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South Africa:

Namibia:
Ben van Zyl, Jean-Paul Roux, Johannes Ittembu, Nadine Moroff, Angie Kanandjembo, Titus Ililende, Peter Amutenya, Penda Ithindi, Zurilea Steenkamp, Christo October, Moses Murihu, Kebekhe Klangelhoeffer, Anna Erastus, Carola Kirchner, Hannes Holtzhausen, Beau Tjipura, Johannes Ittembu, Chris Bartholomae, Graça D’Almeida, Patricia Alexander, Heinrich Lesch.

Angola:

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Photographs © Thomas Peschak, Maria Honig, Samantha Petersen, Eliott Norse (Marine Conservation Biology Institute photobank).
Ecological Risk Assessment:
A Tool for Implementing an Ecosystem Approach for Southern African Fisheries

WWF South Africa Report Series – 2007/Marine/002

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JULY 2007
FOREWORD

An Ecosystem Approach to Fisheries (EAF) has been adopted by many nations as being necessary for sustainable use of marine fisheries, and efforts are being made in many countries to make progress in its development and implementation. Angola, Namibia and South Africa, making up the coastal states of the Benguela Current Large Marine Ecosystem (BCLME), are committed to the implementation of an EAF and are making good progress through the GEF sponsored BCLME Programme. This report examines Ecosystem Risk Assessments (ERA) which resulted from focused workshops on the fisheries of Namibia and South Africa. It provides a checklist of broad operational objectives with management linked indicators which can form the basis of an EAF tracking tool for effective monitoring of performance in the fisheries of these countries. Generic issues include understanding and managing impacts on the ecosystem as a whole, as well as conflicts between sectors, managing the fisheries in a highly variable environment and participatory governance and transparency. The latter includes close cooperation and co-management with industry.

Ecosystem management in all its guises, including EAF is still a confusing topic for many and there is still much debate on what it entails. The approach used in the BCLME project (Cochrane et al. 2006) to clarify the concept was to start by examining, fishery by fishery, the strategy currently being used to manage it and any problems or concerns, related to the ecosystem and the set of stakeholders for the ecosystem, that were not being satisfactorily addressed by the existing management strategy. Any factors beyond the mandate or control of the fishery managers that were impacting on the fishery were also considered. All of these were then prioritized and potential management actions to resolve the problems were identified. The overall goal of this process was to identify where the current management system may be failing to prevent or adequately mitigate impacts that are threatening the sustainability of the fishery itself. These could also affect other stakeholders, both within the wider fishery sector and outside of it, or that may threaten the long term sustainability and productivity of the ecosystem.

Identification of all the issues of concern in the fisheries considered and their prioritization through risk assessment is a key component in separating out EAF issues. This report highlights the main ecological, socio-economic and governance problems facing the fisheries of South Africa and Namibia and analyses these cross-cutting issues in relation to the various fisheries. In the application and implementation of an EAF, the report also identifies operational objectives and management indicators that can be usefully applied in monitoring the effectiveness of an EAF strategy.

This report is a practical and useful contribution towards the implementation of an EAF in the BCLME and attempts to demystify a somewhat complex management strategy into a process that is tangible and achievable. The participatory workshop processes used in the countries was commendable and represented a major step forward in the process of sensitizing the stakeholders to the EAF process. Although a large amount of data and information was gathered
for the synthesis, gaps remain and more work needs to be done to develop and implement an EAF that is workable within the Benguela region.

The synthesis of the Ecological Risk Assessments in this report is a collaborative effort by FAO, the national fisheries management agencies and WWF in partnership with the fishing industries and represents a major achievement in advancing the EAF process in the region. The results form an important contribution towards realizing the WSSD goal of implementing an Ecosystem Approach to Fisheries by 2010 and provides a valuable framework for future refinement and implementation of an EAF in the Benguela with possible applications of its methodologies to other African Large Marine Ecosystems and perhaps even further afield.

Dr Michael J. O’Toole
Chief Technical Advisor
BCLME Programme
United Nations Development Programme

CONTENTS

1. INTRODUCTION 1

2. ECOLOGICAL RISK ASSESSMENT METHODOLOGY 5
   2.1 Identification of issues 5
   2.2 Prioritization of issues 6
   2.3 Development of Performance Reports 6

3. ECOLOGICAL RISK ASSESSMENT REPORTS 8

4. SYNTHESIS AND WAY FORWARD 185
   4.1 Generic issues 185
   4.2 Towards a EAF checklist for South Africa and Namibia 185
   4.3 A proposed way forward for EAF in South Africa and Namibia 189

Ecological Risk Assessment Reports:

<table>
<thead>
<tr>
<th>SOUTH AFRICA:</th>
<th>Compiled by</th>
<th>Pg. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ecological Risk Assessment (ERA) for the South African Demersal Hake Fishery</td>
<td>D.C. Nel</td>
<td>9</td>
</tr>
<tr>
<td>2 Ecological Risk Assessment (ERA) for the South African West Coast Rock Lobster Fishery</td>
<td>D.C. Nel</td>
<td>38</td>
</tr>
<tr>
<td>3 Ecological Risk Assessment (ERA) for the South African Small Pelagic Fishery</td>
<td>D.C. Nel</td>
<td>59</td>
</tr>
<tr>
<td>4 Ecological Risk Assessment (ERA) for the South African Squid Fishery</td>
<td>S.L Petersen and D.C. Nel</td>
<td>82</td>
</tr>
<tr>
<td>5 Ecological Risk Assessment (ERA) for the South African Large Pelagic Fishery</td>
<td>S.L Petersen</td>
<td>98</td>
</tr>
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</table>

<table>
<thead>
<tr>
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<th>Compiled by</th>
<th>Pg. No.</th>
</tr>
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<td>6 Ecological Risk Assessment (ERA) for the Namibian Demersal Hake Fishery</td>
<td>D.C. Nel</td>
<td>125</td>
</tr>
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<td>D.C. Nel</td>
<td>145</td>
</tr>
<tr>
<td>8 Ecological Risk Assessment (ERA) for the Namibian Purse Seine Fishery</td>
<td>D.C. Nel</td>
<td>164</td>
</tr>
</tbody>
</table>
## ABBREVIATIONS TABLE

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCC</td>
<td>Benguela Current Commission</td>
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<tr>
<td>BENEFIT</td>
<td>Benguela Environment Fisheries Training Interactions Programme</td>
</tr>
<tr>
<td>BMSY</td>
<td>Biomass Maximum Sustainable Yield</td>
</tr>
<tr>
<td>BRD</td>
<td>Bycatch Reduction Device</td>
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<tr>
<td>CAF</td>
<td>Consultative Advisory Forum</td>
</tr>
<tr>
<td>CCAMLR</td>
<td>Commission for the Conservation of Antarctic Marine Living Resources</td>
</tr>
<tr>
<td>CCSBT</td>
<td>Commission for the Conservation of Southern Bluefin Tuna</td>
</tr>
<tr>
<td>CPUE</td>
<td>Catch Per Unit Effort</td>
</tr>
<tr>
<td>DEAT</td>
<td>Department of Environment and Tourism</td>
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<tr>
<td>DRM</td>
<td>Directorate of Resource Management</td>
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<tr>
<td>DTI</td>
<td>Department of Trade and Industry</td>
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<tr>
<td>DME</td>
<td>Department of Minerals and Energy</td>
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<td>DWAF</td>
<td>Department of Water Affairs and Forestry</td>
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<tr>
<td>EAF</td>
<td>Ecosystem Approach to Fisheries</td>
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<td>EEZ</td>
<td>Exclusive Economic Zone</td>
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<tr>
<td>FAD</td>
<td>Fish Aggregating Devices</td>
</tr>
<tr>
<td>FIMS</td>
<td>Fisheries Information Management System</td>
</tr>
<tr>
<td>HACCP</td>
<td>Hazard Analysis and Critical Control Points</td>
</tr>
<tr>
<td>ICCAT</td>
<td>International Commission for the Conservation of Atlantic Tunas</td>
</tr>
<tr>
<td>IOTC</td>
<td>Indian Ocean Tuna Commission</td>
</tr>
<tr>
<td>IUU</td>
<td>Illegal, Unreported and Unregulated</td>
</tr>
<tr>
<td>MCM</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>MFMR</td>
<td>Namibian Ministry of Fisheries and Marine Resources</td>
</tr>
<tr>
<td>MLRA</td>
<td>Marine Living Resource Act</td>
</tr>
<tr>
<td>MPA</td>
<td>Marine Protected Areas</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-governmental Organisation</td>
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<tr>
<td>OMP</td>
<td>Operational Management Procedure</td>
</tr>
<tr>
<td>PPE</td>
<td>Policy, Planning and Economics</td>
</tr>
<tr>
<td>RFMO</td>
<td>Regional Fisheries Management Organisation</td>
</tr>
<tr>
<td>RMWG</td>
<td>Resource Management Working Group</td>
</tr>
<tr>
<td>SABS</td>
<td>South African Bureau of Standards</td>
</tr>
<tr>
<td>SAMSA</td>
<td>South African Maritime Safety Authority</td>
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<tr>
<td>SEAFO</td>
<td>South East Atlantic Fisheries Organisation</td>
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<tr>
<td>SVU</td>
<td>Standard Vessel Unit</td>
</tr>
<tr>
<td>SWG</td>
<td>Scientific Working Group</td>
</tr>
<tr>
<td>SWIOPF</td>
<td>South West Indian Ocean Fisheries Project</td>
</tr>
<tr>
<td>TAC</td>
<td>Total Allowable Catch</td>
</tr>
<tr>
<td>TAE</td>
<td>Total Allowable Effort</td>
</tr>
<tr>
<td>TOR</td>
<td>Terms Of Reference</td>
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<tr>
<td>TROM</td>
<td>Target Resource Oriented Management</td>
</tr>
<tr>
<td>VMS</td>
<td>Vessel Monitoring System</td>
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<tr>
<td>WSSD</td>
<td>World Summit on Sustainable Development</td>
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<tr>
<td>WTO</td>
<td>World Trade Organisation</td>
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</table>
1. INTRODUCTION

The benefits of managing fisheries in a manner that takes into account the overall health of the marine ecosystem have long been recognized (Cochrane et al. 2004). In fact, the basic principles of this Ecosystem Approach to Fisheries (EAF) management are firmly entrenched in the primary legal mechanism for management of our global oceans, the 1982 United Nations Law of the Sea Convention (Article 61); thus legally obligating the 155 States that are signatory to this convention to implementing these principles. In the last decade, the need to implement an EAF gained renewed urgency and support through several global mechanisms (most notably the 2001 Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem). This culminated in a global commitment towards the implementation of an EAF in all fisheries by 2010, through the 2002 World Summit on Sustainable Development Plan of Implementation.

These global commitments have spurred a flurry of important scientific activity aimed at understanding the complex marine ecosystem interactions (e.g. Shannon et al. 2004). However, the practical implementation of EAF principles in fisheries management protocols has proved more difficult to achieve. In particular, there has been surprisingly little progress globally towards developing simple and structured guidelines for implementing an EAF within fisheries management organizations (with a few exceptions such as the technical guidance provided by the FAO (FAO 2003, 2005) and Ward et al. (2002)). Another contribution to the development of a simple and structured framework is provided by the Australian Ecological Sustainable Development Framework (Fletcher et al. 2002).

It was within this context that the Benguela Current Large Marine Ecosystem programme (BCLME see www.bclme.org), in partnership with the Food and Agriculture Organisation (FAO), initiated a project to investigate the feasibility of implementing an EAF in the BCLME on the South Western Coast of Africa including South Africa, Namibia and Angola in 2004. The aims of the project were to investigate the feasibility of EAF management in the BCLME region through examining the existing issues, problems and needs related to EAF, and developing different management options to achieve sustainable management of the resources at an ecosystem level.

At an early stage in the life of this project, participants were grappling with two issues:

1. The complexity of implementing an EAF and how to prioritize resources and management actions.
2. Building a simple and common understanding of an EAF with stakeholders; including more specifically what is required for an EAF, and the implications and benefits thereof for stakeholders,
Clearly there was a need for a simple and structured implementation framework within which to implement an EAF that was understood and supported by all stakeholders.

In response to this, a decision was made to conduct Ecological Risk Assessments (ERA’s) as a means of identifying the ecological risks associated with the management of the major fisheries in the region, and to prioritise management responses. Various ERA approaches were considered at a regional workshop held under the auspices of the BCLME/FAO project in Windhoek, Namibia, in September 2004 (BCLME 2005). It was decided to follow the ERA process outlined in the Ecological Sustainable Development Reporting Framework for Australian Fisheries (Fletcher et al. 2002), the approach adopted in the FAO Guidelines on implementation of EAF (FAO 2003). It is important to note two main principles in this methodology. Firstly, the process seeks to build consensus amongst diverse stakeholders about identifying and prioritizing ecosystem issues and prioritizing a programme of action. Secondly the process sees the ‘ecosystem’ in its broadest definition, including the biological, social, economic and governance systems. This latter principle is of particular importance given the fact that in fisheries management, so many biological recommendations are undermined by the lack of consideration of the social and economic implications or governance systems required to implement these recommendations. It also reveals that, contrary to the concerns of those sceptical of the intentions of EAF, humans are seen as an integral component of the ecosystem in the approach.

Figure 1: Ecological Risk Assessments were carried out for three Namibian and five South African fisheries
WWF South Africa was contracted by the project to conduct ERA workshops, in collaboration with the National Marine Information and Research Centre, Namibia (NatMIRC) and Marine and Coastal Management, South Africa (MCM), for eight major fisheries in South Africa and Namibia (BCLME 2006) (Figure 1). BCLME, in collaboration with the FAO, conducted further workshops in Angola. Those reports are available on the BCLME website (www.bclme.org). These workshops were highly successful in bringing a diverse array of stakeholders around single tables to discuss the management of particular fisheries sectors. The facilitators were pleasantly surprised by the high level of consensus reached by stakeholders with obviously diverse interests, and the co-operative spirit with which the stakeholders grappled with the diverse EAF issues. The results from the workshops provide very useful information to stakeholders and policy makers on the issues and priorities in the implementation of an EAF, as well as proposing management responses to address them. Furthermore workshop results provide indicators to assess the issues and to measure progress and effectiveness of the management measures addressing these. These results also formed the basis of subsequent work within the BCLME/FAO project which has investigated the costs and benefits of different management responses to provide further advice on how to implement EAF most effectively.

This report is an attempt to synthesize the main findings of these eight ERA reports and to provide practical advice on how these outputs can be best used to take forward the implementation of an EAF in Southern African fisheries in a simple and structured way, understood and supported by the broad range of stakeholders involved.

References


Methodology
2. ECOLOGICAL RISK ASSESSMENT METHODOLOGY

The workshops used the Ecological Risk Assessment methodology developed under the National Ecologically Sustainable Development reporting framework for Australian Fisheries (Fletcher et al. 2002), the approach adopted by the FAO in its technical guidelines on implementation of EAF (FAO 2003, 2005). This document will only briefly describe this methodology and ideally the report should be read in conjunction with Fletcher et al. 2002 and the two FAO publications (FAO 2003, 2005).

This methodology provides a structure to consider divergent issues in a transparent and accountable manner. Risk Analysis involves consideration of the sources of risk, their consequences and the likelihood that they may occur. Moreover, it allows for the prioritization of issues or hazards with justification and the subsequent prioritization of management responses. It requires stakeholders to deliberate and come up with an agreed position and provides an agreed roadmap for the way forward. In essence it is a way of operationalizing policy.

Briefly this methodology relies on a three step process:
1. Identification of concerns or issues
2. Prioritisation of these concerns or issues
3. Development of Performance Reports which describe the appropriate management response necessary to address the issue

2.1 Identification of Issues

The methodology utilizes generic component trees to help participants to tease out the main issues or concerns that the fishery faces (Figure 1). The process starts off by breaking the fishery down into eight main components in three main categories; ‘Ecological Wellbeing’, ‘Human Wellbeing’ and ‘Ability to Achieve’.

![Diagrammatic representation of the eight major components of the ERA process](image-url)
Each of these eight components is then further disaggregated into more detailed sub-components for which ultimately operational objectives can be developed. The Australian framework provides guidance, in the form of a series of hierarchical trees, on common themes at increasing levels of detail to assist in the disaggregation. Through this process all issues present in the fishery are recorded. Any issue identified by one or more participants is included in the list of issues, whether or not it is supported by others thereby providing a comprehensive list of concerns as perceived by all participants in the workshop.

The above outline was used in all the ERA workshops with the exception of the ‘Indigenous Wellbeing’ component which was considered not to be applicable to these fisheries.

2.2 Prioritization of Issues

Identified issues are then prioritized by scoring the consequence of a given risk actually occurring independent from the likelihood of it occurring. Again, the Australian framework provides useful guides for scoring consequences and likelihoods. A risk value rating is then calculated as the product of the ‘consequence’ and ‘likelihood’ scores. At this step it is necessary, as far as possible, to gain consensus on the consequences and likelihoods. While this can be a contentious stage in these workshops, there was a high level of agreement across the issues that had been identified.

The issue is then categorized as ‘Negligible’ (score of 0), ‘Low’ (score of 1-6), ‘Moderate’ (score of 7-12), ‘High’ (score of 13-18) and ‘Extreme’ (score of 18 or greater) risk according to their overall risk score. The risk value therefore provides a means of prioritizing the issues. Low risk issues require no management action whereas high risk issues require management action. For a Fisheries Agency ‘risk’ is associated with the chance of something affecting the Agency’s performance against the objectives of the relevant legislation. High risk issues were classified as obtaining a risk score higher than 7.

2.3 Development of Performance Reports

Full Performance Reports were then developed for all issues of sufficient priority (i.e. greater than ‘Moderate’ risk) according to the template in Table 1. Briefly, these required the setting of an operational objective, the identification of indicators, targets and milestones. These allow for regular progress to measure against agreed targets. Due to time constraints emphasis was placed on section 7 (the management response) and in some cases section 5 and 6 were omitted. In many cases this third and final step in the ERA process identified the need to continue with, or intensify actions already taking place to address or mitigate the issue raised but also raised the need for action in some areas that have been neglected up until now. It is important to note that, in general, because of the time constraints and the very broad areas covered by the project, these results should be seen as being preliminary. In the
follow-up to the project that will lead to further progress in implementation of EAF, it will be essential to ensure that the best available information is used to validate and expand, as necessary, the results presented here and that the full range of legitimate stakeholders are involved in the process.

Table 1. Diagrammatic representation of the nine steps to developing the Performance Reports.

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<thead>
<tr>
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<tr>
<td>1) Operational Objective (plus justification)</td>
<td>What are you trying to achieve and why?</td>
</tr>
<tr>
<td>2) Indicator</td>
<td>What are you going to use to measure performance?</td>
</tr>
<tr>
<td>3) Performance Measure/Limit (justification)</td>
<td>What levels define acceptable and unacceptable performance and why?</td>
</tr>
<tr>
<td>4) Data Requirements/Availability</td>
<td>What monitoring programs are needed?</td>
</tr>
<tr>
<td>5) Evaluation</td>
<td>What is the current performance of the fishery for this issue?</td>
</tr>
<tr>
<td>6) Robustness</td>
<td>How robust is the indicator &amp; or the performance measure in assessing performance against objective?</td>
</tr>
<tr>
<td>7) Fisheries Management Response</td>
<td>What are the management actions currently being used to achieve acceptable performance?</td>
</tr>
<tr>
<td>o Current</td>
<td></td>
</tr>
<tr>
<td>o Future</td>
<td>What extra management is to be introduced?</td>
</tr>
<tr>
<td>o Actions if Performance Limit is exceeded</td>
<td>What will happen if the indicator suggests performance is not acceptable?</td>
</tr>
<tr>
<td>8) Comments and Action</td>
<td>Summarise what actions will happen in the coming years</td>
</tr>
<tr>
<td>9) External Drivers</td>
<td>What factors, outside of the fisheries control may affect performance against the objective?</td>
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### 3. ECOLOGICAL RISK ASSESSMENT REPORTS

**SOUTH AFRICA:**

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<td>38</td>
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<tr>
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<td>59</td>
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</table>

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<td>164</td>
</tr>
</tbody>
</table>
Ecological Risk Assessment (ERA) for the South African Demersal Hake Fishery

Compiled by D.C. Nel

Deon Nel, WWF Sanlam Marine Programme, WWF South Africa, Private Bag X2,
Die Boord, 7613, South Africa
Email: dnel@wwf.org.za

The ERA workshop for the South African demersal hake fishery took place in Cape Town, South Africa, between the 30th of May and 3rd of June, 2005. The workshop was hosted by Marine and Coastal Management (MCM), a branch of the Department of Environmental Affairs and Tourism, and facilitated by Dr. Deon Nel of WWF-South Africa. After wide distribution of invitations, the workshop was attended by a total of 32 participants. Most attendees were from MCM (16), with good representation from industry and industry bodies (8), including representation from research institutes (6) and NGO's (2). This allowed for a constructive debate.

Please see Annex 1 for a complete list of attendees.
1. A brief description of the Demersal Fishery*

The deep-sea trawl fishery (also referred to as Offshore trawl fishery) for hake commenced in the early 20th Century. Over-fishing by foreign fishers occurred in the 1960’s and 1970’s and resulted in stock decline and overexploitation. Consolidation and stock rebuilding commenced from the late 1970’s. Initially the deep-sea hake trawl sector comprised of only a few pioneer companies. However, the proportion of Total Allowable Catch (TAC) of these companies was systematically reduced from 1994 when many new entrants were introduced to the fishery. The deep-sea trawl fishery targets both species of hake, namely shallow water Cape hake *Merluccius capensis* and deep water Cape hake *M. paradoxus*.

The hake fishery is predominantly an export-driven revenue operation with most of the fresh and value-added products destined for Spain, USA, Australia and Europe. There is a small local market (<20% of products sold locally).

The hake deep-sea trawl fishery sustains about 8 800 direct jobs along South Africa’s west and south-eastern Cape coasts. The market value of the landed catch is worth approximately R1.4 billion annually.

The inshore trawl fishery commenced in the late 19th Century. A global quota management system was applied to the sector in 1978 (Olympic system), and in 1982 individual quotas were introduced. The fishery is relatively stable and comprises companies mostly associated with deep-sea trawl operators. The fishery consists mostly of smaller vessels (than deep-sea) with strict control of boat size and power (effort limitation). The inshore trawl fishery targets the South Coast *Merluccius capensis* stock. The fleet is split between hake-directed (with a sole bycatch) and sole *Austroglossus capensis* directed (with a hake bycatch). The fishery takes a significantly higher diversity of bycatch species than does the offshore sector.

The inshore trawl fishery sustains some 1 100 direct jobs. The market value of catch landed is worth approximately R16 million annually.

The demersal hake longline fishery commenced with an experimental phase from 1994 to 1997 with the introduction of full commercial fishing from 1998. Fishing is somewhat irregular and driven by resource availability and market demand. Hake longliners are mostly small vessels (< 30m) and labour-intensive with little value-adding of product.

The hake longline fishery generates some 3 600 permanent jobs and a further 3 200 part-time jobs. The total value of fish landed in the hake longline fishery is estimated to be worth more than R130 million per annum.

The hake handline fishery originated in 1990 as an expansion of the linefish fishery (a handline fishery using small boats). The sub-sector expanded rapidly, driven by the
availability of shallow-water hake stocks *Merluccius capensis* close to shore (< 100 m water depth) and international demand for fresh hake. The Total Allowable Effort (TAE) currently limits the number of crew and vessels that could target hake using a handline to 130 vessels and 785 crew. The hake handline fishery operates out of small fishing harbours and slipways along the southern Cape and Eastern Cape coasts, as far north as Port Alfred. The handline fishery, like the hake longline fishery, lands prime quality hake for export to Europe.


## 2. Results of the Workshop

### General overview of the ERA process

#### Identification of issues

A total of 96 issues were identified for this fishery. These issues are listed and described in full in Annex 2. The ‘Ecological Wellbeing’ and ‘Ability to Achieve’ components each accounted for 44% of the issues, leaving only 12% of the issues under the ‘Human Wellbeing’ component (Figure 1). ‘Governance’ issues accounted for 34% of all issues.

![Figure 1. Percentages of issues that were identified within each ERA component and category.](image-url)
**Prioritization of issues**

The prioritization process led to a fairly even distribution of issues into the various risk categories (Figure 2). Only 3% and 5% of the issues fell within the ‘Negligible’ and ‘Extreme’ categories, with the bulk of the issues falling within the ‘High’, ‘Moderate’ and ‘Low’ categories. Sixty-nine percent of issues were rated as moderate or higher.

![Figure 2. Percentages of issues per risk category](image)

When considering the spread of risk categories within each of the ERA components (Figure 3) we see that a large proportion of the issues listed under the ‘Governance’ component were rated as ‘High’ or ‘Extreme’ risk. Similarly, many of the issues listed in the ‘Retained Species’ component, were rated as being of ‘High’ risk. Most issues listed under the ‘Non-retained Species’ and ‘General Ecosystem’ components were of moderate risk.
Performance reports

Of the 96 issues identified, 67 (69%) were rated as being of ‘Moderate’ risk or higher. On agreement from the workshop participants, performance reports were developed for all issues rated as ‘Moderate’ risk and higher, excepting those issues from the ‘External Impacts’ component. These were deemed to be beyond the control of hake fisheries management measures.

The major issues

The issues with a risk rating of moderate or higher are shown in Table 1. Note that these were identified as issues at the time of the workshop; some progress has since been made at addressing some of these issues. The discussion in this section cannot cover each of the issues and so will merely highlight some of the main issues and themes under each of the main components.

Ecological Wellbeing

The impact of fishing on the size structure of the *M. capensis*, especially the removal of larger size classes, was rated as the issue of highest risk to the ecological wellbeing of this
fishery. Various issues concerning management under uncertainty were raised as high priority issues. These related to uncertainty about natural mortality, variability in recruitment, migration patterns and the proportions of each hake species in the total catch. There is also uncertainty and disagreement on the status of the *M. capensis* stock due to the model predictions not matching research survey findings. There was concern that the level of discarding (presumably due to ‘high grading’) is being underestimated. In addition, this fishery impacts stocks of several commercial species, such as kingklip, monk, snoek and others, by means of bycatch.

The death and injury of threatened seabirds colliding and interacting with trawl gear as well as the bycatch of protected linefish species (such as silver and dusky kob), and shark species such as *Galeorhinus* and *Mustelus* in the inshore trawl fishery were of concern.

The impact of trawls on benthic habitat and biota was the subject of much debate. This impact was considered to be at a ‘High’ risk to this fishery, although some participants felt that this issue was of greater concern and fell in the ‘Extreme’ risk category. Other ‘General Ecosystem’ issues were related to the impact of removal of top predators from the ecosystem as well as to a change in behaviour of seabirds due to availability of offal as an alternative food source.

**Human Wellbeing**

The lack of baseline social and economic data was seen as a basis of many human wellbeing problems and was rated as being of ‘Extreme’ risk to the fishery. The overdependence of certain coastal communities on the demersal fishery and the vulnerability of dependent business enterprises to the fate of the hake stock are seen as a risk to the objectives of this fishery. Disagreement on the social and economic trade-offs between the longline and trawl fisheries was also of concern.

It was recognized that at a regional scale (western & eastern Cape) this sector was a key employer and a significant contributor to the regional economy. As such, a downturn in the fishery could have social and economic impacts at the regional scale.

**Governance**

Inadequate research and management capacity as well as the loss of institutional knowledge was of great concern to stakeholders for the management of this fishery.

The lack of a Resource Management Working Group (RMWG) and poor communication with industry bodies and stakeholders was raised as being of particular concern. The lack of NGO involvement in the RMWG’s and Scientific Working Groups (SWG’s) was also raised.

Several data collection and processing issues were tabled. Amongst the most important was that catch data is not available for real time response and that fisheries observer data had
not been properly analysed and reconciled with CPUE data. Furthermore, there was concern at the time of the workshop that technological and effort creep were not incorporated in CPUE analyses.

Conflict between the fishing sectors was raised as an issue; along with the lack of Marine Stewardship Council (MSC) certification of the longline and handline fisheries, which is hampering the effectiveness of the certification of the trawl fishery. Furthermore, inadequate communication and coordination between government departments was noted.

**External Impacts**

The most important external impact was deemed to be the effects of global climate change. As with other fisheries, global economic parameters such as fuel price and foreign exchange rates are key aspects of the fishery. An important and very specific issue highlighted for this fishery was the fact that size-related price differentials act as an incentive for fishers to attempt to target a specific size class, which in turn leads to high-grading and discarding. Drug abuse in the small boat sector was also highlighted.

**Table 1. List of issues that scored a 'Moderate' risk rating or higher.**

*Note that the issue number cross-links to the issue numbering in Table 2 and Annex 2.*

* Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)

** Categories: E=Extreme, H=High, M=Moderate

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Both hake sp: Size structure may have been affected by fishing - the additional effect of removing more large hake</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>2</td>
<td>Both hake sp: Fishing mortality is underestimated due to discarding and mortality after escapement</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>3</td>
<td>Both hake sp: Uncertainty about the estimation of natural mortality (predation &amp; cannibalism)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>5</td>
<td>Both hake sp: Uncertainty about variability in recruitment</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>16</td>
<td>Impact on other commercial species (skates, rays, gurnards, sharks, jacopever, john dory, angel fish, bellman, chokka etc.)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>10</td>
<td>M. capensis: Stocks are shared with Namibia</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>M</td>
</tr>
<tr>
<td>1</td>
<td>Both hake sp: changes in distribution</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
<tr>
<td>ID</td>
<td>ISSUE</td>
<td>CONS</td>
<td>LIKE</td>
<td>RISK*</td>
<td>CATEGORY**</td>
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</tr>
<tr>
<td>4</td>
<td>Both hake sp: Uncertainty about longshore, offshore and vertical migration in the water column</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
<tr>
<td>16</td>
<td>Snoek stock is being impacted</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
<tr>
<td>21</td>
<td>Threatened species of seabirds (also protected) caught/injured/killed by trawling</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>27</td>
<td>Bycatch of ‘protected’ linelsh (in MLRA) on soft ground available to the inshore trawling - silver kob, dusky kob etc.</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>20</td>
<td>Threatened species of seabirds (also protected) caught/injured/killed in longline operations</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>24</td>
<td>Mortality of Galeorhinus &amp; Mustelus in the inshore trawl fishery (these species are commercially harvested)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>25</td>
<td>Mortality of all other threatened sharks in longline &amp; trawl</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>30</td>
<td>Bycatch of other sharks, rays &amp; skates (not threatened but not assessed)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>26</td>
<td>Bycatch of wreckfish Polyprion americanus</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>M</td>
</tr>
<tr>
<td>38</td>
<td>Impact of trawls on the benthic biota habitat and biota</td>
<td>3(4)</td>
<td>6</td>
<td>18(24)</td>
<td>H(E)</td>
</tr>
<tr>
<td>33</td>
<td>Trophic effects of removing a proportion of the biomass of a high level predator, with no obvious replacement species</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>34</td>
<td>Removal of predators may have an effect on the abundance of smaller pelagic species and mesopelagics</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>39</td>
<td>Distribution patterns and behaviour of seabirds are being affected by the availability of offal</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>35</td>
<td>Change in size structure of hake leads to a switch in prey preference</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>General Ecosystem</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Human Wellbeing</td>
<td></td>
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<tr>
<td></td>
<td>Community Wellbeing</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>44</td>
<td>There is a lack of baseline socio-economic information</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
<tr>
<td>45</td>
<td>Over-dependence on demersal fishery in certain coastal communities</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>48</td>
<td>A downturn in the fishery will have a negative impact on businesses who provide gear supply, boat repairs etc. in highly dependent communities in Saldanha Bay, St Francis, St Helena, Mossel Bay, Hout Bay &amp; Kalk Bay</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>49</td>
<td>A downturn in the fishery will have a negative impact on businesses who provide gear supply, boat repairs etc. in Cape Town &amp; Port Elizabeth</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
</tr>
<tr>
<td>43</td>
<td>Social and economic/welfare effect of trade-offs between longline and trawl fisheries</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>M</td>
</tr>
<tr>
<td>51</td>
<td>The impact of a downturn in this fishery on the regional economy (Western &amp; Eastern Cape)</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>53</td>
<td>A downturn in the fishery will have a significant effect on employment in the Western and Eastern Cape</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>National Wellbeing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ability to Achieve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Governance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>Inadequate research capacity and institutional knowledge</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>68</td>
<td>Lack of management capacity (no-one appointed at MCM to manage the Demersal fishery at present) and institutional knowledge</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>56</td>
<td>Lack of effectiveness of some present input and output controls</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>60</td>
<td>There is no operational Resource Management Working Group</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>61</td>
<td>There are no formal or informal lines of communication with industry bodies and other stakeholders regarding fisheries management aspects</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>62</td>
<td>Catch data are not available for real time response</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>63</td>
<td>Observer data have not been analyzed properly or reconciled with catch records</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>66</td>
<td>There is inadequate age information</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>69</td>
<td>Co-ordination of research (nationally, regionally and internationally) is inadequate</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
</tbody>
</table>
ID | ISSUE | CONS | LIKE | RISK | CATEGORY
---|---|---|---|---|---
86 | NGO’s not involved in management and scientific working groups | 3 | 6 | 18 | H
65 | Technological and effort creep are not incorporated in the analysis of CPUE data and assessments | 3 | 5 | 15 | H
57 | Conflict between sector users | 2 | 6 | 12 | M
59 | Inspector coverage is inadequate and possibly biased geographically and per sector | 2 | 6 | 12 | M
64 | There are problems with the validity of scientific observer data in portraying the real picture | 2 | 6 | 12 | M
70 | Communication with other government departments is inadequate – specifically with Mineral & Energy Affairs or Petroleum Agency | 2 | 6 | 12 | M
78 | Currently biodiversity audits for marine species are not being done | 2 | 6 | 12 | M
80 | There is a lack of accessibility to records of decisions (minutes etc.) | 2 | 6 | 12 | M
81 | State of the environment reports are lacking | 2 | 6 | 12 | M
84 | The fact that the longline & handline industry are not MSC certified hampers the certification of the Trawl fishery | 2 | 6 | 12 | M
85 | The requirements of the MSC are possibly beyond the abilities of managements resources (for those conditions that require MCM to play a role) | 2 | 6 | 12 | M
55 | Larger number of rights-holders result in increased management complexity | 2 | 5 | 10 | M
71 | There is inadequate co-ordination with National Ports Authority with regard to facilities & services for fishing vessels | 2 | 5 | 10 | M
58 | Compliance is inadequately enforced – occasional examples are made but the coverage is low | 3 | 3 | 9 | M
72 | Allocation of possibly sub-viable quotas has complicated management | 2 | 4 | 8 | M

External Impacts

88 | Effects of global warming and climate change | 4 | 6 | 24 | E
94 | Impact of drug abuse on the workforce – particularly in the small boat sector | 3 | 6 | 18 | H
95 | Global economic parameters such foreign exchange rates and fuel affect profitability | 3 | 6 | 18 | H
96 | Size-related price differentials are an incentive for high grading | 3 | 6 | 18 | H
87 | Anomalous climatic events affect availability and distribution | 4 | 4 | 16 | H
91 | Responsibility of rehabilitation of mined areas has been confused by changes in ownership of companies | 2 | 6 | 12 | M
93 | Impact of AID’s on the workforce | 2 | 6 | 12 | M

Performance Reports

The complete performance reports can be found in Table 2. The following section will only try and distil some of the key data requirements and management responses to the issues outlined above within the three main ERA components. Please refer to the complete performance reports for a more overall understanding of these needs.

Ecological Wellbeing

The performance reports developed in response to several issues highlighted the need to record more detailed at-sea data, presumably by means of fisheries observers, for both hake species. This included at-sea size distributions (in some cases sex-specific) as well as spatially explicit data of catches and sizes. The need for fisheries observers to be able to identify and record catches of the two hake species separately was also noted. Further at-sea data requirements include: catches of small *M. Capensis* in the inshore sole fishery;
catches of a variety of commercial bycatch species (as the proportion that is landed varies according to market forces); bycatch of seabirds on trawl fisheries (currently not being done due to logistical constraints).

In response to a range of issues relating to uncertainty about various model parameters as well as stock status, it was felt that improved quality of existing data (catch statistics and survey), use of more up-to-date data, as well as better utilization of existing data was required. The need for improved age keys was specifically highlighted in several issues.

To assess the impact of bottom trawling on benthic habitats and biota, data on offshore habitats and biota needs to be compiled and compared with trawling effort within these various habitat types. It was noted that part of this work was being undertaken, as a condition of MSC certification. Comparative studies of areas that have been trawled to differing degrees, was also noted.

In order to better understand potential trophic effects of reducing/changing hake stocks within the ecosystem, more and improved diet analyses are required. Trophic models of the role of hake in the system also need to be developed.

Responses to issues relating to uncertainty of modelling parameters and outputs were mostly captured under the ‘data requirements’ section.

Specific practical management responses that were suggested here included additional inspectors on vessels suspected of ‘high-grading’ as well as size-based levy disincentives to counteract market incentives for ‘high-grading’ for certain size classes. Ageing and tagging studies were highlighted to improve knowledge about recruitment. The need to develop the ability and capacity for species-specific management of the two hake stocks was also seen as important.

The need to develop practical and/or technical mitigation measures to reduce the bycatch of a suite of species was noted. Time and/or area closures were also suggested as a means of reducing some of these impacts. Area closures in the form of Marine Protected Areas (MPA’s) were also suggested to reduce impacts on benthic habitats. Here it was suggested that MPA’s be used to protect representative portions of our offshore benthic habitats.

More stringent permit limitations for catches of kingklip and monk were suggested, as well as a more holistic management for bycatch species that were impacted by several fishing sectors. The need to raise awareness about the problem that this bycatch poses for certain suites of species (e.g. threatened seabirds) and the solutions were also noted.
**Human Wellbeing**

There is a pressing need to establish a spatially specific baseline of socio-economic information for each of the hake sectors. Data that would populate such a baseline would include: direct and indirect jobs per ton of fish for each sector; value per ton whole weight for each sector; infrastructure development; business skills (presumably for the small boat sector); and social and economic equity data.

The development of the above internationally accredited social and economic data was also listed as a major management response. In addition to this mention was also made of an effective Fisheries Development Corporation, recognition and strengthening of industrial bodies, and encouragement of social benefit schemes (medical aid, provident funds, insurance etc.).

**Governance**

There is an urgent need to reduce the staff turnover and vacancy rate (currently some 30%) to an immediate target of 10%. The development of human resource policies aimed at staff retention and career pathing was also raised. Engaging International research programmes and increased interaction with international scientists would broaden the knowledge and experience of local scientists. There was also a need to develop the support structure for research (laboratories, research vessels, computers etc). An improved outreach for Historically Disadvantaged Individuals (HDI’s) was urgently needed in order to redress inequities.

The development of a functional and representative RMWG and the appointment of a hake fishery manager by 1 January 2006 were proposed. Sector Management Plans need to be developed as soon as possible. The development of an interdepartmental forum to facilitate better management advice (e.g. Department of Minerals and Energy (DME); Department of Trade and Industry (DTI)) was suggested. Increased NGO participation that could add value to management should also be investigated.

RMWG documents, accurate and up-to-date rights register, access to compliance register and access to real time catch data were listed as data requirements.
Table 2. Summary of Performance Reports developed for issues scoring a risk rating of ‘Moderate’ or higher.

Note that the issue number cross-links to the issue numbering in Table 1 and Annex 2.

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>EW1</td>
<td>Estimate the extent of seasonal and cyclic changes in distribution as well as long-term shifts</td>
<td>1,4</td>
<td>Future</td>
<td>Collection of data to enhance sea- and land-based size/age distributions of catches</td>
<td>Spatial changes in catches and in biomass (as indicated by surveys and CPUE)</td>
<td>Matching observed spatial changes in catches (or CPUE) to expectations i.e. understanding the driving forces</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Investigate links between environmental parameters and distribution</td>
<td>Total population and biomass of different size/age classes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Enhance reporting of environmental information with the catch data</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Capture historic environmental data</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Collect data to enhance sea- and land-based size/age distributions of catches</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>Investigate links between environmental parameters and distribution</td>
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<td>Enhance reporting of environmental information with the catch data</td>
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<td>Capture historic environmental data</td>
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<td>Collect data to enhance sea- and land-based size/age distributions of catches</td>
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<td>Investigate links between environmental parameters and distribution</td>
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<td>Enhance reporting of environmental information with the catch data</td>
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<td>Capture historic environmental data</td>
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<td>EW2</td>
<td>Reduce high-grading</td>
<td>2a, 2b</td>
<td>Current</td>
<td>Record the length distribution of the landed catch per vessel</td>
<td>Lack of small fish being landed – indication of high-grading</td>
<td>Length distribution of the catch per vessel, linked to the spatial distribution of catches by vessel</td>
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<td>At-sea measures to develop expectation of size distribution of catch by area and season</td>
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<td>Record the length distribution of the landed catch per vessel</td>
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<td>At-sea measures to develop expectation of size distribution of catch by area and season</td>
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<td>EW3</td>
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<td>3</td>
<td>Current</td>
<td>OMP approach to management that incorporates robustness tests</td>
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<td>OMP approach to management that incorporates robustness tests</td>
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<td>EW4</td>
<td>Improve recruitment estimates</td>
<td>5</td>
<td>Current</td>
<td>Estimates of recruitment variability from models and direct surveys</td>
<td>Evidence of cohort structure in catch-at-age matrix</td>
<td>Logically consistent picture of resource dynamics of the stock assessments</td>
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<td></td>
<td>Future</td>
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<td>Improved ageing methods (workshops have been held – no new methods found)</td>
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<td>Tagging studies using tetracycline markers to validate age rings</td>
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<td></td>
<td>Consider recruitment surveys</td>
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<td>EW5</td>
<td>To reduce uncertainty in parameters in stock assessment models</td>
<td>6</td>
<td>Current</td>
<td>Improve quality of existing data (catch statistics, survey based data)</td>
<td>Measures of uncertainty from modelling studies</td>
<td>No obvious threshold, different coefficient of variation (C.V.) might be acceptable for different parameters</td>
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<td>Use more up to date data</td>
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<td>Better utilisation of existing data</td>
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<td>Possibly collect experimental data where appropriate (commitment to surveys limits sea time for experimental work, need more flexibility in this regard)</td>
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<td>Better analyse and utilise the data that we have</td>
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<td>Collect additional data as specified under other issues</td>
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<tr>
<td>EW6</td>
<td>Obtain improved species-specific hake catch estimates</td>
<td>7</td>
<td>Current</td>
<td>Sea-based measures of species-specific catches</td>
<td>Some agreed standard error of estimates</td>
<td>Standard error of estimates</td>
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<td>Observer trained in species identification and in random sampling to estimate the species composition</td>
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<td>Future</td>
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<td></td>
<td>Analysis of sea-based data</td>
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<td>EW8</td>
<td>To determine the extent of interaction between Namibian and South African M. paradoxus stocks</td>
<td>8</td>
<td>Future</td>
<td>Performance criteria from numerical studies into different management approaches with respect to a broad range of issues as</td>
<td>Whether in the context of OMP robustness tests within a plausible range of</td>
<td>If single stock management leads to an x% improvement in management, x to be defined</td>
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<td>EW9</td>
<td>Improve stock status to above BMSY</td>
<td>9</td>
<td><strong>Current</strong>&lt;br&gt;• Recently based on generic hake assessments the TAC has been reduced, specific action in view of recent <em>M. paradoxus</em> assessments pending (revised OMP under development) currently no mechanism for species specific management action</td>
<td>• Standard data inputs (survey and fishery based data – refer to standard references on this) into stock assessments and into OMP at current or better levels of quality and availability&lt;br&gt;• Specifically in regard to data requirements, similar requirements for issues 12, 2, 3, 5 and 7</td>
<td>• Estimates of stock status from stock assessments</td>
<td>• BMSY and associated uncertainty&lt;br&gt;• Stock management via an OMP, so this needs to be considered</td>
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<tr>
<td>EW10</td>
<td>Improve relationship between models and observations</td>
<td>10, 11</td>
<td><strong>Current</strong>&lt;br&gt;• Robustness and sensitivity tests within the OMP&lt;br&gt;• Model estimates indicate that <em>M. capensis</em> resource is currently above BMSY&lt;br&gt;• Observations from both fishery and survey suggest that <em>M. capensis</em> is depleted</td>
<td>• Better use of present data&lt;br&gt;• Longer time series of catch-at-age data&lt;br&gt;• Improved age keys&lt;br&gt;• Improved estimates of species specific catches&lt;br&gt;• Inshore trawl and longline CPUE series</td>
<td>• Agreement between models and observations or understanding and acceptance of the causes of the differences</td>
<td>• Understanding of the impacts of assumptions in the models and in subjective estimates of resource status</td>
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<td>EW11</td>
<td>Limit the removal of large, fecund females (Larger females produce more eggs than smaller females, and the eggs may be more viable. Protecting the large females could enhance recruitment.)</td>
<td>12</td>
<td>Current</td>
<td>▪ Compare longline and trawl catches</td>
<td>▪ Record the length distribution of the catch per sex and sector in the fishery</td>
<td>▪ Reduction in the relative abundance of large females</td>
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<td>Future</td>
<td></td>
<td>▪ Develop a length/sex/fecundity key (annual or seasonal?)</td>
<td>▪ Length distribution and abundance per sex and sector in the population</td>
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<td>▪ Record the total catch (per sex?) in each sector</td>
<td>▪ Develop a model to derive the optimal size distribution of females in the population on which to base target criteria</td>
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<td>▪ Monitor variation in length at maturity (perhaps every 5 years)</td>
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<td>EW12</td>
<td>Limit catches of small <em>M. capensis</em> in the sole fishery</td>
<td>13</td>
<td>Future</td>
<td>▪ Will test various mitigation devices and then implement that which is shown to be most effective (area specific differences expected)</td>
<td>▪ At sea estimates of the catch of small <em>capensis</em> in the sole fishery</td>
<td>▪ Catches of small <em>M. capensis</em> in the sole fishery</td>
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<td></td>
<td>▪ Catches of small <em>M. capensis</em> in the sole fishery</td>
<td>▪ No specific threshold</td>
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<td>EW13</td>
<td>Improve status of monk and kingklip stocks to BMSY</td>
<td>15</td>
<td>Current</td>
<td>▪ Limit on snoek bycatch</td>
<td>▪ Whatever presently available, plus (a) targeted CPUE data using modified versus normal gear, (b) catch-at-age data, (c) potential to include additional survey trawl sites to enhance survey based estimates for these species</td>
<td>▪ Best estimates of B relative to BMSY for each stock from available stock assessments</td>
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<td></td>
<td>Future</td>
<td>▪ Limit on snoek bycatch</td>
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<td>▪ BMSY modified by pragmatic/practical considerations</td>
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<td>▪ Limit on snoek bycatch</td>
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<td></td>
<td>▪ Data available for stock assessment are poor</td>
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<td>▪ Depletion of snoek resource</td>
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<td>EW14</td>
<td>Assess the status of snoek (Linefish section)</td>
<td>16</td>
<td>Current</td>
<td>▪ There are limits on the <em>Mustelus</em> catch by demersal</td>
<td>▪ Research surveys</td>
<td>▪ Resource depletion for any of the bycatch species</td>
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<td>Future</td>
<td></td>
<td>▪ Fishery independent and dependant data suitable for</td>
<td>▪ Trends in the research survey biomass</td>
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<td>▪ Limit on snoek bycatch</td>
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<td>shark-directed longlines</td>
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<td>However, <em>Mustelus</em> is taken as bycatch in hake longline and hake trawl</td>
<td>resource assessment</td>
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<td><em>Future</em></td>
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<td>• Although <em>Mustelus</em> catch limits are in place for the demersal shark-directed</td>
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<td>longlines, <em>Mustelus</em> is taken as bycatch in hake longline and hake trawl</td>
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<td></td>
<td>• A holistic management approach of these species must be developed</td>
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<td>EW16</td>
<td>Mitigate seabird injury or mortality in hake fisheries</td>
<td>20, 21</td>
<td><strong>Current</strong></td>
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<td>(trawling &amp; line)</td>
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<td>• Longline fishery permits require mitigation measures including carrying of</td>
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<td>observers, line weighting, tori lines, offal discharge control, all dead birds</td>
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<td>must be landed and specify times of line setting</td>
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<td>• The trawl fishery has no permit conditions of this nature</td>
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<td><strong>Future</strong></td>
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<td></td>
<td>• Compliance in the longline fishery needs to be improved</td>
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<td>• A key issue is offal management in the trawl fishery</td>
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<td></td>
<td>• Modified tori lines, the Brady baffler and other innovations are being tested</td>
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<td>• Seabird mortality should perhaps be considered when determining the proportion of</td>
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<td>*The observer programme in the longline fishery is currently sufficient at 13%</td>
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<td>(5-18% in the last four years), although the target is 20%</td>
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<td>• The current trawl observer programme does not include birds for logistical</td>
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<td></td>
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<td>reasons</td>
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<td>• Evaluation of seabird mortality in the hake trawl fishery is a hake trawl permit</td>
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<td>requirement and a study is underway</td>
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<td>• Recorded mortality is the primary indicator for this issue as most of the</td>
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<td>seabirds are migratory and population status may not give an accurate reflection</td>
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<td>of the mitigation success in South African waters</td>
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<td>• At present (2005) this includes the following species caught in the</td>
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<td>longline fishery:</td>
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<td>o  <em>endangered (4)</em> - Black-browed albatross, Atlantic Yellow-nosed</td>
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<td>albatross, Indian Yellow-nosed albatross, Tristan</td>
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<td>• The National Plan of Action calls for 0.5 birds per thousand hooks in the longline</td>
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<td>fishery, this is also the FAO guideline which equates to 1,000 birds</td>
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<td>• An improvement on current (2005) mortality in the trawl fishery which is estimated</td>
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<td>very roughly at 7,000 birds (back of envelope stuff). This should be reduced to</td>
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<td>match the requirements of the longline fishery, i.e. by 85%</td>
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<td>TAC allocated to longline and trawl</td>
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<td>albatross</td>
<td>In the longline fishery approximately 400,000 sharks were caught 2000-2004 (Petersen 2005). The inshore trawl fishery catches approximately 100 tons annually (Sims) of Galeorhinus &amp; Mustelus. The research survey CPUE for Mustelus has shown a decline since the mid-1980's</td>
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<td>EW17</td>
<td>Minimise bycatch and incidental catch of all chondrichthians</td>
<td>24,25,30</td>
<td>Current&lt;br&gt;• The scientific observer programme which collects data for management of&lt;br&gt;these fisheries does collect data on shark bycatch which is limited, as species identification is poor (65% not&lt;br&gt;identified to species level)&lt;br&gt;• Draft NPOA-sharks&lt;br&gt;Future&lt;br&gt;• Species-level identification is a difficult task but is vital for assessing the impact of the fisheries. In addition need to know if the chondrichthians are retained, discarded or released, sex and size.&lt;br&gt;• Adopt NPOA-sharks which ensure sustainability and long-term conservation objectives for chondrichthians</td>
<td>Current&lt;br&gt;• Catch rates of chondrichthians in longlining are available from observer data but unreliable particularly at the species level&lt;br&gt;• Biomass indices from research surveys</td>
<td>• Chondrichthyan population status&lt;br&gt;• Trophic catch and biomass ratios – proportion in different feeding guilds</td>
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<td>EW18</td>
<td>Minimise bycatch and incidental catch of linefish in the inshore trawl fishery (hake &amp; sole directed) which operates in the nursery</td>
<td>26,27</td>
<td>Current&lt;br&gt;• There is a bycatch limit for kob in permit conditions; and all fish must be landed&lt;br&gt;• Permit conditions may</td>
<td>Current&lt;br&gt;• Independent observer estimates and commercial catch records must include bycatch declarations&lt;br&gt;• Need 10-20% coverage of</td>
<td>• Continued poor stock status for the linefish, although this is not the only fishery responsible</td>
<td>Diminished bycatch of linefish, reduced market availability of small linefish (undersized kob) and possibly even improved</td>
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<td>ISSUES</td>
<td>MANAGEMENT RESPONSE</td>
<td>DATA REQUIREMENTS</td>
<td>INDICATORS</td>
<td>PERFORMANCE LIMITS</td>
</tr>
<tr>
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<tr>
<td></td>
<td>grounds of linefish and therefore is likely to catch juveniles</td>
<td>Future Mitigation methods needed and spatial and temporal restrictions (area/season/depth closures) need to be more reactive/proactive</td>
<td>fleet</td>
<td>for increasing pressure on the species</td>
<td>stock status</td>
<td></td>
</tr>
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<td></td>
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<tr>
<td>EW19</td>
<td>Maintain a balanced size-structure and abundance of both species of hake</td>
<td>33,34,35 Current None.- the TAC is not size-specific other than a minimum mesh-size There is 10% flexibility in TAC from year to year, to avoid filling the quota with small fish Future Discourage/prevent filling the quota with catches of medium and small hake Ensure balance in trophic levels (use models)</td>
<td>Validated catch records, species-specific and size-specific Diet analysis – currently proposed EAF project Biomass estimates for hake and their prey Trophic models of the role of hake in the ecosystem</td>
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<tr>
<td>EW20</td>
<td>Reduce impact of destructive gear</td>
<td>38 Future Eliminate the use of destructive gear (e.g. types of bobbins &amp; trawl doors) Need to identify MPA which protect a representative portion of our offshore</td>
<td>Habitat type data needs to be mapped and systematic benthic distributions Comparative studies of areas which have been trawled to differing degrees Available data has been</td>
<td>Compare species composition and diversity in MPA’s with that of trawled areas</td>
<td>A high proportion of large hake in landings should be avoided (10%, 20% or 30%)</td>
<td>Abundance needs to be rebuilt to optimal levels</td>
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<tr>
<td>ID</td>
<td>OPERATIONAL OBJECTIVE</td>
<td>ISSUES</td>
<td>MANAGEMENT RESPONSE</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>benthic habitats</td>
<td>collated for the MSC certification process and is being collated into a Geographical Information Systems (GIS)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mining companies may have additional data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EW21</td>
<td>Limit impact on seabird distribution</td>
<td>39</td>
<td><strong>Current</strong>&lt;br&gt;- Offal discard is addressed in the longline permits and offal management guidelines are being developed for the trawl fishery&lt;br&gt;&lt;br&gt;<strong>Future</strong>&lt;br&gt;- Responsible offal management will further limit seabird mortalities (see issue 20 &amp; 21)</td>
<td>• Seabirds observed feeding around fishing vessels&lt;br&gt;• Seabird abundance estimates</td>
<td>• Relative abundance of seabird species within the Benguela including species listed in issue 20 &amp; 21</td>
<td></td>
</tr>
</tbody>
</table>

