MANAGING WITHOUT INSTITUTIONS: THE ROLE OF COMMUNICATION NETWORKS IN GOVERNING RESOURCE ACCESS AND CONTROL

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Declaration

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No part of this work has been submitted for a degree at any other University.

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Abbreviations

CDA	Coast Development Authority
CITES	Convention on International Trade in Endangered Species
CRCP	Coral Reef Conservation Project
DC	District Commissioner
DO	District Officer
EACC	East African Coastal Current
FAO	United Nations Food and Agricultural Organisation
GATT	General Agreement on Tariffs and Trade
IMF	International Monetary Fund
ITCZ	Inter-Tropical Convergence Zone
KANU	Kenya African National Union
KWS	Kenya Wildlife Service
LME	Large Marine Ecosystem
NEAP	National Environment Action Plan
OR	Operational Research
PC	Provincial Commissioner
SST	Sea Surface Temperature
TNC	Transnational Corporation
TURF	Territorial User Right in Fisheries
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on Law of the Sea
UNEP	United Nations Environment Programme
WCMC	World Conservation Monitoring Centre
WTO	World Trade Organisation
WWF	World Wide Fund for Nature

Summary

The aim of this study was to test the hypothesis that the way groups or individuals tackle resource access and control problems does not always reflect identifiable institutional processes. This was tested through a case study of livelihoods and resource access problems of a Kenyan coastal community dependent on small scale fisheries. The structure of the study was based on the need to understand the context in which people live in order to interpret their behaviour. Each chapter sought to examine aspects of people's social and biophysical setting, paying particular attention to changes and causes of change. This involved a reconstruction of the community's historical relations with other groups in their area; socio-economic analysis of the livelihoods of different groups within the community; and social network analysis of people's actions in response to resource access and control problems.

All groups within the community depended on a range of activities to provide food and income, but the role of fishing was dominant. Changes in local natural environments were shown to have led to a decrease in household productivity over the last five decades. This was attributed to colonialism, international development and cultural changes. This also led to increased effort in the sea, leading to overfishing. The overall socio-economic situation of the community was revealed as poor.

Social network analysis showed that administrative and political actors were found to be more important than actors with a legal mandate to solve resource related problems. It was shown that formal institutions relating to natural resources stifled the process of problem resolution. Local people were found to use alternative processes, based on communication networks, to solve problems, thus supporting the hypothesis.

The findings stress the importance of understanding local people's socio-economic and socio-political situation before developing resource management strategies. Resource managers could make use of social network analysis to identify and understand the roles of key people, groups and organisations.

1 INTRODUCTION

1.1 Approaches to human-environment interactions

The ongoing epistemological debate in the natural and social sciences reflects a shift in Western attitudes towards the natural environment and development. The heritage of Western rationalism, grounded in attitudes developed during the European Enlightenment era of the seventeenth and eighteenth centuries, is no longer accepted without argument (Habermas, 1984; Wallace *et al.*, 1996). The attitudes of Western society have shifted away from naïve modernism, the tenets of which were cultural Eurocentrism, scientism and a belief in indefinite and continuous progress (Sokal and Bricmont, 1998). This is evidenced by, among other things, an increasing acceptance in the West that many societies in the world do not share these beliefs and that other societies are fundamentally different. Experiences outside the West often find that, for example, cultural factors are of greater or equal importance as economic factors and that community pressures can be greater than state sanctions in influencing social behaviour (Bryant and Bailey, 1997; Ghai, 1999). Despite (or possibly due to) some radical concepts[1] developing from this shift in attitude, the positive spin-offs have been felt in international development and concerns about human-environment relations. In particular there has been an increasing shift towards multidisciplinarity as cultural, social and political dimensions of human-environment relations are considered in conjunction with natural sciences when tackling the dilemmas derived from man's use and abuse of the environment.

The marriage of natural and social sciences is as essential as it is inevitable if an understanding of the relationship between humans and the natural environment is being sought. This alliance is strengthened further by the fact that the relationship between humans and the environment is closely tied to the relationship between humans and humans. There are complex social rules and patterned expectations of behaviour that govern how groups and individuals gain access to, harvest, use and

[1] Post-modernism and related concepts of constructivism (radical and social), post-structuralism, and deconstructivism can be characterized by a non-belief in the objective world and attempts at meta narrative explanations (e.g. the universal theories/explanations generated by science). These concepts view reality as purely a function of social and, by definition, linguistic construction (Mathews, 1999).

distribute natural resources. These rules and patterns of behaviour are manifested as formal and informal institutions[2]. These structural characteristics are considered to determine what can happen in societies (Giddens, 1984). Thus, historical, sociological, ideological and political factors that influence the evolution of social rules must be considered in conjunction with natural factors when considering human-environment interaction. It is from this perspective that the following study is carried out. The interaction between humans and humans and how they shape human-environment relations is a central theme.

The question of how people gain access to and control over natural resources, the focus of this study, illustrates well the duality of social and natural factors. The institutions that govern resource access and control are rooted in social histories and biophysical processes. An important characteristic is that they are inherently flexible. This is because of the need to adapt to both changing social and biophysical conditions and because natural resource exploitation is characterised by uncertainty and irreversibility (Dasgupta, 1982; Berry, 1989; Pido *et al.*, 1997). However, it is possible that the pace of social or biophysical change may be too great for social rules (institutions) to adapt, and as a result environmental and social problems may occur (Watson, 1989). The recent history of global wealth and food distribution suggests that this is the case for much of the world. In the 1990s, 80% of the world's gross product was owned by 20% of the world's population (Robertson and Speier, 1998). By the end of the 20th century, real per capita income in the one hundred poorest countries had not increased for over a decade and a half, leaving 2.3 billion people living on less than two US dollars a day (de Rivero, 1999). Furthermore, an estimated 800 million people in the world are considered chronically undernourished (Ricupero, 1999) and in sub-Saharan Africa people are worse off nutritionally today than thirty years ago (Reid, 1998).

The issue is not simply one of aggregate resource or food availability, global food balance sheets are positive (Ricupero, 1999). As Sen explains, "scarcity is the

[2] Institutions are formed when rules or guidelines become embedded in social settings through regular use (Thomas-Slayter, 1994; Mearns, 1995). They are understood to be the rules by which people gain access to and control over resources – ie. rights (Kiser and Ostrom, 1982; Mearns, 1995), but they also embody responsibilities (Pinkerton, 1997).

characteristic of people not having enough; it is not the characteristic of there not being enough. While the latter may be the cause of the former, it is one of many causes" (1981: 1). One of the major causes is the loss of command over resources (Sen, 1981), due for example, to changing institutions relating to resource access. A principle cause of this change is widely considered to be the superimposition of modern ideology[3] over other societies through processes such as European colonialism[4] and the market economy (Bryant and Bailey, 1997; Robertson and Speier, 1998). The problem of population pressure is acknowledged as a contributory factor, but the long held belief that it is the sole cause of resource scarcity problems is simplistic.

The change in Western attitudes, referred to from the outset, is partly[5] in response to this situation. There has been a realisation that thirty years of technocratic, top down forms of development have not worked and that local communities do not maliciously or ignorantly harm the environment (Baker, 1984; Kanbur, 1992). The complementary fields of natural resource management and international development have become increasingly aware that the crux of the problem is ideological. This is demonstrated by the increasing inclusion of understanding site-specific social conditions (culture, politics and socio-economics) in development programmes. This is true of both the developed and the developing world and is best illustrated by the growing use of local level participation in development and natural resource management as the improvements become apparent (Doulman, 1993; Hviding and Baines, 1994; White *et al.*, 1994; Chambers, 1995; Bavinck, 1996; Horrill, 1998; McGlade, 2000)[6]. Central to this breakthrough, and permitted by the ideological shift, has been the growing understanding of the role of local level institutions governing human-environment relations (Berkes, 1985; McCay and Acheson, 1987; Berkes, 1989; Ostrom, 1990).

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[3] The characterising feature of modern society's relationship with nature is one of domination and mastery (Horkheimer and Adorno, 1993 quoted in Wallace *et al...*, 1996).

[4] Colonial rule fundamentally changed the political and administrative make up of societies. Scientific and administrative techniques adopted in the nineteenth century significantly enhanced the state's ability to control human-environment interaction within its jurisdiction (Bryant and Bailey, 1997)

[5] There are also changing attitudes towards natural resources and the environment in the West, away from a focus on commodity production to the inclusion of aesthetic values, wildlife habitats etc.

[6] Some other illustrations include: McGlade's (1999) observation that hollowing out of the state is occurring; the ecosystem management approach discussed by Wallace *et al.* (1996); Robertson and Speier's (1998) evidence of self organising networks and collaboration paradigm.

However, analysis of these recent approaches to resource management and sustainable development acknowledge that despite a shift in attitude the results have not always met expectations (Bryant and Bailey, 1997; Leach *et al.*, 1997; Forsyth *et al.*, 1998). In practice access to resources is a dynamic political process (Berry, 1989) characterised by unequal power relations between groups and individuals (Kanbur, 1992; Bryant and Bailey, 1997). National and international development policies are subject to this process, which partly explains why the last thirty years of development has tended to favour the better off and politically powerful sections of society, whilst poorer indigenous people are the last to benefit (Boukhari, 1999). Clearly the top down reality has changed little as it still has its uses and because it maintains people in positions of power (Chambers, 1995). Participation of local people infers empowering them and this is often viewed as a threat to the establishment (Chambers, 1994; Eyben and Ladbury, 1995). In addition, Giddens (1999) alludes to the fact that the effect of rapidly changing ideology has meant that formal institutions have become inadequate to the tasks they are now called upon to perform.

Identifying established institutions and creating new institutions that govern how people gain access to resources has become a preoccupation of resource management and development policies that give a central role to local people (Ostrom, 1990; Ghai D. and Vivian J. 1992; Berkes 1995; Mearns, 1995; Baland and Platteau 1996; Leach *et al.*, 1997). The problem of constantly changing conditions is recognised as a significant complication (Gibbs and Bromely, 1989; Watson, 1989; Ostrom, 1990; Kooiman, 1999). In addition there has been great difficulty in coping with the fact that human communities are differentiated and therefore institutions affect individuals and groups differently (Leach *et al.*, 1997). Similarly variations in local ecosystems, changes in culture and local power relations all influence institutional make-up and functioning and are difficult to formalise for application in policy. The response has been to develop an increasingly comprehensive understanding of the institutions that are in place with respect to specific human-environment situations (Leach *et al.*, 1997; Pido *et al.*, 1997; Lamb, 1998) and then to patch the rules into a specific policy framework. But, as Nuitjen (1999) points out, such an approach does not consider the problem that in many cases people are reluctant to participate, preferring to work in

loose personal networks instead of collective projects. Or why we find local people working in continuously changing constellations instead of in more enduring groups.

The suggestion in this study is that an alternative approach to this institutional problem can be taken. Rather than taking the contemporary approach that involves identifying the institutions (rules) that govern resource access and control in a given place, the aim is to analyse how groups and individuals actually tackle resource access and control problems. The former approach assumes the identifiable formal (e.g. state laws) and informal (e.g. local customs) institutions that are in place have some efficacy in solving resource access problems, the latter does not. In reality people's actions in response to resource access problems may not always reflect identifiable institutional processes that can be 'harnessed' for policy. In fact, people organise activities in their daily life in many ways. For most of these activities no organisations or predetermined patterns are set up but networks are mobilised which provide crucial information, financial support, and practical help (Nuijten, 1999). In many instances therefore, local groups and individuals may actually act extemporaneously and create *ad hoc* processes to find solutions to the sorts of problems resource management policies also seek to encompass. Thus, the focus of resource management and development policies on untangling the institutional reality[7] may represent a misunderstanding of the actual processes involved. Admittedly, some of these *ad hoc* processes may in time become new institutions through repeated use, as de Soto (1989) identified for informal economic sectors in developing countries, but they may just as likely not be used again.

This hypothesis does not negate the important role of institutions in governing resource access and control, it simply suggests that embedded social guidelines may not determine all social actions. Understanding these other processes may be beneficial for natural resource management and development strategies.

[7] Such as environmental entitlements (which identifies institutions to particular resource situations, cf. section 5.4) (Leach *et al.*, 1997) and Rapid Appraisal of Fisheries Management Systems (which identifies which informal institutions should be included) (Pido *et al.*, 1997).

1.2 The case study

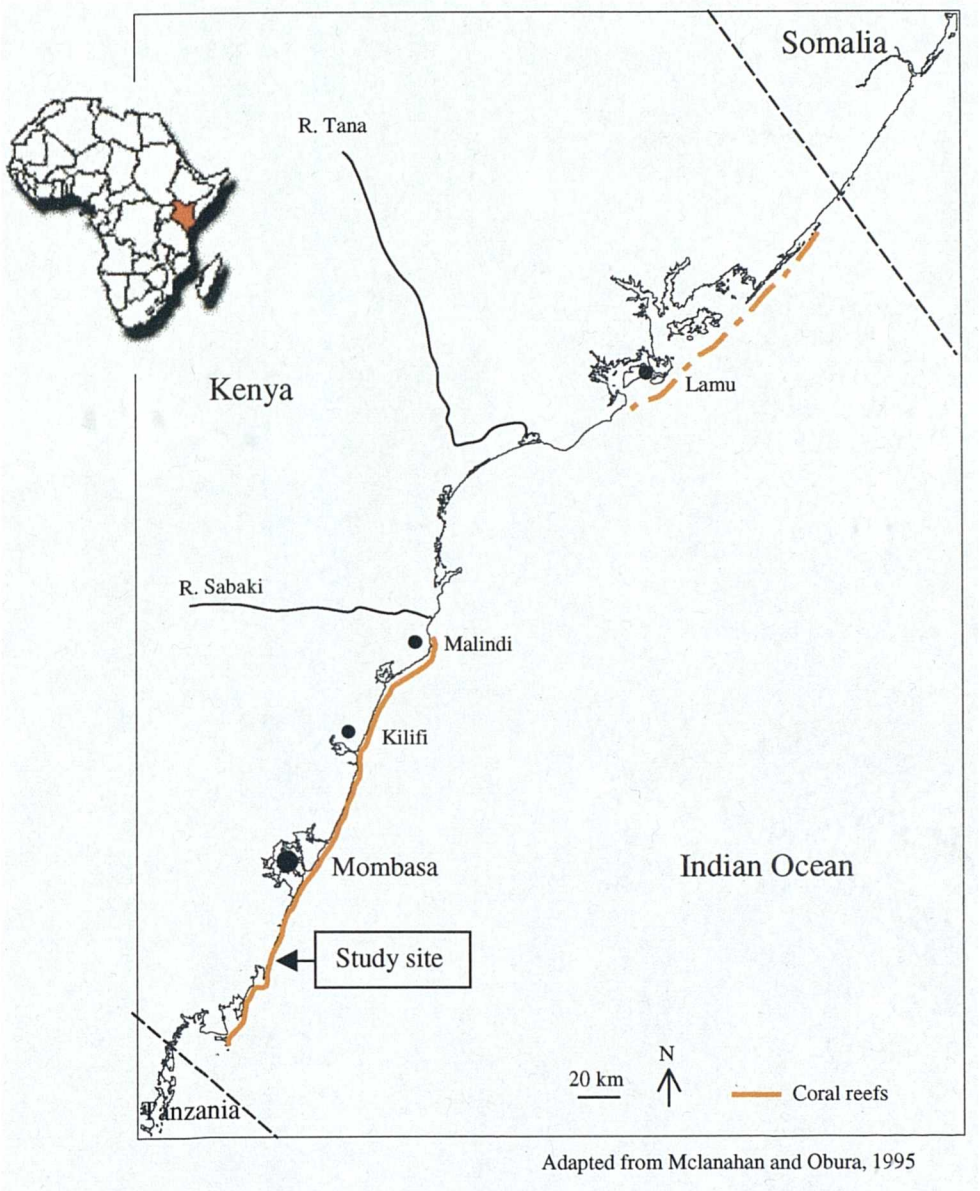
This study focuses on the activities of a community living on the south coast of Kenya (Figure 1.1). Management of natural resources in coastal areas is especially complex because of the diversity of marine and terrestrial environments and the complex patterns of human activity they support (Burbridge, 1995). Consequently, the principles of multidisciplinarity and the participation of local stakeholders have become embodied in contemporary management approaches. Integrated Coastal Zone Management (ICZM) and community-based or co-management are now standard terminology.

This case, of a developing country community living adjacent to a coral reef ecosystem, illustrates further challenges to resource management. Fish for food is extremely important in developing countries, providing 40% or more of the annual protein intake for over 60% of the population (Price *et al.*, 1993). Coral reefs in particular supply about 20-25% of the fish catch of developing countries (IUCN, 1993). In coastal East Africa, where this study was carried out, fish is estimated to provide 90% of the total annual animal protein intake by coastal people, 70% of the catch coming from coral reef related ecosystems (Ngoile and Horrill, 1993). In developing countries it is often the poorest sections of the population who depend on the marine environment for their livelihoods, this is particularly the case in coral reef areas (Tvedten and Hersoug, 1992; Eakin *et al.*, 1996). Yet these areas are also characterised by rapid human population growth and migration to the coast and, as a result, competition for limited marine and terrestrial resources has become a problematic feature (Price *et al.*, 1993; Jameson *et al.*, 1995). Lack or failure of management policies in these regions can have catastrophic effects for millions of the world's most disadvantaged people.

The fieldwork for this study took place in two phases, five months in 1996 and a year from February 1997 to February 1998. The study focused on the livelihoods of a fishing community and three situations in which the fishing community had to deal with issues of access to and control over resources. One issue involved the attempted implementation by the State of a marine protected area that incorporated the community's fishing grounds. Another issue involved a conflict between the

indigenous fishers and a group of well established migrant fishers from Tanzania. A third issue involved the illegal subdivision and sale of seafront state land used by the community to access the sea and to carry out fish trade and other fishing related activities.

Figure 1.1 The Kenya coast, showing the location of the study site.



Adapted from Mclanahan and Obura, 1995

1.3 Objectives and outline

The aim is to test the hypothesis that the way groups or individuals tackle resource access and control problems does not reflect identifiable institutional processes. The structure of the study is based on the need to understand the context in which people live in order to interpret their behaviour. Each chapter seeks to examine aspects of people's social and biophysical setting, paying particular attention to changes and causes of change.

Chapter 2 develops the institutional theme introduced in this chapter, and reviews the way resource management has developed in recent years. Some of the constraints to resource management success are also discussed. The alternative approach to the institutional problem is expanded upon, and social network analysis is presented as a methodological approach suited to the analysis of problem solving processes at the local level.

Chapters 3 and 4 present the historical reasons why resource access problems have arisen at the chosen study site, in terms of both human activity and the natural environment. In chapter 5 the mix of formal and informal institutions in the study site are analysed in their historical context, and their impact on resource use in the study area is examined. Although this study focuses on a single community, other social groups exist in the area. The aim of chapter 6 is to link the main activities that occur in the study area to the issue of resource availability for members of the studied community. These chapters provide the background to the socio-economic analysis of livelihoods in the study site (chapter 7).

The penultimate chapter (chapter 8) analyses the actions taken by members of the community to tackle resource access and control problems. The approach taken is based on the inference that the institutions involved can be deduced from the people or groups (actors) involved and the importance of the actors in solving the problems. The final chapter (chapter 9) considers the extent to which institutions did determine the actions of local people and concludes by discussing the implications of the study findings for natural resource management.

2 MITIGATING HUMAN-ENVIRONMENT RELATIONS

2.1 Introduction

The previous chapter introduced the idea that people's patterns of behaviour with respect to the use of natural resources, are conditioned by their physical environment and rules or guidelines. The notion that these rules evolve or change over time and are therefore inherently flexible was also introduced. Interest in these rules or guidelines, which are broadly defined as institutions (the definition is considered below), has grown in recent years because of their role in mitigating human-environment relations. As outlined in the introduction, the shift in resource management approaches to include groups and individuals previously excluded from the management process has elevated the role of a wide range of institutions. When the results have not always met expectations (Leach *et al.*, 1997), the general response has been to widen the scope of institutions included, for example, by placing greater importance on traditions. Writers such as Rasmussen (1989) and Nuijten (1999) point out that this has meant that other processes that mitigate human-environment relations have been neglected. This study considers the possibility that individuals or groups may well act without the guidance of institutions.

Before describing the nature of small-scale fisheries in section 2.3 (the sector in which this study was carried out), our understanding of an institution and the associated ambiguities is reviewed in section 2.2. The role of institutions in the livelihood strategies of people dependent on locally available resources are also considered in this section, particularly in relation to risk. As indicated in the previous chapter, it has been suggested that the way resource management has been approached is partly responsible for the poor results, especially in fisheries. Some of the well-discussed criticisms are reiterated below, particularly in relation to the oversimplification of theories. However, the intention is not to criticise the theories, but to show that taking a particular view (modernist) of human-environment relations has placed limitations on resource management success (section 2.4). This has been tackled at two related levels: the theoretical biases behind the science of management (part 2.4.1), and the cultural prejudices that have had an over-riding influence on human-environment

relations globally (part 2.4.2). The legacy of this modernist view is argued in section 2.5 to exacerbate the problems of poor people, such as small-scale fishers, in developing countries.

The major shift in approaches to resource management is acknowledged, but it is argued that understanding different processes, other than institutional, could improve resource management further (section 2.6). The fact that it may not be possible to co-opt these processes into management strategies stresses the need to understand the conditions that predicate people's actions that bring about similar results sought by resource managers. Thus, the socio-political environment in which management takes place is considered to be of importance.

The final part of this chapter (section 2.7) introduces a method of analysis that allows people's actions to be analysed in relation to resource access and control problems.

The case study in the following chapters seeks to verify the arguments presented in this chapter.

2.2 The meaning and role of institutions

Recent analysis of problems relating to human-environment relations stress the important role of institutions (Gibbs and Bromely, 1989; Watson, 1989; Ostrom, 1990; Thomas-Slayter, 1994; Mearns, 1995; Leach *et al.*, 1997; Pido *et al.*, 1997; Forsyth *et al.*, 1998; Jentoft *et al.*, 1998). However, there is some ambiguity in the definition of an institution and an organisation, particularly in the context of natural resource management and development. In general, institutions are distinguished by their normative aspects, whereas organisations have structural aspects (Nuijten, 1999). Thus, institutions constitute complexes of norms of behaviour structuring human interaction (Giddens, 1984; Uphoff, 1986; North, 1990), with formal (rules, laws) and informal (norms of behaviour, conventions) constraints. In relation to common property resources (of particular interest in this study), Ostrom (1990) and Leach *et al.* (1997) take such a structured definition, defining institutions as the working rules, meaning those actually used, to organise repetitive activities. Associated with this

definition is the understanding that they become identifiable institutions when the rules become embedded in social settings through regular use (Mearns, 1995). Jentoft *et al.* (1998) stress however, that institutions should not be simply regarded as North's (1990) 'rules of the game', because they also consist of "cognitive, normative, and regulative structures and activities that provide stability and meaning to social behaviour" (Scott, 1995: 33 in Jentoft *et al.*, 1998: 427).

In contrast, organisations are considered to be structures of recognised and accepted roles (Uphoff, 1986) where groups of individuals are bound together by some common purpose to achieve particular objectives (North, 1990). Their existence is dependent on people's interactions. Institutions therefore, are the underlying beliefs, rules and social and political elements that govern the activities of organisations as they seek to realise particular goals (Kiser and Ostrom, 1982; North, 1990; Scott, 1995). Uphoff (1986) argues that an organisation can become 'institutionalised' if it satisfies people's needs by meeting their normative expectations over time. Similarly, the bureaucratic nature of organisations can lead to institutionalisation when people within them are simply role-playing. For example, the United Nations (UN) may have acquired this status (although it doesn't say much about people's normative expectations of certain technical organisations within the UN, see section 2.5). This aspect is important from the point of view of current 'participatory' approaches to resource management, because it infers that the organising practices of local people or community organisations can become institutions over time (Thomas-Slayter, 1994).

In the context of human-environment relations, the role of institutions has been to confer rights and responsibilities and provide livelihood opportunities by authorising and legitimising actions (Pinkerton, 1997; Jentoft *et al.*, 1998). There has been much attention given to understanding that the, often quite complex, composites of rules that involve multiple and overlapping user rights to resources are associated with the pursuit of collective goals (Kiser and Ostrom, 1982; Bryant and Bailey, 1997; Nuijten, 1999). This role has been given precedence in resource management since institutions have been viewed as having to deal with the exclusion problem and the

subtractability problem[8] in common property resource situations (Berkes and Folke, 1997 in Nuijten, 1999). But Nuijten (1999) warns against the notion of collective goals because resource managers may perceive the collective goal (e.g., sustainable resource management) and not the stakeholders. This is because individuals involved in collective actions may all have different goals, and may participate in a variety of institutions to gain greater or lesser advantages (Crowley and Appendini, 1999).

By participating in institutions, which involves establishing relationships, individuals and groups gain an important form of social capital. Crowley and Appendini (1999) suggest that greater social security or 'stronger safety nets' appear to be associated with access to wider ranges of institutions. Thus, participation in institutions does not only affect access to resources, but the contrary is also true: access to resources affects participation in institutions.

Participation in institutions is one way individuals and groups seek to manage risk. The livelihoods of small-scale rural people have been characterised by Chambers (1997) as being complex, diverse and risk-prone. The features of complexity and diversity, in relation to livelihood strategies, are intended to minimise risk. This is discussed below. Institutions fall into the complexity/diversity strategies that seek to reduce environmental, economic and social risk.

Swift and Baas (1999) summarise definitions made in Beck (1992) and Adams (1995), that risk is the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge. This is in contrast to detriment, which is defined as a numerical measure of the expected harm or loss associated with an adverse event. Two aspects of risk have been identified: objective risk, which is the past and likely future occurrence of risk measured by experts; and perceived risk, which is the way lay people anticipate future events or view past ones. Table 2.1 expresses the relationships.

[8] Berkes and Folke (1997: 7,8 quoted in Nuijten, 1999), argue that "institutions have to deal with the two fundamental management problems that arise from the two basic characteristics of all such resources: how to control access to the resource (the exclusion problem), and how to institute rules among users to solve the potential divergence between individual and collective rationality (the subtractability problem)"

Table 2.1 Risk matrix. (Source Swift and Baas, 1999)

	Risk	Detriment
Objective (measured as)	statistical probability	economic cost
Perceived (measured as)	perceptions of likelihood of different events by different actors	economic cost non-economic cost (including eg self-esteem, community solidarity, future livelihood vulnerability)

People are not unwary of risk; they experience it and prepare for it in ways that depend on their prior experience, their expectations of the behaviour of others, and their resources and their objectives. Their behaviour is guided by institutions that have also been built on prior experience and the interactions with their environment and other people. Thus risk is culturally constructed (Adams, 1995 in Swift and Baas, 1999), and individual attitudes to risk differ, for reasons such as wealth, which in turn will influence their behaviour (Milner-Gulland and Mace, 1998). But this is set within certain institutional constraints (customs, land tenure systems, law...).

2.3 The nature of small scale-fisheries

Small-scale fisheries, alternatively referred to as traditional or artisanal fisheries, represents one of the most important livelihood sectors in the world. These fisheries are characterised by locally made boats (dug out canoes for example) and gear (woven fish traps, spears, relatively small nets), and locally available natural resources. Small-scale fisheries are labour intensive, employing approximately 95% of the world's 28.5 million fishers and supplying 50% of the 70 million tonne annual catch for direct human consumption (FAO, 1993, 1995b; O'Riordan, 1994; Le Sann, 1998). This takes place predominantly in the developing world where the sector supports over 140 million[9] people in traditional processing (such as curing and drying) and marketing, providing food and income for many of the world's poorest and most vulnerable people. In coastal East Africa, where this study was carried out, it is estimated that fish accounts for 90% of total annual intake of animal protein and

[9] Based on 1998 fertility estimate for developing countries of 3.3 children per woman (National Geographic, 1998). O'Riordan (1994) estimated at least 100 million people, Weber (1993) estimates 200 million including associated activities.

is the primary source of income for many people (Ngoile and Horrill, 1993). This sector of fisheries is the focus of this study.

Like 'third' agriculture[10], livelihoods based on small-scale fisheries are complex, diverse and risk-prone (Chambers, 1997). Being risk-prone is a characteristic of livelihoods dependent on natural resources and the biophysical environment (Dasgupta, 1982; Chambers, 1997); complexity and diversity are strategies people use to reduce this risk (Tvedten and Hersoug, 1992; Chambers, 1997). Thus, a common feature of small-scale fisheries is that they are often combined with other sources of food and income activities. Different household members may carry out different activities. Usually the additional sources of livelihood are agricultural, but they also include activities such as trade and casual labouring (Tvedten and Hersoug, 1992). In addition, for many people, fishing has become a diversifying tactic from other forms of livelihood, and as such it represents a livelihood of last resort (Russ, 1991) and a source of low cost protein (O'Riordan, 1994).

Apart from small-scale fishing often being part of complex and diverse livelihood strategies, the fisheries themselves tend to be complex and diverse. Tropical nearshore marine fisheries, which are characteristic of many developing countries, involve many species, complex and diverse habitats, and many fishers and gear types (Johannes, 1998). Furthermore, the resource users themselves form complex and diverse groups, often being highly differentiated according to age, gender and ethnicity for resource access and production roles (Tvedten and Hersoug, 1992; Chambers, 1997). Not surprisingly the institutions that determine access to these resources are also complex and diverse (Ruddle, 1988; Bryant and Bailey, 1997; Leach *et al.*, 1997; Forsyth *et al.*, 1998). This is particularly so because so many small-scale fisheries are common property resources (McCay and Acheson, 1987; Ostrom, 1990).

[10] Chambers (1997) identifies three types of agricultural activity: industrial agriculture found in the North (developed world) and plantations of the South (developing world), which is standardised and simple and supports 1.2 billion people; green revolution agriculture found in the South which is also relatively uniform and simple and supports 2.6 billion people; and third agriculture of the South which is complex, diverse and risk-prone, and supports 2.2 billion people.

The institutional arrangements that people develop in a common property situation form what are known as common property regimes. These regimes typically involve two things: well-defined resources and resource users; and strict controls on access and use (Bryant and Bailey, 1997). Generally these situations are not 'open access' in small-scale fisheries (Berkes, 1985, 1989; Ostrom, 1990). Limits to access in fisheries have for example been based on territorial user rights in fisheries (TURFs) (Lutchman and Hoggarth, 1999). As Bromley argues, "common property represents private property for the group of co-owners (since all others are excluded from use and decision-making)" (1991: 25 quoted in Bryant and Bailey, 1997: 161). These regimes are also inherently flexible because of the element of local control and decision-making. Individuals are able to communicate in these localised settings, and to establish institutional arrangements based on their shared norms and patterns of reciprocity (Ruddle and Johannes, 1985; Ostrom, 1990). Thus, resource use practices can be adjusted, in other words the rules changed, in response to changing social and environmental conditions (Bryant and Bailey, 1997). In fact, a state of constant change is normal for common property regimes. People have to constantly respond to shifting property relations, environmental circumstances, and social conflicts amongst themselves both inside and outside a common property regime (*Ecologist*, 1993).

It is therefore not surprising that analysis of institutional arrangements in relation to small-scale common property resource situations has revealed that people have many solutions to cope with many different problems (Ostrom, 1990; Leach *et al.*, 1997).

Clearly complexity and diversity are not only characteristic, but are necessary, features of the livelihoods of people depending on small-scale fisheries. Threats to this complexity and diversity would therefore be expected to weaken the livelihood security of these people by increasing effort in fewer activities and ultimately reducing resources. As many writers suggest (O'Riordan, 1994; Bryant and Bailey, 1997; Chambers, 1997; Jentoft *et al.*, 1998; Johannes, 1998), this has been the case for small-scale common property systems due to Western scientific and development theories.

2.4 Contextual limits to management success

"Most of us are not naïve enough to believe the old myth that scientists are paragons of unprejudiced objectivity, equally open to all possibilities, and reaching conclusions only by the weight of evidence and logic of argument. We understand that biases and preferences, social values, and psychological attitudes all play a strong role in the process of discovery...Science as actually practised, is a complex dialogue between data and preconceptions." (Gould, 1991: 244)

The declining state of many coastal marine environments and the overexploitation of many of the world's fisheries have been widely reported (FAO, 1995b; Economist, 1998). The latter situation has been caused principally by overfishing, destructive fishing methods and pollution (Weber, 1994). There are a number of important theories informing natural resource management. One of the principle theoretical areas, where people are concerned, relates to how people make decisions about the harvesting of resources (Milner-Gulland and Mace, 1998). The perceived failure of natural resource management, as reflected by, but not exclusively, the state of the world's fisheries, has encouraged critical analysis of its theoretical basis. This criticism, the "lifeblood of science" (McGlade, 1997), is part of the ongoing process informing and revising natural resource management approaches. In the context of common property systems, there has been a perceptible shift away from top-down, bureaucratic, and to some extent, science based approaches to management (Jentoft and McCay, 1995; Pomeroy, 1995; Holland, 1996; Christie, 1997; Jentoft *et al.*, 1998). The growing use of community-based management or co-management, and the incorporation of traditional or local knowledge in marine resource management illustrates this[11].

Critical analysis of natural resource management has occurred at two related levels: the applicability of the theories to reality, and at a higher level, the cultural prejudices that have influenced the approach taken by science and 'development'.

[11] For examples see: Doulman (1993); Hviding and Baines (1994); White *et al.* (1994); Pomeroy *et al.*, 1996; Sen and Nielsen (1996); Jorge (1997).

2.4.1 Theories and reality

The main criticism of harvesting and decision-making theories has been the oversimplification of the models derived from the theories (Berkes, 1985; Ostrom, 1990; Ludwig *et al.*, 1993; Kooiman, 1999). For example, the decision-making theory, Game theory, a mathematical tool for analysis of strategic interaction, has been widely applied to fisheries (Sumaila, 1999 reviews different game-theoretic models of fishing). Its application has been related to how individuals make decisions in relation to risks. The Prisoner's Dilemma 'game', for example, has been used to explore the obstacles to the development of trust and co-operation between individuals exploiting natural resources[12] (original applications were by Axelrod, 1984 and in relation to the role of the state, Johnston, 1989). However, as Ostrom (1990: 183-184) points out, this model depends on extreme assumptions that do not reflect many real situations. Similarly, Hardin's (1968) famous 'tragedy of the commons' model is equally constrained (Berkes, 1985; McCay and Acheson, 1987; Ostrom, 1990) because of its basic assumptions. Such models, however, have been extremely influential in resource management because they have been closely tied to justifying the principal role of the state[13] (Bryant and Bailey, 1997).

Aspects of harvesting theory, such as the influential concept of maximum sustainable yield (MSY), have been criticised because of the level of uncertainty in the models (Ludwig *et al.*, 1993). Ludwig *et al.* (1993), and later, Healey and Hennessey (1998) argued that social, political and economic factors make fisheries management regimes based on such stock recruitment models unworkable.[14] Yet, these models have long been used to determine centralised fisheries management policies, even in small-scale situations that are infinitely more complex than single species industrial fisheries. Such critical analysis, in the light of resource management performance, has spawned the range of alternative practices we now see, none of which focus on a neo-Hobbesian Leviathan (see Jentoft *et al.*, 1998). Many stress greater participation of

[12] For an explanation see Milner-Gulland and Mace, 1998: 91-96.

[13] The need for the state as argued by Hobbes in 1651, that individual action in the absence of a state can only lead to anarchy, has remained largely unchanged. This argument has been used in relation to natural resource exploitation, particularly by Ophuls (1977), quoted in Bryant and Bailey (1997: 51).

previously excluded actors, for example in community-based management and co-management regimes.

2.4.2 Cultural prejudice

The higher level of critical analysis relates to the modernist approach taken towards human-environment relations. For example Ghai (1999) and Wallace *et al.* (1996) point out that individualism is a characteristic of modernism and therefore of most Western societies, however it is not characteristic of all societies. Yet, it has been an assumption of resource management theories applied, through the West's power and influence (aid and 'development'), globally. Similarly Western scientific method, with its tendency to reduce the complex and varied to the simple and standard, has been questioned (Ludwig *et al.*, 1993; Wallace *et al.*, 1996; Chambers, 1997; Johannes, 1998). As Chambers explains, reductionism has been "very successful in physical sciences, but not in human sciences and the other more complex intersections of the ecological and biological sciences with people and their needs. In diverse, dynamic and uncontrollable conditions with continuous variance and multiple linkages, reductionist methods can be both costly and misleading" (1997: 42). In this policy environment, with its reliance on expert opinion, democratic processes have been largely ignored in favour of scientific decision-making. Consequently, resource users and other stakeholders have had little room to participate meaningfully in decisions about resource use and management (Wallace *et al.*, 1996). This situation is changing in many instances, as reflected in new resource management approaches, but the legacy of modernism remains for a number of reasons. Some of these reasons are outlined in section 2.5.

As with earlier resource management concepts, the continuous process of critical analysis has highlighted some weaknesses of the more recent approaches to human-environment relations and resource management. For example, co-management or community based management place more emphasis on the participation of resource

[14] Consider the socio-political environment in which management of industrialised fisheries must operate, where fishing fleets are paid between US$21-54 billion in subsidies, worth 75% of global catch (Weber, 1993; Milazzo, 1998). It gives little hope for sustainable resource use.

users and other stakeholders in an attempt to redress the oversimplification of earlier models (Ostrom, 1990; McGlade, 1995; Leach *et al.*, 1997; Kooiman, 1999). This explains why detailed knowledge of local institutional arrangements has been considered a priority. However, analysis of human-environment relations have revealed a level of complexity that are not acknowledged in many cases where community-based resource management has been applied, and this may explain why many cases have not met expectations (Bryant and Bailey, 1997; Leach *et al.*, 1997; Forsyth *et al.*, 1998). Leach *et al.* (1997) show that there has been a weakness in the main assumptions in community-based approaches because they have been based on assumptions of homogenous, consensual communities, the existence of stable universally valued environments, and the potentially harmonious relationship between the two. At the local level however, communities are very differentiated. Factors such as class, gender and wealth can determine local power relations that greatly influence people's access to resources (Chambers, 1997; Leach *et al.*, 1997).

Acknowledging and incorporating local complexity adds numerous challenges for resource management. A look at the institutional aspect provides many examples. Often institutional arrangements are not always as adaptable or as flexible as may be desired for holistic management policies due to internal and external factors relating to the local people concerned (Ostrom, 1990). Gender, wealth, age and ethnic differentiation within communities can result in communication difficulties between groups for many reasons. People with power or status within a community who stand to gain from the existing situation can block efforts by less powerful individuals to change the rules. Similarly, external authorities may prevent institutional change because they risk losing power (Nelson and Wright, 1995). This is further complicated by the fact that institutions themselves reproduce and shape relations of unequal power and influence that exist in societies (Kanbur, 1992). Thus institutions which might appear to be acting for the collective good may actually deprive certain groups of access to resources (Rocheleau and Slocum, 1995; Leach *et al.*, 1997). Such subtleties may only become apparent with hindsight. Another problem for management may be that the rate of change external to the local situation may be too fast for internal structures to respond (Ostrom, 1990; Eyben and Ladbury, 1995). Local institutions have a tendency to breakdown due to the problems of poverty and

inequality that can result from external economic or political influences (Forsyth *et al.*, 1998). This explains why traditional TURFs appear to be vulnerable to exposure to external values, economic pressures and technologies, and decreasing authority of the community (Lutchman and Hoggarth, 1999).

Another question that has been raised about community-based approaches relates to the importance placed on consensus. Consensus processes are considered extremely powerful tools because agreements can be accomplished where ordinary political processes would fail. There is a tendency to believe that consensus can be reached within communities. But, because they are highly differentiated, consensus may be an unattainable goal. Nelson and Wright, (1995) argue that strategies that reconcile living with difference may be a more realistic objective. Consensus processes can also be used to artificially manufacture the appearance of consent and legitimise actions that would otherwise be impossible to accomplish. This can happen when certain groups or individuals are excluded from consensus processes because more powerful actors organise the process (Britell, 1997a, b). Conflicts between local people and large-scale commercial interests could suffer from this problem where national policies tend to support the commercial interests. Moreover, if it is change that is being sought, the role of consensus itself may be questionable. As Marx noted, "it is the dialectical struggle between actors and groups and the contradictions of social structures that govern historical change more than cooperation, harmony and common general interests." He observed that this was because "actors and social groups cannot be regarded as having equal opportunities and resources. This is the foundation of relations of power. But there is always some degree of autonomy and dependence on both sides of any power relations" (quoted in Rasmussen, 1989: 10). So even weaker actors have an ability to resist stronger actors, since it is rare that one actor has overwhelming power over all other actors (Bryant and Bailey, 1997).

The examples above, of theoretical biases and prejudices and the limitations to resource management, represent conventional wisdom in the wealthier and more powerful developed nations. Where the scientific process of critical analysis and shift in Western attitudes (cf. chapter 1) refines and changes the theories, the organisations and institutional processes that apply the concepts have been slow to change. Part of

the problem can be attributed to the bureaucratic nature of the organisations that seek to influence or carry out resource management. Merton demonstrated that individuals within organisations tend to adhere to rules in a ritualistic way and elevate these above the goals they were designed to realise (1957, in Abercrombie *et al.*, 1988). This becomes inefficient if changing circumstances such as described above, have made the rules out of date. But the reluctance to change can also be attributed to prejudices derived from being in a position of power. As Rowe observed, "In the final analysis, power is the right to have your definition of reality prevail over other people's definition of reality" (1989: 16, quoted in Chambers, 1997: 76). Since the powerful individuals within organisations and states determine their actions, power can become an impediment for change. The legacies of powerful global actors are discussed below because it has consequences for the livelihood strategies of small-scale fishers.

2.5 The legacy of modernism

It is ironic that scientific method and reason, as forces of change in Europe during the Enlightenment[15], should be identified as contributing to the current dichotomy between the world's developed and less-developed nations and the state of the environment. The argument appears in political ecology and development literature, for example, Wallace *et al.* (1996), Bryant and Bailey (1997) and Chambers (1997). The industrial model of development and free markets in the developed world grew out of the ideals of enlightenment (Wallace *et al.*, 1996), and has created modern societies based on materialism with very high levels of consumption of natural resources. The USA, for example, with 5% of the world's population consumes 40% of the world's non-renewable resources (O'Riordan, 1994).

The influence of the European economic order, which has dominated much of the world since the colonial era of the nineteenth and early twentieth century,[16] continues

[15] As science and its challenge to societal beliefs in various natural phenomena evolved during the Enlightenment so did the critique of the social order. The ills of society were seen to be a function of the distribution of wealth, power, and prestige, suggesting that egalitarianism was implicit in the thinking of the scholars of the Enlightenment (Mathews, 1999).

[16] Colonialism was precipitated five hundred years ago by Europe's attempts to outflank their eastern Islamic barrier, via sea routes, to the wealth of the 'East'. Famously Colombus's arrival in America in

to influence the livelihoods of people dependent on locally available natural resources, such as small-scale fishers. The dominant economic order that developed in the nineteenth century was the provision of raw materials from colonies established in Africa, Asia and Latin America for consumption and manufacturing in Europe and North America. This involved annexing vast areas of land for the provision of raw materials, either as mono-crops or for exploiting natural resources such as timber, and imposing open access regimes over marine resources. Consequently, those colonies became, and their more recent incarnations remain, economically dependent on natural resource exploitation. From the perspective of many indigenous people, locally available resources became scarce due to a tragedy of enclosure (*Ecologist*, 1993). Property became a system of authority established by colonial governments. For individuals within these regimes, the assignment of property rights affected their bargaining powers and changed the distribution of income and wealth (Dasgupta, 1982) (for this case study, cf. chapter 4).

Institutions established during colonial regimes were created to co-ordinate exploitation of natural resources and only late in the day did the need to 'manage' the exploitation be recognised (Bryant and Bailey, 1997). Obvious problems arose, not excepting the theoretical weaknesses identified above, because the 'science' of management relied on expert opinion and technology (Hays, 1959), which colonial regimes could afford but independent developing countries can not. Yet, the same organisations and institutional structures have remained and continue to be responsible for natural resource use and management. Another consequence of keeping the same institutional structures from the colonial past has been the marginalisation of whole sectors of society dependent on resources deemed of little worth during the colonial era (Bryant and Bailey, 1997). In Kenya for example the colonial regime decided that it was not feasible to develop industrial fisheries in East African coastal waters (Crutchfield, 1958), and did not place importance in a marine fisheries department. Consequently, the current department and small-scale fishers remain under-supported despite the more recent realisation that many tens of thousands of people depend on marine resources in Kenya (pers. obs.).

1492, and Vasco da Gama's voyage to India around the Cape of Good Hope in 1497-99 (Hall, 1996; Bryant and Bailey, 1997).

The problems of bureaucracy identified by Merton (1957) contribute to the entrenchment of outmoded ideas in many developing country organisations. But this is also the case in Western dominated organisations that have influence over developing country organisations. For example, the United Nations Food and Agriculture Organisation's (FAO) work programme for 2000-1 is spending US$ 847,000 field testing participatory methodologies for the acquisition of information in small-scale fisheries (FAO, 2000)[17]. Yet these methods have been applied and have had a proven record for over a decade in small-scale agriculture (Chambers, 1997). What is striking about the FAO since 1945 is how little the institution's core ideas have changed (modernisation, promote export cash crops, enhance productivity and 'efficiency') (Bryant and Bailey, 1997). The consequence of which has been to maintain the international status quo. As in colonial times, 'progress' for the FAO was defined in terms of increased production for the market, and modernisation was thus a process whereby Western science and technology were applied to the task of enhancing yields (Bryant and Bailey, 1997). The quest to apply Western knowledge in aid of 'development' persists, despite the basic concepts, such as technology transfer, being acknowledged as "one of the most expensive and tragic hoaxes of all time" (Smillie, 1991, quoted in O'Riorden, 1994: 1).

The international financial institutions such as the World Bank and International Monetary (IMF) fund have been similarly criticised. Structural Adjustment Policies have deepened the political and economic dependency of many developing countries on the developed world. The export-led growth model on which structural adjustment policies have been based is "a purely extractive one involving more the 'mining' than the management - much less the conservation - of resources" (George, 1992: 2-3 quoted in Bryant and Bailey, 1997: 92). The conditions of loan agreements with the IMF and the World Bank require developing countries to pursue western development ideals with some obscure consequences. In Kenya for example, the increased

[17] FAO 2000 sub-programme 234A4: Promotion of Fisheries Management in Coastal Fisheries
281. Objective: Fisher communities achieve a balanced equilibrium between the need to engage in capture fisheries and the need to preserve aquatic resources.
282. Outputs: Review of policies, planning procedures and management strategies of potential use in Africa and South Asia. Field tests of participatory methodologies. Guidelines for community-level

problem of land grabbing (a problem analysed in the case study) by politicians has been identified as a result of international pressure for political liberalisation which has increased the cost of political patronage (Klopp, 1998). In addition the IMF/World Bank agenda of privatisation and commitment to individual property rights has placed public or community lands under great pressure.

In a similar vein, the World Trade Organisation (WTO), established after the Uruguay round of negotiations of the General Agreement on Tariffs and Trade (GATT), is viewed as promoting the interests of developed nations over other nations (Walker, 1995). The procedural elements of the WTO, particularly in the Understanding on Rules and Procedures Governing the Settlement of Disputes, are based on consensus. Consensus however, is defined in the WTO as the absence of formal objection by any Member present at the meeting. Thus, those countries that cannot afford to have a permanent representative in Geneva, or to send delegates to every meeting, lose their influence (Walker, 1995). This feature of the WTO, present in both decision-making and dispute procedures, favours the developed nations. In addition, the legal status of the WTO, which requires Member countries to amend their domestic laws to conform to the obligations under the Uruguay round, is concerned with gaining access to markets. This favours global business, namely Transnational Corporations (TNCs), which are almost exclusively from developed nations. Milner-Gulland and Mace (1998) observe that the higher legal status of the WTO may also have weakened some established international treaties by reducing the enforcement option of trade sanctions.

The examples above illustrate the globalisation of a particular system in which the individual has primacy over the community (Ophuls, 1977). But, as Shiva reminds us, 'global' does not denote a universal human interest, but rather signifies "a particular local and parochial interest which has been globalised through the scope of its reach" (1993: 150 in Bryant and Bailey, 1997: 81). Habermas (1987: 155-197) discusses this change in societies, showing that 'tribal' societies, such as those in this case study, become less self-maintaining as they become modernised. For rural

communities, the effect has been the loss of community control over local resources, and thus it is at the local level that these effects have been most acutely felt, with the overall result being intensified social poverty and environmental degradation. Many of the risk management strategies of local people have been lost, both through the limits placed on livelihood options and the ability of local institutions to function under over-riding external influences. Common property regimes that were once diverse and complex have been eroded to mono-faceted regimes. In the case of small-scale fisheries, the limitations placed on livelihoods due the imposition of individualistic philosophy have possibly had a greater effect than mismanagement. In Kenya, for example, there is no state management (or mismanagement, therefore) actively carried out in small-scale coastal fisheries (C. Oduol pers. comm.). Yet, as the case study shows, the effects of past (colonial) and present international (development policies, tourism) influence and government policy have significantly reduced the livelihood options for local people.

The appearance of 'participatory' resource management is in recognition of the limits to these regimes. But, as was argued above, these more recent approaches to resource management still face certain limitations due to the same conceptual constraints. If human-environment relations continue to be perceived as bounded by rules and the processes having specific directions, it will be difficult to recognise other processes that are important in mediating human-environment problems (Rasmussen, 1989).

2.6 Less structure, more action

Two factors suggest that individuals and groups act outside the realm of institutions in relation to resource access and control. Firstly, there is evidence that they do so in a variety of circumstances but it is simply not acknowledged in resource management. Secondly, the complexity and diversity of livelihoods in small-scale common property resource situations would be reduced if actions were limited to institutional constraints.

The evidence for individual or group actions that are not guided by institutions, yet involve significant levels of organisation, or derive collective outcomes, is found in a

range of situations. Nuijten (1999) discusses experiences in development projects that often find people preferring to work in loose personal networks instead of collective projects. This is because there can be disadvantages and dangers involved in collective organising. For example, in some situations formalised collective actions may imply political dangers and risks. Therefore, other more individual and less identifiable forms of organising are used to avoid outside control. This is especially the case when the state has the reputation of being unpredictable, dangerous, and sometimes violent. Although not necessarily sinister, Gupta notes that what is most striking "is the degree to which the state has become implicated in the minute texture of everyday life" (Gupta 1995: 375 in Nuijten 1999). Gupta described the situation in India, but it was equally evident in this case study in Kenya (pers. obs.). Such socio-political contexts can be a strong disincentive for people to become involved in 'community based' organisations, or to follow established formal or informal institutions.

Complex and diverse livelihoods include a wide range of activities. But these activities also depend on the life cycle of the household, on who is fit or sick, who can do what, on what has already been done, on competing demands for resources available, on past experiences, social conventions and much else. Even within the same village, different social groups can have completely different strategies (e.g. many livelihood activities over the year) (Chambers, 1997). Each actor has a different perspective on what is a problem and how to improve the situation (Pretty and Scoones, 1995). Such livelihoods are dependent on ingenuity and opportunism with minimal constraints. Institutions serve to allow people to cope in many ways with their local, complex, diverse, dynamic and unpredictable conditions, facilitating diverse behaviour of individuals. But the actions themselves are ultimately unpredictable (Chambers, 1997), being influenced by a multitude of factors that are more transient than institutions.

2.7 Analysing the process of problem solving at the local level

"The structural designers of organisations, those who mandate reporting relationships or memo distribution lists or access to databases, are much like

architects who try to predict where the pedestrian traffic will be or should flow on a university campus. They lay their cement, install fences and other obstacles, but inevitably the flows of people and classes carve bare spots in the grass where the sidewalks need to be." (Salancik, 1995: 347)

The thread of the argument presented above is that a reductionist and over structured approach to human-environment relations has placed limitations on resource management and on the livelihoods of people in common property situations.

