Ecofish WP3:
Incorporation of stakeholders’ knowledge in data collection and analysis

Evidence based management recommendations for the Namibian Hake Fishery with special emphasis on use value and employment

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# Table of Contents

1. Introduction to the Report: .................................................. 4
   1.1 Implementing an EAF ................................................. 4
   1.2 The Namibian Hake Fishery ........................................ 7
   1.3 Material and Methods .............................................. 8

2. History of the Demersal Hake Fishery in Namibia ................. 10
   2.1 Early History ....................................................... 11
   2.2 South African Exploitation ...................................... 11
   2.3 Distant Water Fleets ............................................. 12
   2.4 The Recent Past ................................................... 13

3. Human Dimensions of the Namibian Hake Fishery ................. 15
   3.1 Institutional Dimensions ......................................... 15
      3.1.1 Policies and Legal Framework ............................ 15
      3.1.2 Access/Use Right .......................................... 16
      3.1.3 Participation of Fishers and Fish Workers and Community Level Institutions 19
      3.1.4 Interactions between Different Policies ................... 19
      3.1.5 Enforcement & Compliance .................................. 20
   3.2 Social Dimensions ................................................ 21
      3.2.1 Gender and Age .............................................. 21
      3.2.2 Migration and Family Structures ......................... 23
      3.2.3 Health .......................................................... 24
         3.2.3.1 The Namibian Health Sector ......................... 24
      3.2.4 Education ...................................................... 28
   3.3 Economic Dimensions ............................................ 28
1. INTRODUCTION TO THE REPORT:

This document reports on deliverables 3.3, 3.4 and 3.5 under task 3.2 and 3.3 outlined in appendix 3 of the co-operation agreement between the Benguela Current Commission (BCC) and University of Cape Town (UCT), Marine Research Institute, with regard to the completion of the project entitled ‘development of ecological sustainable fisheries practices in the Benguela Current Large Marine Ecosystem (ECOFISH)’.

As outlined in the project document this report comprises part of a larger study that aims to develop a new framework for an ecosystem approach to fisheries management (EAF) in the Benguela Current Large Marine Ecosystem (BCLME). ECOFISH strives to (1) improve the current knowledge of basic ecosystem processes; to (2) improve current stock assessments; and to (3) incorporate the knowledge of stakeholders in the management of fisheries. ECOFISH activities are organised into four work packages, which together are building an integrated knowledge base for the implementation of an ecosystem approach to fisheries in the BCLME. Work packages 1 and 2 concentrate on improving existing stock assessment models as well as improving the data inputs that inform these models; work package 4 concentrates on capacity building. Work package 3 concentrates on integrating different forms of knowledge into a coherent assessment approach for two case studies: the Namibian hake fisheries and the Angolan purse seine fisheries. This report details results from Work Package 3 on the first case study, the Namibian fisheries for shallow water hake (*Merluccius Capensis*) and deep water hake (*Merluccius Paradoxus*).

1.1 IMPLEMENTING AN EAF

EAF is a relatively new research and management paradigm (FAO 2003), which has emerged as a response to the failure to manage the world’s fisheries in a sustainable manner (Pitcher et al. 1998; Pauly et al. 2002). EAF refers to a holistic approach to fisheries management that emphasizes the importance of integrating both human and ecological aspects into fisheries governance (Garcia et al. 2003; Figure 1).
In southern Africa a regional EAF project was launched in 2004, under the auspices of the Benguela Current Large Marine Ecosystem Programme. Notwithstanding the commitment by signatory nations at the 2002 World Summit on Sustainable Development (WSSD) to implement an EAF by 2012 (Garcia and Cochrane 2005), the process of putting EAF into practice is challenging (Paterson & Petersen 2010). One of the reasons why the move towards EAF is difficult is that this approach demands a rethinking of fisheries management. Traditionally fisheries management has assumed that the productivity of fish populations was largely independent of the physical environment and social-ecological changes (Paterson et al 2014). In this old paradigm, fisheries science assumed that the recruitment of new fish could be predicted based on the size of the adult population and that the size of a fish population could be manipulated through fishing pressure. Consequently, for close to 100 years fisheries management has been guided by scientific advice and focussed on regulating fishing pressure, e.g. the number of boats, the size of fishing nets and the setting of a total allowable catch (Pauly et al 2002; Bavington 2009). However, the collapse of many of the world’s most important fisheries such as the Atlantic cod or the Peruvian anchovy clearly attests that this approach has not been successful (Daw and Gray 2005; Degnbol 2003; Finlayson 1994).

One aspect, which is becoming increasingly clear, is that the sole reliance of traditional fisheries management on scientific knowledge is problematic (e.g. Jarre et al 2008; Paterson et al 2014; Paterson & Kainge 2014). Fishers themselves are a tremendous knowledge resource that has the potential to vastly improve EAF. Increasing attention is thus being given by researchers to fishers’ knowledge in order to provide fisheries management with additional ecological information (e.g. Johannes and Neis 2007, Paterson & Kainge 2014), to improve fisheries scientists’ understanding of fishing effort (e.g. Neis et al 1999, Paterson & Kainge 2014) and fish population dynamics (Stephenson et al 1999), and to improve collaboration between scientists, managers and industry (e.g. Lane & Stephenson 1999, Lane & Stephenson 2000, Jentoft 2000, Daw 2008). Scientific knowledge is data intensive and relies on costly methods such as extensive
at sea surveys, which can only be undertaken a few times per year to collect specific data. Fishers, on the other hand, in their day-to-day work experience at sea accumulate a vast albeit under valued storehouse of knowledge about the marine environment. Tapping into this storehouse is of key importance for the construction of new knowledge as is required by the current paradigm shift in fisheries management.

Moreover, the objectives of an EAF are often conflicting and require trade offs (Paterson et al 2007), the setting of targets and limits entails value judgement and decision making (Prigent et al 2008) and requires the involvement of ecosystem users. International literature and experience suggests that social factors, not ecological or physical variables, are the primary determinants of effective, sustainable fisheries governance (Christie 2004, Pomeroy et al. 2007, Jones 2009). However, notwithstanding the intention to implement an EAF, the current policy environment in Namibia is still dominated by the traditional focus on natural science and industry interests. As a result ecological objectives are underpinned by scientific criteria, while social and economic objectives, although politically important, are less clearly defined. The BCC therefor launched a project investigating the human dimensions of EAF in the fisheries of the region (BCC 2014). This project developed a framework that helps to identify and integrate the multiple human dimensions of research into and management of these fisheries (Table 1).
Table 1 framework for the identification and integration of human dimensions of EAF into fisheries research and management in the BCC (Paterson et al 2014b).

human dimensions of EAF

<table>
<thead>
<tr>
<th>Institutional</th>
<th>Social</th>
<th>Economic</th>
<th>Cultural</th>
<th>Political</th>
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</thead>
<tbody>
<tr>
<td>• policies/legal framework</td>
<td>• gender, age</td>
<td>• poverty</td>
<td>• local knowledge</td>
<td>• power structures</td>
</tr>
<tr>
<td>• access/use right</td>
<td>• social cohesion</td>
<td>• employment (income level, quality of</td>
<td>• customary fishing practices &amp; institutions</td>
<td>(objectives and goals of different</td>
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<tr>
<td>• participation (fishers, fish</td>
<td>• religion</td>
<td>employment)</td>
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<td>stakeholder groups)</td>
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<td>workers)</td>
<td>• values, beliefs, perceptions,</td>
<td>• alternative economic opportunities</td>
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<td>• community level institutions</td>
<td>attitudes</td>
<td>• trade &amp; markets (post harvest)</td>
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<tr>
<td>• interactions between different</td>
<td>• goals and aspirations</td>
<td>• distribution of benefits/risks</td>
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<tr>
<td>policies</td>
<td>• livelihoods, practices,</td>
<td>• access to credit</td>
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<td>• linkages with other institutions</td>
<td>options, strategies</td>
<td>• cost of production</td>
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<td>(e.g. other ministries, universities, NGOs)</td>
<td>• health</td>
<td>• flow of benefits</td>
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<tr>
<td>• enforcement &amp; compliance</td>
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<td>• food security</td>
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<td>• capacity building</td>
<td>• rights/duties of fishers</td>
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<td>• Namibianisation</td>
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1.2 THE NAMIBIAN HAKE FISHERY

The BCLME is a typical eastern boundary upwelling system and as such characterised by high productivity. Fisheries in Angola, Namibia and South Africa benefit from the nutrient rich waters. In particular hake, horse mackerel and sardinella are important fish stocks for the prosperity of the fishing industries of the three countries, and the livelihoods of fishers and fish workers. In contrast to Angola and South Africa, Namibia’s fisheries did not originate from local small-scale subsistence fisheries but have always been subject to industrial style exploitation. For historical and geographic reasons, the fishing industry and all supporting infrastructure are concentrated entirely in Namibia’s two ports, Walvis Bay and Luderitz.
Two species of hake, shallow-water hake *Merluccius capensis* and deepwater hake *M. paradoxus*, are caught by demersal trawl and long-line vessels and support Namibia’s most important fishery.

Before Namibian independence in 1990 Hake resources had been exploited beyond the sustainable limit (Sumaila and Vasconcellos 2000, Roux and Shannon 2004). Catches peaked in 1972 at over 800,000 tonnes followed by a rapid decline. As a result, Namibia at independence inherited an altered ecosystem well below its productive capacity (Roux and Shannon 2004) and it has been estimated that this has cost Namibia 50% of the economic rent that could otherwise have been obtained (Sumaila and Vasconcellos 2000).

After 1990, under the new independent government, a 200-mile exclusive economic zone (EEZ) was declared and catch limits were first drastically reduced but then increased again. Today hake spawning stock biomass is considered to be at about 80% of values in 1990 and 12% of values in 1964 (Kirchner et al. 2012).

Hakes (*Merluccius capensis* and *M. paradoxus*) are an important commercial resource for Namibia, both in terms of revenue earnings and employment. The two species occur on the shelf and upper slope in Namibian waters; *M. capensis* occurs at depths between 100 m and 350 m, while *M. paradoxus* occurs mainly at depths of 300 m and 500 m. More than 90% of hake is currently landed by the freezer and wet fish trawlers, with the rest landed by longliners. 85% of hake products are exported to the European markets, 13% is marketed in Southern Africa and only 2% is consumed locally. The market value of the landed catch as of 2009 was approximately R4.1 billion (Paterson et al 2008).

1.3 Material and Methods

The results presented in this report are based on mixed methods research in Walvis Bay, Namibia.

Interview data

Unstructured interviews and informal conversations were conducted with scientists from MFMR. A series of semi-structured interviews with fish plant workers were conducted in 2012 in three major fish factories in Walvis Bay. This study also utilized data from semi-structured fisher knowledge interviews conducted in 2009 and 2010. All interviews were audio recorded, transcribed and coded for qualitative analysis. For a detailed description of the fisher knowledge interviews see Paterson and Kainge (2014). At the time our research was carried out the participating captains had a minimum of 12 and a maximum of 40 years of fishing experience, and had worked in Namibian waters between 5 and 40 years and in the hake fishery (in Namibia and South Africa) between 5 and 31 years.

To honor the ethical obligation to consider risks and benefits that may derive from participating in this research (Maurstad 2002, Carruthers and Neis 2011) sufficient information explaining the
research process was provided in writing to allow participants to give free and informed consent.

**Fisher data**

Logbook data from commercial trawl (wetfish) and longline vessels were analysed using MS Excel. We analyzed data for the years 1999 to 2012, that included information on date, time, length, location, and depths of lines set; number of hooks per set; and amount of fish caught, in order to calculate change in effort. We also consulted the academic literature on the Namibian fisheries; publications from the Ministry of Fisheries and Marine Resources; and relevant dissertations, technical papers, and project reports.

**Survey data**

A short survey was designed and carried out by 3rd year students of the Fisheries and Aquatic Sciences programme of the University of Namibia during their field work attachment in 2013. Data on years of operation, the number of vessels, number of employees and company clinics was collected from 15 companies in Walvis Bay (one did not provide data). Because there is no complete and up to date list of operators available it is impossible to accurately determine the sampling error. However, we are confident that the companies that participated in the survey constitute 90% of the fishing and processing capacity in Walvis Bay at the time.

In addition ethnographic research with fishers, fish factory workers, rights holders and Union representatives was undertaken in Walvis Bay in 2012 and 2013 by K. Draper as part of her PhD research.

**Fishery objectives**

Following the methodology for transdisciplinary research described by Paterson et al (2010) conversations with industry representatives were structured around two key questions:

1. “What are the most important goals for the fishery?”
2. “What are the main problems you observe related to the hake fishery and what solutions to these problems would you propose?”

Industry representatives responded to these questions during informal meetings that were usually about one hour long. The aim of this process was to develop a conceptualisation of the fishery in the form of objectives and indicators for each dimension. However, the process of eliciting this information from the participants went through various phases and differed somewhat between participants, depending on what they were willing to share or were interested in discussing. In some meetings the objectives hierarchy that had been developed based on the hake management plan (Figure 2) was used as a starting point. In those cases the conversation focused on clarifying assumptions and discussing how the research participants
would improve the objectives hierarchy. Other conversations started with very open and general discussions, which allowed the participants to explore the nature of the problem from various angles. This dialectical cycle of engagement and conceptualisation (Paterson et al 2010) continued over a two-year period.

Results from this broad multi-method research is presented in the following chapters. Some of these results have been published in peer-reviewed journals prior to the completion of this report. Chapter 2 outlines a brief marine environmental history of Namibia’s fisheries from early exploitation to the present. Some of this content has been published in Paterson et al (2014). Chapter 3 presents the results from our analysis of the human dimensions of the Namibian Hake fisheries based on the framework for the identification and integration of human dimensions of EAF into fisheries research and management in the BCC. In chapter 4 we turn to approaches that have the potential to greatly improve the current management of the Namibian hake fisheries. Based on the analyses in the previous chapters we put forward objectives and indicators for the human dimensions of the Namibian Hake fisheries. We then present an electronic decision-support tool that uses a fuzzy-logic model to integrate these objectives into a NetWeaver knowledge base and provides intuitive visual outputs to communicate results to managers and stakeholders. And finally we summarise findings derived from fisher interviews that are discussed in more depth in Paterson and Kainge (2014) and show that fishers’ ecological knowledge has the potential to improve current stock assessments.

2. HISTORY OF THE DEMERSAL HAKE FISHERY IN NAMIBIA
As a consequence of Namibia’s colonial past, the country inherited severely depleted fish resources at the time of independence. Today, Namibia’s fisheries are almost exclusively
industrial. The hake fishery has been restructured from a pre-independence foreign fishery into one that is characterized by locally based, vertically integrated fishing and processing companies. In this chapter, drawing from an analysis presented in Paterson et al (2013) we track the environmental impact of the historic exploitation of Namibia’s fish resources and its effects on Namibia’s fisheries management.

2.1 EARLY HISTORY

Namibia’s inhospitable hyper-arid coastal environment and exposed coastline limited the development of local fishing traditions. However, the Northern Benguela has been subject to large-scale foreign exploitation since the 18th century (Moorsom 1984, Roux and Shannon 2004). As a result of indiscriminate whaling and sealing by North American and European vessels marine mammal populations were rapidly depleted. As early as the 19th century Southern right whale and Cape fur seal populations were declining and by the early 20th century the local breeding population of southern right whales had been eradicated. With the decline of seals the economic exploitation shifted to guano, the so-called “white gold”, which led to the severe depletion of seabird populations by the end of the 19th century (Roux and Shannon 2004).

