SMALL-SCALE FISHERIES GOVERNANCE IN SOUTH AFRICA USING INFORMATION MANAGEMENT SYSTEMS

By: Abongile Ngqongwa

NGQABO001

University of Cape Town

Faculty of Science

Department of Environmental and Geographical Science

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Supervisor: Dr Serge Raemaekers

COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

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Date: 15/09/2015.

ABSTRACT

Conventional management approaches, focused primarily on stock status and top-down driven regulatory measures, such as are employed in many commercial fisheries across the globe, have proven to be inadequate in managing small-scale fisheries and have contributed to marginalisation of this sector. In South Africa, small-scale fisheries have been increasingly recognised since the abolishment of Apartheid and the advent of democracy in 1994. Nevertheless, the management approaches implemented have been largely top-down, natural science-driven and single-species approach.

South Africa's fishery sector is currently going through a historic moment where all small-scale fishers are awaiting implementation of a new Small-Scale Fisheries Policy that will see it endorsing the holistic, multi-species and people-centred approach and the recognition of local and indigenous knowledge of fisheries and addressing the complex socio-economic needs of the fishers. However, in order to implement this policy using a co-management and EAF approach, Government and fishing communities will need to set up the required information-gathering and monitoring tool that would be in line with the principles and objectives of the South African Small-Scale Fisheries Policy as careful assessment of social and economic outcomes of fisheries policies is required to support and sustain livelihoods of these fishers. A proper information management system (IMS) would further ensure that the new approaches to small-scale fisheries management are practical and effective in managing this sector.

In investigating the small-scale fisheries information management system, the researcher conceptualised and designed an IMS and further conducted case studies by analysing and work-shopping results of analysed catch data recorded by an independent service provider to Doringbaai small-scale fishers, and analysed catch data of East Coast Rock Lobster in the Eastern Cape of South Africa. Based on the results of the conceptualised and designed IMS and that of the analysed catch data, it is clear that there is a need for the IMS to be converted into a web-based system and further accommodate more indicators that would assist in equipping fishers and fisheries authorities with relevant decision-making. It is also

clear that there is a need for an urgent overhaul in how catch data is gathered and packaged as there were numerous errors in the data that could affect how small-scale fisheries should be managed. One of the interventions urgently needed is implementation of an electronic data capturing and instant synchronisation of data into the IMS which would present live data through a web interface customised per user type. Such tool would improve the current management measures and further contribute to improving governance of small-scale fisheries when the Small-Scale Fisheries Policy is implemented.

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LIST OF ACRONYMS

CBLE Community-Based Legal Entity

CPUE Catch-per-Unit-Effort

DEAT Department of Environmental Affairs and Tourism

EAF Ecosystem Approach to Fisheries

EEZ Exclusive Economic Zone

FAO United Nations Food and Agriculture Organisation

ID Identity document

IDP Integrated Development Plan

IFQ	Individual Fishing Quotas
ITQ	Individual Transferable Quotas
IUU	Illegal, Unreported and Unregulated (IUU)
kg	kilogram
LSCC	Local subsistence co-management committee
MEY	Maximum Economic Yield
MCM	Marine and Coastal Management
MCS	Monitoring, Control and Surveillance
MDT	Masifundise Development Trust
MLRA	Marine Living Resources Act
MPA	Marine Protected Area
MSY	Maximum Sustainable Yield
NGO	Non-Governmental Organisation
NTT	National Task Team
SAMSA	South African Maritime Safety Authority
SD	Standard Deviation
SFMU	Subsistence Fisheries Management Unit
SFTG	Subsistence Fisheries Task Group
TAC	Total Allowable Catch
TAE	Total Allowable Effort
TURF	Territorial User Rights Fishery

Contents

CHAPTER ONE: INTRODUCTION

1.1 Introduction

Small-scale fisheries have been marginalised throughout the world as fisheries development and governance approaches have tended to favour large-scale commodity-orientated fisheries (Berkes, 2003; FAO 2005a). Conventional management approaches, focused primarily on stock status and top-down driven regulatory measures, such as are employed in many commercial fisheries across the globe, have proven to be inadequate in managing small-scale fisheries (Berkes et al, 2001; Berkes, 2003; Sowman et al, 2005). It is currently broadly accepted that the conventional approach is unable to address the complex socio-economic characteristics, multiple livelihood needs as well as the multi-species nature of many small-scale fisheries (Andrews et al, 2009).

Many leading academic researchers such as Berkes et al, (2001), Berkes (2003) and Staples et al, (2004); non-governmental organisations; governments, etc. have realised this over the years and suggested a more holistic approach to small-scale fisheries governance that would integrate not only scientific and economic data on marine resources and catch levels for decision making, but also put emphasis on socio-economic, cultural and local knowledge of fishers and fishing communities (FAO, 2004; Andrews et al, 2009). This has resulted in calls for a shift from a conventional approach to holistic approaches such as the Ecosystems Approach to Fisheries (EAF), and more participatory governance of fisheries systems (Berkes, 2003; Andrews et al, 2009). These alternative approaches are more in line with the broadly accepted vision of ecologically, socially and economically sustainable small-scale fisheries (Staples et al, 2004). In essence, this means that one should not only assess the resource but assesses a fishery as a system made up of ecological and human sub-systems (Berkes, 2003). Realising the complexity of small-scale fisheries and the need to shift from conventional to holistic approaches, however, necessitates a reconsideration of the type of data and information necessary, and the way data is collected, processed and used for management (FAO, 2005; De Young et al, 2008). It is therefore important to emphasise that management of small-scale fisheries requires the use of a wider variety of information types.

The contribution of small-scale fisheries to poverty alleviation and food security, and more broadly to rural development and national economic growth, will not be adequately

recognised by authorities and fishery planners unless better information is generated about the extent of these contributions (FAO, 2005a).

In South Africa, small-scale fisheries have been increasingly recognised since the abolishment of Apartheid and the advent of democracy in 1994. Nevertheless, the management approaches implemented have been largely top-down and natural science-driven (Branch et al, 2002b; Harris et al, 2002; Raemaekers, 2009; Sunde and Raemaekers, 2010). However, several recent policy processes, such as the involvement of small-scale fishers in policy formulation and the inclusion of references to human systems in the new Small-Scale Fisheries Policy, indicate a willingness from Government to embrace modern governance approaches such as the human-rights approach, co-management and an ecosystem approach to fisheries (EAF). South Africa's fishery sector is currently going through a historic moment where all small-scale fishers are awaiting implementation of a new small-scale fisheries policy that will see it endorsing the co-management approach and the recognition of local and indigenous knowledge of fisheries and addressing the complex socio-economic needs of the fishers. However, in order to implement this policy using a co-management and EAF approach, Government and fishing communities will need to set up the required information-gathering and monitoring tool that would be in line with the principles and objectives of South African small-scale fisheries policy as careful assessment of social and economic outcomes of fisheries policies is required to support and sustain the livelihoods of these fishers.

This study, therefore, seeks to conceptualise a small-scale fisheries Information Management System (IMS) that would aid the transition from current management approaches to an approach that embraces the principles underpinning the approved South African Small-Scale Fisheries Policy and improves the co-management of small-scale fisheries in South Africa. A specific aim and several objectives have been identified for this study and these are listed below:

1.2 Aim and Objectives

The aim of this study is to conceptualise and develop a Small-Scale Fisheries Information Management System (IMS) that would aid in the improvement of small-scale fisheries governance in South Africa. The intention is that such an IMS should assist with the

transition towards the Small-Scale Fisheries policy governance model. To achieve the study aim, the following objectives were pursued:

- To conceptualise and design a Small-Scale Fisheries IMS for South African coastal fishing communities;
- To assess current catch data and other information in order;
    - to assess the current process and analyse the quality of catch data in the local Doringbaai fishing community.
    - to conduct a desktop-type analysis of the East Coast Rock Lobster data recorded in the Eastern Cape and its efficacy for regional fisheries management needs.
- To provide recommendations on improving data management;
- To recommend improvements to the design of the IMS for co-management approach.

1.3 Structure of Thesis

The first chapter has provided an introduction to the study by looking at a brief background of the study, and highlighting the aims and objectives of the research together with the expected outcomes and limitations of the study. Chapter Two presents a literature review and provides the background context for this study, including an overview of the history, background and legal framework of small-scale fisheries. Chapter Three describes the methods used to conceptualise and design the IMS and how it was implemented in the case study sites. Chapter Four describes the conceptualisation and development of the Small-Scale Fisheries IMS. Chapter Five reviews catch data monitoring process and data quality recorded for Doringbaai under the interim relief dispensation. Chapter Six presents a detailed analysis of the regional East Coast Rock Lobster catch data monitoring taking place in the Wild Coast region of the Eastern Cape. Chapter Seven concludes the study by providing discussion and recommendations which focus on the challenges of the conceptualised IMS and challenges noted on the two case study sites and thereafter look at how the IMS can address these challenges and further improve governance of small-scale fisheries in South Africa.

1.4 Expected outcomes

The final research will be presented in a Master's thesis and scientific paper. Findings of the research are expected to play a role in assessing whether the proposed IMS will address the current challenges derived from the lack of information faced by Small-Scale Fisheries management authorities. Findings will also lay out recommendations towards improving the Fisheries IMS to ensure effective transition from the current management model to the model underpinned by the new South African Small-Scale Fisheries Policy.

1.5 Limitations of the study

Due to lack of or low levels of literacy within fishing communities, there are foreseen limitations in the level at which the SSF-IMS can be implemented as this system will need to be used by the co-management committee to make decisions. The researcher will have to analyse and explain the data and this may influence the decision-making by the fishers of Doringbaai.

The catch data presented limitations on analysing the data as there were several other indicators that could not be analysed due to many errors in the data. This was severe with East Coast Rock Lobster catch data analysed for the West Coast of the Eastern Cape.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Despite growing environmental awareness on many environmental phenomena such as global warming, the need for sustainability and action in the form of increasing investments in environmental protection, environmental stewardship etc., pressures on the world's natural resources and ecosystems continue to increase rapidly (MEA, 2005). The impact of human activities due to change in the political, economic and demographic landscape and other factors reach into every corner of the natural world. For example, it has been noted that more than one half of all accessible surface water, as well as an enormous quantity of groundwater, is diverted for human uses (Butler et al, 2012). These uses have brought unquestionable benefits to humans, specifically in developing countries. But the consequence of this growing human domination of the planet is that no ecosystem on Earth is free from human influence (MEA, 2005).

Threats to biodiversity are particularly intense in aquatic systems such as the oceans, and freshwater habitats such as rivers, lakes, and wetlands. Biological invasions from exotic species introduced accidentally through global trade and tourism or by deliberate import for agriculture comprise a kind of "biological pollution" that also poses a growing threat to the world's biodiversity, both aquatic and terrestrial. At the beginning of the 21st century, overfishing has emerged as a major problem all over the world due to biological overfishing that exceeds the Maximum Sustainable Yield (MSY) of a given fish stock and also over investment that does not meet the levels of sustainable stock to realise meaningful profit to cover the capital expense (Hannes, 2009). In the absence of strict management approaches to reduce fishing pressure, many marine fish stocks continue to decline, endangering an important source of food and employment (Berkes et al, 2001; Ye and Cochrane, 2011).

Marine fisheries are, however, very important to the economy and well-being of coastal communities, especially in the poor coastal countries, as this sector is essential for providing food security, job opportunities, income and livelihoods as well as traditional cultural identity (Ye and Cochrane, 2011). The United Nation's Food and Agricultural Organisation (FAO) (2011) has noted that the marine fisheries sector produced about 80 million tonnes of fish in 2009 and directly employed 34 million people in fishing operations in 2008 alone. Considering the type of people assumed or deserving to be benefiting from this sector, it has also been noted that fish and fish products are a vital and affordable source of protein in

the developing countries of the world. Therefore, maintaining the long-term prosperity and sustainability of fisheries resource does not only benefit countries in terms of political and ecological significance but also is of economic and social importance to fisherfolk (FAO, 2011). From the previous to the current management approaches, would it be safe to say that human beings are managing these limited resources effectively? If not, what has been done to ensure this and what should be done going forward?

The purpose of this chapter is to provide literature review on fisheries management and detailed background on small-scale fisheries globally and locally. This chapter also seeks to provide available literature on the lack of information and the need for an information management system for the small-scale fishing sector globally and in South Africa to aid in effective governance of this sector. This chapter will highlight the introduction of the South African Small-Scale Fisheries Policy and how the development and implementation of an Information Management System is urgently needed in order to effectively implement the new Small-Scale Fisheries Policy.

2.2 Fisheries management: from management to governance

Management of marine resources has been heavily influenced by Hardin's seminal 'Tragedy of the Commons' paper (1968) in which he argued that a resource that starts out abundant and freely available to all tends to decrease with time, unless the resource use is somehow regulated in the common interest, otherwise the long-term results will be ecological ruin for all (Hardin, 1968). The fisheries sector is no exception to this theory as in many situations it is difficult for a fisher to see the incentive in conserving the resource for the benefit of all, as opposed to catching as much as possible as soon as possible for personal economic gain. Results of such an act caused by fishers operating with the same rationale are that the very same resource they depend on will be in ruin for all who depend on it (Berkes et al, 2001).

During the expansion of world marine fisheries commencing in the 1950s, commonly perceived open access in most of the globe's oceans and seas, and unregulated fisheries rapidly depleted valuable marine resource stocks and thus compromised commercial profits (Huppert, 2005). In response, several countries unilaterally extended their exclusive economic zones from three nautical miles to two hundred nautical miles from the shore (Juda, 1991; Nadelson, 1992). But it was only in 1982, with the United Nations Convention

on the Law of the Sea that categorised customary marine law, that countries were legally assigned the authority to manage and exploit marine fish stock in their EEZ 200-mile limit. This meant that coastal waters that were previously under open access to everyone became State property or better understood as common property for the nation with the State as custodian of its natural resources. Within this evolution control had become highly centralised and natural scientists gave advice to management. At the centre of this advice was the mathematical modelling of the resource. The bionomic optimisation models were often based on single-species' fish population dynamics and calculated the Maximum Sustainable Yield (MSY) of a particular resource (Caddy, 1999; Larkin, 1977). The MSY objective was also the only target reference point referred to in the Law of the Sea Convention (Caddy, 1999; Hilborn, 2007a). This species-centered approach was then used as a basis for calculating the annual Total Allowable Catch (TAC) obtained through regular stock assessment of harvested species as catch and effort, fishery-independent sampling and modeling of the specific species (Berkes, 2003; Hillborn, 2007; Raemaekers, 2009). From this point onwards, it was obvious that the type of management was "marine-resource centred". Through technical scientific information, fisher behaviour has been controlled through input and output regulations such as those listed in Table 2.1.

Table 2.1: Examples of commonly used input and output regulations used to control fishers' effort.

Input Regulations	**Output Regulations**
• Closed seasons • Closed areas • Gear restrictions • Total Allowable Effort • Law enforcement	• Size limits • Protected species • Restrictions on sex and maturity stage of species • Total Allowable Catch • Quotas • Bag limit • Law enforcement

The main objective of fisheries management has been to ensure that the natural resource is preserved with little compromise and that catch should not exceed Maximum Sustainable Yield (MSY) and controls on fishing activities such as where, when and how many species and what size can be harvested, were implemented. Furthermore, enforcement of fishery regulations has always been an important aspect of fisheries management (Hillborn, 2007). To date, many fisheries across the world are still managed this way.

Although measures were put in place to manage marine resources, stocks have continued to decline and this has caused negative impacts on the fishing sector (Hilborn, 2007). Work by economists, such as H.S. Gordon, in the 1950s had also begun to influence fisheries management. Gordon's bio-economic model of fishing demonstrated reasons as to why open access fisheries performed poorly in economic terms and why overexploitation was inevitable (Gordon, 1954). Introduction of the private-property system, as opposed to open-access system, had generally been motivated by the desire to increase economic efficiency.

This led to the introduction of a limited-access system that aimed to further address the problem of the 'tragedy of the commons' as depicted by Hardin and to further increase the Maximum Economic Yield (MEY). These controls ranged from limited entry through licence limitations, to individual harvest allocations such as use rights, exemplified by Individual Fishing Quotas (IFQ) or catch shares (Field, 2003; Morison, 2004). Individual Transferable Quota systems (ITQs) were also introduced to further counteract the "tragedy of the commons" and to further ensure that the profitability of the commercial fishery sector improved. ITQs differ from IFQs in that the fishers also hold some form of property rights (Ostrom and Schlager, 1996) in addition to withdrawal or use rights (Brady and Waldo, 2009). This meant that the right to withdraw marine resource came with a responsibility of ensuring that the long-term right granted was looked after by sustaining or responsibly harvesting the share of a TAC allocated. In comparison to IFQs, an ITQ system allocates quota shares of the TAC that are subsequently allowed to be purchased, sold or leased among the fishers. This was meant to ensure that less efficient producers would sell their quota and leave the fishery, which in turn reduces excess capacity (Degnbol et al, 2006). It has been argued that transferable catch shares provide a powerful incentive for long-term sustainable use of the stock (Costello et al, 2008; Hilborn et al, 2005). Fishing rights within the EEZ thus replaced the practice of free and open access to marine resource (Berkes,

2003). An example of this is seen in Iceland where before the extension of the exclusive economic zone to 200 miles in 1975, effective management of the fisheries appeared impractical due to the presence of large foreign and local fleets on the fishing grounds. For this reason, fishery management subsequently extended fishing limits to 200 miles. With the *de facto* recognition of the exclusive 200-mile zone in 1975, the situation dramatically changed. One of the most commercially important species at the time was Herring which was highly targeted by all vessels. After the extension of EEZ, Herring was harvested on a reduced scale and subsequent to that, Iceland decided to set a Total Allowable Catch for herring over the annual fishing season and divided this TAC equally among all the fishing vessels within the Iceland zone. In essence, this was an enclosure of the Herring stock though the effort was high due to the high number of vessels that had been harvesting this species over time. In addition, in 1979 the individual Herring quota was made transferable, making this one of the first systems of Individual Transferable Quota (ITQ). It was believed that this system would further improve sustainability of the stock by ensuring that the quotas were held by fishers willing to invest financially in the sector and automatically excluded the vessels that would find it difficult to make a reasonable profit. This system never took into consideration the socio-economic impacts on fishing communities as it was meant to manage the ecological sustainability of the resource and improve the economic spin-off of the sector (Gissurarson, 2000; Runolfsson, 1999).

It is clear from this point that management of fisheries was mainly to conserve fish stocks by limiting access to the stock through property rights and quota allocation to right holders and introducing Individual Transferable Quota systems so as to eliminate or reduce excess capacity without consideration of the socio-economic impact of these regulations/measures on fishing communities. This type of fisheries management approach has been termed the science-centered, single-species 'conventional' or traditional approach and it has been criticised for not taking into consideration the social, cultural and socio-economic needs of other fishing sectors such as the small-scale fisheries comprised mainly of poor and vulnerable fishers (Berkes et al, 2003, FAO, 2003)

2.3 Small-Scale Fisheries Governance

It has been well noted that there is no universal definition of small-scale fisheries and that other terms such as traditional or artisanal are usually used synonymously (Berkes, 2001;

FAO, 2003; Berkes et al, 2003). Many authors have suggested different definitions that differ from location and context (Berkes, 2001). Though there might be differences in definition, many small-scale fishers have common features. The FAO (2012) defines small-scale fishers as:

"traditional fisheries involving fishing households (as opposed to commercial companies), using a relatively small amount of capital and energy, relatively small fishing vessels (if any), making short fishing trips, close to shore, mainly for local consumption. In practice, definition varies between countries, e.g. from gleaning or a one-man canoe in poor developing countries, to more than 20-m. trawlers, seiners, or long-liners in developed ones. Artisanal fisheries can be subsistence or commercial fisheries, providing for local consumption or export."

It has been estimated that 90% of the 38 million fishers and fish farmers in the world are small-scale fishers and they collectively harvest half of the world's fish catch for human consumption, income and livelihoods. It has also been estimated that 135 million are directly or indirectly employed in small-scale fisheries and small-scale aquaculture and that an estimated 10 million Africans rely on small-scale fisheries as their primary livelihood, and a further 90 million (farmers and resource poor) depend on fishing as part of a diversified livelihood strategy (FAO, 2005; Cox, N/A). Based on the above, reported to be still under estimated numbers (FAO, 2005), small-scale fisheries are obviously important as they are a source of employment, food security and income, particularly in the developing world and in rural areas (Béné et al, 2010). For many small-scale fishers and fish workers, the sector represents a way of life and it embodies a diversity and cultural richness that is of global significance (FAO, 2012).

Over many years, small-scale fishers have been marginalised throughout the world and this has been caused mainly by governance approaches that have been based on single species and that were natural science-driven with lack of a more holistic and participatory approach (Berkes, 2001; Isaacs, 2006; Townsend et al, 2008;). Such fishery science has not served the fishery management needs of the developing countries that boast a large number of small-scale fishers. As a result, the conventional approach has not adequately addressed the socio-economic needs of fisherfolk (Berkes, 2001; Hauck and Sowman, 2003). The amount

of effort put into making sure that the large-scale commercial fishing sector is sustainable without compromising MSY and MEY has in fact compromised the small-scale fisheries sector to such an extent that any approaches to counteract the marginalisation of the small-scale sector might be interpreted as counteracting the large-scale commercial fisheries sector as the stock "protection" has been the only determining factor in managing the fisheries sector. For example, the introduction of ITQs has seen many small-scale fishers selling their rights due to attractive offers by large-scale commercial fishers. This has been exacerbated by the difficulty for the small-scale fishing sector to compete with the large-scale commercial sector.

Over the past 15-20 years there has, however, been a vigorous call to shift from a conventional top-down, natural science-driven approach to a more holistic, ecosystems and people-centred approach that would take into consideration environmental, social and economic factors (Berkes, 2001; FAO, 2005; De Young, 2008; Sowman, 2011). This major shift has been influenced by failures of the conventional approach which concentrated on stock assessment and the economic factors thereof (Garcia et al, 2008; Berkes et al, 2001; Sowman, 2006). This has led to the emergence of many alternative approaches such as the Ecosystems Approach to Fisheries (EAF) (FAO, 2003); community or spatially explicit rights-based approaches and participatory systems such as the co-management approach. It has been noted that these approaches are not mutually exclusive as they share common principles of ensuring sustainable fisheries and addressing socio-economic factors through participatory management of fishers (Isaacs, 2006).

The Ecosystem Approach to Fisheries (EAF) and co-management approaches are particularly favoured for the management of small-scale fisheries as is evident from a large volume of literature about these approaches (Berkes, 2001; Andrew and Evans, 2009; FAO, 2003; FAO, 2005). Organisations such as the Food and Agriculture Organisation have led the institutional drive to reform small-scale fisheries governance by promoting and mainstreaming the EAF. The Nineteenth Session of the FAO Committee on Fisheries (COFI), held in 1991, recommended that new approaches to fisheries management which would also take social and economic aspects into consideration were urgently needed. Subsequent to this, FAO was tasked with developing the concept of responsible fisheries and producing a Code of Conduct to foster its applications. An essential step was taken in 2001 with the

adoption of the FAO Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem, which requested that the FAO prepare guidelines for best practices with regard to, amongst others, introducing ecosystem considerations into fisheries management (FAO, 2009). As a result, the concepts and principles of an ecosystem approach to fisheries have been incorporated into many international conventions and agreements such as Agenda 21, the Rio declaration, the Biodiversity Convention, United Nations Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks, and the FAO Code of Conduct for Responsible Fisheries (FAO, 2009; Andrew and Evans, 2009). EAF has been defined by FAO (2003) as an approach which seeks to:

…*"strive to balance diverse societal objectives, by taking into account the knowledge and uncertainties about biotic, abiotic and human components of ecosystem and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries".*

This definition shows that there is a distinct difference between the conventional approach to fisheries management and EAF, which accounts for other factors such as natural environment, social, cultural and economic needs of the fishers. It also takes into consideration the uncertainty of the ecosystem and the human component while taking an integrated approach to adapt to uncertainties without compromising the integrity of the resource (FAO, 2003). Therefore, ensuring that the different components such as human dimensions, biotic elements and abiotic elements are at a balance will ensure successful implementation of the approach (Figure 2.1).

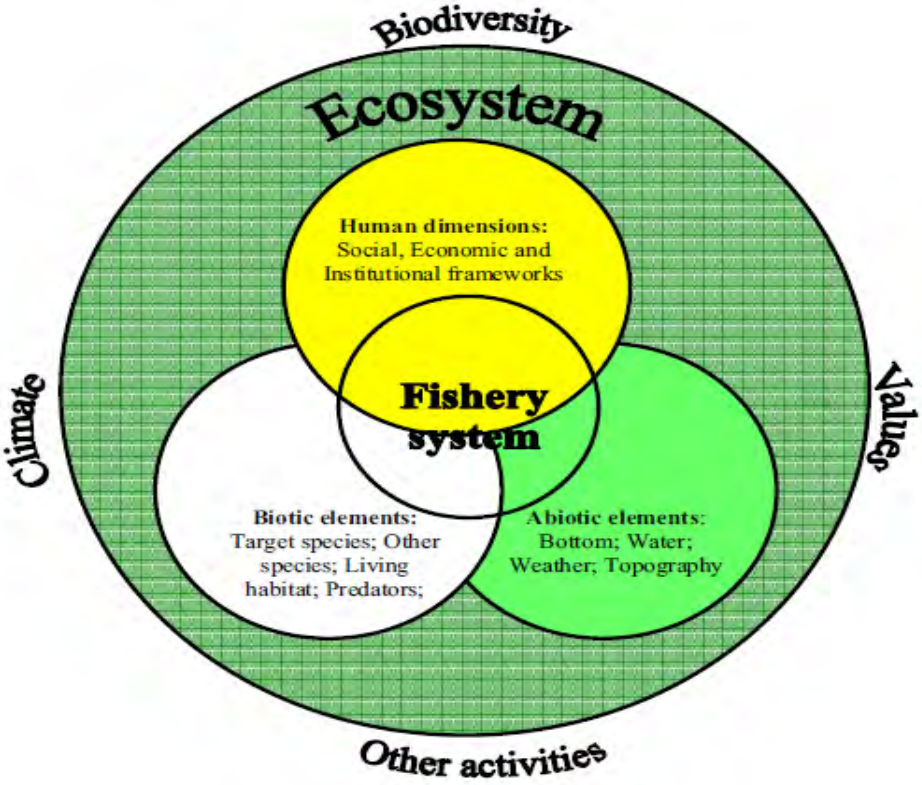

Figure 2.1: Illustration of different components and their balance in Ecosystems Approach to Fisheries

Though this might be the case, many countries still perceive the EAF in a narrow sense which looks at the ecological side without considering the human aspect of the approach (FAO, 2009). Human Dimensions in the Ecosystems Approach to Fisheries take into account that humans are at the centre of this approach. A wide range of social, economic and institutional considerations are said to be relevant to the implementation of the EAF. De Young et al, (2008) highlights that EAF should take place in the context of societal and/or community objectives, which inherently reflect human aspirations and values and that the EAF is a human pursuit, with implications in terms of institutional arrangements that are needed, as there is a need for structured decision-making processes that are based in the accepted set of societal objectives and governed by a suitable set of operating principles.

Alongside EAF, co-management has been promoted as the preferred approach to managing small-scale fisheries. Hauck et al, (2005) and Hilborn (2007) define co-management as a partnership arrangement primarily between government and resource users, and may include other stakeholders, to share the responsibility and authority for managing natural resource. This type of approach recognises the importance of resource users in addition to

the resource. It also takes into account the role that resource users need to play in managing the small-scale fisheries sector (Berkes and Folke 1998). This approach has also been advocated and welcomed in many countries as it has been based on international standards of good governance and enshrined in the Code of Conduct for Responsible Fisheries (FAO, 2003; UNCED, 1992). This approach requires a shift away from the centralised, top-down form of management to a new strategy in which fisheries managers and the fishers jointly manage the fisheries. This approach also takes into consideration other interested and affected stakeholders such as non-government organisations and associations within the fishing sector (Figure 2).