**Human Wellbeing**

<p>| HW1 | Establish a spatially specific baseline of social and economic information for each of the hake sectors | 44 (45,48,49, 43,51 and 53) | <strong>Current</strong>&lt;br&gt;- Fishing rights allocation&lt;br&gt;- BCLME (Optimal Harvesting Strategies for Hake Fisheries in Namibia and South Africa)&lt;br&gt;- Collection of data for Black Economic empowerment (BEE) database (emphasis on SMME’s)&lt;br&gt;&lt;br&gt;<strong>Future</strong>&lt;br&gt;- In depth social and economic study that is internationally accredited | • Extensive social and economic data for each of the sectors and its associated | • Direct jobs created per ton (permanent and temporary/seasonal)&lt;br&gt;• Indirect jobs created (e.g. support industries like ship repairs, gear supplies, etc.)&lt;br&gt;• Unemployment levels&lt;br&gt;• Value per ton of whole weight&lt;br&gt;• Infrastructure development&lt;br&gt;• Development of business skills in relation to baseline | • Baseline to be established within the next three years |</p>
<table>
<thead>
<tr>
<th>ID</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(similar to a Fisheries Development Corporation)</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>• Social and economic equity (transformation and BEE)</td>
</tr>
</tbody>
</table>

**Governance**

<table>
<thead>
<tr>
<th>G1</th>
<th>To retain and expand research capacity</th>
<th>67</th>
<th>Current</th>
<th>See performance measure/limit above</th>
<th>Future</th>
<th>Staff retention strategy that takes account of career paths and market-related salaries</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Organisational restructuring that takes account of career pathing and critical mass</td>
<td></td>
<td>• Invitations and planning in process for International experts as visiting scientists</td>
<td></td>
<td>Policies that sufficiently support HR requirements for a research environment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Development of HR policies</td>
<td></td>
<td>• Source the required infrastructure for office space, labs, computers and replacement vessel for Sardinops</td>
<td></td>
<td>Internationally engaging research programmes (mini Centres of Excellence to build capacity)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organisational restructuring that takes account of career pathing and critical mass</td>
<td></td>
<td>• Ongoing recruitment of staff into vacant positions</td>
<td></td>
<td>Internationally peer-reviewed scientific outputs (number of scientific publications)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Development of HR policies</td>
<td></td>
<td>• Strategic Research &amp; Development plan</td>
<td></td>
<td>Recruitment of PDI’s for tertiary studies in marine science</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Invitations and planning in process for International experts as visiting scientists</td>
<td></td>
<td>Future</td>
<td></td>
<td>Staff turnover (annual vacancy rate)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Source the required infrastructure for office space, labs, computers and replacement vessel for Sardinops</td>
<td></td>
<td>• More staff exchanges with international marine institutions (visiting scientists)</td>
<td></td>
<td>Infrastructure to</td>
<td></td>
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<tr>
<td></td>
<td>• Ongoing recruitment of staff into vacant positions</td>
<td></td>
<td>• Continued recruitment of staff</td>
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</tr>
<tr>
<td></td>
<td>• Strategic Research &amp; Development plan</td>
<td></td>
<td>• Improved outreach programmes particularly for PDI’s</td>
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<tr>
<td></td>
<td>Future</td>
<td></td>
<td>• Ensure a Strategic Research &amp; Development plan for hake resources with</td>
<td></td>
<td>Staff turnover rate of not more than 10%</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>See performance measure/limit above</td>
<td></td>
<td>Increase in employment equity of scientists and technicians (Employment Equity Plan targets)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Staff retention strategy that takes account of career paths and market-related salaries</td>
<td></td>
<td>Policies in place to support excellent research</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Policies that sufficiently support HR requirements for a research environment</td>
<td></td>
<td>Increased number of peer-reviewed publications</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Internationally engaging research programmes (mini Centres of Excellence to build capacity)</td>
<td></td>
<td>International experts as visiting scientists</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Internationally peer-reviewed scientific outputs (number of scientific publications)</td>
<td></td>
<td>Suitable infrastructure in place</td>
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<td></td>
<td>Recruitment of PDI’s for tertiary studies in marine science</td>
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<td>Strategic Research &amp; Development plan</td>
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</tbody>
</table>
### Ecological Risk Assessment (ERA) for the South African Demersal Hake Fishery

<table>
<thead>
<tr>
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</tr>
</thead>
</table>
| G2 | Require highly effective management capacity to manage the demersal fishery | Current  
• Sector policies in place  
• Sector Management Plan (fishery handbook)  
• Oracle relational database  
• Regulations and Permit conditions  
• Efficient and effective compliance | multidisciplinary research outputs (ecosystem approach) | support research (e.g. vessels, offices, labs, computers, etc.)  
• Strategic Research & Development Plan (plan should include operational plans for real time catch data, analyses of observer data, adequate fish ageing information, biodiversity audits, state of the environment reports, scientific working groups, TAC/TAE-driven and other research, etc.) |  
RMWG documents  
• Accurate and up to date rights register  
• Access to real time catch data  
• Access to compliance register |  
Highly trained and knowledgeable fisheries managers  
• Management advice that takes account of research recommendations, resource management and compliance issues (effective input and output controls)  
• Functional RMWG for information exchange with Industrial Bodies  
• Consider NGO input that could add value |  
Appointment of a hake fisheries manager by 1 January 2006  
• MCM quick response (one week) to fishery queries and challenges by end 2006  
• A representative RMWG established by 1 January 2006  
• Interdepartmental forum  
• Archive of management decisions  
• IT system to support data and management requirements (Oracle) by 2007 |
<table>
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<tr>
<th>ID</th>
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<td>to management of the resources</td>
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<td></td>
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<td></td>
<td></td>
<td>• Engage other national departments in developing management advice (DME; DTI)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>• Archiving of management decisions (Access to Information Act)</td>
<td></td>
</tr>
</tbody>
</table>
### Annex 1: List of participants

<table>
<thead>
<tr>
<th>NAME</th>
<th>INSTITUTION/AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrew Kaye</td>
<td>Assoc. of small hake quota industries</td>
</tr>
<tr>
<td>Antoinette Moniz</td>
<td>Tuna Hake Fishing Corporation Ltd.</td>
</tr>
<tr>
<td>Barrie Rose</td>
<td>South African Deep Sea Trawl Industry Association</td>
</tr>
<tr>
<td>Barry Watkins</td>
<td>University of Cape Town</td>
</tr>
<tr>
<td>Coleen Moloney</td>
<td>University of Cape Town</td>
</tr>
<tr>
<td>Dave Japp</td>
<td>CapFish</td>
</tr>
<tr>
<td>Dawit Gebrehewit</td>
<td>University of Cape Town</td>
</tr>
<tr>
<td>Dumile Tshingana</td>
<td>BirdLife SA</td>
</tr>
<tr>
<td>Frances Le Clus</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Jean Glazer</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Johann Augustyn</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>John Field</td>
<td>University of Cape Town</td>
</tr>
<tr>
<td>Larry Hutchings</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Laurent Drapeau</td>
<td>Marine and Coastal Management and Institut de recherche pour le Développement</td>
</tr>
<tr>
<td>Luyanda Antony</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Lynne Shannon</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Mandisile Mqoqi</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Mandla Gxanyana</td>
<td>SMME</td>
</tr>
<tr>
<td>Marek Lipinski</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Mike Bergh</td>
<td>Ocean and Land Resource Assessment Consultants</td>
</tr>
<tr>
<td>Peter Ryan</td>
<td>University of Cape Town</td>
</tr>
<tr>
<td>Peter Simms</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Renee Osborne</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Richard Ball</td>
<td>Pioneer Fishing</td>
</tr>
<tr>
<td>Rob Leslie</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Roy Bross</td>
<td>South African Deep Sea Trawl Industry Association</td>
</tr>
<tr>
<td>Samantha Petersen</td>
<td>WWF-South Africa; BirdLife SA</td>
</tr>
<tr>
<td>Sarah Wilkinson</td>
<td>CapFish</td>
</tr>
<tr>
<td>Tabello Mainoane</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Theresa Frans</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Thuliswa Nkomana</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Tracey Fairweather</td>
<td>Marine and Coastal Management</td>
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</table>
### Annex 2: Complete list of all issues raised and their consequence, likelihood and risk ratings.

Note: Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
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</thead>
<tbody>
<tr>
<td><strong>Ecological Wellbeing</strong></td>
<td></td>
<td></td>
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<tr>
<td><strong>Retained Species</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Both hake sp: changes in distribution</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Both hake sp: Fishing mortality is underestimated due to discarding and survival after escapement</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Both hake sp: Uncertainty about the estimation of natural mortality (predation &amp; cannibalism)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Including M. capensis predation affecting recruitment of <em>M. paradoxus</em></td>
</tr>
<tr>
<td>4</td>
<td>Both hake sp: Uncertainty about longshore, offshore and vertical migration in the water column</td>
<td>2</td>
<td>4</td>
<td>8</td>
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</tr>
<tr>
<td>5</td>
<td>Both hake sp: Uncertainty about variability in recruitment</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
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<tr>
<td>6</td>
<td>Both hake sp: Basic knowledge of the life-history strategy is not well understood</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>Location of spawning, duration of migration</td>
</tr>
<tr>
<td>7</td>
<td>Both hake sp: Uncertainty about the proportions of each Hake species in total catch</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Trawl specific - 80% of landing</td>
</tr>
<tr>
<td>8</td>
<td><em>M. paradoxus</em>: Stocks are shared between Namibia and South Africa</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><em>M. paradoxus</em>: Stock status is below BMSY</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td><em>M. capensis</em>: Stocks are shared with Namibia</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>Linked to 1</td>
</tr>
<tr>
<td>11</td>
<td><em>M. capensis</em>: Uncertainty &amp; disagreement as to the status of the stock – model projections do not match commercial and research survey findings</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Model projections are high, but all other information indicates stock is lower</td>
</tr>
<tr>
<td>12</td>
<td><em>M. capensis</em>: Size structure may have been affected by fishing - the additional effect of removing more large hake</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td><em>M. capensis</em>: Size structure may have been affected by fishing - Continued impact of fishing on small hake</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>These are inter-related issues (14a &amp;b)</td>
</tr>
<tr>
<td>14</td>
<td><em>M. capensis</em>: Increase in parasites which could affect fecundity &amp; marketing</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>Mostly gill parasites</td>
</tr>
<tr>
<td>15</td>
<td>Monk, kingklip stocks are overexploited</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Snoek stock is being impacted</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>Potential large impact if targeted</td>
</tr>
<tr>
<td>17</td>
<td>Lack of understanding &amp; quantification of the impact on Linefish (kob, white stumpnose etc.)</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>Mostly inshore trawl fishery; however concern about linefish in general (esp. kob)</td>
</tr>
<tr>
<td>18</td>
<td>Impact on other commercial species (skates, rays, gumards, sharks, jacopever, john dory, angel fish, bellman, chokka etc.)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>This is the major fishery impacted these species</td>
</tr>
<tr>
<td><strong>Non-retained Species</strong></td>
<td></td>
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</tr>
<tr>
<td>19</td>
<td>Cape fur seals (a protected species) are killed in trawling operations</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>(see study by Wickens)</td>
</tr>
</tbody>
</table>
## Ecological Risk Assessment (ERA) for the South African Demersal Hake Fishery

<table>
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<tr>
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<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Threatened species of seabirds (also protected) caught/injured/killed in longline operations</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>conclusions are based on observer data - other fisheries are having an effect, not hake. Seabirds are not necessarily brought aboard.</td>
</tr>
<tr>
<td>21</td>
<td>Threatened species of seabirds (also protected) caught/injured/killed by trawling</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Evidence is preliminary and mitigation measures are now being tested. Seabirds are not necessarily brought aboard</td>
</tr>
<tr>
<td>22</td>
<td>There is directed catch (for the pot) of seabirds in the handline fishery</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Mortality of the <em>Mustelus</em> and vulnerable <em>Galeorhinus</em> in the longline fishery (these species are commercially harvested)</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>2500 <em>galeorhinus</em> &amp; 800 <em>mustelus</em> over 4 years (of 740 000 sharks in total) - these catches in addition to the targeted fishery</td>
</tr>
<tr>
<td>24</td>
<td>Mortality of the <em>Mustelus</em> and vulnerable <em>Galeorhinus</em> in the inshore trawl fishery (these species are commercially harvested)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Peter Sims noted that about 100 tons are caught a year</td>
</tr>
<tr>
<td>25</td>
<td>Mortality of all other threatened sharks in longline &amp; trawl (see Petersen report)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Over 4 years 740 000 sharks in longline - given the vulnerable life-history strategy of sharks, they are considered as a group with exceptional species listed separately</td>
</tr>
<tr>
<td>26</td>
<td>Bycatch of wreckfish</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>Rob Leslie - reported trawl catches are virtually zero, longline and high seas fisheries may catch this species</td>
</tr>
<tr>
<td>27</td>
<td>Bycatch of 'protected' linefish (in MLRA) on soft ground available to the inshore trawling - silver kob, dusky kob etc.</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Bycatch of 'protected' linefish (in the Marine Living Resources Act) on hard ground</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>Unlikely to be caught in hake-directed trawling but will be available to the longlines and “panga-directed” trawling - seventyfour. Species list compiled by C. Atwood and L. Hutchings.</td>
</tr>
<tr>
<td>29</td>
<td>Bycatch of other benthic species that have been recorded in the trawl catch (see 60-65 species in S. Walmsley PhD Thesis)</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>Including Crabs, molluscs, urchins etc. are caught and dumped/fall out of the net</td>
</tr>
<tr>
<td>30</td>
<td>Bycatch of other sharks, rays &amp; skates (not threatened but not assessed) are caught</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Shooting of seals interacting with gear</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Potential soaking of gannets from fish meal factory vessels</td>
<td>1</td>
<td>2</td>
<td>2</td>
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### General Ecosystem

<table>
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<tr>
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<th>RISK</th>
<th>NOTES</th>
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<tbody>
<tr>
<td>33</td>
<td>Trophic effects of removing a proportion of a high level predator, with no obvious replacement species</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>Fishing on large hake has an effect on inter-species predation which may alter the stock size and distribution (need to explore diff impact on two species)</td>
</tr>
<tr>
<td>34</td>
<td>Removal of predators may have an effect on the abundance of smaller pelagic species and mesopelagics</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td></td>
</tr>
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## Ecological Risk Assessment (ERA) for the South African Demersal Hake Fishery

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<th>NOTES</th>
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<tbody>
<tr>
<td>35</td>
<td>Change in size structure of hake leads to a switch in prey preference</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Ghost fishing by net fragments</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Hake are a component of the diet of marine mammals &amp; other top predators (seals, swordfish, sometimes snoek)</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Impact of trawls on the benthic biota habitat and biota</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>We considered impacts in relation to specific benthic habitats. Impacts uncertain but likely – there are no reference points (i.e. regions which are trawlable but not trawled). L. Hutchings: Cons.=4; therefore risk=24</td>
</tr>
<tr>
<td>39</td>
<td>Distribution patterns and behaviour of seabirds are being affected by the availability of offal</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Moving protein to the surface has made it available to seabirds etc who will alter their behaviour to utilise the resource, possibly forming a dependency. However, this may not have been of any particular benefit (get list from P. Ryan).</td>
</tr>
<tr>
<td>40</td>
<td>Seals benefit from offal discards</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>General pollution associated with fishing vessels &amp; harbour activity is considered across all fisheries</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Disturbance of sediments may change water chemistry (oxygen etc.)</td>
<td>0</td>
<td>5</td>
<td>0</td>
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### Human Wellbeing

#### Community Wellbeing

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</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>Social and economic/welfare effect of trade-offs between longline and trawl fisheries</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>Uncertainty about jobs per ton of hake marketed – economies of scale limit the minimum size of fleet required to maintain processing factories</td>
</tr>
<tr>
<td>44</td>
<td>There is a lack of baseline socio-economic information</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Over-dependence on demersal fishery in certain coastal communities</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>Dramatic fall in employment in last years, also see Namibia</td>
</tr>
<tr>
<td>46</td>
<td>Safety at sea is a problem</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>Could be a problem on smaller vessels</td>
</tr>
<tr>
<td>47</td>
<td>There is a lack of business skills and entrepreneurship in optimal use and processing</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>Majority of fish is sold to the first world, SA quite advanced</td>
</tr>
<tr>
<td>48</td>
<td>A downturn in the fishery will have a negative impact of businesses who provide gear supply, boat repairs etc in highly dependent communities in Saldanha Bay, St Francois, St Helena, Mossel Bay, Hout Bay &amp; Kaik Bay</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>Fishing absorbs a specific strata of society, so job losses may not be absorbs elsewhere</td>
</tr>
<tr>
<td>49</td>
<td>A downturn in the fishery will have a negative impact of businesses who provide gear supply, boat repairs etc in Cape Town and Port Elizabeth</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td></td>
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</tbody>
</table>
### Ecological Risk Assessment (ERA) for the South African Demersal Hake Fishery

#### National Wellbeing

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</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>The impact of a downturn in this fishery on the national economy</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>The most important of the fishing sectors, particularly in terms of exports (see figures in ESS study). Still well less that 1% of GDP.</td>
</tr>
<tr>
<td>51</td>
<td>The impact of a downturn in this fishery on the regional economy (western cape &amp; eastern cape)</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>The impact of a downturn in this fishery on public wellness in terms of food supply</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>One of the most popular choices with the general public, yet most is exported.</td>
</tr>
<tr>
<td>53</td>
<td>A downturn in the fishery will have a significant effect on employment in the Western and Eastern Cape</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Sector has highest permanent employment with benefits in the fishing industry.</td>
</tr>
<tr>
<td>54</td>
<td>A large quantity of white stock fish is being imported into SA</td>
<td>1</td>
<td>6</td>
<td>6</td>
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</tbody>
</table>

#### Ability to Achieve

##### Governance

<table>
<thead>
<tr>
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<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>Larger number of rights-holders result in increased management complexity</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Lack of effectiveness of present input and output controls</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Effort control is not good; input - for handline fishery.</td>
</tr>
<tr>
<td>57</td>
<td>Conflict between sector users</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Compliance is inadequately enforced – occasional examples are made but the coverage is low</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Inspector coverage is inadequate and possibly biased geographically biased and per sector</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>There is no RMWG</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>There are no formal or informal lines of communication with industry bodies and other stakeholders</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Including industry bodies.</td>
</tr>
<tr>
<td>62</td>
<td>Catch data is not available for real time response</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Hake trawl; stock assessment working on data that is two years old (or more); also compliance issues.</td>
</tr>
<tr>
<td>63</td>
<td>Observer data has not been properly analysed or reconciled with catch records</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Problems with the validity of scientific observer data in portraying the real picture</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Coverage is probably sufficient at 15-20%, however may be geographically (and otherwise) biased and observer effect is unknown.</td>
</tr>
<tr>
<td>65</td>
<td>Technological and effort creep are not incorporated in the analysis of CPUE data and assessments</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Inadequate age information</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>Inadequate research capacity and institutional knowledge</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>Lack of management capacity (no-one appointed to manage Demersal fishery at present) and institutional knowledge</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>Inadequate coordination of research (nationally, regionally and internationally)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Need links with Namibian agencies to discuss shared stocks issues.</td>
</tr>
<tr>
<td>ID</td>
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<td>LIKE</td>
<td>RISK</td>
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<tr>
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<td>------</td>
<td>------</td>
<td>------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>70</td>
<td>Inadequate communication with other government departments – specifically with Mineral &amp; Energy Affairs or Petroleum Agency</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Also DTI, SAMS, SABS and Customs &amp; Excise and the Dept of Defence (Navy)</td>
</tr>
<tr>
<td>71</td>
<td>Inadequate coordination with National Ports Authority with regard to facilities &amp; services for fishing vessels</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>Example slipways not being serviceable; specifically SMME’s</td>
</tr>
<tr>
<td>72</td>
<td>Allocation of possibly sub-viable quotas has complicated management</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>Cost involved in attaining transformation – both within the industry and for MCM itself</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>Insufficient flexibility in the current OMP to deal with exceptional circumstances</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td>The MLRA needs to be revised; CAF, consultation</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>Regulations are more important</td>
</tr>
<tr>
<td>76</td>
<td>There is no current clear sector management policy</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>77</td>
<td>There is no formal peer-review of management plans</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>Currently biodiversity audits for marine species are not being done</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>No institutional reviews of research and management</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>80</td>
<td>Lack of accessibility to records of decisions (minutes etc.)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>Lack of state of the environment reports</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
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<tr>
<td>82</td>
<td>Criteria for representation on SWG’s should be reviewed. Difficulties in weighting representation</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>RMWG’s should relieve this pressure</td>
</tr>
<tr>
<td>83</td>
<td>Industry is not particularly interested in some broader management issues, focusing on direct issues</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>The fact that the longline &amp; handline industry are not MSC certified hampers the certification of the Trawl fishery</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>85</td>
<td>The requirements of the MSC are possibly beyond the abilities of management’s resources (for those conditions that require MCM to play a role)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>86</td>
<td>NGO’s not involved in management and scientific working groups</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Combine with 129</td>
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</table>

**External Impacts**

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<thead>
<tr>
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<tbody>
<tr>
<td>87</td>
<td>Anomalous climatic events affect availability and distribution</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>Warm water events and eruptions in Namibian waters (which produce anoxic environments) may have an effect hake stocks</td>
</tr>
<tr>
<td>88</td>
<td>Effects of global warming and climate change</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>Spatial interaction between mining and fishing results in excluded areas for trawling</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>The debris from mining cutting fluids (oil &amp; gas) and dredging (diamond) has an impact on re-suspension of sediments which affects habitat</td>
<td>1</td>
<td>4</td>
<td>4</td>
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</tr>
<tr>
<td>91</td>
<td>Responsibility of rehabilitation of mined areas has been confused by changes in ownership of companies</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>92</td>
<td>General pollution from shipping</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
### Ecological Risk Assessment (ERA) for the South African Demersal Hake Fishery

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<th>NOTES</th>
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<tbody>
<tr>
<td>93</td>
<td>Impact of AIDS’s on the workforce</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>94</td>
<td>Impact of drug abuse on the workforce – particularly in the small boat sector</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>95</td>
<td>Global economic parameters such foreign exchange rates and fuel affect profitability</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Fuel price dramatically affects cost per kg</td>
</tr>
<tr>
<td>96</td>
<td>Size-related price differentials are an incentive for high grading</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Globally high prices for high quality white fish encourage illegal fishing</td>
</tr>
</tbody>
</table>
Ecological Risk Assessment (ERA) for the South African West Coast Rock Lobster Fishery

Compiled by D.C. Nel

Deon Nel, WWF Sanlam Marine Programme, WWF South Africa, Private Bag X2, Die Boord, 7613, South Africa
Email: dnel@wwf.org.za

The ERA workshop for the South African West Coast rock lobster fishery took place in Cape Town, South Africa, between the 30th of May and 3rd of June 2005. The workshop was hosted by Marine and Coastal Management (MCM), a branch of the Department of Environmental Affairs and Tourism, and facilitated by Dr. Deon Nel of WWF-South Africa. Thirteen stakeholders participated in these workshops. The participants were fairly representative of the main sectors. DEAT (MCM) were most well represented (5), followed by industry (4). Two consultants (to the fishing industry) and two marine ecologists (from the University of Cape Town) were also present.

Notable absentees were:
1. Representatives for the Resource Management section of MCM
2. NGO’s (with exception of the facilitator)

Please see Annex 1 for a complete list of attendees.
1. A brief description of the West Coast Rock Lobster Fishery

West Coast rock lobster *Jasus lalandii* are distributed from just north of Walvis Bay, Namibia, to near East London on the east coast of South Africa. Commercial exploitation started in the nineteenth century and expanded in the early twentieth century eventually leveling off at about 10 000 tons from 1950 to 1965. Since 1965 the utilization of the stock declined almost continuously to a minimum of 1 500 tons in 1995/96. Since then the TAC has stabilized and increased. Currently the stock is at about 6% of the pre-exploited levels. Exploitation is made of three main sectors: full commercial, limited commercial (small-scale) and recreational.

About 1 300 seasonal and full-time employees are involved in the commercial sector. The processing component is comprised of approximately 19 factories with over 2 800 employees. South Africa supplies less than 2% of the world's total lobster market demand and foreign earnings in 2002 amounted to approximately R200 million. The current level of transformation in the commercial sector is given as 64%. Between 1992 and 1999, an average of about 52 000 recreational permits were sold each year.

2. Results of the Workshop

General overview of the ERA process

Identification of issues

A total of 71 issues were identified by the workshop participants. These issues are listed and described in full in Annex 2. Most issues (42%) fell within the ‘Governance’ component, followed by ‘Community Wellbeing' issues (21%) (Figure 1). Relative to other fisheries this fishery appeared to have fewer ‘Ecological Wellbeing’ issues (only 21% of all issues).

Figure 1. Percentages of issues that were identified within each ERA component and category.
Prioritization of issues

The prioritization process resulted in a very even spread of issues within each of the risk categories (Figure 2). Fifty two of the 71 issues were deemed to be of moderate risk or higher.

When considering the spread of risk categories within each of the ERA components (Figure 3) we see that the ‘Governance’ component had the highest number of issues in total as well the highest proportion of issues in the ‘Extreme’ or ‘High’ risk categories. The ‘External Impacts’ as well as ‘Community Wellbeing’ components also had a high proportion of issues in the ‘Extreme’ or ‘High’ risk categories.
Ecological Risk Assessment (ERA) for the South African West Coast Rock Lobster Fishery

Performance reports

Of the 71 issues identified, 52 (73%) were rated as being of ‘Moderate’ risk or higher and thus requiring a full performance report. Performance reports were developed for all these issues excepting some of the issues from the ‘External Impacts’ component that were deemed to be beyond the control of west coast rock lobster fisheries management.

The major issues

The issues with a risk rating of ‘Moderate’ or higher are shown in Table 1. The discussion in this section cannot cover each of the issues and so will merely highlight some of the main issues and themes under each of the main components.

Ecological Wellbeing

This fishery does not seem to be plagued with the number of ‘Ecological Wellbeing’ risks that face many other fisheries. This is probably due to the selective nature of the gear and its small impact on benthic habitats.

The trophic influences of rock lobster on urchins and abalone was the only issue that was considered to be of ‘Extreme’ risk under the ‘Ecological Wellbeing’ component. The slow somatic growth and the southward shift in the distribution were considered to be of ‘High’ risk
to the fishery. While it was noted that the stock size was lower than desired, this was qualified by the fact that there have been recent signs of recovery.

Table 1. The list of issues that scored a ‘Moderate’ risk or higher.

* Note that the issue number cross-links to the issue numbering in Table 2 and Annex 2.

* Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)
** Categories: E=Extreme, H=High, M=Moderate

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
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<tbody>
<tr>
<td>Ecological Wellbeing</td>
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<tr>
<td>Retained Species</td>
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<tr>
<td>1</td>
<td>WC Rocklobster: somatic growth rate below historic average (esp. in areas 1-2)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>E</td>
</tr>
<tr>
<td>2</td>
<td>WC Rocklobster: shift in distribution to the south</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>E</td>
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<tr>
<td>5</td>
<td>WC Rocklobster: there is a lack of large females</td>
<td>3</td>
<td>5</td>
<td>15</td>
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</tr>
<tr>
<td>3</td>
<td>WC Rocklobster: current abundance is below the desired level</td>
<td>2</td>
<td>5</td>
<td>10</td>
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<tr>
<td>Non-retained species</td>
<td></td>
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<tr>
<td>10</td>
<td>Bycatch of 27 species, including cat sharks</td>
<td>2</td>
<td>5</td>
<td>10</td>
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<tr>
<td>General Ecosystem</td>
<td></td>
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<tr>
<td>11</td>
<td>Trophic influences on urchin/abalone</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>14</td>
<td>Fishing gear causing damage to benthic biota: hard corals, bryozoans, sea fans</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
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<tr>
<td>15</td>
<td>Discarding of plastics that can lead to ingestion by, and entanglement of birds</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
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<tr>
<td>Human Wellbeing</td>
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<tr>
<td>Community Wellbeing</td>
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<tr>
<td>19</td>
<td>A lack of coordinated marketing results in lower prices (fragmentation of industry)</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>20</td>
<td>Some quota holders have sub-viable quotas (influenced by exchange rates)</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>24</td>
<td>Fishermen excluded from access because of lack of capacity/insufficient resources to prepare applications, pay for licenses etc.</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>18</td>
<td>Unhappiness amongst fishers because of problems with water loss before weighing, having impact on price (especially important for smaller operators)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>E</td>
</tr>
<tr>
<td>22</td>
<td>Concerns about incidence of work-related injuries – safety at sea</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>25</td>
<td>Exclusion of fishers is leading to poaching, that reduces TACs, lowers prices</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>27</td>
<td>Lack of capacity in business skills is hindering effective transformation (near shore fishery)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>16</td>
<td>The three fishing sectors (limited commercial, full commercial, recreational) are competing for the same resource leading to socio-economic conflicts</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>17</td>
<td>Conflicts caused by different prices paid to fishermen for over-the-scale vs. direct deals</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>29</td>
<td>A substantial number of people would be negatively impacted by closure of recreational fishery: dive operators, tourism industry, boat industry, service stations, restaurants, cafes</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>23</td>
<td>Problems related to maintaining employment in processing plants in remote areas</td>
<td>2</td>
<td>5</td>
<td>10</td>
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</tbody>
</table>
# Ecological Risk Assessment (ERA) for the South African West Coast Rock Lobster Fishery

## Ability to Achieve

### Governance

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
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<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
</tr>
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<tbody>
<tr>
<td>35</td>
<td>Lack of cooperation between scientific decisions and management implementation</td>
<td>5</td>
<td>6</td>
<td>30</td>
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<tr>
<td>36</td>
<td>Lack of participation by managers/administrators on Scientific Working Groups</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
<tr>
<td>37</td>
<td>Lack of discussion, feedback, transparency, accountability, for departures by resource managers from scientific advice</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
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<tr>
<td>32</td>
<td>Resource Management Working Groups are not functioning effectively</td>
<td>4</td>
<td>6</td>
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<tr>
<td>33</td>
<td>Effective abolition of the CAF is hindering consultation</td>
<td>4</td>
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<td>42</td>
<td>Poaching is a substantial problem (500t compared 3000t TAC)</td>
<td>4</td>
<td>6</td>
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<tr>
<td>44</td>
<td>Insufficient enforcement (inadequate numbers, salaries, co-operation between agencies)</td>
<td>4</td>
<td>6</td>
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<tr>
<td>46</td>
<td>Understaffing at MCM caused by radical failure to fill posts</td>
<td>4</td>
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<tr>
<td>50</td>
<td>Lack of provision for small scale fishers in the MLRA</td>
<td>4</td>
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<tr>
<td>52</td>
<td>Communication difficulties between industry to managers/administrators on ad hoc issues during the year</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>53</td>
<td>Inadequate implementation of co-management, failure to use Management Working Groups</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>49</td>
<td>1300 rights holders likely to compromise ability to monitor/control fishery effectively</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>38</td>
<td>Inadequate representation of social and economic staff at MCM</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>E</td>
</tr>
<tr>
<td>47</td>
<td>Lack of capacity amongst previously disadvantaged sector to fill science/technical/management posts</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>E</td>
</tr>
<tr>
<td>43</td>
<td>Insufficient observer coverage on deck boats (with specific compliance duties)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>56</td>
<td>Currently, biodiversity audits for marine species are not being done</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>59</td>
<td>Absence of representative structures for communities hinders effective communication and participation</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>48</td>
<td>Failure to cooperate adequately with Trade and Industry, Labour, Mineral &amp; Energy Affairs</td>
<td>2</td>
<td>6</td>
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<tr>
<td>51</td>
<td>Dissatisfaction with allocation policy of not being allowed to have multiple permits</td>
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</tr>
<tr>
<td>34</td>
<td>Lack of devolution of authority to appropriate local level</td>
<td>2</td>
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<td>10</td>
<td>M</td>
</tr>
<tr>
<td>39</td>
<td>Inability to interact with recreational sector (no representative body)</td>
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<td>M</td>
</tr>
<tr>
<td>54</td>
<td>Inappropriate means of communication results in target audience not being reached</td>
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<td>5</td>
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<tr>
<td>55</td>
<td>Peer-review not obligatory part of management plans and OMPs</td>
<td>2</td>
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<td>M</td>
</tr>
<tr>
<td>60</td>
<td>Absence of watchdog NGOs and CBOs at community level is contributing to poaching, disappearance funds, etc.</td>
<td>2</td>
<td>4</td>
<td>8</td>
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</table>

### External Impacts

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<th>RISK*</th>
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<tbody>
<tr>
<td>69</td>
<td>Exchange rate affects profitability</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
<tr>
<td>64</td>
<td>Impact environment on slow growth rate</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>70</td>
<td>Fuel price impacts on profitability</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>66</td>
<td>Problem with attitudes towards perceived human 'rights' to harvest rather than responsibilities (driving force for poaching in many cases)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>E</td>
</tr>
<tr>
<td>61</td>
<td>Increased frequency of harmful algal blooms</td>
<td>5</td>
<td>3</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>62</td>
<td>Increased frequency and magnitude of low oxygen events and related walk-outs</td>
<td>5</td>
<td>3</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>63</td>
<td>Long-term climate change, possibly causing eastward shift of lobster</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>65</td>
<td>Impact of mining: H2S eruption, sediment turnover, suspension particles etc.</td>
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<td>6</td>
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</tbody>
</table>
**Human Wellbeing**

Many of the ‘Human Wellbeing’ issues faced by this fishery are related to the smaller operators. These include the lack of a coordinated marketing ability which will result in lower prices and profitability for small quota holders. In the past many of these small operators have also been allocated economically sub-viable quotas.

Another concern that emerged in several issues was the lack of business skills and capacity amongst the small-scale fishermen. It was felt that lack of capacity and resources could result in *bona fide* fishermen not being able to enter the fishery. This could lead to these fishers engaging in poaching activities. Furthermore, a lack of business skills and coordination amongst the small scale fishers is hindering the effective transformation of the near-shore fishery. This appears to be leading to some frustration amongst small-scale operators over technicalities related to prices (e.g. water loss and over the scale versus direct prices). Conflict between the three sectors involved in this fishery (full commercial, limited commercial and recreational) was also noted.

Finally, the social and economic importance of this fishery for small coastal towns on the west coast and south-western Cape was also noted. A downturn in this fishery could have severe consequences to these predominantly fishing villages.

**Governance**

As noted previously, the workshop participants identified a large number of issues related to the governance of this fishery. At the heart of the problem seems to be poor coordination between science and management within DEAT. Linked to this is the poor participation of resource managers in the Scientific Working Group (SWG) and poor transparency and accountability feedback on decisions that depart from scientific advice. The lack of an effective Resource Management Working Group (RMWG) is exacerbating this situation. This is hindering communications with stakeholders and any potential for co-management of this resource. Communication seems to be further hindered by the lack of effective representative structures for the small-scale and recreational sectors.

Poaching is a large problem in this fishery and is compounded by a lack of appropriate enforcement capacity. Understaffing and lack of socio-economic expertise within MCM is also a problem.

**External Impacts**

External impacts on this fishery include fluctuating foreign exchange rates, fuel prices and a number of environmental factors.
Performance Reports

The complete performance reports can be found in Table 2. The following section will distill some of the key data requirements and management responses to the issues outlined above within the three main ERA components.

Ecological Wellbeing

Ongoing catch statistics and survey based data will continue to be needed in order to inform stock rebuilding strategies and knowledge of distributional shifts. In addition to this, mark and recapture data is important for informing management responses to slow somatic growth and distribution shifts. Further detailed research of trophic interactions between rock lobster and urchins was recommended. Specific studies on fished and un-fished areas to determine the impact of gear on benthic biota were also recommended. In addition, the importance of observer data was highlighted under issues relating to bycatch as well as discarding of litter.

Revision of the Operational Management Plan (OMP) to include spatially disaggregated assessments as well as downgrading the importance of growth in the model were suggested as possible measures to address the issue of changes in distribution and the questionable validity of the growth data.

It was suggested that the possibility of a male-only fishery should be investigated to combat the effect of the skewed sex ratio. The potential of a joint rock lobster and abalone management procedure was suggested in order to deal with the trophic interactions between these species.

Human Wellbeing

Documentation about the economic benefits of coordinated marketing needs is to be undertaken and would be greatly beneficial to assisting small-scale fishers. Lists of registered packers and distributors and economic statistics on small, medium and micro enterprises (SMME’s) were identified as data requirements.

More structured and defined financial and business 'road shows' to assist small-scale fishers need to be undertaken once long-term rights have been allocated. Furthermore, the development of an accepted industry body that is able to standardize quality control and work towards Marine Stewardship Council (MSC) certification would be greatly advantageous to small-scale fishers.

Clearly, consolidation of fishing rights into economically viable packages will assist with many of the ‘Human Wellbeing’ issues that were identified. This is within the fishing policy, but we need to wait and see how effectively this is implemented. More structured and industry-lead safety at sea training courses would assist in reducing accidents in this fishery.
**Governance**

An up-to-date list of rights holders and a list of all interested and affected parties for this fishery were identified as data requirements under this section. The lack of an effective Resource Management Working Group lay at the heart of many of the governance issues that were raised. The participants therefore felt that an effectively operating RMWG should be established by the end of 2005 and should meet quarterly during 2006. A number of practical measures were suggested to decrease the level of poaching in this fishery.

The need to increase the number of staff with socio-economic skills within MCM was also identified. A full review and performance appraisal of MCM by an outside review panel was suggested to rectify some of the main human resources and personnel problems.

