Socio-economic and ecological analysis of a privately managed Marine Protected Area: Chumbe Island Coral Park, Zanzibar

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A Thesis Submitted in Partial Fulfilment of the Requirement for the Degree of Master of Science (Management of Natural Resources and Sustainable Agriculture).

By Kjersti Thorkildsen, May 2006

Norwegian University of Life Sciences
Department of International Environment and Development Studies
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Title picture: Birds' eye view of Chumbe Island Coral Park.

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DECLARATION
I, Kjersti Thorkildsen, do hereby declare that this is my original research work, and that all other used material is referenced. This thesis has never been submitted to any other University than the Norwegian University of Life Sciences (UMB) for any type of academic degree.

Kjersti Thorkildsen, May 2006

Signature: ________________________________

Date: ________________________________
DEDICATION

I dedicate this thesis to my parents, brother, and all my friends who have supported and encouraged me throughout challenging times of data collection and writing. Without them, this work would not have been possible.
ACKNOWLEDGEMENTS

First of all, I would like to extend my sincere thanks to my main-supervisor, Prof. Ian Bryceson, for realising my wishes of conducting this study. He has been extremely helpful in forming the topic, connecting me with relevant people and institutions, and in giving productive comments throughout the research period. His positive attitude and encouragement has helped me along the way, and his moral support has particularly been appreciated during the election times in Zanzibar. I am also deeply indebted to Ass. Prof. Espen O. Sjaastad, my co-supervisor, who has been at least as important for the successful completion of this thesis. I am grateful for his guidance, constructive criticisms, and fast responses.

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I am grateful for the help I received from the management of Chumbe Island Coral Park Ltd. (CHICOP) in terms of access to the island and secondary information. I also appreciate the invitations to attend various meetings arranged by CHICOP, involving the Department of Fisheries (DoF), Department of Environment (DoE), different education authorities, and local fishing communities, as well as to participate in a school excursion to the island. This provided valuable information for this study and contributed to a more holistic view of the ecotourism project. In addition, I appreciate the participation of government agencies, private organizations, and fishermen and other local people in providing data by answering questions during interviews and focus group discussions.
The work leading to this report has been supported by a research grant from Noragric, and this financial support is gratefully acknowledged. I also want to thank Prof. Pål O. Vedeld at Noragric for insightful directions regarding the proposal and stakeholder analysis at an early stage, and to acknowledge the help from the librarians Liv T. Ellingsen and Ingeborg Brandtzæg. Lastly, I wish to thank all my colleagues for making my time at Noragric memorable.

THANK YOU ALL SO MUCH

AHSANTENI SANA
ABSTRACT
Coral reefs are among the World’s most productive and important marine ecosystems. As coral reefs are facing increasing pressure, marine parks have been formed as one response. This study examines socio-economic and ecological impacts of a privately managed marine park off the coast of Zanzibar, by utilising a ‘4Rs’ stakeholder analysis and a social-ecological resilience analysis. Chumbe Island Coral Park (CHICOP) was gazetted as a privately managed marine protected area in 1994 and ecotourism was introduced in 1998 as a revenue-generating tool. The principal decision makers and other stakeholders involved in or affected by this project were identified, and semi-structured interviews were conducted to investigate their interests. The 20 acknowledged stakeholder groups’ rights, responsibilities, returns and relationships were assessed in order to understand the distribution of costs and benefits and thereby conflicts of interests. Socio-economic data were additionally collected from fishermen in 5 villages bordering Chumbe Island through questionnaire-based interviews and focus group discussions, and the roles of management regimes and institutions were evaluated. Furthermore, secondary data on macro-benthic cover and fish fauna was used to measure the ability of the ecosystem to reorganise from disturbance, as well as to support nearby unprotected areas. This study reveals that CHICOP has provided educational, research and conservational benefits to Zanzibar. However, some of the objectives in the management plan and promises made by the proprietor have not been fulfilled. The major underlying cause for conflicts was the poor information flow that existed between and within the various stakeholder groups, which reduces transparency of the project and creates mistrust. Threats to the sustainability of CHICOP include lack of community involvement, corruption, poaching, poverty, low livelihood diversification of fishermen and few supporting institutions. The protected coral reef had high species richness and abundance compared to surrounding unprotected areas that were subject to fishing and some destructive practises. This situation is explained by the high degree of dependence of fishermen on marine resources, the lack of non-resource dependent jobs and the poor enforcement of fishery regulations by the Government. Urban fishers were better able to adapt to the establishment of CHICOP, as they had higher income and more assets to engage in fishing further offshore. The rural fishermen were restricted by lower access to finance, but they had greater social capital and had more diversified livelihood activities.
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<th>Full Form</th>
</tr>
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<tr>
<td>CfT</td>
<td>Commission for Tourism</td>
</tr>
<tr>
<td>CHICOP</td>
<td>Chumbe Island Coral Park</td>
</tr>
<tr>
<td>CRS</td>
<td>Chumbe Reef Sanctuary</td>
</tr>
<tr>
<td>DoE</td>
<td>Department of Environment</td>
</tr>
<tr>
<td>DoF</td>
<td>Department of Fisheries</td>
</tr>
<tr>
<td>DoFo</td>
<td>Department of Forestry</td>
</tr>
<tr>
<td>DoH</td>
<td>Department of Harbours</td>
</tr>
<tr>
<td>IMS</td>
<td>Institute of Marine Sciences</td>
</tr>
<tr>
<td>MoE</td>
<td>Ministry of Education</td>
</tr>
<tr>
<td>MPA</td>
<td>Marine Protected Area</td>
</tr>
<tr>
<td>NGO</td>
<td>Non Governmental Organisation</td>
</tr>
<tr>
<td>NTA</td>
<td>No-take-area</td>
</tr>
<tr>
<td>SA</td>
<td>Stakeholder Analysis</td>
</tr>
<tr>
<td>ZATI</td>
<td>Zanzibar Association for Tourism Investors</td>
</tr>
<tr>
<td>ZIPA</td>
<td>Zanzibar Investment Promotion Agency</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION
Marine environments are under increasing pressure with more people using the sea for food, income and recreation, so over-harvesting and various forms of pollution have resulted in degradation and loss of these habitats (France 1997). Coral reefs are among the most productive and important marine ecosystems because of their unique ecological functions and services, and their socio-economic value to many coastal human populations (Masalu 2000). Coral reefs play a determining role for the livelihoods of local people due to coastal land protection, natural harbours, sites for aquaculture and biological support for important pelagic species (Johnstone et al. 1998). Corals also present opportunities for education, research, tourism, potential for pharmaceutical and medical purposes and coral mining (Francis and Bryceson 2001).

Zanzibar’s dependence on the ocean and demand for its resources has increased in recent years as a result of population growth and increased tourist arrivals. At present, unsustainable use with destructive gear does frequently take place due to overcrowding of fishing grounds, and problems in policy implementation and enforcement of fisheries regulations (Muhando and Jiddawi 1998). There is a common indication that the status of the Zanzibar artisanal fishery is under stress, and signs of environmental degradation are becoming more obvious with declining fish yields and deteriorating conditions of coral reefs in many parts of Zanzibar’s coastline (e.g. McClanahan et al. 2002; Jiddawi and Yahya 2003). This has had significant impact on the livelihoods of numerous coastal inhabitants and also on the ecosystem as a whole. Coral reefs can be set aside for protection, and as they harbour more diverse fish communities than any other marine environment, they provide valuable opportunities for ecotourism (Persson and Tryman 2003).

1.1 Zanzibar’s economy and tourism development
Zanzibar’s major economic sectors include agriculture, trade and industries and tourism (EIU 2006). For decades, Zanzibar relied almost entirely on the export of cloves, but as the prices fell dramatically in the 70s, there was a push for more liberal trade and investment policies. The 1985 Trade Liberalization Policy advocated diversification of the economy and a greater role for the private sector (Honey 1999), and the 1986 Tourism Investment Act encouraged foreign investors to make proposals for hotel constructions (Gössling 2003). This was followed by the foundation of
Zanzibar Investment Promotion Agency (ZIPA), and the creation of Commission for Tourism (CfT). Very few applicants were rejected before either a policy or a plan had been developed. Since then, tourists visiting the island have increased substantially (ZEB 2005). In 1994, Zanzibar adopted ecotourism as a national strategy for sustainable tourism, and called for high class, low volume, high spending tourists using cultural and biodiversity potential.

1.2 Ecotourism

The term ‘ecotourism’ is a fuzzy concept and has therefore been variously defined by different interests. In general, ecotourism differs from traditional tourism in the sense that it is more purposeful and focused on the enhancement or maintenance of natural systems through tourism. Definitions focus on environmentally responsible tourism that provides direct benefits to the nature conservation area and to the economic welfare of the local residents (e.g. Boo 1990; Farrell and Runyan 1991; Ceballos-Lascuráin 1996; Wunder 2000). The International Ecotourism Society defines ecotourism as: ‘responsible travel to natural areas that conserves the environment and improves the welfare of local people’ (TIES 2006). It is evident from recent developments that many have adopted ecotourism to promote their own activities, and there are many examples of the word ‘ecotourism’ being applied to a wide range of activities which do not meet the initial criteria. The use of all-encompassing definitions weakens the power of the concept, contributes to uncertainty and encourages misuse of the idea (Valentine 1993).

Ecotourism has been used to generate incentives for conserving habitats and species, for the benefit of local people as well as stakeholders remote from the resources. It targets a niche group and specialized market willing to pay for a unique product that includes and relies on the protection of valued resources of a destination (Carter 2003). Ecotourism has the capability to improve global awareness of social and environmental problems, create economic alternatives to destructive use of natural resources and contribute both politically and financially to the establishment and survival of marine protected areas (MPAs) (Buckley 2003). By reserving exclusive rights to a coral reef, ecotourism can reduce fishing pressure and other extractive activities. In addition, it can produce economic and protection benefits, as visitors are charged a fee that is used for the management of the MPA, thereby reducing the
trade-offs that normally exist between conservation and use (Hall 2001).

Current debates on the sustainability of ecotourism focus on the need to maintain a balance between ecotourism and resource conservation. Fears have already been expressed about ecotourism as a self-destructive process (e.g. McLauren 1998). This is because deterioration of the marine environment in many designated MPAs has been detected due to inefficient management, failure of government to intervene, or marginalization of important stakeholders who feel excluded and withhold support for the project (Adger et al. 2000). Often, a greater proportion of tourism revenue becomes profit for only a few individuals, while others have to bear the costs like loss of access to an area (Gössling 1999). Small-scale developments therefore seem to be essential in ecotourism, as they allow for stakeholder participation, contribute to economic effects locally and reduce leakages. The quality and integrity of the primary tourist assets must be conserved and sustained or enhanced, and local communities should be involved or receive socio-economic gains to improve the resilience of the system (Westmacott et al. 2000).

1.3 Marine Protected Areas
Coral reefs are conserved to provide restoration, and understanding and enjoyment of the marine environment (Bengtsson et al. 2003). The dominant mode of implementing preservation has been to establish MPAs in the form of parks, reserves and sanctuaries. The formation of no-take-areas (NTAs) are an increasingly prevalent approach to coral reef management, because they are based on the simplistic concept that natural systems can maintain themselves if protected from human interference. NTAs enable full protection of the habitat, as they can enhance adjacent fisheries through spill-over effects, and promote larval recruitment to adjoining exploited areas. Importantly, such protection can permit critical functional groups to persist and act to spread risk, and thus can contribute to local ecosystem resilience (Bellwood et al. 2004). However, several sanctuaries have not addressed the problem of diffuse and large-scale disturbances and long-term management (Bengtsson et al. 2003). Many have shown unfavourable effects due to poor management, and Adger et al. (2000) stated that MPAs originally established to assist users and beneficiaries have often not achieved their stated objectives.
In developing countries, the establishment of MPAs face difficulties regarding lack of adequate management funds and shortage of trained personnel to monitor the project. Despite new interest in MPAs, the Government of Zanzibar assign low priority and insufficient financial resources to the protection of coral reef habitats, so privately owned and managed MPAs have been introduced (Persson and Tryman 2003). The establishment is still a challenging task, as it requires the involvement of various stakeholders, each with their own interest. Particularly, closing a fisheries area off to the local population is controversial, as it can have undesirable effects on their livelihoods (France 1997). The process can therefore result in a resource-use conflict involving conservation needs, fishermen and other indigenous users and foreign investors (Masalu 2000).

1.3.1 Chumbe Island Coral Park

When the importance of marine conservation came to the international forefront with the approval of the Marine Parks and Reserves Act in 1994, Tanzania experienced a rapid establishment and expansion of marine parks (Levine 2004). Chumbe Island Coral Park (CHICOP) was established in 1991 as the first privately created and managed MPA in the world (Riedmiller 2003). In the initial phase, seven government departments were involved in the approval of the project, and in 1992 a private company, CHICOP Ltd., was registered for the management of the reserve. In 1993, an area of 2.44 ha was leased to CHICOP for 33 years (Sterner and Andersson 1998). There was a three-year period of political struggle between the German initiator (Sibylle Riedmiller), the Government and local fishermen before the Government of Zanzibar declared the reef to the west of Chumbe the ‘Chumbe Reef Sanctuary’ (CRS) in 1994 (Gössling 2003). CHICOP got the responsibility for preserving, controlling and managing the reef for 10 years, which has now been extended for another 10 years. The reef has been closed to all fishing activities, anchoring, recreational scuba diving and destructive or extractive research. There are also restrictions on boats trafficking the waters close to the reserve (Lanshammar 2004).

The objectives of CHICOP are non-commercial, while operations follow commercial principles. Ecotourism was introduced in 1998 as a revenue-generating tool to support conservation management and an environmental education program for local school children and their teachers (Riedmiller 2003). The Chumbe Education Programme
enables funds to be directed to assist the schools from Unguja in being transported to Chumbe, and in providing all training, equipment, use and facilities for free (Carter 2002). The project was largely financed with private money as well as funds from the EU and several other donors (Gössling 2003). From 2000, recurrent management costs have been covered by the small-scale ecotourism project. Numbers are restricted to 30 visitors present at any one time, including 14 tourists who pay US$ 200 per night. Day visits cost US$ 70 for non-residents, US$ 35 for residents and researchers and students go free of charge. The total amount of revenue collected over the years can be depicted in table 1 below. However, revenues from ecotourism can be estimated to be at least twice as much as stated by CHICOP when 50 % occupation rate is assumed and 8 weeks subtracted, as the island is closed for tourism during the rainy season in April/May.

