conservative estimate.



Graph 2.11. The total number of dives recorded at the ten most popular dive sites around Utila over a ten week period.

The total number of dives recorded for all the dive schools over the ten week period was 9559, of which 2254 (26.7%) were undertaken by Open Water students. Diving was recorded at a total of 55 sites around the island. Graph 2.11 shows the number of dives carried out over the ten week period at the ten most popular dive sites. As Graph 2.12 shows, these dives accounted for 62.13% of the total recorded dives, with the remaining 45 dive sites accounting for 37.87%. This illustrates how a small number of popular sites are receiving a disproportionally large number of dives.



Graph 2.12. The proportion of dives carried out at the top ten dive sites, as a percentage of all dives over the ten week period.

Last years figures of diving intensity are similar but as the complete data is not available they have not been included here for comparison.

2.2 Diver Impact Survey

2.2.1 Introduction

It has been shown in recent studies that large numbers of divers regularly visiting the same dive sites can cause considerable damage to coral reefs. Most of the damage comes from accidental contact between divers and the coral colonies. Touching the corals can break their fragile skeletons and wipe off the protective mucus that covers the polyps, leaving the corals vulnerable to disease and predation. Other factors such as corals being smothered by kicked up sediment, disruption of fish behaviour by diver intrusion and damage from anchors also contribute to the degradation of the reef.

In the last three years the number of dive schools on Utila has increased from three to thirteen. Discussions with locals and divers on Utila suggested that with the increase in diving that there had been a decline in the health of the reef. The main emphasis of our project was to see if this was the case, and if so would it be possible to quantify the difference in extent of decline between heavily dived and less heavily dived sites around Utila.

2.2.2 Methods

The permanent baseline transects set up at Silver Gardens, Cabanas and Turtle Harbour in 1995 were re-established. At Silver Gardens and Cabanas, two baselines separated by 100 m were re-surveyed. At Turtle Harbour, only the first baseline (located at the mooring buoy) was resurveyed. This was because the second baseline lies on the vertical drop-off, this was considered to be a different type of reef complex to that at the buoy and therefore was not a comparable site to that at the first baseline. As last year, each baseline was divided into three depth zones: deep (20-30 m); medium (10-20 m); shallow (0-10 m). The length of baseline was shortest in the deep and medium zones due to the gradient of the reef. The number of transects within each zone reflected its size. Therefore three survey transects were conducted in the deep zone, four in the medium and nine in the shallow.

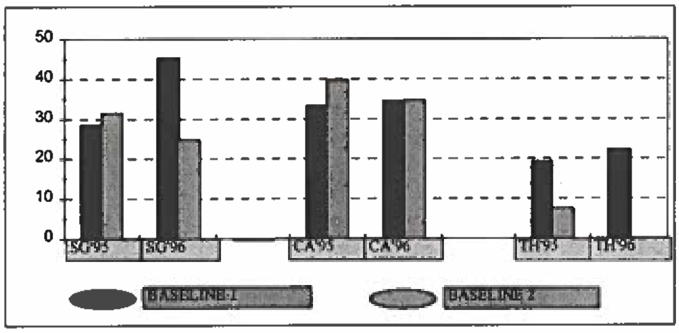
Before beginning the survey work it was essential for the team to standardise the correct identification of a wide range of reef fish (100 + species) and hard corals (40+ species), thus much of the first week of the expedition was spent studying books and snorkelling.

All surveys were carried out by a team of four divers. On each of the survey transects, the following were recorded.
i) Percentage cover of live hard coral species (reef building corals), other living substrate (eg. sponges, zooanthids, anemones), dead coral, rock, rubble and sand along a 10 m line, using Line Intercept methodology. This is where everything that lies beneath the tape measure is recorded.
ii) Density of soft corals and sponges, each in five morphological categories, within a 10 m by 1 m belt transect.
iii) Abundance of fishes recorded to species level along 50 m by 4 m belt transects.

iv) Percentage cover of live coral, dead coral, rock rubble and sand along 50 m line transects, using Line Point Intercept methodology. Line point intercept requires the diver to note the substrate directly below the tape at 1 m intervals. (Full details of all methodologies will be included in the final report).