In terms of affecting better communications, the participants saw a larger role for the Sea Management structures as well as regional representative structures. Higher levels of observer coverage, specifically on deck boats as well as improved training and extended tasks for observers was also envisaged as being helpful to the governance of this fishery.
Table 2. Summary of Performance Reports developed for issues scoring a risk rating of ‘Moderate’ or higher

Note that the issue number cross-links to the issue numbering in Table 1 and Annex 2

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
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<tr>
<td>EW1</td>
<td>Investigate causes and effects of low growth rate</td>
<td>1</td>
<td><strong>Current</strong></td>
<td>Ongoing mark-recapture program, time-at-large experiment, effects of tagging on the OMP model and analysis of size-dependent effects</td>
<td>Knowledge gained about growth rates</td>
<td>Satisfactory/sufficient knowledge gained to assess the impacts on the OMP</td>
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</table>

**Ecological Wellbeing**

<p>| EW2| Understand the shift in distribution | 2      | <strong>Current</strong>           | Measures of abundance within accepted statistical threshold (abundance, growth, size-structure, sex structure) | Generation of CPUE and standard catch statistics | Generate robust survey data |
|    |                                           |        |                      | Allocation of TAC consistent with scientific advice | Gain knowledge about the factors and mechanisms | CPUE performance of stock (if over-allocate will decrease) |</p>
<table>
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<tr>
<th>ID</th>
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<th>PERFORMANCE LIMITS</th>
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<tbody>
<tr>
<td>EW3</td>
<td>Rebuild the rock lobster stock to desired level</td>
<td>3</td>
<td><strong>Current</strong></td>
<td>• Catch statistics, survey based data and growth data</td>
<td>• Improve abundance as estimated from stock assessments</td>
<td>• Achieve 20% stock rebuilding from 1996 level over 10 years</td>
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<td></td>
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<td></td>
<td><strong>Future</strong></td>
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<td></td>
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<td></td>
<td>• Spatially disaggregated assessments and revision of the OMP</td>
<td></td>
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<tr>
<td>EW4</td>
<td>Document and understand change in size-structure of females</td>
<td>4,5</td>
<td><strong>Current</strong></td>
<td>• Historic and present female length frequency distributions and proportions of females in commercial catch</td>
<td>• Proportion of females per size-category</td>
<td>• Use historic data to design plausible model of population dynamics and secure consistency between data and model results</td>
</tr>
<tr>
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<td></td>
<td><strong>Future</strong></td>
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<td></td>
<td>• Consideration given to male-only fishery</td>
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<tr>
<td>EW5</td>
<td>Minimise detrimental by-catch</td>
<td>9,10</td>
<td><strong>Current</strong></td>
<td>• Accurate by-catch estimates across all fisheries (not only rock lobster)</td>
<td>• Adequate estimates of by-catch</td>
<td>• Ensure that the by-catch of other resources by the rock lobster fishery is not in concert with other fishery by-catches of those resources</td>
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<tr>
<td></td>
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<td></td>
<td><strong>Future</strong></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Extended log-books</td>
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<td></td>
<td>• Need to assess by-catch of all fisheries in relation to resources which are under threat</td>
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<tr>
<td>EW6</td>
<td>Understand and manage trophic influences on urchin/abalone</td>
<td>11</td>
<td><strong>Current</strong></td>
<td>• Spawner-biomass estimates for rock lobster and abalone</td>
<td>• Improved understanding of interactions among lobster and benthic organisms</td>
<td>• Maintain or achieve 25% spawner-biomass threshold limit for both species. This is vital as abalone need a threshold number of animals in order to stimulate spawning and ensure reproductive success</td>
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<tr>
<td></td>
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<td><strong>Future</strong></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Development of a joint</td>
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<td></td>
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<td></td>
<td>• Independent assessments and OMPs for both rock lobster and abalone</td>
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<td></td>
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<td></td>
<td>• There is a start on benthic community surveys</td>
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<tr>
<td>ID</td>
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</tbody>
</table>
| EW7| Establish whether fishing gear causes significant damage to benthic biota. If damage is caused – take action to minimise damage | 14     | Future  
- Experiments and observations.  
- Experimental and correlative comparisons of fished and unfished areas  
- Observer coverage of discarding  
- Rate of mortality and entanglement of seabirds  
- Incidence of discarding  
- Zero tolerance of discarding | Development of an assessment | Assessment developed | stock of rock lobster and abalone for use by future generations  
- Development of a joint management procedure for rock lobsters and abalone in the area East of Cape Hangklip |
| EW8| Minimise discarding of fishing gear and plastics           | 13,15  | Current  
- Permit conditions and Industry Code of Conduct stipulates no discarding  
- Monitoring by observer program  
Future  
- Enforcement of compliance and better data on entanglement frequencies  
- Observer coverage of discarding  
- Rate of mortality and entanglement of seabirds  
- Incidence of discarding  
- Zero tolerance of discarding | | | |

Human Wellbeing

| HW1| Reduce conflict between sectors (full, limited and recreational) | 16,29  | Current  
- Sector allocations decided in new rights allocation (ca. 70:20:10 split); recreational (ca. 8-10%)  
- Time exclusions (recreational – weekend; commercial – weekdays)  
Future  
- Spatial management?  
- Once long term rights are allocated, | | Numbers of court cases |
<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>flexibility needs to be built into management to accommodate changes (environmental, oil spills etc.)</td>
<td>List of up to date rights holders (through zonal and central sea management committees)</td>
<td>Number of courses and road shows</td>
<td>Road shows: Aim for quarterly road shows, minimum of twice a year</td>
</tr>
<tr>
<td>HW2</td>
<td>Develop business and financial skills amongst limited and medium commercial rights holders</td>
<td>17,27 Current</td>
<td>Been done in the past, but rights holders changed – should be better now in long term rights allocation</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Future</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Repeat business and financial capacity building road shows once long term rights are in place</td>
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<td></td>
<td>Road shows should be more structured with defined agendas etc.</td>
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<tr>
<td>HW3</td>
<td>Develop a national marketing strategy and formalise the Industry body of marketing with a code of conduct</td>
<td>19 Current</td>
<td>Capacity building road shows ongoing</td>
<td>Documentation of economic benefits of co-ordinated marketing approach</td>
<td>Formalised industry body with a code of conduct</td>
<td>Formalise industry body by end of 2005/6 season</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Quality control road shows ongoing</td>
<td></td>
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<td></td>
<td>Future</td>
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<td></td>
<td></td>
<td></td>
<td>Sell the concept of Industry body to industry and MCM</td>
<td></td>
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<tr>
<td></td>
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<td></td>
<td>List of packers and distributors</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Standardised quality control – driven by Industry body</td>
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<tr>
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<td></td>
<td>Work towards MSC certification</td>
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</tr>
<tr>
<td>HW4</td>
<td>Consolidation of regional rights (not just rock lobster) to make commercially viable fishing entities</td>
<td>20,25 Current</td>
<td>Current rights allocation in process</td>
<td>Economic statistics about SMEs</td>
<td>Long term rights</td>
<td>Long term rights will be allocated by November 2005</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>New policy deals with consolidation however, we are unsure how it will be implemented</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Review progress once long term</td>
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</tbody>
</table>
## Ecological Risk Assessment (ERA) for the South African West Coast Rock Lobster Fishery

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</tr>
</thead>
</table>
| HW4| Reduce and minimise the incidence of injuries, drownings and incidences of distress at sea | 22 | *Current*  
  - Disparate training courses being done, but not structured and co-ordinated  
  *Future*  
  - Industry lead safety at sea training courses for limited commercial rights holders (in conjunction with SAMSA and experienced skippers) | *Need an industry monitoring and evaluation of safety and injuries (lead by industry)* | *Records incidences* | *To be determined with more information* |

| HW5| Improve capacity of HDIs to enable them to apply for rights on an equal footing | 24 | *Current*  
  - Dealt with in the long term rights  
  - Application fee lowered  
  - Form has simplified  
  - Road shows in Zone A, B, C, D, F  
  - Regional industry reps assist with capacity  
  *Future*  
  - Ongoing of the above | | | |

### Governance

| G1 | Minimise or eliminate poaching | 25,42,44,60 | *Current*  
  - Compliance and inspection system in place  
  - Inshore task team  
  - Green courts  
  *Future*  
  - Accredited honorary rangers  
  - Awareness programmes  
  - School education  
  - Increased resources for compliance  
  - Support expansion Green Courts  
  - Rewards for information  
  - Identify hotspots  
  - Research on main channels of distribution  
  - Refer to SADC MCS workshop | *SWG currently estimates poaching impact* | *Proportion of TAC that is lost to poaching* | *2% of TAC lost to poaching* |
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<tbody>
<tr>
<td>G2</td>
<td>Establish an effectively functioning and representative Resource Management Working Group</td>
<td>32,39</td>
<td>Current&lt;br&gt;• Industry is motivating strongly for resuscitation of RMWG&lt;br&gt;Future&lt;br&gt;• Re-establish RMWG&lt;br&gt;• RMWG should have a right of appeal to independent advisory body to the Minister&lt;br&gt;• Develop a interested and affected parties distribution list for records of decisions of the RMWG</td>
<td>• List of interested affected parties</td>
<td>• Minutes and records of decisions of the RMWG&lt;br&gt;• Number of meetings&lt;br&gt;• Representation on the RMWG</td>
<td>• RMWG holds first meeting by March 2006, and meets quarterly thereafter&lt;br&gt;• Representation by researchers, managers, industry, recreational bodies, compliance, mandated representation from conservation bodies&lt;br&gt;• Invited specialists (including socio-economists)</td>
</tr>
<tr>
<td>G3</td>
<td>Effective integration of scientific recommendations and management decisions within MCM</td>
<td>35,36,37</td>
<td>Current&lt;br&gt;• Good intentions, but no measurable response&lt;br&gt;Future&lt;br&gt;(see above) – leave to management to respond&lt;br&gt;• Establishment of RMWG&lt;br&gt;• Records</td>
<td>• Attendance of management at joint meetings&lt;br&gt;• Interactive decision making is taking place&lt;br&gt;• Records of joint decisions&lt;br&gt;• Regular meetings a RMWG</td>
<td>• RMWG established by end 2005 and meets quarterly during 2006&lt;br&gt;• Resource management adequately represented at relevant SWGs henceforth&lt;br&gt;• Archive of record of decisions established henceforth</td>
<td></td>
</tr>
<tr>
<td>G4</td>
<td>Maintain sufficient capacity and experience at MCM to manage this fishery, within transformation targets</td>
<td>38,46,47</td>
<td>Future&lt;br&gt;• Hire socio-economic expertise into MCM&lt;br&gt;• Outside review panel (perhaps independent advisory forum to the minister) to review and appraise performance of the department&lt;br&gt;• Industry to review MCM performance and service delivery (after LTRAMP)&lt;br&gt;• Independent HR dept (from Pretoria)&lt;br&gt;• Outsourcing of work that is not a core competency of MCM (eg</td>
<td>• Job vacancy rate</td>
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<tr>
<td>G5</td>
<td>Increase observer coverage on commercial fleet</td>
<td>43</td>
<td>Current</td>
<td>Number of sea days covered</td>
<td>% cover of offshore and near shore fleets</td>
<td>10-15% observer coverage (boat effort)</td>
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<td></td>
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<td></td>
<td>Started to increase observer coverage</td>
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<td></td>
<td>Improved communications with CapFish and Industry</td>
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<td></td>
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<td></td>
<td>Increasing observer training</td>
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<td>Future</td>
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<td>Increase observer tasks e.g. tagging</td>
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<td></td>
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<td>Self evident</td>
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<tr>
<td>G6</td>
<td>Efficient and effective administrative structure and communication with industry and communities</td>
<td>49,52,53,54,59</td>
<td>Future</td>
<td>Maintenance of the rights holders database</td>
<td>Letters of complaints from industry to MCM</td>
<td>Feasibility of devolving certain tasks and responsibilities to West Coast Rock lobster Sea Management is investigated by after LTRAMP is complete</td>
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<tr>
<td></td>
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<td></td>
<td>Feasibility study of devolution of power for certain tasks and responsibility to West Coast Rock lobster Sea Management</td>
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<td></td>
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<td></td>
<td>Administrative issues could possibly be dealt with at West Coast Rock lobster Sea Management level</td>
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<td></td>
<td></td>
<td></td>
<td>Simplify administrative processes</td>
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<td></td>
<td>Communities to liaise through regional representative bodies or West Coast Rock lobster Sea Management</td>
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<tr>
<td>G7</td>
<td>Monitor frequency of low oxygen events and develop contingency plans for rock lobster walk-outs.</td>
<td>61,62</td>
<td>Current</td>
<td>Installation of real-time monitoring buoy at Elands Bay</td>
<td>Both objectives must be met</td>
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<td></td>
<td></td>
<td></td>
<td>Contingency plan includes logistical requirements such as storage tanks</td>
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<td>Future</td>
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<td>Contingency plan may have to handle larger numbers of lobsters</td>
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<td></td>
<td>Real-time monitoring of temperature, oxygen and chlorophyll at Elands Bay</td>
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<td></td>
<td>Diver surveys to check on imminence of walk-out and monitoring by inspectors whether the lobsters are concentrated inshore</td>
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</tbody>
</table>
## Annex 1: List of participants

<table>
<thead>
<tr>
<th>NAME</th>
<th>INSTITUTION/AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andy Cockcroft</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Donald Grant</td>
<td>Industry (consultant)</td>
</tr>
<tr>
<td>Gaston Fernandes</td>
<td>Industry</td>
</tr>
<tr>
<td>George Branch</td>
<td>University of Cape Town</td>
</tr>
<tr>
<td>H. Levendal</td>
<td>Industry</td>
</tr>
<tr>
<td>J.W.H. Du Plessis</td>
<td>Industry</td>
</tr>
<tr>
<td>Jean Glazer</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Laura Blamey</td>
<td>University of Cape Town</td>
</tr>
<tr>
<td>Lynne Shannon</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Madelene Du Plessis</td>
<td>Industry</td>
</tr>
<tr>
<td>Mike Bergh</td>
<td>Ocean and Land Resource Assessment Consultants</td>
</tr>
<tr>
<td>Steve Brouwer</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Susan Johnson</td>
<td>University of Cape Town – MARAM</td>
</tr>
<tr>
<td>Tracey Fairweather</td>
<td>Marine and Coastal Management</td>
</tr>
</tbody>
</table>
Annex 2: Complete list of all issues raised and their consequence, likelihood and risk ratings.

Note: Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>WC Rocklobster: somatic growth rate below historic average (esp. in areas 1-2)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>WC Rocklobster: shift in distribution to the south</td>
<td>3</td>
<td>6</td>
<td>18</td>
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</tr>
<tr>
<td>3</td>
<td>WC Rocklobster: current abundance is below the desired level</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>Stocks are showing signs of increase</td>
</tr>
<tr>
<td>4</td>
<td>WC Rocklobster: sex ratio skewed towards males</td>
<td>1</td>
<td>4</td>
<td>4</td>
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<tr>
<td>5</td>
<td>WC Rocklobster: there is an lack of large females</td>
<td>3</td>
<td>5</td>
<td>15</td>
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<tr>
<td>6</td>
<td>WC Rocklobster: The stock is shared with Namibia</td>
<td>1</td>
<td>6</td>
<td>6</td>
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</tr>
<tr>
<td>7</td>
<td>WC Rocklobster: variability in moult timing creates problems for monitoring and management</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
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<tr>
<td>8</td>
<td>WC Rocklobster: discarding results in physical damage to individuals</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>Used to be higher 10 years ago</td>
</tr>
<tr>
<td>9</td>
<td>Bycatch of kingklip, octopus, hottentot and other linefish species</td>
<td>1</td>
<td>5</td>
<td>5</td>
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</tr>
<tr>
<td>10</td>
<td>Bycatch of 27 species, including cat sharks</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Trophic influences on urchin/abalone</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Ghost fishing of penguins</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Discarding of netting during repairs can lead to entanglement of birds</td>
<td>1</td>
<td>4</td>
<td>4</td>
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</tr>
<tr>
<td>14</td>
<td>Fishing gear causing damage to benthic biota: hard corals, bryozoans, sea fans</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Discarding plastics that can lead to ingestion and entanglement of birds</td>
<td>2</td>
<td>6</td>
<td>12</td>
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</table>
### Human Wellbeing

#### Community Wellbeing

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<tbody>
<tr>
<td>16</td>
<td>The three fishing sectors (limited commercial, full commercial, recreational) are competing for the same resource leading to socio-economic conflicts.</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Conflicts caused by different prices paid to fishermen for over the-scale versus direct deals</td>
<td>2</td>
<td>6</td>
<td>12</td>
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</tr>
<tr>
<td>18</td>
<td>Unhappiness amongst fishers because of problems with water loss before weighing, having impact on price (especially important for smaller operators)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>A lack of coordinated marketing results in lower prices (fragmentation of industry)</td>
<td>4</td>
<td>6</td>
<td>24</td>
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<tr>
<td>20</td>
<td>Some quota holders have sub-viable quotas (influenced by exchange rates)</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>(this could be addressed through allocation of viable bundles of different resources)</td>
</tr>
<tr>
<td>21</td>
<td>Lack of economic benefits of collecting walk-out lobsters</td>
<td>3</td>
<td>1</td>
<td>3</td>
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<tr>
<td>22</td>
<td>Concerns about incidence of work-related injuries – safety at sea</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Problems related to maintaining employment in processing plants in remote areas</td>
<td>2</td>
<td>5</td>
<td>10</td>
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<tr>
<td>24</td>
<td>Fishermen excluded from access because of lack of capacity/insufficient resources to prepare applications, pay for licenses etc</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Exclusion of fishers is leading to poaching, that reduces TACs, lowers prices</td>
<td>3</td>
<td>5</td>
<td>15</td>
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<tr>
<td>26</td>
<td>Failure to fulfill Transformation targets (80%)</td>
<td>2</td>
<td>1</td>
<td>2</td>
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<tr>
<td>27</td>
<td>Lack of capacity in business skills is hindering effective transformation (near shore fishery)</td>
<td>3</td>
<td>5</td>
<td>15</td>
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<tr>
<td>28</td>
<td>Negative impacts on lobster fishery would create substantial hardship for a large number people between Saldanha Bay and Port Nolloth</td>
<td>2</td>
<td>3</td>
<td>6</td>
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<tr>
<td>29</td>
<td>A substantial number of people would be negatively impacted by closure of recreational fishery: dive operators, tourism industry, boat industry, service stations, restaurants, cafes</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Negative impacts on lobster industry would have significant impacts on socio-economy of Western and Northern Cape</td>
<td>1</td>
<td>2</td>
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</tbody>
</table>
# Ecological Risk Assessment (ERA) for the South African West Coast Rock Lobster Fishery

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<tr>
<td></td>
<td><strong>National Wellbeing</strong></td>
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<tr>
<td>31</td>
<td>Collapse of rock lobster industry would remove important lifestyle component for the Western Cape</td>
<td>3</td>
<td>2</td>
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<td></td>
<td><strong>Ability to Achieve</strong></td>
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</tr>
<tr>
<td></td>
<td><strong>Governance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Resource Management Working Groups are not functioning effectively</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Effective abolition of the CAF is hindering consultation</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Lack of devolution of authority to appropriate local level</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Lack of cooperation between scientific decisions and management implementation (5th/7th Floor hiatus)</td>
<td>5</td>
<td>6</td>
<td>30</td>
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<tr>
<td>36</td>
<td>Lack of participation by managers/administrators (7th Floor) on SWG’s</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Lack of discussion, feedback, transparency, accountability, for departures by resource managers from scientific advice</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Inadequate representation of social and economic staff at MCM</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Inability to interact with recreational sector (no representative body)</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td></td>
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<tr>
<td>40</td>
<td>No agreement on managing shared stock with Namibia</td>
<td>1</td>
<td>5</td>
<td>5</td>
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</tr>
<tr>
<td>41</td>
<td>Exclusion of offshore sector from area east of Hangklip</td>
<td>1</td>
<td>6</td>
<td>6</td>
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<tr>
<td>42</td>
<td>Poaching is a substantial problem (500t compared 3000t TAC)</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
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<tr>
<td>43</td>
<td>Insufficient observer coverage on deck boats (with specific compliance duties)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>Currently 8% coverage as scientific observers</td>
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<tr>
<td>44</td>
<td>Insufficient enforcement (inadequate numbers, salaries, co-operation between agencies)</td>
<td>4</td>
<td>6</td>
<td>24</td>
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<tr>
<td>45</td>
<td>‘Sanctioned’ poaching is allowed in diamond areas</td>
<td>1</td>
<td>6</td>
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<tr>
<td>46</td>
<td>Understaffing at MCM caused by radical failure to fill posts</td>
<td>4</td>
<td>6</td>
<td>24</td>
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<tr>
<td>47</td>
<td>Lack of capacity amongst previously disadvantaged sector to fill science/technical/management posts</td>
<td>3</td>
<td>6</td>
<td>18</td>
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<td>48</td>
<td>Failure to cooperate adequately with Trade and Industry, Labour, Mineral &amp; Energy Affairs</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Mostly in Zone A &amp; B</td>
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<tr>
<td>49</td>
<td>1300 rights holders likely to compromise ability to monitor/control fishery effectively</td>
<td>4</td>
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<td>20</td>
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<td>50</td>
<td>Lack of provision for small scale fishers in the MLRA</td>
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<td>6</td>
<td>24</td>
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<tr>
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<td>51</td>
<td>Dissatisfaction with allocation policy of not being allowed to have multiple permits</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
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<tr>
<td>52</td>
<td>Communication difficulties between industry to managers/administrators on ad hoc issues during year</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
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<tr>
<td>53</td>
<td>Inadequate implementation of co-management, failure to use Management Working Groups</td>
<td>4</td>
<td>6</td>
<td>24</td>
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<tr>
<td>54</td>
<td>Inappropriate means of communication results in target audience not being reached</td>
<td>2</td>
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<tr>
<td>55</td>
<td>Peer-review not obligatory part of management plans and OMP’s</td>
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<tr>
<td>56</td>
<td>Currently biodiversity audits for marine species are not being done</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td></td>
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<tr>
<td>57</td>
<td>Failure of diamond mining companies to address impacts on fisheries</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>Localised</td>
</tr>
<tr>
<td>58</td>
<td>Inadequate access for compliance officers to mining areas</td>
<td>1</td>
<td>4</td>
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<tr>
<td>59</td>
<td>Absence of representative structures for communities effective communication and participation</td>
<td>3</td>
<td>5</td>
<td>15</td>
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<tr>
<td>60</td>
<td>Absence of watchdog NGO’s and CBO’s at community level is contributing to poaching, disappearance funds, etc</td>
<td>2</td>
<td>4</td>
<td>8</td>
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**External Impacts**

<table>
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<tr>
<td>61</td>
<td>Increased frequency of harmful algal blooms</td>
<td>5</td>
<td>3</td>
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<tr>
<td>62</td>
<td>Increased frequency and magnitude of low oxygen events and related walk-outs</td>
<td>5</td>
<td>3</td>
<td>15</td>
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<tr>
<td>63</td>
<td>Long-term climate change possible causing eastward shift of lobster</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Impact environment on slow growth rate</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Impact of mining: H2S eruption, sediment turnover, suspension particles etc</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Localised affect ca. 5% of TAC</td>
</tr>
<tr>
<td>66</td>
<td>Problem with attitudes towards perceived human 'rights' to harvest rather than responsibilities (driving force for poaching in many cases)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>Market preference for smaller sizes (higher price) leads to discard of larger lobsters</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>Previously a problem, but changes in market have reduced the risk-flagged for industry</td>
</tr>
<tr>
<td>68</td>
<td>Subsidies by other countries hindering market access affecting profitability</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>No-one qualified to answer this</td>
</tr>
<tr>
<td>69</td>
<td>Exchange rate affects profitability</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>No-one qualified to answer this</td>
</tr>
<tr>
<td>70</td>
<td>Fuel price impacts on profitability</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>No-one qualified to answer this</td>
</tr>
<tr>
<td>71</td>
<td>Collection of pueruli for aquaculture may affect recruitment</td>
<td>2</td>
<td>3</td>
<td>6</td>
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</tr>
</tbody>
</table>
Ecological Risk Assessment (ERA) for the South African Small Pelagic Fishery

Compiled by D.C. Nel

Deon Nel, WWF Sanlam Marine Programme, WWF South Africa, Private Bag X2,
Die Boord, 7613, South Africa
Email: dnel@wwf.org.za

The ERA workshop for the South African small pelagic fishery took place in Cape Town, South Africa, between the 30th of May and 3rd of June, 2005. The workshop was hosted by Marine and Coastal Management (MCM), a branch of the Department of Environmental Affairs and Tourism, and facilitated by Dr. Deon Nel of WWF-South Africa and Dr Kevern Cochrane of the FAO. After wide distribution of invitations, the workshop was attended by a total of 17 participants. Most attendees were from MCM (10), with fair representation from industry and industry bodies (4), two scientists and one NGO representation. This allowed for very healthy debate. However, it was generally felt that the workshop could have benefited from having more social and economic skills and knowledge available, as well as better representation from NGO’s.

Please see Annex 1 for a complete list of attendees.

1. **A brief description of the South African Small Pelagic Fishery**

The small pelagic fishery dates back to the late 1940’s when a fleet of privately owned purse seine vessels began targeting sardine and horse mackerel. In 1953 an annual maximum catch limit of 270 000 tons was set but was never enforced. As a result, catches regularly exceeded this figure. By 1961, the maximum limit was repealed. In 1962, more than 410 000 tons of sardine were landed, but by 1966, the catch had dropped to 100 000 tons. The fleet then started targeting anchovy, using nets with a smaller mesh size. In 1987 anchovy catches peaked at 600 000 tons, but catches declined thereafter and in 1996 only 40 000 tons of anchovy were landed. Anchovy and sardine catches have subsequently increased, with landings of both species averaging around 250 000 tons each over the past five years.

The fishery is currently managed in terms of an Operational Management Procedure (OMP) that sets annual Total Allowable Catches (TAC) for anchovy and sardine. In terms of catch volumes, the small pelagic fishery remains the largest in South Africa. It is the second most important in terms of value. This fishery’s management procedure is the most complex of the commercial fisheries. Two species are the main targets, namely sardine *Sardinops sagax* and anchovy *Engraulus encrasicolus*, with associated bycatch species being red-eye round herring *Etrumeus whiteheadii* and Cape horse-mackerel *Trachurus trachurus capensis*. Sardines are canned for human consumption while anchovy and most of the bycatch species are reduced to fishmeal, fish oil and fish paste. Small pelagic targeting occurs inshore, primarily along the Western Cape’s west and south coasts (anchovy and sardine) and the Eastern Cape coast (sardine). The pelagic fleet consists of just over 100 wooden, GRP and steel hulled purse-seine vessels, ranging in length from 15 metres to 30 metres. The industry employs approximately 7 800 people. Of these, 5 300 are employed on a permanent basis and 2 500 on a seasonal basis. The average annual income of sea-going workers is R94 000 - the highest in the fishing industry. Ninety-five percent of workers in this fishery are historically disadvantaged people. The value of fish landed in 2005 was worth approximately R800 million per annum. Most of the catch is processed in 8 fishmeal plants, 6 canning factories and more than 40 bait packing facilities.

* Adapted from the POLICY FOR THE ALLOCATION AND MANAGEMENT OF COMMERCIAL FISHING RIGHTS IN THE SMALL PELAGIC (ANCHOVY AND SARDINE PURSE SEINE) FISHERY: 2005

2. **Results of the Workshop**

**General overview of the ERA process**

**Identification of issues**

A total of 91 issues were identified for this fishery by the workshop participants. These issues are listed and described in full in Annex 2. Most issues (48%) fell within the ‘Ecological Wellbeing’ component (Figure 1). This is understandable given the unpredictable and fluctuating nature of the stocks as well as the pivotal position of the target species in our offshore ecosystems. ‘Governance’ issues were also well represented (21%). Surprisingly ‘Human Wellbeing’ issues were less well represented, given that this fishery is the highest employer.
Ecological Risk Assessment (ERA) for the South African Small Pelagic Fishery

Figure 1. Percentages of issues that were identified within each ERA component and category.

Prioritization of issues

The prioritization process resulted in a fairly even spread of issues within each of the risk categories (Figure 2). Fifty (62%) of the 91 issues were deemed to be of ‘Moderate’ risk or higher. Only 23 (25%) issues were deemed to be of ‘Extreme’ or ‘High’ risk.

Figure 2. Percentages of issues per risk category
When considering the spread of risk categories within each of the ERA components (Figure 3) we see that under the ‘Ecological Wellbeing’, most issues were of ‘Moderate’ risk, with only five issues of ‘High’ risk (all under ‘Retained Species’) and one ‘Extreme’ risk issue (under ‘General Ecosystem’). As expected the ‘Community Wellbeing’ component had a high proportion of issues within the ‘Extreme’ risk. The ‘External Impacts’ component also had a very high proportion of ‘Extreme’ and ‘High’ risk issues, indicating that this fishery is vulnerable to influences beyond the control of fishery managers.

**Figure 3. Proportions of issues within given risk categories for each ERA component**

**Performance reports**

Of the 91 issues identified, 50 (55%) were rated as being of ‘Moderate’ risk or higher. On agreement from the workshop participants, performance reports were developed for all these issues excepting some of the issues from the ‘External Impacts’ component. These were deemed to be out of the control of the fisheries management.

**The major issues**

The issues with a risk rating of ‘Moderate’ or higher are shown in Table 1. The discussion in this section serves to highlight some of the main issues and themes under each of the main components, and should not be viewed as a fully comprehensive summary.
Ecological Wellbeing

Only one issue under this component scored an ‘Extreme’ risk rating. This was the “impacts of removal of forage fish on land-based top predators (e.g. seabirds)”, emphasizing the importance of these target species as food for top predators whose foraging options are restricted, while breeding on offshore islands. The impact of the removal of forage fish on other more mobile predators (e.g. cetaceans, and predatory fish) was also of concern, but somewhat less than for the land-based predators.

Issues of ‘High’ risk revolved mostly around perceived changes in distribution, size structure and growth rates of sardine, indicating the dynamic nature of this stock and the potential impacts of a long history of fishing these stocks. Linked to this was the issue of poor understanding of decadal-scale fluctuations in abundance for all primary species. Discarding of small sized sardines in the anchovy fishery was also considered to be of ‘High’ risk to the sustainability of the fishery.

Poor knowledge of the catch histories and the status of the horse mackerel stock were also deemed to be of ‘High’ risk to the fishery. Other issues that were deemed to be of ‘Moderate’ concern included the directed catch of certain linefish species.

Human Wellbeing

Most ‘Human Wellbeing’ issues for this fishery revolved around the lack of understanding and unpredictable nature of decadal-scale fluctuations of stock abundances in this fishery. This resulted in fluctuations in the profitability of the fishery and concomitant standard of living for fishers and highly dependent communities (such as St.Helena Bay, Gansbaai, Laaiplek and Lamberts Bay). Issues related to this central theme were all scored in the ‘Extreme’ risk rating.

Concern was also raised about the fact that there was surplus capacity in the fishery and that the increase in the numbers of rights holders has resulted in potentially sub-viable quotas. It was also noted that this fishery was the highest employer and as such supported many decentralized rural communities. A downturn in the fishery could have an effect at the regional level in these rural areas.

The main ‘Governance’ issues revolved around the lack of a functional Resource Management Working Group (RMWG) and that there was no statutory requirement for participatory decision making. This was compounded by poor communication with stakeholders and poor representation of stakeholders on the RMWG and the Scientific Working Group (SWG).
The lack of resources (including staffing) for resource management and research was considered to be of ‘High’ risk to the fishery. The potential use of input (effort) controls was considered to be of ‘Moderate’ risk.

**External Impacts**

Once again the uncertainty about future trends in the stock abundances due to environmental influences was raised as an ‘Extreme’ risk. Other external impacts include exchange rates, fuel prices and climate change. Social impacts include AIDS and drug and alcohol abuse. Economic influences include market fluctuations and competition with soya.

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**Table 1. List of issues that scored a ‘Moderate’ risk rating or higher.**

*Note that the issue number cross-links to the issue numbering in Table 2 and Annex 2.*

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Sardine: changes in distribution of sardine - eastward shift and absence on the west coast</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>5</td>
<td>Sardine: size structure of commercial catches is skewed towards smaller fish</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>6</td>
<td>Sardine: growth rate, gonad size and condition factor have all declined in recent years – suggest changes in productivity</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>8</td>
<td>Sardine: discard of small sardine in the anchovy-directed fishery - not quantified</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>22</td>
<td>Horse mackerel: insufficient knowledge, poor record of catches and poor stock assessment due to life history</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>1</td>
<td>All primary species: lack of understanding about decadal-scale fluctuations in abundance for all species</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>2</td>
<td>All primary species: the fishery has caused genetic changes in the distribution of the fish</td>
<td>3</td>
<td>4</td>
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<tr>
<td>7</td>
<td>Sardine: Discard of small sardine in the sardine-directed fishery (if not canning size) - not quantified</td>
<td>2</td>
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<td>M</td>
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<tr>
<td>10</td>
<td>Sardine: Potential for disease mortality</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>12</td>
<td>Sardine: life-history strategy is not well understood</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
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<tr>
<td>14</td>
<td>Anchovy: some signs of distributional shifts in spawning patterns from the western Agulhas Bank to the central and eastern bank</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
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<tr>
<td>15</td>
<td>Anchovy: signs of reduced productivity – as evidenced by reduced fat content</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
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<tr>
<td>19</td>
<td>Redeye: life-history strategy is not well understood</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
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<tr>
<td>24</td>
<td>Linfish: illegal and directed catches (yellowtail, white steenbras, kob)</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>M</td>
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<tr>
<td>11</td>
<td>Sardine: possibility of separate spawning stocks</td>
<td>2</td>
<td>4</td>
<td>8</td>
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<tr>
<td>16</td>
<td>Redeye: industry may expand to catching redeye as the resource has been identified as underutilized</td>
<td>2</td>
<td>4</td>
<td>8</td>
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<tr>
<td>ID</td>
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<tr>
<td>17</td>
<td>Redeye: potential fishery may result in increased adult/large sardine by-catch</td>
<td>2</td>
<td>4</td>
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**General Ecosystem**

<table>
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<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>33</td>
<td>Impacts of removal of forage fish on species which are bound by land-based breeding colonies (e.g. seabirds)</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>32</td>
<td>Impacts on top predators through removal of fish by existing fishery (Bryde’s whale, penguins, gannets, swift terns, line fish incl. hake, cormorants)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
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<tr>
<td>35</td>
<td>Seals benefit from fishing activity – artificial food concentration (or dead dumped fish) has led to increased seal populations, resulting in an imbalance in the predator suite</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
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<tr>
<td>31</td>
<td>Impact on the ecosystem of removing increased amounts of redeye if this fishery is expanded</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
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<tr>
<td>34</td>
<td>Impacts on zooplankton &amp; phytoplankton abundance (wasp-waist effect)</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
<tr>
<td>38</td>
<td>Organic effluent discharged from factories in harbours &amp; bays may cause localised eutrophication &amp; de-oxygenation</td>
<td>4</td>
<td>2</td>
<td>8</td>
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</table>

**Human Wellbeing**

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**Community Wellbeing**

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<tbody>
<tr>
<td>45</td>
<td>Lack of understanding about decadal-scale fluctuations in abundance for all species</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>54</td>
<td>Higher salaries and lifestyles resulting from higher catches, will not be maintained in the future when catches decline - impacting factory workers in St Helena Bay, Gans Baai, Laaiplek and Lamberts Bay</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>55</td>
<td>Communities in St Helena Bay, Laaiplek &amp; Lamberts Bay are highly vulnerable to stock status</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>52</td>
<td>According to current estimates, there is surplus capacity in the fishery</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>58</td>
<td>Tourism surrounding seabirds which are dependent on small pelagic fish e.g. Lamberts Bay, Simon’s Town</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>46</td>
<td>Small rights holders are running at a loss or ceasing operation under current price &amp; exchange rate conditions, in spite of high TAC’s</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
</tr>
<tr>
<td>47</td>
<td>Concern that increase in numbers of rights holders has resulted in potentially sub-viable quotas</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
</tr>
</tbody>
</table>

**National Wellbeing**

<table>
<thead>
<tr>
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<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
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</thead>
<tbody>
<tr>
<td>60</td>
<td>A collapse of fishery would counteract national strategy of decentralization of employment opportunities</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
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</tbody>
</table>

**Ability to Achieve**

<table>
<thead>
<tr>
<th>ID</th>
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**Governance**

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<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>72</td>
<td>The RMWG are not functional but are considered as sectoral replacements for the CAF</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>73</td>
<td>There is no statutory requirement or structure for participatory decision making (including co-management)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>78</td>
<td>Costs associated with complying with HACCP</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>63</td>
<td>Legal disputes associated with allocating procedure may result in temporary closure of the fishery</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>H</td>
</tr>
<tr>
<td>70</td>
<td>Lack of resources (and inappropriate allocation within MCM) for resource management and research (staffing issues)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>65</td>
<td>There is evidence of illegal dumping (compliance issue)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>79</td>
<td>Poor communication between MCM and NGO’s and civil society</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>80</td>
<td>Poor representation of stakeholders on RMWG and SWG</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>66</td>
<td>Consideration given to using effort controls as opposed to current output controls</td>
<td>5</td>
<td>2</td>
<td>10</td>
<td>M</td>
</tr>
<tr>
<td>69</td>
<td>Difficulties in accessing VMS data (within MCM)</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
</tbody>
</table>
Ecological Risk Assessment (ERA) for the South African Small Pelagic Fishery

<table>
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<tr>
<th>ID</th>
<th>ISSUE</th>
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<th>RISK*</th>
<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>81</td>
<td>Uncertainty about future trends in abundance (driven by environmental fluctuation) creates problems for industry planning</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>88</td>
<td>Impact of exchange rate on fishery viability</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>89</td>
<td>Impact of fuel price on fishery viability</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>82</td>
<td>Effects of climate change on resource abundance and distribution are inadequately understood</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>85</td>
<td>Impact of AIDS on fishery workforce</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>90</td>
<td>Global market fluctuations affect fishery viability</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>91</td>
<td>Soya is competing with fishmeal</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>86</td>
<td>Impact of drugs on fishery workforce</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>87</td>
<td>Impact of alcohol on fishery workforce</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
</tbody>
</table>

Performance Reports

The complete performance reports can be found in Table 2. The following section will distill some of the key data requirements and management responses to the issues outlined above within the three main ERA components. Please refer to the complete performance reports for a more overall understanding of these needs.

Ecological Wellbeing

In order to make informed management decisions, more and ongoing data on the foraging habits and dietary requirements of top predators that depend on these target species are needed. This includes seabirds, seals, cetaceans, as well commercially important stocks such as snoek and hake.

One of the main themes running through several issues was the need to increase observer coverage as well as information collected by observers. This would assist in both collecting more scientific data, but also in assessing compliance with regulations such as bycatch, discarding etc.

The participants also raised the issue that data on a number of life-history traits are required for the better management of the target species. These are fairly specific and best dealt with by reading the performance reports. Improved and expanded surveys to better understand the life histories of the target species were also listed.

The needs of top predators that are dependent on these target forage fish should be incorporated in management of this fishery. Specifically these should be incorporated in the setting of TAC’s as well as the spatial management of the fishery. Spatially explicit management and potential closed areas is especially pertinent to the land-based predators that are limited in their foraging range while breeding.
Ongoing and renewed work towards being able to make long-term catch ‘projections’ should also be at the core of management of this fishery. This will not only assist in countering ‘Ecological Wellbeing’ risks, but also many arising from the ‘Human Wellbeing’ and ‘Governance’ components of the ERA.

Increased coverage (and presumably mandate) of fisheries observers was listed both under data requirements as well as a management response to several issues. These included the dumping of juvenile sardines in both the sardine and anchovy directed fisheries and the bycatch of several species.

**Human Wellbeing**

Emphasis was placed on the great need to collect, collate and analyse a variety of social and economic data. These include employment and income figures for fishers (specifically small rights holders) as well as dependent communities and the eco-tourism industry.

The need was raised for a precise assessment of the optimal Standard Vessel Units (SVU) and processing capacity to determine the level of overcapacity.

It was recognised that awareness and capacity need to be created, especially amongst small rights holders, to accommodate the need for proper financial planning that will enable rights holders to survive fluctuations in stock abundances. This was seen as especially necessary at the time, when catches were currently at a high (i.e. it is unlikely that the corresponding level of income is sustainable). There was also a need to support and improve business skills of small rights holders. Diversification of income in dependent communities to reduce dependence on highly dynamic and fluctuating stocks was recommended under several issues. Rights should also be prioritized in favour of fisheries operating from dependent communities or towns.

The effect of “technological creep” should be incorporated in fleet limitation programmes. Independent surveying of vessels was also suggested to counteract price inflation caused by the capacity limitation programme.

**Governance**

Due to time constraints not all the Performance Reports for this section were completed during the workshop and will need to be completed at a later date.

A thorough analysis of stakeholders needs is to be undertaken in order to implement an EAF in this fishery.

The need to establish an effectively functioning and representative Resource Management Working Group (RMWG) was recommended in response to several issues.
### Table 2. Summary of Performance Reports developed for issues scoring a risk rating of 'Moderate' or higher.

*Note that the issue number cross-links to the issue numbering in Table 1 and Annex 2.*

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><strong>Ecological Wellbeing</strong></td>
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</tr>
<tr>
<td>EW1</td>
<td>Understand decadal-scale fluctuations in abundance of small pelagic fish</td>
<td>1 Future</td>
<td>• Long-term catch &quot;projections&quot;</td>
<td>• All data contributing to this understanding</td>
<td>• Mid-term (5 years) projections of abundance regimes of small pelagic fish</td>
<td>• Correct forecasting of abundance regimes</td>
</tr>
<tr>
<td>EW2</td>
<td>Minimise spatially disproportionate fishing on sardine stock</td>
<td>4 Future</td>
<td>• Spatially explicit management</td>
<td>• Spatial biomass estimates (every November)</td>
<td>• Biomass distribution</td>
<td>• &gt;50% of stock (biomass) west of Cape Agulhas.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Length frequencies from fisheries-independent surveys as well as commercial catches</td>
<td>• Size distribution</td>
<td>• At least 20% of fish larger than 18cm west of Cape Agulhas.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• Genetic data</td>
<td>• Catch distribution (Note: if management moves to spatially explicit measures, then this will become a management response, rather than an indicator)</td>
<td>• Indicator measuring genetic component</td>
<td></td>
</tr>
<tr>
<td>EW3</td>
<td>Increase mean length of sardine catch</td>
<td>5 Current</td>
<td>• Incentive to minimise catch of small sardine (flow chart determines whether or not catch is classified as by-catch); yet high TACs provide incentive for catching small sardine for reduction</td>
<td>• Size and age structure of catch per pool area</td>
<td>• Mean length of catch, and spatial distribution thereof</td>
<td>• Mean length of catch not to drop below threshold size, e.g. tch 15 cm (?) (caudal length)</td>
</tr>
<tr>
<td>EW4</td>
<td>Optimize productivity of sardine and anchovy stocks</td>
<td>6 Future</td>
<td>• Consider &quot;productivity status/regimes&quot; when</td>
<td>• Condition factor</td>
<td>• Condition factor</td>
<td>• Comparison of current values of indicators with those during the period</td>
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<td></td>
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<td></td>
<td></td>
<td>• Standardized gonad mass</td>
<td>• Standardized gonad mass</td>
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<tr>
<td>ID</td>
<td>OPERATIONAL OBJECTIVE</td>
<td>ISSUES</td>
<td>MANAGEMENT RESPONSE</td>
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<td>INDICATORS</td>
<td>PERFORMANCE LIMITS</td>
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</tr>
<tr>
<td>EW5</td>
<td>Eliminate dumping of juvenile sardine in sardine-directed operations</td>
<td>7</td>
<td>Current</td>
<td>Growth rate</td>
<td>Growth rate</td>
<td>1991 – 1994 (??) (corresponding to a threshold period of sardine stock)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Length at age</td>
<td>Length at age</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Age at maturity</td>
<td>Age at maturity</td>
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<td></td>
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<td></td>
<td></td>
<td>These data should be obtained from both surveys and field stations</td>
<td>Instantaneous surplus production rate</td>
<td></td>
</tr>
<tr>
<td>EW6</td>
<td>Prevent disease-induced mortality of sardine</td>
<td>10</td>
<td>Current</td>
<td>Currently 7% observer coverage</td>
<td>Size composition of catches and catch rates (with and without observers) in sardine-directed fishery</td>
<td>No difference in size composition or catch rates between boats with and without observers</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>Ideally, require 50-100% observer coverage of fishery</td>
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<td></td>
<td></td>
<td></td>
<td>Mass mortality of sardine due to infection</td>
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<td></td>
<td></td>
<td></td>
<td>Future</td>
<td></td>
<td>No mass mortality events due to pathogenic infection</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>50-100% observer coverage</td>
<td></td>
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</tr>
<tr>
<td>EW7</td>
<td>Improve understanding of sardine life-history strategy</td>
<td>12</td>
<td>Current</td>
<td>Routine pathological testing of sardine.</td>
<td>Improved knowledge base regarding sardine life-history</td>
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<td></td>
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<td></td>
<td></td>
<td>Research on pathogen vector transmission</td>
<td></td>
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<td></td>
<td></td>
<td>Future</td>
<td>Extend pre-recruit and recruit surveys (south coast); assess suitability of timing of recruit surveys</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Surveys should cover entire distributional range, and be conducted more frequently</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EW8</td>
<td>Understand reasons for and implications of shift in anchovy spawner biomass distribution</td>
<td>14</td>
<td>Future</td>
<td>Spawner distribution (in Nov)</td>
<td>Improved understanding of reasons for and implications of shifts in anchovy spawner distribution</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
<td>Egg distribution (in Nov)</td>
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<td></td>
<td>Sampling line (high temporal frequency) in the region east of Cape Infanta</td>
<td></td>
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<tr>
<td>EW9</td>
<td>Consider implications of an</td>
<td>17</td>
<td>Current</td>
<td>Catch composition</td>
<td>Landings of adult</td>
<td></td>
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<td>Landings of adult</td>
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<tr>
<td>ID</td>
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</tr>
<tr>
<td>EW10</td>
<td>Improve understanding of red-eye life-history strategy</td>
<td>19 Current</td>
<td>Precautionary upper catch limit for species</td>
<td>Improve the accuracy of biomass estimates (T/S relationship)</td>
<td>Improved understanding</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>SARP line data</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>Interrogate acoustic survey data in more detail with regard to red-eye</td>
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<tr>
<td>EW11</td>
<td>Minimise bycatch of juvenile horse mackerel</td>
<td>22 Current</td>
<td>Permit conditions prevent targeting of juvenile horse mackerel</td>
<td>Juvenile horse mackerel by-catch data (commercial landings)</td>
<td></td>
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<td>Future</td>
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<tr>
<td>EW12</td>
<td>Eliminate directed (illegal) catches of line-fish species</td>
<td>24 Current</td>
<td>Permit regulations</td>
<td>Accurate catch compositions and data from landings</td>
<td></td>
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<td>Self-regulation?</td>
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<td>Future</td>
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<tr>
<td>EW13</td>
<td>Minimise bycatch of associated pelagic species and ensure sufficient forage fish remains in the system for alternative predators (e.g. snoek, tuna and hake)</td>
<td>31 Current</td>
<td>The PUCL is in place and has never been exceeded.</td>
<td>Acoustic survey encompassing full distribution of redeye (i.e. offshore and beyond shelf)</td>
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<td></td>
<td>Future</td>
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</table>
# Ecological Risk Assessment (ERA) for the South African Small Pelagic Fishery

## ID | Operational Objective | Issues | Management Response | Data Requirements | Indicators | Performance Limits |
|-----|----------------------|--------|---------------------|------------------|------------|-------------------|
| EW14 | To maintain viable population size and structure of top predators | 32 Future | • EAF needs to become a priority as reduction of forage fish could have severe impacts on the distribution and status of the snoek and hake stocks and fisheries which would further affect the cetaceans which feed on both pelagic fish and their top predators (hake and snoek) | • Need to assess the trophic role of redeye (forage fish for predators and predation of anchovy and sardine larvae by redeye, competition with hake, anchovy and juvenile horse mackerel for food) | • Basic life history data for hake (age & maturity) are lacking which has serious impacts on the validity of current stock assessment models | completed in order to complement the anchovy and sardine models  
• The contribution of redeye to snoek and hake diets, particularly when feeding offshore | |
| EW15 | To maintain viable population size and structure for penguins, cormorants, gannets and swift terns (listed in order of priority) | 33 Current | • In contravention of the MLRA, there has been no explicit management response about seabirds  
Future | • Identify target population levels for seabirds and establish extent of food escapement necessary to grow seabird populations to target levels | • Need to annually estimate population size, diet and breeding success (fledgling weight, number fledged per breeding pair etc.) | population size/trend and breeding success of each seabird species | Following the IUCN criteria for assessing conservation status, avoiding classification as threatened which includes vulnerable, endangered, critically endangered & extinct in the wild  
• A population might be classified as vulnerable if it drops by 50% within |
<table>
<thead>
<tr>
<th>ID</th>
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<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Understand the relationship among pelagic fish, zooplankton and phytoplankton</td>
<td>34</td>
<td>Current</td>
<td>Seasonal measures of fish abundance and condition, plankton concentrations and</td>
<td>Fish condition factor and growth rate, Trends in zooplankton and</td>
<td>Fish condition factor should be two or above and upwelling indices positive</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>upwelling indices</td>
<td>phytoplankton abundance, Upwelling indicators, Recruitment of pelagic fish</td>
<td>relative to the mean in order to have good recruitment and growth</td>
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<td>EW16</td>
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<tr>
<td></td>
<td>Maintain the historic balance of top predators</td>
<td>35</td>
<td>Current</td>
<td>Need to assess seal population size (pup numbers) and trends as well as</td>
<td>Similar trends in opportunistic and specialist predators, e.g. seals and</td>
<td>Sustainable mortality (from seals) and production (displacement by seals at</td>
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<tr>
<td></td>
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<td></td>
<td>those of other top predators: penguins, gannets and cormorants</td>
<td>penguins have the same trends in populations so that the relative numbers</td>
<td>land-based colonies) of seabirds</td>
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<td></td>
<td>are maintained</td>
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<tr>
<td>EW17</td>
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<tr>
<td></td>
<td>Minimise deleterious effects of organic loading in sheltered bays (Saldanha, St Helena &amp; Hout Bay)</td>
<td>38</td>
<td>Current</td>
<td>Weekly measurement of water quality at hot spots within each harbour/bay</td>
<td>Diminished oxygenation levels, altered benthos and mass mortalities</td>
<td></td>
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*Note: EW16, EW17, and EW18 indicate different ecological risk assessment (ERA) indicators.*
<table>
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<th>PERFORMANCE LIMITS</th>
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<tr>
<td></td>
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<td>how well/frequently this is monitored</td>
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<td>Forestry (DWAF)</td>
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<td>Future</td>
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<td></td>
<td></td>
<td></td>
<td>• Need to investigate alternative production methods which use less water and cause less pollution</td>
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<tr>
<td>HW1</td>
<td>Optimise job security and standard of living within the pelagic fishing industry despite large fluctuations/changes in TACs</td>
<td>45, 54</td>
<td>Future</td>
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<td></td>
<td></td>
<td></td>
<td>• Make the local communities less dependent on jobs and incomes from pelagic fisheries and processing (diversification)</td>
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<td></td>
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<td></td>
<td>• Awareness creation that the present level of jobs and income can not be sustained</td>
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<td></td>
<td></td>
<td>• Awareness around financial planning</td>
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<tr>
<td>HW2</td>
<td>Ensure as far as possible that small rights are economically viable</td>
<td>46,47</td>
<td>Current</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>• No support for small rights holders to up-grade business skills or provision on capital and allocation of economically unviable quotas</td>
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<td></td>
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<td>• It has been mandatory for small right holders to make investment in the industry even beyond what their</td>
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<td>Financial reports from small right holders</td>
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<td></td>
<td>Profitability among small right holders</td>
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<td></td>
<td></td>
<td>100% of small right holders are economically viable</td>
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<tr>
<td>HW3</td>
<td>Balance national fishing (and processing) capacity to average resources availability</td>
<td>Current</td>
<td>Fleet capacity limitation programme (this is not taking technological creep into consideration)</td>
<td>Precise figures on fishing and processing capacity and assessment of optimal Standard Vessel Unit (SVU) of processing capacity and economic data of fleet and processing plant performance</td>
<td>SVU, industry economic performance figures</td>
<td>SVU in range 120-100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Future</td>
<td>Introduce fleet limitation programme that include increased efficiency due to technological creep</td>
<td>Improve awareness of the economic consequences of overcapacity in processing</td>
<td>Operational economic efficiency of processing plants (DANCED study on the fish meal plants)</td>
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<td></td>
<td>Provide support to small right holders in order to improve their business skills, ease their access to capital</td>
<td>Ensure that quota allocation is economically viable (even in troughs) and balance the requirement to investment accordingly</td>
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<tr>
<td>HW4</td>
<td>Optimise job security and standard living in communities</td>
<td>Future</td>
<td>Make the local communities</td>
<td>Employment and income figures (general)</td>
<td>Employment rates, average and income</td>
<td>Maintain past ten years average catches</td>
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</table>
|     | highly dependent on pelagic fishing communities (St. Helena Bay, Laaiplek, Lamberts Bay) | less dependent on jobs and incomes form pelagic fisheries and processing (diversification)  
  - Awareness creation that the present level of jobs and income can not be sustained  
  - Awareness about financial planning  
  - Stabilisation funds for crew members or factory workers  
  - Consider prioritizing communities’ access in future allocations of fishing rights | and fisheries specific)                                                                                                                                                                                                                                                                                                                                                       | level, changes in awareness level | • Lower limit 10% reduction in income and 10% increase in unemployment  
  • Need further investigation, and it might be impossible to distinguish general development from that caused by fishing  
  • The pelagic fisheries have been on a historical high level and can not maintain at this level in future |                                                                                                                                      |
| HW5 | Maintain or increase the potentials for eco-tourism based on small pelagic fish (e.g. seabird colonies, marine mammals and sport and recreational line fishing) | 58 Current  
  - No clear strategy for how to utilize the potential within eco-tourism and the implication of commercial activities  
  Future  
  - Social and economic evaluation of the value of 1 tons of small pelagics to tourism in relation to commercial fisheries.  
  - Include the potentials for eco-tourism in management of small pelagics | Employment and income figures (eco-tourism industry)                                                                                                                                                                                                                                                                     | Economic values of the resources and jobs created in the eco-tourism industry | minimum threshold levels of economic value and jobs created  
 maintained at present level maximum  
 increased by 20 % over the next 5-5 years |                                                                                                                                      |
| HW6 | Ensure employment rates and income generation outside of city centres                   | 60 Future  
  - Prioritize allocation of fishing rights to companies operating in fishing dependent communities  
  - Encourage economic diversification in fishing dependent communities | Employment figures | Employment rates in fishing communities  
 Demographic statistics | Employment rates in fishing dependent communities is maintained |                                                                                                                                      |
<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
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<tbody>
<tr>
<td>G1</td>
<td>Establishment of effectively functioning and representative Resource Management Working Group for small pelagic fishery</td>
<td>72, (73, 70, 80)</td>
<td>Current</td>
<td>Stakeholder analysis</td>
<td>Minutes of meetings;</td>
<td>Upper: RMWG is established by September 2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current</td>
<td>RMWG did exist but dissolved</td>
<td></td>
<td>Transparent and accountable record of decisions</td>
<td>Lower: RMWG is not established by March 2006</td>
</tr>
</tbody>
</table>
### Annex 1: List of participants

<table>
<thead>
<tr>
<th>NAME</th>
<th>INSTITUTION/AFFILIATION</th>
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</thead>
<tbody>
<tr>
<td>Awie Badenhorst</td>
<td>SA Pelagic Fish Industry Association</td>
</tr>
<tr>
<td>Azwianewi Makhado</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Carl van der Lingen</td>
<td>Marine and Coastal Management</td>
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<tr>
<td>Coleen Moloney</td>
<td>University of Cape Town</td>
</tr>
<tr>
<td>Deon Durholtz</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Gert Du Plessis</td>
<td>Fishing Industry</td>
</tr>
<tr>
<td>Jan van der Westhuizen</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Janet Coetzee</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Jesper Raakier Nielsen</td>
<td>Institute for Fisheries Management (Denmark)</td>
</tr>
<tr>
<td>JWH Du Plessis</td>
<td>SA Small Quota Holders Association</td>
</tr>
<tr>
<td>Larry Hutchings</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Lynne Shannon</td>
<td>Marine and Coastal Management</td>
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<tr>
<td>Mike Copeland</td>
<td>Oceana (Fishing Industry)</td>
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<tr>
<td>Rob Crawford</td>
<td>Marine and Coastal Management</td>
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<tr>
<td>Samantha Petersen</td>
<td>BirdLife South Africa, WWF South Africa</td>
</tr>
<tr>
<td>Tebello Mainoane</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Tracey Fairweather</td>
<td>Marine and Coastal Management</td>
</tr>
</tbody>
</table>
Annex 2: Complete list of all issues raised and their consequence, likelihood and risk ratings.