2.2 SOUTH AFRICAN EXPLOITATION

Namibia was under German colonial rule from 1884 until World War 1, when South Africa invaded and occupied South West Africa causing the German troops to surrender. Given the mandate to administer the “territory” by the League of Nations South Africa subsequently refused to surrender the mandate, continued occupation and introduced apartheid laws. Thus Namibia gained independence as late as 1990. South African West Coast fisheries expanded northwards into Namibia during the period of South African occupation. Depletion of west coast rock lobster (Jasus lalandii) through overfishing caused a northwards shift of the “crayfish frontier” into South West Africa (van Sittert 1993 a,b). A Luderitz-based west coast rock lobster fishery developed in the 1930s (Moorsom 1984, van Sittert 1993a). Ladings peaked in the early 1950s at 14,000 tonnes. Shortly after the fishery collapsed. Today the fishable rock lobster biomass is less than 1000 tonnes, recruitment is below average and there is no sign of recovery (WWF 2008).

Fisheries for sardines (Sardinops sagax) and anchovy (Engraulis encrasicolus) started in the 1940s on the west coast of South Africa. The abundance of sardines and anchovy off the Namibian coast caused South African companies again to expand northwards (see Paterson et al 2013 for more detail on the economic history of this expansion). As processing and catching capacity in Walvis Bay grew, so did the demand for more fish, and companies continuously pressured the authorities to give them higher quotas (Moorsom 1984). In addition during the 1960s two big South African factory ships basically eradicated the Namibian sardine stocks. Landings of small pelagic fish peaked in 1968 at about one and a half million tons, but declined rapidly thereafter. In 1977 this fishery also collapsed.
The offshore species, such as horse mackerel (*Trachurus trachurus capensis*) and the two species of hake, were last to be fished, because local demand for fresh and frozen hake was limited in both Namibia and South Africa. South African companies were able to meet their requirement for raw product locally and were thus not interested in Namibian hake until the South African Hake fishery was fully exploited by the 1980s. As result, Namibian trawling and processing remained on a small scale until the late 1960s. Most of the trawl vessels belonged to South African companies and the majority of the catch was landed in South African ports (Moorsom 1984; Paterson et al 2013).

### 2.3 DISTANT WATER FLEETS

While Namibian and South African based interests were slow to develop a deep sea trawl sector, the development of the ‘factory freezer trawler’ caused the world-wide expansion of distant water fleets (Ommer, 2007, p. 57-8). These large freezer vessels made long distance fishing for human consumption in global markets both practical and economic. By the mid 1960s about 100 trawlers from foreign fishing nations began fishing for hake and adult horse mackerel in Namibian waters. Between 1968 and 1972, Soviet and Spanish fleets caught about 90% of the hake catches of all foreign fleets off the Namibian coast. The rapid increase in catches peaked in 1972 at over 800,000t and was followed by an equally rapid decline (Paterson et al 2014, Fig.1). By 1980 the hake population had been reduced to less than 50% its former size. Over the same time period, fishing effort had doubled.

By 1980 all foreign fleets except the Spanish were fishing hake only intermittently, shifting their attention to horse mackerel instead. The fate of this sector was very similar: reported catches which had remained low in the 1960s, increased in the 1970’s and peaked in the 1980s at almost 600 000 tonnes. Since the early 1990s, catch rates have steadily decreased to an average of 300 000 tonnes per year, mainly due to lower fish abundances (Roux and Shannon 2004).

The foreign fishing effort off Namibia remained essentially unregulated until 1972, when the International Commission for South East Atlantic Fisheries (ICSEAF), which was formed in 1969, finally held its first working session. This convention was meant to pool scientific advice so that regulatory measures could be formed. However, Namibian interests were not represented in the convention. Indeed, as Richard Moorsom (1984) put it, ICSEAF was essentially “an open-ended club of foreign states whose trawlers exploit Namibia’s offshore waters”.

Namibia’s neighbours (South Africa and Angola), had declared 200 mile EEZs by 1979, but Namibia’s political situation prevented the implementation of a Namibian EEZ. Attempts by the South African administration to put an EEZ into effect in Namibian waters were considered illegal by the foreign fishing nations, because South Africa’s mandate over Namibia had been revoked by the United Nations. Since South Africa did not enforce the fishery zone, it was ignored and Namibian waters remained an open access area for foreign fishing nations until Namibia’s independence in 1990.
2.4 The Recent Past

The sequential exploitation of Namibia’s marine resources had severe consequences. Not only have total fish landings declined rapidly, but also there have been structural changes in the food web and changes to the functioning of the ecosystem: for instance there seems to be an increase in jellyfish and pelagic goby seem to have replaced sardine and anchovy as the main forage species (Roux and Shannon 2004). What is more, benefits to Namibia’s economy have been few, because profits from the fishery were all channeled away from the country (Moorsom 1984).

It is thus hardly surprising that after independence the Namibian Government restructured the fishing industry from a foreign fishery to a locally based that would maximize benefits for Namibians. A 200-mile EEZ was declared in 1990, a new fisheries institute was created and Namibian scientists were recruited from other Government departments to put in place a Norwegian funded fisheries research programme. It was anticipated that a conservative management regime would soon lead to the recovery of the hake stocks, which were then estimated to support future sustainable catch levels of 250,000-300,000 tonnes (MFMR 1991 as cited in Sherbourne 2010). Thus catch limits were initially reduced to 60,000t, and additional measures to promote stock rebuilding were also put in place. However, from the start there was scientific disagreement regarding the size of the resource and the anticipated rate of rebuilding: estimates based on biomass surveys indicated overexploitation, but estimates based on commercial catch and effort data indicated nearly pristine abundance levels (van der Westhuizen 2001). The conservative catch levels that were put in place by the newly appointed Namibian scientists were contested by established fisheries scientists in South Africa and elsewhere, who had previously advised ICSEAF. These scientists “were stunned by the conservativism [sic] of the initial total allowable catch recommendation by the new government” (Ocean and Land Resource Assessment Consultants 2013).

On the strengths of the high catch levels of the past, and based on related high expectations regarding the productivity of the resource (Sherbourne 2010), and in response to challenges from external scientists to the size of the original post-independence quota (Paterson et al. 2013, Paterson & Kainge 2014), the Namibian government increased the total allowable catch levels from 60,000 in 1990 to 200,000 in 1999 (Paterson and Kainge 2014, Fig. 1).

It is important to note here that the period of Namibia’s transition into independence coincided with the global rise of the neoliberal governance model, which became an important condition for developing nations to tap into international development aid (Kapaama 2007). In line with neoliberal views of traditional fisheries economics (Béné et al. 2010), the new Namibian government hoped to create employment and income for Namibians, profit for industry, increased foreign earnings from exported fish and at the same time improve domestic food supplies and food security. Based on the neoliberal model it was assumed that the development of a vertically integrated sector would achieve these goals.
The Namibian government introduced incentives for investment in onshore processing facilities. The “Namibianisation” policy was designed to motivate Namibians to participate in the fishing industry, either as owners or as employees. This would increase control over the fishery via Namibian majority shareholding in fishing companies and it would also increase economic benefits to Namibians through job creation and earn more revenue for government (Kirchner and Leiman 2014). Sherbourne (2010) notes that after early growth the industry first stagnated and then declined. The 2008 economic crisis and consequently depressed prizes had a negative effect on the fishing industry (“Hangana seafood” 2011).
3 Human dimensions of the Namibian hake fishery

In 2010 the BCC in collaboration with the FAO launched a project to investigate the human dimensions of fisheries management in the region. A key conclusion of the project was that in all three countries available data on human dimensions are fragmented and insufficient. In Namibia in accordance with the country’s focus on large-scale fisheries, data collection by the Ministry of Fisheries and Marine Resources (MFMR) has largely been limited to macroeconomics and rights allocations. Some social and economic data have been collected through the national census, the municipalities of Walvis Bay and Lüderitz, and NGOs. However this information has, for the most part, not been collated or systematically analysed, and is not easily available to resource managers. In this chapter we strive to compliment and contextualize the available data within our own research findings in an attempt to present a more complete picture of the human dimensions of the Namibian hake fisheries.

3.1 Institutional dimensions

3.1.1 Policies and legal framework

Namibian fisheries policies and laws conform to the requirements of the Namibian Constitution (1990), which provides that the State shall actively promote and maintain the welfare of the people by adopting policies aimed at

i) the maintenance of ecosystems, essential ecological processes and biological diversity of Namibia; and

ii) the utilization of living natural resources on a sustainable basis for the benefit of all Namibians, both present and future.

After independence Namibia put in place a strong legal fisheries framework. A White Policy Paper (MFMR 1991) “Toward responsible development of the Fisheries Sector” was proclaimed in 1991 outlining three main goals:

1. The rebuilding of Namibia’s fish stocks;
2. The establishment of an efficient monitoring, control and surveillance system, and
3. The establishment of a viable national fishing and processing industry with maximum Namibianisation of jobs and empowerment of previously excluded people

The White Paper formed the basis from which the Sea Fisheries Act of 1992 was developed (MFMR 1992). In 2000 this Act was updated and replaced by the Marine Resources Act (MFMR 2000), which is the most important law that governs Namibia’s marine environment. The Act empowers the Minister to determine the policy applicable to the conservation and utilization of marine resources, in order to realize the greatest benefit for all Namibians, both present and future.

MRA Regulations (MFMR 2001) include the terms and condition for all vessels and fishers operating within Namibia’s EEZ. The MRA and the Regulations distinguish only between
harvesting marine resources for recreational purposes and for commercial purposes. The Law Enforcement Agency of the Ministry of Fisheries and Marine Resources (MFMR) enforces the fisheries laws in Namibia. Access to marine resources is controlled by the issuing of rights, exploratory rights and quotas for the commercial sector. The policy statement of 2009 (MFMR 2009) sets out the guidelines for the granting of fishing rights and the allocation of quota. Several other policy documents such as the National Plan of Action for Seabirds and the Hake management plan are at various stages of completion.

3.1.2 ACCESS/USE RIGHT
The Namibian fisheries policy is centered on access rights as „no person may harvest any marine resource commercially unless they are the owner of a fishing right“ (MFMR 2000).

All pre-independence fishing rights expired at the end of 1993 and new fishing rights were allocated in 1994 for periods of four, seven and ten years. In 2002 the rights application process was renewed. According to the Marine Resource Act (MFMR 2000), the Minister of Fisheries may announce a period during which applications may be made for rights to harvest marine resources. The criteria, which the minister should consider, are outlined in the Sea Fisheries Act (MFMR 1992):

1. the applicant should be a Namibian citizen
2. the applicants company’s beneficial control is vested in Namibian citizens
3. the applicant should have the ability to exercise the right of exploitation in a satisfactory manner

The duration of rights was increased in 2002 to include 15 year rights (with provision for 20 year rights). The duration is dependent on the extent of Namibian ownership. The extension of the duration of rights served the dual purpose of creating incentives for Namibian participation and long-term capital investment in the industry (Kirchner MBA). Additional rights were granted in 2011. It is clear however, that the degree of Namibian ownership is difficult to evaluate and it has been claimed that foreign control is maintained through preferential shares, proxy ownership and cross-ownership (Manning 1998, Melber 2003, Sherbourne 2010, Kirchner and Leiman 2014).

The Namibian fisheries policy was intended to divert benefits that were previously lost to the Namibian public towards employment creation via investment in the onshore processing sector. Initially this appeared successful as 6000 new jobs were created during 1991-1998 (Erastus, 2002). However, it has been argued that resource rents could be more effectively used for public benefit through investments in health, education and housing (Manning 1998). Armstrong et al (2004) estimate that the policy led to a loss of quota fees that amounts to a government subsidy of 74 500 NAD per person for the 1000 jobs created per annum.

Access rights are non transferrable to ensure that the Namibianisation and empowerment strategies are followed (Nichols 2004 as cited in Kirchner MBA). But the high cost of entry into a
large-scale industrial sector such as the Namibian Hake fishery means that paper quota holders sell their quota to fish processors, a procedure that MFMR refers to as “leasing” (Kirchner & Leiman 2014). This leasing arrangement has much in common with a formal ITQ system (Kirchner & Leiman 2014) and what is more, the transfers of quota have the tacit agreement of the Ministry of Fisheries (Draper 2014).

Access rights are put in place to protect the resource from over exploitation. However it seems that the Namibian rights allocation policy has negatively affected resource exploitation.

Table 2 Number and duration of hake rights 2003-2011 (data: MFMR)

<table>
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<tr>
<th>HAKE</th>
<th>Four-year</th>
<th>Seven-year</th>
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<td>6</td>
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</tr>
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<td>10</td>
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<td>6</td>
<td>22</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td>10</td>
<td>6</td>
<td>22</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>2007</td>
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<td>1</td>
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<td>24</td>
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<td>38</td>
</tr>
<tr>
<td>2008</td>
<td>0</td>
<td>1</td>
<td>13</td>
<td>24</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>2009</td>
<td>0</td>
<td>1</td>
<td>13</td>
<td>24</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>2010</td>
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<td>0</td>
<td>4</td>
<td>34</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td>2011</td>
<td>0</td>
<td>12</td>
<td>4</td>
<td>34</td>
<td>0</td>
<td>50</td>
</tr>
</tbody>
</table>

Between 2002 and 2010 the number of rights for Hake remained stable at 38 rights being allocated with increasing duration for individual rights holders (Table 2). At the end of 2011 MFMR allocated an additional 12 rights to new rights holders, bringing the number of rights for Hake to 50 (Smit 2011), an increase of 31%. The following year the TAC for hake was set at 170,000 tonnes although the scientific recommendation had been, to set the TAC at 130,000 tonnes (Table 3). The Minister justified his decision to grant 30% more quota by saying that “We have to make sure that the quota is of such a nature that it will take the fishing right holders through the year. Keep in mind that we have granted new fishing rights for hake and monk” (Poolman 2012).
<table>
<thead>
<tr>
<th>Year</th>
<th>Recommended</th>
<th>Allocated</th>
<th>Catch</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>60</td>
<td>132</td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td>100</td>
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<td>120</td>
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</tr>
<tr>
<td>1994</td>
<td>130</td>
<td>150</td>
<td>112</td>
</tr>
<tr>
<td>1995</td>
<td>120</td>
<td>150</td>
<td>130</td>
</tr>
<tr>
<td>1996</td>
<td>62</td>
<td>170</td>
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</tr>
<tr>
<td>1997</td>
<td>50</td>
<td>120</td>
<td>117</td>
</tr>
<tr>
<td>1998</td>
<td>140</td>
<td>150</td>
<td>107</td>
</tr>
<tr>
<td>1999</td>
<td>210</td>
<td>210</td>
<td>158</td>
</tr>
<tr>
<td>2000</td>
<td>194</td>
<td>194</td>
<td>171</td>
</tr>
<tr>
<td>2001</td>
<td>200</td>
<td>200</td>
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<tr>
<td>2002</td>
<td></td>
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<tr>
<td>2003</td>
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<td>2004</td>
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<td>160</td>
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<tr>
<td>2006</td>
<td>140</td>
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<td>137</td>
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<tr>
<td>2007</td>
<td>130</td>
<td>130</td>
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</tr>
<tr>
<td>2008</td>
<td>120</td>
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<tr>
<td>2009</td>
<td>110</td>
<td>148</td>
<td>130</td>
</tr>
<tr>
<td>2010</td>
<td>100</td>
<td>140</td>
<td>159</td>
</tr>
<tr>
<td>2011</td>
<td>145</td>
<td>180</td>
<td>154</td>
</tr>
<tr>
<td>2012</td>
<td>130</td>
<td>170</td>
<td></td>
</tr>
</tbody>
</table>
A review of the distributive aspects of Namibia’s fishing policy has been undertaken (Manning 2001). A report was also compiled on the biological, social, and economic impacts of rights allocations in the BCLME region (Enviro-Fish Africa, 2006).

