

Establishment of a marine community protected area, the ‘*Massif des Roses*’, and of a representative association to manage sustainably the resources of the Bay of Ranobe, Southwest Madagascar

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## ABSTRACT

The Bay of Ranobe, in Southwest Madagascar, once noted for its remarkable biodiversity and fish abundance, is under increasing pressure from overfishing, pollution, and tourism. The declining health of the reef is reflected in fishery productivity and survey data on biological diversity.

Sustainable conservation requires engagement of all stakeholders and the integration of their needs into an effective resource management plan. The British NGO ReefDoctor has been applying this encompassing approach in establishing the very first community protected area in the Bay of Ranobe, the '*Massif des Roses*'. This is a large coral patch with a high percentage of live coral cover and important fish diversity compared to other sites surveyed in the lagoon. Since 8 June 2007 it has been legally protected from fishing and damaging tourist practices. Tourists must now pay an entry fee to visit the site, which contributes to the funding of community projects. In parallel with the protection of this site, ReefDoctor has worked with local people, regional and local government, tour operators and hotels, and conservation organisations to set up 'FIMIHARA', an association representative of local people responsible for the management of this site and the development of additional sustainable conservation initiatives in the greater Ranobe land and seascape.

This article explains the approach taken by ReefDoctor to protect the *Massif des Roses* and in catalysing the creation of the association FIMIHARA to manage the site and to develop further conservation initiatives in the Bay of Ranobe.

## RESUME

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La Baie de Ranobe, au sud est de Madagascar, autrefois remarquable pour sa biodiversité et l'abondance de la pêche, est de plus en plus menacée par la surpêche, la pollution et le tourisme. Le déclin de l'état de santé du récif se reflète dans une diminution de la productivité des pêcheries et dans les suivis de biodiversité marine.

Une conservation durable nécessite un engagement concret de toutes les parties prenantes et l'intégration de leurs besoins dans la gestion des ressources. L'ONG ReefDoctor a appliqué cette approche à l'établissement de la première aire marine protégée de la Baie de Ranobe gérée par la communauté locale, le *Massif des Roses*. Cette aire protégée est constituée d'un large massif de corail avec un pourcentage élevé de couverture corallienne et une importante diversité de poissons comparée aux autres sites suivis dans le lagon. Depuis le 8 Juin 2007, ce site est légalement protégé contre la pêche et les pratiques destructrices associées au tourisme. Les touristes doivent désormais payer un droit d'entrée pour visiter le site, qui contribue au financement de projets communautaires. En parallèle avec la protection du site, ReefDoctor a travaillé avec les communautés locales, le gouvernement national et local, les opérateurs touristiques et diverses organisations de conservation pour créer 'FIMIHARA', une association représentative de la population locale, responsable de la gestion et du développement de projets de conservation durable.

Cet article explique l'approche adoptée par ReefDoctor pour protéger le *Massif des Roses* et mettre en place l'association FIMIHARA afin de gérer le site et développer d'autres initiatives visant à protéger de la Baie de Ranobe.

KEY WORDS (4-5)

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## INTRODUCTION

Coral reefs are important ecosystems which are frequently referred to as the 'rainforests of the sea' due to their high biodiversity (Bryant et al., 1998). Coral reef systems provide an essential source of food and services for vast numbers of people. Twenty five percent of marine fish species are associated with coral reef ecosystems (Sale, 2002), which also offer important cultural and aesthetic benefits (Moberg and Folke, 1999). However, coral reefs around the world are suffering from both natural and anthropogenic pressures and their survival is under threat in many areas (Wilkinson, 1999).

The Bay of Ranobe is suffering from an increase in such pressures including overfishing, pollution, sedimentation and tourism. The province of Toliara, where the bay is situated, is the poorest in Madagascar, itself one of the poorest countries in the world (World Bank, 2007). The situation is now critical as coral reefs and their associated marine resources are essential to the livelihood of the coastal population along the bay.

The declining health of the reef is reflected both in fisheries returns and biological surveys (ReefDoctor, unpublished data). Our survey results show that most coral sites in the lagoon (excluding the *Massif des Roses*) are in a very poor state of health with less than 3% live coral, (see site description section below). Recognition of the increasingly poor condition of the reef has spurred efforts to take action and paved the way for more sustainable use of the reef's resources.

Before describing the issues involved in the creation of a marine protected area, it is important to first identify the current threats to the coral reef of the bay of Ranobe.

## Pressures on the Bay of Ranobe

### **Fisheries Pressures**

The villages along the bay are inhabited predominantly by Vezo fishermen. The culture of the Vezo, 'the people of the sea', and the ecology of the oceans are interwoven, the Vezo depending almost exclusively on marine resources for food and income. Nearly 50% of all Malagasy sea fishermen operate in the Toliara Region (Laroche & Ramananarivo, 1995). However in recent years it has become increasingly hard for them to support their families (Village president of Ifaty, pers comm. May 2007). As early as 1988, Vasseur and colleagues reported a decrease in the abundance and size of fish and increased damage to the reef flat. Overfishing is a major cause of coral reef degradation and is often associated with poverty and coastal crowding (McManus, 1997). The population along the coast is indeed growing at a fast rate, 3% a year (World Bank, 2007), which is putting the reef under increased fishing pressures. Increased commercial demand for export, particularly octopus, has also intensified the fishing effort.

