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EAF IMPLEMENTATION IN THE SOUTH WEST INDIAN OCEAN AREA

A baseline report

NANSEN PROJECT

THE EAF-NANSEN PROJECT

FAO started the implementation of the project “Strengthening the Knowledge Base for and Implementing an Ecosystem Approach to Marine Fisheries in Developing Countries (EAF-Nansen GCP/INT/003/NOR)” in December 2006 with funding from the Norwegian Agency for Development Cooperation (Norad). The EAF-Nansen project is a follow-up to earlier projects/programmes in a partnership involving FAO, Norad and the Institute of Marine Research (IMR), Bergen, Norway on assessment and management of marine fishery resources in developing countries. The project works in partnership with governments and also Global Environment Facility (GEF)-supported Large Marine Ecosystem (LME) projects and other projects that have the potential to contribute to some components of the EAF-Nansen project.

The EAF-Nansen project offers an opportunity to coastal countries in sub-Saharan Africa, working in partnership with the project, to receive technical support from FAO for the development of national and regional frameworks for the implementation of Ecosystem Approach to Fisheries management and to acquire additional knowledge on their marine ecosystems for their use in planning and monitoring. The project contributes to building the capacity of national fisheries management administrations in ecological risk assessment methods to identify critical management issues and in the preparation, operationalization and tracking the progress of implementation of fisheries management plans consistent with the ecosystem approach to fisheries.

EAF IMPLEMENTATION IN THE SOUTH WEST INDIAN OCEAN AREA

A baseline report

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PREPARATION OF THIS DOCUMENT

This is the report of a workshop organised by the EAF-Nansen project "Strengthening the Knowledge Base for and Implementing an Ecosystem Approach to Marine Fisheries in Developing Countries (EAF-Nansen GCP/INT/003/NOR)" in Pretoria, South Africa from 20 to 24 February 2011 to examine where countries in the South West Indian Ocean Fisheries Commission (SWIOFC) area stand in the adoption and implementation of the ecosystem approach to fisheries (EAF). The initial materials for the report were provided by the staff of WWF South Africa who also facilitated the workshop. The EAF-Nansen project is grateful to all workshop participants for their input into the report.

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ABSTRACT

In Africa, a number of Ecological Risk Assessment (ERA) workshops have been organized in relation to the application of the ecosystem approach to fisheries (EAF). The ERA is as a structured, transparent process to develop a shared vision amongst stakeholders and to clarify what is required to implement an EAF in a particular fishery. The outputs of these workshops have allowed for the development of a tool to track EAF implementation.

A workshop was held in Pretoria, South Africa from 20 to 24 February 2011 to examine where countries in the South West Indian Ocean Fisheries Commission (SWIOFC) area stand in the adoption and implementation of EAF. The tracking tool was used as a means of establishing a baseline for EAF implementation in each of the SWIOFC countries, and in the region as a whole, by working on selected fisheries that are important both nationally and regionally.

In general, the results of the workshop showed that countries have recorded several achievements towards honouring the World Summit on Sustainable Development commitment on adoption and implementation of the ecosystem approach to fisheries. This notwithstanding, many of the countries are not aware of this effort and are either sceptical about EAF implementation or believe that they do not have the capacity to implement EAF. Overall, the process has provided a good first step in developing a tracking method for EAF implementation in the SWIOFC region and stimulating discussions on the use of an ecosystem approach in the management of fisheries in the region.

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INTRODUCTION

A paradigm shift in fisheries management

Historically fisheries management focused on a single-species approach where only the target species was taken into consideration for long-term sustainability. As pressure on resources and the ecosystem increases, it has become obvious that this approach is not sufficient in ensuring sustainability. Managers are now moving towards an ecosystem approach to fisheries management where not only the ecosystem as a whole is taken into account but also the social and economic wellbeing of the fishery. An Ecosystem Approach to Fisheries (EAF) is now considered the preferred manner in which to manage a fishery and has been adopted by most countries worldwide.

Globally, little progress has been made towards developing simple and structured guidelines for EAF implementation, with the exception of the FAO Code of Conduct for Responsible Fisheries (FAO 1995) and the Australian Ecological Sustainable Framework (Fletcher *et al.* 2002). A significant challenge is dealing with the complexity of the approach and issues, including the difficultly of prioritizing and balancing seemingly opposing objectives. Furthermore, in most cases there are limited resources and capacity for fisheries management and thus the aim should not be to add an extra burden to already limited resources, but rather provide the most efficient way forward, by prioritizing resources and action in a comprehensive manner. Lastly, there is a need to build a common understanding in order to ensure successful implementation.

Workshop background and rationale

In September 2010, a meeting was organized in Dar es Salaam to discuss the results of the ecosystem surveys conducted in the South West Indian Ocean area by the R/V Dr Fridtjof Nansen under the Agulhas and Somali Currents Large Marine Ecosystem (ASCLME), the EAF-Nansen, and the South West Indian Ocean Fisheries projects (SWIOFP). The meeting also considered the implementation of the ecosystem approach to fisheries in the region and how the surveys would contribute to this. The EAF-Nansen project is providing the opportunity for countries in Africa to adopt and implement the ecosystem approach in the management of their marine fisheries. At the said meeting, the need to identify a baseline and set targets for the countries to achieve full implementation of EAF was expressed. It was suggested that progress made by member countries in the implementation of EAF could form a specific agenda item for the Sessions of the South West Indian Ocean Fisheries Commission (SWIOFC). The meeting requested the assistance of the EAF-Nansen project to establish the necessary baseline for EAF implementation in the region.

A workshop was held in Pretoria, South Africa from 20 to 24 February 2011 to examine where countries in the SWIOFC area stand in the adoption and implementation of the EAF. The aim of this exercise was to track and stimulate the implementation of EAF in the countries and thus monitor achievement of their World Summit on Sustainable Development (WSSD) commitment to implement an ecosystem approach by 2010. The Food & Agriculture Organization of the United Nations (FAO), the World Wide Fund for Nature (WWF) and various partners have used Ecological Risk Assessment as a tool to provide a structured, transparent process to develop a shared vision amongst stakeholders and clarify what is required to implement an EAF in a particular fishery. In Africa, a number of workshops have been organised to introduce fisheries managers and scientists to the approach and to track implementation by countries. To date, about 20 workshops have taken place in South Africa and Namibia to review the implementation of the EAF in various local fisheries. The outputs of these workshops have allowed for the development of a tool to track EAF implementation (Paterson and Petersen 2010). This tool, developed by WWF South Africa and the University of Cape Town, was used as a means of establishing a baseline for

EAF implementation in each of the SWIOFC countries, and in the region as a whole, by working on selected fisheries that are important both nationally and regionally.

There are essentially two broad questions relating to fulfilling the WSSD target. The first relates to EAF implementation (are we implementing research programmes, mitigation measures?) and the second relates to the effectiveness of implementation (are management actions resulting in healthier fish stocks and marine ecosystems?). It is important to note that it is highly unlikely that all ecosystem impacts of fisheries will be eliminated. Thus, the tracking tool attempts to measure the successful implementation of an EAF through certain process milestones and the measurement of enabling mechanisms. Ultimately, however, the proof of successful implementation must lie in the reduction of ecosystem impacts. To this end much work is underway to develop appropriate indicators for EAF (e.g. Shin *et al*. 2010; FAO, 2010).

METHODOLOGY

The workshop was attended by 35 participants from Comoros, Kenya, Madagascar, Maldives, Mauritius, Mozambique, Seychelles, South Africa and Tanzania (Appendix 1). Prior to the workshop a questionnaire (Appendix 2) was sent out to the national focal points of the EAF-Nansen project to gather information on selected fisheries that are important both nationally and regionally. The questionnaire was used for single species fisheries (e.g. the industrial shrimp fishery) and multi-species, multi-gear fisheries (e.g. artisanal fisheries). Using a consultative approach involving national fishery managers, scientists and stakeholders, the national focal points reviewed progress against ten EAF operational objectives, divided into sub-objectives (Appendix 2a). For each sub-objective a seven-step process (Appendix 2b) was identified to achieve the goal. The seven sub-objectives are covered by the generic component trees used for issue identification under EAF. The modified component tree for each objective is shown in Appendix 2c.

Table 1: Ten objectives for implementing an EAF:

1. The managing authority has a good understanding of the ecosystem impacts of fisheries including target, non-target and general ecosystem impacts.
2. Ecosystem impacts of fisheries are included when giving management advice.
3. The social wellbeing of dependent fishing communities is accounted for in management advice.
4. The economic wellbeing of the fishing industry is maintained.
5. The managing authority has transparent and participatory management structures that ensure good communication and information-sharing locally and regionally.
6. Management plans incorporate EAF considerations.
7. Compliance to regulations reduces ecosystem impacts of fisheries.
8. Sufficient capacity, skills, equipment and funding exist to support the implementation of an EAF.
9. Good data procedures exist to support EAF implementation.
10. External impacts of fisheries are addressed (e.g. the effect of other sectors, other industries, climate change etc.).

At the workshop, the participants of each country selected one fishery of national or regional importance. The selected fisheries were categorised as follows:

- Small-scale mixed
  - Tanzania artisanal fishery
  - Comoros artisanal fishery
  - Mauritius banks fishery[1]

[1] The Mauritius banks fishery is semi-industrial with elements of both small-scale and industrial fisheries.

- Shrimp
  - Kenya trawl fishery
  - Mozambique Sofala Bank shallow water trawl fishery
  - Madagascar fishery
- Tuna
  - Maldives skipjack pole-and-line fishery
  - Seychelles tuna longline and purse seine fishery
  - South Africa tuna longline fishery

The implementation of EAF in each fishery was reviewed using the modification of a methodology developed by Paterson and Petersen (2010). Based on the completed questionnaires, participants discussed and agreed on the step the fishery was currently at and substantiated their decisions. They also identified key areas of progress, challenges and possible barriers to progress. Participants worked in country specific groups and reported to plenary for broader scrutiny and verifications.

RESULTS AND DISCUSSION

Key outcomes per fishery: All nine countries and ten objectives

The extent to which the ten objectives had been addressed by management in the nine countries showed marked differences (Figure 1). The fishery management authorities of the countries in the region appeared to have transparent and participatory management structures that ensured good communication and shared information locally and regionally (Objective 5). The region performed poorly, however, with Objective 6 (Management plans incorporate EAF considerations) consistent with the SWIOFC Scientific Committee reports on the existence of only a few fisheries management plans in the region (FAO, 2009; FAO, 2011). Even where such plans exist, they have not been developed with much consideration of EAF. The status of Objective 9 (good data procedures exist to support EAF implementation) is surprising considering the poor state of fisheries statistics and social and economic information on the fishing industry in many of the countries. This is rather a reflection of the status of data and information in the industrialised shrimp and tuna fisheries (Figure 2).

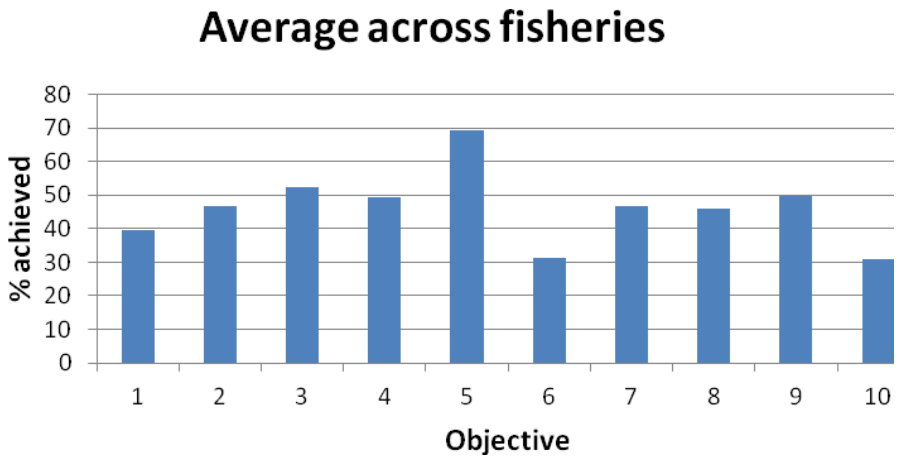

Figure 1: EAF implementation shown as percentage scores for the 10 objectives averaged across fisheries and per region. Overall average score is about 46 percent.

In Figure 2 the results have been presented according to each category. The figure clarifies the differences and highlights the effect of comanagement and community-based management in small-scale fisheries (Objective 5) as well as the lack of management plans for those fisheries (Objective 6).

