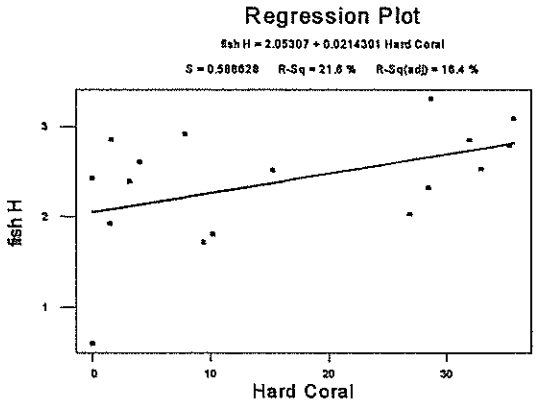
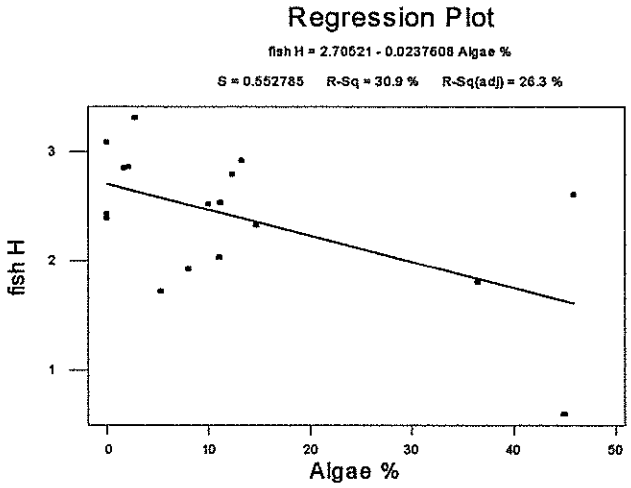
a) Correlations: Fish H, Hard Coral %

Pearson correlation of fish H and Hard Coral = 0.465
P-Value = 0.060



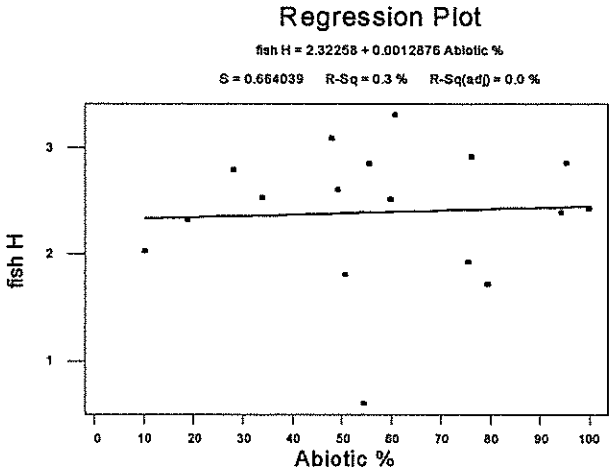
b) Correlations: Fish H, Algae %

Pearson correlation of fish H and Algae % = -0.556
P-Value = 0.021



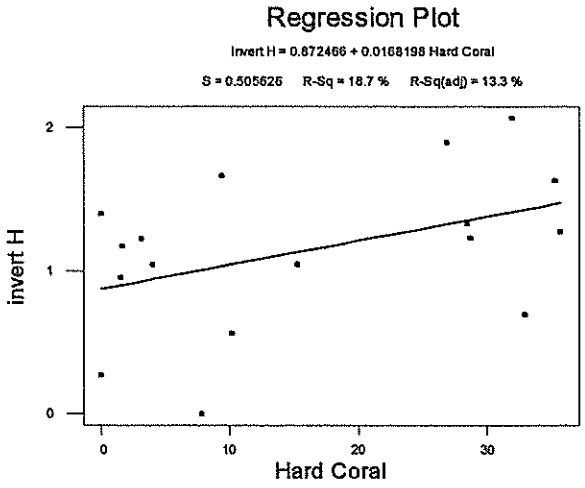
c) Correlations: fish H, Abiotic %

Pearson correlation of fish H and Abiotic % = 0.053
P-Value = 0.841



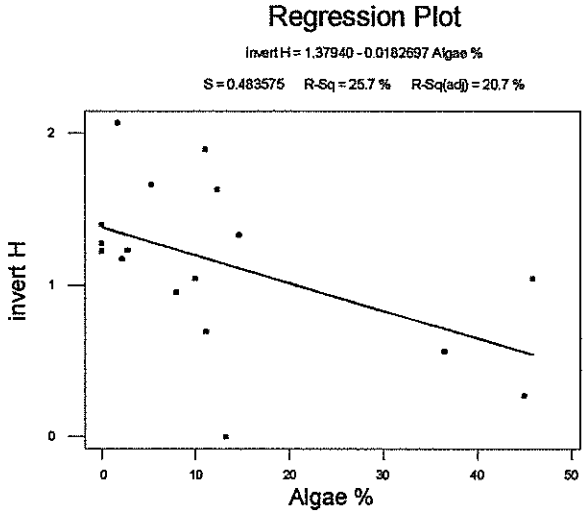
d) Correlations: invert H, Hard Coral

Pearson correlation of invert H and Hard Coral = 0.433
P-Value = 0.083



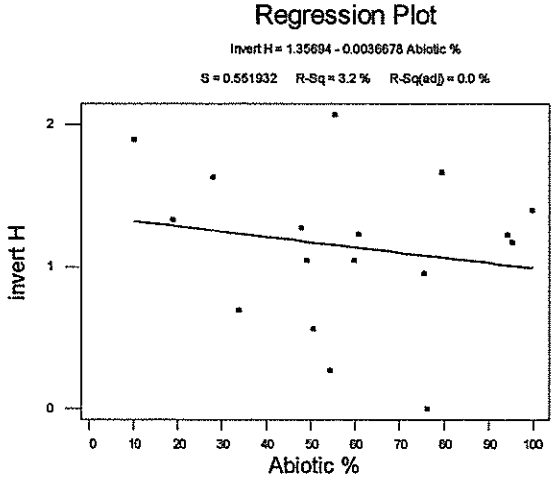
e) Correlations: invert H, Algae %

Pearson correlation of invert H and Algae % = -0.507
P-Value = 0.038



f) Correlations: invert H, Abiotic %

Pearson correlation of invert H and Abiotic % = -0.178
P-Value = 0.494



DISCUSSION (II)

Line Intercept Transects (Fig. 13 & 14): As our reconnaissance work had 'predicted', the unhealthiest reefs appear to be those at Nosy Fasy (49.33% - 95.5% abiotic cover complemented by 0%-45.92% algae) and the east coast of Nosy Hao (100% abiotic). On the northern face of Nosy Fasy OUCARE noted small outgrowths of new coral (3%), including some *Acropora* species, which gives hope despite the presence of numerous "recently bleached" bommie formations (La Trobe-Bateman 2003). The LIT results show north Nosy Hao to have the highest level of hard coral cover (32.92% and 2.83% *Acropora*), followed by the south, west then north reefs of Nosy Andrahombava. Generally as the hard coral percentage decreases, the algae coverage increases, asphyxiating the hard coral skeleons (frequently observed in the algae-dominated reefs of east and west Nosy Fasy and south Récif Parson).

Belt Transects - Fish: Generally the results for fish abundance and species number per site seem closely correlated (Fig. 15 & 16). The abundance and variety of fish at Nosy Fasy appears surprising given the poor health of its reefs (Fig. 13). Indicator species are discussed below, but just looking at the raw data illustrated by Figures 15 and 16 (and LIT results above), there seems to be considerable variation between the different sides of the offshore islands, with the east facing reefs (closest to the mainland) generally appearing less healthy than the west.

The indictor species encountered in survey work are outlined in Figures 17 & 18. The highest frequencies of species indicative of fishing pressure, namely the Thumbprint Emperor (*Lethrinus harak*), were recorded at Baie de Fanemotra and west Nosy Hao. This implies that all other sites surveyed are victims of high fishing pressure. However, it would probably be better to collect more data before making such a sweeping statement. A pattern seems to emerge with indictors of healthy reefs always appearing in higher numbers on the west face than the east at all sites apart from Récif Parson. At the west coast of Nosy Andrahombava, the herbivorous convict surgeonfish (*Acanthurus triostegus*) clearly dominates the selection, and high numbers of the Blue-Green Chromis (*Chromis* viridis) were recorded at the south face of Nosy Fasy. South Nosy Fasy is particularly close to north Nosy Hao (site with the healthiest reefs, OUCARE 2003) so as previously suggested, high numbers of 'healthy reef' indictor species at Nosy Fasy could just be 'visits' from Nosy Hao residents. Other possibilities are discussed below.

Large numbers of herbivorous indicator species on a healthy reef signify that it is well balanced, as they will feed on the competing algaes. In areas where herbivores are few (either due to fishing pressures or other events) and / or nutrient pollution high (a problem mainly associated with river estuary runoff, Johnstone *et al.* 1998), algaes can dominate the reef and aid in its deterioration. However, in situations where the reef is completely degraded but supports a high level of algae cover (such as the west and east faces of Nosy Fasy) herbivores tend to throng in high densities, which may also explain the prevalence seen at south Nosy Fasy. Indicator species do not provide an infallible means to assess the health of a reef. General observations and LIT data are vital to understanding the full picture. That said, corallivorous Butterflyfish species (Chaetodontidae) are fairly well established as bio-indicators of healthy reefs and low human disturbance (Öhman *et al.* 1998), and were encountered in the highest abundance at Baie de Fanemotra, north and south Nosy Andrahombava, and north Nosy Hao (Fig.15). It is later concluded (separately from these particular figures) that these four sites are the healthiest reefs surveyed in the whole project.

At badly impacted reefs, where fish abundance and the species encountered do not appear to reflect their habitat's health (such as the relatively high numbers of *Chaetodon trifasciatus* at north Récif Parson), it is worth noting that in the short term, reef fish seem to be very resilient to changes in the benthic substrate cover (Sheppard *et al.* 2002). Therefore, if the deterioration in living coral cover had occurred recently, as it may well have done around Andavadoaka (see below), the subsequent effects on fish population structure may not be immediately apparent.

Belt Transects and Quadrats – Invertebrates: The different sampling methods used by EUCARE and OUCARE has been discussed, and resulted in difficulties when comparing data. Important species to mention include the Crown-of-Thorns Starfish (*Acanthaster plancii*) seen at the north face of Nosy Fasy.

Data Analysis: (i) The **Shannon Index of Biodiversity (H)** and **Shannon Evenness Measure (J)** were calculated for fish and invertebrate species encountered at all sites (Magurran, 2004). As a general 'rule of thumb', the higher these values are, the 'more diverse' the site. The values ranged from H=0 (where a single *Chromodoris elizabethina* was encountered at south Nosy Hao [16]) to H=3.3109 for the fish at Baie de Fanemotra [1&3], and J=0 (again at site 16) to J=1 for invertebrates at west Nosy Andrahombava [18].

Despite the different methodologies used for invertebrate sampling (see Methods section), raw data was not transformed in any way, and all values were treated the same throughout analyses. In hindsight, this method of analysis was perhaps too crude and biased to produce truly comparable results. However, the majority of surveys (4-19) were carried out using OUCARE's methodology, so I simply highlighted those carried out by EUCARE and kept them in mind when drawing conclusions.

Where replicate surveys were completed at Baie de Fanemotra (1&3) and south Récif Parson (5&8) the individual H and J values were worked out before calculating the means of these values.

According to Figure 19, apart from one 'anomalously high' H value for south Nosy Andrahombava, the four islands follow the pattern of N>S>W>E in terms of decreasing fish diversity. However, the evenness measures (which deems maximum diversity [H_{max}] to be a situation where all species have equal abundance), as shown in Figure 20, do not follow the same pattern, implying inequitability of results from some of the more 'diverse' fish surveys of Figure 19. Invertebrate diversity and evenness (Fig. 21 & 22 respectively) do not seem to follow any particular pattern in relation to site location, apart from higher H & J scores on the west face than the east face of Nosy Fasy, and at Récif Parson, though J at east and west Récif Parson are basically equal. The high H and low J values for invertebrates at north Nosy Andrahombava could be a result of our differing methodologies, as it basically implies lots of species occurring in unequal abundances, which is quite a probable outcome if the quadrat was to fall on a exceptionally diverse patch of benthos. Also, by concentrating on just 9 quadrats in the whole transect, there is likely to be more species perceived than surveys employing 2m wide belt transects along 3x20m sections (a total surface area of $9m^2$ vs. $120m^2$). My reasoning for this suggestion is that invertebrates are often small and inconspicuous, making it difficult to spot and identify all those present on larger surface areas, especially with the time constraints posed by air supply and dive tables.

(ii) Considering variables separately is not the most informative method of analysis, especially in this situation where data is relatively scarce and surveying methodology less than optimal. For this reason I made a (still relatively crude) **ranking table** of 'healthy' features such as fish and invertebrate H & J and % living coral cover; and 'unhealthy' factors including abiotic and algae cover taken from the LIT results. This data is displayed in Table 9, where the highest scores (maximum = 17) correspond to the 'healthiest reef feature'. Table 10 shows the summing of the healthy and unhealthy scores to produce an overall rank of healthiness per site surveyed. This designates east Nosy Fasy as the unhealthiest reef (rank 1) and north Nosy Hao the healthiest (rank 17). The different scores for the four islands are illustrated graphically in Figure 23, and are organised into order of increasing 'overall healthiness' (produced by the average of the four faces), with Nosy Fasy < Récif Parson < Nosy Hao < Nosy Andrahombava.

If one were to analyse only the pooled data from the five 'areas' surveyed, i.e. the four islands plus Baie de Fanemotra, Baie de Fanemotra [1&3] is actually ranked as the healthiest, despite lower living coral cover than both

north Nosy Hao [14] and south Nosy Andrahombava [19]. This is due to the low scores from the unhealthy sides (south and east Nosy Hao / east and west Nosy Andrahombava) bringing the average down. Figure 23 reflects the pattern seen earlier in fish diversity scores (Fig. 19), whereby the east facing side (closest to the mainland) of the island is less healthy than the west facing side. This could be due to a number of factors leading to shifts in reef ecology and health, such as fishing pressures (e.g. the fishing of herbivores resulting in algae dominance), sedimentation or low salinity from mainland river estuaries, or the fact that the west face is most exposed to wave action, and when not too severe (such as in heavy storms), wave action is vital for coral survival by supplying nutrients and washing away sediment. Future research involving our data would benefit greatly from a split-plot test to statistically analyse the differences between variables affecting reef health on the four faces of the islands.

(iii) The Pearson Correlations calculated for different variables were generally insignificant at the 95% confidence interval ($P<0.05$). The correlation analysis of fish diversity (H) with hard coral % was insignificant ($P=0.06$) but showed a 'moderate' positive relationship (Pearson correlation = 0.465), which is the pattern you would expect. Perhaps with more data a significant relationship could be established. Fish diversity and invertebrate diversity showed a significant negative correlation with algae cover ($P=0.021$ and 0.038 respectively). The Pearson correlation values are –0.556 and –0.507 respectively, showing a moderately strong relationship: as fish diversity (and therefore probably herbivore number) decreases, perhaps due to fishing pressures, algae cover increases. The moderate correlation implies other factors are also involved. For both fish and invertebrate diversity, correlation with abiotic cover was weak and insignificant ($P=0.841$ and 0.494 respectively), though perhaps this is a result of pooling together too many substrates (abiotic includes dead coral old & recent, sand, rock, rubble etc), and a stronger correlation might be shown between diversity scores and old dead coral (DCO) cover.