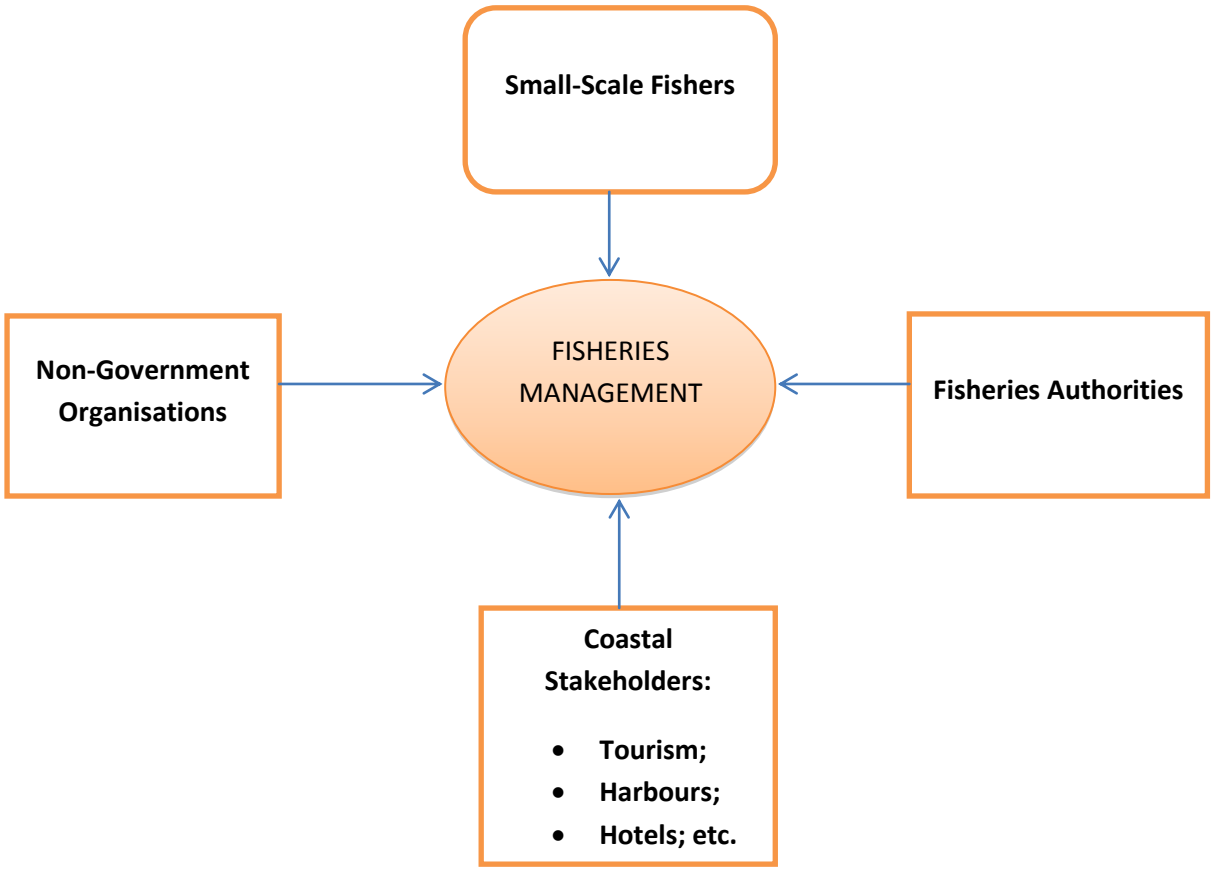

Figure 2.2: Illustration of co-management as a partnership and participatory measure (Source Berkes, 2001)

Fisheries' managers are increasingly recognising that the underlying causes of fisheries resource overexploitation and environmental degradation are often of social, economic, institutional and/or political origins. Berkes (2001) states that small-scale fisheries management will need to be designed by focusing on local-level management;

decentralisation of management authority and responsibility; and use of fishers' knowledge. He further states that fishers can no longer depend on government to solve their problems, whether community or fisheries-related. This means that they will have to take more responsibility for the management of the sector and be accountable for their decisions. This also means bearing the costs of benefiting from those decisions (Berkes; 1994a). There is a hierarchy of co-management arrangements from those in which the fishers are consulted by the government before regulations are introduced, to those in which the fishers design, implement and enforce laws and regulations with advice from the government (Sen and Raakjaer-Nielsen, 1996). Co-management entails a conscious and official distribution of responsibility, and the formal devolving of some authority. The stakeholders develop an agreement which specifies their respective rules, responsibilities and rights in management. The amount of responsibility and/or authority held by the fisheries authorities or devolved to local institutions will differ depending upon country and is often site-specific (Pomeroy; 1999).

It is, therefore, evident that from the expectations that small-scale fishers will have a significant role in managing fisheries, the need to ensure that capabilities meet the expectations of small-scale fishers to play such roles is as important as the approach itself. Therefore, proper management capacitation for all the participating stakeholders in co-management is one of the key factors to a successful co-management approach. One of the key capacitation factors is the availability of information for decision-making. The type of information for such participatory approach needs to inform decision-making in a manner that does not compromise ecological and socio-economic objectives of the sector.

From the above-mentioned approaches it is evident that the new approaches differ significantly from the traditional or conventional top-down approach. The table below illustrates some of the major differences (Table 2.2).

Table 2.2: Major differences between conventional and modern fisheries management approaches

Conventional fisheries management	**Participatory and Systems approaches**
Stakeholders are those directly involved in fishing activities only	Stakeholders are found throughout the fishery system and in other sectors of the ecosystem

Management commonly by government fisheries authority (top-down)	Participation and co-management with a broad spectrum of stakeholder groups
Operates through regulations and penalties for non-compliance	Compliance to regulations is encouraged through incentives
Single-species management	Multispecies and broader ecosystem management
Focus on the fishing	Focus on the broader fishery system
Indicators related to fish catches and status of fish stock	Indicators related to all parts of the aquatic ecosystem and goods and services
Scientific knowledge for decision-making	Traditional, local, and scientific knowledge systems may be used for decision-making

As will be shown in the next section, South African fisheries governance has been heavily influenced by the conventional approach and this has affected how the South African fisheries sector is managed currently.

2.4 South African Small-Scale Fisheries Governance

All along the South African coastline, men, woman and children have been living in coastal communities harvesting marine resource for consumption, livelihoods, medicinal purposes, and as part of cultural and spiritual practices for thousands of years (Branch et al, 2002a; Branch et al, 2002b; Sunde et al, 2010). Currently, a diversity of small-scale fisheries operate along the South African coast ranging from the near-shore harvesting of intertidal resources to the use of motorised vessels needed to target migratory line-fish stocks. Some of these fisheries are still informal, operate under regulations for the recreational fishing sector, or have only certain components recognised by the fisheries authority (Raemaekers, 2009). Similar to many of the world's fisheries, South Africa's fisheries management has favoured the development of a large-scale commercial fishery. Historically, South Africa's small-scale fishers have also been subject to adverse marginalisation due to historic, political, social and economic challenges (Clark, 2002). During the apartheid era, black and coloured[1] South

[1] The Coloured population is a group of people generally regarded as mixed race, descended from slaves, indigenous Khoisan, other black people and European settlers. Historically, the Coloured population occupied an intermediate status in Apartheid South Africa (Van Sittert et al. 2006)

African fishers were dispossessed of their land adjacent to the coast due to the legacy of the 1913 Land Act's Bantustans and apartheid cities. During the 1980's South Africa introduced policy and legislation to establish fisheries management but these were mainly aimed at the commercial fisheries sector and largely neglected the small-scale fishers who were mainly in poverty-stricken communities along the South African coastline. During this era, access to fishing, in a form of quota system, was granted to a few white-owned large-scale commercial companies under the Sea Fisheries Act and the racial bias in the fishing sector saw *bona fide* small-scale fishers being criminalised (Kleinschmidt et al, 2006; Daniels, 2001). In addition to this, economic pressure had forced *bona fide* small-scale fishers, specifically in the Western Cape, to take employment in the large-scale commercial sector and this contributed heavily to the destruction of fishers' traditional livelihood along the western and southern coast (Glavovic, 2000).

In 1994 at the end of this era, a democratic South Africa was tasked with addressing the many imbalances caused by the colonial era and apartheid regime. This saw considerable legislation being promulgated in a bid to address South Africa's past imbalances, among which the Marine Living Resources Act was no 18 of 1998, the principal regulatory framework governing fisheries management in South Africa to date. Due to this Act, for the first time in the history of the South African fishing sector, subsistence fishers were recognised and legalised as fishers deserving access to marine resources (Branch et al, 2002, Branch et al, 2002b; Isaacs et al, 2000). In terms of section 19 of the Act, a subsistence fisher is defined as "*a natural person who regularly catches fish for personal consumption or for the consumption of his or her dependents, including one who engages from time to time in the local sale or barter of excess catch, but does not include a person who engages on a substantial scale in the sale of fish on a commercial basis*" (MLRA, 1998). Though recognition was the first step in implementing effective management of subsistence fisheries, more groundwork had been left untapped as there was a lack of experience and institutional capacity in managing this newly recognised sector (Glavovic, 2000; Branch et al, 2002; Branch et al, 2002b). This led to the appointment of the Subsistence Fisheries Task Group (SFTG) in 1999 by the National Fisheries Authority to advise on the future of this sector's management. The SFTG focused on two key aspects which were 1) Research to identify subsistence fishers, their activities and the resources they harvest and to gain an

understanding of their socio-economic standing, and 2) Consultation and communication to ensure that the needs of fishers and authorities were incorporated in the formulation of recommendations for management (Harris et al, 2002; Branch et al, 2002).

Outcomes from the SFTG suggested that there were at least 147 fishing communities along the South African coast and they comprised approximately 29 200 fisher households with approximately 28 300 individual fishers who could be considered subsistence fishers. This meant that each identified household had one subsistence fisher. The results also reflected that the majority of these subsistence fishing communities were situated in the Eastern Cape and KwaZulu-Natal and that these two provinces were highly poverty stricken. Together with the identification of fishing communities, a recommended list of resources considered suitable for the subsistence sector was tabled and the majority of the lists of species were of low cash value (Sowman, 2011).

The SFTG noted that there were groups considered as subsistence fishers who nevertheless wanted to gain a commercial right. It was therefore recommended that the definition of "commercial" be revised to include small-scale fishers who did not fit into the subsistence definition. They were then classified as small-scale commercial fishers. These groups of fishers were primarily in the Western Cape.

Though the SFTG recommendations were welcomed by the fisheries authority, little effort to administer the recommendations has been evident in KwaZulu-Natal and the Eastern Cape (Figure 2.3), where the fisheries authority has been issuing exemptions in terms of section 81 of the Act which allows the Minister to exempt fishers from section 18 of the Marine Living Resources Act. These exemptions in the form of annual permits have been issued all along the coastline and many more fishing communities are still to benefit from accessing marine resources for their livelihood. These exemptions have also been seen as insufficient to alleviate poverty in these communities as the allocated species were of low value as compared to other inshore species allocated to the commercial fishing sector.

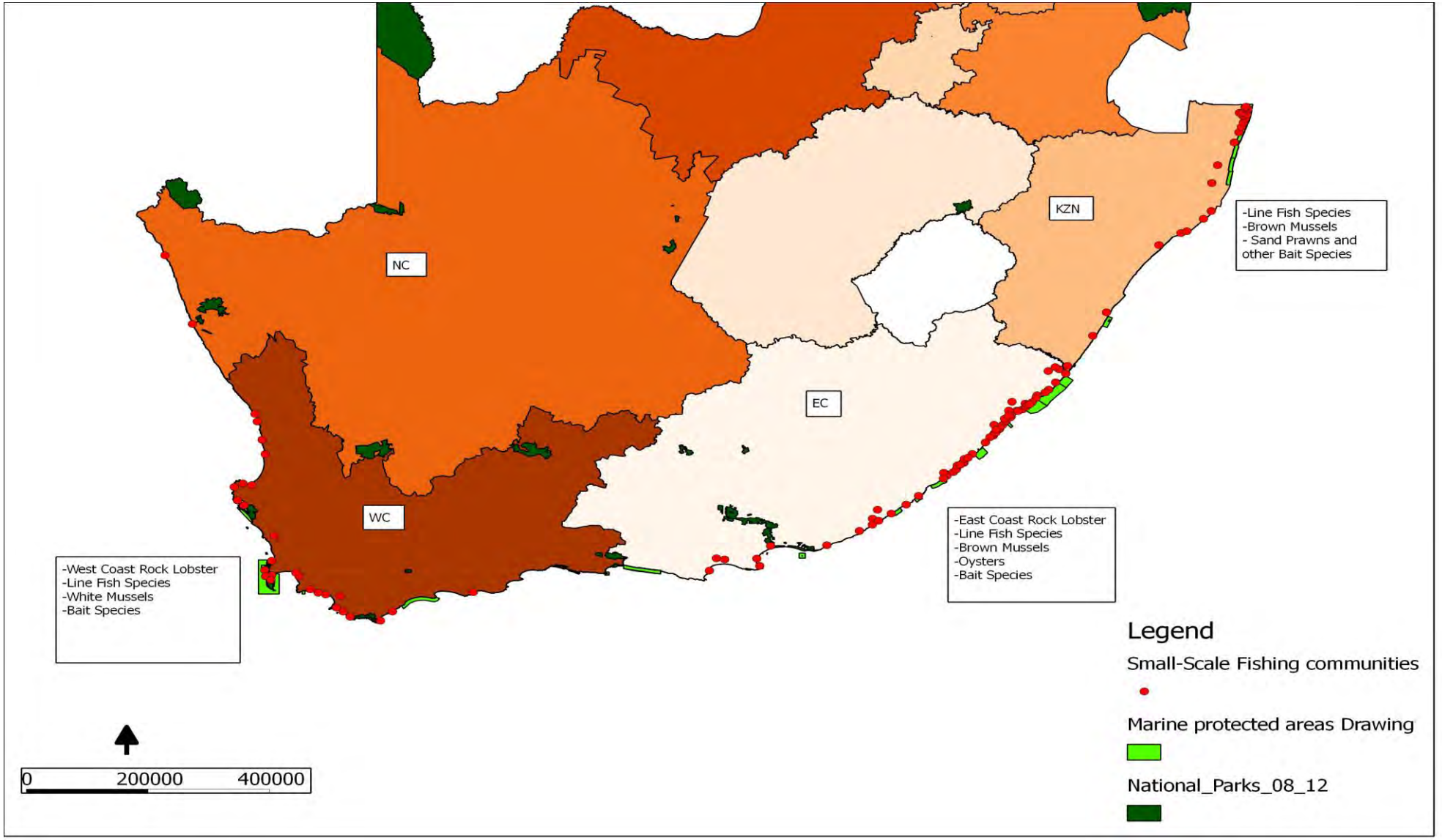

Figure 2.3: Map illustrating distribution of small-scale fishing communities issued with exemptions and some of the resources these fishers target.

Regulations of this sector have been based on the recreational fishing sector whereby fisher behaviour has been controlled mainly by bag limits, gear type and open/closed seasons. To date, no subsistence fishing rights have been granted to any fishing community since the promulgation of the MLRA in 1998. This has caused additional challenges to poverty-stricken fishing communities as they can only harvest on a very limited basis. On the advice of the SFTG the fisheries authorities formed co-management structures as part of the fisheries management approach, but to date there are none that have been/are fully functional in the Eastern Cape (researcher's own observation). Though the Department of Agriculture, Forestry and Fisheries' environmental officials have been placed in Port St Johns, East London and Port Elizabeth for the purpose of issuing exemptions and the formation of co-management structures, forming these structures has been a difficult task for the past 10 years. This has been due to lack of capacity, high staff turnover and the vast distance between the fishing communities due to the type of terrain dominating the Eastern Cape coastal areas, amongst other things.

In KwaZulu-Natal, significant work has been done in forming and maintaining some co-management structures by the provincial agency Ezemvelo KZN Wildlife mandated by the national Department of Agriculture, Forestry and Fisheries to administer the management of marine resources in this province. Besides the formation of co-management structures, allocation of rights to access and harvest marine resources for subsistence fishers has not occurred although the Act advocates allocation in terms of its section 18. Thus far, only yearly exemptions have been issued to small-scale fishers.

In the Western Cape, the SFTG indicated that there were no subsistence fishers and that the majority of poor fishers were small-scale fishers in terms of the "small-scale commercial fishers" definition. This saw many poor fishers who met the criteria as subsistence fishers being further marginalised (Sowman, 2006). Due to increased pressure exerted by small-scale fishers and NGOs such as Masifundise Development Trust, with support from the Legal Resources Centre (LRC), small-scale fishers approached the Equality Court in 2004 after the commercial-fishing rights allocation process for medium-term rights in 2001/2. The fishers expressed their frustration at being marginalised by the MLRA as thousands of fishers were forced to compete for fishing rights with the industrial fishing sector. Therefore, small-scale fishers felt misunderstood and deprived of their constitutional rights. The Equality Court's

ruling was that government should immediately formulate a new policy that would address the socio-economic needs of traditional fishers and come up with a more holistic and participatory approach in managing this sector. In addition the judge ordered interim relief be provided to 1200 identified fishers from the Western Cape and Northern Cape while the policy was being formulated. This gave rise to the currently popular name of "Interim Relief dispensation" which represents the issuing of exemptions while the policy is formulated. Currently, these fishers are issued annual exemptions mainly for West Coast Rock Lobster (*Jasus lalandii*), a few line fish species and white mussels *(Donax serra)*. The West Coast Rock Lobster is the main sought-after species as it is one of the high valued species with a well-established international market. Due to the high number of fishers demanding access to the resource, the government was forced to increase the total number of interim relief fishers from 1200 in 2009 to 2000 by 2014 in 42 identified small-scale fishing communities and this has proved insufficient as there are more fishers waiting to be issued these interim relief exemptions to access the resource.

Eight years have passed since the court order and up to now small-scale fishers are still waiting for Small-Scale Fisheries Policy implementation. Though there are a few small-scale fishers who have benefited from the previous allocation of commercial-fishing right, the majority have been subjected to working for large-scale fishing companies and supplementing their income by means of acquiring interim relief exemptions which have been issued by the fisheries authority in terms of section 81 of the MLRA. Though these interim relief exemptions have brought much needed relief for some fishers, many have experienced social and economic challenges such as exploitation by companies exporting West Coast Rock Lobster, who buy interim relief West Coast Rock Lobster at a very low market price; increased conflict between fishing communities and between fishers within these communities; and increased levels of organised poaching.

In June 2012, history was made when the first Small-Scale Fisheries policy, which has been in the making for almost a decade, was gazetted. By 19 May 2014, the President of South Africa signed into law the Marine Living Resources Bill which was aimed at further formalising and regulating the small-scale fishing sector. Therefore, the new Marine Living Resources Amendment Act 2014 exclusively incorporated the small-scale fisheries sector. The new policy presents a significant move away from past management approaches, which

were characterised by technocratic, science-based and top-down decision processes, to one that advocates a community-orientated and participatory approach (Sowman et al, 2013). This policy defines small-scale fishers as "…*persons that fish to meet food and basic livelihood needs, or are directly involved in harvesting/ processing or marketing of fish, traditionally operate on or near shore fishing grounds, predominantly employ traditional low technology or passive fishing gear, usually undertake single day fishing trips, and are engaged in the sale or barter or are involved in commercial activity"* (Small-Scale Fisheries Policy, 2012).

The new policy is broader and inclusive of the subsistence fishers and takes into consideration fish workers who are involved in the pre-harvesting and the post-harvesting phases of fishing. The new policy proposes a step-by-step approach, from the declaration of a fishing community to the establishment of a legal entity to hold fishing rights, and formulation of criteria for individuals to gain and exercise their fishing right through the following principles:

- Creating a sustainable, equitable, small-scale fishing sector
- Securing the well-being and livelihoods of small-scale fishing communities
- Maintaining the health of marine ecosystems
- Providing for the upliftment of these communities by using appropriate support mechanisms, education and training, infrastructure and participatory management practices.
- Communities and Government co-managing near-shore marine living resources
- Taking fundamental human rights, MLRA principles and international obligations into account
- Giving due regard to promoting interests of women, disabled and child-headed households

With respect to the management of resources, the policy sets out requirements for the fisheries authority to undertake regular assessments of the state of resources, to identify

resources that can be allocated to this sector, and to develop holistic management plans. It proposes that a number of conventional fisheries management tools be applied to these fishing areas, such as total allowable catch (TAC), total allowable effort (TAE), closed seasons and bag limits; however, a fundamental difference is that resource will be issued in a form of a "basket" of species available adjacent or closer to the fishing community and resource users must participate in the relevant decision-making processes such as the identification of fishers to be issued with catch permits on behalf of the community (Sowman et al, 2013). Furthermore, the policy recognises that local contexts and environments will differ along the coast, and the management arrangements will need to be tailored to the particular context in the form of an adaptive approach. Each fishing community is required to establish a local co-management structure, which will serve as the means to manage local resources in partnership with the Government and other stakeholders, while maintaining the link with national resource management of key fisheries. Section 4 of the Small-Scale Fisheries Policy (SSFP) commits to a people-centred and community orientated approach to co-management. The Policy further sets out a model of co-management in which "*the Department and Small-Scale Fisheries Community will have shared responsibility for the management of the fishery*" and involves a "*participative process which promotes social equity, justice and the collective governance of marine living resources"*.

Accordingly co-management of the small-scale fishery will be characterised by the following features:

- Community orientation;
- Empowerment of Small-Scale Fishing Communities;
- Participation of Small-Scale Fishing Communities in developing, implementing and evaluating fisheries policies and management plans;
- Devolution of some management decisions to Small-Scale Fishing Communities;
- Inclusion (in decision-making on some management decisions) of provincial and local government; and
- Adaptive management approach

All of the above listed will require extensive community empowerment and local level knowledge generation in ensuring that the resource users are capable of participating in decision-making and executing the devolved responsibilities.

2.5 Small-Scale fisheries information needs and use

The small-scale fisheries sector is often characterised by resource depletion, poor economic returns, food insecurity and social and livelihood constraints. As much as small-scale fisheries have been neglected compared to other fishing sectors, the conventional management approach for this sector has not been beneficial either with its typical demands for and scientific data of which only a small portion is converted into information that is communicated and used in public decision-making (McConney and Charles, 2008).

In comparison to other fishing sectors such as the large-scale commercial fishing sector, historically, small-scale fisheries have received little attention within both international and national agendas (Gertjan et al*,* 2011). Gertjan et al, (2011) even argues that this has resulted in a general lack of coherent, reliable, and accessible information on small-scale fisheries. Due to this, a large body of information and knowledge about the commercial sector exists, to the extent that common complaints on lack of information about commercial fisheries as the reason for poor management measures leading to overfishing are now largely unjustified. However, the same cannot be said about small-scale fisheries as this has been an unknown sector since the early days of fishing. It has been noted that statistics reported by member countries to the FAO often do not include catches from small-scale fisheries (Jacquet et al, 2010; Chuenpagdee, 2006). This gap then hinders the formulation of well-informed relevant policies for this sector and in return, small-scale fisheries sector challenges are not well addressed. Kolding et al, (2012) notes that in order to diagnose situations and suggest mitigating answers, reliable data is key to this complex sector. He further notes that good governance requires informed understanding of biological and socio-economic systems and how they react and respond to different actions and that lack of quantitative long-term data will highly compromise the shifts to modern approaches in fisheries management such as EAF.

It has been acknowledged, however, that for the past 15 years, fishery management has been moving away from the conventional approach where fish stocks are independent units

that are assessed in isolation, with the key factor being the amount of fishing that a stock can sustain to achieve some optimum yield. However, due to modern approaches to small-scale fisheries management, more general questions arise within a wide field as there is increasing concern about the impact of fishing on the environment and, more generally, its effects at an ecosystem level and the socio-economic impacts towards users (FAO, 2003a; Graham et al, 2011). In the past, fisheries authorities have generally been collecting data with little direct involvement of the fishers. Based on the new approaches, this is no longer preferred as it is being recognised that the fishing industry as a key stakeholder should have a substantive role in the management process, including data collection (Graham et al, 2011).

The Ecosystems Approach to Fisheries comprises many elements that have to be considered and integrated in taking decisions. Therefore, in order for such decision to take place, information about different elements needs to be catered for in any information system in an effort to effectively manage fisheries resources through EAF. The modern approach also advocates participation of resource users in co-managing the resource and this then highlights a need for reliable data for resource users to be able to make meaningful decisions and properly plan and monitor their fishery system.

Typically, there is information that already exists in fishery systems, but has been under-utilised in fishery management and this is the accumulated information that has built up over many years by fishers and coastal communities through regular interaction with their environment. Researchers and scientists working in the small-scale fisheries sector do not always appreciate broad generalisations, claiming that natural and social systems are 'too complex', and that each small-scale fishing community is distinctively different from others (Chuenpagdee, 2006; Graham et al, 2011). Chuenpagdee (2006) further states that another common view is that small-scale fisheries are so different between countries that global, or even regional, definitions and comparisons are impossible, again implying uniqueness for each individual fishery.

The problem with these notions, which often appear convincing at first sight, is that in effect they tend to further marginalise small-scale fishers as the need to start building information for this sector is seen as an unnecessary and impossible initiative due to its uniqueness, and

of which this sector is already disadvantaged by physical, socio-economic, political and cultural remoteness from urban centres (Pauly, 1997; Berkes, 2003). Therefore, the very same reason that is meant to prioritise small-scale fisheries has further marginalised this sector. Small-scale fishing communities in developing countries often operate in areas located away from political power and interests. They generally lack landing facilities and other infrastructure and direct access to markets (Graham et al, 2011). Compared with the large-scale industrialised fishery sector, the small-scale sector usually receives far less support from the governments. Also the lower economic status of small-scale fishers marginalises them further, and undermines the political power that, in democracies, their numbers would ensure (Pauly, 1997).

At the onset, an attempt to counter this marginalisation of small-scale fisheries would be to include an amount of research, and a data collection effort, comparable to that devoted to large-scale fisheries, to enable aggregation of information of similar magnitude. This would help not only to provide a quantitative framework for the sociological and anthropological work performed so far (Pauly, 2006a), but also to allow for comparative analysis of social and economic contributions of the two sectors, as well as their relative impacts on marine and coastal ecosystems (Pauly, 1997; Berkes, 2003).

For any IMS, there are key indicators that are associated with information it contains for the system to be effective (Staples et al, 2004). These indicators include information needs, data collection, data and information management, data analysis, and information dissemination (Berkes et al, 2001). Information needs should include harvesting and catch, processing, marketing, aspects of the fishing community and other relevant activities. It is said that these types of information needs should also be embedded in the authority's planning cycle for easy monitoring of small-scale fisheries (Staples et al, 2004). Data on catch per species per fishing area, fishing effort, and profit sharing and measure of economic change within fisheries are the basis for a fisheries information system aimed at improving efficiency in co-management arrangements (Ramirez-Rodriguez, 2011). Seriousness on lack of data and proper knowledge management systems is also confirmed by the limited amount of literature on this and therefore makes it an urgent matter that will need to be addressed as a priority by all the relevant fisheries stakeholders in order to ensure that small-scale fisheries are adequately managed.

2.6 Current State of available data on Small-Scale Fisheries within the Fisheries Authorities in South Africa

In South Africa, It has been argued that, in addition to the type of management approach, lack of information has been one of the major contributing factors that saw previously-disadvantaged-by-apartheid fishers being even further marginalised by a process that sought to solve the problems of imbalance. This was seen when the Marine Living Resource Act, 1998 failed to recognise that subsistence fishers were not fishers who used the harvest as a source of food only but also used the resource as a means of survival through trading for profit and also for livelihood purposes. Though the democratic government in 1999 decided to appoint a task team, the Subsistence Fisheries Task Group (SFTG), to investigate the newly identified fishery sector known as the subsistence fishery, the type of information collected for drafting recommendations for this newly recognised sector has never been utilised as a baseline data for management purposes. It has also been noted that certain basic socio-economic, cultural and institutional data was missing from this data set and did not adequately reflect the reality on the ground. Sunde et al, (2010) and Sowman (2006) argue that even the approximate number of fishers identified by the SFTG is likely to have been underestimated as the SFTG report reflected that there are no subsistence fishers in the Western and Southern Cape (Sowman, 2006). To date, lack of information has been seen as an additional challenge in managing small-scale fisheries in South Africa.

In the Eastern Cape, the issuing of exemptions in terms of section 81 of the MLRA has seen many challenges. Currently, there are 85 fishing communities that have been issued with 4141 yearly fishing exemptions from Mzamba to Mossel Bay and these exemptions are distributed by four DAFF Environmental Officers based in Port St Johns, East London and Port Elizabeth. Before the Environmental Officials issue exemptions, they are obligated to formulate criteria that would be used to determine deserving fishers to be issued with exemptions. A challenge with this is that even the criteria are formulated without proper consultation and that the criteria are not based on any available data. Instead, the criteria are made stricter as the number of fishers applying for exemptions increases. The criteria are currently viewed as a tool to regulate or limit the number of exemptions issued regardless of the number of fishers who truly deserve to be issued with exemptions.

When the exemptions are issued, conflict on who deserves to be issued with an exemption is usually evident to an extent that the relationship between the fishers and the DAFF Environmental Officials is at risk. For the past 13 years, the fishing authority has had little information on how many fishers have been issued with exemptions and who has been issued these exemptions and the criteria used to identify deserving fishers is currently based on no fishery and socio-economic data. An example of this is also seen in the Eastern Cape where in 2010 available data was mostly in hard copies as electronic data was stored in different computers used by different Environmental Officers. Up to date, most of the information has been lost due to crashing computers and due to high staff turnover. This, therefore, means that management arrangements are not based on any meaningful data and that the authorities lack records of their primary stakeholders.

Projects such as the recent Abalone Experimental Project which is meant to investigate distribution size of abalone in the Eastern Cape and involve fishing communities along the coast has also attested to the fact that lack of a proper information system continuously causes management problems. During the implementation of the project, the Small-Scale Fisheries Management Directorate had to register a list of all fishers who were involved in previous abalone projects in the Eastern Cape. Due to the unavailability of such data, more than 90% of the fishers registered did not meet the criteria for being included in the register. In addition to this, most of the captured information has been in hard-copy form, much of which has been damaged beyond use.

Previously, catch-data monitoring was implemented by the data monitors that were appointed by the fisheries authority and the data was submitted in the form of hard copies. This data was never analysed due to the poor quality and its format. The authority then outsourced this function and subsequently the data quality improved. However, analysis of this data has never been used to address the current prevailing socio-economic issues, overfishing and fishing behaviour in the fishing communities and this data has never been presented to fishing communities for their input. Authorities are planning on taking this function in-house in future but the main concern at the moment is the fact that there is currently no information system that would ensure such data is properly captured and analysed for decision-making by co-management structures within these fishing communities.