In addition, migrants from inland areas drawn to the site by its fishing reputation have often adopted more destructive fishing methods, such as beach seine fishing with small mesh nets, due to their lack of fishing tradition (Gabri  et al., 2000). Beach seine fishing not only removes large numbers of juvenile fish, but also damages the important sea grass habitat over which the nets are dragged. This is particularly worrying given that the vast majority of fishermen fish exclusively within the lagoon.

Overfishing not only directly reduces fish numbers, but also directly impacts coral reef health by the removal of herbivorous fish species, resulting in overgrowth of algae, which can result in a phase shift of the ecosystem from coral to algae (McManus et al. 2000).

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## **Sedimentation and Pollution Pressures**

Coral reefs are also affected by activities in their drainage basins. Urbanization and the intensification of land use increase the run-off of sediment, nutrients and pollutants; this often causes major problems for coral reefs and their associated organisms (Grigg & Dollar, 1990). It is also known that anthropogenic nutrient enrichment has a greater effect on coral reefs closer to shore and within lagoons (Szmant, 2002), like in the Bay of Ranobe.

Deforestation is believed to be a significant threat to the Bay of Ranobe reef system. The destruction of forests for agriculture, fuel and construction leaves the exposed soil vulnerable to large scale erosion. Windblown sediment is also thought to be an important component to this process and is being monitored by the University of Toliara and IRD (unpublished data). The Fiherenana and Manombo rivers, located to the south and north of the bay respectively, thus flanking each side of the bay, carry large quantities of sediments into the lagoon. High concentrations of sediment are a serious threat to corals as they reduce the light intensity required for photosynthesis by the symbiotic zooxanthellae. Areas with increased nutrient inputs generally also have increased sediment and pollutant loads (Szmant, 2002).

Healthy mangroves moderate the sediment problem as they act as a natural filter trapping sediment and nutrients (Bouillon et al. 2004). They also constitute important habitats which are directly linked to the reef ecosystem, for instance they are used as spawning grounds for numerous fish species. Unfortunately, much of the mangrove habitat has been lost to deforestation for use as firewood, particularly to the south of the bay.

In addition, there are no sewage treatment facilities neither in the city of Toliara, which has a population of approximately 400,000 inhabitants, nor in the growing villages along the coast. Data collected by ReefDoctor shows a high percentage of fleshy macro-algae

in the lagoon (unpublished data), which is an indicator of nutrient enrichment usually associated with sewage pollution (Szmant 2002).

### **Tourism Pressures**

As in many developing countries, tourism in the Toliara Region is both an asset and a threat. Some of the pressures directly or indirectly caused by tourism include: destructive anchorage due to the lack of appropriate mooring lines, physical contact with the reef, demand from the hotels for seafood, pollution from hotels due to the lack of sewage facilities, and the curio trade whereby certain shells and marine organisms such as starfish are collected for sale to tourists. Diving tourism is a growing industry in Madagascar and diver impacts need to be considered by those responsible for the management of marine environments (Vicki et al., 1997). On the other hand, the tourism industry, which is a major source of income in this region of Madagascar, depends to a large extent on a healthy reef, and therefore provides an economic incentive to protect it.

As a result of anthropogenic activities, the reefs may show reduced resilience and be more easily affected and possibly degraded by natural pressures such as storms, temperature increases and changes in sea level (Moberg and Folke, 1999). This may also have been a factor in the poor recovery of corals of the bay since the bleaching of corals associated with the El Nino event in 2001 and 2002 (ReefDoctor observations, unpublished). Due to the observed degradation of the reefs in the bay, and especially within the lagoon, both villagers and tourist operators (dive schools and hotels) are becoming aware of the need to protect those remaining sites in good condition, such as the *Massif des Roses*.

### **Past initiatives in the Bay of Ranobe**

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There have been a number of research and conservation projects in the Bay of Ranobe over the last decade. Unfortunately, these have had limited success and in many cases resulted in reduced trust between local people and conservation organisations.

Misunderstanding between these groups has been exacerbated by differences in education, language, culture and economic status.

A particularly damaging initiative, carried out in early 2003 was the provision of funds to small associations to buy fishing equipment. This project unwittingly facilitated the widespread purchase of beach seine nets, which remove juvenile stock and damage the nursery seagrass beds of the bay, therefore putting at stake the future of fisheries in the bay. Friction has developed between the seine fishermen, who depend on the fish for their livelihoods, and others who were openly critical of the method. For instance, some hoteliers have banned their usage on the stretch of beach in front of their properties.

Another problem (pers. comm., Bruno, village president of Ifaty, May 2007) has arisen as a result of foreign visiting researchers who persuaded locals to help them, explaining that the work was for local benefit. Although true in the sense that greater understanding of the reef can inform management, the villagers understanding had been that the work would result in more immediate tangible benefits for them. This has contributed to disappointment and increased mistrust of outsiders from the villagers.