3.1.3 Participation of Fishers and Fish Workers and Community Level Institutions

The Ministry of Fisheries and Marine Resources recognises the fishing associations as the formal voice for the individual fishing sectors, and the Confederation of Namibian Fishing Associations providing the national voice on commercial fishing industry issues (BCC 2014). Mechanisms to facilitate industry participation in the management of the fishery focus on ‘stakeholders’ who are usually either rights holders or company representatives – in other words business administrators.

As a result of the vertical integration of the hake fishery all fishers and fish workers are company employees. Their interests are represented by the Trade Unions. They do not actively participate in fisheries management in any way. Although labour legislation constituted a significant improvement for workers after independence it also served to shift emphasis away from workplace struggles to negotiations between union leaders and management. The trade unions’ main function has thus been narrowed to being the representative of workers in a tripartite arrangement, between labour, capital and the state (Jauch 2007).

Fishing is among the few economic sectors where unions have been successful in negotiating reasonable working conditions. It has to be stressed however, that a large proportion of the fisheries work force is in fact employed by labour brokers. Workers at labour brokers experience the poorest working conditions in Namibia, earning between N$ 2 and N$ 5 (US$ 0.28-0.71) per hour without benefits and job security (Jauch 2007). Although some labour hire workers have joined trade unions, the insecurity of their jobs coupled with potential shifts between workplaces makes unionization difficult (Jauch 2008).

3.1.4 Interactions Between Different Policies

Although Namibia’s fisheries policies have been celebrated for being both scientific and socially sensitive, this is only superficially true. The current ecological, economic, and social realities around Namibia’s fisheries management are not sustainable (Paterson et al 2013).

Kaapama (2007) and Winterfeldt (2007) argue that the Namibian government’s attempt to combine economic neoliberalism and social equity has created developmental dilemmas in economic sectors, such as agriculture and manufacturing. The same is true in the fisheries sector. Namibian fisheries policies had the potential to support an export-led path to development, but the neoliberal model emphasizes growth and corporate profits, whose benefits are assumed to trickle down to the domestic economy through job enhancement. However, this results in the privileging of corporate wealth over the creation of broader local development goals (Paterson et al 2013). Moreover, instead of contributing to the rebuilding of
the hake resource the current rights allocation policy has caused an increased TAC, which is not supported by the best available science. This is not a new phenomenon in the Namibian fisheries management as TACs have in the past been set above the scientific recommendation (Table 3). These detrimental interactions between the different policy goals are currently not tracked by the EAF management framework as implemented in the EAF tracking tool (Paterson & Petersen 2010).

3.1.5 Enforcement & Compliance
The main enforcement and compliance agencies in the Namibian fisheries are MFMR and the Fisheries Observer Agency (FOA) (website www.foa.com.na). MFMR maintains inspectorate offices in both Namibian ports. All commercially caught fish must be landed in either Luderitz or Walvis Bay and the nature of the Namibian coast line makes it impossible to land industrially caught fish elsewhere. This factor contributes substantially to the success of Namibian fisheries enforcement and compliance. No fish may be trans-shipped at sea. Fisheries patrol vessels and aircraft undertake monitoring, control and surveillance to ensure this is adhered to. All hake vessels have to carry fisheries observers whose tasks include the monitoring of fishing operations to ensure that activities on vessels comply with relevant legislation. In addition, observers collect valuable biological and scientific data on the marine species within the Namibia Economic Exclusive Zone (EEZ).

Our research with captains in the hake sector, indicates that they are generally in agreement with the regulations, but would welcome increased interaction with scientists and resource managers. They support the observer programme in principle but are dissatisfied with the conduct of the observers.

Many skippers feel that there is currently little value created through the observer programme. A longline skipper explains:

*The observers that go with, you don’t see them. They just sleep, next to their cabin there is like the, a galley, they just eat and then sleep eat, eat, sleep, you don’t see them at all.*

A trawl skipper explained to me why he thinks the observers are not adding value:

*The observers, like I told you, [are] not doing their job properly. They should, when we start shooting, they must come up on the bridge and do their own recordings [so that] at the end of the trip he can compare his recordings with my recordings to see whether I'm maybe catching skellum fish, you know, giving wrong information to the ministry. [But the observer] just copies me and mine one hundred percent.*

The fact that the skippers frequently refer to the observers as inspectors reveals that they regard them as law enforcement officers. However the Marine Resources Act (2000) does explicitly state the powers of the inspectors but does not confer powers to the observers.
Nonetheless, in reality, the observers do have an implicit power through the fact that they report observations and information they obtain on board the vessels. Consequently there is an implicit power gradient between skippers and observers and both skippers and observers realise that it is possible for the observer to abuse this power. It seems that the resulting situation is detrimental to the relationship between skippers and observers and hinders constructive communication and collaboration between them.

3.2 Social Dimensions

3.2.1 Gender and Age

The workforce in the fish plants is highly stratified along gender lines. Women are almost exclusively employed in the onshore processing sector, whereas men are employed both offshore and onshore (Table 4). A similar gender stratification is observed in the South African Fishing industry. However, in South Africa the larger proportion (62%) of the workforce in the fish plants is female (Jeebhay et al 2004). In contrast, in Namibia in 2010 the onshore employment was more equally distributed with 52% of employees being women. In the onshore processing facilities women work mostly on the lines, filleting, weighing and packing fish. Although some male respondents reported that they initially started off filleting fish, we did not see any men working on the lines during our research and none of the male respondents were working on the lines. Men generally offload fish from the vessels, and work in the strapping and freezing departments or oversee the machines that drive the assembly lines. This means that due to the nature of their work, men in the factory tend to have some freedom of movement whereas women working on the filleting line cannot move away from their stations. The line also determines the speed and rhythm of the work, thus further reducing the women’s self-determination. This gendered division of labour and the different degree of mobility and autonomy between male and female fish plant workers is a typical characteristic of work in fish factories and has been described elsewhere (e.g. Stainsby 1994). Apart from the nature of the work, the gender stratification can impact working hours and wages of women, as offloading, strapping and freezing work is more consistent and involves more overtime than work on the line. Dennis¹, a male factory worker puts it like this

Dennis: [People in] strapping always have work. It is just like an engine to the fishing, you know, industry.

Researcher: How many days?

Dennis: Strapping is working every day and it has more overtime.

¹ All names have been changed to protect the privacy of the respondents
Although the hake fishery is not seasonal, work demand is determined by catch rates and availability of quota, which for many fish plant workers, especially but not only for women, results in unpredictable and sporadic work scheduling and pay.

Table 4 Number of people employed onshore and offshore in the Namibian hake industry by gender 2008-2013 (source: PPE, Employment verification)

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Offshore</td>
<td>2623</td>
<td>2325</td>
<td>2087</td>
<td>1764</td>
<td>1607</td>
<td>1936</td>
</tr>
<tr>
<td>Male Onshore</td>
<td>1776</td>
<td>2511</td>
<td>2871</td>
<td>1187</td>
<td>2054</td>
<td>2747</td>
</tr>
<tr>
<td><strong>Total Males</strong></td>
<td><strong>4399</strong></td>
<td><strong>4836</strong></td>
<td><strong>4958</strong></td>
<td><strong>2951</strong></td>
<td><strong>3661</strong></td>
<td><strong>4683</strong></td>
</tr>
<tr>
<td>Female Offshore</td>
<td>6</td>
<td>11</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Female Onshore</td>
<td>3198</td>
<td>3592</td>
<td>3990</td>
<td>4245</td>
<td>4238</td>
<td>4819</td>
</tr>
<tr>
<td><strong>Total Females</strong></td>
<td><strong>3204</strong></td>
<td><strong>3603</strong></td>
<td><strong>3998</strong></td>
<td><strong>4250</strong></td>
<td><strong>4243</strong></td>
<td><strong>4825</strong></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>7603</strong></td>
<td><strong>8439</strong></td>
<td><strong>8956</strong></td>
<td><strong>7201</strong></td>
<td><strong>7904</strong></td>
<td><strong>9508</strong></td>
</tr>
</tbody>
</table>

Figure 3 Number of people employed in the Namibian hake fisheries by gender, 2009-2011 (source: Russel & Wolf 2012 Occupational Mapping Namibian Fishing and Maritime Industry)
3.2.2 Migration and Family Structures

During colonial rule the distribution of land in Namibia became increasingly unequal. During South African colonial rule the inhabitants of the economically unviable homelands were forced to seek employment, mostly in the emerging mining and fishing industries. The South African administration intensified German policies (Becker 1995 cited in Jauch et al 2011) to meet the growing demand for cheap labour. The resulting contract labour system restricted the mobility of black people. Women and children were not allowed to take up residence with husbands and fathers in towns. As a result black Namibian families were spatially and geographically separated with the husbands and fathers being employed in town and the women and children remaining in the rural villages. It has been argued that female labour in the subsistence economy functioned to subsidise cheap male labour, which was central to the colonial capitalist economy (Jauch et al 2011).

Today, 25% of Namibians, and 30% of Oshiwambo speaking people, rely on subsistence farming for their livelihood (NSA 2012). Another legacy of the countries colonial past is that most of the arable land is reserved for commercial farming production. The land available for subsistence farming in the communal areas, is semi-arid rangeland, characterised by low rainfall and soil infertility. Namibia’s harsh climatic conditions combined with the unequal distribution of arable land, have created a condition of land scarcity (Kapaama 2007). As a consequence labour migration remains a key livelihood strategy in rural Namibia.

The Municipality of Walvis Bay reported in 2004 that the town was growing at the rate of 5.35% per annum. Since estimates based on births and deaths suggest a rate of natural increase of only 0.1% per annum, the actual growth is based on in-migration (Municipality of Walvis Bay, 2004). The 2004 Municipal survey on community needs assessment indicated that 21% of the heads of
households were from the town, 46% from rural areas, 32.7% from other areas in Namibia and 0.9% from outside Namibia.

Many rural-urban migrants maintain a base in the rural areas and Selenius and Joas (2004) suggest that many rural-urban migrants are “more rurally integrated than urban”, and thus invest less into urban households than into the rural homestead. As a consequence of this transience, social cohesion is limited, which is also reflected in high crime rates.

Rural-urban movement is no longer regulated and both men and women seek wage earning employment. Nonetheless, labour migration still creates split households, which rely on resource pooling across geographic boundaries. Frayne (2005) documents the reciprocal flow of remittances and transfers between households in Windhoek and rural areas in the North; he found that cash transfers constituted the main form of remittance from the urban to the rural areas, and food transfers occurred mostly from the rural to the urban areas. We found that in the case of fish workers in Walvis Bay the flow of remittances is slightly altered as not only cash but also fish is sent from Walvis Bay to the rural areas. The rural areas in turn, provide important social support services. For instance of the 20 factory workers that were interviewed in Walvis Bay, 6 were married and 17 reported to have children. In most cases the participants reported that the children lived with other family members, mostly the grandmothers, in the rural area.

Family members also support each other in the urban area, although this does not necessarily mean living together. During the interviews several participants reported that they lived with a family member when they first arrived in town in search for work. But once they have found work they are expected to rent their own accommodation to allow another member of the family to come to town. As Zelda explains:

*My sister now is supposed to be again with someone who wants [a] job just like [me]. If you get a job, you must shift and leave a space [to sleep] for the other people who are coming from home also looking for a job.*

### 3.2.3 Health

#### 3.2.3.1 The Namibian Health Sector

Prior to independence the Namibian healthcare system was based on racial segregation and infrastructure was concentrated in urban areas. Since independence a number of reforms have taken place, and the Ministry of Health and Social Services has now 13 regional directorates. The main challenges are HIV/AIDS, tuberculosis, malaria and child and mother mortality (WHO 2010 Namibia Country Cooperation Strategy, [www.adro.who.int](http://www.adro.who.int)). The government of Namibia is responsible for the public health service, which provides cheap medical treatment and generally affordable medicine. The private health sector is driven by private medical aid funds. Namibia has no national health insurance scheme. The public health sector is highly understaffed with 947 patients per registered nurse and 7,000 patients per registered doctor in 2004 (Brockmeyer
2012). The alarmingly high numbers of women who died in child birth in health facilities in recent years is a sad indicator. In 2010 over 80 mothers and in 2011 62 mothers died in state health facilities (Kisting 2012).

The private health sector, which is based on non-profit medical aid funds on the other hand is well-organised, but infrastructure is concentrated in the main urban centres. About 1.5 million Namibians, that is 85% of the total population rely on primary health care of the public sector. Thus, access to health is still unequal between urban and rural areas and between the rich and the poor population (Brockmeyer 2012).

The majority of fish workers cannot afford private health care. Of the 14 fish processing factories that participated in our survey, 8 report to maintain a clinic to facilitate access to basic health care for workers (Table 5).

Table 5 Results from Walvis Bay survey with local processing companies, N=14

<table>
<thead>
<tr>
<th>Vessels owned</th>
<th>Vessels operating</th>
<th>Number of employees</th>
<th>Health Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3</td>
<td>500</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>1200</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>330</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>9</td>
<td>947</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>200</td>
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</tr>
<tr>
<td>6</td>
<td>4</td>
<td>713</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>95</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>150</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>68</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
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</tr>
<tr>
<td>2</td>
<td>2</td>
<td>260</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>120</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>1500</td>
<td>1</td>
</tr>
</tbody>
</table>
3.2.3.2 Occupational Health in the Fishing Sector

There is a growing body of research on occupational health issues in fish processing factories (Power et al. 2010, Gautrin et al. 2009, Neis and Williams 1993, Jeebhay et al. 2008, Cartier et al. 2004) but little work to date has focused on fish plants in Namibia or the BCC region. Notable exceptions are the work by Jeebhay et al. (2000, 2004, 2008) and Howse et al. (2012). Jeebhay et al. (2004) report health problems among South African fish processing workers due to excessive noise levels and low temperatures, bio-aerosols containing seafood allergens, poor ergonomic practices and workplace organization. They report that musculoskeletal disorders of the neck and shoulders occur in 31-35% of the work force, and a 15% prevalence of epicondylitis and carpal tunnel syndrome. The reported prevalence of occupational asthma associated with fish processing is 2-8% and the prevalence of allergic skin reactions is 2-11%. The comparative study by Howse et al. (2012) between Eastern Canada and South Africa shows that occupational allergy and asthma affects workers in both countries, but that affected workers are unlikely to self-report or file for compensation to avoid negative financial impacts. In addition occupational allergy and asthma tend to be under-diagnosed by health care providers. Consequently under-reporting weakens the evidence of occupational allergy and asthma and there is a common perception among workers that they must choose between their livelihoods and their health.