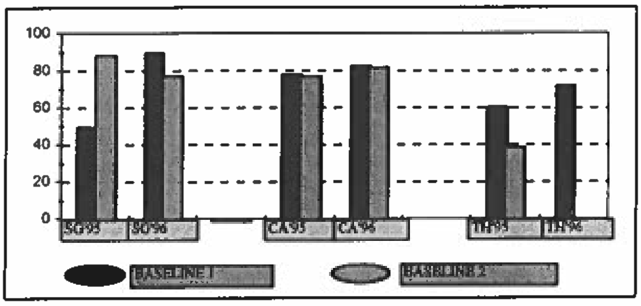
2.2.3 *Results*

In 1995, the total number of hard coral species encountered during the diver impact survey was 40, (with 35 at Silver Gardens, 32 at Cabanas and 27 at Turtle Harbour). In 1996, the total number was 34, (with 29 at Silver Gardens, 28 at Cabanas and 16 at Turtle Harbour). It must be remembered that only baseline one was re-surveyed at Turtle Harbour in 1996.
Whilst the overall sites show no significant change in reef composition when analysed as a whole, graph 2.2.31 shows a number of possible small dynamic changes on the survey sites. It is apparent that the proportion of live coral at baseline one of Silver Gardens has increased over the last year, whilst there may have been a slight decrease at baseline two. Changes in the proportion of live coral over the last year at the other study sites has not been noted at any significant level.



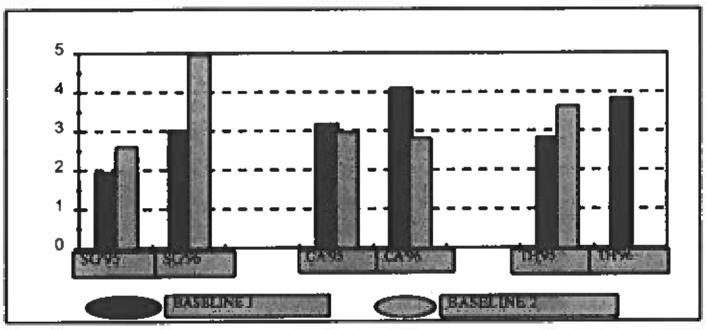
Graph 2.2.31. Comparison of live coral as a percentage of live and dead coral at Silver Gardens (SG), Cabanas (CA) and Turtle Harbour (TH) between 1995 and 1996.

The increase in live coral at Silver Gardens is seen mainly in the middle depth zone. It is at this point that there are notable decreases in the number of species encountered on the transects, suggesting a possible change in the population composition of the reef building corals. Data shows that at each site the dominant hard coral was the Mountainous Star coral (*Montastria annularis*). Distinctions between the communities at each site can be made for comparison against the 1995 data in terms of the community structure. Using this analysis, Turtle Harbour shows only 1 fragile growth form (e.g. Ribbon coral) in the top 8 dominant species, as compared to 2.5 at Cabanas and 3.5 at Silver Gardens.



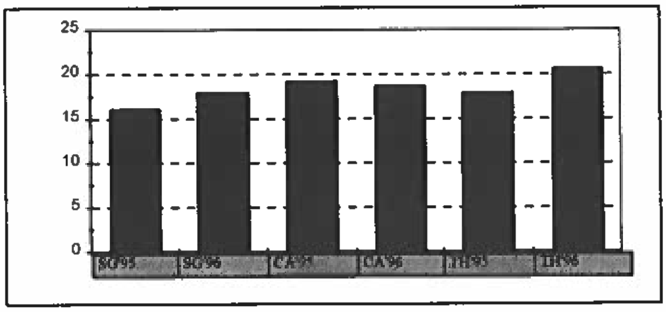
Graph 2.2.32 Comparison of live coral as a percentage of living substrate at Silver Gardens (SG), Cabanas (CA) and Turtle Harbour (TH) between 1995 and 1996.

In an overall analysis, graph 2.2.32 shows the proportion of hard coral as a substrate base has increased at both the Silver Gardens and Turtle Harbour study sites. Living substrate refers to that part of the reef composed of sedentary animal organisms such as live hard coral, gorgonians, zooanthids, anenomes etc. In some cases these data show considerable increases in the representation of the hard corals at baseline one for each site, and with considerable differences between the depth zones.



Graph 2.2.33. Comparison of gorgonian coral densities (No. per m²) between 1995 and 1996.

An increase (1995 - 1996) of gorgonian corals shown across the study sites except for baseline two at Cabanas. Silver Gardens shows an apparently large increase at baseline two since 1995 (see graph 2.2.33). Whilst the changes at all sites may not be statistically or ecologically significant, they do help to distinguish between the nature of the sites, for example Turtle Harbour has a higher density of gorgonian corals.



Graph 2.2.34. Comparison of average fish species encounter rates on 50 m belt transects between 1995 and 1996.

There is only a small difference in the species richness of fish across the three study sites shown in graph 2.2.34, with Turtle Harbour showing approximately 25% more species than Silver Gardens. There are however considerable differences in the community structure between the sites and the depth zones. Analysis at a species level will show community differences, and any possible changes in the balance of the food chain structure that measures of site and baseline diversity fail to identify. No significant differences are seen between the two baselines at any site in terms of species richness, but overall there are site differences with Turtle Harbour having the greatest value.

