Human Wellbeing and the Ecosystem Approach to Fisheries: "Deriving Benefits and valuing ecosystems"

Overview of Objective Frameworks, Potential Indicators, Reference Points and Performance Measures

Kate Brooks *

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*** Kate Brooks, PhD**

B.A., Dip.Mktg., M.Litt (Soc)

KAL Analysis Pty Ltd &

Adjunct Senior Fellow

Research School of Social Sciences,

Australian National University

Canberra 0100 ACT, AUSTRALIA

Tel: 61-3-9917 2665

E-Mail: kate@kalanalysis.com.au

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1.0 Introduction

As outlined in the FAO's technical papers (De Young et al. 2008; Garcia et al. 2003) and Haward's paper (this volume), the relevance of an ecosystems approach to fisheries management has emerged most clearly over the last five decades. This has come about due to the increasing awareness that managing fish stocks alone will not address increasing concerns about both the sustainability of fish stocks and the need to manage fishing activities for the economic and lifestyle benefits to humans, given our dependencies upon aquatic environments. A large number of approaches to ecosystem-based fisheries management have evolved over recent years, which Christie et. al (2007) reviewed and synthesised, identifying that there is little agreement as to the terms used or the ecosystem information utilised, to inform management frameworks. However they do commonly identify the need to broaden the focus on evaluation beyond a single species of fish stocks. Importantly, within the number of approaches identified by Christie et. al (Ibid), Ecosystem Based Fisheries Management (EBFM) was identified and is the most likely precursor to the FAO's chosen Ecosystem Approach to Fisheries – EAF(Gable 2004) - in that EBFM focuses on the need to control and account for the effect of fishing activities and other human activities. The EAF developed this concept further, with a focus on "balancing society economic needs with ecological function" (Christie et al. 2007,p.240). It broadens the EBFM concept by increasing the scope of considered effects of fishing activities to include the dimensions of human well being as well as ecological, in the context of the control fisheries management can exert. As noted earlier by Haward (this volume), the appeal of the EAF has not, to date, generated extensive tools or examples of applied methodologies for the evaluation of this added dimension of human wellbeing in the assessment of fisheries management.

This chapter will elaborate upon the work generated previously by the aforementioned FAO technical papers (most particularly (Garcia et al. 2003)) in providing an overview of the work most recently done in the areas of identifying and assessing social objectives and human wellbeing indicators for fisheries management. It utilises the approach specified by the FAO (2009b), of the hierarchical tree framework (developed by (Fletcher et al. 2002) for framing EAF issues to be considered in management. The identification of components for the tree in the context of Human Wellbeing is also based upon the EAF principles of applying the precautionary approach; ensuring compatibility of management measures across jurisdictions; broad stakeholder participation; and promotes integration between

sectors (Bianchi 2006; 2008). The components proposed identify key objectives that consider the possible multijurisdictional nature of the ecosystems, and the divergent stages of institutional, economic and therefore social development, covered by FAO member nations. As noted earlier, the hierarchical approach has been adopted as it links indicators to operational objectives, which flow from components comprising higher level conceptual objectives. Indicators in the hierarchy are framed around potentially available performance measures, to which reference points can be applied. The result is a hierarchical structure with embedded indicators that provides a sound platform for performance assessments.

Utilising the work that has been undertaken in the area of assessing social objectives and the human wellbeing dimension of fisheries management, this paper indentifies and proposes indicators and performance criteria to assess the higher level conceptual objectives of EAF. Examples of how these indicators could be, or have been, applied is provided. However, while useful, these examples are indicative only and must be reviewed in the context of the generic nature of this chapter, and the specific circumstances of a location that they may be applied to. The key objective here, is to provide a framework and tools for this specific method of implementing and assessing the human wellbeing dimensions of EAF.

2.0 Human Wellbeing: Key Principles

'Human Wellbeing' is broadly defined in the FAO's technical paper as "a condition in which all members of society are able to determine and meet their needs and have a large range of choices to meet their potential" (Garcia et al. 2003,p.22). However this is, as stated, very broad, and is further elaborated on in a subsequent FAO document which discusses the human dimensions of EAF (FAO 2009a), in the context of this definition being the key driver for an EAF.

The principal underpinning the inclusion of Human Wellbeing in EAF is that ecosystem health is fundamental for human health and wellbeing. Despite variability, uncertainty and changes in the ecosystem, it is essential to maintain the capacity of aquatic resources to produce food and employment, fundamental to human health. This flows from the FAO's Code of Conduct which also requires that policies and actions consider social impacts of fishing (FAO 1995). The sensibility in considering the social impacts of how fishing activities are conducted, arises from the value of and benefits derived from marine ecosystems, that individuals and society either explicitly (as users), or implicitly (existence) place upon those systems. Unless those values are understood and communicated, it becomes difficult to manage an ecosystem clearly and transparently to stakeholders in ways that are understood, in the context of those values. In addition, the maintenance of ecosystems cannot occur in this age without the cooperation of people; and unless the ecosystems concerned contribute to the wellbeing of people, through the provision of goods and livelihood services, people are unlikely to be concerned, engaged or supportive (Garcia et al. 2003,p.22). Consequently managing human wellbeing, which is inherently underpinned by the value of the resource to humans, is fundamental to undertaking the EAF process (De Young et al. 2008,p.12-13).

The World Health Organisation and the UNHCR, also note the base principal of relating the management of our environment to human wellbeing if from a slightly different, but no less relevant, perspective. These organisations note that if decision-makers remain unaware of the links between the environment and human well-being, the environment may be marginalised by inappropriate decisions (Corvalan et al. 2005; UNHCR 2000,p.ii). The FAO's documents relating to EAF (De Young et al. 2008; FAO 2009b; FAO Fisheries Department 2003; Garcia et al. 2003), discuss at length, the reality that ecosystem management takes place in a societal context of goals and aspirations for communities and

individuals, and is framed by social structures, cultural values, and economic principles that shape and ultimately determine individual behaviour and responses. This work agrees with the premise that sustainability in fisheries relies on a number of principles, including that decision-making integrates economic, environmental, and social considerations in order to meet human needs and aspiration, to improve and enhance the total quality of human life now and into the future (Potts et al. 2001,p.10-11).

While there are a number of factors that can be considered in the scope of Human Wellbeing, four key areas of interaction with fisheries ecosystem management specifically require the consideration of human well being. These are:

1. Social, economic and institutional objectives and factors that drive decisions to undertake an EAF;

2. Applying EAF has social, economic and institutional costs and benefits, that affect both individuals and the societies in which they reside;

3. To implement EAF, social, economic and institutional instruments must be implemented, and therefore comprehensively understood; and

4. These social, institutional and economic factors play crucial roles in either supporting, constraining or undermining the successful implementation of EAF(De Young et al. 2008,p.ix).

As cited previously, the FAO Technical Guidelines on the Human Dimension of the Ecosystem Approach to Fisheries focuses on the "social, economic and institutional aspects" of the approach to the requirement to consider the potential poverty context of developing countries (FAO 2009a,p.60). This is where the necessity to focus upon the Human Wellbeing dimension of EAF presents as essential; as a basis from which to address any paucity in human capital capacity, and the effects of poverty and unstable food security, on the ability to engage with effective EAF policies.

It is these factors, and the principal of ensuring basic human wellbeing to both sustain life and ensure the ability to care for our marine ecosystems, that drives the development of higher level conceptual Human Wellbeing objectives of EAF. 'Deriving benefits and

valuing ecosystems' are the key principals that frame the EAF approach to assessing the human wellbeing dimensions of fisheries management, which include the elaboration of:

- Ability to engage (communication);
- Levels of participation (industry and community); and
- Identifying and understanding the social impacts of fisheries activities on civil society.

As with the Governance aspects of EAF, the principles underpinning Human Wellbeing are also embedded in not only a number of FAO initiatives, including the Code of Conduct for Responsible Fisheries,[1] but also several FAO Technical Guidelines (FAO 1999: 2003 and 2009). The FAO's technical guidelines identifies specifically that the "requirement to satisfy human well-being (compatible with ecosystem requirements) is central to the concept of sustainable development, and ...recognizes that uses can be sustainable only if they are of value to human beings and contribute to their well-being" (2003,p.85-86). This is the base principal that dictates the development of objectives, indicators, reference points and performance measures, discussed in the following sections of this chapter.

[1] The Code of Conduct is a voluntary instrument that provides high-level guidance for contemporary fisheries management. It refers to capacity to engage, engagement and consultation and understanding the social effect of fisheries management decisions in a number of parts, including Articles 7.1; 7.2; 7.4 specifically, however reference to these principles are scattered throughout the code. FAO (1995). FAO. Code of Conduct for Responsible Fisheries. ROME, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS**:** 41.

3.0 Approaches to the development of Human Wellbeing assessment frameworks.

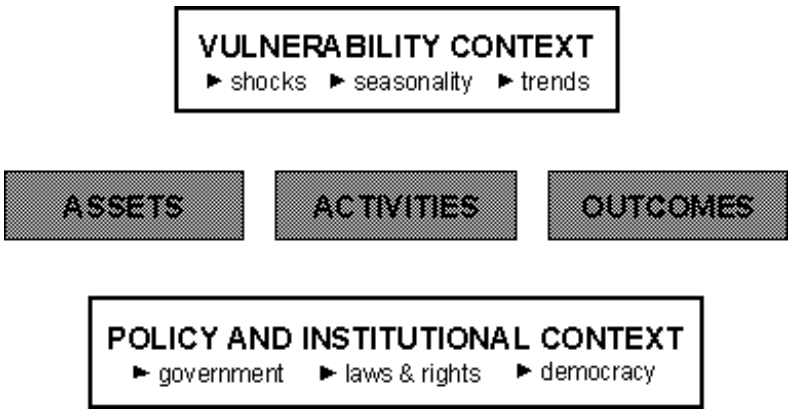
As outlined by Haward (this volume) the FAO's purpose in seeking to have indicators, reference points and performance measures identified for the evaluation of management approaches, is to be able to assess the achievement of fisheries management objectives (FAO (2003). There are, however, many frameworks or structures which provide focus and direction for the selection of objectives and associated indicators to measure the achievement of objectives. The primary focus in the development of the EAF Management framework was to holistically assess ecosystems and the use of them, to allow consideration of a broader range of ecosystem goods and services. That assessment may be qualitative in nature given that some ecosystem goods and services (such as human wellbeing) do not lend themselves to traditional quantitative assessment techniques previously developed for fisheries and ecosystem assessments of the past.

The FAO has previously investigated a number of approaches to assessing an ecosystems approach to fisheries management (De Young et al. 2008), including a 'Livelihoods approach' and 'Integrated Management' as these incorporated hitherto largely unconsidered qualitative or multiple elements. Christie et.al. (2007) also undertook a review of the different approaches to fisheries management, under the categories of both fisheries centric and marine ecosystem approaches. All of these approaches are evident in an EAF management, and to varying degrees incorporate human wellbeing objectives. However where human wellbeing elements are included, few provide detail of how these could, or should, be incorporated and accounted for. The following will briefly summarise this previous work from the perspective of what each approach offers in terms of human wellbeing objectives of fisheries management, with the resolution that the ESD approach developed in Australia (Fletcher et al. 2002; Potts et al. 2001) offers the most useful framework for the further development of the human wellbeing aspect of EAF, in the context of FAO's applications.