<table>
<thead>
<tr>
<th>Financial year</th>
<th>Occupancy rate (%)</th>
<th>Income US$</th>
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<tbody>
<tr>
<td>1998-1999</td>
<td>13</td>
<td>21,759</td>
</tr>
<tr>
<td>1999-2000</td>
<td>28</td>
<td>42,858</td>
</tr>
<tr>
<td>2000-2001</td>
<td>34</td>
<td>82,551</td>
</tr>
<tr>
<td>2001-2002</td>
<td>29</td>
<td>128,893</td>
</tr>
<tr>
<td>2002-2003</td>
<td>43</td>
<td>187,248</td>
</tr>
<tr>
<td>2003-2004</td>
<td>40</td>
<td>231,863</td>
</tr>
<tr>
<td>2004-2005</td>
<td>58</td>
<td>-</td>
</tr>
</tbody>
</table>

CHICOP has cooperated with local and international non-governmental organisations (NGOs), such as the Italian Fondo per la Terra, the SADC, WWF Tanzania and the US National Fish and Wildlife Foundations (NFWF), for some activities, like the Environmental Education Program and school excursions to the island (Riedmiller 2003). CHICOP has also won a number of prizes, including the British Airways Tourism for Tomorrow Southern Regional and Global Awards in 1999, UNEP Global 500 Award to Environmental Achievement in 2000, British Hotelier and restaurant Environmental Award in 2001, and was selected for the EXPO 2000 World Exhibition, as well as identified as Good Practice by the International Coral Reef Initiative (Khatib 2003).

### 1.4 Statement of the problem
A large majority of the neighbouring communities of Chumbe Island rely on fisheries for their livelihoods, and this is of high importance for the economic security of the
region. Many resources of economic and practical value have been derived from Chumbe Island, so the fishermen’s relationship to it is one of mental identity related to material uses. The Chumbe reef used to be one of the main fishing grounds for adjacent coastal villages, and many fishermen used to camp (dago) there to wait for favourable wind conditions, or to stop over in cases of accidents. It was also a centre for fishermen from the mainland Tanzania and Pemba, and many used to pass there on the way to or from other fishing grounds. As the Chumbe reef harbours many species of fish and large octopus and lobsters, the fishermen used to obtain large catches in the area. The island also offered opportunities to collect giant clamshells and bait and to cut firewood and mangrove poles for boats and other constructions. Furthermore, boatmen used to take tourists to the island for scuba diving. After the gazetting of CHICOP, none of these activities can be carried out.

Private conservation strategies have in the past resulted in conflict and resentment from fishermen relegated to less desirable fishing grounds when a marine park has been created. Haaland (1999) argued that the environment and tourists often benefit from conservation areas, but that local people lose out as they are often excluded from economic benefits of the development and thus not compensated for their costs and lost benefits. Many MPAs suffer from having negative socio-economic impacts, which potentially undermine livelihoods and resilience of the communities reliant on those coastal resources (Adger et al. 2000). Consequently, affected people can feel excluded and may not respect the new policies that emerge with the creation of an MPA. The cause of resource depletion can therefore sometimes be traced to the marginalization of important groups who withhold support. Honey (1999) claimed that Chumbe has suffered from poor community relations, and Masalu (2000) stated that illegal and destructive fishing activities have taken place within the protected boundaries of Chumbe Island.

Although the ecotourism program in CHICOP is a private sector enterprise, many actors are involved in the conservation effort, creating a complex relationship between protected area managers, the Government and local communities. Riedmiller (2000) stated that it is difficult for the private sector to engage directly with all local stakeholders without working though pre-existing structures established by the Government. The fishermen have an economic stake in the natural resource
and as such they must understand the benefits as directly translated into economic values in order to accept the MPA. The objective of conservation should be as overt as possible so that the influence and interests of various stakeholders is relatively transparent (Hall 2001). However, it has been a concern that the objectives of CHICOP have changed in recent years from concentrating on conservation and education, to be more focused on generating profit from the ecotourism enterprise. Also, it has been claimed that promises made by the proprietor of CHICOP have not been met.

### 1.5 Significance of the study

Despite increased awareness of the socio-economic and environmental significance of marine ecotourism, it is only in recent years that a substantial body of research has emerged. Ecotourism is a relatively latecomer in the field of tourism study, and most of the associated literature has dealt with environmental impacts (e.g. Boo 1990; Carter et al. 2001). However, there have been a number of investigations undertaken and reports produced on the status of Zanzibar’s inshore fisheries over the last decades (e.g. Jiddawi 1997; Muhando and Jiddawi 1998; Richmond 1999; and Jiddawi and Yahya 2003), as well as the status of coral reefs (e.g. Muhando 1997; Franklin et al. 1998; Johnstone et al. 1998; Muhando and Francis 2000; Mohammed et al. 2002; and Muhando and Kuguru 2002). CHICOP has conducted and supported numerous research projects into many biophysical and ecological technological aspects of the park, but not many socio-economic studies have been carried out (to my knowledge only Levine 2005). This is due to sensitive issues and concerns on the side of CHICOP management about raising expectations of aid and material benefits to the coastal inhabitants.

It is becoming increasingly clear that coral reef conservation is as much about understanding people as understanding ecological processes. Social, economic and cultural factors can influence whether and how individuals and communities overexploit resources or cooperate to conserve them. Many conservation projects fail as they do not understand, address and incorporate the socio-economic needs and concerns of key stakeholders. In order to get effective conservation, stakeholders have to see the connection between human resource use and the condition of the resource. Conservation strategies should be sensitive to the needs of those dependent on the
resource, and it is therefore important to examine the perceptions of resource users and other relevant actors.

While the tourism in Chumbe is obviously nature-oriented, one can discuss whether the criteria for ecotourism are generally met. The distribution of benefits between different stakeholders involved in CHICOP has not been investigated, and no studies have analysed the linkages between the social and ecological system. The literature has revealed some level of suspicion towards the new regulations of CHICOP, as communities opposed the idea of losing their traditional access to resources of the area. In view of the above, there is a need to assess the socio-economic impacts on the various stakeholders as well as the resilience of the social-ecological system to the changed situation after establishment of CHICOP. These components are essential to get an overall assessment of the success of the marine park’s effectiveness.

1.6 Objectives of the study
1. The sustainability of CHICOP is closely linked to the active support and participation of affected individuals, groups and organisations. However, as any development intervention that seeks to change the rules of an existing system will produce winners and losers, I was interested in determining how the institutional change had affected different stakeholders’ interests. The first objective was to assess the various stakeholders’ roles and relationships in the conservation of Chumbe Island. More specifically, the study proposed to accomplish the following:

- Identify key stakeholders;
- Examine the distribution of costs and benefits from ecotourism for key stakeholders;
- Uncover the interests of different stakeholders and investigate the relationship between them;
- Investigate reasons for conflicts and mechanisms for mediation; and
- Explore trade-offs for the various actors.

2. The second objective was to examine the social-ecological resilience of the MPA, and the nearby fisheries and human communities. This was because the ecological resilience of CRS is closely linked to the inshore fisheries outside the boundary, as well as the social resilience of the local fishermen. I was interested in assessing the
status of the reef and explore socio-economic aspects pertaining to the livelihoods of fishermen in adjacent villages to determine their dependence on Chumbe Island, so I attempted to:

- Examine household characteristics for fishermen in five villages;
- Assess alternatives and survival strategies in the event of the decline or disappearance of fish to find out how resilient fishermen were to changes in resource abundance;
- Evaluate the ability of the system to adapt and transform to policy changes and shifts in the natural system; and
- Investigate the fishermen’s perceptions regarding existence of the park and future management.

Based on the above objectives the study attempts to assess CHICOP’s status as an ecotourism enterprise. Understanding of socio-economic characteristics of stakeholders can help resource managers recognize various pressures on reefs. It is hoped that the findings will assist CHCIOP managers, scientists and policy makers in Zanzibar to make informed decisions on coral reef management, and to strengthen the adaptive capacity of the Chumbe reef and the nearby fishing communities.
2.0 THEORETICAL FRAMEWORK AND METHODOLOGY

2.1 Study Area
This study was carried out on the main island of Zanzibar, Unguja, which is situated approximately 40 km off Tanzania’s coast in the Indian Ocean (Gössling 2003). The climate and oceanographic conditions of the Zanzibar region is dominated by two monsoon periods, the Northeast Monsoon (kaskazi) from October to May and Southeast Monsoon (kusi) with strong winds from June to September. Long rains connect these in April/May and short rains in October/November (Richmond 1999). There are seasonal patterns in the catches of all fish species due to the seasonal reproduction and recruitment, but fishing is still practised throughout the year (Muhando 1995). The preferred season is the Northeast Monsoon when the ocean is calmer and clearer, resulting in higher catches due to a greater number of days spent fishing (Jiddawi and Yahya 2003). The western side of Unguja is more protected from strong winds, waves and currents caused by both the monsoons, which provide favourable conditions for hard coral growth (Lanshammar 2004). Coral reefs outside Zanzibar Town harbour the highest cover of hard corals around Unguja (Persson and Tryman 2003).

Chumbe Island
Chumbe is a small coral island of 22 ha, located 12 km southwest of Zanzibar Town (6°19’S, 39°32’E) (Riedmiller 2000). The island is about 1.1 km long and 300 m wide at its widest point, and is covered by a semi-arid coral-rag forest and bordered by a fringing coral reef on its western shore (McClanahan et al. 1999). Chumbe is located in a shallow basin and is supported by prevailing currents. The reef is exposed to northerly winds, and is affected by the northward flowing East African Current as well as southward tidal currents. Still, Chumbe has experienced reduced disturbance levels, as the island has not supported human settlements due to lack of freshwater, and as it became part of a military security zone during the 1960s (Buckley 2003). The island was chosen for ecotourism since it offered an opportunity to decrease possible socio-cultural impacts, and hosted a bio-diverse reef system. Before being gazetted as an MPA, a lighthouse was erected in 1904, and a house for the lighthouse keeper and an Indian styled mosque were constructed (Khatib 2003). CHICOP has in later years transformed the lighthouse keeper’s home into an environmental education...
centre and information office, constructed seven eco-bungalows and developed nature trails (Buckley 2003).

There were many villages and landing sites along the west coast adjacent to Chumbe Island, and 5 of these were selected for this study representing two districts namely, Urban (Mjini) and West (Magharibi) (Figure 1). The total population of Zanzibar is 985,000 of which 391,000 people belong to the Urban West district (SENSA 2002). One of the fishing villages belonged the Urban (Kizingo) and four were situated in the West (Mazizini, Chukwani, Buyo and Nyamanzi), characterized by being more rural. Kizingo and Mazizini were seasonal camping sites, and consisted mainly of migrant fishermen. However, most of these had used the area for more than 10 years.

Figure 1: Map of Unguja, the main island of Zanzibar, showing the location of Chumbe Island and study sites.
2.2 Theoretical frameworks
Knowledge of perceptions and valuation of marine resources by various stakeholders can provide vital information for assessing conservation and ecotourism. Coastal resources have various stakeholders and frequently, these are operating with different objectives (Brown et al. 2001; Musa 2003). As competing interests characterize conservation issues, the system must be viewed holistically, with an understanding of the gains and losses of all stakeholders (Grimble et al. 1996). The relationship between different stakeholders, as well as the relationship between humans and the environment has been explored. In order to assess these linkages, a combination of a stakeholder analysis and social-ecological resilience analysis has been utilised. The question of the ecotourism’s performance is analysed from perspectives of efficiency, empowerment and livelihoods security.

2.2.1 Stakeholder Analysis
The development of Stakeholder Analysis (SA) in the 90s emerged as a result of many projects not meeting their stated objectives because of opposition from key stakeholders (Grimble 1998). The approach has been developed especially in relation to developing countries and to environmental problems, and the roots lie in political economy and overlap with cost-benefit analysis and environmental economics. SA is an analytical framework for understanding environmental and development problems and interactions through analysis of the different perspectives and sets of interest of stakeholders at various levels (Grimble and Wellard 1997; Mushove and Vogel 2005). SA provides a tool that can examine how stakeholders benefit or lose from an ecotourism project, and it has an advantage for understanding conflicts of interests and trade-offs for key stakeholders that may threaten the success (Grimble 1998).

The framework comprises two stages, identification and evaluation (Adger et al. 2000). SA is used to identify the different groups of people with common objectives and sets of interests involved in the conservation of Chumbe Island. The range of institutions, social groups and individuals that possess a direct, significant and specific stake in the protection of the Chumbe reef are referred to as its ‘stakeholders’. The stake holding may originate from institutional authorization, geographic proximity, historical association, dependence for livelihood and economic interests (Woodcock 2002). According to Grimble and Wellard (1997), the most fundamental
division between stakeholders is between those who affect a policy, decision, or action (active stakeholders), and those affected by this (passive stakeholders). Primary stakeholders are those who will be directly or eventually affected by an intervention, either positively or negatively. Secondary stakeholders are intermediaries involved in interventions (Mikkelsen 2005).

Distributional, social and economic impacts of ecotourism projects can be assessed by looking into the interests and impacts of intervention on different stakeholders (Grimble and Wellard 1997). SA also looks at how stakeholders relate to one another. The most powerful have advantages in terms of better access to knowledge or education. In order to further own interests, these may use this knowledge to manipulate the less powerful. A ‘4Rs stakeholder analysis’ has been used in this study, and is a tool for understanding power issues between stakeholders’ roles (Salam and Noguchi 2005). This instrument analyses stakeholders’ rights, responsibilities, returns and relationships, to demonstrate the interdependence and interactions between them. Based on Vedeld (2005), the 4Rs are defined as follows:

- A right is a recognised institution by which one stakeholder has a disposition right over a resource. ‘Rights’ are access to CHICOP and to employment deriving from ecotourism, as well as rights to exclude and enforce regulations.
- Responsibility relates to duties for different actors. ‘Responsibilities’ are management tasks, implementing decisions on rules and following these.
- Returns are associated with the different stakeholders’ abilities to realize their interests in the face of other actors and their interests. ‘Returns’ are accrued from employment, taxation of ecotourism earnings and ownership of the venture, as well as benefits of conservation, such as improved fish stocks.
- The relationship between actors relates to issues of rights and responsibilities. The ‘relationships’ dimension includes stakeholders in conflict and cooperation, and their history with one another. It also includes the intangible of any conflict situation, such as trust, respect and legitimacy.

2.2.2 Social-Ecological Resilience Analysis

Resilience incorporates the ability both of social and ecological systems to absorb perturbations, which entails flexibility and opportunity (Hanna and Jentoft 1996). Resilience for social-ecological systems is related to a) magnitude of stress that the
system can absorb and remain within a given state, b) the degree to which the system is capable of self-organization and c) the degree to which the system can build capacity for learning and adaptation (Berkes and Folke 1998). Ecosystem responses to resource use, and the reciprocal reaction of people to changes in ecosystems, comprise coupled, dynamic systems that exhibit adaptive behaviour.