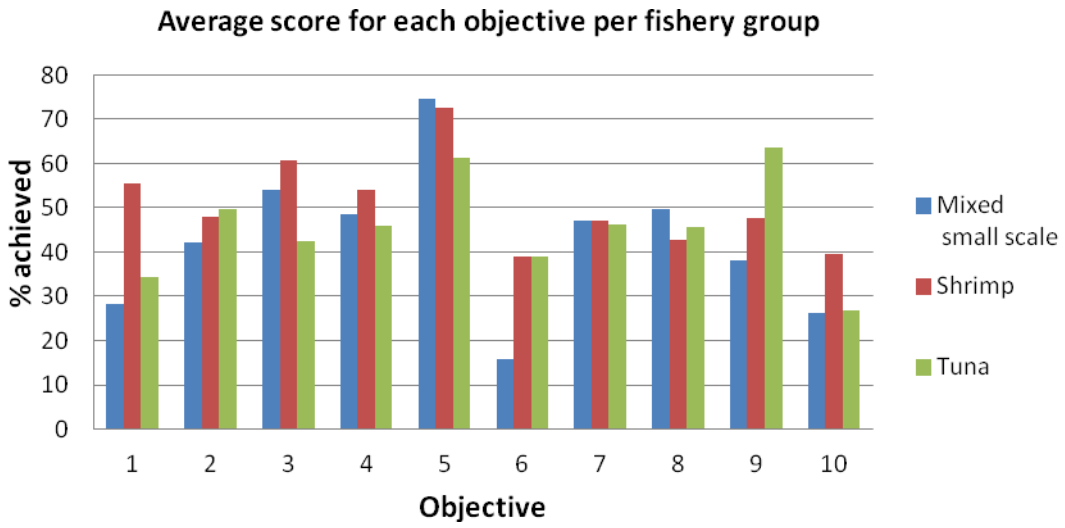

Figure 2: EAF implementation shown as percentage scores for ten objectives in three fishery categories

Overall, there are positive indications of implementation of EAF in the region. Notable areas of EAF implementation include available resources and capacity building to allow for the development of observer programmes, expansion of data collection protocols to include EAF data requirements and improvements in the quality of data through regional training programmes provided by FAO and the SWIOFP in line with the recommendations of the Scientific Committee of the SWIOFC (Objective 9, Figures 1 and 2). There has also been good implementation of Objective 3 (Figures 1 and 2), with many countries giving careful consideration to ensuring the wellbeing of fishing communities in management strategies and decisions. Some consideration has also been given to the economic implications of management decisions (Objective 4) on the fishing industry or on those directly gaining a livelihood from fishing. The workshop also reported an improvement in the participation of a broader group of stakeholders in management decisions in a number of countries (Objective 5, Figures 1 and 2). There are also a number of good examples of EAF understanding being incorporated into management actions (Objective 2). For example, Madagascar has some progressive requirements for ensuring bycatch is landed with the target catch, South Africa has set an upper precautionary catch limit for seabirds beyond which fishing may stop and there are a number of effective Marine Protected Areas (MPAs) such as the Moheli MPA off Comoros.

However, significant challenges remain, most notably the lack of management plans which include the consideration of EAF. This is a serious concern, as a management plan is the cornerstone to guide the proactive and strategic use of resources and provide a framework within which an EAF is implemented (Objective 6). Furthermore, although some research is taking place to further the understanding of ecosystem impacts of fisheries in the region, there is a substantial need to urgently undertake assessment of bycatch and to improve the understanding of the impact of fisheries on bottom habitats (Objective 1). Coupled with this is the need to increase the understanding of the cumulative impacts of various fisheries often targeting the same species or ecosystems as well as the interaction with other industries (Objective 10). A further significant challenge raised by many workshop participants is the need for strengthened monitoring, control and surveillance (Objective 7). In particular, the need to review penalties to ensure

they act as a disincentive to non-compliance and the need to develop incentives to reward or encourage good compliance. Lastly, the need for further funding support and capacity building was highlighted (Objective 8). The role of the workshop was acknowledged as contributing towards the latter and emphasises the value of stakeholder workshops in stimulating information sharing.

Key outcomes per fishery: Small-scale mixed fisheries

Tanzania artisanal fishery

The artisanal fishery in Tanzania, managed by the Fisheries Development Division of the Ministry of Livestock Development and Fisheries, targets approximately ten fish species using a number of different fishing methods including castnets, harpoons, trolling, line and ring nets. This fishery makes up a significant component of the informal fishing sector by employing approximately 2.8 million people. The fishery is open to the local community as long as they possess a licence.

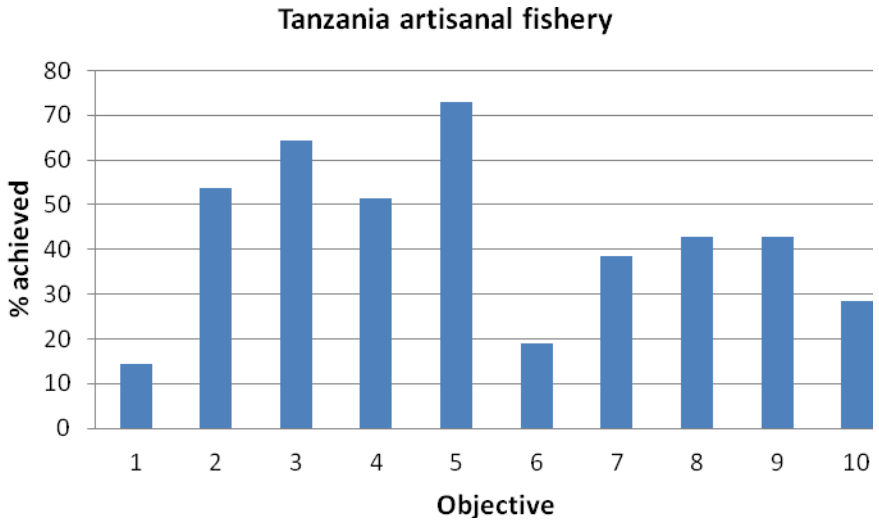

Figure 3: EAF implementation in the Tanzania artisanal fishery

The most notable aspect of EAF application in the fishery is Objective 5 which relates to participatory and transparent management structures. Contributing to this progress is the good communication and information exchange between government agencies for example, Surface and Marine Transport Regulatory Authority (SUMATRA), Tanzania Bureau of Standards (TBS), and the Tanzania Ports Authority (TPA) among others. This fishery also shows good progress in Objective 3, i.e. ensuring the social wellbeing of the fishing communities through an improved understanding of the role the fishery plays in the local economy and through its incorporation and consideration in the National Development Plan (NDP). Furthermore, the Fisheries Policy, Act and Regulations have been developed to address, amongst others, poverty. The establishment of Beach Management Units (BMUs) and the formation of Village Conservation Committees (VCC) will contribute to the long-term stability and financial security of fishing communities (Objective 4).

The two most significant challenges facing this fishery are limited research and the lack of a management plan which includes EAF considerations (Objectives 1 and 6). The biggest barrier to progress is limited funding and expertise to conduct EAF research (Objective 8). There is also limited understanding of the impacts that this fishery has on other fisheries and vice versa. Further challenges relate to compliance, including limited expertise to ensure full functionality of the Vessel Monitoring System (VMS). However, some sea patrols are carried out and relatively good shore based patrols are in place (Objective 7).

Comoros artisanal fishery

Artisanal and subsistence fishing is an important industry to the people of the Comoros with about 5 000 fishers (out of a total national population of half a million people) operating from pirogues and engine-powered vedettes using hand-lines, gill-nets and traps. Prominent species exploited in the artisanal fishery include snappers, emperors, and groupers. Tuna and tuna-like species such as kingfish form the major part of the catch. At times these fishers venture offshore to catch oilfish and the occasional coelacanth. The fishery is managed by the Fisheries Department of the Comoros.

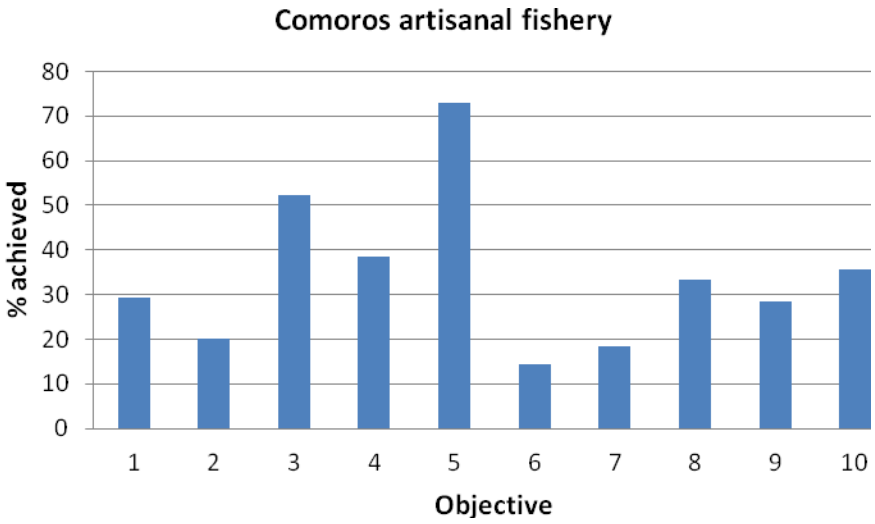

Figure 4: EAF implementation in the artisanal fishery of Comoros

In Comoros there is some capacity to understand the ecosystem impacts of the fishery (Objectives 1 and 8). Some topics are well understood for example, the stock status of the target species as well as the impact of fisheries on sea turtles. Although significant challenges remain to incorporate EAF considerations in management (Objective 2), a successful example where this has taken place is in the Moheli MPA. This MPA could be used as a model for other vulnerable areas which are in need of increased protection. Transparent and participatory management structures are in place and functioning well through traditional fisher forums but communication between these forums, government (the three departments from the different islands) and non-governmental organizations (NGOs) is inadequate and requires some attention (Objective 5). Fishing is one of the most important livelihoods and the social wellbeing of the fishing communities is well understood and accommodated in fisheries management (Objective 3). For example, on Moheli Island and in coastal villages, cooperatives receive fishing gear from the government. The long-term economic stability of the fishers is included in a national policy which emphasises good living conditions and work for fishers and the importance of generating revenue through fuel subsidies and fish aggregating devices (FADs) provided by government (Objective 4). At present there is no management plan other than the full protection of the coelacanth and a plan to ensure the protection of turtles (Objective 6). There is no regulatory framework to ensure compliance besides beach patrols in the Moheli MPA (Objective 7). Observers have been trained through SWIOFP mainly to monitor industrial fishing operations, but licensed vessels have not been taking observers on-board, supposedly because they need the space for anti-piracy personnel (Objective 9).

Mauritius banks fishery

The Mauritius Banks fishery targets a number of fish species (for example *Lethrinius mahsena* and *Lethrinius nebulosus*) using handlines. This semi-industrial fishery consists of about ten vessels. It is

managed by the Ministry of Fisheries and Rodrigues through the allocation of annual licences and quotas. Licences are renewed provided the required conditions are met.

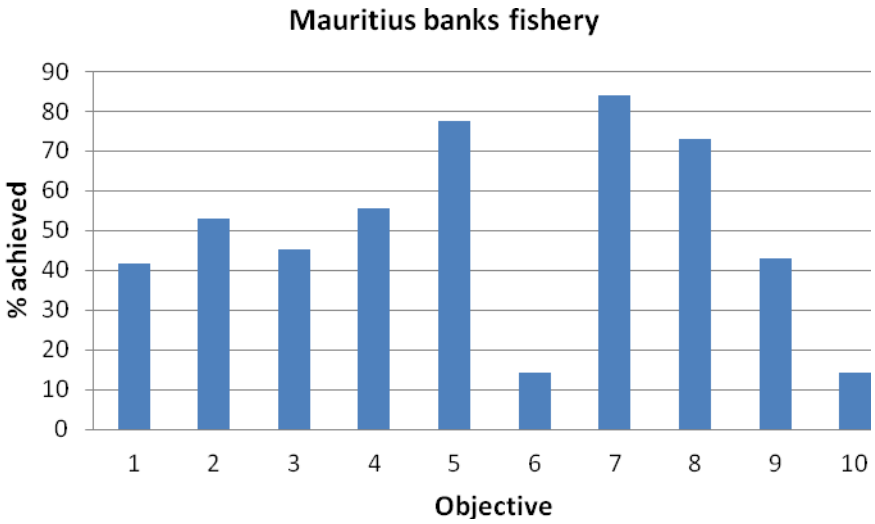

Figure 5: EAF implementation in the Mauritius banks fishery

There is a research programme in place in Mauritius which aims to understand the fishery dependant parameters that enable adequate stock assessment, but a significant challenge relates to the inadequate understanding of broader EAF issues due to a lack of capacity (Figure 5, Objectives 1 and 8). There is also little understanding of the interaction between this fishery and other fisheries (Objective 10). Although there is a need to improve the understanding of the fishery in light of the requirements of the ecosystem approach, management actions take best available information into account including current understanding of bycatch, discards, and fishing mortality (Objective 2). A total allowable catch (TAC) is set based on a maximum sustainable yield (MSY) and quotas are allocated accordingly by means of an annual licence. MPAs have been proclaimed in the lagoon around the islands of Mauritius and Rodrigues. However, there is no MPA declared in the banks area, except for the recent declaration of an MPA around the Chagos Archipelago which is being disputed. No management plans incorporating EAF are in place although fisheries legislation provides for various aspects related to conservation measures of the marine ecosystem (Objective 6). The Fishermen Investment Trust (FIT) and the Fishermen Welfare Fund under the Ministry of Fisheries and Rodrigues contribute in empowering and improving the livelihood of banks fishers by providing a winter allowance as they do not fish during winter months due to bad weather (Objectives 3 and 4). No effective training mechanisms are in place to provide EAF skills to relevant members of the industry. The fisheries training and extension centre provides basic training courses to stakeholders on marine conservation issues but there are budgetary constraints to rolling out EAF skills training. The Protection Services and the National Coast Guards enforce fisheries and other related legislations and a prosecution unit is in place within the Ministry to prepare cases for submission to court (Objective 7). A VMS system has been functional since 2005. There is no observer programme due to lack of personnel but licences do require the presence of an observer on-board (Objective 9).

Key outcomes per fishery: Shrimp fisheries

Kenya trawl fishery

The Kenyan shrimp trawl fishery is an industrial fishery managed by the Department of Fisheries. This fishery consisted of six vessels managed using a TAC as an upper fishery catch limit not divided amongst

the vessels. The operators held annual licences with no long term guarantee to rights (Objective 4). The fishery has been closed for several years and was expected to be opened later in 2011 (FAO, 2011).