As noted earlier, the FAO's technical paper (De Young et al. 2008) examined two multi-sectoral approaches to assessing management frameworks – the 'livelihoods' approach and the 'integrated management' approach (Ibid,p.7). The livelihoods approach, initially developed by Allison and Ellis (Allison et al. 2001; 2003a; Ellis 2003b), endeavoured to increase policymakers understanding of low income country fishers' adaptive capacity,

specifically focusing on the seasonal and/or cyclical variability of strategies utilised in procuring livelihoods. The objective is to take a perspective that encompasses more than the resource alone, by looking at how resource users engage with the resource in the context of their overall lifestyles, and how institutional process affects that interaction. One of the key aspects is its recognition that local people often have answers to local problems. The following diagram is that used to represent the process and considerations involved in the (sustainable) Livelihoods Approach.

Figure 1: Livelihoods Approach



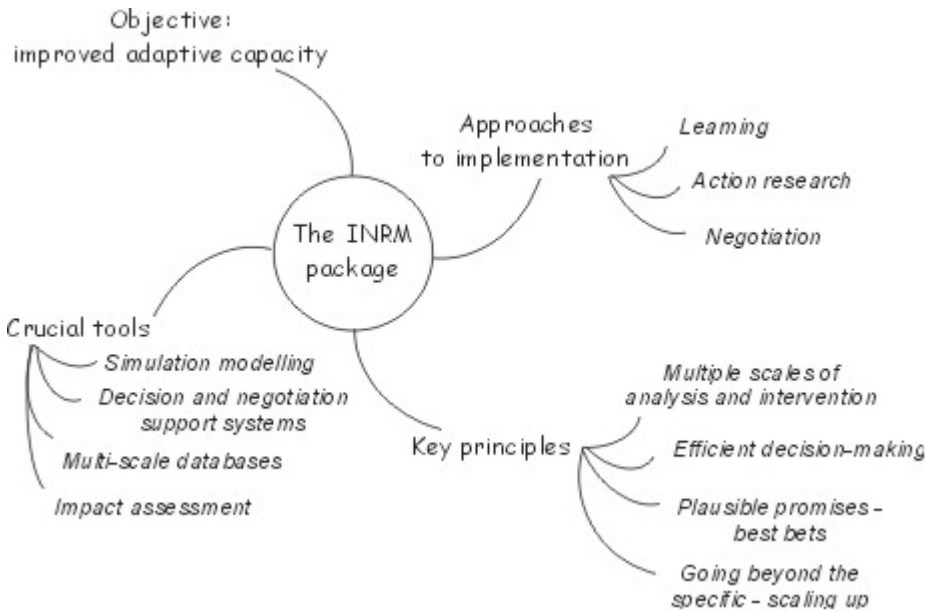
Source: Ellis (2003b) developed from (Allison et al. 2001; Ellis 2000; Scoones 1998)

This approach has been deemed to have weaknesses in the areas of; too great a focus on individual's poverty without a balanced perspective on resource sustainability; a lack of identification of tools to implement the concept to produce useful outcomes; and debateable objectivity and equity in relation to allocation issues (Carney 1999). Further to this was the matter of how to include the role of informal institutions in this assessment approach (Hussein 2002). Despite these, the FAO identified benefits in the approach to EAF in the notion of considering the broader context in which a fisher operates and which therefore may impact fishing behaviour (De Young et al. 2008,p.8)

The 'Integrated Management'(IM) approach is another similar framework for managing natural resources, in that it considers management of the resource from several perspectives, recognising that innovation has several sources and is affected by multiple actors (Douthwaite et al. 2004). Contrary to the Livelihoods approach, the Integrated Management approach considers resource use from the perspective of the multiple

(competing) uses, and the resultant pressures that may be placed on a particular resource (Duda 2003).

Figure 2: Key Features of Integrated (Natural Resource) Managment



Source: (Sayer et al. 2001)

One of the central aims of Integrated Management is to promote co-ordination as a means to achieving sustainable and holistic resource management, through a focus on management and institutional structures and boundaries (Medema et al. 2008). The key benefit of this approach is that it embeds the concept of an institutional framework to allow the management of multiple uses of a resource, simultaneously. While it has this benefit, the downside is that the integration process, although taking account of stakeholder relationships and behaviours, requires interconnectedness on so many different levels that it becomes very complex to translate into specific management actions or policies; or mediate the divergent interests of stakeholders (Campbell et al. 2001; Medema et al. 2008). It could be posited that the ESD/EAF approach incorporates elements of and 'scales up' the IM approach to look at the broader ecosystem status, incorporating multiple layers of analysis, but simultaneously restricts the boundaries considered (that is, to a single ecosystem and/or fishery) increasing the manageability of the analysis.

Elements of both the Integrated Management and the Livelihoods approaches are variously used in a number of fisheries and marine management approaches or systems that have been developed over time. To date, however, management systems have been developed primarily as either fisheries or marine ecosystem centric. The distinction of EAF is that it

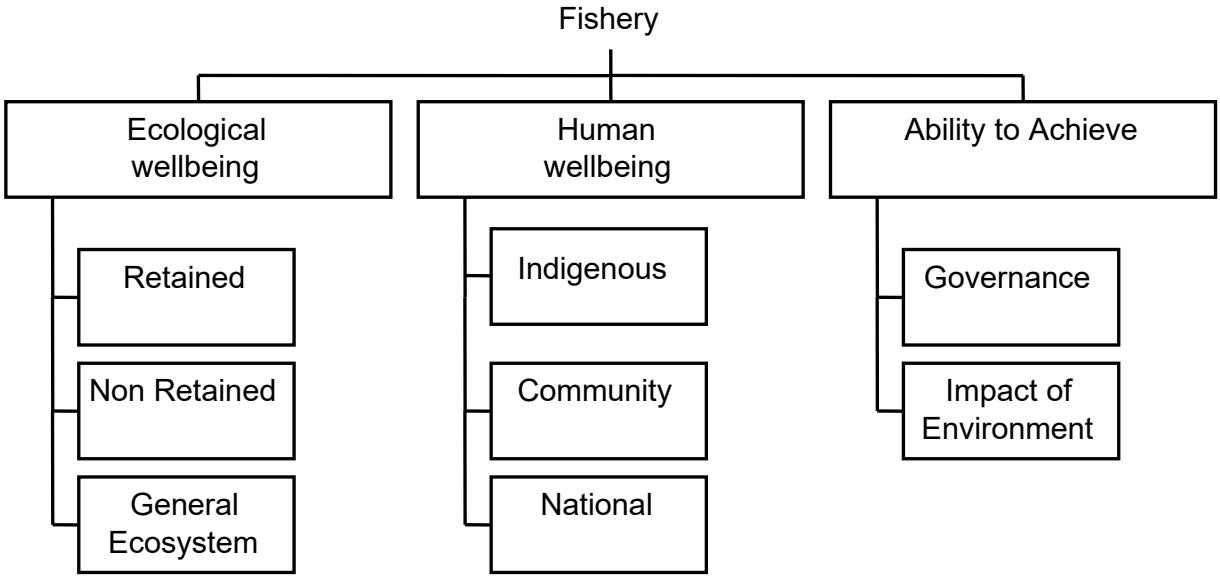
endeavours to integrate all four of these approaches. As discussed by Christie et.al. (2007) some approaches in fisheries are management focused (such as Ecosystems Considerations (EC) and Ecosystem-Based Fishery Management (EBFM)) while others are multi sectoral (such as Integrated Oceans Management (IOM), Ecosystem Based Management (EBM) or Large Marine ecosystem management (LME)) all of which to wrestle to differing degrees with the integration of human wellbeing factors, and are accordingly considered variously in terms of the usefulness as viable approaches to an holistic assessment of fisheries ecosystems.

From a human wellbeing perspective, Ecosystems Approach to Fisheries (EAF) integrates aspects of both the livelihoods and integrated management systems approaches, and also takes elements from the fisheries and marine centric approaches. It seeks to have the ability to focus on a fishery, within the holistic context of its ecosystem, but in a constrained interpretation of the boundaries being considered. The boundaries are determined by the control that can be exerted by fisheries management agencies, thus avoiding the overly complex results of pure Integrated Management systems. However, a focus is maintained on the social and economic contexts that facilitate positive human wellbeing, and hence the ability of users of the system to engage with sustainability requirements of the ecosystem. This engagement with the ecosystem at multiple levels is where the Ecologically Sustainable Development (ESD) Framework for marine fisheries management, developed in Australia (Fletcher et al. 2002) presents the optimal blend of the best of the previous approaches, while maintaining a focus on the integral social and economic influences on ecosystem health, that can also deliver the tangible outputs for management that is required (Douthwaite et al. 2004). It also lends itself to utilising the analytical framework (De Young et al. 2008) where a choice of indicators can be related to the analysis of interactions between causes, effects and actions (Ibid,p.62).

As has been discussed by Haward (this volume), the 'component tree' approach developed in Australia to monitor management of Ecologically Sustainable Development (ESD) provides a useful and manageable approach to any assessment of EAF management performance (Fletcher et al. 2002; Potts et al. 2001). The ESD Component Tree organises the issues and objectives of fisheries management hierarchically, in a manner consistent with achieving sustainable development, which makes this synergistic with the EAF management and an analytical approach to issue and performance analysis. Further to this the Framework explicitly deals with community social and economic wellbeing in the under the higher level component of Human Wellbeing, with the sub components of

indigenous, community and national. The following (Figure 3) is the higher order component tree that can equally be applied to EAF management.

Figure 3: ESD The Hierarchical Tree Framework for the identification of EAF issues



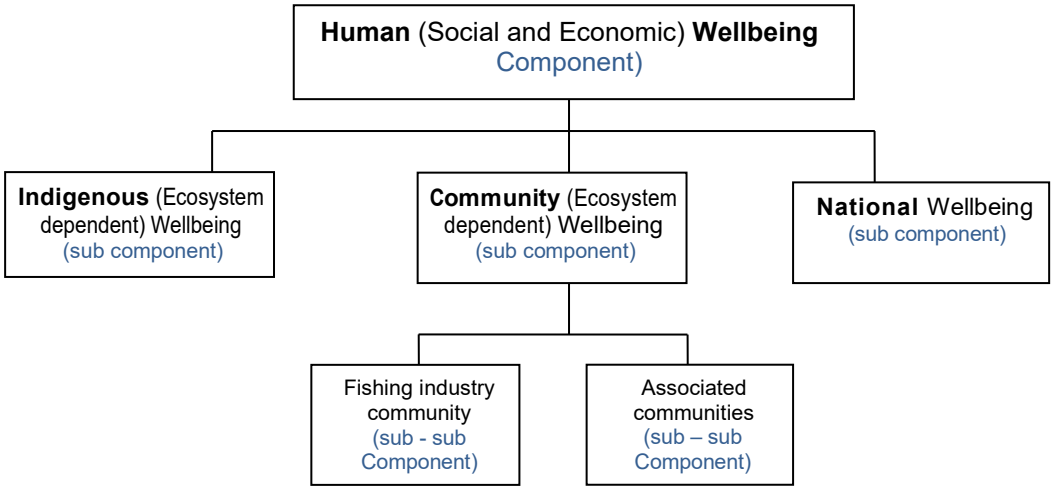
Source: (p.531; Fletcher et al. 2002,p.31)

The above demonstrates that this ESD approach to assessing EAF will allow the integration of both fisheries management and marine ecosystem approaches, and the inclusion of communities (direct and indirect) ensuring synergy in objectives and through simultaneous assessment. The summary of the general key features of this hierarchical approach as presented by Sainsbury (2009) was detailed by Haward (this volume), and reinforced the benefits outlined by Fletcher et al (2002,p.32). These included the consistent assessments of multiple fisheries; determination of issue relevancy to a fishery; a structure to deal with multiple issues within clear boundaries; and finally, the visual layout of the approach assists communication of issues and indicators to assess the status of them (refer Haward, this volume, p XX).