2.7.1 A network approach

In other management disciplines, with a greater attention to the relations between people, such as business management, it has long been recognised that rigid approaches fail to elicit an accurate understanding of situations (see Peters, 1989; Handy, 1990). With reference to the application of systems theories to problem solving approaches in business, Checkland notes that 'hard' methodologies such as systems engineering fail when applied "to the messy, changing, ill-defined problem situation with which managers have to cope in their day-to-day professional lives" (1989: 288). Similarly, early (1970s) criticisms of technical Operational Research (OR)[18], stressed that models could be optimised, but not reality, and "that OR should aim to manage complex messes rather than solve problems" (Mingers, 1992: 95).[19]

One response to these criticisms, which has relevance to problem solving and organising practices in the context of this study, has been the application of a social network approach to organisational settings (proposed by Tichy *et al.*, 1979). These authors argued that a social network perspective enabled both the static and dynamic aspects of organisations to be captured, because of the focus on the linkages between the social objects (actors - individuals, groups, organisations...) (*ibid*). The social network approach Tichy *et al.* (1979) advocated has conceptual origins in sociology, anthropology and role theory that had already been widely applied since the 1950s in

[18] OR was developed in the 1950s and 1960s to improve decision making and problem solving in organisations.

other studies of the behavioural and social sciences (see Tichy *et al.*, 1979: 508 Origins and Perspective; Wasserman and Faust, 1994: 5-6). The uniqueness of the social network approach is that emphasis is placed on the actors and the relationships between them (in contrast to the actors and their attributes), and the notion that the characteristics of the relationships as a whole may be used to interpret the behaviour of the actors. Any regularities and patterns in these relationships are seen to give rise to structures, and the actors are seen as being embedded in these structures of connections (for comprehensive reviews see Scott, 1991; Wasserman and Faust, 1994; Hanneman, 1997). Thus, the focus is on the network of relations, and the network is generally defined as a set of relations linking a defined set of persons, objects or events (Everett, unpub.). Social networks can be developed from four basic flows: exchange of goods; exchange of information and ideas; affect or liking; and the attempt to influence (Tichy *et al.*, 1979). Many of the concepts in social network analysis are founded in graph theory, enabling mathematical operations to be used to quantify structural properties of networks (Wasserman and Faust, 1994). Models of social systems based on graph theory are therefore social networks, and graph theoretic terminology is applied, where nodes are actors and lines connecting nodes are ties between actors. One of the main applications of graph theory in social network analysis has been for the identification of the most important actors in a social network (Wasserman and Faust, 1994).

Identifying important actors in networks formed when people tackle resource access and control problems in common property resource situations, it is argued (part 2.7.3), provides an insight into the question of the role of institutions. In such cases, networks are formed through the exchange of information, forming communication ties between actors. The different sources of actor importance are discussed in part 2.7.2.

In the context of social interactions, power is seen to play a key role in determining social behaviour (for a review of theories of power see Mingers, 1992). In sociology power is a description of a relation, not a 'thing' that people 'have' (Mingers, 1992;

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[19] Similar kinds of constraints have led to the use of network approaches in biological sciences. For example in relation to the dynamics of whole ecosystems (see Baird *et al.*, 1991; Ulanowicz, 1999).

Nelson and Wright, 1995). From a network perspective, an actor's power within a network is therefore derived from their relations with others, whereas an actor's personal attributes and strategies have more influence on how power may be acquired (Brass, 1984). This relational importance is illustrated by Berry's observation that small-scale "farmers' ability to gain or retain access to land for purposes of cultivation depend as much on their relationships with other people as on the specific terms under which they claimed the land rights" (1992: 347). Pfeffer and Salancik (1978) also stress that power is a strong predictor of resource allocation under conditions of uncertainty, a condition characteristic of livelihoods dependent on locally available natural resources. Power is also a property of the overall network, depending on the variations in the patterns among actors. Power, for example may be concentrated in a few actors, and this would be reflected by the overall structure of the network.

Taking a social network approach to questions such as how do actors tackle issues of resource access and control, enables power to be taken into account as well as how action and decision making are embedded in social networks (Schweizer and White, 1998). Furthermore, this approach is actor oriented, which is necessary because, as Seed (1990) argues, working with any individual or group, in any setting, only makes good sense if it incorporates an understanding of the individual's or group's world from the individual's or group's point of view.

In relation to resource access and control, Leach *et al.* (1997: 7-12) describe an actor oriented approach (environmental entitlements analysis) that seeks to understand how different actors' practices are embedded in, and help to shape, formal and informal institutions. They develop the notion of entitlements, first described by Sen (1981), emphasising social and environmental differentiation and the command different people have over environmental resources. They argue that by being actor oriented it takes an analysis of difference and an appreciation of power relations seriously, and by focusing on institutions (illustrative of current approaches) it avoids the Malthusian type of analysis that links people directly with resources. However, they neglect to show how power derived from relations between actors influences social behaviour, and therefore fail to appreciate more flexible processes can also determine

the outcome of a given situation. (Although they do provide a good method of identifying the range of institutions influencing a given social situation, and it is used in chapter 5 to illustrate institutional links to livelihoods.) Eliciting an understanding of the more transient or flexible processes through social network analysis would complement the environmental entitlements analysis, providing a significantly more holistic reflection of social behaviour related to resource access and control.

2.7.2 Sources of actor importance

From a network perspective, actors have constraints or opportunities according to the way they are embedded in a network. Actors with few constraints and more opportunities are in favourable structural positions (Hanneman, 1997). These favourable positions, which are essentially the extent to which actors are connected to other actors (alters), have been considered to put actors in positions of power over other actors in the network. These positions are referred to as central positions. Thus, an actor's centrality in a network can be considered to reflect the actor's power in the network. But the centrality-power relation is not monotonic. As Freeman (1979) showed, centrality is a multidimensional concept, and different kinds of power can be derived from different positions. He identified three types of centrality, degree, betweeness and closeness, each of which are based on graph theoretic concepts. The definitions are widely summarised (Scott, 1991; Wasserman and Faust, 1994; Hanneman, 1997; Mizruchi and Potts, 1998). Degree centrality is defined as the number of other actors (alters) to whom an actor is directly tied. Thus, power (importance) is derived from the ability to communicate directly with others. Betweeness centrality is defined as the extent to which alters must pass through a focal actor in order to communicate with other actors. Power in this case stems from the ability to restrict the communication of others. Closeness centrality is defined as the extent to which an actor can reach a large number of other actors in a small number of steps. So the ability to reach large numbers of alters whilst being able to rely on a minimum number of intermediaries places an actor in an advantageous position.

Other questions have been raised about the centrality-power relation. In certain exchange networks, for example, power and centrality are related in a non-monotonic way. Power and centrality are also considered to be analytically and empirically distinct, since in some cases an actor's power may be influenced by the power of its alters, and this may not be reflected by Freeman's centrality measures. Each of Freeman's measures have been developed upon in an attempt to account for this. For a review of these issues see Mizruchi and Potts (1998). The issue of exchange networks does not affect this study, since it concerns communication networks, however the notion that an alter's power influences the power of an actor is taken into account. The measures applied in this study are described in chapter 8.

2.7.3 The use of social network analysis in this study

The application of a network approach in this study enables networks based on communication ties to be identified for specific circumstances. Through social network analysis (chapter 8), the importance of individual actors (derived from different graph theoretic concepts) within each network can be determined. The assertion is that, as *long as the relationships can be identified (through interviews*, discussions, documentation...), this approach reflects people's actual social behaviour. There may seem to be a contradiction in taking this approach, which asserts that social structures play a significant role in social action, when looking for transient or flexible processes. However, the suggestion here is that the actors in the network will reflect institutions that guide social behaviour, and the actor's importance in the network will reflect the importance of the institution. Or, as is asserted in the hypothesis, the contrary is the case, that it may be that institutions are not determinants of a network's structure or the behaviour of the actors. A focus on actors and their actions (communcative, in this case), is also an attempt to avoid the circular reasoning of the argument that institutions guide people's behaviour, yet at the same time people's repetitive behaviour form institutions. There must be a point at which people's effective behaviour is neither repetitive nor guided by rules.

Social network analysis has been widely applied in relation to many of the problems

discussed in this chapter. Some recent examples are given below. As with the argument presented in this study, Ortegon (1998) showed that communication networks (in her study, 'gossip' networks) were necessary social assets used to express multiple interests where no institutional arrangements existed. She argued that these networks were essential for institution building and every day conflict resolution. With reference to the limitations of too restricted an institutional view, Helbling (1998) showed that in the context of tribal societies, New Institutional Economics (based on North's rules of the game) failed to give sufficient attention to political phenomena. This was mainly because too much attention is given to institutions influencing transaction costs, particularly property rights. Similarly, Lang (1998) used a network approach to show how different actors influenced the process of communal land privatisation in Namibia in the early to mid 1800s. Aunger (1998) found that in the changing socio-economic environment of the Democratic republic of Congo, new kinds of social organisation resulted from the use of belief systems for social ends. Social network analysis has also been applied to demonstrate that the overlaying of colonial social orders on other societies resulted in the redefinition of old social orders and the invention of new strategies (Goelich, 1998). White *et al.* (1998) explain why Tlaxcalan villages in Mexico have been able to maintain cultural autonomy through spatially concentric social network organisations, despite Spanish colonial settlement since the turn of the 16th century.

In this study the communication relationships between different actors involved in a series of resource access and control issues were identified and are analysed in chapter 8. The issues examined were the attempted implementation of a marine protected area, a conflict between two fishing groups and a case of land grabbing. Each chapter prior to the social network analysis provides a detailed examination of the environmental, socio-political and socio-economic situation of the studied community. This is necessary for an informed interpretation of people's behaviour in relation to the resource access problems they face.

3 THE BIOPHYSICAL ENVIRONMENT OF THE KENYAN COAST AND THE STUDY SITE - LOCALLY AVAILABLE RESOURCES

3.1 Introduction

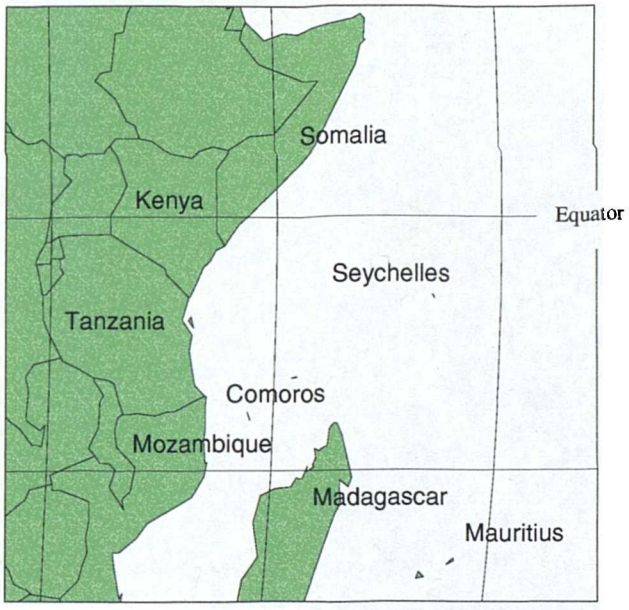
The aim of this chapter is to describe the main biophysical features in the region and study area that are relevant to the activities of the studied fishing community. The availability of resources to coastal human populations of the type in this study depends on the natural characteristics of the areas they inhabit. The productivity of local environments reflects both large-scale phenomena such as climate as well as localised features such as soil type, habitats or the type of ecosystem. Variability and long-term changes in the biophysical environment can change livelihood opportunities. Climatic seasonality for example can dominate livelihood opportunities by determining agricultural growing seasons or limiting access to remote coral reefs. Climatic seasonality also determines the nature of local ecosystems themselves. Similarly, long term changes in local environments can be due to natural events as well as human activities. For example the el Niño event of 1997 resulted in widespread coral bleaching in the Indian Ocean in early 1998 (Wilkinson *et al.*, 1999). The potential consequences of such an event, coupled with continued exploitation of the reefs, could be the loss of coral and a change to different marine habitats. This in turn would alter the kinds of resources available to human populations.

The first part of this chapter considers the large-scale processes that occur on a regional scale and consequently influence the environment of the study area. The second part describes the environment of the study area in more detail. Focus is given to the marine environment and terrestrial environment, introducing the links between biophysical characteristics and human activities, in order to explain the current state of the environment.

3.2 Environmental characteristics of the region and the Kenyan coast

The wider East African coastal region includes the Indian Ocean coasts of Somalia, Kenya, Tanzania and Mozambique and the island States of Comoros, Madagascar, Mauritius and Seychelles (Figure 3.1). It is a region that falls within one of the United Nations Environment Programme's (UNEP) Regional Seas Programmes and the more recent Ecoregions of the World Wide Fund for Nature (WWF). From an ecosystem perspective, the region includes the Somali current and Agulhas current large marine ecosystems (LME) (Sherman *et al.*, 1998), the Kenyan coast falls within the Somali current LME (Alexander, 1998). This study is focused on the livelihoods of people depending on the inshore marine and coastal terrestrial environments of the southern coast of Kenya (Figure 1.1).

Figure 3.1 The wider East African region.



Different tropical marine and wetland habitats occur within the region including coral reefs, sea grass beds, mangroves and salt marshes, all of which are found along the coast of Kenya (UNEP, 1985; Wells and Sheppard, 1988; ECC, 1992). In terms of shorefish fauna the Kenyan coast falls within the Indo-Pacific zoogeographical region. This is the largest zoogeographical region with an estimated 4,000 shorefish species, 3,000 of which inhabit coral reefs (Lieske and Myers, 1994). Coral diversity

is also high in the region, 112 species of hard corals have been identified in Kenya and Tanzania (Sheppard, 1999) and a further 28 species of soft corals in Kenya (Samoilys, 1988).

Terrestrial environments along the Kenyan coast are now dominated by agricultural production predominantly in the form of smallholdings, but there are some plantations of coconut and sisal. This, however is a relatively recent development resulting from coastward human migration and population growth over the last two hundred years. Prior to that, much of the coastal region was covered in dense tropical lowland woodland and bush (Spear, 1978; Sayer *et al.*, 1992).

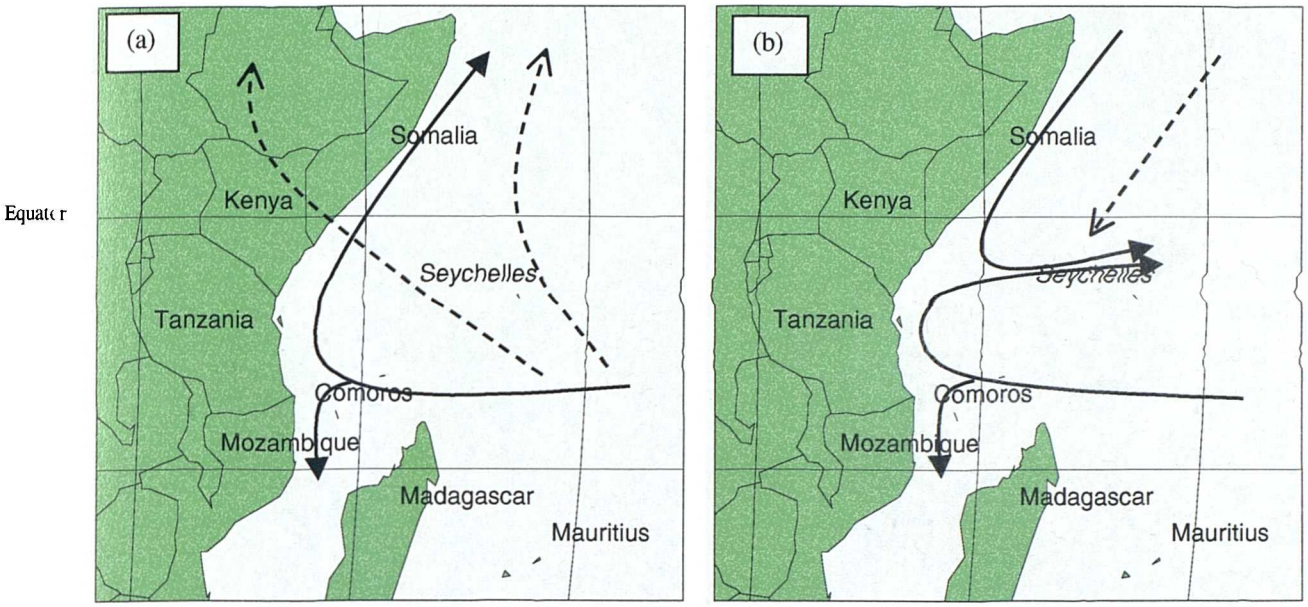
3.2.1 Climatic seasonality

The most influential physical process in the East African coastal region is the climate. There are two distinct seasons, the Northeast monsoon (*kaskazi*) and the Southeast monsoon (*kuzi*) (Figure 3.2). This seasonality is due to the annual north-south migration of the Inter-Tropical Convergence Zone (ITCZ). The ITCZ moves further north than in most tropical areas during the Southeast monsoon because of the low-pressure belt on the Asian continent during the Northern Hemisphere summer. Consequently, there are two rainy seasons in coastal Kenya, the long rains (*masika*) from March to June and the short rains (*mvuli*) from October to December (Figure 3.3). Mean annual rainfall in the south coastal region of Kenya is 1,397 mm and in the north coastal region of Kenya is 889 mm. Mean annual temperature is 26.7°C (80°F) with small seasonal fluctuations according to the monsoons (Ominde, 1984). Wind speeds tend to be highest during the cool dry period (*kipupwe*) from June to August during the Southeast monsoon creating rough seas. The winds drop in strength from August to October (*demani*) prior to the hot dry and calm period (*musimi*) from December to March.

Climatic seasonality has a significant impact on the activities of coastal communities, influencing both fishing and agriculture. High agricultural activity is linked closely to the rainy periods, when land has to be cleared and crops planted. Fishing is predominantly influenced by winds and the corresponding sea-state which make

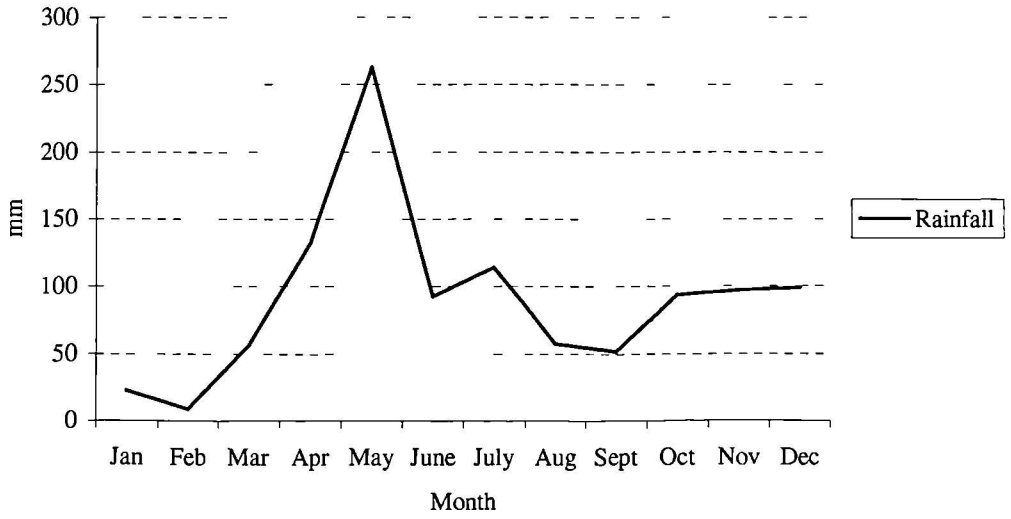
working conditions physically demanding and limit access to exposed outer reef areas. Fish catches reflect this seasonality, being lower in the Southeast monsoon and higher during the Northeast monsoon (McClanahan, 1988).

Figure 3.2 Prevailing wind (dashed lines) and current (solid lines) patterns in the SE (a) and NE (b) monsoon in the East African region.



Source: McClanahan, 1988.

Figure 3.3 Mean Monthly Rainfall at Mombasa, 1985 - 1994 (Source: Kenya Met. Office Mombasa).



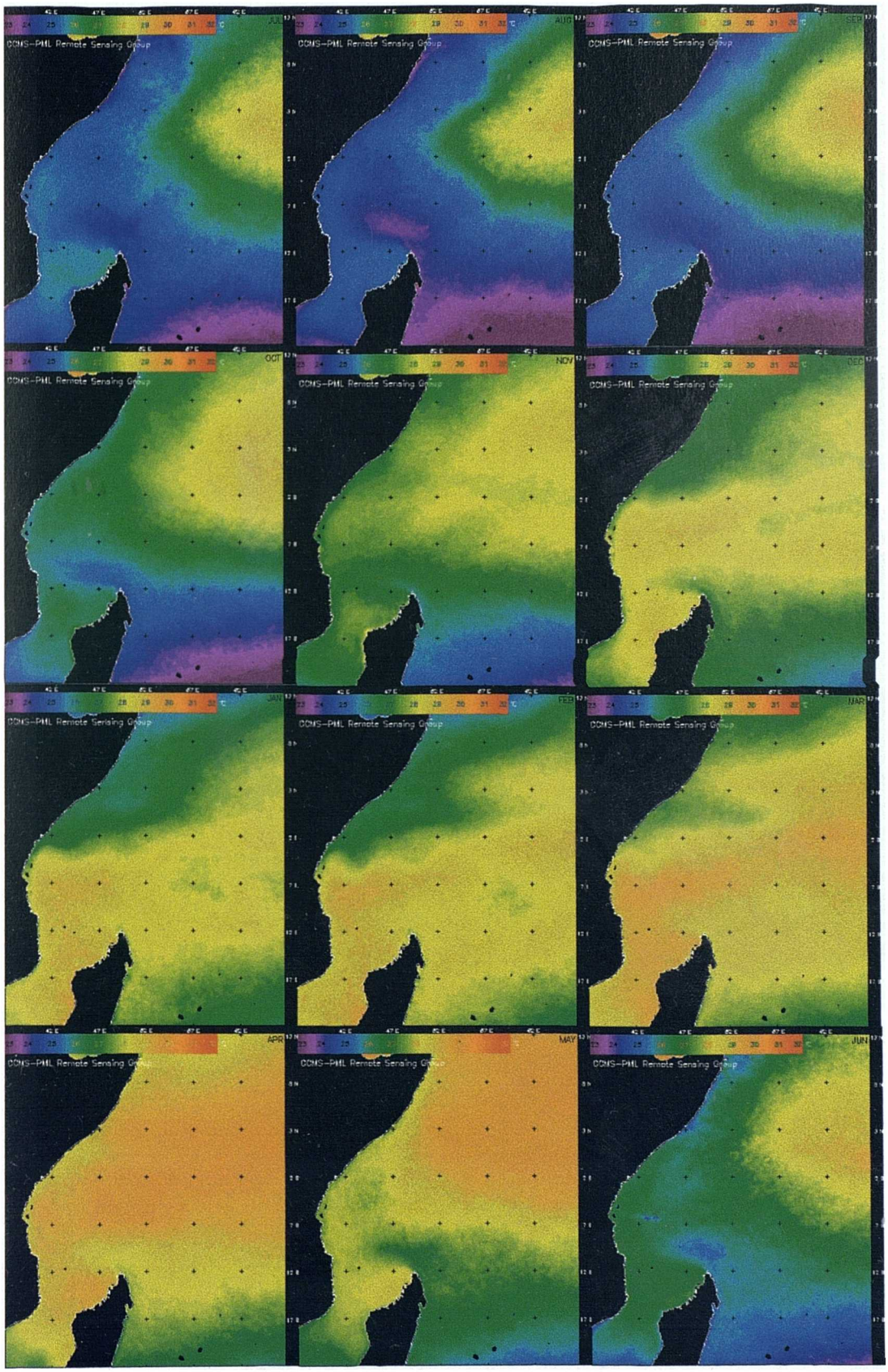
3.2.2 Oceanographic seasonality

There is distinct oceanographic seasonality in East Africa's coastal waters which is directly related to the climate. Climatic changes affect physical, chemical and biological oceanographic parameters due to factors such as wind driven currents, freshwater runoff and sedimentation. Offshore, the East African Coastal current (the EACC is the continuation of the Southern Equatorial Current) flows northwards from Tanzania to northern Somalia during the Southeast monsoon. The changing winds of the Northeast monsoon slow the current's northerly flow and eventually reverse the flow, forming the Somali Counter Current which can reach between 3°S and 4°S (Johnson *et al.*, 1982; Ngoile and Horrill, 1993) (Figure 3.2 and 3.4). The effects of the EACC are largely felt offshore, whereas tidal currents tend to influence nearshore waters. Spring tidal range is approximately four metres along the Kenyan coast. These tides strongly influence the strength of linkages between the different marine and wetland habitats, dispersing sediments, nutrients, organic matter and living organisms (Ngoile and Horrill, 1993). There is a major downwelling area and associated low nutrient water along the Tanzanian coast and the southern Kenyan coast. Downwelling occurs throughout the year but is strongest during the Southeast monsoon (McClanahan, 1988).

3.2.3 Coastal habitats

Much of the coast is bordered by fringing and patch coral reefs (Figure 1.1) (Wells and Sheppard, 1988). The whole of the southern coast of Kenya is bordered by a fringing reef 0.5 km to 1 km from the shore. These reefs create protected inshore lagoons that are characterised by patches of coral, sea grass beds and sand. The coral reefs and associated seagrass beds are the basis for a multispecies small-scale fishery along the entire length of the coast. This near-shore fishery is estimated to occupy 8,000 fishers producing up to 16,000 tonnes of fish in 1990 (McClanahan and Obura, 1995), and is the only significant fishery along the Kenyan coast. Sufficient productivity for large-scale fisheries may be limited because of the narrow continental (Bakun *et al.*, 1998).

Figure 3.4 Mean monthly sea surface temperature (SST) images, July - June (1987 - 1997), illustrating oceanographic seasonality in the East African region. (Source: produced by Dr Tim Smyth, CCMS, Plymouth.)



Mangroves are important wetland habitats that also support small-scale fisheries, either directly or as juvenile habitats for many food fish. There are twelve patches of mangrove forests along the Kenya coast, making up about 530 km^2 in total. Mangroves have been exploited in Kenya for thousands of years and exported to the Arabian peninsular for building material. Local consumption now dominates for building material, charcoal production and firewood and large areas have been lost along with the associated flora and fauna (Kennedy, 1990).

On land the Kenyan coast is characterised geologically by a coastal plain largely underlain by Pleistocene deposits of corals and sands less than 30m above sea level and 5–10 km wide (Ominde, 1984). The southern Kenyan coast is characterised by Pleistocene-Recent raised coral reefs of a constant 15m above sea level (Kent, 1982). Behind the coastal plain is a foot plateau with a varied altitude of 60-135m made up of marine shales, mudstones and limestone of Jurassic age. A feature of the south coast of Kenya is a coastal range west of the foot plateau with altitudes of 150-420m. Further to the west lies the Nyika plain forming the arid Taru desert, a natural barrier between the coast and the densely populated highland areas further inland (Ominde, 1984; DCO, 1993).

The East African coast, particularly in the area of southern Kenya and northern Tanzania, has been an area of stable climate over millennia, including periods of climatic change such as the global ice ages (Kingdon, 1997). A mosaic of tropical lowland woodland and dense bush is the natural terrestrial habitat along the coast. Small patches of woodland remain, either as State protected areas, sacred sites (*Kayas*) or under private ownership. Apart from their ecological value, the few areas of woodland and bush continue to be valued by coastal communities as a source of raw materials for fishing equipment, building material, food, medicines and spiritual needs (Glaesel, 1997; pers. obs).

Agricultural cultivation is now the dominant habitat. There are two forms of cultivation: plantations and subsistence agriculture. The main form of land use is subsistence agriculture and limited cash cropping by coastal communities. A variety of crops are cultivated, such as cassava, millet, maize, beans, sesame, rice and a variety of citrus, mango and coconut trees. Plantation cultivation was historically

associated with coastal towns and was therefore geographically restricted, but during the British colonial era plantations of sisal, coconut and sugar were developed in a number of more remote sites along the coast. Some of these estates have since collapsed and squatter farmers now cultivate the land.

3.3 Biophysical environment of the Study Site

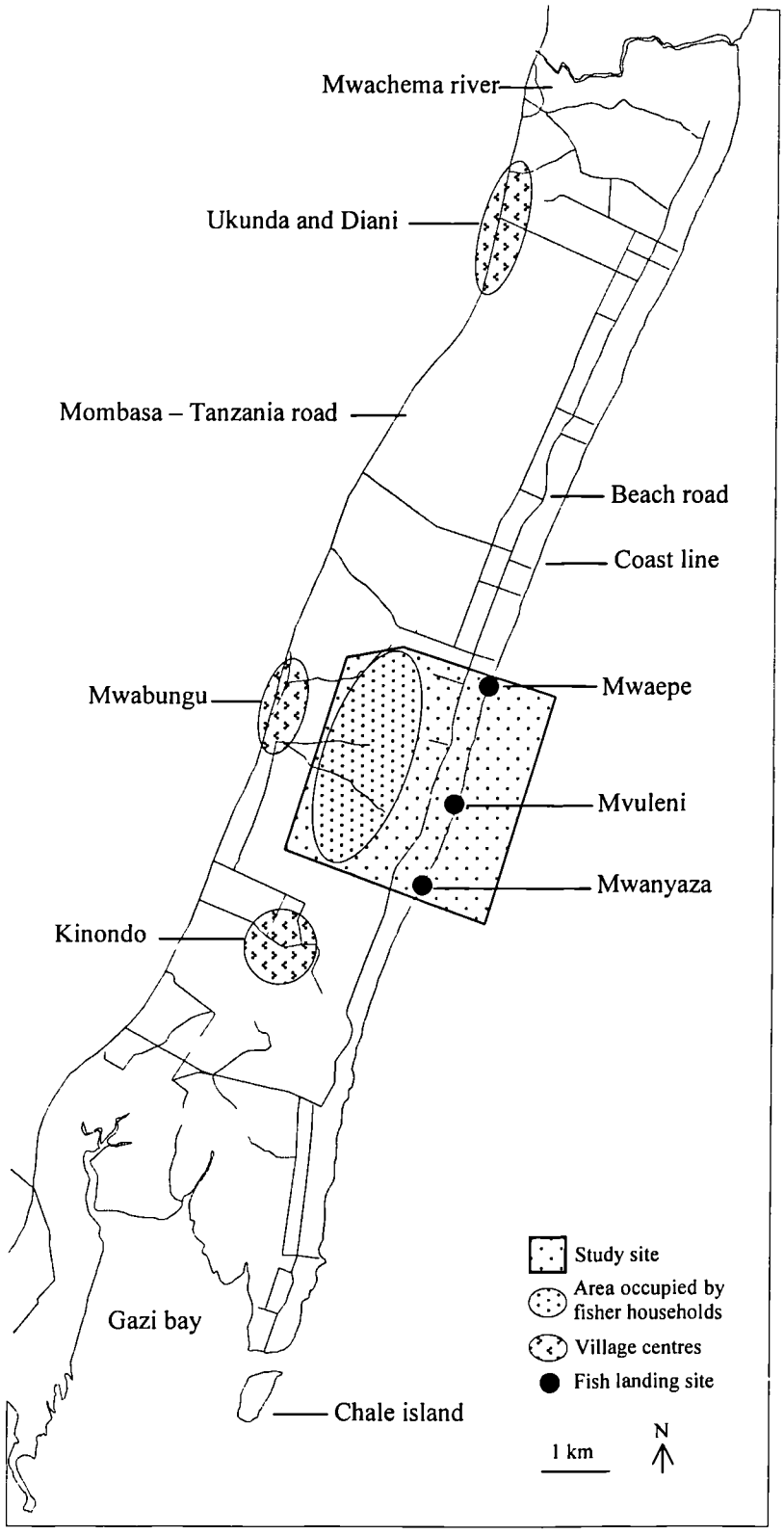
The study site was located on the south coast of Kenya, approximately 40 km south of Mombasa, at approximately 4°20'S (Figure 1.1). The study site covered four kilometres of shoreline, the adjacent coral reef lagoon and stretched inland three kilometres to include the community of Biga (Figure 3.5). The shore and inshore area is characteristic of much of the southern Kenyan coast, with some low Pleistocene-Recent coral cliffs, a wide sandy beach and a fringing reef approximately one kilometre offshore. Within the reef is a lagoon with coral heads, sandy patches and seagrass beds. The sea front has been steadily developed by expatriate residents and non local Kenyans over the last thirty years. Behind the strip of development the land is either owned by expatriates, but undeveloped, and used by the fishing community or migrant farmers from further inland or owned by members of the fishing community.

3.3.1 Marine environment

A survey of the lagoon substrate and main habitats adjacent to one of the fish landing sites was carried out with the assistance of a marine biologist[20]. This enabled the local marine environment on which the community of Biga depended to be described in detail.

[20] Dr David Obura.

Figure 3.5 The study site.



3.3.1.1 Methods

Fourteen sites were visited at which four visual observations were made. Sites were chosen near the shore, midway between the shore and the fringing reef and near the reef. Each site was accessed by boat on the flood tide. Four observations were made approximately ten metres from the boat at four different points, most often northwest, northeast, east and south of the boat. At each sample site, observations of the primary, secondary and tertiary substrates were made, and the percentage cover of the main habitat types was recorded within a sampled area of approximately $10m^2$. The substrate types were coral rock, rubble and sand. If the coral rock was very eroded, particularly by urchins, it was also noted. The main habitat types were coral, macro algae, algal turf, sand and sea grass. The predominant seagrass and algae species were noted as well as maximum and minimum water depth.

3.3.1.2 Results

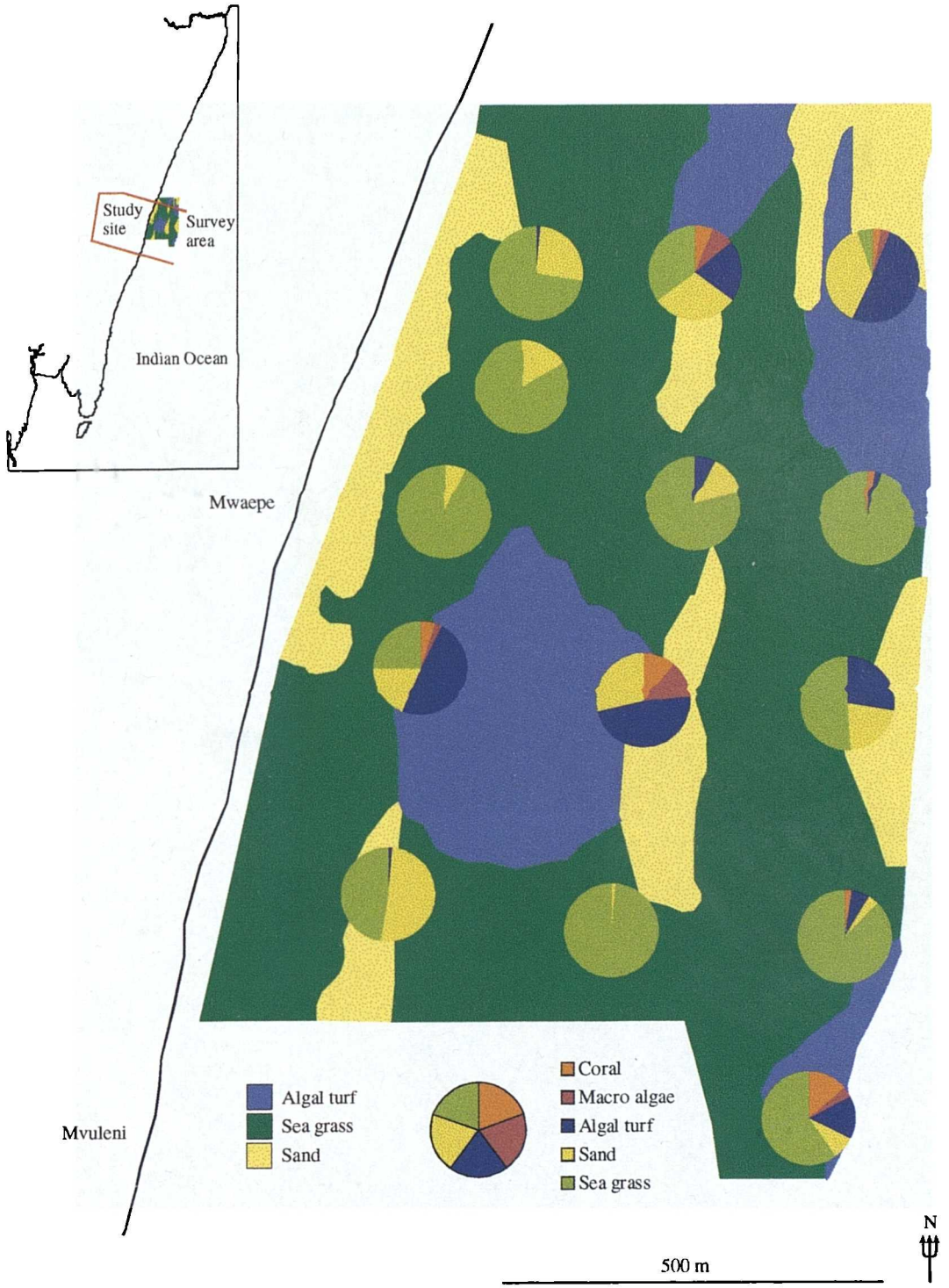
The results are presented in Appendix I and summarised in Figure 3.6 and Table 3.1.

Table 3.1 Mean % cover of the different habitats over the surveyed area. (Source: this study)

Habitat	Mean % cover
Coral	8.43% ± 5.64
Macro algae	8.36% ± 4.81
Filamentous algal turf	30.5% ± 23.24
Sand	27.97% ± 24.86
Seagrass	69.15% ± 29.16

Sand was the primary substrate or framework for 82% of the survey points. Secondary substrate was also predominantly sand, but also coral rubble (36%) and eroded coral rock (20%).

Figure 3.6 Dominant habitats in the lagoon within the study area. Pie charts indicate the % cover of different habitats at specific survey sites based on four observations at each site (Appendix I).



The dominant species of seagrass were *Thalassodendron, Thalassia, Halodule* and *Syringodium.*

3.3.1.3 Discussion

The results show that seagrass is the dominant habitat in the lagoon, and bare sand and filamentous algal turf are other important habitats. Factors such as water depth, salinity, and water motion play a role in limiting seagrass growth (Phillips, 1978; Cappo *et al.*, 1998), and may explain why there are large areas of algal turf and sand. The areas of algal turf are predominantly in shallows exposed at low spring tides, or where the secondary substrate is coral rock under shallow sand. The sandy areas are found in the deeper channels where tidal currents are strongest or where there is wave action, making the sandy substrate unstable.

Seagrasses are acknowledged as being highly productive compared to other habitats (Table 3.2). This is linked to their role in fixing carbon and supporting grazing and detrital food chains. Growth and productivity of seagrasses is greatly influenced by water movement needed to *replenish nutrients and gases and remove metabolites* (Phillips, 1978; Cappo *et al.*, 1998). Thus, the food chains that rely on seagrasses for shelter and food also rely on seagrass connections to adjacent coastal waters and sediment movements.

Table 3.2 Estimated economic productivity of three different habitats. (Source: Dr. E. Green, Global Seagrass Initiative, WCMC.)

Habitat	Total value per hectare ($/ha/yr)	Total Global Flow value ($/year 310^9)
Seagrass beds	19004	3801
Coral reefs	6075	375
Tropical rainforests	2007	3813

Food chains dependent on seagrass habitats are mainly based on the grazing by benthic epifauna of epiphytes or periphyton lying on leaf blades and surface

sediments.[21] In turn a variety of predators feed on these benthic grazers and may themselves feed, to a considerable extent, on the same foods. Most grazers prefer to eat algae rather than detritus or living plant tissue, and it is estimated that on average, only a small fraction (about 10%) of living seagrass tissue is consumed directly (Cappo *et al.*, 1998).

The trophic connectivity of seagrass beds to adjacent habitats is considered particularly important. For example, a study of the Gazi Bay ecosystem, just south of this study site (Figure 3.5), showed a broad interdependence among seagrass beds, marshes, mangroves and adjacent coral reefs (Hemminga *et al.*, 1994; Kitheka, 1996). Gazi Bay is a semi-enclosed shallow bay 10 km^2 in area. An additional 5 km^2 of mangrove forests line the bay. Stable isotope analyses indicate that mangrove-derived particulate organic matter is exported to the adjacent subtidal seabed. The signature of this material decreases rapidly with distance from the shore, indicating that the seagrass beds most proximate to the mangroves receive the most material. Moreover, changes in the isotope composition of seagrass parallel the inputs of mangrove material suggesting that the mangrove carbon is assimilated by the seagrass.

In the case of the study site, there are no adjacent mangroves or marshes, but the high flushing rate of the lagoon (max. tidal range of 4m across a relatively narrow lagoon) may supply sufficient nutrients. The amount of nutrients supplied by the fringing reef is unknown, but Cappo *et al.* (1998) review other studies which find that the organic connection between coral reefs and adjacent coastal ecosystems tend to be localised and that coral reefs are principally sinks of nutrients. A survey of the fringing reef in the same area as this study by The University of York in 1993 found that macroalgae and soft corals tended to cover the outer reef slope (TMRU, 1994). Personal observations found a high cover of free-standing macroalgae on the upper reef slope. This suggests that the base of the food chain on the reef may not be a coral-zooxanthellea relationship, and that nutrient transfer between the lagoon and

[21] Epifaunal amphipods, shrimps, gastropods, isopods, nematodes, and copepods readily graze down complexes of periphyton consisting of diatoms, chlorophytes, encrusting algae, fungi, protozoa, bacteria and sedimentary material lying on leaf blades and colonising understorey surfaces and surface sediments.

the reef slope may be higher than in the case of reefs dominated by branching and massive hard corals. An additional importance of the fringing reef in this case may be principally because it dampens water motion, creating an environment suitable for the colonisation of seagrass beds.

With respect to the health of the ecosystem, studies by McClanahan and others within the same lagoon at different sites found similar conditions to this study site (McClanahan and Muthiga, 1988; McClanahan and Shafir, 1990; McClanahan *et al.*, 1996a; 1996b). Very high levels of the sea urchin *Echinometra mathaei* were observed and this related to the lack of urchin predators, particularly keystone species such as the orangestriped triggerfish (*Balistapus undulatus*) and the tripletail wrasse (*Chelinius trilobatus*) (McClanahan, 1995a), which was attributed to high levels of fishing activity. Between 1970 and 1985 numbers of *E. mathaei* had increased from 5.3/m² to 15/m² (Khamala, 1971; McClanahan and Muthiga, 1988). Compared to marine protected areas in Kenya, where sea urchin abundance were between 20 to 375 kg/ha (wet weight), within this lagoon abundances of around 5,000 kg/ha (wet weights) were found (McClanahan *et al.*, 1996b). The high numbers of *E. mathaei* resulted in a subsequent decrease in coral cover ('10% of the area), increased bioerosion estimated to be 3.8kg/m²/yr, and a loss of topographic complexity (McClanahan and Muthiga, 1988; McClanahan and Shafir, 1990; McClanahan *et al.* 1996b).

The low fisheries yields (discussed in more detail in chapter 6) in this lagoon have been attributed to both high levels of fishing activity and indirect effects of high sea urchin abundance (McClanahan, 1994; McClanahan *et al.*, 1996a). Sea urchins have become the dominant herbivores in the lagoon competing with fish and encouraging the spread of filamentous algal turf, which McClanahan *et al.* (1996b) found to be the dominant substrate in the overall lagoon (64% ± 14.6%). This substrate is not suited to coral recruitment. The low coral cover in the lagoon has also been attributed to human activity such as trampling, disturbance from beach seines and coral collection for the tourist trade. Surveys taken over a period between 1985 and 1996 at one survey site indicated that the hard substrate ecosystem was being replaced by seagrass and sand (McClanahan *et al.*, 1996b).

In conjunction with the habitat and sea urchin surveys, McClanahan and others carried out a census of coral reef fish species in eight families[22] and found the number of species to be less than 20/500m². Similar studies in Kenyan protected areas found twice that number (McClanahan and Obura, 1995; McClanahan *et al.*, 1996b). Fish wet weights for eleven families[23] were found to be about 75 kg/ha in the same lagoon as the study area whereas in Kenyan marine protected areas wet weights for the same families were between 800 and 1500 kg/ha (McClanahan and Obura, 1995; McClanahan *et al.*, 1996b).

In relation to traditional conservation and the possible use of religious sites as conservation areas, the studies by McClanahan in the vicinity of this study site found that there was no difference in corals or fish at marine sacred sites (*Mizimu*) (McClanahan *et al.*, 1996b).

These results show that the lagoon and reef in the study area and its vicinity is in poor condition relative to other reefs in Kenya. The indications are that the ecosystem is changing to algal turf, seagrass and sand. This is a change to less complex topographic habitats and consequently fewer fish species. It does not necessarily mean that the fishery will be less productive, since seagrass beds are acknowledged as being highly productive in terms of fisheries (Phillips, 1978; Cappo *et al.*, 1998), but the opportunities to fish a wide range of species using a range of methods may be diminished.

3.3.2 Terrestrial environment

The Pleistocene-Recent raised coral reefs are exposed at the surface forming a strip about one kilometre wide parallel to the sea front. The result is a coral rag zone characterised predominantly by exposed coral rock and pockets of very shallow soil. Inland from the coral rag zone is a zone of sandy loam stretching inland to form the

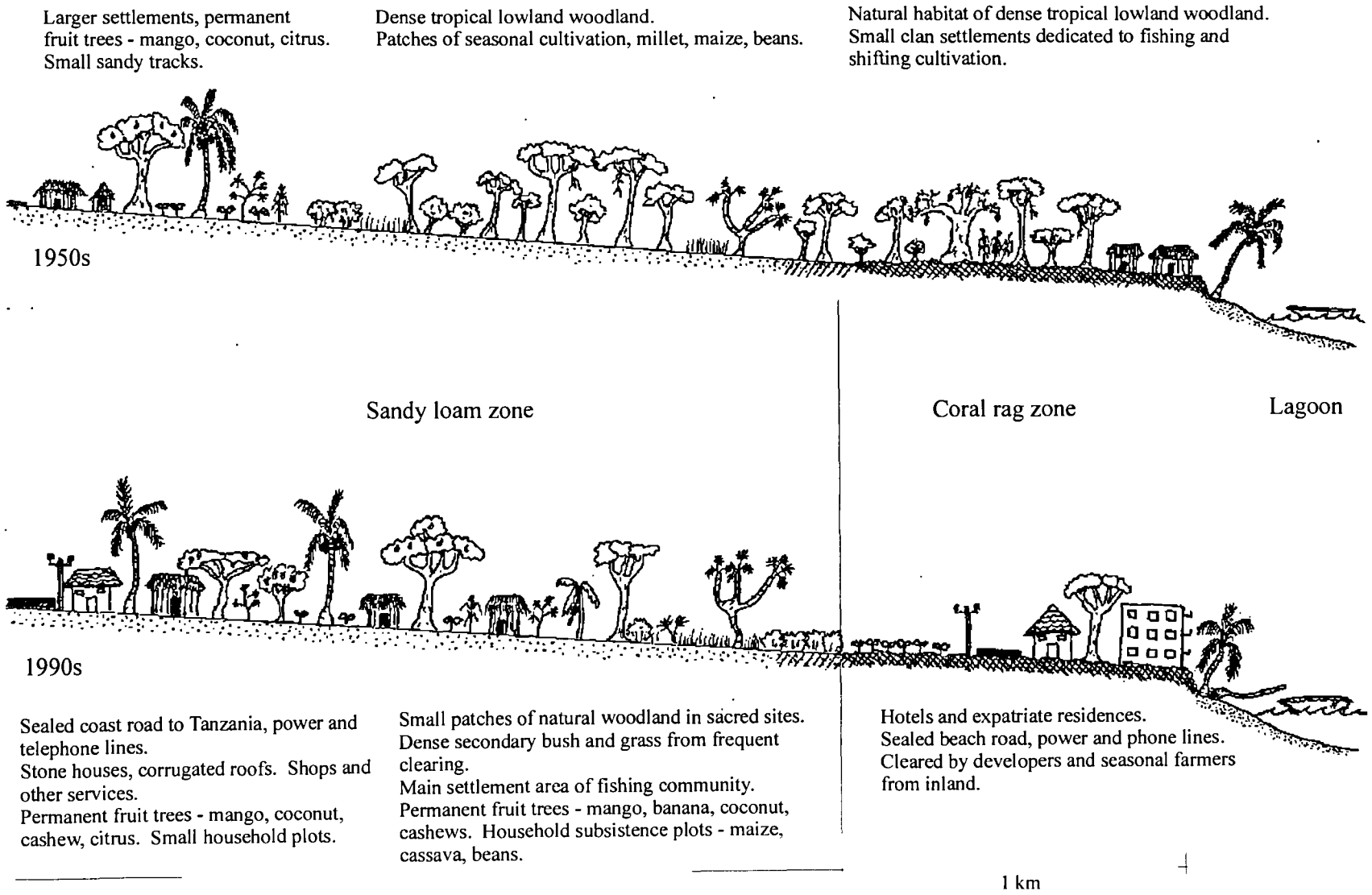
[22] Acanthuridae Balistidae Chaetodontidae Diodontidae Labridae Pomacanthidae Pomacentridae Scaridae

[23] Acanthuridae Balistidae Chaetodontidae Diodontidae Labridae Mullidae Lutjanidae Pomacanthidae Pomacentridae Scaridae Siganidae Others

coastal plain (GOK, 1991a). Despite the lack of soil, the coral rag zone maintains a natural habitat of tropical lowland woodland and dense bush. This is partly due to the levels and reliability of the precipitation and also the fresh water table being relatively close to the surface (as indicated by the number of wells within a few hundred metres of the sea front, pers. obs.) The sandy loam zone also maintains a habitat of tropical lowland woodland for the same reasons. However these natural habitats are now very limited. Since the coastal strip has been settled by human populations land use patterns have brought about changes in the prevailing habitats. Most of the area is now devoid of primary woodland except for some small stands in sacred areas known as *kaya*. Other areas of woodland remain on land that has been held under private expatriate ownership since British colonial times. Most of the land however has been cleared in the last three of four decades for agriculture, charcoal production and development.

Figure 3.7 illustrates the changes in terrestrial habitats over the last three or four decades in the study area. The sea front is now dominated by private development in the form of hotels or private expatriate residences. This zone of development stretches up to a kilometre inland in some places. Behind this strip of development lies the community of Biga, most of the houses are approximately two kilometres from the sea front. Much of the land not owned or occupied by the indigenous community is in the coral rag zone and much has yet to be developed. Migrant farmers from further inland have occupied these areas and cleared the land to grow cash crops on a seasonal basis such as tomatoes, capsicum and aubergine. In many cases seasonal farmers are encouraged by absentee landlords to maintain a presence on the land and to keep it cleared in preparation for possible development. The sandy loam zone occupied by the indigenous Biga community is characterised by household plots of seasonal crops such as maize, cassava and beans, and stands of coconut, mango and citrus trees. Any land that is not under cultivation quickly becomes overgrown with dense scrub. The presence and implications of other resource users in the study area will be discussed in more detail in chapter 6.

Figure 3.7 Changes in terrestrial habitats due to changing land use patterns in the Biga area between the 1950s and 1990s.
(Source: adapted from Malleret-King, 1996; this study)



The loss of woodland and access to the coral rag zone for the community has had an impact on both fishing and agricultural practices. The lack of large trees with which to build dugout canoes has become a major cost and constraint. Now the only trees large enough for canoes are mango trees planted by earlier generations, and these are becoming increasingly scarce within a practical distance to transport to the sea. Other material needed for traditional fishing methods such as traps have also become harder to come by. This has contributed to the increasing use of other methods such as spear guns. Agricultural activities have also changed due to the lack of access to the coral rag zone. The traditional shifting agriculture of the indigenous people took advantage of the more fertile soil on the coral rag zone (Spear, 1978; this study). Although the sandy loam zone is easier to work, the heavily forested areas on the coral rag produced more fertile soil due to the presence of the dense forest, and this was exploited using shifting agriculture. These issues and the land use patterns in the study area are described in later chapters.

3.4 Conclusion

The local environment of the study site, on which the local people depend, is clearly diverse and complex. Climatic seasonality provides opportunities and constraints both on land and in the sea, affecting agricultural and fishing practices. These practices and the effects of seasonality are considered in detail in chapter 7.

Variations in the marine environment have been attributed to the topography of the nearshore environment, where the fringing reef forms a protected lagoon, and to human activities such as fishing, which has increased urchin abundance and algal turf coverage. These habitats and the changes that occur to them determine the species available for human exploitation. For example, increased competition between high numbers of urchins and herbivorous fish has been observed to cause these fish to move to deeper waters (Hay, 1991), which in the case of this site may be inaccessible to fishing for much of the year. The dominant marine habitat is seagrass in the area adjacent to the studied community, and the fringing reef slope is predominated by macro algae and soft corals. From a fisheries perspective, the seagrass beds are important because the outer reef slope can only be fished from December to March during the calm Northeast monsoon. Clearly, the urchin situation within the lagoon

suggests that the productivity of the marine environment is sub-optimal from a fisheries perspective. The socio-economic factors that have led to the current state of the fishery are discussed in later chapters, and an analysis of the fishery is given in chapter 7.

Similarly, the terrestrial environment has undergone changes due to human activity. Most of the natural habitats have been lost due to human settlement in the area. These patterns of settlement and the factors that precipitated the changes are discussed in the next chapter. From the perspective of the local community, the effects include the loss of important raw materials for traditional fishing practices and the inability to carry out traditional shifting cultivation. This in turn may have led to an increasing reliance on the marine environment and changing fishing practices.

From the fishing community's perspective, their local environment provides livelihood opportunities based on agriculture and fishing. The settlement of other groups in the area and the development of tourism should ostensibly have increased the livelihood options for the local community. But, as later chapters show, the reverse has been the case. The changes that have occurred to the local environment have inhibited their traditional livelihood strategies, which have not been compensated by surrounding development.