2.2.4 Discussion

These initial statistics serve mainly to describe some of the data collected on the baseline surveys. Patterns, trends and possible relationships identified at this stage must be treated with some trepidation, and certainly require the support of the more detailed analysis to come.

The '96 data at this stage is integrating well with the '95 data, and often patterns of an almost identical nature and scale are identified. Where pressures on the reef have not noticeably changed over the last year, the similarity between results is to be expected. This suggests that this first annual replication of surveys has been successful as a monitoring project.

The proportion of coral as a fraction of the total substrate, and the proportion of coral that is alive show no significant change between 1995 and 1996. Mean figures of approximately 20 - 30 % live coral cover are indicative of a relatively healthy reef community.

The decrease in the number of encountered species of hard corals may possibly be a reflection of decreasing diversity with increasing cover. If this is the case, it is showing a change in the balance of the community which may well be a direct result of a change or increase in pressures upon the reef. More time series data and species composition analysis will be performed to investigate the nature and proportion of any change. The apparent increase in coral cover and proportion of live coral at Silver Gardens and Cabanas may well be explained by further analysis at species level, especially when compared against the '95 data. There were proportionately more fragile growth forms of stony corals on the two south side sites than at Turtle Harbour. This could well be explained by a number of natural factors, or the possibility of external impacting factors. Any impact occurring on both massive as well as fragile growth forms such as physical damage and bleaching, will create an opportunity for the faster growing fragile species to increase their proportion in the community.

The density of gorgonian corals is taken from the data of the aggregated group of soft corals. This group does not contribute directly to the reef building and sustenance process, and are not commonly prioritised as a primary indicator of reef health. Similar patterns of distribution between sites and baselines as last year have been observed with some slight change in scale.

Differences in the balance of fish communities and trophic levels between sites are still awaiting analysis. As an initial observation there is no notable change from the previous years data, which still maintains the disproportionately low number of large predatory species such as Groupers and Snappers. Such larger species serve to keep the coral and algae grazing species in check, maintaining the overall balance of the biological and physical structure of the reef.

The phenomenon of "Coral Bleaching", or algal symbiont expulsion that occurred in late '95 initially appears to have had no significant effect on coral cover, although diversity may have been affected. Bleaching is not necessarily a fatal process, and depending upon the corals tolerance, recovery is related to the duration of the stress. Recovery in this instance generally seems to have been good, however it is possible that some species have experienced a poorer recovery than others.

2.3. Recommendations

The coral reefs around Utila are still some of the most pristine and beautiful in the Caribbean. That they have remained this way must be partly due to the success of the mooring buoys. Anchoring has had serious effects on many popular diving sites around the world, parts of the Red Sea for example. A policy of not anchoring directly on the reef should be continued. If it is absolutely necessary to anchor at a dive site, a snorkeler or diver could be sent down to lay the anchor behind a dead coral head tying it off with a rope to prevent dragging. The anchoring problem has been addressed at an early stage on Utila with the installation of the mooring buoys. The need to continue using the buoys can not be overemphasised enough. If funds allow, more bouys should be installed not only to reduce the need for anchoring but also to spread out the diving pressure. The continuing programme of installing buoys can only benefit Utila's reef and diving industry.

Project Utila strongly recomends that a buoy rotation system be initiated. This requires a chosen buoy to be removed for a period of say a year, effectively making that site a no-dive area. This would allow some time for the site to recover from any damage. The dive shops are in the best position to decide which sites are in greatest need of a period of regeneration. It can be seen from the dive school survey (page2) that the majority of the diving around Utila occurs at relatively few sites. Clearly these popular sites would benefit most from a period of recovery.

Education is central to reef conservation. The dive shops or more specifically instructors and divemasters are in the best position to put across the conservation message, both in the classroom and on the dive boat. All divers visiting Utila should be informed that touching coral polyps and kicking up sediment is damaging to the reef. The use of gloves while diving should be discouraged and the importance of good buoyancy skills must be emphasised to new and experienced divers alike. We recommend that all training is carried out at sites that have large sandy patches and that pristine sites are saved for more advanced divers.

Finally, we recommend that monitoring of the state of Utila's reef is continued. Project Utila wishes to return to repeat the baseline surveys thus observing changes to the reef as they occur. In this way any decline in the health of the reef would be noticed at an early stage allowing steps to be made to prevent further damage.

Section 3

MARINE PROTECTED AREAS (MPA's)

3.1 Introduction

This part of the report is concerned with two areas around Utila: Turtle Harbour, a large, sheltered bay fringed by mangroves situated on the north side of the island; and Raggedy Cay, a tiny island off the west end of Utila. Turtle Harbour is already a designated marine protected area (MPA). Raggedy Cay is protected as a pelican nesting site and the waters surrounding are a proposed MPA. Geographically they are well situated, both being far enough away from any human settlement so as to avoid the more immediate effects of sewage and pollution.
MPA's are areas considered to be of biological importance and are therefore protected by legislation. The legislation may protect the area from various impacts such as overharvesting of fishery species, developement and diving pressure.