CONCLUSIONS

- On the whole, the reefs surveyed were badly degraded with live hard coral (Order *Scleractinia*) cover consistently below 40%. The dominating substrate was abiotic or algae. Deteriorated hard corals were often asphyxiated by competing algae populations, particularly in shallower reefs such as those around the south and east faces of Nosy Fasy and the inner reefs of Ankareo.
- The healthiest site, concluded by OUCARE and our analyses, was north Nosy Hao, where it was observed that the hard coral forms were also larger and of higher structural complexity (La Trobe-Bateman, 2003).
- Observations made in December 2002 when Tom Savage of Blue Ventures Conservation carried out a reconnaissance trip to Andavadoaka implied that the coral around Andavadoaka was less damaged at this point in time. Therefore degradation must have been rapid.
- It is likely that the high level of coral mortality seen July – September 2003 was a consequence of recent bleaching events. Various environmental stresses can induce coral bleaching, such as changes in water temperature and/or salinity, exposure at extreme low tides, and exposure to strong radiation such as when the water is calm and clear and the sun is strong. Once dead, bacteria and fast-growing algae dominate the coral skeletons, and a succession of opportunistic organisms may ensue. Algae can potentially prevent re-establishment of the original coral. Unless there is a significant recovery of reef-building corals, the erosion of exposed coral skeletons by grazing herbivores (see indictor species) and internal borers (sponges, polychaetes) will accelerate, and can result in a physical breakdown of the reef structure (Westmacott 2000; Sheppard *et al.* 2002).

Fig.24 Bleached Soft coral on the west face of Nosy Fasy (photo courtesy of OUCARE 2003)

- The coral bleaching around Andavadoaka appears to be the result of elevated water temperatures, with reports that the southwest reefs were badly impacted by the El Niño events of 1998 (Wilkinson 2002; cited in OUCARE report 2003), and also in 2001 and 2002 (Andrew Cooke, e-mail communication). In addition, Roderick Stein-Rostaing (www.reefdoctor.org) recorded that December 2002 to the end of March 2003 saw severely elevated (>30°C) water temperatures in the region of Ifaty and Andavadoaka (pers. comm). These bleaching events will hopefully be monitored closely by Blue Ventures Conservation and detailed assessments of erosion vs. recovery made.
- If reef regeneration can occur before erosion sets in or another bleaching event takes place, recovery of these reefs may take place. The small patches of *Acropora* regrowth implied some recovery, but as Sheppard *et al.* (2002) point out, the "nature and stability of the substrate is crucial; coral larvae preferentially settle on encrusting calcareous algae, where motile rubble can quickly kill them". This could be a potential problem in areas where physical damage (and debris / rubble) is high, such as the inner reefs of Ankareo.
- Damage as a result of anthropogenic activities such as over fishing, fine mesh trawling (Fig.25), spearfishing for octopi and reef walking at low tide, plus potential pollutant runoff (such as at Baie de Fanemotra) could be other factors contributing to the high coral mortality observed.

Fig. 25 Fine-mesh trawling. Both harmful to the coral and can remove high numbers of juvenile fish, accentuating the problem of overfishing

- Migrating Humpback Whales (*Megaptera novaeangliae)* could provide room for further study, and there is potential for terrestrial reptile studies on neighbouring islands such as Nosy Hao, so long as prior permission is acquired first.

LIMITATIONS

- We collected a fairly limited amount of data due to frequent bad weather and constraints on time brought about by logistical difficulties such as transport and equipment deployment (See Appendix 5 for Itinerary)
- Money difficulties resulted in a reduced time spent with the IH.SM scientists, and the relative inexperience of our team has resulted in limited recording of coral taxa.
- As discussed previously, the two teams employed different methods for invertebrate survey work making direct comparisons difficult. Efforts to keep methodology standard in all studies should be a priority in future research.
- By choosing to establish permanent transects at our 'full survey sites' Baie de Fanemotra and north Nosy Andrahombava, the EUCARE team took a longer time per survey, resulting in less data collected than we had hoped for. However, in the long-term we hope our work will be helpful in providing data and information from which to compare with and assess future studies.
- The frequent bad weather meant that everytime we took the underwater camera with us the water was too turbid to take photographs, so we have no underwater photos from our particular expedition. However, we have used some of OUCARE's beautiful underwater photographs in this report (thanks!).

Section 3

Non-Survey Fieldwork

Edinburgh University Coral Awareness
& Research Expeditions

Project Madagascar 2003

(i) The general meeting with the Andavadoaka people

On arrival at Andavadoaka, the two Project Coordinators and Jasper met the President of Andavadoaka to ask permission and his blessings to work in Andavadoaka. He was warm and hospitable, and insisted we have an official meeting with the Mayor of the Befandefa Commune and people of the village who wished to learn of our research and ask questions. The meeting took place on 17th July, and was fronted by all three IH.SM scientists and the majority of the EUCARE team. It was well attended. Those present included the President, Mayor, and approximately twenty-five villagers, mostly fishermen. It was a powerful experience for the EUCARE team, with the majority of dialogue in Malagasy but the atmosphere curious and welcoming.

The President of Andavadoaka

<u>The meeting is outlined below</u> (Jasper Andriamanantsoa)

INTRODUCTION (Speaker: Lope)

**** who we are?***

COUT: Cellule des Océanographes de l'Université de Toliara, is an association of students (Masters and PhD) in IH.SM / UNIVERSITE DE TOLIARA. COUT works for the marine and coastal environment: establishing studies, protection and conservation, development... collaborates with many associations/organisations (GO, NGO) that have the same targets (such as : WWF, WCS, PSDR, FRONTIER, EUCARE etc...)

EUCARE : Edinburgh University Coral Awareness and Research Expeditions is another university organisation working towards the same marine conservation aims.

**** What are we doing in Andavadoaka?***

We (EUCARE and COUT) are doing underwater reef survey: fish and corals identification, for that, scuba diving allows us to stay underwater, identifying and counting fish and corals in every transect that we have chosen. Analyse the state of the reef, fish stocks. We stay here for one month, and then, another project (OUCARE) will carry on this task, but it is also for a sort time (one month) and then, the one that will stay with you for one year is BLUE VENTURES. This last one will work as well for the development of the village.

WE ASK THE VILLAGE PEOPLE FOR THEIR COLLABORATION AND THEIR CONSENT:

EUCARE and COUT come here in Andavadoaka to undertake this work, but we can not make it good without your consent and help, we will use the sea, the reef, fishing area. Also, to introduce us to you so that you won't be surprised when you see us in the area. Tell us what are the "**fady**" in the area (They said that the only "fady" is to put pork meat in the sea)

ANSWER (HEAD OF THE VILLAGE):

They appreciate to have us work in their area, they said it is important for them because, first, it will help them to understand the state of the reef, and also there was no study before in the area in mater of marine environment. The

report will allow other people to know about Andavadoaka. They hope that you will bring solutions for the development of the village.

PROPOSITION OF THE VILLAGERS:

They asked help from the association about:

-giving English lesson (which we had started already) for the villagers (children and adults);

-giving some fishing materials (fishing net, etc...);

-bringing solution about drinking water problem ;

END :

We offered some bottles of rum (as a tradition) for asking benediction for the success of the expedition

(ii) English Lessons

The EUCARE undertook a number of basic English lessons, as the people of Andavadoaka were keen to learn and had little, if any, previous education in the English language. They were a great success and very rewarding, particularly when the COUT scientists helped us, for our Malagasy was rudimentary and often their French was limited too. We were given a classroom of the primary school to teach in, and through a mixture of mimes, diagrams on the blackboard, and an English-Malagasy dictionary/phrasebook we taught basics of the English language.

Libby with the pupils...notice the troublemakers at the front!

The first lesson was particularly well attended, and even had the President there, however, frequent misunderstandings about lesson scheduling and poorly attended lessons meant that limited progress was made, though a group of approximately eight children aged 11-16 were particularly keen and made good notes throughout.

Pupils at work...notice the troublemakers at the back!

...and here are the troublemakers at their worst!

(iii) Coral and Fish Training

When weather did not permit diving; we had prepared all diving quotas (cleaned equipment, filled tanks, written up data etc); and an English lesson had not been arranged, the team carried out coral and fish training using 'AIMS Coral ID', 'Fishbase', and identification books such as the Collins Pocket Guide (Myers 2001); the Indian Ocean Reef Guide (Debelius 1999); and Sheppard's Guide to Common Corals (1990).

The three IH.SM scientists were extremely helpful in teaching us how to identify different coral families, though time and financial restrictions meant we had less time with them than hoped for, and the EUCARE team generally only went to coral lifeform on LIT surveys (see above for desciptions).

(iv) Whale Watching!

This was pure fortune of members of the team staying in Andavadoaka for the longest time, as the first Humpback whale (*Megaptera novaeangliae*) sighting was on 3rd August. We only ever saw them diving from the 'open ocean site' to the west of Nosy Hao (reconnaissance site no. 10), and it was aptly named 'WHALE' on the GPS. We did not attempt any scientific studies on these magnificent creatures, as it was so late in the expedition, and you were never guaranteed to see them. We simply watched them in awe, particularly on the occasion when they breached fully out of the water!

Humpback Whale Tail (by Anna P)

Section 4

Individual Reports

Edinburgh University Coral Awareness
& Research Expeditions

Project Madagascar 2003

(i) ANDAVADOAKA SOCIO-ECONOMIC REPORT (Matthew Linnecar)

Andavadoaka is a village of approximately 2090. It is situated in a small bay, approximately 45km south of the nearest major settlement, Morombe. Due to its location and situation, its predominant activity is fishing, although there is a small amount of work undertaken on the land. With the advent of tourism to the area however, there has been more focus in recent years on the collection of curios (shells, sea stars etc) and a wider interest by the villagers in catering to the needs of the tourist (for example providing pirogue trips, or guides for walks).

One of Andavadoaka's Fishermen

The local economy in Andavadoaka has historically been based on artisanal fishing. The first pioneers that settled in Andavadoaka came because its coastal waters were teeming with marine life. The composition of the artisanal fishery in Andavadoaka has changed greatly over the years. Historical matricies as well as interviews conducted by our research team in the village indicated that it was common for one fisherman/pirogue to catch up to 10 – 15 kg more a day as recently as 15 years ago. Now the average fisherman according to our research is only catching 4 – 5 kg a day. 95% of the 65 interviewees stated that their perceptions of fish stocks have decreased dramatically over the last 15 years.

The seafood export industry arrived in 1991 and along with increased habitation pressures due to large numbers of coastal migrants, caused the artisanal fishery to change in a great way. Now, with the advent of tourism, unless the fishery is managed in the correct way and with sufficient local involvement in decision-making and implementation, irreversible problems could occur. There are now strong demands for new types of seafood that were previously rarely caught, or only caught for subsistence. The export companies target species that can be exploited on a very large scale, and demand squid and octopus in particular. These new markets have sustained if not increased the income of artisanal fishermen, despite the drop in ecosystem productivity. Market prices reflect the supply and demand of the products, and as a result, while the seafood populations diminish and the demands continue if not increase, sale prices increase and fishermen make a sizeable income despite the diminishing quantity of their catch.

Olivierre Delpierre taking a meeting/awards ceremony with the fishermen (2nd August)

In October 2002, the French/Malagasy company '**Copefrito**', its parent company being '**Alize**', decided that Andavadoaka was an extremely important octopus location and based a collection boat there for two weeks every month. It is based in the bay just off Andavadoaka's shoreline for a week at a time, coinciding with the full and new moons when the tides are at their biggest range, conducive to favourable octopus fishing conditions. The boat provides an additional market place to the villagers, primarily for their octopus, but also for their exportable fish. It gives the fisherman a higher price than the other collectors that visit the village and as such provides

competition. According to interviews conducted, the presence of the collection boat causes problems among the other collectors who cannot afford to be as flexible with their prices.

Currently, approximately 95% of the families in Andavadoaka derive the majority of their income from activity that is related to the capture or sale of marine resources. There is a consistent division of labour between men and women within the fisheries sector. Men tend to be deep-sea fishermen in outriggers who fish with nets, spear guns, fishing lines, or jigs; while women tend to be pedestrian fishers who fish with volosh. The type of species caught by a fisherman depends on the materials used. The materials and fishing practises employed by fishermen correlates to his income, whereby a fisherman who owns some or all of the materials listed above can target species at different times of year in order to take advantage of seasonal fluctuations in the population densities of different species. The industry changes from season to season because of the impact of the climate on the marine ecosystem and varying population sizes of different marine resources. The four seasons are **Litsaky** from December to February, **Fararano** from March to May, **Asotry** from May to July, and **Faosa** from August to November. Seasonal changes in climate have a significant effect on fishermen earnings, because they not only influence stock size, but also the durability of the seafood after it is caught, which greatly impacts fish prices.

- **Hook and line:** Fishermen who use hook and line tend to fish alone in small pirogues. During the day they fish over sea grass beds for smaller fish. Night fishermen go out 5pm to 2am and catch bigger fish such as Capitain and Carranga, which are both good for markets and export.
- **Nets:** Nets are usually used by a group of pirogues either over grassy areas, near coral islands, or outside the reef. There are usually 3-4 fishermen in a single pirogue and a number of pirogues from an extended family will collaborate to work the nets. Fishermen with nets will bring in a range of valuable products such as unicornfish, sardines, and squid.
- **Jigs:** Fishermen will use jigs to fish squid at night during the week around the full moon. The fishermen will go out alone in small pirogues when the tide is low.
- **Spear guns:** Fishermen who use these home made spear guns will usually go out individually or in pairs and will catch larger fish such as capitain, carranga, and barracuda or lobsters to sell.
- **Volosh:** Fishermen will use these wooden spears with metal tips to fish shells, sea cucumbers, and octopus. Volosh are carried by all pirogues because if a fisherman comes across a valuable shell or an octopus, they will always take it.

As mentioned, tourism is still very much in its infancy in Andavadoaka, although there are plans by the ministry and local businessmen to thrust it more into the industry. At present there are two hotels/guest houses. One is in the heart of the village and is owned by the 'local elite', Mr Coco, who runs a very successful dried-fish business, and the other is where the EUCARE team stayed, and is located just outside the village on a headland and is called 'Coco beach'. Coco beach hotel employs 8 – 10 indigenous people, whose jobs range from gardening, to clothes washing, cooking, cleaning, administration and night watch.

During the time our researchers were installed in the village, very few numbers of tourists visited (4 individuals and 3 tour groups of 15-20 people each). This is probably due to a number of factors. Firstly, the political crisis of 2002 warded many travellers off Madagascar. Secondly, Andavadoaka is extremely remote and also there are no substantial facilities to cater for the tourist. Tourism promotion is limited although current governmental plans are to promote ecotourism as the preferred option. The issue here is though, is Andavadoaka prepared for an influx of tourists and have necessary steps been taken to create awareness and gain insights from the indigenous people as to what they want? The answer is no. Natural resources are very limited – water (there are 3 small wells), and sewerage and rubbish disposal facilities are non-existent. Research showed that although plans have been discussed to develop the tourism facilities in Andavadoaka, no local contact has been made to seek indigenous views and desires. This is something that needs to be addressed and will benefit from data dissemination by NGOs and other development organisations as well as discussions by the ministry of tourism with the local villagers. It is well documented that as well as providing some benefits to the local communities, namely economic, tourism can also bring irreversible negative changes if it is not managed properly, such as significant cultural change, damage to the natural environment, and loss of traditional livelihoods.

Fig. One of Andavadoaka's wells

(ii) DIVING OFFICER'S REPORT (Matthew Linnecar)

During the expedition, there were a number of challenges on the way to completing a successful underwater survey of coral reef habitats in the Andavadoaka region. Logistics were difficult and we had to maintain high safety standards in a region where diving is unregulated, the dive and research base was off the 'beaten track', and access to medical facilities and recompression facilities was extremely limited.

The expedition team proved capable of facing these challenges and fortunately the in water activities were completed very successfully. Here is a report of the difficulties we faced in a challenging environment.

1. Equipment and Logistics

Tanks, Compressor and Powerboat

The tanks and compressor were air freighted from Scotland. It proved difficult in getting them through customs in Antananarivo airport, but eventually they were through and were transported down to the site by minibus. Throughout the expedition the tanks and compressor proved no problem at all. They were looked after, and the compressor was regularly cleaned, checked, and a log was taken of all hours it was used.

The powerboat proved quite difficult to obtain and when we finally did, it was worth the wait. There were no problems as the 60 HP engine was new and there was a new 30HP engine for backup, which incidentally, never had to be used. The boat, compressor, and tanks, in the condition they were, allowed us to survey effectively.

Anna P and Libby using the compressor

Oxygen

Oxygen started off as a problem. Many negotiations were undertaken with the national medical oxygen provider and finally we managed to secure one large medical oxygen tank which was sufficient for our requirements on land, and one small oxygen tank sufficient for use on the boat. The attachments were bought from the same supplier. The oxygen was calculated to be sufficient to get a casualty to the air strip at Tulear by boat, where they would be met by the DAN airplane with sufficient medical supplies on board to take over. Enough boat fuel was always kept spare for any emergency. If the DAN aircraft was for any reason unable to arrange the pick up, then another aircraft was on standby (supplied by a French contact in Reunion) to land at a location close to Andavadoaka on a grass runway.