Due to this, implementation of the approved Small-Scale Fisheries Policy, which advocates co-management, will be highly compromised if there is no plan to formulate an Information Management System which will be used to implement, monitor and manage this fisheries sector. In the implementation of a new resource-management program, feedback on its performance is essential in evaluating its effectiveness, and adapting management responses to ensure that its goals are being met.

There is one lingering question that needs attention: how do fishery authorities monitor and provide evidence illustrating that policies and guidelines in managing this complex, multi-species, people-centred sector meet its objectives of human, economic and resource sustainability and that the resource users are able to take part in actual decision-making?

2.6.1 Similar Information systems used internationally

In order to understand how South Africa's lack of data and/or poor data processing can be addressed it is useful at this stage to review a few selected fisheries information systems used internationally. Similar information systems used internationally will indicate what South African needs to consider, but take into account the unique nature of the South African fishery.

In Poland, the Fisheries Management System is supported by two software systems, that is the Sea Fisheries Information System (SFIS), which is managed by the fisheries authorities, and the NPZDRpl system which is managed by an organisation by the name of the Sea Fisheries Institute. The first system contains basic operational information such as fishing vessel registers, catch and landing by weight, catch compositions and vessel trips.

The Polish SFIS consists of the following components:

- Fishing Vessel Register (FVR)
- Quota Management System (QMS)
- Vessel Monitoring System (VMS)
- Report and Statistics (RS)
- Administration (ADM)

The above components are integrated in such a way that running of reports is easily achieved. The integration between these SFIS components is performed through the

shareable structure of relation database based in Oracle platform and data interchange interface linking database servers. Furthermore, this system is also linked to other national databases related to environmental management such as other VMS and LES (land earth station in INMARSAT - satellite system).

The second system, NPZDRpl, contains information especially important for decision-makers who manage the property rights. All owners of vessels are legally obliged to deliver to the Sea Fisheries Institute their economic statement (by questionnaire) for previous seasons until March of the following year. The questionnaire was designed to investigate an economic performance of fishing vessels. NPZDRpl was implemented on an IBM server and plugged into the SFIS computer network. It uses Windows as its operating system and MS SQL Server 2000. Row data are stored in SQL Database and then transform to averages per vessel as well as aggregated for each segment. More sophisticated calculation is run using MS Access or MS Excel. The database has the possibility of exporting data to Excel or Access software so it will be possible to link information from NPZDRpl with that provided by the SFIS database. A second IBM server is plugged into the SFIS computer net to prepare infrastructure for web services (Mirosława Marciniak, 2011).

Along the Pacific coast of the USA, the main of objective was to create a comprehensive database that would ensure that resource managers have access to any combination of environmental, species, fishery, or human-use data according to specified attribute and spatial queries. Fisheries and coastal spatial data from various agencies in California, Oregon and Washington were collected by the United States Geological Surveys and compiled into a single GIS database. This data was packaged into ArcMap to allow GIS users to be able to make spatial selections and view associated data more simply. In addition to other databases such as commercial, sports, surveys and fish-count databases, the seabird and marine mammal distribution data from California were also included. This fully-integrated GIS database provides a detailed summary of the most up-to-date resource use, which includes fisheries and human-use, and allows marine resource managers the capacity to analyse the data for decision-making. Commercial and Sport fishing data in California, Oregon, and Washington are stored as tabular data. Although the data has a spatial component (e.g. catch location), state agencies use the data for statistical analysis outside of a Geographic Information System. In order to tie this data to actual geographic locations,

the data is placed on ESRI File Geodatabase. The geodatabase structure allows for catch location identifiers inside the data to be associated with spatial features through use of relationship classes. All of the feature classes and data tables organised inside the geodatabase can then be displayed inside an ArcMap document, and the data queried through spatial or attribute selections (Takekawa et al, 2009).

In the Solomon Islands, the Fisheries government partnered with a US-based company by the name of Point 97 to develop a new mobile software application that improves the ability of surveyors to record fish landed. After the Ministry of Fisheries and Marine Resources recognised that there was increasing pressure on fishing stocks due to lack of management approach and increasing population depending on fishing, government began working in cooperation with the United States Agency for International Development's (USAID) funded Coral Triangle Support Partnership (CTSP). Through the CTSP program, the Solomon Island government partnered with Point 97 to build a mobile application and web-based platform built on existing Point 97 mobile data management platform technology. This application known as "Hapi Fis" was aimed at helping to chart a balanced approach to managing declining fish stocks, addressing food and economic security and enabling efficiency in domestic markets. Through use of this application, paper reports were replaced and hence optimised time, improved accuracy for data entry, and minimised resources and related costs to process and analyse data. The authorities were able to capture data and analyse it to make meaningful decisions. The information collected in the field is instantaneously transmitted back to authorities via cellular or wireless connections, allowing the generation of up-to-date reports on demand (Point 97, NA).

Though these countries may have progressed in terms of using information management systems to manage fisheries resource, they still have not focused on feeding back the information to the resource users. From the above scenarios, resource users are not in a position to contribute meaningfully to decisions as they do not have information at their disposal. Therefore, as much as accurate information is important, dissemination of this information must be a priority specifically to the fishers. The overall purpose of this study will therefore outline the current challenges faced by small scale fishers and how these challenges can be resolved through EAF and co-management approaches and how IMS can be used as a tool to further improve the management of the small scale fishing sector

through the above-sated management approaches. This will be looked at in terms of transitioning from the current dispensation to the new small scale fisheries sector outlined by the long awaited small scale fisheries policy.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

The purpose of this chapter is to outline the methodology that has been used in this study. This chapter highlights the type of research that has been adopted and how qualitative and quantitative data has been sourced through case studies, participatory meetings within the Department of Agriculture, Forestry and Fisheries (DAFF) as well as access to catch monitoring programs and related records. This chapter also illustrates chosen case study sites, how the case studies were conducted and how the data was used in relation to the aims and objectives of the study.

3.2 Action Research Approach

An action research was carried out for this study. Action research involves the process of actively participating in an organisation's changing situation whilst conducting research. Action research can also be undertaken by larger organisations or institutions, assisted or guided by professional researchers, with the aim of improving their strategies, practises and knowledge of the environments within which they practise. As designers and stakeholders, researchers work with others to propose a new course of action to help their community improve its work practises (Reason, 1995). Currently, the researcher is employed by the Fisheries Authority and tasked with inter alia the development of a small-scale fisheries database. As such, he is in a unique position to undertake this action-orientated research. The researcher has been in constant interaction with small-scale fishers in four coastal provinces and such relationship has aided in the study.

Through the action research, the study was conducted in two distinct phases. Firstly, a draft Small-Scale Fisheries IMS was designed and developed, secondly the researcher analysed the current catch data captured by a service provider contracted by DAFF. The purpose of this was to assess the quality of data and how it can be improved to be in line with the designed IMS for improving co-management arrangements in small-scale fishing communities.

3.3 IMS design and implementation

3.3.1 Database Design

A database was designed based on Microsoft Access 2010. This was done by designing data forms which were used to capture data on Microsoft Access. Once the data forms were

designed, Microsoft Access database was then populated with data from previous years and updated data was captured through data recordings captured by the Department of Agriculture, Forestry and Fisheries' Environmental Officers. Microsoft Access database was then connected with the ArcGIS 10.1 where the database was used as attribute data source for ArcMap. ArcGIS 10.1 licence was secured through the Department of Agriculture, Forestry and Fisheries and categories of shapefiles were created. The design and development of the database is explained in greater detail in Chapter 4.

3.3.2 Data Sources

a) Quantitative data

The Directorate: Small-Scale Fisheries Management within the Department of Agriculture, Forestry and Fisheries (DAFF) registers identified small-scale fishers annually to issue annual exemptions in terms of section 81 of the Marine Living Resources Act 18 of 1998. The type of data collected during this registration process is mainly names of fishers, identity numbers of fishers and type of species applied for. In an effort to gather broader data, the researcher developed a baseline form on Microsoft access for DAFF officials to collect additional information such as personal, social and economic information per small-scale fisher and social and economic data per small-scale fishing community. Further to that, DAFF had appointed a service provider that recorded catch data throughout the Eastern Cape coastline, and more recently in the Western Cape as well. Along the Wild Coast of the Eastern Cape, this service provider was also responsible for capturing records of harvested and sold East Coast Rock Lobster (*Panulirus homarus*) by small-scale fishers.

Once the IMS was populated with data, the ECRL data was used in a desktop research-type case study towards assessing and evaluating the use and need for improvement of the data. Subsequently the researcher analysed the quality of data recorded and for catch data monitoring in Doringbaai and presented the data to a community fisher structure to assess its potential contribution in strengthening the co-management process.

b) Qualitative data

Qualitative data was sourced from focus groups, semi-structured interviews in the case study site in Doringbaai and participation in workshops. Participation in DAFFs meetings and workshops was also a source of qualitative data as perception on the Small-Scale Fisheries Policy and the Implementation Plan within the broader fishing industry was ascertained. At

the same time the researcher was able to continuously evaluate data needs and requirements for the IMS. Feedback that was received from the case study sites was also used as qualitative data that contributed to the analysis of the case study results for the research.

3.4 Case study sites

There were two case study sites that were explored. Firstly, the researcher analysed catch data which included analysis of line fish, WCRL, and effort data for Doringbaai landings. Secondly, the researcher analysed ECRL data of the landings from Wild Coast region of the Eastern Cape to determine the quality of data collected and the requirements for its improvement.

3.4.1 Case Study Site One:

The first case study was at Doringbaai fishing community where catch data was analysed and presented to an existing community co-management structure. Semi-structured interviews and participation in workshops took place and the outcomes were used to assess if the current data is in line with the proposed management approach and the designed IMS. Figure 3.1 illustrates fishing communities in the West Coast of the Western Cape Province. The figure specifically illustrates case study site one which is Doringbaai.

3.4.2 Case Study Site Two:

The second case study included Eastern Cape's East Coast Rock Lobster fishery data captured by the catch-data monitoring service provider contracted by DAFF. The data included data from fishing communities along the Wild Coast of the Eastern Cape where there are small-scale fishers harvesting and selling East Coast Rock Lobster to registered buyers (Figure 3.2). The researcher analysed the East Coast Rock Lobster data by assessing how easy it is to capture data, identify missing indicators and recommendations that would assist in improving IMS and potential use by the fishers and fisheries managers.

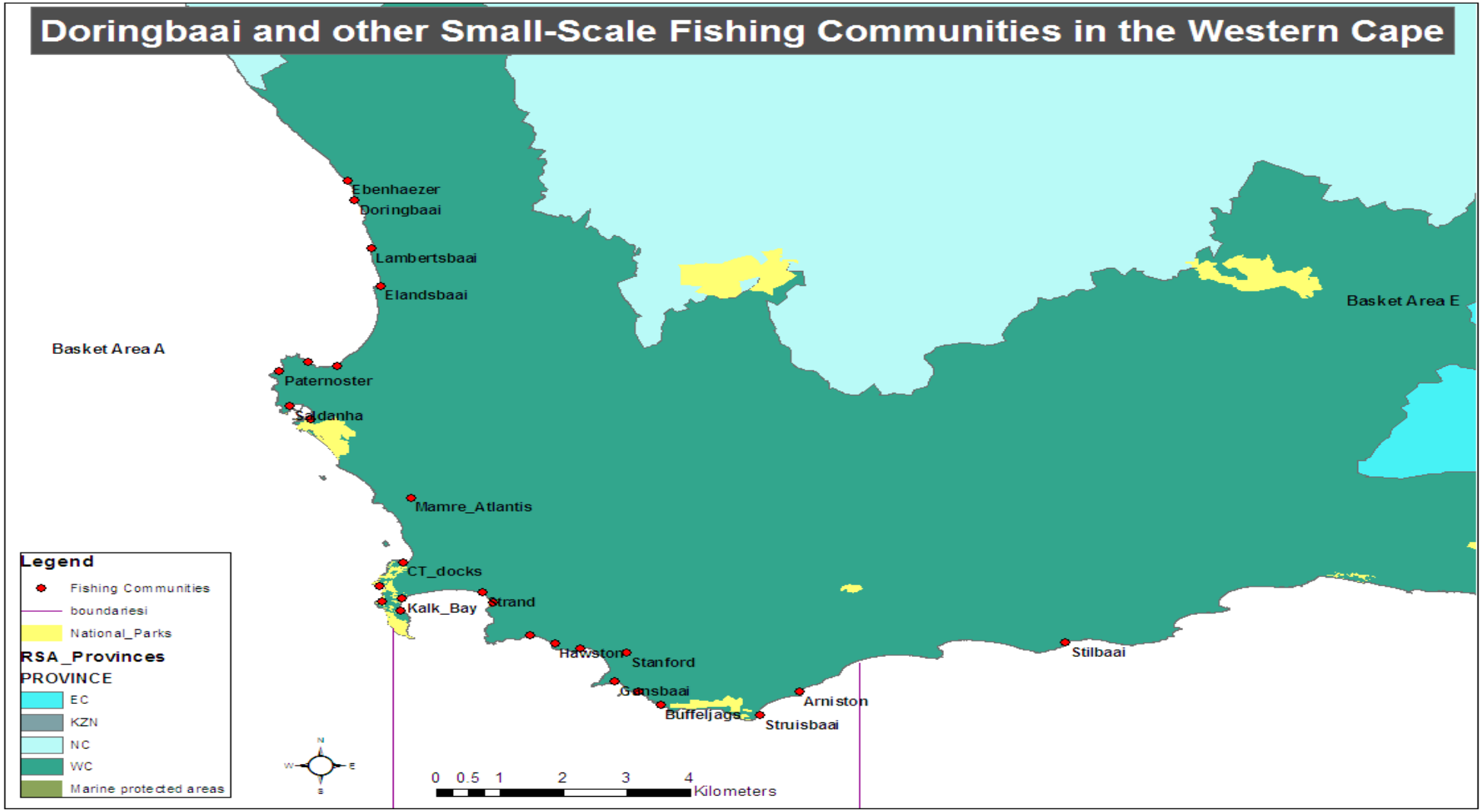

Figure 3.1: Showing Doringbaai small-scale fishing community and other small-scale fishing communities in the Western Cape.

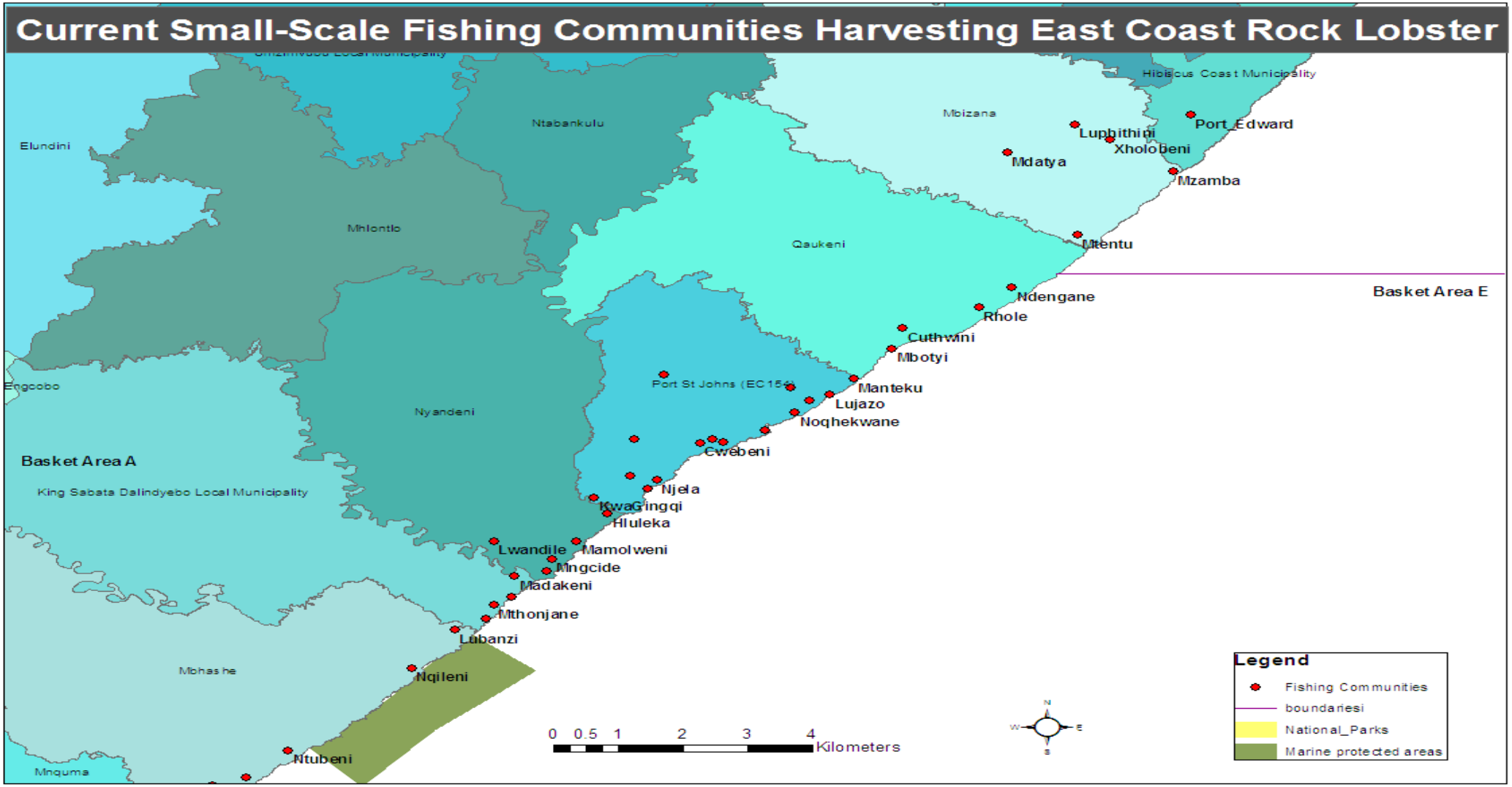

Figure 3.2: Small-scale fishing communities harvesting East Coast Rock Lobster from Ntubeni to Mzamba on the Wild Coast

CHAPTER FOUR: CONCEPTUALISING AND DEVELOPING THE INFORMATION MANAGEMENT SYSTEM

4.1 Introduction

In the past, the then branch of Marine and Coastal Management under the Department of Environmental Affairs and Tourism (DEAT), and now the Fisheries branch under the Department of Agriculture, Forestry and Fisheries (DAFF) has been managing subsistence and small-scale fisheries in a manner that never took into consideration the importance of data management for more informed decision-making. Important data collected in the past has been underutilised and that has caused many challenges for the Department in all the provinces that could have perhaps been prevented. Currently, data is located on different laptops and desktop computers belonging to individual officials in different provinces. This means that there is no centralised master database that would be used holistically in all provinces. Some of the data has also been kept in hard copies and most of these have been damaged beyond use.

The above situation has resulted in DAFF having to make decisions without proper data informing such decisions. An example of this has been seen where a number of fishers have been issued exemptions in terms of the MLRA in the Eastern Cape without proper analysis of the capacity of the marine resource and feeding back such information to the fishers. The number of exemptions issued annually has been increasing for the past few years and there is no fishery data supporting reasons for such an increase. In the Western Cape and Northern Cape, Interim Relief dispensation has been known for its problems that ranged from having a list of non-fishers being issued exemptions over *bona fide* fishers due to lack of a data system that could be used to verify potential fishers. Many of these challenges cause mistrust and tension between DAFF and the fishers as the fishers are not informed of the basis of certain management decisions taken by DAFF.

The “shift in perspective” for the small-scale sector through the Small-Scale Fisheries Policy, takes a community-orientated, participatory, adaptive approach to fisheries management, aiming to tackle non-compliance by addressing its root causes, namely the lack of equitability that continues to plague the sector. In any implementation of a new resource-management program, feedback on its performance is essential in evaluating its effectiveness, and adapting management responses to ensure that its goals are being met (Sowman et al, 2013). Though the Small-Scale Fisheries Policy advocates co-management and an Ecosystems Approach to Fisheries Management, availability of data and practical

analysis and dissemination of such information is important for co-managing the marine resource and ensuring that all the ecosystem elements are considered when decisions are to be made by the co-management structures. Despite this, to date very limited data analysis and feedback has taken place, most notably due to the lack of an integrated information-management system. This has been recognised by the fisheries authority and other affected stakeholders. Section 7 of the Small-Scale Fisheries Policy states that the fishing authorities will have to put in place a monitoring and evaluation system to ensure that useful, reliable, and timely feedback is provided to the department and other relevant stakeholders. It further states that this system should also monitor risk areas and adequacy of support services and environmental issues, performance information recording and management, periodic qualitative monitoring of fishers in order to examine processes and problems and qualitative assessments of the impact of the policy on people living in the focus areas.

In an effort to come up with a tool that would integrate the available data and accommodate much needed additional data that would improve small-scale fisheries management as per the Small-Scale Fisheries Policy, the researcher designed a concept for an Information Management System (IMS). The vision for the IMS is for it to become a tool that can be used by fishery managers and community fishers towards the successful implementation of the long awaited Small-Scale Fisheries Policy in South Africa.

4.2 Conceptualisation and Development

As a means of introducing the idea to DAFF, the researcher organised and facilitated two workshops in the Cape Town Fisheries Branch head office with the Directorate: Information and Communication Technology in order to conceptualise the system, decide on a software platform, and assess data sources and database needs. The ICT staff from DAFF provided advice on design with the aim of ensuring compatibility of the IMS with other long-term plans for commercial fisheries management information systems. It was, however, decided that a small-scale fisheries system needed different specifications and that it should be run separately as the current Marine Administration system (MAST) and future plans of the commercial fisheries systems are not in line with the needs of the small-scale fisheries management approach.

4.2.1 Current available data

The researcher collated data that is currently available from different computers of Environmental Officers within DAFF. This data itself has been collected through the following activities and processes that occur on an annual basis:

- **Annual registration of fishers**: As has been noted above, DAFF issues annual exemptions to registered fishers throughout the four provinces. The process that DAFF follows is one whereby Environmental Officers facilitate meetings in each and every fishing community that has been identified as being eligible for the issuing of exemptions in terms of section 18 of the MLRA. The purpose of the meetings is to inform the fishing communities of the criteria for a person eligible for an exemption and also to register fishers based on the criteria presented (Annexure 1). Information needed for registration consists of: full names, identity number and species applied for per fisher. This information is then used to generate exemptions that are issued to registered fishers by DAFF officials.

  The researcher has collated all the registration lists from KwaZulu-Natal, the Eastern Cape, the Western Cape and the Northern Cape for 2010. This data reflects that there were 119 fishing communities with 6200 fishers harvesting line fish, sand prawns *(Callianassa kraussi)*, brown mussels *(Perna perna)* and bait species in KwaZulu-Natal; line fish, East Coast Rock Lobster *(Panulirius homarus)*, Brown mussels, Oysters and bait species in the Eastern Cape and line fish, white mussels *(Donax serra)*, West Coast Rock Lobster *(Jasus lalandii)* and net fish species in the Western Cape and Northern Cape.

- **Catch Data Monitoring project:** A Catch data monitoring project was initiated by DAFF in 2010 where service providers were appointed to record catch landings for interim relief fishers in KwaZulu-Natal, the Eastern Cape, the Western Cape and the Northern Cape. DAFF appointed different service providers for each province and their main objective was to record catch landings of the above-stated species per province.

  In KwaZulu-Natal, the project was implemented by the provincial government agency Ezemvelo KZN Wildlife. Each official is given a stretch of the coastline to

monitor using standard monitoring sheets. The data is submitted to the Department already analysed and there have been challenges with regard to how the data is submitted as DAFF does not have raw data to analyse. Therefore, the researcher does not have a complete set of data for KwaZulu-Natal catch landings.

There are two monitoring sheets that are used by catch data monitors monitoring catches of the fishing communities (Annexure 2). These monitoring sheets are for biological samples for all species and monthly samples for brown mussels. The monitors have to monitor any person fishing, noting if that person has a commercial permit, an exemption or neither and whether that person is a recreational fisher or small-scale fisher. The data is submitted to DAFF on a monthly basis in the form of spreadsheets.

In the Western Cape and the Northern Cape, for the past years there has been a change in service providers and there have been different monitoring techniques from all the previous service providers which has resulted in inconsistency regarding the quality of data and indicators thereof. Data for 2013 and 2014 improved in quality and accuracy as each and every allocation landed was accounted for by the service provider. This data is collected by monitors who are stationed in landing sites where the monitors are issued landing books and monitoring sheets to monitor all the landed fish and the data sheets are based on those in the Eastern Cape. For West Coast Rock Lobster, the monitors are required to monitor the allocation that is issued to each and every fisher within a fishing community. The monitor has to monitor the balances of the total allocation issued to each fisher by issuing landing slips to the fisher and the person who buys the West Coast Rock Lobster from that fisher, leaving the other landing slip in the landing book. The landing books are then used to ascertain balances per fisher and per community. The monitoring company then submits catch data reports for West Coast Rock Lobster on a weekly basis. Other species such as line fish, red bait and white mussels are also monitored but the emphasis is not given to them to a lesser degree hence there is very limited data on these species in the Western Cape and the Northern Cape.

- **Export Data**: In the Eastern Cape, the Western Cape and the Northern Cape, fishers are issued with East Coast Rock Lobster *(Panulirius homarus)* and West Coast Rock Lobster (*Jasus lalandii*) exemptions respectively and they harvest and sell to

exporting companies. Since DAFF sets the TAC for these exemptions, the TAC is further monitored through monitoring the amount of Lobster exported per fishing season. The researcher created a spreadsheet that would monitor exported lobster and further compares it with the total allocation issued and landed per fisher. This data is updated when an application to export lobster landed by exemption holders is processed and approved.

From the above activities and processes the following data sets have been compiled by the researcher:

Table 4.1: Illustrating current list of datasets

KwaZulu-Natal	**Eastern Cape**	**Western Cape and Northern Cape**
List of identified fishing communities	List of identified Fishing communities	List of identified fishing communities
List of verified fishers	List of verified fishers	List of interim relief fishers
List of species harvested per fishing community	List of species harvested per fishing community	List of species harvested per fishing community
List of species harvested per individual	List of species harvested per individual	List of species harvested per individual
List of Local co-management members	List of East Coast Rock Lobster buyers	List illustrating balance of allocation per community
Catch data monitoring program	List of East Coast Rock Lobster fishers	List illustrating balance of allocation per individual
	Biological data on species harvested per day	List of companies exporting allocation caught by interim relief fishers.
	Monthly data for brown	Catch data monitoring

	mussels	program
	Local Co-management meetings list and schedule	List of external stakeholders such as NGOs in the Western and Northern Cape
	Fishers' list for various projects. E.g. Abalone Experimental project	List of fisher representatives

4.2.2 Microsoft Access (DATABASE)/Data collection and storage

Microsoft Access 2010 has been used to set up a non-spatial database which comprises information on identified small-scale fishing communities. This has been done by standardising and importing all the datasets that have been available for the past years from Microsoft Excel and Microsoft Word to Microsoft Access. In order to ensure that socio-economic data about the small-scale fishers and their communities is captured, data-gathering forms were developed (Annexure 3). The forms were presented to the Director of Small-Scale Fisheries Management within DAFF for endorsement. During the preparations to issue exemptions in 2011, a verification and registration process was used to collect individual fisher data and community data using a form designed by the researcher. The form requested information from each fisher such as gender, ethnic group, number of dependents per fisher, primary source of income, acquired skill, disability, species harvested etc. Community information included information for each fishing community and information such as type of species harvested per fishing community, list of activities adjacent to the fishing community, support that has been provided to the fishing community, needs analysis, etc.

The researcher conducted training on the use of Microsoft Access for capturing information about individual fishers and information about fishing communities. The training was for all the Small-Scale Fisheries Management Extension Officers in Port St Johns, East London and Port Elizabeth offices. The training was further conducted for recording information on Microsoft Access by Extension Officers. Information from 118 fishing communities and 5363

fishers was recorded from October 2011 to October 2013. When all the information was recorded on the designated form, a capturing form (Annexure 4) on Microsoft Access was designed and all the data was captured on the Microsoft Access database.

Other information such as a list of external fishing stakeholders, a list of marine species harvested, a list of municipal Local Economic Development Officials along the coast, a list of East Coast Rock Lobster buyers etc. were developed and captured on Microsoft Access as inventories. All these tables of data were then further related on Microsoft Access to ensure that reports can easily be run without having to use multiple tables with the same information.