The very nature of the oceans - water - makes for a loss of definition between areas; therefore impacts in one area can easily affect other areas. The establishment of a number of small MPA's throughout a larger area guards against the effects of localised catastrophes and encourages the regeneration of dwindling populations, thus acting as a resource for other areas.

The suitability of an area as an MPA is dependent on its biological quality and its function within the overall ecosystem. MPA's should contain communities typical to that region rather than merely protecting rare habitats or aesthetic areas alone. Biological aspects are not the only considerations when choosing an MPA, equally important are the social implications, an MPA will only work if it has the support of the local community. A "Multiple Use MPA" as the name suggests does not need to exclude human activities, even fishing, from an area. It does however require a consensus within the local community for the practical management of the resource.

The 1995 assessments of Raggedy Cay and Turtle Harbour suggested these were suitable areas for further legislative protection as they both fulfil the criteria outlined above. A number of surveys were carried out by Project Utila-96 at both sites. A biomapping exercise was carried out to detail and graphically represent the underwater substrates and habitats of Raggedy Cay and part of Turtle Harbour. "Random swim" fish census assessments were performed to estimate the fish populations of Turtle Harbour. And surveys to assess the densities of two major fishery species, conch and lobster were undertaken. The objectives of the marine reserve surveys were to provide qualitative and quantitative data for comparison between them and non protected areas. These are the initial stages of what should be an on-going monitoring programme strengthening the case for protective legislation by confirming the conservation value of the two areas.

3.2 Biomapping

One of the principal goals of this year's expedition was the biomapping of the present and proposed marine reserves of Turtle Harbour and Raggedy Cay. This essentially involved making a detailed survey of the sub-aquatic substrate i.e. the sea floor. Previously no such information existed about these areas, hindering the design of appropriate management strategies. In conjunction with the mapping work, data were also gathered concerning fish species present in certain biotopes and the population densities of conch and lobster - the details of which are explained later in this section. Combining this material not only gives a objective account of the existing fauna and flora but should also help to identify particular zones of interest for future monitoring.

As there is no specific approach for the detailed biomapping of such large areas, Project Utila developed it's own procedure. After many discussions and a certain amount of trial and error, a workable methodolgy was achieved. All the possibilities would have been impractical if diving was necessary. Fortunately the areas to be surveyed were covered in no more than 10m (and usually considerably less) of water, allowing the work to be accomplished by snorklers alone. The production of maps that completely covered the target areas was well beyond the Project's capacity. The chosen method only required the mapping of substrates covered by regularly spaced 5m belt transects. These belts originated from a central point i.e. the permanent bouy attached near the middle of the reef in Turtle Harbour and from a wooden pole erected on Raggedy Cay. From these points the transects followed compass bearings at 10° intervals and ran for 200m each. In practice this involved teams of four members, one took notes of the predominant substrate within the belt, two handled a 50m rope and temporary bouys and the forth controlled the direction that the snorklers were swimming by signalling to them from the starting point. The latter job, which employed colourful flags and some home spun semaphore, attracted considerable attention from fishermen and divers alike.

As the data was to be presented in graphical form, detailed maps of the areas were needed, these could have been enlarged and the biomapping results overlaid. However no such maps were to be found leaving it up to us to create our own. This was accomplished by renting a four seater Cesna aeroplane and taking aerial shots of the two reserves. Not only did this produce the necessary outlines for the maps but also a great deal of additional information on substrate distribution and topography.

Generally the system described above worked remarkably well with a wealth of qualitative material collected. The substrates were divided into a total of 13 categories such as: sand, rubble, hard coral reef (to species level where appropriate), thin or thick soft coral garden, sea grass etc. These were then colour coded and drawn onto the maps. The finished biomaps clearly presented the data with the illustrated transects radiating in a fan like manner from their central points. The original biomaps have been donated to BICA to be displayed in the visitors centre on Utila.

Disappointingly Turtle Harbour was just too big to map entirely, being approximately 1km by 1/2km in size; the attempt was called off after a week of intensive labour. Raggedy Cay was a much more manageable task which was successfully completed.

3.3 Fish Census In Turtle Harbour

To estimate the fish populations of Turtle Harbour, "random swim" fish census assessments were performed over each of the different habitats. The habitats were classified as follows : Hard Coral Reef Crest; Inner Reef; Soft Coral Garden and Sea Grass.

The method required the observer to swim randomly through the specified habitat for fifty minutes. The survey period was subdivided into five 10 minute segments in which all fish species seen in that segment were recorded. Five random swims were carried out in each habitat. The method relied on the assumption that rarer fish were less likely to be seen and that on average they would be seen later on in the survey - the more abundant fish would generally be seen sooner. As well as creating a species inventory of all of the species observed at the site, it created a qualitative guide as to relative species abundance of each habitat.