Our research with fish workers in Walvis Bay, suggest that similar occupational health issues exist there. Workers spend long hours conducting repetitive tasks in a cold and damp environment.

Vicky: It is wet and it is cold. Because the cleaners work inside while we work there. They spray and rinse the stuff that falls and such things.

One woman reported that her feet would get so cold she had to soak them in warm water at home. Women in particular stand for hours at the filleting lines. We observed women standing on pallets or plastic crates to avoid standing on the cold floor. Although working conditions are to some extent typical for the seafood industry in general, workers experience different conditions in different companies. Some companies provide sweaters and jackets to their workers to compensate for the cold working environment. John, an older man, who has been working as a fish processing worker since 1973, explained that conditions at his workplace have much improved over time:

I see is that in the old days, we used to work in the cold area, like in the freezing area, it is cold fish that we are handling, frozen fish and when we go take a shower, it is cold water and when you get outside, Walvis Bay, it’s cold. So that time we used to have a lot of flu infections and colds. And then you can see that you are weak, but it is only because...
it is flu. And then we saw the change when the company installed hot water in the showers. Now we are fine.

Another aspect of occupational health is the need to work fast and under pressure but with very little control of the work flow. Vicky said:

You just hurry so that you finish so that we can start with another vessel. This is quick, quick work, every day it is just fast, fast work.

Jack, a young man who works in strapping, told us that

Mostly the work is hard. You work under pressure. If there is too much fish, if there is more fish, up and down the vessel [goes] and in only two days it comes, with this one again, you work under pressure.

Many of the jobs, that are more typically done by men, allow the workers to move around some, and perhaps just pause for a moment or have a brief chat while walking from one work area to another or driving a loader. Thus these workers are able to control their own pace between picking up a load here and dropping it somewhere else. This is very different for workers who fillet, weigh or pack fish and who are mostly women. Here the line determines the pace of work. It is not possible to autonomously decide to slow down or speed up based on one’s ability or how one feels in a particular moment. The women are allowed to take the occasional break to visit the bathroom, but it is not possible to take a rest at will, as this would jeopardize the workflow. The following exchange (translated from Afrikaans) illustrates that taking a break is only possible under conditions, such as pregnancy. Unless declared sick by a health professional, a healthy worker is expected to perform equally throughout the day, and day after day.

Researcher: What happens when a woman gets sick or is sick and cannot stand for so long or when someone is pregnant?

Alice: [...] there is a box storeroom where people sit, or outside, there is a box storeroom.

Researcher: So you can indicate that you are tired?

Gloria: Only pregnant women. Not if you just feel tired and need to sit down, no.

Researcher: So, you have to be sick?
Gloria: Yes, you have to be sick. But the thing is we cannot send all the sick people there [...]. Regarding normal illness [other than pregnancy], there are many who are ill, truly.

Alice: Then you have to go to the clinic and the nurse must decide to book you off.

Although some of the managers mentioned that people take chances and try to get booked off without being sick, the workers we interviewed rather gave the impression that to be absent always bears the risk of losing the job and was thus something they would try to avoid. This would suggest that, as in other fish plants elsewhere (cf Howse et al 2012), Namibian fish workers feel they have to choose between their health and their livelihoods. Further research into occupational health in the sector is needed, to get a better understanding of this issue.

3.2.4 Education

Recognising equitable access to schooling as a critical aspect in the process of redressing inequality the Namibian Government after independence undertook to reform the education system (Ministry of Education and Culture 1993). The Namibian Constitution guarantees the right to a free and compulsory education for 10 years (until the age of 16) and government consistently allocated over 20% of its national budget to the education sector (Jauch et al 2011). The ethnic education bodies were replaced by a unified system of educational administration and hundreds of schools were built to respond to the rising numbers of learners.

Despite having achieved significant improvements in the access to education, the results from external school examinations at the end of grades 10 and 12 reveal that the quality of education differs between schools and regions. The best results are achieved by private schools, which are only accessible to those who are able to pay the expensive school fees, followed by the former white schools in urban centers. The worst results are found in rural schools (Jauch et al 2011). Clearly, Namibia has not yet achieved the goal of equal education for all. It is hoped that the Worldbank Funded Education and Training Sector Improvement Programme (ETSIP), the first phase of which ended in 2013 succeeded in addressing the educational challenges. However, the quality of education continues to slide (Immanuel 2014). That said, according to 2013 and 2014 exam results, Erongo region has the best exam performance per region. This may indicate that workers, who migrate from the rural areas to Walvis Bay, may have access to better education for their children than their rural home regions would avail.

Faced with an overwhelming number of job seekers the processing companies tend to use grade 12 as a selection criterion for general workers.

3.3 Economic Dimensions

3.3.1 Poverty

The World Bank upgraded Namibia to upper middle income (UMI) status in 2009. However, a relatively high per capita GDP of $8,200 USD
Poverty has decreased in Namibia. In 2009/2010 close to 19% of households were classified as poor and 10% as severely poor, whereas in 2003/2004 close to 28% were poor and 12% severely poor (NSA 2012).

However, it has to be noted that this poverty assessment is based on a single poverty line for both rural and urban areas. This assumes that the costs for basic necessities are the same for the two types of areas, which is not the case. Essential commodities such as housing, food and transportation are more expensive in towns than in rural villages. In Walvis Bay, which is located in the hyper arid coastal environment, opportunities for reducing costs through growing food or through access to free resources (such as wood for building and fuel) are extremely limited. Urban households in Namibia spend a smaller proportion of their consumption on food (15%) than rural households (39%) and spend a larger proportion of their consumption on housing (NSA 2012). Nonetheless, in 2010, 28% of wage earning households in Namibia and 36% of households in Erongo dwelled in “improvised houses”, commonly referred to as “ghettos”. One of the reasons why so many people in urban areas live in poor quality, insecure accommodations with inadequate provision of basic services are the higher costs of housing, food and transportation in these areas. Another reason is that efforts to provide all residents of Walvis Bay with adequate housing does not match the rapid immigrant growth rate and consequent demand for housing.

3.3.2 Housing and Sanitation

Housing was identified as a priority area in 1990. The Namibian government considers housing as an enabler of economic growth and a tool for reducing poverty by creating sustainable communities. A National Housing Policy has been in place since 1991, and was reviewed and updated in 2009. However, a report by the Institute for Public Policy Research found that few elements of the policy have been taken forward and little has been achieved in the last twenty years to clear the backlog in housing (Sweeney-Bindels 2011).

A survey conducted between September 2010 and May 2011 by the Shack Dwellers Federation of Namibia (SDFN) found 12,500 ghettos in Walvis Bay’s Kuisebmond and Narraville residential areas. Moreover, the survey found that a large number of people working in the fishing industry, particularly onshore processing factory workers, live in ghettos in Walvis Bay (BCC 2014). Full details of the SDFN survey results are available from the Namibia Housing Action Group NGO.

A ghetto is a shack dwelling, constructed in the backyard of a residential property, and there can be as many as 12-15 ghettos established on some normal-sized, regular erven (BCC 2014). This practice puts impossible pressure on infrastructure such as water and sewerage on plots that were development for single family occupation and that now house 30 or more people. Residents are extremely vulnerable, they can be evicted at any time, shacks are prone to fire hazard and the lack of toilets compromises people’s hygiene.
The reason why so many fish processing workers live in inadequate housing conditions is that the salaries of basic workers, both onshore and at sea, are too low to qualify for National Housing Enterprise loans (BCC 2014; Sweeney-Bindels 2011). Many fish factory workers contribute money as members of the Shack Dwellers Federation, a practice, which appears to be more efficient than contributions to governmental housing projects (Sweeney-Bindels 2011). However, there is a huge backlog in housing provision. In 2011 the largest backlog in the lowest income sectors. In the N$ 0 to N$ 1,500 monthly income bracket 45,000 houses were lacking in 2011 and 30,000 houses were lacking in the monthly income bracket between N$ 1,501 and N$ 4,600 (Sweeney-Bindels 2011).

3.3.3 WORK & EMPLOYMENT
The establishment of a viable national fishing and processing industry that creates work and leads to the empowerment of previously excluded people has always been key objective of Namibia’s fisheries policy. In the logic of fisheries management work is understood and measured in terms of the number of jobs that are created in the fishery the quality of the work and the potential to earn a living wage are not further examined.

In practice, work in the hake fishery is an extremely complex and layered entry point for analysis. The majority of the workforce in the hake fishery (87% in 2013) are employed as general workers and crew (Table 6).

<table>
<thead>
<tr>
<th>Positions</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administration</td>
<td>552</td>
<td>438</td>
<td>438</td>
<td>477</td>
<td>409</td>
<td>432</td>
</tr>
<tr>
<td>Management</td>
<td>156</td>
<td>187</td>
<td>187</td>
<td>244</td>
<td>164</td>
<td>231</td>
</tr>
<tr>
<td>Captains, officers, engineers</td>
<td>336</td>
<td>428</td>
<td>428</td>
<td>589</td>
<td>340</td>
<td>413</td>
</tr>
<tr>
<td>General workers &amp; crew</td>
<td>4604</td>
<td>7060</td>
<td>7060</td>
<td>5244</td>
<td>6455</td>
<td>8269</td>
</tr>
<tr>
<td>Other</td>
<td>1955</td>
<td>326</td>
<td>843</td>
<td>647</td>
<td>536</td>
<td>163</td>
</tr>
<tr>
<td>Grand Total</td>
<td>7603</td>
<td>8439</td>
<td>8956</td>
<td>7201</td>
<td>7904</td>
<td>9508</td>
</tr>
</tbody>
</table>

Fish processing is contingent on the availability of raw material. Although the hake fishery is not a seasonal fishery, catch rates are variable. Another factor that determines the availability of
raw material is access to quota. Not all fish processing companies are fishing rights holders and the inclusion of additional rights holders in 2012 has increased the scope for negotiations. Currently rights holders do not know their share of the annual TAC until they receive a notification letter from MFMR for the coming season. Frequently this notification is received a few days ahead of the start of the new season. As a result company managers do not know the exact level of production and their requirement for labour. Administrative issues such as the annual licensing of fishing vessels and the payment of quota fees also impact on production (Hartman 2014). Therefor fish processing companies work with a core labour force of permanent workers that is supplemented with temporary workers when production requires additional labour.

Table 7 The distribution of permanent and temporary employment in the Hake fishery (source PPE, employment verification)

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent jobs</td>
<td>6061</td>
<td>6291</td>
<td>6399</td>
<td>4664</td>
<td>5652</td>
<td>7178</td>
</tr>
<tr>
<td>Temporary jobs (incl. seasonal &amp; casual)</td>
<td>1542</td>
<td>2148</td>
<td>2557</td>
<td>2537</td>
<td>2252</td>
<td>2330</td>
</tr>
<tr>
<td>Total</td>
<td>7603</td>
<td>8439</td>
<td>8956</td>
<td>7201</td>
<td>7904</td>
<td>9508</td>
</tr>
</tbody>
</table>

The use of temporary workers allows companies to minimize labour costs. The fraction of temporary employment was highest in 2011 when employment numbers were lowest and has since decreased as total employment in the hake fishery has increased.

Many of the fish processing companies use the labour broker African Personnel Services (APS) to recruit the temporary workforce. Although this practice is highly controversial, attempts to outlaw labour hire have been unsuccessful. There is intention to enforce stricter regulations on labour brokers in Namibia, but these regulations had not been implemented at the time of research.

To the workers it is not always clear that being employed by a labour broker does not translate into a permanent job and regular pay, as Jack illustrates when he tells us about his first job in the fishing sector:

**Jack:** So, that’s why we came there to help out. Like when they gave us the opportunity that side, they could not say it’s a contract, a short period of time. We knew we find a job when we came here just to find out, they say just 3 months contract. When the Choka finished then we were to be sent back home.

**Researcher:** So, you only found out about that when you got here?

**Jack:** Yes.
Researcher: APS didn’t tell you that?

Jack: No, they did not.

All the workers we interviewed, including those who are permanently employed by the processing company, are in agreement that “being APS is not good”, as wages are lower, benefits are less and employment is less secure.

Worker: As we all know, if there is no work, APS, we just go home and the permanent [workers] they just [form] a line, only one line stay in the factory.

Researcher: And, when there is no work, and APS people can stay at home, does APS pay you anything then?

Worker: Nothing.

Researcher: Social Security?

Worker: No work no pay.

According to our interview data the majority of employees, who work in the factories, are temporary workers. In 2011 the fraction of temporary workers employed in the processing factory of a major Namibian fish processing company, which does not make use of APS was 58%. In another major company, which does recruit through APS, 70% of the factory workers were temporary employees. Thus for the majority of people employed in fish processing the factors that influence production translate into unreliable on-call employment, irregular work scheduling and unpredictable compensation.

Wages

Although the fishing industry is considered among the better-paid sectors in the country (Jauch 2012) many workers cannot effort adequate housing. Moreover, even for some better-paid employees, the irregularity of work and consequent unreliability of income makes it difficult to apply for loans or housing schemes. A skipper in the hake longline industry, as an example, will earn a monthly income upwards from N$ 60,000 (BCC 2014). The basic salary for normal crew ranges between N$ 2 500 to N$ 3 000 per month while officers earn between N$ 6000 and N$ 9000 (BCC 2014). The salaries from basic workers in the factories, varies considerably. Workers and factory managers from three different companies reported hourly rates from N$5 to N$10.50 for casuals and N$9 to N$13 for permanent workers. For example Jeanette (change) who works for one of the processing companies as a basic worker, but is employed by APS, earns between N$ 1080 and N$ 1620 a month, depending on the number of weekends she is able to work. At another company, casuals can earn between N$1890 and N$2835 per month, again depending on the amount of overtime, which in turn depends on the availability of fish. Based on our interview data most permanent workers seem to earn between N$1600 and N$3500 per month depending on the hourly rate and the amount of overtime. It has to be noted
however, that the wages at the higher end of the scale are paid by only a few of the companies. According to Union representative D. Imbili, most of the processing workers earn wages below the poverty line (BCC 2014). According to a factory manager we interviewed, debt is a major issue for many workers and indicative of the fact that wages do not correspond to the cost of living in Walvis Bay.

While low wages help reducing the cost of production for individual companies, low wages also result in a lack of final demand linkage. Higher wages, which increase workers’ capacity to spend are required to increase local demand and stimulate other domestic industries and businesses. As pointed out elsewhere (Paterson et al 2013), value adding, albeit important, is only one of several types of linkages that need to be captured to move Namibia’s export dependent economy to an internally independent developed economy.

Job satisfaction

In the course of our research we became aware that although work is seen as an opportunity, for many factory workers this opportunity is a failing one. Without exception all workers, when asked if they wished their children to do the same work, answered, negatively.

Researcher: Would [you] be happy for your children to start working in the fishing industry?

Esther: No, [we] are not happy. We don’t want it to happen. Its only the situation, the scarcity of jobs, but in my case I have a home with NHE and if I get this small payment and maybe my daughter is also having a small payment, we combine and maybe we see what we do to pay for the bills. But I wanted her now to get a better job to get paid better than we [do here] so that we can struggle with the bills much better. So it is really not a good thing.

This exchange with a woman who has worked in the fishing sector for more than 30 years, illustrates that life remains an ongoing struggle to make ends meet even for those who are lucky enough to have found a job in the fishery.