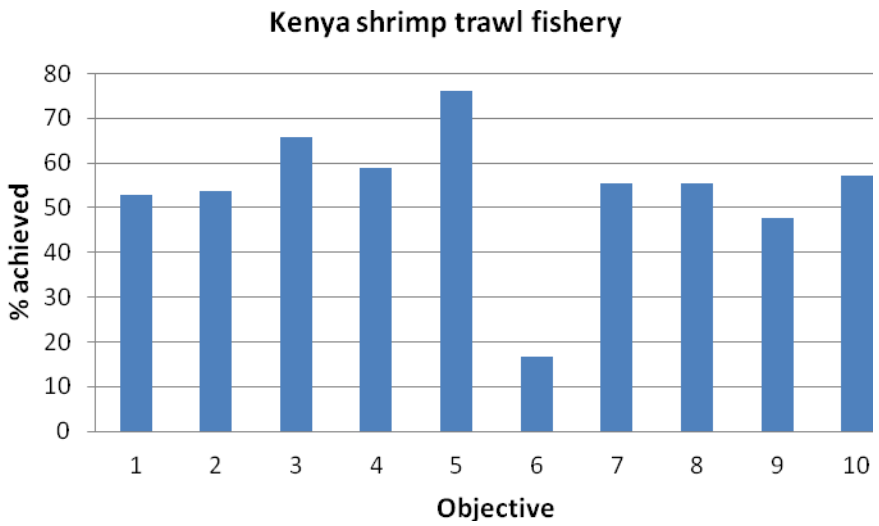

Figure 6: EAF implementation in the Shrimp trawl fishery of Kenya

Kenya has a well-established catch and effort data collection system for this fishery using logbooks and on-board observers. There is also a fairly good understanding of the spatial distribution of the species including prepared maps, life history parameters of the target species, the impacts on bycatch and vulnerable turtle species (Objectives 1 and 9). There is a poor understanding of the impacts of fishing methods on habitats as well as the genetic distribution of stocks. Some ecosystem impacts have been included in management such as mandatory use of a Turtle Excluder Devices (TEDs) and Bycatch Reduction Devices (BRDs) and a closed fishing season during the breeding season (Objective 2). A TAC is set annually but there is no allocation to the vessels. The social wellbeing of fishing communities is taken into account in the management process as contained in the National Oceans and Fisheries policy which was developed in 2008 but there is a lack of capacity to cater for social needs such us primary health care and basic education (Objective 3). There is also no structured engagement of the relevant social sectors.

A management plan has been developed and is intended to be implemented in the near future, although EAF is not fully included in this plan (Objective 6). Beach Management Units (BMUs) have been put in place to address conflicts between the artisanal fishery and the semi-industrial shrimp fishery. This has brought about the potential for greater harmony between the two but there is still a need for a more transparent and strategic approach to communication between government and stakeholders (Objective 5). Difficulties with compliance stem from lack of funding and personnel as well as inadequate disincentives for non-compliance (Objective 7).

Mozambique Sofala Bank shallow water trawl fishery

The Sofala Bank shallow water shrimp fishery is an industrial fishery with a fleet of approximately 55 freezer beam trawlers targeting five penaeid shrimp species. The fishery is managed by the Administraçao Nacional das Pescas (ADNAP) using a TAC divided into individual quotas which are issued annually.

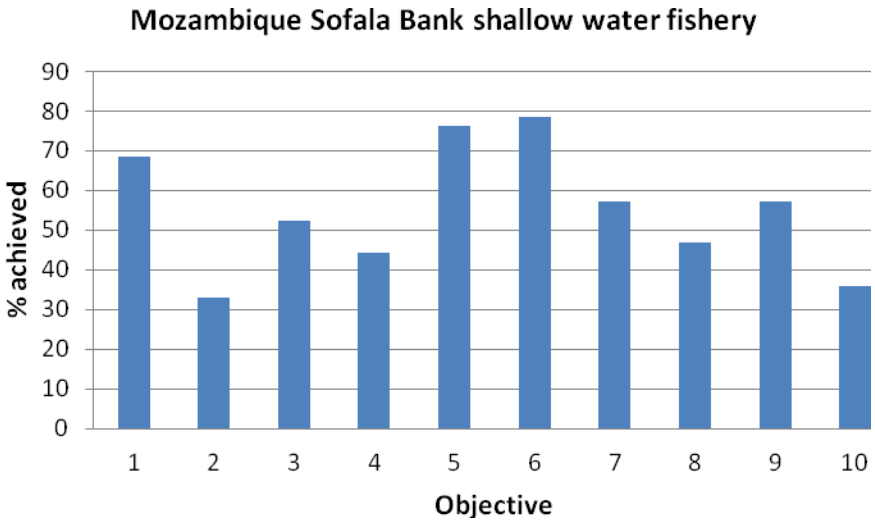

Figure 7: EAF implementation in the Sofala Bank shallow water shrimp fishery of Mozambique

While there is a fairly good understanding of the ecosystem impacts of the Mozambique Sofala bank shrimp fishery on the target species, understanding of the impacts on bycatch, the habitat and the general ecosystem is not so good (Objective 1). Ecosystem impacts are not fully included in management other than for bycatch mitigation such as regulation of mesh size and closed seasons which are all included in permit conditions. There is a requirement to use TEDs but implementation remains a signification challenge (Objective 2). There is a need to increase capacity and funding for EAF skills and implementation (Objective 8). There is an observer programme in place, but data collection protocols need to be expanded to fully include EAF data requirements (Objective 9). The fisheries management authority has a clear understanding of the role fisheries (specifically artisanal fisheries) play in poverty alleviation as set out in the fisheries policy, fisheries strategy and other relevant legal frameworks (Objective 3). Even though socio-economic issues are included in management plans it is still a challenge to collect reliable usable data from the fishing industry. A new fisheries law is being drafted which will take into consideration the possibility of longer term rights, therefore ensuring the long-term economic viability of the fishery (Objective 4). There are good transparent and participatory mechanisms in place (Objective 5).

Madagascar shrimp fishery

The Madagascan shrimp fishery can be divided into two sub-sectors: The first is an artisanal multi-gear fishery operating in estuaries targeting juveniles during their seaward migration. The second is a semi-industrial and industrial fishery trawling for adults off estuaries. Five species of shrimp are commonly caught by trawlers and six species by traditional fishers. In both cases a significant bycatch of over 100 species is recorded. Penaeid shrimps aggregate at the beginning of the fishing season and at this time levels of bycatch are significantly low. The shrimp fishery makes up 73 percent of fish exports in Madagascar by quantity and 83 percent by value. There were 33 industrial shrimp vessels in 2010. The fishery is managed by the Ministry of Fisheries and there is no TAC.

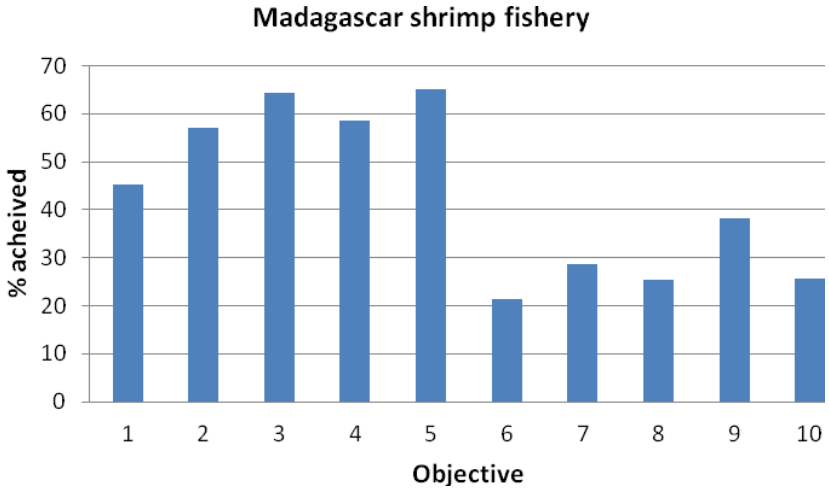

Figure 8: EAF implementation in the shrimp fishery of Madagascar

Some research has been conducted on the target and bycatch species but very little on the general ecosystem considerations (Objective 1). However, in some areas the need for research has been identified and research programmes have been initiated. Some good EAF management is in place for this fishery including limits on night trawling, a 1:2 target to bycatch landing ratio and the good implementation of TEDs and BRDs (Objective 2). There is a management plan for this fishery which includes provisions for breeding, bycatch, data collection through observers and spatial management plans but the plan needs to be updated to incorporate other EAF considerations (Objective 6). The Fisheries management authority focuses on food security and the development of markets and in this way addresses the social and economic needs of fishing communities and the fishing industry (Objective 3 and 4). Some measures are in place to encourage the landing of bycatch to address food security and there is a seasonal closure of the fishery. The consumption of pelagic fish in two coastal areas of the country is restricted due to occasional algal blooms that render some species poisonous or unfit for consumption. This is enforced by the Primary Healthcare and Basic Education Department.

Significant challenges for compliance exist (Objective 7): limited compliance capacity results in inadequate monitoring of all landing sites as well as penalties which are too low to provide disincentive for non-compliance. Furthermore, when penalties are issued there is very little follow up. A further urgent need is the limited funding to provide the adequate capacity and skills required to implement an EAF (Objective 8). An observer programme is in place, but data on EAF requirements are limited (Objective 9). There is also very little knowledge of the interaction between this fishery and others operating in the region, as well as other industries (Objective 10).

Key outcomes per fishery: Tuna Fisheries

Maldives Skipjack pole and line fishery

Skipjack tuna, *Katsuwonus pelamis*, is the most important species caught in the Maldivian tuna fishery, comprising more than 80 percent of the total tuna landings in the Maldives (MPHRE, 1998). The fishery has been in existence for nearly 1 000 years (Adam *et al.*, 1997) and despite the economic diversification in recent years, tuna fishing remains the main economic activity in the outer islands. In recent years, catches of skipjack tuna were approximately 80 000 metric tons annually. The Maldives pole-and-line skipjack fishery is managed by the Fisheries Management Agency of the Ministry of Fisheries and Agriculture. The fishery consists of about 1 200 vessels which are granted annual licences provided they meet certain licensing conditions. The fishery depends on live bait which is caught on nearby reefs using nets.

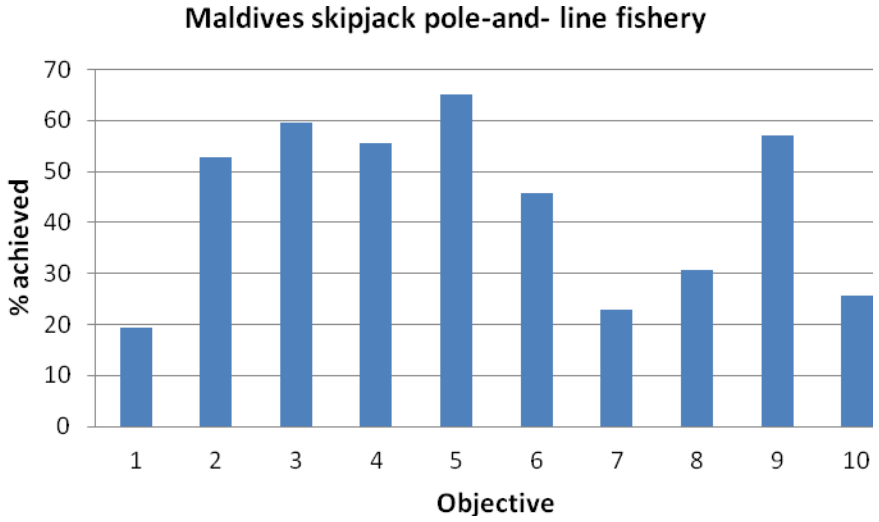

Figure 9: EAF implementation in the tuna pole-and-line fishery of the Maldives

There is very little research undertaken on the target stock and ecosystem impacts of the Maldivian tuna pole-and-line fishery (Objectives 1 and 2). However, given that the target species, skipjack tuna, is a migratory species, this fishery can draw on research undertaken elsewhere including by the Indian Ocean Tuna Commission (IOTC). There are no formal working groups to advise on management structures but there is a fisheries advisory committee, consisting of industry members and other stakeholders which is functioning well (Objective 5). At present there is no management plan for this fishery but one is under development (Objective 6). Maldives has recently been declared a shark sanctuary and thus there is a ban on shark fishing as well as a ban on any net fishing within the exclusive economic zone (EEZ) other than a small fishery for bait. The Fisheries Management Agency generally has good understanding of the socio-economic requirements of the fishery and all the necessary policies are in place to manage the fishery for the benefit of the fishing communities (Objective 3). Appropriate measures are in place to ensure that fishing communities are provided with adequate food security, health insurance and educational facilities.

There has been over-investment in the Maldives tuna fishery, hence management of the fishery is aimed at finding alternatives to minimize possible job loss in future and provide financial security (Objective 4). The fishing industry is one of the major contributors to the Maldives' economy, and hence every effort is made to better understand the economic context of the fishery. An economic driver of this fishery is the price of oil, an increase of which often results in less fishing days thus negatively impacting on the fishery (Objective 10). This means that fishers tend to only go as far as FADs and don't look further for free swimming schools. However, the introduction of a fuel subsidy has allowed fishers to fish further offshore on free swimming schools. There is a lack of funding and capacity to gain the skills required for an EAF (Objective 8). Maldives has an accurate logbook system but does not have an official observer programme besides using the monitoring and compliance officers as observers (Objective 9).

Seychelles tuna longline and purse seine fishery

The Seychelles tuna longline and purse-seine fishery is an industrial fishery that targets all species of tuna and has a fleet of approximately 37 foreign vessels (ten of which are flagged to the Seychelles). This fishery is jointly managed by IOTC and the Seychelles Fishing Authority (SFA).