The ESD component tree structure (Fletcher et al. 2002) allows the development of explicit objectives relating to the higher order component of Human Wellbeing. Through identifying sub-sub components of the specific fishing community ('Fishing Industry), and those in fishing dependent communities ('Associated Communities) under the sub component of 'community', greater clarity can be created around the boundaries of analysis for both objectives and indicators. The ESD approach provides a framework for

assessing Human Wellbeing in EAF through the adaption of the 'Community Wellbeing Component Tree' (Ibid, p. 31), as in the following figure (Fig 4.)

Figure 4: ESD The Hierarchical Tree Framework for the identification of EAF issues



Source: Modified from Fletcher et al., (2002)

Where required and/or appropriate, it is possible to insert additional sub components, and sub (sub) components, to be followed by operational objectives and indicators to suit the specific circumstance or ecosystem (see section 5). In order to gain consistency across all fisheries, or in this case ecosystems, it is recommended that the same components; sub components, operational objectives and indicators be agreed and utilised.

This ESD based approach provides a meaningful way to assess EAF in the context of both the broader ecosystem environment in which the fishery operates (satisfying the requirements of Integrated Fisheries Management) and is also able to be broken down to examine the effect on livelihoods beyond the specific fisher and associated community members that will be impacted by fisheries management decisions (satisfying the objectives of the Livelihoods approach).

As extensively discussed in Haward (this volume) and Sainsbury (2009) objectives and indicators are clearly defined by the expression of what is to be attained with reference points or benchmarks to assist interpretation of data provided by indicators. Indicators that are selected to inform the achievement of objectives must be both standardised across fisheries and regions, as far as possible, and be repeatable. There are a range of objectives and more commonly indicators that have variously been used to assess the social component of fisheries and ecosystem management. The relevance of these to the EAF

Nansen project will be defined by the applicability of them to developing countries; cross jurisdictional boundary issues and data availability.

While the Tree Framework above includes the subcomponent of 'Indigenous', to date the indicators published relating to indigenous welfare, utilising quantitative statistical data reported at a national scale only. This data are more difficult to relate to ecosystem management or, in the ESD Tree, (to avoid duplication) separate from the other two sub components of 'fishing industry' and 'associated fishing dependent' communities'. The indicators that have been most commonly cited for assessment of indigenous welfare (FAO (Stamatopoulou et al. 2006), The World Bank (The World Bank), Australia (Taylor 2008) and Canada (Department of Human Resources and Skills Development Canada 2011)) are noted to suffer, as "Indigenous peoples' own perceptions and understandings of wellbeing are seen to extend beyond and sometimes conflict with conventional reporting frameworks with the latter constructed more around processes of governmentality than Indigenous priorities" (Taylor 2008,p.111). While the following review will include some of the indicators identified by these various sources for a sub component of 'indigenous', the treatment of indigenous objectives and indicators in this work is very cursory. Many of these indicators are of levels of disadvantage (The World Bank), and there may be levels of inappropriateness to apply these to the domain of indigenous wellbeing in the fisheries eco system context. Overall, the lack of in-depth analysis of indigenous objectives and indicators here, is in recognition of the great depth of work that still has to occur in order to identify those for fisheries ecosystems that are both seen to, and have, validity. Consequently, while there is a brief and superficial inclusion of the high profile indicators commonly cited, in literature review these have not been included in Section Five, which details recommended Components, Operational Objectives and Indicators.

The following section g(four) is a literature review of the range of (largely) indicators that have been used to assess fisheries management performance, most commonly without any reference to a particular objective (operational or otherwise). This is a feature currently acknowledged as previously lacking in fisheries ecosystem management, and consequently attempts are currently being made to address this in many forums. As a result, although the following in the main reviews indicators and it relates these to the types of objectives they may be used to measure (as real life examples are few). They are also reviewed in the context of the issues that may be encountered by the range of countries potentially employing EAF. Overall, the review endeavours to capture the broadest cross section of previously identified objectives and indicators.

4.0 Literature Review of Human Wellbeing Objectives and Indicators

To date there has been a range of work undertaken around the globe on identifying indicators of fisheries management performance. However in many cases the key that has been lacking in any attempt to assess the social or economic human wellbeing element, which directly affects the ability to measure performance of a system, is the identification of objectives: the majority of work has revolved around the development of indicators. The following provides a literature review of the human (social and economic) wellbeing dimension of ecosystem and fisheries management, focusing specifically on the development of objectives and associated possible indicators, in relation to the proposed EAF/ESD framework. Generally the review is of marine systems management, however on occasions examples of other ecosystem management elements are referred to where applicable and useful. The focus is on those objectives and indicators that have been employed elsewhere and are useful to the implementation of EAF management, within the context of the ESD Component Tree Framework.

The following literature review will focus on the three components of Industry and National communities, being; Ecosystems dependent Fishing industry and associated Communities and National Community, which underpin the overriding conceptual EAF objective of achieving community Human Wellbeing. The following will focus on sub-sub components that have been identified in the literature for both marine capture and aquaculture fisheries, and any identified operational objectives and indicators that could be associated with these. The review discusses objectives and indicators, organised under headings in the following manner:

4.1 Sub-Component (Ecosystem dependent fishing industry communities)

4.1.1. sub-sub component

4.2 Sub Component (Associated ecosystem dependent communities)

4.2.1 sub-sub component

4.3 Sub Component (National Community)

4.3.1 sub-sub component

4.4 Sub Component (Indigenous Community)

4.4.1 Sub-sub component

4.5 Summary

The specific difficulty with many of the indicators previously researched and tested, is that this current review covers proposed assessments that may be carried out on an ecosystem basis and ecosystems don't always align with jurisdictional and data collection boundaries. Further to this, a number of the countries envisaged to be covered by FAO's EAF management are at varying stages of development and therefore different levels of management and data collection and collation capacity. As a result, while the following provides an overview of the current state of components, objectives and indicators that have been researched or documented, not all of these will be relevant to the FAO EAF-Nansen project for the preceding reasons. In the case of sub-sub component (noted by a heading) a recommendation is given as to which of any objectives and indicators identified might be recommended for use in an EAF context.

4.1 Ecosystem dependent Fishing Industry Communities

The majority of literature in the area of assessing specific industry communities has been focussed on simply the economic performance and viability of that industry community. Recently however, elements, that may be termed more qualitative, including quality of life of fishers, stability of their operating environment, conflict and equity issues, have begun to appear in work being undertaken in this field. The following discusses components, objectives and indicators across both these perspectives, and is organised by operational objectives of fisheries and ecosystems that commonly arise from the literature.

4.1.1 Maximising sustainable economic yield

A number of researchers have identified the objective of maximising economic profitability of fisheries activities; either holistically or associated with a specific fishery (Arthur et al. 2011; Brooks et al. 2011; Cheung et al. 2008; Fulton et al. 2007; Hilborn 2007; Lane 1989; Mardle et al. 2002; Mardle et al. 2004; Pascoe et al. 2009a; Pascoe et al. 2009b; Soma 2003; Symes et al. 2009; Tobin et al. 2009). Maximum Economic Yield (MEY[2]) is the level of catch and associated level of fishing effort that maximises profits in

[2] MEY Is defined as "[t]he sustainable catch or effort level for a commercial fishery that allows net economic returns to be maximized". Commonwealth fisheries harvest strategy: policy and guidelines. Department of Agriculture, Fisheries and Forestry, Australia Canberra: 2007, p.54

the industry over time and on a sustainable basis. In regard to human wellbeing, the benefit of this objective is evident in the contribution it can make to the stability of the industry, the incomes to the fishers and crew and therefore the lifestyle of participants and constituent communities. The majority of these works identified the sub elements of either or both, profit and/or returns on investment (i.e. profits as a proportion of the total value of capital invested in the fishery), where "above normal" returns on investment is often taken as an indication that resource rent is being generated in the fishery. The indicators of these sub elements, where identified by these authors, were the trends in profit levels either per day fished, or per tonne landed relative to that at maximum economic yield. The latter requires some form of bioeconomic model[3] to be developed that enables MEY to be identified and profits at MEY to be estimated as a benchmark against which the economic performance of the fleet can be assessed. These indicators would be amenable to the majority of countries and ecosystem management environments (developing or developed) where fisheries data was collected for commercial fishing activity and bioeconomic modelling capability existed, subject to the alignment of ecosystem boundaries with jurisdictional and data collection boundaries.

4.1.2. Improving economic performance:

Identifying MEY and assessing the fisheries performance against MEY is not practical in many circumstances due to data limitations and/or the costs of model development and data collection. However, as a precursor to the achievement of maximum economic profitability, improving economic performance (also referred to as economic efficiency) was identified by two sources in relation to the objective of enhancing the performance of both the fishing industry itself (Arthur et al. 2011), and/or the industry sectors which support the industry (Leung et al. 1998). Provided that economic performance is improving, then fishers are progressing in terms of achieving economic objectives. In the recent report released by the European Fisheries Fund (Arthur et al. 2011) quantitative trends (or selected reference points during a period) in both business turnover and in the value added[4] to fishing activities were identified as indicators of trends in a fishery's

[3] A bioeconomic model is a model that captures the stock dynamics (which may also be linked to ecosystem models), the costs of fishing and the revenue associated with different levels of fishing activity.

[4] Value added is a measure of the total income generated in a sector, consisting of both vessel profits and payments to crew members.

performance. However this has weaknesses in that it provides no direct indication of the efficiency (i.e. the costs relative to the income) in generating that turnover, but rather of the level of activity. By contrast Pascoe (in Brooks et al. 2011) suggests that the trends in the level of economic profits as a proportion of total revenue is a more appropriate indicator of economic performance/efficiency (i.e. assuming economic performance is increasing if the profit share of revenue is increasing). Pascoe does note that, as a proxy measure, the changes in value of quota, units or licences could be used as these are also related to both current profitability and expectations about future profitability. As a further dimension of this, Leung et al (1998) identified that support industries include all those industries that are linked to the fishery, through activities such as marketing, fuelling, suppliers, transportation, handlers, bait dealers, etc. It is suggested in relation to these that the economic profit of each of these business segments also be included in an analysis which, in this case, was an Analytical Hierarchy Process (AHP) to assist in decision making between alternatives. Consequently no specific data collection technique was discussed other than that of participant response to the AHP. Including support industries should be considered, however, given the scope of an EAF approach, support industries may be restricted to those which support fishers in the specific fishery ecosystem under review.