For the fish workers, there is no excitement, passion, desire, or autonomy associated with work. The work environment does not foster personal growth. Indeed, many of the research participants expressed fear and concern about speaking of their work as if they could potentially lose their job in doing so. This sense that work is precarious was conveyed by workers during all the interviews.

Power and information

Some of the women we interviewed, although they have been working in the sector for several decades have no clear understanding of their own pension schemes. Gloria explains (translated from Afrikaans):
Gloria: So, there was the other day a woman who just made 60 years (at work), who retired, she has, the government has now, they say, the government has now changed the regulations to say that you have to retire at 65. This women worked 60 years and I don’t really understand well what the problem is because if the reis any change that affects the company than we should all be told. But this is something that we heard from that woman, that she must come get her pension at 65. She can’t get it now. But she asked why can’t they allow her to work for those 5 years. They said, they cannot do this because if something happens to her than it is again the company’s fault.

Researcher: Is this a government regulation, that they cannot pay?

Gloria: Apparently, but we also don’t know if this is true or not because they did not tell all of us.

Researcher: What does the Union say?

Gloria: Agh, we don’t know what the Union says, we don’t know. Because this happened last week.

This illustrates the lack of distribution of information in the workplace, and while the shop stewards’ duties do include educating workers on their rights and responsibilities there seems to be a deep alienation in the modes of production. Although the availability of raw material is the single most important driver that by affecting production directly affects workers livelihoods, there is only limited if any understanding of this factor. Jack, a basic worker (?) explains:

Jack: I am not sure [why there is sometimes no fish] because now these companies, I don’t know how I can put it, the communication is lacking within the [company]. They can have […] a shortage of fish, but here they cannot tell us the reason why there is no fish. Sometimes we are only wondering, seeing the vessel standing on the jetty and for 2 to 3 days the vessel is standing there. Further than that, they don’t give us the reasons why. Mostly we don’t know.

Researcher: Do you talk about it? Do you discuss it with your colleagues?

Zelda: We just talk, but we know nothing.

Irma and Alice two women who are supervisors of a production line, explain that only ad hoc information is given to workers via “briefing meetings” which are held in response to continuous demand from the workers. Since management provides little information, workers rely on rumours they hear outside the company. Irma is clearly upset by the fact that as company employees and supervisors they are the last to learn important news such as the purchase of a vessel.
Sometimes you hear things outside, like we heard about the vessels. So we hear that we bought Bounty and Bounty is now our own vessel. Then the workers were saying, you say you don’t have any money but you bought Bounty. Where did you hear that? No, we heard in the location. Bounty belongs to the company now. So we ask management is it true that we bought Bounty. So they tell us this is true, we’ve bought Bounty.

Another rumour at the time of our research was that the company was about to close down. Susanna says: “Like the other day we’ve heard rumours that we are going to close. We are closing and we just hear that only outside from the people. A few months later the company indeed closed down and 700 workers, including Susanna and Linda lost their jobs and livelihoods.

In a context characterized by extreme unemployment and poverty, work is commoditized and regard for the individual’s personhood is limited. Sabina account of her first job in the fishery illustrates this clearly. A while after she registered with APS she was told that there was a job in one of the fishing companies.

Hm, they [said] tomorrow you just go to the [name of company], you [arrive] 7am and just sit at the gate to start. We were just waiting for the supervisor to call us. We just stand there until 10am. The other people they just go home and I am just waiting there and at 1pm they just call us, go in get work.

Many of the workers told us that they had to wait for hours outside the gates, sometimes for days, hoping to get a job. And this ordeal is by no means over once a person has been employed, because when production slows or when the company is waiting for quota or permits, many workers again have to wait outside the gates until they are called in. This means women have to organize child care, leave home early and spend hours waiting in the sun and wind hoping to be allowed to work and earn wages that hardly meet the cost of living.

3.3.4 DISTRIBUTION OF BENEFITS AND RISKS

Fishing is a risky business, due to unpredictable and variable outside factors, such as resource availability, fuel price and market conditions. Large, vertically integrated companies are able to operate cost effectively due to economics of scale and a wider spread of processed products makes them less vulnerable to financial risk (Kirchner & Leimann 2014). It is also believed that larger companies are better prepared for quota variability and economic fluctuations and can thus adopt a longer-term approach to the sustainability of the fish resource (Kirchner & Leimann 2014). However, as mentioned before and demonstrated elsewhere (Paterson et al 2013) this neoliberal model emphasizes corporate profits, which are assumed to trickle down to the domestic economy through job enhancement. The result is a difficult marriage of “socioeconomic justice on a national scale with the merciless dictates of profitability emanating from global economic liberalism” (Winterfeldt 2007). This difficult marriage is reflected in the Hake management plan through the objectives of “economic efficiency” and “benefits to a wide
number of Namibians” (MFMR 2012). The allocation of fishing rights to Namibian rights holders, who subsequently failed to invest in the fishing sector, has made regulation necessary that forces the forming of joint ventures between processing companies and new rights holders. This has effectively promoted the interests of a privileged black minority (Melber 2003, Paterson et al 2013). This policy fails to redress the “grossly inegalitarian social structure and distribution of wealth” (Melber 2003). It has been argued that the main interest of many of the local Namibian partners is to reap profits without re-investing in the maintenance and purchase of assets (Melber 2003). Others have argued that this is inevitable because only a few Namibian operators have both the skills and the capital to run a profitable business. As a result most new rights holders prefer to sell their quota with no significant investment in the industry (Kirchner & Leiman 2014). Such paper quota holders have the highest benefit while facing virtually no risk. In any case it seems that this practice has contributed to the closure of a prominent fish processing plant and the layoff of over 700 workers (Hartman 2013). Which shows clearly that workers are the ones who shoulder the largest risk. The high unemployment makes workers very vulnerable, they can be replaced easily and the protection afforded by the labour law can be circumvented through the use of labour brokers. At the same time the benefits from Namibia’s hake resources are spread very thinly among them.

3.4 Cultural Dimensions

3.4.1 Local Knowledge
A growing body of scholarship has highlighted the potential value and associated risks and challenges of integrating the local knowledge of fishers into fisheries science and management (Agrawal 1995, Nadasdy 1999, Neis and Felt 2000, Soto 2006). In particular, local fishers can provide insights not captured by the quantitative data that are routinely used in fisheries stock assessments and which can help to interpret catch data from commercial fisheries, including CPUE estimates (Neis 1992, Johannes and Neis 2005). Moreover, such information can be made usable in quantitative stock assessments (Neis et al. 1999b). The foregrounding of the formal, technologically aided aspects of knowledge in commercial fisheries tends to limit focus on the economic efficiency that these forms of knowledge aim to increase. Such a focus can obscure the personal and experiential aspects of fishers’ knowledge that remain implicit also in commercial fisheries. In the day-to-day practice of off shore fishing in Namibia different types of knowledge play out in the relations between people, fish, technology, nature and management. These knowledge types range from digitised spatial data and formalised logbooks that are required for fisheries management to the personal books that fishers keep and the non-codified knowledge born of experience.

Some of the knowledge practices in commercial fisheries are highly formalised, i.a. through the use of logbooks and digital cartography. However, being designed for fisheries management logbook data only capture those aspects of fishers’ knowledge that are deemed useful for this purpose, in particular data that are used in the assessment of fish stocks. As shown elsewhere
(Paterson 2014), even in commercial, industrial style fisheries, much of fishers’ knowledge remains personal and experiential.

Tapping into this knowledge by observing where commercial longline and trawl captains prefer to fish, the locations where they set their gear, the direction and duration of the trawl can reveal much information about the skippers’ social networks, the technological, economic and managerial aspects of the fishery as well as the ecology of the fish.

As documented in detail by Paterson and Kainge (2014) and Paterson et al (2014) there are many points of convergence between the experience- based knowledge of fishers and the quantitative knowledge that underpins fisheries science and management in Namibia. Fishers can provide information on hake stock structure, the spatial distribution of different hake stock components, and fishing efficiency, which are important for making accurate assessments of stocks (Paterson & Kainge 2014). Good knowledge of stock structure is important for maximizing the resilience of the stock (Stephenson and Kenchington 2000, Stephenson et al 2009). Moreover, disregarding efficiency increase and fishing strategy leads to inflated indices of abundance based on CPUE data (Paterson & Kainge 2014).

### 3.5 Political Dimensions

#### 3.5.1 Policies Shaping Distribution of Costs & Benefits (Equity)

Namibia’s Marine Resources Act of 2000 has been celebrated internationally as one of the most progressive and successful fisheries policies, earning Namibia the Food Security Policy Leadership Award in 2010 and the Silver Future Award in 2012. The Namibian Fish Consumption Trust has been put in place to provide Namibians with access to fish products at low prices to offset the potentially negative effects that an industry directed at global markets might otherwise have for local food security. These interventions seem to suggest that Namibia has successfully combined the neoliberal economics that have characterized the development narratives since the 1980s (Gore 2000) with welfarist goals for poverty reduction. This belief is further reflected in the awards that Namibia’s fishery policy received from the Future Council and the Food Agriculture and Natural Resource Policy Analysis Network. However, as in other historical export-led fishery economies (see, for example, Ommer 1991), little value added has accrued domestically (Sherbourne 2010). This is particularly worrying given that there are strong indications that the fish stocks are declining (BCC 2011) without the fishery having managed to fulfill economic expectations (Sherbourne 2010).

Employment creation is supposed to be a key policy goal of Namibia’s fisheries management and indeed employment statistics in the sector are high. But as the previous sections have highlighted much of this employment is temporary and insecure. Workers remain extremely vulnerable and have experienced only few material improvements since Independence. It has been argued that the reasons lies in the fact that Namibia followed a path of market-oriented economic policies, coupled with moderate social reforms but without a systematic programme of redistribution (Jauch et al 2011, Jauch 2012).
3.5.2 Political Stability

Namibia since independence has been largely stable and peaceful with virtually no civil strife. A major political achievement has been the smooth transfer of power from one President to another. However, as noted by the African Development Bank, the high levels of poverty, unemployment and inequality in income and land ownership may threaten the stability of the country if the government continues to fail to address these issues.

3.5.3 Transparency of the Decision Making Process and Accountability of Decision Makers

The transparency of decisions made by the Minister and senior MFMR officials has been repeatedly critiqued (e.g. Poolman 2013; Kahiurika 2014). Decisions regarding the setting of the annual TAC, the distribution of quotas and the allocation of rights are made by the Minister. Government scientists present their recommendations to both the Minister and the Marine Advisory Council. The latter is composed of two representatives of the MFMR, five representatives of the fishing industry, and six representatives of other economic sectors including banking, who jointly take cognizance of social and economic considerations. However, the criteria for social and economic considerations are not made explicit and are therefore not transparent. The members of the advisory council then formulate their own recommendation for the Minister, who is under no obligation to follow the advice of his Ministry’s scientists or the council. In fact as a member of the advisory council told us, “if [the minister] doesn’t like [the recommendations] he can make a decision on his own and go to cabinet with that and get approval for TAC allocations”.

The granting of new rights in 2012 and the subsequent quota allocations have caused much controversy in the Namibian press. The Law Reform and Development Commission (LRDC) after extensive stakeholder consultations found, that the allocation of fishing quotas needs to be more transparent, which would require that the Marine Resources Act be amended accordingly. In spite of the Namibian fisheries legal framework being internationally praised, its implementation was found to be “discretional, unequal and erratic” (Poolman 2013). For example, in September 2014 it was reported that the Minister allocated 10 000-metric tonnes of horse mackerel quota to the state owned company Fishcor. Such an allocation seems to be in contravention of the Marine Resources Act, because Fishcor has neither the facilities to process nor the right to catch horse mackerel. In an interview the Minister defended his decision by saying that

I can allocate a quota to whom I want. In this case, 520 jobs were at stake. I will do all I can to save these jobs. The only whip I have are the quotas. I can reduce a quota or add to it depending on how well you are doing like getting a new factory or acquiring a vessel, irrespective of whether you are a Namibian company or not. (Kahiurika 2014)

At the same time three other horse mackerel companies are taking MFMR to court over the
reduction of their quota, which they claim has caused 120 workers to be layed off (Kangootui 2014). According to newspaper reports the Minister apparently also awarded Horse mackerel quota to a hake processing company (Kahiurika 2014), whose hake fishing license was not renewed in 2011 because the company owed N$14 million in fishing levies. Subsequently, and in spite of the horse mackerel allocation, the company closed down in 2011 and more than 700 workers were laid off.

As stated in the LRCD report, the current quota system allows exploitation by so-called paper-quota holders who manipulate the market by selling their quotas to the highest bidder without making any investment in the fisheries sector. Although capital investment is part of the rights allocation criteria, there is currently no legal framework in place to enforce that new right holders comply with the conditions. (Poolman 2013) However, some 18 months after the LRDC investigation the actions by the Minister demonstrate that the trading of fishing quotas not only has tacit agreement from MFMR, but that the Ministry is actively involved in these transactions. Although, investment in the sector and jobs are inevitably mentioned whenever quota allocations are discussed, there is no explicit set of criteria by which to measure the worthiness of applicants or to judge the merit of the Ministers decisions; decisions, which concern the distribution of state resources and should therefore be made publicly (“Something Fishy” 2014). As long as these decisions are made behind closed doors, there is neither transparency nor accountability.
4. EVIDENCE BASED MANAGEMENT RECOMMENDATIONS

In this chapter we present three approaches to integrate stakeholder knowledge into the management of the hake fisheries. The first is a set of objectives and indicators for the human dimensions of the Namibian hake fisheries. The second is a decision tool that links these objectives and indicators to actual input data. And lastly we present findings from our research with captains in the demersal trawl and longline fleets that show that fishers ecological knowledge can contribute to improved stock assessments.

4.1 INDICATOR FRAMEWORK FOR THE NAMIBIAN HAKE FISHERY

EAF relies heavily on the availability of indicators, which are monitored and evaluated against reference points, i.e. targets or limits, related to management objectives (FAO 2003, Degnbol & Jarre 2004). There is growing body of literature on ecological indicators for EAF in the Benguela region, but the development of human dimension indicators is still in an early phase. Objectives and indicators for human wellbeing have been developed for specific industrial fisheries in South Africa (Jayiya et al. 2008, Paterson et al. 2010) and the Benguela Current region (Paterson and Petersen 2010). Sauer et al. (2003) collated snapshot socio-economic information for key South African commercial fisheries. Prototype decision-support tools to measure both efficacy (Paterson et al. 2007, 2010) and implementation of EAF (Paterson and Petersen 2010) were developed for key fisheries in the region.

The latter work has grown out of numerous stakeholder workshops that utilised the EAF framework to identify and address social and economic issues of key South African fisheries (Nel et al. 2007, Paterson and Petersen 2010). This work constitutes the only approach that is currently in place to track EAF implementation in Namibia and the BCC region.