An initiative to help local fishermen in the late 1990s by the expatriate owned 'Ifaty Fishing Club' also badly damaged relations. The Club deployed FADs (Fish Aggregation Devices) attached to anchors just outside the lagoon and within reach of local fishermen with the aim of helping them improve catches. However, the equipment was stolen only days after deployment. Similarly, efforts by the head of the Mangily hotel association to set up an annual pirogue race, intended as the focal point for a local festival to attract tourists have

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been discontinued. The organiser gave up because the winner's trophy from the 2006 race was not returned as agreed.

These examples and others have entrenched views amongst many expatriates who own and manage most of the tourist infrastructure that it is difficult to cooperate with local people; and many Vezo have realised little benefit from tourism or outside intervention and are now less hesitant to participate in new initiatives.

## METHOD OF IMPLEMENTATION OF THE PROTECTED AREA

The community protected area *Massif des Roses*

### **Site description**

The *Massif des Roses* is a patch reef covering an area of approximately 100 m x 150 m with a depth between 2 m and 7 m. The name of the site comes from the form of foliose corals (*Montipora spp.*) which, although rare in the Indian Ocean and off Africa (Tim McCallahan, pers. comm. 2007), is present in large quantities at the site. The *Montipora* species at this site thus seems particularly resilient to the pressures the reef system is under and the site is in a relatively healthy state.

As part of our scientific monitoring of the state of the Bay of Ranobe, part in collaboration with the ISHM (University of Toliara), four patch reef sites including the *Massif des Roses* were chosen within the lagoon based on their potentially high level of biodiversity and coral cover for regular surveys. Fish surveys were carried out along a 20 x 5 m belt transect for and benthic cover was assessed using the Point Intersect Transect (PIT) method every 20 cm, along the same 20 m tape.

Our data shows that the *Massif des Roses* has the greatest level of average fish density and one of the highest species diversity of the sites surveyed in the bay (Figure 2A). The *Massif des roses* also has by far the highest percentage of live coral (38%) even compared to

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other sites within the lagoon which had been chosen for their relatively good health (Figure 2B).

The protected area also includes seagrass beds and sand surrounding the coral patch. This provides a buffer zone around the coral and gives the site more meaningful ecological significance by protecting a variety of habitats. Indeed, seagrass constitutes a vital component of coastal ecosystems thanks to its primary productivity and nursery importance for fish and large invertebrates and the shelter it provides (Edgard et al, 2001).

### **History of informal protection**

The *Massif des Roses* has been an important local tourist attraction for snorkelling and diving since the late 1980s (pers. comm., Bruno, village president of Ifaty, May 2007). There are some 25 small to medium sized hotels in the villages of Ifaty and Mangily. The site is easily accessible from the villages in pirogues (outrigger canoes) or power boats; and the shallow depth of the site makes it suitable for both snorkelling and diving. It is also protected from heavy seas by the barrier reef. Some 1400 tourists a month visit the site in the high season (August to October), 600 a month in the low season (November and December) and less outside the tourist season. This approximates to around 5600 tourists a year (pers. comm., FIMIHARA, 2007).

The site has had informal protection for nearly a decade after tourist operators persuaded the presidents of Ifaty and Mangily that it was in their mutual interest to protect it from fishing. The arrangement was that any fishermen seen operating on the site was reported to the village president who would admonish them. However, some fishing continued, especially when tourist operators were not present and when bad weather made fishing difficult elsewhere (ReefDoctor observations from 2004 to 2007, unpublished data).

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As outlined above, a number of tourist pressures are present in the bay; at the *Massif des Roses* these have resulted in damage caused by snorkelers and divers treading on the delicate coral or taking it and other marine organism such as shells for souvenirs. The most significant pressure at the site however, was the anchors (stone blocks or lumps of metal) and chains of boats and pirogues. Even when anchors were dropped on sand around the patch reef, they were often dragged onto the coral as a result of wind and current, as pirogue owners could not afford suitable anchors that bite into the sand. There was an attempt to address this problem in 2001 when one of the dive clubs provided mooring buoys attached to permanent anchors, but the buoys were stolen shortly after installation (pers. comm., Grand Bleu Dive Club, April 2007).

The informal protection of the site therefore had only limited success. Fishermen could see little benefit in not fishing one of the best locations in an otherwise denuded lagoon. Tourist operators such as pirogue owners continued to break the coral by dropping anchor because they were unaware of the agreement or the damage they were causing. Even when transgression was observed and reported to the village presidents the culprits received no more than a warning. As a result, friction and mistrust grew between the tourist operators and fishing community, which further eroded commitment to the agreement (pers. comm., Bruno, village president of Ifaty).

## The FIMIHARA association

### **Background**

The NGO ReefDoctor has been working in the Bay of Ranobe since 2002, carrying out research, conservation and education programmes. In particular, it initiated a number of socio-economic projects including raising environmental awareness, school restoration and

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marine education, alternative livelihoods initiatives for villagers such as marketing honey and toy pirogues, and promotion of solar ovens. These community projects have helped the NGO win the support and trust of local people and provided examples of the type of work that could be funded through income from the *Massif des Roses*.