2. Diving Conditions and Logistics

The diving in Andavadoaka posed little difficulty for our team of divers. On a few occasions the winds were too strong (mostly in the afternoons) creating big swells that were too dangerous for boat driving and for diving, but often this enabled snorkel surveys to be done. On a few other occasions the visibility was limited to a few centimetres but this didn't prove too much of a problem. Further surveys of the surrounding coastline could be attempted with more success when sea conditions are calmer, perhaps December. During our expedition, the diving in Andavadoaka proved easy and there was a good sheltered area for the team to practice rescue techniques and hone survey techniques. There were no diving incidents during the expedition.

Diving Practice

Keeping to depth limits assigned to each dive, and keeping strictly to dive-table profiles well within the limits of both tables and computers, there was no incidence of Decompression Illness. We also left a member of the expedition in radio contact on shore, which meant that all divers took a day off at least as often as 1 in 4 days, to minimise the effects of 'silent bubbles' of nitrogen. With a difficult Emergency Evacuation Plan it was necessary to be strict with these procedures.

Dive Planning

The most challenging job for the diving officer I found was having to plan for dives leaving when it is not close to low tide, diving at slack tide (to avoid currents), and returning when again it is not close to low tide.

(iii) MEDICAL OFFICER'S REPORT (Elizabeth Prins)

As MO my primary role was to prevent expedition members becoming ill and to treat those who have had an accident or become unwell to the best of my ability using my knowledge and authority to advise the best course of action.

Madagascar exposed team members to a range of pathogens that are either not present, or not common in the UK. Therefore prior to the expedition, all team members had to be "in date" for the standard UK immunisation schedule. Recommended immunisations were polio, hepatitis A, typhoid fever and tetanus. Hepatitis B, rabies, TB (BCG) and diphtheria were all immunisations to be considered. Due to the rural nature and lack of medical facilities in the area of this expedition, all team members were immunised against all of these diseases. Prior to leaving the UK all team members filled in a confidential pre-expedition medical questionnaire.

Once in Madagascar there is still a risk of food and water-borne diseases after immunisation, such as cholera, so all water was purified using either chlorine or iodine, and sealed bottled water was bought when available. All

members were advised to take care when eating high-risk foods such as salads, shellfish, raw/undercooked meat and fish and un-pasteurised products to avoid getting 'travellers' diarrhoea'. Everyone at some point on the expedition suffered from travellers' belly, which sometimes resulted in vomiting as well. Affected individuals had to rest for a couple of days, drink plenty of fluids (which is even more essential in a tropical climate, than the temperate clime of the UK) and take diorylate if necessary.

Malaria is considered endemic throughout Madagascar and antimalarial chemoprophylaxis is advised. In the case of divers doxycycline (Vibramycin) (100mg, SID) is recommended. Unfortunately doxycycline has several possible side effects including photosensitivity, skin irritation, diarrhoea, and oral/oesophageal or vaginal thrush. Capsules were always taken with food and plenty of water, and lying down for at least an hour after taking it was avoided. On this expedition several members of the team suffered from sun sensitivity, which resulted in blisters on the hands and feet. One member suffered badly from sun blisters under the nails, which are extremely painful. According to medical advise on return to the UK, sun blisters, especially under the nails, are becoming an increasingly frequent problem in travellers prescribed doxycycline. Affected individuals had to avoid sun exposure as much as possible, difficult on a diving expedition, and ensure plenty of sun block was used. To avoid mosquitoes, the vectors of malaria, everyone was advised to regularly apply insect repellents, wear long shirts and trousers, especially in the evening, use insect coils and mosquito nets. No one presented any symptoms of malaria on the expedition.

Other problems encountered on the expedition:

There is an increased risk of infection to all types of wounds when working in the sea, especially near coral reefs. All coral cuts, or any other types of skin lesions were thoroughly cleaned and covered in betadine until they had healed.

- A bad graze to the knee of a team member became infected (even after careful cleaning and re-dressing twice a day) and required a five day course of M-Cloxacilline (500mg 4 times a day).
- A team member punctured the fleshy part of the thumb changing the battery of a VHF radio and then proceeded to go diving. When I was made aware of the wound the following day, the site of the puncture was extremely painful, red and swollen, a red tract from the puncture site ran up the arm and the member had swollen glands in the neck and achy shoulders and back. A five day course of M-Cloxacilline (500mg 4 times a day) was given. The hand was soaked in a saline bath using boiled water, and the wound scrubbed and dressed. The entry site of the wound was kept open to allow pus to seep out.
- A burnt sole of a foot from walking on hot chars of a fire resulted in partial thickness burns to the sole of the foot. The foot was doused with copious amounts of cold water, cleaned, all blisters were burst with a sterile needle, flamazine applied and a plastic covering put on top. The foot was elevated as much as possible.

Fortunately our extensive medical kit was hardly put to use and the evacuation plan left as that. No diving related medical problems occurred on the expedition.

(iv) TREASURER'S REPORT

EUCARE MADAGASCAR EXPEDITION 2003 - BUDGET SUMMARY

PAID IN		
Date	Details	Amount (£)
27.02.03	Davis Award	5500
19.06.03	8 team members contributions	4000
24.04.03	Weir Fund	1200
24.04.03	RSGS	300
04.06.03	Student Travel Fund	158.75
25.06.03	Faculty Scholarship Prize	630
25.06.03	Barson Bequest	500
30.06.03	Ede & Ravenscroft	1500
25.06.03	Gordon Foundation	750
29.08.03	Small Projects Grant	1000
04.06.03	Mermaiding and club night	1326.52
12.10.03	Half of the laptop (BV)	250
31.12.03	Half of the field equipment (BV)	742
	TOTAL	17857.27
	BALANCE	0.15

PAID OUT		
Details	Amount (£)	
Brochures + Club night overheads	400	Pre-Expedition
Flights	7149.6	
RGS Advanced Medical Training	190	
4 extra T-shirts (Man Wai, Lope, Tsiri, Jasper)	56	
DAN insurance	344	
Personal insurance	245	
Kit insurance	62.5	
Website (DBWired)	114.75	
Website (Doteasy - change of server)	21.79	
Miscellaneous administration	36	
Visas	481	
Journey to London (2 people)	52	
Equipment when halved with OUCARE *1	3447.48	
Equipment & importation when halved with OUCARE *2	499	In the Field
Accommodation and food	2340	
Extra costs of food and drink (inc. bottled water)	360	
Internal travel (inc. taxis in Tana)	529	
Administration and phone calls	33.5	
Commission from changing travellers cheques	40	
Scientists (Lope, Jasper and Tsiri)	484	
Petrol	290	
Hire of boat (Laguna Blue)	62	
Hire of 4 pirogues for snorkelling	9.5	
Hire of Olivier's Argos 700	45	
Hire of BV boat	225	
Boat driver wages	15	
Report write up (+ translation) plus website costs	325	Post
TOTAL	17857.12	

The EUCARE team shared all equipment and importation costs with OUCARE which was a great help considering the costs associated with diving expeditions, especially in a remote and potentially dangerous location. We unfortunately did not raise as much money as planned, and I underestimated the costs of medical supplies and oxygen administration equipment. These factors, combined with a significant amount of time getting kit through customs meant we overspent our original budget and could not support the wages of the three IH.SM scientists for as long as hoped, and also had to sell equipment following the expedition's completion.

One major oversight was to underestimate the amount of time it would take to set the expedition up. Despite the wealth of knowledge provided by Blue Ventures, there were approximately 3 weeks where all eight members were in Madagascar setting the expedition up but without any diving as a result of equipment, transport and communication problems. Whilst we could obviously undertake fish and coral training in this time, it was

frustrating on all our parts, not to mention expensive for accommodation and sustenance. By collaborating with OUCARE we automatically had our 'available holiday space' shortened to 5 weeks in the field, so the decision was made to deploy all members at once so we would have a decent amount of time in the field. In hindsight this was the wrong decision. It would have been better for the Project Leaders and Dive Officer to have gone out to Madagascar approximately two weeks prior to the rest of the team to set up before their arrival.

*1

Description	FMG	£
DIVEX Compressor / filters		4020.4
Tools		99.6
Medical equipment		133.94
Truck hire		50
AirFrance Cargo		903
Dangerous Goods Management		103.38
AIMS books (x2) and Coral ID CD		63.64
Tape measure (30m)		13
8x Tanks plus delivery		960
Laptop		548
TOTAL		**6895**

*2

Description	FMG	£
Medical supplies	736620	
Funnel/measuring jug	17000	
Tub for cement	15000	
Jerrycans	272500	
Compressor/tank deployment	460000	
Compressor/tank 'release/movement' in tulear	85000	
Dave Razafinarivo's wages	698645	
Power of Attourney	2000	
Cargo release payment at the airport	1060000	
Release of airport documents	25000	
02 bottle	1679400	
02 valve	3180000	
02 masks	37500	
Quadrat	75000	
Weights	375000	
Stakes x15 (0.6m each, 5000/1m)	45000	
Rope (4x100m)	180000	
Petrol for AloAlo boat -> Andavadoaka	500000	
Half of cost of boat driver -> Andavadoaka	115000	
TOTAL	**9558665**	**998.92**

Section 5

Pre-Expedition

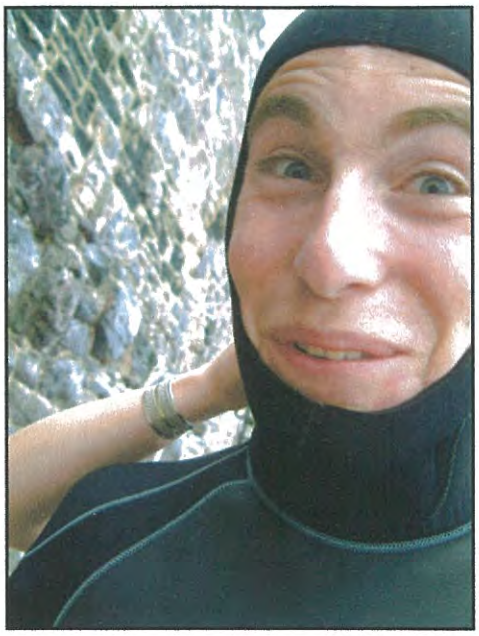
Edinburgh University Coral Awareness
& Research Expeditions

Project Madagascar 2003

(i) PRE-EXPEDITION TRAINING

The team went to Devon for the weekend of 4th June, staying at Libby's house, where equipment was sorted out and valuable team bonding went on. Dan Logan (OUCARE and Blue Venture's Dive Officer) instructed Adrian, Dom and Anna P up to PADI Rescue Diver, under the supervision of our DO, Matt Linnecar.

Dom & Anna P kiss for the camera!



I think Adrian likes his hood!

Dan and Libby talk shop

Mesmerised by Dan's words of wisdom

(ii) FUNDRAISING

- Asides from grant applications, as listed above in the budget summary, the team also went **pub collecting** around some of Edinburgh's finest pubs.

EDINBVRGH
THE CITY OF EDINBURGH COUNCIL

PUBLIC CHARITABLE COLLECTION PERMIT

The City of Edinburgh Council hereby grant a Public Charitable Collection Permit as detailed below to the person named to conduct a street collection in the area specified on the date or dates specified. The Collection will be undertaken on behalf of the Organisation named all in terms of the Civic Government (Scotland) Act 1982 and the Public Charitable Collections (Scotland) Regulations 1984. The permit is granted subject to the conditions specified below.

Organiser	**ANNA PHILLIPS**
Organisation	**EUCARE MADAGASCAR**
Area	**NEWTOWN, TOLLCROSS, HOLYROOD, CALTON AND BROUGHTON**
Date(s)	**25 MAY 2003**

CONDITIONS

1 Street collections may only take place between the hours of 9 am and 8 pm.

2 All collecting boxes shall be provided with a protective chute and shall be securely
boxes must indicate clearly the name of the organisation for which the collection i

3 Maximum Number of Collectors:- 7 (No more than 5 collectors at any one time in

PROPER OFFICER
25 APR 2003
DATE

Official council letter for getting past the bouncers!

Hannah and Anna P begging unashamedly in their cockles!

Even the boys had to do it! Dom hassling an innocent pub goer!

- We also had a club night at the Bongo Club called **Gaijin**, largely organised by Adrian. It was very successful and a lot of fun!

- Our efforts at gaining **corporate sponsorship** were unrewarding, despite many letters and brochures sent, and a couple of articles published about the project (one pre- and one post-expedition).

Our Story

EUCARE was founded in 2000 to organise teams of research divers and local scientists to survey and chart unexplored coral reefs around the world.

Healthy coral reefs are fundamental to the livelihoods of hundreds of millions of people in tropical coastal environments, as well as forming part of the crucial life support system of the biosphere. Despite their enormous value, coral reefs in the Western Indian Ocean are threatened by overexploitation. Rapidly increasing human populations and the resulting increase in fishing pressure, pollution and human activities on coral reefs has frequently led to unsustainable demands on the region's marine resources.

EUCARE is a non-profit, student run organisation dedicated to raising awareness of the need for coral reef conservation and research.

The EUCARE Project 2003

In 2001 the first EUCARE expedition to Madagascar began surveying in the south of the country, this was followed in 2002 by an expedition to the Comoros Islands. In July 2003, our team will return to south-western Madagascar to establish a field research site in Belo-sur-Mer.

The Belo-sur-Mer reef system surrounds a chain of 9 islands located approximately 18km offshore, stretching south from the village of Belo. The main objective of the expedition research programme in the area is to survey and chart the unexplored fringing coral reefs around the offshore islands, studying their biodiversity and health, and assessing the potential threats to these unknown ecosystems.

Please help us to preserve the future of the world's threatened coral reefs.

The expedition will fulfil one of the priorities of the International Coral Reef Initiative (UNEP & IUCN), which is to improve the amount and availability of data on coral reefs in the West Indian Ocean.

Why Belo?

This area is considered a World Heritage Site, and has been targeted as the site for apossible Biosphere Reserve, but no baseline data exists to implement these measures. It is now critical that data be gathered for use in local environmental management plans. Our research aims to identify strategies and targets that local communities and local NGOs can work towards to develop sustainable environmental management plans for these unique reef systems. These plans will focus on improving the quality of life of the local communitie who depend on these marine resources while main taining the biological diversity and productivity of the reefs. The EUCARE team will work hand-in-hand with local biologists, marine institutes, NGOs, and communities whose livelihoods depend on the reefs of Belo-sur-Mer, to carry out research and conservation programmes at this unique marine habitat.

Why Support Us?

- The data this expedition aims to collect will be vital for the protection of a unique environment, globally recognised as a World Heritage Site.
- By supporting us, sponsors demonstrate their commitment to conservation and sustainable development.
- We are receiving more publicity with each project undertaken. This expedition will be accompanied by a film crew, and we have already been approached by several major broadcasters with regard to the film rights.
- EUCARE runs environmental awareness raising programs with local schools.

Businesses know that their employees, shareholders and customers share a common concern about protecting the environment. We are dedicated to expanding private sector commitment to the protection of coral reefs, by mobilising resources from individuals and companies who share our interest in coral reef conservation.

All ideas and enquiries will be greatfully received at
enquiries@eucarenet.com.
www.eucarenet.com

Above: The inside cover of our brochure attempting to get corporate sponsorship prior to departure.

Right: An article in the Kent Messenger Group, May 2003.

Student to research coral reefs

by Karina Hodder

A FORMER Broadstairs student is heading off to Madagascar to carry out important scientific research.

Anna Lewis, 20, is a former pupil of Upton Junior School and was head girl of Dane Court Grammar School.

She is now studying Zoology at Edinburgh University and is co-leading an expedition to some unexplored coral reefs on the African island.

The reefs have been highlighted as a potential World Heritage Site and Biosphere Reserve but no research has been done on them yet because of logistical and financial restrictions.

Miss Lewis is a member of EUCARE, Edinburgh University Coral Awareness and Research Expeditions.

The organisation is run entirely by students and they have no guaranteed source of income.

It is extremely rare for students to lead such a large expedition.