Note: Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
</tr>
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<tbody>
<tr>
<td></td>
<td><strong>Ecological Wellbeing</strong></td>
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<tr>
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<td><strong>Retained Species</strong></td>
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<tr>
<td>1</td>
<td>All primary species: lack of understanding for all main small pelagic species about decadal-scale fluctuations in abundance</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>All primary species: the fishery has caused genetic changes through selective fishing on part(s) of the geographic distribution of the fish</td>
<td>3</td>
<td>4</td>
<td>12</td>
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<tr>
<td>3</td>
<td>All primary species: concentration of fishing effort may have changed the distribution of fish (disturbance)</td>
<td>2</td>
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<tr>
<td>4</td>
<td>Sardine: changes in distribution of sardine – eastward shift and absence on the west coast</td>
<td>3</td>
<td>6</td>
<td>18</td>
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<tr>
<td>5</td>
<td>Sardine: size structure of commercial catches is skewed towards smaller fish – this appears to be caused by lack of availability to the industry and high TAC’s which encourage heavy fishing on smaller fish</td>
<td>3</td>
<td>6</td>
<td>18</td>
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<tr>
<td>6</td>
<td>Sardine: growth rate, gonad size and condition factor have all declined in recent years – suggest changes in productivity</td>
<td>3</td>
<td>6</td>
<td>18</td>
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<tr>
<td>7</td>
<td>Sardine: discard of small sardine in the sardine-directed fishery (if not canning size) – not quantified</td>
<td>2</td>
<td>6</td>
<td>12</td>
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<tr>
<td>8</td>
<td>Sardine: discard of small sardine in the anchovy-directed fishery – not quantified</td>
<td>3</td>
<td>6</td>
<td>18</td>
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<tr>
<td>9</td>
<td>Sardine being used for fish meal rather than leaving fish to grow to larger more valuable fish is resulting suboptimal economic use</td>
<td>1</td>
<td>6</td>
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<tr>
<td>10</td>
<td>Sardine: potential for disease mortality</td>
<td>4</td>
<td>3</td>
<td>12</td>
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<td>11</td>
<td>Sardine: possibility of separate spawning stocks</td>
<td>2</td>
<td>4</td>
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<td>12</td>
<td>Sardine: life-history strategy of is not well understood</td>
<td>2</td>
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<td>12</td>
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<td>13</td>
<td>Anchovy: discarded by sardine-directed operations</td>
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<td>14</td>
<td>Anchovy: some signs of distributional shifts in spawning patterns from the western Agulhas Bank to the central and eastern bank</td>
<td>3</td>
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<td>15</td>
<td>Anchovy: signs of reduced productivity – as evidenced by reduced fat content</td>
<td>3</td>
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<td>16</td>
<td>Redeye: industry may expand to catching redeye as the resource has been identified as an underutilized</td>
<td>2</td>
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<td>17</td>
<td>Redeye: potential fishery may result in increased adult/large sardine bycatch</td>
<td>2</td>
<td>4</td>
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<td>Redeye: lack of confidence in abundance estimates as current survey design does not incorporate full range of distribution</td>
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<td>19</td>
<td>Redeye: life-history strategy is not well understood</td>
<td>2</td>
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<td>20</td>
<td>Lantern fish &amp; Light fish: Insufficient estimates of abundance and distribution</td>
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<td>21</td>
<td>Horse mackerel: impact of high mortality (catching and dumping) of juveniles on midwater and bottom trawl fisheries</td>
<td>1</td>
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<td>22</td>
<td>Horse mackerel: insufficient knowledge, poor record of catches and poor stock assessment due to life history</td>
<td>3</td>
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<td>Chub mackerel: stocks abundance fluctuates – currently low, possibly correlated with sardine abundance</td>
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<td>Linetfish: illegal and directed catches (yellowtail, white steenbras, kob)</td>
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<td>25</td>
<td>Incidental bycatch of snoek, gurnard, geelbek and other linetfish – particularly with deeper nets in shallower-water</td>
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<td>Bycatch of chokka squid</td>
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<td><strong>Non-retained Species</strong></td>
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<td>Incidental bycatch of cetaceans</td>
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<td>Bycatch of Jellyfish</td>
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<td>Bycatch of Gobies</td>
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<td>Incidental mortality of seals (protected species)</td>
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<td>Impact on the ecosystem of removing increased amounts of redeye if this fishery is expanded</td>
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<td>10</td>
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<tr>
<td>32</td>
<td>Impacts on top predators through removal of fish by existing fishery (Bryde’s whale, penguins, gannets, swift terns, line fish incl. hake, cormorants)</td>
<td>2</td>
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<tr>
<td>33</td>
<td>Impacts of removal of forage fish on species which are bound by land-based breeding colonies (e.g. seabirds)</td>
<td>4</td>
<td>6</td>
<td>24</td>
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<td>34</td>
<td>Impacts on zooplankton &amp; phytoplankton abundance (wasp-waist effect)</td>
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<td>4</td>
<td>8</td>
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<tr>
<td>35</td>
<td>Seals benefit from fishing activity – artificial food concentration (or dead dumped fish) has resulted in increased seal populations resulting an imbalance in the predator suite</td>
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<tr>
<td>36</td>
<td>Discarding/dumping may cause localized anoxic effects</td>
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<tr>
<td>37</td>
<td>Seabirds possibly benefit from discarded dead fish while they float on the surface</td>
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<tr>
<td>38</td>
<td>Organic effluent discharged from factories in harbours &amp; bays may cause localized eutrophication &amp; de-oxygenation</td>
<td>4</td>
<td>2</td>
<td>8</td>
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<tr>
<td>39</td>
<td>Fishing activity might result in injection of nutrients into the water column (mainly from fish while in the net)</td>
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<td>40</td>
<td>Impact of fishmeal production on air quality</td>
<td>1</td>
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<td>41</td>
<td>Noise pollution from vessels and factories</td>
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<td>42</td>
<td>Occasional incidences of fish-oil spilled by processing factories may cause oiling of birds</td>
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<td>43</td>
<td>Vessels sheltering close to protected islands and breeding colonies may discard pieces of fishing gear, operational oil spills may occur etc.</td>
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**Human Wellbeing**

**Community Wellbeing**

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<th>LIKE</th>
<th>RISK</th>
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<tr>
<td>44</td>
<td>Concerns about the high proportion of landed sardine catch that is reduced to fish meal</td>
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<tr>
<td>45</td>
<td>Lack of understanding about decadal-scale fluctuations in abundance for all species – in timing and levels and interactions between species (regime shifts, species alternations)</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>46</td>
<td>Small rights holders are running at a loss or ceasing operation under current price &amp; exchange rate conditions, in spite of high TAC’s</td>
<td>2</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>47</td>
<td>Concern that increase in numbers of rights holders has resulted in potentially sub-viable quotas</td>
<td>2</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>48</td>
<td>Value-adding is sub-optimal</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>49</td>
<td>A number of west coast fishermen now find themselves based on the East coast as the fish have moved eastward (only sardine)</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>50</td>
<td>Safety at sea is a concern as it is a highly industrial fishery</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>51</td>
<td>During periods of high availability – factories tend to process their own catches ahead of those of smaller independent operators - could disadvantage small quota holders</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>52</td>
<td>Under current estimates their is surplus capacity in the fishery</td>
<td>4</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>53</td>
<td>Unhappiness about Namibian vessels being used to fish our quota (happened on temporary basis)</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>54</td>
<td>Higher salaries and lifestyles resulting from higher catches, will not be maintained in the future when catches decline including factory workers in St Helena Bay, Gans Baai, Laaiplek and Lamberts Bay</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>55</td>
<td>More than 50% of the whole community in St Helena Bay, Laaiplek &amp; Lamberts Bay are dependent on the pelagic fishing industry – as such are highly vulnerable to stock status</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>56</td>
<td>Factory workers in Hout Bay, Mossel Bay and Port Elizabeth are dependent of healthy stocks</td>
<td>1</td>
<td>6</td>
<td>6</td>
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</tbody>
</table>
### Ecological Risk Assessment (ERA) for the South African Small Pelagic Fishery

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<tr>
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<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
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</thead>
<tbody>
<tr>
<td>57</td>
<td>Tourism around KZN sardine-run (lifestyle &amp; seasonal economic benefits for lower income groups) dependent on sardines</td>
<td>3</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>58</td>
<td>Tourism surrounding seabirds which are dependent on small pelagic fish e.g. Lamberts Bay, Simon’s Town</td>
<td>3</td>
<td>4</td>
<td>12</td>
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#### National Wellbeing

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
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<th>LIKE</th>
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<tbody>
<tr>
<td>59</td>
<td>The effect of a collapse of the pelagic fishery on the national economy</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>60</td>
<td>A collapse of fishery would counteract national strategy of decentralisation of employment opportunities</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>61</td>
<td>The sector is the biggest employer in the fishing industry (10,000)</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Ability to Achieve

##### Governance

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
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<tbody>
<tr>
<td>62</td>
<td>There are large delays in administration of permits</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>63</td>
<td>Legal disputes on the allocation procedure may result in temporary closure of the fishery</td>
<td>4</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>64</td>
<td>Need increased observer coverage of vessels at sea and scale monitors or inspectors at landing points</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>65</td>
<td>There is evidence of illegal dumping (compliance issue)</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>66</td>
<td>Quantity of landings has prompted the compliance directorate to investigate controlling the fishing effort because of problems of monitoring the landings (but this is contrary to the needs of the data requirements for assessment of the resource)</td>
<td>5</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>67</td>
<td>Need to quantify processing capabilities for assessing effort and capacity</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>68</td>
<td>Concern about target identification on acoustic surveys</td>
<td>4</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>69</td>
<td>Difficulties in accessing VMS data (within MCM)</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>70</td>
<td>Lack of resources (and inappropriate allocation within MCM) for resource management and research (staffing issues) – industry is concerned at the lack of skilled and experienced scientists in MCM</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>71</td>
<td>Potential conflict due to interference by large purse-seiners with line fishery when they come close inshore</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>72</td>
<td>The RMWG’s are not functional but are considered as sectoral replacements for the CAF</td>
<td>3</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>73</td>
<td>There is no statutory requirement or structure for participatory decision making (including co-management)</td>
<td>3</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>74</td>
<td>There is a lack of follow-up reporting on management decisions taken</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>75</td>
<td>Interaction between scientists and new rights holders (esp. smaller rights holders) and industrial bodies is perceived to be suboptimal</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>76</td>
<td>CapFish have been contracted to place observers on vessels – lack of communication with industry &amp; formal documents identifying observers</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>77</td>
<td>Self policing of by-catch and closed areas – problem companies &amp; skippers</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>78</td>
<td>Costs associated with complying with HACCP</td>
<td>3</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>79</td>
<td>Poor communication between MCM and NGO’s and civil society</td>
<td>2</td>
<td>6</td>
<td>12</td>
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</tbody>
</table>

##### External Impacts

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>80</td>
<td>Poorly representation of stakeholders on RMWG and SWG</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>81</td>
<td>Uncertainty about future trends in abundance (driven by environmental fluctuation) creates problems for industry planning</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>82</td>
<td>Effects of climate change on resource abundance and distribution are inadequately understood</td>
<td>3</td>
<td>6</td>
<td>18</td>
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<tr>
<td>83</td>
<td>Potential conflict with developing oil &amp; gas industry</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>84</td>
<td>Impact of seals on fishing operations (damage gear etc.)</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>85</td>
<td>Impact of AIDS on fishery workforce</td>
<td>3</td>
<td>6</td>
<td>18</td>
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</table>
## Ecological Risk Assessment (ERA) for the South African Small Pelagic Fishery

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<tr>
<td>86</td>
<td>Impact of drugs on fishery workforce</td>
<td>2</td>
<td>6</td>
<td>12</td>
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<tr>
<td>87</td>
<td>Impact of alcohol on fishery workforce</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>88</td>
<td>Impact of exchange rate on fishery viability</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>89</td>
<td>Impact of fuel price on fishery viability</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>90</td>
<td>Global market fluctuations affect fishery viability</td>
<td>3</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>91</td>
<td>Soya is competing with fishmeal</td>
<td>3</td>
<td>6</td>
<td>18</td>
</tr>
</tbody>
</table>
The ERA workshop for the South African squid fishery workshop took place in Cape Town, South Africa, on the 19th and 20th of February and 5th of March 2007. It was hosted by Marine and Coastal Management (MCM), a branch of the Department of Environmental Affairs and Tourism, and facilitated by Dr. Deon Nel of WWF-South Africa. After wide distribution of invitations, the workshop was attended by a total of 22 participants. Most attendees were from MCM (11), with fair representation from the fishing industry and industry bodies (4), including representation from the social and economic sector (1), NGO’s (4) and research institutions (2). This allowed for very healthy debate.

Please see Annex 1 for a complete list of attendees.
1. A brief description of the Squid Fishery*  

Chokka squid *Loligo vulgaris reynaudii* has been used as bait by linefishers for many years. In the 1960’s and 1970’s, the squid resource was heavily exploited by foreign fleets. During this period, squid were caught predominantly by trawlers from the Far East. Foreign activity was phased out in the late 1970’s and early 1980’s following South Africa’s declaration of an Exclusive Economic Zone (EEZ). However, squid and other cephalopods continued to be taken as bycatch by South African trawlers. This bycatch in the demersal fishery fluctuates between 200 tons and 600 tons annually.

A dedicated jig fishery for chokka was initiated in 1984. The jigs are operated by handlines, making this a particularly labour-intensive fishery. The jig fishery registered its highest catch of approximately 12 000 tons in 2003/2004. Average catches in the 1990’s amounted to between 6 000 and 6 500 tons per annum. The abundance of chokka squid fluctuates substantially. The effects of fluctuations in predation, prey availability and the physical environment are more acutely felt by squid because their short life span (approximately 2 years) offers little inter-annual continuity. Presently, chokka squid abundance is at near-record levels, but experience suggests that substantial declines can be expected.

Squid is frozen at sea, usually in 10 kilogram blocks. It is found between Namibia in the west and the Transkei coast in the east. It spawns on the seabed, usually in inshore areas, but sometimes in deep water on the Agulhas Bank. It is generally landed at harbours between Plettenberg Bay and Port Alfred and exported whole to Europe. In 2002, when the South African Rand was at its lowest levels against the major currencies, the price of squid rose to almost R50 per kilogram. The average price of squid in 2004 was R30 per kilogram.

Between 1986 and 1988 a licensing system was introduced with a view to limiting the number of vessels participating in the fishery. The fishery is currently regulated in terms of a Total Allowable Effort (TAE). The squid fleet is divided into vessel categories and the maximum crew complement for the vessels in each category is fixed. Since 1988, the fishery has been closed once a year for four weeks in an attempt to counter the effects of "creeping effort". Increases in vessel efficiency and catch technology have led to increases in fishing efficiency. The Chokka Squid fishery provides employment for approximately 3 000 people, including land-based personnel. The landed catch is worth more than R180 million per year.

*Adapted from BCLME LMR/EAF/03/01 – Ecosystem Approach to Fishery Management: South Africa Chokka-squid TROM Review*
2. Results of the Workshop

General overview of the ERA process

Identification of issues

A total of 61 issues were identified for this fishery by the workshop participants. These issues are listed and described in full in Annex 2. Most issues (41%) fell within the ‘Ecological Wellbeing’ component (Figure 1). The majority of which pertained to ‘Retained Species’. This is understandable given the unpredictable and fluctuating nature of the stocks. Only 11% of issues related to the ‘General Ecosystem’ category and no issues relating to ‘Non-retained Species’ were identified. ‘Human Wellbeing’ issues represented 26% of all issues. This is not surprising given that this fishery provides high local employment predominantly in the Eastern Cape. Almost a quarter of the issues related to the governance of this fishery.

![Pie chart showing percentages of issues identified within each ERA component and category.]

Prioritization of issues

The prioritization process resulted in the majority of issues falling into one of two categories i.e. 36% in the ‘Moderate’ category and 44% in the ‘Extreme’ category (Figure 2). Fifty-two (85%) of the 61 issues were deemed to be of ‘Moderate’ risk or higher.
Ecological Risk Assessment (ERA) for the South African Squid Fishery

Figure 2. Percentages of issues per risk category

When considering the spread of risk categories within each of the ERA components (Figure 3) we see that the majority of the ‘Extreme’ issues were found in the ‘Governance’ category. The ‘Retained Species’ and ‘Community Wellbeing’ categories also has a large proportion of issues with risk rating that were greater than ‘Moderate’.

Figure 3. Proportions of issues within given risk categories for each ERA component
Performance reports

Of the 61 issues identified, 52 (85%) were rated as being of ‘Moderate’ risk or higher. On agreement from the workshop participants, performance reports were developed for all these issues excepting some of the issues from the ‘External Impacts’ component. These were deemed to be beyond control of the squid fisheries management.

The major issues

The issues with a risk rating of ‘Moderate’ or higher are shown in Table 1. The discussion in this section cannot cover each of the issues and so will merely highlight some of the main themes under each of the main components.

Ecological Wellbeing

The majority of issues in the ‘Retained Species’ category centred around two major themes. Firstly, the appropriateness of the current stock assessment models and reliability of input data, and secondly, the reliability and delays in collation of information being collected by industry. Several issues relating to the stock assessment model concerned the spatial structure of the stock and related fisheries information.

Other issues related to impacts on recruitment by disturbance to spawning concentrations by jigging and trawl impacts on eggs beds. ‘General Ecosystem’ issues included the impacts of lights on inshore ecosystems and trophic impacts of removing squid biomass.

Human Wellbeing

The majority of issues in this component concerned the seasonal nature of the fishery and job security for fishers. This was augmented by the lack of formal labour structures, difficult working conditions and other broader social issues (such as substance abuse). The role of this fishery in terms of employment in the region made these issues all the more important. The lack of information on the social and economic impacts of alternative management scenarios prohibited informed decision making. The fishing industry also felt that inflexible regulations regarding officer and crew qualifications were impeding the functioning and transformation of the fishery.

Governance

A significant proportion of high scoring issues related to data collection, collation and co-ordination. Other high scoring issues were unclear decision making, inadequate communication and co-management. The lack of a sector management plan was key to many of these issues. Inadequate funding for research and quayside monitors was identified as an impediment to proper management of this fishery. Other issues related to the lack of an independent means of verifying onboard compliance in this fishery.
**External Impacts**

Bycatch of squid, particularly in the demersal trawl fishery, is of concern. Other external impacts include exchange rates, fuel prices, climate change and competition for quayside space.

Table 1. List of issues that scored a ‘Moderate’ risk rating or higher.

*Note that the issue number cross-links to the issue numbering in Table 2 and Annex 2.*

* Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)
** Categories: E=Extreme, H=High, M=Moderate

<table>
<thead>
<tr>
<th>ID</th>
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<th>RISK*</th>
<th>CATEGORY**</th>
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<tbody>
<tr>
<td></td>
<td><strong>Ecological Wellbeing</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td><strong>Retained Species</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Reliability of catch effort database</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>15</td>
<td>Reliability of trends in the jig CPUE data</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>18</td>
<td>Appropriateness of assumptions regarding abundance indices that input into models</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>3</td>
<td>Impact on recruitment through disturbance of concentrations by jigging</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>13</td>
<td>Model Structure: incorporation of spatial disaggregation</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>16</td>
<td>Different jig CPUE trends in different areas not taken into account in current model</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>9</td>
<td>Delays in availability of recent data (industry &amp; survey data)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>E</td>
</tr>
<tr>
<td>10</td>
<td>Lack of direct methods of estimating abundance</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>E</td>
</tr>
<tr>
<td>1</td>
<td>Uncertainty regarding whether we are dealing with one stock or more</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>2</td>
<td>Spawning biomass depleted to levels where recruitment is impaired</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>6</td>
<td>Little known of the extent of offshore spawning</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>7</td>
<td>Environmental impacts on recruitment not fully quantified</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>14</td>
<td>Model Structure: more detailed representation of biological processes</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>5</td>
<td>Damage to egg beds by trawl gear</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
</tr>
<tr>
<td>17</td>
<td>Trawl CPUE: whether to include amongst model inputs</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
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<tr>
<td></td>
<td><strong>General Ecosystem</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Effect of lights on other inshore sp and ecosystems</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>19</td>
<td>Trophic impact on predator populations: seals, linefish, cetaceans, sharks, seabirds</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>20</td>
<td>Trophic impacts on prey populations (anchovy, crustaceans and dragonets)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>21</td>
<td>Increased plastic pollution (including fishing gear)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td><strong>Human Wellbeing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Potential additional closed season risks continuity of employment</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>25</td>
<td>Social and economic impact of reduced TAE unclear</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>29</td>
<td>Low job security</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>33</td>
<td>Social and economic well being of coastal communities dependant on sustainability of fishery (second largest income and employment generator)</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>34</td>
<td>High substance abuse amongst some fishers</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
</tbody>
</table>
### Ecological Risk Assessment (ERA) for the South African Squid Fishery

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<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Shortage of officers (due to high qualifications, language barriers)</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>27</td>
<td>Lack of formal labour structure (including lack of negotiating power)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>30</td>
<td>Conflict between different legislative frameworks and also with operational realities of the fishery</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>31</td>
<td>Poor working conditions for crew: lights, long hours</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>26</td>
<td>Performance-based pay leads to periods of low income</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
</tr>
<tr>
<td>28</td>
<td>Perception by some of poor transformation in this fishery</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
<tr>
<td>32</td>
<td>Safety at sea: skippers &amp; crew taking responsibility</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>M</td>
</tr>
</tbody>
</table>

**National Wellbeing**

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>The more effort increases the greater the chance that catch rates drop below economically viable levels</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>37</td>
<td>Available (questionable) data suggests overcapacity</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
</tbody>
</table>

**Ability to Achieve**

**Governance**

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Quality of data recorded by skippers is poor</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>41</td>
<td>Poor data management between industry &amp; MCM</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>42</td>
<td>Adequacy of research funding</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>43</td>
<td>Inability to access VMS data for research &amp; management purposes</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>45</td>
<td>Lack of coordination between SABS and MCM regarding export data</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>46</td>
<td>Lack of communication within different departments of MCM</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>47</td>
<td>Resource management has not followed the advice of the Squid SWG under the current decision-making set-up</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>48</td>
<td>Unclear channels with regard to management decision making</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>49</td>
<td>Lack of the sector management plan</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>50</td>
<td>Lack of effective co-management</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>39</td>
<td>Lack of independent verification of compliance with permit conditions (not including data collection)</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>44</td>
<td>Lack of funding for quay-side monitors for independent verification</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>52</td>
<td>Lack of eco-labelling</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td>M</td>
</tr>
</tbody>
</table>

**External Impacts**

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>55</td>
<td>Fuel price and price variability as a result of exchange rates and market</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>54</td>
<td>Bycatch in other fisheries (demersal trawl, pelagic)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>56</td>
<td>Quay space (possibly as a result of competition with pelagic fishery and allocation process)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>58</td>
<td>Effects of large-scale climatic variability not well understood</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>57</td>
<td>Possible distribution change</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
<tr>
<td>59</td>
<td>Occurrence of seals and dolphins in association with fishing operations disrupts fishing activity</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
</tbody>
</table>

**Performance Reports**

The complete summary of the performance reports can be found in Table 2. The following section will distil some of the key operational objectives and management responses to the issues outlined above within the three main ERA components. Please refer to the complete performance reports for a more overall understanding of these needs.
Ecological Wellbeing

Several performance reports related to the refinement of the stock assessment model and adjustments to input data. Updating the catch and effort database and refinement of the CPUE data was identified as a critical issue. The group sought urgent action on these points and wished to see these remedied with the next few months. It was then envisaged that this procedure be used to quantify risks associated with different effort levels in time for provision of the next TAE advice (September 2007).

The group also recommended that studies be undertaken to understand minimum lighting requirements for optimal fishing, trophic impacts of squid removal of predators and prey, and environmental impacts on recruitment.

Human Wellbeing

Performance reports in this component advocated a study to make recommendations on improving working practices, and the development of appropriate standards for inshore officers and crew.

Governance

The group recommended a suite of management responses that could lead to better co-ordination of the catch and effort database. This is seen as critical to informed management of the squid fishery. An internal MCM meeting is needed to resolve these issues and an interim (and subsequently a permanent) data coordinator should be appointed.

Improved understanding of the social and economic effects of advice on effort control is also seen as critical to providing appropriate and informed management advice. It was recommended that a study be commissioned to evaluate the social and economic effects of different management advice from the Scientific Working Group (SWG).

Communications need to be improved to better facilitate co-management and transparent decision making. This needs to be initiated by a high level meeting between MCM and industry and then followed through within the relevant working groups and manifested in an agreed sector management plan.

The group also sought to improve governmental funding for the management of this fishery, especially to be able to conduct independent surveys. Finally the group committed to continue to monitor the need for eco-labelling and benefits it may provide to the fishery.
Table 2. Summary of Performance Reports developed for issues scoring a risk rating of ‘Moderate’ or higher.

Note that the issue number cross-links to the issue numbering in Table 1 and Annex 2.

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
</table>
| EW1 | Agreed modifications to historical catch and effort database | 8 | Future  
  - Squid WG appoints a task group to determine correction factors  
  - Develop guidelines for industry cooperation | ▪ Consensus reached by squid working group | ▪ Completed by end May 2007 |
| EW2 | Revised GLM standardisations of jig CPUE data | 15 | Future  
  - Input into updated models | ▪ EW1 will provide data for this | | ▪ Two months after completion of EW1 (end July 2007) |
| EW3 | Development and testing of working hypotheses of the relationship between CPUE and survey indices on the one hand and underlying squid abundance on the other | 18 | Future  
  - Results inform the modelling process | ▪ Could answer with the existing database | | ▪ Should run in parallel to EW1, completed by the end of July 2007 |
| EW4 | Quantify the risks (through updated assessment models) associated with alternative levels of effort (man-days) for the fishery | 1, 2, 3, 13, 14, 16, 17, (10, 36, 37, 43, 55 part of 36) | Future  
  - Model revisions to be taken forward by the SWG  
  - Consider the appropriateness of spatial disaggregating of management measures  
  - Re-appraisal of the appropriate effort level  
  - Highlight future research needs to support modelling efforts, post 2007 (e.g. Genetics, spawning areas, migration) | Model is updated | ▪ Completed by end of September 2007 |
| EW5 | Investigate minimum lighting power and focus for maintaining catch levels | 62 | Future  
  - Undertake empirical study as well capturing fisher | | | |
**Ecological Risk Assessment (ERA) for the South African Squid Fishery**

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>EW6</td>
<td>To ensure acceptable populations of dependent predators and prey species for adequate ecosystem functioning</td>
<td>19, 20, (12, 54)</td>
<td><strong>Current</strong>&lt;br&gt;• Study on shark reliance on squid (<em>Squalus</em> sp)&lt;br&gt;• Routine stomach content sampling of squid on demersal biomass surveys (needs to be quantified)&lt;br&gt;<strong>Future</strong>&lt;br&gt;• Trophic modelling around squid (understanding and assessing community structure)&lt;br&gt;• Consider using the two commercial vessels for research during closed season</td>
<td>• Detailed diet studies (from research vessels)</td>
<td>• Predator and prey population sizes and trends&lt;br&gt;• Diet composition of predators and squid</td>
<td></td>
</tr>
<tr>
<td>EW7</td>
<td>Understand and quantify environmental impacts on recruitment</td>
<td>7</td>
<td><strong>Current</strong>&lt;br&gt;• Ongoing research (Mike Roberts, Jean Glazer)&lt;br&gt;• Developing forecasting model&lt;br&gt;<strong>Future</strong>&lt;br&gt;• Secure funding to continue with this research</td>
<td></td>
<td>• Physical environmental parameters</td>
<td></td>
</tr>
</tbody>
</table>

### Human Wellbeing

| HW1 | Development of appropriate standards for officers and crew for inshore fisheries<sup>1</sup> | 32, 35, (Could help with 28) | **Future**<br>• SASMIA, with support from MCM, to motivate for appropriate standards with SAMSA |                                                                                  |                                                                                  |                                                                                  |
| HW2 | Improvement in working practices                                                        | 27, 31, 34 (30) | **Future**<br>• Social study to make recommendations on improvement of working practices |                                                                                  |                                                                                  |                                                                                  |

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<sup>1</sup> Note: This problem is wider than just squid fishery and is seen as a barrier to transformation by the industry

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<table>
<thead>
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<th>ID</th>
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<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Governance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| G1 | Coordinate catch and effort data collection | | Current | ▪ Yellow books in place by 1 April  
▪ Training of skippers in completion of data logs (George Kant)  
Future | ▪ Identify problems  
▪ Initiate internal MCM meeting to resolve issues  
▪ Include monitors and SABS co-ordination  
▪ Appoint a data coordinator to verify and debug data  
▪ In the interim the responsibility is assigned to a person  
▪ Feedback to industry on data quality  
▪ Industry to look to potentially assisting in process | ▪ Internal MCM meeting by end of March 2007  
▪ Data coordinator appointed by end of May 2007 |

| | | Future: 46, 47, 48, 49, 50 | | | |
| G2 | Improved communication for co-management and transparent decision making | 46, 47, 48, 49, 50 | Future | ▪ Special meeting between MCM senior management and industry  
▪ Follow up within relevant WG’s  
▪ Sector Management Plan completed | ▪ Meeting within two months (end April 2007)  
▪ Draft Sector Management Plan finalised by end April 2007  
▪ Final Sector Management Plan signed off by December 2007 |
<p>| G3 | Evaluate the socio-economic implications of different methods of controlling effort | 24, 25, 26, 29, 33 | Current | ▪ Effort management options have been developed at the Squid SWG | ▪ Project completed | ▪ Completed by end September 2007 to inform next TAE recommendation (30 October) |</p>
<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Recheck list of options from Squid SWG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Develop a project to evaluate socio-economic consequences of all different options previously tabled at the Squid SWG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Draft concept for project developed by Squid SWG – forwarded to senior management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Possibly outsourced project</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Project initiated by the industry and Senior Management WG (and/or the RMWG)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G4</td>
<td>Enhance funding to improve management</td>
<td>39, 42, 43, (10, 44, 6 -linked to survey)</td>
<td>Current</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Methodology for direct acoustic survey developed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acoustic survey should be done in conjunction with trawl survey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Provision of this (ERA) document to senior management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Develop rationale if deemed appropriate by senior management</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Investigate the operational feasibility of doing direct survey</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G5</td>
<td>Continue to monitor the need and possible benefits of eco-labelling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Annex 1: List of participants

<table>
<thead>
<tr>
<th>NAME</th>
<th>INSTITUTION/AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaniyah Omardien</td>
<td>WWF-South Africa</td>
</tr>
<tr>
<td>Deon Durholtz</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Doug Butterworth</td>
<td>University of Cape Town</td>
</tr>
<tr>
<td>E. Van Niekerk</td>
<td>South African Squid Management Industrial Association</td>
</tr>
<tr>
<td>G.P. Christy</td>
<td>South African Squid Management Industrial Association</td>
</tr>
<tr>
<td>Jacques Van Zyl</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Jean Glazer</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Jean Mwicigi</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>K. Booi</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>K. Korsbrekke</td>
<td>Institute of Marine Research</td>
</tr>
<tr>
<td>K. Morake</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Kerry Sink</td>
<td>South African National Biodiversity Institute and WWF-SA</td>
</tr>
<tr>
<td>Lynne Shannon</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>M. Mqoqi</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Mafa Hara</td>
<td>University of the Western Cape</td>
</tr>
<tr>
<td>Marek Lipinski</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Maria Honig</td>
<td>WWF-South Africa</td>
</tr>
<tr>
<td>Mike Bergh</td>
<td>Ocean and Land Resource Assessment Consultants</td>
</tr>
<tr>
<td>Richard Ball</td>
<td>South African Squid Management Industrial Association</td>
</tr>
<tr>
<td>Rob Tarr</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Samantha Petersen</td>
<td>WWF-South Africa</td>
</tr>
<tr>
<td>Tracy Fairweather</td>
<td>Marine and Coastal Management</td>
</tr>
</tbody>
</table>
Annex 2: Complete list of all issues raised and their consequence, likelihood and risk ratings.

Note: Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Retained Species</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Unsure whether there is one stock or more</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Potential split at Cape Agulhas</td>
</tr>
<tr>
<td>2</td>
<td>Spawning biomass becomes depleted to levels where recruitment is impaired</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Impact on recruitment through disturbance of concentrations by jigging</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>Peak recruitment occurs in the closed season. This could imply disturbance by fishing</td>
</tr>
<tr>
<td>4</td>
<td>Damage to egg beds by anchor gear</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Damage to egg beds by trawl gear</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>Anecdotal reports from demersal trawl fishery</td>
</tr>
<tr>
<td>6</td>
<td>Little known of the extent of offshore spawning</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>There is concern that refuge areas are now exploited</td>
</tr>
<tr>
<td>7</td>
<td>Environmental impacts on recruitment not fully quantified</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Reliability of the catch effort database</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Reliability of trends in the jig CPUE data</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Different trends in different areas. Does this mean different stocks? Historic changes in the season affects CPUE data</td>
</tr>
<tr>
<td>10</td>
<td>Lack of direct methods of estimating abundance</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Constant light affects hatching period of larvae</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Potential catch of linefish species</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Model structure does not incorporate spatial disaggregation</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Model Structure does not contain enough detailed representation of biological processes</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>General Ecosystem</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Trophic impact on predator populations: seals, linefish, cetaceans, sharks, seabirds</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
### Ecological Risk Assessment (ERA) for the South African Squid Fishery

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>Trophic impacts on prey populations (anchovy, crustaceans and dragonetts)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Linked to trophic impacts (generic fishing problem; addressed at higher level)</td>
</tr>
<tr>
<td>21</td>
<td>Increased plastic pollution (including fishing gear)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Linked to trophic impacts (generic fishing problem; addressed at higher level)</td>
</tr>
<tr>
<td>22</td>
<td>Operational discharge of oil from boats in sheltered bays</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Lights attract seabirds</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Lights attract insects</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>May have terrestrial impacts (i.e. important pollinating insects being drawn offshore?)</td>
</tr>
<tr>
<td>61</td>
<td>Negative effects of lights on other inshore ecosystems and species</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Especially nocturnal fish</td>
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</table>

### Human Wellbeing

#### Community Wellbeing

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
</tr>
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<tbody>
<tr>
<td>23</td>
<td>Impact of lights on residents along the coast</td>
<td>1</td>
<td>4</td>
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<tr>
<td>24</td>
<td>Potential additional closed season risks continuity of employment</td>
<td>4</td>
<td>5</td>
<td>20</td>
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<tr>
<td>25</td>
<td>Social and economic impact of reduced TAE unclear</td>
<td>4</td>
<td>5</td>
<td>20</td>
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<tr>
<td>26</td>
<td>Performance-based pay leads to periods of low income</td>
<td>2</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>27</td>
<td>Lack of formal labour structure and consequently lack of negotiating power</td>
<td>3</td>
<td>5</td>
<td>15</td>
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<tr>
<td>28</td>
<td>Perception by some of poor transformation in this fishery</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>29</td>
<td>Low job security in this fishery</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>30</td>
<td>Conflict between different labour legislative frameworks and operational realities of the fishery</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>31</td>
<td>Poor working conditions for crew: lights, long hours</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>32</td>
<td>Safety at sea: skippers &amp; crew taking responsibility</td>
<td>4</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>33</td>
<td>Socio-economic well being of coastal communities dependant on sustainability of fishery (second largest income and employment generator)</td>
<td>5</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>34</td>
<td>High substance abuse amongst some fishers</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>35</td>
<td>Shortage of officers due to high qualifications required by SAMSA and language barriers</td>
<td>4</td>
<td>5</td>
<td>20</td>
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#### National Wellbeing

<table>
<thead>
<tr>
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<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
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<tbody>
<tr>
<td>36</td>
<td>The more effort increases the greater the chance that catch rates drop below economically viable levels</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>37</td>
<td>Available (questionable) data suggests overcapacity</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>38</td>
<td>Future allocations may not consider the importance of Eastern Cape at a regional level</td>
<td>4</td>
<td>1</td>
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**Pg 96**
### Ecological Risk Assessment (ERA) for the South African Squid Fishery

<table>
<thead>
<tr>
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<th>CONS</th>
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<th>RISK</th>
<th>NOTES</th>
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<tbody>
<tr>
<td>39</td>
<td>Lack of independent verification of compliance with permit conditions (not including data collection)</td>
<td>4</td>
<td>5</td>
<td>20</td>
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<tr>
<td>40</td>
<td>Quality of data recorded by skippers is poor</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Timely submission of landings and catch records</td>
</tr>
<tr>
<td>41</td>
<td>Poor data management between industry &amp; MCM</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Especially hydro-acoustic &amp; age and growth data</td>
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<tr>
<td>42</td>
<td>Adequacy of research funding</td>
<td>4</td>
<td>6</td>
<td>24</td>
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<tr>
<td>43</td>
<td>Inability to access VMS data for research &amp; management purposes</td>
<td>4</td>
<td>6</td>
<td>24</td>
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<tr>
<td>44</td>
<td>Lack of funding for quay-side monitors for independent verification</td>
<td>4</td>
<td>5</td>
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<tr>
<td>45</td>
<td>Lack of coordination between SABS and MCM regarding export data</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Political imperatives override scientific advice on resource status in the total number of rights allocated</td>
</tr>
<tr>
<td>46</td>
<td>Lack of communication within different departments of MCM</td>
<td>4</td>
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<td>24</td>
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<tr>
<td>47</td>
<td>Resource management has not followed the advice of squid scientific working group under current decision making set-up</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Unclear channels with regard to management decision making</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>RMWG does not meet frequently. Short-lived spp needs rapid responses</td>
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<tr>
<td>49</td>
<td>Lack of the sector management plan</td>
<td>4</td>
<td>6</td>
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<td></td>
</tr>
<tr>
<td>50</td>
<td>Lack of effective co-management</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Monitors, Compliance with closed areas and crew allocations (more likely)</td>
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<tr>
<td>51</td>
<td>Meeting European Union quality standards</td>
<td>5</td>
<td>1</td>
<td>5</td>
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<tr>
<td>52</td>
<td>Lack of eco-labelling</td>
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<tr>
<td>53</td>
<td>Resource management has not followed the advice of squid scientific working group under current decision making set-up</td>
<td>4</td>
<td>6</td>
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<tr>
<td>54</td>
<td>Bycatch in other fisheries (demersal trawl, pelagic)</td>
<td>2</td>
<td>6</td>
<td>12</td>
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<tr>
<td>55</td>
<td>Fuel price and price variability as a result of exchange rates and market</td>
<td>4</td>
<td>6</td>
<td>24</td>
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<tr>
<td>56</td>
<td>Lack of quay space (possibly as a result of competition with pelagic fishery and allocation process)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Product not being channelled through big retail markets</td>
</tr>
<tr>
<td>57</td>
<td>Possible distributional change in squid stocks</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>May be a shift in abundance to the East</td>
</tr>
<tr>
<td>58</td>
<td>Effects of large-scale climatic variability not well understood</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Occurrence of seals and dolphins in association with fishing operations disrupts fishing activity</td>
<td>2</td>
<td>4</td>
<td>8</td>
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### External Impacts

<table>
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<th>LIKE</th>
<th>RISK</th>
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<tr>
<td>54</td>
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<td>2</td>
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</table>
The ERA workshop for the South African large pelagic fishery took place in Cape Town, South Africa, between the 23rd and 25th of April, 2007. The workshop was hosted by Marine and Coastal Management (MCM), a branch of the Department of Environmental Affairs and Tourism (DEAT), and facilitated by Dr. Deon Nel and Samantha Petersen of WWF-South Africa. After wide distribution of invitations, the workshop was attended by a total of 19 participants. Attendees were from MCM (6), industry or industry bodies (8), NGO’s (2) and research institutions (3). This allowed for very healthy debate.

Please see Annex 1 for a complete list of attendees.
1. A brief description of the Large Pelagic Fishery*

**Pelagic Longline Fishery**

The South African domestic pelagic longline fishery dates back to the early 1960’s. This fishery predominantly targeted Albacore *Thunnus alalunga*, Southern Bluefin *T. maccocyii* and Bigeye *T. obesus* tunas. Effort waned in the domestic fishery in the mid 1960’s, as interest shifted to more lucrative fisheries. Thereafter, pelagic fishing effort was largely conducted by Japanese and Taiwanese vessels as part of a bilateral agreement. Their fishing effort accounted for 96% of the c. 12 million hooks set annually within the South African Exclusive Economic Zone (EEZ) during 1998-2000. In 1995 a permit was issued to conduct a joint venture between a South African and Japanese vessel. This joint venture showed that tuna and swordfish *Xiphias gladius* could be exploited profitably in South African waters and consequently the directorate MCM issued 30 experimental permits in 1997. All foreign licences were revoked in 2002. This resulted in a smaller domestic fishery operating in South Africa’s EEZ. However, the domestic fishery was further developed in 2004 when 50 commercial fishing rights were made available for allocation. The reason for the expansion of the fishery is to improve South Africa’s catch history and thereby motivate for larger country allocations at Regional Fisheries Management Organisations (RFMOs), such as the International Convention for the Conservation of Atlantic Tunas (ICCAT) and Indian Ocean Tuna Commission (IOTC).

**Shark Longline Fishery**

Shark longline fisheries have been in existence since the 1990’s, operating seasonally. There are two distinct fisheries, a demersal longline fishery mainly targetting soupfin, *Galeorhinus galeus* and hound sharks, *Mustelus mustelus* in shallow coastal waters, and a pelagic longline fishery targetting mako, *Isurus oxyrinchus* and blue sharks, *Prionace glauca* offshore in the open ocean. Of the 23 shark longline rights allocated in 2002 only nine vessels actively targetted pelagic sharks in 2005. Given the global concern regarding the stock status of pelagic sharks, the DEAT adopted the ‘precautionary approach’ and has taken the decision to close the pelagic shark longline fishery with the view to incorporating these fishers in the tuna and swordfish longline fishing sectors. Pelagic sharks will in future be managed solely as a bycatch of the tuna and swordfish directed longline fishery.

**Tuna Pole Fishery**

Poling has been used to target juvenile albacore in near-shore waters of South Africa since the 1970’s. The fishery is seasonal, operating between September and May along the west coast of South Africa, when albacore is most abundant. It is the largest large pelagic fishery in South Africa, with 163 vessels registered between 2002-2005 and an annual catch averaging approximately 6 000 tonnes (including bycatches of yellowfin *Thunnus albacares* and bigeye tuna). The bulk of albacore, including those caught by longline vessels, are exported for canning, making the profit margins for this fishery quite low. Annual fluctuations in catch
tonnage appear to be strongly influenced by foreign exchange rates and the availability of albacore in inshore waters. More recently, a number of vessels have begun trolling for yellowfin tuna off Cape Point.

*Adapted from South Africa’s country report to ICCAT and the TROM review, Cooper & Ryan 2003, Ryan et al. 2002.

2. Results of the Workshop

General overview of the ERA process

Identification of issues

A total of 93 issues were identified for this fishery by the workshop participants. These issues are listed and described in full in Annex 2. Most (52%) issues fell within the ‘Ability to Achieve’ section, although 19% of these were relating to ‘External Impacts’ which are outside of the management of this fishery (Figure 1). ‘Ecological Wellbeing’ and ‘Human Wellbeing’ accounted for 38% and 11% respectively.

![Figure 1. Percentages of issues that were identified within each ERA component and category.](image-url)
Prioritization of issues

The prioritization process resulted in the majority of issues falling into the ‘Extreme’ category, 62% (Figure 2). ‘High’ and ‘Moderate’ rated issues accounted for 8% and 13% respectively.

When considering the spread of risk categories within each of the ERA components (Figure 3) we see that the all three categories were dominated by issues with an ‘Extreme’ risk rating. The highest number of ‘Extreme’ issues fell into the ‘Governance’ category.
Performance reports

Of the 93 issues identified, 77 (83%) were rated as being of ‘Moderate’ risk or higher. On agreement from the workshop participants, performance reports were developed for all these issues excepting some of the issues from the ‘external impacts’ component. These were deemed to be beyond the control of large pelagic fisheries management.

The major issues

The issues with a risk rating of ‘Moderate’ or higher are shown in Table 1. The discussion in this section will highlight some of the main themes under each of the main components.