In the social context, resilience can be interpreted as the ability of an individual, group or organization to withstand social, economic and natural disturbances without fundamentally altering what they do. Social resilience is determined in part by the livelihood security of individuals (Berkes et al. 2003). More resilient people will be able to absorb higher levels of disturbance, adapt to change and have the capacity to re-organize (Cinner and McClanahan 2006). Social resilience is an important component of how stakeholders respond to and are affected by policy decisions, natural disturbances and significant declines in resource abundance. Coastal communities are dependent on the continued functioning of interrelated aspects of coastal ecosystems for their own dependence on multiple livelihood sources (Adger 1997). Social resilience can be observed through governance, access to resources and different knowledge systems pertaining to the environment (Berkes et al. 2003).

In terms of ecological resilience, the view of coral reefs has changed in recent years, from concentrating on stability near a single equilibrium state, to a dynamic ecosystem with multiple states where phase shifts might occur (Nyström et al. 2000). The resilience of an ecological system relates to the functioning of the system, rather than the stability of its component populations. For coral reefs, resilience can be indicated by the speed of return to an equilibrium position after a disturbance, or by the magnitude or scale of disturbance that can be absorbed before the system changes in structure (Adger 1997). In this sense, it is a measure of robustness and buffering capacity of the system to changing conditions (Berkes and Folke 1998).

2.3 Methods
Socio-economic data was collected between October 2005 and January 2006. As ecotourism is a collection of interrelated elements and the objectives explicitly linked ecology, economics and social sciences, the study required an interdisciplinary case study methodology. An initial rapid appraisal was undertaken to obtain more
information on CHICOP and to be familiar with salient issues relating to the study sites.

At the outset, the stakeholders actively involved in the ecotourism project, or whose interests had been positively or negatively affected as a result of project completion, were identified. Informal semi-structured interviews were conducted for 20 stakeholders, and several informal conversations were held. Respondents included CHICOP managers and employees, officers and managers in private organizations, employees, officers and directors in various government agencies, researchers at the Institute of Marine Sciences (IMS), district officers, beach recorders, community leaders, school children, tourists and fishermen. A set of topic categories corresponding to the stakeholder analytical framework was established, but the interviewees were allowed to express their views on the aspects they considered important. The interviews were performed in English and took approximately 45 minutes to complete.

A semi-structured questionnaire for fishermen was developed (Appendix 1), and this was tested through pilot surveys in different villages bordering Chumbe Island. Questionnaire-based interviews were conducted in the national Kiswahili language, with the help of a translator. 15 individual fishermen were interviewed in each of five villages, making a total of 75 interviews. The informants were selected using non-probability sampling techniques, including convenience sampling (respondent approached during resource use activities) and snowball sampling (where community members suggested appropriate respondents) (Bryman 2004).

Four focus group discussions were held in the rural fishing villages to obtain detailed information about their perceptions of CHICOP and suggestions on how to improve social-ecological resilience. The number of participants in Mazizini, Chukwani, Buyo and Nyamanzi were 10, 13, 15 and 14 respectively. These were gathered by informing the village leader in advance and consisted of fishermen only, except in Nyamanzi where 9 bivalve-collecting women also participated. Aspects of household economies, dependence and perceptions of marine resource use and conservation, fishing gear and practices, social organizations and access to resources and social services were
discussed (Appendix 2). Two interpreters were present during these discussions to ensure that as little information as possible would pass undetected.

In addition, I attended two meetings with the Department of Fisheries (DoF), the Department of Environment (DoE), CHICOP and fishing communities (Nyamanzi and Buyo), and one meeting with different education authorities and CHICOP. The former meetings discussed the boundary of CRS and poaching, and the latter was organised to discuss adjustments to the educational material and activities on Chumbe. All the information attained was complimented by indirect investigation, such as observation of individuals’ actions and behaviour, and this provided important verification and crosschecking functions. To assess the quality of the coral reef, an ecological resilience analysis was carried out based on data collected by Fiebig (1994), McClanahan et al. (1999), Muhando and Francis (2002), Muhando and Kuguru (2002), McClanahan et al. (2002), Mohammed et al. (2002), Persson and Tryman (2003), Lanshammar (2004), Larson (2004), Rostad (2005) and Smith (2005). Secondary data such as reports, books, journals and meeting minutes were gathered to supplement the information collected through interviews. These documents played a crucial role in establishing triangulation and maintaining the chain of evidence.

### 2.3.1 Statistical tests

All socio-economic variables gathered during the fishermen interviews showed normal distribution, so parametric analyses were used. In order to compare categorical data, such as age, boat type, gear type, ownership, occupation and changes in fishing practices, across the five fishing villages, Chi-square tests were utilized. Relationships between the various parameters were investigated by using Pearson correlation coefficient. One-way ANOVAs were performed to test for differences in total income between the villages as well as the number of occupations per household. A Tukey-Kramer test was further employed in order to find pair-wise differences for the former variable, and a Students t-test was utilized to compare means of the latter. The level of significance was set to \( p < 0.05 \) for all analyses.

### 2.4 Limitations of study

Socio-economic impacts of CHICOP on local fishermen are bound to be selective and unequally distributed over time. Thus, the total impacts may only be fully captured in
an extensive study using a wider range of data. The use of non-probability sampling made some members of the fishing villages more likely to be selected than others, so the sample was not necessarily representative of the population. As the sample was not random, it cannot allow generalisations to be made for the entire population (Bryman 2004). Human judgement affected the selection process, and my main interpreter particularly biased the sampling as he had already established contacts within the rural villages. However, focus group discussions were held to complement the obtained information. There are also a few problems associated with this method like group effects (Bryman 2004). This includes the problem of reserved speakers who may not express a perfectly legitimate perspective, resulting in important information being suppressed.

Another limitation was that quantitative baseline data on coral and fish diversity prior to the establishment of CHICOP were not available, so later research have been based on comparison with similar adjacent unprotected areas. As the Chumbe reef was chosen due to high quality of the habitat, it leaves open the possibility that differences detected are due to habitat rather than protection effects. In reality, it is probably a combination of these two factors. There are also disadvantages in terms of lack of familiarity with the secondary data, complexity of the data and no control over the quality.
3.0 RESULTS

3.1 Stakeholder Results
By using the stakeholder analytical framework as a theoretical lens to analyze the case data, this study has developed four major findings: identification, distribution of costs and benefits, stakeholders’ roles and their relationships. These contributed to increased understanding of how relevant actors were involved in CHICOP.

3.1.1 Stakeholder identification
The ocean surrounding Chumbe Island has various uses, and therefore a large range of stakeholders expressing differing views according to the conservation of coral reefs. Many of the values people attached to the reef were incompatible. Depending on the interest groups, coral reefs were seen as inputs of production, sources of income, areas for recreation, reservoirs of known and unknown genetic resources, or as a means of subsistence. The key stakeholders involved in the protection of the Chumbe reef were individuals, groups and institutions that significantly influenced or were important to the success of the project. In this report, influence is defined as the authority that stakeholders have over the project; to control what decisions are made, facilitate its implementation or exert power that affects the MPA. Based on Salam and Noguchi (2005), importance refers to those stakeholders whose problems, needs and interests are priorities of project implementers.

From the key informant interviews, focus group discussions and informal conversations, the CHICOP management and workers, government departments, investment organizations, NGOs, tourists, school children and their teachers and nearby fishing communities were identified as key stakeholders. Based on this, 20 different stakeholder groups were recognized and ranked according to their importance and degree of influence in decision-making (Table 2). The identified stakeholder groups represented primary and secondary stakeholders.
Table 2: Stakeholder groups, their interest, importance and influence in relation to Chumbe Island Coral Park.

<table>
<thead>
<tr>
<th>Stakeholder groups</th>
<th>Interests at stake relative to project</th>
<th>Effect of project on those interests (+; -)</th>
<th>Importance of stakeholder (1-highest, 5-lowest)</th>
<th>Degree of influence over project (1-highest, 5-lowest)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary stakeholders</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHICOP management</td>
<td>-Conservation. -Ecotourism revenue.</td>
<td>+</td>
<td>1 (High)</td>
<td>1 (High)</td>
</tr>
<tr>
<td>Department of Fisheries</td>
<td>-Conservation of corals and fish. -Increased awareness.</td>
<td>+</td>
<td>1 (High)</td>
<td>2 (High)</td>
</tr>
<tr>
<td>Ministry of Education</td>
<td>-Establishment of education centre. -Increased awareness.</td>
<td>+</td>
<td>2 (High)</td>
<td>2 (High)</td>
</tr>
<tr>
<td>Commission for Tourism</td>
<td>-Promotion of Zanzibar. -Tourism development.</td>
<td>+</td>
<td>2 (High)</td>
<td>2 (High)</td>
</tr>
<tr>
<td>Department of Environment</td>
<td>-Example for other protected areas.</td>
<td>+</td>
<td>2 (High)</td>
<td>3 (Medium)</td>
</tr>
<tr>
<td>Institute of Marine Sciences</td>
<td>-Access to area for research purposes.</td>
<td>+</td>
<td>3 (Medium)</td>
<td>3 (Medium)</td>
</tr>
<tr>
<td>Department of Forestry</td>
<td>-Conservation of coral-rag forest.</td>
<td>+</td>
<td>3 (Medium)</td>
<td>3 (Medium)</td>
</tr>
<tr>
<td>School teachers</td>
<td>-Teacher training and new knowledge.</td>
<td>+</td>
<td>4 (Low)</td>
<td>3 (Medium)</td>
</tr>
<tr>
<td>CHICOP rangers</td>
<td>-Employment. -Training.</td>
<td>+</td>
<td>1 (High)</td>
<td>4 (Low)</td>
</tr>
<tr>
<td>Other CHICOP staff</td>
<td>-Employment.</td>
<td>+</td>
<td>2 (High)</td>
<td>4 (Low)</td>
</tr>
<tr>
<td>Tourists</td>
<td>-Attractive holiday destination.</td>
<td>+</td>
<td>1 (High)</td>
<td>5 (Low)</td>
</tr>
<tr>
<td>School children</td>
<td>-Environmental education. -Opportunity to snorkel.</td>
<td>+</td>
<td>2 (High)</td>
<td>5 (Low)</td>
</tr>
<tr>
<td>Rural fishing communities</td>
<td>-Access to island and protected reef to sustain livelihoods.</td>
<td>-</td>
<td>3 (Medium)</td>
<td>5 (Low)</td>
</tr>
<tr>
<td>Urban fishing communities</td>
<td>-Access to island and protected reef for fishing.</td>
<td>-</td>
<td>4 (Low)</td>
<td>5 (Low)</td>
</tr>
<tr>
<td>Other local people</td>
<td>-Access to island; forest products, mosque.</td>
<td>-</td>
<td>4 (Low)</td>
<td>5 (Low)</td>
</tr>
<tr>
<td><strong>Secondary stakeholders</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zanzibar Investment Promotion Agency (ZIPA)</td>
<td>-Foreign investment.</td>
<td>+</td>
<td>4 (Low)</td>
<td>1 (High)</td>
</tr>
<tr>
<td>Zanzibar Association for Tourism Investment (ZATI)</td>
<td>-New member.</td>
<td>+</td>
<td>5 (Low)</td>
<td>3 (Medium)</td>
</tr>
<tr>
<td>NGOs</td>
<td>-Support to community enhancement.</td>
<td>+</td>
<td>4 (Low)</td>
<td>4 (Low)</td>
</tr>
<tr>
<td>Department of Harbours</td>
<td>-Control operation of lighthouse.</td>
<td>-</td>
<td>4 (Low)</td>
<td>5 (Low)</td>
</tr>
</tbody>
</table>
It should be recognized that the stakeholder groups were defined on the basis of each group having a distinct set of interests that distinguished it from other groups. However, the fishing communities were heterogeneous in the sense that the individuals were socially differentiated and diverse, so the fishermen could not be treated as one singular stakeholder entity. The interviewed fishermen had different interests in the same coral reef, as they were engaged in different fishing methods, and had used Chumbe Island for different purposes. For simplicity, the fishermen were divided between urban and rural in the analysis of their roles, as these districts had significantly different income levels and reflected different attitudes. When explaining their relationships, the groups have further been divided by specific location.

Another point to be highlighted is the definition of importance by Salam and Noguchi, as it is only concerned about the priorities of the project initiators. Even though many of the stakeholders’ problems, needs and interests have not been prioritized, they are still important. This applies for example to the fishermen who have been affected by the establishment of CHICOP, but have not received much attention. It is therefore a crucial distinction between intended and unintended effects on stakeholders by the project, and the term ‘importance’ should thus also refer to the degree stakeholders are affected. However, in that case, all the actors would have been classified as having high importance as all are key stakeholders relevant to CHICOP, and it would prove difficult to further divide them into primary and secondary stakeholders. The first definition has therefore been adhered to.

As can be seen from table 2 above, not all stakeholders were equally prioritised by the project implementer and had different degrees of influence in the decision-making process. By combining influence and importance using a matrix diagram, the different stakeholders have been classified into four groups (Matrix 1). In Box A, the stakeholders having high influence in decision-making and high importance regarding prioritisation, were the CHICOP management and most of the public sector institutions. These represent active stakeholder groups. In practice, CHICOP was the sole authority to take decisions, but the Government departments were consulted and they cooperated in terms of having occasional meetings.
A: Primary stakeholders, high importance and high influence
1. CHICOP management-Chumbe Island Coral Park Ltd.
2. Government departments:
   -Department of Fisheries (DoF)
   -Department of Environment (DoE)
3. Government institutions:
   -Ministry of Education (MoE)
   -Commission for Tourism (CfT)

B: Primary stakeholders, high importance and low influence
1. Institute of Marine Sciences (IMS, part of the University of Dar es Salaam) and other researchers
2. Department of Forestry (DoFo)
3. School-teachers, children and other students
4. CHICOP rangers and other staff
5. Tourists
6. Other local people
7. Rural and urban fishing communities

C: Secondary stakeholder, low importance and high influence
Private sector:
1. Zanzibar Investment Promotion Agency (ZIPA)
2. Zanzibar Association for Tourism Investments (ZATI)

D: Secondary stakeholder, low importance and low influence
1. Department of Harbours (DoH)
2. NGOs

Matrix 1: General categories of key stakeholders in relation to CHICOP.

Tourists were highly prioritised as they affect the financial sustainability of the project, but had low level of influence on decision-making except being able to give comments on improvements and to spread words of dissatisfaction. It is important to satisfy the tourists’ expectations, since they represent a type of customers that have an option to travel to other unspoilt areas. The interests of CHICOP employees, fishermen and other local people have not been prioritised, and they do not participate in decision-making and were therefore less influential. These stakeholders have therefore been characterized as passive. The decision-making is top-down, where the stakeholders in Box A make decisions and impel these on those in Box B. The consultation process in the initial phase of the establishment of CHICOP, using community meetings, served to divulge knowledge about the decision rather than to seek opinions or allow for influence.