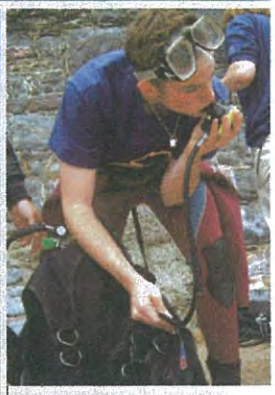
They need to raise as much money as possible towards the £25,000 cost of the trip.

They have a website, www.eucarenet.com where they can offer space for businesses, and they are in talks with a television crew about making a documentary.

When Miss Lewis went to Zanzibar last year on a similar mission she was helped by several Broadstairs businesses, who are thanked on the site. She can be contacted by email on anna@eucarenet.com or on her mobile 07813

Newsletter for donors to The University of Edinburgh

Friends'Folio



Trawling Methods used by local fishermen (left) and EUCARE members Adrian (above), Anna and Ana (below)

EUCARE about Coral

During the last few decades coral reefs throughout much of the globe have been increasingly affected by pollution and other forms of human impact.

EUCARE (Edinburgh University Coral Awareness and Research Expeditions) was founded in autumn 2000 to organise teams of research divers and local scientists to survey and chart unexplored coral reefs around the world.

A recent collaborative expedition, part funded by the Development Trust, set out to survey and chart the unexplored fringing coral reefs around Andavadoaka in Madagascar. The group studied the biodiversity and health of the reefs, and assessed the potential threats to these unknown ecosystems.

The team held meetings with local officials, the general public and fishermen who were interested in the important research being conducted. The expedition group was warmly welcomed by the village and gave English language classes to local individuals, including the President.

Snorkelling and SCUBA diving activities led to the discovery that an unusually high percentage of the hard corals (Order Scleractinia) were dead and heavily asphyxiated by algae populations. EUCARE identified other threats to the reefs which included destructive fishing practises.

Through their research, EUCARE will develop sustainable local environmental management plans for the unique reef systems. These plans will focus on improving quality of life for the local communities who depend on marine resources while maintaining the biological diversity and productivity of the reefs.

An article in the Friends' Folio Newsletter for donors to the University of Edinburgh, 'Winter 2003'

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APPENDICES

Appendix 1 – Raw Data of Reconnaissance Inventories (Elizabeth Prins) **(NB. 6 & 10 are averaged)**

EDCARE (RHSM)			Snorkelling	Snorkelling	Diving	Diving	Diving	Diving	Diving
		SITE NO.	1	2	3	4	AVERAGE 6	AVERAGE 10	11
Reconnaissance Inventories		DIVE	Andavadoaka	Nosy Hao	S.Nosy Hao	Nosy Fasy	N. Nosy	W. of Nosy Hao	(+) N. Nosy
		LOCATION	coastline				Andrahombava		Andrahombava
		SURVEY GPS CODE	ALGAE	18 TANG	STINGRAY	BABY	NAPOLEON	WHALE	NAPOLEON
		DATE (dd-mm-yy)	17-Jul-23	18-Jul-23	02-Jul-23	22-Jul-23	28-Jul-23	3 - 5th August	05-Aug-23
		TIME OF SURVEY (')			16:05	11:05	-	-	09:03
		DURATION OF SURVEY (mins)			2mins	25mins	-	-	36mins
		LOW TIDE	13:34	14:11	15:24	16:07	11:01	multiple days	15:57
		HIGH TIDE	07:03	08:06	09:02	01:03	17:17	multiple days	09:46
		TIDAL PHASE	OUT	OUT	IN	OUT	-	-	IN
		UNDERWATER VISIBILITY (m)	1	1	3	3	15	-	25
		SURVEYOR	LOPE	LOPE	AQM	AP	AQM, DJ	AP, AL, EP	AL
		GPS (S) START	22°5.471	22°4.242	22°7.463	22°8.271	21°57.72	22°04.681	21°57.72*
		GPS (E) START	43°13.666	43°11.526	43°11.474	43°11.81	43°11.823	43°09.291	43°11.823*
		SURVEY DEPTH (m)	8m	8m	14m	8m	12m	20 - 25m	20.7m
		WATER TEMPERATURE (°C)	24	24	23	23	23	23	23
SUBSTRATE TYPE (LEAVE BLANK IF VARIED)				SAND/DEBRIS				*=GPS point not recorded	
COMMON NAME	SCIENTIFIC NAME								
	Genus	Species							
Yellowtail sergeant	*Abudefduf*	*notatus*	1						
Scissortail sergeant	*Abudefduf*	*sexfascialus*	2		1			1.333333333	
False eye sergeant	*Abudefduf*	*sparoides*				1		0.333333333	
Skunk anemonefish	*Amphiprion*	*akallopiosis*						1	
Seychelles anemonefish	*Amphiprion*	*fuscocaudatus*	1		1				
Maldives anemonefish	*Amphiprion*	*nigripen*	1		1				
Sebae anemonefish	*Amphiprion*	*sebae*	1		1				
Twotone chromis	*Chromis*	*dimidiata*			1		1.5	2	3
Blue-green chromis	*Chromis*	*viridis*	2			1		0.666666667	
Humbug dascyllus	*Dascyllus*	*aruanus*	1					1.333333333	
Indian dascyllus	*Dascyllus*	*carneus*	1		1				
Threespot dascyllus	*Dascyllus*	*trimaculatus*						2	
Creole damsel	*Pomacentrus*	*agassizi*	1		1				
Jewel damsel	*Plectroglyphidon*	*lacrymatus*						0.333333333	1
Threadfin butterflyfish	*Chaetodon*	*auriga*						0.666666667	
Bennett's butterflyfish	*Chaetodon*	*bennetti*			1				
Spotted butterflyfish	*Chaetodon*	*guttatissimus*					0.5	1	1
Klein's Butterflyfish	*Chaetodon*	*kleinii*					0.5		
Lined butterflyfish	*Chaetodon*	*lineatus*			1				
Racoon butterflyfish	*Chaetodon*	*lunula*	1		1			0.333333333	
Madagascar (redback) butterflyfish	*Chaetodon*	*madagascariensis*					0.5	0.666666667	1
Meyer's butterflyfish	*Chaetodon*	*meyeri*					1.5	1	1
Latticed butterflyfish	*Chaetodon*	*rafflesi*					0.5		
Redfin butterflyfish	*Chaetodon*	*trifasciatus*	1		1		0.5	0.666666667	1
Zanzibar butterflyfish	*Chaetodon*	*zanzibariensis*						1	
Yellow fin butterflyfish	*Chaetodon*	*xanthorephalus*					0.5		
Longnosed butterflyfish	*Forcipiger*	*flavissimus*			1		0.5	1.333333333	1
Big longnosed butterflyfish	*Forcipiger*	*longirostrus*						0.666666667	
Masked bannerfish	*Heniochus*	*monoceros*						1.333333333	
Longfin bannerfish	*Heniochus*	*acuminatus*	1		1		1	1.333333333	
Bluespotted wrasse	*Anampses*	*caeruleopunctatus*						0.333333333	1
Axilspot hogfish	*Bodianus*	*axillarius*						0.333333333	1

Diana's hogfish	*Bodianus*	*diana*						0.333333333	1
Indian Ocean bird wrasse	*Gomphosus*	*caeruleus*					0.5	0.333333333	1
Checkerboard wrasse	*Halichoeres*	*hortulanus*					0.5	0.333333333	2
Cleaner wrasse	*Labroides*	*dimidiatus*						1.333333333	2
Bicolour cleaner warsse	*Labroides*	*bicolor*					1		
Hebrew (Goldbar) wrasse	*Thalassoma*	*hebraicum*					0.5		
Six bar wrasse	*Thalassoma*	*lansenii*						0.333333333	1
Slingjaw wrasse	*Epibulus*	*insidiator*					0.5		
Napoleon wrasse	*Cheilinus*	*undulatus*					0.5	0.333333333	
Orange socket surgeonfish	*Acanthurus*	*auranticaurus*						0.333333333	1
Powder blue surgeonfish	*Acanthurus*	*leucosternon*					0.5	1.333333333	
Yellowfin surgeonfish	*Acanthurus*	*xanthopterus*					0.5		
Blackstreak surgeonfish	*Acanthurus*	*nigricauda/nubilis?*						0.666666667	2
Eyestripe Surgeonfish	*Acanthurus*	*dussumieri*						0.333333333	
Whitecheek surgeonfish	*Acanthurus*	*nigricans*			2				
Thompsons's surgeonfish	*Acanthurus*	*thompsoni*						0.333333333	
Lieutenant surgeonfish	*Acanthurus*	*tennenti*						0.666666667	
Convict surgeonfish	*Acanthurus*	*triostegus*	3		1				
Twospot bristletooth surgeonfish	*Ctenochaetus*	*binotatus*						1.333333333	
Goldring bristletooth surgeonfish	*Ctenochaetus*	*strigosus*					0.5		
Striped bristletooth surgeonfish	*Ctenochaetus*	*striatus*	1				0.5	1.333333333	1
Humpback Unicornfish	*Naso*	*brachycentron*						1.333333333	
Orangespine Unicornfish	*Naso*	lituratus					0.5	0.666666667	
Bluespine Unicornfish	*Naso*	unicornis			2		3	1.333333333	
Moorish idol	*Zanclus*	*cornutus*	1		1		2	1	2
Sailfin tang	*Zebrasoma*	*desjardinii*					0.5		
Brushtail tang	*Zebrasoma*	*scopas*					2	1.666666667	3
Bicolour parrotfish	*Cetoscarus*	*bicolor*					0.5		
Greenlip parrotfish-female	*Scarus*	*viridifucatus*					0.5		
Russell's parrotfish	*Scarus*	*russelli*						0.333333333	
Bullhead/Daisy parrotfish	*Scarus/chlorurus*	*sordidus*	1		1		0.5	0.666666667	
Black saddled toby	*Canthigaster*	*valentini*				1	1	0.333333333	
Star puffertish	*Arothron*	*stellatus*			1		0.5		
Indian triggerfish	*Melichthys*	*indicus*						0.333333333	
Blue triggerfish	*Pseudobalistes*	*fuscus*						1	
Picasso triggerfish	*Rhinecanthus*	*aculeatus*	1		1				
Orangestriped triggerfish	*Balistapus*	*undulatus*					0.5	1	
Scythe triggerfish	*Sufflamen*	*bursa*					0.5	0.333333333	
Titon triggerfish	*Balistoides*	*viridescens*						0.333333333	
Clown triggerfish	*Balistoides*	*conspicillum*					0.5	0.333333333	
Flagtail (Halfmoon) triggerfish	*Sufflamen*	*chrysopterus*					0.5	0.333333333	1
Peacock grouper	*Cephalopholis*	*argus*						0.666666667	
Whiteblotched grouper	*Epinephelus*	*multinotatus*						0.333333333	
Whitespotted grouper	*Epinephelus*	*caeruleopunctatus*						0.666666667	
Longspined grouper	*Epinephelus*	*longispinis*			1				
Potato grouper	*Epinephelus*	*tukula*			1			0.666666667	
Squaretail coral grouper	*Plectropomus*	*areolatus*			2			0.333333333	1
Spotted coral grouper	*Plectropomus*	*Maculatus*						0.333333333	
Malabar grouper	*Epinephelus*	*malabaricus*					0.5		
Lyretail grouper	*Variola*	*louti*					0.5		
Marbled coral grouper	*Plectropomus*	*punctatus*						0.666666667	
Unknown	*Unknown*	*sp.*						0.333333333	
Whitetail dwarf angelfish	*Centropyge*	*flavicanda*						0.333333333	1
Three spot angelfish	*Apolemichthys*	*trimaculatus*						1	1
Earspot angelfish	*Pomacanthus*	*chrysurus*					0.5		
Emperor angelfish	*Pomacanthus*	*imperator*					0.5	0.333333333	

Yellowbar angelfish	*Pomacanthus*	*maculosus*			1				
Semicircle angelfish	*Pomacanthus*	*semicirculatus*					1.5	0.666666667	
Regal/ royal angelfish	*Pygoplites*	*diacanthus*					0.5	0.666666667	1
Goldbanded fusilier	*Caesio*	*caerulaerae*						2	
Lunar fusilier	*Caesio*	*lunaris*						1	1
Yellowback fusilier	*Caesio*	*teres*	2		3			2	
Yellowlined fusilier	*Caesio*	*varilineata*	2		1			1.333333333	4
Yellowback(scissortail) fusilier	*Caesio*	*xanthonota*	1				1.5	2	4
Twinstripe fusilier	*Pterocaesio*	*marri*	1		1				
Bluestreak fusilier	*Pterocaesio*	*tile*	1		1				
Blackspot snapper	*Lutianus*	*Fulviflamma*	2					1.666666667	
Bluebanded snapper	*Lutianus*	*kasmira*	1					3	
Lunulate snapper	*Lutianus*	*lunulatus*	2						
Bigeye snapper	*Lutianus*	*lutianus*			1				
Humpback snapper	*Lutianus*	*gibbus*						3	
Onespot Snapper	*Lutjanus*	*Monostigma*						1	3
Bluestriped snapper	*Lutjanus*	*notatus*						1	3
Yellow Stripe Snapper								1.333333333	
Blackspotted sweetlips	*Plectorhinchus*	*gaterinus*					0.5		
Painted sweetlips	*D.*	*pictum*						0.333333333	1
White barred sweetlip								0.333333333	
Threadfin anthias	*Nemanthias*	*carberryi*						1.333333333	
Yellowback anthias	*Pseudanthias*	*evansi*						1.333333333	
Lyretail (Scalefin) anthias	*Pseudanthias*	*squamipinnis*						1.333333333	
Mono	*Monodactylus*	*argenteus*			2				
Dash and dot goatfish	*Parupeneus*	*barberinus*	1					0.333333333	1
Bicoloured goatfish	*Parupeneus*	*barberinoides*	1		1				
Blackspot emperor/thumbprint	*Lethrinus*	*horak*	1						
Spangled emperor	*Lethrinus*	*nebulosus*	1						
Unknown	*Lethrinus*	*sp.*	1						
Bridled threadfin bream	*Scolopsis*	*frenatus*						0.666666667	
African Whitespotted rabbitfish	*Siganus*	*sutor*	2		1				
Bigscale soldierfish	*Myripristis*	*berndti*						0.666666667	
Bronze soldierfish								0.666666667	2
Clearfin lionfish	*Pterois*	*radiata*	1		1				
Fire dartfish	*Nemateleotris*	*magnifica*						0.666666667	
Blackfin dartfish	*Ptereleotris*	*evides*					0.5		
Giant moray	*Unknown*	*sp.*						0.333333333	
Blackspotted moray	*Gymnothorax*	*favagineus*						0.666666667	
Reef lizardfish	*Synodus*	*variegatus*						0.333333333	1
Mozambique fangblenny	*Meiacanthus*	*mossambicus*						0.333333333	1
Dusky sweeper	*Pempheris*	*adusta*					1		
Banded pipefish	*Corythoichthys*	*intestinalis*			2	1			
Big eye Trevally	*Caranx*	*sexfasciatus*	1						
Blackspot barracuda	*Sphyraena*	*forsteri*	1					0.333333333	
Sharksucker	*Echeneis*	*naucrates*			1			0.333333333	
Bluespotted ribbontail ray	*Taeniura*	*lymma*			1		1	0.333333333	
Sea cucumber	*Holothuria*	*sp.*	1						
Painted spiny lobster								0.666666667	
Acroporidae	*Acropora*	*humilis*			1				
	Acropora	*sp.*			1				
	Montipora	*sp.*			1				
	Porites	*lobata*			1				
	Porites	*nigrescens*	1						