The complete set of results includes an inventory of over one hundred species of fish. To avoid the inclusion of such a long list, an average number of species found during each random swim, for each of the four habitats is shown below (see Table 1). The complete species lists will be included in the final report.

Habitat	Average Number Of Species
Sea Grass	12.40
Soft Coral Garden	34.00
Hard Coral Reef Crest	36.75
Inner Reef	39.00

Table 1. Average number of species of fish found in four habitats at Turtle Harbour.

Fewest species were recorded in the sea grass habitat. In general, the number of ecological niches is greater in reef habitats than in seagrass habitats. The reef ecosystem is complex due to the high diversity of coral species with varying biological and physical characteristics. High levels of habitat variation can occur over short distances, making it possible to accomodate a large number of species in a small area . In comparison, the sea grass habitat is relatively uniform over larger areas with less habitat variation. It is important to add that some reef dwelling fish migrate to sea grass habitats at night to feed and these fish will not have been present in the habitat at the time of the surveys. Sea grass habitats provide a nursery area for many species of juvenile fish. Juveniles are more difficult to observe and identify than adult fish and consequently may not be fairly represented in the results.

The difference in numbers of species recorded, between the three reef habitats was small. However, further analysis may show differences in the individual species that make up the communities within each habitat.

3.4 Assessment Of Queen Conch Densities

3.4.1 Introduction

The queen conch *(Strombus gigas)* is a marine mollusc, easily recognised as a species of snail with distinct shell shape and colouration - it is large relative to other marine snails with a short conical spire that has blunted spikes. Areas of sea grass act as a food source for queen conch and are therefore a favoured habitat. Large aggregations of individuals can sometimes be found.

Throughout its range in the Caribbean, a general picture of decline has been recorded which can be attributed to over exploitation by man. The queen conch is valued for its meat and to a lesser extent for its shell which can be used for jewellery and artefacts.

The ecological significance of conch as an important part of the food chain is rarely considered by those that seek to exploit it. Various species of fish, lobster & crab feed on small conch. Larger individuals are susceptible to predation by Octopus, stingrays and turtles. Although difficult to measure, it can be predicted that a decrease in this important food source affects the balance in numbers of other species, to the detriment of those that depend upon it most.

The dramatic decline that has been witnessed over the last 20 years is considered to be a direct result of increased efficiency in transportation using freezer technology which has widened the market threshold. An increase in local human populations throughout the Caribbean, mainly in response to a growth in the tourism industry has provided a greater demand for conch meat. Utila is no exception - in recent years, a flourishing tourist trade has placed greater pressures upon the local conch population.

As a result of reduced populations throughout the Caribbean, the queen conch has been placed on appendix II for the Convention of International Trade for Endangered Species (CITES). This means that suitable management through conservation and enhancement of stocks is needed to prevent the queen conch from becoming endangered, at the same time maintaining the interests of the commercial industry. In theory, licences for exportation are issued to members of the convention who have implemented a management strategy. Honduras (present member of CITES), according to estimates has extracted 2173 tonnes of Queen Conch meat from 1990-1994.

3.4.2 Aims

Conch have not been studied before in the waters surrounding Utila, basic data being required that can be built upon in further studies.

The primary aim of this study was to determine population densities of queen conch in the defined areas of Turtle Harbour (marine protected area) & Raggedy Cay (proposed marine protected area) to provide an indication of whether the status of these areas is effective. Measurements were taken from the shells of live conch to provide an estimate of abundances of juvenile, immature and adult conch within local populations.

Other conch species and their associated densities were also counted to provide an insight into the species diversities of the two areas.

3.4.3 Methodology

Using randomely chosen starting points, conch were counted within belt transects of 50m length and 4m width. With 9 people it was possible to cover 7200m^2 in one day,.

3.4.4 Results

Species	Turtle Harbour	Raggedy Cay
Queen conch	1 per 1080m2	1 per 1200m2

Table 1. Density values of queen conch at Turtle Harbour and Raggedy Cay.

The results collected for queen conch indicate no significant difference in the population densites between Turtle Harbour and Raggedy Cay. Other species of conch were noticed within transects at Raggedy Cay but reliable identification at the time could not be made to species level. They were believed to be the milk conch *(Strombus costatus)* and the florida horse conch *(Pleuroploca gigantea*). Subsequent studies in future years may provide more positive identifications. At Turtle Harbour only Queen conch were observed within transects but congregations of milk conch have been observed on sandy patches in the vicinity of patch reefs.

It is hoped that recorded sizes of individual conch can give an estimate of age. Length and width data requires further analysis to provide an indication of age structure that may be included in the final report.