4.1.3. Minimise management costs:

The objective of minimising management costs has been discussed by a number of authors in relation to decreasing both costs to industry of management and compliance, and also those of overall management (recoverable and non recoverable) (Fulton et al. 2007; Pascoe et al. 2009a; Pascoe et al. 2009b; Soma 2003). The human wellbeing benefit of such an objective is derived from decreasing cost imposts on either fisher persons directly or the jurisdiction responsible for the ecosystem management which, by extension, creates the possibility to release these resources elsewhere to the benefit of the population. The indicators of compliance costs that can be used include the cost to fishers of; licensing fees, new gear to target catch, or the cost of providing catch data in the form of Vessel Monitoring Systems (VMS). In regard to management costs, the indicator of this was identified as potentially, the cost of management[5] relative to the value of the fishery.

[5] Cost of management is used here, according to the definition of costs being those associated with management that are attributable to a specific fishery (or user group). Cox, A. (2000). Cost Recovery in Fisheries Management. The Australian Experience. IIFET 2000 Conference. International Institute of

However it was deemed by Pascoe (Brooks et al. 2011) that either the cost of management relative to the economic profits generated by the fishery; or net (industry wide) economic profits after management costs have been deducted or the economic profits generated by it, were better indicators to use for monitoring trends in management costs. This objective and the last two indicators of achievement of it are envisaged to be generally applicable to the circumstances of EAF management in the jurisdictions covered by the FAO.

4.1.4. Improve productivity:

Improvement of productivity in this particular circumstance is not envisaged as being to increase catch rates per se, but rather to improve these for the effort expended within the sustainable yield limits that have been established for a fishery and ecosystem. The human wellbeing benefit of this can be seen as decreasing effort of fishers for the same economic return, allowing them increased time to expend on leisure or diversification of their income earning capacity, which can result in an increase in the welfare of individuals. However it should also be noted, that in many communities, particularly subsistence ones, this particular objective may not be optimal, due to the identity gained by individuals from the activity of fishing and lack of alternative income generating options. To reduce effort and increase productivity has the potential to affect the social fabric and resilience of a community by destabilising individuals within it, unless suitable alternative activity options are available to them. Catch per unit effort (CPUE) was identified as an indicator of productivity (as well as both profitability and sustainability), by Glaser and Diele (2004). Pascoe (in Brooks et al. 2011) suggests that this effort should be defined as either by time or area fished, however it has also been suggested that due to the ecosystem focus of EAF, CPUE using all three components of effort, area and time fished would be the most appropriate definition to employ, as this would capture any potential concentration of effort in short periods of time in a specific area; an activity most likely to lead to ecosystem degradation.

4.1.5. Employment in the sector

A focus on adequate employment is an agreed objective in fisheries management and NRM generally (Arthur et al. 2011; Brooks et al. 2011; Chesson et al. 1999; Cheung et al. 2008; Gómez-Limón et al. 2009; Hilborn 2007; Leung et al. 1998; Mardle et al. 2002;

Fisheries Economics and Trade. Oregon USA, Australian Bureau of Resource Economics,. **ABARE Conference Paper 2000.18**.

Mardle et al. 2004; Paracchini et al. 2011; Rossing et al. 2007; Singh et al. 2007; Symes et al. 2009). In many fisheries around the world, the objective of 'maximising' employment is contested. While on the one hand maximum industry employment may be identified as potentially desirable in regard to generating income and spending in a community, it is not necessarily compatible with objectives of profitability or environmental sustainability. As a consequence, many fisheries managers are refocusing this objective to reflect aspirations to maintain (rather than decrease) employment in fisheries. In line with that focus, possible indicators include; the number of people employed; seasonal employment; and proportion of skilled and unskilled labour (nature of employment). Due to the seasonality of fishing activity, it is suggested that monitoring the proportion of full time crew (Brooks et al. 2011) to identify changing trends, is a more realistic analysis, that accounts for fluctuations in seasonal labour. Similarly, Arthur et.al (2011) suggests tracking the balance of full compared to part time employment, to identify any relationship with seasonal trends and changes in these trends, which may indicate larger shifts in industry employment. Additionally, tracking gender ratios of employment is commonly identified as a key indicator of changing trends in industry and community welfare or circumstance. The indicator ultimately used will largely be dictated by the circumstance of the ecosystem; the fishery being assessed; the data available, and resources of the jurisdiction involved.

4.1.6. Maintain or enhance quality of life/ income/ livelihoods

More recently, work in the area of monitoring fishery health has also taken into account the effect of fisheries management and structure on the quality of life of fishers; particularly as pressure has increased to decrease fishing activity. Retractions in fisheries and the number of participants has effects on social networks and support systems for those individuals remaining in the fishery. In relation to the objective of enhancing the quality of life for fishers, the indicators that have been proposed include; quality of life; overall life satisfaction; satisfaction with employment; satisfaction with fishing catch and access arrangements; physical and mental health; and levels of bonding social capital[6] in community life; family fishing income; share of income from the resource (resource

[6] Bonding Social capital refers to those social networks with trusted people with whom an individual has common values, experiences and aspirations, providing a sense of belonging and purpose, and which also gives them access to resources. Brooks, K. (2009). Rural resilience and Prosperity: the relevance of government and community networks Saarbucken, VDM Verlag, Putnam, R. (1993). "The Prosperous Community. Social capital and public life." The American Prospect **4**(13): 35-42.

dependency) and security of fishing rights (Chesson et al. 1999; Glaser et al. 2004; Hilborn 2007; Lane 1989; Leung et al. 1998; Marshall 2007; Mascia 2003; Schirmer et al. 2005a; Singh et al. 2007; Soma 2003; Symes et al. 2009; Tobin et al. 2009). Many of these indicators do however entail employing specific data collection, which may not be applicable to the capacity and resources of the majority of developing countries. Consequently, proxies for 'quality of life' and 'overall life satisfaction' are commonly used in the form of industry age profiles (trends in average ages) and net migration (numbers entering and exiting the industry), for which census data can be utilised. Where possible, this data can be both identified in association with specific communities and also aggregated up to regional and national profiles associated with employment in an industry. This data can be used as a proxy indicator for 'quality of life', and may be more useful in the particular circumstances of many FAO countries applying EAF management.

4.1.7. Minimise conflicts/social exclusion and maximisation of equity

The objective of minimising conflict or, conversely, maximising the perceived equity of access, allocation, and income distribution from the resource, is increasingly evident in many discussions around fisheries and ecosystem management (Ahmed 2006; Bennett et al. 2006; Brooks et al. 2011; Claytor 2000; Fulton et al. 2007; Glaser et al. 2004; Leung et al. 1998; Mardle et al. 2002; 2004; Pascoe et al. 2009b). Conflicts are generally recognised as centring around quotas and allocation (recreational / commercial / environmental), gear use and interacting uses of the resource (Symes et al. 2009). In relation to catch levels, Claytor (2000) suggested an indicator which relies on the comparison of reported catch levels in a fishery with the age data of the stock in the area of the fishery or ecosystem (p.1117), to identify relative abundance to inform the validity of allocation. While these issues are recognised as an area of tension with a need to be monitored and managed, aside from the previous indicator, there are very few suggested indicators in the literature. Rather the majority discuss methods of allocation to minimise conflict and/or management of conflict and equity of allocation (of access and therefore potential income), rather than monitoring levels of conflict or effectiveness of allocation. Pascoe (in Brooks et al. 2011) and, to some extent, Ahmed (2006) suggest the adoption of monitoring of the number of official complaints or conflicts over access or allocation by industry, other stakeholders, and between these two groups, as an indicator of conflict. The crude nature of this indicator is, however, overtly recognised. It is a simple trend measure of satisfaction compared to dissatisfaction, where a lack of complaints/conflict is generally taken as a proxy for satisfaction. As identified by Bennett et al (2006), conflict is often determined

by the ability of formal and informal institutions to adapt to change, and the severity of the conflict is determined by the institutions' ability to deal with rising transaction costs (p.47). This suggests that an indicator of institutional flexibility and adaptability would be appropriate to monitor. Currently the IndiSeas Project (IndiSeas 2011) is the only venture that could be identified as investigating this in current work on the status of marine ecosystems. As yet unpublished work is being undertaken on the development of an indicator which seeks to assess the degree to which management plans are developed to minimise conflict among different sectors.

4.1.8. Management stability

Although the stability of management is identified by Fulton et al(2007) and Bennett et.al.(2006) as a relevant management objective, neither discusses a means to monitor the achievement of this. However, in work currently being undertaken (Brooks et al. 2011) indicators to assess levels of management flexibility to allow regional fisheries adaptability are being investigated, and are based on relying on a qualitative assessment of management plans and frameworks and/or quantitative records of management revisions in a set period. Management stability has a tendency to be included as an operational objective with regard to providing surety to fishers of access and operational licence. However, equally, management that is overly stable (i.e. inflexible or lacking any adaptive capacity to changing circumstances) can be equally detrimental to both a fishery and ecosystem health.

4.1.9. Industry community health and safety

Aiming for high standards of health and safety in an industry is commonly highlighted as a human wellbeing factor to be considered in the assessment of successful industry management. This is due to its essential contribution to the viability of the industry through maintaining a robust workforce, and also in terms of ensuring a safe food product is delivered to the market (Brooks et al. 2010; Mardle et al. 2004; Soma 2003). The indicators that have been identified relate to the existence of Occupational Health and Safety (OHS) standards; the level of monitoring in fishing business through identifying the use of a set of OHS standards; the number of incidents and accidents that are reported; levels of health and safety training in fishing businesses; and documentation of OHS systems. These may be good indicators for developed countries which are often heavily regulated, however may prove problematic for developing countries where different standards of OHS apply.

4.2. Associated ecosystem dependent communities

Much of the literature in the area of assessing human wellbeing or social aspects of fisheries and marine ecosystem management has previously focussed on developing indicators for the industry. More recently, the necessity for human wellbeing management objectives has been recognised, to both guide decision making and demonstrate consideration for industry participants, as well as industry associated communities. When discussing communities associated with fisheries and marine ecosystems in the context of EAF, it is imperative to identify the boundaries, as identified in the discussion of the 'integrated management approach'. The boundaries of the following discussion are those of fisheries managers' ability to influence or affect the outcome of the particular behaviour or activity which is the subject of the objective. For example, an objective of 'enhancing community resilience' in the general community must be acknowledged as being affected by many factors and influences other than fisheries management that may not be operating with the same objective. Consequently, it is essential that the objective is very specifically tied to clear indicators that define the scope of the regional and/or associated fisheries/ecosystem community. While the following is a generic listing of commonly identified objectives for regional communities associated with fisheries ecosystems, not all of them have clear or well developed indicators aligned with them or alternatively clear objectives that can be affected by the fishing industry.

4.2.1. Social Profile

As discussed by a number of authors (Arthur et al. 2011; Barrow 2000; Brooks 2010a; Schirmer et al. 2005a; Schirmer et al. 2005b) profiling the social structure (or population demographics) of communities associated with fishing activities is commonly the first task recommended in an assessment, to clarify a community's demographic strengths and weaknesses. Ideally trend data is identified comparing two data points at least 5 or more years apart (Arthur et al. 2011,p.4), focussing on changes in age structure and population levels over time. Increasing median ages and decreasing population identifies communities that are likely to be struggling with or have limited, none or negative economic growth and opportunities, both because of and due to the lack of labour. These communities are much more vulnerable. Additionally Schirmer et al (2005a) recommends trend analysis of education levels, length of residence in current hometown, household spending profiles; ethnic characteristics; dependency levels; gender ratios and income levels, to identify further vulnerabilities of communities that might be presented by a concentration of any one of these factors.