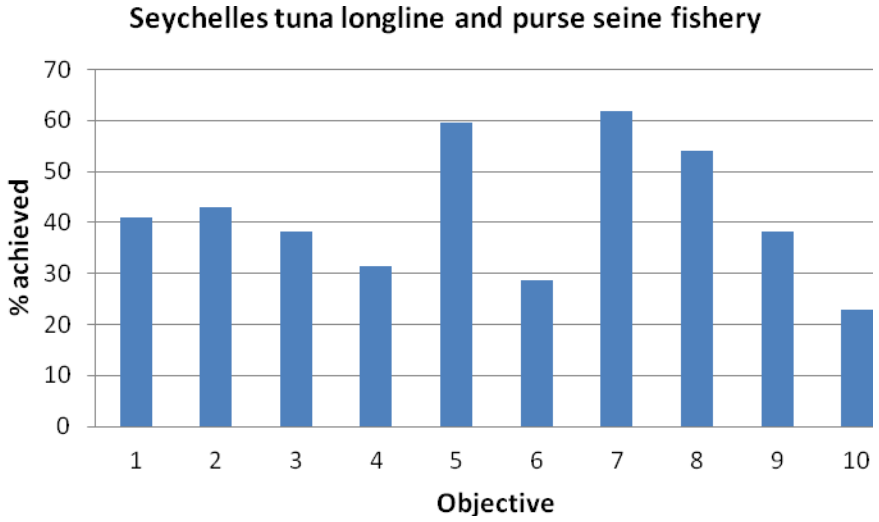

Figure 10: EAF implementation in the Seychelles tuna longline and purse seine fishery

Tuna fisheries in the region are managed by the IOTC who undertake research and develop management recommendations and resolutions. The SFA largely relies on this regional management with little local intervention (Objectives 1 and 2). The fleet largely consists of foreign flagged vessels with only a few Seychelles-flagged vessels. As a result, consideration for the direct socio-economic wellbeing of the Seychellois fishing communities is low though the fishery contributes significantly to the overall economy (Objective 10). There are some working groups and associations in place but they need more attention and priority (Objective 5). There is no local management plan in place for this fishery although the Seychelles has developed a National Plan of Action (NPOA) for sharks (a bycatch) and a NPOA to address illegal, unreported and unregulated fishing (IUU) (Objective 6). There is no NPOA for seabirds in place at present. There are adequate disincentives for non-compliance in place but for other areas of compliance there are limitations, such as capacity, funding and skills (Objective 7).

South Africa tuna longline fishery

The South African tuna swordfish fishery consists of a well developed pole-and-line and longline sectors. The tuna pole-and-line subsector operates along the west coast of South Africa targeting albacore and yellowfin with little bycatch. The tuna and swordfish longline subsector mainly operates along the south and east coasts targeting bigeye, yellowfin and swordfish, with significant bycatch including seabirds, turtles and sharks. The fishery (both subsectors) is subject to dual management by Regional Fisheries Management Organisations (RFMOs) and the Department of Agriculture, Forestry and Fisheries. The fishery is managed through a Total Allowable Effort scheme with 200 rights-holders in the pole-and-line sector and 50 longline vessels.

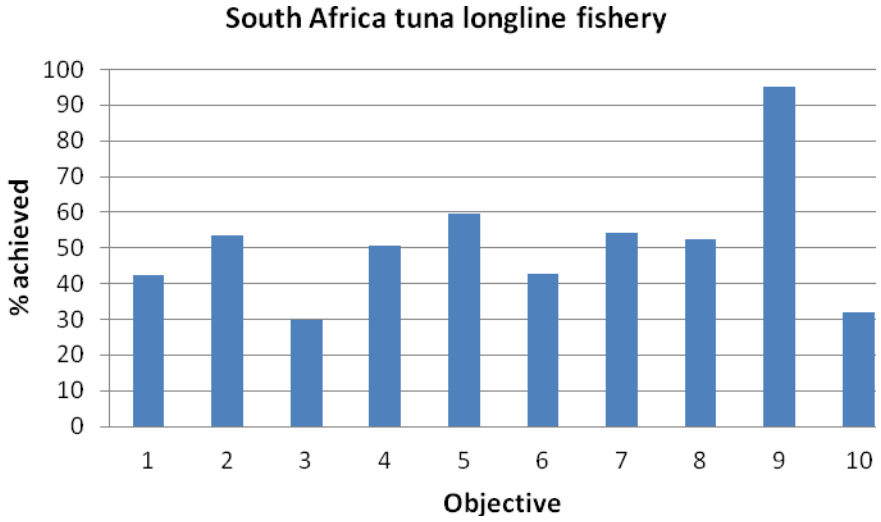

Figure 11: EAF implementation in the South Africa tuna longline fishery

South Africa has carried out some good research on the target species but there is still a need for more research on the life history of the fish within South Africa's EEZ, as well as on the extent of mixing of stocks on the boundary between the Indian and Atlantic Oceans (Objective 1). Ecosystem considerations are included in the management system through the use of regular stock assessments to inform the TAC, bycatch mitigation measures and a good observer programme (Objectives 2 and 9). South Africa is still not a member of the IOTC and the TAC is not divided into country quotas which creates a barrier for further development in this fishery. There are a number of working groups including a Management Working Group (MWG) and a Scientific Working Group (SWG) which have broad stakeholder participation and ensure transparent decision making (Objective 5). There is also a well functioning industry association in place which represents industry interests on the MWG but there are still about 30 percent of fishers who are not members of this association.

An outstanding challenge for this fishery is to adequately incorporate social considerations into the management plan as well as improve research to better understand the social wellbeing of the fishers in this fishery (Objective 3). Long term rights have been allocated to ensure the long term economic viability of this fishery but some right-holders lack the skills to effectively run their operations as a business and the transfer procedure is too long and thus affects economic viability (Objective 4). There is a fisheries management plan in draft as well as a shark NPOA. A seabird NPOA has been developed and implemented but the IUU and capacity NPOAs have not been drafted yet (Objective 6). There is an observer program with 100 percent observer coverage on foreign-flagged vessels, 100 percent monitoring of landings and 100 percent VMS coverage but there is still a need to have a performance review of this fishery (Objective 7 and 9). In general there are adequate skills to implement an EAF, but there is an urgent need for researchers of large pelagic fish species (Objective 8). There is a good understanding of the interactions between the different large pelagic sectors but more collaboration with climate change scientists is needed (Objective 10).

Comparison of EAF implementation status by objective across the SWIO region

The implementation status for each objective was compared among the nine countries. The results were graphed with the countries in each fishery type placed side-by-side.

Objective 1: The managing authority has a good understanding of the ecosystem impacts of fisheries including target, non-target and general ecosystem impacts

There are clear differences in the understanding of the ecosystem impacts of the fisheries in question (Figure 12). The ecosystem impacts of shrimp fisheries are relatively better understood, partly due to the nature of the fisheries where the bycatch is known to be high. All three countries in the study regulate the use of BRDs and TEDs although implementation remains a challenge.

Target species
The three shrimp fisheries have the best understanding of their target species, with Mozambique having a good understanding of life history parameters, the ecology and the recruitment process for the main species (*Penaeus indicus, Metapenaeus monoceros, P. latisulcatus* and *P. japonicus*) and most data are published in reports and peer-review journals. The small-scale mixed fisheries have little understanding of their numerous target species. A few national research programmes are planned but due to a lack of resources and capacity these programmes are not always carried out. The SWIOFP is addressing some of these research gaps across the region with Tanzania leading that component of the project. Within the tuna fisheries the situation differs between countries, with Maldives recording limited research or understanding of life history parameters for their main target species (skipjack). Seychelles tuna fishery is managed closely within the IOTC and therefore research programmes are carried out through this body. South Africa has a good understanding of the regional target species but there is a limited understanding of the target species in South African waters.

Bycatch (non-retained) species
Bycatch species are poorly understood throughout all countries. In most countries there is very little non-retained catch as often all species caught are consumed.

General Ecosystem (habitats and food webs)
Research on the general ecosystem was identified as a need in most countries but is lacking due to lack of funding and capacity. In some countries the SWIOFP presents the opportunity to gain funding to undertake research. In South Africa *ad hoc* research is conducted and some information is collected by observers but there is still a need to increase this knowledge.

Objective 2: Ecosystem impacts, including target, non-target and general ecosystem impacts, of fisheries are included in management advice

Many countries collect information, mainly through catch assessment or monitoring schemes or have ongoing research but this is not necessarily included in management decisions. Observer programmes exist in South Africa and are being established elsewhere in the region with the assistance of SWIOFC. There is, however, a move to include more EAF information in the future for some of the countries. Even though this information is not available to all countries, there are still some management measures in place which are relevant to EAF.

Target species
The Kenyan shrimp fishery had a closed season and the use of a TAC to manage the fishery. The artisanal sector has regulations in place, such as size limits. Madagascar has also implemented limits to the fishery in the form of a ban on night fishing for the first 45 days of the shrimp fishing season and for the full season for the artisanal subsector. Maldives recorded that little research has been undertaken on the target species. Mozambique recorded limited use of life history parameters in the stock assessments but does use management measure such as gear restrictions and closed seasons. The Seychelles and South African tuna fisheries are managed by RFMOs and these RFMOs conduct the stock assessments and allocate quotas which include size and catch limits.

Bycatch
Comoros reported that there is a management plan for some target and non-target species and that available data on coelacanths and turtles are used in educating fishers and raising awareness for comanagement. In Madagascar data are being collected on bycatch through observer programmes and studies are in the process of being conducted, but bycatch is not taken into consideration for management. There is a requirement though, for the target to bycatch ratio to be at least 1:2. TEDs and BRDs are used as a bycatch management measure. Maldives has not done research on bycatch and it is not a problem as the pole-and-line fishery is highly selective.

General ecosystem
Comoros has a successful MPA in Moheli with good regulations and access rights. Kenya has implemented trawling zones as well as a 3 nautical mile limit from the shoreline where industrial operators are excluded. Madagascar has implemented a spatial management plan and is in the process of implementing MPAs but this does not yet cover all the sites identified as conservation priorities.

Objective 3: The social wellbeing of those who directly or indirectly depend on fishing is accounted for in management advice

It was recorded that this objective is fairly well addressed in most of the countries except South Africa and Seychelles. In the other countries the social wellbeing of the people dependant on the fishery was considered to be relatively well understood and included in management actions. Some of the countries have empowerment programmes although there is a need for increased capacity and expertise to implement such programmes. In South Africa and Seychelles there is a need for data collection to gain more information, and for a review of implementation.

Objective 4: The economic wellbeing of the fishing industry is accounted for in management advice

In some countries, initiatives such as FADs, artificial reefs and fuel subsidies are in use. There is some form of comanagement in most regions, in the form of working groups and BMUs, but the adequate skills to roll out these programmes is lacking in some countries such as Tanzania. In Mauritius not all stakeholders are equipped with the adequate comanagement skills. None of these fisheries hold any eco-label but the Maldives fishery has entered into full assessment for MSC certification. Seychelles was an outlier for this objective.

Objective 5: The managing authority has transparent and participatory management structures that ensure good communication and information-sharing locally and regionally

All countries participate in relevant Regional Fishery Bodies (RFBs)/RFMOs, either as members or as cooperating, non-contracting parties (e.g. Mozambique and South Africa in IOTC). All countries have some sort of working group/stakeholder engagement system in place although some are more effective than others. Most only include government and industry as stakeholders with only Madagascar and South Africa including NGOs.

Objective 6: Management plans incorporate EAF considerations

For the fisheries considered during the workshop, some of the countries (Mozambique, Madagascar, Kenya, South Africa, and Seychelles) have management plans that are currently implemented and only a few have incorporated EAF. Mozambique developed a management plan for the Sofala Bank shrimp fishery and, with the support of the EAF-Nansen project, this plan is being revised to include EAF considerations. In Madagascar, a shrimp trawl management plan is implemented and updated from time to time but the extent of EAF considerations in it is unclear. Kenya has developed a management plan for its

shrimp fishery which is now being re-examined to include EAF elements even though this fishery is currently closed. The South African management plan is in the draft stage and awaiting finalisation but does include EAF considerations.

The other countries have recognised the need for a management plan and are in the process of developing one. For example, the EAF-Nansen project is assisting Seychelles and Tanzania to develop EAF management plans for their respective artisanal fisheries. Mozambique and Mauritius have IUU and capacity NPOAs which are both implemented. Tanzania has developed an NPOA and this is still to be fully implemented. Seychelles has implemented a shark NPOA and have partly implemented an IUU NPOA. South Africa has developed and implemented a seabird NPOA and it effectively controls IUU in its waters. The Mauritius banks fishery is regulated by most of the elements of a management plan including some EAF considerations.

Objective 7: Compliance to regulations reduces ecosystem impacts of fisheries

Comoros has no regulatory systems or incentives for voluntary compliance, but Moheli has introduced an MPA with regular patrols. Outside of the MPA there is little to no compliance or regulation. Mauritius recorded very good regulatory mechanisms with adequate penalties, an operational VMS system since 2005 and the court system apprehends offenders according to the Fisheries and Marine Resources Act. The other countries generally recorded regulatory mechanisms that are only partially implemented with inadequate penalties and no incentives for compliance. There was often a lack of funds or capacity to implement various regulatory mechanisms.

Objective 8: Sufficient capacity, skills, equipment and funding exist to support the implementation of an EAF.

Comoros has limited funding and capacity to implement an EAF and although the current staff are skilled in implementing an EAF there is very little work to do due to the lack of funding. In Mauritius and Kenya there is some capacity to implement an EAF although further training is required. However, due to lack of funding and budgetary constraints, little can be implemented. Mozambique needs to increase EAF training for the fisheries managers and researchers. Madagascar and Maldives require an increase in funding and capacity to implement an EAF as, at present, there is little funding and skills within the relevant government departments. Although South Africa is implementing an EAF in the management of some of its fisheries there is still a need for further funding to increase the research, training and equipment needed for compliance.

Objective 9: Good data procedures exist to support EAF implementation

In its tuna longline and swordfish fishery, South Africa was significantly ahead of the other countries in terms of data procedures. Its tuna longline subsector has 100 percent observer coverage as well as five day trip reports for verification of logbooks and an appropriate electronic data management system. The other countries either have an observer programme or are in the process of training observers or, in the case of Seychelles and Mauritius, have no observer programme. All countries excluding Comoros have logbooks and an electronic data management system which, in some cases, is effective but in most it is not.

Objective 10: External impacts of fisheries are addressed (e.g. the effect of other sectors, other industries, climate change, etc.)