4 THE HISTORY OF POLITICAL AND SOCIAL CHANGE: INFLUENCES ON RESOURCE ALLOCATION AND USE IN THE STUDY AREA

4.1 Introduction

A major influence on the processes and structures determining access to and control over resources has been identified in earlier chapters as the cultural and political situations of local communities. These aspects determine to a large extent the social differentiation within social groups and this in turn affects an individual's access to resources. The aim of this chapter is to present the cultural and political history of the community of Biga so that the present situation, in terms of the both the natural environment and socio-economics, can be understood. Significant historical events or periods in the past often determine the current availability of resources, such as wholesale annexing of resources by more powerful groups or the imposition of different political regimes. Other historical factors include how embedded local traditions relating to resource use are. These kinds of traditions can be considered *de facto* resource management strategies, but their persistence in changing conditions will depend on how embedded they are and how applicable they can be to contemporary situations.

The first part of this chapter outlines the origins of the people who make up the studied community. The resource use patterns of the people of Biga relate as much to the environments they originated from and other groups they have been in contact with as to their current situation. East Africa has been a melting pot of cultures for many millennia and this aspect has influenced resource use patterns in the study area to the present day. The opportunities available to the people of Biga and their forebears will be shown to tied to the activities of different peoples who have been in the area at certain times in the past.

In the context of resource use patterns over time, the second part considers the origins of fishing as a livelihood activity in Biga. The evidence presented in the first part suggests that fishing is a relatively recent activity. There is a possibility therefore, that customs relating to the marine environment are not sufficiently embedded to resist strong external influences. The third part examines the principal cultural

influences on resource use and access in the area, Islam and traditional spirit-based beliefs.

The final part of the chapter is concerned with politics and power. In communities where livelihoods are based on the exploitation of natural resources, politics and power play an important role in determining resource allocation. Changes in the balance of power relate to cultural influences as well as political regimes. The historical influence of traditional beliefs, Islam and the British colonial regime on power and politics are examined in the context of resource access in the study area. This leads on to the contemporary situation where the influences of the past are clearly evident. This chapter is in essence a historical description of key influences on resource availability to local people in the study area. Without an understanding of the past it would not be possible to understand the present situation, including livelihood activities and the capacity to which people can determine their situation.

4.2 The origins of the people of Biga

The geographical position of Biga, given in the previous chapter, accounts to a great extent for key cultural and political moments in their history. Although the people of the Biga community will be shown to be relative newcomers to the coast, the major cultural influences owe much to the regional importance, particularly commercial, of the East African coast over many millennia.

The East African coast has had a long association with many of the cultures in the Indian Ocean basin, Asia and the Mediterranean. Surviving documents of the trading opportunities along the East African coast date to the "Periplus of the Erythraen Sea", written in the middle of the first century AD as a traders' manual for Egypt-based Greek merchants. The document lists the available exports and imports in demand at each port along the East African coast (Allen, 1993). Later Ptolemy's "Geography" also described a number of ports along the East African coast (Allen, 1993). Other texts referring to trade with East Africa include Procopius's "Persian Wars" written in the sixth century AD, and Chinese texts from about AD 860 describing the East African coast (Throckmorton, 1987). Chinese coins dating from the seventh century AD have been found in such numbers along the East African coast that they must

have been used for trade, and large quantities of tenth century Chinese ceramics have also been found. Prior to this the area was also known to belong to the lands of the ancient civilisations of Egypt, Mesopotamia, Persia, Arabia, the Indus Valley and later the Hellenic world. In the second and first millennium BC the area belonged to the Himyartic Kingdom of Southwest Aramia which meant that the Kingdoms of South Arabia had direct contact with the East African coast at that time (Prins, 1961). The strong influence of Islamic states in the area occurred between the seventh and thirteenth centuries, when people from the Arabian peninsular and Persia settled along the coast. Significantly the leaders and followers of these settlers set out to play a political and economic role in the region (Prins, 1961). These Asian and Arabian settlers formed relationships with the coastal people they met, intermarrying and settling (Knappert, 1979).

Who the Arabian, Asian and Mediterranean people were trading with is of some debate. The pre-history of East Africa suggests that the origin of the people of the northern region of the coast as far as modern southern Somalia, was Afroasiatic, and further south the people were of Bantu origin (Prins, 1961; Spear, 1978; Knappert, 1979; Hromnik, 1981; Sutton, 1981a; Allen, 1993). The people of Biga, the community of this study, are Bantu and are a member of one of the two main ethnic groups of the Kenya coast. These two coastal ethnic groups are the Mijikenda who are Bantu and the Swahili who have mixed Bantu and Asian/Arabian origins. The Mijikenda constitute a group of nine subgroups[24] to which the people of Biga belong to the Digo.

The early history of the Bantu, 8,000 to 10,000 years ago, suggests a distinctive way of life in the central region of Africa from the Atlantic coast to the Nile basin. The region was thought to be much wetter than at present with many waterways. The people were assured food and water and they developed an aquatic tradition with advanced techniques of boat building and fishing. They were more sophisticated than other late stone age hunter gatherer cultures in the region (Sutton, 1981a). The starting point of the Bantu now on the East African coast is thought to be in the area

[24]Kauma, Giriama, Chonyi, Jibana, Kambe, Ribe, Rabai, Duruma and Digo.

of central Cameroon (Hromnik, 1981) or the headwaters of the Zambezi and Lualaba rivers (Knappert, 1979). They are thought to have started moving eastwards in the middle of the first millennium BC (Knappert, 1979; Hromnik, 1981) along the tributaries of the Zambezi river by means of canoes (Knappert, 1979). At some point in the eastward migration there was a split, some continuing east to the coast of present day Mozambique and others heading north (Hromnik, 1981).

This split may explain the possible separate origins of the Mijikenda and the Bantu aspect of the Swahili. The Bantu branch that continued to the Indian Ocean coast made a transition from riverine paddlers to maritime fishers and began a northerly migration along the coast, establishing small fishing villages along the way. This was possible because at some point in the middle of the first millennium AD the Bantu learned to sail and build outrigger canoes, a Malay-Polynesian invention (Knappert, 1979; Allen, 1993), from people of Indonesian origin who had reached the East Coast of Africa via Madagascar. The Bantu villages became remote trading and fishing outposts along the coast north to modern day southern Somalia and east as far as the Comoro islands. Their northerly migration was probably halted by contact with the Cushitic peoples such as the Galla and Oromo (Knappert, 1979; Sutton, 1981b). During their northerly migration the Bantu came into contact with the Arabs, Persians and Indians with whom they intermixed and became the Swahili people. The use of outrigger canoes became less common as they moved north and took on the sailing technologies of the Arabian and Asian traders (Allen, 1993). By 800 AD Swahili was a distinct language and by the 1400s it was used all along the East African coast (Nurse and Spear, 1985). The linguistic roots of Swahili remain Bantu and words common to the Bantu languages from the East Coast to Central Africa relate to boating and fishing (Knappert, 1979; Hromnik, 1981).

The origins of the Mijikenda suggests that this geographical grouping of Bantu lost their fishing and boating skills as they migrated further north and east from the point of the inland split with the coastal branch. Through contact with southern and eastern Cushitic people and changing environments they became pastoralists and agriculturalists (Spear, 1978; Hromnik, 1981). Again their northerly spread in the east was halted by the Cushitic peoples in the region of southern Somalia, an area known as Shungwaya. Allen (1993) suggests that the Shungwaya peoples were the

antecedents of all the East African coastal Bantu people, including the Swahili, but Spear (1978) and others (Hromnik, 1981; Robertson, 1984) prefer the split theory. According to Mijikenda traditions they arrived in their present homeland of the hilly coastal hinterland of Kenya and northern Tanzania from Shungwaya in the mid sixteenth century following conflicts with the Cushitic peoples (Spear, 1978; Allen, 1993). On the strength of their agricultural activities they developed trading relationships with the coastal Swahili communities and also with the Kamba, Waata, Chagga and Galla peoples inland and to their north. Through trade cultural and political relationships developed and these in turn became inter-ethnic institutions set up to deal with their trading situations (Spear, 1978). Much of the Arab ivory trade in the eighteenth and nineteenth centuries was established through the trading relations the Mijikenda had with hunting tribes further inland.

As agriculturalists the Mijikenda supplied the coastal settlements of the Swahili with grain and other foodstuffs, dominating the food trade for coastal communities who could otherwise only import food by sea through their maritime trade networks. Only in drought years were foodstuffs imported by sea and the trade of grain went from the Swahili to the Mijikenda. This integrated local economy continued through the seventeenth and eighteenth centuries. The situation at the time in the area of the study site is illustrated on map (a) in Figure 4.1. Gazi was a Swahili town and Kinondo was one of the main Digo villages established on the lowlands as the Digo people expanded from the range of hills further inland.

During the nineteenth century the influence of the Swahili and Arab villages and towns along the coast began to increase. This was because they were under the jurisdiction of the Sultan of Zanzibar whose power and wealth was based on the slave trade, a booming industry at the time. Influential Swahili and Arab households all along the coast were able to develop a plantation economy of their own based on slave labour. Slave labour originating from southern central Africa was imported from Kilwa four hundred miles to the south via Zanzibar and as a result the trading relationship with the Mijikenda began to collapse (Figure 4.1 (b)). The slave driven plantation economy continued to thrive despite the abolition of sea trade of slaves in 1873 by the British. The plantation economy had strengthened the influence of the Sultan of Zanzibar and slaves could be imported overland and then exported from

numerous small ports along the coast. In many areas the Mijikenda were forced to move off the land they had previously occupied. The plantations were eventually abandoned some time after 1876 when the land transport of slaves was also stopped by the British (Brantley, 1981). After the abolition of slavery in 1907, slaves remained on the plantation land, still owned by Swahili-Arabs, as squatters working as casual labourers and small-scale farmers on the most fertile coastal strip of land. The Mijikenda also resettled parts of the coastal where they had been kept off by the plantation economy (Cooper, 1986).

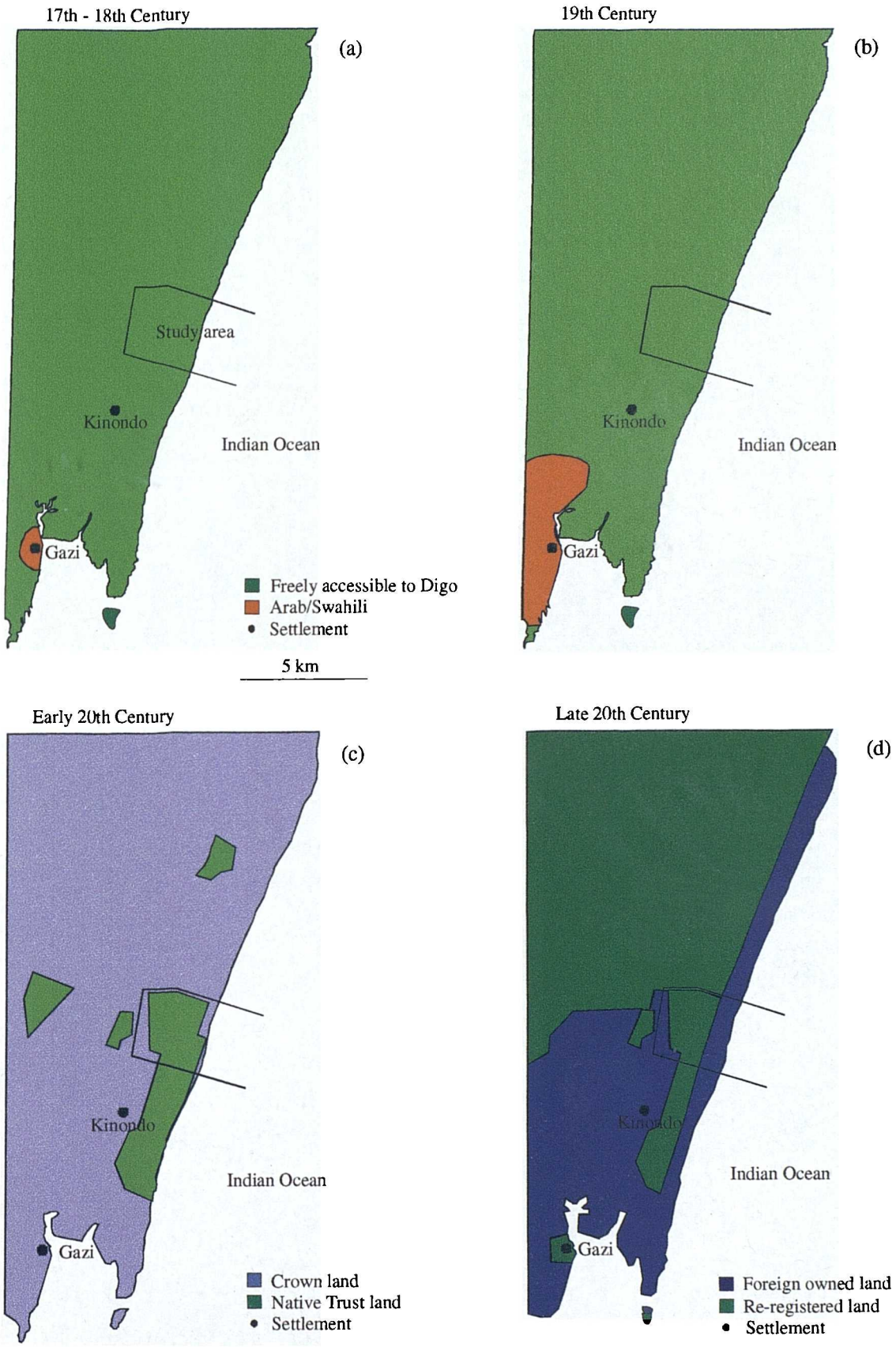
By the early twentieth century British influence in the region was strong. A market for land developed, which further strained the old alliances between the Mijikenda and the Swahili. Where previously the Swahili had been the political representatives of the Mijikenda to outside powers, they now used their position to sell land to European and Indian speculators (Willis, 1987).

Half a century of British colonial rule followed the plantation era, with equally dramatic effects on resource access for the Digo. Under the Foreign Jurisdiction Act of 1890 Crown lands were established where there were no settled forms of government or where land had not been 'appropriate either to the local sovereign or to individuals' (Okoth-Ogendo, 1991). This was the precursor to the Crown Lands Ordinance of 1902 which asserted "that the Crown and not the local people had title to some land" (Okoth-Ogendo, 1991:12) and was the basis for establishing native reserves (Figure 4.1 (c)). The ramifications of these manipulations of land ownership continue to be felt by local people today (Figure 4.1 (d)). As the case study of Biga will show, their continued reduced access to land since the nineteenth century plantation era has had a direct influence on their activities in the sea.

4.3 The take up of fishing by the Digo

If the genealogical history of the Mijikenda and the Bantu aspect of the Swahili separated some time ago is correct, as suggested by a number of writers (Prins, 1961; Spear, 1978; Knappert, 1979; Hromnik, 1981; Sutton, 1981b), then the Digo took up fishing relatively recently. The exodus from Shungwaya eight age sets ago was by

Figure 4.1 Changing land tenure over the last 400 years in the area of the study site.



agriculturists who settled the hilly and densely forested hinterland overlooking the ten mile wide coastal plain. This area was sufficiently far south from their northern aggressors and the hilly territory meant that their fortified villages (*Kayas*) were also more secure. The region was also wetter than the north and therefore more productive, particularly in the southern zone of their range. The Digo settled the southern and most fertile part of the range and it was on the strength of their agriculture that they formed the closest relationship with the Swahili through trade.

The expansion of the Digo from their fortified hilltop *Kayas* to the fertile coastal plain occurred during the seventeenth and eighteenth centuries (Spear, 1978). Smaller sub-*Kayas* were established along the coast near Swahili coastal settlements where the Digo exchanged sorghum, maize, sesame, copal and coconuts for fish, cloth, beads and wire from the Swahili (Spear, 1978). With the collapse of the trading economy due to the growth of the Arab slave trade and the establishment of Arab-Swahili plantations the Digo now living near the coast were also competing for land with the plantation developers. Having lived in close proximity to the trading and fishing Swahili communities for over a hundred years the Digo would have been exposed to fishing techniques and opportunities and many could well have been fishing with or for the Swahili. The fact that Islam is more widespread among the Digo than other Mijikenda people may be further evidence that the Digo took up fishing with the Swahili and at the same time taking on their religion and customs (Mkangi, 1995; Glaesel, 1997). Without the trading economy many more Digo living on the coast would have taken up fishing to supplement the food from their agricultural activities.

During the nineteenth century Digo communities living on the coast became dedicated fishing and farming communities. They traded their fish with other Digo people from further inland and also with other Mijikenda communities. Older members of Biga community said they remember trading fish for millet and cassava and other agricultural produce with Duruma people (the most inland of the southern Mijikenda) earlier this century. The families and clans who had taken up fishing established settlements on the seafront. As older members of Biga explained, agricultural activities took up more time than fishing, which were only a few days a week to meet their needs. There were fewer fishermen earlier this century applying

much less effort to catch sufficient fish for the needs of the small communities (cf. Chapter 7).

The relatively recent role of fishing amongst certain Digo communities suggests that their other forms of livelihood, namely agriculture, would have remained important. Yet some Digo communities have become predominantly fishing dependent over a relatively short period, as will be shown by the community in this study. The reasons for this, as suggested above, are because of the reduced access to land for cultivation. Further evidence of this in recent years has been the increasing number of young men who have taken up fishing as a livelihood of last resort. These two aspects of fishing amongst the Digo, the relatively short take-up period and an activity of last resort, may mean that the traditional institutions used by Digo people to govern their fishing related activities are not sufficiently embedded to persist through changing social and ecological conditions. The traditional aspects of resource use and allocation are discussed below.

4.4 Local beliefs and Islam

The early expansion of Islamic people on the East African coast started in the seventh century and continued through to the thirteenth century (Prins, 1961). Yet the Mijikenda were not part of this and it was only until the trading era of the seventeenth and eighteenth centuries did they begin to assimilate aspects of Islamic culture and then it was only by those who lived close to Swahili/Arab settlements. Conversion to Isalm was done on an individual basis and as a result Digo fishing communities held a mix of Islamic and local beliefs which, among other things, affected their access to and control over resources (Trimingham, 1964; Glaesel, 1997).

4.4.1 Local beliefs

The local beliefs of the Digo are spirit-based. Belief in a potentially harmful spirit realm that can be partially controlled through acts of appeasement or codes of behaviour affects every aspect of life in Digo society (Gleasel, 1997). There were numerous cases of the spirit realm affecting life in Biga during this study. In one

significant case a household had not cultivated their land because evil spirits had possessed it for many years. It has been suggested by Mkangi (1995) that some of the earliest Mijikenda to enter fishing were the sons of traditional healers (*mganga*) who were known for their ability to manipulate powerful spirits. This may have given them the confidence to venture into the unfamiliar marine environment.

Trimingham (1964) identified three classes of spirits: ancestral spirits (*mizimu*), nature spirits (*jini* and *shetani*) and possessive spirits (*pepo*). All these types of spirits may require offerings (*sadaka*) at sacred sites either to abate their anger or bring good fortune. All these kinds of spirits inhabit terrestrial and marine habitats, but their activities tend to be restricted geographically at specific sacred sites or physical features (Glaesel, 1997).

Among Digo fishing communities the maintenance of good spirit-human relations were considered to be of great importance. Certain spirits, such as *vibwengo*, were considered to inhabit beaches and inshore areas, and if they were sited bumper harvests of fish could be expected. Other spirits include *ngoloko*, which inhabits mangroves areas and was greatly feared for its murderous claw, along with *kitu nusi* who drowned sleeping night fishers and fishers using their canoes for sexual activities (Glaesel, 1997). Great importance was given to making offerings to the spirits to maintain good relations. Offerings were made at specific sacred sites (*mizimu*, *kaya*) that tended to be entered only for reasons of spirit mediation. As a result some of these sites (*kaya*) have become islands of biodiversity in the Digo areas, but none of these sites are in the sea. Although there were sacred sites in the sea related to sites on land, the extent to which they have been left untouched for customary reasons has been very limited. Marine related customs may not be as embedded in the culture of the Digo people as land based customs because fishing is a relatively recent activity. The 'sacredness' of sacred areas in the sea has not been able to resist the growth in demand for resources as pressure on land has increased.

In recent years belief in the spirit world has been challenged by the younger generations who have either taken up stronger Islamic beliefs or taken on western ideas. In many instances sacred areas have disappeared because sightings or evidence of spirit activity have ceased to be reported. Elders of Digo communities lament that

the lack of spirit-human mediation has been the cause of the problems fishing communities now face (Glaesel, 1997). Although the belief in the spirit world enabled there to be social causation of environmental problems, the dominant role played by certain elders in spirit human relations was equally to do with the maintenance of community power and influence structures. In the changing political environment, younger generations and other authorities have challenged the traditional power of the elders.

4.4.2 Islam

Despite contact with Islam for a number of centuries, mass conversion amongst the Digo did not take place until the early twentieth century. The principal reason for conversion to Islam was in response to the British colonial government's land allocation policies.

The ten-mile wide coastal strip had been a British protectorate since the signing of an agreement between the Sultan of Zanzibar and the British in 1895. Strictly it should only have included the pockets of land relating to the plantations around Swahili/Arab settlements. However the British administered the ten-mile coastal strip as a protectorate, with concessions to Muslims, until Kenya gained independence in 1963. Access to land in the British protectorate was tied to ethnicity (Ng'weno, 1995), which the British had difficulty defining and so used religion as the defining characteristic. Under the Crown Lands Ordinance of 1902 the protectorate authorities had extended their political jurisdiction to included claims to ownership of the original title to the land (Okoth-Ogendo, 1991). To make more land available for colonial use, the Crown Lands Ordinance reduced the amount of land with secure tenure for indigenous people by removing the possibility of acquiring land through clearance (Moore, 1991; Ng'weno, 1995) (see figure 4.1 (c)). This effectively eliminated most Digo claims because shifting agriculture was how they used the land. For them, the only form of ownership was vested in trees planted for fruit such as coconuts, citrus and mangoes. As a result only Muslim subjects of the Sultan of Zanzibar had their claims recognised and only a small proportion of the land was set up as native reserves. So the indigenous people became tenants of the Crown in their

own land (Ng'weno, 1995). Muslims were allowed to acquire freehold title to land but Digo were not (Sperling, 1988).

However the British racial and ethnic segregation did not correspond in terms of residence and land use because of the historical relationship between Swahili Muslims and Digo people. There were enough Muslims who were Digo on the coast to make the artificial distinction cause problems for the Protectorate administration in matters relating to land ownership and inheritance. Further more the British subjected the Muslim people and the 'native' people to different laws. The Digo were subject to the British colonial Native councils and District Court whereas Muslims were subject to Mohammedan law and under the jurisdiction of the Liwali and Mudirs (Sperling, 1988; Ng'weno, 1995). So it was in response to the British colonial policies that most Digo people converted to Islam in the 1920s in an attempt to resist the loss of their land, and to maintain a degree of independence through Mohammedan law.

In terms of increased access to and control over land for the Digo under British policies, the mass conversions of the 1920s had limited success. However, within Digo society the conversions had profound effects on resource use and allocation because it was in direct conflict with many of their traditions. For instance Islamic inheritance laws are patrilineal whereas customary Digo laws of inheritance are matrilineal. Although the Muslim structures of authority provided an alternative to the British colonial ones, it challenged the traditional structures of authority. The most important member of a family changed from being the mother's brother to the father in terms of inheritance, a situation reinforced by British policies. Married women became economically dependent on men and notions of status taken from the Islamic culture changed dress codes, introduced leisure time and encouraged a disdain for agricultural work (Ng'weno, 1995). These conflicts of authority between the structures of dominance and the differing social attitudes continue today.

Both the British colonial land policies and Digo conversions to Islam in reaction to the colonial policies undermined the customary institutions by which resources were used and allocated. Without the land available to continue traditional shifting agriculture, and the increasing dependence on the growing cash economy, increasing numbers of Digo were forced to enter fishing or increase their fishing effort, or seek

wage labour elsewhere. These changing cultural and socio-economic conditions would have reduced the effectiveness of many spirit-based rules because they ceased to be appropriate or possible to adhere to.

4.5 Politics and power

Some of the impacts of the Arab plantation economy and the British land policies on resource access and use have been described above. It is evident that power and politics in the region are intimately linked to the relationship between the people and the resources they exploit for their livelihoods. In pre-Islamic times the power of the elders and certain individuals through the spirit-based traditions were a reflection of the importance of natural resources in Digo society.

If the basis for political influence and power lies in the use and allocation of resources, the mechanisms by which resources are used and allocated are important to understand. The socio-cultural evolution of the Digo people described above identifies three important influences: the traditional beliefs of the Digo, Islam and the British colonial regime.

Whilst many traditional beliefs were maintained in conjunction with Islamic beliefs; Islam changed the balance of power in many ways. Apart from challenging customary inheritance laws, Islam also encouraged individualism and wealth accumulation (Ng'weno, 1995). Traditionally success was considered to be a function of supernatural forces or fate. Successful people were envied because people feared that the wealth would be used to increase power and to extend influence and control over resources at other peoples' expense. A prosperous individual was typically called on to share wealth with kinsmen and wives. Failure to share resulted in future community help being withheld and accusations that the individual's prosperity had come about by cheating and stealing through the use of black magic (Gerlach, 1964). Such traditional systems facilitated food distribution and reduced big divisions in society. Prosperous individuals invested in their kin groups and thus obtained a host of social, economic and political rewards, primarily by obligating others to aid them in the future (Gerlach, 1964).

The colonial administration found liasing with communities through the traditional authorities, groups of elders, difficult and inefficient so they introduced a hierarchy of representatives for the regions they administered. This included the position of chief to represent a number of villages. Gerlach (1965) notes the demise of tradition in the late 1950s when Digo elders made half hearted attempts to bring down rain, previously an important ritual, because government appointed chiefs and headmen were concerned that the district government would remove them if they carried out such pagan activities. The appointed chiefs realised that their political futures were no longer dependent on traditional activities relating to spirit based beliefs.

Despite the imposition of a new structure of authority by the British some traditional institutions and organisations have adapted well to the changes and many of the old beliefs and customs continue to play a role in contemporary Digo society. The layout of settlements and the social organisation amongst the Digo are based on kinship groups. Whilst describing the evolution of Biga to its present layout, the elders referred to clans and particular individuals who were heads of these groups. There was no reference to a single leader in the past and it was explained to me that the community consisted of an association of kinship groups. Traditional leadership was based on kinship groups and authority exercised through the elders of the kinship group. Elders of different kinship groups continue to meet to discuss issues of mutual interest and to resolve conflicts despite the existence of administrative authorities carried over from the British. The role however is now limited to very local concerns and they are very careful not to undermine the authority of the government administration.

4.5.1 Recent changes

As indicated above, the colonial system of administration has continued to the present day, with the position of chief being government appointed. Lower levels in the hierarchy include sub-chiefs or assistant chiefs, appointed to assist the chiefs and village chairmen to represent each village (see Table 4.1). Throughout the study period I frequently noticed an underlying conflict between the roles of the traditional leaders and the appointed civil servants, particularly because they were members of

the same community. I was required to present myself formally to both groups before undertaking any research in the community, and suspicion on the part of traditional elders in the early stage of the study held up aspects of the work for many months.

The mass conversion to Islam in the early 1900s, which was in response to colonial government land regulations, brought about further change in the local leadership and social organisation. The Islamic religious leaders in the villages became increasingly influential in social aspects of everyday life. Many traditional laws were based on the fear of the spirits, but the increasing influence of Islam and the more recent exposure to western European cultures lead the younger generation to be sceptical of the traditional beliefs.

4.5.2 Contemporary politics and power

Contemporary politics and the distribution of power in Kenya continue to be shaped by the British colonial past. Since independence in 1963 the country has been ruled by a single party, the Kenya African National Union (KANU), in much the same way as the colonial government. Rule has been legitimised on a paternalistic ideology of trusteeship based on limited participation, non-democratic representation by an elite and developmentalism (Klopp, 1998). Although a bicameral national legislature was established after independence, the principal structures of governance established by the colonial government, such as the provincial administration and county councils, has not changed. These structures effectively extend central government into local areas. Since there has only been a single party these structures ensure political control throughout the country by the strategic appointment of KANU members to key civil service positions. Thus the boundary between politicians and civil servants has been blurred and the power wielded by politicians and their appointees is significant. It is this characteristic of contemporary power distribution in Kenya that has such an impact on people's access to and control over resources.

The mechanics of land allocation provides a good example of political influence on access to and control over resources. One of the issues investigated in this study relates to illegal allocation of land. The important relationship between the terrestrial

and marine activities of the people of Biga is based on the fact that constraints to resources in one environment increase pressure on resources in the other.

As described earlier, the British took control of all land in Kenya under the Crown Lands Ordinance of 1902. The Governor had the power to alienate land at will, even after 1939 when trust lands were established for the African population (Figure 4.1 (c)). This gave the Colonial authorities complete control over who gained access to and control over land (Klopp, 1998). Following independence the President inherited these powers of allocation through the constitution and the Trust Land Act. Responsibility for trust lands in rural areas was given to county councils as a mechanism to prevent illegal allocations through their locally accountable membership. However the county councils are not autonomous from central government. Although two thirds of the councillors are elected by local people and are therefore accountable to local people, the rest are nominated by the Minister of Local Government. Thus local KANU members or clients, some of whom have been rejected in local council elections, become councillors (Oyugi, 1993; Klopp, 1998).

In allocating land the county council has to ratify each allocation of land, following a series of meetings and debates. The allocation is then screened by the provincial administration when it passes through the District Plot Allocation committee chaired by the District Commissioner (DC). Finally the allocation passes to the Commissioner of Lands for the title deeds to be drawn up. Despite the theoretical possibility of public scrutiny, KANU has such control over the councils and other civil servants through political appointees, that the allocation of trust land, which is public land, in return for financial and political favours is common place. The beneficiaries are seldom the local people. A prospective councillor at the 1997 local elections in Kwale district explained the situation. "People haven't understood that the ruling party and the government should be separate. The party runs the government, which is a toothless dog. The government is not independent, administration has to do what the politicians say." (Mwabata pers. comm.). The examples of illegal allocations in the coastal area in and around Biga are numerous. In Diani, the neighbouring location to Biga, illegal allocation of land to a foreign hotel group sparked violent protests by locals (*East African Standard*, 1997). In early 1996 fishermen in the area protested to the DC against the allocation of beach access roads

to developers. The local Member of Parliament was implicated in the allocations (*East African Standard*, 1996).

Table 4.1 The current (from the British colonial) administrative structure and regional division for the study site of Biga community.

Administrative Division	Name	Senior Civil Servant
Country	Kenya	President
Province	Coast	Provincial Commissioner (PC)
District	Kwale	District Commissioner (DC)
Division	Msambweni	District Officer (DO)
Location	Kinondo	Chief
Sub-location	Galu	Assistant Chief
Village (*Mjiji*)	Biga	Village Chairman (elected)

Within the administrative division of Kwale district outlined in Table 4.1, there are three political constituencies, Matuga, Msambweni and Kinango. Moves towards democracy began in the early 1990s when constitutional changes allowed for multiparty elections in 1992 and again in 1997. Like much of the developed world in the nineteenth century (Giddens, 1999), democracy has been strongly resisted by established elites and changes to the way the country is governed have been slow to come. Within Msambweni constituency, which incorporates the study site, the MP (Mr Kassim Mwamzandi) had been in place for more than thirty years until the second multiparty elections in 1996. This was also the case in the neighbouring constituency of Matuga. The established elite has resorted increasingly to desperate tactics to stay in power in the face of growing disillusionment from the public. During the run up to the 1997 elections ethnic differences stirred by KANU connected people lead to inter-ethnic clashes and the death of sixty people in Kwale district (EIU, 1998). The use of land for political patronage have increased as the stakes for power have risen following calls for liberalisation from the international community (Klopp, 1998). More local conflicts over natural resources, including fisheries, have also become increasingly politicised. Local fishers have questioned the relationships between migrant fishers from Tanzania and local officials. As competition for fish increase, prospective politicians have supported local fishers by exposing illegal

identity card scams in a bid to remove the migrant fishers (*East African Standard*, 1996).

The current politicised environment is largely due to liberalisation and the influence of politicians over civil servants. Groups seeking to resolve conflicts over resources often use politicians to put pressure on civil servants, but the power imbalance means that decisions are often based on local vested interests. As a result decisions relating to resource allocation may have nothing to do with long term interests or the wider social needs and sometimes decisions blatantly flout the law.

4.6 Conclusion

In this chapter I have sought to illustrate how events in the past have determined to a great extent the current availability of resources for local people. Some examples discussed in the chapter include cultural influences, such as Islam, that have changed traditional resource access patterns. Powerful regimes such as the Arab plantation era and British colonialism changed established livelihood opportunities. Traditional systems of authority have been undermined and challenged causing the exploitation behaviour of local people to change. Individualistic policies pushed by the state, rooted in Western ideology, and the recently adopted Islamic religion have also changed exploitation patterns of local people.

The final part of the chapter gave the illustration of land grabbing as an example of an increasingly politicised environment. Politicians were shown to be disproportionately powerful for historical reasons. The effect of this was the abuse of institutional structures and the misallocation of resources. Small-scale fisheries have not escaped the effects of this situation.

5 ANALYSIS OF KEY ORGANISATIONS AND INSTITUTIONS IN THE STUDY AREA

5.1 Introduction

An examination of different institutional arrangements that relate to human-environment interaction in the study area forms a key element in understanding the current circumstances of the people of Biga. It also sets the context for the analysis in chapter 8 of their actions relating to resource access problems. In this chapter, the main organisations and institutions that the studied community faced when dealing with specific resource access and control situations are considered; principally those that form part of the social network analysis (chapter 8). Some of the factors that inform or influence these institutions, such as international policies and sources of power, are also examined.

The hypothesis advanced is that the way groups or individuals tackle resource access and control problems does not reflect identifiable institutional processes. This does not mean that in every case institutions were not involved, for in most cases 'people's resource access and control are shaped by many interacting institutions' (Leach *et al.*, 1997b). But the suggestion is that there may also be cases when people simply seek whatever path is necessary to solve their problems (cf. part 2.6 and 2.7). This study tests the hypothesis by investigating the actions members of the fishing community of Biga took to solve resource access and control problems.

In the first and second parts of this chapter, the roles and functions of the institutions that relate to resource access and control within the study area are identified and their status is assessed. The role of an organisation's power in determining the outcome of negotiations over resource access and control is considered in the first part. This is followed by a look at the wider influences on national institutional arrangements, such as international trade agreements and regional conventions. The difference between organisations and institutions for the purpose of this study were given in section 2.2. This chapter refers to formal and informal institutions and/or organisations for ease of description. In this case, institutions that have a direct organisational manifestation

are considered formal institutions, whereas those that are maintained by people's practices or traditions are considered informal institutions.

In the third part of this chapter the environmental entitlements framework developed by Leach *et al.* (1997) is used to illustrate how some of these institutions are linked to resource access and control, and subsequently the livelihoods of the studied community. The environmental entitlements framework links livelihoods, environments and institutions to the way different people have command over resources. Using this framework also illustrates how the different components of the thesis are linked to the question of resource access and control. In addition, the frameworks set a broad base for the detailed *analysis of livelihood systems (chapter 7)* and problem solving actions (chapter 8) in Biga.

5.2 Formal institutions and resource access in the study site

The formal institutions identified below are dominated by Western European approaches to resource access and control. The main reason for this is because Kenya inherited most of its State organisations and institutions from the British, and because Western organisations dominate international 'development' and trade.

In Kenya there are many pieces of State legislation influencing resource access and control. For example, there are 77 statutes within various Ministries that set out to govern the environment, but as Mbendo (1998) points out, they are not co-ordinated in any way. The National Environment Action Plan (NEAP), which was initiated after the United Nations Conference on Environment and Development (UNCED) in 1992, is a Bill that attempts to redress this problem, but has yet to be passed through parliament.

5.2.1 An organisation's power

The roles and effectiveness of formal organisations in influencing resource access and control has been closely linked to an organisation's power (Burkardt *et al..*, 1997). When negotiating with other organisations and groups to determine the outcome of a

resource-related conflict, or to influence policies, an organisation's role in the process stems from that organisation's power. Lamb (1998) outlines an institutional analysis method (Legal-Institutional Analysis Model, LIAM) that identifies four principal organisational roles in negotiations or interactions. These roles are identified as: advocates, which seek change in decision processes; guardians, which seek to protect the *status quo*; brokers, which use tradeoffs and bargaining to manage decisions; and arbitrators, which rely in knowledge and information in an attempt to make objective decisions (Lamb, 1998: 1).

The power of an organisation, in the context of interacting with other organisations, is derived from three elements: information, resources and constituency. These relate to the organisation's attributes that influence how power may be acquired (Brass, 1984), as opposed to power derived from relations with others (which is considered in the social network analysis in chapter 8). The elements of power are summarised in Table 5.1.

Power from information relates to an organisation's ability to process information and present a coherent opinion. Thus power is derived from having a technical body of knowledge few understand, and producing results that can be widely understood.

Resources power stems from having statutory authority, physical control of the resource, legal management responsibility, financial backing, and available personnel (Lamb, 1998: 3). Within this source of power are two sub-sources: the frequency and intensity of involvement in a specific issue. Frequent involvement generates experience with an issue, which is considered an asset. Intensity relates to how close the issue is to the interests of the organisation, which usually means that the organisation cannot be ignored. Constituency power derives from political or public support for an organisation.

In relation to the issues analysed in chapter 8, the roles of each organisation are considered in the final chapter. The analysis in this chapter outlines how the different organisations derive elements of power. Some organisations are shown to have certain elements of power, such as statutory authority, but are weakened because they lack other elements such as financial or human resources. Others in turn have no

statutory authority in relation to resource access and control issues, yet derive power from political support.

Table 5.1 Elements of power in resource access and control negotiations or interactions. (Adapted from Lamb, 1998: 4)

Power Element	Examples of Strong Power
Statutory authority	A clear legislative mandate to act
Physical control of resource	Ability to restrict access
Legal control of resource	Management responsibility
Political support	Legislatively favoured
Public support	Organised cohesive constituency
Financial resources	Sufficient funds to focus on issue
Personnel	Sufficient staff to focus on issue
Frequency	Experiences with similar issues
Intensity	Issue close to the organisation's 'heart'

5.2.2 Regional and International influences on formal institutions

Many international institutional arrangements have been set up to influence national policies relating to people's resource access and control. These are generally international agreements that fall into two categories, environmental conventions and economic agreements. As an illustration, some of these conventions and policies relating to national policies on coastal and marine environments or the economy are presented below. The general effects of which were discussed in chapter 2.

UNCED, for example has had a significant influence on recent environmental policy development in Kenya. NEAP is a direct response to requirements set out in UNCED (1992). NEAP aims to tackle the lack of co-ordination in environmental legislation within many different Ministries by integrating environmental considerations into socio-economic planning in all sectors of government. In relation to the coastal environment, another consequence of UNCED was the 1993 Arusha Resolution on Coastal Zone Management in Eastern Africa including Island States (Lindén, 1993).

As with so many of these initiatives, implementation is dependent on external financial assistance and expertise (cf. chapter 2). In this case from Sweden (SIDA) and the World Bank within the Regional Marine Science Programme for Eastern Africa. The most recent development of SIDA expertise and enthusiasm in the region, along with World Bank financial support, is the Coral Reef Degradation in the Indian Ocean (CORDIO) project, which was set up in response to the mass bleaching and mortality of corals in 1998.

Other regional initiatives include the United Nations Environment Programme's (UNEP) Regional Seas Programme, the East African Action Plan. Within the East African Action plan there are programmes assessing land based pollution (EAF/6) and coastal zone management (EAF/5). Similarly, the Intergovernmental Oceanographic Commission (IOC) has a Regional Committee for the Co-operative Investigation of the North and Western Indian Ocean (IOCINCWIO). This meets every three years to assess scientific achievements and plan future research priorities in the region (Coughanowr *et al.*, 1995). The list of conventions includes the African Convention on the Conservation of Natural Resources and the Nairobi Convention at a regional level, and Ramsar, MARPOL, Biological Diversity, CITES and UNCLOS at an international level (Mbendo, 1998).

The globalisation of trade, development loans and the policies of donor agencies are economic influences on institutional arrangements at the national level. Some of the effects of the conditions attached to loan agreements with the IMF and the World Bank were highlighted in chapter 2. In many cases these economic agreements conflict with other treaties, particularly environmental ones. The IMF/World Bank agenda of privatisation and commitment to individual property rights has placed public or community lands under great pressure. The General Agreement on Tariffs and Trade (GATT), and its 1995 incarnation as the World Trade Organisation (WTO) is another example. The Uruguay round of GATT, which was concluded in 1994, led to policies favouring large multinational business over national producers in the global economy. The WTO has also limited the ability to use economic sanctions or pressures to enforce international environmental treaties (Milner Gulland and Mace, 1998).

All these initiatives set out to inform or influence institutional arrangements at the national level, and consequently can determine activities at the local level. But, as was discussed in chapter 2, there are a number of major constraints to meeting the expectations set out in these regional and international initiatives. These include the lack of organisational and institutional capacity to implement agreements due to technical, human and financial resource constraints (Bryant and Bailey, 1997), and conflicting objectives of international economic agreements and environmental treaties (Milner-Gulland and Mace, 1998).

5.2.3 Legislation as formal institutions in national government

Legislation affecting resource access and control falls within the roles and functions of a range of different government ministries and their departments. In many cases the institutions (laws, regulations, memoranda of understanding...) that govern the functioning of government ministries or departments have indirect influence on social behaviour relating to local natural resources. For example, there are limits to the size of public gatherings set by law and enforced by organisations such as the police department. In relation to influencing resource access and control there are numerous government organisations and corresponding pieces of legislation to consider. Table 5.2 lists the departments of ministries that were associated, to differing extents, with the three resource access and control issues analysed in chapter 8.

The main departments affecting the community in relation to the social network analysis of the issues in chapter 8 were the Fisheries Department, Kenya Wildlife Service and the Provincial Administration. These are discussed in more detail below.

Table 5.2 Government ministries active in the study site and their functions relating to issues of resource access and control.

Ministry	Function relating to resource access and control in the study area
Office of the President	Provincial Administration Police Citizenship
Agriculture	Land use and development Veterinary services Survey and control of Tsetse fly
Co-operative Development	Co-operative legislation and extension services Accounting and auditing for co-operative societies
Environmental Conservation	Environmental protection Natural Environment Secretariat National Environment Action Plan
Home Affairs, National Heritage, Culture and Social Services	Museums and antiques Community development
Lands and Settlement	Administration of State and Trust land Land registration and valuation Mapping and land surveys Land adjudication Physical planning
Local Authorities	Local Authorities policy By-laws of all local Authorities
Natural Resources	Forests and forest development Fisheries development and management Wildlife management Game control and preservation
Public Works and Housing	Buildings Roads
Rural Development	Regional Development policy Coast Development Authority
Tourism	Development and promotion of tourism Kenya Tourism Board Supervision of Hotels and Game Lodges

5.2.4 Local government

Much of the decision making relating to local resources and associated activities takes place at the District level, and sometimes at the Provincial level (cf. part 4.5.2, Table 4.1). The Administration, under the Office of the President, is the most influential aspect of government at the local level. It is an extension of Presidential control to the village level. Representatives of the Administration have executive powers within most government committees at all levels. The District Commissioner, for example, heads most committees at the district level. The County Council is the other key part of local government and is the only potential check on the abuse of power and

manipulation of legislation by politicians and government personnel. But, as was pointed out in chapter 4, part 4.5.2, the relationship between the ruling KANU party and national government effectively eliminates this check.

The County Council (Kwale County Council in the case of this study) is responsible for the provision of basic services in the district, mainly water, education and maintenance of markets. In addition the County Council reviews most activities requiring some kind of formal government endorsement, such as the allocation of State land or development proposals. Matters are then passed on to specific committees set up to deal with particular tasks. These committees are made up of members of relevant government departments and representatives of relevant authorities. Land allocation, for example, is dealt with by the District Plot Allocation Committee, which is chaired by the District Commissioner and includes District personnel of the Ministry of Lands and Settlement. However, it is not uncommon for the County Council to be bypassed in circumstances where there may be resistance to proposals by some councillors, and the Clerk, District Commissioner, prominent politician and necessary civil servants to go directly to the Commissioner of Lands (Klopp, 1998).

Apart from land allocation, the other important committees that deal with situations where resource access and control is an issue are the District Development Committee (DDC) and the District Executive Committee (DEC). The District Development Committee is made up of civil servants and elected representatives and co-ordinates development activities in the district. There are a number of sub-committees within the DDC that relate to education, agriculture, social development, water and sanitation and loans. The relevant ministries are represented in each of these. The District Executive Committee consists of the senior personnel of each of the ministries in the district and oversees all major activities in the district.

5.2.5 Fisheries Department

The Fisheries Department is the principal State organisation concerned with fishing, and therefore directly influences the activities of the people of Biga. The legislation

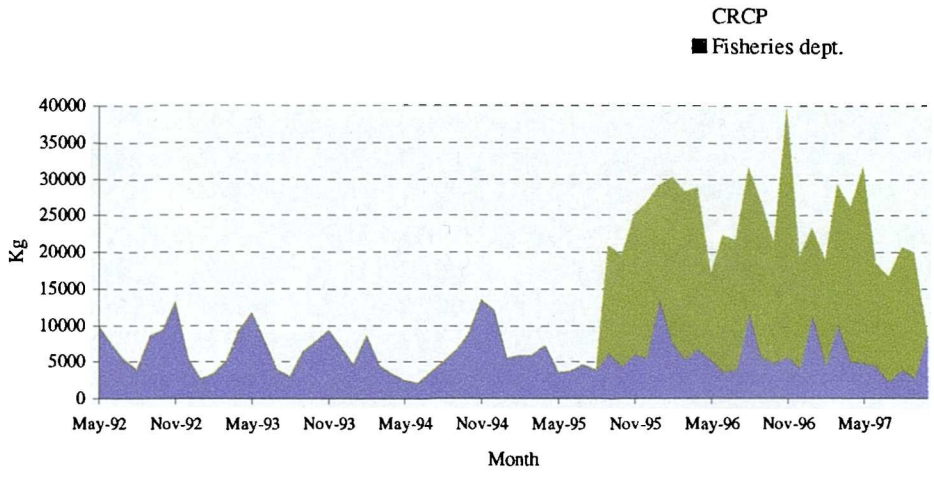
behind the functions of the Fisheries Department is the Fisheries Act, 1989, revised in 1991. The purpose of the act is 'to provide for the development, management, exploitation, utilisation and conservation of fisheries and for connected purposes' (GOK, 1991b). Despite having comprehensive legislation to determine and support its role and functions, it is evident that it falls short of meeting its aims. The main reason for this is because the organisation is under funded and under staffed for the tasks it sets itself (Oduol pers. comm.; pers. obs.), and this in turn is due to the historical approach of government to marine fisheries in Kenya.

Historically the emphasis during the British colonial period was to develop commercial marine fisheries by supporting European and Asian businesses. Development programmes in the 1950s and 1960s that provided nylon gill nets and shark nets to businesses that sought to exploit stocks further offshore did not favour local fishers. When it was evident that sea fisheries in Kenya was not going to become a significant industry, and that tourism was to be the industry of the coast, the relative importance of local small scale fisheries increased. However, the State took less interest in coastal fisheries generally because the inland Lake Victoria fishery was growing rapidly. The organisation remained rooted in its commercial fisheries past, seeking to manage fisheries on the basis of Northern Hemisphere single species concepts. In an attempt to meet the needs of these management approaches, Fisheries Department personnel were faced with an impossible task. Catch and effort statistics needed to be collected from a fishery that employs tens of thousands of widely spread people who land numerous species at thousands of different landing sites. Similarly impossible was the need to issue licences and collect revenue (see Johannes, 1998, for a discussion of this issue and the need for data-less marine resource management).

This is the situation in the study site. The Fisheries Department's Diani substation employs two fisheries personnel, a Fisheries scout and an Assistant Fisheries Officer (FO). Their tasks include extension services, collecting statistics and law enforcement. Data should be collected on the number of registered boats, the gear types, number of fishers and traders and the species and sizes/weights of fish landed (FO Mwangare pers. comm.) (for the list of species see Appendix II). Within the area of responsibility for the two Diani Fisheries personnel there are 35 designated fish landing sites over about 30 km of coast. This they must cover without a vehicle.

There are also numerous other landing sites used by small groups of fishers and traders. Less than half the area is served by public transport and most landing sites are accessible only by foot or bicycle. This is the situation throughout the coastal region, except that many other areas are far more remote. This raises questions about the accuracy of the data. As the Assistant Director for Fisheries in Mombasa admitted, field staff 'cook' the data (C. Oduol, pers. comm.). Figure 5.1 illustrates the difference between data collected by the Fisheries department and that collected by the Coral Reef Conservation Project in the Diani area that includes the study site. CRCP is an independent organisation supported by the New York based Wildlife Conservation Society that undertakes coral reef related research in Kenya.

Figure 5.1 The difference between catch statistics for the Diani/Galu Kinondo area collected by the Fisheries Department (May 1992 – Sept. 1997) and CRCP (Sept. 1995 – Sept. 1997). (Source: Fisheries Department - Diani substation; CRCP)



In relation to the quality of data, I did not see any Fisheries personnel collecting statistics throughout the study. Also, the fishermen said that they were not required to pay for licences and did not do so, contrary to statements from Fisheries personnel. Some traders did pay their licences to trade because they transported their fish out of the area they had bought the fish, but most traders avoided this requirement. Furthermore, there was no record of any prosecutions for infringements of Fisheries legislation in the five years up to the end of the study (Fisheries Department monthly

and yearly reports). This was contrary to the Fisheries officer's statement that they started prosecuting traders and fishers without licences in July (FO Mwangare, pers. comm.).

From the point of view of the fishers, the importance of the Fisheries Department personnel is their role as the link between the State and law and the fishing communities on issues related to fishing, rather than performing any management function.

The Fisheries Department has links with other state and parastatal organisations through 'Memorandums of Understanding' (MOU). These Memorandums of Understanding are signed by the directors of the organisations and are not legally binding or passed in parliament. MOUs aim to reduce conflicts of interest and share limited resources, and are an example of creating indirect institutional links to resource use activities. Table 5.3 lists the organisations the Fisheries department has MOUs with.

Table 5.3 Organisations that have MOUs with the Fisheries Department. (Source: Oduol, pers. comm.)

Organisation	Purpose
Kenya Wildlife Service (KWS)	Aerial surveillance in nearshore commercial fisheries, co-ordination in marine protected areas.
Kenya Marine Fisheries Research Institute (KMFRI)	Research
Kenya Navy	Policing commercial and foreign vessels, preventing dynamite fishing.
Coast Development Authority (CDA)	Integrated Coastal Area Management, monthly meetings relating to the CDAs role as co-ordinator of coastal activities.

5.2.6 Kenya Wildlife Service

The importance of the Kenya Wildlife Service (KWS) in the study area results from the attempted implementation of the Diani Marine Reserve in 1995. The issue of the

marine reserve is one of the resource access and control problems that is analysed in detail in chapter 8.

The Kenya Wildlife Service is a parastatal organisation formed in 1989 to increase the autonomy of the wildlife management and development authorities. These authorities were previously set within the Ministry of Tourism and Wildlife and are now within the Ministry of Environmental Conservation. The relative autonomy of KWS and the international popularity of wildlife and its importance to the tourism industry attracted large sums of foreign financial aid. Consequently, KWS became an effective organisation during the early 1990s under the directorship of Dr Richard Leakey. This high profile also meant that KWS was able to develop a high level of expertise in resource management through the involvement of foreign organisations and training of personnel. For example, KWS collaborated with the University of Rhode Island to implement an Integrated Coastal Zone Management plan near Mombasa, with financial support from the United States (USAID). This has also meant that the organisation has been in a position to assist other organisations such as the Fisheries Department through, for example, workshops.

The Wildlife Conservation and Management Act allows the KWS to enforce property rights to all wildlife within protected areas and also outside protected areas (Norton-Griffiths, 1998). If the Diani marine reserve had been imposed the use of spear-guns and seine nets would have been prohibited. Spear-guns are the largest sector in the fishery and seine nets one of the most lucrative. Although the marine reserve in the Diani area has not been implemented, it is officially gazetted and thus the role of the KWS in the area continues to be a possibility. This has implications outside the fishery as well. The agricultural activities of the fishing community are under constant threat from animals that raid crops such as monkeys, baboons, wild pigs and antelope. Wildlife legislation prevents individuals from killing animals without consent. People in Biga have to rely on deterrents in most cases, but wild pigs are such a problem they are occasionally killed.