Various frameworks are available for the development of fishery indicators. The World Bank has developed Fishery Performance Indicators (FPIs) designed to evaluate and compare the world’s fisheries management systems in terms of a “triple bottom line” of environmental, economic, and social sustainability (Figure 1; Anderson and Anderson 2010). Several neoliberal assumption underpin this framework, most notably (i) that commercial fisheries should create wealth by achieving maximum economic yield (MSY) (ii) that state regulation should be minimal and that this is best achieved through vertically integrated fisheries sector that is managed on a large spatial and economic scale and focused on export. Corresponding with the general trend in the neoliberal development philosophy (Gore 2000) the framework limits consideration of social objectives to income distribution, basic needs and employment. The Fishery Resources Division of the Food and Agricultural Organisation (FAO) developed an indicator framework as part of a sustainable development reference system (SDRS) for capture fisheries. The SDRS was developed in support of the Code of Conduct for Responsible fisheries (FAO 1995) and aims to provide the broader perspective needed for a sectoral and holistic approach to sustainability in fisheries. Four dimensions of sustainability (ecological, economic, social, and institutional) are considered as well as aspects of the socio-economic environment in which fisheries operate. Underpinned by the United Nations programme for sustainable development (FAO 1999) and
similar to the World Bank framework, the FAO indicator framework also favors export led
development as opposed to welfare based considerations and promotes a cybernetic fisheries
model (Johnsen et al 2009). Socio-economic monitoring guidelines were developed for the
western Indian Ocean (SocMon WIO) in response to the need for greater understanding of the
human dimensions of coastal and marine resource management. The SocMon WIO is the
product of substantial collaboration between social scientists and resource managers in the
Western Indian Ocean and critiqued by an extensive network of reviewers (Malleret-King 2006).
The Organisation for Economic Co-operation and Development (OECD) has put forward a
framework for social indicators (OECD 2011a) that draws on the OECD experience with
environmental indicators following a “Pressure-State-Response” model (OECD 2003).
Developed as part of the genuine Progress Index (GPI) for Atlantic Canada the Fisheries and
Marine Environment Account for Nova Scotia includes a comprehensive set of indicators
that allow the assessment of social, economic and environmental wellbeing of Nova Scotia
fisheries (Charles et al 2002). The Kingdom of Buthan has developed a Gross National
Happiness (GNH) index, which unlike poverty measures is focussed on flourishing over a
wide array of conditions, rather than survival (http://www.grossnationalhappiness.com).

4.2 OBJECTIVES AND INDICATORS FOR THE HUMAN DIMENSIONS OF THE NAMIBIAN HAKE
FISHERIES

The current management plan for the Namibian hake fisheries posits five main objectives for the
Namibian demersal hake fisheries (Figure 2) and describes strategies for the achievement of
these broader goals as well as some indicators (MFMR 2012). Nevertheless, the management
plan is somewhat vague with regard to the human wellbeing objectives of economic efficiency
and benefits for Namibians. Based on the outcomes of our research detailed in the preceding
chapters we propose a more detailed set of objectives and candidate indicators for the human
dimensions of the Namibian Hake Fishery. However, it is important to keep in mind that
“indicators are a means to an end”, thus the relevance of an indicator depends on the specific
objectives for management, and the institution that is to be informed by the indicator (Degnbol
& Jarre 2004). As the preceding sections of this report show, much work is still needed before
research on the human dimension provides the same depth of understanding that ecological
and biological research is providing for fishery managers. With this in mind, and also recognising
that a management plan needs to be as concise as possible we are limiting the proposed set of
objectives for human well being to respond to the most pressing issues that have emerged from
our research. The proposed indicator framework (Table 8) for the Namibian hake fishery lists
candidate indicators for operational objectives, which are derived from goals stated in the policy
framework that underpins this fishery.
Table 8 Proposed indicator framework for the Namibian Hake fisheries. Numbers in superscript indicate the policy document that specifies the stated goals, i.e. 1 FAO code of conduct 2 Marine Resources Act (2000); 3 Hake Management Plant; 4 The White paper (2004).

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Goal</th>
<th>Objective</th>
<th>Indicator</th>
<th>Description</th>
<th>Parameters</th>
<th>Properties</th>
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<tbody>
<tr>
<td>Ecological Wellbeing</td>
<td>Sustainable resource utilization</td>
<td>Precautionary Approach</td>
<td>TAC amount</td>
<td>Total allowable catch</td>
<td>TAC exceeding scientific advice indicates precautionary approach not followed</td>
<td>Source: MFMR; Type: time series;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Two separate TACs are set; yes - no</td>
<td>yes - no</td>
<td>Source: MFMR; Type: boolean</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Separate assessments are carried out for <em>M. capensis</em> and <em>M. Paradoxus</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Fishers LEK informs stock assessment</td>
<td>Higher values indicate higher confidence that fishers knowledge is integrated into management</td>
<td>Source: Industry, MFMR; Type: opinion poll among fishers and scientists</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>% fishers and scientists believing that information from fishers is used to improve the accuracy of stock assessment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stock Recovery</td>
<td>Biomass</td>
<td>Spawning biomass</td>
<td></td>
<td>Approaching or exceeding 1990 levels</td>
<td>Source: MFMR; Type: time series;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Minimise catches of undersized hake</td>
<td>Source: MFMR; Type: time series;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MLOC</td>
<td>Mean length of catch</td>
<td>Above 36 cm</td>
<td>Source: MFMR; Type: time series;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spatial distribution of catches</td>
<td>Spatial distribution of catches</td>
<td>Equal distribution is desirable</td>
<td>Source: Logbook data; Type: GIS;</td>
<td></td>
</tr>
</tbody>
</table>

42
<table>
<thead>
<tr>
<th>Dimension</th>
<th>Goal</th>
<th>Objective</th>
<th>Indicator</th>
<th>Description</th>
<th>Parameters</th>
<th>Properties</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Minimize ecosystem impact (^1\ 2\ 3\ 4)</td>
<td>Biodiversity and ecosystem functioning are maintained</td>
<td>Tropodynamc indicators</td>
<td>Tropodymnic indicators, as suggested in current literature.</td>
<td>TBD</td>
<td>Source: Ecosystem Modelling; Type: time series</td>
</tr>
<tr>
<td>Minimise bycatch</td>
<td></td>
<td>Vulnerable bycatch</td>
<td>Amount of bycatch per species by unit of effort</td>
<td>as low as possible</td>
<td></td>
<td>Source: logbook data; Type: time series</td>
</tr>
<tr>
<td>Non targeted fish bycatch</td>
<td></td>
<td>Amount of bycatch per species by unit of effort</td>
<td>as low as possible</td>
<td></td>
<td>Source: logbook data; Type: time series</td>
<td></td>
</tr>
<tr>
<td>Human Wellbeing</td>
<td>Economic efficiency (^1\ 2\ 3)</td>
<td>Optimise fishing efficiency</td>
<td>Landings level relative to TAC</td>
<td>The fraction of the total allowable catch that is landed annually</td>
<td>Should be close to equal, but not exceed TAC</td>
<td>Source: MFMR; Type: time series</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Fishing capacity relative to TAC</td>
<td>The total fishing capacity in the industry</td>
<td>Should be close to equal, but not exceed TAC</td>
<td>Source: MFMR; Type: numerical</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Number of fishing days (fleet avg)</td>
<td>The average number of days a vessel is at sea</td>
<td>As close to full season as possible</td>
<td>Source: logbooks</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Age of vessels</td>
<td>The average age of the fleet</td>
<td>&lt; 30 years</td>
<td>Source: MFMR; Type: numerical</td>
</tr>
<tr>
<td>Dimension</td>
<td>Goal</td>
<td>Objective</td>
<td>Indicator</td>
<td>Description</td>
<td>Parameters</td>
<td>Properties</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Optimise processing efficiency</td>
<td>Value landed vs.processed</td>
<td>The value of annual landings (ex vessel) compared to the value after processing (ex factory)</td>
<td>Increase of value of landings while maintaining or reducing volume of landings indicates value addition</td>
<td>Source: MFMR; Type: time series;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Processing capacity relative to TAC</td>
<td>The volume of fish that the industry can process annually</td>
<td>Processing capacity should be close to but not exceed the TAC</td>
<td>Source: MFMR; Type: numerical</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Maximise profitability</td>
<td>Cost of production relative to price</td>
<td>The cost of production as a fraction (%) of the selling price</td>
<td>Lower cost of production indicates higher profitability</td>
<td>Source: Industry; Type: time series</td>
</tr>
<tr>
<td>Dimension</td>
<td>Goal</td>
<td>Objective</td>
<td>Indicator</td>
<td>Description</td>
<td>Parameters</td>
<td>Properties</td>
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<td>-----------------------------</td>
</tr>
<tr>
<td>Human Wellbeing</td>
<td></td>
<td>Minimise risk exposure</td>
<td>Annual total revenue volatility</td>
<td>Ratio of standard deviation of annual total revenue and mean annual revenue over the last 10 years</td>
<td>High ratio indicates high volatility</td>
<td>Source: MFMR-PPE; Type: time series</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Annual landings volatility</td>
<td>Ratio of standard deviation of annual total landings and mean annual landings over the last 10 years</td>
<td>High ratio indicates high volatility</td>
<td>Source: MFMR-PPE; Type: time series</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Annual price volatility (use final value)</td>
<td>Ratio of standard deviation of annual price and mean annual price over the last 10 years</td>
<td>High ratio indicates high volatility</td>
<td>Source: MFMR-PPE; Type: time series</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Annual TAC volatility</td>
<td>Ratio of standard deviation of annual TAC over the last 10 years.</td>
<td>High ratio indicates high volatility</td>
<td>Source: MFMR-PPE; Type: time series</td>
</tr>
<tr>
<td>Benefits for all Namibians</td>
<td>Maximise rents</td>
<td>Total revenue vs. historic high</td>
<td>the ratio of total revenue to the average of the three highest total revenues in the past 10 years.</td>
<td>High ratio indicates more rents are recovered</td>
<td>Source: MFMR-PPE; Type: time series</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>% workers living in informal housing</td>
<td>Fraction of workers living in informal housing</td>
<td>Smaller value points to improved living conditions</td>
<td>Source: NSA Housing survey; Type: numerical</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Dimension</th>
<th>Goal</th>
<th>Objective</th>
<th>Indicator</th>
<th>Description</th>
<th>Parameters</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender equality</td>
<td></td>
<td>% jobs held by women</td>
<td>Percentage of women</td>
<td>Employed in the industry</td>
<td>50 % or higher</td>
<td>Source: MFMR/Industry/Unions; time series</td>
</tr>
<tr>
<td>Human Wellbeing</td>
<td></td>
<td>% shares held by women</td>
<td>Percentage of women</td>
<td>Shareholders in the industry</td>
<td>50 % or higher</td>
<td>Source: Industry/MFMR; Type: time series</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Women's wages vs. men's wages</td>
<td>Difference between</td>
<td>Women's mean annual wages and men's mean annual wages</td>
<td>Smaller ratio indicates higher equality</td>
<td>Source: Industry; NSA labour survey; Type: time series</td>
</tr>
<tr>
<td>Optimise</td>
<td>Optimise employment</td>
<td>Number jobs per unit of landed value</td>
<td>The number of jobs per USD 1000 per annum</td>
<td>More jobs per unit of value indicates value creation through processing</td>
<td>Source: MFMR-PPE; Type: numerical</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>% permanent jobs with benefits</td>
<td>Fraction of total</td>
<td>Employment (%) which is permanent and has benefits</td>
<td>Higher number indicates better quality of employment</td>
<td>Source: NSA labour survey; Type: numerical</td>
</tr>
<tr>
<td></td>
<td></td>
<td>% of jobs with labour broker</td>
<td>Fraction of total</td>
<td>Employment in the sector (%) which is which is with labour brokers</td>
<td>Lower value indicates less exploitation</td>
<td>Source: industry; Type: numerical</td>
</tr>
<tr>
<td>Optimise wages</td>
<td></td>
<td>Workers wages vs living wage</td>
<td>Difference between</td>
<td>Workers wages and living wage</td>
<td>Small ratio indicates adequate wages</td>
<td>Source: NSA labour survey; Type: numerical</td>
</tr>
<tr>
<td>Dimension</td>
<td>Goal</td>
<td>Objective</td>
<td>Indicator</td>
<td>Description</td>
<td>Parameters</td>
<td>Properties</td>
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<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Workers indebtedness</td>
<td>Average degree of indebtedness of workers</td>
<td></td>
<td>Source: NSA labour survey; Type: numerical</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Income distribution</td>
<td>Income distribution index (gini coefficient calculated for income across industry)</td>
<td>Lower value indicates equitable distribution of benefits within sector</td>
<td>Source: survey; Type: numerical</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>% Namibian ownership</td>
<td>Percentage of industry shares owned by Namibians</td>
<td>Higher value indicates Namibinaisation goals are being achieved</td>
<td>Source: MFMR-PPE; Type: numerical</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>% rights holders who are operators</td>
<td>Percentage of right holders owning and operating facilities</td>
<td>Higher value indicates less paper quota holders</td>
<td>Source: MFMR-PPE; Type: numerical</td>
</tr>
<tr>
<td>Good Governance</td>
<td>Management is transparent and participatory</td>
<td>Data on rights and quota allocations are publicly available</td>
<td>MFMR website</td>
<td>Relevant, up to date data on rights and quota allocations are available on the MFMR website</td>
<td>If no such data are readily available to the public, there is no transparency</td>
<td>Source: MFMR; Type: likert scale</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Criteria for quota allocation are explicit and available</td>
<td>MFMR website</td>
<td>Criteria for quota allocation are explicitly stated on the MFMR website</td>
<td>If no such data are readily available to the public, there is no transparency</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Functional hake working group</td>
<td>Frequency of meetings</td>
<td>Hake working group meets frequently</td>
<td>&gt; 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stakeholder representation</td>
<td>All stakeholders are represented on the hake working group</td>
<td>Higher diversity points to improved collaboration</td>
<td>Source: MFMR; Type: likert scale</td>
</tr>
<tr>
<td>Dimension</td>
<td>Goal</td>
<td>Objective</td>
<td>Indicator</td>
<td>Description</td>
<td>Parameters</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Legal challenges</td>
<td>Annual number of legal actions against MFMR</td>
<td>Lower value points to successful collaboration</td>
<td>Source: MFMR; Type: numerical</td>
</tr>
<tr>
<td>Good communication</td>
<td></td>
<td></td>
<td>Perception by MFMR</td>
<td>Percentage of MFMR staff believing that communication is good/bad</td>
<td>Higher value indicates better communication</td>
<td>Source: MFMR; Type: poll</td>
</tr>
<tr>
<td>Good communication</td>
<td></td>
<td></td>
<td>Perception by industry</td>
<td>Percentage of industry representatives who believe that communication is good</td>
<td>Higher value indicates better communication</td>
<td>Source: Industry; Type: poll</td>
</tr>
<tr>
<td>Good communication</td>
<td></td>
<td></td>
<td>Perception by fishermen</td>
<td>Percentage of fishermen who believe that communication is good</td>
<td>Higher value indicates better communication</td>
<td>Source: Industry; Type: poll</td>
</tr>
<tr>
<td>Good communication</td>
<td></td>
<td></td>
<td>Perception by public</td>
<td>Percentage of civil society representatives who believe that communication is good</td>
<td>Higher value indicates better communication</td>
<td>Source: MFMR; Type:</td>
</tr>
<tr>
<td>Good Governance</td>
<td></td>
<td>Degree of self regulation</td>
<td>Fraction of issues addressed by industry</td>
<td>Number of issues addressed by industry relative to number of MFMR interventions</td>
<td>Higher value indicates higher degree of self regulation</td>
<td>Source: MFMR; Type: time series</td>
</tr>
<tr>
<td>Management is cost effective</td>
<td>Management cost is adequate</td>
<td>Management cost is adequate</td>
<td>Budget vs revenue from quota</td>
<td>Budget allocation relative to revenue from quota</td>
<td>High ratio indicates high management cost</td>
<td>Source: MFMR; Type: time series</td>
</tr>
<tr>
<td>Dimension</td>
<td>Goal</td>
<td>Objective</td>
<td>Indicator</td>
<td>Description</td>
<td>Parameters</td>
<td>Properties</td>
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<tr>
<td></td>
<td></td>
<td>Industry contributes through research and compliance</td>
<td>% or research cost contributed by industry</td>
<td>Percentage of research budget funded by industry</td>
<td>High value indicates industry controls research agenda - middle values might be desirable</td>
<td>Source: MFMR-PPE; Type: numerical</td>
</tr>
<tr>
<td>Management</td>
<td>Management draws from multiple knowledge sources¹</td>
<td>Fishers' LEK is integrated into management</td>
<td>% fishers believe their knowledge informs management decisions</td>
<td>Percentage of fishers who believe their knowledge informs management decisions</td>
<td>High percentage indicates strong feedback loops between scientists and fishermen</td>
<td>Source: Industry; Type: poll</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Academic research is integrated into management</td>
<td>% MFMR scientists believe that all relevant academic research informs management decisions</td>
<td>Percentage of MFMR scientists who believe that all relevant academic research informs management decisions</td>
<td>Low percentage indicates management decisions are not based on best available science</td>
<td>Source: MFMR; type: poll</td>
</tr>
</tbody>
</table>
4.3 A KNOWLEDGE BASED DECISION SUPPORT TOOL