Agariciidae	*Pavona*	*cactus*	1	1					
Faviidae	*Favia*	*sp.*	1	1					
	Favites	*sp.*	1	1					
	Goniastrea	*sp.*		1					
	Leptoria	*phlygia*		1					
	Montastrea	*sp.*		1					
	Platygyra	*daedalea*	1	1					
	Platygyra	*sp.*	1	1					
Euphyllidae	*Physogyra*	*lichensteini*		1					
Alcyoniidae	*Lobophyton*	*sp.*		1					
	Lobophyton	*venestum*	1	1					
	Lobophyton	*crussum*	1	1					
	Sareophytum	*sp.*	1	1					
	Sareophytum	*geaucum*	1	1					
	Sinularia	*sp 1.*		1					
	Sinularia	*sp 2.*	1	1					
	Sinularia	*abrupta*		1					
	Lithothamnion	*sp.*	2	2					
	Halimeda	*opuntia*	1	1					
	Caulerpa	*sp.*	1	1					
	Padina	*gymnospora*	1	1					
	Hyphea	*sp.*	1	1					
	Galaxaura	elongata	1	1					
	Tubinaria	*decurress*	2	2					
	Thalaesodendron	*ciliatata*	1						
	Cynodocea	*serrulata*	1						
	Leptocesis	*sp.*	1	1					
	Pocillopora	*verrucosa*	1	1					
	Seratopora	*sp.*		1					
	Stylophora	*sp.*		1					

Appendix 2 – Raw Data: Fish Visual Census (100m) for 19 Survey Sites

			EUCARE	EUCARE	EUCARE	OUCARE	OUCARE	OUCARE	OUCARE	OUCARE	OUCARE	OUCARE
EUCARE / OUCARE / IHSM			Diving	Diving	Diving	Diving	Diving					
Collaborative Reef Research Expedition 2003	SURVEY NO.		1	2	3	4	5	6	7	8	9	10	11
Survey data: FISH VISUAL CENSUS	**SITE**		**Baie de**	**North of Nosy**	**Baie de**	**W.Recif**	**S.Recif**	**E. Recif**	**N.Recif**	**S. Recif**	**Nosy**	**W. Nosy**	**E. Nosy**
	LOCATION		**Fanemotra (P)**	**Andrahombava**	**Fanemotra**	**Parson**	**Parson**	**Parson**	**Parson**	**Parson**		**Fasy**	**Fasy**
	DATE (dd-mm-02)		26-Jul-03	01-Aug-03	06-Aug-03	12-Aug-03	12-Aug-03	13-Aug-03	14-Aug-03	15-Aug-03	15-Aug-03	18-Aug-03	18-Aug-03
	TIME OF SURVEY (00:00)		10:31	09:15	10:21	09:20	16:05	12:26	09:45	11:45	10.45	09:46	11:22
	DURATION OF SURVEY (mins)		29mins	27mins	43mins	20mins	20mins	20mins	30mins	20mins	20mins	28mins	23mins
	LOW TIDE		09.43	13:15	17:15	11:32	11:32	12.07	12:40	13:12	13:12	14.37	14:37
	HIGH TIDE		16.02	02:09	10:56	17:47	17:47	18.20	18:52	19:32	19:32	20:43	20:43
	TIDAL PHASE		Flood (in)	Flood	HIGH	Ebb	Flood	Flood	Ebb	Ebb	Ebb	Ebb	Ebb
	CURRENT DIRECTION AND		Moderate (W to	Not significant	Significant (W	None	None	South -	South	none	none	none	none
	UNDERWATER SWELL		None	Moderate	None	Small	Small	Small	present	none	none	some	none
	UNDERWATER VISIBILITY (m)		20m	7m	15m	25m	20m	10m	20m	20m	15m	15m	15m
	SURVEYORS (FISH)		A.P. / A.L.	A.P.	A.L.	Fran and	Fran and	Fran and	Hatty	Matty	Matty	Hatty	Matty
	SURVEYORS		D.J. / M.L.	D.J./E.P/A.L.	E.R.W	Hatty and	Hatty and	Hatty and	Ellie	Ellie	Ellie	Ellie	Ellie
	GPS (S) START		22 13.725	21 57.072	22 12.726	22 00.546	22 01.0585	22 00.676	22 00.1085	22 00.912	21 57.330	22 03.685	22 03.699
	GPS (E) START		43 14.397	43 11.623	43 14.397	43 10.921	43 11.621	43 11.773	43 11.2109	43 11.360	43 12.644	43 11.145	43 11.939
	MAX SURVEY DEPTH (m)		10m	15m	8.7m	10m	10.5m	10m	9.7	6.4m	10.2m	7.5m	6.3m
	WATER TEMPERATURE (SO)		23	23	23	23	23	23	23	23	23	23	23
GEOMORPHOLOGICAL CLASS OF REEF			fringing	fringing	fringing	fringing	fringing	fringing	fringing	fringing	fringing	fringing	fringing

COMMON NAME	SCIENTIFIC NAME												
	Genus	Species											
(A) CLASS													
Scissortail sergeant	*Abudefduf*	*sexfascialus*			2					4			
False eye sergeant	*Abudefduf*	*sparoides*	10	30				7					
Indopacific Sergeant	*Abudefduf*	*vaigiensis*											
Skunk anemonefish	*Amphiprion*	*akallopiosis*		6									
False Clown Anenomefish													
Madagascan Anenomefish	*Amphiprion*	*chrysopterus*											
Twotone chromis	*Chromis*	*dimidiata*	12	10	23		13			12			
Ternate chromis	*Chromis*	*ternatensis*	6		10								
Blue-green chromis	*Chromis*	*viridis*											
Humbug dascyllus	*Dascyllus*	*aruanus*									2	5	
Threespot dascyllus	*Dascyllus*	*trimaculatus*									15		
Baensch's damsel	*Pomacentrus*	*baenschi*			1								
Carulean damsel	*Pomacentrus*	*caeruleus*						5			12	8	
Sulphur damsel	*Pomacentrus*	*sulfureus*											
Dick's damsel	*Plectroglyphidc*	*dickii*	2	8							2		
Pacific gregory	*Stegastes*	*fasciolatus*	4		6								
Unknown	*Unknown*	*sp.*											
Threadfin butterflyfish	*Chaetodon*	*auriga*	2		5								
Bennett's butterflyfish	*Chaetodon*	*bennetti*	1										
Saddleback butterflyfish	*Chaetodon*	*falcula*	4		1								
Spotted butterflyfish	*Chaetodon*	*guttatissimus*	6	4	4	6							
Lined butterflyfish	*Chaetodon*	*lineatus*			1								
Racoon butterflyfish	*Chaetodon*	*lunula*	1		1								
Madagascar (redback)	*Chaetodon*	*madagascarier*	3		3								
Blackback butterflyfish	*Chaetodon*	*melannotus*				1							
Meyer's butterflyfish	*Chaetodon*	*meyeri*	1	1	2	1				1			
Chevroned Butterflyfish	*Chaetodon*	*trifascialis*										1	
Redfin butterflyfish	*Chaetodon*	*trifasciatus*	4	2	3				4				
Vagabond butterflyfish	*Chaetodon*	*vagabundus*						2				1	
Yellowhead butterflyfish	*Chaetodon*	*xanthocephalus*							3				
Zanzibar butterflyfish	*Chaetodon*	*zanzibariensis*				2							
Longnosed butterflyfish	*Forcipiger*	*flavissimus*			1								
Masked bannerfish	*Heniochus*	*monoceros*											
Longfin bannerfish	*Heniochus*	*acuminatus*	5	3									
Yellowtail wrasse	*Anampses*	*meleagrides*			2								
Yellowbreasted/Twist's	*Anampses*	*twisti*	6	2									
Axilspot hogfish	*Bodianus*	*axillaris*		2	3								
Red banded wrasse	*Chellinus*	*fasciatus*							1			1	
Indian Ocean bird wrasse	*Gomphosus*	*caeruleus*	3	9								5	
Bird wrasse	*Gomphosus*	*varius*					6		1				
Checkerboard wrasse	*Halichoeres*	*hortulannus*			6	2			7			4	
Barred thicklip wrasse	*Hemigymnus*	*fasciatus*	5										
Bicolour cleaner wrasse	*Labroides*	*bicolor*	2	5									
Cleaner wrasse	*Labroides*	*dimidiatus*			3							5	
Ornate wrasse	*Macropharyngo*	*ornatus*			1								
Twotone (Blunthead)	*Thalassoma*	*amblycephalum*			1								
Hebrew (Goldbar) wrasse	*Thalassoma*	*hebraicum*			1	2	4		8			4	
Six bar wrasse	*Thalassoma*	*jansenii*			2								
Crescent (moon) wrasse	*Thalassoma*	*lunare*			2								
Unknown	*Unknown*	*sp.*				5	2						
Eyestripe surgeonfish	*Acanthurus*	*dussumieri*											
Powder blue surgeonfish	*Acanthurus*	*leucosternon*		1		8							
Blackstreak surgeonfish	*Acanthurus*	*nigricauda*	10	25	18				1				
Lieutenant surgeonfish	*Acanthurus*	*tennenti*				12							
Thompson's surgeonfish	*Acanthurus*	*thompson*							5				
Convict surgeonfish	*Acanthurus*	*triostegus*					35					5	
Yellofin surgeonfish	*Acanthurus*	*xanthopterus*	6	18									

Goldring bristletooth	*Ctenochaetus*	*strigosus*					15		4			4		
Striped bristletooth	*Ctenochaetus*	*striatus*										2		
Orangespine Unicornfish	*Naso*	*lituratus*		3										
Bluespine Unicornfish	*Naso*	*unicornis*		15										
Moorish idol	*Zanclus*	*cornutus*	5	7	30							1		
Sailfin tang	*Zebrasoma*	*desjardinii*			1									
Brushtail tang	*Zebrasoma*	*scopas*	6	30	8				20	12		13		
Unknown	*Unknown*	*sp.*												
Bicolour parrotfish	*Cetoscarus*	*bicolor*			3									
Blue humphead parrotfish	*Chlorurus*	*cyanescens*			2									
Bullhead/Daisy parrotfish	*Scarus/chlorurus*	*sordidus*		3										
Greenlip Parrotfish	*Scarus*	*viridifucatus*		3										
Unknown	*Unknown*	*sp.*					2		1	2		5		
Crown toby (sharpnose	*Canthigaster*	*coronata*							1					
Solander's sharpnose toby	*Canthigaster*	*solandri*			1									
Bennett's sharpnose toby	*Canthigaster*	*bennetti*			3									
Black saddled toby	*Canthigaster*	*valentini*	4		4									
Star puffer fish	*Arothron*	*stellatus*	1											
Black spotted puffer fish	*Arothron*	*nigropunctatus*												
Unknown	*sp*													
Spotted boxfish	*Ostracion*	*meleagris*							1					
Indian triggerfish	*Melichthys*	*indicus*			12									
Orange striped triggerfish	*Balistapus*	*undulatus*		1					1	1				
Clown triggerfish	*Balistoides*	*conspicullum*	1	3										
Scythe triggerfish	*Sufflamen*	*bursa*	1	1					1			1		
Wedge Triggerfish	*Rhinecanthus*	*rectangulus*						1						
Flagtail (Halfmoon) triggerfish	*Sufflamen*	*chrysopterus*		1						1	4			
Peacock grouper	*Cephalophalis*	*argus*							1					
Blacktip / Redbanded grouper	*Epinephelus*	*fasciatus*			1									
Brownmarbled grouper	*Epinephelus*	*fuscoguttatus*			1									
Honey comb Grouper	*Epinephelus*	*merra*		1										
Marbled coral grouper	*Plectropomus*	*punctatus*		1										
Unknown	*Unknown*	*sp.*							1			1		
Manyspined/dusky angelfish	*Centropyge*	*multispinis*			3			2	3			5		
Three spot angelfish	*Apolemichthys*	*trimaculatus*		2			5		4					
Earspot angelfish	*Pomacanthus*	*chrysurus*												
Semicircle angelfish	*Pomacanthus*	*semicirculatus*	2	1	1				1					
Regal/ royal angelfish	*Pygoplites*	*diacanthus*	1	1		1								
Yellowband fusilier	*Caesio*	*chrysozona*	25	40										
Lunar fusilier	*Caesio*	*lunaris*												
Yellowlined fusilier	*Caesio*	*varilineata*												
Yellowback(scissortail) fusilier	*Caesio*	*xanthonota*	18	40										
Twinstripe fusilier	*Pterocaesio*	*marri*												
Unknown	*Unknown*	*sp.*				35	8		60			25		
Red/Twinspot snapper	*Lutjanus*	*bohar*			1									
Blackspot snapper	*Lutjanus*	*Fulviflamma*												
Bluebanded/Yellowstripe	*Lutjanus*	*kasmira*									1			
Silver sweetlips	*Plectorhinchus*				4									
Blackspotted sweetlips	*Plectorhinchus*	*gaterinus*	10		28									
White barred sweetlips	*Plectorhinchus*	*playfairi*			2									
ANTHIASES	Unknown	sp.												
GOBIES	Unknown	sp.							1					
Dash and dot goatfish	*Parupeneus*	*barberinus*	3	4	1	11		12	10					
Bicoloured goatfish	*Parupeneus*	*barberinoides*												20
Doublebar (barred) goatfish	*Parupeneus*	*bifasciatus*								4				
Rosy goatfish	*Parupeneus*	*Rubescensis*												
Blackspot	*Lethrinus*	*horak*			4									
Crown squirrelfish	*Sargocentron*	*diadema*			17			6						
Blackfin	*Neoniphon*	*opercularis*												
Unknown	Unknown	sp							5					

Arabian Spinecheek	*Sxolopsis*	*ghanam*												
Indian												4		
Bronze soldierfish	*Myripristis*	*adusta*	10		4									
White edged soldierfish	*Myripristis*	*murdjan*			6								2	
Unknown	Unknown	sp.					13							
Lionfish; turkeyfish	*Pterois*	*miles (volitans)*												
Decorated	*Neruteleotris*	*decoratus*												
Unknown species	Unknown	sp.						1						
Unknown	Unknown	sp.						7	1		3	2	4	
Mozambique fangblenny	*Meiacanthus*	*mossambicus*	2		3									
Bluestriped fangblenny	*Plagiotremus*	*rhinorhynchus*									1			
Vanicolo sweeper	*Pempheris*	*vanicolensis*	10	1	19									
Schwenk's sweeper	*Pempheris*	*schwenkii*												
Scrawled filefish	*Aluterus*	*scriptus*			2									
Unknown														
Speckled sandperch	*Parapercis*	*hexaphthalma*			5									
Trumpetfish	*Aulostomus*	*chinensis*												
Banded pipefish	*Corythoichthys*	*intestinalis*	9		4									
Morish Idol	*Zanclus*	*carnescens*				13			5					
Cornetfish	*Fistularia*	*commersonii*												
Indo-Pacific	Unknown	sp.												
Unknown sp	Unknown	sp.												1
(A) (ii) CLASS														
Bluefin trevally	*Caranx*	*melampygus*			3									
(B) CLASS														
Bluespotted ribbontail ray	*Taeniura*	*lymma*		1										

			OUCARE	OUCARE	OUCARE	OUCARE	OUCARE	OUCARE	OUCARE	OUCARE
EUCARE / OUCARE / IHLSM										
Collaborative Reef Research Expedition 2003	SURVEY NO		12	13	14	15	16	17	18	19
Survey data: FISH VISUAL CENSUS	SITE		**S. Nosy**	**N. Nosy**	**N. Nosy**	**E. Nosy**	**S. Nosy**	**W. Nosy**	**Nosy**	**Nosy**
	LOCATION		**Fasy**	**Fasy**	**Hao**	**Hao**	**Hao**	**Hao**	**Andrahombava**	**Andrahombava**
	DATE (dd-mm-02)		19-Aug-03	20-Aug-03	21-Aug-03	21-Aug-03	23-Aug-03	25-Aug-03	26-Aug-03	26-Aug-03
	TIME OF SURVEY (hh:mn)		10:05	10:07	09:30	11:05	11:00	10:40	10:50	11.45
	DURATION OF SURVEY (mins)		28mins	22mins	20mins	20mins	20mins	22mins	20mins	22mins
	LOW TIDE		15:05	15:39	16:39	16:39	09:37	10:14	10:46	10:46
	HIGH TIDE		21:10	21:43	10:28	10:28	15:05	16:29	16:53	16:59
	TIDAL PHASE		Ebb	Ebb	Ebb	Flood	Flood	Flood	Flood	Flood
	CURRENT DIRECTION AND SPEED (m		None	none	none	none	none	none	slight - North	none
	UNDERWATER SWELL		none	none	none	none	none	none	none	none
	UNDERWATER VISIBILITY (m)		10m							
	SURVEYORS (FISH)		Hatty	Hatty	Matttv	Matty	Hattv	Ellie	Ellie	Ellie
	SURVEYORS (INVERTEBRATES)		Ellie	Ellie	Ellie	Hatty	Ellie	Hattv	Hatty	Hatty
	GPS (S) START		22 04.268	22 03.9365	22 04.6065	22 06.430	22 06.2045		21 07.305	21 59.0595
	GPS (E) START		43 11.621	43 11.950	43 11.591	43 11.777	43 11.748		43 11.800	43 11.579
	MAX SURVEY DEPTH (m)		10.3m	8.8m	12.8m	5m	9m	12.6m	8.2m	11.2m
	WATER TEMPERATURE (°C)		24	24	24	24	24	23	23	23
GEOMORPHOLOGICAL CLASS OF REEF			frinaina	frinaina	frinaina	frinaina	frinaina	frinaina	frinaina	frinaina
COMMON NAME	SCIENTIFIC NAME Genus	Species								
(A) CLASS										
Scissortail sergeant	*Abudefduf*	*sexfasciatus*								
False eye sergeant	*Abudefduf*	*sparoides*	15		25	13	5	8		7
Indopacific Sergeant	*Abudefduf*	*vaigiensis*				16				
Skunk anemonefish	*Amphiprion*	*akallopiosis*	10		8		5			
False Clown Anenomefish			12							
Madagascan Anenomefish	*Amphiprion*	*chrysopterus*			3		1			
Twotone chromis	*Chromis*	*dimidiata*	50	15		11				15
Ternate chromis	*Chromis*	*ternatensis*								
Blue-green chromis	*Chromis*	*viridis*	30							
Humbug dascyllus	*Dascyllus*	*aruanus*	20		12					
Threespot dascyllus	*Dascyllus*	*trimaculatus*	15	5		3	12		3	