In general the countries appeared to have little verified knowledge of external impacts on these fisheries, such as climate change, other industries and other fisheries. There is a need for research to increase the knowledge of these impacts. All countries noted that the fishers are generally aware of the impact of

changing fuel prices as this directly affects their incomes. However, no country referred to any objective study of the impact of changing fuel prices upon a fishery that could be used by fisheries management or inform national fisheries policy.

Comparison of EAF implementation status between SWIOFC and Benguela Current Commission (BCC) regions

The results of this workshop were compared with those obtained from the BCC region where several ecological risk assessment workshops have been undertaken in the last eight years (Nel *et al.*, 2007).

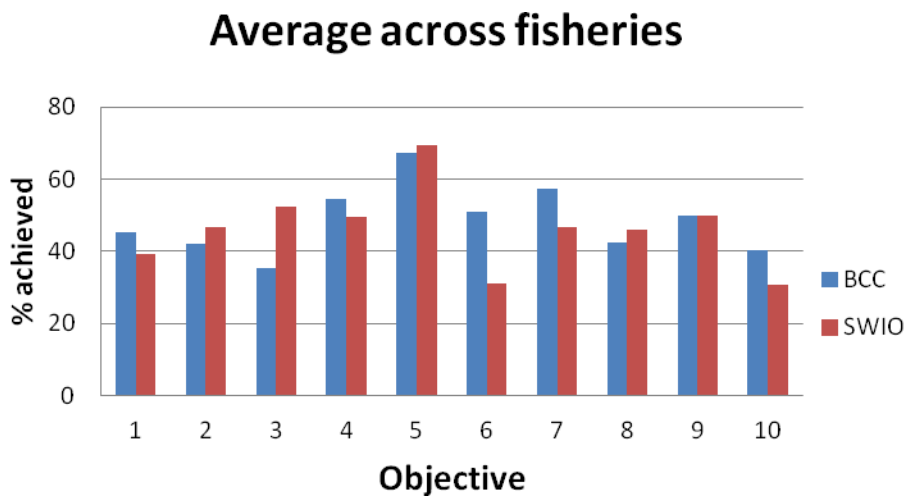

Figure 12: Comparison of results of overall implementation (by Objective) between SWIOFC and BCC Countries

A comparison of the scores for the ten objectives that track the implementation of EAF showed general similarities between the two regions (BCC and SWIOFC) as well as some marked differences (Figure 12). Marked differences were found in Objective 3 (Social wellbeing of dependent fishing communities is accounted for in management advice) and Objective 6 (Management plans incorporate EAF considerations). Artisanal fisheries are important in the SWIOFC region and they contributed markedly higher scores in country group assessments of the consideration by management of the social well-being of fishery communities (Objective 3). On the other hand it was evident that the BCC region had significantly more management plans that incorporated EAF.

CONCLUSIONS AND RECOMMENDATIONS

In general, the results of the workshop showed that countries have recorded several achievements towards honouring commitments made at the WSSD to further the implementation of an ecosystem approach to fisheries. This notwithstanding, many of the countries are not aware of this effort and are either sceptical about EAF implementation or believe that they do not have the capacity to implement EAF.

To make further progress in EAF implementation, the following areas require attention across the region:

1. Improve the mitigation and utilization of bycatch and impact of shrimp trawl fisheries on bottom habitats;
2. Increase the incorporation of EAF into management actions;

3. Further examine and adopt rights-based management;
4. Increase capacity, skills and funding for EAF;
5. Develop management plans which adequately address EAF;
6. Continue to improve and expand data collection protocols (for catch assessments, logbooks and observers) to include EAF requirements;
7. Improve compliance mechanisms, including review of penalties to ensure they act as a deterrent to non-compliance;
8. Improve the understanding of broader fishery interactions with other fisheries, industries and the environment.

The EAF Tracking tool has provided a structure for fisheries managers to grapple with the complexity of implementing an EAF. The workshop allowed for improved stakeholder communication and understanding of EAF issues, and sharing of information among stakeholder groups. However, within a regional workshop covering selected fisheries from nine countries, it was not possible to bring all the relevant national stakeholders within the discussions and deliberations. Some country groups had broader and more dynamic stakeholder representation than others. As a result of these limitations there is need for caution in interpreting comparisons between the countries. In the SWIOFC region, further workshops with broader stakeholder participation (including more fishing industry and NGO representatives) preferably at country level, would be required to improve upon and consolidate the results.

While a generic approach such as this allows for discussion, interrogation and reporting, it has limits to the extent that it can capture differences between fisheries that are often important to unlocking barriers to implementation. Overall, this process has provided a good first step in developing a tracking method for the SWIOFC region and in stimulating discussions on the implementation of an EAF in the region. Its real value will be furthered by extending it to national level and reviewing the same fisheries over time to track progress. It is also important to note that EAF implementation is a process that goes from planning to implementation and monitoring and each phase is important. However, it is important to note that countries are not starting from scratch with EAF implementation and knowledge about the system differs from case to case and country to country. The workshop has highlighted areas requiring additional work so as to be able to fully include ecosystem considerations in the management of fisheries, and governments should be stimulated to do more for EAF implementation.

It is also essential to review some elements of the questionnaire specific to the SWIOFC region (e.g. artisanal fisheries and catch assessments), in order to make it more generic and suitable for EAF implementation at national level across all fisheries.

The outcome of this study could be of interest to the FAO Committee on Fisheries (COFI) as part of the implementation of the Code of Conduct for Responsible Fisheries by member states and could also be replicated in other regions.

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APPENDIX 2

Questionnaire to assess status of EAF implementation by member states of the South West Indian Ocean Fisheries Commission

Country..... Date.....
Name (s) of Individual (s) completing the questionnaire..... Designation.....
Management authority/Research agency and contact details.....
.....
Name/Description of Fishery.....

Introduction

This exercise is to help assess the level of implementation of the ecosystem approach to fisheries (EAF) in countries in the South West Indian Ocean Fisheries Commission (SWIOFC) area. One of the World Summit on Sustainable Development (WSSD) plan of implementation targets is for countries to adopt the EAF in the management of their fisheries by the year 2010. The implementation involves a process of putting in place necessary mechanisms that support EAF.

FAO and partners have used Ecological Risk Assessments as a tool to provide a structured, transparent process to develop a shared vision amongst stakeholders and clarifies what is required to implement an EAF in a particular fishery. Generic Component Trees are used in the identification of issues in a structured way to ensure that all the key components of a fishery system are assessed. Once the risks and priorities for a fishery have been identified through the ERA process, it is necessary to check regularly whether progress is being made in addressing these priorities. An EAF tracking tool has also been developed to track selected operational objectives for management. Usually, the tool is used at a workshop with all the key stakeholders to make sure that different societal objectives or aspirations are reflected in identifying the key priorities.

This approach will be used to establish a baseline for EAF implementation in each of the SWIOFC countries, and in the region as a whole, by working on selected fisheries that are important both nationally and regionally. This questionnaire is to gather background information for the exercise. It may be used for a single species fishery (e.g. industrial shrimp fishery) or a collection of multi-species, multi-gear fisheries (e.g. the artisanal fisheries sector). The questions are based on the ten operational objectives for EAF implementation, formulated to follow the generic component trees (Appendix 2c).

In the tables "*****" refers to the table (Appendix 2a) used to identify the appropriate process step, and "******" should enable the respondent (and participants) to decide on the process step the fishery is currently at (and the management intervention) using the appropriate table. These should guide your decision on level of management and the answers will be discussed at a workshop to be held in Mombasa, Kenya 21–24 February 2011.

APPENDIX 2a
Objectives

Objective 1: Good understanding of ecosystem impacts of fisheries	Table*	Step**	Comments (including details of progress, barriers etc.) and actions to be undertaken within the next 18 month
Target species and bycatch			
Is there a good understanding of life history parameters for stock assessment (e.g. natural mortality, age length key, age at maturity, factors affecting recruitment)?	1		
Is there a good understanding of the fisheries dependent parameters that enable adequate stock assessment (e.g. fishing mortality, fishing effort)?	1		
All fishing mortality including bycatch, poaching and discarding is adequately understood	1		
The spatial distribution (including trans-boundary distribution) is adequately understood	1		
The stock identity and/or genetics is well understood	1		
The impacts of the fishery on bycatch or vulnerable species have been quantified	1		
Relevant catch and survey data are monitored	5		
General Ecosystem considerations			
Fishing impacts on marine habitats and ecologically important areas e.g. spawning areas, nursery areas, predator foraging areas, have been assessed and quantified.	1		
There is good understanding of the trophic role, diets and foraging behaviour of predators that are dependent on small pelagic species.	1		
There is good understanding of the diet and role of small pelagic species as secondary consumers in the trophic web.	1		
There is good understanding of the ecosystem impacts of supplementary feeding (by making offal and/or catches available to predators) and/or de-predation by top predators including its impact on the economic viability of the fishery.	1		

Objective 2: Ecosystem impacts are incorporated into management advise	Table	Step	Comments (including details of progress, barriers etc.)
Target species and bycatch			
The relevant life history parameters for sardine are incorporated into management strategies and appropriate management actions are implemented	2		
All fisheries data are incorporated into management strategies and appropriate management actions are implemented	2		
All fishing mortality including bycatch, poaching and discarding is adequately incorporated into stock assessment models	2		
The spatial distribution (including trans-boundary distribution) is adequately incorporated into stock assessment or other management advise	2		
The stock identity and/or genetics is incorporated into stock assessment models or other management advise	2		
Management minimizes bycatch e.g. gear restrictions, closed areas/seasons etc., have been identified, tested, supported by stakeholders and implemented.	4		
General Ecosystem considerations			
Appropriate spatial management (e.g. marine protected areas) are implemented.			
The necessary biomass to sustain healthy populations of these predators (by volume and spatially) has been quantified and these needs are formally included into management procedures.	2		
The biomass needed to ensure stability in the ecosystem has been quantified and the ecosystem impacts of fishing on secondary consumers has been formally included in management procedures.	2		
Fisheries operations have been amended to mitigate the impacts of diet supplementation on, or depredation by top predators.	2		

Objective 3: Social wellbeing of fishing communities is incorporated into management advice.	Table	Step	Comments (including details of progress, barriers etc.)
Fisheries management agency, as custodian of a common resource (that policy requires to be utilized for the benefit of all Namibians), has a good understanding of the role of the fishing sector in addressing poverty alleviation (e.g. food security, employment, health, education).	1		
Data management systems for socio-economic data are in place and are being used.	12		
Issues of poverty alleviation (e.g. food security, primary health care and basic education) are included in management plans and policies and appropriate management actions are taken.	13		
Social implications related to the fishery are included in Integrated/Local Development Plans.	14		
Fisheries management agency has sufficient capacity to address gazetted social priorities (e.g. poverty alleviation, job creation, food security, primary education, health care).	7		
Transdisciplinary collaborations on issues of poverty alleviation, basic education and primary health care between the fisheries management agency and other line ministries (e.g. Ministry of Education, Health etc.) & NGOs are established.	15		
Objective 4: Economic wellbeing of fishing communities is incorporated into management advice.	Table	Step	Comments (including details of progress, barriers etc.)
Individual rights are economically viable.	16		
An appropriate and fair rights allocation process is in place.	17		
Management of the fishery is aimed at long-term stability and financial security.	16		
All rights holders have adequate business skills and marketing skills	8		
All stakeholders possess adequate skills to participate in co-management.	8		
Effective training mechanisms are in place to provide EAF skills development to relevant members of the industry (e.g. responsible fisheries training courses).	8		

The fishery is eco-labeled.	18		
The industry has a strategy to ensure long-term market security (e.g. diversity of markets/products, product branding).	19		
There is a clear understanding of the economic context of the fishery.	1		
Economic implications of management decisions are clearly integrated into fisheries management advice and procedures.	20		
Objective 5: Transparent and participatory management structures locally and regionally	Table	Step	Comments (including details of progress, barriers etc.)
Effective and cohesive industry associations are in place and functioning.	21		
Effective participatory management fora (e.g. Working Groups) are functioning.	21		
Working groups have good stakeholder participation (e.g. fishing industry, NGO etc.).	22		
Channels or forums are in place for communication with other government agencies (e.g. oil and minerals, transport, safety at sea, health standards, and customs).	15		
Channels or forums are in place to facilitate communication among senior managers of the different fisheries departments (i.e. compliance, research and resource management).	15		
Channels or forums are in place to facilitate communication among operational managers of the different fisheries departments (i.e. compliance, research and resource management).	15		
Regional co-operation is operational and institutionalized (e.g. SWIOFC)	29		
SWIOFC			
ASCLME			
IOTC	30		

Objective 6: Management plans incorporate EAF	Table	Step	Comments (including details of progress, barriers etc.)
Sector management plans which incorporate EAF considerations for all three dimensions of EAF are in place and peer reviewed	24		
All relevant National Plans of Actions have been developed and implemented			
Seabirds NPOA	25		
Shark NPOA	25		
IUU NPOA	25		
Capacity NPOA	25		
Objective 7: Good compliance to regulations exists	**Table**	**Step**	**Comments (including details of progress, barriers etc.)**
Appropriate regulatory mechanisms exist and adequate follow-through provide effective disincentive for non-compliance	26		
Adequate voluntary incentives are in place to reward good compliance by industry (e.g. performance review procedures, eco-labeling, etc.)	27		
Adequate penalties act as a dis-incentive for non-compliance	28		
Regular at sea patrols are undertaken	28		
Adequate shore based controls are in place (e.g. in harbours, at landing sites etc.)	28		
The specialised investigations unit functions well	28		
Functional VMS system implemented	28		
Legal/Court system adequately apprehends offenders	28		
Regular aerial patrols are undertaken	28		
Appropriate electronic data management systems are in place to ensure effective monitoring of compliance	28		