In October 2006, ReefDoctor organised a meeting with fishermen from Mangily and Ifaty to discuss the protection of the *Massif des Roses*. The fishermen were enthusiastic and agreed to form an association with elected representatives to work with ReefDoctor. The association was called 'FLMI.HA.RA' (*FIkambanana MIaro sy HAnasoa ny RAnomasina* - Association to Protect and Enhance the Marine Environment). At this stage the association did not have legal standing.

On the advice of the Toliara branch of SAGE (*Service d'Appui à la Gestion de l'Environnement*), the representation of the association was subsequently broadened. SAGE's advice was based on their experience in working with a similar association (FIMIMANO) based at Anakao, south of Toliara, where a community marine protected area off the Island of Nosy Ve has been in operation for several years. The structuring of the association and the necessity to include neighbouring villages were presented at a public meeting of stakeholders organised by ReefDoctor at the end of 2006. More than a hundred people attended representing all key stakeholder groups; however, only two expatriates from the tourist industry were present, reflecting the difficulty in engaging them in the project. SAGE encouraged FIMIHARA to take on longer term objectives and expand its focus to the whole of the Bay of Ranobe. SAGE was also instrumental in convincing representatives of neighbouring villages that it was in their interest to support the association which would initially concentrate on the villages of Ifaty and Mangily.

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The association consists of a president, vice presidents, a treasurer, secretaries, accountants, advisers and active members. All committee members are elected by the active members; each active member and committee member pays an annual membership fee; and FIMIHARA members meet every two months to discuss their activities. The association was formally established by the same laws that protect *the Massif des Roses* and has the following stated objectives:

- Provide a voice for all stakeholders who have an interest in the future of the bay.
- Improve the quality of life of those who live and work along the Bay of Ranobe.
- Work to conserve marine and terrestrial natural resources for future generations.
- Improve knowledge and understanding of the natural environment.
- Provide guidance in managing the community protected area '*Massif des Roses*'.

Although poorly represented at the stakeholder meeting, an expatriate representative was elected onto the committee of the association as primary *Commissaires aux Comptes* (internal auditor). This places him in an ideal position to oversee the financial management of the association and, importantly, to help win the support of the expatriate community, some of whom expressed doubts about the capability of the Malagasy representatives. Table 1 outlines the main role of each stakeholder group and how they are specifically involved in the FIMIHARA association and the protection of the *Massif des Roses*.

The association is responsible for overseeing the site, including the employment of a site guardian, collecting revenue from ticket sales and fines. The funds are then used for community projects as identified by FIMIHARA for the villages of Ifaty and Mangily. In support of FIMIHARA, ReefDoctor provides advice, funding and support such as recording meetings and setting up a bank account; and encourages broader and longer term strategic thinking.

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## **Legal Protection of the site and establishment of the association**

It was clear that for site protection to operate effectively a formal legally binding agreement was required. The statute and *dina* (local law) approved on 2 April 2007 to protect the site are outlined below.

The association FIMIHARA with nominated committee members is recognised by law and given the authority to manage the protected site (including financial management). The *Massif des Roses* and surrounding area covering a total of 160,000 m<sup>2</sup> marked with buoys is recognised as a community protected area, which means that:

- Fishing is banned within the protected area. Infractions are punishable by fines enforced and collected by FIMIHARA via an on site guardian.

- Dropping anchor is forbidden throughout the protected area; visiting boats must moor to buoys already in place for this purpose within the site, at the edge of the coral. Infractions are punishable by fines.

- The theft of materials from the site such as marking and mooring buoys is punishable by fines.

- Tourists who visit the site must pay an entry fee of 2000 Ariary (under 1 €).

- A guardian is on site daily to collect tickets and ensure compliance with the laws.

- Funds generated from ticket sales and fines are used for community projects as identified by FIMIHARA for the villages of Ifaty and Mangily.

Awareness of FIMIHARA's role and authority has been raised through a number of communication initiatives with stakeholders. Considerable effort was made to build support for the project and raise awareness of the new laws by various means including canvassing Regional Government representatives, organising meetings in all villages, creating

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multilingual publicity material, and visiting all tourist industry representatives including the ORTU (*Office Régional du Tourisme de Tuléar*).

In February 2007, the government of Madagascar published the framework *Système d'aires protégées de Madagascar - Guide pour la création*. However, the guidance was aimed at larger and more complex sites and primarily targeted at the creation of terrestrial sites. For this reason, on the advice of Regional Government, the recommended steps were followed as guidelines only. In addition, as a mean to critically review the protection and management of the *Massif des Roses*, we followed the criteria defined by the Principles for Good Governance agreed at the December 2005 workshop on the management of protected areas (*Atelier Gouvernance des Aires Protégées, 2005*): Rights and means for all to influence decision making (*Legitimité et Voix*), Management by those with direct involvement and interest (*Subsidiarité*), Clarity of lines of responsibility (*Imputabilité*), Share of costs and benefits and accountability (*Équité*), Performance (delivery of objectives and response to challenges), and Direction (long term management and goals).