Ecological Wellbeing

Poor knowledge and understanding of the spatial distribution and movements of a number of stocks including yellowfin tuna, pelagic sharks and swordfish, was rated as an “Extreme” risk. Coupled with this, were the transboundary nature of tuna stocks especially albacore (tuna pole) and pelagic sharks (longline). Furthermore, the impact of foreign Illegal, Unregulated
and Unreported (IUU) effort and illegal finning of sharks was also rated as an ‘Extreme’ issue.

Other ‘Extreme’ issues include the impact on vulnerable non-target species such as seabirds, sea turtles, pelagic rays and crocodile sharks by the longline fishery. The ecosystem impact of removing top predators from the ecosystem given the potential the top down role that these species play in structuring ecosystems also was listed as a top priority. The habituation of killer whales *Orcinus orca* and the depredation of catches as a result thereof, was also rated as an ‘Extreme’ risk.

**Human Wellbeing**

The lack of economically viable or multi-species/sectoral rights was considered to be the greatest threat to the human wellbeing component of this fishery. The highly seasonal nature of the tuna pole fishery was considered a moderate risk although this risk could in part be overcome if multi-species rights or sectoral rights were considered. A further ‘Extreme’ issue highlighted was the social and economic effect of the shark fishery closure.

Concern was also raised about the fact that there was a lack of scrutiny resulting in non *bona fide* fishers receiving rights. Another major inhibition to the rights allocation process was the pending the outcomes of "section 28" (MLRA, 1998) in the fishery. A lack of South Africanisation had occurred in the longline fishery (i.e. the re-flagging and skills transfer has not occurred as expected), and was also noted as a major human wellbeing concern.

Other issues identified included barriers to remaining competitive on international market include fuel costs, the South African Maritime Safety Authority’s (SAMSA) requirements for re-flagging, distance to market, European Union trade tariffs etc.

**Governance**

A high proportion of extreme risk rated issues threatened the effective governance of this fishery. Of highest risk to the efficient management of the large pelagics fishery was the limited management and level of competence of compliance officers. This was highlighted by a number of issues relating to poor compliance and limited skills, motivation, understanding and communication amongst compliance personnel and management. Further compliance related issues were also rated highest risk, particularly the daily reporting by pole fishers. Further, the illegal sale of recreational fish was considered as a major compliance-related issue.

The lack of credible and effective participation in all relevant RFMO meetings was raised as a particular concern. Equally as important was the South Africa’s non-membership to IOTC and CCSBT, as both issues pose a risk of losing access to regional and high seas quota allocations respectively. Unfilled positions at management and research levels for this sector at MCM plays a key role in many of the issues listed here.
Underperformance by the pole and longline fisheries targeting swordfish and albacore would have major consequences for RFMO quota allocations. This was identified as another issue that lay at the heart of many of the governance issues that were raised. Partially linked to this issue was the inadequacy of the vessels and poor expertise in the longline fishery.

Effective management plans were not in place for the protection of seabirds and sharks and there are currently no guidelines on the bycatch of sea turtles in the longline fishery. Similarly, effective management plans had not been developed for the individual sectors, IUU and the overall fishing capacity. This highlighted the need for an EAF, rather than the single species approach to fisheries management.

Also noted as a major inhibition to informed decision-making in the fishery, was the lack of inter-governmental agency communication between MCM, SAMSA, South African Bureau of Standards (SABS), and Department of Trade and Industry (DTI).

**External Impacts**

Major issues highlighted in this category include the impact of climate change and variability, changes in prey distribution and the impact of the removal of prey species such as small pelagics. Furthermore barriers to market access such as fuel costs, distance to markets, foreign currency exchange rates, increased competition from farmed product and the illegal sale of recreational fish on the local market. Competition with high seas fleets and IUU fishing were also highlighted in this section.

Table 1. List of issues that scored a 'Moderate' risk rating or higher.

*Note that the issue number cross-links to the issue numbering in Table 2 and Annex 2.*

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>FISHERY</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
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<tbody>
<tr>
<td>3</td>
<td>BigEye: Concern for viability of stocks</td>
<td>LL, limited pole</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
<tr>
<td>5</td>
<td>Albacore: Transboundary stock concern re: harmonise management</td>
<td>Pole</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
<tr>
<td>6</td>
<td>Blue &amp; Mako: Lack of stock assessment</td>
<td>LL</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
<tr>
<td>8</td>
<td>Sharks: Illegal practice - illegal trade of fins, under-reporting, discarding</td>
<td>LL</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
<tr>
<td>10</td>
<td>Transboundary impacts on sharks (Namibia and high seas)</td>
<td>LL</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
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<tr>
<td>12</td>
<td>Swordfish: Lack of understanding of distribution and migratory patterns</td>
<td>LL</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
<tr>
<td>1</td>
<td>YFT: Lack of research (source, distribution)</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
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</table>

* Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)
** Categories:  E=Extreme, H=High, M=Moderate
<table>
<thead>
<tr>
<th>ID</th>
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<th>RISK*</th>
<th>CATEGORY**</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>YFT: Lack of research (stock assessment)</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>11</td>
<td>Swordfish: Localised depletion</td>
<td>LL</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>17</td>
<td>Impact of foreign IUU effort in South African EEZ on all stocks and vulnerable species</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>E</td>
</tr>
<tr>
<td>13</td>
<td>Swordfish: The impact of capture of large females on stock viability</td>
<td>LL</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>16</td>
<td>Impact of under reporting of South African vessels on all stocks and vulnerable species</td>
<td>Pole, limited LL</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>21</td>
<td>Lack of understanding of non commercial prey species implications for stock viability and catchability</td>
<td>Both</td>
<td>3</td>
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<td>15</td>
<td>H</td>
</tr>
<tr>
<td>4</td>
<td>Yellowtail: Concern for perceived recent decline in catches</td>
<td>Pole, limited LL</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
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<tr>
<td>9</td>
<td>Impacts of fishing on potential nursery areas for sharks</td>
<td>LL</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
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<td>Snoek: Potential future impact of the large no. of pole licences on snoek populations resulting from seasonal variability in tuna stocks</td>
<td>Pole</td>
<td>2</td>
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<td>12</td>
<td>M</td>
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<tr>
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<td>Seabirds: Concern regarding the capture of vulnerable seabird species</td>
<td>LL</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
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<tr>
<td>26</td>
<td>Sea turtles: Concern regarding the viability of capture</td>
<td>LL</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>27</td>
<td>Pelagic rays: Sustainability of capture</td>
<td>LL</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>E</td>
</tr>
<tr>
<td>29</td>
<td>Impact of fishing on crocodile shark populations</td>
<td>LL</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>E</td>
</tr>
</tbody>
</table>

**Non-retained Species**

| 31  | Habituation of Killer whale, seals, sharks, pilot whales etc. resulting in depredation of catches | LL, limited pole | 4    | 6    | 24    | E          |
| 30  | Impact of the removal of top predators on ecosystem functioning i.e. sharks and tunas | Both             | 3    | 6    | 18    | E          |

**General Ecosystem**

| 37  | Lack of understanding of management decisions resulting in socio-economic knock on effects e.g. effect of shark fishery closure | Both             | 5    | 6    | 30    | E          |
| 40  | Social and economic impact of the closure of pelagic shark longline fishery | LL               | 5    | 6    | 30    | E          |
| 38  | The specialisation in the allocation process (as opposed to a multi-species or sectoral allocation process) has impacts on socio-economic viability, poaching and ecosystem impacts | Both             | 4    | 6    | 24    | E          |
| 41  | Large secondary industry built around large pelagic sector (e.g. Foreign vessels using SA's ports) implications for local management | Both             | 4    | 5    | 20    | E          |
| 39  | Lack of scrutiny resulted in non bona fida fishers receiving rights    | Pole             | 3    | 6    | 18    | E          |
| 43  | Uncertainty around rights allocation pending the outcome of "section 28" | LL               | 3    | 6    | 18    | E          |
| 42  | Lack of South Africanization (Re-flagging and skills transfer has not occurred as expected) | LL               | 3    | 5    | 15    | H          |
| 36  | Highly seasonal, unpredictable nature of fishery - implications for employment | Pole, limited LL | 2    | 6    | 12    | M          |

**Human Wellbeing**

**Community Wellbeing**

| 45  | Remain competitive on international markets (import tariffs (e.g. EU) fuel costs, SAMSAs requirements for re-flagging, distance to market etc) | Both             | 5    | 5    | 25    | E          |
| 44  | Sub-optimal market access (e.g. Asian market)                          | Both             | 2    | 6    | 12    | M          |
# Ecological Risk Assessment (ERA) for the South African Large Pelagic Fishery

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>FISHERY</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CAT.**</th>
</tr>
</thead>
<tbody>
<tr>
<td>49</td>
<td>Poor management of compliance officers (limited participation at RMWG, limited understanding of permit conditions etc)</td>
<td>Both</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
<tr>
<td>54</td>
<td>Lack of follow through from non-compliance</td>
<td>Both</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
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<tr>
<td>57</td>
<td>Head of compliance signing off on foreign fishing licenses</td>
<td>Both</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
<tr>
<td>58</td>
<td>Lack of research capacity</td>
<td>Both</td>
<td>5</td>
<td>6</td>
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<tr>
<td>72</td>
<td>Concern regarding unsuitable vessels operating in the tuna pole sector</td>
<td>Pole</td>
<td>5</td>
<td>6</td>
<td>30</td>
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<tr>
<td>75</td>
<td>Under performance - swordfish and albacore, consequence for RFMO quota allocations</td>
<td>Both</td>
<td>5</td>
<td>6</td>
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<tr>
<td>61</td>
<td>Non-membership to IOTC and CCSBT poses risk of losing access to high seas allocation</td>
<td>Both</td>
<td>5</td>
<td>5</td>
<td>25</td>
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<tr>
<td>46</td>
<td>Single- vs. Multi- sector approach in allocation</td>
<td>Both</td>
<td>4</td>
<td>6</td>
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<tr>
<td>52</td>
<td>Single species focused, need for a comprehensive ecosystem process approach</td>
<td>Both</td>
<td>4</td>
<td>6</td>
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<tr>
<td>55</td>
<td>Lack of appropriate skills, knowledge and motivation of compliance officers</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
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<tr>
<td>60</td>
<td>Daily reporting of catch and effort data is poor</td>
<td>Pole</td>
<td>4</td>
<td>6</td>
<td>24</td>
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<tr>
<td>62</td>
<td>Lack of credible and effective participation in all relevant RFMO meetings</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
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<tr>
<td>71</td>
<td>Lack of suitable vessels</td>
<td>LL</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>73</td>
<td>Limited expertise to target tuna effectively</td>
<td>LL</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>63</td>
<td>Lack of implementation of Port state obligations under RFMO resolutions</td>
<td>Both</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>64</td>
<td>Lack of FAO plans of action (e.g. seabirds, sharks, IUU, fishing capacity) &amp; sea turtle guidelines</td>
<td>Both</td>
<td>4</td>
<td>5</td>
<td>20</td>
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</tr>
<tr>
<td>47</td>
<td>Lack of co-ordinated sector management plan</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
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<tr>
<td>48</td>
<td>Lack of compliance - illegal sale of recreational fish</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
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</tr>
<tr>
<td>53</td>
<td>Lack of inter-agency cooperation (e.g. MCM, SAMSA, SABS, DTI)</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
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</tr>
<tr>
<td>56</td>
<td>Poor communication between industry and compliance staff</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
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</tr>
<tr>
<td>65</td>
<td>Industry participation at meetings is limited to a few</td>
<td>Both</td>
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<tr>
<td>67</td>
<td>Associations and meeting participation limited by costs/fees</td>
<td>Both</td>
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<tr>
<td>68</td>
<td>Lack of consolidation and cohesion within the sector (SATLA, fresh tuna export, SA tuna association, shark longline association)</td>
<td>Both</td>
<td>3</td>
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<tr>
<td>74</td>
<td>Permitting process - vessels licence, transport permits etc</td>
<td>Both</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>H</td>
</tr>
<tr>
<td>66</td>
<td>Lack of Eco-labelling e.g. MSC</td>
<td>Both</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>70</td>
<td>Lack of wider effective participation in co-management</td>
<td>Both</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>50</td>
<td>Disproportionate threat for non-compliance</td>
<td>Both</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
<tr>
<td>51</td>
<td>Lack of coherent bycatch management plan</td>
<td>LL, limited pole</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
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## External Impacts

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>FISHERY</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CAT.**</th>
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<tbody>
<tr>
<td>82</td>
<td>Competition from high seas fleets (longline and purse-seine)</td>
<td>Both</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
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<tr>
<td>85</td>
<td>Foreign currency exchange rates</td>
<td>Both</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
<tr>
<td>93</td>
<td>Bluefin tuna: Stock in crisis</td>
<td>LL</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>E</td>
</tr>
</tbody>
</table>
ID | ISSUE                                                                                   | FISHERY | CONS | LIKE | RISK* | CAT.** |
---|-----------------------------------------------------------------------------------------|---------|------|------|-------|--------|
76 | Climate change - possible changes in distribution and productivity in the system        | Both    | 5    | 5    | 25    | E      |
84 | The lack of adequate protection of aggregations spawning and juvenile fish              | Both    | 4    | 6    | 24    | E      |
86 | Fuel costs                                                                              | Both    | 4    | 6    | 24    | E      |
87 | Distance to market                                                                      | Both    | 4    | 6    | 24    | E      |
91 | Impact of IUU effort on all stocks and vulnerable species                               | Both    | 4    | 6    | 24    | E      |
77 | Climate variability - the effect of El Nino                                             | Both    | 3    | 6    | 18    | E      |
80 | Changes in prey distribution                                                             | Pole, limited LL | 3  | 6  | 18  | E     |
81 | Impact of recreational fishery driven by illegal activity                              | Both    | 3    | 6    | 18    | E      |
88 | Artificial trade barriers                                                               | Both    | 3    | 6    | 18    | E      |
79 | Dependence of Pole fishery targeting YFT feeding on hake offal                           | Pole    | 4    | 4    | 16    | H      |
92 | Impact of the removal of prey species such as small pelagics                             | Both    | 4    | 4    | 16    | H      |
78 | Unregulated snoek capture by trawl fishery (Tuna-pole)                                  | Pole    | 2    | 6    | 12    | M      |
83 | Effects of fish aggregating devices (FAD’s) on distribution and movement patterns       | Both    | 3    | 4    | 12    | M      |
89 | Increased competition in fresh fish market and from farmed product                      | Both    | 2    | 6    | 12    | M      |

**Performance Reports**

The complete performance report table can be found in Annex 3. The following section will distil some of the key data requirements and management responses to the issues outlined above within the three main ERA components. Please refer to the complete performance reports for a more overall understanding of these needs.

**Ecological Wellbeing**

In order to make informed management decisions, more and ongoing catch data on all commercial species are needed. Critically, the catch and effort database and timely submission of reports to RFMO’s needed to be made. A management action that was critically linked to this was the filling of a data manager and researcher positions at MCM. The group sought urgent action on these points and wished to see these remedied with the next few months.

Research on the migratory patterns and links with environmental conditions of the major retained species was highlighted as important for the effective management of this fishery. Tagging studies by a number of agencies and NGO’s are ongoing and are intended to be complete by 2009. Research efforts also need to focus on the killer whales behaviour, in order to reduce depredation of catches in the longline fishery.

There is a pressing need to establish and implement an effective and consolidated bycatch strategy of retained species, particularly of snoek, yellowtail and sharks. In order to achieve
this, a suit of management actions needs to take place, including stock status assessment, gear modification trials, the introduction of observer coverage in the pole fishery and observer specialisation in the longline fisheries. Presently and in the past, a lot has been done to reduce the mortality and capture of vulnerable species to sustainable levels, however these actions should continue. Participants felt that even with some regulations in place to reduce bycatch, non-compliance and the lack of awareness were threats to the efficient management of this fishery and needed to be resolved.

In order to better manage and ensure the sustainability of the local fishery (straddling stocks and bycatch species), harmonization of fisheries management objectives and procedures throughout the southern African region was deemed highly necessary, and should be achieved through the Benguela Commission. Furthermore, active participation at RFMO meetings was highlighted as a priority.

**Human Wellbeing**

Consolidation of fishing rights into economically viable rights will assist with many of the human wellbeing issues that were identified, particularly the issues revolving around the closure of the shark fishery and the restrictions on yellow tail bycatch in the pole fishery. The group sought urgent action on these points and wished to see these remedied with the next few months.

Ongoing efforts to increase market competitiveness would rely on reducing trade tariffs, rationalising SAMSA regulations, enhancing trade and industry marketing of the product and investigating eco-labelling.

**Governance**

The group recommended a suite of management responses that could reduce non-compliance. Improving the skills, capacity, level of awareness and involvement of the compliance staff was seen to be essential to improving compliance management. Sector-specific compliance forums would also help in this regard.

The need to fill the data manager and researcher positions and building research capacity in general at MCM and other institutions would aid in resolving many of the governance issues raised at the workshop. The timeous submission of reports and data, becoming members of IOTC and CCST and effective stock assessments (with the aid of real time data capture) would assist South Africa receiving competitive quota allocations by RFMO’s and ensure the viability of this fishery.

The adoption of a number of management plans on seabirds, sharks, IUU, fishing capacity, sectors and bycatch would allow for the effective management of this fishery.
Table 2. Summary of Performance Reports developed for issues scoring a risk rating of ‘moderate’ or higher.

Note that the issue number cross-links to the issue numbering in Table 1 and Annex 2.

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
<th>NOTES</th>
</tr>
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<tr>
<td><strong>Ecological Wellbeing</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
| EW1 | Stock assessment allows for effective management of retained species (tunas, swordfish and sharks) | 1,2,3,6,12,13,58 | Current | Quality data  
- Review blue book data sheets for the pole fishery | Timely submission of reports to RFMOs  
- Reliable stock assessments by RFMOs  
- Functional updated database (particularly for foreign vessels)  
- Data manager employed  
- Researcher posts filled  
- Timely submission of reports to RFMOs | Submission of country report to RFMO’s on an annual basis  
Positions filled by Jun-07  
Database updated by Jun-07 | *Links with EW2  
Maintain access database  
If post not filled within 6 months, then out-sourcing should be considered  
e.g. use of email or other electronic means  
Co-management could assist in resolving; Fisher patterns, gear changes, effect of price, exchange rates affect CPUE etc. |
| EW2 | Improved understanding of migratory patterns of major retained species and links with environmental conditions | 11,12, 13, (10) | Current | Tag reporting  
SWIOFP action plan  
Msc and hons degree complete  
Genetic marking | SWIOFP complete by 2009  
Post-grad studies complete by 2009 | Improved communication with ORI  
SWIOFP is a component of ASLME |
<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>EW3</td>
<td>Implementation of an effective bycatch strategy (retained and non-retained) especially snoek, yellowtail and sharks</td>
<td>4, 9, 15, 30, 51, 14, 20, 16, 22, 19, 18 (7, 10 - transboundary issues), 27 (pelagic rays), 29 (crocodile),</td>
<td><strong>Current</strong>&lt;br&gt;• Shark bycatch limit&lt;br&gt;• Ban on shark finning&lt;br&gt;• ICCAT provisional stock assessment - blue, mako, marlin&lt;br&gt;• Yellowtail bycatch limit - pole&lt;br&gt;<strong>Future</strong>&lt;br&gt;• Reassess permit conditions relating to yellow tail bycatch at SAMLMA&lt;br&gt;• Realistic comprehensive estimate of bycatch&lt;br&gt;• Gear modification trials&lt;br&gt;• Specialised observer programme&lt;br&gt;• Need for observers in pole fishery&lt;br&gt;• Investigate alternative economic incentives e.g. bycatch credits&lt;br&gt;• Improved reporting of shark catches</td>
<td>• Bycatch data</td>
<td>• Estimates of bycatch&lt;br&gt;• Consolidated bycatch management plan&lt;br&gt;• Stock status of bycatch species and precautionary catch limits&lt;br&gt;• Biological reference points</td>
<td>• WSSD targets</td>
<td>• Incentives and disincentives&lt;br&gt;• bycatch credits&lt;br&gt;• No assessment for snoek and yellowtail since 1990’s&lt;br&gt;• New research vessel could conduct gear trials</td>
</tr>
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</table>
### Operational Objective and Management Response

<table>
<thead>
<tr>
<th>ID</th>
<th>Operational Objective</th>
<th>Issues</th>
<th>Management Response</th>
<th>Data Requirements</th>
<th>Indicators</th>
<th>Performance Limits</th>
<th>Notes</th>
</tr>
</thead>
</table>
| EW4 | Understand trophic relationships supporting target species (and vice versa) | 21,30,52 | **Current**  
- Currently lacking any formal management consideration of trophic interactions involving large pelagic fish  
- Holistic management of fisheries on small pelagic fish (prey) and their large pelagic fish predators | Observer data  
- Diet analyses | Ecosystem model developed to encompass the large pelagic fish community in South African waters  
- Management strategy that takes into account fishing on different feeding guilds of large pelagic fish, and of effects of fishing prey versus predators | |
| EW5 | Harmonization of fisheries management objectives throughout the region to ensure the sustainability of the local fishery | 5 (albacore), 10 (sharks), 24 (seabirds), 26 (turtles), 27 (pelagic rays)) | **Current**  
- No access to the traditional fishing grounds on Tripp seamount | CPUE data  
- Length  
- Frequency  
- Bycatch data  
- Operational data  
- Environmental data | Stock assessment  
- Bycatch assessment  
- Regional Management plan  
- Participation in meetings | |
<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
<th>NOTES</th>
</tr>
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<tbody>
<tr>
<td>EW6</td>
<td>Reduce the mortality &amp; capture of vulnerable species to sustainable levels</td>
<td>24, 25 (seabirds), 26 (sea turtles), 7 (Porbeagle), 28 (sharks), 52</td>
<td>Current&lt;br&gt;- Seabird and turtle mitigation measures in permit conditions&lt;br&gt;- Reasonable assessment of impact on seabird, turtle and sharks by longline operations&lt;br&gt;- Stainless steel hooks and steel traces banned&lt;br&gt;- Awareness and capacity building&lt;br&gt;- Shark bycatch restriction&lt;br&gt;&lt;br&gt;FUTURE&lt;br&gt;- Further research spatial distribution&lt;br&gt;- Reduce non-compliance&lt;br&gt;- Create incentives for compliance&lt;br&gt;- Further integrated mitigation and gear modification trials e.g. circle hooks&lt;br&gt;- Co-management&lt;br&gt;- Continue awareness and capacity building&lt;br&gt;- Specialised observer</td>
<td>Bycatch data&lt;br&gt;- Gear modification trial on commercial and research vessels</td>
<td>Compliance level&lt;br&gt;- Gear modification implemented as required&lt;br&gt;- Awareness materials developed&lt;br&gt;- Assessments complete</td>
<td>- Annual review of impacts</td>
<td></td>
</tr>
<tr>
<td>EW7</td>
<td>Understand and mitigate habituation of marine mammals</td>
<td>31</td>
<td>Current&lt;br&gt;- Observer data&lt;br&gt;- Assessment of</td>
<td>Behavioural data</td>
<td>Improved understanding&lt;br&gt;- Assessment of mitigation</td>
<td>- Strobe being tested by toothfish fishery</td>
<td></td>
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<tr>
<td>ID</td>
<td>OPERATIONAL OBJECTIVE</td>
<td>ISSUES</td>
<td>MANAGEMENT RESPONSE</td>
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<td>▪ Behavioural study (including interviews with skippers)</td>
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<td>▪ Include in logsheets</td>
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<tr>
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<td></td>
<td></td>
<td>▪ Investigate mitigation</td>
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<tr>
<td>EW8</td>
<td>Capacity</td>
<td>58</td>
<td>Future</td>
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<td>▪ Fill vacant posts</td>
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<td></td>
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<td>▪ All posts filled</td>
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### Human Wellbeing

<table>
<thead>
<tr>
<th>HW1</th>
<th>Consolidation of economically viable rights</th>
<th>40, 46, 38, 36, 75</th>
<th>Current</th>
<th>Year round utilization of resource</th>
<th>Year round utilization of resource in June 2007</th>
<th>SAMLMA meeting in June 2007</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Yellow tail limited in Pole fishery</td>
<td>▪ Absence of latent effort</td>
<td>▪ Implementation of SAMLMA decision</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Reassess permit conditions relating to yellow tail bycatch at SAMLMA</td>
<td>▪ Economic performance of rights holders</td>
<td>▪ Allowing for acquiring additional rights finalized in June 2007</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>▪ Allow for acquiring of additional rights</td>
<td>▪ Rights transfer policy (ITQ)</td>
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<td></td>
<td></td>
<td>▪ Year round utilization of resource in June 2007</td>
<td>▪ Implementation of SAMLMA decision</td>
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<td></td>
<td></td>
<td>▪ Reassess permit conditions relating to yellow tail bycatch at SAMLMA</td>
<td>▪ Allowing for acquiring additional rights finalized in June 2007</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Economic performance of rights holders</td>
<td>▪ Rights transfer policy (ITQ)</td>
<td></td>
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<td></td>
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<td></td>
<td>▪ Rights transfer policy (ITQ)</td>
<td>▪ Rights transfer policy (ITQ)</td>
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<tr>
<td>HW2</td>
<td>Minimize economic dislocation through the consolidation process</td>
<td>37</td>
<td>Current</td>
<td>Extent of adverse comment</td>
<td>Extent of adverse comment</td>
<td>End October 2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Incorporate shark fishery into large pelagic sector</td>
<td>▪ Transparent allocation process</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>▪ Recognize shark capture performance in rights allocation</td>
<td>▪ Recognition of performance and investment of existing shark rights holders</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Recognize exemption rights holders as existing fishery participants</td>
<td>▪ Recognition of performance and investment of existing shark rights holders</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Adaptive management</td>
<td>▪ Recognition of performance and investment of existing shark rights holders</td>
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### Ecological Risk Assessment (ERA) for the South African Large Pelagic Fishery

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
<th>NOTES</th>
</tr>
</thead>
</table>
| HW3 | Increase international competitiveness and market security | 44,45,66 | **Current**  
- Fuel rebate  
**Future**  
- Reduce EU trade tariffs  
- RFMO engagement to reduce foreign subsidies  
- Trade and industry to further promote large pelagic industry  
- Rationalization of SAMSA regulations  
- Investigate eco-labelling | **Market information** | **Remain competitive on international market**  
- Market access  
- Market security  
- Eco-label | **Ongoing** |  |
| HW4 | Secure use of our ports by responsible fishing vessels | 41 | **Current**  
- Working group for foreign vessel ship agents  
**Future**  
- Consistent application of RFMO resolutions | **Number of vessels using SA ports** | **Optimal use of SA ports by foreign fishing vessels** |  |  |

**Governance**

| G1 | Development of effective compliance management strategy that is supported by industry | 8,48,49,54,55,  
56,57,63,81, 50 | **Current**  
- Birdlife & WWF training of compliance staff  
**Future**  
- Development of sector-specific compliance forums (similar to Community Police forums)  
- Participation in RMWG  
- Training and awareness for compliance officers including Port State obligations under RFMO resolutions  
- Revise delegated authority for foreign | **Development of training and awareness materials**  
- Compliance participation at RMWG  
- Development of sector-specific compliance forums  
- Follow up on non-compliance and prosecutions | **Thorough knowledge of permit conditions** | **Sector specific compliance forum could be a sub-group under the RMWG**  
- Reconsider honouree inspector programme |
<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
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<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>G2</td>
<td>Reduce non-compliance as far as possible</td>
<td>8, 16, 17, 23, 60</td>
<td>Current</td>
<td>Permit conditions&lt;br&gt;You use observer data to include compliance monitoring – feed into performance review process&lt;br&gt;Need for thorough debriefing of observers by MCM R&amp;D&lt;br&gt;Observers to receive compliance training&lt;br&gt;Consider video vessel monitoring (remote CCTV)&lt;br&gt;Non-regulatory mechanisms to reduce recreational tuna reaching the market&lt;br&gt;Revise bag limits for tuna (species specific)&lt;br&gt;Port state inspections&lt;br&gt;Monitoring by MCM R&amp;D and follow-through by compliance of non-reporting of data by pole fishery</td>
<td>Observer reports&lt;br&gt;Performance review reports&lt;br&gt;Assessment of the scale of recreational fish on the market&lt;br&gt;Develop infringement database&lt;br&gt;Awareness boards at harbours</td>
<td>Bag limits revised&lt;br&gt;Appoint data manager and researcher (refer EW1)&lt;br&gt;Level of infringement&lt;br&gt;Recreational fish assessment complete</td>
<td>Level of reporting by pole fishery corresponds to export figures</td>
</tr>
<tr>
<td>G3</td>
<td>Fair rights administration processes</td>
<td>74, 43, 39</td>
<td>Current</td>
<td>Section 28 review committee&lt;br&gt;Complete section 28 reviews - Legal advice on</td>
<td>“Section 28” issue resolved timeously&lt;br&gt;Implementation and resolution of Section 28</td>
<td>Maximum of 60 days between issuing to resolution of a section 28</td>
<td></td>
</tr>
</tbody>
</table>
### Ecological Risk Assessment (ERA) for the South African Large Pelagic Fishery

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
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<th>PERFORMANCE LIMITS</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>G4</td>
<td>South Africanisation of the large pelagic fishery is complete</td>
<td>42,71,73 Current Allocation policy (under review, revised policy to be gazetted shortly) + Incentives for South Africanisation - levies halved, reduced observer coverage, unrestricted use of ports</td>
<td>Use entire period of allocation for South Africanisation (8 years)</td>
<td>Economic and SAMSA drivers limit South Africanisation of fishery; SAMSA has the power to waive requirements + Transferring of skills to deck crew occurs easily. Skills transfer of Fishing masters, Bosun, processing master is more complicated. Suggestion of keeping these key positions filled by foreign individuals</td>
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</tr>
<tr>
<td>ID</td>
<td>OPERATIONAL OBJECTIVE</td>
<td>ISSUES</td>
<td>MANAGEMENT RESPONSE</td>
<td>DATA REQUIREMENTS</td>
<td>INDICATORS</td>
<td>PERFORMANCE LIMITS</td>
<td>NOTES</td>
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</tbody>
</table>
| G5 | Adequate quota allocation for South African fisheries from RFMOs | 17, 61, 62, 63, 75, 82, 83, 84, 91 | **Current**  
- Member of ICCAT  
- Cooperating non-contracting parties of IOTC & CCSBT  
- Submit catch, effort and bycatch data  
- In the process of implementing port state obligations  
**Future**  
- Build catch performance  
- Become a member of IOTC (secondly CCSBT)  
- Appoint data-manager and researcher (refer EW1)  
- Develop real time data capture  
- Participation and attendance at meetings  
- Build research capacity both within MCM and with other institutes  
- Ensure continuity of participation at meetings  
- Develop cohesion between SADC and African states | - Catch and effort data  
- Bycatch data | - Membership of IOTC and CCSBT  
- Equitable quota  
- Data-manager and researcher appointed (refer EW1) | - At least 50% of stocks allocated to coastal states (i.e. quotas commensurate with coastal states role with biology of the stock) |
<table>
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<tr>
<th>ID</th>
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<th>MANAGEMENT RESPONSE</th>
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<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
<th>NOTES</th>
</tr>
</thead>
</table>
| G6 | Fisheries Managed by effective management plans | 47,51,64 | Current  
- Draft NPOA – seabirds and sharks  
- Permit conditions  
Future  
- Develop sector management plan  
- Finalise and adopt NPOA-seabirds and sharks  
- Develop bycatch management plan  
- Develop NPOA – IUU and fishing effort capacity |  
- NPOA – sharks, seabirds, IUU and fishing effort capacity adopted  
- Sector management plan developed  
- Bycatch management plan developed |  
- NPOA – sharks, seabirds, IUU and fishing effort capacity implemented  
- Sector management plan implemented  
- Bycatch management plan implemented  
- Data-manager and researcher positions filled (refer EW1) | |
| G7 | Inter-governmental agency communication improved (MCM, SAMSA, SABS, DTI) | 53 | Future  
- Ad hoc issue driven communication  
- More constructive engagement with SAMSA  
- Needs to be driven by industry associations and MCM |  
- Agreed safety limits |  
- NPOA – sharks, seabirds, IUU and fishing effort capacity implemented  
- Sector management plan implemented  
- Bycatch management plan implemented  
- Data-manager and researcher positions filled (refer EW1) |  
- Old SEA-PAC committees – forum to coordinate interagency communication regarding compliance |
## Annex 1. List of participants

<table>
<thead>
<tr>
<th>NAME</th>
<th>INSTITUTION/AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andre Hector</td>
<td>Hacky Fishing</td>
</tr>
<tr>
<td>Astrid Jarre</td>
<td>University of Cape Town</td>
</tr>
<tr>
<td>Basil Lucas</td>
<td>South African Tuna Longline Association</td>
</tr>
<tr>
<td>Colleen Moloney</td>
<td>University of Cape Town</td>
</tr>
<tr>
<td>Craig Smith</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Dave Japp</td>
<td>CapFish</td>
</tr>
<tr>
<td>Herman Oosthuizen</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Jeremy Hare</td>
<td>Fresh Tuna Export Association</td>
</tr>
<tr>
<td>Johan de Goede</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Judian Bruk</td>
<td>Shark longline</td>
</tr>
<tr>
<td>Liesl Jansen</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Lynne Shannon</td>
<td>Marine and Coastal Management</td>
</tr>
<tr>
<td>Maria Honig</td>
<td>WWF-South Africa</td>
</tr>
<tr>
<td>Meidad Goren</td>
<td>BirdLife South Africa</td>
</tr>
<tr>
<td>Nivalda Fernandes</td>
<td>Shark Longline Association</td>
</tr>
<tr>
<td>Olivier Maury</td>
<td>Institut de Recherche pour le Developpement</td>
</tr>
<tr>
<td>Richard Ball</td>
<td>South African Tuna Longline Association</td>
</tr>
<tr>
<td>Rob Giddey</td>
<td>South African Tuna Longline Association</td>
</tr>
<tr>
<td>Seshnee Maduray</td>
<td>Marine and Coastal Management</td>
</tr>
</tbody>
</table>
## Annex 2: Complete list of all issues raised and their consequence, likelihood and risk ratings.

Note: Risk core is the product of the consequence score (CONS) and the likelihood score (LIKE)

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>FISHERY</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
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<tbody>
<tr>
<td><strong>Ecological Wellbeing</strong></td>
<td></td>
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<tr>
<td><strong>Retained Species</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>1</td>
<td>Yellowfin tuna: Lack of research (source, distribution)</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>200 tuna-pole licences</td>
</tr>
<tr>
<td>2</td>
<td>Yellowfin tuna: Lack of research (stock assessment)</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Bigeye tuna: Concern for viability of stocks</td>
<td>LL, limited pole</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>Likely to be fishing on both stocks</td>
</tr>
<tr>
<td>4</td>
<td>Yellowtail: Concern for perceived recent decline in catches</td>
<td>Pole, limited LL</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Dispute around interpretation of CPUE data</td>
</tr>
<tr>
<td>5</td>
<td>Albacore: Transboundary stock - concern re: harmonise management</td>
<td>Pole</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>Tripp sea mount now in Namibian waters - leading to change in fishing patterns and possible impact on viability of fishery</td>
</tr>
<tr>
<td>6</td>
<td>Blue &amp; Mako sharks: Lack of stock assessment</td>
<td>LL</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Porbeagle: Concern of stock viability</td>
<td>LL</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>Difficulty in distinguishing between mako &amp; porbeagle, possible CITIES listing</td>
</tr>
<tr>
<td>8</td>
<td>Sharks: Illegal practise – illegal trade of fins, under-reporting, discarding</td>
<td>LL</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>Implications of bycatch limit</td>
</tr>
<tr>
<td>9</td>
<td>Impacts of fishing on potential nursery areas for sharks</td>
<td>LL</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Requires confirmation (e.g. Mako on Agulhas Bank?)</td>
</tr>
<tr>
<td>10</td>
<td>Transboundary impacts on sharks (Namibia and high seas)</td>
<td>LL</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>Need for harmonisation of shark management</td>
</tr>
<tr>
<td>11</td>
<td>Swordfish: Localised depletion</td>
<td>LL</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Requires confirmation</td>
</tr>
<tr>
<td>12</td>
<td>Swordfish: Lack of understanding of distribution and migratory patterns</td>
<td>LL</td>
<td>5</td>
<td>6</td>
<td>30</td>
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<tr>
<td>13</td>
<td>Swordfish: The impact of capture of large females on stock viability</td>
<td>LL</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Oilfish: Impact of high seas fishing on local oilfish stocks</td>
<td>LL, limited pole</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>Targetted by foreign LL fleets (south of PE), this could become an option for local fleets in the future</td>
</tr>
<tr>
<td>15</td>
<td>Snoek: Potential future impact of the large no of pole licences on snoek populations resulting from seasonal variability in tuna stocks</td>
<td>Pole</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Maybe important for Tuna-pole in the future</td>
</tr>
<tr>
<td>16</td>
<td>Impact of under reporting of South African vessels on all stocks and vulnerable species</td>
<td>Pole, limited LL</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>Including seabirds and sea turtles</td>
</tr>
<tr>
<td>17</td>
<td>Impact of foreign IUU effort in South African EEZ on all stocks and vulnerable species</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Important for SBT</td>
</tr>
<tr>
<td>18</td>
<td>Marlin: Continued fishing pressure contributes to the poor stock status</td>
<td>LL</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>Specific concern with conflicts with recreational fishery</td>
</tr>
<tr>
<td>ID</td>
<td>ISSUE</td>
<td>FISHERY</td>
<td>CONS</td>
<td>LIKE</td>
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<td>-------------------------------------------------------------------------------------------</td>
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<tr>
<td>19</td>
<td>Sailfish and short-billed spearfish: Concern regarding stock status and catches on high seas</td>
<td>LL</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>Could become an issue with the inclusion of foreign vessels</td>
</tr>
<tr>
<td>20</td>
<td>Opah: Lack of understanding of population dynamics &amp; impact of fishery</td>
<td>LL</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>Diet: midocean prawn, red flying squid, swimming crab, garfish (pike)</td>
</tr>
<tr>
<td>21</td>
<td>Lack of understanding of non commercial prey species implications for stock viability and catchability</td>
<td>Both</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>Diet: midocean prawn, red flying squid, swimming crab, garfish (pike)</td>
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<tr>
<td>22</td>
<td>Lancet: Lack of understanding of population dynamics &amp; impact of fishery</td>
<td>LL</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
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<tr>
<td>23</td>
<td>Dumping of catch</td>
<td>Both</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>High impact locally e.g. Ports and Tripp sea mount - dumping of Bigeye by SA flagged vessels</td>
</tr>
<tr>
<td></td>
<td><strong>Non-retained Species</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>24</td>
<td>Seabirds: Concern regarding the capture of vulnerable seabird species</td>
<td>LL</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Seabirds: Concern regarding seabird mortality</td>
<td>Pole</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>Less applicable to traditional pole</td>
</tr>
<tr>
<td>26</td>
<td>Sea turtles: Concern regarding the viability of capture</td>
<td>LL</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Pelagic rays: Sustainability of capture</td>
<td>LL</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>All pelagic rays i.e. pelagic ray, devil, manta etc</td>
</tr>
<tr>
<td>28</td>
<td>Impact of shark capture and release on shark populations</td>
<td>Pole</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>Mainly blue, occasionally mako</td>
</tr>
<tr>
<td>29</td>
<td>Impact fishing on crocodile sharks populations</td>
<td>LL</td>
<td>3</td>
<td>6</td>
<td>18</td>
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<tr>
<td></td>
<td><strong>General Ecosystem</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>30</td>
<td>Impact of the removal of top predators on ecosystem functioning i.e. sharks and tunas</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Different methods have different impacts on a range of species; uncertainties around quantification</td>
</tr>
<tr>
<td>31</td>
<td>Habitation of Killer whale, seals, sharks, pilot whales etc resulting in depredation of catches</td>
<td>LL, limited pole</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Up to 30% of catch taken (reported by Japanese elsewhere), impacts on management of stock, socio-economic and the ecosystem</td>
</tr>
<tr>
<td>32</td>
<td>Creating a demand for sardine for bait</td>
<td>Both</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Plastic pollution causing entanglement (e.g. strops and bait boxes) seals, seabirds etc</td>
<td>Both</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>High local impacts in harbours</td>
</tr>
<tr>
<td>34</td>
<td>Impact of transport (fuel) on ecosystem</td>
<td>Both</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Dumping of offal</td>
<td>Both</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>Increased nutrification and changes in distribution of scavengers</td>
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<tr>
<td></td>
<td><strong>Human Wellbeing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Highly seasonal, unpredictable nature of fishery - implications for employment</td>
<td>Pole, limited LL</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Need for alternative target species, Need for the opportunity to participate in other fisheries e.g. Snoek &amp; Yellowtail</td>
</tr>
<tr>
<td>37</td>
<td>Lack of understanding of management decisions resulting in socio-economic knock on</td>
<td>Both</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>minority view of 4</td>
</tr>
<tr>
<td>ID</td>
<td>ISSUE</td>
<td>FISHERY</td>
<td>CONS</td>
<td>LIKE</td>
<td>RISK</td>
<td>NOTES</td>
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<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>38</td>
<td>The specialisation in the allocation process (as opposed to a multi-species or sectoral allocation process) has impacts on socio-economic viability, poaching and ecosystem impacts</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Need for rationalisation and economic logic. Employment security and economic viability of large number of tuna pole sector (200)</td>
</tr>
<tr>
<td>39</td>
<td>Lack of scrutiny resulted in non bona fide fishers receiving rights</td>
<td>Pole</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Resulted in increased capacity</td>
</tr>
<tr>
<td>40</td>
<td>Socio-economic impact of the closure of pelagic shark longline fishery</td>
<td>LL</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Large secondary industry built around large pelagic sector (e.g. Foreign vessels using SA's ports) implications for local management</td>
<td>Both</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Lack of South Africanisation (Re-flagging and skills transfer has not occurred as expected)</td>
<td>LL</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>Has implications for socio-economic viability of fishery</td>
</tr>
<tr>
<td>43</td>
<td>Uncertainty around rights allocation pending the outcome of &quot;section 28&quot;</td>
<td>LL</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Sub-optimal market access (e.g. Asian market)</td>
<td>Both</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>More difficult for frozen fish</td>
</tr>
<tr>
<td>45</td>
<td>Remain competitive on international markets (import tariffs (e.g. EU) fuel costs, SAMSAs requirements for re-flagging, distance to market etc)</td>
<td>Both</td>
<td>5</td>
<td>5</td>
<td>25</td>
<td>LOME agreements (trade agreements)</td>
</tr>
<tr>
<td></td>
<td><strong>National Wellbeing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>46</td>
<td>Single- vs. Multi- sector approach in allocation</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Lack of co-ordinated sector management plan</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Lack of compliance - illegal sale of recreational fish</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Poor management of compliance officers (limited participation at RMWG, limited understanding of permit conditions etc.)</td>
<td>Both</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Disproportionate threat for non-compliance</td>
<td>Both</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>Licence security</td>
</tr>
<tr>
<td>51</td>
<td>Lack of coherent bycatch management plan</td>
<td>LL, limited pole</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>Spans all fisheries</td>
</tr>
<tr>
<td>52</td>
<td>Single species focused, need for a comprehensive ecosystem process approach</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Idea of a compliance forum with representation from industry (similar to police forums - CPF)</td>
</tr>
<tr>
<td>53</td>
<td>Lack of interagency co-operation (e.g. MCM, SAMS, SABS, DTI)</td>
<td>Both</td>
<td>3</td>
<td>6</td>
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<tr>
<td>54</td>
<td>Lack of follow through from non-compliance</td>
<td>Both</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>EKZN Wildlife better</td>
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<tr>
<td>55</td>
<td>Lack of appropriate skills, knowledge and motivation of compliance officers</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Poor communication between industry and compliance staff</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>Head of compliance signing off on foreign fishing licenses</td>
<td>Both</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>Large pelagics and shark sections</td>
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<tr>
<td>58</td>
<td>Lack of research capacity</td>
<td>Both</td>
<td>5</td>
<td>6</td>
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<tr>
<td>ID</td>
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<td>-------------------------------------------------------------------------------------------</td>
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<tr>
<td>59</td>
<td>Lack of baseline data in general</td>
<td>Both</td>
<td>1</td>
<td>6</td>
<td>6</td>
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<tr>
<td>60</td>
<td>Daily reporting of catch and effort data is poor</td>
<td>Pole</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Albacore</td>
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<tr>
<td>61</td>
<td>Non-membership to IOTC and CCSBT poses risk of losing access to high seas allocation</td>
<td>Both</td>
<td>5</td>
<td>5</td>
<td>25</td>
<td>Both in terms of exploitation and conservation</td>
</tr>
<tr>
<td>62</td>
<td>Lack of credible and effective participation in all relevant RFMO meetings</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Particularly ICCAT albacore stock assessment, under performing</td>
</tr>
<tr>
<td>63</td>
<td>Lack of implementation of Port state obligations under RFMO resolutions</td>
<td>Both</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Lack of FAO plans of action (e.g. seabirds, sharks, IUU, fishing capacity) &amp; sea turtle guidelines</td>
<td>Both</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Industry participation at meetings is limited to a few</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Lack of Eco-labelling e.g. MSC</td>
<td>Both</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>67</td>
<td>Associations and meeting participation limited by costs/fees</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>Lack of consolidation and cohesion within the sector (SATLA, fresh tuna export, SA tuna association, shark longline association)</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>69</td>
<td>Impact of non-constructive NGOs</td>
<td>Both</td>
<td>1</td>
<td>6</td>
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<tr>
<td>70</td>
<td>Lack of wider effective participation in co-management</td>
<td>Both</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Excluding industry, sharks</td>
</tr>
<tr>
<td>71</td>
<td>Lack of suitable vessels</td>
<td>LL</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Leading to a reliance on foreign vessels</td>
</tr>
<tr>
<td>72</td>
<td>Concern regarding unsuitable vessels operating in the tuna pole sector</td>
<td>Pole</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td>Loss of life, 4 vessels lost in last 2 seasons</td>
</tr>
<tr>
<td>73</td>
<td>Limited expertise to target tuna effectively</td>
<td>LL</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>74</td>
<td>Permitting process - vessels licence, transport permits etc</td>
<td>Both</td>
<td>4</td>
<td>4</td>
<td>16</td>
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<tr>
<td>75</td>
<td>Under performance - swordfish and albacore, consequence for RFMO quota allocations</td>
<td>Both</td>
<td>5</td>
<td>6</td>
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**External Impacts**

<table>
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<tr>
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<th>RISK</th>
<th>NOTES</th>
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<tr>
<td>76</td>
<td>Climate change - possible changes in distribution and productivity in the system</td>
<td>Both</td>
<td>5</td>
<td>5</td>
<td>25</td>
<td>Effects of upwelling - may become warmer and reduce productivity</td>
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<tr>
<td>77</td>
<td>Climate variability - the effect of El Nino</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>Unregulated snoek capture by trawl fishery (Tuna-pole)</td>
<td>Pole</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>79</td>
<td>Dependence of Pole fishery targeting yellowfin tuna feeding on hake offal</td>
<td>Pole</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>The Cape Canyon closure, Major implication for the fresh fish sector</td>
</tr>
<tr>
<td>80</td>
<td>Changes in prey distribution</td>
<td>Pole, limited LL</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Eastward shift in Sardine and Anchovy distribution; Interaction with small pelagic prey (tuna satiation and limitation) for YFT</td>
</tr>
<tr>
<td>81</td>
<td>Impact of recreational fishery driven by illegal activity</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>95% export for LL and Pole, Pole would sell more on local market but limited access due to this issue</td>
</tr>
<tr>
<td>82</td>
<td>Competition from high seas fleets (Longline and purse-seine)</td>
<td>Both</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>ISSUE</td>
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<td>CONS</td>
<td>LIKE</td>
<td>RISK</td>
<td>NOTES</td>
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<td>--------------------------------------------</td>
</tr>
<tr>
<td>83</td>
<td>Effects of fish aggregating devices (FADs) on distribution and movement patterns</td>
<td>Both</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>84</td>
<td>The lack of adequate protection of aggregations spawning and juvenile fish</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Outside of SA’s EEZ</td>
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<tr>
<td>85</td>
<td>Foreign currency exchange rates</td>
<td>Both</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>86</td>
<td>Fuel costs</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>Distance to market</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>88</td>
<td>Artificial trade barriers</td>
<td>Both</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>89</td>
<td>Increased competition in fresh fish market and from farmed product</td>
<td>Both</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>Conflicts with recreational fishery</td>
<td>LL</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>e.g. Marlin</td>
</tr>
<tr>
<td>91</td>
<td>Impact of IUU effort on all stocks and vulnerable species</td>
<td>Both</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>Including seabirds and sea turtles</td>
</tr>
<tr>
<td>92</td>
<td>Impact of the removal of prey species such as small pelagics</td>
<td>Both</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>Seen changes in diet composition</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Diet: midocean prawn, red flying squid, hake offal,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>swimming crab, garfish (pike), sardine and</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Anchovy</td>
</tr>
<tr>
<td>93</td>
<td>BFT: Stock in crisis</td>
<td>LL</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>
Ecological Risk Assessment (ERA) for the Namibian Demersal Hake Fishery

D.C. Nel

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The ERA workshop for the Namibian hake fishery took place in Swakopmund, Namibia, between the 4th and 6th of April, 2005. It was hosted by National Marine Information Research Centre (NatMIRC), Ministry of Fisheries and Marine Resources, Namibia and facilitated by Dr. Deon Nel and Samantha Petersen of WWF-South Africa and Kevern Cochran of the Food and Agriculture Organisation (FAO). A wide range of stakeholders were invited from the Ministry of Fisheries and Marine Resources, the Directorate of Policy, Planning and Economics, fishing industry, local NGOs, and the University of Namibia. The workshop was attended by 41 participants. The majority of participants were from the Ministry of Fisheries and Marine resources (MFMR) (35), the Directorate of Policy, Planning and Economics (3), Benguela Environment Fisheries Training Interactions programme (BENEFIT) (2) and the fishing industry (1).