The following diagrams (Figures 4.1 and 4.2) show examples of the various sources of information that are captured in the integrated database as well as a snapshot of the IMS as a Microsoft Access Database:

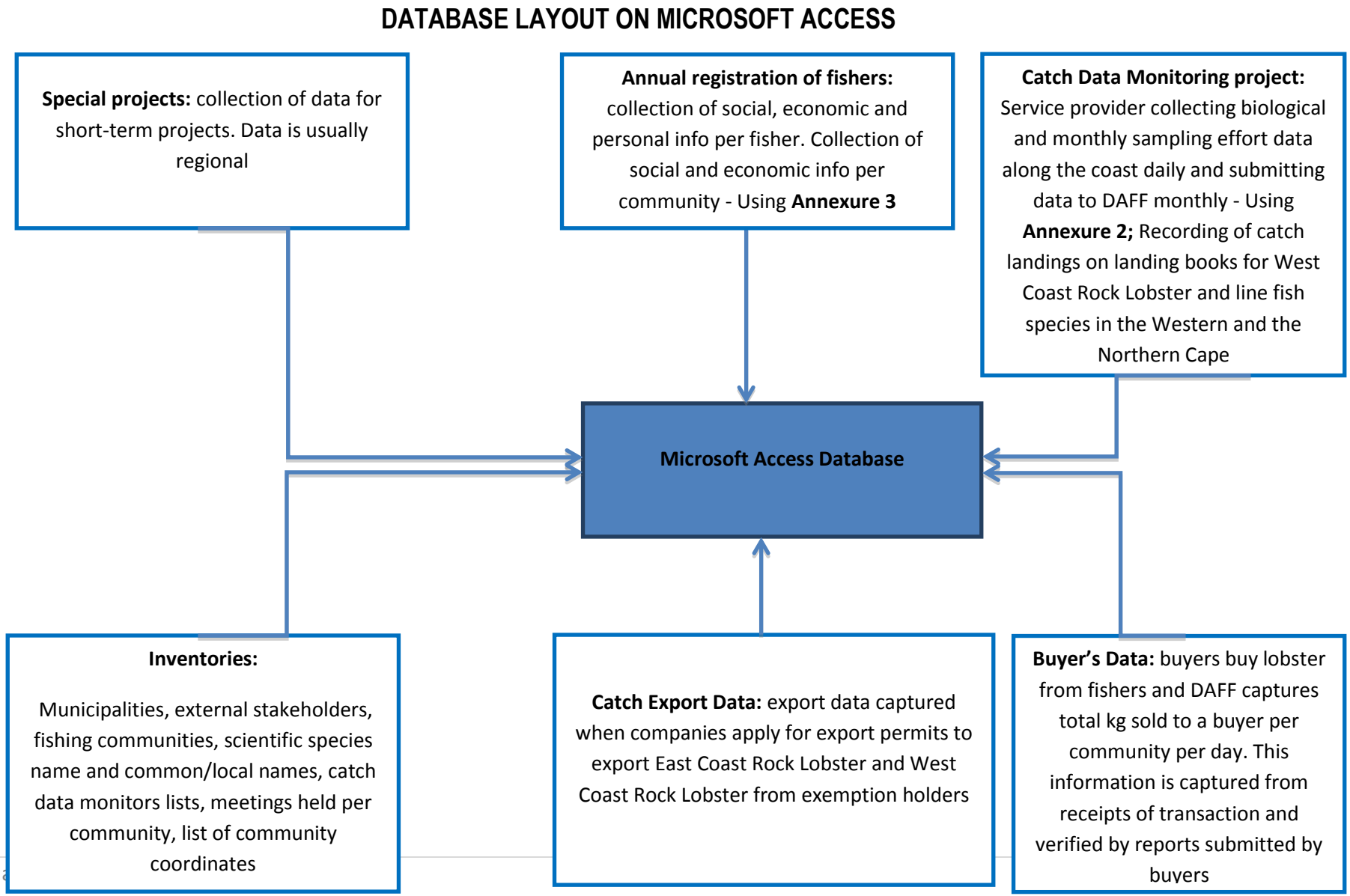

Figure 4.1: Illustrates Information sources for the SSF IMS and database mapping

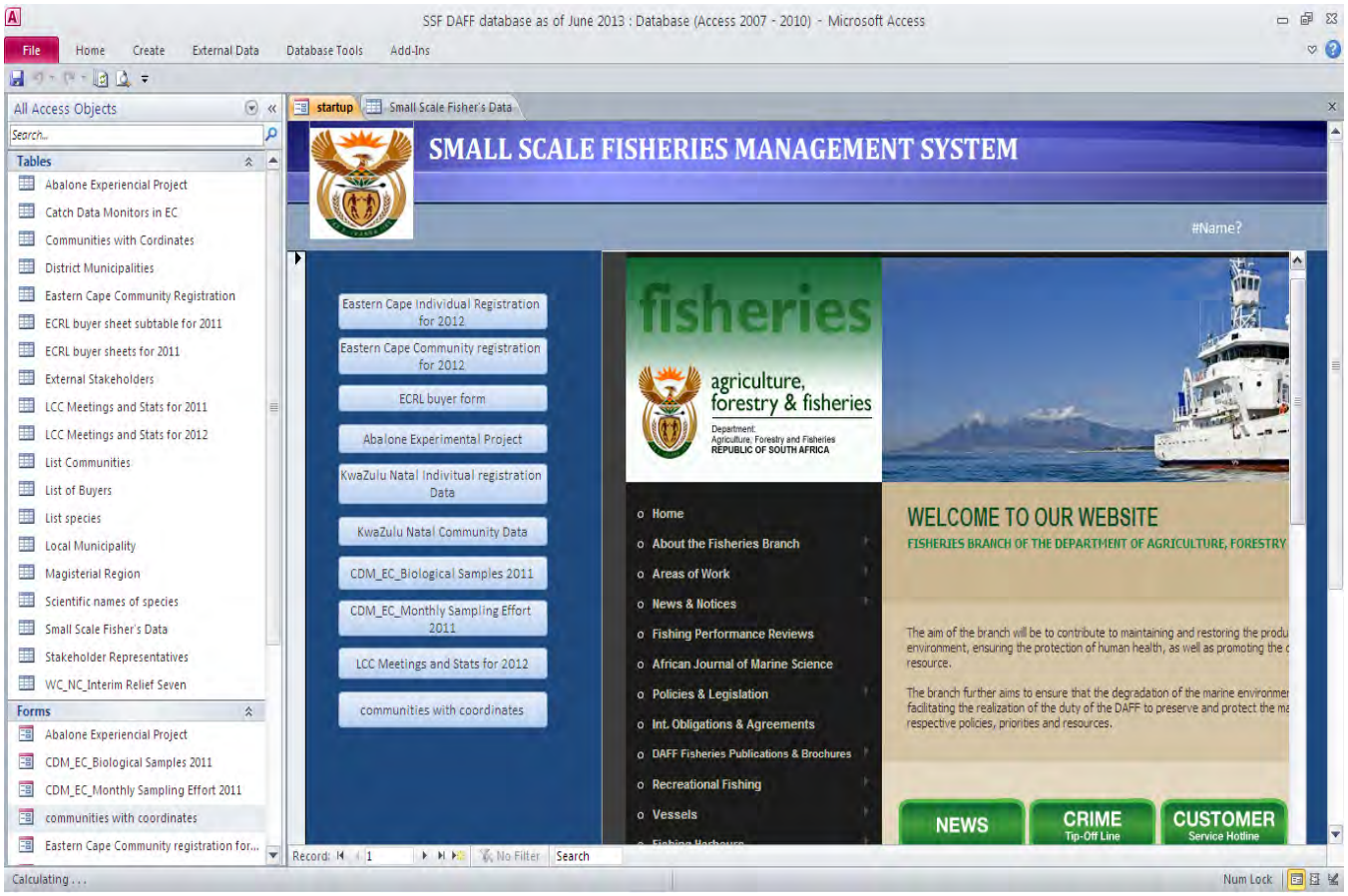

Figure 4.2: Snapshot of the IMS as a Microsoft Access Database

Besides using the Microsoft Access database to run queries and extract reports for the small-scale fisheries sector, the database has also been connected with the spatial data base. This further aids in the analysis of data. This has been done by connecting Microsoft Access with ArcGis and with Quantum GIS and using the database as an attribute data which is easily interpreted into spatial visualisation by categorising the shapefiles related to the data.

4.2.3 SPATIAL DATA

Since 2002, the Directorate: Small-Scale Fisheries management within DAFF has not had in place any spatial data related to small-scale fisheries. In order to set up such spatial data, the researcher had to secure a spatial software licence by the name of ArcGIS 10.2. The research then captured coordinates of identified communities in the Eastern Cape and acquired coordinates of KwaZulu-Natal identified fishing communities from the provincial KwaZulu-Natal Ezemvelo Wildlife and Western Cape coordinates from the University of Cape Town. Using ArcGIS 9.2, 10.1 and Quantum GIS, shapefiles were created. A list of all the

fishing communities and their coordinates was then generated. Different government departments and government organisations were approached to source different shapefiles that are related to coastal communities. The following shapefiles were acquired:

- Provinces;
- Municipalities;
- South African Land cover;
- South African population;
- Marine Protected Areas
- National Parks;
- Rivers
- Catchment areas
- Population density;
- Government grant pay points;
- Poverty Index;
- Unemployment;
- Potential labour force;
- South African market fresh produce;
- Roads; and
- Rivers

Though the above shapefiles were generally for the whole of South Africa, such information is key to managing small-scale fisheries as it reflects socio-economic and ecological status of the coastal areas. Through the above shapefiles, it can be seen where highest percentage of unemployment is more prevalent and which small-scale fishing communities are mostly affected by this. Shapefiles on the poverty index could also indicate fishing communities that are prone to poverty in South Africa. Figures 4.3 and 4.4 overleaf visually Illustrate the unemployment trend in South Africa and the poverty index and where the current small-scale fishing communities are located in relation to unemployment and poverty per municipality.

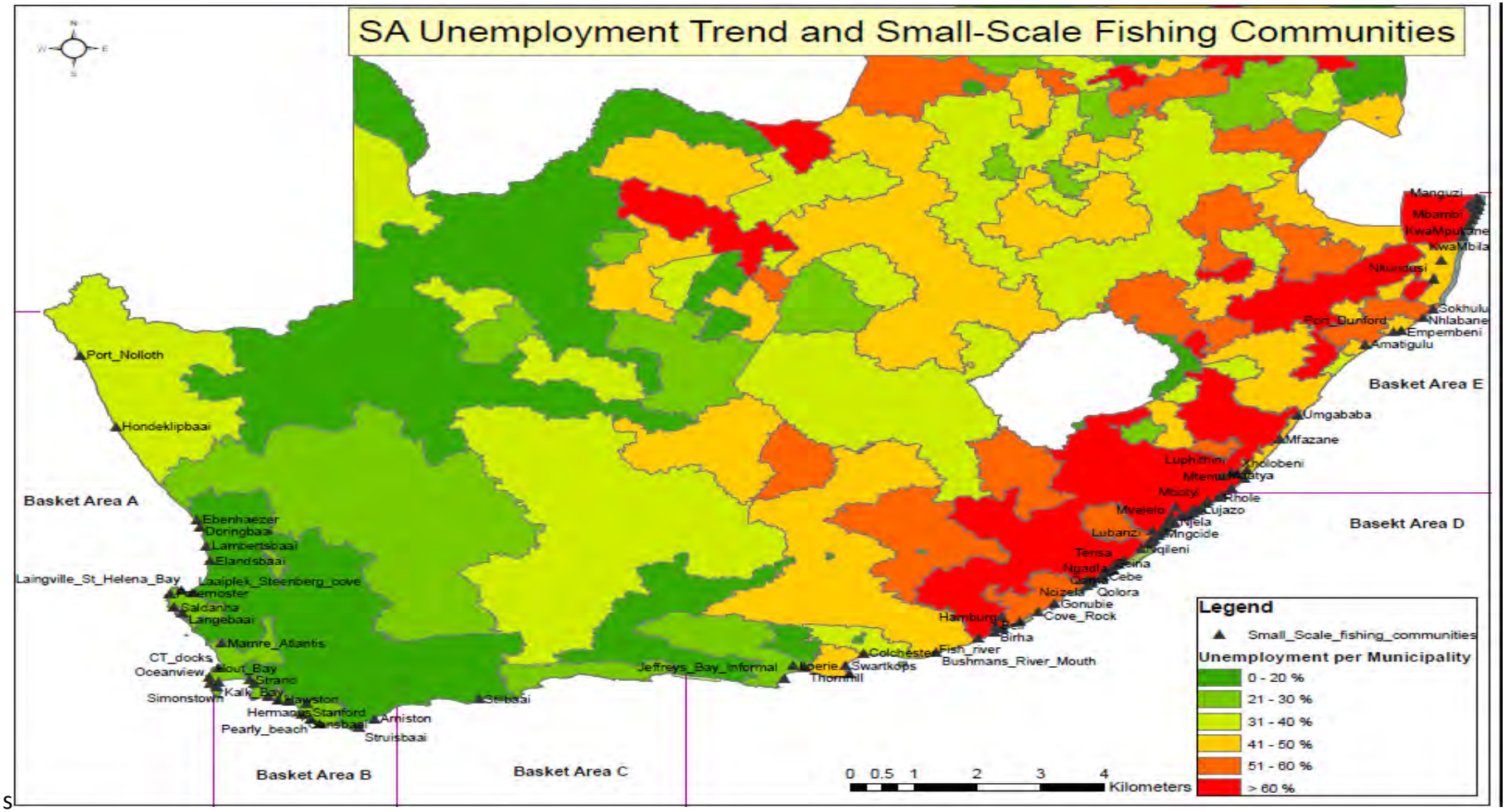

Figure 4.3: Illustrating unemployment trend in South Africa and where the current small-scale fishing communities are located in relation to unemployment per municipality

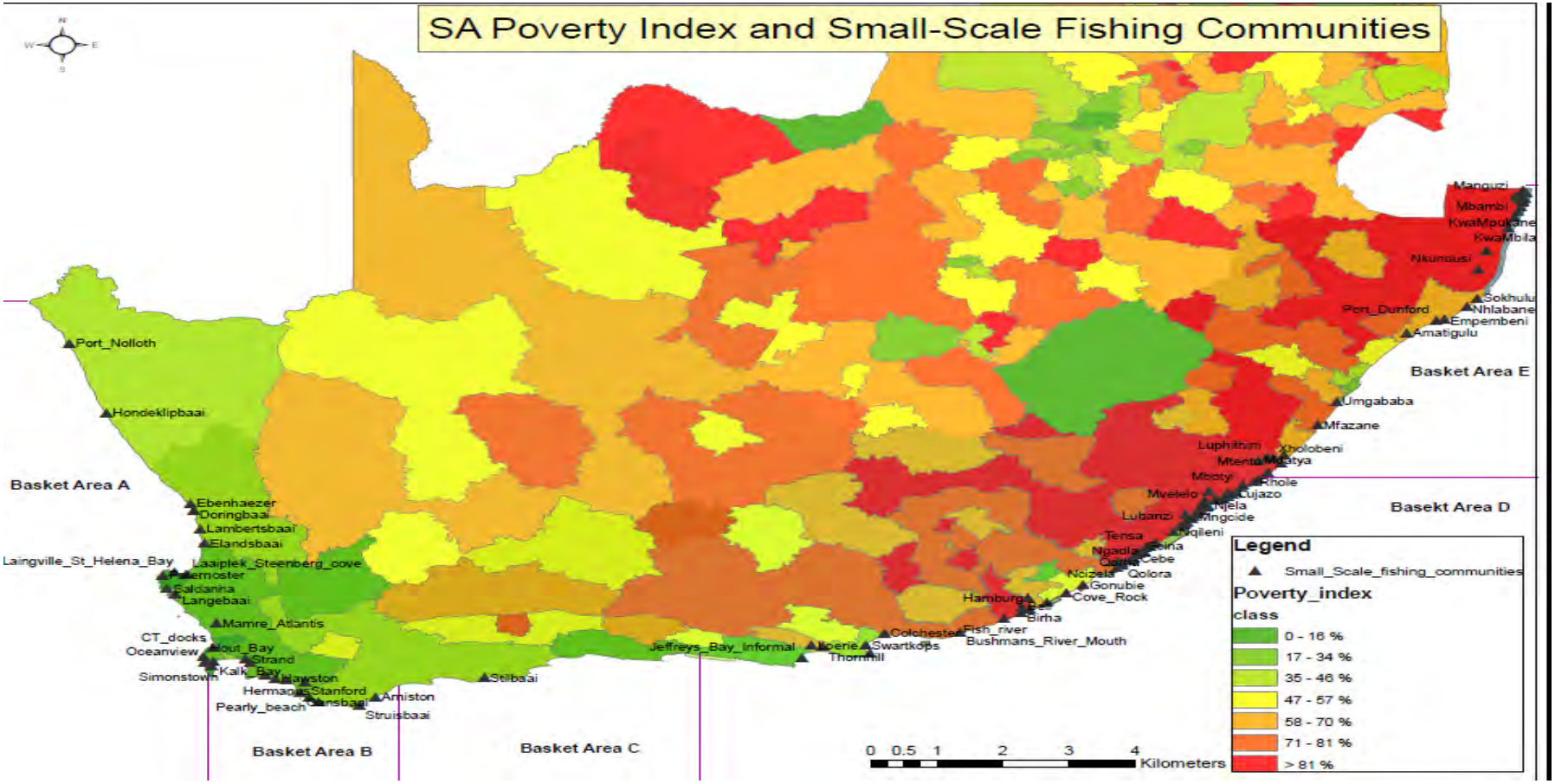

Figure 4.4: Illustrating poverty index in South Africa and how small-scale fishing communities are affected

Therefore, conceptualisation of IMS has provided an opportunity for the researcher to be able to put different types of data sets on one database and further ensured that data is spatially visualised through linkage with ArcGis. This has provided much needed improvement to DAFF's management processes and procedures such as registration and verification of fishers to be issued exemptions and formulation of criteria. As much as conceptualisation of IMS has contributed to improving governance of small-scale fishers from DAFF, there is a need for further improvement that would ensure that the IMS is in line with the principles of the Small-Scale Fisheries Policy to ensure smoother transition from the current management measure to that of the Small-Scale Fisheries Policy.

CHAPTER FIVE: ASSESSING QUALITY OF FISHERY MONITORING IN THE DORINGBAAI SMALL-SCALE FISHERY

5.1 Introduction

Doringbaai is the village of a traditional small-scale fishing community located in the Western Cape Province; approximately 300 km north of Cape Town, South Africa (see Figure 5.1). With approximately 1260 inhabitants (NEAF 2008: 1), Doringbaai is a small rural village where marine resources have traditionally constituted the main source of income and livelihood. Fishers fish both for income as well as for food using low technology gear and therefore fit the definition of small-scale fishers according to the recently gazetted Marine Living Resources Bill. Demographically, the majority of these small-scale fishers are considered 'Coloured' in terms of past racial categories. Doringbaai falls within the Matzikamma Local Municipality.

Figure 5.1: Map illustrating parts of the Western Cape and the Northern Cape provinces highlighting Doringbaai in the Western Cape (NEAF 2008:2).

According to the 2011 census the municipality has a population of 67,147 people in 18,835 households. Of this population, 74.7% describe themselves as "Coloured", 14.8% as "White", and 8.5% as "Black African". The first language of 91.8% of the population is Afrikaans, while 3.5% speak Xhosa and 1.8% speak English (Matzikamma IDP based on 2011 census).

Many Doringbaai women used to work in the rock lobster processing factory which was the major employer in the area. Its closure in 2007 had a huge impact on the whole community and especially on the women who lost their jobs in the processing facility.

Interim relief dispensation has been seen as one of the few more recent opportunities from which the local fishers derive their income. The fisheries authority has been issuing fishing permits under this dispensation from 2007 and Doringbaai has been benefiting since then. Doringbaai has been one of the few fishing communities that have tried to overcome the many challenges faced by the interim relief dispensation. These challenges ranged from conflict between different local organisations to a limited number of fishers accommodated in the dispensation.

With the support of a non-government organisation called Masifundise Development Trust and a community-based organisation by the name of Coastal Links, Doringbaai interim relief fishers have managed to organise themselves into Primary cooperatives and one secondary, umbrella cooperative by the name of U'Kondleka Secondary Cooperative. This has exposed the cooperatives to opportunities ranging from workshops, training and much needed infrastructure support from the Department of Trade and Industry in the form of vessels. For the 2013/14 fishing season known as interim relief 8, there are a total of 111 interim relief fishers. These fishers are all members of the U'Kondleka Secondary Cooperative.

DAFF has issued interim relief permits to U'Kondleka Secondary Cooperative for West Coast Rock Lobster, Line fish, White Mussels and Red Bait as follows:

Table 5.1: Illustrating types of species included in the permit issued to Doringbaai under the IR 8 season

SPECIES	FISHING ARRANGEMENT	DURATION
West Coast Rock Lobster	138 kg per person which amounts to a total of 15 318 kg of WCRL for the secondary cooperative	From 15 November 2013 to 30 June 2014
Traditional line fish	A cumulative total of not more than 420 fish per person per week in any combination of species (Yellowtail, Snoek, Cape Bream (Hottentot) with a specific limit of 210 Cape Bream (Hottentot) per week	From date of issue to 30 June 2014 or on implementation of the Small-Scale Fisheries Policy, whichever comes first.
White mussel	Not more than 350 per person per week (may be harvested in one trip).	From date of issue to 30 June 2014 or on implementation of the Small-Scale Fisheries Policy, whichever comes first.
Red bait	200kg of washed/sand up red bait without shells and permitted to sell per person.	From date of issue to 30 June 2014 or on implementation of the Small-Scale Fisheries Policy, whichever comes first.

The permits were issued to U'Kondleka Secondary cooperative as a communal permit. This meant that no individual was entitled to a specific amount of the allocation as the permit was meant to be shared equally and that deviation from sharing equally depended on the fishers as a collective. The cooperative was tasked to decide who should go to sea and when, although a list of all beneficiaries was preapproved by DAFF. This gave an opportunity for the cooperative to maximise their allocation as operational decisions were devolved to the cooperative. The cooperative was then tasked to ensure that its members abided by the set of permit conditions and any other management tools implemented by DAFF. In preparation for the season, U'Kondleka registered about 42 fishing vessels to fish WCRL and line fish species. The cooperative further signed an agreement with a marketing company to market 15 318 kg of WCRL on their behalf at a price of R200/kg.

Catch data monitors were tasked to be present in all the landing sites used by Doringbaai fishers. The monitors had to record catch landings and issue landing slips for WCRL landed to the caretaker of the permit and also to the marketing company on the landing sites. This information has been submitted to DAFF on a weekly basis by the catch data monitoring company subcontracted by DAFF. This data is used by DAFF in order to monitor the total allocation issued to Doringbaai and to broadly manage the interim relief dispensation. Doringbaai has a total of two catch data monitors dedicated to recording their catches. These monitors are stationed on one landing site that is used by fishers of Doringbaai though Doringbaai fishers are allowed to land their allocation anywhere within the zone shared with other fishing communities.

The purpose of this chapter is to analyse the effectiveness of the current monitoring system as it feeds into the IMS, highlight its weaknesses and potential improvements. This data consists of WCRL data recorded, updated and submitted to DAFF on a weekly basis and also line fish data focusing on biological sampling and boat monitoring data. A focus group discussion with key community fishers has been used to feed back the results and validate key findings.

5.2 Material and methods

Quantitative data

DAFF has appointed a service provider that recorded catch data which included that of Doringbaai interim relief fishers. The service provider is responsible for monitoring and recording catches landed by interim relief 8 fishers. Data is submitted to DAFF on a weekly and monthly basis. The researcher used this data as a source of quantitative data by analysing and feeding back the analysed data to fishers of Doringbaai. Monitoring forms are in Annexure 2

West Coast Rock Lobster Landings

WCRL data reflecting landings per trip were analysed by focusing on total weight of WCRL landed per season and total weight of WCRL per day in December 2013 and January 2014. Average weight of WCRL per day between December 2013 and January 2014 was also analysed.

Effort and Line fish landings

Effort and line fish landings data were analysed by using data submitted by the Catch Data monitoring company. From this data, average number of vessels counted versus average number of vessels checked and total number of vessels counted from August 2013 to February 2014 were analysed to determine the average and total effort of vessels used during the WCRL and line fish landings period.

The total number of various species caught over the period of August 2013 to February 2014 was analysed. The total number of various species caught per month over seven months was also analysed. Hottentot and Snoek landings were also plotted with the total number of vessels counted to confirm the relationship between the two. Average length of Hottentot was also looked at applying trend analysis on the total length of Hottentot per month.

Qualitative data

Qualitative data consisted of the researcher's participant observation and experience with DAFF's management system and procedures, action research during the 2013/2014 lobster season and a final workshop with Doringbaai fishers to discuss findings and interpretation of results.

5.3 Results

This section focuses on presenting the analysed catch data from August 2013 to February 2014 for interim relief dispensation in Doringbaai and presenting results from a workshop which was facilitated to feed back the results of this analysed catch data. The analysed data includes that of West Coast Rock Lobster catches, line fish catches, and actual landings versus estimated trade for Doringbaai fishers, and analysis of responses from structured questions from the workshop.

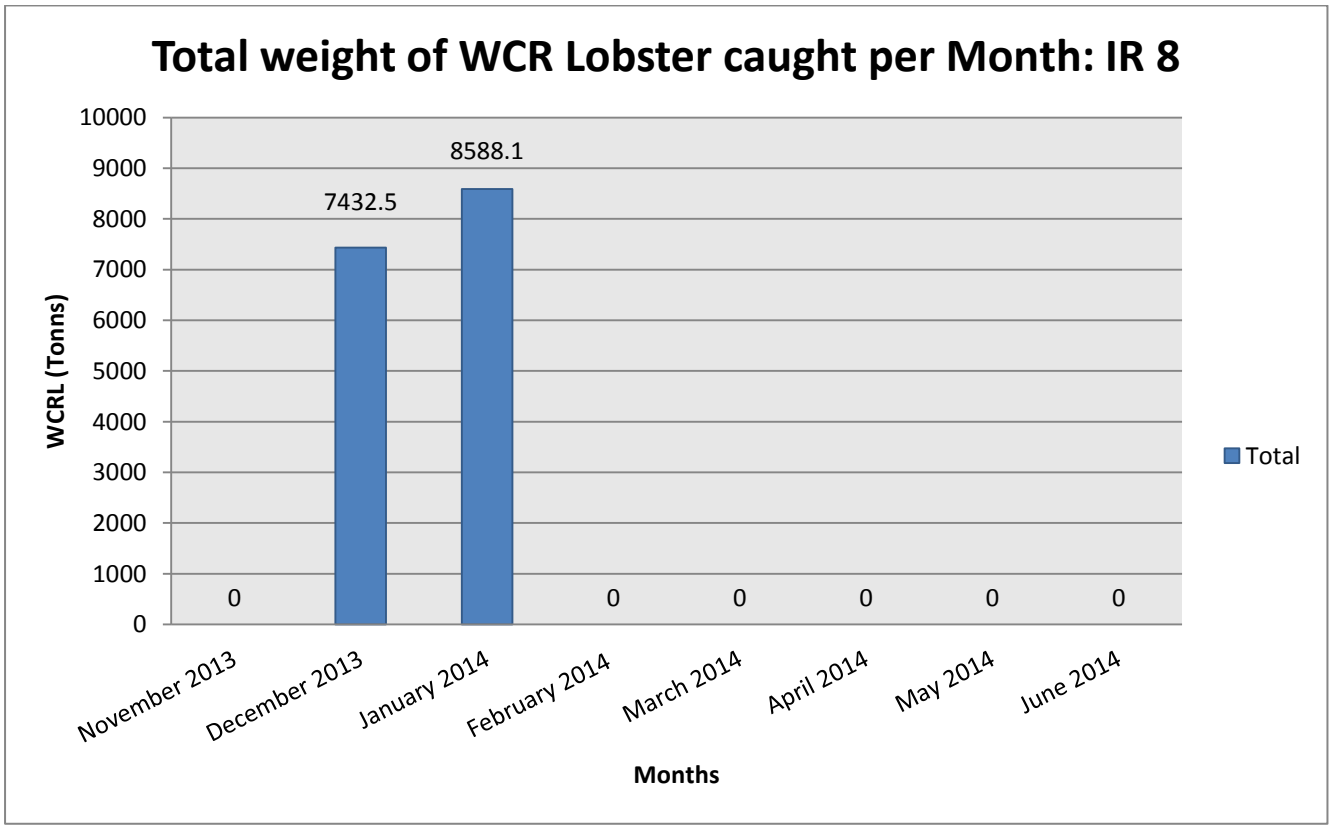

Figure 5.2: Total weight of West Coast Rock Lobster caught per month during the interim relief 8 season

The above graph illustrates total weight of West Coast Rock Lobster caught in Doringbaai during the interim relief 8 season which started from 15 November 2013 to 30 June 2014. The graph illustrates that Doringbaai interim relief fishers caught 16 146 kg of WCRL within two months of the eight months long 2013/14 fishing season. This allocation was landed in December 2013 (when 7432.5 kg was landed), and January 2014 (when in 8588.1 kg was landed). The above figure also indicates that the total WCRL caught is over and above the

allocation issued to the interim relief fishers. This means that there was an over-catch of about 702.6 kg for interim relief 8 season.