## EVALUATION OF THE *MASSIF DES ROSES* MANAGEMENT

### An early success

During 60 years of French rule, the colonial government established two national parks and several protected areas in Madagascar (Wright 1997). However, people regarded them as foreign and an additional facet of colonial oppression. Particularly in developing countries this has led to problems when local people were denied access to resources and did not benefit from the protection of the site. A similar failure to engage all stakeholders in decision making can be blamed at a smaller scale for the limited success of initial attempts to protect the *Massif des Roses*. The inclusion of all stakeholders, particularly the local

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communities, through the creation of the association FIMIHARA, was a key factor in the success of the project.

At the time of writing the site has been in operation for 18 months and more than 1500 tickets have been sold, making a net benefit of over 1200 €, some of which has already been used for community projects (see below). As expected, the small fee (about 1€) that tourists and tour operators have to pay, has been well accepted as it is for a 'good cause', helping to fund community projects and ensuring that the site remains protected for future generations. Villagers are still in the process of submitting short proposals to the association. So far the funds collected have mainly been used for the maintenance of the site, but also allowed to pay for sanitation workers in Ifaty, to make a contribution to the opening of a small clinic in Ambolimailaka and to the refurbishment of a middle school in Mangily, and to fund part of the costs associated with the opening ceremony of new MPAs and No Take Zones (see below). Importantly, more than a year after its creation, all key stakeholders continue to be supportive of the project. In particular, dive centres are now working more closely with FIMIHARA and ReefDoctor and have been active in assisting with the initial set up and maintenance of the site.

The presence of a guardian clearly acts as a strong deterrent against fishing and anchor dropping in the protected area; he has also been effective in enforcing payment. There has been only one instance of transgression of the laws. In February 2008, three pirogue fishermen were caught fishing with nets inside the *Massif des Roses* and a fine was imposed; the laws and lines of responsibility were thus tested and proved to work.

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The diversity of the work previously carried out by ReefDoctor within the communities placed the NGO in a very good position to understand the issues of the different stakeholders involved and facilitate dialogue amongst them. The role of ReefDoctor's Malagasy staff has been particularly important in enabling communication with local people and convincing them of the intention to provide local benefit. It has indeed been a challenge to steer the aspirations of some committee members away from a fisheries focus to broader sustainable resource management. The NGO still provides advice on management to FIMIHARA and is continuing capacity building to enable the association to run independently in the long term.

## Future prospects

For the management of the *Massif des Roses*, the long term goal is to continue protecting it from further damage and to allow its biodiversity to recover. It is now too early to assess the ecological impact of the site protection; however, preliminary data seem to indicate an increase in fish diversity and coral cover at the site (pers. comm., Grand Bleu Dive Club, 2008). As the scope of work of FIMIHARA broadens within the bay, the representation of the stakeholder interests is regularly reviewed, and more and more weight is given to other villages outside Ifaty and Mangily.

Although the site is protected and mechanisms are in place to manage it efficiently, this does not guarantee long term success. However, the application of the laws has already been successfully tested (see above) thereby forming an ongoing deterrent. In addition, because the site had informal protection and ecotourism was already established, it made establishing legal protection easier in many ways; future sites where there is no such history may prove more challenging. Successful operation of the *Massif des Roses* is important if it is

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to act as a model that can help gain support for similar projects elsewhere, especially within the Bay of Ranobe.

As part of our long term plan to protect additional sites within the Bay of Ranobe, on the 1 December 2008, three more MPAs were created at the following locations:

Ankarandjelita in the North, Ankarabory in the middle of the bay and Andabotira in the South. In addition, six rotating protected octopus fishery areas (No Take Zone, NTZ) have been closed for fishing for a six month duration. A similar initiative was carried out in Andavadoaka (Southwest Madagascar) with the creation of a network of community-run protected areas set up by the British NGO Blue Ventures; however, only few NTZ were closed at the same time, which resulted in over-harvesting following the NTZ's opening (Harris 2007). Here, we hope that the simultaneous closure of six areas throughout the whole Bay of Ranobe will counteract this problem and improve the sustainability of octopus.

The establishment of the *Massif des Roses* community protected area comes at a critical time for the Bay of Ranobe. Against the background of increasing pressure on the natural resources of the Bay, the commitment of the Malagasy Government to the 'Durban Vision' is reflected in the National Environmental Action Plan, a programme that prioritises marine and coastal ecosystem management. The government indeed aims to expand the nation's coastal and marine protected areas from 15,000 km<sup>2</sup> to 50,000 km<sup>2</sup> within a period of five years (Gouvernement de Madagascar 2007).