Please see Annex 1 for a complete list of attendees.

1. A brief description of the Demersal Hake Fishery

Hake (\textit{M. capensis} and \textit{M. paradoxus}) is an important commercial resource for Namibia, both in terms of revenue earnings and employment. In 2003, hake products were worth N$ 2.9 billion and over 9 000 Namibians were employed in the fishery.

The two species of hake occur on the shelf and upper slope in Namibian waters. \textit{M. capensis} occurs at depths between 100 m and 350 m, while \textit{M. paradoxus} occurs mainly at depths of 300 m and 500 m. The spawning biomass of the two hake species was estimated at 1.3 million tonnes in 2004. The current state of the hake stock gives a ‘fishing down’ ($B_{2004}^{opt}/B^0$) level of a median value of 34%. The Maximum Sustainable Yield (MSY) is estimated to be 45% of the pristine biomass level.

Three types of vessels - freezer trawlers, wet fish trawlers and longliners – operate in the hake fishery. More than 90% of hake is currently landed by the freezer and wet fish trawlers, with the rest being landed by longliners. More than half the processing is conducted ashore. Eighty five percent of hake products are exported to the European markets, 13% is marketed in Southern Africa and only 2% is consumed locally.

2. Results of the Workshop

General overview of the ERA process

Identification of issues

A total of 74 issues were identified. These issues are listed and described in full in Annex 2. Most of the identified issues fell within the ‘Ecological Wellbeing’ (50%) and ‘Ability to Achieve’ (41%) categories (Figure 1). Only 9% of identified issues were from the ‘Human Wellbeing’ category. While this may reflect the composition of the group that participated in this exercise, it may also simply reflect that there are fewer ‘Human Wellbeing’ issues, but those may potentially be of greater importance (see later).
Prioritization of issues

The prioritization process resulted in a reasonably even spread of issues within each of the risk categories (Figure 2). This indicates that participants were successful in teasing out issues of greater importance and thereby reaching agreement on the major issues pertaining to this fishery.

Figure 1. Percentages of issues that were identified within each ERA component and category.

Figure 2. Percentages of issues per risk category
When considering the spread of risk categories within each of the ERA components (Figure 3) it is clear that although more issues were identified within the ‘Ecosystem Wellbeing’ components, most of these issues were within the ‘Low’ or ‘Moderate’ risk categories. Fewer issues were identified under the ‘Human Wellbeing’ components, but most of these issues were within ‘High’ or ‘Extreme’ risk categories. Issues within the ‘Governance’ components were fairly evenly distributed, with a significant proportion of these issues also falling within the ‘High’ and ‘Extreme’ risk categories.

![Figure 3. Proportions of issues within given risk categories for each ERA component](image)

**Performance reports**

Of the 74 issues identified, 55 (74%) were rated as being of ‘Moderate’ concern or higher and thus requiring a full performance report. Performance reports were developed for all these issues excepting those from the ‘External Impacts’ component as it was felt that by definition, there was little that fisheries management and its stakeholders could do to rectify these issues, although they should be considered at a higher policy level.

**The major issues**

The major issues (those of a risk rating of ‘Moderate’ and higher) are listed in Table 1. The discussion in this section will highlight some of the main issues and themes under each of the main components.
Ecological Wellbeing

Two ‘Extreme’ issues were identified in the ‘Ecological Wellbeing’ category. The first relates to the bycatch or incidental mortality of threatened seabirds in both longline and trawl operations. The second is the potential impact of monkfish bycatch within the hake fishery on the sustainability of the monkfish fishery.

Fifteen issues were scored ‘High’ risk. These included concerns that the present biomass of *Merluccius* species is lower than it should be and that current fishing mortality could be contributing to this. There was also a concern regarding the effect of the low selectivity of trawls and the impact they may be having on the size structure of the stock. The lack of a bycatch plan or management of several major fish bycatch species (e.g. kingklip and sole) as well as the damage to benthic fish communities (especially rattails) and crustaceans were also considered to be of ‘High’ risk. An important issue raised was the effects of biomass removal on trophic structure and ecosystem functioning.

Issues under ‘Retained Species’ centred around impacts on size structure of the stock, high variability and uncertainty in stocks, shared stocks with South Africa, and the combined management for the two *Merluccius* species. ‘Non-retained Species’ involved the bycatch of sharks and skates, as well as soaking of Gannets in macerated offal discharge. The shooting of bull Cape fur seals was also of concern. As was the damage of trawling on benthic biota and habitats which was raised under ‘General Ecosystem’ category.

Human Wellbeing

The fact that living standards of the fishing community and fishery service providers were linked to the state of the fishery and of the stock were identified as issues that required careful management consideration. High levels of unskilled labour and lack of training and development opportunities within industry structures were also highlighted as needing urgent attention. The economic dependence of coastal towns on the hake fishery as well as the effect the fishery has on national employment were issues considered to be ‘High’ risk.

Governance

Of greatest concern to the management of this fishery was the lack of an approved management plan that reconciled conflicting objectives in an integrative manner and was bound by management reference points. Implementation was also considered by workshop participants to be hampered by inadequate resources. This included allocation of appropriate budgets and facilities as well as the inability to attract and retain high quality human resources. Problems with data capture procedures as well as slow revision of legislation were also identified.

Issues rated as ‘High’ risk were mainly concerned with the restructuring and development of the industry in order to increase local benefits (Namibianisation). The need for wider
representation from NGO’s, civil society and other stakeholders in decision making bodies (e.g. council and working groups) was given a ‘High’ risk rating.

Also noted were compliance issues such as, Vessel Monitoring Systems (VMS), inadequate penalties, real-time reporting, and poor observer coverage on smaller vessels. The need for a transboundary management plan was also raised.

**External Impacts**

International economic factors such as fuel prices and exchange rates as well as local health issues such as HIV and AID’s were amongst the ‘Extreme’ risks that could inhibit the fishery attaining its objectives.

Table 1. List of issues that scored a ‘Moderate’ risk rating or higher.

* Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)
** Categories: E=Extreme, H=High, M=Moderate

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
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<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
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<tr>
<td>14</td>
<td>Bycatch of Monkfish may affect its sustainability</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>3</td>
<td>Present biomass is lower than it should be.</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>6</td>
<td>Fishing mortality contributes to low abundance of <em>M. capensis</em></td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
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<tr>
<td>9</td>
<td>Low selectivity of trawls affects size structure of the <em>M. paradoxus</em></td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>13</td>
<td>No bycatch plan for several major bycatch species</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>4</td>
<td>High Variability and uncertainty in abundance and estimates</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
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<tr>
<td>8</td>
<td>Longline fishery affects the natural size structure</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>11</td>
<td>Combined management of the two species leads to undesirable impacts</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>5</td>
<td>Fishing mortality contributes to low abundance of <em>M. paradoxus</em></td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
</tr>
<tr>
<td>1</td>
<td>The <em>M. paradoxus</em> stock is shared with South Africa</td>
<td>3</td>
<td>3</td>
<td>9</td>
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</tr>
<tr>
<td>10</td>
<td>Low selectivity of trawls affects the size structure of the <em>M. capensis</em></td>
<td>2</td>
<td>4</td>
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<tr>
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<tbody>
<tr>
<td>16</td>
<td>Bycatch of threatened seabirds may impact populations</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>27</td>
<td>Changes in foraging behaviour and population dynamics of seabirds</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>22</td>
<td>Fishery impacts the benthic fish community</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
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<tr>
<td>23</td>
<td>Fishery impacts the population of crustaceans</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>18</td>
<td>Bycatch of endemic demersal sharks may impact populations</td>
<td>2</td>
<td>6</td>
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</tr>
<tr>
<td>19</td>
<td>Bycatch of endemic skates may impact populations</td>
<td>2</td>
<td>6</td>
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<tr>
<td>25</td>
<td>Fishery impacts the populations of other sharks and skates</td>
<td>3</td>
<td>4</td>
<td>12</td>
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<tr>
<td>29</td>
<td>Shooting of bull seals impacts population structure and dynamics</td>
<td>2</td>
<td>5</td>
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### General Ecosystem

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<tbody>
<tr>
<td>28</td>
<td>Maceration/release of offal leads to “soaking” of Cape Gannets</td>
<td>2</td>
<td>4</td>
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<td>M</td>
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<tr>
<td>34</td>
<td>Removal of biomass may alter the trophic structure and ecosystem functioning</td>
<td>3</td>
<td>5</td>
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<tr>
<td>32</td>
<td>Deliberate disposal of oil affects seabirds</td>
<td>2</td>
<td>6</td>
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<tr>
<td>33</td>
<td>Trawling causes physical damage to benthic habitat</td>
<td>2</td>
<td>4</td>
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</tr>
<tr>
<td>35</td>
<td>Trawls cause damage to sensitive benthic biota</td>
<td>2</td>
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### Human Wellbeing

#### Community Wellbeing

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<tbody>
<tr>
<td>38</td>
<td>Living standards of the fishing communities linked to the fishery</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>39</td>
<td>Levels of unskilled labour and inadequate training opportunities within the industry</td>
<td>4</td>
<td>5</td>
<td>20</td>
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</tr>
<tr>
<td>40</td>
<td>Negative impacts on the industry will be reflected in fishery service providers</td>
<td>4</td>
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<tr>
<td>41</td>
<td>Economic wellbeing of fishing harbour towns linked to the fishery</td>
<td>3</td>
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#### National Wellbeing

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<th>CATEGORY**</th>
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<tbody>
<tr>
<td>44</td>
<td>Impact on the fishery will affect national unemployment rate</td>
<td>3</td>
<td>5</td>
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<tr>
<td>42</td>
<td>Fishing makes a substantial contribution to the National GDP</td>
<td>3</td>
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### Ability to Achieve

#### Governance

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<tr>
<td>45</td>
<td>Lack of an approved management plan</td>
<td>4</td>
<td>6</td>
<td>24</td>
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</tr>
<tr>
<td>52</td>
<td>Inadequate and incomplete data recording, capture and storage</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>53</td>
<td>Problems with attracting and retaining qualified and experienced staff</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>54</td>
<td>Inadequate research budget leading to insufficient services and facilities</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>56</td>
<td>Irregular updating of legislation</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>58</td>
<td>Need for real capacity and development in joint venture agreements</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>H</td>
</tr>
<tr>
<td>59</td>
<td>Need for implementation of transparency in quota transferability</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>H</td>
</tr>
<tr>
<td>60</td>
<td>Failure to meet the policy standard of Namibianisation of the fishing sector</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>H</td>
</tr>
<tr>
<td>61</td>
<td>Lack of wider representative participation in council and working groups</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>H</td>
</tr>
<tr>
<td>46</td>
<td>Working groups need clear terms of reference</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>47</td>
<td>Need for improved transparency in the management of resources</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>48</td>
<td>Vessel Monitoring Systems (VMS) is still not in place</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>49</td>
<td>Penalties for transgressions are not adequate</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>50</td>
<td>Need for real time reporting and over-catching of quota</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>M</td>
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<tr>
<td>51</td>
<td>Lack of observer coverage on smaller vessels</td>
<td>2</td>
<td>4</td>
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<td>M</td>
</tr>
<tr>
<td>57</td>
<td>Establishment of trans-boundary management regime for shared Hake stock(s)</td>
<td>2</td>
<td>4</td>
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#### External Impacts

<table>
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<th>CATEGORY**</th>
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</thead>
<tbody>
<tr>
<td>68</td>
<td>Human health (e.g. AID’s) will affect the work force</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>72</td>
<td>International economic factors affect the profitability of the fishery</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>67</td>
<td>Trophic impacts induced by other fisheries</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>64</td>
<td>Climatic and oceanographic factors affect stock leading to variability and uncertainty</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
</tbody>
</table>
**Ecological Risk Assessment (ERA) for the Namibian Demersal Hake Fishery**

<table>
<thead>
<tr>
<th>ID</th>
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<th>CATEGORY**</th>
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<tbody>
<tr>
<td>66</td>
<td>Climate change (global warming) affects stock</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>69</td>
<td>The profitability of the fishery is at the mercy of global eating habits</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>71</td>
<td>The national political climate affects foreign and local investment</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>M</td>
</tr>
<tr>
<td>70</td>
<td>A number of socio-economic factors that affect the profitability of the fishery</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
<tr>
<td>73</td>
<td>Export standards can influence access to foreign markets (e.g. EU regs, eco-labeling)</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
</tbody>
</table>

**Performance Reports**

Performance reports where developed for all major issues except those from the 'External Impacts' component. It was felt that by definition there was little that fisheries management could do about issues from this category. The full performance reports produced at the workshop can be found in Table 2. The next section summarises the main objectives and management responses that arose from the workshop.

**Ecological Wellbeing**

There was an urgent need to reduce the bycatch of monkfish to as low as possible, this could be achieved by applying levies on the bycatch of this species. A suite of management actions such as not allowing fishing effort to increase, possibly reducing the TAC, assessing the potential of Marine Protected Areas (MPA’s), closed areas/seasons and increasing research efforts in this fishery, would resolve many management issues of retained target species. The group agreed that it was essential the target biomass reached the desired limit of 40% of its pristine biomass in the next five years and ecosystem impacts of removing biomass greater than this limit, should be considered in the management of this fishery.

At present, no bycatch plan exists for this fishery and it is vital that bycatch limits and levies be introduced to resolve this issue. Observers should monitor and enforce these regulations. Further research of gear modifications is also necessary. The use of grids was suggested by the participants to increase the selectivity of trawl gear in the offshore fishery, but further research of their effectiveness is necessary. Separate assessments of the two hake species need to be conducted in order to improve their management. Coordinated surveys should be undertaken with South Africa.

To address the bycatch of seabirds, sharks and rays, National Plan of Action (NPOA) i.e. NPOA-sharks and NPOA-seabirds should be adopted, level of mortality assessed, mitigation research undertaken and implemented and awareness of the issue increased. Dumping should be limited to during the night. There was also a need to identify and implement management measures such as closed areas, MPA’s, levies and further research efforts in order to reduce trawl impacts on crustaceans and the benthic environment, an associated sensitive benthic biota.
**Human Wellbeing**

There was an overall concern that the current impacts on the fishery consequently impacted all those whose livelihoods depend on it, from a national level through to fisheries communities. This issue highlighted the need for industry to rationalise and plan strategically and to give the minister feedback on job and income levels. Also, rebates, relief measures, precautionary approach measures and alternative livelihoods need to be sought to aid further in this matter. There was also a pressing need to increase the training and skill levels of Namibians employed in this fishery.

**Governance**

The development of a management plan with reconciled objectives was at the heart of improving the governance of this fishery. The group sought a completed and approved plan by the end of 2005, its implementation by June of 2006 and the first review by 2008. The appointment of a hake fishery database manager was proposed for many governance related issues. High staff turnover requires addressing. Management actions on this issue included the development of a performance appraisal and career advancement opportunities within months of this workshop and introducing advanced marine and oceanographic degrees and diplomas at the relevant institutions. Also of great importance to the effective management of this fishery, was the need to increase the research budget, facilities available and acquire a suitable multi-disciplinary research vessel. Current legislation was evidently outdated and needed to be updated by 2005, in accordance with the NPOA’s.

Furthermore, it was felt that the decision making structures needed to be changed to include improved representation from this fishing industry on the Minister’s Advisory Council and improved representation from responsible NGO’s and civil society groups on the management working group as well as possibly the Advisory Council. In order to facilitate transparency, it was suggested that the working group request for access to information established on a regular basis, and that this information be disseminated in the local languages.

Real time data reporting would allow for constant monitoring and database updating within a time-frame that was acceptable. For the enhancement of compliance with regulations, a VMS system urgently needed to be up and running by the end of 2005. Coupled with this, new effective penalties needed to be implemented and enforced by June of 2006. The ‘terms of reference’ (TOR) for the hake working group (WG) need to be revised as it was deemed inadequate for informed decision-making to take place in this fishery.

Due to time constraints not all the Performance Reports for this section were completed during the workshop and will need to be completed at a later date.
Table 2. Summary of Performance Reports developed for issues scoring a risk rating of ‘Moderate’ or higher.

Note that the issue number cross-links to the issue numbering in Table 1 and Annex 2.

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>EW1</td>
<td>Minimize bycatch of monkfish</td>
<td>14</td>
<td>Current</td>
<td>Observers (in place)</td>
<td>Catch statistics</td>
<td>Bycatch should be as low as possible. Any decrease to the monk TAC due to bycatch of monk should be avoided.</td>
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<td></td>
<td></td>
<td></td>
<td>Levies are implemented when catch comprises more than 2% of monk</td>
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<td></td>
<td></td>
<td></td>
<td>Future</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Levies should be paid on all bycatch</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Current</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>The recommended TAC has been lowered</td>
<td></td>
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<td></td>
<td>Future</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Decrease the TAC in larger increments</td>
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<tr>
<td>EW2</td>
<td>Rebuild the stock to the MSY level</td>
<td>3, 6, 5</td>
<td>Current</td>
<td>Stock assessment</td>
<td>Stock assessment</td>
<td>40% of pristine level within the next 5 years, (i.e. approximately MSY).</td>
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<td>The recommended TAC has been lowered</td>
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<td></td>
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<td></td>
<td></td>
<td>Effort should not be increased</td>
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<td></td>
<td>Future</td>
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<td></td>
<td>Decrease the TAC in larger increments</td>
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<tr>
<td>EW3</td>
<td>Develop a bycatch management plan</td>
<td>13</td>
<td>Current</td>
<td>Catch statistics</td>
<td>Catch statistics</td>
<td>To be determined</td>
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<td></td>
<td>More research e.g. gear selectivity</td>
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<td>Possible bycatch levies</td>
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<td>Catch limitations</td>
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<tr>
<td>EW4</td>
<td>Ensure balanced size structure of target stock for optimum utilization</td>
<td>9, 8</td>
<td>Current</td>
<td>Observer programme in place</td>
<td>Observer and survey length frequency data</td>
<td>No fish caught of size less than 36 cm.</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Move out of area</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Considering closed areas and effort restriction</td>
<td></td>
<td></td>
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<td></td>
<td>Future</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Investigate the effectiveness of the grids</td>
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<tr>
<td>EW5</td>
<td>Understand variability and uncertainty of stock</td>
<td>4</td>
<td>Current</td>
<td>Require modelling expertise</td>
<td>Stochastic modelling</td>
<td>10-20% risk, i.e. acceptable risks levels</td>
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<td>Research in progress</td>
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<td>DATA REQUIREMENTS</td>
<td>INDICATORS</td>
<td>PERFORMANCE LIMITS</td>
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<td>----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>EW6</td>
<td>Understand trans-boundary nature of stock and adapt management accordingly</td>
<td>11</td>
<td>Current</td>
<td>Observer in place</td>
<td>Available data</td>
<td>Separate management</td>
</tr>
<tr>
<td></td>
<td>Require human resources and computers</td>
<td></td>
<td>Separate stock assessments</td>
<td>Annual coordinated survey</td>
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</tr>
<tr>
<td>EW7</td>
<td>Reduce the bycatch of vulnerable species (e.g. endemic demersal sharks)</td>
<td>18,19, 25</td>
<td>Current</td>
<td>Observers - daily logsheets, species-specific reports and biological data (Length Frequency and Sex)</td>
<td>Bycatch rate (% per catch)</td>
<td>Continuous decline in bycatch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>None</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Future</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>NPOA –Sharks</td>
<td></td>
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</tr>
<tr>
<td>EW8</td>
<td>Reduce seabird mortalities and interactions (i.e. mortality, oilying and ‘soaking’)</td>
<td>28, 27, 16, 30</td>
<td>Current</td>
<td>Island observations, weekly records available 95-96</td>
<td>Presence of soaked gannets on Islands</td>
<td>Reduction by 90% of currently observed levels of soaked birds</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No legislation yet</td>
<td>Observer data on total effort by area by month per fishery per species</td>
<td>Increase in the presence of birds scavenging around vessels, decrease in chick growth and survival rate of some local species</td>
<td>Reduction in the current observed numbers of seabirds around vessels</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Draft NPOA-seabirds</td>
<td>Monitoring of oiling events and affected bird numbers</td>
<td>Seabird CPUE - longliners (no. birds per 1000 hooks set per species)</td>
<td>0.05 birds per 1000 hooks (international standards)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>International laws (MARPOL),</td>
<td></td>
<td>Numbers of birds per fishing day – trawl</td>
<td>Significant decrease in the number of birds oiled</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>however not enforced</td>
<td></td>
<td>Numbers of birds oiled and number of oiling events</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Future</td>
<td></td>
<td>Records by observers</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Implementation of the NPOA</td>
<td></td>
<td>Zero reports of killed bulls</td>
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<td>recommendations</td>
<td></td>
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<td>Strict enforcement of relevant</td>
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<td>laws</td>
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<td>Future</td>
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<td>NPOA recommendations</td>
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<td></td>
<td></td>
<td></td>
<td>Introduce gear selectivity</td>
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<tr>
<td>EW9</td>
<td>Reduce seal mortality</td>
<td>29</td>
<td>Future</td>
<td>Intend to place observers onboard longliners</td>
<td>Records by observers</td>
<td>Unknown, target is zero</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Introduce strict regulations to</td>
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<td></td>
<td>stop shooting practices</td>
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<tr>
<td>EW10</td>
<td>Reduce benthic fish bycatch</td>
<td>22</td>
<td>Future</td>
<td>Observers onboard trawlers, daily logbooks (impractical for observers to collect species specific data on the benthic fish)</td>
<td>Records by observers</td>
<td>Unknown, target is zero</td>
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<td></td>
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<td></td>
<td>Introduce Bypatch Reduction Devices (BRD’s)</td>
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<tr>
<td>EW11</td>
<td>Reduce crustacean (e.g. deep sea red crabs and shrimps) bycatch</td>
<td>23</td>
<td>Current</td>
<td>Observers onboard trawlers, daily logbooks, data collection particularly in the northern areas</td>
<td>Records by observers, species distribution through FIM surveys</td>
<td>80% reduction of the current level</td>
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<tr>
<td></td>
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<td>200 m depth restrictions for lobsters only</td>
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<td></td>
<td>Future</td>
<td></td>
<td>Records by observers</td>
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<td></td>
<td></td>
<td></td>
<td>Introduce gear selectivity</td>
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</table>
### Ecological Risk Assessment (ERA) for the Namibian Demersal Hake Fishery

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>EW12</td>
<td>Maintain ecosystem integrity and biodiversity</td>
<td>34</td>
<td>Current: Only single-species management</td>
<td>Biomass estimates and depletion level of commercial stocks need to be monitored</td>
<td>Indicators derived from ecosystem models (e.g. from Ecopath: Ratios e.g. predator/prey)</td>
<td>Keep all commercial stock at or above MSY</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future: Ecosystem considerations regarding trophic interactions to be used in management</td>
<td>Species distribution</td>
<td>Indicators derived from top predator abundance trends (e.g. seabirds)</td>
<td>Prevent loss of biodiversity</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Population monitoring of vulnerable species</td>
<td></td>
<td>Vulnerable species should be kept above the minimum viable population levels</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Regularly updated food web models</td>
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<td></td>
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<td></td>
<td>Diet monitoring of some key species</td>
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<tr>
<td>EW13</td>
<td>Minimize damage to sensitive areas</td>
<td>33, 35</td>
<td>Future: Gear restrictions, closed areas if warranted</td>
<td>Collect baseline data</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td>Map trawling frequencies</td>
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<td></td>
<td>Map habitats and species</td>
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<td></td>
<td>Compare heavily and sparsely trawled areas</td>
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<td></td>
<td></td>
<td>Benthic/sediment surveys</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Time series</td>
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</tbody>
</table>

### Human Wellbeing

| HW1 | Improve social and economic status of fishers                                         | 38     | Current: Rebate system (some of group felt it is not effective)                       | Regular feedback reports from the fishing Industry to the Ministry specifying the number of employees and their average income | Increased number of employees in the industry, Increased income, thereby resulting in improved standard of living | Higher limit: Restoration of lost income to 2002 levels, Lower limit: Continuation of the deteriorating industry income (2006) |
|     |                                                                                        |        | Future: Relief measures to be negotiated                                              |                                                                                   |                                                                            |                                                                                  |
| HW2 | Ensure sustainable business relations between the fishing industry and dependent communities | 40     |                                                                                      | Obtain employment level of dependent communities through Ministry of labour etc.    | Reduction in businesses leading to closure                                       | Higher indicator: dependent communities remain operational and still provide services to the industry, Lower indicator: Laying off of workers and highly |

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Page 136
<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>HW3</td>
<td>Maintain economic well being of harbour town communities</td>
<td>41 ▪ There are responses from management (town council), but not necessarily from the fisheries management body</td>
<td>▪ Monitoring of the performance of the business in harbour towns (Town council, NCCI, etc.)</td>
<td>▪ Investment outlook ▪ Increase in unemployment rate in the town due to influx</td>
<td>▪ Higher limit: Increase in investments in the near future ▪ Low limit: Decrease in overall economic performance of harbour town communities</td>
<td></td>
</tr>
<tr>
<td>HW4</td>
<td>Ensure job creation in the fishing sector</td>
<td>44 Current ▪ Negotiation agreements in place Future ▪ Precautionary approach</td>
<td>▪ National Planning Commission (NPC) and Labour survey conducted by the Ministry of Labour</td>
<td>▪ Employment rate from the fishing sector</td>
<td>▪ Higher limit: Employment rate increase by at least 5% within the next 2 years ▪ Lower limit: Persistence of current job losses</td>
<td></td>
</tr>
<tr>
<td>HW5</td>
<td>Ensure contribution of fisheries sector to GDP remains substantial</td>
<td>42 Current ▪ Continuous allocation of quotas Maintain fish stock at a substantial level and ensure sustainable utilization of the resource</td>
<td>▪ Ministry’s Annual Report, NPC</td>
<td>▪ Contribution of Fishery sector to GDP</td>
<td>▪ Higher limit: Maintain current position as second largest contributor to GDP ▪ Lower limit: Fisheries contribution to GDP shifts from being in second position to being fourth</td>
<td></td>
</tr>
</tbody>
</table>

**Governance**

| G1  | To develop and implement management plans with reconciled objectives and reference points with the aim of rebuilding the M. capensis and M. paradoxus stocks | 45 Current ▪ Busy developing management plan                                                                                                                                                                                                                                           | ▪ Review required by 2008                                                                                                                                                                                                   | ▪ Management plan approved and implemented (signed by minister)                                        | ▪ Plan approved by end of 2005 and implemented by June 2006 and thereafter reviewed 2008                                                                                                                                   |
| G2  | To introduce a revised TOR for the hake working group (WG)                              | 46 Current ▪ TOR currently in place needs revision Future ▪ TOR to include 1) Longer and more technical scientific WG meetings well in advance of industry and scientific WG meetings 2) Allowing TAC and resulting                                                                                       | ▪ New input to the TOR                                                                                                                                                                                                     | ▪ The next hake TAC discussions will follow the new TOR                                               | ▪ TOR finalised and used by March 2006                                                                 -------------------------------------------------------------------------------------------------------------|
### Ecological Risk Assessment (ERA) for the Namibian Demersal Hake Fishery

<table>
<thead>
<tr>
<th>ID</th>
<th>Operational Objective</th>
<th>Issues</th>
<th>Management Response</th>
<th>Data Requirements</th>
<th>Indicators</th>
<th>Performance Limits</th>
</tr>
</thead>
</table>
| G3 | Ensure participation and communication with the public | 47 Current • Reports available but not accessible • Procedure for final TAC determination not clear  
Future • More openness and transparency | • Popular articles, reviews, website updates | • Information or reports about performance, research and management of resources (e.g. cruise reports, TAC reports) should be made available (e.g. newsletter, website, media journal clubs) | • Access to information established on a regular basis  
• Dissemination of information in local languages |
| G4 | All vessels fishing within Namibian EEZ have VMS system in place to improve compliance | 48 Current • VMS in process of being tested  
Future • VMS in place | • Inspectorate to comment on monitoring system | • VMS in place on all vessels  
• VMS, regular surveillance | • VMS is functional by end 2006 |
| G5 | Introduce effective penalties to deter transgressors of regulations | 49 Current • Penalties not yet revised  
Future • VMS in place, higher penalties | • VMS, regular surveillance | • Reduced transgression | • Penalties implemented and enforced by June 2006 (Shivute to comment on level of penalty) |
| G6 | To establish constant monitoring and an effective, up to date database to be used to advise management | 50, 52 Future • Planning to establish real-time data system for both catch and effort data | • Continuous reconciling of data and close monitoring of catches until the filling of quota  
• Full-time database manager needed | • All data used in management recommendation are available and accessible within a reasonable time frame  
• Logsheets re-designed to capture all relevant information including bycatch data  
• Satisfactory completion of logsheets  
• Data available on time  
• User-friendly database  
• All available data featured in TAC recommendations | • Database to be established within the next season  
• Logsheet re-designed by end 2005  
• Logsheets checked by inspector at every landing and every week by scientist  
• Logsheets captured within a week of offloading  
• FIMS functional at all times  
• Time of working group meeting for TAC report |
<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G7</td>
<td>Build research and management capacity (attract and retain good quality staff)</td>
<td>53</td>
<td></td>
<td>Reconciled fishery-dependent data</td>
<td>High performance staff retained within the ministry (and their section) for more than 10 years or else, continuity and excellence of research</td>
<td>Control mechanisms between PPE and DRM implemented by June 2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Performance appraisal reactivated</td>
<td>Performance appraisal and career advancement opportunities in place by the end of 2005</td>
<td>Performance appraisal and career advancement opportunities in place by the end of 2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Comparable salary packages</td>
<td></td>
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<tr>
<td>G9</td>
<td>Ensure appropriate research facilities</td>
<td>54</td>
<td>Current</td>
<td>More efficient system of acquiring high priority equipment such as computers</td>
<td>Research equipment available when needed</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Vessel specifications and designs</td>
<td>Vessel available</td>
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<td></td>
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<td></td>
<td>Research equipment available when needed</td>
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<td>Vessel available</td>
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<td></td>
<td></td>
<td>Vessel available</td>
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<tr>
<td>G9</td>
<td>Legislation updated regularly</td>
<td>56</td>
<td>Current</td>
<td>Current legislation is lacking recent information</td>
<td>Legislation is updated in accordance with NPOA’s</td>
<td>Legislation updated by end of 2005</td>
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<td></td>
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<td></td>
<td>Future</td>
<td>PPE to update legislation</td>
<td></td>
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<td></td>
<td>Legislation is updated in accordance with NPOA’s</td>
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<td></td>
<td>Legislation is updated by end of 2005</td>
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<tr>
<td>G10</td>
<td>Adequate representation at working group meetings (e.g. public, responsible NGO’s)</td>
<td>61</td>
<td>Future</td>
<td>Currently, only industry and ministry represented in WG and imbalanced representation in council</td>
<td>Presence of public, responsible NGO’s in WG and advisory council</td>
<td>At least one member of public or NGO’s present in 2006 discussions</td>
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<td>Imbalance is corrected</td>
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<td>Presence of public, responsible NGO’s in WG and advisory council</td>
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<td>Presence of public, responsible NGO’s in WG and advisory council</td>
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</table>
Annex 1: List of participants

<table>
<thead>
<tr>
<th>NAME</th>
<th>INSTITUTION/AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angie Kanadjembo</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
</tr>
<tr>
<td>Anja Kreiner</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
</tr>
<tr>
<td>Anja van der Plas</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
</tr>
<tr>
<td>Anna L. Mukamungeni</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
</tr>
<tr>
<td>Ben van Zyl</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
</tr>
<tr>
<td>Benedictus L. Dundee</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
</tr>
<tr>
<td>Caroline H. Garus-Oas</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
</tr>
<tr>
<td>Carolla Kirchner</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
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<tr>
<td>Chris Bartholomae</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
</tr>
<tr>
<td>David Kaanandunge</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
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<tr>
<td>Faye Brinkman</td>
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<tr>
<td>Ferdinand Hamukwaya</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
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<tr>
<td>Graca D’Almeida</td>
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<tr>
<td>H. Hdjaula</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
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<tr>
<td>Hannes Holtzhausen</td>
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<tr>
<td>Heidi Skrypzeck</td>
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<tr>
<td>Helvi Mupupa</td>
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<tr>
<td>Janine Basson</td>
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<tr>
<td>Jean Paul Roux</td>
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<tr>
<td>Johannes Hamukwaya</td>
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<td>Johnny Gamatham</td>
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<tr>
<td>Johnny Kathena</td>
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<tr>
<td>M. Goagoreb</td>
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<tr>
<td>Margit Wilhelm</td>
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<tr>
<td>Mathew Shikongo</td>
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<tr>
<td>Moses Maurihungirre</td>
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<td>Nadine Moroff</td>
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<td>Ndako A. Mukapuli</td>
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<td>P. Elago</td>
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<td>Paul Kainge</td>
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<td>R.S. Hatukale</td>
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<td>R.V. Hammyylea</td>
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<tr>
<td>Renate Lemke</td>
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<tr>
<td>Richard Kangumba</td>
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<tr>
<td>Rudy Cloete</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
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<tr>
<td>T. Idemk</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
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<tr>
<td>T. Shiwanapo</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
</tr>
<tr>
<td>Twali Akawa</td>
<td>Benguela Environment Fisheries Interaction and Training Programme</td>
</tr>
<tr>
<td>Uanivi Uatjavi</td>
<td>Benguela Environment Fisheries Interaction and Training Programme</td>
</tr>
<tr>
<td>Vicky Herbert</td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
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<tr>
<td></td>
<td>Ministry of Fisheries and Marine Resources, Namibia</td>
</tr>
</tbody>
</table>
# Annex 2: Complete list of all issues raised and their consequence, likelihood and risk ratings.

Note: Risk score is the product of the consequence score (CONS) and the likelihood score (LIKE)

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The <em>M. paradoxus</em> stock is shared with South Africa; Namibia on its own cannot ensure that it achieves its objectives</td>
<td>3</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>2</td>
<td>The <em>M. capensis</em> stock is shared with South Africa; Namibia on its own cannot ensure that it achieves its objectives</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Abundance: present biomass is lower than it should be - stock rebuilding is necessary</td>
<td>3</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>4</td>
<td>High variability and uncertainty in abundance and estimates of the stocks</td>
<td>3</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>Current fishing mortality may be contributing to low abundance of <em>M. paradoxus</em></td>
<td>2</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>Current fishing mortality may be contributing to low abundance of <em>M. capensis</em></td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>7</td>
<td>Bycatch in the Horse Mackerel mid-water trawl fishery might be contributing disproportionately to low abundance</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>The longline fishery is affecting the natural size structure by catching larger fish. This is leading to a negative impact on the viability of the population</td>
<td>3</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>The low selectivity of the trawl fishery affects the natural size structure of the <em>M. paradoxus</em> stock leading to a negative impact on the viability of the population</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>10</td>
<td>The low selectivity of the trawl fishery affects the natural size structure of the <em>M. capensis</em> stock leading to a negative impact on the viability of the population</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>11</td>
<td>Combined management of the two species may lead to undesirable impacts on one or both species</td>
<td>3</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>12</td>
<td>Fishing activity reduces or changes geographical distribution of the species</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>No management or bycatch plan is in place to ensure the sustainability of the following bycatch species: angelfish, kingklip, dentex, jacopever, sole, alfonsino, squid (especially kingklip and sole)</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>14</td>
<td>The Hake Fishery may be negatively impacting the sustainable use of monkfish</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>15</td>
<td>The Hake Fishery may be negatively impacting the sustainable use of horse mackerel and orange roughy</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

## Non-retained Species

<table>
<thead>
<tr>
<th>ID</th>
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</thead>
<tbody>
<tr>
<td>16</td>
<td>Bycatch of seabirds may be negatively impacting the viability of 13 species of albatross and petrel plus one other (Cape Gannet <em>Morus capensis</em>)</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>17</td>
<td>Bycatch of sharks may be negatively impacting the viability of species of threatened shark e.g. Blue and Mako sharks (note: a targeted fishery for Mako sharks exists)</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>18</td>
<td>Bycatch of sharks may be negatively impacting the viability of 3 endemic (Benguela) species (Puffadder Shy Shark <em>Haploblepharus edwardsii</em>, St Joseph's <em>Callorhinchus capensis</em> and White-spotted <em>Mustelus palumbres</em> Sharks)</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>
## Ecological Risk Assessment (ERA) for the Namibian Demersal Hake Fishery

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>19</td>
<td>Bycatch of skates may be negatively impacting the viability of 3 endemic (Benguela) species (Slime Raja pullopectata, Munchkin R. caudaspinosa and Yellowspot Skate R. wallacai)</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>20</td>
<td>Fishery catches dolphin species that are protected under Namibian legislation</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>21</td>
<td>The fishery impacts the population of seals</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>22</td>
<td>The fishery impacts the populations and structure of the benthic fish community (predominantly rat tails)</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>23</td>
<td>The fishery impacts the population of crustaceans</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>24</td>
<td>The fishery impacts the populations of jellyfish</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>25</td>
<td>The fishery impacts the population of other sharks and skates (not currently classified as threatened or specifically protected)</td>
<td>3</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>26</td>
<td>Change in behaviour and population dynamics (foraging and distribution driven by supplementation of diet) of seals—offal management; ingestion of pollution</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>27</td>
<td>Change in behaviour and population dynamics (foraging and distribution driven by supplementation of diet) of seabirds—offal management; ingestion of pollution</td>
<td>3</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>28</td>
<td>Maceration/release of offal leads to “soaking” of Cape Gannets</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>29</td>
<td>Shooting of bull seals impacts population dynamics e.g. sex bias or age structure</td>
<td>2</td>
<td>5</td>
<td>10</td>
</tr>
</tbody>
</table>

### General Ecosystem

<table>
<thead>
<tr>
<th>ID</th>
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<th>RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>Seabirds become entangled or ingest plastics and persistent materials dumped from fishing vessels</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>31</td>
<td>Seals become entangled or ingest plastics and persistent materials dumped from fishing vessels</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>Seabirds become oiled from small chronic spills and deliberate disposal of oil and fuel at sea from fishing vessels</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>33</td>
<td>Trawling causes physical damage to benthic habitat</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>34</td>
<td>Removal of biomass (hake and other caught species) may alter the trophic structure and functioning of the ecosystem</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>35</td>
<td>Damage to sensitive benthic biota</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>36</td>
<td>Cetaceans and seals and other species become entangled in lost and trawl longline gear</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>37</td>
<td>Seabirds become entangled in lost and trawl longline gear</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

### Human Wellbeing

#### Community Wellbeing

<table>
<thead>
<tr>
<th>ID</th>
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<th>RISK</th>
</tr>
</thead>
<tbody>
<tr>
<td>38</td>
<td>Income and living standards of the fishing communities are linked with profitability of fishery and health of the resource</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>39</td>
<td>High levels of unskilled labour and inadequate training opportunities within the industry structure result in uneven distribution of income and fringe benefits and possibility of labour unrest</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>40</td>
<td>Any negative impacts on the industry will be reflected in service providers and equipment suppliers</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>41</td>
<td>The economic well-being of fishing harbour towns (Walvis and Luderitz) are linked to the profitability of fishery and health of the resource</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
</tbody>
</table>
### Ecological Risk Assessment (ERA) for the Namibian Demersal Hake Fishery

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</tr>
</thead>
<tbody>
<tr>
<td>National Wellbeing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Fishing activity makes a substantial contribution to GDP and any down turn in profitability will have a negative impact</td>
<td>3</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>43</td>
<td>Down-turn in stock will result in less fish available for local consumption and/or higher local prices</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>44</td>
<td>Any down turn in the hake fishery will have an effect on national unemployment rate</td>
<td>3</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Ability to Achieve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Governance</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Lack of an approved management plan including reconciled objectives based on an integrated approach with reference points</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>46</td>
<td>Working groups need clear terms of reference</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>47</td>
<td>A need for improved transparency in the management of resources</td>
<td>2</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>48</td>
<td>VMS is still not in place</td>
<td>3</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>49</td>
<td>Penalties for transgressions are not adequate</td>
<td>3</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>50</td>
<td>Need for real time reporting and over-catching of quota</td>
<td>4</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>51</td>
<td>Lack of observer coverage on smaller vessels (while observers do not have an enforcement function, their presence increases compliance)</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>52</td>
<td>Inadequate and incomplete recording, capture and storage</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>53</td>
<td>Problems with attracting and retaining qualified and experienced staff</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>54</td>
<td>Inadequate research budget leading to insufficient services and facilities</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>55</td>
<td>Poor co-operation/interaction between stakeholders (Observer agency, Industry, directorates, Department of Marine Affairs, NGO’s)</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>56</td>
<td>Regular updating of legislation (e.g. NPOA – sharks adopted, but hasn’t filtered down into legislation)</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>57</td>
<td>Establishment of transboundary management regime for shared Hake stock(s)</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>58</td>
<td>Need for capacity and development in joint venture agreements in order to achieve desired outcomes (economic empowerment)</td>
<td>4</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>59</td>
<td>Need for implementation of transparency in quota transferability</td>
<td>4</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>60</td>
<td>Problems with the current allocation system result in a failure to meet the policy standard of strengthening the Namibianisation of the fishing sector</td>
<td>4</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>61</td>
<td>The lack of wider representative participation in council and working groups e.g. public interests, conservation groups, NGO’s</td>
<td>4</td>
<td>4</td>
<td>16</td>
</tr>
<tr>
<td>62</td>
<td>Improved communication to the general public</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>63</td>
<td>The absence of an industry code of conduct may disadvantage Namibia’s fisheries in the light of global pressure and trends for responsible fisheries</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>External Impacts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>The stock is under the influence of climatic and oceanographic factors that we have no control of, but that influence its availability to the industry and the stock dynamics. This leads to variability and uncertainty</td>
<td>3</td>
<td>6</td>
<td>18</td>
</tr>
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</table>
## Ecological Risk Assessment (ERA) for the Namibian Demersal Hake Fishery

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</thead>
<tbody>
<tr>
<td>65</td>
<td>Human induced changes outside the Hake fishery also have a direct influence on the viability and productivity of the stock e.g. mining (substrate, turbidity, pollution), pollution, other fisheries, oil exploration</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>66</td>
<td>Climate change (global warming) effects factors in 64 (which received a higher score) which will have widespread implications</td>
<td>3</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>67</td>
<td>Trophic impact induced by other fisheries (e.g. over-fishing of other stocks – prey and predators)</td>
<td>4</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>68</td>
<td>Human health (e.g. AID’s) will affect the work force</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>69</td>
<td>The profitability of the fishery is at the mercy of global eating habits (First World)</td>
<td>4</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>70</td>
<td>There are a number of social factors that affect the profitability of the fishery such as cheap labour, education, and population distribution</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>71</td>
<td>The national political climate affects foreign and local investment</td>
<td>3</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>72</td>
<td>There are a number of international factors that affect the profitability of the fishery e.g. fuel price, exchange rates, import taxes, foreign subsidies and competition with other markets</td>
<td>4</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>73</td>
<td>Export standards can influence access to foreign markets (e.g. EU regulations, eco-labelling)</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>74</td>
<td>There are a number of local factors that affect the profitability of the fishery such as taxes and lack of infrastructure</td>
<td>1</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>
Ecological Risk Assessment (ERA) for the Namibian Midwater Trawl Fishery

D.C. Nel

Deon Nel, WWF Sanlam Marine Programme, WWF South Africa, Private Bag X2, Die Boord, 7613, South Africa
Email: dnel@wwf.org.za

The ERA workshop for the Namibian Midwater Trawl Fishery took place in Swakopmund, Namibia, between the 28th and 30th of April, 2005. It was hosted by the National Marine Information Research Centre (NatMIRC), Ministry of Fisheries and Marine Resources, Namibia and facilitated by Dr. Deon Nel of WWF-South Africa. The workshop was attended by 25 participants. The majority of participants (19) were from the National Marine Information and Research Centre (NatMIRC). Other sectors represented were: fishing associations and industry representatives (2), Non Governmental Organisation (1), Ministry of Fisheries and Marine Resources (MFMR) – Economics Division (1), MFMR Monitoring, Compliance and Surveillance (MCS) (1) and MFMR Luderitz Marine Research (LMR) (1).

Please see Annex 1 for a complete list of attendees.

1. A brief description of the Midwater Trawl Fishery

The midwater trawl fishery is the largest contributor by volume to the Namibian fishing industry and targets primarily cape horse mackerel *Thrachurus capensis*. The fleet was dominated by various eastern block countries from the 1960’s to the 1980’s. After independence in the 1990’s, the fishery underwent structural changes. It is currently mainly composed of Russian vessels which are registered in Namibia but still operated by a foreign crew. The fleet size has decreased since independence from 57 to 17 in 2001 and has 22 active vessels at present. The midwater trawl fishery operates using trawls within the water column to catch schools of adult horse mackerel. Production is mainly frozen whole although fishmeal, oil and in some cases dried fish and fillets were also produced.

Over the years landings have fluctuated. Low catches were reported in the early 1960’s and increased in the 1970’s. The highest catches of almost 600 000 tonnes were reported in the early 1980’s. Catch rates have steadily decreased since the early 1990’s mainly due to lower fish abundances and have averaged 300 000 tonnes per year.

The horse mackerel resource is managed through a quota allocation method whereby a combined assessment is carried out and a Total Allowable Catch (TAC) is set for the resource after scientific recommendations are given to management. Since 1999, the quota allocation to the midwater fishery has been about 86% of the TAC.

For both the pelagic and midwater fleets, no specific season is proposed and thus fishing takes place year round. Restrictions on areas, size, depth and bycatch are adhered to. The midwater fleet is restricted to operate outside the 200 m bottom depth contour line. This restriction was imposed to avoid trawling in nursery areas as well as to prevent high bycatches of juvenile hake and sardine. A minimum mesh size of 60 mm is allowed and a size restriction of 17 cm total length or greater is applied. Within the depths allowed, the fleet is to leave a fishing area if a catch by weight comprises of more than 5% of hake or sardine and/or horse mackerel less than 17 cm total length per haul.

2. Results of the Workshop

*General overview of the ERA process*

*Identification of issues*

A total of 54 issues were identified for this fishery. These issues are listed and described in full in Annex 2. The ‘Governance’ component accounted for the highest proportion of issues (31%), whilst the ‘External Impacts’ and ‘Retained Species’ components were responsible for 20% and 19% of issues respectively (Figure 1). ‘Non-retained Species’ and ‘General Ecosystem’ components both accounted for 11% of issues. Interestingly, only 8% of issues related to ‘Human Wellbeing’ issues.
Ecological Risk Assessment (ERA) for the Namibian Midwater Trawl Fishery

Figure 1. Percentages of issues that were identified within each ERA component and category.

Prioritization of issues

The prioritization process resulted in a classic bell shaped graph, with most issues falling into the ‘Moderate’ risk category and very few in the ‘Extreme’ and ‘Negligible’ categories (Figure 2).

Figure 2. Percentages of issues per risk category
When considering the spread of risk categories within each of the ERA components (Figure 3), we see that only the ‘External Impacts’ component contained ‘Extreme’ risk issues. Both the ‘Retained Species’ and ‘General Ecosystem’ components contained a high proportion of ‘High’ risk issues. The ‘Governance’ component contained a large number of issues in both the ‘High’ and ‘Moderate’ risk categories.