3.4.5 Discussion

The results were produced from intensive searches over a relatively large area of turtle grass - 21600m^2 of sea grass were covered at Turtle Harbour and 7200m^2 at Raggedy Cay. The density values were much lower than what would be expected for natural, unexploited population densities. The similarly low results between the two survey areas suggests that queen conch are now so spread out that not enoughof them can be removed any more to significantly reduce densities.

Survey work was limited to 4 days at the end of August, measurement of fluctuations throughout the year not being possible. The greatest change would probably be through the close season which exists through the months of April, May and June. Within this period it is possible that queen conch migrate up from deeper water to replenish stocks. Reports from local fishermen have suggested that large catches of queen conch have been made in the first few weeks of the new season. Similar density studies at the beginning and end of the close season should provide an interesting comparison of results.

Anecdotal evidence strongly suggests that the density values are lower than expected due to overfishing - a number of suggested recommendations could be carried out either through enforcement or raising awareness amongst the local fishermen:

- **Reduce capture of immature queen conch** - full size is not attained until 3 years of age when a thin outer lip is evident. A thickening of this lip normaly indicates sexual maturity. At present, conch are considered acceptable market size at 2.5 years of age which prevents many conch reproducing

- **Restriction on scuba diving** - in exploited areas conch populations often find sanctuary in deeper water. It is essential that these populations are not over exploited using scuba diving to remove them since they may contribute to stocks in shallower areas. It should also be recognised that without suitable training, deep diving can be a dangerous occupation.

- **Marine protected areas (MPA)** - It is proposed that Raggedy cay is made a no take zone, which is a successful method of stock management provided that certain criteria are met. The chosen areas need to be sufficiently large to support local populations of conch that can contribute to the surrounding area. The status of these areas requires enforcement by patrol boats and the support of the local fishermen who need to have an understanding of why no take zones are important.

3.5 Assessment Of Spiny Lobster Densites

3.5.1 Introduction

There are two different species of spiny lobster, the caribbean *(Panulirus argus)* and the spotted *(Panulirus guttatus)*. Both are characterised by a thick carapace for protection and two long antennae. They are easily distinguishable:- the caribbean lobster is brown with a few light spots compared to the spotted lobster which is smaller and is covered with numerous white spots. During the day spiny lobsters commonly hide in protective recesses provided by the reef, their exposed antennae often giving their presence away.

The spiny lobster is an important part of the food web both as a food source and as a consumer. It has numerous predators including octopus, groupers, trigger fish, nurse sharks and stingrays. In turn lobsters feed upon worms, crabs, shrimp, snails, clams, sea eggs of various urchins, sponges and dead fish..

Throughout the Caribbean a general decline in lobster populations has been documented for reasons that apply to other marine resources such as the queen conch. Increasing human populations have created a greater demand for lobster as a food source.

3.5.2 Aims

Studies of lobsters have not been made before in the waters surrounding Utila. The aim of this study was to measure densities of lobster, the results giving an indication of the state of lobster populations.

The selected sites of Turtle Harbour and Raggedy cay were surveyed, the aims following those of the queen conch survey. The presence of other species were also recorded to give an indication of species diversities in the two areas.

3.5.3 Methodology

Thorough searches within belt transects of 50m length and 4m width were used to count lobsters, mainly along the reef crest and also soft coral garden.

3.5.4 Results

Species	Turtle Harbour	Raggedy Cay
Caribbean	1 per 800m2	0
Spiny	1 per 1200m2	1 per 600m2
Spanish	1 per 2400m2	0
Copper	1 per 2400m2	0

Table 1. Density values for lobsters at Turtle Harbour and Raggedy Cay.

3.5.5 Discussion

Results for the number of lobsters were taken from surveyed areas that were considered to be a favoured habitat of lobsters. The areas were searched as thoroughly as possible but it has been recognised that not all lobsters could be found. The results represent the numbers found rather than the actual number of lobsters present, the data being useful for comparison in future years. However, the density values for caribbean and spotted lobster were still lower than what would be expected for natural populations. This is most probably due to overfishing for reasons similar to the queen conch. Results could have been made more represenative by a larger area being covered at the survey sites of Turtle Harbour and Raggedy Cay.

The low density values for the spanish and copper lobster reflects their generally lower abundance than the spiny lobster throughout the Caribbean. Also, the copper lobster prefers to inhabit deep under water caves.

A number of recommendations can be made using enforcement and raising awareness amongst local fishermen. These recommendations may be elaborated upon in future years with further studies:-

- **Reduce removal of immature lobsters -** spiny lobsters need to reach spawning age if they can have any chance of contributing towards future populations. Individuals attain sexual maturity at 3-5 years of age, normaly indicated by a back length (from horns to beginning of tail) of at least 9cm.

- **Maintain & enforce close season -** Spawning occurs within the close season of April, May and June when females can be observed carrying bright orange to dark brown eggs on the underside of their tail.