In line with this government policy, there are significant opportunities to build on the work to date. Amongst others, the international NGO WWF is bidding for funds to set up conservation management and protected areas in Southwest Madagascar. As well as seeking to work collaboratively with conservation bodies, FIMIHARA and ReefDoctor have received

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funds from the United Nations Development Programme Small Grants Project for the following projects within the Bay of Ranobe: the creation of artificial reefs outside the lagoon using Fish Aggregation Devices (FADs), the restoration of mangroves and a programme of fishing gear exchange whereby destructive equipments such as beach seines are exchanged for gill nets of legal size. Other FIMIHARA projects include the introduction of restrictions on the use of damaging fishing equipment, setting up an association of pirogue tourist operators, the development of artisanal products such as handicrafts and ecotourism through the development of marine guides for the MPAs.

There are also significant pressures which lie outside the immediate scope of the MPA projects, for instance nutrient and sediment loading, and the destruction of nursery grounds such as mangroves and seagrass beds. Because FIMIHARA represents the people who live and work along the whole of the Bay of Ranobe some of these wider issues are within its remit. However, important threats such as climate change including extreme weather events, pollution and large scale deforestation, and political instability that may impact on funding availability and tourism fall outside FIMIHARA's influence.

You may want to also discuss the Toliara Sands project and their scenario to send their minerals through the north pass and their potentially catastrophic consequences of this.

## CONCLUSION

The initial success of the management of the *Massif des Roses* is important in its own right, but also as a model that can be, and is being, replicated elsewhere in the Bay of Ranobe and more widely. Long-term success will depend on developed governance capacities locally for sustainably managing, conservation and restoration efforts to build

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resilience to climate change and the Rose Garden and additional sites in the Bay. It will also depend on developing region capacities for addressing some of the more macro issues (pollution, deforestation, mining, and etc...).

The establishment of the FIMIHARA association and the protection of the first MPA in the Bay of Ranobe has so far proved a success. (BUT CHALLENGES REMAIN and there is a need to continue to build internal governance and external communications programs and better transparency within the organisation as it grows.). It provides a good basis on which to build further sustainable resource management initiatives such as the MPAs and NTZs established in 2008. To assess the impact of MPAs on the preservation of biological diversity, ReefDoctor has set up a regular biodiversity monitoring programme. This will allow for the comparison of diverse sites both within and outside the lagoon, including protected and non protected areas. In addition, since 2007 regular fishery surveys are being carried out to assess the evolution of the biomass and biodiversity of catches in the bay.

Finally, this first and initially successful experience shows that for the ecological protection of a site to be efficient, the interests of all stakeholders need to be taken into account and a careful balance has to be reached between the many factors involved: local people and their culture, community politics, fisheries, ecological needs and tourism. Indeed, conservation initiatives need to benefit both local people and the economy if sustainable ecological protection is to be achieved. FIMIHARA has played an essential role in the establishment of the *Massif des Roses* protection and, more importantly, in empowering the local communities. ReefDoctor has been pivotal in the work to date, providing its expertise on how sustainable resource management can be effective. This role will continue to be

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important in the near future, but it is our hope that FIMIHARA will increasingly take the lead in managing its own marine resources.

General referencing: Another variation on McClanahan needs addressing.

Avoid pers. comments – try to find published literature

Incomplete references such as the following are not acceptable: “[Gouvernement de Madagascar. 2007. Système d’Aires Protégées de Madagascar - Guide pour la création.”