Influential stakeholders, but with less importance in achieving the project’s goals, were classified into Box C. This group includes two private investment companies, ZIPA and ZATI (Zanzibar Association for Tourism Investments). They can influence the outcome of the project, as they have the power to approve the lease of Chumbe Island, but their priorities are not in accordance to those of CHCIOP. DoH (Department of Harbours) and NGOs have been identified as possessing both low influence and importance (Box D). DoH has little interest in coral reef conservation, but is concerned about the visibility and functioning of the lighthouse.
3.1.2 Distribution of costs and benefits
The distribution of costs and benefits from conservation and ecotourism across stakeholders has been explored to assess which actors that are the gainers and losers in the project (Table 3).

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Direct benefits</th>
<th>Indirect benefits</th>
<th>Direct costs</th>
<th>Indirect costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHICOP management</td>
<td>-Control.</td>
<td>-Satisfied tourists and good reputation.</td>
<td>-Application permit to ZIPA.</td>
<td>-Destruction of corals by tourists.</td>
</tr>
<tr>
<td></td>
<td>-Revenues from ecotourism and awards.</td>
<td>-Improved understanding of environmental</td>
<td>-Land rent.</td>
<td>-Poaching.</td>
</tr>
<tr>
<td></td>
<td>-Tax holiday and discounted lease.</td>
<td>issues.</td>
<td>-Salaries.</td>
<td>-Economic vulnerability due to changes in tourist taste and political</td>
</tr>
<tr>
<td></td>
<td>-Improved marine ecosystem.</td>
<td></td>
<td>-Taxes.</td>
<td>instability and in times of terrorism.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-Accommodation license, manager’s license, boutique license to CfT.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-Hotel levies.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-Residence permits to CfT.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-Opposition from local fishermen.</td>
<td></td>
</tr>
<tr>
<td>CHICOP employees</td>
<td>-Income.</td>
<td>-New relations with tourists.</td>
<td>-Taxes.</td>
<td>-Low paid and low skilled employment.</td>
</tr>
<tr>
<td></td>
<td>-New skills.</td>
<td></td>
<td>-Enforcement of boundary (conflict with fishermen).</td>
<td>-Jealousy from other villagers.</td>
</tr>
<tr>
<td></td>
<td>-Increased knowledge.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-State taxes.</td>
<td></td>
<td>-Increased fishing pressure in unauthorized areas.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Conservation of fishery and forest resources (benefit future generations).</td>
<td>-Improved environmental awareness of tourists and locals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Study opportunities.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private sector</td>
<td>-Investment fees.</td>
<td>-Marketing of Zanzibar.</td>
<td>-Loss of access to traditional fishing grounds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Membership fees.</td>
<td></td>
<td>-Loss of returns from marine products.</td>
<td></td>
</tr>
<tr>
<td>Local people</td>
<td>-Creation of employment.</td>
<td>-Encourage sustainable resource use.</td>
<td>-Increased competition in unauthorized areas.</td>
<td>-Losses of esteem and control over resources.</td>
</tr>
<tr>
<td></td>
<td>-Improved environmental education.</td>
<td>-Improved awareness through sharing of knowledge.</td>
<td></td>
<td>-Increase in prices for goods and services affect people with low income and purchasing power.</td>
</tr>
<tr>
<td></td>
<td>-Recreational benefits.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tourists</td>
<td>-Recreational benefits.</td>
<td>-Relaxation and recreation.</td>
<td>-Entry fees.</td>
<td>-Internalised degradation of corals occurring with tourism.</td>
</tr>
<tr>
<td></td>
<td>-Scenic beauty.</td>
<td>-Environmental appreciation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-Improved knowledge of the coral ecosystem.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Positive effects of the project on stakeholders’ interests

In the initial phase, only a few stakeholders were benefiting from the project. These were CHICOP, and the previously called Commission for Natural Resources, which have now been divided into DoE, DoF and DoFo (Department of Forestry). At the present, tourists, MoE (Ministry of Environment), IMS, students, school children and their teachers also benefit through access to environmental education and visitation. The education centre on Chumbe provides an opportunity to learn in a good environment. CHICOP has targeted education towards junior secondary schools, which include Form 1 and 2 for ages between 14-16 years, since it is generally easier to influence children’s perceptions and attitudes. Fishermen in several nearby villages as well as from mainland Tanzania and the other major island of Zanzibar, Pemba, have received education about natural resource management. Enhanced awareness about marine conservation, waste management and eco-friendly technologies has been attained for the local community at large.

CHICOP offers an opportunity to conduct research on otherwise rare fish species, and provides an undisturbed monitoring site and a scientific control site. The reef is a sound laboratory for demonstrating biological and ecological complexity to students, thus playing a role in education and research. Research conducted by IMS and international academics has found that CRS harbours high species diversity for fish and corals, and had high habitat complexity and community stability compared to unprotected areas (e.g. Muhando and Francis 2000; McClanahan et al. 2002; Mohammed et al. 2002). The formation of CRS can be of significant tangible benefits to the local people in terms of the effects of enhanced fish yields from possible ‘spill-over’ of commercial species. Nevertheless, this has so far not been proven. It can also insure against stock collapse outside boundaries by protecting spawner stock and hence larval production (Beckley et al. 1997). Some of the more advantaged fishermen in the urban villages stated that they could see the benefits of fishing around the boundary in terms of obtaining larger catches. Moreover, DoFo stated that the coral-rag forest on the island has increased species diversity, as the exploitation of trees for boatbuilding and firewood has ceased.

Parts of the income from ecotourism go to the Government in the form of taxes, thereby contributing to the economy of Zanzibar. Other benefits include training and
employment of some Zanzibaris, the purchase of produce in informal markets and marketing of local handicrafts. Ecotourism also promotes inter-cultural understanding between host and visitor.

**Negative effects of the project on stakeholders’ interests**

The rural fishermen have lost access to one of their main fishing grounds, and the catches and income has decreased for many of the worst-off who did not have the opportunity to buy engines or larger boats to go offshore. Most of these had increased time of fishing, as they could no longer camp on the island. They have also lost the opportunity to anchor their vessels during times of strong wind, look for bait and use the mosque. Many of the rural fishermen claimed that there was no proof of increased fish stocks after the establishment of CHICOP, referring to a mark-recapture study that had been conducted in 2000. Only a few fish swam beyond the boundary, so several stated that they had benefited less than promised. In addition, the fishermen had not received alternative income sources after the establishment, since the tourists go to the island by own means arranged by CHICOP.

Costs of conservation include enforcing rules and monitoring behaviour, and internalised environmental damage occurring with tourism. As many fishermen were not aware of the benefits of coral protection, they did not respect the boundary and fished illegally inside the MPA. Disputes have therefore arisen between the fishermen and the rangers. Increased fishing pressure and competition in unprotected areas has further led to conflicts between fishermen engaged in different fishing practices. Other negative impacts relate to leakages, which exist at all stages and areas of the tourism industry. This implies that the revenues are not captured locally and therefore do not benefit the local population. There is also a potential increase in local prices for certain items, such as land and foodstuffs.

**3.1.3 Stakeholder roles: rights, responsibilities and returns**

The stakeholders’ roles (rights, responsibilities and returns) have been assessed in order to explore relationships between the different groups (Table 4).
<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Rights</th>
<th>Responsibilities</th>
<th>Returns</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHICOP management</td>
<td>-Management authority.</td>
<td>-Overall leadership.</td>
<td>-Revenue from eco-tourism, awards and international funding agencies.</td>
</tr>
<tr>
<td></td>
<td>-Ownership- and exclusion rights.</td>
<td>-Send quarterly reports to government departments and other relevant institutions.</td>
<td>-Improved status of corals.</td>
</tr>
<tr>
<td></td>
<td>-Revenue collection.</td>
<td>-Arrange meetings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Train employees.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Fulfil objectives of conservation and education.</td>
<td></td>
</tr>
<tr>
<td>Department of Fisheries</td>
<td>-Banning of illegal fishing gear and methods (legislations).</td>
<td>-Enforce fishing laws.</td>
<td>-Conservation of fishery resources and corals.</td>
</tr>
<tr>
<td></td>
<td>-Approval of project.</td>
<td>-Sanctions of illegal fishing gear.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Collection of fishermen licences and registration of vessels.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Extension services.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Arrange meetings with fishermen and CHICOP.</td>
<td></td>
</tr>
<tr>
<td>MoE</td>
<td>-No legal rights.</td>
<td>-Make training programs for schoolteachers.</td>
<td>-Increased awareness about conservation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Organize workshops.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Provision of educational material (develop syllabus).</td>
<td></td>
</tr>
<tr>
<td>Commission for Tourism</td>
<td>-Approval of project.</td>
<td>-Promote destination.</td>
<td>-Revenue from taxes.</td>
</tr>
<tr>
<td></td>
<td>-Issue/cancel operational license and work permits for foreign workers.</td>
<td>-Advice investor.</td>
<td>-Annual investment licence.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Provide guidelines.</td>
<td></td>
</tr>
<tr>
<td>Department of Environment</td>
<td>-Approval of project.</td>
<td>-Organize school excursions.</td>
<td>-Pilot study for waste management.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Attend meetings.</td>
<td></td>
</tr>
<tr>
<td>IMS</td>
<td>-Conduct research.</td>
<td>-Baseline study.</td>
<td>-Scientific control site.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Notify research and publication of studies.</td>
<td>-Monitoring site.</td>
</tr>
<tr>
<td>Department of Forestry</td>
<td>-Approval of project.</td>
<td>-Monitoring of coral-rag forest.</td>
<td>-Conservation of coral-rag forest.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Introduce the endangered antelope, Addis duiker.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Attend meetings.</td>
<td></td>
</tr>
<tr>
<td>CHICOP rangers</td>
<td>-Enforcement rights.</td>
<td>-Patrol boundary.</td>
<td>-Salary.</td>
</tr>
<tr>
<td></td>
<td>-Language- and environmental education training.</td>
<td>-Educate tourists, school children and fishermen.</td>
<td>-Travel to accept awards (head ranger).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Act as guides in both reef and forest.</td>
<td>-Attend larger meetings.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Pay taxes.</td>
<td></td>
</tr>
<tr>
<td>Other CHICOP staff</td>
<td>-Language- and environmental education training.</td>
<td>-Organize bookings.</td>
<td>-Salary.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Interact with the tourists.</td>
<td></td>
</tr>
<tr>
<td>Local people</td>
<td>-Employment.</td>
<td>-Teach other community members about conservation.</td>
<td>-Improved ecosystem.</td>
</tr>
<tr>
<td></td>
<td>-Education.</td>
<td></td>
<td>-Improved environmental awareness.</td>
</tr>
<tr>
<td>Fishermen</td>
<td>-No legal rights.</td>
<td>-Fish in authorized areas with legal fishing gear.</td>
<td>-Protected breeding ground for fish.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Register boat and have license.</td>
<td></td>
</tr>
<tr>
<td>ZIPA</td>
<td>-Approval of lease and tax holiday.</td>
<td>-Check that activities at Chumbe are in accordance with objectives.</td>
<td>-Lease of island.</td>
</tr>
<tr>
<td></td>
<td>-Exemption on imported goods.</td>
<td></td>
<td>-Residence- and work permits for employees.</td>
</tr>
</tbody>
</table>
- Authority to cancel permits and lease.
- Inform about new Acts and Laws.

ZATI
- No legal rights.
- Organize meetings 5 times a year (open business council).
- Report about new issues.
- Membership fee from CHICOP.

DoH
- No legal rights.
- Minimizing disturbance to the reef by boats and visitors.
- Monitor distance kept by passing high-powered vessels.
- Place visible marker buoys.
- Supply island with freshwater.
- Help in cases of emergencies.
- Revenue for water (400 tons).

Rights
ZIPA has the right to reject the renewal of the lease of Chumbe Island, based on approval by the various government departments. The CHICOP management has ownership and revenue collection rights over the ecotourism enterprise, and can exclude other actors from access and management. Enforcement rights, that the rangers hold, are essential because the value of the reef is high and enforcement costs are low. Fishermen have been deprived of their traditional property and usufruct rights in the area, so many oppose the new rules. Researchers at IMS and other academics have a right to conduct research on the Chumbe reef, and local people have a right to access the island, to environmental education and to employment. The other stakeholders have no significant legal rights corresponding to CHICOP.

Responsibilities
The responsibilities of the CHICOP management are to fulfil the initial objectives of the Management Plan 1995-2005 (CHICOP 1995). It needs to apply for all permits and permission prior to commencing an activity, and inform the different government departments about these in a quarterly report. Researchers at IMS have an advisory role to the Government of Zanzibar on coastal and marine affairs, and have to send copies of research and monitoring projects to CHICOP and other interested agencies. Copies of all reports as well as research should be stored in a library at the CHICOP office.

CHICOP is also obliged to arrange meetings with the Advisory Committee (established for crisis management in the initial phase and includes representatives from DoF, DoFo, DoE, IMS and local fishing communities), provide training for the
staff, invite schools and satisfy tourists’ expectations. The public and private sectors should both attend the meetings and respond to reports. Both CHICOP and the Government, mainly represented by the DoF and DoH, have a role to play in the protection of the CRS, in particular in the publicising of the legal status and regulations applying to the MPA and in enforcing these. The Government is responsible for announcements and for providing information on education and extension measures with user groups who have an interest in Chumbe Island. Also, the management has to hold open days when members of local communities can visit Chumbe to see the latest development, ask questions and discuss the project.

Duties for the rangers are to protect the reef, dissuade fishermen and boatmen from fishing and anchoring on the reef, operate the boats and transport workers and visitors to and from the island and assist researchers. They also have an obligation to provide assistance to fishermen in emergencies. Adverse activities have to be reported to the DoF, DoFo and DoE, which has resulted in an extensive database of poaching activity. In addition, the rangers have to control nature trails and swimming activities in the reef and guide and help tourists.

An overall distribution of responsibility is between the state and local, primary stakeholders. It is the responsibility of DoF to make sure that all fishermen hold a license according to the Fisheries Act of 1988, and that their vessels are registered. Prior to issuing registration, DoF should ensure that the vessel does not engage in illegal fishing (based on previous records). DoF has also an authorization to protect the ocean from misuse and to maintain both biodiversity and a healthy reef, as well as to enforce fishing rules. It is the responsibility of fishermen to follow good methods of harvesting marine resources. Illegal methods include the use of small mesh size, dynamite, poison, spears and guns and beach seining. Fishers have an obligation to sell their marine catches at the landing site they belong.