- **Marine protected areas** - Following the criteria set out in the conch recommendations, no take zones at Turtle Harbour and Raggedy Cay would contribute to stocks in surrounding areas.

3.6 Black Band Disease

Black band disease was first described in 1973, when it was found infecting hard corals on Belizian reefs. It has since been found throughout the Caribbean region and Indo-Pacific. It affects mainly hard corals but has also been noted on milleparinids (fire corals) and gorgonaceans (soft corals).

Black band disease is caused by the cyanobacterium ("blue-green algae"), *Phormidium corallyticum*. After primary infection by *Phromidium corallyticum*, other opportunist pathogenic microorganisms may also invade the colony. Infection results in the appearance of a distinct black to dark brown algal band encircling an area of dead coral. Coral polyps are killed as the band advances, digesting the coral and leaving only the white limestone skeleton behind. The coral colony does not always die. Some regrowth can occur over dead areas of coral.

Black band disease on reefs around Utila has never been investigated.

The aim of this study was to map an area of reef, noting the location of healthy and diseased hard coral in order to :

- calculate the percentage of coral colonies affected by black band disease in that area;
- discover which species of coral are affected by black band disease in that area;
- illustrate the spatial distribution of the disease;
- establish a study area and methodology that can be used as a basis for a more detailed study of black band disease in 1997.

The study site was chosen as it was an area where several cases of black band disease had been noted. An infected colony of *Diplora strigosa* (smooth brain coral) was chosen as the central point of a 20m x 20m quadrat. An area of this size was considered to be the maximum that could be studied in the time available. The site was surveyed by divers using $1m^2$ quadrats positioned successively over the entire area of the study site. A detailed map of the substrate within each $1m^2$ quadrat was drawn onto a slate, marking species of coral and noting any signs of disease or coral bleaching. Four hundred individual quadrats were surveyed, and the information collated to produce a map of the site.

Section 4

FLUCTUATING ASYMMETRY

This year a new approach to assessing differences between baselines, depth zones and sites was attempted. This involved measuring the level of symmetry or in fact, the level of asymmetry, of the individual corallites that make up some colonies. The level of asymmetry in a naturally symmetrical organism is thought to give an indication of the environmental stress the organism is subject to. This is quite a recent theory which is still being researched. We are confident that the hypothesis has not yet been tested on corallites so providing Project Utila with the opportunity to assay this new application.

Not all corals are suitable for this kind of analysis as the corallites have to possess a generally symmetrical morphology. An ideal species due to its abundance and clear corallites is mountainous star (*Montastraea annularis*). Mountainous star corallites are radially symmetrical i.e. their symmetry is similar to a flower such as a daisy. The level of asymmetry is calculated by measuring the angles between septa (the calcareous structures that produce the 'star' shape). Mountainous star corallites are segmented into six basic sections. The angle between two neighbouring segments should be 60^o, therefore any deviation from 60^o is an indication of asymmetry.

The samples were selected by swimming along randomly chosen line transects until a colony was encountered. The transects originated from the permanent baselines and nine samples were photographed in each depth zone at each baseline. Accomplishing this work on very small corallites while SCUBA diving was impossible and the removal of live colonies undesirable. Instead, one to one scale photographs of the corallites were taken on transparency film using close up camera equipment.

The slides will be projected (and therefore enlarged) onto a screen where the appropriate readings can easily and accurately be made. The data collected will be statistically analysed to remove the effect of natural variation in asymmetry. This enables any significant differences between samples to be identified.

Section 5

EDUCATIONAL WORK

One of the aims of Project Utila was to teach some basic ecology and marine biology to the island's children. The children were fourth, fifth, and sixth graders at Utila Public School. All members of the team were involved in these activities which took place over three monday mornings. The first week was spent teaching the concept of food webs and fundamental reef ecology. This involved a combination of talks, question and answer sessions, work sheets, and games. The second week the subject was the adaptation of plants and animals to their terrestrial and marine environment. This had the children thinking about the adaptations that were required for living organisms in and around Utila. The children designed their own animals to suit a range of different surroundings. Again this lesson involved individual and group work, games and discussion. The third morning's theme was conservation. A talk and discussion session was followed by the fifth and six graders designing and painting a marine mural based on the ecology they had been learning about. Their creative and artistic talent resulted in a colourful mural on a wall next to the main dock. Utila's visitors will now be greeted by a vibrant underwater seascape as they arrive on the island.

Unfortunately time constraints meant that we were unable to approach the remaining schools on the island. Project Utila intends to continue and expand its commitment to teaching when it returns in 1997. We wish to thank Tomoas Garcia, the school's director, for allowing us into the classrooms. Special thanks to the students for their enthusiasm and to Phyla Borden for allowing the children to use her wall for their mural.