An important change in the KWS policy objectives in recent years has been to create an enabling environment within which landowners and resource users have incentives to support KWS in achieving national conservation objectives (Norton-Griffiths,

1998). A key part of this has been the Community Wildlife Scheme and Partnership Officers, through which KWS has sought to have greater influence on the behaviour of people depending on natural resources.

KWS' importance in the area of the study site stems both from its role in attempting to establish a marine protected area in the region (cf. chapter 8 for details), and also from its relative power as a resource management body thanks to international interest in Kenya's wildlife.

5.2.7 Coast Development Authority

The Coast Development Authority (CDA) was established under the auspices of the Ministry of Rural Development. The main function of the CDA is to co-ordinate development activities in the coastal region that aim to improve the food security of coastal people, increase employment opportunities and diversify the rural economy. One of the roles of the CDA is to evaluate tourism developments in relation to sustainable development and alternative developments. It was not evident at the time of the study how effective CDA was. One of the problems for CDA as a cross sectoral organisation was to achieve co-ordination between different sections of government without the necessary legislation to do so. NEAP may change this. The organisation also suffered from the political weakness. For example, CDA denied being part of the Diani Marine Reserve process (Mwandoto pers. comm.), despite its coastal zone management and development mandate and contrary to the analysis in chapter 8.

5.2.8 Integrated Coastal Area Management (ICAM) Team

This is the most recently established governmental body concerned with the sustainable and equitable development of the coastal region. As its name implies, its mandate is specifically concerned with management, and its role is principally advisory since it relies on sectoral legislation. Membership is flexible, depending on the issues and activities being addressed, but the core representatives include technical

representatives from the organisations listed above. In addition local and municipal councils are represented and the Ministry of Culture and Social Services.

The importance of the initiative is that it is multidisciplinary, and as with NEAP and the community programmes of KWS, illustrate a gradual shift in the way human-environment interactions are tackled in Kenya.

5.2.9 Fishermen's Co-operative Societies

In 1991 there were five co-operatives in Kwale district co-ordinated by the South Coast Fishermen's Co-operative Union under the auspices of the Ministry of Co-operative Development. The co-operatives were established as a means of providing financial support for fishing communities. Members sold their fish through the co-operative and a small percentage was taken from their sales and placed in a central fund from which loans could be taken. The co-operatives had long-term agreements with traders so that fish were sold at prearranged prices that were periodically adjusted. The fisheries officers and co-operative personnel said that the co-operatives handled more than 60% of the catch within their areas of operation. Further investigation of this figure showed that it was wishful thinking since very little fish passed through the co-operative, for reasons described below. The figure derives from Section 48 of the Co-operatives Act giving the co-operative the right to be the monopoly purchaser if 60% of the catch passes through the co-operative.

None of Digo fishermen interviewed or spoken to in the course of the study saw any benefit from the co-operatives. Many had joined in the 1970s when the concept was introduced (from FAO influence), but no one had had a loan application accepted and they had never heard of a fisherman getting a loan. The fishermen felt that their money had been misspent and so they stopped selling their fish through the society and consequently the society had ceased to function. In addition, as the former Member of Parliament pointed out, the idea was foreign and therefore doomed and the only successful co-operatives were based on salary deductions not voluntary contributions (Mwamzandi pers. comm.).

Despite the lack of significant membership, the co-operative society continued to have influence in the area, and particularly the fishery. One of the problems analysed in this study relates to the presence and activities of migrant fishermen from Tanzania. Their use of fine meshed beach seines was a point of contention with the local Digo people, and the mesh size was illegal under fisheries legislation. However, the beach seine fishermen continued to 'support' the co-operative society long after it was effectively defunct. Thus they were able to 'legitimise' their fishing activities by supporting a government initiative (and personnel). The effects of the beach seines on the fishery are discussed in chapter 7. Extraordinarily, Fisheries Department personnel continued to cite the lack of fishers' and traders' organisation in the form of co-operatives as the reason for many of the problems the fishers face. Such comments would suggest that some government personnel do not place much importance on the informal institutional arrangements and organising practices that do function, some of which are identified below.

5.2.10 Land tenure

Land adjudication in the Biga area started in the 1970s with the beachfront and has continued inland sporadically since then. Ostensibly to ensure local people were granted title deeds to land, interest in the beachfront was primarily driven by its potential for tourist development (the British had subdivided the adjacent Diani beach area in 1908). All the individuals in Biga who received allocations of land on the beachfront (based on interpretations of claims relating to stands of trees) were 'persuaded' to sell their land immediately. They did not appreciate the implications of losing land under a system of property rights so different to their own (see part 5.3.1 and the previous chapter). Others claimed that they were not allocated all or any of their traditional land, but instead the land had been allocated to well-connected upcountry people (government is dominated by tribal groups from inland). One man showed me the area of his family land that had never been allocated to him. He pointed out the fruit trees that had been planted by earlier generations of his family, it covered a number of beach plots, one of which had been developed for tourism and the rest had been fenced in by absentee landlords. It was interesting to hear that his strongest complaint was that he no longer had access to his coconut trees, and that

many had been cut down (Chicho pers. comm.), rather than the loss of such potential financial wealth. At the time, in 1996, the value of beachfront plots was about 3-4 million shillings an acre (KSh 85/£ 1996). His claim, based on the area of coconut and mango trees, would have covered at least five acres. The value in 1996 represented 280 times his annual disposable income (cf. chapter 7 for calculations of income for fishers with canoes).

The process of land adjudication has transformed the beachfront and changed land use patterns. The land market and process of land allocation remains a significant influence on resource access in the area. One of the issues analysed in chapter 8 relates to land ownership and access.

5.3 Informal institutions and resource access in the study site

Traditional rules relating to resource access and control are very different to the formal institutions described above. Ideas of ownership of natural resources are different, and the ways decisions are made relating to the allocation of resources are also different. Contrary to the hierarchical decision making trees of the formal organisations identified above, many traditional organisations are based on debate and consensus with wider participation of individuals than formal organisations.

As with formal institutions, globalisation has had an influence on informal institutions. For example, economic changes due to absorption into the global market system has caused some East African societies to shift from matrilineal to patrilineal societies (Gough, 1961; Ng'weno, 1995). These kinds of changes have implications for customary inheritance laws, the relative authority or power of different age groups and genders and consequently social relations. The effects of global markets for land and products found within the study site and the cultural effects of tourism has lead to changes in some traditional institutions in the Biga community.

5.3.1 Traditional land tenure

In traditional Digo society land itself was not considered to be property in the sense that an individual had rights of freehold tenure. Ownership was vested in trees planted by individuals, in houses, livestock and rights of land use (Ng'weno, 1995). Provided that land was available a person had full rights in a neighbourhood by virtue of membership of the kinship group. Trees could be rented, sold or inherited by descendants. Land under cultivation of seasonal crops was not owned, its was merely used. Land could be accessed by taking-over fallow land, clearing forest or bush, or areas under planted trees could be inherited or bought. Inheritance in Digo society was traditionally matrilineal. Rules of inheritance were negotiable and flexible, children inherited from male and female maternal relations as well as from their matri-clans, but not usually from their father (Ng'weno, 1995).

The adoption of Islam and successive colonial and independent governments (dominated by different tribes and externally influenced) ignored these arrangements relating to land (cf. chapter 4), thereby undermining the traditional institutions and ultimately changing patterns of land use. In the Biga area there continues to be some use of these informal institutions relating to a market for squatter land on an estate that covers part of the Biga area.

5.3.2 Traditional sea use and beach use organisation

From discussions with fishermen and from observing the way the newly created fishermen's group functioned, traditional institutional arrangements relating to activities in the sea continued to be used. The beach/sea chairman is an elected position, usually taken by an older fisherman, with responsibilities for all marine related activities in the area adjacent to the community. When the fishermen of Biga formed a committee in 1996 the natural choice for the chairman was the traditional beach/sea chairman. The effect of allocating responsibility for activities within the lagoon adjacent to each community effectively partitioned the sea into community territories. As a matter of protocol fishermen from other areas continue to introduce

themselves to the resident beach/sea chairman and frequently pay a fee (*ubani*) to fish in the area. The ineffectiveness of State fisheries institutional arrangements to deal with problems fishermen face has contributed to the continued traditional role of the beach/sea chairman.

Taboos and ceremonial acts are another important part of traditional institutional arrangements. Glaesel (1997) found that Digo fishing communities continued to perform ceremonies in relation to fishing activities in order to appease certain spirits, but these activities were rapidly declining. The older members of Biga community said that there were areas in the sea which were associated with sacred sites on land (*Kayas*) known as *Mizimu*, and fishing was not permitted in these areas. However, they admitted that since the 1960s these traditions had become increasingly less respected and that fishing now took place everywhere. This was attributed to need for fishermen exploit all accessible areas, and because the younger generation claim that belief in the spirits is against their Islamic beliefs (Glaesel, 1997). Older members of the community continue to recognise the marine sacred sites that they believe harbour spirits, and they continue to be important sites for offerings (*sadaka*). But most fishermen are reluctant to admit to ceremonies taking place at all. This indicates that these informal institutions are becoming less effective in determining social behaviour.

5.3.3 Traditional landing site organisation

As with the beach/sea chairman, a traditional trading institution exists, where each landing site has a trader chairman voted in by the fishermen and traders. Every trader must have permission from the chairman to buy fish at a particular landing site (Bakari pers. comm.). Traders could guarantee a supply of fish by paying the chairman to ensure fishermen supplied them. Informal credit systems were observed to exist. Often traders would pay fishermen the following day or later, having sold their fish, and in other situations fishermen would borrow from traders and repay in the future. The landing site chairman ensured that individuals made their payments by controlling who could do business and who could not. This process continued

throughout the period of co-operatives and remains the main institutional arrangement at the landing sites, whereas the co-operative societies have collapsed.

5.3.4 The Galu Fishermen's Committee

Illustrative of the organising capabilities within local communities, the fishermen in Biga formed an interest group to tackle fishery related problems that State organisations were incapable of dealing with (for the organisation of the group see Appendix III). This group was not sanctioned by the State, but proved effective in tackling the beach seine problem in the area (cf. chapter 8 for an analysis). This short-lived informal organisation functioned despite constraints placed by formal institutions, such as laws *restricting public gatherings unless sanctioned by the State.*

5.4 Institutional links to livelihoods

Having outlined some of the more important formal and informal institutional arrangements and their associated organisations in the study site, their links to resource access and control can be presented.

A recent approach to linking the range of different institutions that exist at different levels to livelihoods is environmental entitlements analysis (for a full description see Leach *et al.*, 1997). This approach considers the problem of people gaining command over resources by identifying what have been termed people's endowments and entitlements and what they do with them. Endowments are the rights and resources people have to make use of certain environmental goods and services. The entitlements are the sets of benefits subsequently derived as a result of having legitimate effective command over the environmental goods and services. What people can do or be with these entitlements enhances their capabilities. At each stage in this process different formal and informal institutions, at different scale levels, are considered to interact to shape people's resource claims and practices. Legitimate effective command over resources is an important distinction because it acknowledges that resource claims are often contested. In many instances the resource claims of more powerful actors tend to prevail over those of others. In addition it recognises

that not everyone is necessarily able to mobilise critical endowments, such as capital or labour, in order to make effective use of other endowments such as land (Leach *et al.*, 1997). Figures 5.2 and 5.3 illustrate some of these linkages in relation to fishing in the lagoon and using beachfront land for trading and related activities.

Problems of resource access and control, such as the conflict between the local Digo fishers in Biga and the migrant beach seine fishers or the marine reserve issue, would be similar to the more generalised structure presented in Figure 5.2. The environmental goods and services are found in a multispecies fishery in the lagoon adjacent to the community's territory. The endowments the people have are rights of access to fish in the lagoon. A range of institutions that affect different people in different ways determines these rights of access. With access to the lagoon, fishers gain entitlements such as fish, again within interacting sets of rules. Converting the entitlements of fish to capabilities, such as contributing to wellbeing (schooling, nutrition) are also considered to be influenced by sets of rules.

A similar process can be described for the problem of gaining access to beachfront land to carry out other essential activities related to fishing, such as interacting with traders or even getting access to the sea. A generalised structure is presented in Figure 5.3. As the value for beachfront land has increased due to the growth of tourism, fishers have found less and less space available to carry out their activities. The value of land has reached such a level that even land held under trust by local councils has found its way into private ownership (see the land issue analysed in chapter 8). The institutional arrangements that ensure people do or do not continue to gain access to that land include the effects of international policies on people in positions of power at a national level (cf. section 2.5 on political patronage). Some of the interactions between the different institutions result in conflicts of interest, as was discussed above.

Figure 5.2 Environmental entitlements analysis of fishing in the waters adjacent to Biga.

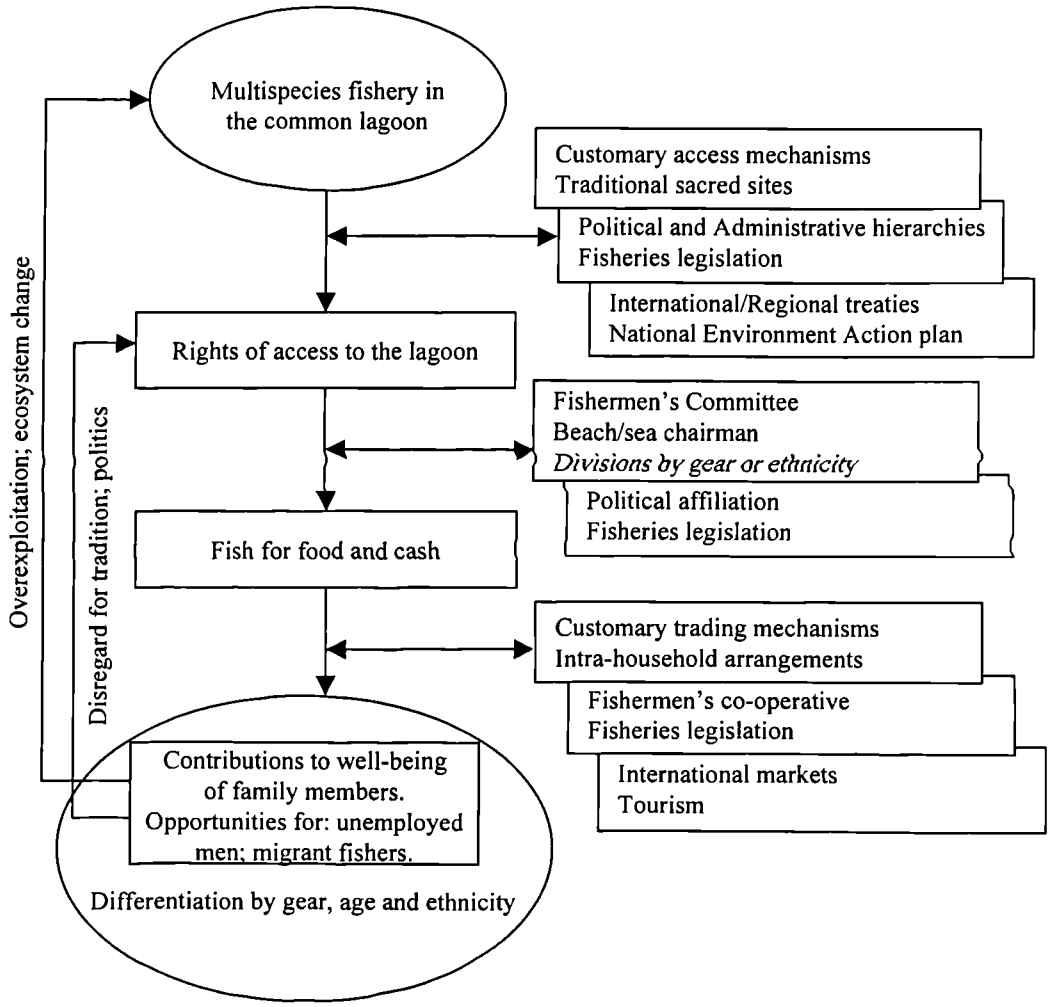
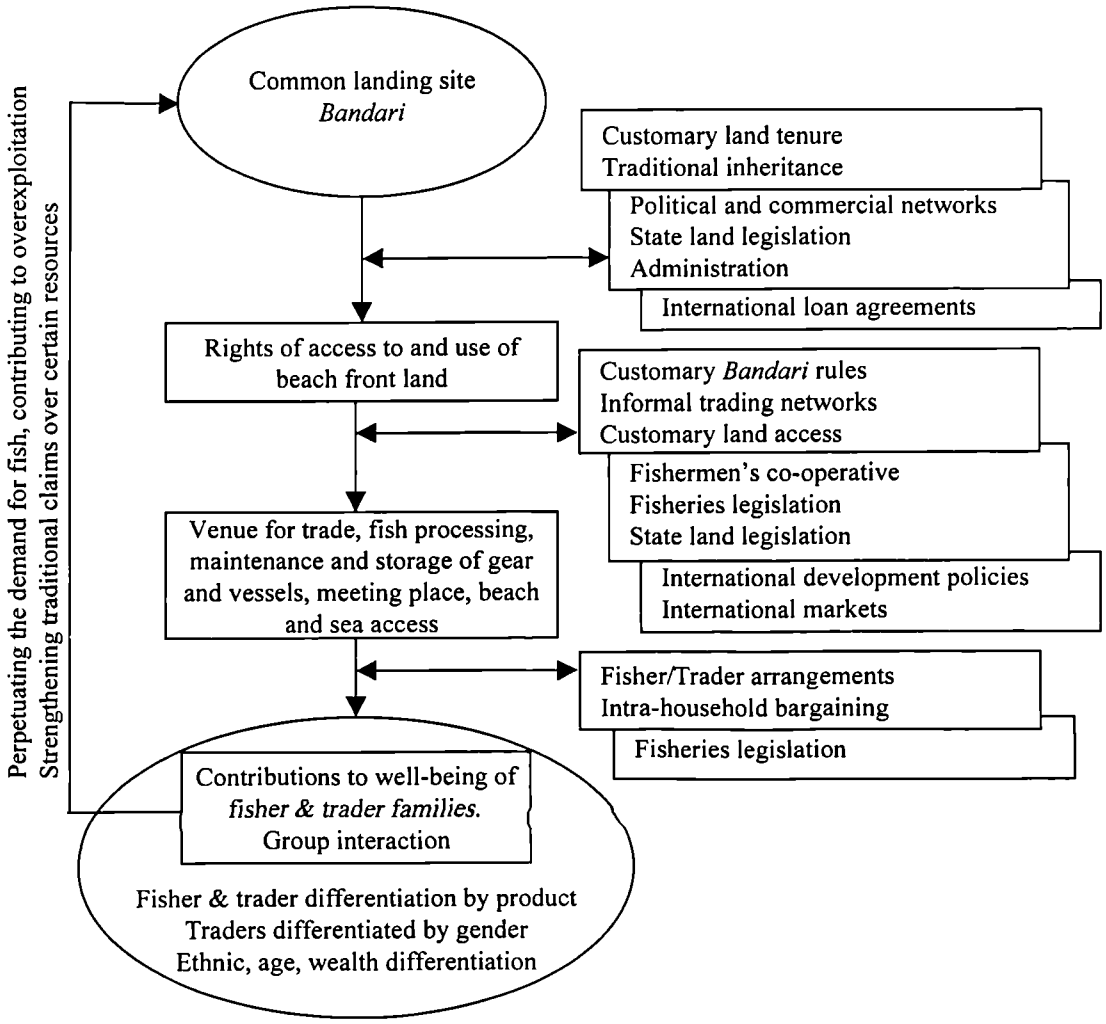


Figure 5.3 Environmental entitlements analysis of the use of beachfront land for trading fish, getting to the sea and other marine related activities.



5.5 Conclusion

Clearly institutional dynamics and local political manoeuvring play an important role in determining people's resource access and control. Equally important are the institutional arrangements, the organisations and politics that occur at other scale levels, such as nationally and internationally. The interplay between the different scale levels is an important influence on the rules that actually determine people's actions at the local level. Formal macro institutions, such as GATT or international development policies, influence the effectiveness of informal micro institutions through indirect or 'trickle down' effects.

There were a number of important differences between the formal and informal institutions identified above. Formal institutions had a direct organisational manifestation and were concerned with modern government departments or international organisations. Informal institutions were principally concerned with people's customary practices or traditions, many of which were pre-modern, reflecting the type of society in Biga. The fishermen's committee was considered an informal organisation. It was created to tackle a specific problem in the community, and was therefore a short-lived. But, its importance lay in its effectiveness (cf. chapter 8) despite the formal institutional environment, and was therefore illustrative of the organising capabilities of community groups. Table 5.4 presents a summary of the institutions identified in this chapter and their respective scale levels and roles in influencing resource access and control.

Table 5.4 Institutional analysis matrix for the Biga community (adapted from Ahluwalia, 1997).

	Community	Local/National	International
Mobilising endowments	• Community/clan membership • Customary access mechanisms on land or at sea • Inheritance and religious/gender implications • Traditional customs, taboos and sacred sites	• Local politics and Administration • Local government - DDC, DEC... • Fisheries legislation and other natural resources legislation • Commercial networks and power • Land legislation	• International loan agreements – IMF, World Bank... • International economic agreements – GATT, WTO... • International/regional environmental treaties and initiatives – UNCED '92, UNEP...
Gaining entitlements	• Customary rules • Ethnicity • Local power relations • Gender/gear divisions • Fishermen's committee • Beach/sea chairman	• Land legislation • Fisheries legislation • Co-operatives • Local government - • National development policies • Political networks	• International development policies – USAID, SIDA... • Globalisation and international markets
Enjoying capabilities	• Number of wives • Intra-household arrangements • Fisher/trader relations and credit systems	• Fisheries legislation	• Globalisation and international markets • Tourism

Having described the environmental, historical and institutional context of the community of Biga, the next chapter considers the interactions between different groups in the area and the resulting social and environmental impacts.

6 BROAD ISSUES AND IMPACTS ON THE PEOPLE AND THE ENVIRONMENT OF BIGA TODAY

6.1 Introduction

As indicated in the previous chapters, the community that is the focus of this study does not exist in isolation from the other social groups and their activities in the Biga area. The coast of Kenya, south of Mombasa has been an attraction to European visitors from the highlands since the 1950s and international tourists since the 1960s. The stretch of coast immediately to the north of Biga has been one of the principal areas of tourism development in Kenya, and in recent times the development has spread into the Biga area. These activities have direct and indirect impacts on members of the community. Direct impacts may include competition for resources such as land. Indirect impacts would include the effects of other activities on the natural environment such as visitor pressure on coral reefs, which may in turn affect members of the community.

The aim of this chapter is to link the main activities that occur in the local area to the issue of resource availability for members of the studied community. Such an understanding also places the role of different institutional arrangements that exist within different stakeholder groups into the context of resource access and control for the studied community. Evidently the rules that govern tourism development are not necessarily part of the local communities' institutional arrangements, but they may overshadow the functioning of local rules and organisations. The key organisations and institutions that influence resource access and use were outlined in the previous chapter; this chapter identifies the main groups they represent or relate to.

The first part of this chapter identifies the other resource users or stakeholders in the study area and the resources they use. Although the focus of this study was the Digo fishing community of Biga, there were numerous other groups settled or working in the same area. The different groups could be differentiated according to their activities and distribution patterns. For example members of the Biga community lived in a distinct place separate from expatriate residents or hotels, yet they shared

many of the same resources such as ground water, the beach and the sea. The second part of this chapter identifies direct and indirect impacts the different stakeholder groups have on the studied community.

6.2 Resource users and stakeholders in the study area

Seven different societal groups that live or work in the Biga area were identified and are listed below. A number of these groups are made up of people from inland tribes who are collectively referred to as upcountry people.

i) Indigenous Digo community including fishers, fish traders, hawkers, farmers
ii) Seasonal and permanent upcountry farmers
iii) Migrant fishermen from Pemba (Tanzania)
iv) Upcountry hawkers and curio merchants
v) Upcountry and Asian businesses such as shops
vi) Tourism developers from Europe and upcountry
vii) Expatriate European residents

These societal groups can be further subdivided into stakeholder sub-groups. In this case stakeholders are those groups who depend on the direct or indirect use of coastal resources for all or part of their livelihood. Table 6.1 identifies the principal natural resources in the study area and the different stakeholder groups who exploit them.

In some cases, competition for the same resources by different groups has lead to conflict. The status of each stakeholder group is assessed below.

6.2.1 The Digo community

The local Digo community of Biga is the focus of this study. As described in chapter 4 they were the first inhabitants of this area and as such define the extent of the study area. Their livelihoods have evolved over generations to take advantage of a wide range of resources available in their local area. As a group they exploit all of the resources identified in Table 6.1, and are therefore in competition with all of the

Table 6.1 Resource use by different stakeholder groups in the study area of Biga.

Resource	Direct use	Indirect use
Coral and shells	Shell collectors, tourism	Fishermen, tourism
Seagrass beds		Fishermen, migrant fishers, curio collectors
Fish	Fishermen, fish traders, migrant fishers, tourism	Tourism
Beaches	Fishermen, migrant fishers, fish traders, tourism, hawkers, expatriate residents	
Forest	Fishermen, fisher households, farmers	Tourism, expatriate residents
Land for cultivation	Farmers, fisher households, migrant fishers	Kenya Sugar Estate
Land for habitation	Fisher households, tourism, expatriate residents, migrant fishers	
Ground water	All	

other groups to a greater or lesser extent. The analysis of the production systems of the community in chapter 7 presents a more detailed account of resource use by the different groups within the Digo community of Biga.

6.2.2 Tourism

Tourism is the largest single source of foreign exchange in Kenya. During the global tourism boom in the 1980s the number of visitors to Kenya increased by 97%, from 362,000 in 1980 to 713,000 in 1989 (WTO, 1990). Numbers continued to rise during the 1990s to a peak of 863,400 in 1994, but have since dropped to around 700,000 per year (GOK, 1997). The coast has been the main destination for the majority of tourists because it offers both a beach holiday and good access to game parks. In 1996 the beach hotels accounted for 63.5% of occupied hotel bed-nights in the country (GOK, 1997). Along the stretch of coast in the vicinity of the study site there are 19 large hotels (Figure 6.1). Hotels were first built on this stretch of coastline during the 1950s to cater for Europeans resident in the capital city Nairobi and in the highlands. During the late 1970s and the 1980s eleven hotels were built and a further six were built between 1991 and 1996 to cater for the overseas markets.

Since then however the industry has suffered from negative press in Europe and competition from other parts of the world. Some hotels have had to close and the general trend for all the hotels has been to target budget tourists in order to maintain reasonable levels of occupancy. The number of hotel beds on this stretch of coastline, including the smaller enterprises is about 7,030 with yearly occupancy rates of around 60% (Rubens, 1996).

Figure 6.1 The location of large hotels in the vicinity of the study site.

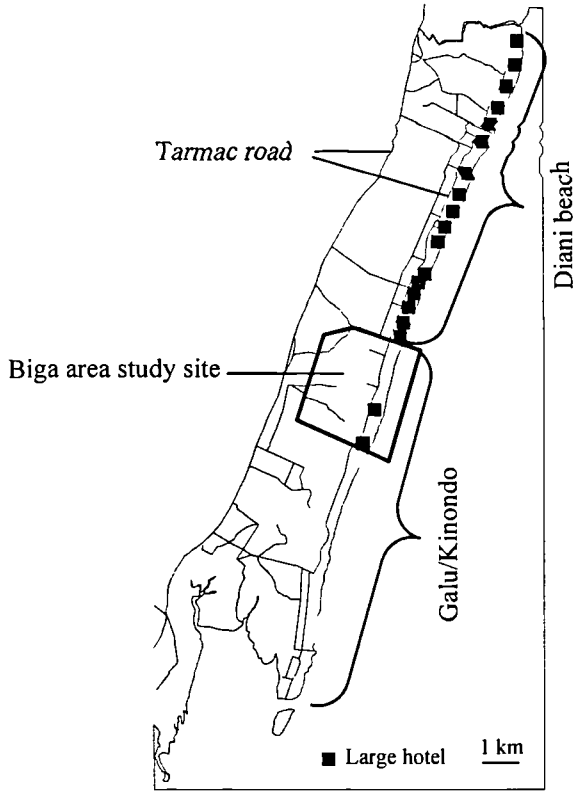


Figure 6.1 shows clearly the heavily developed area to the north of the study site known as Diani beach. Within the Biga study area there is only one large hotel catering for overseas tourists, however there is a large holiday villa development catering predominantly for German tourists, and a number of smaller self catering holiday cottage developments that cater for Kenyan or European residents living upcountry. There is also a night club and three restaurants that cater for the tourist industry. Tourism can be considered to be the main economic activity in the area, but the degree to which this activity is transferred to the local Biga community is

very limited. Very few local people are employed in the tourist industry either within the immediate area or in the Diani beach area.

Beach front land has been the primary resource used by the tourist industry. The heavier development along the Diani beach stretch was possible because the land had been expropriated from the local Digo people during the colonial era and divided into 20 acre plots. As the market for land grew, subdivision and development followed. Further south, in the area of the study site, the beachfront land was not divided during the colonial times, but after independence the new government continued the colonial governments policy of land adjudication. In the 1960s and 1970s the market for beach front land driven by the tourist industry lead to further expropriation of land for well connected upcountry individuals (O. Chicho, pers. comm.; Jommo, 1986). The result now is that no seafront land is owned or occupied by local Digo people.

The growth of tourism increased the demand for marine products both for food and as souvenirs. But the tourist industry ceased to buy fish from the local Digo fishers and traders in the boom of the 1980s because the supply was unreliable, instead using wholesalers from Mombasa. The market for marine souvenirs has dropped in recent years because tourists have become less inclined to buy environmentally sensitive products. In any event, it is unlikely that the local environment could supply any marine products to the tourist industry in its present state of degradation (cf. chapter 3 and 7).

Recreational activities such as sports fishing, SCUBA diving, windsurfing and sailing have also grown with the tourist industry. Many people now use the protected lagoon for different recreational activities alongside the local fishing people. At low tide many tourists venture out onto the exposed reef flats, in the past to look for shells and starfishes, but increasingly simply to look at not much at all save for a mass of sea urchins.

The primary attraction to tourists was the idyllic palm fringed wide white sandy beach and protected lagoon. The beach has been a strip of access for all users to move along the coast. At low tide it is about 100m wide and enables tourists to

explore further afield and enjoy the space for sunbathing or other activities. The present situation is somewhat different. Tourists are reluctant to venture onto the beach except to dash to the sea for a swim because of the harassment they receive from hawkers selling curios. Those who do venture further afield run the increasing risk of being mugged.

6.2.3 Upcountry hawkers and curio merchants

As a result of the tourist industry many people from upcountry have been attracted to the coast in search of work. Some of these people find work within the formal tourism sector, but a large number make and sell curios such as carvings, jewellery, cloths and baskets and provide services such as massage and prostitution. Upcountry people form the majority of the hawkers on the beach. Young local Digo men tend to specialise in selling boat trips to the reef, drugs and prostitution. This informal sector is focused around the more developed Diani beach area where there are in excess of 400 hawkers in the high season (December-March) (pers. obs.), and is relatively undeveloped in the Biga area, between 10-15 individuals (pers. obs.), due to the lack of hotels. Within the wider area of Diani and Galu the upcountry hawkers are an important, well organised and vocal group. They have established stalls above the high tide mark wherever there is space, usually between hotels and on public rights of way. Many of them rent rooms from Digo people and are an important contributor to the local economy. Within the Biga area itself they do not however make a significant contribution.

6.2.4 Expatriate European residents

European expatriates own most of the beachfront land in the Biga area. Most of these plots were developed as holiday houses, but the owners or tenants now occupy many of them on a permanent basis. As a stakeholder group they are important because of the land they own and in some cases their interest in environmental issues.

6.2.5 Seasonal farmers

Over the past 20 years Tharaka and Meru migrants from inland have come to the coast to grow cash crops during the long rains, taking advantage of the local tenure system which does not protect uncultivated land and absentee landlords. The majority arrive in February to start clearing areas of bush and forest in preparation for the rain and leave early in October at the end of the season. The main cash crops grown are tomatoes and green peppers, but many other subsistence crops are grown. The crops are sold in Mombasa, 40 km away. The migrant farmers only clear land in the coral rag zone, where the soil is more fertile, working on a rotational basis of three years fallow. This once densely forested zone was rapidly cleared during the early 1980s, producing good charcoal from the hardwoods and subsequently cash crops. The pressures for land in the Meru area upcountry continues to encourage more people to move down to the coastal strip and increasing numbers are settling, working as labourers on building sites during the dry season. Some of the migrant farmers said that they were encouraged to clear private land, making it easier to develop by the non-resident owners.

6.2.6 Upcountry and Asian businesses such as shops

This is a very small group within the Biga area, but through political affiliations is influential. The development of at least one of the larger owned businesses is on land previously owned by the state, and illustrates the relationship between wealthy businesses and local politicians. This relationship is considered in the analysis of one of the resource access issues in chapter 8.

6.2.7 Migrant fishers

One of the issues analysed in chapter 8 concerns the conflict between the local Digo fishers and migrant fishers from Tanzania. Migrant fishermen from the islands of Pemba and Zanzibar, and the associated smaller islands of Kojani and Tumbatu, in northern Tanzania have been fishing in Kenya since British colonial times. These

people are collectively known as the Wapemba (people from Pemba). At that time the better market for fish in Kenya and the common currency in the two countries attracted the island fishermen to travel on fishing expeditions as far north as Malindi. Contacts between Kenyan fishing communities and people in Pemba had previously been established because Bajuni men from Kenya had migrated to Pemba on a seasonal basis to work in the clove plantations and some had intermarried (Glaesel, 1997). From the beginning the Wapemba fishermen were not universally accepted by Kenyan fishing communities because they used seine nets. But the level of competition between the two groups was sufficiently low to have made their presence tolerable, to the extent that virtually every landing site on the Kenya coast as far Malindi had Wapemba fishers. There was also the benefit to local fishing communities of fees paid (*ubani*) for permission to fish in their areas. The main influx of Wapemba to Kenya occurred in 1964 following the overthrow of the Zanzibar government. The political unrest at the time caused sympathisers of the Zanzibar government to flee the country. With the established links and some small settlements in Kenya, many thousands of Wapemba moved to Kenya on a permanent basis.

In the area of the study site a community of Wapemba had been settled on a permanent basis for over thirty years. Elders of the Biga community had chosen a site for their settlement and accepted their presence. Throughout this period Wapemba people had migrated between the two countries, but a core group remained, although always separate from the local Digo community of Biga. The issue of fishing method continued to be the key factor in determining local acceptance. Even if there was intermarriage, the children for instance would only be accepted by the Digo community if their fathers did not use seine nets (Glaesel, 1997).

In terms of resource use the Wapemba fishers operate from large dugout canoes fishing in the lagoon with seine nets up to 100 m long. During the calmer north east monsoon they also fish the reef slope outside the lagoon. They have also planted fruit trees such as coconut, mango and citrus around their settlements, and some have cattle.

6.2.8 Plantation estate

Although this has not been listed as a stakeholder group, land belonging to the defunct Kenya Sugar Estates covers approximately a fifth of the Biga area, and is therefore under private ownership. The estate was formed during the colonial era, originally growing sisal and coconut and later sugar cane, coconut and cashew nut. The last owner was an Asian businessman from Uganda, but the company collapsed about fifteen years ago and the owner has fled the country in debt to the Government. The title deeds for the estate land however are held by the Bank of India and cannot be claimed by the Government (District Surveyor Maina, pers. comm.). The part of the estate that incorporates part of Biga was never used for plantations and the local community continued to use the land in the traditional way. In recent years however, the need for land has become an issue and questions of land ownership are frequently discussed. The fact that the estate land was never developed in Biga has meant that a number of squatter households have been established, some of whom have been there for more than a generation. A local, informal market for the land has developed, drawing on traditional institutions of land tenure and kinship ties. The estate land remains the only significant area of undeveloped land and the local community hopes that the Government will somehow acquire the land and subdivide it among the locals.

6.3 Direct and indirect impacts of the different stakeholder groups

The presence or activities of the various groups within the Biga area have different impacts on the local Biga community. Some of these impacts relate to competition for limited resources within the area and other impacts include social and cultural effects. Degradation of the environment due to the activities of some groups has also had an impact on the livelihoods of the Biga community. The different users of each resource and their degree of interaction in Biga are summarised in Tables 6.2 and 6.3.

6.3.1 Competition for resources

Competition for land has been an ongoing issue in the area. Subdivision and allocation of land on the beachfront has been in favour of wealthy and politically influential people from upcountry (cf. part 5.2.9), many of whom sold on to developers. As beach front land has become less available, development has moved inland reducing the available space for the agricultural activities of the people of Biga. In addition, many of the traditional rights of way used by fishers and traders to access the sea have been closed off due to private land ownership. The more recent and widely publicised illegal allocation of public rights of way to developers in neighbouring Diani was also of concern to the people of Biga (Galu fishermen's Committee pers. comm; East African Standard, 1996).

Competition for marine resources between the local Digo fishers and Wapemba fishers has been the cause of significant friction between the two groups. This issue is analysed in detail in chapters 7 and 8 and as indicated below, the local Digo fishers blame the lack of fish on the methods used by the Wapemba fishers. There is also competition between different fishing groups within the Biga community. As highlighted in chapter 2, communities are not homogenous groups. In Biga there is some friction between the older fishermen who use traps and the younger fishermen who use spear guns (Galu Fishermen's Committee pers. comm.). This conflict stems from the problem of limited resources and the cultural effects of Islam and Westernisation on the younger generations and its impact on traditional authority (cf. part 5.3.2).

Ground water is an important resource used by all the groups in the area because there is no piped water. In the area of the fisher households (see Figures 3.5 and 7.1) the water table is between 10m and 25m below the surface (pers. obs.). Wells sunk within 800m to 1000m from the sea tend to be brackish (from discussions during household interviews for socio-economic survey; pers. obs.), but within the area of the households the water is fresh and has never been known to dry out (Chief Mwaropia pers. comm.). One well in Biga, in the Madago quarter, was said to have been built by the Arabs who plied the coast hundreds of years ago (this is very possible as the Kongo mosque in neighbouring Diani dates to back to the 16th century). More recently five bore holes with hand pumps were put in by Swedish Aid, these are sealed and therefore do not have problems of collapsing or becoming

polluted. Each bore hole is managed by a committee of user households who contribute 20 Shillings (approx. KSh 100/£1) per household each month for the maintenance of the hand pump (household survey).

The people of Biga consider there to be two threats to the ground water: the increasing development which is a heavy user of water; and the government requirement that pit latrines should be used by households, which locals say will pollute the well water.

6.3.2 Environmental impacts

Within the Biga area the clearance of the natural woodland has reduced the natural resources available to the Biga community for house building, boats, fishing gear and other traditional uses. Coupled with the exclusion of the remaining stands of woodland on private land these materials have to be collected or bought from further afield. As discussed above and in previous chapters, clearance has been due to changes in land tenure and land use patterns. The only remaining stands of natural woodland are the sacred sites of the Biga community (*kayas*) and land owned by expatriates who take an interest in the environment.

As indicated in chapter 3, the marine environment is heavily degraded. The lack of certain fish species, particularly trigger fish, and the large numbers of sea urchins (*Echinometra mathaei*) suggest that fishing is the primary cause of this situation (cf. part 3.2.1.3). Local Digo fishermen blame the fishing practices of the Wapemba. Accusations made by the Digo fishermen are that the use of fine-meshed beach seine nets and the process of dragging the nets catches juvenile fish and damages coral and breeding areas (see Appendix III for the Galu Fishermen's Committee argument). A comparison of catches from different gear types (chapter 7, Figure 7.4) support the problem of catching juveniles. However, personal observations made during a fishing trip with the Wapemba seine net crews casts some doubt on damage to corals or seagrass beds. The number of fishers, both Digo and Wapemba, and the level of fishing effort is more likely to be the cause of the degraded state of the marine environment (cf. section 7.7). The impact of other groups on the marine

environment is probably less chronic. The overflow water from some of the Diani beach hotel swimming pools spills onto the beach, but there is no direct sewage outfall. Trucks collecting sewage from hotel septic tanks have been known to empty their tanks into the sea without any action taken by local authorities (Daily Nation, 1997). The impact of tourists walking on the exposed reef flats at low tide is unknown.

6.3.3 Socio-cultural impacts

Each of the stakeholder groups identified above are ethnically different and as a result they have had an effect on local culture. It has been suggested that tourism can have a potentially devastating effect on local culture and social equilibrium leading to changes in the values and attitudes of the local population. The inevitable demands of western tourists for prostitution, drugs and other entertainment have lead to the commercialisation or bastardisation of traditional folklore and increased petty crime and drug abuse among the local population (Migot-Adholla *et al.*, 1982; Robinson, 1999).

Hostility between the ethnic groups from upcountry and the local population has been an underlying feature of the coast. People from upcountry began settling in the coastal region during the British colonial era to work in the ports, railways and factories (Willis, 1987). More recently the tourism sector has attracted many people from upcountry. There are also seasonal migrants who move to parts of the coast to farm. Although there were seldom direct conflicts between coastal and upcountry people, the Government's policy to settle upcountry people in the coastal region during the 1960s and the blatant grabbing of beachfront land by wealthy upcountry individuals (Jommo, 1986) has antagonised the relationship between the coastal and upcountry ethnic groups. These underlying ethnic tensions were used by politically motivated trouble-makers during the 1997 general election to influence the results by frightening away a proportion of the electorate (The same tactics in 1992 led to the deaths of 1,500 people and the displacement of 300,000 people in western Kenya, Odhiambo, 1997). The events resulted in numerous deaths, destruction of property belonging to upcountry people and the exodus of tens of thousands of people (pers.

obs. Odhiambo, 1997). Conflicts based on religion have also taken place, particularly in the neighbouring Diani area where there is a large Christian population from upcountry. Senior Muslims blame the upcountry dominated District administration in Kwale and Diani police for inciting violence, which in August 1999 led to the massacre of people in a local mosque (IANA, 1999).

Within the Biga area itself upcountry people tend to be employed by expatriate residents or in the hotel and some of the smaller tourist establishments or be seasonal farmers. Discussions with seasonal farmers and Digo people indicated that there was no animosity between them, unlike the neighbouring Diani area.

6.3.4 Economic impacts

Price rises have been a significant economic effect of tourism. Land values have moved far beyond the reach of the local Digo population (cf. part 5.2.9). For some individuals who owned land in the second, third or even fourth strip from the beachfront this has meant that they have been able to sell parcels of land for enormous sums in recent years.

Competition for formal work in the tourist sector has tended to benefit upcountry people more than local Digo people. In Biga community there was only one person (of approximately 580 adults, Chief Mwarupia pers. comm.) who worked in a hotel, as a swimming pool attendant (household surveys). Local Digo people have trouble finding work in hotels for historical reasons. During the colonial era and post independence education at the coast was less developed than in central and western Kenya. As a result coastal people were at a disadvantage when it came to gaining managerial or skilled positions in hotels (Migot-Adholla, 1982). The result subsequently was that nepotism based on tribal affiliations has dominated recruitment into the hotel industry. A study in 1996 estimated that Digo people accounted for only 16.4% of employees at six of the biggest hotels at Diani (Rubens, 1996). The same study also showed that Digo positions tended to be the lowest paid manual jobs such as gardeners and swimming pool attendants. This situation has

also contributed to the resentment the local Digo population have towards both upcountry people and the hotel industry as a whole.

Although there is less opportunity for selling to tourists on the beach in the Biga area, Rubens (1996) found that in this sector local Digo people were also underrepresented. In the Diani beach area only 10% of the beach sellers and hawkers were Digo people (Rubens, 1996).

The export of octopus from Kenya by Mombasa based businesses has had a small impact on the local economy. Octopus has become a target species for spear gun fishermen who sell their catch to companies who have collection points on the main Mombasa road. One of the Mombasa companies was exporting approximately 20 tonnes of octopus a month to Italy (P. Rocca, pers. comm) from Kenya. Other export businesses include the aquarium trade and the export of sea cucumber (Holothurian sp.). Occasionally Mombasa based aquarium fish traders send teams of fish collectors to the Biga area, but they did not employ local people and consequently had no economic impact on the area. Their environmental impact had not been assessed, but having observed their method of using small scoop nets it was fairly benign. Their infrequent visits reflected the degraded state of the local marine environment, due more to local fishing activity than overexploitation by aquarium fishers. There was only one sea cucumber trader in the Biga area, but only as a sideline activity due to the very small numbers found in the area.

6.4 Summary of user interactions and resource-use in Biga

The importance of the different resources to the different user groups in the Biga area is summarised in Table 6.2. This summary is based on the role of a particular resource in the livelihood of a user group. In many cases the importance of a resource is indirect (see Table 6.1). For example, the coral reef is important to tourism because it creates a protected lagoon and wide sandy beach, rather than direct exploitation by tourism (see Rubens, 1996). Similarly, foreign expatriates have settled in the area because of the coastal environment, but don't depend directly on many of the local resources for their livelihoods despite using them.

The degree of interaction between the different groups according to their overlapping resource use and direct and indirect impacts is summarised in Table 6.3. These represent the principle natural resources different groups compete for or use share use of. Ground water is not included because all groups use and depend on it (see part 6.3.2 for details). Marine resources include seagrass beds, coral reefs and fish. Land resources include forests and fallow land.

The spatial distribution of the main user groups in Biga is illustrated in Figure 6.2. These include the local Digo community, the seasonal farmers from upcountry, private landowners (including Kenya Sugar estate) and the tourist industry.

6.5 Conclusion

The presence of other groups in the vicinity of the study area influences the resources available to the local Biga community in a number of ways. The changes in land use patterns due to the introduction of land allocation pre and post independence and the subsequent development of tourism and expatriate residences, have been the primary causes of impacts (through loss of access) on the terrestrial resources used by the local community. The observation that the tourism sector tends to aggravate existing patterns of inequality (Migot-Adholla *et al.*, 1982), runs true in the Biga and Diani area. This inequality fails to ensure that the local population, whose land and other resources may have been expropriated for tourism development and wealthy expatriates, are in a position to benefit directly from tourism (the livelihood analysis in the next chapter illustrates this).

The primary issue in the marine environment stems from the fishing activities of both the local fishers and the migrant Wapemba fishers. The lack of fish (which will be shown in more detail in chapter 7) due to the level of fishing effort and methods of fishing has lead to competition and conflicts between the local Digo fishers and the Wapemba.

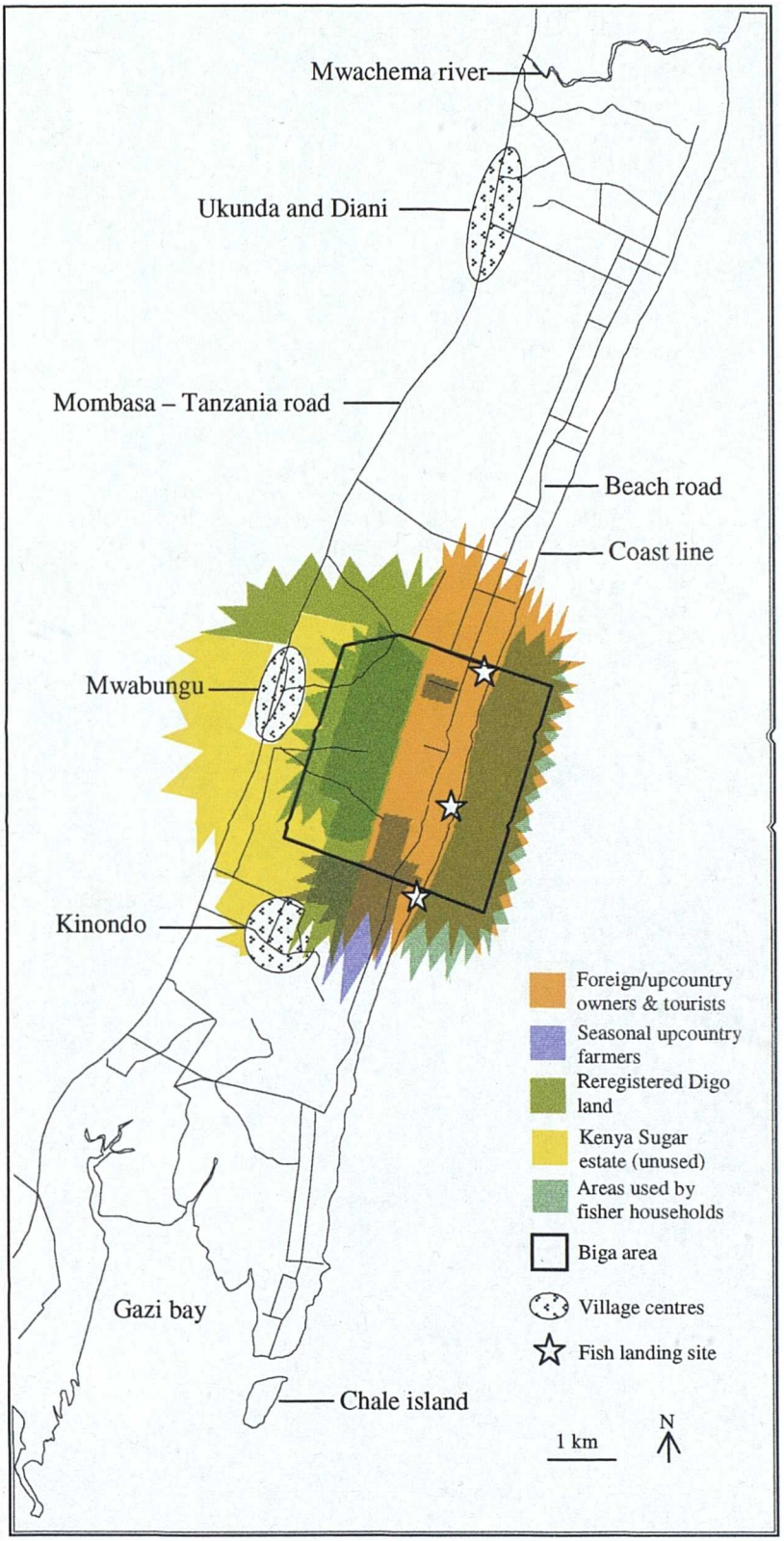
Table 6.2 Summary of the importance of different natural resources to the livelihoods of different user groups in Biga.

Natural Res.	Digo	Wapemba	Farmers	Hawkers	Expatriates	Tourism	Business/shops
Sea	High	High	Low	Medium	Medium	High	Low
Seagrass	High	High	Low	Low	Low	Low	Low
Coral reef	High	High	Low	Low	Low	Medium	Low
Fish	High	High	Low	Low	Low	Low	Low
Beach	High	High	Low	High	Medium	High	Low
Land	High	Medium	High	Low	Medium	High	Medium
Ground water	High	High	High	High	High	High	High
Forest/fallow	High	Low	High	Low	Low	Low	Low

Table 6.3 Summary of strength and type of interaction between the different groups in the Biga area

	Digo	Wapemba	Farmers	Hawkers	Expatriates	Tourism	Business/shops
Digo		High	High	High	High	High	High
Wapemba	Marine; cultural; economic		Low	Low	Low	Low	None
Farmers	Land; cultural; economic	Land; cultural		None	High	High	None
Hawkers	Access; beach; cultural	Access; cultural	None		Medium	High	None
Expatriates	Land; access; cultural	Access; cultural	Land; cultural	Beach; access; cultural		High	High
Tourism	Land; sea; access; cultural	Sea; cultural	Land; cultural	Beach; access; cultural	Land; economic		High
Business/shops	Land; cultural	None	None	None	Land	Land	

Figure 6.2 The distribution of user groups in Biga. (Source: District Surveyor; this study)



From the point of view of the local community, all the other stakeholder groups are perceived as competitors for local resources. In many instances the precarious socio-

economic predicament of the local community has lead to conflict over resources. Unfortunately for the Digo people, they have become one of the weakest stakeholder groups, despite having the most at stake in the local environment, because most of the other groups are linked to the politically and economically powerful tourism sector.

The next chapter analyses the livelihoods of the Digo households in Biga.

7 ANALYSIS OF LIVELIHOODS AND PRODUCTION SYSTEMS THROUGH DISCUSSIONS AND SEMI-STRUCTURED INTERVIEWS

7.1 Introduction

This chapter presents an analysis of the livelihoods and production systems within the Digo community of Biga. It forms the basis for understanding conflicts over resources and reactions to perceived and real threats to local people's access to and control over resources. The aim is to present the socio-economic situation of the local community in the context of the social and biophysical setting developed in the preceding chapters.

This part of the study is based on information collected through semi-structured interviews and discussions with individuals and groups in the community. The methods follow the principles of Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA), which have been developed in the field of overseas development. The former is used to elicit or extract information and the latter used primarily to enable local people to analyse their local situation and to plan and act. In terms of understanding local situations, the methods have proven to be more valid and reliable than rigid questionnaire surveys (Chambers, 1992).