4.2.2. Community support through industry activity

The objective of maintaining or supporting communities associated with fishing activities, relates to the recognised need and/or preference for fishers to live in communities that are provided with services and infrastructure, in the form of schools, support industries, retail and transport services. The contribution or influence that the industry can have in this regard is its contribution to the regional community economy, which in turn provides an element of 'resilience'[7] in that community. This also has a further associated benefit of contributing to the maintenance of the industry's social licence to operate[8]. A number of projects and reports have discussed this objective identifying a range of indicators which focus on different elements of regional community contributions (Arthur et al. 2011; Brooks et al. 2010; Lane 1989; Leung et al. 1998; Mardle et al. 2002; 2004; Marshall 2007; 2010; 2007a; 2007b; Pascoe et al. 2009b; Slee 2007; Symes et al. 2009; Tobin et al. 2009). The indicators suggested include; the proportion of income or employment in the regional community derived from the fishing sector; degree of community involvement in the management of the industry; level of indirect economic impacts from the fishery on the regional economy; the level of infrastructure provided as a result of the industry's existence in the community; degree of integration of fishing activity into local economic development plans; the number of small vessels in the regional community (contribution to the culture of the community); profitability of the sector (proxy for contribution to the regional economy and thereby community) and number, or profitability of, associated support industries, such as fish processing/chandlers/net makers/transporters. Many of these are only useful if the data is either collected regularly (which is not commonly the case) or the resources are available to specifically collect data for each assessment in each community considered. This is commonly not feasible on a whole of country basis, such as in an FAO country assessment circumstance. Consequently the indicators that might be considered for this objective in this particular EAF context are problematic, but may

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[7] "A resilient community is one that is able to maintain the same or an improved functionality in the face of changed circumstances." Brooks, K. (2010b). "Sustainable development: Social outcomes of structural adjustments in a South Australian fishery." Marine Policy 34: 671-678.

[8] A "Social Licence to Operate exists when a[n industry] is seen as having the approval, the broad acceptance of society [social and political] to conduct its activities" Joyce, S. (2000). "Earning a Social Licence to Operate: Social Acceptability and Resource Development in Latin America." The Canadian Mining and Metallurgical Bulletin **93**(1037).

include degree of community involvement in management decisions; or if data is available the proportion of community income or employment derived from the sector.

4.2.3. Maintain social capital

Social capital is seen as a key element in reducing conflict and transaction costs generally in the operation of industries. It is a concept equally applicable to fisheries management in the context of being situated in diverse regional communities, often with conflicting aspirations for resources (Bennett et al. 2006; Brooks 2010b; DeFilippis 2001; Gutierrez et al. 2011; Marshall 2007; Rossing et al. 2007; Slee 2001; 2007; Soma 2003). The means to assess social capital is often confounded however, by the diversity of opinion as to what type[9] of social capital is being assessed and for what purpose. Despite this, the common types of indicators of social capital that appear in the literature related to regional communities associated with the fishing industry include; the level and/or intensity of social networks between members of the industry and associated community; a comparison of the number of bonding, bridging and linking networks between the industry and regional community; and education levels which contribute to bridging social capital through exposure to diverse sources of knowledge and problem solving approaches. Many of the easily collected proxies for social capital such as membership numbers of general community associations (Onyx et al. 2000; Putnam et al. 1993) have been proven to be unreliable in regard to the conclusions that can be drawn from them. That is, that membership cannot in reality be equated to participation and therefore access to resources that might otherwise be generated by membership of that network. However, DeFilippis (2001) argues that when linked to economic capital, such as the existence and use of microenterprise lending circles, which can act as focal points for social networks to come together, social capital can be relatively easily assessed. In this context it has both economic relevance and also to developing and developed countries equally. The very nature of membership in financial based associations or enterprises equates to participation, which generates access to resources individuals would not otherwise have. Therefore such an indicator does not have the inadequacies of other proxies for social capital and could be considered a reliable indicator for FAO EAF assessments.

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[9] Social capital is broken down into three different types: bonding (homogenous supportive networks); bridging (heterogeneous diversifying networks); and linking (networks that facilitate access to power and decision making)Woolcock, M. (1998). "Social capital and economic development: Toward a theoretical synthesis and policy framework." Theory and Society **27**: 151 - 208.

4.2.4. Health and Safety

In many countries industry has a direct responsibility to its employees for their safety; however the benefit of this extends beyond the direct industry workforce. There is also the associated community benefit to maintaining a healthy workforce. Primarily this is in the prevention of health costs that low industry standards may impose on associated communities (Brooks et al. 2010; Mardle et al. 2004; Soma 2003). Equally, high or improving standards of occupational health and safety (OHS) standards in a seasonal fishing industry has potential to ensure the availability of labour for other industries during fishing downtimes, if industry participants remain fit and healthy after a fishing season. The same indicators of OHS as applied directly to the industry can also be applied here, but interpreted with regard to the flow on benefit to participants' associated communities.

4.2.5. Contribution to, and conservation of, traditional activities, culture and products

The maintenance of traditional fishing activities is perceived as a social and human wellbeing benefit to many communities through the conservation of not only these practices, but the culture and products generated by the industry's activities. The consequence of the demise of these activities often has a reach far beyond the actual fishers themselves, as has been discussed in relation to both fishing and other industries utilising natural resources (Brooks et al. 2010; Chesson et al. 1999; Gómez-Limón et al. 2004; Karjala et al. 2004; Leung et al. 1998; Paracchini et al. 2011; Tobin et al. 2009). However the indicators for assessing the achievement of this objective are scant. The most commonly noted are those of; attachment to lifestyle by fishers; perceptions of industry importance by communities; and/or proportion of diet acquired from wild foods. The limited ability (or inability) to measure this objective with readily available data in many developed countries, let alone those with less well developed institutional arrangements and resources available to collect primary data, results in it rarely being employed despite being universally considered important. Monitoring of other objectives, such as 'attachment to lifestyle', produce data that may be utilised to make comment on the cultural contribution of an industry to its associated communities.

4.2.6. Enhance quality of life/ community resilience

Although the majority of contributions by the industry to community resilience will be commonly derived from the income generated by the industry, the dependence of regional communities on fishing and marine ecosystems through secondary or support industries

and services accessed by fishers must be considered as a regional or associated community benefit (Marshall et al. 2007b). The indicator of this most commonly suggested is that of economic multipliers, however even within Australia, a developed and reasonably data rich country, the data for this is difficult to collate without resorting to primary data collection (Brooks et al. 2010,p.17). In relation to the contribution to overall community resilience Marshall (2007b) identified four key factors that contributed to resilience: the perception of risk; ability to cope; ability to plan and learn; and level of interest in adaptation. However, while these concepts could be extended to general community resilience, more work would be required to clarify the nexus between a specific industry or industry sector (fishery) and a general community's level of resilience.

4.3 National Community

The ESD Framework recommends that a component of fisheries assessment, which has also been included in the recommendations for EAF, is the higher level of 'National Community' human wellbeing. The 'Sunken Billions Report'(Arnason et al. 2009) identified that inefficient harvesting of the world's marine fisheries has resulted in "lost economic benefits ...on the order of $50 billion annually"(Ibid,p.xvii) to communities globally. The report identifies that reduction in fishing effort and rebuilding of fish stocks through a variety of measures including foremost 'strengthening and formalising marine access and removing open access conditions. However, on a national scale, while the economic benefits of a more efficient structure are undeniable, the social human wellbeing costs of treading this path too readily are also of a magnitude that should be carefully considered. Emphasis must be placed upon the notation that "successful reforms should take the time to build consensus among fishers on the transition pathways..." (Ibid p.xx).

The literature suggests several high level indicators for assessing contributions of an industry, which are discussed following. However it must be recognised that many other factors, other than marine ecosystems, will potentially influence the results of any measures at this level.

4.3.1 Food supply

The primary benefit of fisheries and marine ecosystem management to associated national communities is the protein food source provided by seafood. National data sets for this information (as either a % of protein or volume of food by source per capita per annum) may be available which could be compared over time. The Food and Agricultural

Organisation (FAO) publishes this data in a number of forms[10], unfortunately however these are several years behind real time in publication. It also is important to note that the apparent annual per capita consumption is based on the live weight equivalent, however actual consumption and nutrition benefits will depend on the consumed part of the seafood and its preparation. Additionally, at this time this data does not break down the percentage sourced from local produce compared to imported product. For example, Australia, which obtained 26.4 kilograms per capita of its food protein from seafood in 2007[11], has increased the volume of edible fish imports since 2004-05; despite being a net exporter in value terms (Pham 2010), as a result adjustments for import and export variations are required to render this indicator meaningful. Overall, despite this being an appealing national indicator of national benefit from seafood derived from marine ecosystems, given current data there are a number of issues with its assessment.

4.3.2 Community perceptions – provision of a 'social licence to operate'

A 'social licence to operate' is a phrase only more recently coined to refer to the social and political sentiment towards an activity or industry, and that the existence of such a licence allows that activity to continue. As defined by Gunningham et al., (2002,p.6)

> *… social licence…is based not on compliance with legal requirements (although breach of these requirements may jeopardise the social licence), but rather upon the degree to which a corporation and its activities are accepted by local communities, the wider society, and various constituent groups.*

The social license to operate can be assessed on a four point scale, from being 'withheld/withdrawn' (1- 2.4) through 'acceptance' (2.5 – 3.4) and 'approval' (3.5 – 4.4) to 'co-ownership' (4.5 – 5), being assessed using a survey instrument (Australian Centre for Corporate Social Responsibility 2011; Boutilier et al. 2009). The success relies on the ability to identify attitude survey questions that suitably assess a community's perception

[10] http://www.fao.org/fishery/statistics/global-consumption/en
ftp://ftp.fao.org/FI/CDrom/CD_yearbook_2008/navigation/index_content_food_balance_e.htm

[11] Fish and Fishery Products Food Balance Sheets and Fish Contribution to Protein Supply by country from 1961 to 2007, FAO 2008, Rome, p.13

of an industry. The final score of derived from such a survey would be the mean of the rating scale responses of all stakeholders surveyed. In the case of a national survey this could be undertaken as a random sample of the population. However in the context of the FAO EAF nations, the implementation of an appropriate survey to specifically collect such data is considered unlikely to expect at this time given the resources that would be required.

4.3.3. Community Development

Discussions emanating from Australia and the USA identify the use of MEY and the supply driven approach as useful tools to assess the economy wide impacts of changes (commonly reduction of activity) in fishing activities (Leung et al. 2002; Norman-López et al. 2011). As noted by Leung et al (2002) economy wide contributions of a sector have commonly been assessed using input-output models (ibid,p.252), however there has been a wide variation in the measurement procedures utilised, which is often based on the specific objective or policy question being addressed (Leones et al. 1994). Norman-Lopez et al (2011) asserts that MEY, utilising an input-output framework, is a useful tool in assessing the impact of the fishing industry on the broader economy. In case studies of several Australian fisheries they have found that this particular framework is useful for assessing both short and long term performances to both local and the broader community (p.489) of a fishery. Leung et al (2002) identify that no single method is ideal to measure the returns from a sector after the contribution has taken place. Consequently, they developed a supply driven approach to assessing the impact of a fishery output reduction to a State economy (in this case Hawaii), to be applied in resource management planning. Although this approach has the benefit of alleviating double counting present in other methods, it is aimed at an ex ante approach, rather than the FAO monitoring (ex post) objective being sought in this instance. Both of these approaches have possible limitations in data poor countries, being a data intensive approach to the assessment of fishery industry contribution to community development.