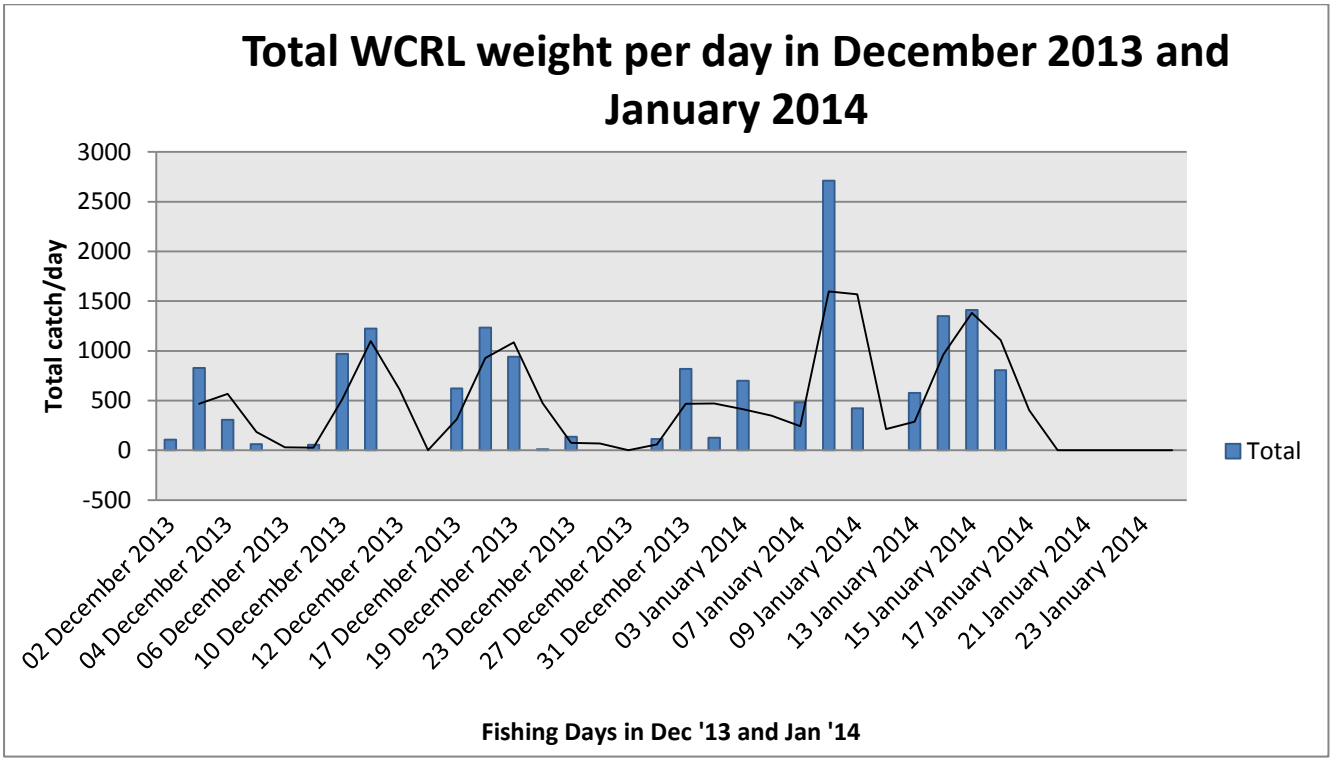

Figure 5.3: Total WCRL caught per day during the months of December 2013 and January 2014.

The above illustrates that within the two months of WCRL landings, total number of landings varied per day. The above shows that catch varied per day and also per week. The first and last weeks of December 2013 recorded the lowest catches as compared to other weeks within these two months. The last week of December 2014 recorded the lowest catches throughout the two months. The first and second week of January 2014 recorded the highest catches. On the 08th January 2014, Doringbaai interim relief fishers caught over 2600 kg of WCRL.

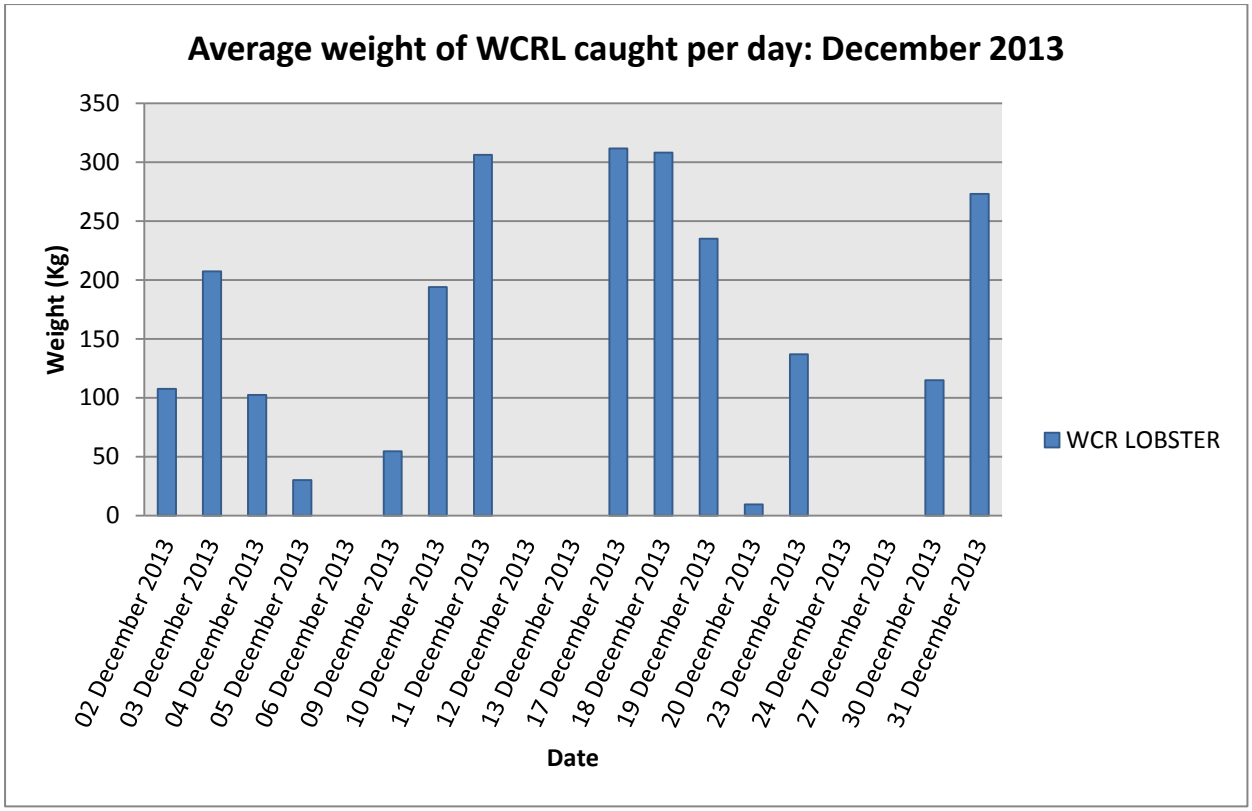

Figure 5.4: Average weight of West Coast Rock Lobster caught per trip per day in December 2013

The graph above illustrates that from the total of 7432.5kg landed in December 2013, average weight of WCRL caught per day varied from the 2nd December 2013 up to 31st December 2013. The lowest average weight of WCRL caught per day was on the 20th December 2013 and the highest was on the 17th December 2013. There is a total of five days where vessels were recorded as having gone to sea but came back with no WCRL.

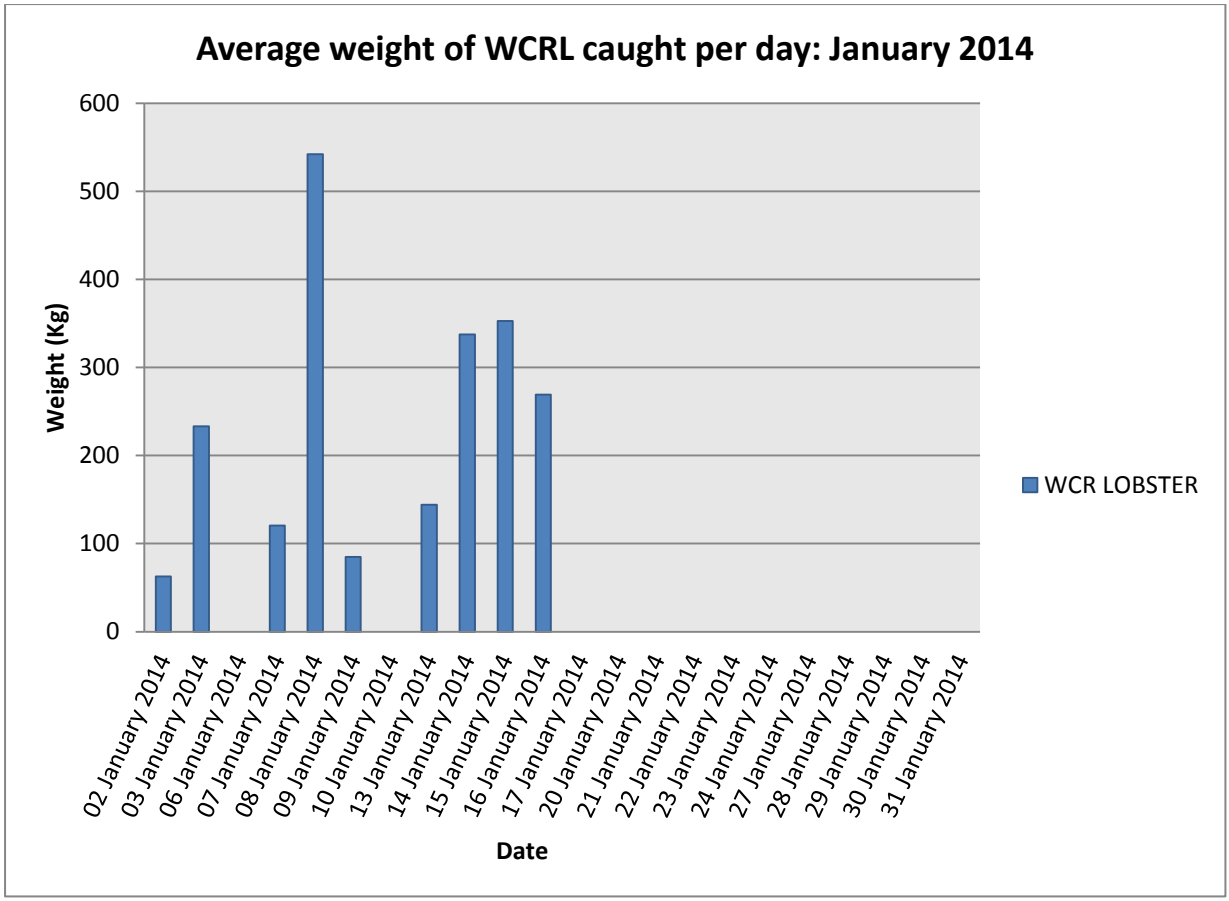

Figure 5.5: Average weight of West Coast Rock Lobster caught per trip per day in January 2014

The graph above illustrates that from the total of 8588.1kg landed in January 2014, average weight of total WCRL caught per day varied from the 2nd January 2014 up to 16 January 2014. The lowest average weight of WCRL caught per trip was on the 2nd January 2014 and the highest was on the 8th January 2014 where an average of 560 kg was caught. The average weight of WCRL caught in January 2014 was 505.1 kg.

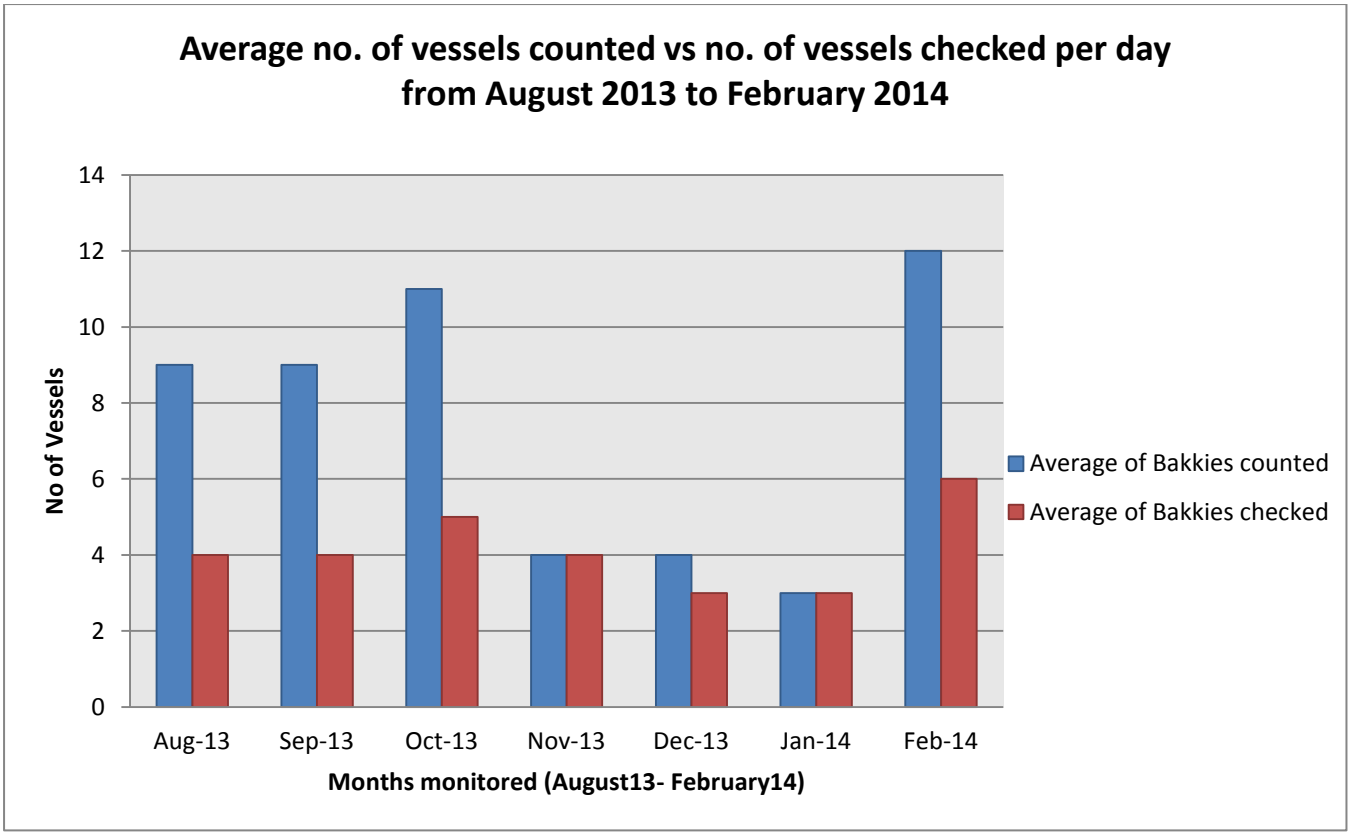

Figure 5.6: Average number of vessels counted versus number of vessels checked per day over the interim relief 8 dispensation

As mentioned previously, Doringbaai has a total of 42 vessels used for the interim relief 8 season. Catch data monitors have counted and checked vessels on a daily basis from August 2013 to February 2014. Based on the above, the average number of vessels counted and checked increased from August 2013 to October 2013 and the number decreased from December 2013 and January 2014. The number of vessels counted and checked increased again in February 2014. The graph also illustrates that of the average number of vessels counted, more than 50% of them were further checked by the monitors.

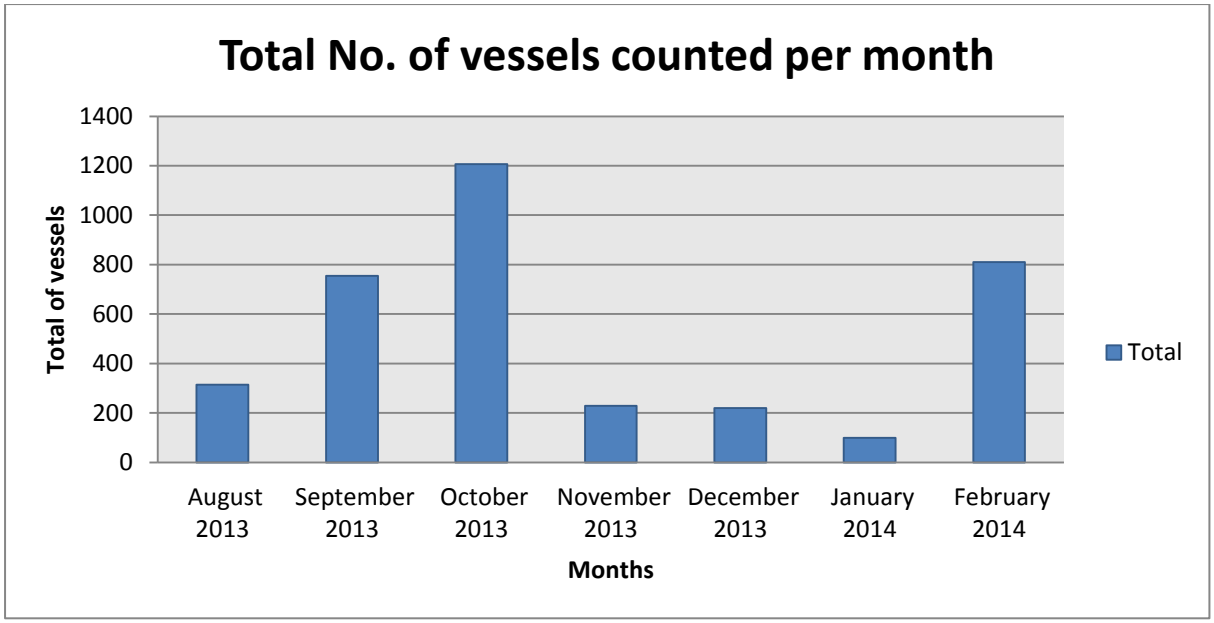

Figure 5.7: Total number of vessels counted per month

The above illustrates that the total number of vessels counted increased from August 2013 to October 2013 and then the total decreased dramatically from November 2013 to January 2014. The above figure also illustrates that the total number of vessels increased again in February 2014. October 2013 and February 2014 had the highest number of vessels counted and January 2014 had the lowest number of vessels counted.

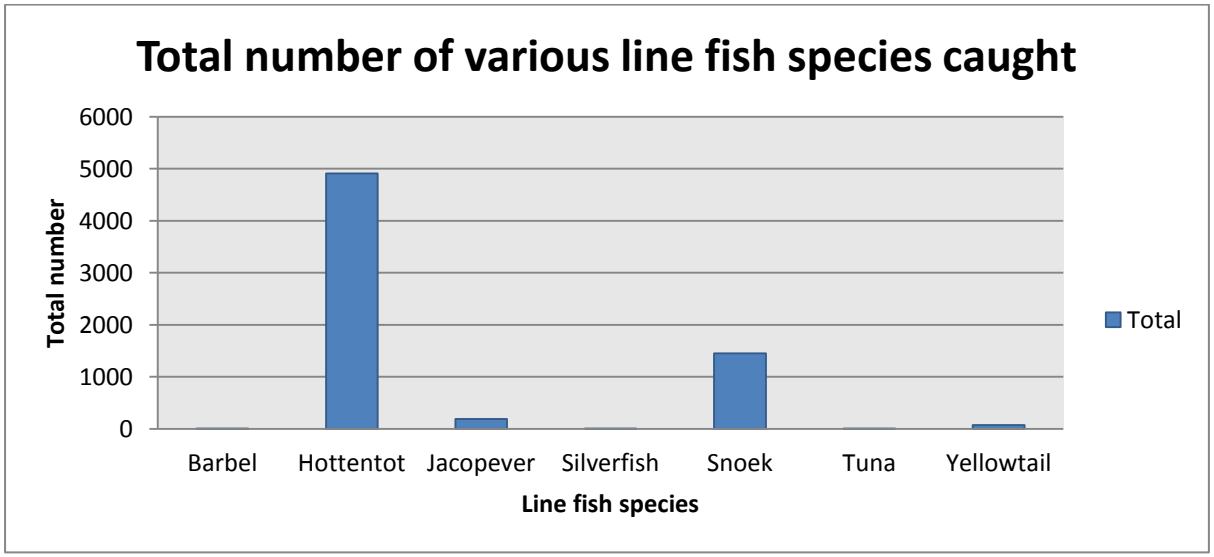

Figure 5.8: Total number of various line fish species caught

The graph illustrates that Doringbaai fishers caught Barbel, Hottentot, Jacopever, Silverfish, Snoek, Tuna and Yellowtail. It also indicates that the most commonly caught species are Hottentot and Snoek. A total of about 4906 Hottentot were caught followed by 1452 Snoek. Other species were caught in very limited amounts.

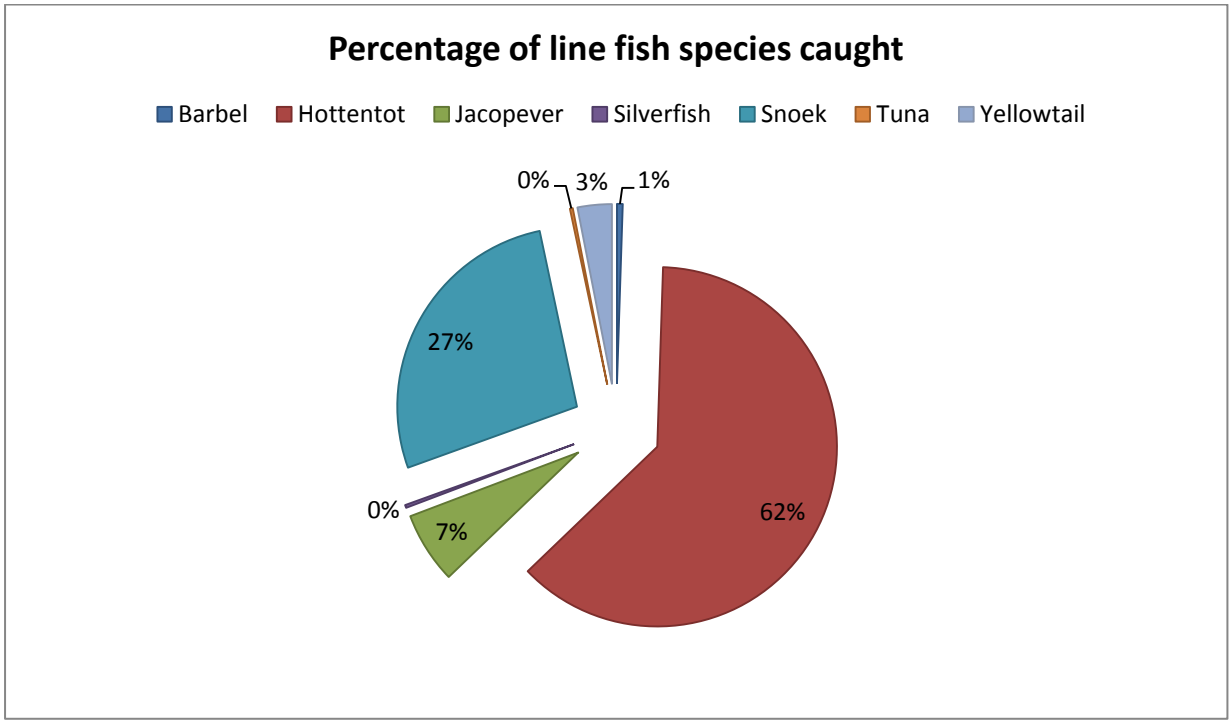

Figure 5.9: Percentage of line fish species caught

As indicated in figure 5.8, Hottentot was the most commonly caught species followed by Snoek. The graph above indicates that 62% of the total number of line fish species caught in Doringbaai was Hottentot and that 27% of line fish caught was Snoek followed by Jacopever comprising 7%.

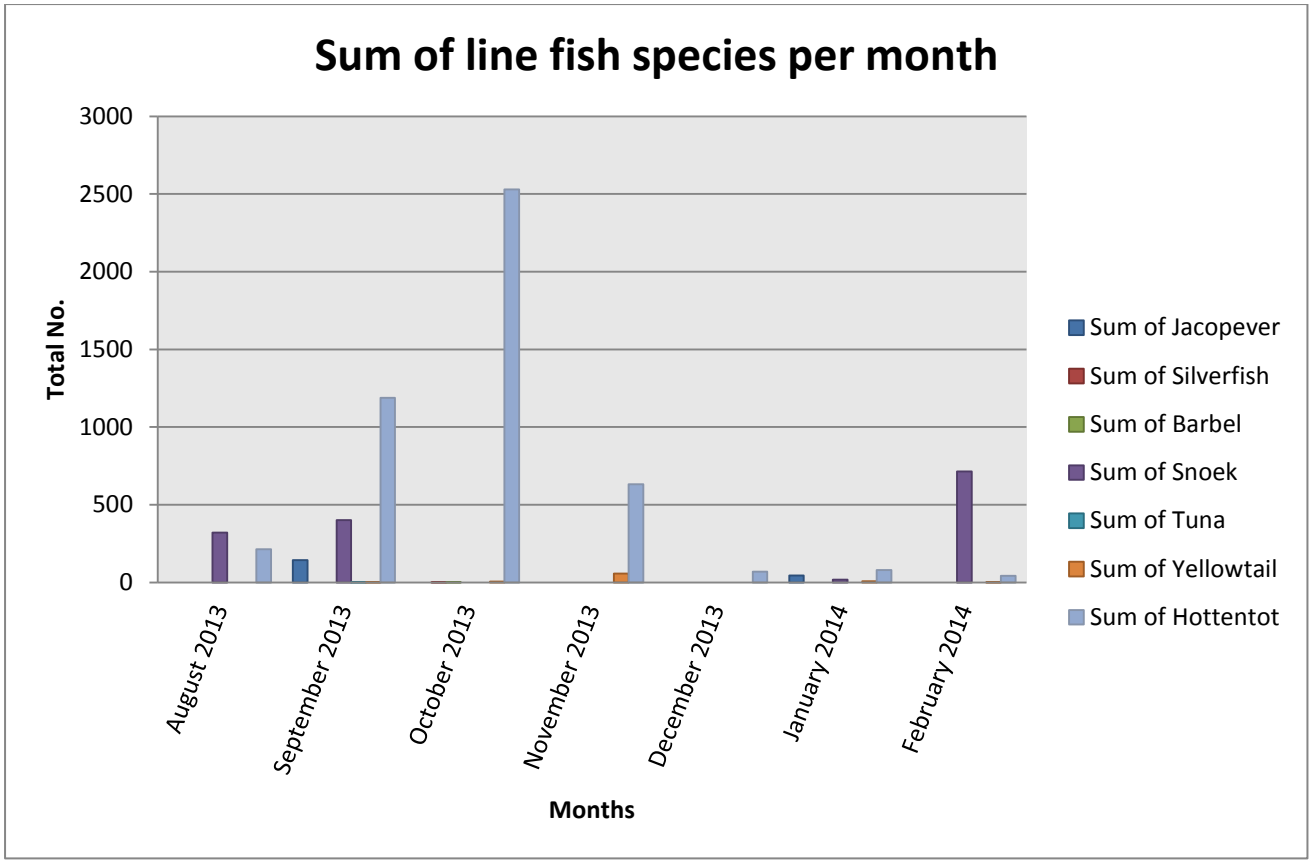

Figure 5.10: Sum of various line fish species caught per month

As per previous graphs, Hottentot has been the most commonly caught line fish species and the above graph indicates that it was mostly caught from September 2013 to November 2013. Snoek was caught mainly in August 2013, September 2013 and February 2014. Other species were caught in smaller numbers throughout the season. December 2013 and January 2014 was shown to have the smallest catch of line fish species.

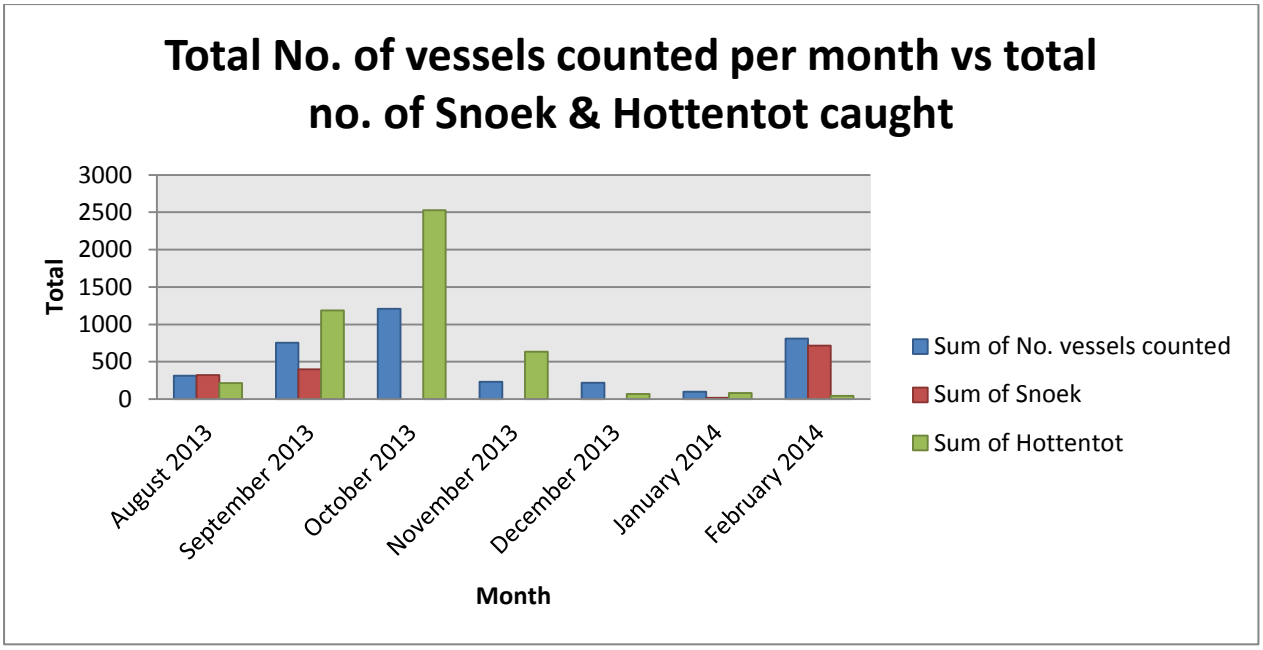

Figure 5.11: Total number of vessels counted per month versus total number of Snoek & Hottentot caught

The above graph illustrates that the total number of vessels counted per month is directly influenced by the presence of Snoek and/or Hottentot. The graph shows that the number of vessels counted increased with the total number of Hottentot and Snoek caught from August 2013 to October 2013. The decrease in the number of vessels counted from November 2013 to January 2014 coincided with the decrease of the total number of Hottentot and Snoek caught in these months. The increase in the number of vessels counted in February 2014 occurred with the appearance of Snoek during the same month.