Objective 8: Sufficient skills, capacity and funding for an EAF	Table	Step	Comments (including details of progress, barriers etc.)
Good research capacity is available to adequately understand EAF in this sector.	7		
The skills development mechanisms (e.g. training courses etc.) are adequate to allow EAF related research.	8		
The funding to facilitate adequate capacity, equipment and skills for research are understood and met.	9		
The fisheries management agency has adequate capacity to advise fisheries management decisions	7		
The fisheries management agency has the necessary skills to support EAF management i.e. the technical expertise which allows for the identification of the appropriate management tools (e.g. closed area/season, quota, gear restriction)	8		
The fisheries management agency has funding to facilitate adequate capacity, equipment and skills for implementing management decisions	9		
There is adequate capacity to address compliance issues	7		
The compliance section has the necessary skills to implement an EAF (including a good understanding of the regulations, the appropriate penalties and evidence collection)	8		
There is adequate funding to facilitate capacity, equipment and skills for compliance	9		
Objective 9: Good data and data procedures to support an EAF	**Table**	**Step**	**Comments (including details of progress, barriers etc.)**
An observer programme is operational and provides accurate information to inform the management of the sector.	10		
Accurate logbook/landings declaration informs the management of the sector.	11		
Appropriate electronic data management systems are in place (research and catch data).	12		

Objective 10: External impacts of the fishery are taken into account	Table	Step	Comments (including details of progress, barriers etc.)
There is good understanding of the effect of other fisheries on this fishery and vice versa	1		
There is a good understanding of the effect of climate change on this fishery	1		
There is a good understanding of the effect of other industries (e.g. mining) on this fishery	1		
There is a good understanding of economic drivers (e.g. oil price, exchange rates etc.) on this fishery	1		
There is a good understanding of the effect of social factors (e.g. HIV/Aids) on this fishery.	1		

APPENDIX 2b
Process step tables for assessment

TABLE 1	Research/good understanding
1	No research programme initiated or needs identified
2	Research needs/issues have been identified and prioritized
3	Research programme to address needs is in place
4	Research programme provides minimum results which are incorporated into stock assessment
5	Research programme adequately addresses priority needs and results are incorporated into stock assessment
6	Research programme is producing comprehensive results beyond priority needs and most of these are incorporated into the stock assessment
7	Research programme is producing comprehensive results beyond priority needs and most of these are incorporated into the stock assessment are regularly published in peer reviewed reports/papers

TABLE 2	Management - general
1	No management actions implemented or strategy developed whatsoever
2	Some indication of intention to develop a strategy to incorporate parameters into stock assessment models
3	Responsibility assigned (e.g. relevant researcher, task group constituted, or Resource management working group etc.)
4	Activities towards implementation (e.g. identification of appropriate management actions)
5	Some relevant parameters are addressed by management actions (e.g. stock assessment, permit conditions, etc)
6	All relevant parameters are addressed by management actions
7	All relevant parameters are addressed by management action and good compliance

TABLE 3	Management/mitigation - bycatch
1	No consideration of management actions
2	Identification of possible mitigation measures/actions
3	Preliminary testing appropriate mitigation measures/actions
4	Stakeholder support and input
5	Refined testing and/or investigation with stakeholder support
6	Incomplete suite of measures implemented and supported by stakeholders
7	Practical, appropriate mitigation measures that consider the entire eco-system are implemented and supported by stakeholders

TABLE 4	Regulation – bycatch
1	No regulation whatsoever
2	Some indication of intention to develop regulation
3	Responsibility assigned (e.g. relevant researcher, task group constituted, or working group etc.)
4	Activities towards implementation (e.g. identification of appropriate management actions)
5	Partial implementation
6	Adequately included into permit/licence conditions
7	There is good compliance

TABLE 5	Monitoring of non-vulnerable species
1	No monitoring programme initiated
2	Intention to develop monitoring programme
3	Data needs have been identified and prioritized
4	Monitoring programme has been designed
5	Monitoring programme adequately addresses priority needs and is producing preliminary results
6	Monitoring programme produces comprehensive results
7	Comprehensive understanding based on reliable, long-term data series

TABLE 6	Management of non-vulnerable species
1	No consideration of bycatch information
2	Some indication of intention to manage bycatch
3	Responsibility assigned (e.g. relevant researcher, task group constituted, or working group etc.)
4	Thresholds of potential concern determined
5	Activities to address different indicator levels determined
6	Management decision made based on indicator levels
7	Management actions taken and results fed back to stakeholders (research, industry etc)

TABLE 7	Capacity
1	Capacity needs not understood
2	Good understanding of the capacity needs
3	Number of positions reflects capacity needs
4	60% of required positions filled
5	75% of required positions filled
6	85% of required positions filled
7	100% of required positions filled

TABLE 8	Skills
1	No understanding of skill needs
2	Good understanding of skill needs
3	Mechanisms for skills development in place/ specific courses being developed
4	Less than 50% of staff/industry are at required levels
5	60% of staff/industry are at required levels
6	80% of staff are at required levels
7	All staff are at required levels

TABLE 9	Funding
1	No understanding of funding needs
2	Good understanding of funding needs
3	Less than 50% of required funding obtained
4	50% of required funding obtained
5	65% of required funding obtained
6	80% of required funding obtained
7	All required funding obtained

TABLE 10	Observers
1	Observer programme only addresses single species needs
2	Good data sheets designed to adequately capture all the relevant information (e.g. target and non-target species)
3	Training programme implemented to ensure that observers are adequately skilled in data collection
4	Observer coverage is adequate to ensure that data is representative
5	Data collected that is representative and useful to inform research and management
6	Reliable data management procedures in place to ensure that data is up to date and verified
7	Observer data is being routinely used and communicated to stakeholders

TABLE 11	Logbooks
1	Logbook design only captures target species information
2	Good data sheets designed to adequately capture all the relevant information (e.g. target and non-target species) for an EAF
3	Training programme implemented to ensure that skippers are adequately skilled in data collection
4	Data collected that is representative and useful to inform research and management
5	Functional system to get logbooks from vessels to MFMR in efficient and timely manner
6	Reliable data management procedures in place to ensure that data is up to date and verified
7	Logbook data is being routinely used and results are communicated to stakeholders

TABLE 12	Electronic data management
1	No electronic data management system in place
2	Intention to develop data management system
3	Current data management system only incorporates single species data or development is incomplete
4	Reliable and comprehensive data management procedures in place which incorporates all aspects of an EAF and clear terms of reference for database manager in place
5	Database is regularly updated OR Mechanisms are in place for verification (Score if either is true)
6	Database is regularly updated AND mechanisms are in place to ensure adequate independent verification
7	There is timely feedback of analysed data to stakeholders

TABLE 13	Human wellbeing - management
1	No strategy for action whatsoever
2	Some indication of intention to develop a strategy
3	Structures in place to ensure trans-disciplinary collaboration and stakeholder co-operation (e.g. trans-disciplinary working group or task group)
4	Activities towards implementation (e.g. identification of appropriate management actions) but no mechanism for evaluation in place
5	Mechanism for strategy evaluation in place
6	Ongoing evaluation of strategy is taking place and the strategy is adjusted accordingly
7	Strategy is amended and implemented successfully

TABLE 14	Human wellbeing - development plans
1	No understanding of the role this fishery plays in the local economy
2	Good understanding of the role this fishery plays in the local economy
3	Some indication to include this fishery as a component in Development Plans (national or local)
4	Activities towards inclusion (e.g. identification of appropriate policies and actions)
5	Inclusion of this fishery component but no integration with other sector components (e.g. tourism, agriculture)
6	Integration with other sector components (e.g. tourism, agriculture)
7	Fishery component into Development Plans (national or local) in proportion to its contribution to local economy

TABLE 15	Communication
1	No communication
2	The relevant agencies have been identified, but no communication
3	Ad hoc communication and information exchange takes place
4	Regular communication and information exchange takes place
5	Regular meetings and a record of decisions
6	Regular meetings, a record of decisions and actions are taken
7	Regular meetings, a record of decisions, actions are taken and MOU in place

TABLE 16	Economic wellbeing – management
1	No management actions implemented or strategy developed whatsoever
2	Some indication of intention to develop a strategy
3	Structures in place to ensure trans-disciplinary collaboration and stakeholder co-operation (e.g. trans-disciplinary working group or task group)
4	Activities towards implementation (e.g. identification of appropriate actions) but no mechanism for evaluation in place
5	Mechanism for strategy evaluation in place
6	Ongoing evaluation of strategy is taking place and the strategy is adjusted accordingly
7	Strategy is amended and implemented successfully

TABLE 17	Rights allocation process
1	No rights allocated
2	Short term rights allocated
3	Medium term rights allocated
4	Long-term rights allocated and/or no performance review criteria developed
5	Performance criteria developed but not implemented
6	Performance criteria implemented
7	Performance criteria are effective to achieve social and ecological goals

TABLE 18	Eco-labeling
1	Fishery is not eco-labeled
2	Pre-certified
3	Preparation for certification (addressing issues arising from pre-certification)
4	Applied for certification
5	Fishery is Eco-labeled/certified
6	Addressing conditions of certification
7	Meeting conditions of certification

TABLE 19	Market security
1	No strategy whatsoever
2	Some indication of intention to develop a strategy
3	Market research has been conducted
4	Strategy has been developed
5	Partial implementation of the marketing strategy
6	Strategy is being implemented and continuously evaluated and adjusted
7	Strategy has been successful over time

TABLE 20	Trans-disciplinary
1	No management strategy whatsoever
2	Some indication of intention to develop a strategy
3	Structures in place to ensure trans-disciplinary collaboration and stakeholder co-operation (e.g. trans-disciplinary working group or task group)
4	Activities towards implementation (e.g. identification of appropriate management actions) but no mechanism for evaluation in place
5	Mechanism for strategy evaluation in place
6	Ongoing evaluation of strategy is taking place and the strategy is adjusted accordingly
7	Strategy is amended and implemented successfully

TABLE 21	Working groups
1	No structures in place
2	Structures constituted but no meetings yet (e.g. sector specific association)
3	Group meets regularly and minutes are taken
4	Minutes are circulated and adopted
5	Minutes are circulated and adopted and follow-up actions taken
6	Group represents all sectors of the fishery
7	Group meets regularly, actions are followed up on and feedback is given on decisions with explanations

TABLE 22	Co-management
1	Not everyone invited to meetings
2	Identify all affected parties
3	Key stakeholders are identified and invited to attend meetings
4	All government sectors attend meetings regularly (resource management, compliance and research)
5	Key government sectors and industry attend meetings regularly
6	Key government sectors and industry and civil society attend meetings regularly
7	All of above attend meetings regularly and broader stakeholder communication occurs (e.g. road shows, public meetings etc)

TABLE 23	Employment equity
1	No policy in place
2	Policy developed but not implemented
3	Less than 50% of the employment equity goals are met
4	50% of the employment equity goals are met
5	65% of the employment equity goals are met
6	80% of the employment equity goals are met
7	All (100%) of the employment equity goals are met

TABLE 24	Management plans
1	No management plan
2	Management plan is in place but no ERA was undertaken
3	ERA has been undertaken to identify issues
4	Management plan has been developed and ERA issues are incorporated into the plan, but plan is not yet implemented
5	Management plan has been implemented but is not being evaluated
6	Mechanisms for monitoring and evaluation of management are in place
7	Management plan is being implemented, evaluated and remedial action is being taken according to the evaluation

TABLE 25	National Plan of Action (NPOAs)
1	No NPOA exists
2	There is some indication of intention to develop a NPOA
3	Fishery has contributed to the development of a draft NPOA or to the objectives of the NPOA
4	The NPOA has been adopted but not implemented
5	The NPOA has been partially implemented but is not legislated (e.g. through permit/license conditions in relevant fishery)
6	The NPOA has been implemented through regulations (e.g. Permit/license conditions)
7	The NPOA has been fully legislated and there is good compliance

TABLE 26	Penalties for non-compliance
1	No regulation of EAF considerations
2	50% of EAF considerations are appropriately regulated
3	75 % of EAF considerations are appropriately regulated
4	All EAF considerations are appropriately regulated
5	Appropriate regulation, but inadequate penalty
6	Adequate penalty, but no follow through
7	Penalties and adequate follow through provide a real incentive for compliance

TABLE 27	Incentives for compliance
1	No incentives identified
2	Incentives identified
3	Decision taken to implement incentives
4	Incentives implemented for 1 of the 3 dimensions (i.e. Ecological and Human Wellbeing, Governance)
5	Incentives implemented for 2 of the 3 dimensions (i.e. Ecological and Human Wellbeing, Governance)
6	Incentives implemented for all 3 dimensions (i.e. Ecological and Human Wellbeing, Governance)
7	Adequate incentives act to reward good compliance