Returns
Returns a stakeholder hold relative to the coral reef can be both material and non-material. CHICOP has obtained funds from NGOs and more than 10 awards. It also receives all the revenues accrued from the ecotourism enterprise. However, the occupancy rate varies with season and year, and is affected by political instability.
CHICOP also pays for student visits, workshops and meetings (unless funded by NGOs), its employees, various supplies to the island, the lease of the island, residence and work permits, membership fees to ZATI and taxes. Returns to the enforcement of the boundary still warrant the effort in terms of improved status of corals, fisheries and the forest that attract tourists, as well as increased environmental awareness for local residents.

3.1.4 Relationships: conflicts, trade-offs and cooperation

There is an imbalance in the power interactions, which in turn makes it difficult to achieve good relationship between all stakeholders. There are two types of relationships of significance here: stakeholders’ relationship to CHICOP and the relationship between them. The relationships can be conflict ridden and unsettled or solved through trade-offs, or they can be of cooperation and mutual benefits. To identify and assess conflicts of interest and co-operation between stakeholder groups, a matrix has been developed (Matrix 2).

<table>
<thead>
<tr>
<th>CHICOP mgt.</th>
<th>CHICOP staff</th>
<th>Government departments</th>
<th>Private sector</th>
<th>Fishermen</th>
<th>Other local people</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHICOP mgt.</td>
<td>X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHICOP staff</td>
<td>X X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government departments</td>
<td>X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private sector</td>
<td>X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fishermen</td>
<td>X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other local people</td>
<td>X X X X X X X X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Matrix 2: Relationships: conflicts of interests are represented by X and cooperation by □ (ordering express the dominant relationship).

Relationships between stakeholders and CHICOP

The relationship between the project implementers and local stakeholders has been poor in the past due to ambiguities over rights. Since the reef sanctuary covers a small area and is likely affected by activities occurring in the surrounding marine environment, the boundary was extended an extra 500 meters to create a buffer zone. This was established without consultation and cooperation between all interested parties, and thus created a conflict with fishermen who felt left out. However, this was originally a mistake created by the Government due to poor announcement, and CHICOP has now arranged meetings with affected villages to show maps of the boundary and explain negative effects of poaching.
Conflicts have also taken place between the rangers at Chumbe and the fishermen. The fishers have in general not been aware of the reasons for conservation, as the benefits have not been obvious to them. It has therefore been difficult to get fishermen to accept the new rules, and the rangers used to be threatened. Some fishermen sneak into the sanctuary to set traps or snorkel with spear to catch octopus, and many stated that they fish during dark moon or hide and poach at night. As CHICOP used to have limited numbers of rangers and boats to patrol (explained by high expenses of petrol), the fishermen had the opportunity to go fishing when rangers had to pick up tourists or get supplies. Nevertheless, the number of incidences of illegal fishing has decreased over the years as the rangers provide education to the fishermen. Infringements of park regulations reached a peak in 1994/5 with 45 incidences a month, but have declined to less than five now (Riedmiller 2003).

Broken promises have further aggravated the tension between fishers and CHICOP. The fishermen claimed that the proprietor had agreed to give assistance in the form of a dispensary, boat engines and new fishing vessels. They also complained about local people in affected villages not being employed. However, CHICOP stated that 38 people work for them of which 21 are Zanzibaris, including 9 from affected coastal villages. Now, the relationship between most fishing communities and CHICOP has improved. Particularly, there is less conflict with the rangers as a result of increased awareness of the fishermen regarding corals as living beings, and their proper behaviour. The fishermen can get help from the rangers if they have boat problems or engine failure, during times of storm, as well as illness and lack of drinking water. The rangers can give them a lift or help with food and fuel. In the absence of marine rescue services in the country, the rangers have rescued over 160 vessels with 2-16 fishermen since 1994.

It also used to be some problems between DoH and CHICOP concerning the functioning of the lighthouse. The rangers utilised it for observation to detect illegal activities inside CRS and in the process would open up the windows and blow out the light. The light depends on gas and needs an enclosed environment to be operational, and when not lit, it can have critical consequences for the boat traffic. DoH tried to enter the island to tell the CHICOP staff, but they were denied access. In addition,
ZIPA complained about a problem with the payment of the lease, but as the case has gone to a higher level, there are no further complaints from the Department of Land. There were also arguments about what rate to pay, and Riedmiller (2003) stated that CHICOP had been in a conflict with the Zanzibar tax authorities over the Chumbe Education and Research Programs, since full tax payment was demanded for school children and researchers visiting the island, though no income was generated with these programs. The interested parties have now agreed, and all government departments claimed that the new CHICOP management has improved.

There is a mutual dependence between the Government and CHICOP that ensures that gains made by ecotourism remain satisfactory to investors, and the Government receives foreign exchange earnings. Some positive cases of cooperation are seen in the interaction between the MoE, DoE, DoFo, IMS and CHICOP in arranging teacher training and school group visits, developing education material in English and Kiswahili and organising workshops. There is cooperation between CHICOP and DoE in encouraging, arranging and facilitating visits by environmental. CHICOP also works with DoF in making competition for schools and create awareness rising. DoFo collaborated with CHICOP to introduce the small, endangered antelope, Ader’s Duiker, to the island, and exchange rangers between Chumbe and another ecotourism project in Zanzibar in Jozani Forest, to improve their skills. IMS conduct research together with CHICOP, and rangers produce daily reports on events to help researchers with baseline surveys.

Relationships between stakeholders relative to CHICOP
ZIPA, ZATI and CfT assess and approve tourism projects together. Based on the Tourism Promotion of 1986, ZATI has to smoothen the responsibility and duties for CfT, as they can forward problems directly to the Government for resolution. CfT also works closely with DoE, DoF and IMS in implementing and administrating MPAs.

An internal conflict between the Chumbe rangers and other employees was observed, caused by differences in payments between rangers and office workers, which created some jealousy. Many rangers have quit as they thought the payments were too low and that the working conditions were too demanding. There were also internal
conflicts between fishermen. As there was multiple use of the same unauthorized areas, most of the conflicts over marine resources were typically between gear users (Table 5). There is no particular resource allocation with respect to the use of different gear types. However, there was an unwritten rule that people from outside areas were not allowed to fish in local waters, and that it was forbidden to steal fish from other individuals’ traps.

Table 5: Relationships observed for the five fishing villages

<table>
<thead>
<tr>
<th>Conflict Village</th>
<th>Within village</th>
<th>Among villages</th>
<th>Migrating fishermen</th>
<th>Rangers</th>
<th>CHICOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kizingo</td>
<td></td>
<td>-Nyamanzi fishermen favoured due to employment of rangers from that area. -Beach seine versus traps.</td>
<td></td>
<td>-Good, but some are corrupt. -Rangers sometimes destroy fishermens’ gas lamps.</td>
<td>-4 respondents attended seminar. -Conflict with owner.</td>
</tr>
<tr>
<td>Mazizini</td>
<td>-Steal catch from others’ traps.</td>
<td>-Nets versus traps.</td>
<td>-Conflict between campers and native fishermen.</td>
<td>-Good.</td>
<td>-2 respondents attended seminar.</td>
</tr>
<tr>
<td>Chukwani</td>
<td>-Good connection with Buyo. -Women cooperate with seaweed farming. -Jealousy towards the other villages for grant.</td>
<td>-Fishermen from Stone Town who use beach seine. -Dema traps versus hand-line and nets. -Fishers using small mesh size.</td>
<td>-Fishermen from the mainland who use dynamite and poison. -Kojani people who use beach seine.</td>
<td>-Good, but used to be conflict.</td>
<td>-Anger due to expansion of protected area and unfulfilled promises.</td>
</tr>
<tr>
<td>Buyo</td>
<td>-Women cooperate with seaweed in Nyamanzi.</td>
<td>-Think Chukwani receives more help as closer. -Competition for fishing grounds. Nets (most use) versus traps.</td>
<td></td>
<td>-Good, but some are corrupt.</td>
<td>-No connection.</td>
</tr>
<tr>
<td>Nyamanzi</td>
<td>-Jealousy regarding fund distribution between 2 different landing sites in Nyamanzi.</td>
<td>-Nets versus traps (most use). -Fishermen from Stone Town.</td>
<td>-Outside fishermens using poison and seine net. -Kojani people who fish illegally inside the MPA.</td>
<td>-Good, but some are corrupt.</td>
<td>-Anger due to expansion of protected area and unfulfilled promises.</td>
</tr>
</tbody>
</table>
Trade-offs

Human values are not homogenous, so people have conflicting ideas about the appropriate balance between uses of the reef. There are trade-offs between recreational uses of the reef system and other economic uses. In addition, there are trade-offs between recreational users and ecological values such as biodiversity conservation and ecological functions, however, ecotourism attempts to have a mutual benefit of the two. A trade-off can be for a ranger to allow fishermen to fish inside the MPA because if he denies, they will still enter and may do more harm through illegal fishing than through making an agreement to allow for less destructive fishing methods. Trade-offs at micro level often reflects questions of local resource allocation between different activities, which are mutually exclusive. For instance, fishers make trade-offs between different fishing techniques, fishing grounds and timing, according to season and other factors. Policy-makers make trade-offs when giving priority to environmental, equity, or economic efficiency objectives.

3.2 Social Resilience Results

3.2.1 State of the social system

Uses and dependence on coral reefs

Fisheries are 95% artisanal in Zanzibar, as the majority of the local fishermen use traditional fishing methods and catch fish close to the shore within coral reef areas (Jiddawi and Yahya 2003). These fisheries are predominantly small-scale and play an important role as a source of protein-rich food and employment. Most of the rural fishermen were poor, and used traditional gears and vessels with limited operational range. From Figure 2 below, it can be viewed that type of boat was related to location (ChiSq: p < .0001). Ngalawa was the most common boat used by the fishermen (39 %) followed by the dau (33 %), particularly in the rural villages (see Appendix 3 for translation and description of vessels and gears). These vessels were mostly operated by sails or propelled by paddles, oars or poles. The fishermen in Kizingo were able to carry out their activities in distant deep waters, as they used the bigger mechanically driven boti or boti ya barafu. The smaller traditional vessels were more frequently utilized with increasing distance from Zanzibar Town.
The type of boat was also associated with the kind of gear used (ChiSq: p < .0001), where nyavu was mostly used together with boti ya barafu, and less frequently with boti and dau (Figure 3). This is a surrounding net fishery that obtains large catches. The fishermen having a dau, used principally jarife, which is a gill net fishery. The ngalawas were associated with mishipi and madema, which are the least developed and efficient fishing practices involving hook and line and traps. The most common fishing gear and methods used varied with location (Table 6).

Table 6: Most frequent fishing practices used in the villages.

<table>
<thead>
<tr>
<th>Village</th>
<th>Type of boat</th>
<th>%</th>
<th>Type of gear</th>
<th>%</th>
<th>Type of engine</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kizingo</td>
<td>Boti</td>
<td>53</td>
<td>Nyavu</td>
<td>67</td>
<td>Engine</td>
<td>100</td>
</tr>
<tr>
<td>Mazizini</td>
<td>Dau</td>
<td>60</td>
<td>Mishipi/Madema</td>
<td>33/33</td>
<td>Sail</td>
<td>93</td>
</tr>
<tr>
<td>Chukwani</td>
<td>Ngalawa</td>
<td>53</td>
<td>Mishipi</td>
<td>80</td>
<td>Sail</td>
<td>93</td>
</tr>
<tr>
<td>Buyo</td>
<td>Dau</td>
<td>73</td>
<td>Jarife</td>
<td>60</td>
<td>Sail</td>
<td>73</td>
</tr>
<tr>
<td>Nyamanzi</td>
<td>Ngalawa</td>
<td>93</td>
<td>Madema</td>
<td>40</td>
<td>Both/Sail</td>
<td>47/47</td>
</tr>
</tbody>
</table>
Often young adults were disadvantaged in their ability to control their own labour. Older fishermen (> 43 years) hired more labour than young and middle aged, and more of them owned boats (ChiSq: p = 0.0411). The majority of active fishers therefore depended on the goodwill of older men to be able to fish. To pay for use of boat, they divided the catch into two, where one half went to the fishermen and the other went to the owner and the boat. The ownership of gear was not significantly different between age groups (ChiSq: p = 0.0752), which can be explained by many fishermen making their own traps or by cooperative ownership of nets.

The fishermen mentioned certain habitats and fishing grounds that they used for their daily fishing activities. 60% of all the interviewed fishermen ranked coral reefs as the most important habitat for fishing. More of the Nyamanzi fishermen relied on inshore reefs than the other villages, and 80% stated that the unprotected part of Chumbe reef was still one of their fishing grounds. However, 40% of the Kizingo fishers used to fish offshore, which is connected with their larger vessels. They were therefore not dependent on wind conditions or tides to get to a designated area, and faced less competition from other fishermen. Also, a large proportion of the fishermen in Buyo stated that they had changed to deep-sea fishing even though sail powered their vessels, and only 13% mentioned fishing in the unprotected Chumbe reef.

Elders stated that marine resources used to be more abundant in the past, and that outsiders had been encouraged to fish in the area. 61% of all the interviewed believed that the abundance of coral reef species had declined. The fishermen mentioned seven fish species that had disappeared, where at least one (*Fistularia petimba*) had returned after the establishment of CRS. The fishermen observed declining availability of mature fish, and according to 83% of the respondents, there was increasing difficulties of obtaining the same amount of catch as previously despite increasing efforts. A shift has therefore occurred, to concentrate more on juvenile fish and less valuable species.

*Income sources and alternatives*

Kizingo had significantly higher income than the other villages (ANOVA, F = 5.9552, p < 0.0004). Most of these fishermen worked on or owned larger boats with
engines, enabling them to exploit pelagic fish species. The income had not changed much after losing access to the Chumbe reef for the urban wealthier fishermen, as they had better opportunities to adapt. The poorer, rural fishermen claimed to have reduced catches and hence decreased income, even though the price of fish has increased in recent years.

Figure 4: Total income for households across villages.

Most fishers solely relied on fishing, but others combined their income with small businesses like shops, or farming practices. The number of fishers having a second occupation was significantly different between villages (ChiSq: p = 0.0013), with Kizingo being the village where most respondents only engaged in one income generating activity (Figure 5). Fishermen who were involved in business and formal employment were generally better off than fishermen only engaged in farming. The agricultural sector had an overall involvement of 43% of the fishermen, with disproportionately higher partaking in rural areas. As the urban fishermen had highest incomes there was less need for them to diversify. This can also be explained by that the urban villages consisted mostly of migrant fishermen living in temporary homes. The dependency of coastal communities on fisheries and other marine resources directly affected their land based livelihood strategies.
The households of urban fishermen participated in fishing, selling of marine products and salaried employment. Contrary, smallholder farming, seaweed farming, livestock husbandry and small-scale trade handicrafts were the main and most important economic activities providing income for the rural households. Most rural families were involved in more than one economic activity so if one income to the household failed, the family had other sources of food and income. However, a large proportion of households in Kizingo and Chukwani had no income diversification (Figure 6). In general, the rural fishing villages were more diverse as most were involved in cultivation of different crops either for selling or subsistence compared to urban areas. Nyamanzi had a significantly higher number of occupations than all the other villages, and Mazizini, Chukwani and Buyo had higher than Kiziglo (ANOVA, F = 6.1762, p < 0.0003). The most rural and remote sites had therefore the highest number of occupations (Figure 7).