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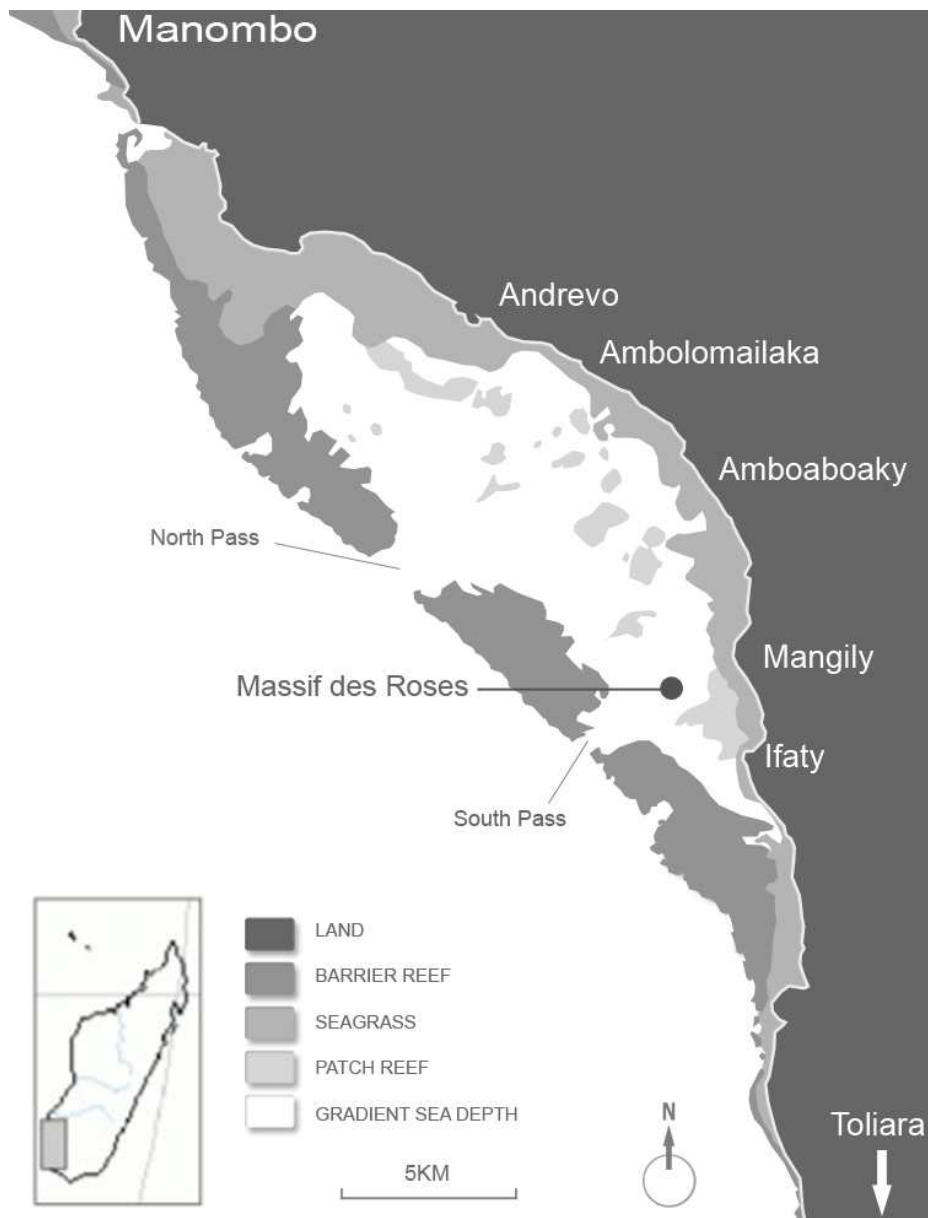
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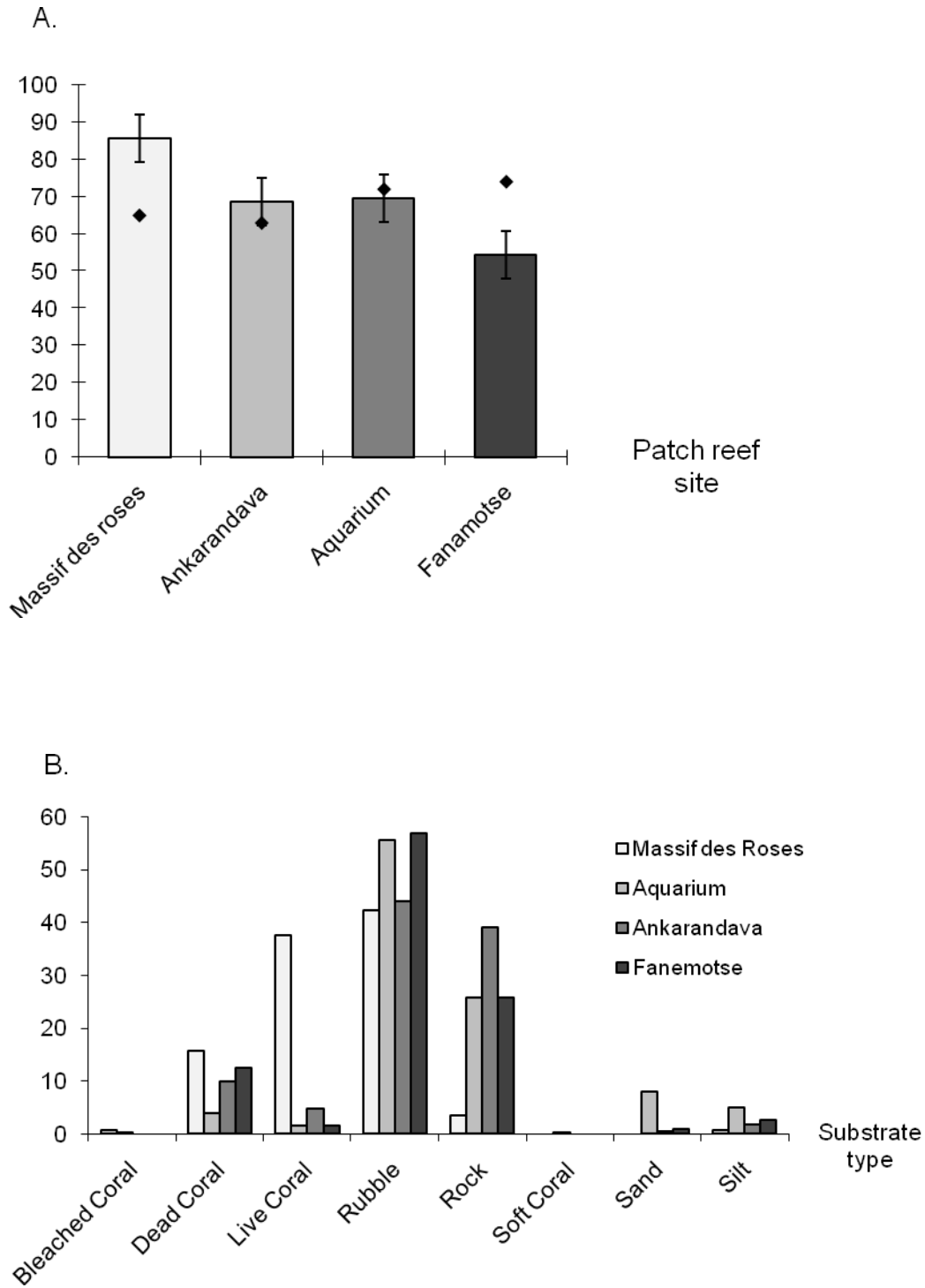
## TABLE AND FIGURE CAPTIONS