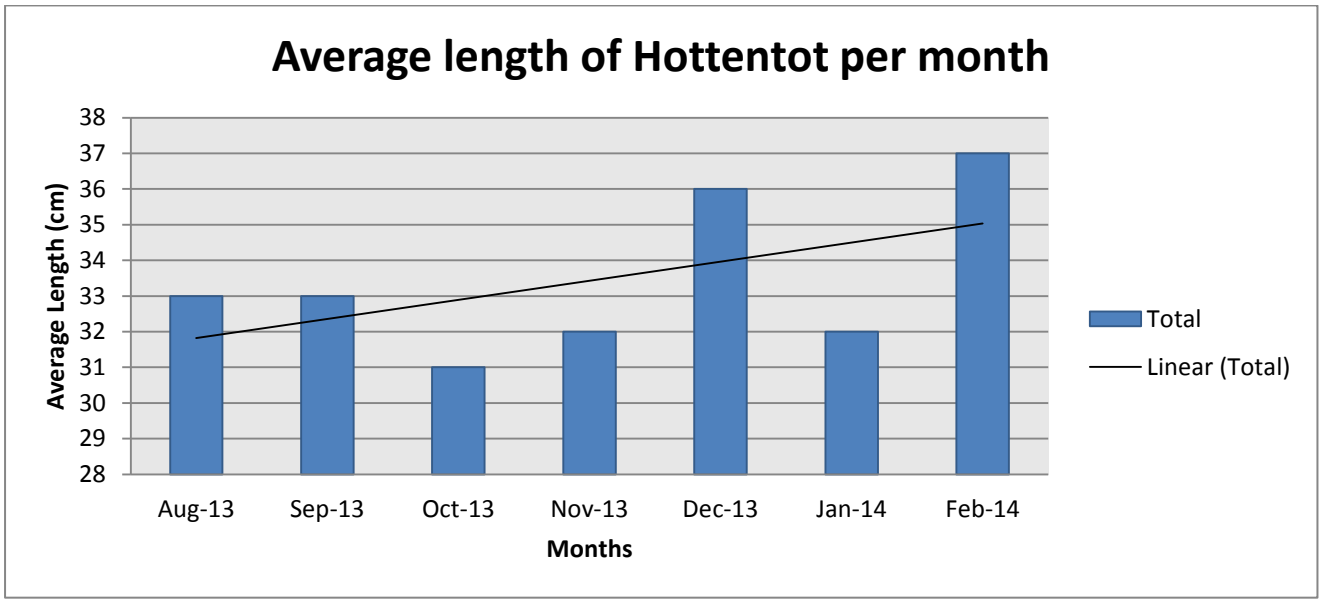

Figure 5.12: Average length of Hottentot per month

The above shows that the average length of Hottentot ranged from 31cm to 37cm from August 2013 to February 2014. December and February recorded the highest average length of Hottentot caught and October recorded the lowest average length of 31cm.

Table 5.2: Illustrating actual landings and estimated trade for Doringbaai fishers

Actual landings and estimated trade for Doringbaai fishers			
	WCRL	**Snoek**	**Hottentot**
Number of rights holders	111	111	111
Number of Vessels	42	42	42
Average crew involved	3	3	3
Average cost of fishing (R per day)	R 2,000	R 2,000	R 2,000
Total landed over four months(no.)	16,021 kg	1452	4906
Ave Landing/scale price (2014)	R 200/ kg	R 20/ fish	R 17/ kg
Estimated total landing value	R 3,204,120	R 29,040	83,402
Average export or retail price (2014)	R 350/ kg	R 50/ fish	n/a
margin on export or retail price (R per kg)	R 150/ kg	R 30/ fish	n/a
Margin on export or retail price (%)	75%	150%	n/a
Estimated export or retail value	R 5,607,210	R 72,600	n/a
estimated % exported out of Doringbaai	100%	most of it	0%
Export Volume (kg)	16,021 kg	1452	n/a

The above table illustrates data on WCRL, Snoek and Hottentot. It indicates total number of fishers , total number of vessels and total landed for the season and what price species from each sector achieved and its potential value thereof. This table further illustrates the comparison between WCRL and line fish caught and sold by Doringbaai fishers. The table indicates that if fishers could have access to their catch data, they would be able to plan and be able to generate various reports that would indicate their potential and actual financial status.

In addition to the analysis of Doringbaai's catch data submitted by the service provider subcontracted by DAFF, the researcher facilitated a workshop with selected small-scale fishers involved in the interim relief dispensation. The table (Table 5.3) overleaf indicates structured questions for the workshop and responses to these questions from the fishers.

Table 5.3: Questions related to catch data results and summary of responses from focus group in Doringbaai

Reference to Figure	Questions	Response from Interim Relief 8 fishers in Doringbaai
Figure 5.2; 5.3; 5.4	• Comparing the previous seasons, how did Doringbaai manage to land their entire allocation in one month and two weeks?	• For the first time Doringbaai fishers were allowed to catch their allocation in Elandsbaai and this area is perceived to be WCRL abundant in December and January.
Figure 5.5	• How were Doringbaai interim relief fishers able to land over 8 tons within two weeks in January 2014?	• The 7th of January 2014 was the perfect sea day and many boats were launched. On this same day, near shore commercial vessels had over-catches and the over-catches were transferred to Doringbaai interim relief fishers as per the permit conditions.
Figure 5.3;5.4	• Why were there differences in catches per day, per week and per month?	• This depended on the number of vessels dispatched per day. WCRL in Doringbaai (Donkins) is bigger in size and weighs more than that of Elandsbaai. This also depended on weather conditions per day.
Figure 5.2; 5.3; 5.4; 5.5	• How did Christmas holiday preparations influence WCRL landings?	• Many vessels had to be dispatched during the festive season so there would be enough money for fishers to buy clothes and food for their families in preparation for Christmas celebrations.

Figure 5.6; 5.7	• Why is there a difference between a number of vessels counted versus number of vessels checked per day?	• Not all the vessels are checked by the monitors as most of the vessels land after 16:00 when the monitors have long gone home for the day.
Figure 5.6; 5.7	• Why were there more vessels outside WCRL season?	• Due to the nomadic nature of line fish species, additional vessels were sourced from private vessel owners in and around Doringbaai. • During November 2013, SAMSA certificates of many vessels had expired and they had to be resurveyed. This caused reduction of available number of vessels for WCRL. • Due to the ongoing line fish season, some vessels had engine problems before the start of WCRL season.
Figure 5.8-5.11	• Did you target Snoek and Hottentot from November 2013 to January 2014?	• Yes, due to their economic value. Other species are not targeted as they occur further than 1 nautical mile and the vessels are limiting targeting of such line fish species.
Figure 5.8-5.11	• What caused the drop in total number of line fish species caught in November?	• There were fewer vessels available due to expired SAMSA certificates.
Figure 5.12	• Why is the average length of Hottentot varying?	• Hottentot breeds around October, therefore mature Hottentot species relocate to deeper and colder waters and leave smaller species behind. During this time, smaller Hottentot species are caught.

		• Snoek is preferred over Hottentot.
Table 5.2	• What are your thoughts on the presented actual landings and estimated trade for Doringbaai fishers.	• There is a need for strategic marketing of WCRL and line fish species.
• Do you think that this data reflects what has taken place		• Yes, the data is eye-opening and there is a need for more such workshops whereby fishers will be able to have an understanding of their data.

5.4 Discussion

This section focuses on discussing the results presented above and looks at highlighting gaps and identifying what may have influenced the catch data results for interim relief 8 dispensation in Doringbaai. This will be done by first discussing the West Coast Rock Lobster results and thereafter focusing on the effort and line fish data between August 2013 and February 2014.

5.4.1 West Coast Rock Lobster landings

As indicated on figure 5.2, it is clear that the total allocation issued to Doringbaai interim relief 8 fishers was landed in December 2013 and January 2014 and there were no landings recorded in November though the season started on 15 November 2013. There was an over-catch of over 700 kg which was recorded for IR 8 season though interim relief fishers were disputing this over-catch. The above may be due to the fact that bad weather conditions were experienced during the last week of November 2013 and the fishers had not gone to sea. This may have also been caused by a shortage of catch data monitors in Elandsbaai as the Doringbaai allocation was landed in Elandsbaai.

The reason why the allocation was landed so early may be due to the fact that the Department negotiated with commercial WCRL exporting and marketing companies, informing them that for a minimum price of R200 per kg the fishers would land their allocation within a short space of time so that the product could be exported while the Asian market was strong. Due to the fact that Doringbaai is one of the most organised communities with structures in place such as the U'Kondleka Secondary Cooperative, the community managed to land their allocation at a price of R200/kg. As per the response from the focus group workshop on the 10 July 2014 in Doringbaai, approval for the interim relief fishers to launch and land anywhere within their zones resulted in Doringbaai landing their allocation in Elandsbaai where WCRL is perceived to be more abundant in December and January.

It is well known in fishing communities that the best price for WCRL is achieved from December up to the middle of January the following year. This is created by high demand from the Asian market for Chinese New Year occurring annually at the beginning of February. Many communities have delayed landing their allocation and this has caused

them to miss an opportunity to sell their WCRL at a reasonable price. For example, many communities on the South Coast of the Western Cape land their WCRL after the peak season and get an average of about R130 per kg as opposed to R200 per kg. Therefore, the organisation and structure of the Doringbaai community has resulted in them being able to catch and sell their allocation within two months and being able to realise a profit. It is also said that the quality and abundance of WCRL is at its highest during these months.

Figure 5.3 indicated that the first and last weeks of December 2013 recorded the lowest catches as compared to other weeks within these two months. The last week of December 2013 recorded the lowest catches throughout the two months. The first and second weeks of January 2014 recorded the highest catches. On the 7th January 2014, Doringbaai interim relief fishers caught over 2600 kg of WCRL. Considering that the Interim relief permits were issued towards the end of November 2013, U'Kondleka Secondary Cooperative was requested to submit a list together with supporting documents of all the vessels that they planned to utilise for the fishing season. The compilation of some information took longer than expected and this resulted in the use of fewer vessels, hence the low catches in the first week. From the 19th to 27th of December most exporting or marketing companies close for holidays and therefore demand for WCRL from them is at its lowest. According to Doringbaai interim relief fishers, Christmas holiday preparations within fishing communities influenced low catches over the 24th to 27th December 2013. Considering the financial need after Christmas holidays in preparation for the beginning of the new school year and the rise in WCRL demand in January, the increased catches may have been influenced by this coupled with suitable weather conditions.

In line with figure 5.3, figure 5.4 illustrates that in December 2013 average weight of WCRL caught per day varied from the 2nd December 2013 up to 31st December 2013. The lowest average weight of WCRL caught per day was on the 20th December 2013 and the highest was on the 17th December 2013. The average weight of WCRL caught per day fluctuated from a minimum of 13 kg up to a maximum of 320 kg in the month of December 2013 with an average of 125.9 kg for the month.

Variation in the average weight of WCRL may be attributed to the following:

- number of vessels dispatched on a particular day;

- total number of crew per day;
- weather conditions; and
- fishing area
- availability of sufficient monitors
- size/weight variations in lobster

Doringbaai has a total of 42 fishing vessels that are registered with the fisheries authorities and there are 111 registered fishers. Total numbers of vessels are dispatched based on the weather conditions and the total number of crew for the day. This then affects the amount of WCRL caught on that particular trip. Doringbaai is demarcated within Zone C (Figure X) along the West Coast. Within Zone C, there are many launching sites that are used by other fishing communities such as Elandsbaai and Lambertsbaai and some of the landing sites are used more often than others due to the uneven distribution of WCRL. Therefore, the choice of a launching site influences the fishing area chosen for that particular day as fuel costs have to be kept as low as possible.

For the month of January 2014 the last trip for Doringbaai to catch their total allocation was the 16th January 2014 (Figure 5.5). This means that if we consider the total weight of WCRL caught in December 2013, which is 7432.5 kg, versus that of January 2014, which is 8588.1 kg, fishing effort may have been increased in order for more WCRL to be landed per trip using half the number of days used in December 2013 and/or this may also be caused by good weather conditions coupled with WCRL availability in Elandsbaai and increased demand from the market. It was reported that this was also contributed to by commercial near shore rights holders transferring their overcaught WCRL to Doringbaai interim relief fishers- which is illegal in terms of fishing regulations and catch permit conditions.

This ultimately indicates that the Doringbaai interim relief fishers landed their allocation and overcaught by more than 700kg within two months and that the first month of the season, which was November 2013, was not utilised. This also highlights that in January 2014, WCRL was caught within two weeks and that the total weight and average weight of WCRL caught was highest in January 2014 as compared to December 2013 though the number of vessels used in January 2014 were fewer than those of December 2013. The results also indicated that the average weights varied per week in the two months. This depended on the number

of vessels despatched per day, weather conditions and the landing sites used. Doringbaai interim relief fishers indicated that WCRL in the Donkins area near Doringbaai is bigger in size and weighs more than those in Elandsbaai, but they took a decision not to use this site to allow Donkins to rebuild its stock.

5.4.2 Effort and Line fish landings

Figure 5.6 and figure 5.7 indicated that the average and total number of vessels counted increased from August 2013 to October 2013 and then the total decreased dramatically from November 2013 to January 2014. Due to the nomadic nature of line fish species, additional vessels were sourced from private vessel owners in and around Doringbaai. This was also the reason for the high number of vessels outside WCRL season.

The above figures also illustrate that the average and total number of vessels increased again in February 2014. Doringbaai fishers have indicated that this was caused by harvesting line fish species from August 2013, as the line fish permit was still valid under the interim relief 7 fishing season. The decrease in the number of vessels counted and checked between December 2013 and January 2014 was due to a number of vessels with expired SAMSA certificates at the beginning of November 2013.

This decrease may have been caused by issuing the WCRL permit for interim relief 8 which demanded that monitors be at the landing slip to focus on recording WCRL landings. This means that there might have been a decrease in vessels going to sea and also monitors could have been focusing on WCRL and giving little attention to line fish vessels. Targeting of Snoek and Hottentot could have affected the average and total number of vessels counted and checked. When there is no Snoek and Hottentot, it is expected that there would be fewer vessels used as other species caught are not usually targeted as they are of a low value. Figure 5.11 confirms this as it shows that the increase in total number of vessels counted is directly related to the occurrence of Snoek and Hottentot. Figure 5.11 also illustrates that the decrease in the number of vessels counted from November 2013 to January 2014 is indicative of the decrease of the total number of Hottentot and Snoek caught in these months. An increased number of vessels counted in February 2014 occurred with the appearance of Snoek during the same month. This may have been caused by the fact that Doringbaai fishers returned from Elandsbaai landing sites to Doringbaai landing site

when they were catching line fish species and that monitors stationed in Doringbaai were able to properly count and check vessels again.

Of the types and total number of line fish species caught in Doringbaai, the most common are Hottentot (4906 caught) and Snoek (1452 caught). Other species have been caught in very limited amounts (Figure 5.9; 5.10). This may be because Hottentot is the most abundant species in Dorringbaai and Snoek occurs randomly and is therefore unpredictable. During December 2013 and January 2014 less line fish species were caught because the Doringbaai interim relief fishers were targeting WCRL during those two months. According to Doringbaai fishers, other species are not targeted as they occur further than 1 nautical mile and are less profitable.

Though Hottentot is considered as a low value species, it has been the most caught species in Doringbaai. Hottentot is at about 50% of carrying capacity and it is known that the Hottentot biomass have recovered to levels close to MSY (Oceanographic Research Institute, 2013). Amongst the line fish species, Snoek is considered a high value species and it is mostly targeted throughout the season. Due to its unpredictable occurrence caused by its nomadic nature, the total number of Snoek caught has been less though this is the targeted and preferred species. It is likely that the rest of the species were caught either as a by-catch of the targeted species or they were the only species available at the time of the catch. The results also show that Snoek occurred mainly in August 2013, September 2013 and February 2014 and Hottentot were mainly caught in August 2013, September 2013, October 2013 and November 2013 with the highest number caught in October 2013.

Looking at the average size of Hottentot caught per month, results indicate that size increased gradually from August 2013 to February 2014 though there were minor variations in average size per month. According to commercial permit conditions, 25cm is the minimum length for Hottentot and according to the Oceanographic Research Institute (2013), the maximum recorded length of Hottentot has been 54cm. Doringbaai fishers indicated that Hottentot breeds around October, therefore mature Hottentot relocate to deeper and colder waters and leave smaller fish behind. During this time, smaller Hottentot species are caught, but still within size limit.

These figures clearly illustrate that Hottentot was caught within its legal size limit. They could also indicate that there is potential for further exploitation in a sustainable manner though a suitable market needs to be found in order to sell this fairly abundant species around Doringbaai.

5.5 Conclusion

Based on the focus group workshop held in Doringbaai, the data received from Catch Data monitors reflects the actual activities though there is significant room for improvement. From the results and discussions above, it is apparent that a review is needed of the indicators of the data and how the monitoring is rolled out. This also includes the process of how the fishing communities can be involved in the monitoring of landings and feeding back the data so that fishing communities would be able to make informed decisions based on reliable data.

Raw data submitted to DAFF

When the researcher was preparing for the analysis of the data, there were many minor errors on the data that could easily falsify or give an incorrect analysis of the data. With the researcher's knowledge of the data requirements and his being familiar with the data and DAFF processes, it was easier to correct the data in preparation for analysis. Some of the errors that were noted were different formats used for different fields of the data. For an example, column for "date" had different formats where date was recorded. Some fields had empty cells and obviously incorrectly recorded data. In light of this, there is a need for catch data monitors to monitor landings and any other information in an easy and consistent manner that would ensure that the data has the least number of errors. This would ensure that the data analysis reflects what is occurring in the fishing communities and that any decisions made are based on efficient and reliable data. There is therefore a need for standardised electronic capturing forms that will eliminate these anomalies.

Currently, the data does not indicate to which sector the line fish vessels used belong. This was evident when Doringbaai fishers used vessels from the near shore commercial sector to catch Snoek and yet these vessels are not registered with DAFF as part of the 42 registered vessels under the Doringbaai interim relief vessels. This means that there is more effort used compared to that recorded by the monitors and DAFF. In order to address this, there is

a need for the recording of Catch per Unit Effort (CPU) which would indicate average landings per boat per trip in one day. This would then indicate the average number of vessels per trip per day and how much each vessel catches per trip and ultimately indicate the effort levels in greater detail than at present. This would shed light on the abundance trends which the local co-management committee would use to manage their resource through controlled effort and limiting their TAC to a sustainable level as per the Small-Scale Fisheries Policy.

Monitoring capacity

As much as DAFF has outsourced the catch data recording, one challenge to this program has been the insufficient number of monitors despatched in Zone C where Doringbaai is permitted to catch its allocation. Currently there are 3 monitors allocated for this zone, with more than 300 fishers and more than 150 registered vessels for interim relief. From the discussions with Doringbaai fishers, it became evident that a significant number of line fish vessels were not monitored due to the unavailability of monitors who prioritise WCRL season, and due to line fish vessels landing after 16:00 when the monitors have already gone home. The data also illustrated this very well when it was evident that 50% of vessels counted were not checked. This means that the data might only be representing 50% of the data for line fish or what is taking place on the fishing grounds. There is a need for additional monitors who are able to monitor all launched and landed IR vessels in areas where Doringbaai catches their allocation. It is therefore recommended that there should be two additional monitors and that two monitors should focus on monitoring line fish landings and three monitors should be dedicated to monitoring WCRL when the season starts. This would ensure consistent monitoring of vessels and ascertain that more vessels are counted and properly checked at all times. This would then result in DAFF receiving more accurate data on which to make informed decisions.

Collusion of certain individual fishers with catch data monitors in Doringbaai has been raised in the workshop. However, this is very difficult to prove from just looking at the data yet it significantly affects the data submitted. There is a need for a well-structured co-management committee which would ensure that such destructive tendencies are dealt with locally and that the data provides a platform for the co-management structure to identify such practices and prevent it from taking place. An example is seen when

individuals collude with catch data monitors and convince the monitors not to record some landings and also issue incorrect landing slips for the catches. A well organised co-management structure would counter this by ensuring that whoever lands the allocation properly allows monitors to record their catches and that the co-management structures base their decisions on such data.

Outcomes of the focus group workshop also indicated that there is a dire need for feedback of information analysed from the catch data; and that fishers would like to be involved in the recording of the data as they feel that their local knowledge has not been considered. The data also illustrates that there are many potential opportunities that can be explored by the Doringbaai fishers. These include proper marketing strategy for Hottentot and Snoek as these two species are landed in significant quantities in and around Doringbaai. However, there is a need to strengthen monitoring by adding capacity, using correct data forms that would include important indicators such as CPUE. Value addition on WCRL is seen as another opportunity that can assist the fishers in Doringbaai as the data presented to them highlighted potential financial benefits if there was proper access to direct markets. All of this needs adequate monitoring of post-harvest activities coupled with proper operational planning that can be further informed by analysed catch.

In order for the Doringbaai fishers to realise these benefits, there is a need for a well-structured and packaged data system that will be used by fishers for decision-making in Doringbaai. This would assist the fishers in tracking their TAC and TAE, planning in terms of supply and demand of their products and overall management of the resource and related activities in a sustainable manner. Therefore, there is a need for a properly planned IMS that would address all of the above-mentioned challenges and gaps in the data and management measures.

CHAPTER SIX: ASSESSING QUALITY OF EAST COAST ROCK LOBSTER CATCH MONITORING IN THE EASTERN CAPE

6.1 Introduction

The Eastern Cape coast is about 820km in length and it stretches from Tsitsikamma National Park in the South to the Mtamvuna River in the north (Figure 6.1). It is diverse in physical, biological and socio-economic characteristics. The shoreline is characterised by alternating beaches and rocky headlands, which provide a wide variety of habitats for inshore marine organisms. The coastline is influenced both by warm Agulhas Current and the cooler Benguela Current, and this together with the availability of diverse habitat accounts for the high biodiversity along this coastline (Coastal & Environmental Services, EnviroFish Africa and MBB Consulting Services, 2004)

Rural communities of the Eastern Cape coast of South Africa have relied on subsistence fishing as a source of food for several thousands of years (Glavovic, 2000; Isaacs et al, 2000; Raemaekers, 2009). However, it was only in the 20th century, with the advent of holiday makers and the establishment of holiday resorts, that the commercial value of local marine resources became apparent. Since the 1950s, this demand has been satisfied by the traditional coastal communities, whose growing population has become increasingly reliant on marine resources as part of their subsistence livelihoods (Robertson and Fielding, 1997; Coastal & Environmental Services, EnviroFish Africa and MBB Consulting Services, 2004).

Over the last 17 years, however, remote sources of high-valued marine resource have increasingly been targeted by exporting companies to fill the growing supply-demand gap within the rapidly globalising economy (Garcia and Charles, 2008; Marshall et al, 2001). Subsistence fishers in the Eastern Cape have been catching and selling marine resources such as line fish, lobster and abalone to buyers for local, national and international markets (Robertson and Fielding, 1997). The East Coast Rock Lobster, scientifically known as *Panulirus homarus rubellus*, has been fished by small-scale fishers from the north of Kei Mouth to the northern border of the Eastern Cape for many years. This has contributed to communities' livelihoods over the past years as they consume or sell their catches to tourists, cottages, hotels and to buyers from other provinces for the export market.

East Coast Rock Lobster is known locally as 'ikolofish' or 'inkala'(translated as "Crab"), and is usually caught in the early hours of the morning by diving and or by using poles and baited

sticks from the shore (Coastal & Environmental Services, EnviroFish Africa and MBB Consulting Services, 2004).

The growing number and interest of lobster-exporting companies to market East Coast Rock Lobster to Asian countries has influenced the rate and trend at which this species has been harvested throughout the years as this has become the most important marine source of direct income for the coastal communities (Fielding et al, 2004; own observation). The high value of the East Coast Rock Lobster, combined with its potential to address the socio-economic needs of the fishing communities in this area, prompted the fisheries authority to formalise the lobster fishery as early as 2002 (Fielding et al, 1994, Researcher's observation).

Fisheries authorities had to identify fishers who met established criteria. The Department of Agriculture, Forestry and Fisheries' Environmental officials have been placed in Port St Johns, East London and Port Elizabeth for the purpose of issuing fishing permits. DAFF has issued about 1995 ECRL fishing permits annually to 48 fishing communities along the Wild Coast of the Eastern Cape from Coffee Bay to Mzamba. DAFF appointed a service provider to record catch efforts and biological data in the Eastern Cape. A total of 108 catch data monitors were employed to capture data in all the fishing sites in the Eastern Cape. Monthly effort and biological data is submitted to DAFF by the service provider on a monthly basis and the data is meant to be analysed by DAFF for fisheries management purposes.

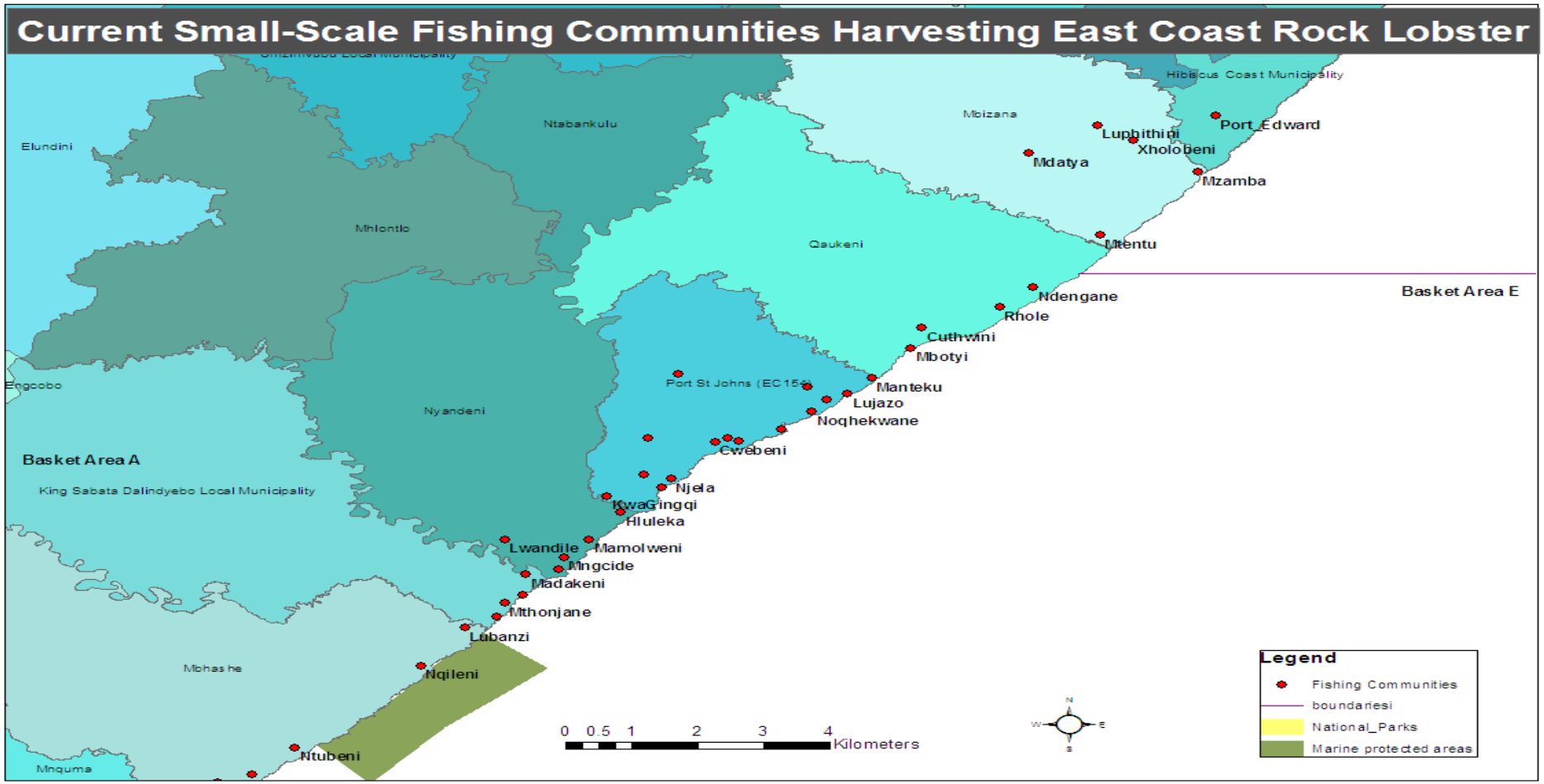

Figure 6.1: Illustration of fishing communities in the Wild Coast of the Eastern Cape

The purpose of this chapter is to assess the quality of East Coast Rock Lobster catch monitoring in the Eastern Cape and to provide insight as to how this data can be used for the management of the resource. This will be done by analysing catch data submitted by the service provider to DAFF on a monthly basis from April 2011 to May 2013. This data will include effort data and biological data of East Coast Rock Lobster in the Eastern Cape recorded over two fishing seasons.