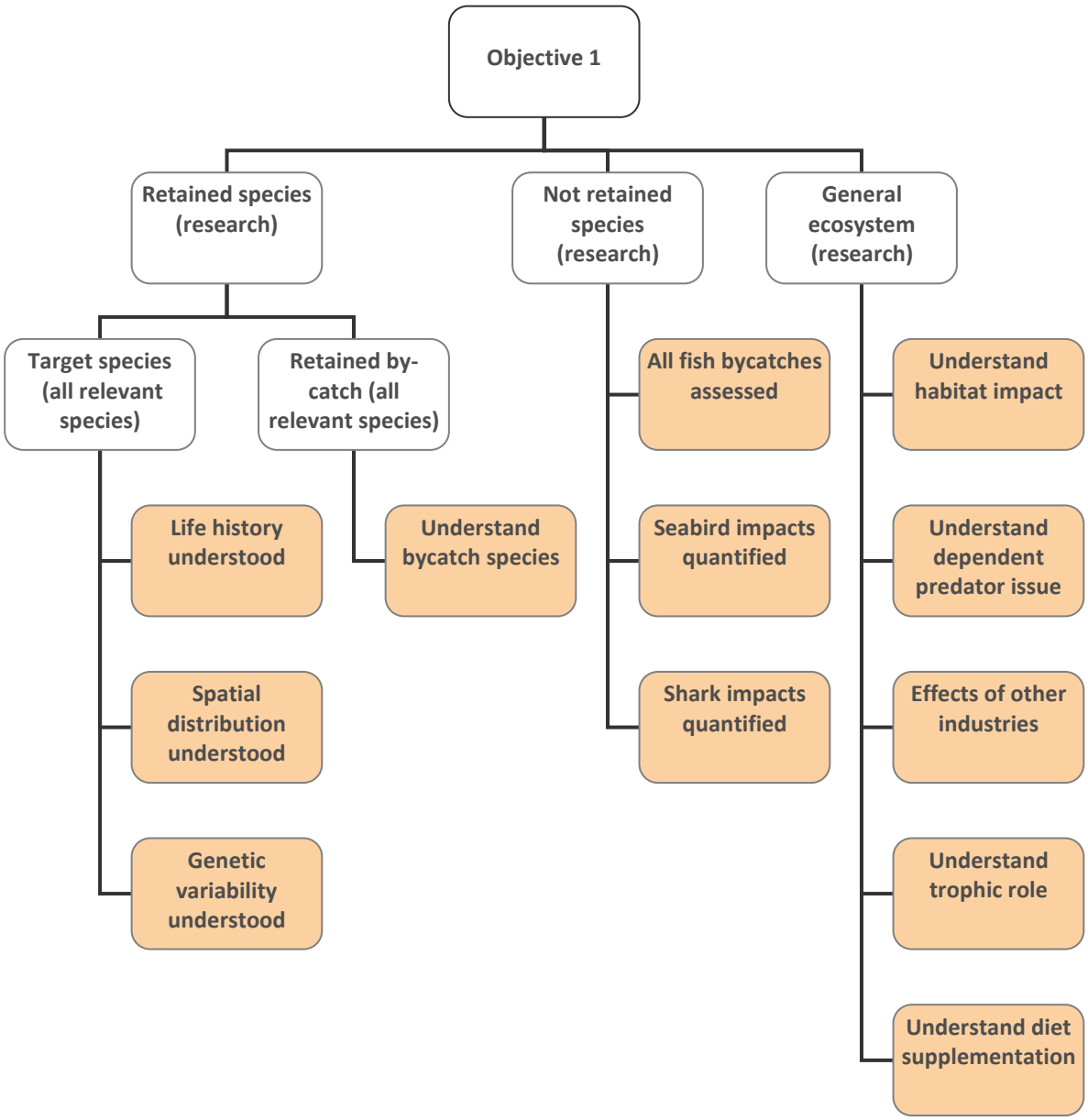
TABLE 28	MCS – general Tick one or more applicable statement(s)
1	No aspect is functioning
2	Regular at sea patrols are undertaken.
3	Adequate shore based controls are in place (e.g. in harbours, at landing sites etc.)
4	The special investigation unit functions well
5	Functional VMS system implemented
6	Court system adequately apprehends offenders
7	Regular aerial patrols are undertaken

TABLE 29	Trans-boundary stocks
1	No understanding of trans-boundary stocks
2	Good understanding of shared stocks
3	There is knowledge of a shared stock and intention to share information
4	Information is shared between countries
5	Some harmonisation of management between neighbouring countries
6	Management of shared stock is harmonised between the countries
7	Regional co-operation is operational and has been institutionalized (e.g. BCC)

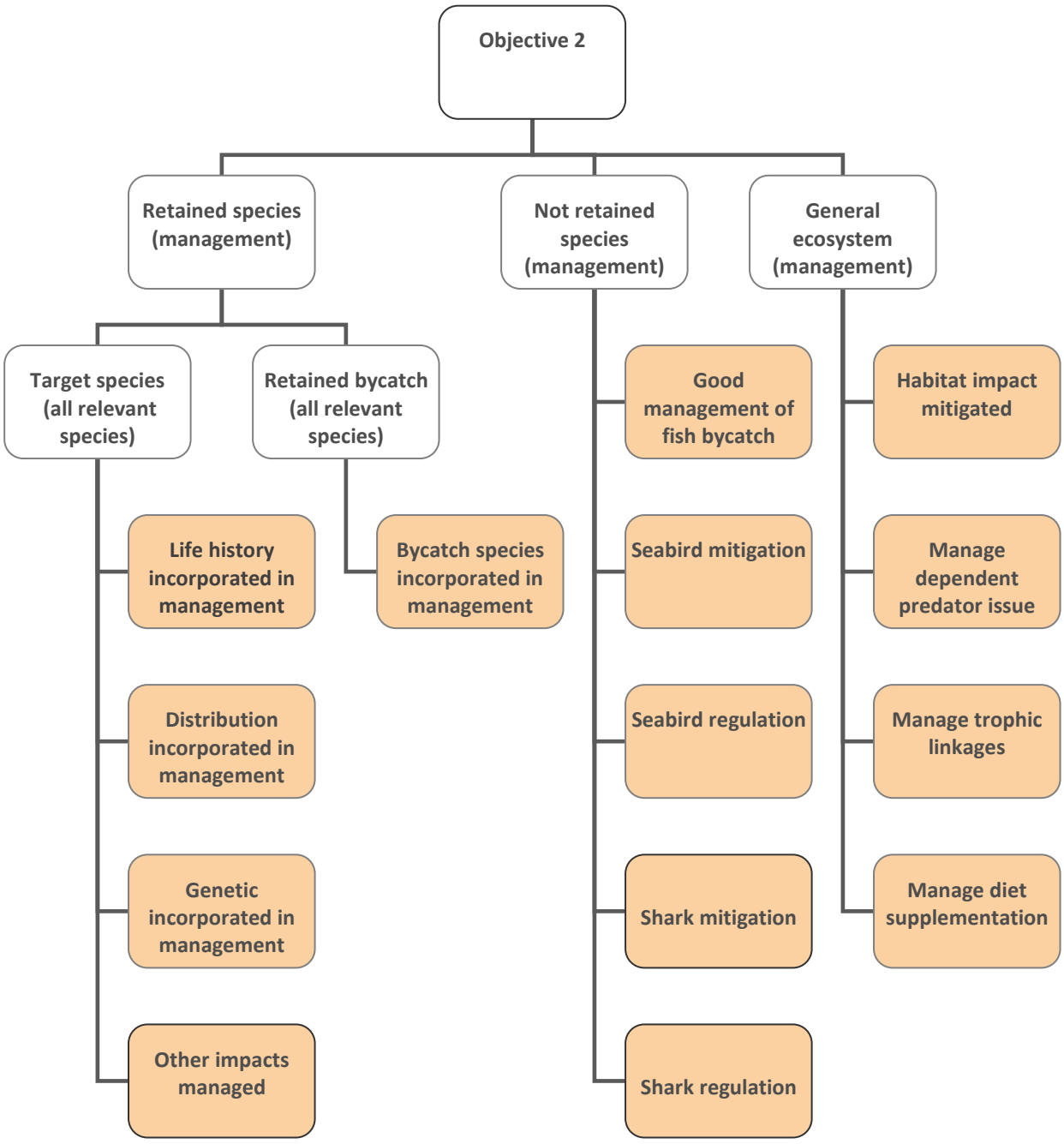
TABLE 30	RFMOs
1	No involvement in the above mentioned RFMO
2	Involved in the above mentioned RFMO at observer level i.e. does not yet hold cooperating non member status
3	Cooperating non-member but not participating
4	Cooperating non-member and participating
5	Member, but not participating
6	Participating member
7	Participating member and developing recommendations/ resolutions

APPENDIX 2c
Generic component trees used in the identification of EAF issues in a structured way

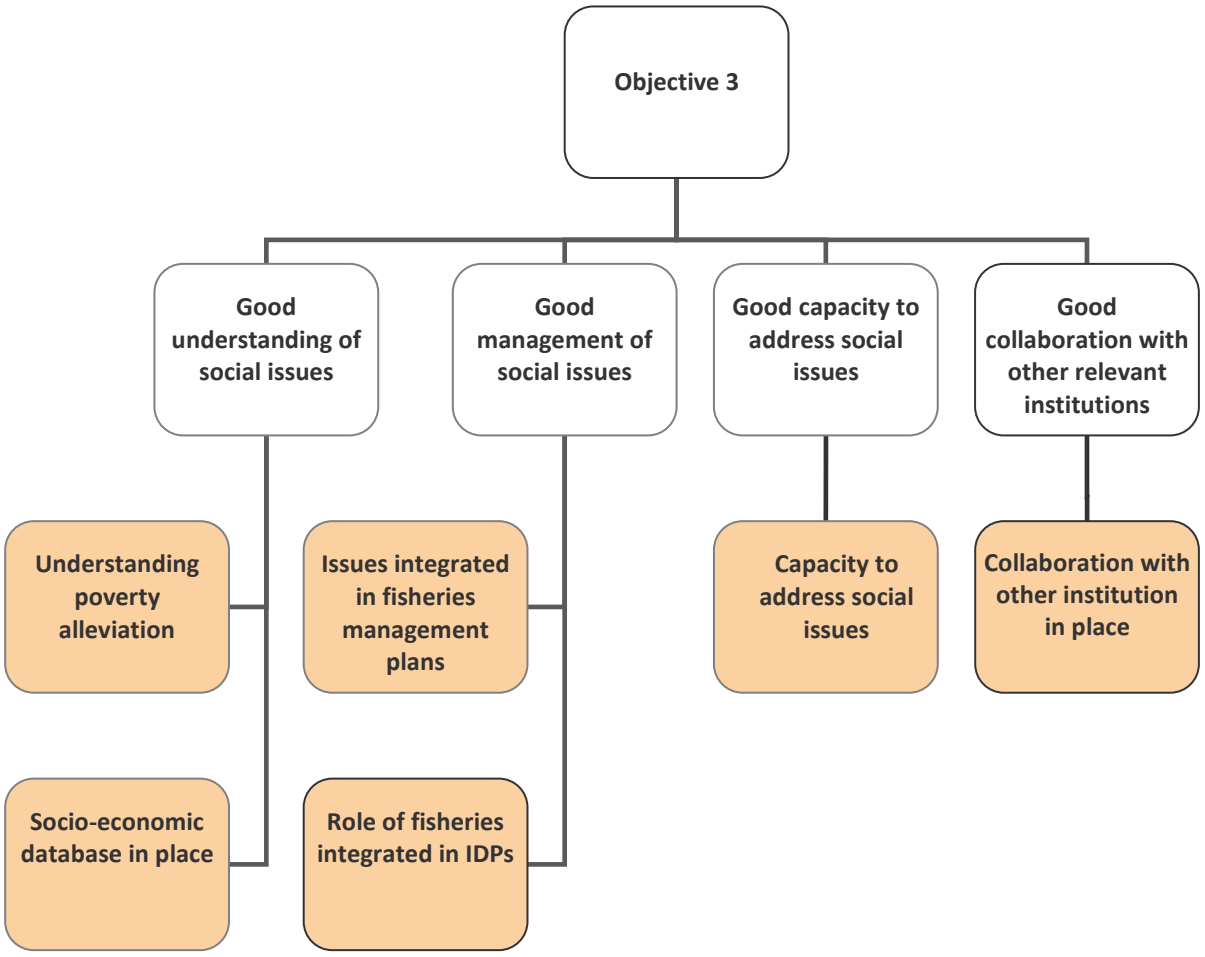
Objective 1: The managing authority has a good understanding of the ecosystem impacts of fisheries including target, non-target and general ecosystem impacts.



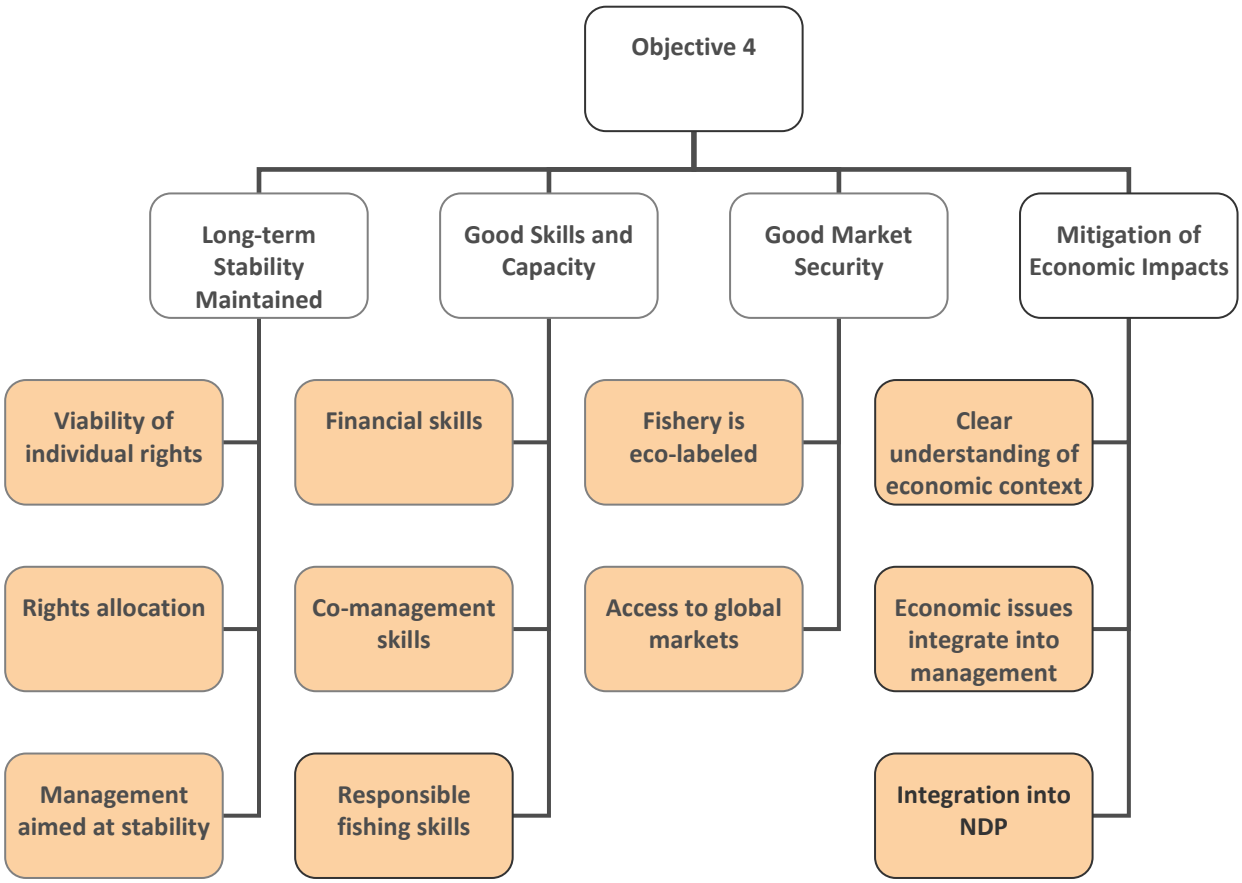
Objective 2: Ecosystem impacts of fisheries are included into management advice.