A further indicator of national social human wellbeing that could be employed is that of Social Development Elasticity (SDE) (Rogers et al. 2008). This concept is defined as the

percent of change that occurs in income ratios[12], and is also a derivative of the Ginni Co-efficient, measuring aggregate inequality of income, which could equally be used over time to assess the trends of community wellbeing at a national level. Equally the Human Development Index (HDI), which takes several factors, including life expectancy, adult literacy, expected or mean years of schooling, and GNP per capita into account[13], can be used to assess the relative status of a nation over time. While these assessments are useful to assess the development of a country, they are problematic if attempting to relate them to a particular industry or ecosystem, but may still be considered a useful measure to assess overall progress of a nation, to contextualise the assessment of EAF management progress or success.

4.4. Indigenous Community

As noted earlier, the work that has been undertaken to date on objectives and indicators of indigenous welfare have been focused at a high level, utilising quantitative statistical data, which has been critically assessed as being inadequate from indigenous communities' perspectives (Taylor 2008). The headline indicators that are commonly employed when investigating indigenous welfare include: population; gender ratios; life expectancy at birth; disability and chronic disease; (culturally appropriate) education levels; labour force participation and unemployment; poverty; household and individual income; home ownership; suicide and self harm; substantiated child abuse and neglect; deaths from homicide and hospitalisations from assault; access to health care; family and community violence; imprisonment and juvenile detention; urban indigenous population; net indigenous migration; use and intergenerational transmission of language; sovereignty of and access to traditional lands and resources; recognition of indigenous governance and laws by State governments; indigenous inclusion and participation in ecosystem management; government expenditure on indigenous support programs and existence of policy measures to address indigenous discrimination (Department of Human Resources and Skills Development Canada 2011; Stamatopoulou et al. 2006; Taylor 2008; The World Bank).

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[12] This is measure by the ratio of income of the richest 20% of the population to the poorest 20%, divided by the aggregate percentage of change in the economy, which is measured by GDP growth. (Rogers, P. P., K. F. Jalal, et al. (2008). An Introduction to Sustainable Development. London, Earthscan. p.251)

[13] http://hdr.undp.org/en/statistics/hdi/ (accessed 27/4/11)

Although this list of indicators is significant (and by no means exhaustive in regard to the literature) there are acknowledged issues with both attaining data for some of these indicators, and in being able to meaningfully relate outcomes from these particular indicators to resource use or access. Further to this, as noted earlier, these indicators have largely been developed by government departments, abstracted from the issues and concerns upper most in the minds of indigenous communities (Taylor 2008,p.116). A further component of this is that the issue of culture and how that is interpreted into meaningful indicators in the indigenous context can vary widely within nations, let alone across national boundaries.

Dependent upon the national reporting and data collection systems a good proportion of the indicators listed above can be informed. However, given the difficulties of establishing relevancy of these to ecosystem resource use and specific cultural circumstance, as identified by the FAO workshop (Stamatopoulou et al. 2006), significant further work is still required to explore the various alternative approaches, particularly in this situation of EAF implementation.

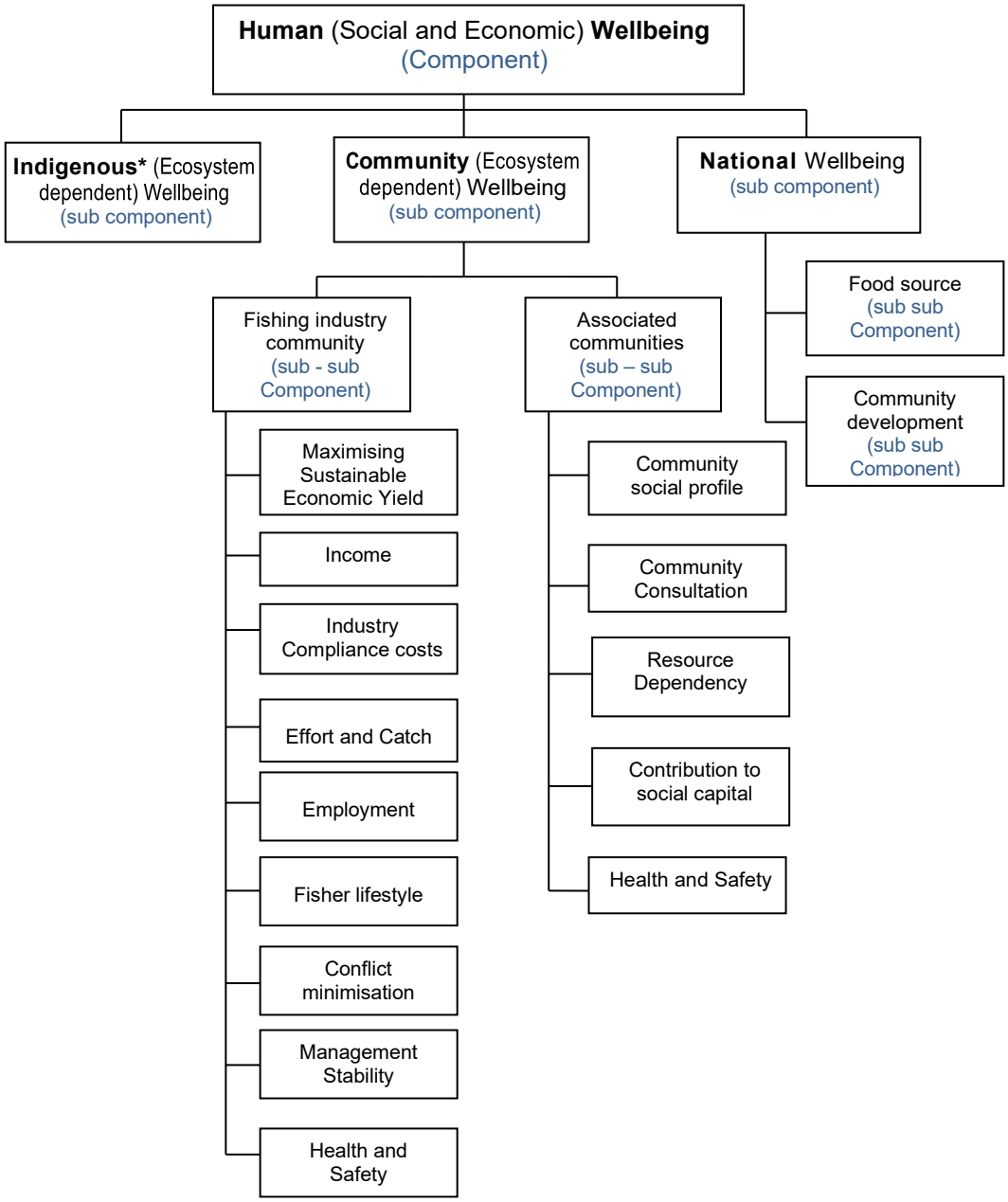
4.5 Summary

The preceding discussion does not claim to be an exhaustive review of all the literature that has been generated on human wellbeing objectives and indicators. It does, however, cover the main themes and the most commonly cited objectives and indicators in relation to assessing the social and economic elements of human wellbeing in a natural resource context. From this summary, the following section suggests the most applicable objectives and associated indicators for the assessment of EAF in the context of the EAF-Nansen project (excluding indigenous for the reasons previously mentioned). However, none of the objectives and indicators in the preceding review should be discarded out of hand. Rather it should be recognised that some are only able to be applied in very specific situations where resources and circumstances allow. Alternatively, with further information and exploration of implementation and data collection options, others may be able to be employed in the future. Consequently, the possibility exists that many of the objectives and indicators in this review may potentially be useful in generating a greater understanding of the social and economic human wellbeing effects of EAF management decisions.

5.0 Human Wellbeing Components, Operational Objectives, and Indicators

Utilising the literature review and synthesis framework posed by Haward earlier (this volume), the following discussion will elaborate on the key sub components to suggest sub sub components, (and sub sub sub components where appropriate), operational objectives and indicators that could be utilised. This builds on Figure four in the following manner:

Figure 5: Human Wellbeing ESD Hierarchical Tree



* The Sub component of Indigenous has not be extrapolated in this chapter due to the further extensive work that would be required to advise on credible subcomponents, operational objectives and indicators.

The following details suggested conceptual objectives, (sub (sub)) components, operational objectives and indicators, to provide context for the detail of assessment that follows.

Table 1: ESD/EAF Component Tree application example

Sub Component	Sub-sub Component	Sub-sub-sub Components	Operational Objective	Indicators
Community Wellbeing	*Fishing Industry Community*	Sustainable Economic Yield	*Maximise profitability in a sustainable manner*	Profit levels per day fished Profit per tonne landed relative to the MEY profit Profit as a proportion of total revenue, compared with MEY profit
		Income	*Improve Economic performance*	Trends in profits as a proportion of revenue (Net Economic Return)
		Industry Compliance costs	*Minimise industry compliance costs*	Trends in annual industry compliance costs as a percentage of total operating costs
			Minimise fishery management costs	Trend in sector management cost relative to the net economic return of the fishery
		Effort and Catch	*Improve productivity*	Catch per unit of effort, time, and area (CPUE) subject to the stocks not being overexploited.
		Employment	*Maintain (or maximise) employment*	Number of full time crew Proportion of full time crew in relation to number employed
		Fisher lifestyle	*Maintain or enhance lifestyle*	Levels of family fishing income. Security of fishing rights Average age of fishers
		Conflict Minimisation	*Minimise conflict through management*	Management plans developed to minimise

			arrangements	conflict.
			Maximise equity of resource use	Level of access equity across operators in the fishery.
		Management stability	*Maximise effectiveness of management change*	Monitor achievement of intended management change outcomes.
		Health and Safety	*Improved industry health and safety*	Developed and implemented occupational health and safety Standards.
	Associated Communities	Community Social Profile	*Monitor Community Demographics*	Population level & net migration Age structure
		Community consultation	*Engage associated communities in resource stewardship*	Inclusion of broader community in management plan reviews.
		Resource dependency	*Monitor resource dependency of associated community activities*	Economic contribution by the industry as a proportion of regional income. Trends in overall regional employment / unemployment levels
		Contribution to Social Capital	*Monitor relationship networks between industry and regional communities*	Existence of lending or finance cooperatives Levels of industry participation in finance cooperatives.
		Health and Safety	*Maintenance of a healthy community & workforce*	Industry Occupational Health and Safety Standards developed*.
National Wellbeing	*Food Source*		*Provision of protein for human consumption.*	The % or volume of nation's food protein sourced from fish protein.
	Community Development		*Maintain or improve community development*	Relative change in HDI/SDE or similar index.

* Note: This indicator is covered by the industry sector component of the assessment.