Figure 1. The Bay of Ranobe ( $23^{\circ}00'S$   $43^{\circ}30'E$ ,  $23^{\circ}18'S$   $43^{\circ}38'E$ ) is enclosed by a 32 km long reef. The reef is part of the fourth largest coral reef system in the world which extends from Morombe in the North, to Toliara in the South.



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Figure 2. Survey results for each patch reef site studied in the Bay of Ranobe in 2006. A. Species diversity (diamond shapes) and average density (vertical columns). B. Percentage of each substrate type. Standard deviations are indicated by vertical bars in both graphs.



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Table 1. Outline of the involvement of all stakeholders in the development of the FIMIHARA association and the *Massif des Roses* protection.

<b>STAKEHOLDER GROUP</b>	<b>INVOLVEMENT IN FIMIHARA</b>
<b>Local People</b>	
Fishermen	<ul style="list-style-type: none"> <li>- Representation on FIMIHARA committee</li> <li>- FIMIHARA gives empowerment and encourages commitment to adhere to protect the <i>Massif des Roses</i></li>   <li>- Their representative – village president and chef de cartier commented on draft laws (dina).</li> </ul>
<b>Research and Conservation Organisations</b>	
ReefDoctor NGO	<ul style="list-style-type: none"> <li>- Research, education and conservation initiatives in the Bay of Ranobe</li> <li>- Main actor in the establishment of FIMIHARA and the protection of the <i>Massif des Roses</i></li> <li>- Main advisers to FIMIHARA</li> </ul>
<i>Service d'Appui Gestion de l'Environnement</i> (SAGE)	<ul style="list-style-type: none"> <li>- Prepared EP3 (Environmental Program 3) as part of the UN Environmental Action Plan for Madagascar</li> <li>- Advised on laws (dina) and set up of FIMIHARA based on experience of similar association FIMINANO at Anakao.</li> <li>- Advisory members of FIMIHARA committee</li> </ul>
<i>Institut Halieutique et des Sciences Marines (IHSM), University of Toliara</i>	<ul style="list-style-type: none"> <li>- Research and education on the Bay of Ranobe and close collaboration with ReefDoctor</li> </ul>
<b>Private Sector (Tourism)</b>	
Hoteliers and dive centres (represented by the association of hoteliers and the <i>Office Régional du Tourisme de Tuléar</i> , ORTU)	<ul style="list-style-type: none"> <li>-</li> <li>- Sell <i>Massif des Roses</i> entry tickets to tourists</li> <li>- Promotion of protection of <i>Massif des Roses</i> to tourists eg by display of environmental information material</li> <li>- Comment by a representative on drafts of laws (dina)</li> <li>- Representation on FIMIHARA committee</li> </ul>
Pirogue owners	<ul style="list-style-type: none"> <li>- Site visits for tourists</li> <li>- Promote the site to tourists.</li> <li>- Members of FIMIHARA association</li> </ul>
Tourists	<ul style="list-style-type: none"> <li>- Pay site visit entry fee to FIMIHARA</li> <li>- Awareness of site and broader marine conservation issues through visits to site and FIMIHARA environmental information material.</li> </ul>
<b>Regional and Local Government</b>	
Region (Toliara): Heads of	<ul style="list-style-type: none"> <li>- Consulted on draft laws</li> <li>- Signed off local laws (dina) to establish FIMIHARA and</li> </ul>

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DRDR, <i>Ministère de la Pêche</i>	protect <i>Massif des Roses</i> - Members of FIMIHARA association
Communes (Belalanda and Manombo): Mayors / Deputy Mayors	- Signed off local laws to establish FIMIHARA and protect <i>Massif des Roses</i> - Members of FIMIHARA association
<i>Fokontany / Quartier</i> (administrative units of one or more villages): Presidents / Deputy Presidents	- Consulted on draft laws - Signed off local laws to establish FIMIHARA - Represent local people on FIMIHARA committee - Members of FIMIHARA committee
Ministry of Forests and Water, Chief of district and chief of Police, Toliara	- Signed off local laws to establish FIMIHARA  - Officially legalised the status of the organisation

Note: \*there are some 25 hotels and 4 dive clubs in Ifaty and Mangily.