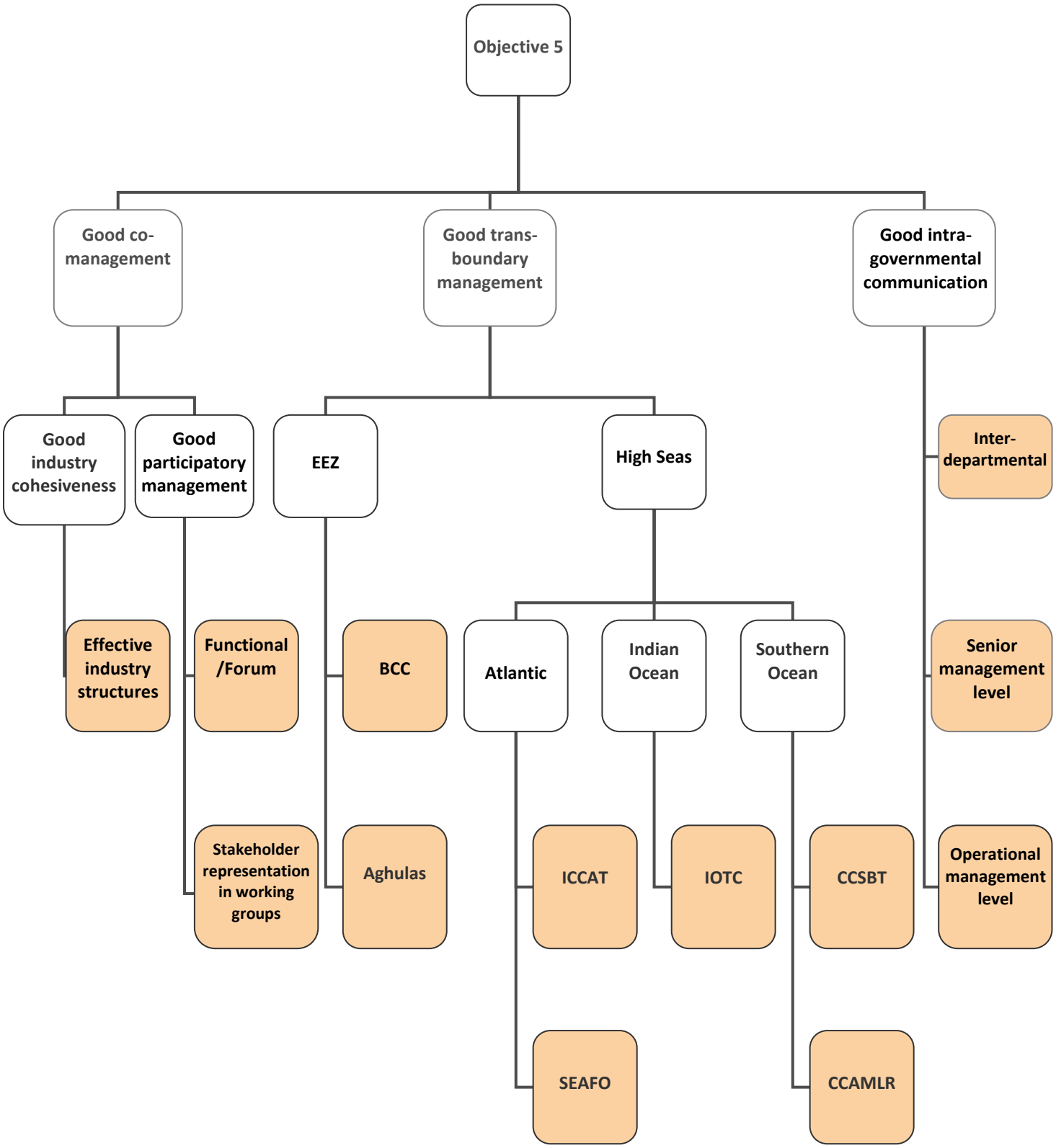
Objective 3: The social wellbeing of dependent fishing communities is accounted in management advice.



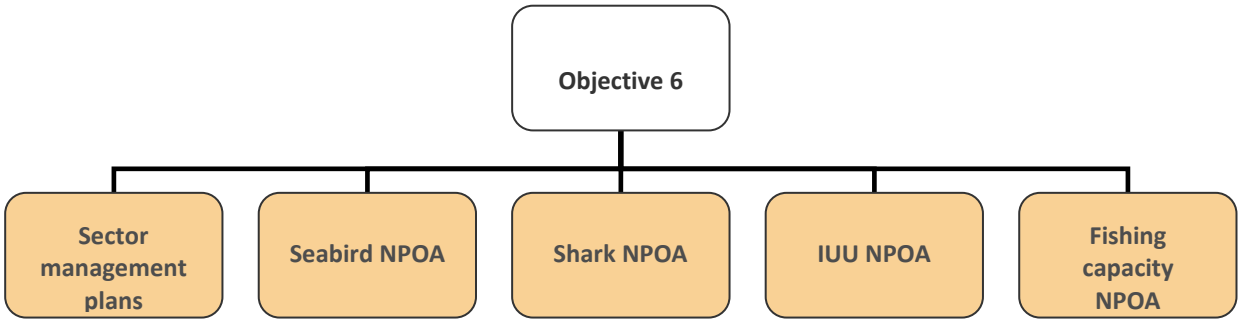
Objective 4: The economic wellbeing of the fishing industry is maintained



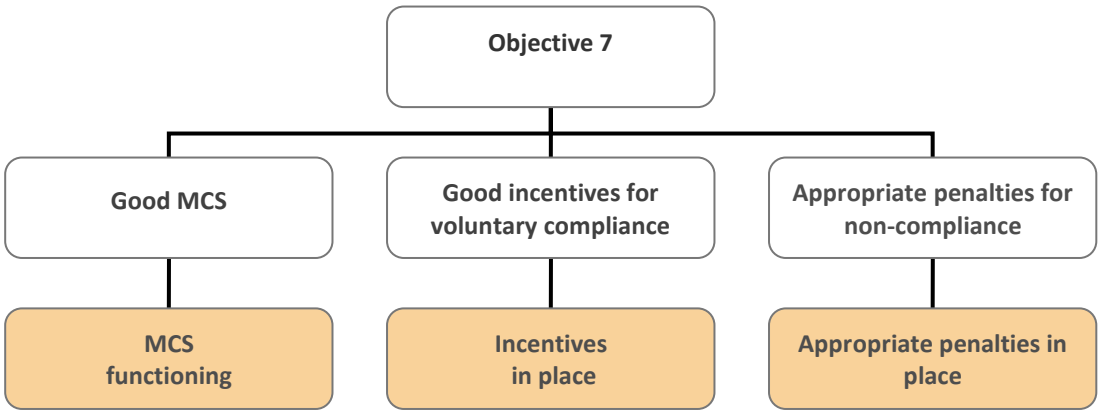
Objective 5: Transparent and participatory management structures ensure good communication and information sharing locally and regionally



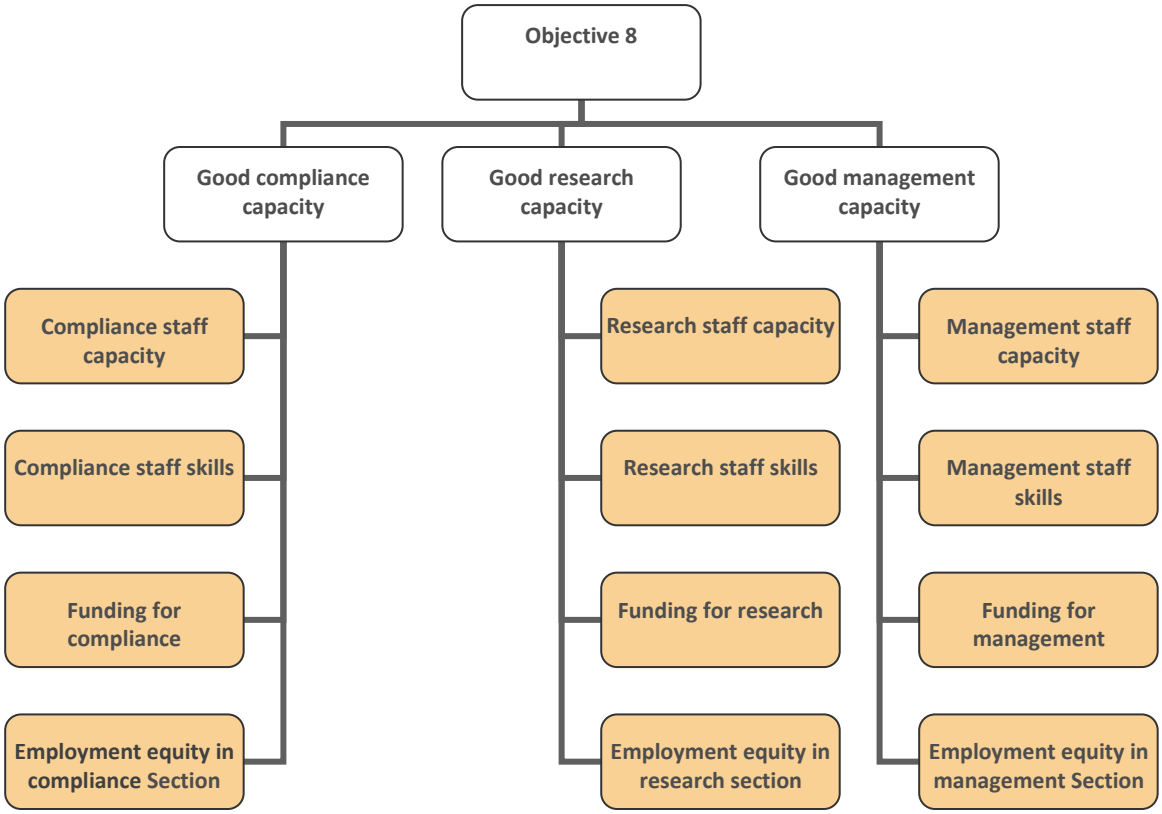
Objective 6: Management plans incorporate EAF considerations.



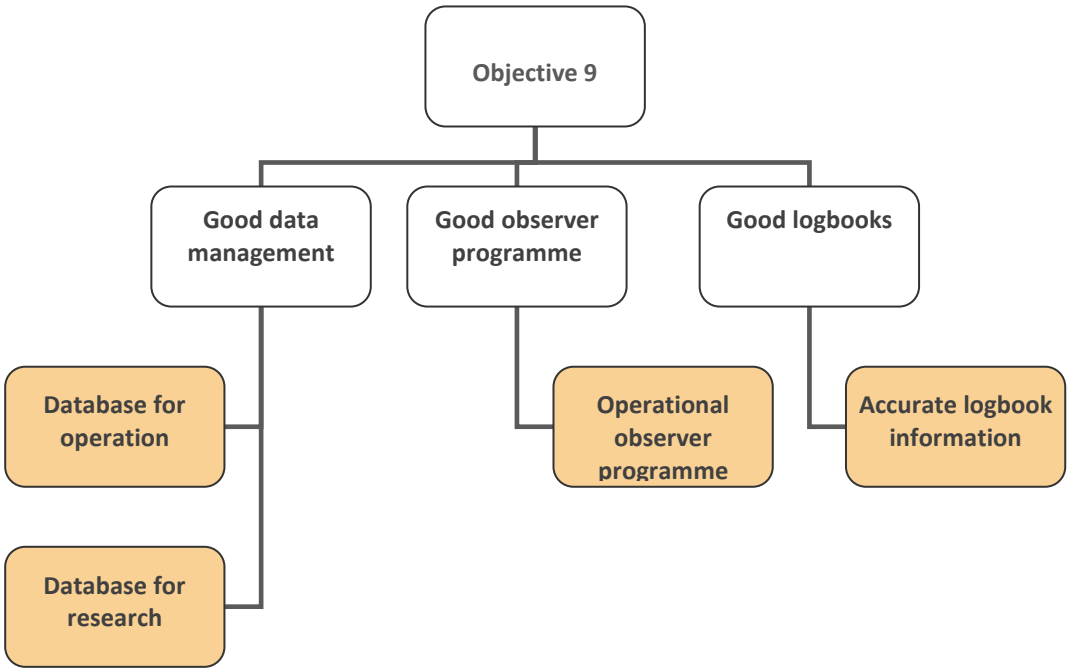
Objective 7: Good compliance to regulations reduces ecosystem impacts of fisheries.



Objective 8: Sufficient capacity, skills, equipment and funding exist to support the implementation of an EAF.



Objective 9: Good data procedures exist to support EAF implementation



Objective 10: External impacts of fisheries are addresses (e.g. the effect of other sectors, other industries, climate change etc).