The process of eliciting information about livelihoods, presented in this chapter, was also tied in with eliciting information about the issues investigated in the next chapter (concerned with problem solving actions). Issues of access to and control of resources are intimately tied to, or are an integral part of livelihoods. In some situations the process shifted from eliciting information to the local people analysing their situation. Thus engaging in conversation with a group of fishermen and discussing their situation not only provided information, but it also facilitated investigation and learning on their part. This is not to say that the process developed a consciousness about their problems; this was already well established, but it did on occasion lead to fuller and more confident discussion amongst them. Thus the principle of an outsider initiating a process and sitting back, not interviewing or interrupting occurred and was a consequence of the subjects being discussed. Sharing of information, another principle of PRA, was a key part of our relationship.

Chambers (1992) emphasises that the principles behind PRA tend to be personal, relating to behaviour and attitudes of outsiders in their interactions with people.

The first section of this chapter presents the methods of information collection and analysis. The methods of eliciting information are also those used for chapter 8. The second section puts into context the previously described methods and their application in the field and gives meaning to 'participation' in this case. It illustrates the fact that the appearance of a researcher investigating some fairly sensitive issues can be considered to be a resource to be exploited by members of the community, and that the give and take of eliciting information is a consuming part of the research process. The third section describes the physical layout and demography of Biga. The fourth (*production systems*) and fifth (*productivity and incomes*) sections present the analysis of livelihoods of the Digo community. Emphasis is given to the livelihoods of the Digo people because they are the focus of this study and represent 90% of the community. The importance of fishing to most households becomes evident through the analysis, and therefore a brief discussion of the state of the fishery is given in section 7.7. Some of the information on the fishery was collected with another researcher[25]. All the household interviews that form the basis of many of the results presented in this chapter were carried out in conjunction with another researcher[26].

Presentation of the production systems includes the methods of production on land and at sea and non-fishing/farming employment. Attention is given to the variety of food crops grown and the methods of cultivation, the different methods of fishing and selectivity of fishing gear. The seasonality of production and therefore incomes both on land and in the sea is also an important characteristic of the livelihoods.

[25] Jason Rubens, University of Newcastle, UK. MSc thesis: An analysis of the benefits and costs of marine reserve regulations at Diani, Kenya.
[26] Delphine Malleret-King, Institut d'Etude du Developpement Economique et Social, Paris. DESS Memoire: Les systemes de productions des agricultures et pecheurs de Biga, petite communaute de pecheurs.

7.2 Methods

Chambers (1992: 15-19) presents a list of methods used in RRA and PRA. Some of these methods were included in this study. The choice and application of these methods in the field were based on the manuals compiled by Nichols (1991), Waters-Bayer and Bayer (1994), Mikkelsen (1995), Slocum *et al.* (1995) and the extensive anthropology text by Bernard (1995). Other literature on the application of PRA in policy research and development has given terms to some of the approaches that were used to elicit information (Nelson and Wright, 1995; Leach *et al.*, 1997; Holland and Blackburn, 1998). The analysis in this chapter and chapter 8 are based on these methods of data collection.

7.2.1 Livelihoods and production systems information

Non-random sampling methods were carried out, principally purposive sampling of households, where 'typical' households were selected following group interviews or based on discussions with other households. This approach suited the small sample sizes that resulted from the detailed and time consuming interviews carried out with each household.

The identification of **key informants** was an important part of the fieldwork. The focus of the overall study on problems faced by fishers in relation to resource access and control meant that it was necessary to find out who the experts were.

Informal and unstructured interviewing took place throughout the fieldwork. Informal interviews were essentially the process of building a rapport with informants particularly early on when there was some suspicion about the presence of researchers. Unstructured interviews were principally focused conversations and these often took place on car journeys when there were one or two informants who could talk more freely away from others. These sessions enabled the informants to provide what information they thought necessary (Bernard, 1995). They knew what the conversations were about but it was up to them what they said.

Household surveys that sought to elicit information about incomes and productivity were based on **semi-structured interviews**. There were two reasons for this: there was a need to ensure that the same underlying information was collected from each household; yet the questions needed to be sufficiently open ended to allow informants to expand on responses if they wanted to. The household surveys were devised and carried out in conjunction with another researcher[27] who was also working on the production systems of the Biga community. Households were not chosen at random because the different subgroups identified within the community needed to be sampled (cf. Holland and Blackburn, 1998:170-178). Initially households were selected through the village chairman and with members of the fishermen's committee who were involved in group interviews (see below) relating to the fishery. Once a number of interviews had been carried out it became possible to select other households that were dependent on different sources of livelihood. The questions used as the basis for the interviews are given in Appendix IV. The principle areas of interest were the family and the number of dependants; land ownership; work; agricultural activities; fishing activities and finally general questions of socio-economic interest such as savings, education and the future of Biga. This process also meant that people's responses could be checked and triangulated to other discussions or interviews over the period of the fieldwork.

Group interviews were carried out with the fishermen's committee. These sessions were also based on semi-structured interviews and sought to elicit different kinds of information relating to the fishery, the socio-economic predicament of the community and the perceived importance of different actors analysed in the next chapter. One of the group interviews based on questions relating to the fishery was carried out in conjunction with another researcher[28] working in the area. The questions that formed the basis of that interview are presented in Appendix V. The principal areas of interest were the transferability of gear types; awareness of change in catch and causes; seasonality of effort and catch; extent of fishing zone and alternatives to fishing (cf. Rubens, 1996). It was partly based on that group interview that it became evident that the informants identified different groups within the community according to the fishing method used by the man of the household.

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[27]Delphine Malleret-King

Some of the questions asked at both the household interviews and the group interviews sought information about changes that may have occurred over time. **Seasonal activity calendars** have been used as a method of analysis and presentation of results based on information derived from the household surveys. In pure PRA terms, this method would be used as a method of eliciting information, but in this case it would have taken too long (for the informants) in conjunction with the semi-structured interviews.

Livelihood analysis is one of the underlying threads to this chapter. On the basis of the semi-structured interviews carried out at the household level, incomes and expenditure for the different groups and the range of activities within households were calculated. These calculations include subsistence production. In addition the production maintenance threshold for an average family in the community was also calculated and the different groups were considered in relation to this.

Identification of differences within community activities and structure is another underlying thread to this chapter. As Leach *et al.* (1997) identified, communities are not homogenous, differentiation occurs for a variety of reasons and institutional arrangements affect the different groups in different ways. The household surveys considered the main groups within the community based on different production systems. The focus of this study was essentially the predicament of fishermen and their households in relation to resource access and control. As such different groups were identified on these terms, as has been described above. It is acknowledged however that other groups did exist in relation to resource access and control, based on factors such as gender, age, ethnicity, activity and wealth.

7.2.2 Additional fisheries information

Additional information to the semi-structured interviews collected on the fishery included sample measurements of length, body depth and weight for three target

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[28] Jason Rubens

species, Siganus argenteus, Lethrinus harak and Leptoscarus vaigiensis. The objective was to compare the length class distributions of the selected species between fish traps and beach seines. Some of the data were collected jointly with another researcher (Jason Rubens). Length, body depth and weight data was also collected to establish a relationship between fish size and weight. This enabled visual estimates of fish lengths to be made and weights derived later, without having to weigh fish and disrupt fishers (Laroche and Ramananarivo, 1995). It also enabled some data to be collected when it was otherwise difficult, as fishers landed their catch in different places within a given landing site, and when they didn't want their fish weighed.

The primary source of fisheries data was provided by the Coral Reef Conservation Project (CRCP cf. part 5.2.5). An officer from the Fisheries Department had been seconded to CRCP to collect catch data at eight landing sites within an area that included this study site. The data had been collected since September 1995 for twelve days per month. Data was made available for this study for the period September 1995 to September 1997. None of the Fisheries Department's data was used in this chapter (for a discussion on the quality of Fisheries Department data see part 5.2.5 and Figure 5.1).

7.2.3 A general note on sources of information

The field work covered two phases, five months in 1996, between May and September and twelve months between February 1997 and February 1998. Information was collected from informants, personal observations, official government records and data sets from non-governmental research organisations. This section relates to both this chapter and chapter 8.

7.2.3.1 Selecting the study site

The first phase of fieldwork was concerned with identifying an appropriate study site and collecting information on the livelihood systems of a fishing community. The

problem of the marine reserve (analysed in chapter 8) meant that all the communities within the proposed boundaries of the reserve, which covered twenty kilometres of coast (from Mwachema River in the north to Chale Island in the south, see Figure 3.5), were initially uncooperative. I visited the four main communities (Ukunda area, Diani area, Galu-Biga, Kinondo) to introduce myself and to select a study site. At one main landing site (Ukunda area) the fishers were unhelpful and one senior fish trader was hostile each time I visited the site. That particular community had been very threatening to KWS personnel, stoning KWS vehicles a few months earlier (Kaka and Muthiga pers. comm.). The adjacent community had relatively few fishers (Diani area) due to the level of tourism development in their area and was therefore not appropriate for my research. The community I chose to work with (Biga in Galu area) was not hostile, but their suspicions meant that the fishermen were initially reluctant to discuss any questions relating to fishing.

7.2.3.2 Informants

The informants I worked with were fishers, fish traders, relatives of fishers, government officials, researchers, boat operators, beach hawkers and European expatriate residents. I worked with four key informants throughout the duration of the field work (April-September 1996; February 1997 to February 1998). Three of these informants were fishermen and were members of the local fishermen's committee and one was a fish trader who was the chairman of a fish landing site. I spent extended periods of time with key informants, often at the fish landing sites, on journeys together when visiting government officials, or at their homes in the evenings. I met with approximately seventy secondary informants on a number of occasions. There were a number of government officials who gave me privileged access to written records and were frank and open in many discussions. Because I spent most of my time in Biga I frequently met many other people for short periods of time at the landing points or in the village.

Initial contacts with fishermen and their families were made through a member of the community I knew. Initially there was suspicion within the community about my intentions because researchers were mostly associated with conservation projects and

my association with expatriate residents who had pushed for a marine reserve in the area did not allay the concerns of local people. This situation slowed down the process of information collection for a period of about three months, but it provided me with a good insight into the reactions and behaviour of the community in response to perceived and real threats. Questions relating to why the community had rejected the marine reserve were of interest to me. It was essential for example that I had no association with KWS (who were very understanding) if I was to gain the confidence of the community. It took two months before I could take length or weight measurements of fish, such was the level of distrust as a result of the attempted implementation of the marine reserve. As a result I spent much of the first phase of the fieldwork focused on the land-based activities of the community. This served two functions: it reassured people that I was not part of an attempt to reintroduce the marine reserve and it provided me with the information necessary to understand how the community lived.

The process of introductions to senior officials and members of the community provided an insight into the social hierarchy in the area. Having gained permission from the Office of the President to carry out research in Kenya it was necessary to introduce myself to senior members of the Administration. This included the District Commissioner (DC), from whom a letter supporting the research was necessary in order to reassure other government officials and members of the community that the research had been sanctioned locally, and introductions to the District Officers, Chiefs and Village Chairman. The DC's letter was effective in opening doors to most government offices in the district. Similarly introductions were made to any government departments relevant to the research, such as the Fisheries Department and the Kenya Marine Fisheries Research Institute (KMFRI). In the early stages of the fieldwork the Chief and Village Chairman arranged meetings with members of the community. It was important to be perceptive of the established hierarchies if there was any chance of discussing fairly sensitive social and political issues. In this respect it was not possible to consider a random sample of informants, as some individuals were clearly uncomfortable about some topics of discussion unless a higher authority had sanctioned the meeting. Fortunately the time scale of the study meant that I became sufficiently immersed in the community that I gained access to

most members of the community, and also the wider community of officials and non-local people.

Once the process was underway the fishermen's committee in the area considered charging me a large fee to carry out my work and suggested certain obligations surrounding use of the vehicle, but it went no further than that. On one occasion they tried some gentle blackmail, saying that they had seen me wearing KWS marked clothing and so I would have to show a high degree of loyalty in order to work in the area (see Appendix VI disclaiming a link to KWS). It was inevitable that there were attempts to sound me out and make what they could out of me. In the event the situation was really a conflict between the local fishers and the migrant Wapemba fishers (cf. part 8.3.2) who were trying to undermine the authority of the committee by suggesting that they had been bought off by KWS.

Most of my interactions were directly with informants as I was able to speak Swahili to a sufficient standard to carry out the interviews and discussions. One key informant spoke very good English, so on occasion I could seek clarification from him. There were a few occasions when older members of the community could not understand my Swahili and in such instances a friend of theirs or member of their family would translate into their language, Digo. Reciprocating with informants for the information they shared with me took a number of forms. In almost every case I avoided giving money in return for their time. For prearranged interviews and discussions that were held at informants' homes, such as during the household surveys carried out in conjunction with another researcher[29], we would bring a gift of one kilogram of sugar and two kilograms of rice or maize meal. We felt that a food gift to the household was more appropriate than simply a gift to the man (fisher), as conversations often included the senior wife of the fisher. In instances when informants had given me their time on the spur of the moment, I would give them a small thank you in the form of cigarettes (most men smoked) or cash. The relationship with my key informants was established on the basis of reciprocation. I was in the fortunate position to posses a vehicle and so was able to provide transport for delegations of fishers to government offices that were normally inaccessible due

[29] Delphine Malleret-King

to public transport costs. I also made numerous journeys alone on behalf of the fishing community to government offices, delivering letters or 'getting signatures'. Other forms of reciprocation included rushing someone to hospital for an emergency operation, occasionally buying medicines, using the vehicle to carry heavy loads of plantains or copra to the main road for transport to Mombasa market and giving lifts locally. I met with my key informants at my home on a few occasions, reciprocating in the same way as they did with me.

Despite wanting to remain an impartial observer within the community it was inevitable that my assistance in providing transport and facilitating access to government officials influenced the outcome of the problems I was interested in. In addition having to be seen to take sides in the conflict between the local fishers and the migrant Wapemba meant that I did not get access to Wapemba households. I did however go fishing with the Wapemba.

The results from the interviews and discussions are presented in the following sections.

7.3 Demography of Biga

The village community (*kijiji*) of Biga is located in Galu sub-location, Kinondo location, Kwale district (Figure 6.1 *map*). Biga is a Digo community and like many others is a collection of family homesteads (cf. Gerlach, 1963, on characteristics of Digo communities) dispersed over an area of about 8 km^2. There are also other ethnic groups living within the village area (cf. chapter 6). Excluding the tourism development and expatriate residences along the seafront, approximately 90% of the population of Biga are Digo. The remaining 10% are made up of migrant fishermen from Tanzania (3%) and migrant farmers from upcountry (7%) (Chief Mwarupia pers. com.; household surveys). The number of people over eighteen years of age was estimated to be 580 (Chief Mwarupia pers. com.). From the household[30] surveys the average number of people per household was calculated to be eight. In general

[30] Household was a group of people living together, usually but not necessarily related. Members contributed to the household's maintenance and subsistance and shared the resources produced within the household (food and money) (Mwadime, 1996).

this was made up of two adult active producers[31] and six children or the same number of active adult producers, one adult non-active producer (aged) and five children. The number of children per household was less than the national average of eight (GOK, 1995). The total population of Biga, including the main ethnic groups, was estimated to be 1,500 people.

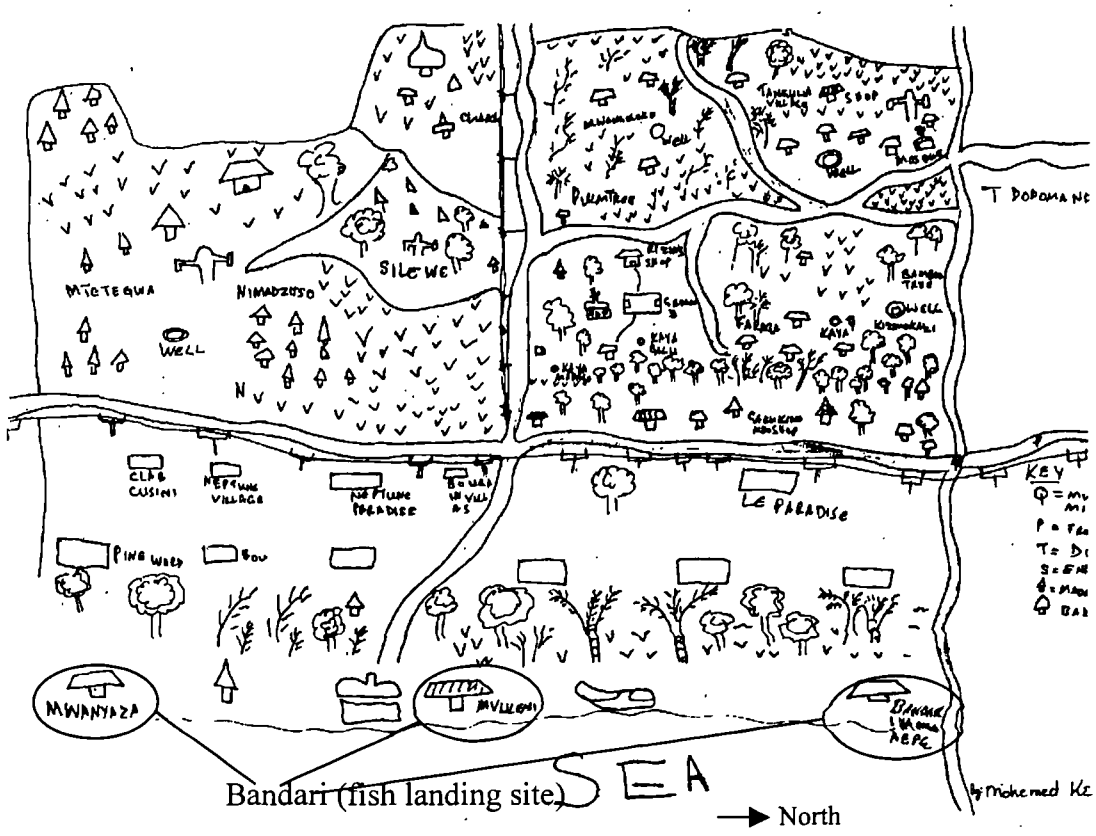
According to older members of the community Biga started as a collection of family dwellings in three seafront sites. The community has subsequently grown to twelve 'quarters' (*mtaa*), the original three on the sea front: Mwaepe, Mvuleni, Mwanyaza and nine inland: Mtangizeni, Kizimkazi, Tangulia, Mwangoloko, Silewe, Nimadzitso, Mtetegwa and Madago (Figure 7.1). Each of these quarters is associated with a family or clan and contains a cluster of family dwellings except in the seafront area where the development of tourism and expatriate residences has forced Digo people off the land (cf. Figure 3.7 and Figure 6.2). There are some dwellings that are more dispersed and these tend to be the more recent arrivals, either the migrant farmers or other Digo households (mostly 'squatters' on land owned by Kenya Sugar, cf. part 6.2.8). Each sea front quarter has a gazetted (officially recognised) fish landing site (*bandari*) that retains the same name as the quarter (i.e. Mwaepe, Mvuleni, Mwanyaza). Figure 7.1, drawn by one of the Biga children, illustrates the village area of Biga. Despite the seafront strip between the road and the sea being unoccupied by Digo people, it is still considered part of Biga.

7.3.1 Community differentiation

From initial interviews and the household surveys the informants identified three groups living within the Biga area based on ethnicity: the Digo community, the Wapemba migrant fishers and the migrant Meru/Tharaka farmers from upcountry. The core community of Biga was identified as the Digo group, but the other minority groups were well established in the area. Some of the Wapemba had Digo wives, some of the migrant farmers were now permanently based in the area, and their

[31] Active producer includes any individual involved in generating resources for the household, either

Figure 7.1 Biga community area, showing the main quarters and principal features.



(Source: drawn by Mohemed Keke, chosen from 15 maps drawn by the pupils of Madago Primary school in Biga.)

children attended the local primary school. Household differentiation within the community was also associated with the principal food production system (activity) or economic activity. Households surveyed were selected according to the different production systems (Table 7.1).

Thirty households, 16% of the total number, were surveyed in depth about their livelihoods and production systems. The low number of samples was due to the detail and length, up to three hours, of each interview and in some cases the small sizes of the groups. No household surveys were carried out with the Wapemba group because of the conflict over fishing methods with the Digo fishers (the implications for the fieldwork were outlined above, part 7.2). The subgroups and their defining characteristics and proportion of the number of households in each group sampled are presented in Table 7.1.

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through agriculture, fishing or non farm/fishing employment.

Table 7.1 The main household groups and subgroups within Biga according to ethnicity and production system.

Ethnic group	Group	Subgroup (% sampled)	Defining characteristics
Digo	Fishers	With canoes (13%)	Traps, lines, gill nets. 80% of fishers aged over 40 yrs. Original clans.
		Without canoes (7%)	Spear guns. Biggest group, most fishers aged between 18-30 yrs. From fishing families. Living on family land. A very few older men using spears. Other fishers sharing canoes.
	Non fishers	Subsistence agriculture (80%)	Retired fishers for reasons of age, illness or were unable to reinvest in capital items (canoe). Only small areas of land cultivated.
		Non farm/fishing employment (28%)	Fish traders, shop keepers, traditional doctors. Many not from original fishing clans.
Meru/Tharaka	Migrant cash crop farmers	Established - Cultivating > 0.5 acre/active producer (44%)	Settled or regular migrants to the area, either men 40 - 70 yrs old or second generation.
		Recent arrivals - Cultivating < 0.5 acre/active producer (40%)	Either young people recent to the area, lack of capital or established people forced off the land they were cultivating by local Digos.
Wapemba	Fishers	Migrant fishers (not sampled)	Seine nets. Established settlement with fruit trees, supplemented food production, frequent migration of younger men to Tanzania.

(Source: 30 household surveys; group interview with the Galu Fishermen's Committee; discussion with Chief Mwarupia and Village Chairman; Malleret-King (1996).)

7.4 Production systems of the Digo

The most important observation was that all the Digo households had land under cultivation (surveyed and observed). This indicated that household livelihoods were based on a combination of activities. As outlined in Table 7.1, the main activities providing food and/or income for households were fishing, farming and non fishing/farming activities such as trading, but in all cases this was supplemented by household food plots (*shamba*). The extent of the household food plots depended on a number of factors such as labour, age or health, security of land tenure, spare time and the amount of income generated from the main activity. The crops grown for subsistence, the methods of cultivation, seasonal activities and secondary sources of income related to the *shambas* are first described because they were common to all

households. Fishing production systems, including methods, seasonal activities and target species and non fishing/farming employment are then described.

7.4.1 Digo household and subsistence plots (*shamba*)

All Digo households grew crops for subsistence and some income. Most of the Digo households were fishing households, but there were some that had retired from fishing or had other sources of income. However, the division of labour, methods of cultivation and types of crops were common to all households. Similarly, most households had other (informal) sources of income. All households had some fruit trees, mostly mango and coconut, that provided both food and additional income at certain times of the year. The numbers and types of trees depended principally on how long the site had been settled by a family (cf. part 5.3.1 on traditional land tenure). Labour, rather than land has been identified as the primary constraint to food production in sub-Saharan Africa (Mwadime and Hoorweg, 1996). For the Digo households in Biga, division of labour was a key factor in producing a variety of food and income sources.

Most Digo men were fishermen. This occupied most of their time, but they also worked in the *shambas*, clearing the land, planting, weeding and harvesting. Those men that did not fish either worked full time in the *shambas* or had other business and divided their time with cultivation in the same way as the fishermen.

Women were responsible for looking after children, preparing food, collecting firewood for cooking, collecting water from the wells, washing clothes, as well as assisting in clearing land for cultivation, weeding and harvesting. Women also had informal sources of income, such as baking and selling cakes, making palm thatch or weaving mats.

Children spent most of their time at school, but would also help with the preparation of land for cultivation and the weeding and harvesting. In the few households that kept livestock, cattle or goats, the children were usually responsible for keeping an eye on the herd when they were not at school.

Reciprocal assistance among households was also an important source of labour within the community, but because people were in very similar situations in terms of activities, there were seldom spare hands available during the busiest times of the year, such as clearing land and harvesting. On the whole people assisted in one off jobs such as re-thatching, transporting large loads of produce to the main road and so on. In some instances, if there was sufficient disposable income, households employed temporary labour to assist in clearing land or harvesting at a rate of about 100 Ksh/day (£1) or paid in kind (fish, or maize during harvest time).

All cultivation was carried out by hand. The two tools were machete (*panga*) and large bladed hoes (*jembe*) with long (*mrefu*) or short (*mfupi*) handles. All clearing was done with *pangas*, and in the sandy loam zone (cf. Figure 3.7) the soil was worked with hoes. Land cleared on the coral rag zone could not be worked with a hoe. Here the method of cultivation was to use small pockets of soil in the rocks that had been exposed after slash and burn clearing. The great majority of Digo homes were in the sandy loam zone but those that cultivated maize had separate *shambas* on the coral rag zone where the soil was more fertile.

The main staple food crops are maize (*mahindi*) and cassava (*muhogo*) for starch and beans (*kunde, pojo, mbazi*) for protein. Important secondary food crops are sweet potatoes, bananas and plantains, citrus fruit, pawpaws, mangoes and coconuts. This range of food crops have remained the same for over fifty years (Gerlach, 1961). In addition small quantities of millet, sesame, tomatoes, kale, groundnuts, capsicum, chillies, ocra and aubergines were grown. The system of cultivation is rainfed and therefore all activities are seasonally dependent. Figure 7.2 illustrates the seasonal activities related to the main food crops. None of the households interviewed were entirely self sufficient for food. In general the main staple crops provided food for 2-6 months depending on the area cultivated (depending on other activities and availability of land) and the success of the seasons (rainfall and ripening period).

Although maize flour (*posho*) is the principle source of food in Biga, only 20% (Malleret-King, 1996) of the households interviewed grew maize, Zea mays (scientific names for cultivated crops were found in Rehm and Espig, 1991). The

main reason for this was the increasing inaccessibility of land on the coral rag zone that was better suited to maize production (changes in land use patterns and ownership). Two maize hybrid cultivars were grown in Biga, known locally as short maize (*mahindi mfupi*) and tall maize (*mahindi mrefu*). The short hybrid was the most widely grown because of its shorter growing season (three months). Treated seeds were bought at the local market in Mwabungu (cf. Figure 3.5) on the main Mombasa road in preference to keeping seed from previous crops. Despite the relatively short growing season of the short hybrid variety, maize was only grown during the long rains (*masika*) (Figure 7.2). The area cultivated varied between 0.2 and 2.5 acres. The larger areas were on the coral rag zone about 20 minutes walk from the homes, whereas the smaller areas were adjacent to the homes. The areas cultivated away from the homes required a permanent presence to guard against baboons, bush pigs and other animals. Harvested maize was stored on the cob in grain stores and milled for flour (*posho*) when needed.

Cassava, Manihot esculenta, (*muhogo*) was planted by 60% of households (Malleret-King, 1996). Being a root crop it was grown in plots adjacent to homes in the sandy loam zone (cf. Figure 3.7). Areas planted were between 0.1 to 1 acre. Two varieties were cultivated in order to take advantage of the two rainy seasons and ensure some food supply during the dry season, November to March. One took 7 months to mature and the other 10 months. New plants were propagated from cuttings taken from harvested plants. During the dry season no planting took place but cuttings were stored in the shade ready for the long rains in April (Figure 7.2). Where possible cassava was grown close to homes so that a permanent watch could be maintained to ward off bush pigs.

All Digo households grew beans of some type. Often they were inter-planted with the cassava or maize. The three principal varieties grown were cowpea, Vigna uniguiculata (*kunde*), green gram, Phaseolus aureus (*pojo*) and pigeon peas, Cajanus cajan (*mbazi*). 90% of households grew between 0.1 to 0.5 acres of cowpea and green gram as an important source of protein (Malleret-King, 1996). Most households bought seeds. Pigeon peas are small shrubs and were grown by all households as hedges between *shambas*. Seeds were seldom bought.

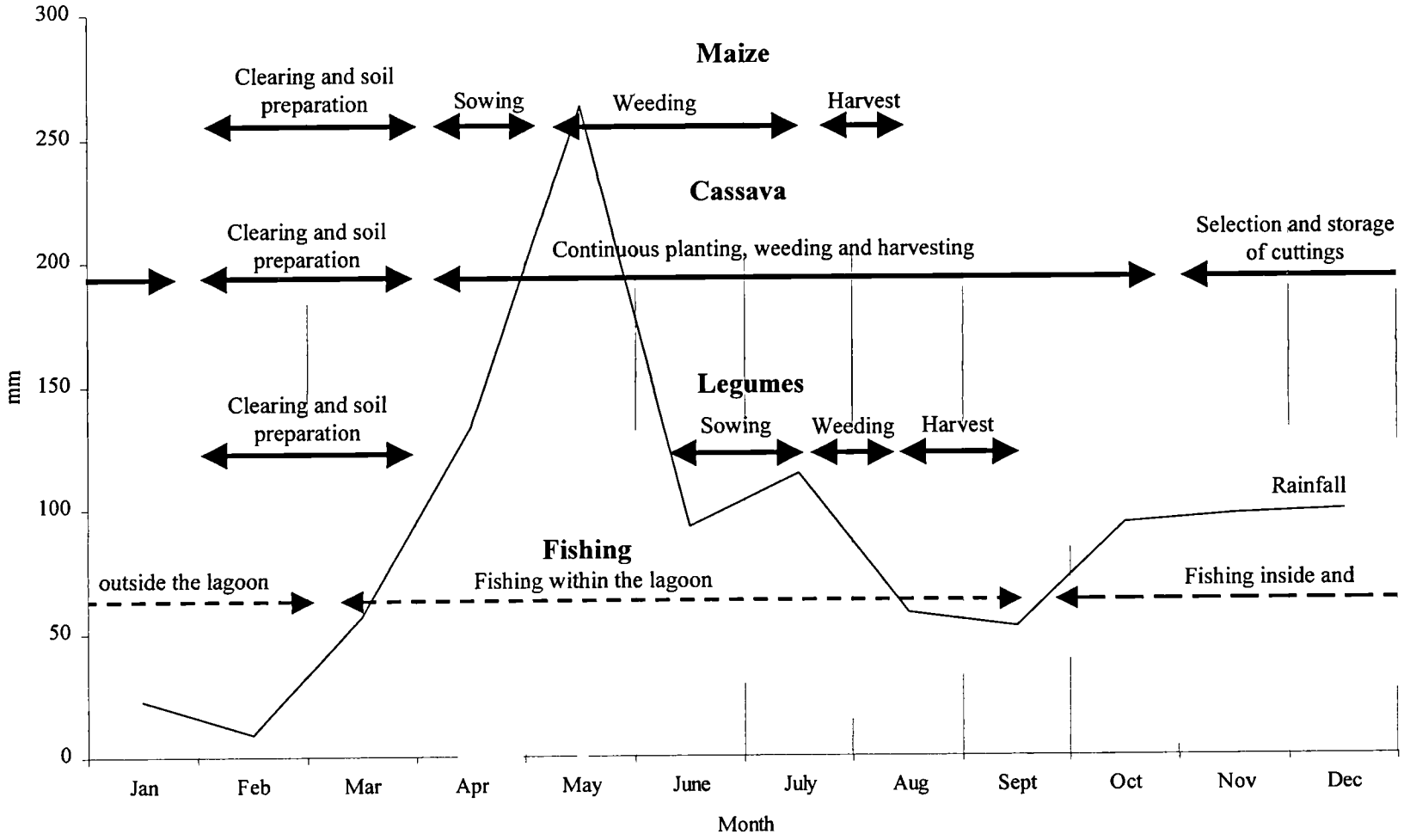
No chemical fertilisers, organic compost or manure was used, instead people relied on the fallow periods and inter-planting with legumes to maintain fertility. Household plots were cultivated for about 3 to 4 years and where possible left fallow for the same period. If land had been fallow for more than a year the secondary undergrowth was sufficiently dense to require slash-and-burn clearing. Areas that had been left for shorter periods were usually only overgrown with grass and this was simply dug over and turned into the soil with a hoe. Inter-planting beans with the maize and cassava limited the growth of weeds and reduced soil erosion.

All households kept poultry (5-15 chickens, 20% of households kept 2-7 ducks), as a form of savings and for emergency food supply (Malleret-King, 1996). Some households kept goats (Small East African Goat) and a very few kept cattle (Zebu). Livestock was considered a good investment as a form of savings if there was surplus income from fishing or another economic activity. However only 0.1% kept cattle and it was evidently a risky investment because the area is very prone to Trypanosomiasis which is carried by Tetse fly. One fisherman had lost 10 cattle, nearly half his herd, in 1995 to Trypanosomiasis. In addition cattle do not generate a regular income, but are sold off when times are hard.

7.4.2 Secondary sources of income in Digo households

In addition to providing food, many of the fruit trees and crops grown by Digo households provide some income. The main trees planted for additional income are coconuts, mangoes and cashew. All these trees have been planted in the sandy loam zone around homesteads and some coconuts have been planted in sandy areas on the seafront between Mvuleni and Mwanyaza beach landing sites. Very few of the trees on the seafront remain accessible to Digo people because the land is under foreign ownership.

Figure 7.2 The main seasonal activities relating to subsistence food production in Digo *shambas*.



Source: In depth interviews with Digo households and group interviews with Digo fishermen; adapted from Malleret-King (1996); rainfall from Mombasa Met. Office, 1985-1994.

All Digo households have access to coconut trees (*mnazi*). These provide a wide range of products used both in the home and sold. Uses in the home include thatch from fronds, fuel for cooking (husks and frond stems), coconut oil for cooking, coconut cream (*tui*) used in many dishes particularly with beans and cassava and the liquid of young coconuts (*madafu*) as a drink. The principal products produced for sale from coconut trees are copra, which is the dried flesh of mature coconuts from which oil is extracted, and thatch. Only 10% of households had sufficient numbers of coconut trees to make copra production worthwhile, although some households would sell any surplus ripe fruit to copra producers. Copra is produced during the dry season when the ripe fruit are split open and sun dried. Thatch is made throughout the year and stacked until a sufficient quantity has been produced to sell.

Mango trees (*mwembe*) are grown by 95% of households both for food and for sale. The three most popular varieties grown for cash are *apple mango*, *boribo* and *dodo*. There are two seasons, June-July and December-January following the long and short rains. Households interviewed sold between 300–7000 mangoes per year. In addition large old trees were occasionally sold to make canoes.

Cashew nut (*korosho*) trees were once widely grown as a cash crop in the area, but world cashew nut prices have become too low to make it an important crop. Approximately 20% of households had cashew nut trees, but they were either old or neglected and not very productive. Only three households interviewed sold any quantity of nuts (20–100 kg).

Any surplus from other fruit and vegetables grown in household plots were either sold or bartered. Two households were growing tomatoes, peppers, aubergines and chillies as cash crops to supplement household income. Other activities included weaving mats and baskets and making cord from the dried fronds of Dwarf palms, *Hyphaene coriacea* (*mnya*), other palms and grasses. Some households sold cakes and fried fish within the village or at stalls on the road, and one lady bought tobacco leaves and made snuff for sale.

The planting of fruit trees around homes and on the household plots has reduced the amount of land available for cultivation of staples. This is a recent problem because

of the lack of land now available (due to encroaching development and closure of private land) around the periphery of the homesteads.

7.4.3 Fishing

Fishing is the most important economic activity in Biga. It accounts for over 70% of the income in 80% of the households (cf. part 7.5.2 below; Malleret-King, 1996; household surveys; group interviews with fishers; surveys of fishers at sea). The main groups that were identified were households that had canoes from which to fish and households that did not (Table 7.1). Having a canoe determined to some extent the method of fishing, and therefore there were subgroups according to the methods of fishing. For the majority of households fishing was a full time occupation for men. There were no women fishers. The number of fishers according to fishing method and the landing site used are presented in Table 7.2 below. There were also a number of part time fishermen who preferred to focus on agriculture during the wetter months when the fishing was poor, or had other forms of employment throughout the year.

The four main methods of fishing used by Biga fishermen were traps, spear guns, nets and hand lines. Within each of these methods there were a number of gear types used. There were two types of vessel, simple dugout canoes and outrigger sailing canoes, none of which were motorised. The vessels and gear types are described below.

Simple dugout canoes 4-5 metres in length (*dau* is the local term, although *mtumbwi* is a more widely understood Swahili term for a small dugout) were commonly hewn from a single mango tree. These canoes were poled in shallow lagoon waters and paddled in deeper water. In the past local hardwoods were used but these no longer exist. The large mango trees now used are also becoming scarce near the sea. Basket traps, gill nets and hand lines were the fishing methods used by canoe fishers. The outrigger canoes (*ngalawa*) were also dugouts made from mango tree but with an additional wash strake superimposed. The outriggers were lashed across the canoe and a lateen sailing rig was the main form of propulsion (for origin cf. chapter 4, section 4.2). They tended to be slightly longer, 4-8 metres, than the *dau*. These vessels tended to be used for trolling or bottom fishing outside the reef during the

calmer NE monsoon. The vessels were careened about every two weeks by burning a fast fire underneath the hulls, no other method of anti-fouling was used.

Approximately 23% of the fishers in Biga used woven cane hexagonal basket traps (*malema*). These traps varied between 0.5-2 m across, with mesh sizes of 5-7 cm and an entrance depth of about 15-20 cm. The larger traps had larger mesh sizes and were only used in deeper waters outside the reef during the calmer NE monsoon. Traps were made from the split canes of four local trees, *Mlanga*, *Mvamva* or *Mushumari* for the sides, top and cone and hard wearing *mnya* (Dwarf palm) for the base and ties. The traps are weighted with coral stones tied to the sides with *mnya* cord. All these materials were gathered locally, but fishers complained of having to search further afield because of increasingly restricted access to forested land. A trap had a working life of about three months, with the ties renewed every two weeks when the traps were sun-dried for a few days to remove algae.

Hand lines (*mshipi*) were used for bottom fishing and trolling. During the calmer weather two or three fishers would fish for five to six hours from an *ngalawa* outside the reef. One or two fishers worked from *duas* either in the reef channels or on very calm days outside the reef.

The only gill nets used by Digo fishermen in Biga were relatively small meshed (1.5" - 3") *nyavu ya kutega*. These were usually operated by one or two fishers from a canoe inside the lagoon, and in very calm weather outside the lagoon. Many of the fishers aspired to having large meshed nets (*jarife*) (6" or greater) to use outside the reef, but the costs were prohibitive and none were in use at the time.

Other nets in use were sardine nets (*nyavu ya simu*) made of synthetic material with a 19 mm mesh and sewn to form a long pocket. This type of net was only used for the occasional shoals of sardines that passed through the lagoon. Similarly cast nets (*kimia*) were very occasionally used.

The most widely used fishing method (approximately 50% of fishers) was the spear gun (*bunduki*), despite being an illegal fishing method in Kenya (cf. GOK, 1991b). This method required the lowest amount of capital investment because the guns were

home made from easily acquired materials. The metal spear was usually made from fine reinforcing rods used in the building industry, either scavenged from building sites or bought by the three-spear length. The rubber was ideally bought as new bicycle inner tube. The rest of the gun was fashioned from wood. Most of these fishers were young, very few older than thirty years old, although one of the most successful was over fifty years old. Most part time fishermen used spear guns because of the low investment. The other kind of spear used in Biga was a spike about 4m long (*mkonzo*). Local forest timbers are the preferred material for the shaft, the metal head is bought. This is a traditional method that requires great skill and accuracy and has largely been replaced by spear guns.

There were approximately 180 Digo full time fishers in Biga. Fishers tended to use the landing site nearest to their homes, about half an hour away by foot. Table 7.2 shows the numbers of fishers at each landing site according to fishing method.

The main families of fish caught by Biga fishermen are given in Table 7.3. These families reflect the predominant habitats found within the lagoon (cf. chapter 3), namely seagrass beds and coral rubble.

Table 7.2 The number of Digo fishermen for each of the main gear types at each landing site in Biga. The numbers in brackets include part time fishermen.

Gear/Landing site	Mwaepe	Mvuleni	Mwanyaza	**Total**
Trap (*Malema*)	10	15	16	**41**
Spear gun (*Bunduki*)	25 (30)	20 (30)	40 (45)	**85**
Gill (*N. Kutega*)	6	8	5	**19**
Hand line (*Mishipi*)	8	14	13	**35**
Total	**49 (54)**	**57 (67)**	**74 (79)**	**180 (200)**

(Source: group interview with the Galu Fishermen's Committee, see Appendix V.)

Table 7. 3 The main families of fish caught by Biga fishermen (pers. obs.).

Family	Common name	Local name
Siganidae	Rabbitfish	*Tafi*
Lutjanidae	Snapper	*Tembo*
Lethrinidae	Scavenger/Emperor	*Chango*
Mullidae	Goatfish	*Mukundasi*
Scaridae	Parrotfish	*Pono*
Acanthuridae	Surgeonfish	*Tongo*
Gaterinidae	Sweetlips	*Foote*
Labridae	Wrasse	*Bua*
	Octopus	*Pwesa*

Outside the lagoon the fishery targeted larger pelagic species such as tuna, jacks, kingfish, barracuda and sailfish as well as demersal species such as groupers and snappers. However, the amount of fishing outside the lagoon was very small due to the limitations of vessels to cope with the rough conditions for six months of the year and also the lack of suitable fishing gear (*jarife*) in Biga.

Observations showed a degree of species/family and size selectivity according to gear type. Table 7.4 shows the selectivity of the different gear types. The seine nets used by the Wapemba fishers are also included in this table because the issue of competition between Digo fishermen and Wapemba fishermen is discussed in chapter 8. Factors that determined gear selectivity included bait used in traps or on fishing lines and where gear was set or used.

Table 7.4 Gear selectivity (F) in the Biga fishery from observations of catches.

Family/Gear	Trap	Seine net	Spear gun	Hand line	Gill net
Rabbit fish - *Siganidae*	F	F			F
Snapper - *Lutjanidae*	F			F	
Scavenger - *Lethrinidae*	F	F			
Goatfish - *Mullidae*	F				
Parrot fish - *Scaridae* (seagrass)	F	F	F		F
Parrot fish - *Scaridae* (coral)			F		
Sweetlips -*Gaterinidae*				F	
Wrasse -*Labridae*			F		F
Mixed coral fish			F		
Puffers - *Tetraodontinae*			F		
Grouper - *Serranidae*			F	F	
Octopus			F		
Jacks - *Caranguidae*				F	
Barracudina		F			
Wolfherring		F			
Halfbeaks - *Hemirhamphidae*		F			

The productivity (catches) and incomes of the different gear types are calculated in section 7.5.

7.4.4 Non fishing/farming employment

The three main non-fishing/farming activities that households depended on in Biga were fish trading, shop keeping and for two households, traditional medicine. Income earned from these activities was invested predominantly in the household plots to produce food and cash crops. In the case of the shopkeepers, income from cash crops was then reinvested in the shop.

Fishermen seldom sold their catches directly to consumers, but to traders, most of who were men who sold the fish from their bicycles to expatriate homes, hotels and within the villages. The majority of traders who bought fish from the three Biga landing sites were not from Biga but from other local villages. They travelled to the

landing sites by bicycle, some were from much further afield and travelled by public transport to the Mwaepe landing site. On the whole traders did not process the fish, although one trader smoked fish during the low season (rough SE monsoon) when the supply was low and another trader sold shells to tourists in addition to selling fish. At Mwaepe landing site there were between 5-8 traders buying fish on a daily basis, with similar numbers at the other two Biga landing sites Mvuleni and Mwanyaza. Under fisheries legislation fish traders in rural areas were required have a licence which cost 100 Ksh per year. In addition any trader who transported fish out of the area paid an additional 50 Ksh for a movement permit.

During the early stages of the study there was also a group of up to fourteen women who bought small fish at Mwaepe landing point to sell fried within Biga and other villages. However the supply of small fish for sale ceased when the local Digo fishermen stopped the Wapemba fishermen from landing fish or operating in Biga waters (cf. section 7.7 on the size selectivity of gear). Not having bicycles, the women were restricted to Mwaepe landing site because it was the most accessible by foot or public transport. Most of the women had an hours walk to the landing site.

There were three very small shops in Biga which sold basics such as sugar, soap, maize meal, cigarettes and tea. The main market was in the neighbouring village of Mwabungu on the main Mombasa road. There was also an Asian owned supermarket next to Mwaepe landing site.

7.5 Digo household productivity and incomes

Household incomes were calculated from the thirty household surveys carried out with another researcher[32] for each of the activity groups within Biga in 1996. Malleret-King (1996) calculated the basic maintenance threshold for a household in Biga based on the household surveys. The methods of calculation and results presented below were adapted from Malleret-King (1996) with the addition of fish catch data from 1997. The results of household incomes for each activity group are presented in relation to the maintenance threshold.

[32] Delphine Malleret-King

7.5.1 Calculating the maintenance threshold

The maintenance threshold was the minimum amount of income required to maintain the household at its current level of production and supplied in essential items such as basic food, clothing and education. This was determined from interviews, predominantly with women, during the household surveys. The most important factor in determining regular income supply was the work carried out by members of the household (fishing, cultivation, weaving, trade etc.) rather than income from capital items such as buildings. The only situation where capital items were an important factor was expensive items of fishing equipment and vessels. In these cases 500 Ksh/year (based on capital depreciation of these items) was added to the maintenance threshold. Table 7.5 presents the weekly and annual cost of essential items for an average Biga household of eight people (cf. section 7.3).

Table 7.5 Calculation of the maintenance threshold for an average Biga household in Kenya shillings (at the time of the household surveys there were 85 Ksh/£).

Essential item	Cost per week	Cost per year
Tea with milk (breakfast)	22	1144
Bread/*Mahambre*	20	1040
Maize meal or equivalent	560	29120
Salt	5	260
Sugar	196	10192
Soap/washing powder	36	1872
Paraffin (lighting)	21	1092
Clothing		200
Schooling		600
Total	**860**	**45520**

(Source: 30 household surveys; calculation by Malleret-King (1996))

Thus each active producer per household (on average 2) needed to earn a minimum of 22,760 Ksh/year. If the daily income was not sufficient, about 123 Ksh, the strategy was to reduce consumption of essential items, which on a daily basis tended to be food.

7.5.2 Calculating incomes and productivity

As indicated in the description of the production systems above, households depended on a combination of cultivation and another activity such as fishing or trading. In calculating household incomes, the productivity of each part of a household's range of activities was calculated and converted to a monetary value based on market prices. Thus subsistence production has also been included in the calculation. Productivity of subsistence crops for each household surveyed was calculated according to the area cultivated or the number of plants grown, depending on the crop. Maize, for example, was converted to the number of meals derived from their own production (2 kg of flour/meal) and this figure was cross checked with the acreage cultivated and estimated kg/acre. Prices for the staple food crops, maize, cassava and beans did not change during the year. The production and incomes from fishing was based on 164 daily catches sampled between September 1995 and September 1997 (CRCP data), interviews (Malleret-King, 1996; this study), and cross checked with samples of fishers' catches at Mwaepe (this study). Fish prices changed according to the seasons and the species or sizes, therefore mean values were derived through discussions with fishers. The basis for the calculation of household disposable income is presented below in Table 7.6. Note that the depreciation of capital items is not deducted in the final calculation because disposable income is the money available to spend. The values for depreciation of capital items are calculated to illustrate the amount of income that would be needed to be saved for their replacement. This situation only affects the boat and gear owners.

During the household surveys an attempt was made to determine the change in productivity and incomes over three years, and to have an average figure for productivity and incomes. However none of the households kept any records or mental notes of the amount of land they cultivated or how much they had produced or caught in the preceding years. Generalised statements were made about changes over longer periods of time, such as fish catches had dropped by 90% over the last thirty years, which were useful, but not for income calculations.

Table 7.6 Calculating household disposable income (adapted from Malleret-King, 1996).

Gross income	income from main activities (cash crops, fishing, trading etc.) + subsistence consumption + changes in stocks (poultry, livestock) + other income (weaving, cakes etc.)
Disposable income	net value added – non monetary income (e.g. a calf born) – costs of the factors of production (wages, land, capital items) + unpaid costs (e.g. depreciation, death of an animal)

Note: the net value added is the gross income – the intermediate goods (seeds etc.) – the depreciation (of vessels and gear).

The productivity, costs and incomes of the different Digo groups are presented below (calculations in Tables 7.8 - 7.11).

7.5.2.1 Fishing households with boats

This group were those who fished with traps, lines and nets, most of whom owned the canoes they fished from or were members of a household that owned a boat. There were very few instances where boats were shared on a long-term basis. The fishermen were mostly over forty years old. The range of catch per man per day for each of the fishing methods based on 164 daily catches between 1995 and 1996 are presented in Table 7.7. The seasonality of catches is highlighted in the table below. For example samples taken in August (low season) 1996 from 10 trap fishers at Mwaepe landing site found mean daily catch to be 1.038 kg/man/day. Whereas figures collected during the previous NE monsoon in the same area were 4.46 kg/man/day (Rubens, 1996). Based on the results presented in Table 7.7 the mean catch per fisher for those with vessels was 3.93 kg/day. This figure is used in the calculation of disposable income in Table 7.8.

Table 7.7 Daily catch range per fisher for the three gear types used by canoe fishermen. The range reflects the seasonality of the fishery.

Gear	Daily range of catch (kg/man/day)	Sample size
Trap	1.34 - 6.0	155
Line	1.18 - 7.08	75
Gill nets	0.74 - 7.24	21

Source: 164 daily catches sampled between Sept. '95 – Sept. '97

Bearing in mind the cost of capital depreciation, households were asked about their savings or whether they needed to borrow money. Overall they were not keen to discuss the subject in detail, but most fishers said they borrowed from friends or took out loans from local creditors. None of the households interviewed had savings accounts. One fisher used cattle as a means of saving, but as explained in part 7.4.1, it was a risky business. Households said they would not trust their savings with organisations such as banks or the post office. They said it was impossible to get loans from banks because they did not have title to their land or were not prepared to put family land as security against loans.

Table 7.8 Calculation of disposable income per year for fishing households with boats (Ksh).

Activity	Product	Value Ksh/yr	Cost	Value Ksh/yr
Monetary	**Fishing**. 3.93 kg/man/day – 0.5 kg taken home for subsistence. Mean prices throughout the year: 50 Ksh/kg. 275 days/yr fished due to illness (malaria), tides and religious days.	47162.5	**Depreciation of Boats.** Fishers said the new price of a boat was between 6000 – 12000 Ksh. They estimated the boats lasted 6-10 years.	1000
	Mangoes	1000	**Depreciation of Gear.** Lines 500 Ksh last 3 yrs. Nets 2000-3000 Ksh last 7 yrs. Sardine nets owned by many fishers 10000 Ksh last 10 yrs. Averaged over the group:	800
	Coconuts and **Coprah**	900		
	Chickens (average 3 @ 80 Ksh each)	240		
Subsistence	**Cassava**. Average 0.1 acres producing 60 meals @ 40 Ksh/meal over 6 months.	2400	**Seeds**. 1-5 kg of maize @ 80 Ksh/kg. 0.25-1 kg of beans @ 35 Ksh/kg.	463
	Fish. 0.5 kg of very small or unpalatable fish taken home. Lowest value @ 15 Ksh/kg. 275 days fished/yr.	2062.5	Note: other costs such as salaries for labour were negligible. Only one of these fishers had livestock it has not been include. Disposable income does not have depreciation deducted because it is the money to spend.	
	Beans. Average production was 50 kg/yr @ 35 Ksh/kg.	1750		
	Maize. Only 20% grew maize of significant quantity of 1 acre on average. Produced 40 meals @ 40 Ksh/meal over 4 months.	1600		
	Mangoes.	1000		
	Coconuts. 4 per week @ 3 Ksh each.	624		
Other activities	**Cakes, Thatch, Snuff, Weaving..** were examples of income earning activities of women in the households.	5000		
	Gross income/year	63739	**Disposable income/year**	63276

(Source: 6 household interviews - 13% of group; group interviews with fishers; 164 daily catches; adapted from Malleret-King (1996).)

7.5.2.2 Fishing households without boats

This group was predominantly the households of spear gun fishermen based on a subdivision of the family plot. They were young families, the fishermen were in the age range 18-30 years, and did not have title to the land. The fruit trees they planted were still young and not very productive and thus provided negligible income. Spear guns were the most accessible fishing method due to the low cost, but it was also the most physically demanding and this affected their work on land. As a result only 0.3

acres were cultivated on average. They depended to some extent on gifts of fruit and crops from friends or more established members of their family.

Mean daily catch per man between 1995 and 1997 was 3.66 kg (SD 2.66, sample size 154). This group in particular were regularly observed to target easily shot fish such as pufferfish (Arothron sp.) and lionfish (Pterois sp.), which were of no commercial value, to take home for food.

Spear gunners represented the largest number of fishers by gear type in Biga (most of the part time fishers). This method was taken up due to the lack of alternative sources of employment. In other villages closer to the tourist development men of this age group tend to become hawkers to supplement their income.

Table 7.9 Calculation of disposable income per year for fishing households without boats.