6.2 Materials and methods

The case study included the Eastern Cape's East Coast Rock Lobster fishery data recorded by the catch data monitoring service provider contracted by the Department of Agriculture, Forestry and Fisheries. The data included data from fishing communities along the Wild Coast of the Eastern Cape where there are small-scale fishers harvesting and selling East Coast Rock Lobster to registered buyers. The researcher analysed the ECRL data by analysing how easy it is to capture data, identify missing indicators and provide recommendations that would assist in improving the IMS and potential use by the fishers and fishery managers. The researcher analysed the data over the period from April 2011 to May 2013 as a source of quantitative data. Literature and the researcher's experience and knowledge of DAFF processes have been the source of qualitative data for this case study.

6.3 Results

This section focuses on presenting the analysed catch data of East Coast Rock Lobster from the Wild Coast of the Eastern Cape from April 2011 to May 2013 for 2011/12 and 2012/13 fishing seasons. The analysed data includes that of East Coast Rock Lobster catch effort data and biological data for the above-mentioned periods.

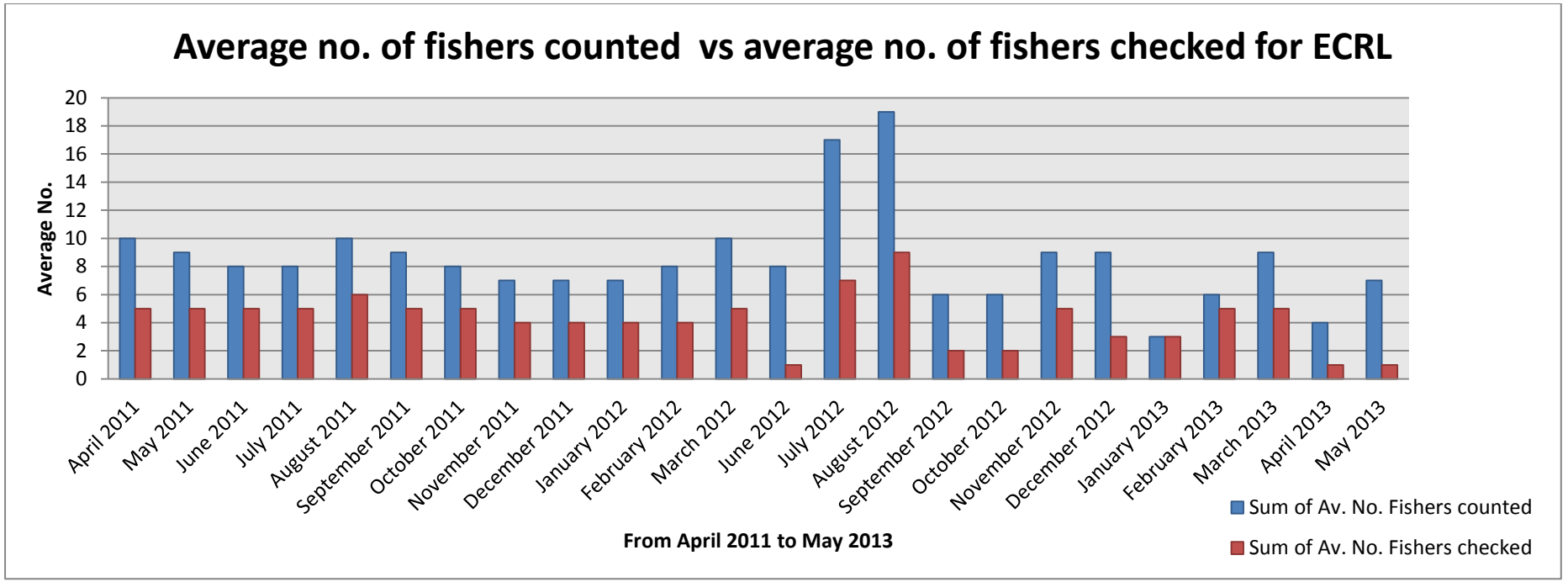

Figure 6.2: Average number of fishers counted versus average number of fishers checked for East Coast Rock Lobster per day for each month from April 2011 to May 2013

The above figure illustrates the average number of fishers counted per day for each month versus the average number of fishers checked per day per month. The figure indicates that the average number of fishers counted per day per month has been between 7 and 10 fishers though this number increased dramatically between July 2012 and August 2012. The average number of fishers counted per day for each month shows a decrease from September 2012 to May 2013. The average number of fishers checked per day for each month follows the same trend as the average number of fishers counted. However, in some months the average number of fishers checked per day per month is as low as 1. This means that there were months where there were many fishers counted but not checked.

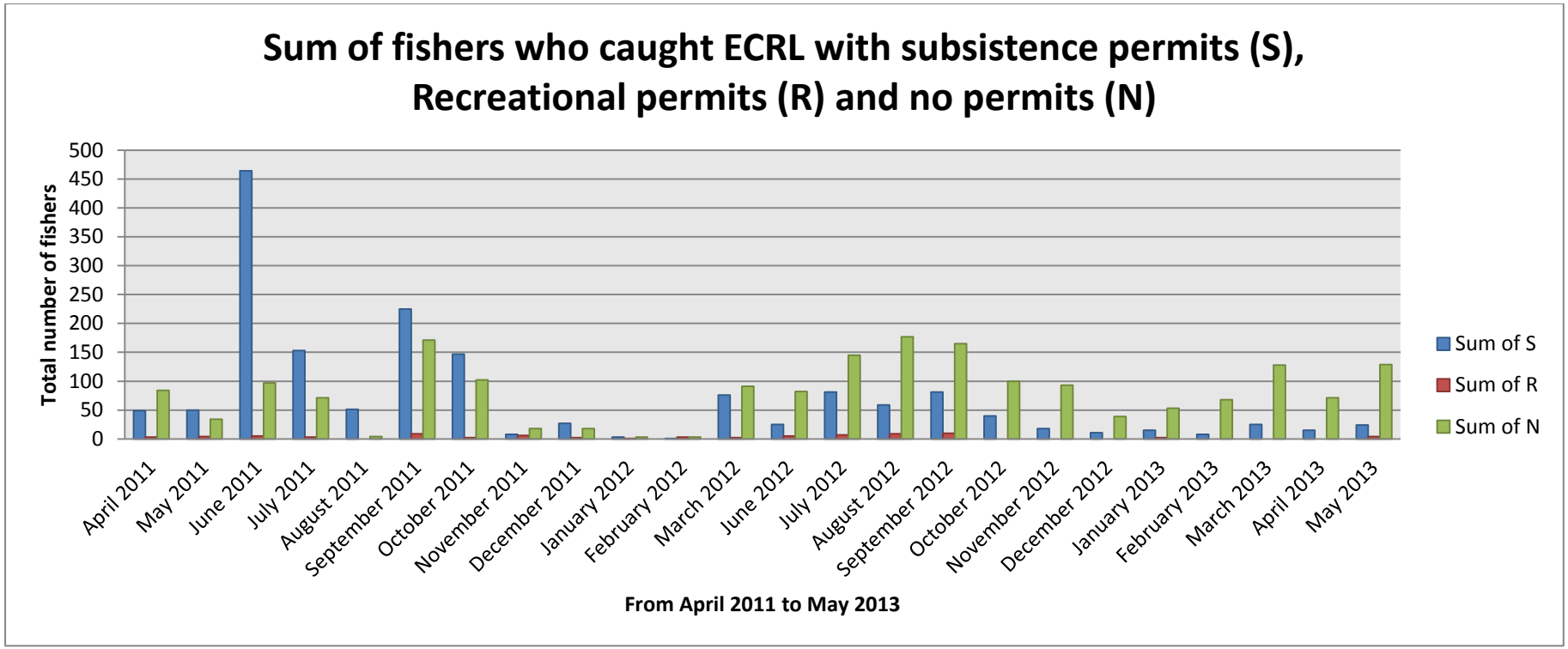

Figure 6.3: Total number of fishers recorded per month catching East Coast Rock Lobster with subsistence permits (S), with recreational permits (R) and fishers who caught East Coast Rock Lobster without permits (N).

The above figure indicates that from the three different types of fishers who caught ECRL from April 2011 to May 2013, there were many fishers who caught ECRL without permits and that the number was highest from March 2012 to November 2012. The above also indicates that the total number of fishers with subsistence permits decreased from April 2011 to May 2013 and that there was an increase in June 2011. The

figure also illustrates that there are very few fishers who were recorded catching ECRL using recreational fishing permits. The three groups of fishers caught ECRL mainly from April 2011 to October 2011, from March 2012 to November 2012 and from March 2013 to May 2013. The graph indicates that fishers were catching lobster during closed fishing season which is from November to end February annually.

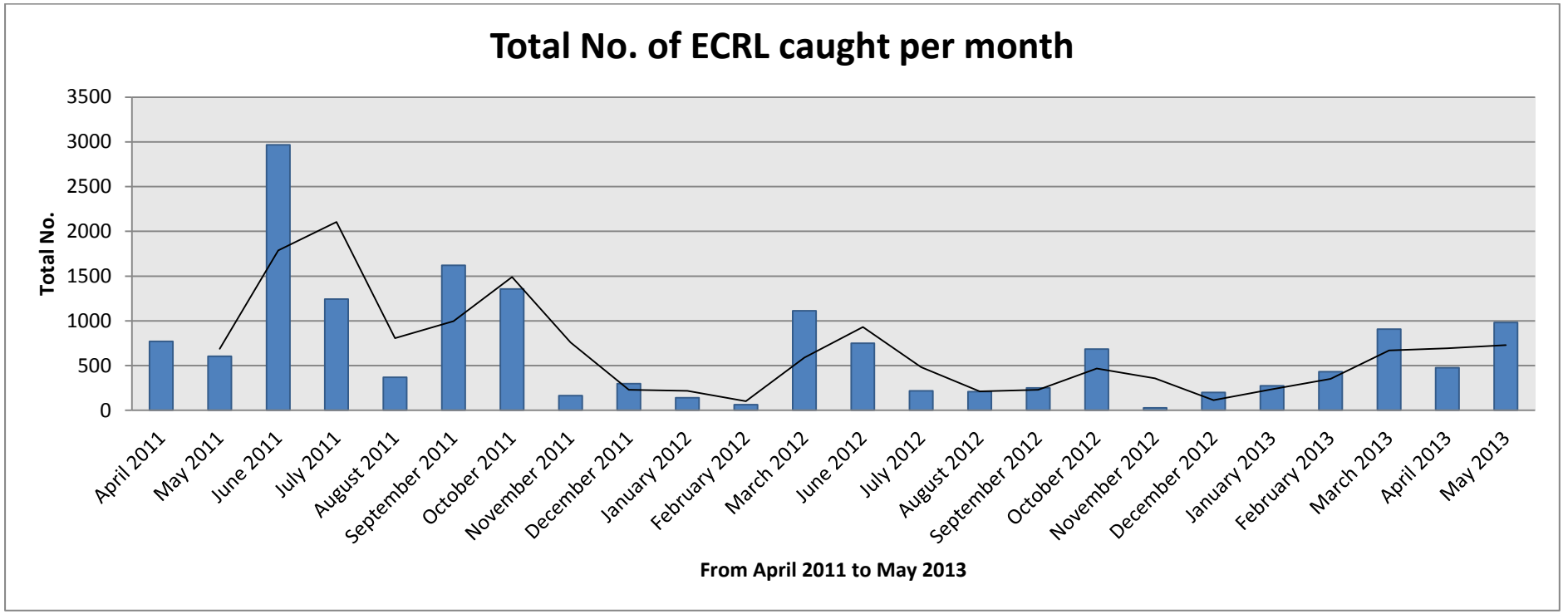

Figure 6.4: Total number of East Coast Rock Lobster caught per month from April 2011 to May 2013.

Based on the trendline, the above graph indicates that generally the total number of ECRL caught has been decreasing from April 2011 to May 2013. This further indicates that total number varied per month; that the month with highest ECRL caught was in June 2011 and that the

lowest number of ECRL caught was in November 2012. The figure also indicates that the total number of ECRL caught decreased from November to February during 2011/12 and 2012/13.

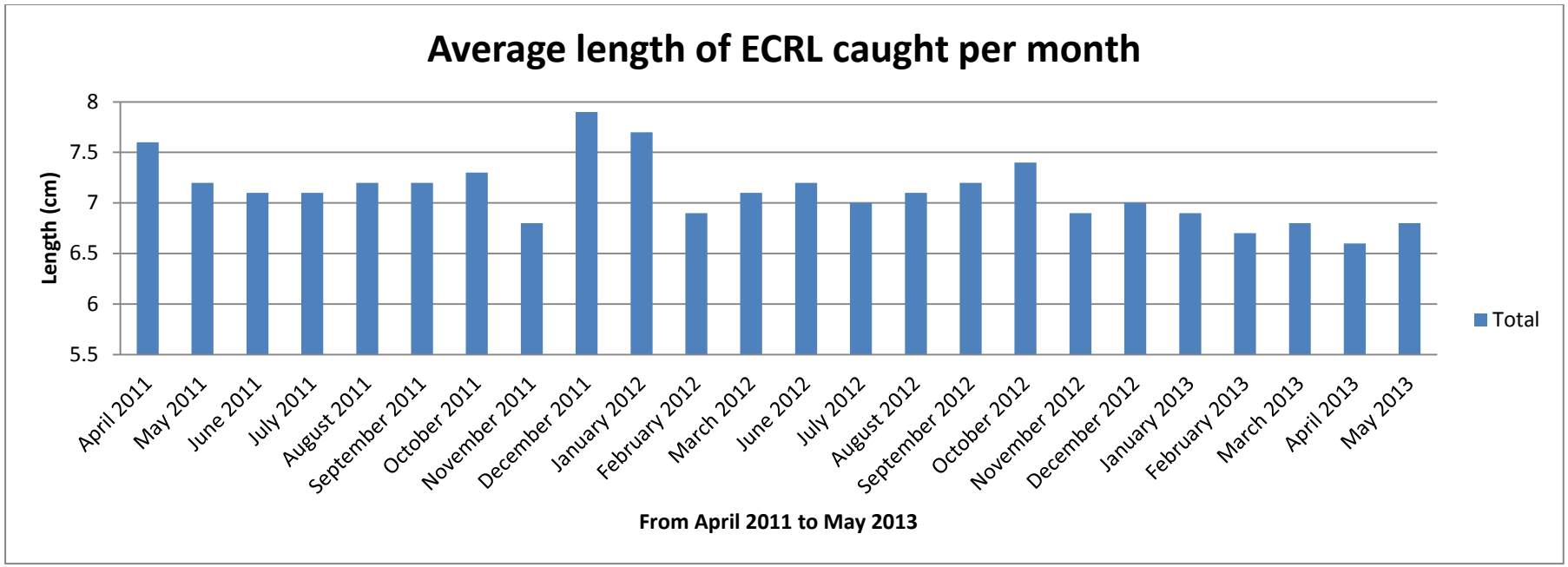

Figure 6.5: Average length of East Coast Rock Lobster caught per month from April 2011 to May 2013

This illustrates that the average length per month has been between 6.7cm and 7.9cm throughout the two fishing seasons. As much as there are no major differences in average length per month, variation per month is evident with some months recording higher average length compared to other months.

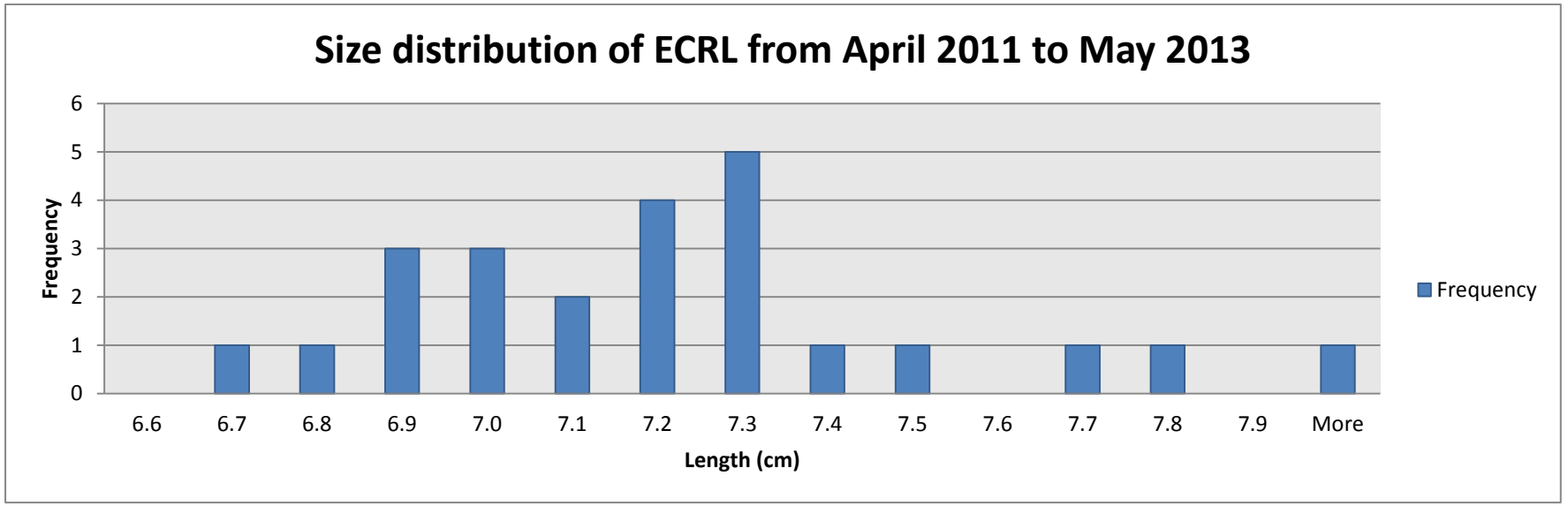

Figure 6.6: Size distribution of East Coast Rock Lobster caught from April 2011 to May 2013

The above figure illustrates the size distribution of ECRL from April 2011 to May 2013. It indicates that the majority of ECRL caught were 7.3 cm in length followed by 7.2 cm. Based on the above size distribution of recorded lobster, there were no undersized ECRL caught from April 2011 to May 2013 as the minimum length is 6.5 cm as per DAFF's catch permit conditions issued together with subsistence permits on an annual basis.

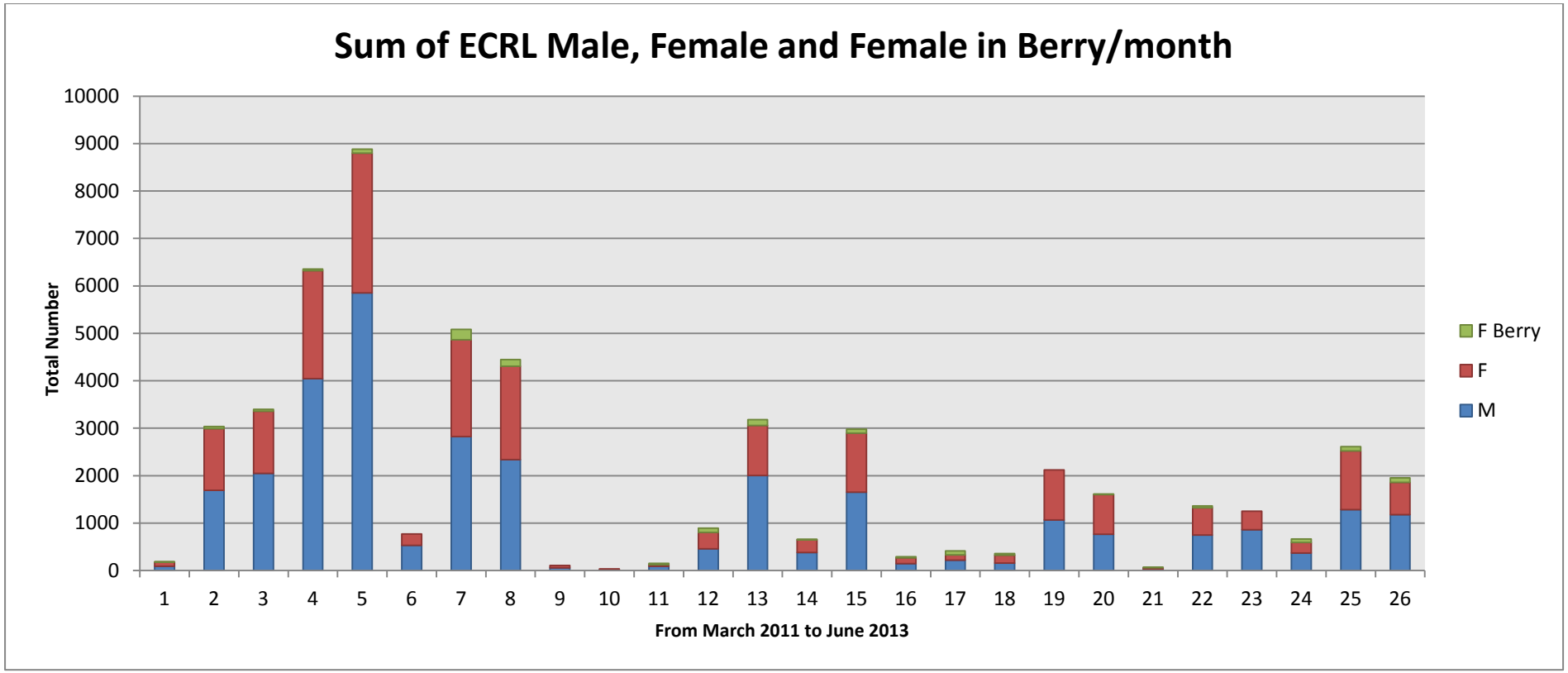

Figure 6.7: Total number of East Coast Rock Lobster caught that are Male, Female and Female in berry per month from March 2011 to June 2013

The above indicates that from the total number of ECRL caught per month, the majority were male. This also illustrates that the total number of female in berry occurred throughout the months though their total number was between 220 and 1 per month.

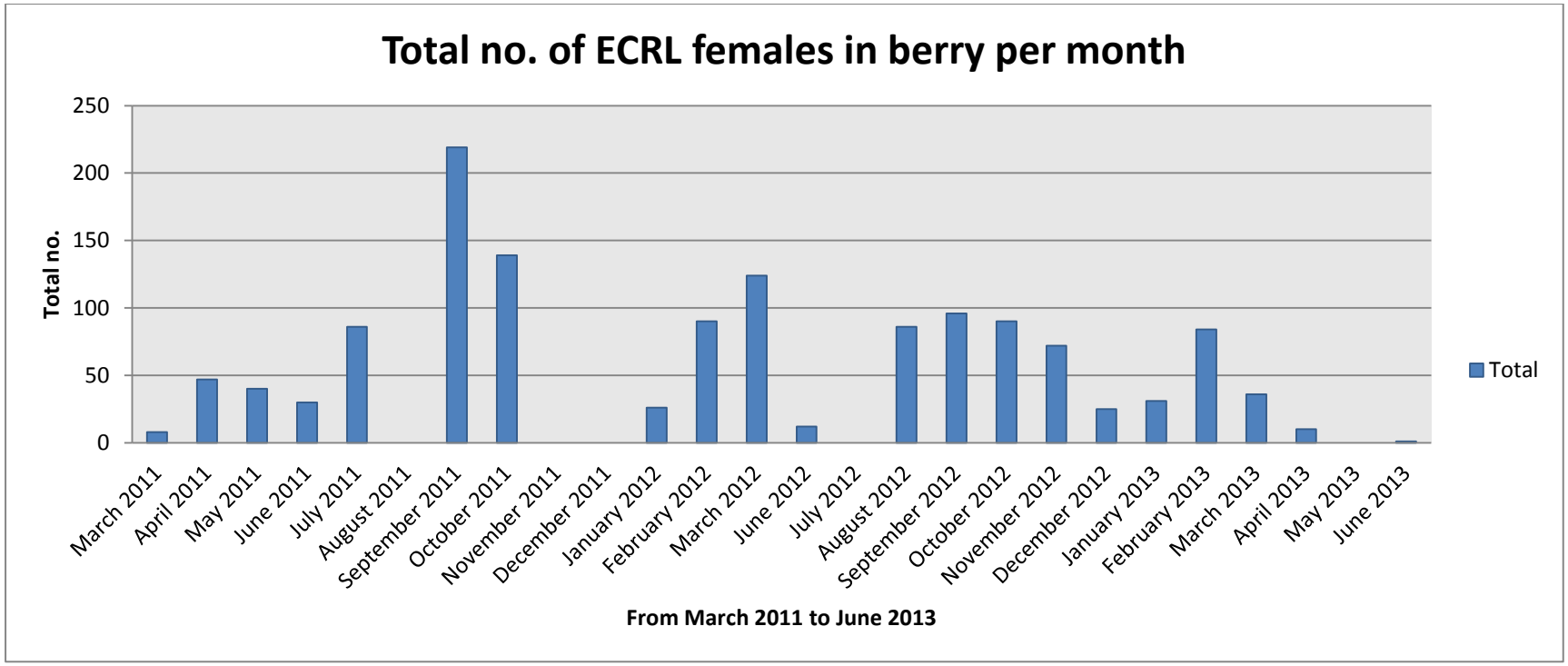

Figure 6.8: Total number of ECRL females in berry per month from March 2011 to June 2013

The above indicates that the total number of female lobsters in berry was the highest in September 2011 and October 2011. This figure also illustrates that there were no females in berry caught in August 2011, November 2011, December 2011, July 2012 and May 2013. ECRL females in berry appeared consecutively from March 2011 to July 2011 and from August 2012 to April 2013.

6.4 Discussion

Based on the data presented in Figure 6.2, the total number of fishers counted versus the total number of fishers checked per day per month has been more consistent between 5-10 and 2-7 respectively, although there was a sharp increase in July and August 2012. As much as this is reflected by the data, it leaves uncertainties on the data as this means that the monitors only managed to count an average of 10 fishers a day and checked an average of 7 fishers per day from the total of 1995 fishers issued with subsistence permits on an annual basis. Considering that the monitors are expected to patrol their specific areas on a daily basis, this might be indicative of the fact that there might be some areas where fishers do not catch this valuable species or that the monitors are not aware of the areas or spots where most of the fishers catch ECRL, hence there is a very low number of fishers recorded by the monitors.

Figure 6.3 indicated that from the three different types of fishers who caught ECRL from April 2011 to May 2013, there were many fishers who caught ECRL with annual subsistence permits issued by DAFF and there were fishers who caught ECRL without permits and that the number was highest from March 2012 to November 2012. Due to the fact that DAFF issues permits in the form of an A4-sized paper with no form of protection from water damage, many fishers opt to leave their permits at home. Some fishers do so because they know that the monitors are aware that they were issued permits by DAFF. There are, of course, those fishers who do not see a need to apply for a permit from DAFF as they believe that the marine resource belongs to their communities. Fisheries authorities view this as poaching as it is against the MLRA regulations. This, therefore, means that the number of fishers who caught ECRL without permits might be due to the above-mentioned reasons and the total catches could be much higher than those recorded by the monitors.

In this part of the Eastern Cape, there are many tourists visiting hotels and fishing recreationally. However, most visitors mainly harvest line fish species as the ECRL is not allowed to be caught under a recreational permit. Even so, there were a few recreational fishers who were recorded by monitors to have caught ECRL. Figure 6.4 also illustrates that the effort increased during the fishing season which is from March to October of every year. This also indicated that fishers continued to catch ECRL during the closed season period which is from November to February annually. This may be influenced by the fact that there

are already a high number of fishers who catch ECRL without permits and that open or closed seasons have little significance when balanced against the demand from holiday makers and other interested groups. There is a need for further analysis of the fisher behaviour in this regard as this might reveal the need to revise closed season based on the amount of ECRL harvested during the closed season and amount of production taking place at this time.

The total number of ECRL caught has been decreasing from March 2011 to May 2013 and that might be caused by a variety of reasons from a decrease in the number of fishers catching ECRL, to DAFF issuing permits late and incorrect data captured by catch data monitors. When the researcher was tasked with sorting the raw data, there were many errors that were evident on the data. These errors might have influenced the data on total number of ECRL caught. For example, in January 2012, there were 9 fishers counted and 4 fishers checked and yet these fishers were able to dive and catch 102 ECRL in one day.

Figure 6.6 illustrates the size distribution of ECRL from April 2011 to May 2013. It indicates that the majority of ECRL caught was around 7.3 cm in length followed by 7.2 cm. Based on this size distribution, there were no undersized ECRL caught from April 2011 to May 2013 as the minimum length is 6.5 cm as per DAFF's catch permit conditions issued together with subsistence permits on an annual basis. This may be influenced by the fact that ECRL is bought per Kg and that each individual has a limit of 167 units per month and that the bigger the lobster the more money a fisher would get from the buyers registered with DAFF. Another possibility is that fishers with no permits do catch undersized lobster but they are not recorded.

The data indicated that ECRL were caught using rod and line, iron bar and by knife. This is not accurate as this gear is used for line fish, oysters and mussels. Therefore there were numerous errors in capturing the gear used for ECRL and other species. This means that the data has been captured incorrectly and it can distort the data analysis. Therefore, the data analysed for ECRL might not reflect the fishing activities taking place in these fishing areas as incorrect data between different species may distort the results. For example, 200 mussels can be caught in one day by one fisher and that one fisher diving or catching 200 ECRL per day is highly unlikely; and if such information can be recorded for ECRL, this might imply a

large abundance in that specific area if the average number of ECRL caught per month or per season is considered.