A knowledge based decision support tool was developed and structured for human wellbeing in the Namibian hake fishery according to the hierarchical tree approach recommended in the FAO guidelines for responsible fisheries (FAO 2003). Issues relevant for the Namibian hake fishery were identified in the literature and through primary research (see section 1.3 Material and Methods and section 3 Human dimensions of the Namibian hake fishery). During a consultative process with key experts from research, management and industry, the main issues were structured into a hierarchy of objectives by breaking general top-level objectives into increasingly specific operational objectives (Figure 5).
This objectives hierarchy was then implemented in NetWeaver, a knowledge-engineering tool for the development of fuzzy-logic knowledge bases (Miller and Saunders 2002). Netweaver knowledge bases are dependency networks, which function to evaluate the truth of a proposition (Reynolds et al 2000, Paterson et al 2007). Given input data the dependency network generates a truth value that is expressed as values between -1 (100% false) and +1 (100% true). In the case of missing data 0 is returned to express that the level of trueness is undetermined. A NetWeaver knowledge base is a hierarchical network of propositions, in which each proposition is based on antecedent propositions. At the lowest level input data are transformed based on fuzzy input variables to generate a truth value (Figure 6). For example the truth value of the proposition “Employment is good” is evaluated based on the antecedent propositions “number of jobs is high”, “quality of employment is high”, “wages are good” and “workers living conditions are excellent” (Figure 7, Figure 8). All variables were given equal weights following the NetWeaver recommendation (Miller and Saunders 2002). In the case of the knowledge base for the Namibian Hake fishery the dependency networks represent a hierarchical representation of goals and objectives for the fishery, and the indicators described in the previous section provide the input data for operational objectives (Figure 5).
Figure 6 Structure of a dependency network in NetWeaver, which evaluates the trueness of the proposition ‘Good employment’. A truth value is generated based on the truth values of the four antecedent networks ‘number of jobs is high’, ‘quality of employment is high’, ‘wages are good’ and ‘workers living conditions are excellent’.

4.3.1 Input Data

Two input datasets for 2003/2004 and 2008-2012 were compiled, based on available data obtained from MFMR, information published in the literature and qualitative information elicited from research participants (Table 9).

Table 9 Input data sets for candidate indicators used to measure human wellbeing in the Namibian hake fishery in the prototype decision support tool

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<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Fishing capacity (% of TAC)</td>
<td>no data</td>
<td></td>
<td>149</td>
<td>average 2008-2010</td>
</tr>
<tr>
<td>vessels fishing 200 or more days/year (% fleet)</td>
<td>no data</td>
<td></td>
<td>32</td>
<td>2008</td>
</tr>
<tr>
<td>age of vessels (years)</td>
<td>22</td>
<td>average (2003-2004)</td>
<td>29</td>
<td>average 2008-2012</td>
</tr>
<tr>
<td>increase in value after processing</td>
<td>19</td>
<td>average (2003-2004)</td>
<td>13</td>
<td>average 2008-2010</td>
</tr>
<tr>
<td>(%)</td>
<td>No data</td>
<td>218</td>
<td>average 2008-2010</td>
<td></td>
</tr>
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<td>---------------------------------------------------</td>
<td>---------</td>
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<td>------------------</td>
<td></td>
</tr>
<tr>
<td>Processing capacity (% of TAC)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue vs. historic high</td>
<td>87</td>
<td>65</td>
<td>2008 value, other data lacking</td>
<td></td>
</tr>
<tr>
<td>revenue volatility</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>landings volatility</td>
<td>0.1</td>
<td>0.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>final value volatility</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>workers living in informal housing (%)</td>
<td>No data</td>
<td>48</td>
<td>average 2008-2012</td>
<td></td>
</tr>
<tr>
<td>jobs held by women (%)</td>
<td>No data</td>
<td>40</td>
<td>average 2008-2012</td>
<td></td>
</tr>
<tr>
<td>Number of jobs $^2$</td>
<td>9000</td>
<td>8021</td>
<td>average 2008-2012</td>
<td></td>
</tr>
<tr>
<td>permanent jobs with benefits (%)</td>
<td>No data</td>
<td>72</td>
<td>average 2008-2012</td>
<td></td>
</tr>
<tr>
<td>jobs with labour broker (%)</td>
<td>No data</td>
<td>47</td>
<td>AVERAGE 2008-2011</td>
<td></td>
</tr>
<tr>
<td>workers wages</td>
<td>No data</td>
<td>2300</td>
<td>AVERAGE 2008-2011</td>
<td></td>
</tr>
</tbody>
</table>

$^2$ Due to lack of data the indicator ‘Number of jobs per 1,000 USD’ was modified to ‘total number of jobs’.
It has to be noted that Namibian fisheries management has traditionally focused on collecting those data that are needed for the stock assessment, as well as data related to exports. Information about employment creation has been measured in number of jobs. Nonetheless, the type of data made available by MFMR in annual reports varies from year to year. Data on revenues are only available aggregated for the entire fishery. Hake specific employment data are only available since 2008. There is no central repository for more detailed information that is relevant for the human dimensions such as data about rights holders, the fishing fleet and the quality of employment. The data used to populate the DST were therefore aggregated across several years (Table 9, Table 10). Because there is no indication of a regime shift in the natural system in the northern Benguela in the 2000s (Jarre et al. in press) there is no ecological reason not to aggregate years based on data availability. Thus the period 2003/2004 was selected because the rights allocation was renewed in 2002. The period 2008-2012 was selected because qualitative data from interviews as well as MFMR employment data are available for this period.

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**Figure 7** Fuzzy arguments defining the truth value for some of the economic variables measuring efficiency: (a) Fishing capacity matches TAC, (b) Landings are close to TAC, (c) Low average age of fleet, (d) Full season at sea, (e) Processing capacity matches TAC, (f) High increase in value after processing.
Figure 8 Fuzzy arguments defining the truth value for some of the socio-economic variables measuring quality of employment: (a) Employment is high, (b) Fraction of women employment is high, (c) No labour hire, (d) Jobs have benefits, (e) Workers’ living conditions are excellent, (f) Worker’s wages are high.

It was impossible to obtain data for all of the indicators. For instance, information on wages in the industry is not easily obtainable. There is no sector specific data on wages or income across different income brackets in the industry. Consequently it is impossible at this stage to calculate an index of income distribution, nor is any information available on how women’s wages compare with men’s wages. Although the degree of Namibian ownership is a key criterion for rights allocation no reliable information is available. Conflicting data is cited in the literature regarding the degree of Namibian ownership of the hake fishery. Information about rightsholders and quota shares is equally unavailable. Consequently it is impossible to determine the number of rights holders who are actively operating in the sectors as opposed to rights holders who choose to trade their quota without direct involvement in the sector, which again is a criterion for rights allocation. Neither is it possible to determine the number of women who are involved in the sector as quota holders or shareholders of fishing companies. Rights were again renewed in 2011, but unfortunately no MFMR annual reports are available since 2010. However, employment data for the hake fishery are available for 2008-2013. The MFMR reports provide mainly data on registered vessels (hake specific) and revenues. The latter are summarized for the entire fishery.
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<tr>
<td>Landings (% of TAC)</td>
<td>MFMR annual reports;</td>
<td>Average</td>
<td>Average 2008-2011</td>
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<tr>
<td>Fishing capacity (% of TAC)</td>
<td>Based on information provided in Kirchner and Leiman (2014) for wetfish vessels in the year 2008; It is assumed that the capacity has not substantially changed between 2008 and 2010.</td>
<td>No data</td>
<td>Average 2008-2010</td>
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<tr>
<td>vessels fishing 200 or more days/year (% fleet)</td>
<td>Based on information provided in Kirchner and Leiman (2014) for wetfish vessels in the year 2008; It is assumed that this value has not substantially changed between 2008 and 2010.</td>
<td>No data</td>
<td>2008 data</td>
</tr>
<tr>
<td>age of vessels (years)</td>
<td>MFMR list of vessels registered in 2008. The ages were adjusted for each year.</td>
<td>Average</td>
<td>Average 2008-2012</td>
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<tr>
<td>increase in value after processing (%)</td>
<td>MFMR annual reports.</td>
<td>Average</td>
<td>Average 2008-2010</td>
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<tr>
<td>Processing capacity (% of TAC)</td>
<td>MFMR annual reports; Sherborne 2010.</td>
<td>No data</td>
<td>Average 2008-2010</td>
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<tr>
<td>Revenue vs. historic high</td>
<td>MFMR annual report 2008; Caveat: Revenues are not sector specific; no data for subsequent years</td>
<td>Average</td>
<td>2008 data</td>
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<tr>
<td>revenue volatility</td>
<td>MFMR annual reports; Caveat: Revenues are not sector specific.</td>
<td>Average</td>
<td>Average 2008-2010</td>
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<td>landings volatility</td>
<td>MFMR annual reports.</td>
<td>Average</td>
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<td>final value volatility</td>
<td>MFMR annual reports.</td>
<td>Average</td>
<td>Average 2008-2012</td>
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<tr>
<td>workers living in informal housing (%)</td>
<td>Interview data; Assuming that all temporary workers and 10% of permanent workers live in informal housing.</td>
<td>No data</td>
<td>Average 2008-2012</td>
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<tr>
<td>jobs held by women (%)</td>
<td>MFMR</td>
<td>No data</td>
<td>Average 2008-2012</td>
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<td>Number of jobs</td>
<td>Erastus 2002 (2002 values carried forward)</td>
<td>2002 data</td>
<td>Average 2008-2012</td>
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<td>permanent jobs with benefits (%)</td>
<td>MFMR</td>
<td>No data</td>
<td>Average 2008-2012</td>
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<td>temporary jobs (%)</td>
<td>Interview data; based on values given for three of the major companies.</td>
<td>No data</td>
<td>Average 2008-2012</td>
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<tr>
<td>jobs with labour broker (%)</td>
<td>Interview data; based on values given for three of the major companies.</td>
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<tr>
<td>workers wages</td>
<td>Interview data; based on values given for three of the major companies.</td>
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### 4.3.2 Decision Support Tool Outputs

Outputs were generated for the period 2003/2004 (Figure 9) and 2008-2012 (Figure 10). The DST evaluation in terms of human wellbeing for the period 2003/2004 is characterized by data deficiencies (Figure 9). The output graph for the overall goal of human wellbeing expresses neither positive nor negative values for economic efficiency, benefits for Namibians and employment. Based on available data the model generated truth values for risk exposure, resource rents and employment: risk exposure was relatively low (truth value of 20% true), rents were maximized (truth value 75%) and employment was high (truth value 70%).
Results for the period 2008-2012 DST are more detailed because more data are available (Figure 10). Overall evaluation of human wellbeing in the fishery is low (truth value 100% false). The sub-goals processing efficiency and employment quality are evaluated as 100% false and 90% false respectively.


4.3.3 Discussion of DST Results

The results for 2003/2004 and the period 2008-2012 correspond with the research results presented in the previous sections. The results for the period 2003/2004 are characterized by large gaps in input data. If only those indicators are considered for which data is available, than the results look positive at first glance: employment in the fishery is depicted as high, rents are high and risk is relatively low. This reflects the goals that were set for the fishery at the time of independence, when it was assumed that these achievements would translate into direct benefits for Nambians. However, closer examination is possible for the period 2008-2012 for which more detailed information is available, in particular employment data from MFMR. With this added information the DST evaluates the proposition “benefits for all Namibians” as neither true nor false because the proposition “employment is good” is evaluated as 80% false. Although the proposition “number of jobs is high” is evaluated as 43 % true, the proposition “workers living conditions are excellent” is evaluated as 92% false. In other words, although employment numbers are high, the quality of employment is low, i.e. because workers living conditions are too bad to indicate “good” employment. For the period 2003/2004 economic efficiency is evaluated as neutral, but for the more recent period the model evaluates economic efficiency as 100% false because processing capacity is twice the current TAC. These model results indicate that current management of the hake fishery is falling short of the social and economic goals that were intended in the Namibian policy.

All of the indicators used in these model scenarios are based on measurable indicators. This is a clear improvement from past prototypes such as the model for EAF evaluation of the South African sardine fishery (Paterson et al 2007, Paterson et al 2010). But in spite of this advantage, many of the input values used to evaluate the realistic scenarios for the periods 2003-2004 and 2008-2012 are still somewhat unreliable. As stated earlier, input data are evaluated by the system against thresholds that determine at which input level a fuzzy variable returns true or false. Just like the selection of objectives and indicators these threshold levels reflect value judgments and can therefore be neither correct nor incorrect. For example, in the case of the proposition “Workers’ wages are high” threshold definition will be different if done from the perspective of the industry or the perspective of the individual worker. The industry is under pressure from Government to maximize employment, but to maintain profitability, high employment is only possible if wages are low. The fishing industry is considered among the better paying sectors for the broader worker base (Jauch 2012). However, such a comparative statement does not illuminate whether individual wages are adequate to guarantee workers wellbeing. It is likely that it is impossible to achieve consensus among all stakeholders on what the threshold levels should be for every fuzzy variable in the DST. In any case, the required political process would be far beyond the scope of this project. Although the subjectivity of the threshold values is a constraint that needs to be taken seriously, it does not reduce the value of the modeling exercise. Like any multi-criteria decision analysis (MCDA), the purpose of this decision-support tool is to structure the evaluation of EAF and to distil its complexity into key factors (Belton and Stewart 2002). The idea is to find indicators that can be accepted by stakeholders and generate insight and understanding (Paterson et al 2007). Subjectivity is inherent in all decision making through the choice of criteria and the relative importance that is given to them. Improving decision-making is therefore not a question of eliminating subjectivity but to render it explicit (Belton and Stewart 2002). The model scenarios that are presented here involve initial thresholds for fuzzy variables that were defined based on the research results presented in section 2 and 3. These can be varied to create different scenarios that evaluate human wellbeing from
different stakeholder perspectives, which would allow examination of different stakeholder values and their effect on the management goals.