Activity	Product	Value Ksh/yr	Cost	Value Ksh/yr
Monetary	**Fishing.** 3.66 kg/man/day - 0.5 kg taken home for subsistence. Mean prices 50 Ksh/kg. 275 days fished.	43450	**Depreciation of Gear.** Material for spear guns cost about 200 Ksh every 2 years. Masks cost about 500 Ksh, replaced every 3 years.	266.7
Subsistence	**Fish.** 0.5 kg of unpalatable fish taken home, valued at the lowest price of 15 Ksh/kg.	2062.5	**Seeds.** The only seeds bought were about 0.5 kg of beans @ 35 Ksh/kg.	17.5
	Cassava. 40 meals @ 40 Ksh/meal over 2 months.	800		
	Beans. Very small cultivation produced on average 15 kg @ 35 Ksh/kg.	525		
	Mangoes. Most trees unproductive.	300		
	Coconuts. Most trees still unproductive, supplemented from family plot.	150		
Other income	The wives were still preoccupied with looking after babies and young children.			
	Gross income/year	47287.5	**Disposable income/year**	47270

(Source: 7 household interviews - 7% of group; group interviews with fishers; 154 daily catches; adapted from Malleret-King (1996).)

7.5.2.3 Households depending on subsistence agriculture

This group were either households that had retired from fishing for reasons of age or illness, or were unable to reinvest in capital items such as boats or gear because they were not part of established Biga families and had problems borrowing money. Within this group men were able to go fishing up to twice a week by borrowing a boat from another fisher when he came ashore.

Table 7.10 Calculation of disposable income per year for subsistence agriculture households.

Activity	Product	Value Ksh/yr	Cost	Value Ksh/yr
Monetary	**Mangoes.** **Coconuts.** **Sesame.** **Chickens.**	1000 900 500 160	This group had no capital items required in production except for *jembe* (150 Ksh) and *panga* (120 Ksh) which lasted for 20 years.	
Subsistence	**Beans.** These were interplanted with cassava and substantial hedges of pigeon pea were cultivated. On average 130 kg/yr were produced @ 35 Ksh/kg.	4550	All this group kept some of their seeds from the previous crop to plant the next season.	
	Cassava. About 0.1 acre was culitvated producing 35 meals @ 40 Ksh over three months.	1400		
	Mangoes.	1000		
	Fish. Being able to borrow a boat about twice a week provided about 75 Ksh worth/month.	900		
	Coconut. 4/week @ 3 Ksh.	624		
Other income	They seldom had any other income earning activity. In absolute desperation one household said they would sell land.			
	Gross income/year	11034	**Disposable income/year**	11034

(Source: 4 household interviews - 80% of group; adapted from Malleret-King (1996).)

Many were squatters on small plots (on average 3 acres) on Kenya Sugar land which they had bought in the informal land market that exists in Biga (cf. part 6.2.8). As a group they cultivated very small areas of land, on average 0.2 acre, but relatively intensively.

The only source of income was from their fruit trees, some sesame or the occasional sale of chickens. They were in the worst long-term socio-economic situation in Biga, relying heavily on gifts from other people.

7.5.2.4 Non fishing/farming households

This group consisted of households that traded fish, had a shop (*duka*) or were traditional doctors (*mganga*). They cultivated 0.5 acre of land for subsistence crops and planted the rest of their land with fruit trees (predominantly coconut, mango

Table 7.11 Calculation of disposable income per year for non fishing/farming households.

Activity	Product	Value Ksh/yr	Cost	Value Ksh/yr
Monetary	**Sales of Fish** or from **Shops** was on average 2000 Ksh/month.	24000	**Depreciation** of **Bicycles**. For fish taders this was an essential capital item. New cost 3000 Ksh and lasted 15 yrs.	200
	Mangoes. Grown for income, particularly the higher value kinds.	6000		
	Coconut and **Coprah**.	3000		
	Cashew nut. The low prices mean that the trees were old and not very productive.	1500	**Seeds**. Up to 2 kg of beans @ 35 Ksh/kg. One household used chemical pesticides and fertilizers on a very small scale.	70
Subsistence	**Cassava**. Relatively large amounts were grown providing 80 meals @ 40 Ksh/meal over 8 months.	3200	**Salaries**. Some of these households employed labour to clear land.	2000
	Beans. On average 50 kg/yr @ 35 Ksh.	1750		
	Coconut. 5 per week @ 3 Ksh.	780		
	Chickens. 3 per year @ 80 Ksh.	240		
Other income	**Cakes, thatch.**. in much the same way as the households with boats.	5000		
	Gross income/year	45470	**Disposable income/year**	43400

(Source: 5 household interviews - 28% of group; adapted from Malleret-King (1996).)

and cashew nut). The produce from the fruit trees was either sold to local traders or transported to Mombasa market for sale. They were not from fishing families and some were relatively recent migrants to Biga, although they were Digo people.

For fish traders the two problems they faced were the increasingly smaller catches and small fish sizes (lower value) landed by fishermen and the rapid deterioration of the

fish due to the lack of cheap ice. The best prices for fish were from door to door sales to holiday cottages and expatriate residences, but these were not guaranteed and involved significant distances. Any remaining fish were usually sold within the villages at lower prices.

7.5.2.5 Other groups in Biga

Household interviews were carried out with four established migrant farmer households (more than 0.5 acre cultivated) and four new migrant farmers (less than 0.5 acre cultivated). Calculations were carried out by Malleret-King (1996), and their incomes relative to other groups are illustrated in Figure 7.3. The very low disposable income for the recently arrived migrant farmers was due to the failure of their crops that year due to bad rains and inexperience. They therefore depended on help from other migrant farmers and would return to their homelands without funds. The more established migrant farmers were relatively successful and sold most of their produce at Mombasa market.

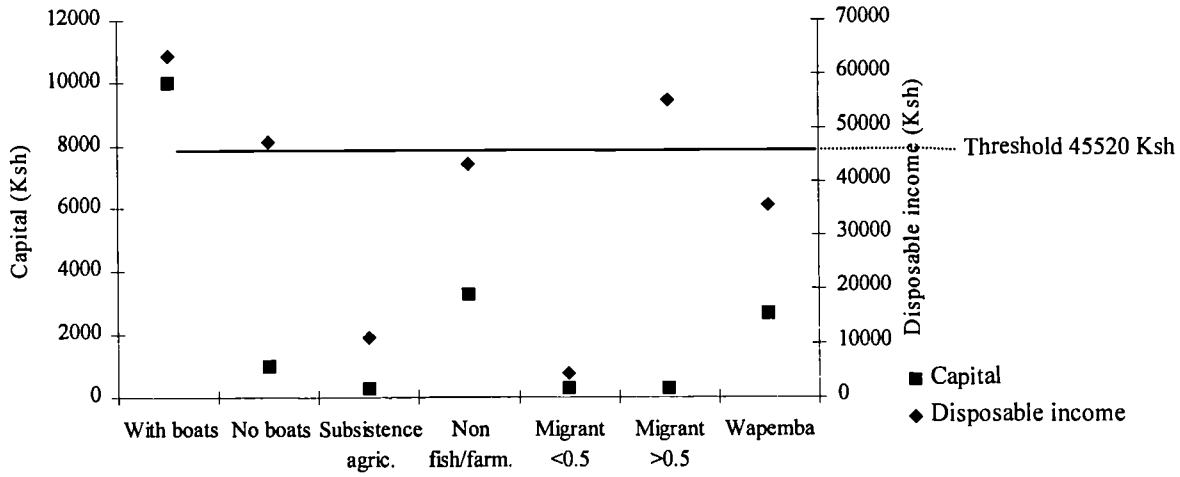
There were no household interviews with the Wapemba seine fishers, but their fish catches were estimated from 20 daily samples in 1995 and 1996, and observations of their cultivation suggested it was similar to the less productive Digo households in terms of area and number of trees. Subsistence production was estimated to be approximately 3837 Ksh/year (as with spear gun fishers). Mean catch per man per day was calculated to be 4.33 kg. Much of their catch was small fish (cf. part 7.7) which was of lower value, estimated to be approximately 30 Ksh/kg over the year. The figures of income and capital are only an indication because their fishing method, way of life and distribution of income make it difficult to calculate without detailed information. The crews were large, up to ten per canoe, made up of young men who returned to Pemba Island in Tanzania regularly. Only a small number were full time resident in Biga. The beach seines were approximately 100 m long and were operated by teams in two large canoes, thus the value of the gear and boats were much higher than Digo operations. However, the crew did not own the gear and thus the catch was divided between the crew, the captain and the owner of the gear and vessels in different proportions. The capital value is estimated on the value of the gear and the

boat divided by the average crew size of eight because the exact division of income was not known (21000 Ksh/8 crew).

7.6 Socio-economic position of households in relation to the maintenance threshold and other groups.

The relative positions of each group in relation to the maintenance threshold are presented in Figure 7.3. Included in this figure are the migrant farmers (in Malleret-King, 1996) and an estimation for the Wapemba seine net group. The figure presents the household incomes against the value of the capital items required in the respective production systems.

Figure 7.3 Positions of the different groups in Biga relative to the maintenance threshold.



The group of households with boats had the highest level of disposable income, but the amount of capital equipment needed in their production system was much higher than the other groups. Only three groups were above the maintenance threshold, two of which were the fishing groups. The established migrant farmer group had a relatively high income compared with their capital investment, however their activities were seasonally dependent and the study did not account for their investments in their homelands. None of the groups were in a secure socio-economic position in terms of threats to the resources on which they depended. For most Digo households, income from fishing was essential. The state of the fishery and trends in its productivity are discussed below.

7.7 State of the fishery

The production systems of the different Digo groups presented above showed that livelihoods were dependent on a range of activities. For fishing households, who were the majority in Biga, the effort put into fishing determined to a large degree the amount of time and energy available for activities on land. Fishers consistently said that they were having to fish for longer and with more effort to catch sufficient fish and this was having a negative effect on the productivity of their *shambas*. During a group interview with older fishers they claimed that fish catches had dropped by 90% over the last 30 years. Fishing effort for trap fishermen, indicated by the number of traps per fisherman, had increased by three or four times over the same period (3-4 traps/man to 9-11 traps/man). Fishermen now had to fish at every opportunity whereas in the past they only needed to fish every two or three days. They also estimated that there were four times as many fishermen now as there had been 50 years ago. All the Digo fishers interviewed blamed the decline in catches on the use of beach seines. Some also said that fish from traps were occasionally poached by spear gun fishermen. Both fishing methods are relatively recent arrivals to the area (within the last thirty years) and were not considered traditional methods. The impact of these methods is discussed below.

7.7.1 Effect of non traditional fishing methods

Trends over the last thirty years for fishing effort and catches based on interviews with fishers suggest that catch per unit of effort have dropped significantly. During this period seine nets and spear guns were introduced to the fishery. The Digo fishers in Biga blame the drop in catches to be due primarily to the seine nets used by Wapemba fishers, which they claimed caught juvenile fish and destroyed marine habitats. This was the basis of a conflict that is analysed in the next chapter. A simple comparison of length-frequency distribution (Figure 7.4) and length-body depth and length-weight relations of important food and income species from trap and beach seine catches (Table 7.12 and 7.13; calculated by Rubens, 1996, based on jointly collected data) supported the problem of juvenile catches. The length-body

depth relation enabled the size of the fish recruited into each fishery to be estimated based on the different mesh sizes of the gears. Using the length-weight relation the weight and value of fish could be estimated for seine caught fish if they were left to recruit into the trap fishery.

The problem of beach seines destroying habitats was less evident. Observations of the seine net operations suggested that they avoided hard substrates such as coral in order to minimise damage to the nets.

Table 7.12 Estimated size of recruitment to the trap (5 cm) and beach seine (2 cm) fisheries of three important food and income species based on body length (cm) - body depth (cm) relations.

Species	Traps	Seines	Regression equation
Forktail rabbitfish	14 cm	6 cm	Depth = 0.11 + 0.3655 × length
Marbled parrotfish	18 cm	7 cm	Depth = 0.36 + 0.2576 × length
Blackspot emperor	15 cm	4 cm	Depth = 1.16 + 0.2621 × length

(Source: calculation by Rubens (1996) based on jointly collected data at Mwaepe fish landing site.)

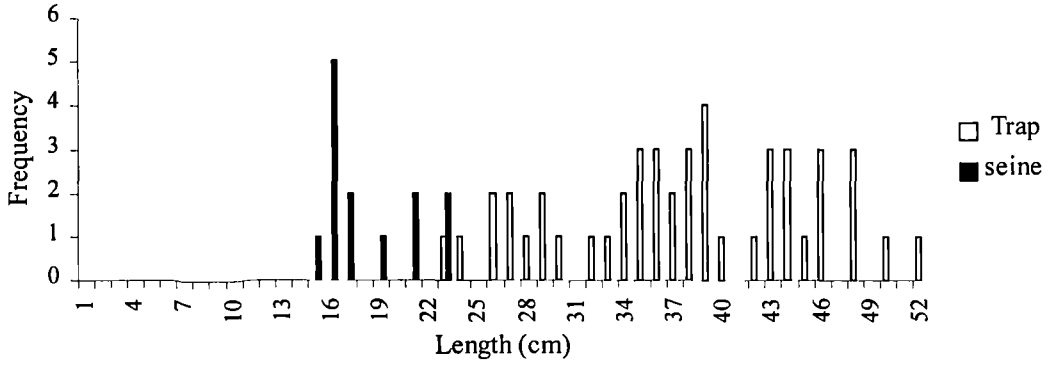
Table 7.13 Estimated weight (g) and value (Ksh) of three important food and income species when recruited into the trap and seine fisheries based on body length (cm) – wet weight (g) relations.

Species	Traps		Seines		Regression equation
	g	Ksh	g	Ksh	
Forktail rabbitfish	164	2.5	13	0	Weight = $10^{-1.17136}$ × length $^{2.9544}$
Marbled parrotfish	91	1.5	7	0	Weight = $10^{-1.5207}$ × length $^{2.7728}$
Blackspot emperor	65	1	2	0	Weight = $10^{-1.2004}$ × length $^{2.5606}$

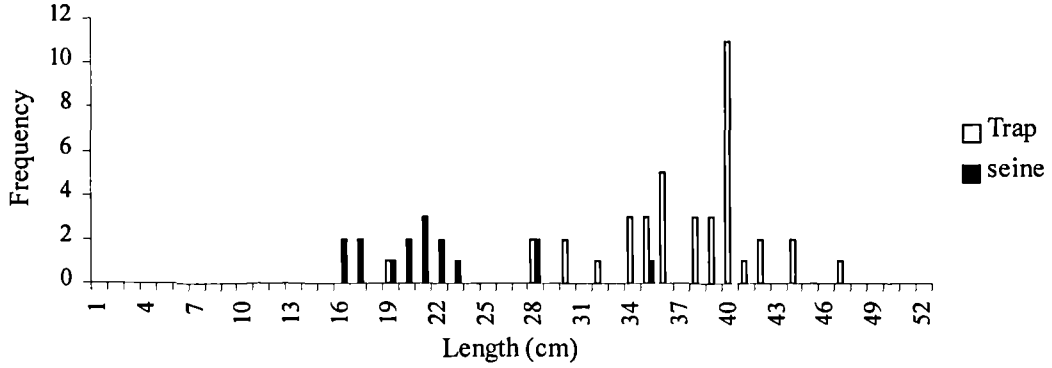
Source: adapted from Rubens (1996) based on jointly collected data at Mwaepe fish landing site.

Figure 7.4 Length-frequency distribution of three important food and income species from trap (5 cm mesh) and beach seine (2 cm mesh) catches in Biga waters.

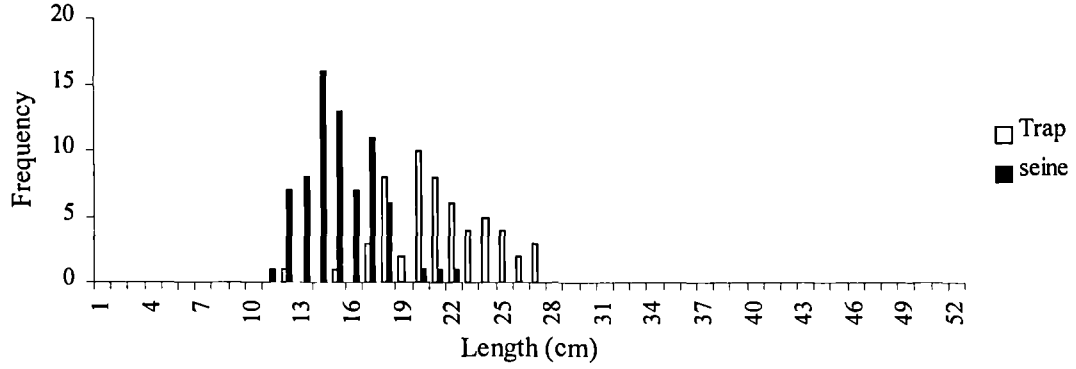
Forktail rabbitfish (*Siganus argenteus*)



Marbled parrotfish (*Leptoscarus vaigiensis*)



Blackspot emperor (*Lethrinus harak*)



(Source: this study collected in July and August 1996.)

The price bracket for the smallest fish for sale was 15 Ksh/kg, which was essentially determined by the smallest fish recruited into the trap fishery. The smallest fish recruited into the seine fishery had no value and were therefore discarded. This explains why the length-frequency distribution for seine catches (Figure 7.4) does not show fish smaller than about 15 cm contrary to the indications in Table 7.12. From observations during a fishing trip with the Wapemba seine crew, discards were at least 5% of the total catch.

The impact of spear guns probably relates more to the number of fishers than the fishing method. Target species were not the same as traps (60% of observed catches included octopus; Table 7.4), but they were the biggest group and they represented the majority of part time fishers (Table 7.2). Analysis by McClanahan (1995b) showed that fisher density (fishers/km^2) was a significant contributor to catch levels. McClanahan's (1995b) model showed that at fisher densities of 8 to 9 fishers/km^2 there was a significant ecological phase shift from fish-grazer dominated communities to urchin dominated communities (cf. part 3.2.1 on the state of the marine environment, part 3.3.1.3 page 46). At densities above 9 fishers/km^2 the catches and catch per unit of effort dropped dramatically. Rubens (1996) calculated the fisher density in the Biga lagoon to be 7.5 fishers/km^2. This figure did not account for the number of part time fishermen, which would push the number closer to the critical density of 9 fishers/km^2.

Thus non traditional gears have had an impact on the fishery during the last thirty years, but for different reasons. Seine nets have tended to target juvenile fish that will have lead to growth overfishing[33]. Spear guns have dramatically increased the number of fishers because of the low cost of the gear and the lack of alternative sources of livelihood, and this has had an impact on the fishery as a whole. The combined effects of the additional non traditional gears against a background of continued use of traditional gear has lead to a situation of ecosystem overfishing shown by the ecological phase shift to urchin dominated communities.

[33] As opposed to recruitment overfishing which relates to abundance of young fish produced by larval settlement (Russ, 1991).

7.8 Conclusion

The community of Biga was found to be made up of different ethnic groups, 90% Digo, 7% upcountry migrant farmers and 3% migrant Wapemba fishers. This chapter focused on the livelihoods and production systems of the Digo community and made some comparisons with the other ethnic groups. Analysis was based primarily on information gathered from semi-structured interviews at the individual, household and group level. Different groups within the community were identified according to their production systems, which were either fishing based or not. Most households were dependent on fishing, but the methods and capital equipment differed and this further differentiated the community into subgroups (summarised in Table 7.14). Analysis of household livelihoods showed that all groups depended on a range of activities to provide food and income but the economic role of fish was dominant in the community. Even within fishing households, however, the value of production from land based activities was important for supplementing food and income (Table 7.14).

Seasonality was a feature of the production systems, influencing activities both on land and in the sea. Prior to and during the long rains in April and May was the busiest time on land and this coincided with poor fishing conditions and low catches

Table 7.14 The importance of fish for Digo household food and income in Biga (monetary and subsistence values).

Group	% income from fish
Fishers with boats	78
Fishers without boats	96
Non fishing/farming	55*
Subsistence agriculture	8

* This figure is for fish traders.

(Figure 7.3). Thus, households were most food insecure from March – July while the catches were low and crops had yet to be harvested. Fishing conditions were also harder at this time due to strong winds and rain. This made fishers less able to work

on the cultivation of crops due to fatigue. There were also more instances of malaria and other illness at this time of the year. Some households stopped fishing at this time and concentrated on cultivating food crops to increase food production.

The trend over the last five decades has been a relative decrease in productivity per household. Traditional systems of cultivation can no longer be practised due to the change in land tenure and land market (cf. Figure 3.7; chapter 4; part 5.3.1). The small isolated household plots now cultivated are more susceptible to damage from wild animals than the communal plots previously cultivated. Households depend more on income earning activities, such as fishing or planting fruit trees, to buy food, and this also reduces the time, energy or space available for food cultivation. The lack of different sources of economic employment, despite the proximity of the tourist development, has forced increasing numbers of people into fishing. This has lead to overfishing, shown by the fall in catch per unit effort and the ecological phase shift to urchin dominated communities in the lagoon.

The overall socio-economic situation of the community was found to be poor. This was illustrated by the level of disposable income available to households when compared to the amount of income needed to maintain the household at a productive level (Figure 7.3). The highest earning households had the most capital investment with relatively high levels of depreciation. Thus saving money was essential but it was not evident how this was done. Most households were very close to the maintenance threshold. This meant that they could maintain their current level of production. However, with continued pressure on the fishery and the lack of alternative sources of income, the productivity of households is not secure. Consequently any further threats to their access to and control over the resource base would be expected to provoke a reaction from the community. The community's response to such threats is the subject of the next chapter.

8 ASSESSMENT OF CONFLICT AND PROBLEM SOLVING ACTIONS IN BIGA USING SOCIAL NETWORK ANALYSIS

8.1 Introduction

The precarious socio-economic predicament of the Biga community, presented in the previous chapter, emphasised the importance of marine and terrestrial resources for household survival. Analysis of both the social and biophysical histories of the area in earlier chapters showed that the availability of resources for local people was reduced by a combination of growing numbers of resource users and changing rules surrounding resource allocation and use. These institutional changes, imposed by more powerful or better-off sectors of society who did/do not depend directly on the local environment for their survival, have caused the authority of traditional institutions and practices to be undermined.

This chapter investigates the new institutional environment of resource allocation and use in Biga through the responses of the fishers to situations where their access to or control over marine resources is threatened (three issues). Based on the observation that institutions evolve, reproduce and shape relations of power and influence that exist in societies (Kanbur, 1992), the aim is to identify the people and organisations (actors) that have power and influence in resolving these conflicts. The inference is that the underlying institutions can be deduced from the actors involved. The actors were identified through their communications with other actors involved with each issue. Thus networks of actors were derived based on communication ties and the importance of each actor was based on their role and position in each network.[34]

8.2 Methods

Information was collected on the communication relations between actors involved in three different conflicts or issues faced by the Digo fishers. The issues investigated (which are described in more detail below) were: (1) the attempted

[34] The rationale for this approach is given in chapter 2.

implementation of a marine protected area that would have included the community's fishing grounds; (2) the conflict between the Digo fishers and the Wapemba beach seine fishers; and (3) the threat to Mwaepe fish landing site due to illegal land appropriation.

8.2.1 Data collection

Information came from a variety of sources including 167 government documents, letters, semi-structured interviews with government officials and fishing community members, public meetings and informal discussions. The methods and sources of information described in section 7.2 relate to this chapter as well. Snowball sampling was used to find out who was involved in each issue (see Wasserman and Faust, 1994: 34; Bernard, 1995: 97-98). This process was initiated through semi-structured interviews with fishers (their response to each problem was being investigated). This identified other actors in the network who were either interviewed or their roles were verified in the documentation or by other actors. Inclusion in the set of actors was determined by their role in an issue and the frequency of their interactions. For example the tourist industry was central to the wider issue of the marine reserve but peripheral to the issue faced by the fishers and it was therefore excluded. In this way, it was possible to determine who the relevant actors were and to establish a boundary to the set of actors.

8.2.2 Social network analysis

The data collected consisted of communication relations between actors. The rationale for using this approach was given in section 2.7. The network communication data that resulted identified the ties between different actors in the networks. These ties were directional so that the actor who instigated a process of communication was identified as a source and the recipient a sink. The use of this method enabled the origins of a conflict and the process of problem resolution to be mapped through communication networks of the actors involved.

The network information was expressed in two ways: graphs and matrices. The graphs provide a visual representation of the networks where each node represents an actor and the lines are the communication ties. The matrices (sociomatrix), made up of a row and column for each actor (node), indicate whether two actors are adjacent or not. The networks are presented as graphs in the text below and the calculations of actor importance were derived from the corresponding sociomatrices using UCINET V network software (Borgatti *et al.*, 1998).

In the first part of the analysis, the scale of measurement for the communication ties is considered in a number of ways to determine the extent to which the inherent characteristics (attributes) of the actors determine their importance in the networks. The second part of the analysis considers the importance of actors in each of the networks, in other words their prominence in each issue. The third part attempts to determine whether the institutional levels or types represented by the actors in the networks are related to their importance in the networks. The final part of the analysis considers the extent to which actors are affiliated through their joint participation in the different issues.

8.2.2.1 Scales of measurement

Two measures of relations were considered for this study: binary and full-rank ordinal (see Hanneman, 1997). The binary measures simply distinguish between the presence of a relation (coded one) and the absence of a relation (coded zero).

However, this study is a retrospective analysis of three issues of which the outcomes were known but the processes that lead to the outcome were not understood. The aim is to understand these processes through the communications between individuals and groups. It was evident during the fieldwork that the hierarchies that existed in the community and the wider field of actors involved in the issues (the Administration for example) had at least a qualitative influence on the outcome of the issues. Simple hierarchies of power have been found to be prevalent in small communities (Martin, 1998). Thus analysis of the networks using the binary measures of the ties would not account for the inherent importance of an actor based

on the established power structures. Therefore values were given to the relations in order to weight the ties to reflect an actor's inherent importance (actor attribute), semi-quantitatively, based on their position in established hierarchies. The scales reflect the degree of importance, but not equal differences between each score because this could not be measured (Hanneman, 1997) (see below for this case study). Allocating actor attributes to the relations to give a value to the tie is an accepted procedure (Everett pers. comm.).

As was outlined in chapters 4 and 5, the two hierarchies that dominate life in Kenya are the Civil Service and the political structure, and therefore actors were allocated scores in relation to their position in these hierarchies (Table 8.1).

Table 8.1 The basis of the hierarchy scores for valued graphs.

Administrative Hierarchy	Score	Political Hierarchy	Score
State	7	President	6
Province	6	Cabinet Minister	5
District/Constituency	5	Deputy minister	4
Division	4	Member of Parliament	3
Location	3	Political party rep.	2
Sublocation	2	Chief	1
Village	1	Not Political	0
No admin. level	0		

The administrative hierarchy score reflects an actor's position in the administrative sector of government or an equivalent position in any other government department, parastatal or formal organisation. This score reflects the recognised levels of importance people have at different hierarchical levels of government departments.

The political hierarchy score is based on the national political hierarchy associated with government. The score encompasses not only politicians but also overtly political bodies and individuals whose positions are widely recognised to have political weight in relation to the issue in case (for example political appointees). The County Councils, for example, were shown in chapter 4 to be very politicised. The intention was to avoid as much as possible the subjectivity of allocating political weight based on, among other things, measures of status such as wealth or age.

The relationship between the administration and politics was also observed to be influential (consider the role and effect of state organisations and politics for resource access and control discussed in chapters 2, 4, 5 and 6, and evident in the issue descriptions below), and therefore actor attributes were also derived from a combination of position in government and politics.

The scores given to each actor in the networks are presented in Appendix VII.

However, it was not known which of these hierarchies influenced the observed outcomes of the three issues. Thus, the networks were analysed without weighting (binary) and with each of the hierarchy scores in order to determine which model to adopt for the social network analysis. For the purpose of choosing which hierarchy to adopt the measure of Eigenvector centrality, which reflects an actor's overall influence in a network, was used (see part 8.2.2.2 below). Only the final phases of the issues, which could be verified from observations during the study period, were analysed to determine which model to adopt. The results of the analysis are presented in Appendix IX.

The analysis of the networks using the binary measures, which did not account for actor attributes, did not fit the observed outcomes of the issues. Actors with few ties but who were known to have been highly influential in determining the outcome of an issue were not well reflected. This could be explained by the fact that hierarchies were observed to be influential in the study site, and therefore actor importance based simply on the links with other actors could not be expected to reflect the observations made during the study.

Similarly the results based on either the administrative or political hierarchies did not reflect observations made during the study. The results tended to overemphasise an actor's importance in the networks if they were members of the hierarchy being used to weight the ties. Thus administrative actors dominated when the administrative hierarchy was used, and political actors dominated when the political hierarchy was used.

The results based on the combination of administrative and political hierarchy scores, which aimed to reflect the effect of both administrative and political weight, closely reflected the observed outcomes of the issues. The link between the government administration and politics, which was discussed in earlier chapters, was also observed in each of the three issues analysed below and largely explains the fit between this model and observations made during the study. Based on these results the model of combined hierarchy scores was used for the social network analysis of the three issues.

8.2.2.2 Analysis of actor importance

The idea that power is inherently relational, and therefore a fundamental property of social structures (Mingers, 1992; Nelson and Wright, 1995; Hannemann, 1997), is the basis for the analysis in this chapter. The definitions and measures of the different notions of power with respect to this study were discussed in chapter 2. Each measure stems from the concept of centrality which is based on the idea that prominent actors are those that are extensively involved in relationships with other actors (Wasserman and Faust, 1994). Most of the centrality measures are based on this concept. However, the centrality-power relation has recently been questioned in communication networks[35], and as in exchange networks[36], power has been shown to relate to the network structure and actor position as well (Mizruchi and Potts, 1998). These findings have influenced which measures have been selected for the analysis of actor importance in this study. Three different measures of centrality have been used in this study in order to consider different derivations of importance in the networks based on communication ties. Each measure is described below, based on the texts of Scott (1991), Wasserman and Faust (1994), Hanneman (1997).

Degree centrality is the simplest to define because it is based on the idea that central actors must be the most active because they have the most ties (Wasserman and Faust, 1994). It is therefore a measure of local centrality (Scott, 1991) and does not account for the overall structure of the network. However the direction of the ties are

[35] In communication networks power is the ability to influence the outcome of a decision, regardless of whether this occurs at the expense of others.

accounted for, which in the context of this study may reflect the importance of an actor depending on whether they are the object (**indegree**) of many ties or the source (**outdegree**) of many ties. Actors with high indegrees can be considered to be prominent because other actors seek to communicate with them. They may be important because they are sources of information or because they perform some sort of supporting role. On the other hand they may simply be the source of instruction or information about the activities of other actors. Actors with high outdegrees set out to communicate with many other actors to pursue a cause or interest and as a result can be considered to be influential. They are often sources of action either co-ordinating or organising activities. The difference between an actor's indegree and outdegree can indicate their overall network activity (Everett pers. comm.).

Eigenvector centrality, used in this study, is an extension of closeness centrality with an attempt to incorporate the influence of the overall structure of the network on actor importance. Closeness centrality considers an actor to be important if it lies at short distances from other actors in the network. It is frequently used to measure relative access to network resources and information, and can also be interpreted as measuring the degree of independence from others in the network (Hagen *et al.*, 1997). However, closeness centrality does not account for the fact that the importance of an actor may also be proportional to the strength of its ties to other actors and the importance (centrality) of these other actors (Faust, 1997; Hanneman, 1997). Eigenvector centrality (an eigen decomposition method) does this by a identifying the dimensions of distances (by factor analysis) among the actors and giving each actor a value (eigenvalue) based on its location with respect to each dimension identified. The measure takes the distance between two actors as the longer of the direct paths between them in the calculation and as a result considers the overall structure of the network rather than the local patterns. Most of the variability in the locations of the actors are usually accounted for in the first few dimensions (referred to as factor 1, 2 etc.) (Hanneman, 1997; Richards and Seary, 1997). Eigenvector centrality has been used to study the extent to which actors are in a position to influence other actors in a network (Faust, 1997).

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[36] In exchange networks power is the ability to gain benefits at the expense of others.

Flow-betweeness centrality is another measure that extends a more straightforward approach, betweeness centrality, by seeking to account for the position of an actor in the overall structure of the network. Betweeness centrality considers an actor to be important if it lies on the path between two others because it might have some control over the interactions between the two nonadjacent actors (Wasserman and Faust, 1994). In addition the two nonadjacent actors will also display a level of local dependency upon the actor between them (Scott, 1991). Thus an actor with high betweeness could have more control over resources, such as information, than other actors and this could translate into power. In addition other actors may depend on a certain actor to make connections between them. This measure only considers the most efficient route between two actors (geodesic path). However, the geodesic path may not be the only route to connect pairs of actors. If an actor sitting between two others uses the position to block information flow, the pair of actors may try other paths that connect them. Flow-betweeness considers this possibility, but it assumes that actors will use the paths between them proportionately to the length of the paths. Thus flow-betweenes centrality for an actor is derived by quantifying the extent to which the maximum flow of information between all other pairs of actors depends on the paths that include that actor.

Thus the actor centrality measures used in this study determine that an actor's importance is a function of the number and direction of their ties (degree), the effect of the overall structure of the network (eigenvector), their position in the network (flow-betweeness) and their inherent characteristics (actor attribute).

In addition to the individual actor scores calculated for each of the three centrality measures **network centralization** scores were also generated. Network centralization describes the extent to which the network as a whole is organised around a few actors according to a particular centrality measure. The degree based measure of network centralization is considered by Scott (1991) to be particularly sensitive to the local dominance of actors, whereas the betweeness based measure is more sensitive to the 'chaining' of points. Network centralization based on closeness has been suggested by Tichy (1980) to reflect how much a network is guided by a formal hierarchy. These scores can only be derived from binary data, but for both binary and valued data the underlying graphs are the same. High network centralities

have been associated with a few actors having reputations of power and influence over community affairs or economic sectors (Mizruchi and Galaskwieicz, 1994).

The analysis was carried out using UCINET V network analysis software (Borgatti *et al..*, 1998).

8.2.2.3 Analysis of the importance of institutional levels and types in the networks

The basis of this chapter is to elucidate the important people, organisations and institutions involved in three resource access and control issues. The proposition is that the institutions (see section 2.2 for definitions) are represented by the actors involved in the issues and that the actor's importance, based on the centrality measures, also reflects the importance of the institution in the network. As was shown in chapter 5, different types and sub-types of institution influence resource access and control in the Biga area. For example the Fisheries Department, KWS and the fishermen represent rules relating to natural resource management and exploitation, whereas the District Commissioner represents State administrative rules. Thus the institutions can be differentiated into types and sub-types, and into formal or informal types. In addition the different scale levels (national, local...) of institution were identified following the approach taken in the environmental entitlements analysis (cf. section 5.4).

By coding each actor for its institution it was possible to investigate the relationship between the importance of an institution in a network and the scale level, sub-type and type according to the ranked importance of the actors (from centrality scores) in each network. The institutional scale level, sub-types and types and their codes are summarised in Table 8.2. The test for significance for the institutional scale levels and sub-types was the Kruskal-Wallis test. This test was used because there were more than two independent samples and the results of the social network analysis were ranked ordinal data. The test for significance for the type of institution was the Mann-Whitney *U*-test because there were two independent samples and the results were ranked ordinal data (Argyrous, 1997). This analysis was carried out using SYSTAT® 7.0.1 (SPSS, 1997).

Table 8.2 Actor codes to reflect institutional levels and types in the networks

Type	Code	Scale level	Code	Sub-type	Code
Formal	1	Local	1	Administrative	1
Informal	2	District	2	Political	2
		Provincial	3	Natural resource management/exploitation	3
		National	4	Non natural resource management/exploitation	4

Using the codes, for example, the District Commissioner in the networks represents formal (1) district level (2) administrative (1) institutions, whereas the Biga fishermen represent informal (2) local (1) natural resource management/exploitation institutions (3). The codes for each actor's institutional level and type are given in Appendix VIII.

8.2.2.4 Analysis of actor importance across all the issues

In addition to determining the importance of the actors involved in each issue, the overall importance of actors across a range of issues was determined. The aim was to determine whether there was a core group who were consistently important in all the issues. The networks of actors analysed for each issue were also linked to each other through their joint participation in each issue. The three issues being investigated were considered to represent typical resource management problems. Therefore actors common to all the issues may suggest an underlying quasi-resource management network. This in turn would reflect the underlying institutional structures. By linking the actors and the issues (events) it was possible to create an affiliation network. This network consisted of a set of actors and a collection of subsets of actors (issues/events). The information was represented as an affiliation matrix and a bipartite graph.

Faust (1997) considered the measurement and interpretation of centrality in affiliation networks. She concluded that centrality should be measured for both actors and events. Her correlations between centralities for a bipartite graph and the one-mode relations (separate actor and event networks) were strongest for eigenvector centrality. Therefore this measure has been used in this study.

The analysis was carried out using UCINET V network analysis software (Borgatti *et al.*, 1998).

8.3 Presentation of Issues

In chapter 5 the main organisations and underlying institutions that the fishers faced when dealing with the three issues described below were considered. These organisations, or people within them, appear as actors in the social network analysis. The environmental entitlements framework presented in section 5.4 illustrated how different institutions at different scale levels interacted to shape people's resource claims and practices. The environmental entitlement analysis presented in Figure 5.2 illustrated the process for fishing in Biga waters. It therefore relates to two of the issues, the attempted implementation of the marine protected area (part 8.3.1) and the conflict between the Digo fishers and the Wapemba beach seiners (part 8.3.2). Figure 5.3 illustrated the environmental entitlements analysis for the use of beachfront land for fish trade and fishing related activities. The figure relates to the issue of access to and land for Mwaepe fish landing site being threatened (part 8.3.3).

8.3.1 The Diani – Chale marine reserve (marine reserve issue)[37]

The tourism boom of the 1980s brought increased numbers of visitors to the Diani area and with it increasing levels of harassment of tourists by beach hawkers and muggings/robbery. At the same time researchers were drawing attention to the degradation of the marine environment in the area (McClanahan and Shafir, 1990). Following the establishment of a marine protected area and beach management programme in 1991 for the tourism area just north of Mombasa, the tourism industry and expatriate residents petitioned for the same in the Diani area. The principal incentive was the possibility of increased security for tourists resulting from the presence of Kenya Wildlife Service (KWS) patrols supporting the beach management programme.

In order for KWS (cf. part 5.2.5 for an overview) to have authority over activities on the beach a marine protected area was proposed. The area proposed included the 20 km stretch of coast between the Mwachema River in the north and Chale Island in the south (Figure 3.5), and incorporated the fringing reef and lagoon and 30 m of land above the high water level. The marine protected area was to be the fifth in Kenya, and as with the other sites, to be divided into a marine park and marine reserve. In Kenya marine parks are areas of no exploitation and access requires a fee, whereas marine reserves allow for traditional fishing. From the point of view of local communities marine parks are total exclusion zones. The proposed marine park was a small area in the vicinity of Chale Island and the remainder of the area was to be reserve.

In May 1992 KWS and Fisheries Department representatives visited the main fish landing points to explain the proposal to local communities. Initial reactions from the Digo fishers were positive because one of the effects of the reserve would have been to stop the use of seine nets. Other incentives for the local community included promises of aid in the form of medical centres and the possibility of new fishing equipment courtesy of a grant from USAID, the United States aid agency. The local fishers were unhappy about the marine park proposal at Chale Island and it was changed to reserve status.

Following the positive response from the fishing communities KWS sought approval from the District Development Committee. However problems arose when KWS found they had to insist that the USAID funding would be spent on the fishing communities and not elsewhere in the District. Similarly an argument over the income generated through the beach management programme (each visitor was to pay US$ 0.50 per day through their hotel charges) developed between the local Council and KWS. These problems and delays in getting maps drawn up for the legislative process set the initiative back and little had been done on the ground by 1994, when the first democratic elections in Kenya were to take place. In March

[37] Sources: KWS personnel Kaka, Muthiga and Kavu pers. comms.; KWS archives; Fisheries Department archives; District Administration archives; unstructured interviews with fishers and traders; Rubens (1996).

1994 the Director of KWS resigned following a vituperative campaign by government ministers. The reserve proposal was reviewed in parliament, as were many initiatives of the previous KWS regime, setting things back further. The reserve was eventually gazetted in June 1995, nearly three years after the initial and only contacts between KWS and the fishing communities.

During the three year absence of KWS the local fishing communities had frequently sought the assistance they had been promised in terms of aid, but were given no explanation for the delays and as a result felt let down. In the light of this atmosphere and the poor relationship between KWS and local Councillors and Politicians relating to the sharing of funds, the fishers were easily persuaded to oppose the marine reserve. Rumours spread that the park would be reinstated and that seine fishers continued to operate in Mombasa Marine Reserve despite a KWS presence. In addition there was evidently external influence on the local politicians and civil servants to oppose the presence of KWS patrols when a US$ 1.5 million hall of cannabis was discovered at Chale in April 1996 (East African Standard, 1996).

Not surprisingly KWS personnel arrived to a lukewarm reception in late 1995. The issue had become highly politicised and local fishers had been successfully incited to oppose the reserve by any means. KWS attempted to re-establish their rapport with the local communities through stakeholder meetings, but with little success. At a public meeting at Mwaepe in October 1995 a KANU (ruling political party) representative and a local Councillor openly incited anti KWS sentiments by rewarding people with cash for provocative remarks and speeches. Following that debacle the District Commissioner announced at a public meeting that the marine reserve initiative was suspended.

Analysis was carried out on three phases of this issue:

Phase 1 The initial meetings between KWS and Fisheries Department personnel in February 1992 to the presentation of the initiative to the fishers at the fish landing sites in May 1992.

Phase 2 The presentation of the proposal to the District Development Committee in June 1992 to the parliamentary review in May 1995

Phase 3 The official gazettment of the marine reserve in June 1995 to the District Commissioner's announcement in October 1995.

8.3.2 Beach seining by the Wapemba (beach seine issue)[38]

The use of fine meshed beach seines by the Wapemba was basis for the conflict between them and the local Digo fishermen in Biga. The problem of seine nets catching juvenile fish and the impact on the fishery was described in chapter 7. Although seine nets were partly to blame for the current state of the fishery, the local Digo fishers found the foreign Wapemba to be convenient scapegoats for the lack of fish. The problem of numbers of Digo fishermen was not an issue for the local fishers.

The Wapemba beach seine crews originated from the Island of Pemba in Tanzania (cf. part 6.2.7). Originally only migrant fishermen, the Wapemba sought permanent bases in Kenya in 1964 following the overthrow of the Zanzibar government. As with many other sites in Kenya, Wapemba fishermen, seeking refuge from the political unrest in Tanzania and better fishing than in their own overfished waters (Glaesel 1997), approached the elders of Biga. At the time the Wapemba were not considered to be a threat to the fishery and a settlement site was granted. The Fisheries Department legitimised the use of their fine meshed beach seines by granting the Wapemba licences. The Wapemba also capitalised on the establishment of the Co-operative Societies in the 1970s by becoming active members, and by the 1980s the only members, thereby further legitimising their presence in the area in the eyes of the authorities.

Over the following three decades the catch per unit of effort in the fishery declined. During the 1970s and early 1980s some of the Digo fishermen began to suggest that

[38] Sources: Semi-structured interviews with fishers and traders; Senior Fisheries Officer Ngoloma pers. comm.; Chief Mwarupia pers. comm.; public meetings with fishers, traders, District Officer,

the seine nets were having a detrimental effect on the fishery. By the mid 1980s the Wapemba were perceived by the local Digo fishers to be a threat to their survival and the Digo fishers asked them to fish elsewhere, which they did. In 1988 the Wapemba returned to fish in the area, but said they would only fish outside the lagoon. However the impracticality of fishing outside the lagoon throughout the year brought the Wapemba back into Biga waters. Numerous requests by the Digo fishermen were made to the elders and village level authorities and Fisheries Department personnel to stop the use of the beach seines, but to no avail. The Digo fishermen were convinced that the lack of action by the village authorities and the local Fisheries personnel was because they were being bribed. In addition they were certain that many of the Wapemba had somehow acquired Kenyan identity cards and this would have implicated the chief and possibly more senior officials. By 1992, frustrated by the lack of action by village authorities and the inability of the Fisheries Department to recognise the problem, the Digo fishermen beat up some Wapemba in an attempt to frighten them off. The attack on the Wapemba fishers lead to the arrest and detention of the Digo fishermen and fuelled the conflict and raised its profile.

Concerted efforts by the Digo fishermen to remove the seine crews were supported by local Councillors and KANU representatives who had become sensitised to the 'plight' of the Digo fishers during the marine reserve conflict. In addition the District Commissioner's (DC) public announcement about the suspension of the marine reserve in October 1995 had encouraged the local fishers to be more organised when presenting their concerns. Galvanised by the marine reserve issue and the DC's announcement the Biga fishermen formed a group, known as The Galu Fishermen's Committee, to present their case to government officials (Appendix III). Intensive lobbying of government officials by both the Digo fishermen and the Wapemba fishermen continued until the middle of 1996, but again with no sign of action on the part of the authorities. The Digo fishers then threatened to burn the houses of the Wapemba if seine netting was not stopped. This caused the District Administration to force the Fisheries Department to instigate a ban on seine nets on the grounds of civil disorder. At a public meeting on the 14th of August 1996 at Mwabungu (Figure 3.5), on the main Mombasa road, the District Officer announced the prohibition of

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Councillors and Fisheries Department personnel; Fisheries Department archives; District

beach seining. The Wapemba stopped their fishing activities in Biga waters although they continue to live in the Biga area. They now fish to the north and south of Biga.

Analysis was carried out on three phases of the issue:

Phase 1 The arrival of the Wapemba in 1964 to the point when the Digo fishermen requested them to fish elsewhere in 1988.

Phase 2 The recommencing of seine fishing in the lagoon at the end of 1988 to the physical conflict in 1992.

Phase 3 The heightened profile as a result of the arrests and the eventual cessation of beach seining in Biga waters in August 1996.

8.3.3 Land grabbing at Mwaepe (land issue)[39]

Some of the issues surrounding land ownership in the Biga area have been discussed in earlier chapters. The seafront strip was shown to be owned by non-local people following land adjudication after independence. In some instances, however, plots of land were not sold and were held under trust by the county council. The purpose of this was to ensure that there was land available for local development projects or public use and that the locally accountable membership of the council would prevent illegal allocation. However, as was explained in part 4.5.2, the county councils are not autonomous from central government and the power politicians have over civil servants means that the allocation of trust land for financial and political favours is common place. This issue is a case in point[40].

In the late 1980s a fisheries development project was initiated along the southern Kenya coast to provide fish storage depots (a building with insulated boxes and tiled work surfaces) at strategic sites. The project was funded by the International Fund

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Administration archives.

[39] Sources: Fisheries Department archives; Ministry of Land and Settlement archives; District Administration archives; District Survey Department; Diani Fishermen's Co-operative Society archives; semi-strucutured interviews with fishers and traders; Senior Fisheries Officer Etian pers. comm.

[40] I am grateful to Dr David Obura for his contribution to the investigation of this issue.

for Agricultural Development (IFAD)[41]. The Fisheries Department was responsible for the execution of the project. The officially sanctioned Diani Fishermen's Co-operative Society, which was theoretically functioning in the Biga area (cf. part 5.2.8), was contacted to propose a site for a depot. The Society suggested a piece of land in the Kinondo area to the south of Biga (reflecting the origin of the Society's management committee). This site was rejected by the IFAD project co-ordinators due to its inaccessibility and an alternative site at Mwaepe, the northern fish landing site in Biga (Figure 3.5), was proposed. At the time Mwaepe was at the end of the sealed road. The seafront plot at Mwaepe was 0.6 hectares of trust land so the Fisheries Department applied for the site for the development project. The County Council and District Development Committee approved the proposal and the land was allocated to the Fisheries Department in May 1991. However, while the land was being released by the County Council a local Member of Parliament from the neighbouring constituency communicated with the then Minister for Lands and Settlement and had the land 'unofficially' allocated to a company called Kinondo Fishermen's Inn Ltd.

The IFAD project continued unaware of the situation and started building the depot in July 1991. During the initial stages of construction a debate between the Fisheries Department and the Diani Fishermen's Co-operative Society developed over who should own the land. During the wrangling the Fisheries Department discovered that the land had been allocated to a politician who had had the designation changed from a residential to a commercial plot and had sold the land to a private developer. The situation threatened both the IFAD project and the continued use of Mwaepe landing site by the community. Delegations of fishers and members of the Fisheries Department sought to change the allocation but were unsuccessful. The District Commissioner proposed a compromise and suggested that a portion of the land should be allocated to the IFAD project. The subdivision was approved, allocating approximately ¾ acre on the seafront to the project, but it meant that part of the depot had to be demolished because it straddled the two plots. The depot was eventually opened two years later in August 1993 without the question of who owned the ¾ acre resolved.

[41] Source: Fisheries Department Diani Depot IFAD project file held at Shimoni office.

At the time of this study, in 1996 and 1997, the land ownership question had reached a head. There were three factions involved, the Fisheries Department, the Diani Fishermen's Co-operative Society and the local Biga fishers who had formed an interest group (Mwaepe Fishermen's Group) in 1996. The Biga fishers felt that since the Co-operative Society no longer functioned it was merely a ruse by the neighbouring community to claim their land. The Co-operative Society was well placed to claim the land because on paper at least they represented the interests of the all the fishing communities in the area, and were considered as such by various government bodies who were unaware of the situation on the ground. In reality the Co-operative had not functioned for years and the management committee had become an autonomous interest group from the neighbouring area. The Fisheries Department stuck by their claim that as a government department they served the interests of the wider community and would not be drawn into local politics. With little track record of safeguarding the interests of fishers, and having been let down by government departments before (Lands Department, Fisheries Department and KWS), both fishing communities challenged the Fisheries Department. At the end of the study the problem remained unresolved.

However, as a post script, in 1998 Dr David Obura, a marine biologist working in the Biga area, assisted the Biga fishers in their cause by providing a delegation with transport to visit the Lands Department in Nairobi (300 miles inland) and the Lands offices in Mombasa (30 miles away). On the strength of these and other visits the Biga fishermen at Mwaepe were able to have the plot allocated to the Co-operative Society (to suit official requirements) with the intention of changing the name to Mwaepe Fishermen's Association or similar to reflect the interests of the Mwaepe fishers. The Co-operative Ministry, however, has been reluctant lose a 'paper co-operative'. The only security the fishers at Mwaepe have, which is more than they had before, is that they hold the letter of allocation (Obura pers. comm.).

Analysis was carried out on three phases of this issue:

Phase I The start of the IFAD project in 1988 to the first indication of a problem over land allocation in February 1991.

Phase 2 The illegal sale of the plot to the developer and subsequent subdivision to the completion of the depot in July 1993.

Phase 3 The wrangling over ownership to the new Plot Development Plan in April 1998.

8.4 Results

The results below are based on social network analysis of the complex issues described above. The salient actors were identified using a snowball sampling approach of semi-structured interviews and reference to written records. Valued sociomatrices for each phase of the three issues were derived from the communication data and the combined administrative and political hierarchy scores (cf. part 8.2.2.1). These matrices (which represent the graphs shown in Figure 8.1, 8.2 and 8.3) were analysed for actor importance using three centrality measures: degree centrality (indegree and outdegree), eigenvector centrality and flow-betweeness centrality.

The results are the absolute scores for each network and therefore cannot be normalised and compared across the different networks, unlike binary data that can be normalised (Everett pers. comm.). Thus the order of importance for each actor is compared in this study. The network centralization scores were calculated from the binary data because the calculation returns meaningless scores >100% with valued data, although the structure of the graph is the same.

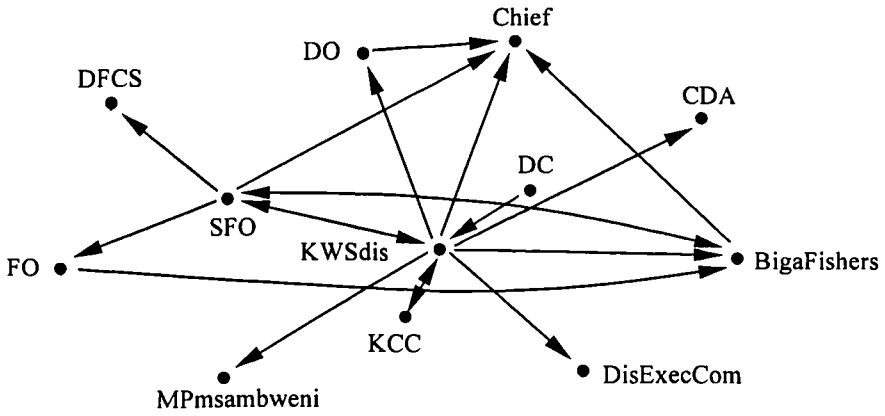
The position of each actor in the directed graphs (Figures 8.1, 8.2, 8.3) were determined by multidimensional scaling of the valued sociomatrices. This gives a visual indication of the importance of each actor in the network, the more central actors being more important (referred to as core, semi-peripheral and peripheral). It must be remembered that the position of each actor relative to the other actors is a function of both the ties and the value of the ties.