Baensch's damsel	*Pomacentrus*	*baenschi*								
Cerulean damsel	*Pomacentrus*	*caeruleus*	12	5		3				
Sulphur damsel	*Pomacentrus*	*sulfureus*				14				
Dick's damsel	*Plectroglyphidon*	*dickii*						3		
Pacific gregory	*Stegastes*	*fasciolatus*								
Unknown	*Unknown*	*sp.*	15	16						
Threadfin butterflyfish	*Chaetodon*	*auriga*	1		1					
Bennett's butterflyfish	*Chaetodon*	*bennetti*								
Saddleback butterflyfish	*Chaetodon*	*falcula*			2					
Spotted butterflyfish	*Chaetodon*	*guttatissimus*						2	2	
Lined butterflyfish	*Chaetodon*	*lineatus*								2
Raccoon butterflyfish	*Chaetodon*	*lunula*								
Madagascar (redback)	*Chaetodon*	*madagascariensis*								
Blackback butterflyfish	*Chaetodon*	*melannotus*	1					1		
Meyer's butterflyfish	*Chaetodon*	*meyeri*			2			1		1
Chevroned Butterflyfish	*Chaetodon*	*trifasciatus*	1							
Redfin butterflyfish	*Chaetodon*	*trifasciatus*			2					9
Vagabond butterflyfish	*Chaetodon*	*vagabundus*						1	1	
Yellowhead butterflyfish	*Chaetodon*	*xanthocephalus*								
Zanzibar butterflyfish	*Chaetodon*	*zanzibarensis*								
Longnosed butterflyfish	*Forcipiger*	*flavissimus*					1			
Masked bannerfish	*Heniochus*	*monoceros*			2					
Longfin bannerfish	*Heniochus*	*acuminatus*			5				1	
Yellowtail wrasse	*Anampses*	*meleagrides*								
Yellowbreasted/Twist's	*Anampses*	*twistii*								
Axilspot hogfish	*Bodianus*	*axillaris*								
Red banded wrasse	*Cheilinus*	*fasciatus*								
Indian Ocean bird wrasse	*Gomphosus*	*caeruleus*	2						2	
Bird wrasse	*Gomphosus*	*varius*								1
Checkerboard wrasse	*Halichoeres*	*hortulanus*	3	1				4	7	2
Barred thicklip wrasse	*Hemigymnus*	*fasciatus*								
Bicolour cleaner wrasse	*Labroides*	*bicolor*								
Cleaner wrasse	*Labroides*	*dimidiatus*	1	8	8		5		3	3
Ornate wrasse	*Macropharyngodon*	*ornatus*								
Twotone (Bluntnead)	*Thalassoma*	*amblycephalum*					15			
Hebrew (Goldhan) wrasse	*Thalassoma*	*hebraicum*	1		2				4	
Six bar wrasse	*Thalassoma*	*jensenii*								
Crescent (moon) wrasse	*Thalassoma*	*lunare*			5		5			
Unknown	*Unknown*	*sp.*				8				
Evestripe surgeonfish	*Acanthurus*	*dussumieri*			12					
Powder blue surgeonfish	*Acanthurus*	*leucosternon*								
Blackstreak surgeonfish	*Acanthurus*	*mancauda*	4	1					1	2
Lieutenant surgeonfish	*Acanthurus*	*tennenti*							6	3
Thompson's surgeonfish	*Acanthurus*	*thompson*								
Convict surgeonfish	*Acanthurus*	*triostegus*							50	
Yellowfin surgeonfish	*Acanthurus*	*xanthopterus*								
Goldring bristletooth	*Ctenochaetus*	*strigosus*	5		4					2
Striped bristletooth	*Ctenochaetus*	*striatus*						6	10	15
Orangespine Unicornfish	*Naso*	*lituratus*								
Bluespine Unicornfish	*Naso*	*unicornis*								
Moorish idol	*Zanclus*	*cornutus*	4		3	2	5	3		7
Sailfin tang	*Zebrasoma*	*desjardinii*								
Brushtail tang	*Zebrasoma*	*scopas*	17		16	10	5	10	12	15
Unknown	*Unknown*	*sp.*				14	12			
Bicolour parrotfish	*Cetoscarus*	*bicolor*								
Blue humphead parrotfish	*Chlorurus*	*cyanescens*								
Bullhead/Daisy parrotfish	*Scarus/chlorurus*	*sordidus*						10	6	5
Greenlip Parrotfish	*Scarus*	*viridifucatus*								
Unknown	*Unknown*	*sp.*		8	9		12	13	3	9
Crown tobv (sharnnose	*Canthigaster*	*coronata*	2	3	2	4	2			
Solander's sharnnose/tobv	*Canthigaster*	*solandri*								
Bennett's sharnnose tobv	*Canthigaster*	*bennetti*								
Black saddled tobv	*Canthigaster*	*valentini*						3	2	
Star pufferfish	*Arothron*	*stellatus*								
Black spotted pufferfish	*Arothron*	*nigropunctatus*			2					
Unknown	*sp.*						2			
Spotted boxfish	*Ostracion*	*meleagris*								
Indian triggerfish	*Melichthys*	*indicus*								
Orange striped triggerfish	*Balistapus*	*undulatus*	2	1	1		1			1
Clown triggerfish	*Balistoides*	*conspicullum*								
Scythe triggerfish	*Sufflamen*	*bursa*		1					1	
Wedge Triggerfish	*Rhinecanthus*	*rectangulus*								

Flagtail (Halfmoon)	*Sufflamen*	*chrysopterus*			1		1		2	2
Peacock grouper	*Cephalopholis*	*argus*							1	1
Blacktip / Redbanded	*Epinephelus*	*fasciatus*								
Brownmarbled grouper	*Epinephelus*	*fuscoguttatus*								
Honey comb Grouper	*Epinephelus*	*merra*								
Marbled coral grouper	*Plectropomus*	*punctatus*								
Unknown	*Unknown*	*sp.*		1						
Manyspined/dusky	*Centropyge*	*multispinis*								
Three spot angelfish	*Apolemichthys*	*trimaculatus*	15		1		12			2
Earspot angelfish	*Pomacanthus*	*chrysurus*			1					3
Semicircle angelfish	*Pomacanthus*	*semicirculatus*	1							4
Regal/ royal angelfish	*Pygoplites*	*diacanthus*			1		3			1
Yellowband fusilier	*Caesio*	*chrysozona*								
Lunar fusilier	*Caesio*	*lunaris*	30						15	
Yellowlined fusilier	*Caesio*	*varilineata*					12			
Yellowback(scissortail)	*Caesio*	*xanthonota*							15	
Twinstripe fusilier	*Pterocaesio*	*marri*	10		25					
Unknown	*Unknown*	*sp.*		8						
Red/Twinspot snapper	*Lutianus*	*bohar*								
Blackspot snapper	*Lutianus*	*Fulviflamma*				5				
Bluebanded/Yellowstripe	*Lutianus*	*kasmira*								
Silver sweetlips	*Plectorhinchus*									
Blackspotted sweetlips	*Plectorhinchus*	*gaterinus*			25		2			
White barred sweetlips	*Plectorhinchus*	*playfairi*								
ANTHIASES	Unknown	sp.		35			2			
GOBIES	Unknown	sp.								
Dash and dot goatfish	*Parupeneus*	*barberinus*		5	4	2	5	3	6	
Bicoloured goatfish	*Parupeneus*	*barberinoides*	2							
Doublebar (barred)	*Parupeneus*	*bifasciatus*						1		
Rosy goatfish	*Parupeneus*	*Rubescensis*			5					
Blackspot	*Lethrinus*	*horak*						1		
Crown squirrelfish	*Sargocentron*	*diadema*								
Blackfin	*Neoniphon*	*opercularis*							1	
Unknown	Unknown	sp.	8		8					
Arabian Spinecheek	*Sxyloprisis*	*ahenam*			25	4	12			
Indian										
Bronze soldierfish	*Myripristis*	*adusta*								
White edged soldierfish	*Myripristis*	*murdjan*								
Unknown	Unknown	sp.		25	8			1	6	
Lionfish; turkeyfish	*Pterois*	*miles (volitans)*	1				1			
Decorated	*Neruteleotris*	*decoratus*								2
Unknown species	Unknown	sp.							1	
Unknown	Unknown	sp.		25			1			
Mozambique fangblenny	*Melacanthus*	*mossambicus*								
Bluestriped fangblenny	*Plagiotremus*	*rhinorhynchus*								
Vanicolo sweeper	*Pempheris*	*vanicolensis*								
Schwenk's sweeper	*Pempheris*	*schwenkii*		50	14		2			
Scrawled filefish	*Aluterus*	*scriptus*								
Unknown			2							
Speckled sandperch	*Parapercis*	*hexaphthalma*								
Trumpetfish	*Aulostomus*	*chinensis*			1					
Banded pipefish	*Corythoichthys*	*intestinalis*								
Moish Idol	*Zanclus*	*cornescens*			3					
Cornetfish	*Fistularia*	*commersonii*			1					
Indo-Pacific	Unknown	sp.		5						
Unknown sp	Unknown	sp.								
(A) (ii) CLASS										
Bluefin trevally	*Caranx*	*melampygus*								
(B) CLASS										
Bluespotted ribbontail ray	*Taeniura*	*lymma*						1		

FUCARE / IHSM Survey data:INVERTERRATE QUADRATS	LOCATION		Site 1: Baie de Fanemotra									
	SURVEY CODE		FANEMOTR									
	SURVEYOR		M.H. / D.I									
	TRANSECT SECTION (20m)		1			2			3			
	QUADRAT NO.		1	2	3	4	5	6	7	8	9	Averag
Cone Shell	Cornis	eburneus										
Spindle Shell	Pleuroploca	sp.										
Whelk	Phos	senticosus										
Spider Shell	Lambis	sp.										
Elongate Giant Clam	Tridacna	maxima		2								0.2222
(Diadematidae) very long spined blackurchin	Diadema	setosum or saviqnyi					2					0.2222
Sea star	Leiaster	species			1							0.1111
Feather star	Unknown	sp.					1					0.1111
Unknown species	Unknown	sp.										
Sea cucumber	Pearsonothuria	graeffi										
Orange sponge	Thalysias	vulpina										
Tube sponge	Unknown	sp.										
Sea squirt	Clavelina	moluccensis										
	Didemnidae	sp.	6				12		14	19		5.6666
	Ecteinascidia	sp.										
	Polycarpa	clavata										
	Pycnoclavella	sp.										
	Rhopalaea	crassa										
	Unknown	sp.										
Tubeworm	Sabellidae	sp.	2	1					1	2	1	0.7777
Flatworm	Unknown	sp.										
	Unknown	sp.										
Sea Anemone	Stichodactylidae	sp.	1	1								0.2222
Zooantharian	Palythoa	sp.										
Zooantharian	Protopalythoa	sp.										
Zooantharian	Unknown	sp.						16		12		3.1111
Gorgonian Sea Fan	Unknown	sp.		1					1		1	0.3333
Green Algae	Valonia	aegagropila										
LC	LIVING CORAL		22%		15%	100%	25%	7%		42%	25%	26%
DC	DEAD CORAL		7%	25%			20%			5%	5%	7%
SC	SOFT CORAL				15%			8%	35%			6%
AA	ALGAL		65%	40%	20%		10%	65%	11%	45%	28%	32%
CA	CORRALINE			6%	20%		20%		17%			7%
DEB	DEBRIS		6%	10%	5%					8%	7%	4%
SA	SAND			15%	25%			20%	20%		23%	11%
RK	ROCK						25%		11%		12%	5%
	OTHER:											
	ANEMONE								6%			1%
	ZOOANTHARIAN											
	COMMENTS		CM.			CM	CM	CM			CM	

FUCARE / IHSM Survey data:	SURVEY NO.		2									
INVERTERRATE QUADRATS	LOCATION		North point of Nosy Andrahombava									
	SURVEY CODE		NAPOLEON									
	SURVEYOR		D.I			AI / FP						
	TRANSECT SECTION (20m)		1			2			3			
	QUADRAT NO.		1	2	3	4	5	6	7	8	9	Average
Cone Shell	Cornis	eburneus			1							0.11111
Spindle Shell	Pleuroploca	sp.		1								0.11111
Whelk	Phos	senticosus		1								0.11111
Spider Shell	Lambis	sp.	1									0.11111
Elongate Giant Clam	Tridacna	maxima										
(Diadematidae) very long	Diadema	setosum or saviqnyi										
Sea star	Leiaster	species										
Feather star	Unknown	sp.			1	1						0.22222
Unknown species	Unknown	sp.				1						0.11111
Sea cucumber	Pearsonothuria	graeffi			1							0.11111
Orange sponge	Thalysias	vulpina										
Tube sponge	Unknown	sp.										
Sea squirt	Clavelina	moluccensis			12							1.33333
	Didemnidae	sp.										
	Ecteinascidia	sp.										
	Polycarpa	clavata			9							1
	Pycnoclavella	sp.										
	Rhopalaea	crassa	6									0.66667
	Unknown	sp.					2			6		0.88889
Tubeworm	Sabellidae	sp.										
Flatworm	Unknown	sp.		1								0.11111
	Unknown	sp.										
Sea Anemone	Stichodactylidae	sp.	1	1								0.22222
Zooantharian	Palythoa	sp.	24									2.66667
Zooantharian	Protopalythoa	sp.			35							3.88889
Zooantharian	Unknown	sp.				30					12	4.66667

Gorgonian Sea Fan	Unknown	sp.		1									0.11111
Green Algae	Valonia	aegagropila		1									0.11111
LC	LIVING CORAL		6%	27%	3%	7%	65%	25%	40%	30%	15%	24%	
DC	DEAD CORAL		15%			60%	30%	55%	50%	60%	50%	36%	
SC	SOFT CORAL			9%		3%	5%	10%	10%	5%		5%	
AA	ALGAL		23%	26%	23%	15%		5%			30%	14%	
CA	CORRALINE		8%		30%	15%		5%		5%	5%	8%	
DEB	DEBRIS		20%	16%	4%							4%	
SA	SAND			8%	12%							2%	
RK	ROCK		9%		10%							2%	
	OTHER:												
	ANEMONE		12%	6%								2%	
	ZOOANTHARIA		7%	7%	8%							2%	
	COMMENTS		CE	CM,CE	ACD	CE	SC:Sarcophyton		CM, CE	CT (1/2	CE		
				SC=Simul			CM	CT (1/2		domina			
							CE	dom by					