At times, similar issues may underpin different principals and components; however the emphasis in each will be different. For example 'employment' is clearly linked in both the components of industry economic wellbeing and associated community resource dependency, but focus is on a different element or effect of the employment in each sub component. Equally the same is true for Health and Safety, where in the industry it is to maintain a fit and healthy workforce, and in the circumstance of the associated communities' the focus is the flow on effect that can be expected of preserving a seasonal workforce to be available for other industries out of fishing seasons and/or the decreased health care impost on the general community of ill or injured workers.

The following section discusses methods of implementing the indicators identified above. This is specifically in terms of how they should be further developed (or modified as necessary) in order to produce data that can be usefully tracked over time and to inform the success or otherwise of EAF management; the scope of indicator data collection; and lastly a suggested format of assessment for the suggested operational objectives and indicators.

6.0 Application of Indicators, Interpretation and Evaluation

It would be a simplification to assert that the indicators of the previously identified human wellbeing objectives for EAF could be easily identified and implemented in the range of environments envisaged by the Food and Agricultural Organisation. Despite this, and as has been underlined elsewhere, it is essential that indicators commonly used in assessing human wellbeing goals should be standardised and repeatable. This can be achieved only in so far as there are agreed interpretative objectives and reporting expectations in regard to the value/description of the indicator and the performance measure. The following discusses these elements separately and then seeks to draw them together in a guidance framework for the application and assessment of the Human Wellbeing Objectives in EAF Management.

Indicator Development

The achievement of standardised interpretation of indicators is advanced through the utilisation of those indicators which can be assessed in a relatively straight forward manner. That means identifying those indicators which can be answered in any of the following ways:

- binary yes/no;
- positive /negative response; or
- Increase or decrease of an event; behaviour; or occurrence; or
- The presence of absence of an event; behaviour or occurrence.

Scope

The scope of the human wellbeing assessment needs to be clearly understood at the outset of any assessment. This relates specifically to the two aspects within ecosystem dependent community: those specific fisheries dependent on the ecosystem, and the communities associated with those fisheries: both landing port and home ports. The data collected for associated communities will then have to be aligned and collated as closely as possible with these community boundaries cognisant of any specific industries or activities either within those communities or impinging on their boundaries that may influence the

associated community data. The interpretation of the indicator assessment must then be interpreted cognisant of that contextual knowledge.

Assessment:

The aim of monitoring-based performance assessment is, on the basis of agreed 'standards' or 'targets', to guide decision makers as to the appropriate actions in relation to stated objectives, according to the evidence provided by indicators. This is done through identifying examples of 'great' (i.e. exceeds minimum standard), 'acceptable' (i.e. achieves minimum standard) and 'unacceptable' results (i.e. does not achieve minimum standard). Assessment is designed to assess the state of a factor in relation to a stated outcome or objective: does that factor exceed, meet or fail to achieve the desired outcome? In many cases where no monitoring has previously occurred, the initial assessment must consist of identifying the status quo, in relation to the stated objective (or outcome), in order to determine the required direction of movement toward that outcome. The further benefit of assessments, is the potential ability to monitor the effectiveness of management or other actions taken in relation to objectives and outcomes ((Jones 2009) and (Parks and Wildlife Service 2010) cited by Haward this volume). In the context of human wellbeing outcomes, the stated objective may need to be varied on the basis of the political or economic environment and structure of a particular jurisdiction; however the following format is recommended for managing the application and assessment of social and economic objectives in EAF management.

Visualisation Methods:

As discussed by Sainsbury earlier (this volume) there are a range of methods that can be employed to assist in visualising the results generated by the indicator data. The selection of the method will not only be dependent upon the indicator, however at times the data results may lend themselves more graphically to one version rather than another, particularly in instances where time series data is available as against single point benchmark data. Alternatively, it may also be appropriate to represent several points of industry community data together, such as profitability; income; security of fishing rights; and health and safety on a kite diagram to identify the relative focus in a fishery accessing a particular ecosystem. This may identify that the performance across all areas is approximately equivalent, or alternatively it may identify that good performance in one or

more areas, is offset against poor performance in welfare and security issues. As described in detail by Sainsbury (p. XX), the methods that are most commonly employed to visually illustrate and communicate social and economic data most effectively include; bar graphs; box and whisker plots; traffic lights, kite diagrams; coding of a hierarchical tree of components and objectives with fonts or colours to identify proximity to limits or targets; time series graphs, with target lines overlaid; and Geographical Information Systems (GIS) , which is particularly effective for the illustration of demographic data. The data from the suggested indicators could individually be represented in a number of these different formats, however for the sake of consistency; the following is the suggested format for assessing the indicators across the board as it can be applied to all the indicators. The use of colours (similar to the traffic light system) in this instance is recommended as the key visualisation tool.

Table 2: Recommended Format for Presenting Planned Outcomes, Indicators and Criteria for Assessing Human Wellbeing objectives

OPERATIONAL OBJECTIVE :
Indicator: Monitoring actions: *(e.g. timeframe, frequency, seasonality, sites, etc.)* Reporting actions: *(e.g. how and when the findings of monitoring will be reported)*
Great result:
Acceptable result:
Unacceptable result:
Reference conditions: *(e.g. photos, data and/or other evidence documenting the existing conditions for this planned outcome)*

(Source: Haward this volume (Jones 2009; Parks and Wildlife Service 2010)).

This framework identified from the literature by Haward, generates the connection between the operational objective and associated indicator, by focussing on the performance or effectiveness of an indicator in relation to the stated objective. As noted

this is a qualitative approach, which is also equally applicable to assessments of human wellbeing where many objectives are not easily quantified. As in the governance chapter of this volume, the following has been adapted to the hierarchical approach to EAF and framework for assessing human wellbeing, effectively providing the ability to monitor the performance of management actions aimed at achieving selected objectives. The following (Table 3) is a diagrammatical summary of the process.

Table 3: Summary table of EAF Management Objective performance assessment

Component	Sub Component	Sub-sub Component	Operational Objective	Indicator	Monitoring Actions	Performance Assessment		
						Exceeds Operational Objective	Meets Operational Objective	Fails to Meet Operational Objective

Table 4: Objectives, Components, Indicators, Monitoring and Assessment

Sub –sub Component	Sub sub sub Component	Operational Objective	Indicator	Monitoring Action	Source of Monitoring information	Performance Assessment		
						Exceeds OO	**Meets OO**	**Fails to Meet OO**
Fishing Industry Community	Sustainable Economic Yield	Maximise profitability in a sustainable manner	Profit as a proportion of total revenue, compared with MEY2 profit.	Assessment of profit compared with MEY profit.	Top down (Management data)	Profit ***exceeds*** MEY profit	Profit is ***equal*** to MEY profit	***Does not meet*** MEY profit
	Income	Improve Economic Performance	Trends in profits as a proportion of revenue (net economic return)	Identifying trends in the level of economic profits as a proportion of total revenue	Top down (management data)	***Exceeds*** X%[14] of total revenue	***Meets*** X% of total revenue	***Does not meet*** X% of total revenue
	Industry Compliance Costs	Minimise industry compliance	Trends in annual industry compliance costs for	Monitor annual compliance costs (licence fees &	Top down	Annual industry compliance costs are X% or less of total industry operating costs ***below*** that	Annual industry compliance costs are between X% and X% of total industry operating	Annual industry compliance costs are X% or more of total industry operating

[14] Where 'XX' is noted it is to be determined by the jurisdiction undertaking the assessment. Setting standardized benchmarks for social and economic indicators across national boundaries which are potentially at differing stages of development is unrealistic. Rather it is more important that the jurisdiction be able to identify its desired targets relative to national criteria, economic circumstance and cultural expectations.

		costs	industry participants	equipment modifications) for industry participants		deemed acceptable.	costs and deemed acceptable.	costs ***above*** that deemed acceptable.
		Minimise fishery management costs	Trends in sector management cost relative to fishery profit	Monitoring of sector management costs relative to fishery net economic return	Top down	Management costs XX% below fishery net economic return	Management costs at XX% of fishery net economic return	Management costs above xx% of fishery net economic return .
Fishing Industry Community	Effort and Catch	Improve productivity	Catch Per Unit of effort, measured by time and (ecosystem) area, subject to the stocks not being overexploited	Monitor catch per unit of effort, time and area (CPUE).	Top down	CPUE is increasing over time but stock levels are not exceeding fully exploited	CPUE is stable over time and stock is fully exploited.	CPUE is decreasing over time and stock levels are not fully exploited.
	Employment	Maintain (or maximise) employment	Number of full time crew	Monitor proportion of full time crew in relation to annual total employed.	Bottom up	% of full time crew is increasing	% of full time crew is stable	% of full time crew is decreasing

Fishing Industry Community	Fisher Lifestyle	Maintain or enhance lifestyle	Attachment to lifestyle	Monitoring levels of family income from fishing (it may be appropriate to split this by gender if possible)	Top down	Reported levels of fishing income increasing relative to costs of living (or jurisdictional equivalent)	Reported levels of fishing income maintained in line with changes in costs of living (or jurisdictional equivalent)	Reported levels of fishing income falling in relation to changes in costs of living (or jurisdictional equivalent)
				Security of fishing rights	Top down	Secure fishing rights exists for fishers that provide surety of access for a clearly identified period of time	Fishing rights for fishers are legally acknowledged	Fishing rights are not acknowledged for fishers.
				Monitoring age of fishers (in relation to community average)	Top down	Average age of fishers is decreasing	Average age of fishers is remaining stable	Average age of fishers is increasing.
	Conflict Minimisation	Minimise conflict through management arrangements	Management plans developed to minimise conflict.	Identify management plan action to minimise conflict	Top Down	Management plans explicitly acknowledge the need to minimise conflict and are developed with specific measures to do so.	Management plans acknowledge the need to minimise conflict, and management actions take this into account	No acknowledgement of the need to minimise conflict in management plans
					Bottom up	Stakeholders have formally incorporated in dispute resolution	Some stakeholders involvement in dispute resolution	No stakeholder involvement in dispute resolution

		Maximise equity of resource use	Management plans are developed to maximise equity of access	Presence of equity considerations in management plans	Top Down	Clear and transparent rules for allocation	Some rules for allocation	No rules for allocation
	Management stability	Maximise effectiveness of management change	Monitor achievement of intended management change outcomes.	Effective management changes positively affecting fisher's operating environment	Top Down	All management changes achieved intended outcomes. Number of changes	Management changes implemented, with minimal discernable intended outcomes Number of changes	No change in fishery operating environment Number of changes
	Health and Safety	Improved standards of industry health and safety	Developed and implemented occupational health and safety (OHS) standards	Identification of existence and use of industry OHS standards	Top Down	Clear and legislated system of OHS applicable to the industry	OHS guidelines for the industry	No formal system or guidelines
					Bottom Up	Industry have formally incorporated OHS into business operations	Some industry members have incorporated OHS into business operations	No industry incorporation of OHS standards into business operations
Associated Communities	Community Social Profile	Monitor community demographic to understand the strengths and weakness inherent in community structures in	Total Population Age structure. (Additionally, gender and Youth & Aged Dependency ratios; and net	Monitor levels and trends of community demographics to identify changes that could be detrimental to a diverse and robust	Top Down	Population levels increasing or stable and community age profile decreasing	Population levels and community age profile stable.	Population levels decreasing and community age profile increasing.