**Figure 5: Percentage of fishermen with a second occupation.**

**Figure 6: Percentage of households with no income diversification across the five villages.**
CHICOP had only provided employment for a few interviewees, so the villagers themselves developed alternative sources of income to fishing. Out of all the respondents, one had been working on Chumbe Island for 3 years as a ranger and boat driver, another got work as a boatman during the construction period and yet another used to be employed. This year one of the interviewees painted rooms on Chumbe and was involved in advertisement. Building material for construction was purchased locally and transferred by locals.

Institutions and organizations

a) Extension and advisory services
The Government has realised the deteriorating situation of the reefs along the coast of Zanzibar, and has initiated several programmes aimed at educating the fishermen on better and sustainable utilization of the resource. DoF provides extension services in terms of organising seminars or giving information and training on aquaculture, seaweed farming, fishing methods, handling of fish and processing, as well as preservation and marine conservation. The information is distributed from DoF through fisheries officers at landing sites. CHICOP has also jointly arranged a seminar together with ZAYEDESA, funded by UNESCO for sensitisation of young fishers in sustainable fishing practices and conservation. In addition, a seminar has been arranged for the women cooperation in Buyo and Nyamanzi, and these have received inputs for seaweed farming (tie tie). DoFo and DoE deliver some information about mangroves and other coastal issues.

b) Committees
In order to receive grants from the Government, the landing sites have to be registered which implies establishing a Fisher’s Association and paying a fee. Newly formed
committees existed in all the villages, consisting of 10-15 members. Kizingo, Mazizini and Nyamanzi had received grants from DoF in the form of a vessel, engine and gear, as well as a fund for cases of emergency. These were under the ownership of the committee in the associated villages. Cooperatives were formed in order to use the supplied gear, where 50% of the net revenue was allocated to the fishing crew and 50% to the cooperative to cover the use of the gear. Even though Chukwani had a Fisher’s Association, the landing site was not registered, so the fishermen had not received any support from the Government. In Buyo, only the women cooperative had received support from the Government.

c) Access to credit
There was in general a lack of capital and formal credit operations in the villages. In order to receive credit from the Government, the fishermen needed to be organized, and this is the reason why the landing sites had recently been registered and committees established. The Government used to provide loans in the past, but this has ceased. All of the fishermen stated that they had no bank accounts, however, the lack of financial capital was compensated by high social capital. Members of committees supported each other, and many of the fishermen stated that they could borrow money from their families, colleagues or friends. Fishers gradually saved funds earned from crewing for maintenance of vessel and gear, and for purchase of boat-building materials leading to eventual ownership.

d) Markets and sale
The fishermen did not get an appropriate price on marine products under the current marketing system. They were dependent on small-scale traders, which included fishmongers and middlemen, for sale, as there was a lack of motorized transport. The fishermen argued that the prices were not sufficient compared to the fishing effort. The prices fluctuated from day to day and with season, where SEM provided the highest earnings. This is due to demand and supply factors, and as there was a general lack of refrigeration facilities. Ice was normally not used for post-harvest treatment, except for fishers using boti ya barafu.

3.2.2 Perceptions of CHICOP
The general attitude towards conservation was ambivalent. On the one hand the fishermen recognized the importance of protection of coral reefs, and the possible
benefits of a ‘spill-over’ effect from the MPA. On the other hand, minimal or no
direct benefits from ecotourism have been accrued to the majority of fishermen, as
CHICOP offers few job opportunities. Furthermore, they have been negatively
affected by facing restrictions from access to an important fishing ground, so some
expressed anger towards the establishment of CHICOP. This was exacerbated by no
NGOs operating in the area to offer alternative resource utilizations or employments
to sustain the local economy.

The fishermen in Kizingo were the most positive regarding the establishment of
CHICOP, and this can be explained by their more efficient fishing equipment and
higher income. These fishermen had been less affected and in addition, had more
assets to adjust to the new situation. Buyo had also few concerns regarding CHICOP,
and many of the respondents showed less dependence on the Chumbe reef as they
used offshore fishing grounds. Neither Buyo or Chukwani had received funds from
DoF, but the Chukwani fishermen were still much more aggravated and withheld
support for both CHICOP and the Government. Nyamanzi was the most organized
village, and felt that the community was able to influence the management of
CHICOP due to the establishment of an environmental committee.

3.2.3 Adjustments to the establishment of CHICOP
Kizingo had the highest number of fishers having changed their fishing practices (60
%), reflecting their better opportunities. However, this was not significantly different
from the other villages (ChiSq: p = 0.0738). The Kizingo fishers had adapted to the
lost access in terms of changing habitat from coral reefs to the deep sea. Some of
these were the only ones stating that the time they spent fishing had decreased. 53 %
of the fishermen stated that time fishing had increased, as they had to travel longer to
look for fish due to over-exploitation. In order to still fish inside the CRS, some of the
worse-off fishermen had changed their style of encroaching, particularly to night
fishing.
4.0 DISCUSSION

4.1 Factors enhancing social-ecological resilience

4.1.1 Protection
After Chumbe was gazetted as a reef sanctuary, disturbances in terms of fishing and boat traffic has been removed. This has led to less anthropogenic destruction of corals and less sediment re-suspension caused by high-power boats. As there is no baseline study prior to the protection of Chumbe, it has mostly been compared with other nearby unprotected reefs in order to assess its status. In this study, the role of protection and level of ecological resilience has been investigated by comparing various studies that have been conducted on macro-benthic cover and fish species composition. According to Costanza and Folke (1996), species richness is a good indicator for reef health.

Macro-benthic cover
Fiebig (1994) conducted a coral reef baseline study in CRS to assess its status. It included a benthic- and invertebrate survey, and coral species represented 45 genera, dominated by Acropora. McClanahan et al. (1999) compared 15 sites along the Tanzanian and Kenyan coast, including CRS, and found that the coral cover was 20% lower in unprotected reefs. In the same study, Chumbe was found to have 62.8% hard corals, 13.1% turf algae, 7.3% fleshy algae 7.3% coralline algae and 1.6% soft corals. Four years later, Persson and Tryman found that Chumbe had the highest live coral cover (51%), Acropora cover (28%), substratum composition diversity, complex corals and lowest dead/living ratio (13%) compared to two other adjacent unprotected reefs. Larson (2004) also found that Chumbe had the highest live coral (71%) and high substratum composition diversity, as well as the lowest percentage of algal cover.

In 2005, Rostad investigated the recruitment of coral larvae and CRS showed higher success of a species of Acropora, Acroporidae, than one unprotected reef. However, recruit mortality was also higher, and this can be explained by the increased abundance of herbivores that has enhanced the predation pressure on the larvae, and by competition for space. According to Mohammed et al. (2002), Chumbe experience seasonal growth of macro-algae, which can pose a problem for coral settlement and led to algal dominance. The reason for this can be the six times lower abundance of
sea urchins observed by McClanahan et al. (1999), which can graze more intensively than herbivorous fish.

The Chumbe reef was exposed to the 1997-1998 large-scale bleaching event of El Niño. After this episode, the extent of coral cover on Chumbe decreased from 51.9 to 27.5 %, and values of bleaching index averaged around 65 % (Muhando and Francis 2000). Particularly high mortality among the fast-growing branching corals *Pocilloporidae* and *Acroporidae* was observed. Mohammed et al. (2002) also found higher loss of live coral cover on Chumbe in this period compared to other reefs along the Zanzibari coast. The fleshy algal cover increased from 8.8 to 18.4 % in CRS, while outside there was no significant change. There was also an increase in sea urchin abundance, suggesting a deteriorating condition. This suggests that areas protected from human interference are less resilient as they are not used to adapt to disturbances. Corallimorpharians tend to establish themselves on degraded reefs and prevent coral settlement, but the low abundance and species richness of these observed by Muhando and Kuguru in 2002 indicate that CRS recovered more quickly than other adjacent reefs and was more resilient. Moreover, Smith (2005) calculated bleaching indexes of 5 and 9 % for the reef, and this signifies a normal, healthy reef in terms of bleaching levels. CRS was therefore hardest hit by the bleaching episode, but did also recover fastest.

*Fish fauna*

The structure and complexity of reefs influence diversity and abundance of fish. As a part of the baseline study, Fiebig (1994) carried out a fish species count, where 343 species of fish from 49 families were recorded. This includes about 90 % of all recorded in East Africa. McClanahan et al. (1999) found that the total fish wet weight was 3.5 times higher in CRS than in unprotected reefs, and species diversity and predation rates were two times higher. Larson (2004) also found that the total fish density, number of families and diversity were about twice as high on Chumbe than adjacent areas. Another study by Lanshammar (2004) showed that the distribution over size classes and ten different species of groupers (Serranidae) was much greater on Chumbe. Average density of butterflyfish (Chaetodontidae) and triggerfish (Balistidae) was also higher at Chumbe, which are crucial in balancing the ecosystem by predating on sea urchins. McClanahan et al. (2002) stated that triggerfish are
vulnerable to fishing due to its aggressive behaviour, so the higher abundance shows that recovery is likely. Higher abundance of obligate coral feeders in CRS was also observed, and more of these than omnivores and invertebrate feeders. Increased animal abundance and size translate into increased reproductive potential and insinuate high resilience (Gell and Roberts 2003).

**Connectivity**

The basis for the high productivity of Chumbe is a combination of the productivity of the reef with support from the surrounding environment (Muhando 1995). According to Hughes et al. (2003), high connectivity promotes resilience and recovery from disturbances. Coral and fish larvae, as well as juvenile and adult fish in CRS have the possibility to disperse as passive and mobile links to northern heavily fished reefs, which can help to restock nearby locally depleted fisheries and promote recovery of degraded coral reefs. However, coral fish species that respond most quickly to protection are often sedentary (characterised by a pelagic larval stage, limited movement of adults and slow growth) and spend much of their time in reserves, making their emigration role small (Holland and Brazee 1996; McClanahan and Mangi 2000). Larval supply from site-attached species may therefore be more important in enhancing adjacent fisheries than the export of adults.

**4.1.2 Education**

Even though Zanzibar is a coral based island, with its economy and livelihood predominantly dependent on marine resources, the Government has failed to incorporate marine issues into school syllabi. Coastal curriculum is introduced only in standard 3, where only a small section is about corals and their uses. MoE has in general a loose connection to most of the other government departments, and this can be a reason why the syllabus in secondary school is not updated regarding relevant environmental issues, and for a general low awareness level in the wider community. The importance of corals has not been obvious for most people in Zanzibar, but this is starting to change as a result of activities carried out by IMS and different NGOs, TV and radio broadcasts and seminars and meetings organized by CHICOP.

The main target groups for environmental education by CHICOP are residents of local communities and tourists. The number of school children going to Chumbe has increased over the years and there is now approximately one group visiting every
CHICOP has provided education material to teachers, and is currently in the process of writing this in Kiswahili for primary schools. Extension services and field trips to Chumbe Island have helped to clarify the importance of resources and reasons for conservation, which have made resource users as well as government officials more aware of their responsibilities. By gaining insights into marine biology, forest ecology and environmental protection, the local community and tourists can enhance the ecological resilience as a result of more responsible behaviour towards natural resources. In addition, resource users are better equipped to see new opportunities and to adapt to changing environmental conditions due to new knowledge. Environmental education can also influence aspects of resource management that increases the chances for resilient or adaptive institutions.

4.1.3 Cooperation
The cooperation between CHICOP, MoE, DoF and IMS in conducting research and spreading new knowledge about the marine environment has led to enhanced awareness in the larger community. Extension services provided by DoF made fishermen realise the benefits of cooperation, and committees have now been established in all the villages. These were used to distribute information and knowledge about resource use, as well as to access grants and collectively share these. The Government is also positively affected due to the mutual dependence between resource users and regulators for improved fisheries. As fisheries are characterized by high degrees of risk and uncertainty in terms of personal safety, amount of catch and income, cooperation between fishermen was important. Networks built reciprocity and provided a form of assurance to decline in resource abundance and outside disturbances. The rural villagers showed a higher reliance of others for access to credit, but were engaged in more risk-spreading mechanisms than the urban fishermen. These had also higher social capital, which increases resilience as connections strengthens the robustness for fishermen.

4.2 Factors reducing social-ecological resilience

4.2.1 Coral reef degrading factors
The Chumbe reef is subject to large and infrequent events such as outbreaks of the coral-eating crown-of-thorns starfish and bleaching events caused by El Niño. The most commonly mentioned human factor affecting fish abundance in the surrounding unprotected fishery was the use of destructive gear and practices due to increased
human population. There were claims that illegal methods were being used, and many knew about others engaging in destructive fishing practices or admitted that they were doing it themselves. Adjoining areas showed decline in abundance and sizes of fish, disappearance of large species and decline of the size of the catch, which indicate over-exploitation. Damage from intensive fishing can reduce the structural complexity of the reef habitat, partly by reducing cover of corals and other benthic invertebrates (Roberts and Polunin 1993). Disturbances may have a more detrimental effect on specialists than on generalists, because the former are often slow growing and site attached. As highlighted by Msuya (1998), the rural communities were in general more aware of environmental issues than their urban counterparts, but they were socially and economically hindered in their ability to make changes.

**4.2.2 Poverty and low livelihood diversification**

Social stresses are manifest in instability in income and risk of failure of a resource, and are related to poverty. This is a significant driver behind localised anthropogenic threats to reefs. The traditional artisanal gears used by most rural fishermen did not give enough catch to sustain the fishermen economically. As poor fishermen with large families are interested in solving immediate problems, many have started to use destructive methods as a shortcut to solve their needs. This can also be explained by the influx of rich tourist to Zanzibar, as they increase both the demand and prices for marine products. Despite technological advances in boat building and gear design, economic factors have limited the area of the sea where the rural fishermen can harvest marine resources. Therefore, fish stocks are reduced in near-shore waters, leading to social and economic vulnerability as it changes the ecosystem’s capacity to supply human society with essential services. This impacts the sustainability of livelihoods of local populations. Even though delaying a fish harvest may result in bigger and more valuable fish, there is no assurance that the fishermen will catch those fish in the future so they have less incentive to wait for returns from foregone current use. The daily struggle for food and household income therefore keeps most of the fishermen from improving their situation.