EUCARE (IUCN) Survey data:		SURVEY NO	3									
INVERTEBRATE QUADRATS		LOCATION	Baie de Fanemotra									
	SURVEY CODE		FANEMOTR									
	SURVEYOR		FRW									
	TRANSECT SECTION (20m)		1			2			3			
	QUADRAT NO		1	2	3	4	5	6	7	8	9	Averag
Cone Shell	Cornis	eburneus										
Spindle Shell	Pleuroploca	sp.										
Whelk	Phos	senticosus										
Spider Shell	Lambis	sp.										
Elongate Giant Clam	Tridacna	maxima										
(Diadematidae) very long spined	Diadema	setosum or savignyi										
Sea star	Leiaster	species										
Feather star	Unknown	sp.										
Unknown species	Unknown	sp.										
Sea cucumber	Pearsonothuria	graeffi										
Orange sponge	Thalysias	vulpina	3									0.3333
Tube sponge	Unknown	sp.							3			0.3333
Sea squirt	Clavelina	moluccensis										
	Didemnidae	sp.										
	Ecteinascidia	sp.							3	1		0.4444
	Polycarpa	clavata										
	Pycnoclavella	sp.	7				1					0.8888
	Rhopalaea	crassa										
	Unknown	sp.	5	1				3	3	3	14	3.2222
Tubeworm	Sabellidae	sp.										
Flatworm	Unknown	sp.										
	Unknown	sp.					1					0.1111
Sea Anemone	Stichodactylidae	sp.										
Zooantharian	Palythoa	sp.										
Zooantharian	Protopalythoa	sp.										
Zooantharian	Unknown	sp.			24		18		24		14	8.8888
Gorgonian Sea Fan	Unknown	sp.										
Green Algae	Valonia	aegagropila										
LC	LIVING CORAL		15%	50%	55%	100%		30%	26%		30%	34%
DC	DEAD CORAL		40%	40%	20%		70%	50%	70%	25%	50%	41%
SC	SOFT CORAL			10%	10%					45%	20%	9%
AA	ALGAL		15%				30%		4%			5%
CA	CORRALINE		20%		15%			20%				6%
DEB	DEBRIS											
SA	SAND		5%							30%		4%
RK	ROCK		5%									1%
	OTHER:											
	ANEMONE											
	ZOOANTHARIAN											
	COMMENTS		CA=hali	CE	Halime	CM		Halime	CE		CE,	
					CE, CM	Porite		CE				

OUCARE INVERTEBRATE SURVEY DATA		Site No.	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Cone Shell	*Unknown*	*species*										1				1		
Cowrie Shell	*Cypraea*	*tigris*											5	1				1
Whelk	*Phos*	*senticosus*							1									
Nudibranch	*Ardeadoris*	*egretta*					1											
Nudibranch	*Phyllidia*	*coelestris*	1									2						
Nudibranch	*Unknown*	*sp.*															1	
Nudibranch	*Chromodoris*	*elizabethina*	5											1	1			

Elongate Giant Clam	*Tridacna*	*maxima*	1						1	1		1	2						
Unknown	*Unknown*	*sp.*					3									1			
(Diadematidae) Regular	*Echinothrix*	*diadema*										24							
Regular urchin	*Salmacis*	*bicolor*	3			2							18						
Blue Linckia	*Linckia*	*laevigata*									7	6		12					5
Brown Linckia	*Linckia*	*guildingii*						3											
Crown of thorns starfish	*Acanthaster*	*planci*										1							
Cushion star	*Cucita*	*schmideliana*										1		1					3
Star fish	*unknown*	*sp*			1		3												
Feather star	*Unknown*	*sp.*				1			2				1						
	Topiometra	*sp.*	1																
Sea cucumber	*Bohadschia*	*sp.*									1	1		2					1
Sea cucumber	*Holothuria*	*fuscopumctata*				1													
Mantis Shrimp	*Unknown sp.*						1	1											
Lobster	*Unknown*	*sp.*			1								1						
Vase sponge	*Unknown*	*sp.*	7																
Sea squirt	*Unknown*	*sp.*			3		1			12									
Unknown	*Unknown*	*sp.*	2				3				10		4						3
Stinging hydrozoan	*Aglaophenia*	*cupressina*	1																
Sea Anemone	*Heteractis*	*magifica*									4			10					5
	Unknown	*sp.*				1													
Zooanthanian	*Unknown*	*sp.*	1																
Gorgonian Sea Fan	*Unknown*	*sp.*														2	1		
Sea Whip	Unknown	sp												1					

Appendix 3 – Regression Analyses (minitab)

Regression Analysis: fish H versus Hard Coral

```
The regression equation is
fish H = 2.05307 + 0.0214301 Hard Coral

S = 0.588628      R-Sq = 21.6 %      R-Sq(adj) = 16.4 %

Analysis of Variance
Source            DF         SS         MS         F      P
Regression         1    1.43542    1.43542   4.14284  0.060
Error             15    5.19725    0.34648
Total             16    6.63267
```

Regression Analysis: fish H versus Algae %

```
The regression equation is
fish H = 2.70521 - 0.0237608 Algae %

S = 0.552785      R-Sq = 30.9 %      R-Sq(adj) = 26.3 %

Analysis of Variance
Source            DF         SS         MS         F      P
Regression         1    2.04910    2.04910   6.70579  0.021
Error             15    4.58358    0.30557
Total             16    6.63267
```

Regression Analysis: fish H versus Abiotic %

```
The regression equation is
fish H = 2.32258 + 0.0012876 Abiotic %

S = 0.664039      R-Sq = 0.3 %      R-Sq(adj) = 0.0 %

Analysis of Variance
Source            DF         SS         MS         F      P
Regression         1    0.01845   0.018448  4.18E-02  0.841
Error             15    6.61423   0.440948
Total             16    6.63267
```

Regression Analysis: invert H versus Hard Coral

```
The regression equation is
invert H = 0.872466 + 0.0168198 Hard Coral

S = 0.505626      R-Sq = 18.7 %      R-Sq(adj) = 13.3 %

Analysis of Variance
```

Source	DF	SS	MS	F	P
Regression	1	0.88425	0.884252	3.45873	0.083
Error	15	3.83487	0.255658		
Total	16	4.71912			

Regression Analysis: invert H versus Algae %

The regression equation is
invert H = 1.37940 - 0.0182697 Algae %

S = 0.483575 R-Sq = 25.7 % R-Sq(adj) = 20.7 %

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	1.21145	1.21145	5.18058	0.038
Error	15	3.50767	0.23384		
Total	16	4.71912			

Regression Analysis: invert H versus Abiotic %

The regression equation is
invert H = 1.35694 - 0.0036678 Abiotic %

S = 0.551932 R-Sq = 3.2 % R-Sq(adj) = 0.0 %

Analysis of Variance

Source	DF	SS	MS	F	P
Regression	1	0.14969	0.149686	0.491371	0.494
Error	15	4.56943	0.304629		
Total	16	4.71912			

Appendix 4 - MADAGASCAR 2003 DIVE PLAN

DIVING PROTOCOL

Due to the dangerous nature of diving, a protocol was developed for EUCARE to ensure maximum safety for participants during diving.

All diving follows the code of the Professional Association of Diving Instructors. Also, our diving protocol closely follows the UK HSE Diving at Work Regulations 1997 Approved Code of Practise for Scientific & Archaeological Diving projects and the Scientific Diving Supervisory Committee Advice Notes for the Approved code of practise.

All divers were briefed on these protocols before diving and where applicable are responsible for following them. All team members signed the protocol and completed 'PADI Statement of Risks and Liability' forms.

DIVING

- No diving by anyone younger than 18 years of age
- All volunteers must have an approved medical certificate from their home country. Any medical problems must be brought to the attention of the medical officer before diving
- Divers will familiarise themselves with the regulations on equipment, specific local safety, conditions and access to local medical support before any diving
- Diving will always be planned using PADI tables. The PADI tables used have been modified to be more conservative in order to ensure maximum safety
- Diving will always be conducted in buddy pairs
- Each diver will be of at least PADI Advanced standard before undertaking any survey diving
- Dives will only be undertaken to a maximum depth of 30 meters

Summary of depth and time limits for diving on EUCARE expedition

Metres	18	20	25	30
Mins	37	29	20	14

- Dives in the afternoon will always be shallower than those undertaken in the morning, and their maximum depth will be 18 metres
- No volunteer will complete more than 2 dives per day
- Divers will always re-surface with no less than 50 bar in their tank. If this is not adhered to, the next day's diving will be forfeited
- Divers must conduct a buddy check before every dive
- Each diver will have one day off diving in every four to minimise the build up of nitrogen bubbles in their system
- Night diving will only be undertaken when each diver has a torch and a spare in their possession, along with mini fluorescent tubes attached to their SMB
- All volunteers will obtain a medical certificate for diving prior to attending an expedition

- Any medical issue must be brought to the attention of the medical officer and prior to any diving, this includes the use of any prescribed drugs whilst on an expedition.
- All volunteers will be given talks on Dangerous sea creatures, oxygen administration, meteorology, the diving protocol and other safety issues
- No one will be allowed to dive if they have consumed any alcohol that day.
- Reasonable abstinence from alcohol is expected prior to diving.
- It is recommended that no food or fizzy drinks should be consumed less than half an hour before diving.
- There are to be no extended range or mixed gas diving on the programme
- All dives are to be no-decompression dives
- Dives are to be conservative and accurately recorded
- If the nearest recompression chamber is out of commission, unavailable due to weather, technical reasons or in extended use then all diving is suspended. A limited amount of very conservative shallow diving may take place pending approval of both the diving officer and the expedition leader.
- No flying, or travels at an altitude over 300 meters within 24 hours of diving
- All dive records and logs must be completed by the diving officer and should be retained at each field base

KIT

- It is recommended to volunteers that a diving computer be used at all times.
- Every survey team will use a Surface Marker Buoy (SMB). If at any point during the dive the SMB becomes detached, tangled or lost, the survey will be aborted immediately. No more than 6 divers may dive with one SMB on either scientific or recreational dives.
- Oxygen will always be carried on board the boat along with a larger container of oxygen at base camp. There will always be a qualified oxygen administrator.
- A boat box containing satellite telephone, VHF radio, and an emergency evacuation procedures slate will always be on board the boats in case of emergency.
- A fully stocked medical kit will remain on board at all times.
- A tool kit will remain on board at all times in case of engine troubles.
- Each volunteer will be responsible for assembling and testing their kit prior to diving.

PERSONNEL

- A diving officer will either accompany divers or remain on the boat at all times during diving.
- A dive team must consist of at least four qualified people comprising two surface cover and two divers with the lead diver identified prior to commencing the dive.
- At least one member of a diving team (divers & boat marshal) must have a certification of PADI Rescue Diver or above with medic first aid training
- A boat marshal will remain on the boat during diving. They are responsible for recalling divers if they have strayed over their profile. Other responsibilities include marking down divers' air consumption, times in and out of the water, and pressure groups.
- There will always be an assigned shore marshal whilst a diving team is on the water. They are responsible for maintaining radio contact with the boats and instigating emergency procedures if required. All shore marshals' will be briefed on their role at the beginning of each expedition. Whilst on duty they will have in their possession detailed instructions of what to done in the case of an emergency, as well as a mobile telephone with relevant numbers.

PLAN FOR A TYPICAL DAY'S DIVING

- Times of dives will be dictated by tide tables.
- Typically each member (less one who is the shore marshall) will undertake 2 dives, one in the morning and one in the afternoon, the length of which is detailed in the table above
- Each days diving will be preceded with a dive briefing from the dive officer detailing buddy pairs, profiles, emergency signals, and the local conditions that day
- Depths and therefore times of dives will be dictated by the different scientific surveys required. These will vary day to day but as a rule the first dive will be no deeper than 30 metres, and the second will be no deeper than 18 metres (but will always be shallower than the first).
- When the day's diving has been completed, a debriefing will commence and dive profiles will be recorded in a central database as well as in each diver's personal log books.

OUTLINE PLAN FOR A TYPICAL WEEK'S DIVING

Each diver should complete about 12 dives a week (including the one day off diving in every four), depending on local conditions and health of volunteers

DIVE LOG / BUBBLES CHART! (Elizabeth Prins)
(PG: Pressure Group, SI: Surface Interval)

			DIVE 1								DIVE 2					
Date	Location	Diver	AIR IN	AIR OUT	TIME IN	TIME OUT	Max Depth (m)	PG	SI	PG	AIR IN	AIR OUT	TIME IN	TIME OUT	Max Depth (m)	PG
20 07 03	NOSY HAO	AP	185	95	15:32	16:04	14	H								
		DJ	190	110	15:32	16:04	14	H								
		EP	185	100	15:29	16:04	14.7	L	00:48	E	180	130	16:50	17:10	13.4	L
		LOPE	195	140	16:50	17:10	14	D								
		AM	185	125	16:50	17:10	14	D								
		JASPER	195	130	16:50	17:10	14	D								
		TSIRI	195	100	15:29	16:04	15	L								
22 07 03	NOSY FASY	DJ	200	150	11:05	11:30	7	C	00:45	B	150	95	12:15	12:45	12	K
		AP	200	150	11:05	11:30	8	C	00:45	B	150	110	12:15	12:45	12	K
		AM	200	150	11:05	11:30	9	C	00:45	B	150	100	12:15	12:45	9	I
		EP	200	150	11:05	11:30	7	C	00:45	B	150	100	12:15	12:45	7.7	I
24 07 03	BAIE DE	EP	190	150	11:35	11:55	7	B								
	FANEMOTRA	ML	187	150	11:35	11:55	7	B								
		AP	190	150	12:26	12:35	7	A	00:16	A	190	90	12:51	13:22	7	G
		LOPE	190	150	12:26	12:35	7	A	00:16	A	190	80	12:51	13:22	7	G
		DJ	190	100	12:44	13:20	7	F								
		AM	190	100	12:44	13:20	7	F								
25 07 03	BAIE DE	AL	200	85	11:30	12:11	10	G								
	FANEMOTRA	AP	200	90	12:15	12:50	10	F	03:39	A	200	150	16:29	16:57	9	G
		DJ	200	85	11:30	12:11	10	G	04:18	A	190	120	16:29	16:57	9	G
		AM	200	85	11:42	12:19	10	F	04:10	A	185	130	16:29	16:57	9	G
		AE	200	55	11:42	12:19	10	F	04:10	A	190	105	16:29	16:57	9	G
		LOPE	200	70	12:15	12:50	10	F								
		TSIRI	200	70	12:15	12:50	10	F								
		JASPER	200	70	12:15	12:50	10	F								
26 07 03	BAIE DE	AM	195	100	10:34	11:10	9	F	01:24	B	100	80	12:34	12:39	9	C
	FANEMOTRA	AP	190	160	10:03	10:14	6	B	00:11	B	160	95	10:31	11:00	9	I
		AL	200	160	10:03	10:14	6	B	00:11	B	155	90	10:31	11:00	9	I
		ML	198	66	11:36	12:16	9	G								
		DJ	190	90	11:36	12:16	9	G								
		LOPE	189	95	10:34	11:10	9	F								
		EP	190	80	11:45	12:16	9	F								
28 07 03	NAPOLEON	AP	190	80	10:05	10:43	13	K								
		AL	200	90	10:05	10:43	15	M								
		AM	190	80	10:05	10:43	12	H	00:53	C	200	110	11:36	12:16	10	M
		ML	186	85	10:05	10:43	12.7	K								
		DJ	200	110	11:36	12:18	12	I								
		EP	190	110	11:36	12:18	13.1	L								
		LOPE	200	95	11:36	12:15	11	I								
29 07 03	NAPOLEON	AP	190	70	10:25	11:10	10	H								
		AL	200	75	10:00	10:42	11.4	I								
		AM	190	85	09:32	10:04	13	H	01:12	B	190	100	11:16	11:55	11	M
		DJ	190	85	09:32	10:04	13	H	01:12	B	200	100	11:16	11:55	11	M
		EP	190	70	10:00	10:42	11.4	I								
		LOPE	195	45	10:25	11:10	13.5	M								
1 08 03	NAPOLEON	AP	190	100	09:43	10:15	13	H	01:14	B	200	110	11:29	12:05	11	L
		DJ	200	90	09:43	10:15	14	H	01:14	B	200	110	11:29	12:05	11	L
		ML	198	92	10:31	11:06	11.2	G								
		AE	200	80	10:31	11:06	11.2	G								
		AL	200	75	10:39	11:13	13.5	H								
		EP	220	150	10:39	11:14	11.1	G	01:03	B	135	105	12:17	12:29	19	I