Appendix

PROJECT UTILA - 96 UK PERSONNEL

Project Utila had eight full time team members who are all experienced divers . Everyone was involved in all the various studies. Each member also took responsibility for a particular aspect of the work .

Jeremy Milne - 32. Ecology graduate from Edinburgh University. Jeremy was an original member of Project Utila '95 and has also done under water survey work as a volunteer for Seasearch. He was responsible for leading the project and is editor and statistician for the final report. He organised the Honduran students participation in the project and liaised with Carlos Cerrato of the Universidad Nacional Autonoma de Honduras .

Peter Todd - 29. Second year ecology student at the University of North London. As an experienced carpenter and builder he organised the provision and making of the equipment for the project. As well as acting as project treasurer on Utila he co-ordinated the biomapping exercise and the production of the maps of Turtle Harbour and Raggedy Cay. The fluctuating asymmetry coral study was conceived by Peter. His experience teaching children in Taiwan was invaluable for the work done in the school.

James Guest - 25. First year marine biology student at Newcastle University. He has conducted coastal surveys in Sussex for Seasearch and was a volunteer for Coral Cay Conservation in Belize. James is diving officer at his university and has extensive diving experience around the Caribbean. He was responsible for Project Utila's diving practice, safety and scheduling. An accomplished photographer, he produced an underwater photographic record of the expedition. The photography was also necessary to the fluctuating asymmetry study.

Alison Pink - 30. Second year biochemistry and ecology student at the University of North London. As Registered General Nurse with a course in tropical nursing from the London School of Tropical Medicine and Diseases, she was responsible for the health and safety of the project. This included comprehensive first aid training for all team members. Alison has done previous underwater survey work as a volunteer for Coral Cay Conservation and was also a member of an Operation Raleigh expedition. She was involved in the planning of the black band disease monitoring programme and the production of the map illustrating the data.

Katharine Woods - 20. First year marine biology student at Newcastle University. Katharine has previous training in underwater survey work with Coral Cay Conservation and terrestrial work in New Zealand for the Department of Conservation. She organised the collection and analysis of data from the dive schools on Utila, popularly known as "that girl with the dive forms"! She was involved in the planning and implementation of the black band disease study and map production.

James Hunt - 21. Second year ecology student at Edinburgh University. James' previous experience of underwater survey experience was with Coral Cay Conservation. He acted as treasurer in Britain. On Utila he was responsible for the conch and lobster methodologies and their execution in the field.

Chico Birrell - 21
Second year ecology student at Edinburgh University. As a fluent Spanish speaker Chico played the vital role of translator. He initiated the black band investigation and identified several cases of black band disease in a preliminary study.

Adam Mellor - 21
Graduate in marine biology at Newcastle University. An original member of Project Utila '95, he is involved with ongoing research into the establishment and management of marine protected areas. He undertook the initial statistical analysis of the data collected over the eleven weeks and will be involved with the more extensive analysis for the final report .

VOLUNTEER PERSONNEL.

Project Utila was fortunate to be joined by a total of six graduate volunteers with diving experience.

Clare Bradshaw.
A phD student in ecology from Edinburgh University. Clare joined the project for two weeks, she offered advise and expertise in the discussions concerning methodology, and actively participated in the collection of data on soft coral and physical substrate.

Elizabeth Keenan and Jennifer Marland.
Elizabeth and Jennifer are graduates in biology from the University of Vermont and Duke University, with experience of fieldwork in Kenya. They joined the project for a total of six weeks. They were involved with all aspects of the work done in this time, this included underwater survey work, the conch and lobster study, biomapping, and the black band disease investigation. Their Spanish skills were used to the full in the classroom.

Katrina Beedia and Sarah Helyar
Katrina and Sarah are graduates in ecology from Edinburgh University. They both have experience of field work in Africa. Participating in the project for four weeks they were involved with the conch and lobster work, biomapping, and the black band disease study. Having had experience of working with children they were also involved in the teaching .

Katherine Bennett
Katherine is a biology teacher in England. During her visit she planned the lessons and games that were used in the school. She also offered excellent advise on how to go about the teaching !

HONDURAN PERSONNEL

Gilda Ordonez, Ana Lucia Ochoa, Miriam Chantal Rodriguez, Calina Zapada and Marilena Rodriguez.
Five biology undergraduates from the Universidad Nacional Autonoma de Honduras joined the project for three weeks. They comprised most of the biomapping team working at Raggedy Cay and Turtle Harbour. Other work included collecting data for the random swim fish census.

Carlos Palmese, Marvin Martinez, David Juen, Emelia Urrea, Lola and Ester Lopez.
Undergraduate biologists from the Universidad Nacional Autonoma de Honduras they became involved with the project for a week, biomapping both at Turtle Harbour and Raggedy Cay.