These results have illustrated that from the total number of ECRL caught per month, the majority of ECRL are male and that females in berry occurred randomly throughout the period analysed and that they ranged from a total of 220 to 1 per month. This is directly proportional to the total number of ECRL caught per month. This means that chances of a fisher catching female ECRL in berry increases with the increase in number of ECRL caught per day. This puts the spotlight on the current fishing season which is from March to October, as the main purpose of closed periods is to ensure that stock breeding occurs and sustains itself. Figure 6.8 further illustrates that a significant number of females in berry have been caught during the fishing season. If the quality of the data submitted to DAFF is a reflection of what is taking place in these fishing areas, then DAFF needs to consider revising fishing seasons and permit conditions for ECRL.

6.5 Conclusion

The quality of ECRL data captured from April 2011 to May 2013 needs urgent improvement as this data is limiting due to its major errors and the difficulty of analysing important aspects of the fishery such as CPUE as there is absolutely no consistency in the naming of sub-areas and the same applies to monitor name-spelling. Correct assignment of Patrol Areas is crucial for understanding replicate of sites and account for differences between estuarine and open coast areas.

The monitor names must be standardised across Catch Effort and Biological spreadsheets, as 'Monitor' in combination with date and interview number is the only way to connect the two sources of information and link the biological information to areas. As there were minor errors as well, the researcher spent a significant amount of time rectifying them before the data could be analysed.

There is an urgent need for revision of which elements of data should be captured and how the data should be packaged as well as the purpose of the data. Currently, the data has many errors that would negatively affect management of this fishery. Some of the errors encountered are as follows:

- Different formats used within one column;
- Different formats used in columns of the different sheets;
- Irrelevant data captured in columns, e.g.: under column "permit type" you expect "N, R or S" but you find other letters and numbers;
- Some data captured with spaces and/or punctuation. This affects "count of data"
- Some fields are empty with no explanation, etc.
- "F-Counted and F-Checked" versus the "monitor" for a specific day does not add up
- Some data captured as text instead of numbers format
- Biological data not correlating with Effort data
- Effort data for March 2011 and June 2013 is missing as there is only Biological data for March 2011 and biological data for June and July 2012 is missing.

The above-mentioned errors can significantly distort the data and what really occurs in this fishing sector. An overhaul of the catch data monitoring service is urgently needed. Such an overhaul needs to consider the following:

- Sufficient monitors and coverage of the fishing grounds by the monitors;
- Ensure that catch data monitors understand objectives of recording data and that they are aware of the principles of the small-scale fisheries sector
- Revision of catch forms to be in line with principles of the Small-Scale Fisheries Policy;
- Development of an easy-to-use capturing system that would minimise as many errors as possible; and
- Involvement of local fishers in verification and analysis of the data

The above can be achieved with proper planning and the implementation of an integrated information system that will ensure improved quality of the data and its use thereof. DAFF needs to prescribe what type of data is needed currently and develop a catch data monitoring plan in preparation for the small-scale fisheries sector. Without these improvements, DAFF will not be able to effectively manage the small-scale fisheries sector in accordance with its policy.

CHAPTER 7: DISCUSSION AND RECOMMENDATIONS

7.1 Introduction

It has been noted in the previous chapters that 1) management of fisheries internationally has been focused on single species and a top-down conventional approach, 2) that small-scale fisheries have been marginalised, and 3) that there is a clear need to change management approaches towards an EAF embracing both ecological and human dimensions.

South Africa has been no exception to this dominant management paradigm, however, the Government's realisation for a need to change this management approach puts the country in a leading position to come up with innovative management measures that will ensure that small-scale fishers effectively manage fisheries in partnership with fisheries authorities as per the co-management approach advocated by the newly minted Small-Scale Fisheries Policy.

Considering the history of South Africa and how small-scale fishers have been marginalised, implementation of the Small-Scale Fisheries Policy, which advocates a people-center, multiple-species, co-management and EAF approach, will need careful thinking in terms of how to address the above concepts in a practical way. It has been highlighted repeatedly in previous chapters that lack of information is seen as one of the major challenges that affect the current and successful management of small-scale fisheries. The expectation that small-scale fishers will have a significant role in managing fisheries, and the need to ensure that the fishers have the capabilities to meet these expectations are as important factors to consider as the new approaches themselves. Therefore, adequate capacity building for all the stakeholders participating in the co-management process is one of the key factors to a successful co-management approach. A tool that could support this capacity-building need would comprise of easily packaged and presented information for decision-making. The type of information for such a participatory approach needs to inform decision-making so that ecological and socio-economic objectives can be met.

Effective implementation of the Small-Scale Fisheries Policy depends heavily on reliable and accessible data that would be used to further manage this newly-established fishing sector. Prior to this, one needs to acknowledge that there is currently information that has been captured by the fisheries authority in the past which cannot be effectively used. Having

conceptualised an information management system and critically looked at two case studies and analysed the quality of catch data in Doringbaai, and a regional case study of the quality of ECRL data, it is safe to say that there is a need to address the challenges identified and further improve data management.

This chapter will focus on unpacking the limitations of the current available data by looking at the conceptualised IMS and thereafter look at the outcomes of the two case studies which would indicate the current challenges. This chapter will also look at the opportunities to address these challenges through an IMS and further provide recommendations in preparation for implementation of the Small-Scale Fisheries Policy which advocates for EAF and co-management approaches.

7.2 Limitations of Current information

It has been stated in Chapter 4 that for many years the data collected used to be housed in different desktop and laptop computers without any electronic backup. Ever since 2010 when the researcher was employed by DAFF, data from various computers has been consolidated, captured and saved into the Microsoft Access database. Based on the annual activities of DAFF, data has been collected and, for the first time, registration and verification of fishers in preparation for the issuing of annual fishing permits was reviewed in 2011, when the researcher developed a registration form that allowed for socio-economic data per individual fisher and per fishing community to be captured. This list included more than 6500 entries from a total of 7414 fishers issued with permits annually under the interim relief dispensation in the Western Cape, subsistence permits in KwaZulu-Natal and the Eastern Cape. This data was captured on designed catch forms on Microsoft Access database and each Environmental Officer had to capture information of all the fishers in communities for which he/she is responsible. In return, the researcher consolidated all the information into an IMS based on a Microsoft Access database.

Community catch data has also been imported from Microsoft Excel to Microsoft Access. It has been suggested that the service provider contracted by DAFF to record catch data should capture information on Microsoft Access as well so as to have an integrated database which would assist in improving data management. By using ArcGIS 10.2, the

researcher has linked the database and used it as an attribute data. This resulted in the ability to present data spatially with relevant information.

For the past few years, however, DAFF has introduced criteria for verifying fishers which has not been based on any data or information. Thus the conceptualised IMS based on a Microsoft Access database has allowed DAFF to draft new criteria that is in line with the socio-economic profiles of fishing communities in the Eastern Cape. This also assisted fishers from some fishing communities in various provinces to understand their socio-economic profile, as the data has been presented to selected community representatives. This database further keeps a record of the total number of fishers verified and issued with permits and the type of species allocated to each fisher. This has assisted DAFF to properly verify fishers and keep a proper record of fishers who no longer meet the criteria. This has also given DAFF a sense of the socio-economic profile of fishers and their communities leading up to the implementation of the Small-Scale Fisheries Policy.

An example of this is illustrated in Figure 7.1 overleaf where it indicates that in the Wild Coast region, the average age of small-scale fishers is currently about 38 years old and that the average number of dependents per household was 4 individuals within a household with an average total of 7 individuals. In addition, this figure indicates an average age of the youngest and oldest household occupants in the family of a small-scale fisher. It further indicates that on the Wild Coast of the Eastern Cape, the highest grade passed at school on average is currently Grade 6 which indicates that the level of education is very low. Such information can be used to plan for the implementation of the Small-Scale Fisheries Policy and to monitor contribution or impact of this policy to small-scale fishing communities over a period of time.

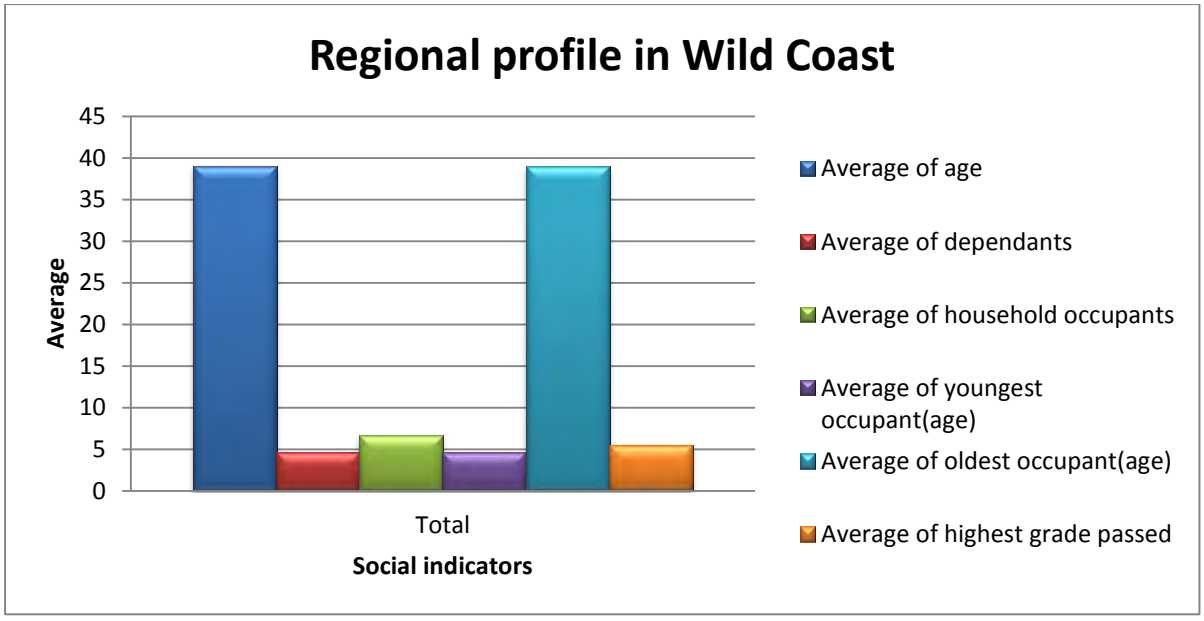

Figure 7.1: Illustration of a sample of the socio-economic information that has been captured.

For the first time at DAFF various maps have been produced relating to small-scale fishing communities. This has been made possible by linkages between the Microsoft Access database and shapefiles from ArcGis 10.2. Through this database DAFF is now able to map out fishing communities and overlay various social and economic indicators (Figure 4.3, 4.4).

As much as the researcher has conceptualised a database that houses different data sets in one database and linked it to spatial data for visual presentation, more needs to be done in order for this IMS to be fully effective. Considering the Small-Scale Fisheries Policy principles and governance approach, the database is currently considerably limited and these limitations include:

- The current data still housed in one machine though there is backup;
- Most of the data is outdated and some datasets date back to 2009;
- The database does not consider or is not capable of accommodating local knowledge
- There are high-value species caught by small-scale fishers, but the database design does not fully take into consideration economic data relating to marine resources caught and sold by small-scale fishers;
- The database does not take into consideration the catch data as catch data is manually imported to the database. Therefore, monitors do not capture the data using the developed electronic catch forms;

- The data is not live and it is currently accessed by the researcher. The data is also not housed on any server;
- Most importantly, various fisheries managers have not worked with this data and the data has not been used to its full potential;
- Small-scale fishers do not have direct access to the data and they have never had an opportunity to fully analyse the data for their planning and understanding of the fishery;
- The current data is not linked to other DAFF systems such as the Marine Administration System (MAST) which houses other relevant DAFF processes.

As much as the development of this Microsoft Access-based IMS database has provided a realistic and operational data management structure, catch data has proved to be a major challenge as has been highlighted in Chapter Five and Chapter Six. In order for DAFF to properly manage marine resources it depends on the availability and quality of catch data. Therefore, catch data processing and recording thereafter has the most significant limitation as, in its current state, the data cannot be used to properly manage marine resource and the fishery in general. The following are the limitations to the catch data:

- Catch data program is not in line with Small-Scale Fisheries Policy principles as it does not consider the human dimensions of EAF and co-management;
- Based on the two case studies, there is insufficient capacity from the monitors;
- The data is submitted to DAFF at the end of every month and that the data is not live, or it is not in real-time;
- The data has many errors that could have been easily avoided through use of a proper web-based data management system;
- Due to lack of key indicators and errors, it is almost impossible to effectively determine Catch per Unit Effort (CPUE). This is mainly caused by lack of integrated indicators and lack of additional indicators that may be for specific regions and various coastal provinces;
- The data is usually challenged by resource users as it is usually used to inform DAFF of fishers who have over-caught their allowable catches. This is the only time that the fishers get feedback regarding catch data;
- The data does not effectively address or accommodate compliance ambiguities;

- The data does not accommodate needs of various stakeholders such as Compliance, Stakeholder Engagement, Fishers and the public in general, etc.

Therefore, the above-mentioned current challenges will be a contributing factor to the failure of effective implementation of the Small-Scale Fisheries Policy as the management approach to small-scale fisheries management is very much dependent on reliable, secure and accessible data.

7.3. Opportunities for IMS

As explained in Chapter One, the Small-Scale Fisheries Policy advocates a shift from a conventional top-down, natural science-driven approach to a more holistic, ecosystems and people-centred approach that would take into consideration environmental, social and economic factors through an EAF and Co-management process. The type of data collected needs to be in line with the ambit and needs of the Small-Scale Fisheries Policy. An Information Management System that would improve capturing of various data sets - integrating and packaging various data for various groups such as fisheries authorities, small-scale fishers and other stakeholders - would contribute to ensuring that the Small-Scale Fisheries Policy is implemented and it would contribute to proper management of this new fisheries sector.

In order for this to occur, there is a need to convert the designed desktop-based Microsoft Access IMS into a server-based IMS database with a web interface. The spatial interface must integrate Google Maps capabilities. The web-based IMS must also allow for remote log-in for visualisation, data input and analysis by fisheries authorities. User-defined access and tools will need to be developed, and some basic reporting functionality will need to be defined and established.

The purpose for the web-based IMS is to become a tool that can be used by fisheries authorities and small-scale fishers towards the successful implementation of the Small-Scale Fisheries Policy. The Marine Living Resources Amendment Act is prescriptive in defining the type of community-based legal entities as it prescribes for small-scale fishers to form co-operatives. Considering that in South Africa co-operatives are a business model, the co-operatives will have to meet various legal expectations which include recording of finances and decisions executed by the cooperatives in relation to managing their business and in

this case to manage their fishing rights. This would be part of the approach in managing the small-scale fisheries sector; IMS would bring an opportunity for all these requirements to be met through integration and seamless packaging of this data for optimum convenience. The tool itself should take shape as a web-based spatial information system, depicting all the fishing communities along the South African coast and with easy navigation to a particular community and access to its information.

With regard to the challenges highlighted in section 7.2, the web-based IMS would ensure that monitors use an electronic device such as smart cell phones to capture landings on behalf of small-scale fishers. Capturing of this data would be through a designed standard form that is integrated into an electronic system which allows for the data to be verified and submitted electronically. This would also ensure that the data submitted is immediately available for fisheries authorities for their processes. Keeping up with the requirements of the co-management approach, this system would ensure that specific information is available to stakeholders participating in co-management structures. Most importantly, small-scale fishers would be able to assess their data and to contribute to verification of this data and capture data related to their local knowledge. Therefore, small-scale fishers would be able to do the following basic functions through the IMS:

- *Descriptive data*: Co-operative registration information, small-scale fisher profiles, socio-economic and livelihood data, rights allocation and conditions, TAC/E management and monitoring, resource status indicators, register of fishers identified by the community, sale and pricing records, export records etc.
- *Basic analysis:* Fishing effort patterns, resource status trends and stock impact at various harvesting spots, market changes, weather pattern,
- *Ease of use:*
    - DAFF service providers or project managers would be able to log in and assess the status of implementation of policy, management decisions, etc.
    - Researchers log in to analyse or upload data and make recommendations for further improvement
    - Catch data monitors upload catch data and clearly visualise what is happening in the fishing communities they are monitoring in terms of resource pressures and distribution of benefits

In conclusion, this web-based IMS would bring together various fisheries-related information and data in one comprehensive and integrated management system with the aim of making current management procedures such as rights allocation, TAC/TAE determination, permit conditions formulation etc. more efficient. This would also further improve data on much needed catch effort, species size distribution, gear, markets, fishing areas etc. Considering new approaches in the small-scale fishing sector, the IMS will therefore provide socio-economic data and make it possible to generate a baseline of both ecological and social indicators against which to assess the Small-Scale Fisheries Policy implementation and its progress and to ascertain the need for further review.

This system would be a powerful tool for small-scale fisheries as they would be able to formulate recommendations for improved management at a community level. The IMS would also improve the legitimacy of the catch data monitoring process by involving fishers in catch data recording, research and data analysis through co-management structures.

In order for this IMS to fully contribute to improvement in the current management process and assist in the implementation of the Small-Scale Fisheries Policy, there is a need for intensive training of DAFF officials who will be hosting and maintaining the data. Considering the current capacity, or lack thereof, within the Directorate: Small-Scale Fisheries Management within DAFF, training of all the Environmental Officers and Fishery Development workers together with the relevant DAFF manager should be considered at different levels based on the role each official will play in the implementation of the policy.

Most importantly, small-scale fisheries cooperatives will need to be trained in operating the IMS. This training, therefore, should include various processes and procedures that they might use for managing their sector. Once the DAFF officials and small-scale fishing cooperatives are trained, co-management structures would have specific roles and responsibilities that would also need the participants to have relevant training pertaining to their responsibilities on IMS whereby reporting will be customised and user-defined.

The IMS would be a key tool in small scale fisheries as the co-management committees would depend on credible information in order for the sector to be properly managed. This would further empower fishers to responsibly manage their fishing rights through well informed decisions. Considering that there is currently high level of mistrust within these

fishing communities, transparency on decisions through well-presented information within small scale fisheries cooperatives will reduce conflict and promote cohesion in these fishing communities as there will be less assumptions of how things are done. As a means of a co-management approach, small scale fishers should be recording their own catches/ fishing trips using a mobile application/mobile IMS whereby they will be able to track their effort and catches and properly plan and manage their fishing rights. This would also further ease the burden from fisheries authorities as this activity would be devolved to cooperatives. This would also have a positive impact of the co-management structures as the communities will be able to properly understand their sector and make informed decisions

This definition of EAF shows that there is a distinct difference between the conventional approach to fisheries management and EAF, which accounts for other factors such as natural environment, social, cultural and economic needs of the fishers. It also takes into consideration the uncertainty of the ecosystem and the human component while taking an integrated approach to adapt to uncertainties without compromising the integrity of the resource.

Therefore, ensuring that the different components such as human dimensions, biotic elements and abiotic elements are at a balance will ensure successful implementation of the approach. This balance can only be realised by use of a IMS with relevant human, biotic and abiotic information that would safely inform or assist small scale fisheries to make decisions that are in line with this EAF. An example of this would be when a co-management structure decides on the duration of the fishing season for a particular species. The structure would depend on the data produced through monitor and capturing of boat trips and catches by the fishers (CPUE determination). Further to this after the duration of the season is determined, small scale fishers would have to develop a fishing management plan which would be informed by catch data, socio-economic profile of individual fishers and that of the community and the availability of the species. IMS with all this information would therefore be at the centre of ensuring that the small scale fisheries sector is sustainably managed through partnerships between fisheries authorities, small scale fishers and other key stakeholders through co-management structures.

Considering that the study was aimed at conceptualizing IMS based on the current data and looking at how the IMS can be improved, the above illustrates clearly the importance and the need for a web-based IMS with its mobile application and it is believed that an urgent implementation of the web-based IMS is needed to improve the current management arrangement and the implementation of the Small-Scale Fisheries Policy which is expected to commence in 2015. As a priority, it is recommended that DAFF should make funding available to further improve its management system by following the outlined IMS and addressing the highlighted gaps. This would further lead to roll-out the small-scale fisheries Information Management System in preparation for the implementation of the Small-Scale Fisheries Policy as this system would improve small-scale fisheries governance in South Africa. Sufficient funding should also be availed to train all the relevant stakeholders that should be using the IMS. This is more especially with the small scale fishers and fisheries authorities.

ANNEXURES

Annexure 1: Registration and verification criteria

Annexure 2: Data Capturing template

Annexure 3: Registration forms with socio-economic data indicators

Annexure 4: Sample of data form based on Microsoft Access

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forestry & fisheries

Department:
Agriculture, Forestry and Fisheries
REPUBLIC OF SOUTH AFRICA

Private Bag X2, Roggebaai 8012, Foretrust Building, Martin Hammerschlag Way, Foreshore, CAPE TOWN,8001
Tel: (+27 21) 402 3911 Fax: (+27 21) 402 33 64

SMALL SCALE FISHERIES VERIFICATION CRITERIA FOR 2012/13 FISHING SEASON

The following criteria are applicable in the determination of the eligibility of Small Scale fisher's exemption holders.

1. Personal involvement in traditional fishing for at least 10 years and/or total dependence on the marine living resources for a living.
2. Applicants shall **not** be active in any other commercial fishing sector including being a full time **crew member** or have any other form of permanent employment including being employed as a contract worker for more than six (6) months.
3. Applicants shall reside within a fishing community as per the attached list, *see Annexure A.*
4. Applicants earning a Government Grant (**Permanent Disability Grant, War Veterans Grant <u>except</u> Child Support Grant and Foster Care Grant, Health Care Grant)** will not be accommodated in the dispensation. Old Age grant may be included provided they are actively involved in fishing.
5. Small Scale fisheries Exemption Holders in possession of recreational permits may not use their recreational permits to target species listed under the small scale exemption.
6. Only one person per household or family will be allowed to hold interim relief exemption, i.e., not more than one member of the same immediate family.

ACTING CHIEF DIRECTOR: MARINE RESOURCE MANAGEMENT

DATE: 06/08/2012

Subsistance and Small-scale Commercial fisheries monitoring data sheet
Monthly sampling effort

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REPUBLIC OF SOUTH AFRICA

Monitors Name: **Area Name:**

Date	Areas patrolled	Start time	End time	Total fishers counted	Total fishers checked	
dd - mm - yy	2. beach	00h00	00h00			

R = recreational, S = subsistence, N= no permit

interview number	type of fisher (S or R or N)	permit number	time of interview	gear	bait	number + species of fish	number of mussels and oysters	number of lobsters	number + species of other inverts

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BIOLOGICAL RESOURCES DATA COLLECTION FORM

Name of Monitor: **Date:**

Interview No	Exemption No	Organism (Species)	Length (cm)	Sex (male/female), berry	Weight (g or kg)

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1. PERSONAL DETAILS

Name:	**Surname**:	**ID:** **Age**:
Gender: ☐ M ☐ F	**Ethnic group**: ☐ *Black* ☐ *White* ☐ *Coloured* ☐ *Asian*	**Disability**: ☐ Yes ☐ No Type:

2. ECONOMIC DETAILS

Primary source of income:		**Secondary source of income:**	
Number of dependants:	**Number of household occupants**:	Youngest:	Oldest:
Highest standard (Grade) **passed:**		**Species applied for:**	
Acquired skill (excluding fishing) e.g.: brick laying, driving, sewing			

3. COMMUNITY DETAILS

Community Name:								**Number of registered Fishers:**			
District/ Municipality:								**Local Municipality:**			
Province:								**Exemption year:**			
Location of the Fishing Area (GPS Reading)	**From**	**S**									
		E									
	To	**S**									
		E									

3.1. CONTACT DETAILS OF CHAIR PERSON/ COMMUNITY LEADER/ OTHER

Name:	**Surname:**	**Gender** ☐ **M** ☐ **F**	**Position:**
Postal Address:		**Residential Address**	
Tell:	**Fax**	**Cell:**	**Email:**

3.2. SPECIES HARVESTED

I. Species			**Bag Limit**			**Bag Limit**
	Oyster			Periwinkle		
	Line Fish			Octopus		
	Mussel			Alikreukel		
	East Coast Rock Lobster			Red Bait		
	West Coast Rock Lobster			South Coast Rock Lobster		
	Abalone					

3.3. EXISTING ACTIVITIES ADJACENT TO FISHING AREA; NAME AND DISTANCE FROM FISHING AREA

INFRASTRUCTURE	TYPE	NAME	DISTANCE(KM)
i. MARKETS			
ii. LEARNING INSTITUTIONS			
iii. INPUT SUPPLIERS E.G. co-operatives			
iv. RESEARCH INSTITUTIONS			
v.ACCESS TO TRANSPORTATION (E.g. Private or Public)			
vi.OTHER ADJACENT BUSINESS			

3.4. CURRENT SUPPORT SERVICES

3.4.1 SUPPORT PROVIDED:

SUPPORT ACQUIRED	INSTITUTION/S	KIND	DURATION/ FREQUENCY/ AMOUNT
1. TRAINING SKILLS DEVELOP.			
2. FINANCIAL (GRANTS/ LOANS)			
3. EXTENSION			
4. INFRASTRUCTURAL			
5. MARKET			
6. OTHER			

3.4.2 SUPPORT NEEDED CURRENTLY

3.4.3 EXPECTED OR EXPERIENCED STUMBLING BLOCKS (CONSTRAINTS) AND NEEDS ANALYSIS

ii. RESOURCES - FINANCES	
iii. MARKETS	
IV. SOCIAL - DISPUTES,POACHING, TRESSPASSING, ETC.	
V. CAPACITY - SKILLS AND TRAINING	

NEEDS ANALYSIS OF THE FISHING AREA	

3.5. VISITING OFFICER'S REMARKS/ COMMENTS

3.6. ACTION/ FUTURE PLANS AND RECOMMENDATIONS

3.7 YIELD/ INCOME FACTOR

CURRENT USE:	POTENTIAL USE:

3.8 AVAILABILITY OF BUYER/S

Company/ Buyer's Name:	
Director's Name:	**ID:**
Area:	**Species Name:**
Date Of Signed Contract:	**Selling Point:**

DECLARATION				
	Name/s	**Contact**	**Date**	**Signature**
Monitor/s:				
Environmental Officer/s:				

3. COMMUNITY DETAILS

Community Name:			**ward number:**		**Number of registered Fishers:**							
District/ Municipality:			**Local Municipality:**									
Province:			**Exemption year:**									
Location of the Fishing Area (GPS Reading)	**From**	**S**										
		E										
	To	**S**										
		E										
Community Location		**S**										
		E										

3.1CONTACT DETAILS OF CHAIR PERSON/ COMMUNITY LEADER/ OTHER

Name:	**Surname:**	**Gender** **M** **F**	**Position:**
Postal		**Residential Address**	
Tell:	**Fax**	**Cell:**	**Email:**

3.2 SPECIES HARVESTED

I. Species			**Bag Limit**			**Bag Limit**
	Oyster			Periwinkle		
	Line Fish			Octopus		
	Mussel			Alikreukel		
	East Coast Rock Lobster			Red Bait		
	West Coast Rock Lobster			South Coast Rock Lobster		
	Abalone					

3.3 EXISTING ACTIVITIES ADJACENT TO FISHING AREA; NAME AND DISTANCE FROM FISHING AREA

INFRASTRUCTURE	**TYPE**	**NAME**	**DISTANCE(KM)**
i. MARKETS			
ii. LEARNING INSTITUTIONS			
iii. INPUT SUPPLIERS E.G. co-operatives			
iv. RESEARCH INSTITUTIONS			
v.ACCESS TO TRANSPORTATION (E.g. Private or Public)			
vi.OTHER ADJACENT BUSINESS			

3.4 CURRENT SUPPORT SERVICES

3.4.1 SUPPORT PROVIDED:

SUPPORT ACQUIRED	INSTITUTION/S	KIND	DURATION/ FREQUENCY/ AMOUNT
1. TRAINING SKILLS DEVELOP.			
2. FINANCIAL (GRANTS/ LOANS)			
3. EXTENSION			
4. INFRASTRUCTURAL			
5. MARKET			
6. OTHER			

3.4.2 SUPPORT NEEDED CURRENTLY

3.4.3 EXPECTED OR EXPERIENCED STUMBLING BLOCKS (CONSTRAINTS) AND NEEDS ANALYSIS

ii. RESOURCES - FINANCES	
iii. MARKETS	
IV. SOCIAL - DISPUTES,POACHING, TRESSPASSING, ETC.	
V. CAPACITY - SKILLS AND TRAINING	

NEEDS ANALYSIS OF THE FISHING AREA	

3.5 VISITING OFFICER'S REMARKS/ COMMENTS

3.6. ACTION/ FUTURE PLANS AND RECOMMENDATIONS

3.7 YIELD/ INCOME FACTOR

CURRENT USE:	POTENTIAL USE:

3.8 AVAILABILITY OF BUYER/S

Company/ Buyer's Name:	
Director's Name:	**ID:**
Areas:	**Species Name:**
Date Of Signed Contract:	**Selling Point:**

DECLARATION				
	Name/s	**Contact**	**Date**	**Signature**
Monitor/s:				
Environmental Officer/s:				