Underlying this difficult situation is the poor communication, lack of social services, limited access to credit facilities, little investment and lack of non-resource dependent jobs. CHICOP has not created alternative livelihoods for the fishermen, and only a
few have been employed as rangers and boatmen. Kizingo fishermen had the lowest number of livelihood options and showed high dependence on fishing. The specialisation to increase efficiency or resource use makes it difficult to turn to non-fishing alternatives during periods of resource scarcity. As a result of little financial capital in rural fishing villages, there was less investment in fishing, and therefore less specialisation. Even though these villages were the poorest in terms of income, they had highest diversification, which is in accordance with the results of Cinner and McClanahan (2006). Diversification reduces the risk of livelihood failure by spreading it across more than one income source. The rural fishermen were inherently diverse, had multiple economic niches including agricultural production, seaweed farming and bivalve collection and had high social capital.

4.2.3 Conflicts
A diversity of agents with conflicting goals and attributes has created tension between authorities and interests at various levels, as well as among different users in the same group. The latter has mainly been due to the heterogeneity that exists in the fishing practices fishermen use and benefits they have derived from the Government. Also, according to Leach et al. (1997), aspects of social identity contribute to diverse and often conflicting values and resource priorities. All the interviewed fishermen expressed resentment of visiting fishermen who used destructive fishing methods more frequently. Particularly the fishermen from Kojani using nets were believed to harvest large catches of reef fishes outside the boundary of CRS, to the extent that the spill-over effect was reduced, making it uneconomical for hand-line and trap fishers. Due to the rising number of fishers exploiting near-shore waters causing reduced catches and degradation of corals, competitive conflicts among multiple users have taken place over the remaining resources. These conflicts have further intensified with the increased interest in coral reefs from tourists and the associated creation of CRS, as the fishermen have lost access to one of their traditional fishing grounds.

Weak information flow
The major cause of conflicts related to CHICOP was the poor information flow, both vertically and horizontally, between the various actors. Each set of stakeholders recognized the constraints on information. In order to maintain good public relations it is important to inform key stakeholders about development and activities on Chumbe as well as the objectives. CHICOP has wardens and an Advisory Committee
to guide activities, and decisions are made at committee level with opportunity for all concerned to express their opinions and wishes (Carter 2002). However, many staff stated that they refrained from commenting on issues, as they were scared of losing their job. CHICOP receives feedback by visiting participating schools and from comments given by tourists and the Government, but according to the different government agencies, the suggestions are seldom fulfilled. Government agencies had horizontal linkages to departments and organizations, but these were also in many instances poor. There was also inadequate information flow between the fishing villages as well as between different landing sites within villages, which caused unnecessary scepticism and jealousy. Some of the fishermen claimed that their viewpoints according to CHICOP had not been asked for at any stage, and many stated that the CHICOP management had never been to their landing site. This is a clear sign of poor information flow within the communities, as CHICOP has been to all the villages and announced the meetings in advance, but few people have attended or talked about it.

Lack of transparency and trust
The weak information flow reduces transparency, and therefore undermines the level of trust towards CHICOP. CHICOP has exclusive knowledge and influence over the project and the local people have remained effectively outside the decision-making process. Ecotourism on Chumbe Island has raised expectations about provision of jobs and income, establishment of electricity supplies and support to schools and health centres. The owner promised to provide nearby villages with gear so that they could access new fishing grounds, but they have so far not received anything. The expansion of the boundary of CRS further reduced the level of trust. The project is not transparent, and even staff complained about not knowing the objectives. The work plan did not include management objectives or the costs for different activities and expenses. Many of the respondents stated that the proprietor and management were mostly concerned about profit, and believed that marketing was now their main focus. ZATI did not believe in the ecotourism project in Chumbe, and perceived it only as a new marketing mechanism to attract elite tourism.

Many fishermen cited corruption within the project, and CHICOP rangers were accused of allowing fishermen to fish inside the MPA because of friendship, or of
selling fish that the ranger had caught himself. This can be an argument for not employing more fishermen from affected villagers, as they are more likely to be corrupt if they know other local people. On the contrary, it can be seen as a result of the low salaries earned by the rangers. Most of the employees get less than US$ 100 per month, even though the company advertise and state that they pay them US$ 200. The initiator had promised to raise the salary after paying back the investment costs, which was believed to be in 2004. However, the salary has not increased, only the number of staff. Also, little of the money is reinvested in the development of Zanzibar, or goes back to the local people, making the benefits few. Another point of worry is that there has been an increase in tourism arrivals in Zanzibar from 1990-2005, but the related tax revenue contributions have not increased proportionately (ZEB 2005). This has raised concerns among many stakeholders, as the distribution of profits is not reaching the relevant actors.

**Lack of conflict resolution mechanisms**

Communication and sharing of information and experiences are important to reduce tensions and thereby enhance resilience of the social system. CHICOP and DoF have arranged meetings with the local communities as an attempt to clarify misunderstandings, e.g. in the case of expansion of the boundary. However, Mushove and Vogel (2005) stated that it takes time to build and nurse mutual trust between a project and the various stakeholders considered important for success. Zanzibar does not have an established management mechanism for resolving existing marine resource use conflicts between fishermen. There is little legitimacy and effectiveness as district officials attempt to resolve the conflicts that arise on an *ad hoc* case-by-case basis. Prosecution in courts are long lasting, and enforcement agencies lack personnel, equipment, training and finance to enforce the laws. In addition, the penalties are not sufficiently effective to prevent poaching, as the sanctions are not perceived to be a threat. There were some allegations that a few individuals in power were open to bribery, and this was thought to be one of the reasons why enforcing the law against destructive fishing practices proved difficult. The controversy over regulations concerning illegal gears lies in finding alternative methods of exploiting the resource.
4.2.4 Management regime
Many of the resource use conflicts appeared as a result of improper or poor implementation of government policies, particularly the lack of penalties for illegal fishing. Management Agreements oblige the Government to assist CHICOP with enforcement. However, the support has been weak and the enforcement has been left to the rangers, who have limited enforcement power other than educating the fishers. CRS provides insufficient protection alone because it is not isolated from natural or more diffuse anthropogenic threats. In order to prevent and eradicate destructive use, the Fisheries Act of 1988 and Zanzibar Environmental Policy 1992 have been developed. However, the Government lacks resources and infrastructure to monitor and enforce fishery regulations effectively. In addition, large numbers of fishers and landing sites make monitoring of artisanal fisheries very comprehensive. A diversity of stakeholders should be involved in the management, such as IMS in terms of scientific research, DoF by monitoring resources and MoE by providing education. Effective management of CRS requires equitable treatment of key stakeholders, but the local people are viewed as outsiders in the management of the resources and excluded from the management system.

Knowledge systems
The linkage between the ecosystem and management practice is provided by ecological knowledge and understanding (Berkes et al. 2003). Scientific knowledge gained by research can contribute significantly to more efficient management of coral reefs. In addition, traditional environmental knowledge, and long-term communal understanding of dynamics of change possessed by coastal communities are also important. Local fishermen have gained an experience-based relationship to the ocean, where indigenous knowledge and skills-based competence in use are predominant features. Therefore involvement of locals and their knowledge is detrimental to a successful management regime and to incorporate resource users’ needs (Francis and Bryceson 2001). The lose connection between CHICOP, the Government and Zanzibari residents reduce the resilience of management institutions.

4.3 Coping strategies
4.3.1 Adaptive capacity
Because the dynamics and direction of change in a social-ecological system are dominated by human actions, adaptability can be considered to be mainly a function
of the social component (Walker et al. 2004). Fishing is a high-risk occupation and is prone to seasonal and cyclical fluctuations in stock size and location. Strong wind and rough sea reduce number of days fishing, particularly during the Southeast Monsoon. Livelihood adaptation to this uncertainty includes a range of available technological options, stocks of human and social capital and access to risk spreading mechanisms (Adger and Vincent 2005). Fishermen who can renew rapidly were those who had accumulated experience, skills, knowledge and contacts as well as financial capital. Urban fishers had increased the travel capacity and distance to exploit new opportunities, and used nets less frequently during the Southeast Monsoon. Efforts to create assurance were developed by using multi-species and multi-gear fisheries, which are more flexible to adapt to changes in fish stocks and their resource base. As large predatory fish have been reduced in abundance, the fishermen have started to target herbivorous fish species that are less valuable and to increase the number of pieces of fishing gear. These strategies show that the fishermen are postponing the breakdown of their most important income source, rather than dealing with the cause of the problem.

The two villages closest to Zanzibar Town consisted mainly of migrating fishermen. This is a type of adjustment to maximize economic returns. It is an important factor in resilience, but it is both cited as evidence for instability and a component of enhanced stability. Pull migration is the demand to move caused by attractive circumstances elsewhere, and can be an individual decision or an inter-temporal family contract for risk spreading and adaptation (Adger 1997). It can contribute to livelihood security and resilience at household level through remittances providing opportunity for diversification and reduction of resource dependency.

### 4.3.2 Response diversity and reorganization

Ecological resilience is critically dependent on the range of responses to environmental change by species within functional groups, and is important for renewal and reorganisation (Bellwood et al. 2004). Response diversity also increases the tolerance to management mistakes (Elmqvist et al. 2003). Depending on the number of zooxanthellae species available, the response to change may differ between coral species. This suggests that corals that host several species of zooxanthellae are more resilient (Smith 2005). CRS showed high species richness both within and
among functional groups, which made it better able to recover from the 1997-1998 El Niño. Adjacent areas of Chumbe were initially less affected by the bleaching event, but showed slower recovery after disturbance. As CRS preserves biodiversity, it can function as insurance for the rest of the seascape surrounding it however, the degree of connectedness is uncertain.

4.4 Status of the ecotourism project in Chumbe

4.4.1 Success
Success will be elusive unless all major stakeholders are included and the process itself is transparent. According to Gössling (1999), the positive development of ecotourism is dependent on successful strategies to limit tourist numbers, inform and educate both visitors and locals and to manage and control the area efficiently. For the purpose of this study, the following indicators have been used to illustrate the performance of CHICOP:

- Financial sustainability;
- Measurable increase in biodiversity; and
- Level of support by stakeholders.

Financial sustainability
The overall investment in CHICOP from 1991 was about US$ 1.2 million, where about two thirds were financed by the project initiator (Francis et al. 2002). A variety of donor funds available for private investments have supported several non-commercial project components with small grants for construction of the Visitor’s centre, baseline surveys, nature trails, translocation of Ader’s duikers, as well as patrol boats. The 1996 Zanzibar Environmental Protection Act has offered some incentives for private investment in conservation and environmentally friendly technology, and CHICOP has been entitled to some incentives like tax holidays, and exemption on imported goods.

The running costs of CHICOP are now mainly covered by income generated through ecotourism earnings and according to Riedmiller (2003), these are around US$ 150,000 per year. An occupancy rate of 30-40 % is sufficient for running the park. By having low expenses, as the eco-lodges are independent of external electricity supply, low payments to staff and high returns from the tourism enterprise and awards, there
should be sufficient profit. Riedmiller stated that there should be an official acknowledgement that making profits from conservation is not morally bad, but a condition for sustainability. However, as outsiders appropriate most of the profits, and there is an absence of a large local workforce, economic leakage is likely.

**Measurable increase in biodiversity**

CRS appears to be managed properly from a biodiversity point of view, as the richness, density and biomass of large, predatory coral reef fish are high, and these are good indicators of reserve effectiveness and healthiness of a reef. Functional groups that each has a large number of substitutable insurance species have also been detected in CRS. High coral cover and structural complexity further suggests that the corals are in good condition. Fish stocks, reef structure and coral diversity are necessary in order to get a sustainable reef fishery, and all these were present in CRS. However, there is no evidence that CRS contributes to increased fish stocks in adjacent areas. In addition to having high fish and coral diversity, CHICOP is a sanctuary for the highly endangered endemic Ader’s duiker (*Cephalopus adersi*), which was facing extinction from poaching and habitat destruction, and the Coconut crab (*Birgus latro*).

The studies by Persson and Tryman (2003), Lanshammar (2004) and McClanahan et al. (2002) support the possibility that the total resilience of the coral reef fishery can be increased by providing a refuge that contain habitats required by larger, reproductively mature individuals. However, the loss of fishing ground for local fishermen should be compensated for by increased yields from spill-over effects, but the catch increase is believed to be insufficient (Roberts and Polunin 1993). The research has suggested benefits, but has so far failed to explicitly prove that it can support fisheries in nearby unprotected areas. According to Francis et al. (2002), NTAs should be of sufficient size to encourage a significant increase in the numbers of sedentary species and fish stocks. CRS is less than a square kilometre in size, and this might be too small in terms of providing benefits or to sustain the ecosystem services that the local population depends upon. As human impacts continue, recruitment from already degrading reefs into the protected area is likely to decline and can include a growing number of undesirable species, such as the crown-of-thorns starfish (Bellwood et al. 2004). Nevertheless, the Chumbe reef is ecologically resilient
in itself as an individual ecosystem, and since this was one of the targets, it must be considered successful in this respect.

The level of support by stakeholders
Generally, the Government and private investment companies supported CHICOP and these were the driving forces behind the establishment of the MPA and ecotourism development. The Government profits from foreign exchange earnings, and ZIPA receives payments for various fees and licenses. Tourists, NGOs, school children and their teachers, researchers and employees were also supportive of the reserve. However, CHICOP contributes little to the livelihoods of most of the local population, rendering especially the fishermen as losers in this context.

As ecological resilience requires stewardship practices that successfully promote social over individual behaviour, local people have an important role to play regarding accepting the MPA. By returning benefits to local people, conservation initiatives can achieve long-term sustainability (Levine 2004). Consultation with key stakeholders, and meetings in several fishing villages were therefore arranged in 1991 to present the project and try to win support prior to the protection. For the first meeting, CHICOP invited all the stakeholders, and Riedmiller (2003) claimed that only a few people felt affected by the closure of the reef. This statement was not supported by this study that found many local fishermen opposing the project. Besides the meetings with stakeholders during the initial phase, there has not been much cooperation later on. Fishermen were engaged in order to derive information, but they were not incorporated at the outset in order to frame the resource management issue. CHICOP therefore presents an imposed model, where community participation is virtually absent.

The type of participation involved in CHICOP’s policy is defined by Pretty (1995) as ‘passive participation’ (Table 7). This implies that the CHICOP management constraints fishermen from articulating their own goals and interests. By involving the local people in the planning and management of MPAs, it can in the long run help to build the capacity and trust of local communities as well as increase their share of tangible benefits accrued from the park.
Table 7: Seven typologies of participation by Pretty (1995).