![Figure 3. Numbers of issues within given risk categories for each ERA component](image)

**Performance reports**

Of the 54 issues identified, 36 (67%) were rated as being of ‘Moderate’ concern or higher and thus requiring a full performance report. Performance reports were developed for all these issues excepting those from the ‘External Impacts’ component as it was felt that by definition, there was little that fisheries management and its stakeholders could do to rectify these issues, although they should be considered at a higher policy level.

**The major issues**

The major issues with a risk rating of ‘Moderate’ and higher are shown in Table 1. The discussion in this section will highlight some of the main issues and themes under each of the main components.
**Ecological Wellbeing**

Concern was raised about the variability in the estimates of horse mackerel biomass and that there was a lack of confidence in certain parameters in the population model. Added to this is the concern that the size structure has changed towards smaller fish, a phenomenon characteristic of heavily fished populations. For several non-target species, little is known about their biology, status and the potential impact of this fishery on these populations. Catches of juvenile hakes in this fishery are not accounted for in the hake population models and could also be contributing to low abundances of these species.

Bycatch of threatened species of shark and seabirds were also considered to be of 'Moderate' risk. There was also concern that little is known about the trophic role of horse mackerel and the impacts of fishing on ecosystem structure. Despite this, horse mackerel has become a major forage fish for several top predators. Concern was also raised about the potential impact of fishing within the 200 m contour. It was felt that this could impact on the horse mackerel stock as well as the wider ecosystem (e.g. through bycatch of sardine).

The fact that these vessels re-bunker at sea poses a pollution risk. This fishery is also the largest fleet in Namibian waters, and as such poses a general marine litter problem.

**Human Wellbeing**

Few Namibians are employed in this fishery and those that are, are mostly unskilled. However, this fishery contributes significantly to food security in Namibia and in West Africa. Poor management of this fishery could thus have significant effects on food security.

**Governance**

The lack of an approved management plan with reconciled objectives poses a significant threat to the wise management of this fishery. This is compounded by the fact that fines imposed by inspectors are not an adequate deterrent. Certain rights holders were also guilty of overcatching their quota.

Several issues relating to transparent and participatory governance were also raised. These include: no representation of this industry on the Minister’s Advisory Council (despite the economic importance of this fishery); a lack of external review of management practices; a lack of transparency and record of decisions; and a lack of organized NGO participation.

The industry was also concerned about the impact of the 200 m depth exclusion zone was having on the economic viability of this fishery. It was felt the stock straddles this contour. The industry would like to be given the opportunity to scientifically test the positive and negative effects of fishing within this zone. Industry also felt that there were many misconceptions about the impacts and benefits of this fishery to Namibia.
**Ecological Risk Assessment (ERA) for the Namibian Midwater Trawl Fishery**

### External Impacts

Lack of information sharing and cooperation with Angola on management of horse mackerel was seen as a problem.

There was concern about the impact of competition with the purse seine fishery. Limited markets within Africa and the fact that there was a preference for horse mackerel from other countries was also of concern.

High fuel prices and the impacts of exchange rate fluctuations were deemed an ‘Extreme’ risk to this fishery, whilst both short-term variability as well as long-term environmental changes were considered to be a ‘High’ risk to this fishery.

As with most fisheries in southern Africa, the impact of HIV/AIDS on the workforce posed a risk to the fishery.

Table 1. List of issues that scored a ‘Moderate’ risk rating or higher.

*Note that the issue number cross-links to the issue numbering in Table 2 and Annex 2.*

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Cape Horse Mackerel: estimates of current biomass are highly variable (confidence in certain parameters for model is limited and uncertainty around survey results)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>5</td>
<td>Cape Horse Mackerel: size has decreased significantly and fish are maturing earlier</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>10</td>
<td>Dentex, angelfish, snoek, jacopever, squid, dories, mackerel, ribbonfish: we know very little on the biology and potential impacts</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>3</td>
<td>Cape Horse Mackerel: bulk of catches are taken from a small area (where the species is concentrated) in comparison with the wider distribution of the species as a whole</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>H</td>
</tr>
<tr>
<td>7</td>
<td>Juvenile hake: may be contributing to low abundances (this is not accounted for in Hake models)</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>M</td>
</tr>
<tr>
<td>12</td>
<td>Sharks are caught</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
</tr>
<tr>
<td>13</td>
<td>Seabirds are caught</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
</tr>
<tr>
<td>17</td>
<td>Little known about the trophic role of horse mackerel (e.g. trophic relationship with hake and pelagics) and how fishing impacts this relationship (e.g. changes in size, distribution and biomass)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>18</td>
<td>Horse mackerel has become a major forage fish for top predators (seals, seabirds (gannets, penguins), large pelagic and demersal fish) and little is known about how fishing impacts this relationship (e.g. changes in size, distribution and biomass)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>19</td>
<td>Bycatch mortality may have ecosystem impacts in itself</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
</tbody>
</table>
### Ecological Risk Assessment (ERA) for the Namibian Midwater Trawl Fishery

#### Impact of relaxing the 200m on the ecosystem and horse mackerel stock
- Impact: 3
- Risk: 5
- Impacts: 15
- Response: H

#### Compliance with waste and litter regulations (largest fishing vessels in our fleets)
- Impact: 2
- Risk: 5
- Impacts: 10
- Response: M

#### Fuel bunkering inside the EEZ
- Impact: 3
- Risk: 3
- Impacts: 9
- Response: M

### Human Wellbeing

#### Not a large number of Namibians employed in this industry and these are mainly unskilled
- Impact: 2
- Risk: 5
- Impacts: 10
- Response: M

#### Contributes to food security in Namibia and Africa
- Impact: 4
- Risk: 2
- Impacts: 8
- Response: M

### Ability to achieve

#### Governance

#### Lack of an approved management plan (for midwater trawl fishery but also for horse mackerel as a whole) with reconciled objectives
- Impact: 3
- Risk: 6
- Impacts: 18
- Response: H

#### Fines imposed by inspectors are not an effective deterrent
- Impact: 3
- Risk: 6
- Impacts: 18
- Response: H

#### Budget not adequate for broader ecological research
- Impact: 3
- Risk: 6
- Impacts: 18
- Response: H

#### No direct representation from this industry on the Advisory Council
- Impact: 3
- Risk: 6
- Impacts: 18
- Response: H

#### Lack of regular external review and appraisal of management and research
- Impact: 3
- Risk: 6
- Impacts: 18
- Response: H

#### Lack of skilled Namibian labour
- Impact: 3
- Risk: 6
- Impacts: 18
- Response: H

#### Impact of not relaxing 200m contour on the industry
- Impact: 3
- Risk: 4
- Impacts: 12
- Response: M

#### Overcatching by certain rights holders
- Impact: 3
- Risk: 4
- Impacts: 12
- Response: M

#### Research resources perceived to not be adequate by the industry
- Impact: 3
- Risk: 4
- Impacts: 12
- Response: M

#### Issues general to government departments: availability and retention of skilled personnel; poor training and career development plans; research budgets are limiting (equipment, ship time etc.)
- Impact: 2
- Risk: 6
- Impacts: 12
- Response: M

#### Misconceptions on the impact of this fisheries and its benefits to Namibia
- Impact: 2
- Risk: 6
- Impacts: 12
- Response: M

#### Lack of transparency in decision making and no clear record of decision
- Impact: 2
- Risk: 6
- Impacts: 12
- Response: M

#### Need for responsible NGO’s and civil society to be well organised and better represented in fisheries matters
- Impact: 2
- Risk: 6
- Impacts: 12
- Response: M

#### Information sharing with Angola needs to be improved for Cape horse mackerel
- Impact: 2
- Risk: 5
- Impacts: 10
- Response: M

### External Impacts

#### Fuel price
- Impact: 5
- Risk: 6
- Impacts: 30
- Response: E

#### Fluctuations in the exchange rate
- Impact: 4
- Risk: 5
- Impacts: 20
- Response: E

#### Effect of environmental variability on recruitment and other population parameters (recruitment very poorly understood)
- Impact: 3
- Risk: 5
- Impacts: 15
- Response: H

#### Potential long term impacts of climate change
- Impact: 3
- Risk: 4
- Impacts: 12
- Response: H

#### Levels of competition and interaction between midwater and purse seine fishery targeting horse mackerel
- Impact: 2
- Risk: 6
- Impacts: 12
- Response: M

#### HIV/AIDS’s impact on workforce
- Impact: 2
- Risk: 6
- Impacts: 12
- Response: M

#### Limited markets (to Africa mainly) & market preference for horse mackerel from other countries
- Impact: 2
- Risk: 6
- Impacts: 12
- Response: M

### Performance Reports

Performance reports where developed for all major issues except those from the ‘External Impacts’ component. The full performance reports produced at the workshop can be found in Table 2. The next section will summarise the main objectives and management responses that arose from the workshop.
Ecological Risk Assessment (ERA) for the Namibian Midwater Trawl Fishery

Ecological Wellbeing

There was an urgent need to improve understanding of the cause of variability in the estimates of the biomass of the horse mackerel stocks and to reduce variance in estimates to acceptable levels. There was also a need to better understand the cause of changes in the size distribution. Should this be found to be the result of fishing pressure, management measures (e.g. gear and area restrictions) need to be adapted to allow a natural size and age structure to return.

There was a need to understand the biology and stock status of several bycatch species (including dentex, angelfish, snoek, jacopever, squid, dories, mackerel, ribbonfish). This would involve improved and expanded data collection during surveys and analysis of distribution, trends in catch statistics and other abundance data. These results in turn need to be incorporated into an improved ecosystem model. There was also a need to gain a better understanding of the trophic role of horse mackerel. This can be done by analysis of spatially segregated diet matrices.

The impact of a potential relaxation of the 200 m depth closed area, was something that the workshop felt needed investigation. In particular there was a need to obtain information on the distribution and abundance of species that are likely to be impacted (both horse mackerel and all bycatch species).

Human Wellbeing

There is a need to increase both the number and skill levels of Namibians employed in this fishery. One of the bottlenecks for this appears to be the fact that the Namibian Fisheries Institute’s (NamFI) training is not appropriate for the midwater trawl fishery, and needs to be adapted.

Governance

The development of a management plan with reconciled objectives was at the heart of improving the governance of this fishery. This will require assessing international practices, consulting with stakeholders, and having the draft plan reviewed by international experts. It was also felt that a review workshop of all management practices should be held every five years. However, as a first step, sources of funding will need to be identified for this.

It was felt that the decision making structures needed to be changed to include improved representation from this fishing industry on the Minister’s Advisory Council and improved representation from responsible NGO’s and civil society groups on the management working group as well as possibly the Advisory Council. In order to facilitate transparency, it was suggested that the working group request for clear records of decisions and minutes of the meetings of the Advisory Council.
There was a need to increase the research budget to include research on ecosystem effects. However, it was recognized that alternative sources of funding and/or international collaborations would be required to allow this additional work.

Finally there was a need to investigate the benefits and impacts of a more flexible zoning system, including wider impacts on the ecosystem and other fisheries, which allowed fishing within the 200 m depth contour. The meeting was informed that the Minister was currently considering the need for such an assessment. Should the Minister respond positively, it was suggested that a consultative meeting be held before the end of 2005 to discuss the rollout and potential co-financing of such a project.
Table 2. Summary of Performance Reports developed for issues scoring a risk rating of ‘Moderate’ or higher. 

Note that the issue number cross-links to the issue numbering in Table 1 and Annex 2.

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ecological Wellbeing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EW1</td>
<td>Understand and reduce variability in estimates</td>
<td>1</td>
<td>Current &lt;br&gt;• Low confidence by management in biological recommendations &lt;br&gt;Future &lt;br&gt;• Improvement of biological evaluation &lt;br&gt;• High confidence in biological recommendation</td>
<td>Review of improved estimates parameters by experts &lt;br&gt;Comparison of present versus new parameter estimates</td>
<td>Mortality, catchability (q), steepness (h) - &lt;br&gt;Improved age-length key &lt;br&gt;Survey errors (e.g. acoustic errors)</td>
<td>Reducing variance of estimates to acceptable level comparable with other stocks by 2008 &lt;br&gt;Annual age-length key by 2008 &lt;br&gt;Continuation of survey errors project – present results inconclusive</td>
</tr>
<tr>
<td>EW2</td>
<td>Improve understanding of size and age structure of the stock</td>
<td>5</td>
<td>Current &lt;br&gt;• Restrictions in size (gear), depth (area) &lt;br&gt;• Leves &lt;br&gt;Future &lt;br&gt;• Adapt management actions to size and age structure of the stock</td>
<td>Monitoring of size distribution, landings, ageing, age at maturity</td>
<td>Better size and age structure &lt;br&gt;Better knowledge of the underlying processes</td>
<td>Understand causes &lt;br&gt;If appropriate, recommend management measures to improve size and age structure</td>
</tr>
<tr>
<td>EW3</td>
<td>Manage fish bycatch</td>
<td>10, 19</td>
<td>Current &lt;br&gt;• Monitoring of catch &lt;br&gt;Future &lt;br&gt;• Appropriate management measures depending on state of the stock &lt;br&gt;• Incorporation of bycatch information into management measures</td>
<td>Monitoring of size distribution and landings</td>
<td>Trends in catch statistics &lt;br&gt;Spatial distribution &lt;br&gt;Size distribution &lt;br&gt;Biological indicators</td>
<td>Spatial distribution results to be obtained by 2006 &lt;br&gt;Biological results and improving on data collection during surveys available by 2011 &lt;br&gt;Update ecosystem model with by-catch information</td>
</tr>
<tr>
<td>EW4</td>
<td>Determine impact on stock abundance of localised fishing</td>
<td>3</td>
<td>Future &lt;br&gt;• Possible spatial and temporal management measures</td>
<td>Localised CPUE and comparison with other areas CPUE &lt;br&gt;Localised maturity trends</td>
<td>Retrospective CPUE trends of the main spawning ground vs. other areas &lt;br&gt;Stock distribution and abundance patterns in</td>
<td>Adequate monitoring data &lt;br&gt;Maturity data obtained and analysed &lt;br&gt;Retrospective analysis (2008)</td>
</tr>
</tbody>
</table>
### Ecological Risk Assessment (ERA) for the Namibian Midwater Trawl Fishery

#### ID | OPERATIONAL OBJECTIVE | ISSUES | MANAGEMENT RESPONSE | DATA REQUIREMENTS | INDICATORS | PERFORMANCE LIMITS
---|----------------------|-------|---------------------|------------------|------------|-------------------
EW5 | Improve understanding of ecosystem functioning and the trophic role of horse mackerel | 3 Future | • Incorporate trophic effects in management | • Assess the trophic impact of the horse mackerel fishery on the ecosystem | • Spatial segregated diet matrices (diet distribution) | • Reduce the uncertainties in the ecosystem model
EW6 | Evaluate more flexible spatial management to mitigate ecosystem impacts (i.e. Re-evaluate 200 m depth restriction) | 19, 30 Current | • Conflict about the justification of the current restriction of 200 m | • Assess the Horse Mackerel stock parameter by depth | • Obtain information on distribution and abundance of species susceptible to be impacted upon | • Agreed (and possibly co-funded) Industry/Ministry assessment projects in place | • Spatial distribution and abundance of potential bycatch species |

#### Human Wellbeing

| ID | OPERATIONAL OBJECTIVE | ISSUES | MANAGEMENT RESPONSE | DATA REQUIREMENTS | INDICATORS | PERFORMANCE LIMITS |
---|----------------------|-------|---------------------|------------------|------------|-------------------|
HW1 | Improve Namibianisation of this fishery | 23, 42 Current | • Currently 40% (mostly unskilled. Unskilled positions are saturated by Namibians) | • Proportion of Namibians | • 50% by 1 Jan 2007 (% of total number of persons aboard all vessels) | • Relaxation of Namibianisation (was supposed to be 55% by 2005, but industry applied for relief) | • Skill levels of Namibians | • NAMFI training is not appropriate for these vessels | • Inappropriate skills from school | • Obtaining information on distribution and abundance of species susceptible to be impacted upon | • Assess the impact on the Horse Mackerel stock through modelling | • Should the Minister respond positively: consultative meeting to discuss assessment projects by end of 2005 |
<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
</table>
| HW2 | Maintain food security provided by this fishery | 26 Future | Increase numbers of Namibians with Grade 12 (incl. maths)  
Develop bridging courses for maths  
Develop seagoing careers (first step is the able seaman qualification)  
NAMFI needs to adapt training for Midwater fishery | • TAC has been stable for last four years | • Production levels | • Current levels maintained |
| **Governance** | | | | | | |
| G1 | Adopt an approved Management plan | 27 Current | Draft management plan developed  
Assessment of global management practices  
Stakeholder consultation to reconcile objectives of management plan  
International review of Management Plan | • First draft of a management plan  
Approval by stakeholders | • Management plan is in place | • Management plan is in place by end of 2006 |
| G2 | Appropriate penalties for non-compliance | 33 Current | Repeated offenders  
Regulations are being formulated  
Need to align with best practice elsewhere | | • Reduction in repeat offences | • Reduction in repeat offences |
<p>| G3 | Industry representation on Fisheries management council | 37 Current | Industry is represented but not this fishery specifically | | | • Representation from this fishery is in place when the current term of office of the Council expires |</p>
<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G4</td>
<td>Regular external review of management and research strategic direction</td>
<td>40</td>
<td>Current</td>
<td>Previous workshops were funded by Norad</td>
<td>2000 Management and survey methodology reviewed</td>
<td>Reviews</td>
</tr>
<tr>
<td></td>
<td>Future</td>
<td></td>
<td>Future</td>
<td>Investigate ways of funding such workshop from new sources</td>
<td>Model reviewed in stock assessment workshop in 2004</td>
<td></td>
</tr>
<tr>
<td>G5</td>
<td>All rightsholders catch within their allocated quotas</td>
<td>32</td>
<td>Future</td>
<td>Apply overcatch rule consistently</td>
<td>One major overcatch in last two years</td>
<td>Numbers of rightsholders overcatching</td>
</tr>
<tr>
<td></td>
<td>Future</td>
<td></td>
<td>Real-time monitoring on quota progress (need to work on information systems)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>G6</td>
<td>Acquire adequate funding for research</td>
<td>34, 35</td>
<td>Future</td>
<td>Find alternative sources of funding</td>
<td>Annual surveys, routine collection of industry and observer data, stock</td>
<td>Increase in research, especially on ecosystem impacts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Research needs discussed within working groups</td>
<td></td>
<td>assessments</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>International collaboration and exchange programmes, especially on ecosystem research</td>
<td></td>
<td>Need supplementary funding for additional work beyond the basics</td>
<td></td>
</tr>
<tr>
<td>G7</td>
<td>Eliminate misconceptions of the impact of this fishery and its benefits to Namibia</td>
<td>38</td>
<td>Current</td>
<td>Proposal by industry to present such information</td>
<td>Decision makers have information available</td>
<td>Workable systems in place that ensure information available</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Respond to industry proposal</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Collect and synthesis relevant social and economic information and make this</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>available to decision makers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>OPERATIONAL OBJECTIVE</td>
<td>ISSUES</td>
<td>MANAGEMENT RESPONSE</td>
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<td>PERFORMANCE LIMITS</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Contribution of the HM to the fishing industry national accounts (including indirect investments in the community and training etc.)</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>▪ Need to agree on key indicators that the industry can supply relevant information</td>
<td></td>
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</tr>
<tr>
<td>G9</td>
<td>Ensure transparent decision making by the Advisory Council and Fisheries Management Council (FMC)</td>
<td>39 Future</td>
<td>▪ Working group request through appropriate channels that records of decisions be made available</td>
<td>▪ Records of Decisions from Advisory Council and FMC available to stakeholders and public</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G10</td>
<td>Wider representation in working groups and improved information dissemination</td>
<td>43 Future</td>
<td>▪ Representation on working groups is improved immediately (civil society, responsible NGO’s), subcommittees discussed in technical matters ▪ Responsible NGO’s should be represented on the Advisory Council ▪ Improved representation from specific fisheries associations on the Advisory Council</td>
<td>▪ Representation levels</td>
<td>▪ Representation on working groups (civil society, responsible NGO’s) ▪ Responsible NGO’s should be represented on the Advisory Council ▪ Improved representation from specific fisheries associations on the Advisory Council ▪ Representation from all relevant Directorates</td>
<td></td>
</tr>
</tbody>
</table>
### Annex 1: List of participants

<table>
<thead>
<tr>
<th>NAME</th>
<th>INSTITUTION/AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angie Kanandjembo</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Anja Kreiner</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Anja van der Plas</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Antoinette Heita</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Beau Tjizoo</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Callie Jacobs</td>
<td>Midwater Trawl Association</td>
</tr>
<tr>
<td>Chris Bartholomae</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>D. van Bergen</td>
<td>Pelagic Fishing Association</td>
</tr>
<tr>
<td>Graca D’Almeida</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Heidi Skrypzeck</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Helvi Mupupa</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Hilma Asino</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>I. Uirab</td>
<td>Ministry of Fisheries and Marine Resources M.C.S.</td>
</tr>
<tr>
<td>Jackson Karupa</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Jean Paul Roux</td>
<td>Ministry of Fisheries and Marine Resources</td>
</tr>
<tr>
<td>Justine Kakuuai</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Martha Uumati</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Marthe Ntinda</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Mathew Shikongo</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Nadine Moroff</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Nande Nikanor</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>R.V. Hamunyela</td>
<td>Ministry of Fisheries and Marine Resources P.P.E.</td>
</tr>
<tr>
<td>Stefanus Voges</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Sue Roux</td>
<td>CETN &amp; Merus Seafood</td>
</tr>
<tr>
<td>Uanivi Uatjavi</td>
<td>National Marine Information and Research Centre</td>
</tr>
</tbody>
</table>
## Annex 2. Complete list of all issues raised and their consequence, likelihood and risk ratings.

Note: Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Ecological Wellbeing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Cape horse mackerel: stocks of both species (Cape and Kunene) are shared with Southern Angola could lead to overexploitation</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cape horse mackerel: stock is potentially shared with South Africa - could lead to overexploitation</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Cape horse mackerel: bulk of catches are taken from a small area (where the species is concentrated) in comparison with the wider distribution of the species as a whole</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Industry: Cons = 2</td>
</tr>
<tr>
<td>4</td>
<td>Cape horse mackerel: estimates of current biomass are highly variable (confidence in certain parameters for model is limited and uncertainty around survey results)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Cape horse mackerel: size has decreased significantly and fish are maturing earlier</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Kunene horse mackerel: composition not adequately reflected in sampling (lack of id knowledge - difficult to id when smaller)</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Juvenile hake: may be contributing to low abundances (this is not accounted for in hake models)</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Species and size composition of catch of small fish (going to fish meal) may not be accurately recorded and not accounted for</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>Ecosystem section may want a higher score for consequence since we don't know what species are being caught</td>
</tr>
<tr>
<td>9</td>
<td>Pilchard: can potentially contribute to mortality</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Dentex, angelfish, snoek, jacopever, squid, dorries, mackerel, ribbonfish; we know very little on the biology and potential impacts</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Non-retained Species</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Small cetaceans are caught</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>Need to collect information to really ascertain the consequence better; suspect that this impacts dusky dolphins</td>
</tr>
<tr>
<td>12</td>
<td>Sharks are caught</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>Need to collect information to really ascertain the consequence better: look at the BirdLife &amp; WWF project report</td>
</tr>
</tbody>
</table>
### Ecological Risk Assessment (ERA) for the Namibian Midwater Trawl Fishery

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Seabirds are caught</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>Need to collect information to really ascertain the consequence better: look at the BirdLife &amp; WWF project report</td>
</tr>
<tr>
<td>14</td>
<td>Seals are caught</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Jellyfish are caught</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Sunfish are caught</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>Need to collect information to really ascertain the consequence better: look at the BirdLife &amp; WWF project report</td>
</tr>
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</table>

**General Ecosystem**

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Little known about the trophic role of horse mackerel (e.g. trophic relationship with hake and pelagics) and how fishing impacts this relationship (e.g. changes in size, distribution and biomass)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Horse mackerel has become a major forage fish for top predators (seals, seabirds (gannets, penguins), large pelagic and demersal fish) and little is known about how fishing impacts this relationship (e.g. changes in size, distribution and biomass)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Bycatch mortality may have ecosystem impacts in itself</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Impact of relaxing the 200m on the ecosystem and horse mackerel stock</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Compliance with waste and litter regulations (largest fishing vessels in our fleets)</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>Localised problem in Walvis Bay</td>
</tr>
<tr>
<td>22</td>
<td>Fuel bunkering inside the EEZ</td>
<td>3</td>
<td>3</td>
<td>9</td>
<td>Observers need to monitor this better; some votes for a cons of 2</td>
</tr>
</tbody>
</table>

**Human Wellbeing**

<table>
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<tr>
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<th>ISSUE</th>
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<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>23</td>
<td>Not a large number of Namibians employed in this industry and these are mainly unskilled</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Large number of dependent service providers (cold storage, shipping agents, transport, stevedooring, health, launch, port costs etc.)</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Contribution to government in levies and other fishing fees is N$60M, also large contributor to Social Responsibility projects</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>Hake not paying full levies at the moment, Pilchard low TAC etc.</td>
</tr>
<tr>
<td>26</td>
<td>Contributes to food security in Namibia and Africa</td>
<td>4</td>
<td>2</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>The contribution to the National GDP should be maintained</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>N$300M is being invested in the Namibian economy</td>
</tr>
<tr>
<td>ID</td>
<td>ISSUE</td>
<td>CONS</td>
<td>LIKE</td>
<td>RISK</td>
<td>NOTES</td>
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<tr>
<td>----</td>
<td>-----------------------------------------------------------------------</td>
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</tr>
<tr>
<td>27</td>
<td>Do not have an approved management plan (for midwater trawl fishery but also for horse mackerel as a whole) with reconciled objectives</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>G. D'Alemida: Cons = 2</td>
</tr>
<tr>
<td>28</td>
<td>Information sharing with Angola needs to be improved for Kunene horse mackerel</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Information sharing with Angola needs to be improved for Cape horse mackerel</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Impact of not relaxing 200 m contour on the industry</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>NatMIRC feels that the likelihood = 2; Some industry feel likelihood should be 5</td>
</tr>
<tr>
<td>31</td>
<td>Non-compliance with the depth (200 m) contour (VMS needs to be in place to assist in compliance)</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Overcatching by certain rights holders</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Fines imposed by inspectors are not an effective deterrent</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Research resources perceived to not be adequate by the industry</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Budget not adequate for broader ecological research</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Issues general to government departments: availability and retention of skilled personnel; poor training and career development plans; research budgets are limiting (equipment, ship time etc).</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>No direct representation from this industry on the Advisory Council</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Misconceptions on the impact of this fisheries and its benefits to Namibia</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Lack of transparency in decision making and no clear record of decision</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Lack of regular external review and appraisal of management and research</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Lack of specific labour regulations for seagoing staff</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Lack of skilled Namibian labour</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Relaxation of the Namibianisation policy for this sector</td>
</tr>
<tr>
<td>43</td>
<td>Need for responsible NGO's and civil society to be well organised and better represented in fisheries matters</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Effect of environmental variability on recruitment and other population parameters (recruitment very poorly understood)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Potential long term impacts of climate change</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Levels of competition and interaction between midwater and purse seine fishery targeting horse mackerel</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
### Ecological Risk Assessment (ERA) for the Namibian Midwater Trawl Fishery

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>47</td>
<td>Shipping pollution</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Oil and gas explorations and mining</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Harbour development at Cape Frio (shipping disturbance of spawning grounds and reduction in local abundance)</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>HIV/AIDS’s impact on workforce</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Political Environment</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Fluctuations in the exchange rate</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Fuel price</td>
<td>5</td>
<td>6</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Limited markets (to Africa mainly) &amp; market preference for horse mackerel from other countries</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>
Ecological Risk Assessment (ERA) for the Namibian Purse Seine Fishery

Compiled by D.C. Nel

Deon Nel, WWF Sanlam Marine Programme, WWF South Africa, Private Bag X2, Die Boord, 7613, South Africa
Email: dnel@wwf.org.za

The ERA workshop for the Namibian purse seine fishery took place in Swakopmund, Namibia, between the 26th and 28th of September, 2005. It was hosted by the National Marine Information Research Centre (NatMIRC), Ministry of Fisheries and Marine Resources, Namibia and facilitated by Dr. Deon Nel from WWF-South Africa. The workshop was attended by 25 participants. The majority of participants (19) were from the National Marine Information and Research Centre (NatMIRC). Other sectors represented were: fishing associations and industry representatives (2), NGO (1), Ministry of Fisheries and Marine Resources (MFMR) – Economics Division (1), MFMR Monitoring, Compliance and Surveillance (MCS) (1) and MFMR Luderitz Marine Research (1).

Please see Annex 1 for a complete list of attendees.
1. A brief description of the Purse Seine Fishery*

The purse-seine fishery in Namibia is based largely on sardine *Sardinops sagax* and juvenile cape horse mackerel *Trachurus capensis*, and to a lesser extent on anchovy. The fishery commenced soon after World War II when there was a great demand for canned fish. Sardine landings increased rapidly from 0.02 million tonnes in the 1950’s to a maximum of 1.4 million tonnes in 1968. Subsequently there was a sharp decrease to less than 0.03 million tonnes in 1971, followed by a slight increase for a few years before a sudden collapse in the late 1970’s. By 1990, when an acoustic survey started being used, the stock was estimated at roughly 700,000 tonnes and continued to decrease through the 1990’s with the lowest estimated in 1996 of only a few thousand tonnes. In 2001, a similar low point was observed again when a zero estimated was recorded. Although a slight increase has been observed subsequently, the stock remains in a critical state. These collapses are attributed mainly to overfishing and environmental perturbations.

In the past, the fleet operated mainly in the vicinity of Walvis Bay, however that has extended further north to Cape Frio. This fishery operates almost entirely from the port of Walvis Bay, however for a limited period during the 1960s and early 1970s it also operated out of Luderitz and from sea-going processing plants. The sea-going plants, converted ex-whaling, factory ships, were supplied by 27 catcher boats fishing the same stock as the land-based purse seiners but operating further than 12 nautical miles from the coast. Refrigerated seawater boats using 28 mm nets have been employed since 1979 and have been responsible for most of the sardine catch since 1980.

* Adapted from the Pilchard Draft Management Plan.

2. Results of the Workshop

General overview of the ERA process

Identification of issues

A total of 66 issues were identified for this fishery. These issues are listed and described in full in Annex 2. Most of the identified issues fell within the ‘Retained Species’ component (30%) (Figure 1). The ‘Governance’ component was responsible for 23% of issues while ‘Human Wellbeing’ and ‘External Impacts’ both accounted for 15% of issues each. The ‘General Ecosystem’ component accounted for 12% of the issues and very few issues were identified in the ‘Non-retained Species’ component.
Prioritization of issues

The prioritization process resulted in a reasonably even spread of issues within each of the risk categories (Figure 2). In general, however, the distribution of issues was slightly skewed towards the higher risk categories, with a reasonably high proportion of issues (18%) considered to be of ‘Extreme’ risk. Seventeen of the 66 issues (26%) were considered to be of ‘Low’ or ‘Negligible’ risk and thus not necessitating the development of performance reports.
Ecological Risk Assessment (ERA) for the Namibian Purse Seine Fishery

When considering the spread of risk categories within each of the ERA components (Figure 3), we see that the ‘Retained Species’ component contained the most issues and that most of these were in the ‘High’ risk category, indicating that there may be serious problems with the target species. Significant numbers of ‘Extreme’ and ‘High’ risk issues were found in the ‘General Ecosystem’, ‘Community Wellbeing’, ‘Governance’ and ‘External Impacts’ components. The ‘Non-retained Species’ component contained few issues and these were of ‘Negligible’ risk.

Figure 2. Numbers of issues per risk category

Figure 3. Numbers of issues within given risk categories for each ERA component
Performance reports

Of the 66 issues identified, 49 (74%) were rated as being of ‘Moderate’ concern or higher and thus requiring a full performance report. Performance reports were developed for all these issues excepting those from the ‘External Impacts’ component as it was felt that by definition, there was little that fisheries management and its stakeholders could do to rectify these issues, although they should be considered at a higher policy level.

The major issues

The major issues (those of a risk rating of ‘Moderate’ and higher) are listed in Table 1. The discussion in this section will highlight the main issues and themes under each of the main components.

Ecological Wellbeing

The current low abundance of several target species were of concern. Sardine abundance is considered to be critically low and the size and age structure of the stock has changed. The low anchovy stock was also considered to be of ‘Moderate’ risk. Transboundary sharing of stocks also posed considerable risk for the management of this fishery (sardine and horse mackerel – shared with Angola; anchovy – potentially shared with South Africa).

The impact that fishing has had on decreasing food availability for certain predators that have not been able to adapt to changes in the ecosystem (e.g. gannets and penguins) was considered to be an ‘Extreme’ risk, as was the fact that overfishing may have resulted in long-term changes in the trophic structure of the ecosystem. These long-term changes may also be partially responsible for environmental events such as sulphur eruptions and low oxygen events.

Human Wellbeing

Historically this fishery was the highest employer in Namibia but is currently operating on the verge of commercial collapse. Fluctuations in the TAC were considered as an ‘Extreme’ risk to the livelihoods of the fishing community and industry felt that a TAC of below 20 000 tonnes could close the fishery permanently. This could have consequent knock-on effects on dependent industries. Above the 20 000 tonne TAC mark, it appeared variability in resource availability (rather than the actual amount) seemed to be the most important risk as this made long-term planning very difficult and inhibited investment in the sector. The poor present economic situation of this fishing sector has resulted in some very specific social and economic problems such as the inability of certain companies to afford basic employee benefits such as medical insurance.
Ecological Risk Assessment (ERA) for the Namibian Purse Seine Fishery

**Governance**

The highest risk to this fishery is the fact that currently social and economic demands conflict with sustainability of the stocks. This was compounded by the fact that the lack of reliable economic data and a management with reconciled objectives. At an international level the lack of co-operation and information sharing on stock management with Angola was seen as an ‘Extreme’ risk.

A number of governance issues relating to transparent and participatory decision making were also identified. These include narrow representation on the Advisory Council, lack of review and appraisal of management procedures, poor communication with general public and the lack of involvement of organized civil society groups and NGO’s in decision making.

There also appeared to be poor communication between different government ministries involved in aspects of the fishery as well as poor communication between different directorates within the Ministry.

Annual variability in the TAC also posed a medium-term economic risk through loss of previously secure and reliable overseas markets.

**External impacts**

The effects of long-term climate change as well as short-term climatic anomalies posed ‘Extreme’ and ‘High’ risk to this fishery. Political climate, fuel prices the effects of HIV/AID’s and currency exchange rates were also of ‘High and ‘Moderate’ concern.

Table 1. The list of issues that scored a ‘Moderate’ risk or higher.

* Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)
** Categories: E=Extreme, H=High, M=Moderate

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sardine stock is shared with Angola</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>2</td>
<td>Sardine abundance is critically low</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>3</td>
<td>Sardine: size and age structure has changed (fish are much smaller and no more fish older than 3 years)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>4</td>
<td>Sardine: variability in recruitment is not well understood</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>5</td>
<td>Sardine: unusually high and unknown natural mortality</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>6</td>
<td>Anchovy: variability in recruitment is not well understood</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>7</td>
<td>Horse mackerel stock is shared with Angola</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>ID</td>
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<td>RISK*</td>
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</tr>
<tr>
<td>14</td>
<td>Horse mackerel: variability in recruitment is not well understood</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>16</td>
<td>Gobies: little known about this species (life history, ecology, etc.)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>2</td>
<td>Pilchard: distribution of shoals has become more patchy (effect of decreasing abundance)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>8</td>
<td>Anchovy abundance is low</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>13</td>
<td>Horse mackerel: fishing of juveniles has unknown effect on recruitment</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>15</td>
<td>Round Herring: little known about this species (life history, ecology, distribution etc.)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>9</td>
<td>Anchovy stock is potentially shared with South Africa</td>
<td>2</td>
<td>4</td>
<td>8</td>
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</tr>
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</table>

**General Ecosystem**

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK*</th>
<th>CATEGORY**</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Decreased food availability for predators (gannets, penguins - species unable to make switch to gobies)</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>28</td>
<td>Overfishing may have led to long term change in the trophic structure (possibly an alternate stable state)</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>24</td>
<td>Removal of grazers leads to accumulation of plankton biomass possibly leading to sulphur eruptions and low oxygen events</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>H</td>
</tr>
<tr>
<td>25</td>
<td>Removal of small pelagics may have led to the increase in goby, jelly fish etc. abundance and distribution (and other possible trophic impacts)</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td>H</td>
</tr>
<tr>
<td>27</td>
<td>Decreased food availability for predators able to make switch to alternate prey (seals, sharks, hake, snoek etc.)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
</tbody>
</table>

**Human Wellbeing**

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
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</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>Changes in TAC affects income and loss of livelihood for workers' dependents</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>41</td>
<td>Historically this fishery was the largest employer (large potential for future especially for Namibians)</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>33</td>
<td>Threat of TAC &lt;20 000 tonnes could close the fishery permanently</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>34</td>
<td>Variability in resource availability makes planning difficult, low security, low investor confidence</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>M</td>
</tr>
<tr>
<td>40</td>
<td>Historically this fishery was a large contributor to National GDP (large potential for future)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>M</td>
</tr>
<tr>
<td>32</td>
<td>Recent decrease in numbers of jobs available - including recent closures of canneries (but fishery still has high potential for future)</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>36</td>
<td>Medical insurance and other employer benefits are no longer available/affordable for the majority of sea-going personnel</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>37</td>
<td>Collapse of fishery could result in large scale knock-on effects on dependent service providers and retailers (engineering companies, transport, shipping repairs, provisions, fuel etc.) in Walvis Bay and Swakopmund</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
</tr>
<tr>
<td>38</td>
<td>Knock on effects on the rural areas from which migrant labour is drawn</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>M</td>
</tr>
</tbody>
</table>

**Ability to Achieve**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>Socio-economic demands conflict with sustainability</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>44</td>
<td>Lack of co-operation and information sharing with Angola on the management of shared stocks &amp; inconsistent national application of rules for fishing on same stock</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>42</td>
<td>Lack of an approved management plan that includes reconciled objectives</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>45</td>
<td>Lack of economic information for decision making</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>46</td>
<td>Research budget has got smaller with catches (drawn from levies) - leads to less research vessel availability</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>51</td>
<td>Narrow representation on the Advisory Council and working groups (no labour, civil society, fisheries specific etc.)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
</tbody>
</table>
Ecological Risk Assessment (ERA) for the Namibian Purse Seine Fishery

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</tr>
</thead>
<tbody>
<tr>
<td>53</td>
<td>Lack of external review and appraisal of management procedures</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>55</td>
<td>Loss of markets due to variability in TAC</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>49</td>
<td>Lack of communication between Ministries (Transport, Fisheries, Labour, Finance)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>H</td>
</tr>
<tr>
<td>47</td>
<td>Lack of sufficient co-operation within the Ministry (between different Directorates)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>50</td>
<td>Lack of specific labour regulations for seagoing staff</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>52</td>
<td>Poor communication with the general public (including transparency in decision making)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>56</td>
<td>Civil Society and NGO’s are poorly organised and represented in fisheries matters, mainly due to a lack of information and communication by management</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>54</td>
<td>Lack of newly trained skilled labour</td>
<td>2</td>
<td>5</td>
<td>10</td>
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</table>

**External Impacts**

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>58</td>
<td>Short term climatic anomalies (Benguela Ninos) affect all population parameters</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>64</td>
<td>Political environment</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>66</td>
<td>Fuel prices</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td>E</td>
</tr>
<tr>
<td>57</td>
<td>Long term climate change - effect unknown but major</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td>E</td>
</tr>
<tr>
<td>63</td>
<td>HIV/AIDS’s impacts the workforce</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>H</td>
</tr>
<tr>
<td>59</td>
<td>Localised anomalies (Sulphide eruptions, low oxygen events etc)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
</tr>
<tr>
<td>65</td>
<td>Exchange Rate</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>M</td>
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</tbody>
</table>

**Performance Reports**

Performance reports where developed for all major issues except those from the ‘External Impacts’ component. It was felt that by definition there was little the fishery management could do about issues from this category but they would need to be reviewed at a higher policy level. The full performance reports produced at the workshop can be found in Table 2. The next section will summarise the main objectives and management responses that arose from the workshop.

**Ecological Wellbeing**

The most critical issue requiring addressing is the critically low sardine biomass and there is an urgent need to rebuild the stock. Workshop participants felt that in the short-term (2011) there was a need to rebuild the spawning stock to above 500 000 tonnes and in the long-term (WSSD target of 2020) rebuild the stock to 1 000 000 tonnes. Protecting years of good recruitment by keeping a conservative fishing strategy could contribute to achieving these targets.

In terms of research, an urgent need was expressed for more effort to be put into better understanding of the variability in recruitment of sardine, anchovy and horse mackerel as well as high natural mortality rates of sardine. This would involve the collection of additional...
environmental data as well as the quantification of various causes of mortality. More research needs to be done on gobies, as well as a management plan developed.

The shared nature of the stocks, especially sardine with Angola, makes it imperative that a regional management regime is adopted for the Benguela Large Marine Ecosystem (BCLME). This could come in the form of the envisaged Benguela Current Commission (BCC). However, the workshop felt that the process still has a long way to go and a more realistic medium-term goal was to have a joint Ministerial technical committee in place by 2007 and regional TAC's set by 2008.

The target species for this fishery occupies a critical trophic position in the Benguela ecosystem and current low biomass is having a detrimental effect on several dependent species (especially gannets and penguins). It was felt that there was a need to set targets and trends for the populations of these dependent predators and determine the minimum target biomass and spatial distribution of prey needed to rebuild these populations. These data then need to be incorporated in management procedures.

Furthermore, it is purported that overfishing may have led to a long-term change in the trophic structure of this ecosystem. Research was needed to understand the key factors that have led to the change and key factors that are causing the persistence of the present state.

**Human Wellbeing**

The most pressing human wellbeing need was to stabilize the TAC within acceptable levels. It was felt that stability in the TAC was more important than the actual level of the TAC and that the management plan should stipulate a minimum TAC with acceptable fluctuation levels. These limits should aim to maintain current employment levels. However, this issue also highlighted the need for a management plan with reconciled objectives that would seek to reduce conflicting sustainability and social and economic demands. It was therefore felt that a management plan that is accepted by all stakeholders should be finalized and implemented by the end of 2006. However in order to make these decisions it will be necessary to improve the economic data for the fishery. For this there needs to be improved communication and transparency between the industry and the Ministry on economic information.

In the event that this fishery should collapse, the economic basis of dependent towns such as Walvis Bay, Swakopmund and Luderitz, needs to become more diversified. It was noted that initiatives such as Namport expansions, the Walvis Bay Corridor initiative, and tourism initiatives were already being expanded in these areas and should continue to be supported.

**Governance**

Within the theme of transparent and participatory governance, there was an immediate need to improve representation from civil society groups and responsible NGO's on the fishery
working groups. The Advisory Council also needed to widen its representation to include specific fisheries associations and responsible NGO’s. There was also a need to improve communication with the general public with the objective of increasing the sense of national ownership of marine resources. Some examples of how this could be done, include: wider dissemination of the Minster’s annual briefing, newsletters, websites and general media outreach. It was noted that these communications needed to be done in all the official languages of Namibia.

In terms of research, it was felt that the Ministry was happy with survey methodology and techniques, which had been favourably reviewed by international experts. However, there was a need to increase the quality of data being collected by the fisheries observers aboard commercial vessels.
Table 2. Summary of Performance Reports developed for issues scoring a risk rating of 'Moderate' or higher.
Note that the issue number cross-links to the issue numbering in Table 1 and Annex 2.