			DIVE 1								DIVE 2					
Date	Location	Diver	AIR IN	AIR OUT	TIME IN	TIME OUT	Max Depth (m)	PG	SI	PG	AIR IN	AIR OUT	TIME IN	TIME OUT	Max Depth (m)	PG
2.08.03	BALEINE	AL	200	120	10:19	10:39	25	K								
		AE	190	70	11:25	11:44	8.4	D								
		DJ	195	120	10:19	10:39	25	K	00:44	E	120	80	11:25	11:44	3	J
		ML	184	95	10:19	10:39	25	K								
		AP	190	120	10:19	10:39	25	K	00:44	E	110	80	11:25	11:44	8.4	J
3.08.03	WHALE AND	AP	120	80	09:57	10:27	25	N	01:37	B	190	140	12:04	12:24	20	N
	NAUTILUS	DJ	190	80	09:57	10:27	25	N	01:37	B	190	120	12:04	12:24	20	N
		AL	205	80	09:57	10:27	25	N								
		EP	200	140	12:04	12:25	22	I								
4.08.03	WHALE	AP	200	80	09:15	09:35	23.9	K								
		DJ	187	66	09:15	09:35	23.9	K								
		AL	195	80	10:31	10:53	24.5	L								
		EP	195	95	10:31	10:53	24.5	L								
5.08.03	NAPOLEON &	AL	195	90	09:30	10:06	20.7	R	01:47	B	200	120	11:53	12:17	20	O
	WHALE	EP	185	100	09:30	10:06	20.7	R	01:47	B	195	135	11:53	12:17	20	O
6.08.03	BAIE DE	AL	195	95	10:21	11:04	8.7	H	01:12	B	175	85	12:16	12:59	8.2	L
	FANEMOTRA	EP	190	95	10:21	11:04	8.7	H	01:12	B	190	85	12:16	12:59	8.2	L

APPENDIX 5 - ITINERARY (Elizabeth Prins)

DATE	ACTIVITY
4-5th June	Pre-expedition training with Dan Logan at Libby's place in Devon (Rescue Diver course for Anna P, Dom and Adrian)
26th June	Libby takes tanks, compressor and other equipment to Air France cargo for air freight.
27th June	Hannah, Ryan, Libby, Anna L, Matt and Adrian depart from London Heathrow. Air France Flight 2471. Dep 0645 Arr Paris 0905 AF 908. Dep Paris 1015 Arr Tana 2200 Meet Dava Razafinarivo, Anna P and Dom at the airport. Stay at Manoir Rouge in Ivato. Make plans when to leave for Tulear with Dave.
28th June	All into Antananarivo by taxi brousse. Matt, Anna L and Libby to hospital for emergency oxygen, to no avail. We are told to try SOAM. The rest work in groups to buy equipment for in the field.
29th June	Matt, Libby and Anna L remain in Ivato preparing for in field phase. Rest of the group go to Parc National d'Andasibe-Mantadia.
30th June	Libby, Anna L and Matt to Tana to visit Andrew Cooke and to buy medical supplies from the Medical Store. Rest of the group return from the parc.
1st July	Anna L waits for Dave at Manoir Rouge to start the long process of bringing freighted equipment through customs. Everyone else goes into Tana. Matt, Libby and Adrian go to SOAM to get oxygen cylinder and have to order demand flow oxygen valve from France. Elphie arrives late afternoon.
2nd July	Libby, Adrian, Hannah, Ryan, Anna P and Dom start their 18hr taxi brousse journey to Tulear. Anna L, Matt and Elphie remain in Ivato. Anna L goes to the Ministry of Finance.
3rd July	Anna L waits at the airport all day with Dave to sort out freightage. Rest of the group arrive in Tulear at 10am. Stay at Chez Alain. Go to IH SM in the afternoon to meet the scientists Lope, Jasper and Tsiry. Anna L retrieves equipment at airport and takes straight to taxi brousse station.
4th July	Matt goes to SOAM to collect oxygen valve, which turns out to be expensive. Anna L starts her journey from Tana to Tulear. Hannah, Ryan and Libby meet with Lope, Jasper and Tsiry at the IH SM.
5th July	Anna L arrives in Tulear at 1415 where she's met by the rest of the group. Hannah's Birthday! All go to Vassili's, a Greek Restaurant, for supper.
6th July	Libby and Anna L remain in Tulear. The other five leave for Ifaty to find a dive boat.
7th July	Anna L and Libby receive news that Paulo from Laguna Blu came to Tulear the previous week, due to bad communications, to take us to Andavadoaka, and is not happy. Anna L and Libby meet Edward, Jasper, Lope and Tsiry at the IH SM. Meet Rob from Frontier.
8th July	Anna L changes money. Anna L badly grazes her knee. Walk along mud flats IH SM in afternoon. Anna L and Lib go to Service du Peche to consider using a pirogue as a dive boat. Meet Reef Doctor (Rod) and arrange to have supper with him and his dive officer, James, at Esplanade that evening. Libby gets 'travellers belly'.
9th July	Libby sick. Elphie and Matt arrive late afternoon, and Matt is weak from 'travellers belly'. Matt speaks to someone at Laguna Blu. Paulo calls back and says that he'll pick us up on Saturday (11th).
10th July	Anna L returns to the bank. Anna L, Matt and Elphie to IH SM for talks. All four to Trajectoire in the afternoon to try to find a boat. Everyone getting very stressed.
11th July	Lib and Matt buy lorry batteries and take to Ifaty for the rest of the group to make diving weights from the lead. Other half of the group have all had 'travellers belly'. Search for a dive boat is not successful. Anna L collects letters of approval from IH SM. Stakes bought for transects.
12th July	Supermarket sweep!! Collect remaining supplies, pack and wait for Paulo. Paulo arrives, but wants to leave at 6am on Sunday.
13th July	Matt remains in Tulear. 6.30am Elphie, Lib and Anna L leave Tulear with Paulo. Collect rest of group from Ifaty and start 12hr journey to Andavadoaka. Flat tyre 6km from Laguna Blu and all decide to walk the last leg. Zebu cart carries punctured tyre guided by a big moon. Hot showers, good sleep, but little food!

14th July	Scientists from IH.SM arrive in Morombe, but no transport to fetch them because of flat tyre on the lorry. Sort equipment. Start talks with Paulo regarding adjusted cost of our accommodation. Not looking good.
15th July	Tyre now fixed so Anna L and Elphie go to Morombe to meet the Mayor of the Toliara region. On arrival they meet the scientists who have already done so. Fruitless journey for Elphie who then returns to Tulear. Anna and the scientists return to Laguna Blu. Group prepare to leave Laguna Blu. Anna L's knee isn't getting better.
16th July	Hannah and Ryan dive from Laguna Blu boat due to lack of time before they leave. Anna L, Jasper, Lib and Atilus walk to Coco Beach to sort out alternative accommodation. Meet Olivier and Luc. Walk to village of Andavadoaka to meet the president. All move to Coco Beach.
17th July	All snorkel from hired pirogues for reconnaissance surveys. Anna L remains on shore and meets the Mayor of Befandefa. Anna arranges a meeting with the president and the village in the afternoon. In the afternoon we are blessed and accepted by the village. Big boost to our confidence.
18th July	Anna L, Dom and Anna P snorkel for recci surveys. Ryan and Hannah leave. Libby accompanies them to Morombe airport and then goes to get oil for Olivier's boat. Landrover breaks down so late return to Coco Beach. All stay in the village library for the night. Bat attack!
19th July	Start compressor and compress tanks.
20th July	Hire Olivier's boat for the day. Anna L remains behind for shore watch because her knee is still bad. All dives south of Nosy Hao. All coral dead.
21st July	Strong trade winds, no diving. All remain in huts for the day.
22nd July	4 people dive at Nosy Fasy. Scientists move into Andavadoaka village. Matt and Elphie arrive in the afternoon with a boat – 'AloAlo'.
23rd July	Strong winds, no diving.
24th July	Anna L and Lib have early morning familiarisation on board AloAlo. Anna L and Elphie on shore watch. Rest to find 'Baleine'. Dive site is actually Baie de Fanemotra. Hammer in stakes and lay line. Cement is bad. Matt 'pops' his shoulder whilst starting the motor. 4pm, Anna P and Anna L give an English lesson at the school.
25th July	Anna L starts diving. Dive Baie de Fanemotra to finish line. Lib sees a shark! Do T1 & T2. Anna L, Dom, Elphie and Adrian dive in the afternoon to try to find next dive site. Wind proves to be too strong in the afternoons for diving. Anna L and Matt give the English lesson.
26th July	Jasper and Tsiry leave. Dive at Baie de Fanemotra. Do T3, fish, inverts and sort LITs. Relax in the evening and have a fire on the beach.
27th July	Day off! Compress tanks and continue learning fish, inverts, corals.
28th July	Dive north of Nosy Andrahombava. See Napoleon wrasse on dive, which then gives the site its name. Reef is in better condition. Anna P, Elphie and Anna L go to give English lesson, except no one shows up, so have a volleyball match with some of the locals.
29th July	Return to Napoleon. Stakes put in at 0, 50 and 100m. Line laid, T1, T2 and 3 quadrats completed.
30th July	Strong winds, no diving. Go for a walk to flamingo lake in the afternoon. No flamingos and no lake!
31st July	Strong winds, no diving. Adrian leaves in the morning and Lope in the afternoon.
1st August	Dive Napoleon. Anna L's BCD LPH breaks. Finish T2 and T3 inverts.
2nd August	Snorkelling and diving at Dos de Baleine. Find rock and sand. Elphie and Matt leave on 'Awards Ceremony'. Olivier's fishing boat for Tulear.
3rd August	Anna L, Lib, Dom and Anna P go to 'Dive 1'. Best reef, lots of fish, but too deep for a transect. See humpback whales breach, incredible!! Second dive, west of Nosy Hao has very bad visibility in deep water. See nothing.
4th August	Return to 'Dive 1'. See more whales. Dom and Anna P leave in afternoon. Only Anna L and Lib remain.
5th August	Luc comes on as boat marshall. Dive north of Napoleon and west of Nosy Hao. 4pm, Anna L and Lib give English lesson.
6th August	Replicate surveys at Baie de Fanemotra.
7th August	Anna not feeling well. No diving. Start inventories of all equipment for arrival of oxford team.
8th August	Packing and data write up continues.
9th August	No taxi brousse to Morombe so Anna L and Lib wait for Matt, Elphie and Olivier to return from Tulear with the Oxford team. Olivier drives AloAlo to Morombe with Elphie so that Anna and Lib can catch a taxi brousse to Tulear that night. Anna and Lib say goodbye, and start their journey back to Tana.

APPENDIX 6 -EUCARE LIT DATA

SITE	Baleine -	Lope	SITE	Baleine -	AOM	SITE	BALEIN	Jasper/Tsiry
DATE	25.07.03		DATE	26.07.03		DATE	25.07.0	
TIME			TIME			TIME		
Transition	CODE	genera/species	Transition	CODE	genera/species	Transition	CODE	genera/species
149	CMT	Favia	58	DCO		30	DCR	
156	SC	Simularia sp.2	412	CMT		41	SC	Simularia
180	DCO		500	CMT	Porites lobata	60	DCR	
200	SAT		600	DCO		210	CMT	Favia sp.
220	CMT	Favia	620	CMT	Porites lobata	234	CMT	Favites sp.
260	SAT		760	DCO		285	CMT	Porites lobata
308	CMT	Porites sp.	872	SAT		390	DCO	
334	CMT	Faviidae sp.	882	CMT	Porites sp.	440	SC	Simularia
350	DCO		915	DCO		534	SAT	
365	CMT	Porites sp.	1000	CMT	Porites lobata	550	CMT	Goniopora
420	DCO		1004	SAT		620	SAT	
454	SAT		1100	DCO		650	DCO	
471	DCO		1152	CMT	Porites solida	770	SAT	
500	CMT	Favia	1170	CMT	Porites lobata	850	DCO	
592	CMT	Porites lobata	1312	DCO		920	SC	Simularia
600	CMT	Porites solida	1317	EA		1070	DCO	
700	SAT		1372	CMT	Porites lobata	1116	SC	Simularia
740	CMT	Porites lobata	1400	SC	Similaria sp.1	1240	CMT	Porites lobata
850	CMT	Porites solida	1408	RK		1340	DCO	
906	DCO		1415	SC	Similaria sp.1	1420	CMT	Porites sp.

912	OTG		1487	DCO		1610	DCR	
923	DCO		1530	CMT	Porites sp.	1630	ZO	
937	SC	Simularia sp.1	1590	SAT		1700	DCO	
941	CMT	Favia	1604	DCO		1850	SAT	
944	DCO		1607	ZO		2000	CMT	Porites sp.
952	CMT	Faviidae sp. YOUNG	1653	DCO				
1083	DCO		1660	EA				
1105	SAT		1740	DCO				
1122	FA		1780	SC	Similaria sp.2			
1143	CMT	Faviidae sp. YOUNG	1890	SAT				
1152	DCO		2000	DCO				
1162	SAT							
1170	SH	Tridacna sp.						
1340	DCO							
1400	CMT	Favia						
1440	DCO							
1450	SH							
1490	DCO							
1630	CMT	Favia						
1710	RK							
1730	SAT							
1770	DCO							
1780	CE	Galaxea fascicularis						
1820	DCO							
1920	SAT							
2000	DCO							

SITE	ANDRAH	LOPE	SITE	Andrahom	AO & DJ	SITE	Andrahom T3	Matt
DATE	29.07.03		DATE	29.07.03		DATE	01.08.03	
TIME			TIME			TIME		
Transition	CODE	genera/species	Transition	CODE	genera/specie	Transition	CODE	
12	DCO	Faviidae	20	DCO		11	CE	
25	CMT	Platygyra sp	30	CE		23	T	
47	FA		51	DCO		160	DCO	
68	DCO		54	ACE		194	CE	
78	CMT	Faviideae faviites sp	66	CMT		317	DCO	
127	T		110	DCO		388	CE	
134	CMT		121	ZO		434	DCO	
149	CE	Montipora sp	146	ACE		441	CE	
160	DCO		162	EA		453	SC	
189	CMT	Porites liutea	184	ACD		665	RK	
240	DCO		189	SC		701	SC	
248	CE	Montipora sp	211	DCR		743	CMT	
258	T		236	CMT		768	CE	
370	CD	Pavona clavus	386	RL		899	DCO	
430	DCO		396	CE		934	CE	
451	CD	Pavona clavus	518	DCO		956	T	
471	ACD		638	RL		976	SC	
492	DCO		646	CE		998	HA	
550	CE	Montipora sp	654	ACD		1177	DCO	
610	DCO		656	EA		1265	RK	
670	DCO		676	SC		1284	CM	
680	CMT	Musviolae	691	CMT	Galaxea	1734	DCO	
722	DCO		799	DCO		1766	CE	
739	CM	Porites solidae	804	CMT		1974	CD	
770	RK		812	T		2000	DCO	
800	CMT	Faviidae oulophy???	826	RK				
830	DCO		845	SC				
936	ACT	Montipora plaedialeoi	930	DCO				
950	DCO		944	CE				
971	CE	Montipora sp	968	T				
1020	DCO		996	DCO				
1045	CMT	Faviidae faviites	1011	CMT				
1150	DCO		1055	RL				
1155	CD	Porites cylindrica	1063	EA				
1290	CMT	Lobophytum sp	1089	DCO				
1370	DCO		1096	CE				
1393	SC	Lobophytum sp	1101	T				
1410	CMT	Favites	1108	ACD				
1442	DCO		1168	DCO				
1470	CMT	Favites	1173	CE				
1551	SC	Similaria sp	1182	ACD				
1680	DCO		1230	DCO				
1690	CMT	Favites	1239	CD				
1730	DCO		1260	OTH				
1760	SC	Similaria sp	1267	FA				
1782	CMT		1274	CE				
1797	DCO		1282	ZO				
1817	CMT	Favites	1286	DCO				
1830	CMT	Porites solidae	1336	CE				
1860	DCO		1342	DCO				
1868	CMT	Galaxea	1361	FA				
1898	DCO		1393	SC				