<table>
<thead>
<tr>
<th>TYPOLOGY</th>
<th>CHARACTERISTICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Manipulative Participation</td>
<td>Participation is simply a pretence under which people are manipulated.</td>
</tr>
<tr>
<td>2. Passive Participation</td>
<td>People participate by being told what has been decided or already happened. Information being shared belongs only to external professionals.</td>
</tr>
<tr>
<td>3. Participation by Consultation</td>
<td>People participate by being consulted or by answering questions. Process does not concede any share in decision-making, and professionals are under no obligation to take on board people’s views.</td>
</tr>
<tr>
<td>4. Participation by Material Incentives</td>
<td>People participate in return for food, cash or other material incentives. Local people have no stake in prolonging technologies or practices when the incentives end.</td>
</tr>
<tr>
<td>5. Functional Participation</td>
<td>Participation seen by external agencies as a means to achieve project goals, especially reduced costs. People may participate by forming groups to meet predetermined objectives related to the project.</td>
</tr>
<tr>
<td>6. Interactive Participation</td>
<td>People participate in joint analysis, development of action plans and formation or strengthening of local groups or institutions. Learning methodologies used to seek multiple perspectives, and groups determine how available resources are used.</td>
</tr>
<tr>
<td>7. Self-Mobilisation</td>
<td>People participate by taking initiatives independently of external institutions to change systems. They develop contacts with external institutions for resources and technical advice they need, but retain control over how resources are used.</td>
</tr>
</tbody>
</table>

The urban fishermen were the most positive towards conservation due to potential spill-over effects and control of illegal gear, and stated that the protected area was not of sufficient size to affect them. However, Mazizinì complained about lack of employment opportunities and broken promises. Fishermen from rural fishing villages have been less supportive than the urban communities. Especially, the communities closest to CHICOP office expressed scepticism over the creation of the MPA, and complained about the expansion of the boundary. Nyamanzi fishermen were more positive, as they had a good understanding of protection benefits. Across the villages, young fishermen were generally more optimistic than older, and wealthier fishers more positive than poorer. Their view was also affected by level of part taking, as fishermen who had attended seminars were commonly very supportive. The MPA would prosper if supported by local people, the private sector and the full range of
government agencies. If all parts of society are convinced of the importance of MPAs, they will support it in safeguarding their own interests when the protected area is well managed and contributes to the welfare of the residents. A promising sign was a decline in the number of detected offences of park regulations, such as the use of destructive gear and methods and the frequency of MPA border incursions.

4.5 Future outlook
The fishermen in Chukwani were the most negative concerning future options, and many stated that there were no alternative activities to fishing due to lack of financial capital and knowledge. In Kizingo, which was closest to the city, a greater proportion of the fishermen mentioned business opportunities. Many respondents mentioned the need to invest in new equipment to reach more distant fishing grounds and improve their catches. Essentially, they saw new gear as a way to catch more fish, rather than a way to make their catches in a more sustainable manner. Also, many wanted to invest in storage facilities, as a cooperative, to reduce fluctuations in prices. Fishermen were often not motivated to engage in other employment, since alternative livelihoods were not perceived as equally beneficial or real alternatives. This is because fishermen attach values to the work they are carrying out and the way they are living. Surprisingly, a large proportion suggested establishment of more protected areas to make a network of marine parks, or protection of the eastern side of Chumbe Island, in order to benefit future generations. These were generally younger fishermen with more livelihood options.
5.0 CONCLUDING REMARKS
Overall, protection of the Chumbe reef and the introduction of ecotourism have had a positive effect on the private sectors, the Government, researchers, students, school children, teachers and tourists. In particular, CHICOP has provided educational, research and conservational benefits to Zanzibar. However, different stakeholders with different interests and needs have caused conflicts between various actors. The stakeholder group that has been most negatively affected was the rural fishermen along the adjacent coast on Unguja main island. The stated objectives of CHICOP were to offer employment to people from these villages, promote awareness rising and empower the local people to feel committed towards preserving their natural heritage. However, few jobs have been created as CHICOP is a small-scale project, salaries have been insufficient, leading to corruption among rangers, and poor information flow has resulted in conflicts between key stakeholders and CHICOP.

The major cause for the detected conflicts was the weak information flow that existed between and within the various stakeholder groups. This has reduced the transparency of the project, which has led to undermining of trust. Short-term threats to the sustainability of CHICOP were the occurrence of bribery and related poaching, but the enforcement has improved over the years. Long-term threats however, were more numerous and these are more difficult to control or deal with. These included poverty and few supporting institutions for fishermen, which are underlying factors for resource degradation due to lack of alternatives and poor enforcement of fishery regulations in adjacent unprotected areas. In addition, change in consumer demand and taste threatens the viability of CHICOP, and political instability in Zanzibar can make tourists refrain from visiting. All these aspects bring about reduced resilience of the system.

Poor communication between CHICOP, the Government and local communities has resulted in information asymmetry whereby local people have not been convinced about benefits of conservation. The relationship between CHICOP, Government and local people was characterised by mutual mistrust, which reduces the robustness of the system. Overall, many resource users had a negative perception of the marine parks, and did not understand the rationale behind the enclosure. The current approach fails to include key stakeholders at critical points and is unable to resolve
the different kinds of conflicts. However, this situation is starting to change now, as a result of new management personnel who are more committed and reliable. More meetings, seminars and educational trips have been arranged resulting in improved relationships between all relevant stakeholders. Nevertheless, the build-up of trust is a slow enduring process.

Underlying the resentment felt by many rural fishermen towards CHICOP was the lack of technological and financial capacities to allow them venture into more lucrative fishing grounds. This has increased competition in inshore waters, causing conflicts between fishermen engaged in different fishing practices. It should be noted that with a high rate of dependence, exacerbated by poverty and lack of alternative income sources, the new rules of an NTA are not likely to be accepted and followed. CHICOP has thus encroached upon the limited available livelihood options for rural fishermen, and thereby decreased their social resilience. The rural fishermen were restricted by high degrees of poverty, but had high social capital and multiple livelihood options. Urban fishers had more financial assets to cope with the establishment of CHICOP, but were characterised by having low livelihood diversity. The local fishermen’s resource dependence and the influx of visiting fishers have put pressure on the fisheries around Chumbe, and thus reduced ecological resilience of the coral reefs.

The high levels of ecological specialists in the coral reef system, and high diversity within functional groups make the Chumbe reef better able to recover from disturbance. However, as CRS is protected from human impacts, the reef is not used to adapt to changing conditions and can be more harder hit by a disturbance, as was seen in the El Niño event in 1997-1998. The issue of social resilience of CHICOP has been shown to depend upon economic states of people depending on the resources, and strong Government commitment. Maintaining both ecological and social resilience is important for both resource management and social institutions, indicating that the well-being of social and ecological systems is thus closely inter-connected. For the ecotourism project to achieve long-term success, the interests of the whole range of stakeholders who can influence or be influenced by the project need to be taken into account. The marine environment should be managed in partnership with local people who have vested long-term interests.
6.0 REFERENCES


7.0 APPENDICIES

7.1 Appendix 1: Fisherman questionnaire

Interview number……………….                  Date…………………………
Location: District……………….                 Village…………………………
Name of interpreter………………………………………………………………………. 
Name of respondent (voluntary)………………………………………………………….
1. Sex: **Male**  Female  2. Age (years):………………
3. Marital status: Single Married
4. Are you the household head? Yes No
5. How many dependants do you have?………………. 6. How many live with you?......
7. Educational level: None Madras Primary Secondary Higher Other please specify;
8. Occupation: Fisher Farmer Tourism Taxi driver Shop Other please specify;
9. How long have you been a fisherman?........
10. Do you hold a fishing licence? Yes No
11. Do you sell labour hire labour or are you self employed?
12. How many crew?
13. What kind of boat do you use? Mtumbw Dau Boti Ngalawa Hori Boti ya barafu Other please specify……………….
14. Machinery: Sail Engine 15. Do you own it? Yes No
16. What kind of gear do you use? Mishipi Nyavu Madema Njora Glasi Jarife Other please specify;………………………………
17. How many pieces?
18. Do you own it/them? Yes No
19. Name of the main fishing grounds you use now:………………………………………
………………………………………………………………………………………………
20. Type of habitat:…………………………………………………………………………
21. Species of fish or other products derived from the sea:……………………
22. How many days do you go fishing per month?

<table>
<thead>
<tr>
<th></th>
<th>Average income per week during NEM</th>
<th>Average income per week during SEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bad day</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

23. Amount of other income sources throughout the year……………………………

<table>
<thead>
<tr>
<th>Household members</th>
<th>Sex</th>
<th>Age</th>
<th>Education</th>
<th>Occupation</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
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<td></td>
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<tr>
<td>2.</td>
<td></td>
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<tr>
<td>3.</td>
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<tr>
<td>4.</td>
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<tr>
<td>5.</td>
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<td></td>
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</tr>
<tr>
<td>6.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

H=housewife, F=fisher, Fa=farmer, S=seaweed farming T=tourism, S=shop, Ha=handicraft

Chumbe Island Coral Park

What do you know about the ecotourism project in Chumbe?..........................

.................................................................

Have you been to Chumbe before it was gazetted as an MPA? Yes No
When: Reason:

Have you been to Chumbe after it was gazetted as an MPA? Yes No
When: Reason:

Do you know the boundary (No Take Zone) of Chumbe? Yes No
Do you know about any illegal fishing activities, or other violations of the rules?

Observed changes in:

- Earnings from fishing after establishment of the MPA?
• Fishing practices or gear after establishment of the MPA?
• Average time spent fishing: [Increased] [Same] [Decreased]
• Number of species present: [Increased] [Same] [Decreased]
• Size of fish: [Larger] [Same] [Smaller]
• Price of fish: [Increased] [Same] [Decreased]
• Catch: [Increased] [Same] [Decreased]
• Number of fishermen: [Increased] [Same] [Decreased]

Participation
Did you receive any form of information from CHICOP before the establishment of the MPA? ..............................................................
Any information after the establishment?

Has your community been allowed to influence the management of the MPA?

What do you think of the monitoring of the MPA’s boundaries?

What stakeholders used to have conflicting interests to you and in what ways?
Any conflicts with other stakeholders now? [Yes] [No]  Who:

Reason............................................. Mechanism to solve the conflict:.............

Any support from government or extension services?.................................
................................................................................................................
Are you a member of a Committee?
If yes, how have you benefited as a member?
Any donations from the committee or other lending schemes?

Future
What are your suggestions to improve the management of the MPA?..............
................................................................................................................
What are your views on the future with respect to fishing and other income opportunities?
7.2 Appendix 2: Focus group discussions

How many people belong to this village?
Are you registered as a fishing community?
How many has fishing as the primary occupation?
How long have you fished in the study area?
What role did Chumbe play for you before it was gazetted as an MPA?
Do you know the boundaries?
Have you ever been there after establishment? Reason:
What do you know about the ecotourism project in Chumbe?
Do you know the goals for the conservation program in Chumbe?

Participation
Are you or have you in any ways been involved with CHICOP?
Are you or do you know about anyone in your community that are involved?
What is your decision-making environment?

Assets
Human capital:
What competence and skills did you have prior to and after the establishment of the MPA? Have you received any form of information/education?
Any help from extension services? Researchers?

Social capital:
Are you a member of an interest group (Fishers Association)?
If yes, how have you benefited as a member?
Do you co-operate with other groups of actors? What are your mutual interests?
History and reasons behind co-operation:

Physical capital:
Any common resources?

Natural capital:
What goods and services do you extract from the sea?
Are marine species still available in good quantities?
Have you observed any changes in: (a) species present, (b) size of fish?
Trend in fish yield (catch size) and other marine products derived from the sea:
Trend in time spent fishing (fishing effort):
Trend in number of fishermen (fishing pressure):
Any improvements in fishery after MPA? Is the unprotected reef over-fished?

_Financial capital:_
Access to credit? Conditions for accessing credit:
Support from government or other institutions?

_Institutions_
_Rules:_ What rules do you follow as regards to harvesting marine resources?
What restrictions do you face over the use of the ocean?
How is the resource allocation between different activities?

Do you know about any illegal fishing activities, or other violations of the rules?
What are the sanctions faced if this takes place? How are the rules enforced?
What do you think of the monitoring of the MPA’s boundaries?

_Conflict:_ What stakeholders have conflicting interests to you and in what ways?
What are the reasons for conflict? How are the conflicts played out?
What do you think is needed to solve these problems?
What kinds of mechanisms exist to negotiate between you and the stakeholders with conflicting interests to you?

_Future vision_
What improvements to the management of CHICOP would you like to see?
Can you see alternative uses of the ocean?

_Challenges/constraints:_
Market-demand?
Do you receive the actual price of marine products under the current marketing system?
### 7.3 Appendix 3: Description of fishing equipment

**TABLE 1: Fishing vessels used by the interviewed fishermen**

<table>
<thead>
<tr>
<th>Type of vessel</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mtumbwi</td>
<td>Dugout canoe without riggers, often made from a single log. It has a flat bottom and is powered by ore, pole or sail.</td>
</tr>
<tr>
<td>Dau</td>
<td>Wooden planked boat with pointed bow and rounded stern. Uses sail or outboard engine, and can travel long distances.</td>
</tr>
<tr>
<td>Boti</td>
<td>Wooden planked boat with pointed bow and square or rounded stern powered only by engine.</td>
</tr>
<tr>
<td>Boti ya barafu</td>
<td>Boat that carries ice boxes for storing of fish.</td>
</tr>
<tr>
<td>Ngalawa</td>
<td>Small (&lt;7 m) double out rigged (paddles) canoe typical of reef and aritsanal small pelagic fishery (Richmond 1999). Driven by a cotton canvas sail.</td>
</tr>
</tbody>
</table>

**TABLE 2: Fishing gears used by the interviewed fishermen**

<table>
<thead>
<tr>
<th>Type of gear</th>
<th>Size</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jarife</td>
<td>70 m long and 5 m wide, 100 m long 9 m wide</td>
<td>Larger meshed gillnets or shark nets. Used for drifting or set overnight, anchored and attached to boat.</td>
</tr>
<tr>
<td>Nyavu</td>
<td>12 m long and 4 m wide, 60 m long and 2 m wide</td>
<td>Small meshed gillnets with mangrove floats and stone sinkers.</td>
</tr>
<tr>
<td>Glasi</td>
<td></td>
<td>Mask and fin used for skin diving.</td>
</tr>
<tr>
<td>Njora</td>
<td></td>
<td>Spear used for skin diving.</td>
</tr>
<tr>
<td>Mishipi</td>
<td></td>
<td>Hand-lines with hook sometimes trolled when sailing or after anchored.</td>
</tr>
<tr>
<td>Madema</td>
<td>1.5 m wide and 0.5 m high with entrance funnel</td>
<td>6-sided traps left overnight.</td>
</tr>
</tbody>
</table>