All calculations and multidimensional scaling were carried out using UCINET V software (Borgatti *et al.*, 1998). Key aspects of the results are summarised in section 8.5.

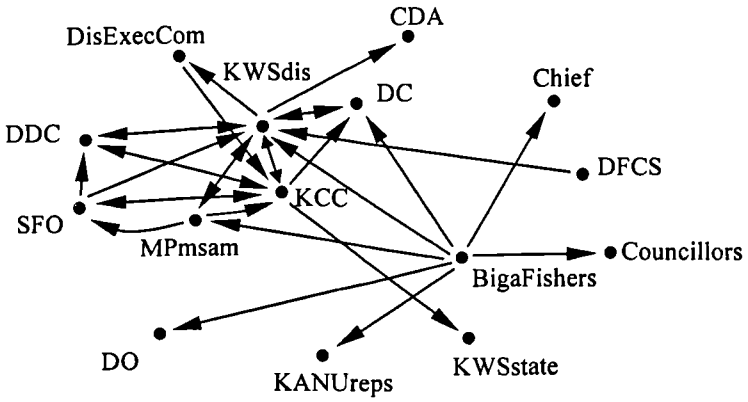
8.4.1 Marine reserve issue

The centrality scores for each phase of the marine reserve issue are presented in Table 8.3 and the directed graphs are presented in Figure 8.1.

Figure 8.1 Directed graphs for the marine reserve issue (abbreviations in Table 8.3). Phase 1.



Phase 2.



Phase 3.

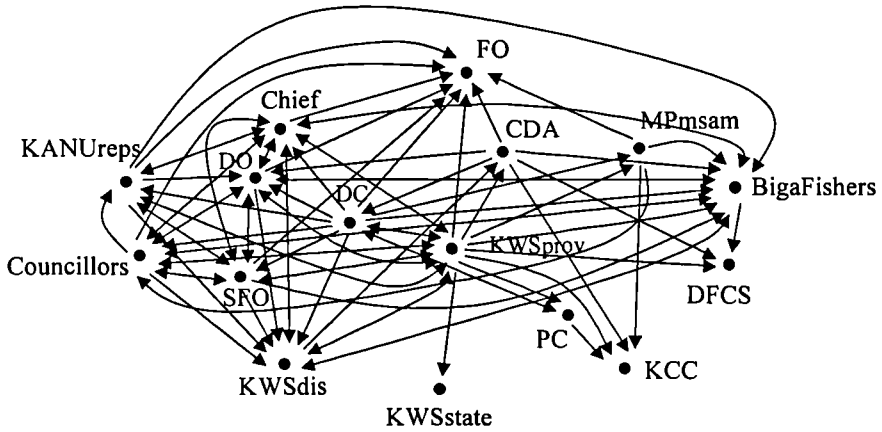


Table 8.3 Centrality of actors in the marine reserve issue calculated from the sociomatrix of combined administrative and political hierarchy values.

Phase 1	OutDeg	InDeg	Eigenvec	FlowBet	**Phase 2**	OutDeg	InDeg	Eigenvec	FlowBet	**Phase 3**	OutDeg	InDeg	Eigenvec	FlowBet
CDA	0	6	0.146	0	CDA	0	6	0.089	0	CDA	42	13	0.216	262
Chief	0	20	0.330	0	Chief	0	1	0.001	0	Chief	40	44	0.255	78
DC	9	0	0.218	-18	Councillors	0	1	0.001	0	Councillors	40	47	0.280	154
DEC	0	6	0.146	0	DC	9	15	0.263	-34	DC	99	25	0.416	102
DFCS	0	6	0.104	0	DDC	12	20	0.286	25	DFCS	0	15	0.067	0
DO	7	6	0.240	0	DEC	6	6	0.185	6	DO	49	43	0.300	149
BigaFishers	1	16	0.287	0	DFCS	1	0	0.015	0	BigaFishers	4	64	0.282	88
FO	4	6	0.151	0	DO	0	1	0.001	0	FO	0	58	0.257	0
KCC	8	6	0.194	0	BigaFishers	7	0	0.035	0	KANUreps	24	32	0.212	31
KWSdis	48	23	0.592	18	KANUreps	0	1	0.001	0	KCC	0	34	0.115	0
MPmsm	0	12	0.249	0	KCC	40	33	0.519	88	KWSdis	24	42	0.253	133
SFO	36	6	0.421	0	KWSdis	36	40	0.482	172	KWSprov	105	41	0.367	446
					KWSstate	0	8	0.128	0	KWSstate	0	7	0.039	0
					MPmsm	27	7	0.383	7	MPmsm	36	16	0.225	18
					SFO	18	17	0.376	18	PC	22	16	0.128	188
										SFO	48	36	0.269	57
Net. Cen.	70.00%	26.36%	61.64%	109.09%	Net. Cen.	41.76%	41.76%	60.91%	70.44%	Net. Cen.	73.81%	35.71%	24.48%	18.00%

Key: CDA – Coast Development Authority; DC – District Commissioner; DDC – District Development Committee; DEC – District Executive Council; DFCS – Diani Fishermen's Co-operative Society; DO – District Officer; FO – Fisheries Officer; KANUreps – Political party reps.; KCC – Kwale County Council; KWS – KWS district, state, province level; MPmsm – MP Msambweni; PC – Provincial Commissioner; SFO – Senior Fisheries Officer.
Eigenvec – Eigenvector centrality; FlowBet – Flow-betweeness centrality; InDeg – Indegree centrality; OutDeg – Outdegree centrality; Net. Cen. - Network centralization.

There is some variation between the network centralization scores derived from each measure for each phase. With respect to outdegree network centralization, the scores suggest that the graphs are dominated by a small number of actors in each phase. The indegree network centralization scores suggest that there is less concentration of importance in a few actors.

The first two phases have high network centralization according to eigenvector centrality, but a more equal distribution of centrality (importance) in the third phase.

The flow-betweeness network centralization measures are high for the first two phases, but these scores are dubious because the graph is disconnected. The third phase suggests a more equal distribution of importance with respect to this measure.

In the case of **phase 1**, the degree and eigenvalue measures indicate that the most important actors are the district level KWS, the Senior Fisheries Officer and the Chief. The most important actor as a source of communication is KWSdis closely followed by SFO. KWSdis is also the most important recipient of communication, followed by the Chief and the Biga fishers. This reflects the situation when the marine reserve was proposed to the local fishing community and these actors were the core group.

The flow-betweeness measure does not work well because the graph is very disconnected and many actors are singletons and therefore not on paths between other actors. The directed graph for phase 1 (Figure 8.1) illustrates the situation well.

During the **second phase** the Kwale County Council became the most important actor as a source of communication (outdegree), followed by KWSdis, the local MP, the Senior Fisheries Officer and the District Development Council. The most important actors as recipients of communication are the same as for the outdegree measure, although in a slightly different order.

In terms of importance in the overall structure of the network and communication with other important actors, the eigenvector centrality scores also identifies the same

actors as the most important. Again the order is slightly different, placing Kwale County Council ahead of KWSdis, the local MP, the Senior Fisheries Officer, the District Development Council and closely followed by the District Commissioner.

The flow-betweeness measure has not worked for all the actors for the same reason as the previous graph, many actors are not on paths between other actors. However the measure places KWSdis as more important than Kwale County Council in terms of involvement in all the flows of communication between all the other pairs of actors.

The directed graph of phase 2 (Figure 8.1) illustrates the position of the core group identified by the centrality measures. The graph also shows that the Biga fishers are a source of many communication ties, however their centrality scores are relatively low. This is due to their low inherent importance in the established administrative and political hierarchies. This accurately reflects the situation in phase 2 when the other actors largely ignored the Biga fishers.

The results for the **third phase** of the marine reserve issue show that the overall level of communication has increased compared to the previous phases. The provincial level of KWS has become the most important actor in terms of initiating communication (outdegree). This was because the individual who was responsible for the implementation of the marine reserve was promoted form district to provincial level responsibility in the organisation. The District Commissioner has become the second most important source of communication and a group consisting of the Distirct Officer, Coast Development Authority, Chief, Councillors and local MP follow as somewhat less important but with similar scores. Most of the actors are in a similar position in terms of recipients of communication (indegree), the Biga fishers and the local Fisheries Officer are slightly more important than the other actors.

In terms of communicating with other important actors throughout the network (eigenvector centrality) the District Commissioner is the most important, followed by KWSprov. There is then a group in similar positions of importance, including the

District Officer, the Biga fishers, local councillors, the local Fisheries Officer, the Chief, KWSdis and the local MP.

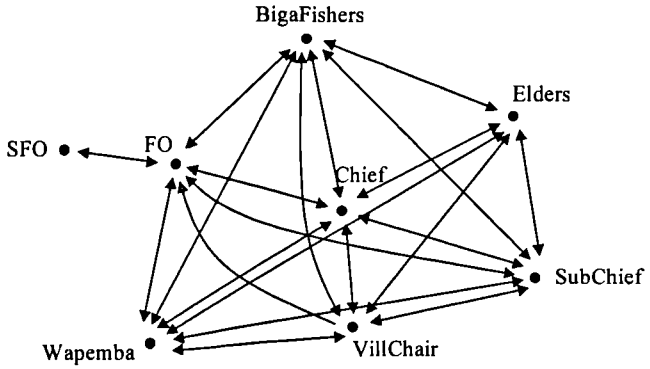
The flow-betweeness centrality measure works well in this graph because it is well connected (Figure 8.1). Contrary to the eigenvector measure, the most important actor in terms of being involved in most of the communication is KWSprov. The Coast Development Authority is found to be more important using this measure than with the other centrality measures. The next important group of actors is similar to the eigenvector measure except that the Provincial Commissioner has risen in importance and the local MP and Biga fishers have decreased in importance.

The directed graph of phase 3 (Figure 8.1) shows the increased number of communication ties which also tend to be both ways between most pairs of actors. It was during this phase of the issue that protest against the reserve took place, involving a wide range of actors, and KWS failed to regain the support of local communities.

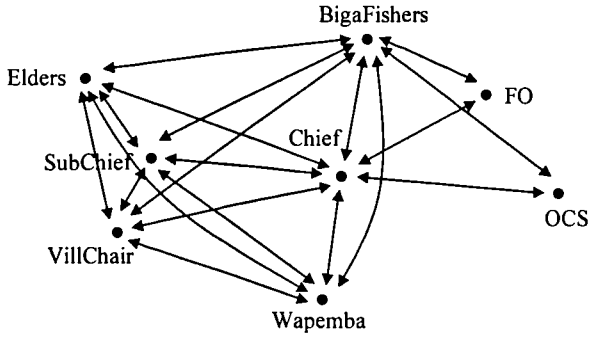
8.4.2 Wapemba beach seine issue

The centrality scores for each phase of the Wapemba beach seine issue are presented in Table 8.4 and the directed graphs of the networks are presented in Figure 8.2.

Figure 8.2 Directed graphs for the beach seine issue (abbreviations in Table 8.4).
Phase 1.



Phase 2.



Phase 3.

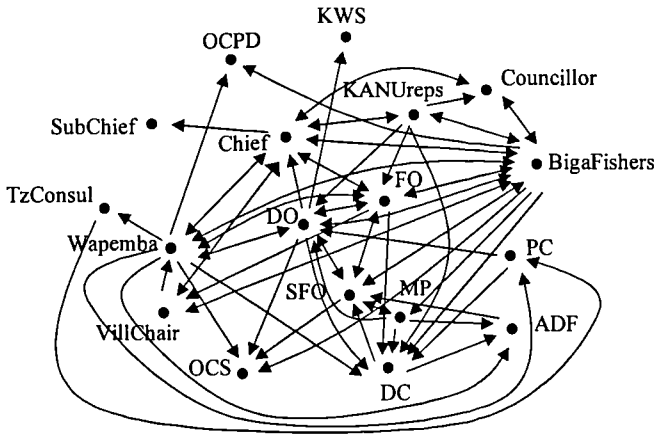


Table 8.4 Centrality of actors in the Wapemba beach seine issue calculated from the sociomatrix of combined administrative and political hierarchy values.

Phase 1	OutDeg	InDeg	Eigenvec	FlowBet	**Phase 2**	OutDeg	InDeg	Eigenvec	FlowBet	**Phase 3**	OutDeg	InDeg	Eigenvec	FlowBet
Chief	30	10	0.560	38	Chief	35	16	0.577	79	Chief	35	23	0.198	361
BigaFishers	6	14	0.342	17	BigaFishers	7	20	0.387	43	Councillor	10	9	0.063	41
Elders	5	10	0.252	14	Elders	5	12	0.287	15	BigaFishers	12	33	0.234	166
FO	16	16	0.417	55	FO	8	6	0.241	7	ADF	7	25	0.233	27
SFO	6	4	0.142	0	OCS	8	6	0.241	7	DC	18	42	0.403	86
SubChief	6	10	0.275	15	SubChief	15	10	0.365	18	DO	56	35	0.472	198
VillChair	12	9	0.344	18	VillChair	10	11	0.320	15	FO	28	23	0.257	138
Wapemba	6	14	0.342	18	Wapemba	5	12	0.287	14	KANUreps	18	6	0.130	130
										KWS	0	7	0.081	0
										MP	36	7	0.335	29
										OCS	0	15	0.147	0
										OCPD	0	2	0.010	0
										PC	22	6	0.245	94
										SFO	42	37	0.380	326
										SubChief	0	5	0.024	0
										TanzConsul	5	1	0.034	15
										VillChair	6	10	0.069	19
										Wapemba	10	19	0.167	89
Net. Cen.	19.05%	19.05%	13.71%	5.30%	Net. Cen.	42.86%	42.86%	24.16%	16.96%	Net. Cen.	52.94%	26.47%	36.38%	25.68%

Key: ADF – Assistant Director for Fisheries; DC – District Commissioner; DO – District Officer; FO – Fisheries Officer; KANUreps – Political party reps; OCPD – District level police; OCS – Local level police; PC – Provincial Commissioner; SFO – Senior Fisheries Officer; VillChair – Village chairman; TanzConsul – Tanzanian Consul.
Eigenvec – Eigenvector centrality; FlowBet – Flow-betweeness centrality; InDeg – Indegree centrality; OutDeg – Outdegree centrality; Net. Cen. - Network centralization.

The network centralization scores in this issue suggest that a small number of actors dominate the networks, but not to the extent as in the previous issue.

For the **first phase** of the beach seine issue, the Chief is the most important actor in terms of a source of communication, followed by the local Fisheries Officer and the Village Chairman. In terms of important recipients of communication, the actors are more equal, with the local Fisheries Officer slightly more important than the local Biga fishermen and the Wapemba fishermen.

The importance of the Chief and local Fisheries Officer is supported by the eigenvector measure. The Village Chairman, Biga fishers and Wapemba fishers are of similar importance.

The flow-betweeness measure reflects a similar situation except that the local Fisheries Officer is more important than the Chief in terms of being involved in most of the communication flows between other actors.

The multidimensional scaling for the directed graph of phase 1 (Figure 8.2) places the Chief at the core of the network.

In the **second phase**, the Chief is again the most important actor in terms of a communication source. The next two actors are the Sub-Chief and Village Chairman, who are subordinate to the Chief in the village hierarchy. The indegree scores suggest that the Biga fishermen are the most important recipients of communication, closely followed by the Chief. The other actors are considered similarly important except for the local Fisheries Officer and the local Police.

In terms of the communication ties with other important actors and how close the actor is to other actors, the eigenvector measure places the Chief as the most important, followed by the Biga fishermen, the Sub-Chief and the Village Chairman.

The flow-betweeness measure reflects a similar situation, placing the Chief as the most important actor followed by the Biga fishermen. The Sub-chief, Village

Chairman, Elders and Wapemba fishermen are all of similar importance using this measure.

As with phase 1, the directed graph of this phase (Figure 8.2) shows the Chief to be at the core of the network.

The **third phase** of the issue involves many more actors than the previous two phases although some of the actors are quite peripheral (Figure 8.2). In this phase, a different group of actors have become important. The District Officer, Senior Fisheries Officer, local MP and Chief are the most important in terms of sources of communication (outdegree). The District Commissioner, Senior Fisheries officer, District Officer and the Biga fishermen are important as recipients of communication (indegree).

In terms of communicating with other important actors (eigenvector) the District Officer is slightly more important that the District commissioner and they are followed by the Senior Fisheries Officer and the local MP.

The flow-betweeness measure reflects a different result, finding the Chief as the most important followed by the Senior Fisheries Officer and somewhat less important the District Officer, the Biga fishermen and the local Fisheries Officer. The local KANU political party representatives are also in this semi-peripheral group.

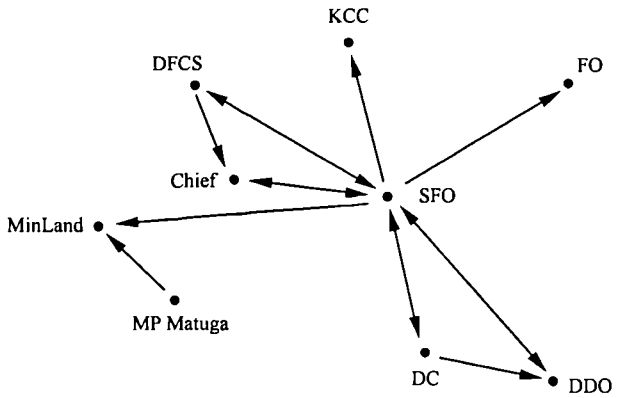
On the whole it is the same group of actors who are the most important according to all the measures. The directed graph of phase 3 (Figure 8.2) illustrates the core, semi-peripheral and peripheral actors quite well.

8.4.3 Land issue

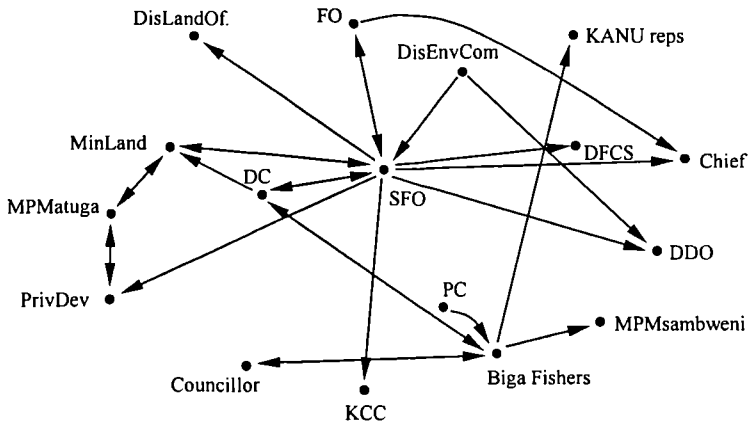
The centrality scores for the three phases of the land issue are presented in table 8.5 and the directed graphs for the three networks are presented in Figure 8.3.

Figure 8.3 The directed graphs for the land issue (abbreviations in Table 8.5).

Phase 1.



Phase 2.



Phase 3.

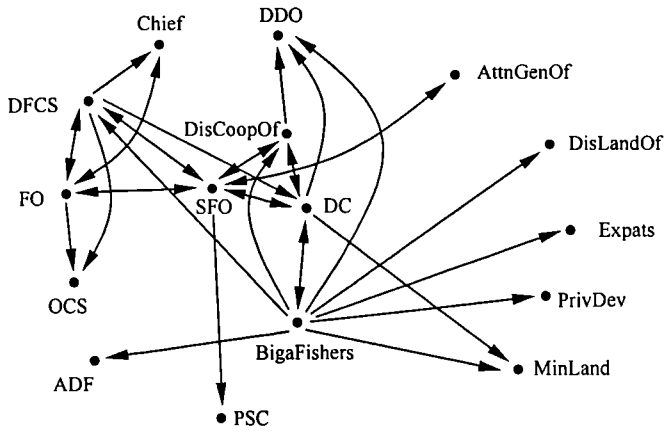


Table 8.5 Centrality of actors in the land issue calculated from the sociomatrix of combined administrative and political hierarchy values.

Phase 1	OutDeg	InDeg	Eigenvec	FlowBet	**Phase 2**	OutDeg	InDeg	Eigenvec	FlowBet	**Phase 3**	OutDeg	InDeg	Eigenvec	FlowBet
Chief	10	7	0.246	2	Chief	0	10	0.137	0	AttnGenOf	0	6	0.104	-27
DC	18	6	0.448	-2	DC	27	7	0.377	153	Chief	5	5	0.035	5
DDO	6	15	0.383	0	DDO	0	12	0.149	0	DC	45	14	0.597	136
DFCS	2	11	0.246	1	DisEnvCo	12	0	0.149	0	DDO	0	16	0.321	0
FO	0	6	0.186	0	DFCS	0	6	0.119	0	DFCS	5	11	0.163	45
KCC	0	6	0.186	0	DisLandOf	0	6	0.119	0	DisCoopOf	18	16	0.405	24
MinLand	0	15	0.231	0	BigaFishers	4	25	0.141	15	DisLandOf	0	1	0.010	0
MPmatuga	9	0	0.102	0	FO	8	6	0.137	4	BigaFishers	9	9	0.260	0
SFO	42	21	0.632	24	KCC	0	6	0.119	0	FO	16	12	0.141	23
					MinLand	26	24	0.502	150	MinLand	0	10	0.225	0
					MPmatuga	18	14	0.289	18	OCS	0	5	0.029	0
					MPmsam	0	1	0.005	0	PrivDev	0	1	0.010	0
					PrivDev	1	15	0.208	2	PSC	0	6	0.104	0
					SFO	54	32	0.575	152	SFO	36	20	0.433	72
					Councillor	5	1	0.024	0	Expats	0	1	0.010	0
					KANUreps	0	1	0.005	0	ADF	0	1	0.010	0
					PC	11	0	0.053	0					
Net. Cen.	85.71%	37.50%	86.57%	79.89%	Net. Cen.	52.50%	17.08%	88.84%	92.25%	Net. Cen.	52.86%	14.76%	47.31%	57.81%

Key: ADF – Assistant Director for Fisheries; AttnGenOf – Attorney General's Office; DC – District Commissioner; DDO – District Development Officer; DFCS – Diani Fishermen's Co-operative Society; DisCoopOf – District Co-operative Office; DisEnvCo – District Environment Committee; DisLandOf – District Land Officer; Expats – Expatriate residents; FO- Fisheries Officer; KANUreps – Political party reps.; KCC – Kwale county Council; MinLand – Minister for Lands and Settlement; MPmatuga – MP Matuga; MPmsam – MP Msambweni; OCS – Local level police; PC – Provincial Commissioner; PrivDev – Private Developer; PSC – Provincial State Council; SFO – Senior Fisheries Officer. Eigenvec – Eigenvector centrality; FlowBet – Flow-betweeness centrality; InDeg – Indegree centrality; OutDeg – Outdegree centrality; Net. Cen. - Network centralization

The network centralization scores tend to be high for all the issues, suggesting that there are a small number of actors dominating the networks. The flow-betweeness measures are dubious in this issue, as in the marine reserve issue, because the graphs tend to be disconnected with many actors not between any others.

For the **first phase** of the land issue the Senior Fisheries Officer is clearly the most important actor in terms of outdegree which reflects his role in implementing the IFAD project. The District Commissioner, the Chief and the MP from the neighbouring constituency follow in importance. The Senior Fisheries Officer is also the most important actor in terms of receiving communications (indegree), followed by the Minister for Lands and the District Development Officer.

The eigenvector centrality scores also place the Senior Fisheries Officer as the most important actor followed by the District Commissioner and the District Development Officer. Both the Chief and the Diani Fishermen's Co-operative Society come higher with this measure than the degree measures.

The flow-betweeness measure supports the importance of the Senior fisheries Officer, but the graph is not well connected so many of the actors are not between other actors and therefore have no scores.

The directed graph of this phase (Figure 8.3) illustrates the central position of the Senior Fisheries Officer.

In the **second phase** the Senior Fisheries Officer again comes out as the most important in terms of outdegree. The Minister for Lands has risen in importance and the District Commissioner and MP from the neighbouring constituency remain important as sources of communication, however the Chief has no outdegree score at all. The Senior Fisheries Officer is again the most important in terms of receiving communication ties. According to this measure, the Biga fishermen are a new group of important actors that appear in this phase. The Minister for Lands is also one of the more important actors according to indegree.

The eigenvector scores support the degree measures, showing that in terms of communicating with other important actors, the Senior Fisheries Officer is most important followed by the Minister for Lands, the District commissioner and the neighbouring MP.

The flow-betweeness scores also place the Senior Fisheries Officer as the most important actor, closely followed by the District commissioner and the Minister for Lands.

The directed graph of this phase (Figure 8.3) shows the Senior Fisheries Officer at the centre of the network.

The **final phase** of the land issue shows a slight change in the order of actor importance. The District Commissioner is the most important actor according to outdegree followed by the Senior Fisheries Officer and a new actor, the District Co-operative Officer. The Senior Fisheries Officer is once again the most important in terms of indegree followed by a group in similar positions consisting of the District Co-operative Officer, the District Development Officer and the District Commissioner.

The eigenvector measure determines the District Commissioner to be the most important in terms of communication with other important actors, followed by the Senior Fisheries Officer and the District Co-operative Officer. The Biga fishermen have risen in importance in this phase.

The flow-betweeness measure determines the District Commissioner to be the most important actor in the phase, followed by the Senior fisheries Officer and the Diani fishermen's Co-operative Society. However, as with many of the other graphs in the analysis, there are a number of singleton actors that do not lie on paths between other actors. The directed graph of phase 3 (Figure 8.3) illustrates this.

The core actors are shown to be the District Commissioner, the Senior Fisheries Officer and the District Co-operative Officer.

The key results for actor importance in all the issues are summarised in section 8.5.

8.4.4 Relationship between institutional levels or types and importance in networks

The results of the analysis of the importance of the level, sub-type and type of institution as reflected by the actors involved in each network are presented below in Table 8.6. The different levels were local, district, provincial and national. The sub-types were administrative, political, natural resource management/exploitation, non-natural resource management/exploitation. The types were formal and informal.

There was no significant relationship ($p>0.05$) between the four levels of institution (Local, District, Provincial, National) and their importance in the different networks using the Kruskal-Wallis test except in some instances of the marine reserve issue.

In the second phase of the marine reserve issue there was a significant relationship ($p<0.05$) between the level of institution and its importance in the network according to outdegree and indegree centrality. The relationship was highly significant ($p<0.01$) for eigenvector centrality in the second phase. In the third phase of the marine reserve issue there was a significant relationship between the level of institution and its importance ($p<0.05$) in terms of flow-betweeness centrality.

There was no significant relationship ($p>0.05$) between the four sub-types of institution and their importance in the networks using the Kruskal-Wallis test. There was also no significant relationship between the type of institution, formal or informal, and its importance in the network, except in the second phase of the Wapemba beach seine issue according to outdegree centrality.

The implications of these results are discussed in the conclusion at the end of the chapter.

Table 8.6 Relationship between the levels or types of institution and the importance of that institution to the network as reflected by the centrality scores of the actors. (Kruskal-Wallis test and Mann-Whitney *U*-test, not significant if p>0.05.)

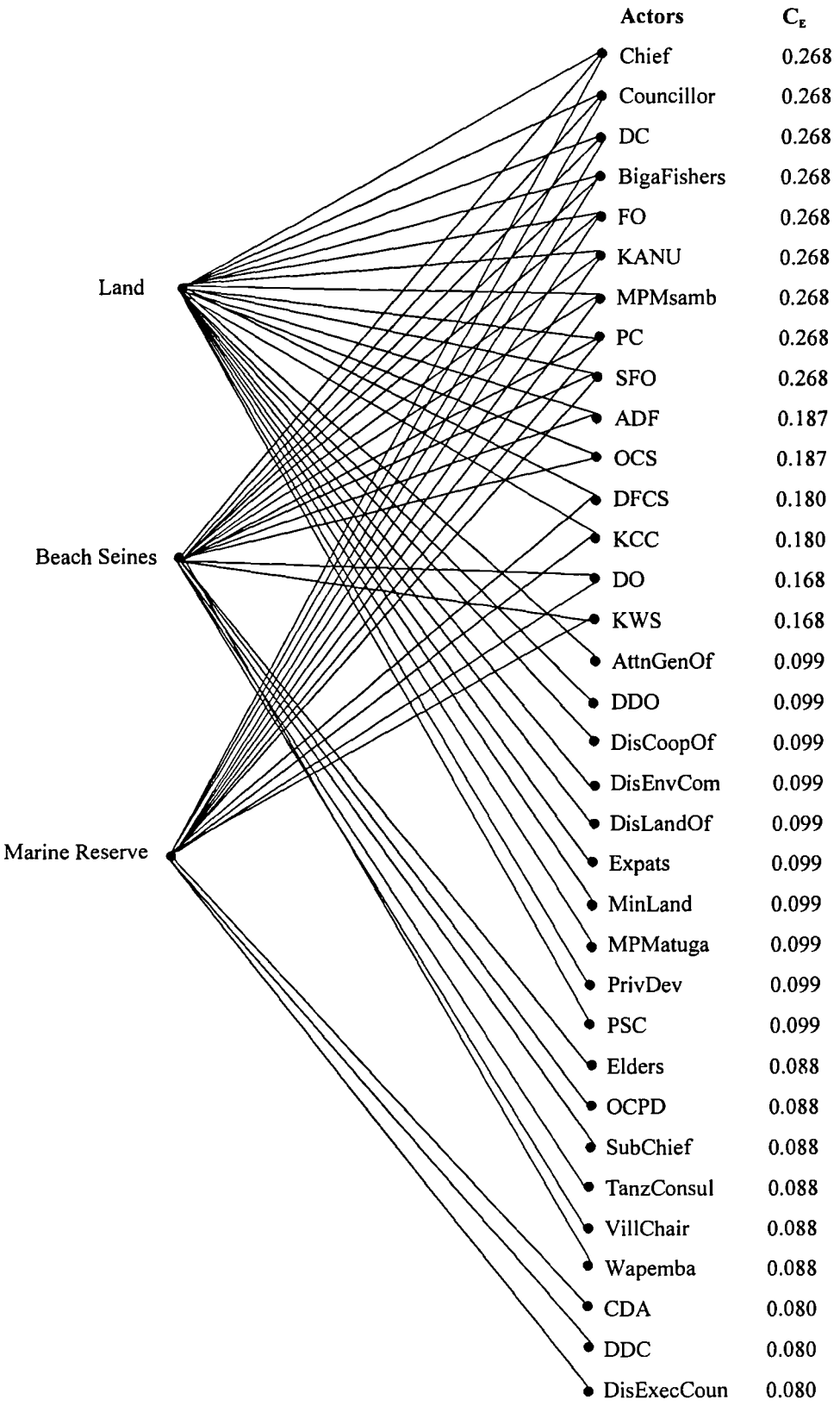
Network	Centrality Measure	Scale level			Sub-type			Type	
		K-W	df	p	K-W	df	p	U	p
Land 1 N = 9	Outdegree	2.115	2	0.347	2.621	3	0.454	ALL FORMAL	
	Indegree	0.979	2	0.613	4.939	3	0.176		
	Eigen value	0.407	2	0.816	3.944	3	0.268		
	Flow-between	1.301	2	0.522	2.053	3	0.561		
Land 2 N = 17	Outdegree	2.995	3	0.392	1.978	3	0.577	16.00	0.877
	Indegree	3.692	3	0.297	3.240	3	0.356	3.00	0.071
	Eigen value	4.355	3	0.266	4.456	3	0.216	10.00	0.454
	Flow-between	2.586	3	0.460	1.307	3	0.728	9.00	0.317
Land 3 N = 16	Outdegree	4.324	3	0.229	5.728	3	0.126	23.00	0.604
	Indegree	4.872	3	0.181	0.166	3	0.983	31.00	0.118
	Eigen value	5.056	3	0.168	0.708	3	0.871	28.00	0.249
	Flow-between	5.318	3	0.150	5.423	3	0.143	27.00	0.266
Reserve 1 N = 12	Outdegree	2.630	2	0.268	2.829	3	0.419	6.00	0.881
	Indegree	0.513	2	0.774	1.065	3	0.786	2.00	0.258
	Eigen value	1.659	2	0.436	3.098	3	0.377	3.00	0.468
	Flow-between	0.000	2	1.000	2.933	3	2.305	5.50	1.000
Reserve 2 N = 15	Outdegree	10.594	3	0.014	1.354	3	0.716	6.00	0.811
	Indegree	11.172	3	0.011	0.545	3	0.909	13.50	0.128
	Eigen value	11.938	3	0.008	1.795	3	0.616	9.00	0.640
	Flow-between	6.303	3	0.091	3.600	3	0.308	9.50	0.530
Reserve 3 N = 16	Outdegree	3.195	3	0.363	2.970	3	0.396	11.00	0.444
	Indegree	6.472	3	0.091	2.085	3	0.555	0.00	0.103
	Eigen value	2.731	3	0.435	1.711	3	0.634	3.00	0.329
	Flow-between	7.996	3	0.046	4.159	3	0.245	7.00	0.913
		U		p	U		p	U	p
Seines 1 N = 8 [only 2 scale levels and sub-types (U)]	Outdegree	4.500	-	0.642	8.500	-	0.878	13.00	0.081
	Indegree	7.000	-	0.115	4.000	-	0.834	4.00	0.282
	Eigen value	7.000	-	0.124	9.000	-	0.772	10.00	0.453
	Flow-between	7.000	-	0.124	7.500	-	0.885	9.50	0.549
		K-W	df	p	K-W	df	p	U	p
Seines 2 N = 8	Outdegree	ALL LOCAL			2.017	2	0.365	15.00	0.024
	Indegree				1.761	2	0.415	2.00	0.097
	Eigen value				2.529	2	0.282	7.00	0.880
	Flow-between				2.831	2	0.243	6.50	0763
Seines 3 N = 18	Outdegree	0.774	3	0.856	5.223	3	0.156	16.50	0.944
	Indegree	2.740	3	0.433	6.206	3	0.102	9.00	0.325
	Eigen value	2.442	3	0.486	4.339	3	0.227	14.00	0.779
	Flow-between	1.627	3	0.653	4.937	3	0.176	9.00	0.323

8.4.5 Affiliation between actors and issues

The affiliation between the actors according to their involvement in each of the three issues is presented in the bipartite graph (Figure 8.4). The results of the eigenvector centrality scores for the actors based on their co-membership of each issue are presented in Figure 8.4. The order in which the actors and issues are presented in Figure 8.4 is based on these centrality scores.

The most important actors according to their involvement in all three of the issues are the Chief, the Councillors, the District Commissioner, the Biga fishermen, the local fisheries officer, the local KANU political party representatives, the local MP, the Provincial commissioner and the Senior Fisheries Officer.

Figure 8.4 Bipartite graph of the three issues and actors involved. The eigenvector centrality (C_E) scores derived from the actor co-memberships of the issues are also presented.



8.5 Results summarised

Each of the issues described and analysed above were resource access or control problems faced by members of Biga fishing community. The analyses set out to comprehend how the Biga fishing community achieved an outcome in their favour. The three phases of each issue aimed to reflect distinct periods in the sequence of events. The general trend was the recognition of a problem followed by the pursuit of a solution through a conventional process followed by a period of problem resolution. The trends and characteristics of each issue are presented below followed by a presentation of the overall trends and some underlying patterns.

8.5.1 Summary of actor importance

Each centrality measure has been used to identify the importance of the actors in each network. A range of measures were used because an actor's importance in a network differs according to its role in the network (cf. part 8.2.2.2).

8.5.1.1 Summary of actor importance in the marine reserve issue

The important actors according to their differing roles are summarised in Table 8.7. The key actors and processes identified by social network analysis correspond well with the reality of the marine reserve initiative, as discussed below.

Table 8.7 The principal actors according to their roles in the marine reserve issue.

Phase	Principal organisers	Principal sources of info.	Pursuing a cause	Being informed	Overall influence
	outdegree	indegree	outdegree	indegree	eigenvector
1	KWSdis SFO	KWSdis		Chief Fishers MP	KWSdis SFO Chief Fishers
2	KCC KWSdis	KWSdis KCC DDC DC	MP	DC	KCC KWSdis MP
3	KWSprov DC DO		Councillors MP	Fishers	DC KWSprov Fishers

The active organisers involved in initiating the marine reserve process were clearly identified as the district level Kenya Wildlife Service (KWSdis) and the Senior Fisheries Officer in the first phase, as can be expected. Similarly the primary source of information was identified as KWSdis. The main group being informed included the Chief, the fishers and the local MP, reflecting the community *approach taken by* KWS and the Senior Fisheries Officer. The key actors of influence in the first phase were clearly identified as KWSdis, the Senior Fisheries Officer, the Chief and the fishers.

During the second phase, when district authorities were considering the reserve proposal and the legal status was being determined, a different set of actors were identified as key organisers. The County Council and KWSdis were the most prominent as was expected. The outdegree scores also identified the local MP as an important actor. Since this measure also reflects actors who may be pursuing a cause, it could explain why the MP is important following the questions asked by the fishers regarding the US aid and control of beach seining.

The important sources of information are not surprising in view of the procedures involved at this stage of setting up the marine reserve (Table 8.7). However the District Commissioner appears to be important, either as a source of information or an informed actor. Here again the fishers communicated with him, seeking clarification of the situation in view of his authority in the district. In terms of

overall influence in the network however, the County Council and Kwsdis were found important. This was because they were negotiating the terms of the marine reserve. The local MP however does appear to be influential and this reflects his association with the County Council and why the fishers sought to communicate with him.

In the final phase, which concerns the ultimate suspension of the marine reserve initiative, KWS remains an important organiser but two senior members of the Administration, the District Commissioner and the District Officer, have also become important. In addition, the local Councillors and MP were relatively central, reflecting the anti-reserve cause they were pursuing, ostensibly on behalf of the fishing communities. The fishers were the most informed actors during the intense lobbying against the reserve.

Interestingly, the District Commissioner is the most influential actor within the overall network. This reflects his authority to suspend the reserve initiative following discussions with KWS. This also explains why the KWS is influential on the outcome, since they agreed to put their initiative on hold. The fishers are also an influential group, which is surprising considering their low level of importance in pursuing their cause. However it can be explained if their relations with the actors who were pursuing the anti-reserve cause on their behalf (the Councillors, KANU representatives and MP) are considered (see Figure 8.1).

8.5.1.2 Summary of actor importance in the Wapemba beach seine issue

The important actors according to their differing roles are summarised in Table 8.8. The general trend in this issue is that it remains at the local level for many years (Phases 1 and 2, 1964 - 1992). The results suggest that this may be due to the Chief's control of information flow.

Table 8.8 The principal actors according to their roles in the Wapemba beach seine issue.

Phase	Principal organisers	Principal sources of info.	Pursuing a cause	Being informed	Overall influence	Controlling info. flow
	outdegree	indegree	outdegree	indegree	eigenvector	flowbetween
1	Chief FO VillChair	FO Fishers		Fishers Wapemba	Chief	FO Chief
2	Chief SubChief VillChair	Fishers			Chief FO VillChair	Chief
3	DO SFO MP	Fishers	MP	DC SFO DO	DO DC SFO	Chief

The early stage of the beach seine issue did not involve any conflict between the Wapemba fishers and the local fishers. After some time questions were raised by the local fishers about effects of the beach seines on the fishery. The principle organisers were the local authorities and the local Fisheries Officer, who seemed to support the activities of the Wapemba. The Wapemba, local fishers and local Fisheries Officer were important sources of information and were the recipients of instruction from local authorities. Overall the Chief was the most influential at this stage, which is not surprising while the issue remained of local concern. Interestingly, the traditional leaders, the elders, are not prominent in the networks despite being responsible for giving the Wapemba permission to settle in the area.

During the second phase the local fishers came into conflict with the Wapemba fishers and attempted to stop their fishing activities in the area. The local fishers continued to seek a solution through local level authorities, hence the importance of the Chief, sub-Chief and Village Chairman as organisers. However the local fishers increased their influence by communicating with many more actors. The Chief and village authorities remained influential over the outcome of the situation by constraining the flow of information to other actors. This frustrated the local fishers, who had assumed the local authorities would support them, causing them to attack the Wapemba in an attempt to prevent them fishing.

The third phase shows a shift to a different set of important actors reflecting the

raised profile of the conflict. District level authorities replace the local authorities as prominent organisers, and the local MP appears to be important. This was probably because the local Councillors and KANU representatives were pursuing the cause for the local fishers (cf. Figure 8.2). The District Commissioner becomes the most important informed actor, followed by the Senior Fisheries Officer and the District Officer. Ultimately it is the pressure brought to bear on the Senior Fisheries Officer by the District Officer, District Commissioner and MP that lead to the ban on beach seining and are found to be the most influential in the network. Interestingly the Chief remains important as an actor with relative control of information by virtue of his position, but the profile of the issue and the importance other actors prevent him from using this to influence the final outcome.

8.5.1.3 Summary of actor importance in the land issue

The important actors according to their differing roles are summarised in Table 8.9, and the results are expanded on below.

The land issue initially started as a fisheries development project funded by IFAD. This is reflected by the importance of the Senior Fisheries Officer as an organiser and the Chief and District Commissioner who were also involved in the process. The KANU Member of Parliament from the neighbouring constituency appears to be important, but this relates to his pursuit of his own cause – the illegal acquisition of the land proposed for the development project.

The main source of information was the Senior fisheries Officer, principally for the District Development Officer, because of their roles in the development project. However the Minister for Lands is also an important informed actor which is surprising since the decision over the land allocation should be taken by the County Council and usually only ratified by senior members of the Lands Department. The Minister of Lands' importance is derived from his role in the informal communications with the MP over the illegal allocation. This informal process obviously occurred without the principle project organisers knowing. The results of actors with overall importance in the network reflect the group involved in the

development project.

The second phase relates to the discovery that the land had been 'grabbed' from the project, and therefore the local fishing community as well. The Senior Fisheries Officer and the District Commissioner remain the most important source of action in relation to the project. The MP and the Minister for Lands are also important sources of action, but this relates to their informal activities and the onward sale of the land.

The Senior Fisheries Officer retains his key role as a source of information, but the local fishers are also important as they become involved in the process. In terms of overall influence on the situation, the District Commissioner joins the core group of

Table 8.9 The principal actors according to their roles in the land issue.

Phase	Principal organisers	Principal sources of info.	Pursuing a cause	Being informed	Overall influence
	outdegree	indegree	outdegree	indegree	eigenvector
1	SFO DC Chief	SFO DDO	MPmatuga	DDO MinLand	SFO DC DDO
2	SFO MinLand DC	SFO Fishers MinLand	MPmatuga	Fishers	SFO MinLand DC MPmatuga
3	DC SFO DisCoopOf	SFO		DisCoopOf DDO DC	DC SFO DisCoopOf Fishers

Senior Fisheries Officer, Minister for Lands and the MP as prominent. The District Commissioner's involvement was inevitable following the Fisheries Department and local fishers raising the profile of the issue as they sought to regain ownership of the land. The District Commissioner's solution to subdivide the land was politically astute in view of KANU's dominance in government affairs. Although the fishers communicated with local Councillors and KANU representatives, their absence as prominent actors is conspicuous.

The final phase shows that the neighbouring MP and Minister for Lands are no longer important actors. This was because the outcome of the illegal allocation had

been satisfactory (to them) and the land had been sold on and 'legally', subdivided and registered. However, from the point of view of the parcel of land for the development project, the question of ownership remained unresolved.

The District Commissioner's position was again important, both as a key organiser and with overall influence on the final outcome. The Senior Fisheries Officer remained important since the Fisheries Department were claiming the land. The District Co-operative Officer was also important because the Diani Fishermen Co-operative Society were also claiming the land. All of these actors were influential in the outcome with the addition of the local fishers who had been able to communicate their concerns and wishes directly to the District Commissioner. On the strength of the District Commissioner's suggestions the local fishers had secured the letter of allocation, although not in their name.

The process that enabled the fishers to acquire the letter of allocation involved an actor that has not been included in the networks, a researcher working in the area. The local fishers may not have been so successful without the logistic and moral support of this actor. However, excluding the external researcher does not affect the underlying network and centrality scores. But the implications are discussed in the conclusion.

8.5.2 Summary of general trends and underlying patterns across all the issues

The amount of activity associated with each issue tended to increase over its development. The graphs (Figures 8.1, 8.2, 8.3) illustrate this well.

The network centralization scores for each measure showed that importance was generally concentrated in a few actors. The eigenvector network centralization scores suggested that some form of hierarchy guided the processes of communication (Tichy, 1980).

8.5.2.1 Level of institution and importance in the network

Although the Kruskal-Wallis tests did not reveal much significance in the relationship between the level of an institution and its importance in the network (as reflected by the actors, cf. part 8.2.2.1), there were some trends. The level at which any initiative was conceived tended to determine the level of important actors and respective level of institution in the first two phases. Whereas the final, usually more involved phase, tended to include a wider range of levels.

In the marine reserve issue district level actors dominated the first two phases, but in the third phase the local, district and provincial level actors were included. The seine net issue was conceived at the local level, and this is reflected in the first two phases. The third phase however includes district level actors as well. The land issue is a little more complicated because the initial conception was the IFAD development project involving district level actors. However, the land issue arose from the informal relations of more senior actors, an MP and a Minister. However, district level actors dominate the processes in all the phases.

8.5.2.2 Type of institution and importance in the network

The Mann-Whitney U-test showed that there was no significant relationship between the type (formal, informal) of institution and its importance in the network (Table 8.6). However, the results summarising the most important actors for each phase of each issue presented in Tables 8.7, 8.8 and 8.9 show that formal institutions dominate in almost every case. This was reflected by the importance of State organisations, particularly the Administration and the departments concerned with each particular issue (KWS, Fisheries Department). Formal institutions also included the political processes that involved MPs, Councillors and party representatives. Although the relationship between sub-type and importance was not statistically significant, administrative institutions tended to be the most influential in the final outcome of each issue.

8.5.2.3 Actor co-membership in the issues

The affiliation network analysis (Figure 8.4) identified a group of nine actors involved in all three issues. This suggests certain actors tend to be included in situations that involve resource access or control problems for the fishing community. These actors include the local fishers and the local and district level representatives of the Fisheries Department. This would be expected because of the role of formal and informal marine resource related institutions. However the others are three administrative actors, the Provincial Commissioner, District Commissioner and Chief, and three political actors, the local MP, local councillors and KANU representatives. The administrative actors and Fisheries Department and MP are consistently among the most influential actors in this study. The District Commissioner consistently stands out as the most influential actor in all the phases. Although the Councillors and KANU representatives do not consistently appear to be prominent in the networks, their presence in all the issues suggests an importance of some kind. This indicates that these actors would be important in other issues of this kind, but their membership is not obligatory.

8.6 Conclusion

The retrospective analysis, above, of three situations (issues) in which access to or control over community resources was threatened, sought to identify how the final outcomes were achieved. The outcomes were known to favour the local fishing community, but in view of their poor socio-economic situation, low status and apathy of certain government departments it was not evident how this was achieved. The analysis sought to identify the important people or organisations and the underlying institutions involved in the process of solving the issues. The three issues included the attempted implementation of a marine protected area, a conflict between local fishermen and migrant fishermen over fishing methods, and the threat to some land used by the community for fishing related activities.

The analysis was based on a method that could identify the importance of actors involved in each of the situations based on their communication relations. The

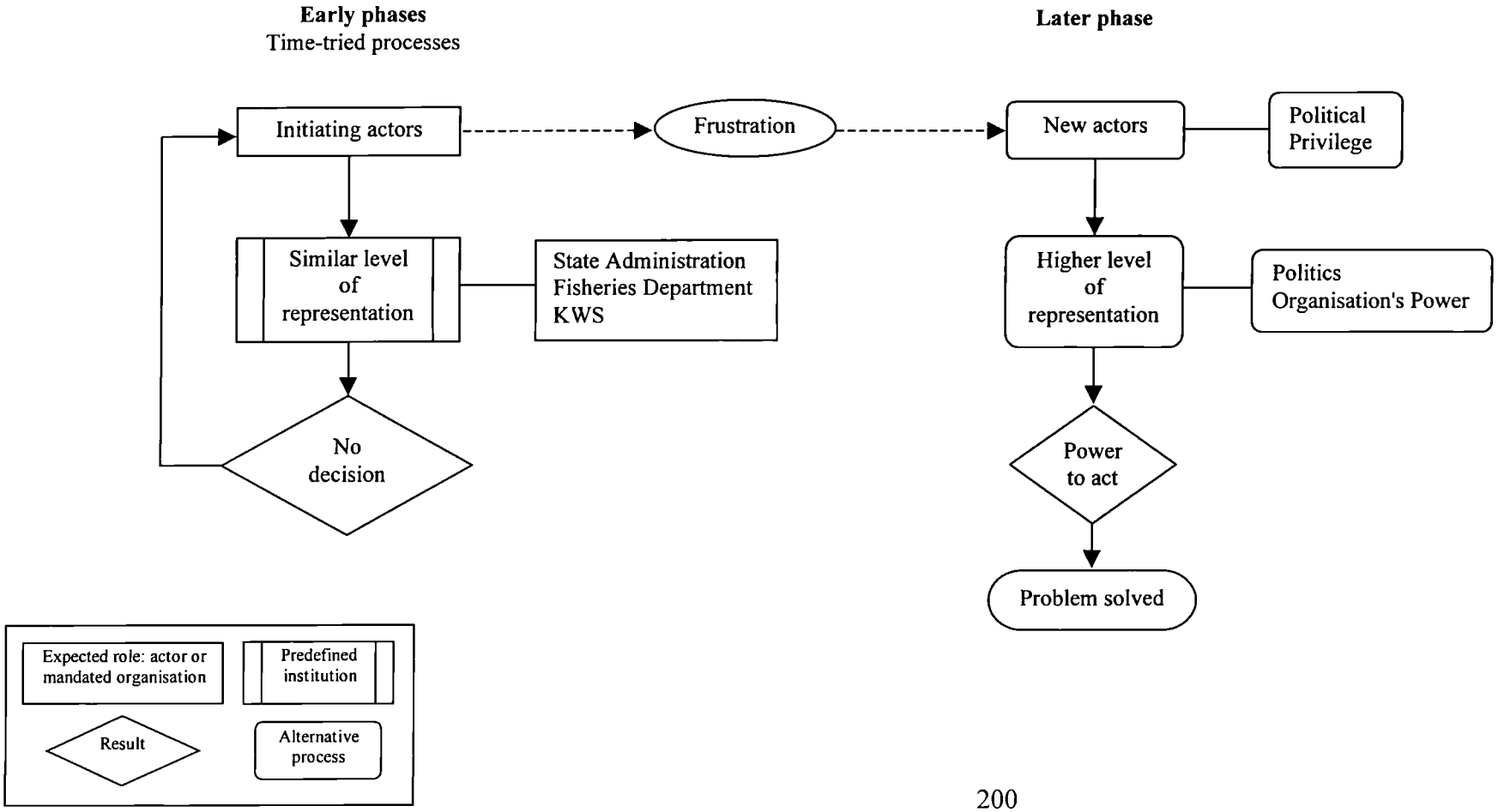
importance of an actor was essentially reflected in their ability to influence the outcome of a decision or decision process. Thus communication ties between actors were identified and communication networks for each issue were generated. An actor's importance was understood to derive from their position in the communication network, their relationships with other actors and their inherent characteristics.

The actors in each network, and their relative importance, were considered to represent the underlying level of institution guiding people's actions. This inference was based on Kanbur's (1992) observation that institutions reproduce and shape relations of power and influence in society.

Figure 8.5 gives a generalised impression of the roles and importance of the different actors and represented level of institution based on the results. The results showed that the initial phases of each issue revolved around the actors that initiated the situation and a *status quo* was maintained. The important actors reflected the nature of the issue and tended to include the Fisheries Department or Kenya Wildlife Service and local authorities such as the Chief. The institutions in the early phases, represented by the actors, were dominated by these formal State organisations. However, the final phases of each issue reflected a break in the *status quo* and the involvement of different actors and the level of institution involved was higher. For example the beach seine issue revolved around institutions at the local level for many decades, but shifted to institutions represented at the district and national level at the height of the conflict prior to its resolution.

Throughout each issue Administration members were consistently among the more important actors in the networks, the District Commissioner was usually the most influential actor. Initially this is surprising because each issue could theoretically have been contained and resolved by resource management organisations, such as the Fisheries Department or the Kenya Wildlife Service. But the analysis showed that the Administration became important in the processes because of the lack of action on the part of resource management organisations. This also reflected the dominance of formal State institutional processes in determining the outcome of the issues.

Figure 8.5 Simplified flow of communication as fishers attempt to resolve resource access and control problems.



The analysis also showed that the shift to institutions represented at a higher level and the involvement of senior members of the Administration invariably involved actors from political organisations. However, the results did not suggest that an issue needed to be politicised in order for the *status quo* to change, the political actors were seldom very important in the issues. Their roles however were related to the course of action pursued by the local fishermen.