4.4 INTEGRATING FISHERS ECOLOGICAL KNOWLEDGE INTO FISHERIES MANAGEMENT

The Namibian hake fishery is, one of the most important fisheries in the northern Benguela. In spite of attempts to rebuild the hake stocks, stocks have failed to recover (MFMR 2012; Paterson et al 2013). Because politically the ecological goal of stock rebuilding competes with social and economic objectives, it is important that abundance estimates are as accurate as possible. However, limited understanding of hake behavior and the effects of environmental factors on hake catchability interfere with the precision of abundance estimates. What is more, both species of hake still are assessed and managed as one Namibian stock. As described in more detail in Paterson and Kainge (2014) qualitative information derived from interviews conducted with Namibian hake trawl and longline fishers can be used to contextualise data from logbooks and has the potential to improve the accuracy of survey estimates and stock assessments.

4.4.1 VERTICAL MIGRATION

Both M. capensis and M. paradoxus undergo vertical migration away from the seabed (Payne 1995) a behavior that is poorly understood but affects catchability of the fish by bottom trawl gear. This introduces a variable bias into the results of bottom trawl surveys because a proportion of the fish is excluded from the biomass estimates (Iilende et al. 2001). Both hake trawl and hake longline are demersal fishing operations that are geared towards catching hake on the seabed. Consequently, skippers are acutely aware of the movement of hake up and down the water column. During interviews trawl skippers reported better daytime catches when the fish are closer to the bottom than at night when they rise into the midwater. Skippers adjust their fishing strategy accordingly, e.g. by shifting to deeper water and using nets with wider openings to increase night catches. These observations corroborate findings by Johnsen and Iilende (2007) who investigated the effect of hake behavior on commercial catches. They realized that variation observed in the CPUE cannot be taken as a direct reflection of catchability because changes in fishing strategy may be responsible for increased depth at night. The reasons for this kind of strategy change cannot be gleaned from logbook analysis. Further research conducted in partnership with fishers is required to improve understanding of the complex environmental, ecological, and social processes underlying changes in catch rates.

4.4.2 STOCK STRUCTURE

Although conserving fish stock structure is a critical aspect of preserving biodiversity, stock components are difficult to determine from traditional fisheries data (Stephenson and Kenchington 2000). What is more, the spatial units of fisheries management are the result of political and administrative considerations, which do not always match biological realities. As a consequence, stock components are difficult to determine from traditional fisheries data (Stephenson and Kenchington 2000). Thus common stock assessment techniques assume discrete populations. However, conserving fish stock structure is a critical aspect of preserving biodiversity. Therefore knowledge of fish movement is important for management, because it has implications for stock structure. The reasons for and patterns of horizontal migration of hakes in the northern Benguela, and their effects on distribution, are not well understood by science (von der Heyden et al. 2007). It is difficult to conduct tagging studies because hake seldom survive being brought on board from
the deep water. Thus there is only limited scientific knowledge about the movement of hakes and it is impossible to conclude a direct link between hake behavior and environmental signals from logbook data. The systematic collection of qualitative data on such observations through interviews with skippers can contribute to a better understanding of this relationship. Fishers using demersal longline gear, in particular, take notice of the movement of fish aggregations want to have a clear understanding of the position and anticipated movement of the fish before they commit to a fishing spot and set their lines. Consequently, they spend time observing fish movement through their echo sounders and plotting the position of fish shoals to collect observational information regarding the movement of hake at small spatial and temporal scales as a matter of course (Paterson 2014).

As documented in more detail in Paterson and Kainge (2014) observations by fishers of the spatial dynamics of hake aggregations may be indicative of the existence of substocks and thus warrant further investigation. In addition, fishers using trawl gear reported changed distributional dynamics. In the context of scientific information which shows a depressed biomass and failure to rebuild the Namibian *M. capensis* stock, this may suggest that range contraction and fishers’ knowledge of fish movement may be sustaining the availability of *M. capensis* to commercial fishing in the context of declining abundance as was the case with cod (*Gadus morhua*) in Atlantic Canada. Although *M. capensis* are not considered a schooling species, fish of similar size tend to be found in aggregations (Gordoa and Duarte 1991, Burmeister 2001), and thus potential links between hake biomass, patterns of change in aggregation, and catch rates should be investigated. Given that tagging studies are not feasible, a study based on field observation is one alternative option. A combined research project involving fishers and fisheries scientists may be able to take advantage of the skippers’ high-resolution information on hake distribution to learn more about horizontal migration and the aggregation behavior of hakes. For this, scientists would need to spend time talking with and observing fishers on fishing vessels. Such close collaboration would allow joint development of a research design (Stanley and Rice 2003) and in-season assessment (Stephenson et al. 1999) of the migration of *M. paradoxus* between South Africa and Namibia, which is currently disregarded in the assessments in both countries.

### 4.2.3 Different Types of *M. capensis*

Genetic information regarding the Namibian hake stocks is limited and inconclusive (van der Heyden 2007) an issue that is addressed in other work packages of ECOFISH. However, genetic studies have been more concerned with the question internationally shared stocks which has implications for management and landings in Namibia and South Africa. The question of genetically distinct populations within the northern Benguela, has not been addressed in genetic research. Given the drastic decline in biodiversity at all levels (Worm et al. 2006), consideration of the potential effects of diversity within species on ecosystem functioning is important. It is also important to note that traditional stock identification techniques can fail to differentiate between populations, which are known to have been temporally or spatially distinct (Stephenson and Kenchington 2000).

Namibian longline skippers are able to describe differences in appearance and behavior among *M. capensis* that seem to be linked to geographic areas, suggesting that there are multiple hake stocks within Namibian waters. Morphological differences have been used as a basis for assuming the existence of separate stocks in other species of marine fish (e.g., Draganik and Sachs 1991, Beckley and van der Lingen 1999) but differences
in color can also be caused by diet (Gosse and Wroblewski 2004). Approaches to defining stocks using a combination of body morphology and geographic difference are considered unsuitable for hakes in the northern Benguela because there are few pronounced environmental differences within their range (Grant et al. 1987). However, the so-called “Wall” immediately north of the Orange River, where longliners differentiate catches of “white” and “brown” capensis, is a distinct feature of marine geography within the Namibian distribution of M. capensis and might involve to different habitat conditions (Paterson and Kainge 2014).

There is currently no distinction between the two species of hake, M. paradoxus and M. capensis in the Namibian stock assessment model. There is even less consideration of different subcomponents of the M. capensis stock, which opens up the possibility of a serial depletion of subspecies and populations and a corresponding reduction in biodiversity (genetic and behavioral) in these fisheries (Paterson and Kainge 2014). If more effort were made by fisheries scientists to involve fishers in the data-collection process, it may be possible to separate landings data based on subspecies, or at least, given spatial and temporal differences in distribution, to begin to estimate fishing mortalities at this level. Skippers are routinely providing logbook data on catches as part of the fisheries regulations. Moreover Namibian skippers have stated during a stakeholder workshop that data accuracy and format could be improved if they were involved in the research (Uanivi et al. 2010). The fishers and the companies that employ them would consequently have a better understanding of how the information they provide is used.

4.4.4 EFFORT AND EFFICIENCY INCREASES

During interviews fishers reported that they make constant improvements in their fishing gear. These improvements are documented in Paterson and Kainge (2014). The scientific literature on Namibian hake does at times make note of such improvements (e.g. Johnsen and Ililende 2007), but there seems to be no detailed data on this or on trends over time. Fishers estimate that efficiency in the longline fishery may have increased by up to 25% (Paterson and Kainge 2014), which is noteworthy because, in the assessments, fishing effort in the longline fishery is quantified in terms of numbers of hooks set per day, avoiding the problem of changes in the number of hooks per line. However, this quantification does not reflect increases in efficiency through reduced visibility of the fishing lines or use of swivels, nor the effect of better fish-finding technology and knowledge of fish behavior on catch rates (Paterson and Kainge 2014). Trawl effort is measured as number of hours trawled, standardized according to vessel size, and does not take into account net size and engine power. As already mentioned improved fish-finding equipment, knowledge of fish movements, aggregation, and shifting across stocks likely increase fishing efficiency relative to abundance, and thus offset the effects of resource decline. The Namibian stock assessment methodology assumes efficiency in the fleet to be constant (C. Kirchner, personal communication) and, because this assumption is clearly inaccurate (efficiency has been increasing rather than decreasing), the result is likely positively biased stock assessments based on commercial CPUE assessment (Neis et al. 1999b). A closer investigation and quantification of this trend involving fishers in the assessment process, would have the potential to improve the accuracy of the assessments.

The above analysis (see Paterson and Kainge 2014 for more detail) shows that, lack of understanding of hake behavior on the one side, and the social and ecological factors affecting fishing behavior on the other, lead
to inaccuracies in the current assessment of resource abundance. Systematic collection of fishers’ information is important. As documented in Paterson and Kainge (2014) there are details that are not being captured either in the logbook data or in Namibian fisheries surveys. These details are potentially important for making accurate assessments of stocks and for undertaking improved management. Erosion of subcomponents leads to reduced intra-specific diversity. Thus, good knowledge of stock structure is important for maximizing the resilience of the stock. Moreover, lack of information about efficiency increase and fishing strategy leads to inflated indices of abundance based on CPUE data.

5. CONCLUSION

This report comprises part of a larger study that aims to develop a new framework for EAF in the Benguela Current Large Marine Ecosystem (BCLME). In the context of this larger project and with respect to the Namibian hake fisheries this report addresses the need for greater integration of stakeholder knowledge in the fisheries management process in three different ways: a) through the development of indicators for the human dimension of the fishery with specific focus on user value and employment; b) through the development of a multi-criteria decision support tool based on these indicators; c) through an analysis of fishers’ ecological knowledge.

Our social-ecological analysis of the human dimension of the Namibian hake fisheries shows that although Namibia’s fisheries policy attempts to be both scientific and socially sensitive, this is only superficially true. It is becoming increasingly clear that simply injecting social objectives as a welfarist slant into an otherwise neoliberal wealth-based management approach is not only inadequate but has created a management dilemma where social, economic, and ecological goals are in conflict on the political stage (Paterson et al 2013). As our research shows, sound science alone is not enough to guarantee a healthy fishery. Unless ecological, economic, social, and political factors are considered together, the chances for successful rebuilding of the hake stocks and the direction of the flow of benefits towards the socioeconomic uplifting of the majority of Namibians are minimal.

Access rights are put in place to protect the resource from over exploitation. However, the current access regime has negatively affected resource exploitation as TACs have been increased in proportion to new rights allocations. Moreover, the findings from the Law Reform and Development Commission public consultation process are worrisome. They show that the current fisheries management system in Namibia, notwithstanding the international praise it received, is implemented in a “discretional, unequal and erratic” manner. Improvements would require that the Marine Resources Act be amended to allow for greater transparency, especially in the allocation of quotas.

A second important issue that was surfaced by our research is, that the interests of a major stakeholder group are continually sidelined in the current system. Workers in the Namibian fisheries not only constitute the largest number of stakeholders, but their livelihoods are directly dependent on the fishery. However, although these livelihoods are literally at stake, workers do not actively participate in fisheries management in any way. Their interests are represented by trade unions and interaction is limited to negotiations
between union leaders and company management. The protests that took place in Walvis Bay in 2014 showed clearly that workers do not feel that their interests are taken care of (Finck 2014).

Work in the fishing sector is highly stratified along gender lines, a typical characteristic of work in fish factories. Although the high proportion of women employed in the sector may be looked upon as gender equity – there are other qualitative factors that might indicate otherwise as such gender stratification may impact working hours and wages of women, as offloading, strapping and freezing work is more consistent and involves more overtime than work on the line. Further, more focused gender research is needed in this regard. Another area that requires more in depth research is the effect of labour migration on the flow of benefits. Split households and varying degrees of urban integration not only result in lack of social cohesiveness which affects quality of life, but also makes it difficult to trace the flow of benefits from the fishery via individual workers to households and communities.

Due to their urban location fish workers may enjoy better access to health care than people in the rural areas. However, our research with fish workers in several Walvis Bay fish factories suggests occupational health issues related to repetitive tasks in a cold and damp environment. Further research in this area is needed to shed more light on this emerging issue.

The same factors that make fishing a “risky business” for fishing companies, most notably uncertain quota allocations and changing market conditions, translate into unreliable on-call employment, irregular work scheduling and unpredictable compensation for fish workers. The use of temporary workers and labour hire further erode employment benefits. Most fish-workers earn wages too low to cover the cost of urban living, debt is a major issue for many and few qualify for National Housing Enterprise loans. Thus the majority of fish workers live in informal houses, commonly referred to as “ghettos” in Walvis Bay, and are therefor extremely vulnerable. What is more, although low wages help reducing the cost of production for individual companies, in terms of the national economic context low wages result in a lack of final demand linkage. Higher wages, which increase workers’ capacity to spend are required to increase local demand and stimulate other domestic industries and businesses. Value adding is important but only one of several types of linkages that need to be captured to move Namibia’s export dependent economy to an internally independent developed economy.

Our research shows that local fishers can provide insights that are vital to interpret catch data from commercial fisheries. Fishers can provide information on stock structure, the spatial distribution of different stock components, and fishing efficiency, which are important for making accurate assessments of stocks. Good knowledge of stock structure is important for maximizing the resilience of the stock. Moreover, disregarding efficiency increase and fishing strategy leads to inflated indices of abundance based on CPUE data.

Notwithstanding Namibia’s efforts to rebuild its most valuable fishery, the Hake resources remain depleted. Precisely because the ecological goal of stock rebuilding competes with social and economic objectives on the political stage, accurate abundance estimates are more important than ever. However, the precision of abundance estimates is currently impeded by lack of understanding of hake behavior and of the effects of environmental factors. Fishers are able to provide valuable insights and also track quantitative information
that has the potential to fill some of these gaps. This will require much better integration of fishers and their knowledge into the assessment processes. Engaging fishers more directly in gathering and interpreting the data used in stock assessments could help strengthen this knowledge and improve the accuracy of Namibian hake stock assessment. However, close collaboration between scientists and fishers contains potential risks for fishers and fishing companies as improved accuracy may result in decreased quotas. On the other hand, in-depth knowledge of the assessment process and associated uncertainties may lead to directed efforts by the industry to manipulate information to avoid quota reductions. Clearly, this is a complex problem and there is no easy solution. However, the rebuilding of the Namibian hake stocks is in the interest of all who have a long-term stake in the fishery, including Namibian society as a whole.

The current management plan for the Namibian Hake fisheries is vague regarding the implementation and measurement of the two key objectives “economic efficiency” and “benefits for all Namibians”. Based on our research we have proposed a more detailed set of objectives and candidate indicators. However, recognizing that while understanding of the human dimensions requires further in depth research better management is needed now and requires a concise set of objectives for human well being that speaks to the most pressing issues that have emerged from our research. We have developed and structured a knowledge-based decision support tool that links these objectives to indicators, thus allowing the evaluation of each objective based on actual input data. This decision tool helps to cut through the complexities of fisheries management by structuring the decision problem into key factors. In doing so the decision tool renders explicit the inherently subjective perspectives and value judgments of all policy actors, thus allowing close examination of the different stakeholder agendas and their effects on the management goals.
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75