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
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<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
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<tr>
<td></td>
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</tr>
<tr>
<td>EW1</td>
<td>Coordinated and harmonized regional management regime for the Benguela MCS capacity shared Science sharing</td>
<td>1, 44</td>
<td>Current</td>
<td>Bi-annual regional surveys in place</td>
<td>Multi (bi)-lateral agreement in place (BCC perhaps)</td>
<td>Bi-annual regional survey continues</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ministries have met and a draft protocol has been finalised</td>
<td>Regional TACs</td>
<td>Ministerial joint technical committee in place by 2007</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BCLME project to make recommendations on the BCC</td>
<td>Joint surveys and standardized methodology</td>
<td>Regional TACs are being set by 2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>BCLME project on transboundary stocks (pilchard and horse mackerel)</td>
<td>Ministerial joint technical committee</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SADC MCS protocol is in place</td>
<td>Regular regional workshops</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Finalise and implement protocol</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Establish the joint technical committee</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Joint technical committee sets joint TACs</td>
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</tr>
<tr>
<td>EW2</td>
<td>Rebuild the spawning stock above MSY Wider distribution area Balanced age structure</td>
<td>2,3,4</td>
<td>Current</td>
<td>Biannual biomass surveys in place</td>
<td>More than three age groups (x % above 5 years)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Control fishing mortality</td>
<td>Short term: Rebuilt to 500 000t spawning stock</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Good recruitment should be protected until equilibrium age structure has been reached</td>
<td>Long-term: Rebuilt to 1 000 000t spawning stock</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Distribution should cover historically described</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>500 000t spawning stock by 2011</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>WSSD target (2020) – 1 000 000t spawning stock</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Balanced age structure (see above) by 2011</td>
<td></td>
</tr>
<tr>
<td>ID</td>
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<td>ISSUES</td>
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<td>DATA REQUIREMENTS</td>
<td>INDICATORS</td>
<td>PERFORMANCE LIMITS</td>
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</tr>
<tr>
<td>EW3</td>
<td>Understand and Predict recruitment (short and medium term)</td>
<td>5,11,13</td>
<td>Current</td>
<td>Recruit surveys vs. model prediction (no surveys for anchovy)</td>
<td>Understanding the influence of environment on recruitment (from retrospective studies and incorporating new data)</td>
<td>How successful prediction is</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Incorporate recruitment prediction into management</td>
<td>Gain ability to predict recruitment</td>
<td>How far ahead we can predict</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Additional data collection (e.g. CUFES, environmental surveys)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Incorporate recruitment prediction into management</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Possible management action to alleviate some mortality causes (bycatch, predation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EW4</td>
<td>Understand and quantify the causes of high mortality</td>
<td>7</td>
<td>Current</td>
<td>Accuracy and precision of estimates</td>
<td>Major causes of mortality identified and quantified</td>
<td>Accurate estimates of different causes of mortality (2015)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Estimates of total mortality</td>
<td>Predict and control the causes wherever possible</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Quantify different causes of mortality</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Incorporate results into management</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Possible management action to alleviate some mortality causes (bycatch, predation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EW5</td>
<td>Understand role of gobies in the ecosystem and their interaction with small pelagics and their predators</td>
<td>16</td>
<td>Future</td>
<td>Necessary data available and incorporate in models and into EAF management by 2009</td>
<td>Life history and distribution</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evaluate commercial potential of gobies</td>
<td></td>
<td>Future</td>
<td>Research on gobies</td>
<td>Biomass estimates</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td>Management plan for gobies</td>
<td>Diet studies</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EW6</td>
<td>Improve the conservation status of affected species by maintaining adequate food availability (distribution and quantity)</td>
<td>26</td>
<td>Current</td>
<td>Gannets locally endangered, globally vulnerable</td>
<td>Population trends of these species</td>
<td>Conservation status is stabilized within five years and improving within next decade</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Current</td>
<td>No account of these predators is taken in the management of the pelagic resources</td>
<td>Diet, breeding success, foraging distribution (see BCLME predator project)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Current</td>
<td>Monitoring systems are being put in place for these predators (BCLME project)</td>
<td>Predator monitoring system and database in place by 2007</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Current</td>
<td>Historical data on seabird</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Ecological Risk Assessment (ERA) for the Namibian Purse Seine Fishery

<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>EW7</td>
<td>Investigate the means and possibilities of improving the state of the system. Identify the key factors leading to changes in the ecosystem. Identify the key factors leading to the persistence of the present state (3 decade)</td>
<td>28</td>
<td>Current</td>
<td>Models and hypothesis formulated</td>
<td>Improved knowledge of causes of ecosystem shift through retrospective analysis of biological, commercial, environmental and ecological series</td>
<td>Data available for model by 2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No management consideration of ecosystem shifts at present</td>
<td>Some data are available</td>
<td>Combined series into ecosystems models</td>
<td>Model outputs and associated advice to management by 2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Future</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scientific advice on ecosystem shift to management to be used for policy objective for small pelagic</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>trends and diets are available (not perfect, but adequate)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Future</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Establish targets for trends and population levels of these species</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Determine minimum target biomass and spatial distribution of prey needed to rebuild these populations</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Combine the above and feed into management procedures (e.g. adjust TACs, spatial management zones)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HW1</td>
<td>Stabilization TAC within acceptable levels</td>
<td></td>
<td>Current</td>
<td>Large fluctuations prior to 2003 – zero TAC in 2002 since 2003 quite stable</td>
<td>Current employment levels Infrastructure Stable markets</td>
<td>Current employment levels are maintained Agreed Minimum TAC with acceptable fluctuation levels determined in the Management Plan by end of 2006</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>OMP has been formulated but has not been approved</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Draft management plan in place but does not refer to fluctuation currently</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ID</td>
<td>OPERATIONAL OBJECTIVE</td>
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</tr>
<tr>
<td></td>
<td><strong>Economic basis of these towns is diversified</strong></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>HW2</td>
<td></td>
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</tr>
</tbody>
</table>

**Issues**

| HW2  | 37 | **Current** |
|      |    |             |
|      |    | • Walvis Bay Corridor group working towards increasing the importance of Walvis Bay as a gateway for transport into Africa |
|      |    | • Tourism initiatives mainly individually-based, but definitely increasing |
|      |    | • Building a new floating dry-dock |

**Future**

| HW2  | 37 | **Future** |
|      |    |             |
|      |    | • Namport expansions |
|      |    | • Tourism |

**Data Requirements**

- Employment rates are available on internet
- Employment rates and sectors where people are employed
- Current employment rates in these towns is maintained or increased

**Performance Limits**

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Management plan that is accepted by all stakeholders is in place</strong></td>
</tr>
<tr>
<td>G1</td>
<td></td>
</tr>
</tbody>
</table>

**Issues**

| G1   | 42,43,53 | **Current** |
|      |          |             |
|      |          | • Draft Management Plan |
|      |          | • Stakeholders have seen OMP |
|      |          | • Stakeholders participate in this ERA process |

**Future**

| G1   | 42,43,53 | **Future** |
|      |          |             |
|      |          | • Stakeholder consultation to reconcile objectives of management plan |
|      |          | • Ratification by Minister and Council |
|      |          | • International review of Management Plan |

**Data Requirements**

- Draft MP
- Stakeholders have seen OMP |
- Stakeholders participate in this ERA process

**Performance Limits**

- Management plan is operational
- Management plan is implemented by end of 2006
**Ecological Risk Assessment (ERA) for the Namibian Purse Seine Fishery**

<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
</table>
| G2 | Improved communication and transparency between industry and the Ministry on economic information | 45 | Current | ▪ Low response rate from companies in providing information  
▪ Averages of prices given and not specifics, so difficult to assess how companies are doing  
▪ Lack of trust between industry and government on confidentiality on information | ▪ Response rates and quality of assessment questionnaires | ▪ All companies comply and provide information |
|    |                        |        | Future    |                  |             |                    |
|    |                        |        |           |                  |             |                    |
| G3 | Improved representation of relevant stakeholders on the Advisory Council and working groups | 51,47 | Future | ▪ Representation on working groups is improved immediately (civil society, responsible NGOs), subcommittees discussed in technical matters  
▪ Responsible NGOs should be represented on the Advisory Council  
▪ Improved representation from specific fisheries associations on the Advisory Council | ▪ Representation levels | ▪ Representation on working groups is improved immediately (civil society, responsible NGOs), subcommittees discussed in technical matters  
▪ Responsible NGOs should be represented on the Advisory Council  
▪ Improved representation from specific fisheries associations on the Advisory Council | ▪ Representation from all relevant Directorates |
|    |                        |        |           |                  |             |                    |
| G4 | Increase research budget and improve the equipment on the Welwitchia (and new vessel) | 46 | Current | ▪ Ministry happy with the survey methodology  
▪ International review of research and survey methodology |               |                    |
<p>|    |                        |        | Future    |                  |             |                    |
|    |                        |        |           |                  |             |                    |</p>
<table>
<thead>
<tr>
<th>ID</th>
<th>OPERATIONAL OBJECTIVE</th>
<th>ISSUES</th>
<th>MANAGEMENT RESPONSE</th>
<th>DATA REQUIREMENTS</th>
<th>INDICATORS</th>
<th>PERFORMANCE LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>G5</td>
<td>Increase the sense of national ownership of marine resources amongst the general public</td>
<td>Increase the sense of national ownership of marine resources amongst the general public</td>
<td>National government</td>
<td>Increase quality of information from observers</td>
<td>Newsletters, Media hits, Websites etc</td>
<td>Previously a newsletter</td>
</tr>
</tbody>
</table>
Annex 1. List of participants

<table>
<thead>
<tr>
<th>NAME</th>
<th>INSTITUTION/AFFILIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angie Kanandjembo</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Anja Kreiner</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Anja van der Plas</td>
<td>National Marine Information and Research Center</td>
</tr>
<tr>
<td>Antoinette Heita</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Beau Tjizoo</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Callie Jacobs</td>
<td>Midwater Trawl Association</td>
</tr>
<tr>
<td>Chris Bartholomae</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>D. van Bergen</td>
<td>Pelagic Fishing Association</td>
</tr>
<tr>
<td>Graca D'Almeida</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Heidi Skrypzeck</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Helvi Mupupa</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Hilma Asino</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>I. Uirab</td>
<td>Ministry of Fisheries and Marine Resources – M.C.S</td>
</tr>
<tr>
<td>Jackson Karupa</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Jean Paul Roux</td>
<td>Ministry of Fisheries and Marine Resources</td>
</tr>
<tr>
<td>Justine Kakuuai</td>
<td>National Marine Information and Research Center</td>
</tr>
<tr>
<td>Martha Uumati</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Marthe Ntinda</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Mathew Shikongo</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Nadine Moroff</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Nande Nikanor</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>R.V. Hamunyela</td>
<td>Ministry of Fisheries and Marine Resources P.P.E.</td>
</tr>
<tr>
<td>Stefanus Voges</td>
<td>National Marine Information and Research Centre</td>
</tr>
<tr>
<td>Sue Roux</td>
<td>CETN &amp; Merus Seafood</td>
</tr>
<tr>
<td>Uanivi Uatjavi</td>
<td>National Marine Information and Research Centre</td>
</tr>
</tbody>
</table>
### Annex 2. Complete list of all issues raised and their consequence, likelihood and risk ratings.

*Note: Risk score is product of the consequence score (CONS) and the likelihood score (LIKE)*

<table>
<thead>
<tr>
<th>ID</th>
<th>Issue</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sardine stock is shared with Angola</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Sardine: distribution of shoals has become more patchy (effect of decreasing abundance)</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td>Industry and inspectorate vote for a 4 Likelihood; NatMirc - external review of research technique (John Simmons) reveals that the research techniques are internationally acceptable</td>
</tr>
<tr>
<td>3</td>
<td>Sardine abundance is critically low</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Sardine: size and age structure has changed (fish are much smaller and no more fish older than 3 years)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Sardine: variability in recruitment is not well understood</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Sardine: discarding of fish with jelly fish (in the bottom of net)</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>Need to experimentally quantify this (industry comment); also need to determine rate of occurrence</td>
</tr>
<tr>
<td>7</td>
<td>Sardine: unusually high and unknown natural mortality</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Anchovy abundance is low</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Anchovy stock is potentially shared with South Africa</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Anchovy stock is shared with Angola</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Anchovy: variability in recruitment is not well understood</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Horse mackerel stock is shared with Angola</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Horse mackerel: fishing of juveniles has unknown effect on recruitment</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Horse mackerel: variability in recruitment is not well understood</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Round herring: little known about this species (life history, ecology, distribution etc.)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Gobies: This is ecologically an important key species (Seals, seabirds, - check with JP)</td>
</tr>
<tr>
<td>16</td>
<td>Gobies: little known about this species (life history, ecology, etc.)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Chub mackerel: Little known about this species (life history, ecology, distribution etc.)</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>Not really being targeted; need to learn more; perhaps it could be a commercial product</td>
</tr>
<tr>
<td>18</td>
<td>Snoek: little known about impact on the population</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>Consequence taken from general table</td>
</tr>
</tbody>
</table>
## Ecological Risk Assessment (ERA) for the Namibian Purse Seine Fishery

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Snoek: stock identity unknown (not known if shared with SA and Angola)</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Kob, steenbras and other linefish are being caught</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

### Non-retained Species

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>Gannets are occasionally caught in nets</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Seals are killed in nets</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Bycatch of Jelly fish</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
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</table>

### General Ecosystem

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>Removal of grazers leads to accumulation of plankton biomass possibly leading to sulphur eruptions and low oxygen events</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Removal of small pelagics may have led to the increase in gobie, jelly fish etc. abundance and distribution (and other possible trophic impacts)</td>
<td>4</td>
<td>4</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Decreased food availability for predators (gannets, penguins - species unable to make switch to gobies)</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Decreased food availability for predators able to make switch to alternate prey (seals, sharks, hake, snoek etc.)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Overfishing may have led to long term change in the trophic structure (possibly an alternate stable state)</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Seals benefit from fishing activities</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Seabirds (mainly gannets and gulls) benefit from fishing activities</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Impacts of factory effluents</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

### Human Wellbeing

#### Community Wellbeing

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>Recent decrease in numbers of jobs available - including recent closures of canneries (but fishery still has high potential for future)</td>
<td>3</td>
<td>4</td>
<td>12</td>
<td>Comment: fishery has stabilised at a lower level of activity</td>
</tr>
<tr>
<td>33</td>
<td>Threat of TAC &lt;20 000 tonnes could close the fishery permanently</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>Industry; likelihood = 4 (won't happen due to political pressure)</td>
</tr>
<tr>
<td>34</td>
<td>Variability in resource availability makes planning difficult, low security, low investor confidence</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Changes in TAC affects income and loss of livelihood for workers' dependents</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Medical insurance and other employer benefits are no longer available/affordable for the majority of sea-going personnel</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td>Some rights holders (mostly those which have rights in other fisheries) are in the position fully subsidise this</td>
</tr>
<tr>
<td>ID</td>
<td>ISSUE</td>
<td>CONS</td>
<td>LIKE</td>
<td>RISK</td>
<td>NOTES</td>
</tr>
<tr>
<td>----</td>
<td>----------------------------------------------------------------------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>37</td>
<td>Collapse of fishery could result in large scale knock-on effects on</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>dependent service providers and retailers (engineering companies,</td>
<td></td>
<td></td>
<td></td>
<td>Some NatMIRC; Likelihood =</td>
</tr>
<tr>
<td></td>
<td>transport, shipping repairs, provisions, fuel etc.) in Walvis Bay</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>and Swakopmund</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Knock-on effects on the rural areas from which migrant labour is</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>drawn</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Fish meal smell affects tourism potential</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>National Wellbeing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>Historically this fishery was a large contributor to National GDP</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(large potential for future)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Historically this fishery was the largest employer (large potential</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>for future especially for Namibians)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td><strong>Ability to achieve</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Governance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Lack of an approved management plan that includes reconciled</td>
<td>4</td>
<td>5</td>
<td>20</td>
<td>Some NatMIRC; Likelihood =</td>
</tr>
<tr>
<td></td>
<td>objectives</td>
<td></td>
<td></td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>43</td>
<td>Socio-economic demands conflict with sustainability</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Lack of co-operation and information sharing with Angola on the</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td></td>
<td>management of shared stocks &amp; inconsistent national application of</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>rules for fishing on same stock</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Lack of economic information for decision making</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>Research budget has got smaller with catches (drawn from levies)</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td>Graca; Consequence = 2</td>
</tr>
<tr>
<td></td>
<td>- leads to less research vessel availability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Insufficient co-operation within the Ministry (between different</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Directorates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>Insufficient co-operation between scientists of SA, Nam and Angola</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Lack of communication between Ministries (Transport, Fisheries,</td>
<td>3</td>
<td>5</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Labour, Finance)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Lack of specific labour regulations for seagoing staff</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Narrow representation on the Advisory Council and working groups</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(no labour, civil society, fisheries specific etc.)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Poor communication with the general public (including transparency</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>in decision making)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>53</td>
<td>Lack of external review and appraisal of management procedures</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>Lack of newly trained skilled labour</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Loss of markets due to variability in TAC</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Civil Society and NGO’s are poorly organised and represented</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>in fisheries matters, mainly due to a lack of information and</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>communication by management</td>
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</tr>
</tbody>
</table>
### Ecological Risk Assessment (ERA) for the Namibian Purse Seine Fishery

<table>
<thead>
<tr>
<th>ID</th>
<th>ISSUE</th>
<th>CONS</th>
<th>LIKE</th>
<th>RISK</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>57</td>
<td>Long-term climate change - effect unknown but major</td>
<td>5</td>
<td>4</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Short-term climatic anomalies (Benguela Ninos) affect all population parameters</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>Localised anomalies (sulphide eruptions, low oxygen events etc.)</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Shipping pollution</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Mineral and gas exploration and mining (Kudu oil fields and Southern Angola)</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>Development of harbour at Cape Frio (increased shipping traffic could disturb spawning)</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>HIV/AIDS's impacts the workforce</td>
<td>3</td>
<td>6</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>Political environment</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>Exchange Rate</td>
<td>2</td>
<td>6</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Fuel prices</td>
<td>4</td>
<td>6</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>
Synthesis and way forward
4. SYNTHESIS AND WAY FORWARD

4.1 Generic Issues

Despite the very different nature of the eight fisheries selected for this exercise and the diverse array of stakeholders that participated in these workshops, there was a surprisingly high level of concurrence in the issues raised within these ERA workshops. In this section of the report we have attempted to distil the main generic issues that arose consistently, in one form or another (Tables 1 and 2). Although there was also overwhelming agreement on these generic issues between the two countries, we decided to present separate tables for each of them (Tables 1 and 2), due to the differing legislative and policy environments. It is important to note that the presence or absence of an issue for a particular fishery in Tables 1 and 2 reflects whether this issue was recorded by the stakeholders and does not show the priority accorded to each issue (i.e. these are merely a reflection of the list of issues produced at the workshops).

On average 77 issues per fishery were raised at the ERA workshops (range 54 – 96). We have distilled these issues down to 28 generic issues for the South African Fisheries and 23 generic issues for the Namibian fisheries. These lists of generic issues represent a valuable overview of the main ecological, socio-economic and governance issues being faced by the fisheries in these countries and it is hoped that they can be used as templates for future ERA workshops in these countries.

4.2 Towards a EAF checklist for South Africa and Namibia

We used this synthesis of the generic issues (Tables 1 and 2) and the performance reports developed in the ERA workshops to generate a checklist of 22 broad operational objectives, with linked management indicators that could be used to guide the implementation of an EAF in South Africa and Namibia (Table 3). The checklist of management indicators is particularly helpful as this can form the basis of a means to assess the effectiveness of fisheries management in an EAF context in these countries.

We provide here a general discussion on some of the main themes that underlie these operational objectives.

Understanding and managing impacts on the ecosystem as a whole

Clearly, if we wish to maintain the health of the ecosystems that underpin a fishery and its social and economic benefits, we need to understand and mitigate the impacts the fishery is having on the ecosystem as a whole. This will require an understanding of trophic links, diets and energetic requirements of the different components of the ecosystem. Whilst this has
been the subject of much research in the BCLME over past decades, little of this knowledge has, as yet, been incorporated into management procedures of the fisheries in the region. It is felt that whilst our understanding of these complex systems is not (and probably never will be) perfect, serious consideration needs to be given to incorporating some of this knowledge into management procedures in appropriate cases; specifically with regards to the needs of top predators.

Furthermore, there is a great need to quantify direct impacts of fisheries on vulnerable species (such as seabirds, sharks, sea turtles, and certain overexploited linefish) and to develop practical mitigation measures that enjoy the support of the industry. Finally, impacts of fisheries on marine habitats need to be better understood and managed; particularly, areas of high biodiversity value or that are sensitive to these impacts.

However, we wish to emphasise that while the effectiveness of EAF will be improved with increased relevant knowledge and insight, the implementation of EAF is not dependent on it. Even while research is underway to improve our understanding, an EAF can and should be implemented on the basis of the best available existing knowledge, giving due consideration to the application of a precautionary approach. The results of these workshops have demonstrated where the most urgent needs occur and in most, if not all cases, there is sufficient knowledge to make a start in addressing and remedying the problems, where this is not already underway.

Managing conflicts between fisheries sectors and compounding factors

Without fail, the ERA workshops highlighted conflicting impacts between the different fisheries sectors. These impacts were mainly in the form of the bycatch of fish targeted by another fisheries sector, but also through trophic impacts by removal of prey biomass (see Figure 4). This results not only in conflicts between different fisheries sectors, but also in compounding factors (i.e. components of the ecosystem are being impacted by more than one fishery, in different ways). Figure 4 shows the critical position of the inshore linefish fishery in the centre of many of these impacts. Although we have not yet conducted an ERA for the linefish fishery, we know that this fishery is of particular importance for fishery-dependent coastal communities and that many of the target species have been over-exploited. This illustrates the social and economic importance of developing an overarching mechanism for dealing with issues such as the above-mentioned.

In summary, several identified issues are very difficult to deal with at the fishery specific management level and need to be dealt with at an overarching level. One South African ERA workshop suggested the need to develop an overarching national bycatch plan that incorporated all bycatch and dealt with all these conflicts and compounding factors. This report endorses this suggestion.
Managing fisheries in a spatially explicit manner

The spatial dimension of marine ecosystems and fisheries has not been effectively incorporated into management at this stage. From the ERA workshops it was clear that we still need to understand much about the spatial distribution and genetic identity of different stocks of target fish. Furthermore, there is a need to identify and protect spatially explicit habitats and ecosystem processes that are important for the life-history of target stocks and other marine organisms. These include spawning areas, nursery areas, areas of high biodiversity value and foraging areas of top predators.

Managing fisheries in an environment of high temporal variability

Marine ecosystems, and particularly upwelling systems, have a high temporal variability in their physical nature and therefore result in a variable abundance of commercial fish species. The need to manage fisheries in this highly variable temporal dimension runs throughout the different components of an EAF. Adaptive management approaches, which underpin the existing management procedures in the two countries, are essential for coping with this variability. However, the ability to predict some of this variability could substantially improve our capability to manage in a proactive and timely manner. Therefore there is a need to focus research on understanding the causes and consequences of ecosystem variability and thereby acquire a predictive ability.
From a governance point of view, we need to adopt strategies that seek to moderate impacts of this variability. By way of example, reducing 'effort creep' in years of high abundance will minimize social and economic impacts when there is a downturn in abundance. Furthermore, data management and analysis needs to allow for timely management responses to short and medium term variability. Finally, fisheries plans and policies would benefit from the ability to explicitly take into account these predicted long term changes in the physical environment.

From a social and economic point of view, strategies need to be put in place to equip the fishers themselves with skills and solutions to be able to withstand this variability. This is especially true in the smaller-scale fisheries with performance-based pay and highly seasonal variability in stock abundance. This includes development of financial management skills and a diversification in the economic base of fishery-dependent coastal communities.

**Participatory governance and transparency**

The importance of this area of EAF cannot be overstated. The successful implementation of an EAF is highly dependent on effective participatory governance structures and transparent decision making. In legal terms, marine ecosystems are generally considered to be a "public good held in trust by the government". This effectively means that marine ecosystems and their resources are under the ownership of all citizens of a country and its future generations. Decisions pertaining to the management and future of marine ecosystems therefore affect a wide array of stakeholders and need to be dealt with in a participatory and transparent manner. Furthermore, the implementation of an EAF is highly dependent on voluntary support from the fishing industry and other stakeholders having an impact on marine ecosystems. Developing such support will require very effective participatory and co-management structures with industry and the fishing communities. Finally, such participatory structures will greatly facilitate communications and development of a 'common understanding' between industry and management agencies as well as between different divisions within the management agency (i.e. research, resource management and compliance).

**Building skills and capacity for an EAF**

The implementation of an EAF will require the development of new skills and understanding between all stakeholders. From the government’s perspective, new skills and capacity will need to be developed in research, resource management and compliance. Research capacity will need to be bolstered to understand ecological interactions and linkages. Resource management capacity needs to be built to better understand the social and economic implications of ecological advice and to mitigate these effects. Compliance on the other hand will need to develop an understanding and appreciation of ecological and socio-economic complexities to effectively enforce EAF regulations.
Integrated compliance strategies

Any regulatory framework remains a paper exercise unless it is underpinned by effective compliance. Within an EAF framework, compliance needs to be integrated with other aspects of management and not operate separately. Enforcement also needs to be complemented by effective co-management and voluntary compliance mechanisms. Finally, an effective EAF fisheries compliance strategy will need to be integrated with activities of other government departments (e.g. customs, revenue services, health and safety) to ensure intelligent use of limited resources.

4.3 A proposed way forward for EAF in South Africa and Namibia

Completion of ERA processes for all major fisheries

Given the success of this ERA process in progressing towards a common understanding of EAF and in attaining agreement amongst diverse stakeholders on the priority issues and guidelines for EAF implementation in each fishery, we recommend that the governments of South Africa and Namibia complete this process by conducting ERA workshops for all their major fisheries.

It is suggested that the lists of generic issues developed in this report (Tables 1 and 2) provide a useful basis for templates for future ERA processes conducted in these countries. These lists provide localized context through which more detailed issues can be explored.

Monitoring EAF performance per fishery

The ERA reports presented here provide a valuable framework for the implementation of an EAF in each fishery. Not only are the reports successful in prioritizing the main issues for EAF implementation, but in many ways provide suggested management responses and performance limits. In addition these reports detail and prioritise important gaps in current knowledge and could be used to define a structured framework for research required for progress in the implementation of an EAF. The ERA outputs provide such a framework for each fishery.

It is recommended that the ERA reports presented for each fishery form the basis of an annual EAF review workshop for these fisheries. At such annual workshops, stakeholders can review progress against the main issues that were highlighted in the ERA reports, using the agreed performance limits as indicators of success. Furthermore, these workshops can be used for stakeholders to agree on priority actions and performance limits for the following year. Such annual workshops will provide an excellent way of monitoring and stimulating EAF implementation in a transparent and participatory manner.
Finally, given the dynamic nature of fisheries, it is suggested that full ERA processes are run for each fishery at five yearly intervals.

**Tracking EAF implementation at a national level**

South Africa and Namibia have committed themselves to the WSSD target of implementing an EAF by 2012. However, it remains unknown how countries will be able to judge whether they have been successful in this endeavour, or how they will measure their progress.

It is suggested that the EAF checklist of management indicators (Table 3) developed for South Africa and Namibia in this report, is used in the development of an EAF management tracking tool by which fisheries managers can measure their progress towards an EAF.
Table 1: Summary of cross cutting issues among five South African fisheries broken down into four categories, namely; Ecological Wellbeing, Human Wellbeing, Governance and External Impact. Management actions follow each issue in italics. Note: “✓” means that the issue was raised at the ERA workshop.

<table>
<thead>
<tr>
<th>Sector: Cross cutting issues per subsection:</th>
<th>Demersal Sector</th>
<th>West Coast Rock Lobster</th>
<th>Small Pelagic</th>
<th>Large Pelagic Sector</th>
<th>Squid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ecological Wellbeing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Inadequate stock assessment models for target stocks</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a) Inadequate understanding of population dynamics, certain life history parameters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Inadequate understanding of spatial and genetic composition</td>
<td></td>
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<tr>
<td>c) Certain stock impacts not quantified or underestimated (e.g. discards, bycatch, poaching, technological creep effects on CPUE)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Research to refine certain life history parameters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Research to refine understanding of spatial and genetic composition of stock</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Quantification of all stock impacts</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>▪ Development of refined demographic models</td>
<td></td>
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<tr>
<td>2. Bycatch of (often over-exploited) fish</td>
<td>✓ (Kingklip, silver kob, dusky kob)</td>
<td>×</td>
<td>✓ (Yellowtail, white steenbras, kob)</td>
<td>✓ (Yellowtail, snoek)</td>
<td>×</td>
</tr>
<tr>
<td>▪ Need for comprehensive (cross sectoral) bycatch plan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>▪ Ensure high levels of compliance</td>
<td></td>
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<tr>
<td>3. Incidental mortality of vulnerable species (e.g. seabirds, turtles and sharks)</td>
<td>✓ (Birds assessed, regulations amended and gear modified, Education underway, moderate compliance; line fish and shark bycatch</td>
<td>✓ (Demersal sharks)</td>
<td>×</td>
<td>✓ (Birds, turtles and sharks assessed, some regulations amended and some gear modified, Education underway, moderate compliance)</td>
<td>×</td>
</tr>
</tbody>
</table>
### Sector: Cross cutting issues per subsection:

<table>
<thead>
<tr>
<th>Sector</th>
<th>Demersal Sector</th>
<th>West Coast Rock Lobster</th>
<th>Small Pelagic</th>
<th>Large Pelagic Sector</th>
<th>Squid</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Impact on benthic habitat</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Identify sensitive habitats</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Need to limit the use of destructive gear</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>Spatial protection of sensitive habitats</td>
<td></td>
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</tr>
<tr>
<td>5. Impact on trophic structures</td>
<td>✓ (Top predator removal e.g. sharks)</td>
<td>✓ (Top predator removal e.g. Rock Lobster, affect on abalone and urchin)</td>
<td>✓ (Effect of predators and prey through removal of sardine and anchovy biomass)</td>
<td>✓ (Top predator removal e.g. tunas, sharks)</td>
<td>✓ (Effects of removal of squid which are important prey for several predators)</td>
</tr>
<tr>
<td>a) Lack of understanding of trophic relationships and diets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Lack of incorporation in Management Plans</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Need to better understand trophic relations and diets of top predators</td>
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<td></td>
</tr>
<tr>
<td>Incorporate ecosystem needs into management procedures</td>
<td></td>
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<tr>
<td>6. Impact on spatially defined sensitive or important areas (e.g. nursery areas, spawning concentrations, foraging areas)</td>
<td>✓ (Inshore linefish impacts, sensitive benthic habitats)</td>
<td>✓ (Effect of rock lobster on abalone settlement)</td>
<td>✓ (Seabird islands)</td>
<td>✓ (Shark nursery areas)</td>
<td>✓</td>
</tr>
<tr>
<td>Develop a representative Marine Protected Areas network</td>
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</tbody>
</table>

### Human Wellbeing

| 1. Socio-economic impacts of management decisions (including secondary industries and dependent communities) | ✓ | ✓ | ✓ | ✓ (Shark fishery closure) | ✓ |
| a) Lack of understanding of social impacts | | | | | |
| b) Lack of social and economic expertise at MCM | | | | | |
| c) Inability to mitigate against social impacts (i.e. alternative livelihoods) | | | | | |
|   Develop better understanding of socio-economic context and drivers | | | | | |
|   Need to understand socio-economic impacts of biological management advice | | | | | |
|   Integrate socio-economic and biological advice | | | | | |
|   Diversify economic base of dependent communities | | | | | |
### Sector: Cross cutting issues per subsection:

<table>
<thead>
<tr>
<th>2. Overcapacity leads to sub-viable quotas</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Concern over the increase in the number of rights holders has resulted in potentially sub-viable quotas (overcapacity)</td>
</tr>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Concerns regarding recent rights allocation process</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Rights allocation process resulted in non bona fida fishers receiving rights (including unsuitable vessels)</td>
</tr>
<tr>
<td>b) Uncertainties regarding finality of rights allocations</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Job security and stability in the context of stock variability</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Unclear understanding of decadal scale changes in abundance of target stocks</td>
</tr>
<tr>
<td>b) Seasonal variability in stock abundance</td>
</tr>
<tr>
<td>c) Performance-based pay leads to periods of low income</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>5. Market competitiveness and access</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Competing against subsidized fleets</td>
</tr>
<tr>
<td>b) Competing against eco-labelled products</td>
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</table>

<table>
<thead>
<tr>
<th>Sector</th>
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<th>West Coast Rock Lobster</th>
<th>Small Pelagic</th>
<th>Large Pelagic Sector</th>
<th>Squid</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>✓ (Pole fishery)</td>
<td>✓</td>
</tr>
<tr>
<td>3.</td>
<td>✗</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>4.</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>5.</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
### Sector: Cross cutting issues per subsection:

<table>
<thead>
<tr>
<th></th>
<th>Demersal Sector</th>
<th>West Coast Rock Lobster</th>
<th>Small Pelagic</th>
<th>Large Pelagic Sector</th>
<th>Squid</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. Skills development for fishers</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a) Inadequate skills for rights applications, financial management, fishing skills</td>
<td></td>
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</tr>
<tr>
<td>b) Inappropriate safety standards prohibit skills development and transformation</td>
<td></td>
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</tr>
<tr>
<td>▪ Ensure skills development programmes in place</td>
<td></td>
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</tbody>
</table>

#### Governance

<table>
<thead>
<tr>
<th>1. Inadequate research and management capacity and funding</th>
<th>✓</th>
<th>✓</th>
<th>✓</th>
<th>✓</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Fill vacant posts</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>▪ Source adequate funding</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Lack of effective participatory management and co-management</th>
<th>✓</th>
<th>✓</th>
<th>✓</th>
<th>✓</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Absence of functional Resource Management Working Groups (RMWG)</td>
<td></td>
<td></td>
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<tr>
<td>b) Poor representation of stakeholders and MCM compliance on RMWG’s and Scientific Working Group (SWG)</td>
<td></td>
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</tr>
<tr>
<td>c) Lack of effective representative structures for the small-scale and recreational sectors</td>
<td></td>
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<tr>
<td>▪ Develop mechanisms for stakeholder participation</td>
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<tr>
<td>▪ Improve stakeholder communication</td>
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<td></td>
</tr>
<tr>
<td>▪ Functional RMWG with representative participation</td>
<td></td>
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<tr>
<td>▪ Develop clear communication channels and records of decisions</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Transparency with regards to decision making</th>
<th>✓</th>
<th>✓</th>
<th>✗</th>
<th>✗</th>
<th>✓</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Lack of clear Records of Decisions</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>b) Unclear decision making channels</td>
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<tr>
<td>▪ Develop mechanisms and procedures to ensure transparent decision making and the record thereof</td>
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</tr>
<tr>
<td>▪ Decisions understood by all stakeholders</td>
<td></td>
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</tr>
<tr>
<td>Sector: Cross cutting issues per subsection:</td>
<td>Demersal Sector</td>
<td>West Coast Rock Lobster</td>
<td>Small Pelagic</td>
<td>Large Pelagic Sector</td>
<td>Squid</td>
</tr>
<tr>
<td>---------------------------------------------</td>
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<td>-------</td>
</tr>
<tr>
<td>4. Poor communications and co-operation within MCM and between government departments (e.g. MCM, SAMSA, SABS, DTI)</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>▪ Develop interagency communication channels</td>
<td></td>
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<td></td>
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<tr>
<td>▪ Develop clear lines of communication and records of decisions</td>
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</tr>
<tr>
<td>5. Concerns relating to data management:</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a) Concern relating to data collection, collation and coordination (including reliability of these data)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Fisheries observer data not appropriately collected or analyzed</td>
<td></td>
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<tr>
<td>c) Under-reporting</td>
<td></td>
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<tr>
<td>d) Delays in availability of data for real time response</td>
<td></td>
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<tr>
<td>e) Inaccessibility of VMS data</td>
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<td></td>
</tr>
<tr>
<td>▪ Improve data coordination</td>
<td></td>
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<tr>
<td>▪ Analysis of observer data</td>
<td></td>
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<tr>
<td>▪ Improve response times</td>
<td></td>
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</tr>
<tr>
<td>6. Inadequate Compliance</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a) Lack of appropriate skills, knowledge and motivation of compliance officers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Lack of follow through from non-compliance</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>c) Limited participation at Resource Management Workshop Group</td>
<td></td>
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</tr>
<tr>
<td>▪ Improve education and awareness of compliance officers</td>
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<tr>
<td>▪ Improve follow through of non-compliance</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>▪ Compliance section to participate in RMWG</td>
<td></td>
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<td></td>
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<tr>
<td>7. Lack of acceptable management plans</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a) Sector management plans (potentially peer reviewed)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) FAO National Plans of Action</td>
<td></td>
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<tr>
<td>▪ Develop a sector management plan for sectors where it does not exist</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Competition between or within fisheries sectors (including recreational sector)</td>
<td>✓ (Linefish, demersal sharks, squid bycatch and</td>
<td>✓ (Recreational, small commercial and full</td>
<td>✓ (Juvenile horse mackerel bycatch)</td>
<td>✓ (Pole fishery dependent on presence of demersal fishery; line</td>
<td>✓ (Squid caught as bycatch in demersal and small pelagic</td>
</tr>
<tr>
<td>▪ Address this competition through consultation</td>
<td></td>
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</tr>
</tbody>
</table>
### Transboundary Impacts on Shared Stocks

- Develop trans-boundary or regional management plans where necessary
- Improve communication and information sharing between countries

9. **Transformation and South Africanisation of fishery**
   - Lack of skills development
   - Inappropriate safety and crewing standards
     - Skills development to promote transformation
     - Dialogue with SAMSA to set appropriate safety and crewing standards

10. **Lack of consolidation and cohesion within fisheries sectors**
    - Address through formal labour and community structures

### External Impacts

1. Uncertainty resulting from environmental influences or climate change
2. Global economic parameters (e.g. fuel price and exchange rates)
3. Social issues e.g. AID’s, substance abuse
4. Depredation and interactions with top predators as a result food availability (e.g. whales, seals and seabirds)
5. Impact of marine mining
Table 2: Summary of cross-cutting issues among three Namibian fisheries into four categories, namely: Ecological Wellbeing, Human Wellbeing, Governance, and External Impact. *Management actions follow each issue in italics. Note: “✓” means that the issue was raised at the ERA workshop.*

<table>
<thead>
<tr>
<th>Sector: Cross cutting issue per sub-section:</th>
<th>Demersal Sector</th>
<th>Midwater Trawl</th>
<th>Purse Seine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ecological Wellbeing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. <strong>Inadequate stock assessments of target stocks</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a) Inadequate understanding of certain life history parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Inadequate understanding of population dynamics, variability, size structure and distribution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Certain impacts on stocks not quantified (e.g. fishing on juvenile Horse Mackerel)</td>
<td>✓ (Need for further research)</td>
<td>✓ (Need for spatial management)</td>
<td>✓ (Kingklip, sole, monk)</td>
</tr>
<tr>
<td>2. <strong>Bycatch of fish</strong> (targeted in other sectors or overexploited stocks)</td>
<td>✓ (Need for bycatch plans)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a) Inadequate understanding of certain life history parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Inadequate understanding of population dynamics, variability, size structure and distribution</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>c) Certain impacts on stocks not quantified (e.g. fishing on juvenile Horse Mackerel)</td>
<td>✓ (Need for further research)</td>
<td>✓ (Need for spatial management)</td>
<td>✓ (Kingklip, sole, monk)</td>
</tr>
<tr>
<td>3. <strong>Incidental mortality of vulnerable species</strong> (such as seabirds, turtles and sharks)</td>
<td>✓ (Preliminary assessment shows high seabird and shark bycatch, requires addressing)</td>
<td>✓ (Preliminary assessment shows seal and shark bycatch, requires addressing)</td>
<td>✓</td>
</tr>
<tr>
<td>a) Inadequate understanding of certain life history parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Inadequate understanding of population dynamics, variability, size structure and distribution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Certain impacts on stocks not quantified (e.g. fishing on juvenile Horse Mackerel)</td>
<td>✓ (Need for further research)</td>
<td>✓ (Need for spatial management)</td>
<td>✓ (Kingklip, sole, monk)</td>
</tr>
<tr>
<td>4. <strong>Impact on benthic habitat</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a) Inadequate understanding of certain life history parameters</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Inadequate understanding of population dynamics, variability, size structure and distribution</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Certain impacts on stocks not quantified (e.g. fishing on juvenile Horse Mackerel)</td>
<td>✓ (Need for further research)</td>
<td>✓ (Need for spatial management)</td>
<td>✓ (Kingklip, sole, monk)</td>
</tr>
<tr>
<td>5. <strong>Impact on trophic structures</strong></td>
<td>✓ (Effect of removing hake, top predator removal e.g. sharks)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a) Knock on effect of the removal of predators (e.g. sharks and tunas) and prey (e.g. sardine)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Research to understand trophic interactions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c) Incorporate ecosystem needs into management procedures</td>
<td></td>
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</tr>
<tr>
<td><strong>Human Wellbeing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. <strong>Socio-economic impacts of management decisions</strong></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a) Lack of understanding of socio-economic context (includes impacts on secondary industries and communities)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Inability to mitigate socio-economic impacts of management decisions</td>
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</tbody>
</table>

Ecological Risk Assessment: A Tool for Implementing an Ecosystem Approach for Southern African Fisheries

Pg 197
## Sector: Cross cutting issue per sub-section:

<table>
<thead>
<tr>
<th>Sub-section</th>
<th>Demersal Sector</th>
<th>Midwater Trawl</th>
<th>Purse Seine</th>
</tr>
</thead>
<tbody>
<tr>
<td>c) Lack of integration between socio-economic and biological advice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Investigate socio-economic factors</td>
<td></td>
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<tr>
<td>2. Balance socio-economic and biological advice</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Lack of skills and development opportunities for fishers</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2. Develop skills upliftment strategy</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3. Market competitiveness and access</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>a) Export standards can affect access to foreign markets (EU regulations and eco-labeling)</td>
<td></td>
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<tr>
<td>b) Variability in TAC affects market access</td>
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<td></td>
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<tr>
<td>2. Ensure health and environmental standards are achieved</td>
<td></td>
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</tr>
<tr>
<td>Governance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Inadequate research and management capacity and funding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Source funding</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Lack of effective participation and co-management</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2. Develop mechanisms for stakeholder participation</td>
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<td></td>
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<tr>
<td>2. Improve stakeholder communication</td>
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<td></td>
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</tr>
<tr>
<td>3. Poor communications within MFMR and between government departments</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>a) Between government and stakeholders hinders the potential for co-management</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>b) Between government departments</td>
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<tr>
<td>3. Improve communication</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4. Lack of transparency in decision making</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>4. No clear ‘Record of Decision’ for Ministry decisions</td>
<td></td>
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<tr>
<td>4. Lack of transparency in quota transfers</td>
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<tr>
<td>5. Data and research</td>
<td>✓</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>a) Concern relating to data collection, collation and co-ordination</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>b) Need for timeous reporting</td>
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<tr>
<td>6. Inadequate observer coverage on smaller vessels</td>
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<tr>
<td>5. Improve data coordination and verification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Inadequate Compliance</td>
<td>✓</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>a) Lack of enforcement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b) Inadequate penalties for non-compliance</td>
<td></td>
<td></td>
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</tbody>
</table>
### Sector: Cross cutting issue per sub-section:

<table>
<thead>
<tr>
<th></th>
<th>Demersal Sector</th>
<th>Midwater Trawl</th>
<th>Purse Seine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve education and awareness of compliance officers</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Improve follow through of non-compliance and penalties</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

7. Lack of sector management plans
   a) Lack of peer review mechanism
      - Develop a sector management plan for sectors where it does not exist

8. Competition within and between sectors
   - Address this competition through consultation between sectors

9. Trans-boundary stocks
   - Develop transboundary or regional management plans where necessary
   - Improve communication and information sharing between countries

10. Namibianisation of fishing fleets
    - Address the failure to meet the policy standard for Namibianisation of fishing fleets

11. Irregular revision of policy, regulations and management procedures
    - Regularly appraise and adapt

### External Impacts

<table>
<thead>
<tr>
<th></th>
<th>Demersal Sector</th>
<th>Midwater Trawl</th>
<th>Purse Seine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Environmental anomalies and climate change</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2. Global economic parameters (e.g. fuel price and exchange rates)</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>3. Social issues e.g. HIV AID's, substance abuse</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Table 3: A checklist of 22 broad operational objectives, with management indicators developed from the eight ERA workshops in South Africa and Namibia

<table>
<thead>
<tr>
<th>Operational Objectives</th>
<th>Management Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ecological Wellbeing</strong></td>
<td></td>
</tr>
</tbody>
</table>
| 1. Adequate stock assessment models and management procedures maintain target stocks at ecologically sustainable levels | - Life history parameters adequately understood and incorporated in stock assessment procedures  
- Spatial distribution and genetic variability of target stocks understood and incorporated into stock assessment procedures  
- All impacts on stock (e.g. bycatch, poaching, discarding) are quantified and incorporated in stock assessment procedures  
- Genetically distinct stocks are managed individually |
| 2. Understand and manage bycatch of over-exploited fish stocks                         | - All fish bycatches are assessed (particularly over-exploited stocks and those that are caught in other sectors)  
- Development of management strategies to avoid over-exploitation of bycatch species e.g. biologically meaningful bycatch limits, closed areas/seasons, gear regulations etc  
- Development of a comprehensive cross-sectoral bycatch plan |
| 3. Assess and mitigate fisheries impact on vulnerable species                         | - Quantify fishery impacts on all suites of vulnerable species (e.g. seabirds, sharks, turtles, cetaceans)  
- Mitigation measures tested and supported by stakeholders  
- Fishing regulations amended to require the use of mitigation measures  
- Evidence of high levels of compliance with mitigation measures |
| 4. Assess and manage impact on marine habitats                                        | - Assessment and quantification of fishing impacts on marine habitats  
- Spatial maps of marine habitat types and impacts  
- Identification and mapping of sensitive and vulnerable habitats  
- Formal protection status for areas sensitive to impacts |
| 5. Understand and manage trophic impacts of fishing                                   | **For fisheries targeting forage fish:**  
- Understanding of the diets and foraging behaviour of top predators that are dependent on fish being targeted  
- Quantification of the biomass needed to sustain healthy populations of these top predators (by volume and spatially)  
- Formal inclusion of these needs into management procedures  
**For fisheries targeting top predators:**  
- Understanding of diet and role of top predator in trophic web |

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Pg 200
### Operational Objectives

<table>
<thead>
<tr>
<th>Management Indicators</th>
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</thead>
<tbody>
<tr>
<td>- Quantification of biomass needed to ensure stability in the ecosystem</td>
</tr>
<tr>
<td>- Formal inclusion of the ecosystem impacts of fishing on top predators in their management procedures</td>
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</table>

**For fisheries that supplement the diets of top predators (by making offal and/or catches available to predators)**

- Quantification of ecosystem impact of supplementary feeding and depredation
- Fisheries operations amended to mitigate impact on economic viability of fishery and on top predators

6. **Identification and protection of ecologically important areas (spawning areas, nursery areas, predator foraging areas)**

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<tr>
<th>Management Indicators</th>
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<tbody>
<tr>
<td>- Maps of biodiversity hotspots and ecologically important areas within fishing distribution</td>
</tr>
<tr>
<td>- Management approaches to include management of biodiversity hotspots and ecologically important areas through e.g. MPA’s, gear restrictions etc.</td>
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### Human Wellbeing

7. **Understand and mitigate socio-economic impacts of management advice**

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<tr>
<th>Management Indicators</th>
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</thead>
<tbody>
<tr>
<td>- Clear understanding of the socio-economic context of the fishery</td>
</tr>
<tr>
<td>- Socio-economic implications are clearly integrated into overall management advice and procedures</td>
</tr>
<tr>
<td>- Strategies in place to diversify economic base of dependent communities to mitigate against variable nature of fisheries</td>
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8. **Improve long term stability of fishery and financial security of fishers**

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<tr>
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<tbody>
<tr>
<td>- Rights allocation process is complete</td>
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<tr>
<td>- Consolidation of rights leads to optimal capacity</td>
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<tr>
<td>- Long term economic viability of rights holders</td>
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<tr>
<td>- Management procedures are aimed at long term benefits and stability</td>
</tr>
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9. **Improve skills and capacity of fishers to deal with variability and change**

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<thead>
<tr>
<th>Management Indicators</th>
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</thead>
<tbody>
<tr>
<td>- Financial skills development plans for small scale fishers</td>
</tr>
<tr>
<td>- Strategies to diversify skills of highly dependent fishing communities</td>
</tr>
<tr>
<td>- Skills development plans for fishers to fulfil their obligations in co-management arrangements</td>
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10. **Improve international market security**

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<tbody>
<tr>
<td>- Products adherence to environmental and health standards</td>
</tr>
<tr>
<td>- Feasibility study for eco-labelling</td>
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<tr>
<td>- Eco-labelling of appropriate fisheries</td>
</tr>
<tr>
<td>- National strategies to promote international competitiveness, work within WTO to ensure equal access to global markets</td>
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### Governance

11. **Government has adequate capacity and skills to implement an EAF**

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<tbody>
<tr>
<td>- Identification of skills and capacity required to implement agreed EAF priorities</td>
</tr>
<tr>
<td>- Sourcing of additional capacity (specifically with regards to socio-economic aspects)</td>
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<tr>
<td>- Sourcing of additional funding to implement these priorities</td>
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12. **Effective participatory management and**

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<tbody>
<tr>
<td>- Effective participatory management forums (e.g. Resource Management Working Groups identified for</td>
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<tr>
<td>Operational Objectives</td>
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<td>-----------------------</td>
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</table>
| transparent decision making processes are in place | South Africa) are functioning  
- Participatory management forums enjoy representative support  
- Stakeholders understand the decision making processes  
- Clear records of decisions are available to stakeholders |
| 13. Develop common understanding and clear communication between government departments and between fisheries management divisions within fisheries agencies (i.e. research, resource management and compliance) | Participation of all fisheries management divisions (i.e. research, resource management and compliance) at participatory management forums  
- Channels or forums in place for communication with other government agencies (e.g. oil and minerals, transport, safety at sea, health standards, and customs) |
| 14. Data management allows for timely management response | Reliable and comprehensive data management procedures developed  
- Appropriate capacity and skills available to implement data collection, collation and analysis  
- Mechanisms in place to ensure adequate independent verification of reported data (observers, quay-side/shore-based monitors, video monitoring)  
- Timely feedback of analysed data to stakeholders |
| 15. Government has appropriate skills, understanding and motivation to ensure high levels of compliance to fisheries regulations | Compliance officers equipped with appropriate skills and understanding to implement regulations  
- Representatives of appropriate Compliance body participate in management forums  
- Incentives in place to reward good compliance by industry (e.g. performance review procedures, eco-labelling)  
- Penalties and adequate follow-through provide a real disincentive for non-compliance |
| 16. Appropriate plans incorporate EAF considerations and guide management of the fishery | Sector management plans, incorporating EAF considerations, are in place  
- Sector management plans are peer reviewed  
- Relevant NPOA’s and policies are developed for vulnerable species  
- Comprehensive bycatch plan (cross sector) is developed |
| 17. Minimise conflict between fisheries sectors and manage compounding risks | Development of a comprehensive (cross-sectoral) bycatch plan  
- Development of an overall fisheries management plan which balances the needs of various sectors and provides clarity on the guiding principles to resolve conflicts |
| 18. Harmonize regional management procedures for transboundary issues | Regional working groups meet regularly and share expertise within the Benguela Current LME  
- Benguela Current Commission (BCC) is operational and facilitates regional management  
- The Ecosystem Advisory Committee of the BCC is implemented and functions effectively  
- The BCC facilitates the harmonization of management procedures under the BCC (i.e. setting of regional input and output controls)  
- Countries are active members of all other relevant Regional Fisheries Management Organisations (RFMO’s) (e.g. ICCAT, IOTC, CCSBT, SEAFO) |
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</table>
| 19. Cultural and national transformation of fisheries | - Skills development programmes in place to enhance transformation  
- Pragmatic targets for transformation and nationalization of foreign fleets are accepted by stakeholders  
- Fisheries meet transformation and nationalization targets |
| 20. Fishing sectors and employees are consolidated around structures that enhances communication, consultation and competitiveness | - Presence of cohesive fishery stakeholder associations  
- Effective participation and report back by industry associations to members  
- Employees (fishing crew and factory workers) are organised and formally represented in relevant management structures |

**External Impacts**

| 21. Ensure that fisheries are able remain economically viable within predicted climate change scenarios | - Research underway to understand biological, social and economic implications of climate variability scenarios  
- Climate change strategies developed for fisheries sectors  
- Implications of potential climate change scenarios incorporated in management procedures |
| 22. Integrated management of the Exclusive Economic Zone which incorporates and balances multiple needs i.e. fisheries, mineral and gas exploration, civil society etc. | - Map ecological processes, biodiversity patterns and resource utilization  
- Integrated multi-use zoning for EEZ implemented. |