The fishermen initially pursued a 'standard' course of action (guided by natural resource related institutions) when seeking to address their concerns, but were frustrated by the lack of action using these channels (phases 1 and 2). They then sought other ways of dealing with their concerns and the local political representatives, either party members or local Councillors, were obvious contacts with inherent influence in the area. The relationship between political actors and civil servants, particularly in the Administration, meant that the fishermen's concerns were likely to be voiced at more senior levels. However, the politicians were not the only actors involved for this reason. The fishermen, for similar reasons, also drew researchers or expatriate residents living or working in the area into the process. These people tended to have privileged access to senior government officials and had the resources (vehicle) to provide access to government officials. These relations reflected the importance of opportunistic behaviour on the outcome of the issues.

The role of traditional institutions was not important in the outcome of the issues. The elders, for example, did not feature as important. The local fishermen were also relatively low powered despite being the main stakeholders and being involved in a high number of relations with other actors. One of the reasons for this was because of their lack of inherent power within the wider community. Thus, their high number of communications reflected their reliance on other actors to raise the profile of their concerns, and the weakness of traditional institutions. Significantly, the actors they relied upon were seldom within resource management organisations.

With respect to natural resource management and the processes by which people gain access to and control over natural resources in the study area, the results in this chapter have identified some key points. Different organisations had different roles.

The Government Administration had the most power in the area and was the main authority deciding the outcome of each issue. The natural resource management organisations, which included the Fisheries Department and the Kenya Wildlife Service, merely legitimised the actions taken by the Administration. The principal agitators were local politicians on behalf of the local fishermen. Few of the formative processes involved formal rules relating to natural resources. In fact natural resource related organisations and the associated institutions served to maintain a *status quo* and constrain the process of conflict resolution.

The final chapter relates the historical and current socio-environmental context of the people of Biga, described in the earlier chapters, to these findings. The implications of these results with respect to coastal resource management in areas that include small-scale fisheries of this type are also discussed.

9 GENERAL DISCUSSION

9.1 Scope of the study

The livelihoods of people dependent on locally available natural resources have been characterised as complex, diverse and risk-prone (Chambers, 1997). This risk-proneness is primarily due to a reliance on the natural environment (Dasgupta, 1982; Chambers, 1997). The complexity and diversity of livelihoods are strategies aimed to reduce risks (Tvedten and Hersoug, 1992; Chambers, 1997). Small-scale fisheries are an extreme example of this, where livelihoods are dependent on a diverse range of activities that exploit both marine and terrestrial resources. This diversity enables people to cope with seasonal variations in climate and adverse events by transferring effort from one environment to the other. Factors that reduce the portfolio of activities (or options) carried out by small-scale fishers and their families are likely to increase their risks. The effect of which is to reduce household food security and increase pressure on the local environment. Since small-scale fisheries support more than 140 million people world wide, and these are often livelihoods of last resort for some of the world's poorest people (Russ, 1991), the situation of reduced options must be widespread.

There are a number of reasons why people's livelihood options are constrained, but the principal causes relate to either an absolute lack of resources or the loss of people's command over resources (Sen, 1981). The loss of command over resources in areas where small-scale fisheries are prevalent, namely the developing world, has been linked to the superimposition of modern ideology over other approaches to human-environment relations (Bryant and Bailey, 1997; Robertson and Speier, 1998). Where in the past people had many solutions to cope with many different problems (Ostrom, 1990; Leach *et al.*, 1997), these have been undermined by the global market system and foreign structures of authority (Berry, 1989; Bryant and Bailey, 1997; Chambers, 1997; Boukhari, 1999).

This problem is widely recognised in the fields of third world development and natural resource management, particularly in the context of small-scale common property regimes (O'Riordan, 1994; Bryant and Bailey, 1997; Chambers, 1997;

Jentoft *et al.*, 1998; Johannes, 1998). The response to which has been to shift towards greater involvement of local people in solving environmental and socio-economic problems. It has also highlighted the important role of institutions in mitigating human-environment interactions, particularly those at local scale levels. The understanding is that institutions play a central role in ensuring people have command over resources, and threats to these institutions tend to threaten people's livelihoods. However, there are indications that overemphasising the importance of institutions has meant that other, less structured, processes have been neglected.

This study set out to investigate the role of institutions in determining local people's behaviour when tackling resource access and control problems. Many of the arguments set out in chapter 2 relate to factors that cause changes in the situations of local people. These include the influence of cultural attitudes towards human-environment relations and the overlaying of powerful regimes on local structures of authority.

Social and environmental changes were understood to influence the rules that guide (institutions) people's access to resources. Thus, in order to interpret people's actions in relation to resource access and control problems, it was necessary to examine the environmental and social context of a community. This examination involved a reconstruction of the community's historical relations with other groups in their area to explain their current predicament (chapters 3-6). Socio-economic analysis of people's livelihoods was carried out to determine the current situation of different groups within the studied community (chapter 7). People's actions in response to resource access and control problems were analysed using a network approach (chapter 8).

9.2 Explaining the community's current predicament

The community of Biga was found to be made up of different ethnic groups, 90% Digo, 7% upcountry migrant farmers and 3% migrant Wapemba fishers. Analysis of livelihoods found that most households were dependent on fishing, but the methods and capital equipment differed, further differentiating the community into subgroups (Table 7.1). All groups depended on a range of activities to provide food and income but the economic role of fish was dominant in the community. Even within fishing households, however, the value of production from land based activities was important for supplementing food and income (Table 7.14).

The diversity and complexity of the local environment had a direct influence on livelihoods. Seasonality influenced the production systems both on land and in the sea. Prior to and during the long rains in April and May was the busiest time on land and this coincided with poor fishing conditions and low catches (Figure 7.3). Thus, households were most food insecure from March – July while the catches were low and crops had yet to be harvested. Fishing conditions were also harder at this time due to strong winds and rain. Variations in marine and terrestrial habitats were also shown to determine the resources available for local people, with seagrass beds being the dominant habitat in the local fishery.

Changes in the local environments were shown to have led to a decrease in household productivity over the last five decades. Traditional systems of cultivation had been lost due to the changes in land tenure and land market (cf. Figure 3.7; chapter 4; part 5.3.1), and this was attributed to colonialism, international development approaches and cultural changes. The small isolated household plots now cultivated were more susceptible to damage from wild animals than the communal plots previously cultivated. Households depend more on income earning activities, such as fishing or planting fruit trees, to buy food, and this reduced the time, energy or space available for food cultivation. In addition, resources had become scarce due to increasingly reduced access to land. This again was attributed to the role of colonialism and modern concepts of individual property rights and tenure that had led to the development of tourism and private residences.

Despite the proximity of the tourist development, few households were able to find alternative sources of livelihood. This was attributed to the dominance of other tribal groups in tourism due to the historical process of development on the coast and the role of the state, which was predominantly controlled by people from upcountry. All the factors that limited livelihood options on land were shown to have led to increased effort in the sea. Similarly, the imposition of different approaches to the environment and the overlaying of a more powerful system of authority had undermined the role of traditional institutions. Factors such as the global market economy, cultural change and politics had all had an influence on the way people determined resource access and control. This ultimately has led to overfishing, which was shown by the fall in catch per unit effort and the ecological phase shift to urchin dominated communities in the lagoon.

Thus, the overall socio-economic situation of the community was revealed as poor. This was illustrated by the level of disposable income available to households when compared to the amount of income needed to maintain the household at a productive level (Figure 7.3). Most households were very close to the maintenance threshold. This meant that they could maintain their current level of production. However, with continued pressure on the fishery and the lack of alternative sources of income, the future productivity of households was considered insecure.

The high dependence on fishing and the increasing scarcity of the resource meant that local people were having to compete with many different groups for increasingly scarce resources. In some instances this led to conflict, such as with the Wapemba fishers. However, a major problem for the local community was their relative weakness compared to some of the other groups (Table 6.2, 6.3; Figure 6.2).

9.3 Problem solving actions in context

The social network analysis of the three issues, in which access to or control over community resources was threatened, sought to identify how the outcomes were achieved. The outcomes were known to favour the local fishing community, but in view of their poor socio-economic situation, low status and apathy of certain government departments it was not evident how this was achieved.

The social network analysis determined the importance of each actor in influencing the outcome of the issues. This was related to their roles and positions in the network structure. It also showed that the people who were 'suffering' from the resource access or control problems had to pursue many different paths to find a solution, and that this appeared to be due to problems associated with relying on institutions. However, the social network analysis could not be used to explain why each actor was involved in the networks or how power was acquired (see part 5.2.1).

Clearly institutional dynamics and local political manoeuvring played an important role in determining people's resource access and control. The actors involved in each issue were shown to have inherent characteristics stemming from the relationship between politics and the administrative state system. These attributes had an effect on their roles and influence in the networks. In addition, the institutional analysis in chapter 5 introduced the notion that organisations involved in such issues derived power in different ways, and this influenced their respective roles and effectiveness.

The general trend for the first two phases of each issue was that the fishers pursued processes directly linked to the issue at hand. This meant that those organisations with a statutory mandate to resolve the issue were involved, and were usually represented at the local or district level. Hence the importance of Kenya Wildlife Service and the Fisheries Department. The effect of depending on the institutions associated with these organisations was that none of the issues were resolved. This problem relates to the relative power of the organisations, based on their statutory authority, resources or political constituency and their role as guardians of the *status quo* (see Lamb, 1998). This was demonstrated by the dominance of formal

institutions represented at low levels in the early phases. Figure 8.5 illustrates this, showing the *status quo* loop preventing problem resolution.

However, the final phases of each issue reflected a break in the *status quo* through the involvement of different actors. The social network analysis revealed that in the final phase of each issue the important actors were not the same as in the earlier phases. By involving actors that did not have statutory authority to resolve the issues, the fishers acknowledged that the time-tried processes of established institutions were of no avail (see Figure 8.5). The social network analysis of the final phases of each issue also showed that higher levels of representation were needed to resolve the issues. Higher levels of the administration became important in the processes because of the lack of action on the part of the organisations with statutory authority to resolve the issues. The weakness of the Fisheries Department was because it lacked certain elements of power, such as financial and human resources. Similarly, the loss of constituency support for the Kenya Wildlife Service reduced their influence. The network analysis also showed that the involvement of political actors or actors with privileged access to higher authorities were key for the fishers to break the *status quo*.

The power of the administration and importance of the political actors was generally derived from constituency support rather than statutory authority or legal mandates with respect to the issues. The exception occurred when the threats of violence between the Wapemba and the local Digo fishers gave the administration statutory reason to become involved. However, the results did not suggest that an issue needed to be politicised in order for the *status quo* to change, the political actors were seldom very important in the networks. Their roles however were related to the course of action pursued by the local fishermen and the alternative links they created.

The role of traditional institutions was not important in the outcome of the issues. The elders, for example, did not feature as important. The local fishermen were also relatively low powered despite being the main stakeholders and being involved in a high number of relations with other actors. One of the reasons for this was because of their lack of inherent power within the wider community. Thus, their high number of communications reflected their reliance on other actors to raise the profile of their concerns. It also illustrated the weakness of traditional institutions to provide

solutions to their problems. However, their ability to organise themselves in order to present a coherent argument to so many different actors in the networks must be considered an element of power.

9.4 Alternative processes influencing local action

It was evident from the social network analysis that institutions can stifle the process of problem resolution. If there is a tendency for organisations to use institutions to maintain a *status quo* and prevent problem solving, then the environmental entitlements analysis of, for example access to the fishery (see section 5.4), would look different (Figure 9.1). The *status quo* loop, made up of locally represented institutions, can be seen to prevent or reduce the feedback between people's resource claims and practices and the processes that supposedly determine them (see Figure 9.1). In time, this lack of feedback would mean that the institutions would cease to be relevant to the situation of the people depending on the local resources.

The fact that people dependent on local resources are able to pursue different courses of action, as shown in the social network analysis, suggests that institutions are not solely responsible for determining people's resource claims and practices. When faced with a *status quo* situation, local fishers were able to use alternative processes to force a decision (see Figure 8.5). This means that feedback between institutions and people's actual practices can occur through these alternative processes, such as through different people or organisations (see Figure 9.2). It may be through these processes that institutions can adapt or change to cater for people's needs.

Figure 9.1 The stifling effect of institutions due to the 'status quo loop'.

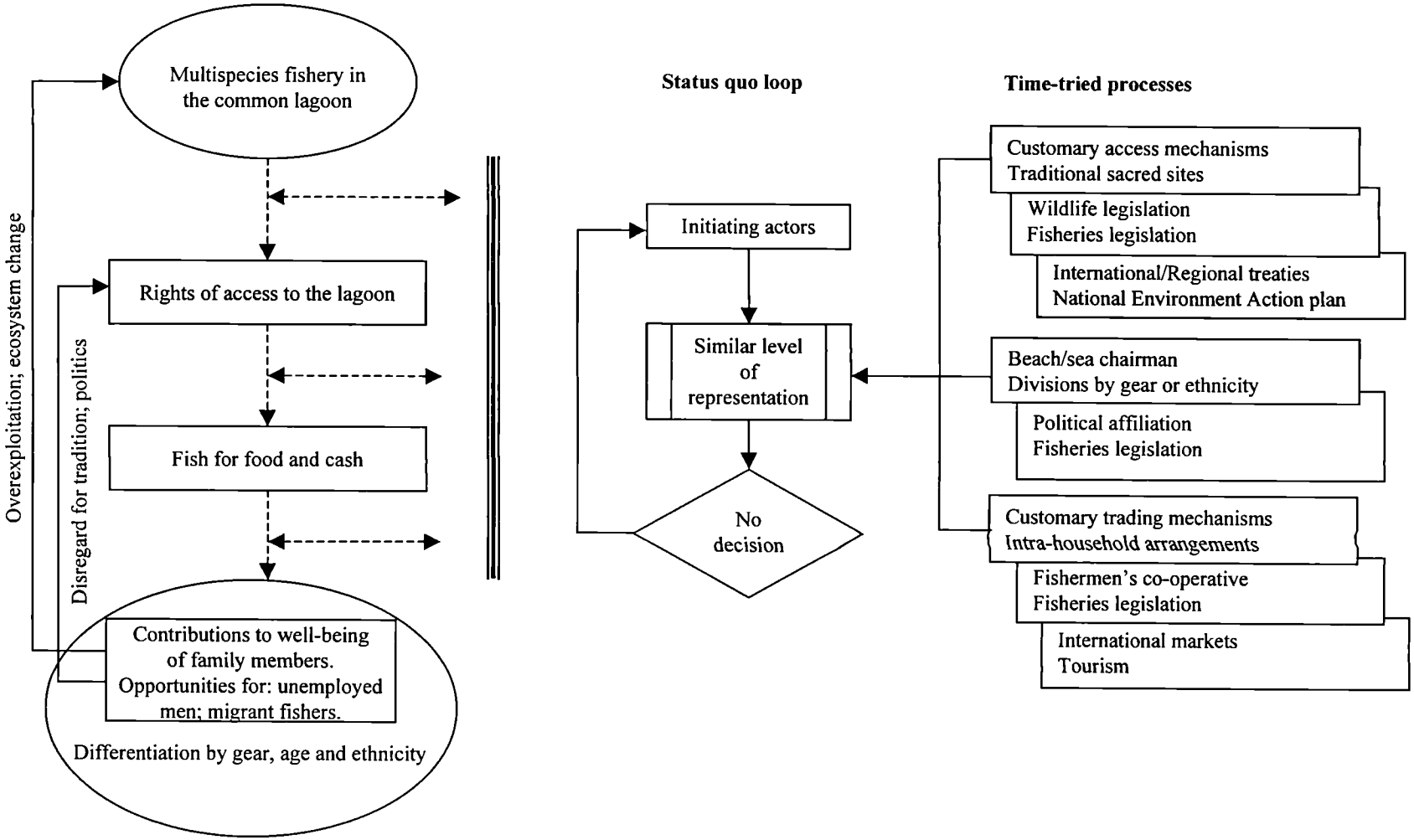
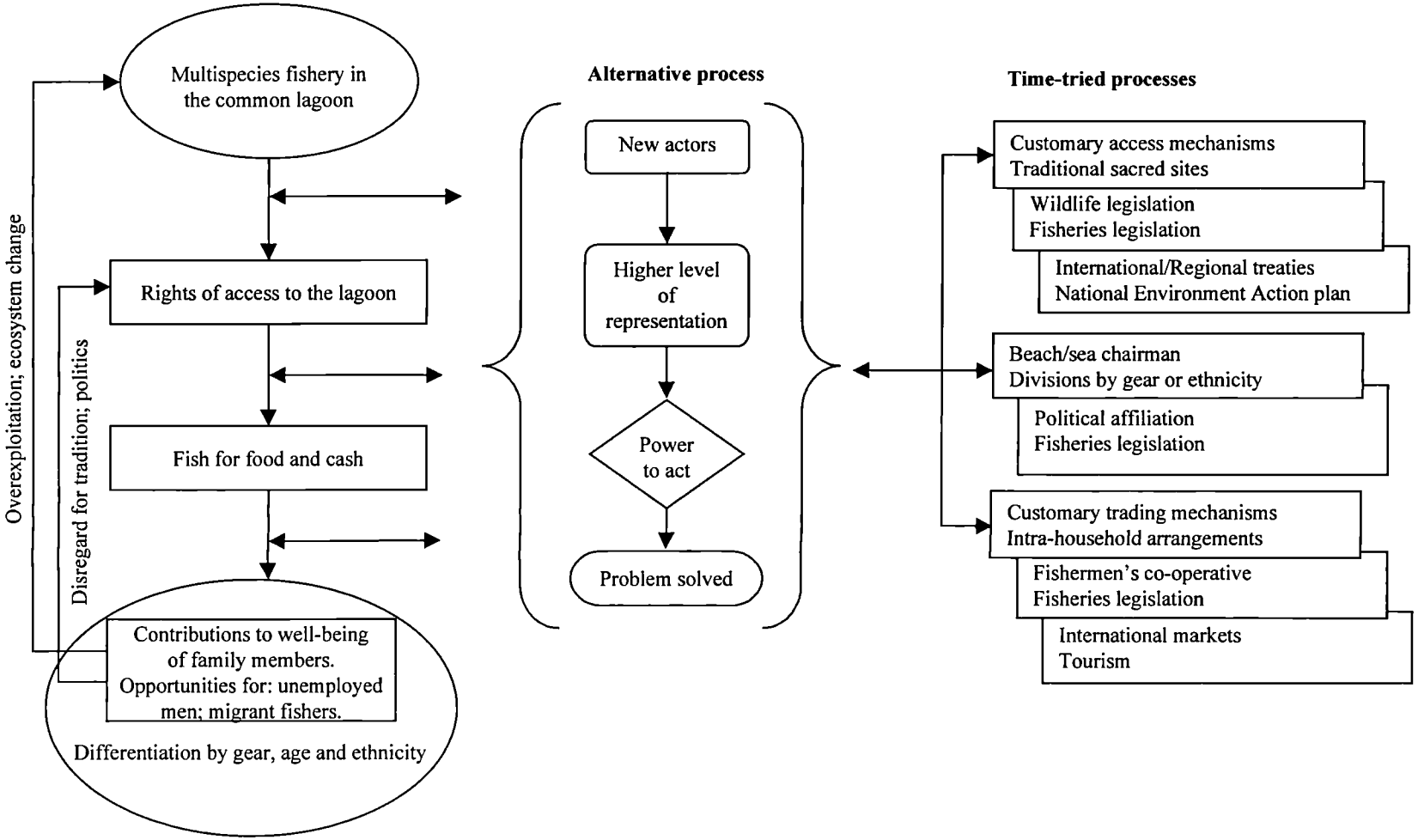


Figure 9.2 The role of alternative processes in facilitating feedback between people's practices and the institutions that supposedly determine them.



Importantly for people dependent on local resources, it demonstrates that they can find solutions to seemingly intractable problems.

9.5 Adequacy of research methods

The final section makes some generalisations based on the results of this study. It is recognised, however, that there are limits to what can be extrapolated from a single case study based on local and specific conditions. The perception in this study, that a detailed understanding of people's past and present social and environmental situations was needed to interpret their behaviour, constrained the possibility of conducting parallel case studies. Nevertheless, the approach could be applied in any setting and time saved if prior knowledge of people's past and current status existed.

In chapter 2 it was shown that scientific theory cannot be separated from its cultural roots. The experience, economic policies and political interests of governments and groups dominated by Western values has perpetuated received wisdom about human-environment relations through much of the world. Examples of inappropriate resource management approaches and loss of traditional systems of management illustrate the weaknesses of this situation. The approach taken in this study was to integrate social and natural sciences in an attempt to understand and explain people's social and natural situation and people's behaviour. The use of participatory research methods explicitly aimed to avoid cultural prejudice on the part of the researcher. Such approaches are increasingly used in fields such as development and conservation and have been generalised to both the developed and the developing world.

The validity of the social network approach relates to how closely the networks reflected reality. The networks were models of people's communication relations in relation to specific issues. The question of accuracy and validity of data in reflecting the "true" structure of the network is discussed by Wasserman and Faust (1994: 56-59). Research on informant accuracy suggests that people are not very good at reporting on each individual interaction in particular situations, but the relatively prolonged and stable patterns of interactions are well reported. The concern in this study were the long term patterns of the network, which were well reported and validated by cross checking with the different sources of information. In situations

where an individual was interviewed or identified as a representative of an organisation, care was taken to ensure that the individual was salient to the issue.

The use of semi-structured interviews and unstructured techniques to construct the social networks ensured that people's responses could be validated through cross checking. Similarly for the household surveys, the semi-structured interviews provided more coherent detail needed for a wide understanding of people's situations than rigid questionnaire surveys could have.

A different problem relating to the validity of the social network analysis was the inclusion of actor attributes to weight the value of ties between actors. This arose because the initial analysis of the networks, without any weighting, did not reflect the outcome of the issues. This was easily explained by the fact that the socio-political environment in Kenya is strongly influenced by established hierarchies. These hierarchies were identified as the administrative structure of government and the political hierarchy. Each hierarchy was considered separately, but again the results failed to reflect the outcome of the issues. Finally, the combination of the two hierarchies was used, as set out and justified in part 8.2.2.1. However, without the comprehensive understanding of the local socio-political context developed in the preceding chapters, it would have been difficult to identify which attributes influenced the accumulation of power across the range of actors in the networks.

The approach taken in this study, to understand the behaviour of local people and the relationships between groups and individuals, can be generalised to any setting. This makes it an appropriate method for application by resource managers or developers. In addition, the different methods also stand up independently. For example, participatory approaches to conducting socio-economic assessments are widespread. Social network analysis can be used independently to identify potential problems and solutions in resource management or development strategies. The range of people, groups and organisations important to the management or development process, not just at the community level, can be identified according to their roles and importance. This would also help to determine where funding effort and other forms of support should go.

9.6 Conclusion

The identification of a *'status quo* loop' and the need for local actors to find alternative processes to solve resource access and control problems, supports the hypothesis presented in chapter 1. The institutions that were in place did not help solve the three resource access and control problems in the studied community. It was found that in all cases institutions contributed to the problems of local people.

A principal weakness in depending on institutions to solve people's problems was that the rules that guided people's behaviour did not keep pace with changes on the ground. This was attributed to the lack of feedback between people's activities and guiding institutions, due to the role of government organisations (part 5.2.1), their bureaucratic nature, prejudicial tendency from being in a position of power (part 2.4.2) and the low level representation at the local level. This problem also had implications for people's livelihoods since institutions should theoretically reduce risk. The results suggested that without feedback between people's everyday practices and the guiding institutions, livelihood complexity and diversity was reduced because people's ability to adapt was constrained (see Figure 9.1).

It is questionable, therefore, to assume that all actions are legitimised or authorised by institutions, as suggested by the literature relating to human-environment relations (Gibbs and Bromely, 1989; Watson, 1989; Ostrom, 1990; Thomas-Slayter, 1994; Mearns, 1995; Leach *et al*, 1997; Pido *et al*, 1997; Pinkerton, 1997; Forsyth *et al*, 1998; Jentoft *et al*, 1998). The communication networks showed that it was possible to express multiple interests where no institutional arrangements existed, and that conflict resolution was possible through the communication networks (see Ortegon, 1998 for similar findings). Clearly, Orstom's (1990) observation that people have many solutions to cope with many different problems runs true, but it extends beyond relying on multiple levels and types of institution.

Similarly, institutions cannot be considered to have the monopoly over guiding people's behaviour in pursuit of collective goals. Both the exclusion problem and the subtractability problem (Berkes and Folke, 1997) were tackled in the communication

networks in the study. This suggests that institutions may not always cater for the different goals individuals have in common property resource situations.

9.6.1 Implications for resource management

The findings in this study illustrate the applicability of integrating both social science and natural science methodologies when considering human-environment interactions. The need to understand people's socio-economic predicament prior to developing resource management strategies is now widely accepted, underlining the need to include a wide range of methods when tackling problems relating to the use of natural resources. The use of participatory research methods can help resource managers appreciate cultural biases and to challenge received wisdom in relation to how people interact with other people and their natural environment.

The social network analysis highlighted the importance of understanding people's relationships surrounding resource allocation and use. Resource managers could make use of such an approach because key people, groups or organisations can be identified and their roles understood. In addition, the notion that distinct phases can be identified in the evolution of resource management type problems is of use. Different actors at different levels are important at different phases of resource related problems. Clearly, resource managers need to understand this and to ensure that management strategies can adapt to such changes.

The analysis of the historical context of the local people's socio-economic situation illustrated the role of external influences on local people and their behaviour. Regulations and legislation that seek to influence how resources are allocated and used must reflect the spectrum of processes that exist. International trade treaties, for example, can conflict with national environmental policies, and national policies can conflict with traditional institutions. Similarly, the regulatory ladder must also reflect the processes by which natural resource governance take place, from the identification of problems, the balancing of needs and capacities, to the mode of governance (McGlade, 2000).

This study also suggests that efforts to create a socio-political environment in which solutions to problems can be found through a variety of processes, rather than depending on institutions to solve problems, may improve resource management. This is principally because many problems arise before there are rules to deal with them. Management on the other hand often tries to fit problems into predetermined rules. Not only must the rules be responsive to the problems – adaptive management, but the socio-political environment must also facilitate problem solving.

This tackles at least two of the problem areas in resource management: that rules don't respond to change and the socio-political environment actually prevents problem solving (such as the blocking effect of the *status quo* loop). Understanding the social relations associated with specific resource access or control issues could well help to facilitate the problem solving process.

In the context of more recent approaches to resource management, the benefits of involving local people may stem as much from facilitating problem solving, than from the bag of institutions they bring with them. Resource management strategies in common property situations should aim to manage for complexity and diversity. This could be achieved by focusing on those institutions that promote or permit complex, diverse and locally fitting behaviour (see Chambers, 1997 on managing for complexity and diversity).

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PERSONAL COMMUNICATIONS

Mwadzoyo, Bakari	Chairman of Mwaepe fish landing site
Chicho, Omari	Chairman, Galu Fishermen's Committee
Etian, Paul	Senior Fisheries Officer, Kwale District
Everett, Prof. M.	School of Computing and Applied Mathematics, University of Greenwhich, London
Galu Fishermen's Committee (See Appendix III)	
Kaka, Ali	At the time of the fieldwork: KWS Senior Warden, Coast Region. Currently Assistant Director, KWS
Maina	District Surveyor, Kwale District
Mwabata, Ali	Local Council Candidate, Mwabungu
Mwamzandi, Kassim	Former (> 30 yrs) Member of Parliament for Msambweni constituency (includes the study site)
Mwandoto, B.A.	Coast Development Authority
Mwangare, Suleiman	Fisheries Officer, Diani substation
Mwarupia, Mr	Chief – Kinondo Location
Ngoloma, Mr	Senior Fisheries Officer, Kwale District
Obura, Dr David	Regional Coordinator, CORDIO
Oduol, Charles	Assistant Director for Fisheries, Coast Province
Rocca, Paolo	Sea Harvest (K) Ltd, Seafood Exporters, P O Box 2175, Mombasa

Appendix I Substrate survey results of the Biga lagoon. (Source: this study with Dr David Obura.)

Site	Repl.	Head.	Depth		Time	Substrate/Framework			% Cover					Comments
			min	max		Primary	Secondary	Tertiary	Coral	Mac algae	Algal turf	Sand	Sea grass	
1	1	NW	2.5	2.5	13:35	rubble	rock eroded	sand	5	5	70	20		
1	2	SE	2.5	2.5	"	rock	rubble	sand	5	5	65	20	5	
1	3	E	2.5	2.5	"	sand		rock			5	80	15	
1	4	SW	2	2.5	"	rock	sand	rubble	2	2	60	30		
2	1	NW	2.5	2.5	13:40	rock	sand		10	10	40	20	20	
2	2	SE	2.5	3	"	sand	rock eroded		10	10	10	50	20	
2	3	E	2.5	2.5	"	sand						50	50	
2	4	SW	2.5	3	"	sand	rock eroded		5	10	35		50	
3	1	NW	3	3	13:45	sand						70	30	*Thalassia,*
3	2	NE	2	2	"	sand							100	
3	3	SW	1.5	1.5	"	sand	rubble					30	70	
3	4	SE	1.5	1.5	"	sand	rubble				5	5	90	
4	1	NW	4	4	13:55	sand						10	90	*Thalassondendron,*
4	2	NE	3	4	"	sand						25	75	
4	3	S	3	4	"	sand						10	90	
5	1	NW	2.5	2.5	14:00	sand							100	*Thalassodendron*
5	2	NE	2.5	2.5	"	sand						5	95	*Mixed*
5	3	SW	1.5	2	"	sand						20	80	
5	4	SE	1.5	1.5	"	sand						5	95	
6	1	NW	1.5	1.5	14.10	sand	rubble				10	10	80	*Thalassia, Syringodium*
6	2	NE	1.5	1.5	"	sand	rubble				5	5	90	
6	3	SW	1.5	2	"	sand	rubble				5	30	65	
6	4	SE	1.5	2	"	sand	rubble				10	10	80	
7	1	NW	4	4	14:20	sand	rock		10		10		80	
7	2	NE	4	4	"	sand							100	*Thalassodendron*
7	3	S	4	4	"	sand							100	
7	4	E	4	4	"	sand							100	
8	1	NW	2	2	14:30	sand					10	15	75	*Thalassodendron*
8	2	NE	2.5	2.5	"	sand						70	30	*Thalassia, Halodule,*
8	3	S	1.5	1.5	"	sand					50		50	
8	4	E	1.5	1.5	"	sand					50		50	

9	1	NW	2	2.5	14:50	rock	rubble	sand	10	10	60	20		
9	2	NE	1.5	2	"	rock	rubble	sand	10	20	60	10		
9	3	E	2	2	"	rock	rubble	sand	5	15	50	30		
Site	**Repl.**	**Head.**	**Depth**		**Time**	**Substrate/Framework**			**% Cover**					**Comments**
			min	**max**		**Primary**	**Secondary**	**Tertiary**	**Coral**	**Mac algae**	**Algal turf**	**Sand**	**Sea grass**	
9	4	S	2	2	"	rock	rubble	sand	20	5	20	55		
10	1	NW	2.5	2.5	15:00	sand	rubble	rock eroded	5		35		60	*Mixed*
10	2	NE	1.5	2.5	"	sand	rubble	rock eroded	5	5	60	10	20	
10	3	E	1.5	3	"	sand	rubble	rock	5	5	60	30		
10	4	S	3	3	"	sand	rubble		5		40	35	20	
11	1	NW	2.5	2.5	15:10	sand							100	*Thalassia, Syringodium*
11	2	NE	3	3	"	sand						80	20	
11	3	E	3	4	"	sand						100		
11	4	S	3	3	"	sand	rock				5	25	70	
12	1	NW	2	2	15:20	sand							100	*Thalassodendron*
12	2	NE	2	2	"	sand						5	95	*Thalassodendron,*
12	3	E	1.5	1.5	"	sand							100	
12	4	S	1.5	1.5	"	sand							100	
13	1	NW	2	2	15:30	sand						10	90	*Thalassodendron,*
13	2	NE	2	2	"	sand	rock eroded				5	5	90	*Thalassodendron, mixed*
13	3	E	1.5	1.5	"	sand	rock		5				95	
13	4	S	1.5	1.5	"	sand	rubble	rock	5		20		75	
14	1	NW	1.5	3.5	15:40	rock eroded	rubble	sand	15	5	40		40	
14	2	NE	2	3.5	"	rock	sand		5	10	15	10	60	
14	3	E	2	5	"	sand	rock		25		5		70	
14	4	S	3	3	"	sand	rock		10			20	70	

Appendix II List of species (common and Swahili names) on which catch data should be collected by Fisheries Department personnel.

Demersal

Rabbit fish	*Tafi*
Scavenger	*Changu*
Snapper	*Tembo*
Parrot fish	*Pono*
Surgeon fish	*Kangaja*
Unicorn fish	*Puju*
Grunter	*Pamamba*
Pouter	*Chaa*
Black skin (spot)	*Fute*
Goat fish	*Mukundaji*
Streaker	*Pali*
Rock cod	*Tewa*
Cat fish	*Fume*
Mixed demersal	

Pelagic

Cavala Jacks	*Kole kole*
Mullets	*Mkizi*
Little Mackerel	*Kiboma*
Baracouda	*Tengesi*
Milkfish	*Mwatiko*
Kingfish	*Nguru*
Queenfish	*Pandu*
Sailfish	*Sulisuli*
Bonito, Skipjack Tuna	*Kiboma*
Dorado	*Filusi*
Mixed pelagic	

Sharks/Rays	*Papa*
Sardines	*Simu*

Mixed fish/others

Crustacea

Lobster	*Kamba mawe*
Prawns	*Kamba ndogo*
Crabs	*Kaa*

Miscellenious	
Game fish	
Oysters	*Shaza*
Oyster shell/grint	*Koa*
Sea cucumber	*Jongoo*
Squid	*Ngisi*
Octopus	*Pweza*
Shells	*Madondo*

Appendix III Illustration of informal organisation with Biga community - the fishermen's interest group

Dear Sir 22nd June 1996

REQUEST FOR SUPPORT FROM GOVERNMENT AUTHORITIES

The Galu Fishermen's Committee is asking for support from a number of Government authorities to ensure that the livelihoods of the indigenous fishing communities are safeguarded. The livelihoods of the fishing communities are currently under serious threat.

The Galu Fishermen's Committee was created on Sunday 28th of April 1996 under the supervision of the Area Chief of Kinondo location and with the assistance of the KANU Secretary of the location. The following are the committee members:

MWANYZA:

1. Omari B. CHICHO - Chairman
2. Hassan J. MWALIPHUNZO - Assistant Chairman
3. Ayyub R. MWAVYAUSA - Committee Member
4. Ali Khalfan MWAHAGA - Committee Member

MVURENI:

5. Rashid Masoud MWABANDA - Committee Member
6. Saïd Omar MWATUNDE - Committee Member
7. Mohamed Ali TINGA - Committee Member
8. Hassan MWINYI - Committee Member

MWAEPE:

9. Ismail FAKI - Committee Member
10. Isaack S. MWACHALA - Secretary
11. Bakari H. MWIYAKA - Committee Member
12. Omari SIMBA - Committee Member
13. Mfaki SULEIMAN - Committee Member
14. Hatib S. HAMAD - Committee Member

On Tuesday the 18th of June the Committee met to discuss an on going problem which is having a detrimental effect on the lives of the fishermen and their families. The problem is the lack of fish in the Galu - Kinondo area. The reason for the lack of fish is the use of seine nets with very small meshes. In addition to the problem of very fine meshes, the Committee considers the way in which the nets are used, by dragging over the seabed, also has a detrimental impact on the marine environment (NYAVU YA KUVUTA).

Thus, there are two factors which have dramatically reduced the number of fish in the area:

i) Small meshed nets catch juvenile fish of all species, these fish are killed and therefore do not reach maturity to reproduce and therefore there are no fish for the future. Many of the fish that are caught are too small to eat and are thrown away dead, other species are no good for food and are also thrown away dead.

ii) The system of dragging the nets is also considered to be very damaging. By dragging the nets many important habitats for young fish and eggs are destroyed or disturbed. The particularly important habitats are the corals and the seagrass areas. This method of fishing also damages the fish traps belonging to other fishermen because the traps are turned over or broken as the net passes.

The Committee understands that under the law of the country, as stated in the Fisheries Act (chapter 378 - Laws of Kenya), it is illegal to use any seine net with a stretched mesh size of less than 50mm. The nets currently being used in the Galu area are much less than 50mm.

In order to stop this destruction of the sea the Committee and the fishermen of Galu have made the following decisions if the destructive fishing continues:

i) The fishing equipment and boats should be taken out of work.
ii) The fishermen should be suspended from fishing for a period of three months.
iii) If these are groups, then their Captains will be handed over to the police.
iii) Further steps to be taken under Government supervision.

The Galu Fishermen's Committee needs the full support of the law and the maximum assistance from the under mentioned officers.

cc D.C. - Kwale District; O.C.P.D. - Kwale; D.F.O. - Shimoni; D.O. - Msambweni; Fisheries Officer - Msambweni; Chief - Kinondo location; Ass. Chief - Kinondo & Gazi sub-location; O.C.S. - Diani Police; O.C.S. - Msambweni Police; Hon. K.B. Mwamzandi (area M.P.); Councillor Kinondo Location - H.M. Mwabwagizo.

Appendix IV Questions used as the basis for household surveys (Source: Malleret-King, 1996; this study)

Family and dependants:

How many people eat in this house?
How many people depend on you?
How many wives do you have, and children?
Does your family originate from Biga?
Was your father a fisherman?

Land:

Is this your land? Is this Madvani (Kenya Sugar Estate) land? Do you have a title deed, in whose name?
How long has your home been here? Were your parents and grandparents at this site/plot?
How many acres of land is the plot?
How many families live on this plot?

Work:

Who works in the fields (shamba)?
When you settled here who worked in the shamba?
Have you employed temporary workers to help this year? And other years?
Describe the different tasks in the shamba for each month of the year and the tools or implements required.

Agricultural production:

Do you sell any produce from your shamba? Which products?
How much do you earn from the sales each season/month?
Do you sell the same products every year?
If there are variations, why?
How many times do you cultivate on the same piece of land? After harvesting the maize, do you plant other things?
How long do you leave land fallow?
How many kilos of maize seeds do you plant each season?
Do you use chemicals on your crops? Do you use fertilizer/manure/compost?
How long does your produce last (maize, beans, pigeon peas, sesame, millet etc.)? How many times a week do you eat your own produce? Do you have any of last years produce remaining?
Are there particular work problems, (such as lack of labour)? During which period?
What are your main problems?

Fisheries production:

Do you fish every day? All year?
Which method of fishing do you use? Do you change method according to season?
Do you have a dugout canoe (dau)? How old is the dau? How much did you pay for it?
How long do you expect the dau to last?

How many traps do you set? According to season?
How much did your spear gun (bunduki) cost? How long does it last?
During the low/bad season (kuzi – SE monsoon) how much money do you bring home on average (daily)? How many/much fish do you bring home? Do you bring home fish every day? Is it sufficient (for food or income)?
And during the high/good season (kaskazi, shwari)

What are the main problems?
Over the last thirty years, what changes have you seen in what you bring home?
Do you encourage your children to become fishers?

Socio-economic situation:

What is your situation (general economic, activity,....) now? What was your situation when you were twenty?
When you don't have enough to eat what do you do?
When you are ill what do you do?
Do you have financial savings (e.g. post office account)?
Do you borrow money? If so, from whom? What do you do spend borrowed money on?
Did you choose your occupation? Would you rather do something else?
Have you been to school?
How do you see the future of Biga?
According to you what is the main thing you wish changed?

Appendix V Group interview - Questions posed to the Galu fishermen's committee, 8 members were present, and responses. (26/6/96) (Source: Rubens, 1996; this study)

1. **How many fishermen are there at each of the landing points, by fishing method?**

	Mwaepe	Mwanyaza	Mvureni
Lema	10	16	15
Bunduki	25-30	40-45	20-30
Jarife/kutega	6	5	8
Mshipi	8	13	14

2. **How many days per month do you fish?** On average 25 days in the good season, 2 days per month rest days. During the low season days lost due to bad weather, illness, and some people don't fish but concentrate on the crops (Hassan Juma Mwaliphunzo), some fishermen don't fish on fridays, but most of the Digos do.

3. **Are there many more fishermen today than in the past, 30 years ago.** Three to Four times as many.

4. **Have catches changed over the last 20-30 years.** (Effort) 20-30 years ago used to only have three traps and get 100 fish per trap, and would catch fish having reset the the trap and gone back to it a few hours later. Now have 9-11 traps, leave them out all night and get very few fish. (Method/bait) Wouldn't catch anything if you didn't use urchins as bait. In the past would only used seaweed because you would get too many fish if urchins were used, would fill 4 big baskets with uchins. (Effort) In the past didn't fish every day, sometimes only every three days, because there was enough fish.

5. **Has the sea and the lagoon changed.** Yes, at mwanyaza tbe sea used to be deep, used to have to paddle the canoes, now can pole everywhere and even walk to the reef. The sea has also receded 50m.

6. **Has the area of seagrass changed.** It has reduced because of the pull nets (beach seines), and because areas are exposed at low tide.

7. **Has the beach changed.** The sand at Mwaepe comes and goes with the season, during the kuzi there is no sand, in the kaskazi the sand comes back.

8. **When were the Wapemba baned from fishing at mvureni.** They were asked to stop fishing/landing at mvureni, they moved to mwaepe in 1980, now they won't go, they are giving money to the leaders, to the chairman, some bribe the police...

9. **Do the other areas want the wapemba to leave (chale, kinondo, mgwani).** At kinondo pull seine nets are used by the digo, they have joined the pembas and don't care about the desruction.

10. **The wapemba were chased away from Golden,will they come back?**
The local leaders there were not bribed, so the local fishermen could stop the beach seine crews.

11. **How does their system of sharing/ownership work.** One man owns the net, he owns the boats and nets, every day the catch is divided into three: shares for the boat and gear; the crew; and the bribe fund. The younger crew periodically go back to Pemba with money for families. This system of fishing is banned in Tanzania.

12. **Does the DC care about this situation.** Unless the problem is explained to him, he won't know what is going on. There is no-one here with the authority to go and explain.

- Bunduki is hard work, so no energy to work in the shambas as well.
- Bunduki get good fish, but hard work and a short life, gill nets good but the fish can go bad, traps best they think.
- none of the members of their families sell curios, very few have work in hotels, and then only as shamba boys
- if it was available they would like their children to work in hotels, but if there were no Wapemba and the se was as it used to be, then there would be no need to work in the hotels.

Appendix VI Disclaimer to reassure the fishermen's committee

LETTER OF INTRODUCTION

19/6/96

At the request of the Biga Fishermen's Committee we would like to outline the purpose and subjects of our studies:

Anthony King - To study the artisanal fisheries in Kenya, starting in Diani and Galu/Kinondo, with particular interest in the traditional and indigenous methods of resource use and resource management and the effect of tourism on the fisheries. This work is for a PhD at the University of Warwick in England.

Delphine King - To study the production systems of the fishing communities in Kenya, to understand the division of time and labour between fishing and agriculture and to understand the costs and benefits of this division. This work is for a PhD at the University of Warwick in England.

Jason Rubens - To study the economics and ecology of coral reef fisheries in Kenya. This work is for a Masters of Science at the University of Newcastle in England.

All our work is purely for our academic studies at our universities in England. It has no link to any KWS project or any other project. We would hope that the results of our studies would identify the problems fishermen face and suggest some solutions to these problems.

Anthony King Delphine King Jason Rubens

Appendix VII Hierarchy scores applied to all the actors in all the networks for the valued graphs.

Basic administration hierarchy **(AdHi)** includes organisations such as formal committees, it reflects an individual's position in the hierarchy.
Political hierarchy **(PoHi)** includes the politicians and the administration, and any overtly politicised bodies or people.
Note that an actor in the network, ie. has a tie, starts with 1. So if the Att. Gen has a tie it is 7 *(+ 1)* = *8* as shown in italics. The Combined hierarchy **(ComHi)** includes the + 1.

Actor	Code	AdHi	*(+1)*	PoHi	*(+1)*	ComHi
Assistant Director Fisheries	ADF	6	*7*	0	*1*	7
Attorney General	Att. Gen.	7	*8*	5	*6*	13
Coast Development Authority	CDA	6	*7*	0	*1*	7
Chief		3	*4*	1	*2*	5
Construction Company	Constr. Co.	0	*1*	0	*1*	1
Councillors		2	*3*	2	*3*	5
District Commissioner	DC	5	*6*	3	*4*	9
District Development Council	DDC	5	*6*	0	*1*	6
District Development Officer	DDO	5	*6*	0	*1*	6
District Environment Committee	DEC	5	*6*	0	*1*	6
District Executive Council	DEC	5	*6*	0	*1*	6
Diani Fishermen's Coop. Soc.	DFCS	0	*1*	0	*1*	1
Digo Fishers		0	*1*	0	*1*	1
District Accountant	Dis. Acc.	5	*6*	0	*1*	6
District Cooperative Officer	Dis. Coop.	5	*6*	0	*1*	6
District Land Officer	Dis. Land.	5	*6*	0	*1*	6
District Works Officer	Dis. Wks.	5	*6*	0	*1*	6
District Surveyor	Dis. Surv.	5	*6*	0	*1*	6
District Officer	DO	4	*5*	2	*3*	7
Elders		0	*1*	0	*1*	1
Expatriate residents	Expats.	0	*1*	0	*1*	1
Fisheries Officer	FO	3	*4*	0	*1*	4
Hoteliers		0	*1*	0	*1*	1
Independent Fishers &Traders	Inde. Fishers/Traders	0	*1*	0	*1*	1
KANU reps.		0	*1*	2	*3*	3
Kwale County Council	KCC	5	*6*	2	*3*	8
Kenya Power & Lighting	KP&L	5	*6*	0	*1*	6
Kenya Wildlife Service (district)	KWS dis.	5	*6*	0	*1*	6

Kenya Wildlife Service (provincial)	KWS prov	6	7	0	1	7
Kenya Wildlife Service (state)	KWS state	7	8	0	1	8
Ministry of Land	MoLand state	7	8	5	6	13
Ministry of Public Works	MoPW state	7	8	0	1	8
Ministry of Regional Development	MoRegDev state	7	8	0	1	8
Member of Parliament	MP Matug	5	6	3	4	9
Member of Parliament	MP Msam	5	6	3	4	9
Police (distict)	OCPD dis	5	6	0	1	6
Police (location)	OCS	3	4	0	1	4
Provincial Commissioner	PC	6	7	4	5	11
Private Developer	Priv. Deve.	0	1	0	1	1
Private Investor	Priv. Inves.	0	1	0	1	1
Provincial State Council	PSC	6	7	0	1	7
Senior Fisheries Officer	SFO	5	6	0	1	6
Sub Chief		2	3	0	1	3
Tanzanian Consul	TZ Consul	0	1	4	5	5
Village Chairman	Vill. Chairman	1	2	0	1	2
Wapemba		0	1	0	1	1

Appendix VIII Actor codes to reflect institutional levels and types in the networks

Scale level	Code	Sub-type	Code	Type	Code
Local	1	Administrative	1	Formal	1
District	2	Political	2	Informal	2
Provincial	3	Natural resource management/exploitation	3		
National	4	Non natural resource management/exploitation	4		

Actor	Scale level	Sub-type	Type
ADF	3	3	1
AttnGenOf	4	4	1
BigaFishers	1	3	2
CDA	3	4	1
Chief	1	1	1
Councillors	1	2	1
DC	2	1	1
DDC	2	4	1
DDO	2	4	1
DFCS	1	3	1
DisCoopOf	2	4	1
DisEnvCom	2	3	1
DisExecCoun	2	4	1
DisLandOf	2	4	1
DO	1	1	1
Elders	1	1	2
Expats	1	3	2
FO	1	3	1
KANUreps	1	2	1
KCC	2	2	1
KWSdis	2	3	1
KWSprov	3	3	1
KWSstate	4	3	1
MinLand	4	4	1
MP	2	2	1
MPMatuga	2	2	1
MPMsambweni	2	2	1
OCPD	2	4	1
OCS	1	4	1
PC	3	1	1
PrivDev	1	4	2
PSC	3	2	1
SFO	2	3	1
SubChief	1	1	1
TanzConsul	4	4	1
VillChair	1	1	1
Wapemba	1	3	2

Appendix IX Values of actor importance according to Eigenvector Centrality (C_E), used to identify which model (hierarchy scores) to adopt for the social network analysis of all the phases of the three issues. Actor hierarchy scores are presented in Appendix VII.

Marine Reserve							
Binary (C_E)		**Administrative (C_E)**		**Political (C_E)**		**Combined (C_E)**	
KWSprov	0.350	KWSprov	0.427	DC	0.445	DC	0.416
DC	0.330	DC	0.358	Councillors	0.352	KWSprov	0.367
DO	0.305	SFO	0.293	DO	0.324	DO	0.300
BigaFishers	0.305	DO	0.287	KANUreps	0.322	BigaFishers	0.282
Councillors	0.302	BigaFishers	0.279	Chief	0.278	Councillors	0.280
Chief	0.285	CDA	0.267	BigaFishers	0.269	SFO	0.269
KANUreps	0.285	KWSdis	0.262	KWSprov	0.261	FO	0.257
SFO	0.285	Chief	0.256	FO	0.259	Chief	0.255
KWSdis	0.280	Councillors	0.250	SFO	0.242	KWSdis	0.253
FO	0.266	FO	0.248	KWSdis	0.235	MPmsambweni	0.225
CDA	0.212	MPmsambweni	0.197	MPmsambweni	0.222	PC	0.218
MPmsambweni	0.173	KANUreps	0.181	PC	0.107	CDA	0.216
DFCS	0.091	KCC	0.128	CDA	0.072	KANUreps	0.212
KCC	0.086	PC	0.119	KCC	0.067	KCC	0.115
PC	0.081	DFCS	0.096	DFCS	0.023	DFCS	0.067
KWSstate	0.037	KWSstate	0.056	KWSstate	0.010	KWSstate	0.039
Wapemba Beach Seine							
Binary		**Administrative**		**Political**		**Combined**	
BigaFishers	0.393	DO	0.450	SFO	0274	DO	0.472
DO	0.369	SFO	0.422	DO	0.493	DC	0.403
Wapemba	0.338	DC	0.365	DC	0.381	SFO	0.380
DC	0.327	FO	0.309	MP	0.296	MP	0.335
FO	0.321	MP	0.299	KANUreps	0.291	FO	0.257
Chief	0.270	BigaFishers	0.274	PC	0.279	PC	0.245
SFO	0.263	ADF	0.234	BigaFishers	0.269	BigaFishers	0.234
KANUreps	0.243	Chief	0.209	Chief	0.241	ADF	0.233
MP	0.203	PC	0.194	FO	0.224	Chief	0.198
OCS	0.184	Wapemba	0.190	Wapemba	0.197	Wapemba	0.167
VillChair	0.178	OCS	0.172	Councillor	0.134	OCS	0.147
ADF	0.152	VillChair	0.098	OCS	0.124	KANUreps	0.130
PC	0.148	KANUreps	0.075	ADF	0.114	KWS	0.081
Councillor	0.122	KWS	0.074	TanzConsul	0.089	VillChair	0.069
OCPD	0.098	Councillor	0.057	KWS	0.082	Councillor	0.063
TanzConsul	0.066	SubChief	0.027	VillChair	0.065	TanzConsul	0.034
KWS	0.050	OCPD	0.015	SubChief	0.027	SubChief	0.024
SubChief	0.036	TanzConsul	0.013	OCPD	0.026	OCPD	0.010
Land							
Binary		**Administrative**		**Political**		**Combined**	
BigaFishers	0.447	SFO	0.517	DC	0.652	DC	0.597
DC	0.436	DC	0.494	BigaFishers	0.373	SFO	0.433
DFCS	0.379	DisCoopOf	0.406	DisCoopOf	0.350	DisCoopOf	0.405
SFO	0.336	DDO	0.285	DDO	0.323	DDO	0.321
DisCoopOf	0.331	DFCS	0.247	SFO	0.311	BigaFishers	0.260
DDO	0.270	FO	0.232	MinLand	0.289	MinLand	0.225
FO	0.218	BigaFishers	0.209	DFCS	0.138	DFCS	0.163
MinLand	0.196	MinLand	0.161	FO	0.050	FO	0.141
Chief	0.133	AttnGenOf	0.158	DisLandOf	0.036	AttnGenOf	0.104
OCS	0.133	PSC	0.158	PrivDev	0.036	PSC	0.104

DisLandOf	0.099	Chief	0.060	Expats	0.036	Chief	0.035
PrivDev	0.099	OCS	0.060	ADF	0.036	OCS	0.029
Expats	0.099	DisLandOf	0.011	AttnGenOf	0.030	DisLandOf	0.010
ADF	0.099	PrivDev	0.011	PSC	0.030	PrivDev	0.010
AttnGenOf	0.075	Expats	0.011	Chief	0.023	Expats	0.010
PSC	0.075	ADF	0.011	OCS	0.018	ADF	0.010