		the context of resource use	migration may also be monitored)	community				
	Community Consultation	Engage associated communities in resource stewardship	Inclusion of broader community in management plan reviews	Identify inclusion of community consultation in management plans	Top Down	Fisheries management plan requires associated community review and comment.	Fisheries management plan acknowledges potential effects on associated communities	Fisheries management plan does not consider effects on associated communities.
	Resource Dependency	Identify and monitor levels of associated community resource dependency	The economic contribution of ecosystem related industries to associated communities	Monitoring Economic contribution by the ecosystem/ fishing industry as a proportion of regional income	Top Down	Contribution to regional income is increasing	Contribution to regional is stable	Contribution to regional income is decreasing.
	Contribution to social capital	To track mutually beneficial relationship networks between the industry and community, which thereby benefit the overall regional	Monitor relationship networks between industry and regional communities	Identification of existence of regional lending and/or finance cooperatives	Top Down	Existence of active regional finance cooperatives that are regularly used by the fishing industry	Existence of active regional finance cooperatives that are available to service the fishing industry	No regional finance cooperatives available to the fishing industry
					Bottom up	Active use of regional finance cooperatives by the fishing industry	Awareness by the industry of the availability of regional finance cooperatives.	No awareness of regional finance cooperatives for the fishing industry

		community.						
	Health and Safety	Maintenance of a healthy workforce, for the regional community	Developed and implemented occupational health and safety (OHS) standards	Identification of existence and use of industry OHS standards	Top Down	Clear and legislated system of OHS applicable to the industry	OHS guidelines for the industry	No formal system or guidelines
					Bottom Up	Stakeholders have formally incorporated OHS into business operations	Some stakeholders incorporation of OHS into business operations	No stakeholder incorporation of OHS standards into business operations
National Community	Food Source		Provision of protein for human consumption	The % or volume of the nation's food protein that is sourced from fish[15]	Top Down	The level of protein sourced from fish products is increasing	The level of protein sourced from fish products is stable.	The level of protein sourced from fish products is decreasing
	Community Development		Maintain or improve community	Relative change in HDI index[16]	Top Down	The status of the country is moving towards '1'	The status of the country is stable	The status of the country is moving towards '0'

[15] http://www.fao.org/fishery/statistics/global-consumption/en or ftp://ftp.fao.org/FI/CDrom/CD_yearbook_2008/navigation/index_content_food_balance_e.htm

[16] http://hdr.undp.org/en/statistics/hdi/

			development					

The explicit focus on all three aspects of human wellbeing – ecosystem dependent industry and associated communities and the national perspective – is essential given the interaction and co-dependence of each of these elements. As has previously been noted, however, performance assessment of some of these elements is challenging due to data availability. The above methodology relies as far as possible on a desk-top methodology, to facilitate the easiest possible transition to EAF management approaches and assessment.

The following boxes apply the FAO's Standardised Outline for Indicator Text Boxes (see Appendix 1 Haward – this Volume) to outline the application of 'Human Wellbeing: Deriving Benefits and Valuing Ecosystems' Indicators. Real life examples have been employed, where possible, to illustrate implementation of an indicator. However, it must be recognised that, previously, despite extensive discussion, very little explicit linking of indicators to operational objectives has been undertaken, that has been documented and can be identified in the literature. Consequently, the majority of the following descriptions link the data and information available on indicators to the ability to logically inform the identified objectives.

IMPLEMENTATION EXAMPLES OF COMPONENT OPERATIONAL OBJECTIVES AND INDICATORS

6.1 Component/Sub (Sub) Component Implementation: Community Wellbeing – Fishing Industry Community

Sub component: Sustainable Economic Yield

What is this Operational Objective?

The objective is to maximise profitability of the fishery in a sustainable manner for the ecosystem.

What is the indicator(s)?

The suggested indicators include profit levels per day fished (where an effort limit is in place); profit per tonne landed relative to MEY profit; or profit as a proportion of total revenue, compared with MEY profit. The indicator of maximum economic yield is based on the premise that a fishery that maximises its economic potential will also usually satisfy its conservation objectives.

Why is it estimated?

These indicators facilitate monitoring the economic return generated to the community from resource utilisation, in the context of maintaining resource sustainability. Utilising profit per days fished (limited effort) or per tonne landed, identifies the return relative to the effort expended; and if it can be related to MEY2(p.19) it identifies the level of profit relative the maximum potential profit from a sustainable level of take from the fishery.

What data and/or information is needed?

The information required is dependent upon the indicator selected. In the case of profit per days fished, data is required for the overall fishery, and the number of days fished (effort); and if selecting the indicator of per tonne landed, then this data is also required. The estimation of MEY requires the construction of bioeconomic models3 (p.20). MEY seeks to identify in yields and effort levels that are less than the maximum sustainable yield (MSY[17]) and maintains stock levels greater than MSY (Dichmont et al. 2010,p.1). Identifying MEY requires the development of models to map the interaction of stocks, costs, and

[17] MSY is defined as "Maximum sustainable yield refers to the maximum use that a renewable resource can sustain without impairing its renewability through natural growth or replenishment." Source: Glossary of Environment Statistics, Studies in Methods, Series F, No. 67, United Nations, New York, 1997. http://stats.oecd.org/glossary/detail.asp?ID=3075

prices into account, therefore requiring this input data. A set of assumptions is inherent to construct the models, covering changes in fish stock size over time; bycatch, and fleet dynamics, and there is a need for detailed economic data (in the form of fuel and fish product price), and these assumptions must also be confirmed in relation to the constancy of prices and costs over time.

How is the indicator analysed and interpreted?

The objective is to have the maximum level of profit from the minimum effort, but most importantly while maintaining a sustainable biomass. Therefore this objective and subsequently the indicators have to be based on a clear annunciation of the sustainability limits of the fishery, and therefore the maximum catch rates that profitability is centred around. In this context, the higher the profit in relation to the effort or yield, the better the outcome.

Examples of indicator implementation:

The Northern Prawn Trawl Fishery in Australia is one of the few examples of implementing a measure of sustainable economic yield using MEY in a multispecies fishery. Full details of the implementation of an assessment of MEY, the issues and outcomes are detailed in Dichmont et.al.(2010), which could then be used to apply to the fishery. For example, using the data given by Dichmont et.al (2010,p.4) where no effort constraints were applied the Endeavour Prawn fishery generated 837 ton of product at '*x*'[18] profit per ton landed, then this should be compared to the profit per ton landed of fish that has been achieved. If the profit achieved is the same or higher than '*x*' but the tonnage landed is the same or lower than 837, then a good sustainable economic yield has been achieved.

Decision Triggers and Management responses:

Triggers for changes in management decisions would be where profits are decreasing but effort or tonnage is increasing – this indicates an erosion of the biomass and ecosystem stability for no economic gain. In such a case effort limits or constraints might be considered to reduce take. Similarly the industry and management would have to examine how to improve efficiency in terms of costs savings in operations to address profit where greater prices could not be demanded.

Similarly, where profit levels were improving relative to tons landed or days fished (i.e. these were remaining stable or decreasing) the indication is that the fishery is being managed responsibly and sustainably.

[18] '*x*' is an agreed figure based on the assumptions inherent in the methodology.

Sub component: Income

What is this Operational Objective?

The objective is to improve economic performance of the fishery.

What is the indicator(s)?

The suggested indicator is net economic return (NER[19]) for the fishery, which identifies and tracks the trends in profits as a proportion of total revenue.

Why is it estimated?

This indicator facilitates identifying if the return on effort in the fishery is increasing/decreasing or remaining stable, which assists in estimating the viability of the industry and the state of its development. From the perspective of human wellbeing, the state of profit identifies the contribution of the industry to community wellbeing and its likely future contribution, which is identified where time series or trend data is available.

What data and/or information are needed?

Two figures for a fishery are required – total revenue and profit – in order to identify the net economic return to the fishery.

How is the indicator analysed and interpreted?

The objective is to have a stable or preferably increasing net economic return to the fishery over time. In the first instance, the objective is to establish that a fishery has a positive net economic return.

Examples of indicator implementation:

The Southern and eastern Scalefish and shark (commonwealth) fishery (SESSF) in Australia provides a good example of how this indicator was employed to track the performance of the fishery and trigger management change. In 2005/06 NER figures identified a 40% decline since 2001, with revenues falling faster than costs, resulting in a zero to negative NER for the five year period. Full details of utilisation of this indicator with graphs are detailed in Vieira et.al. (2010,p.51-52)[20].

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[19] NER are the long-term profits earned from a fishery after all costs have been met, including fuel, crew costs, repairs, the opportunity cost of family and owner labour (where a family member or owner has not been paid a market wage), fishery management costs, depreciation and the opportunity cost of capital. Opportunity costs simply refer to the foregone returns that could have been earned had an input been put to its next best alternative use. Vieira, S. and Perks C., 2009, *Australian fisheries surveys report 2009: Survey results for selected fisheries, 2006-07 and 2007-08,* preliminary estimates for 2008-09, ABARE report to the Fisheries Resources Research Fund, Canberra, October.

[20] http://www.abare.gov.au/publications_html/fisheries/fisheries_10/fisheries%20adjustment.pdf

Decision Triggers and Management responses:

Information on Net Economic Return to a fishery allows identification of the relative benefit as a result for effort expended in a fishery. While this has obvious management benefits in the ecological area of identifying level and trends of net economic returns which, if decreasing, may indicate that effort is too high; from a human wellbeing perspective it is essential to determine if the fishery is being managed to be profitable and beneficial to the community. Zero to negative net economic returns will be undermining the resilience and viability of the industry and by extension its associated community. Therefore such an outcome is a trigger to review management arrangements, whether that is in the areas of, total allowable effort; access costs or subsidies etc.

Sub component: Industry compliance costs

What is this Operational Objective?

The objective is to minimise the costs associated with the industry and undertaking fishing.

What is the indicator(s)?

The suggested indicators include trends in annual industry compliance costs (fees, licences, gear requirements etc – often termed 'other' in fisheries statistics); and/ or the actual costs of fisheries management relative to the profit of the fishery.

Why is it estimated?

These indicators assist in identifying if compliance and management costs are a major factor in the viability of the fishery. From the perspective of human wellbeing, the compliance costs are an indicator which provides greater clarity as to the issues that may be affecting profitability and therefore quality of life for fishers.

What data and/or information are needed?

Data is required in regard to compliance costs, total profit and management costs of a specific fishery.

How is the indicator analysed and interpreted?

The indicator of compliance costs (or 'other costs') for the fishery is tracked to identify if it is increasing, stable or decreasing, and can also be interpreted relative to the percentage of total operating costs that it represents, where it ideally it would be stable or decreasing. Similarly management costs can be tracked to identify the relative component this comprises of net economic return of the industry, with the objective being to have a stable or preferably decreasing level of management costs relative to the profit return.

Examples of indicator implementation:

The Australian Commonwealth Trawl Fishery provides a good example of how this indicator can be employed to track the impact of these costs on the overall performance of a fishery (Vieira et al. 2010,p.54). Between 2005 and 2008 the overall other operating costs of the fishery declined 39% in the period, from $AUD 18.2 million to $AUD11 million. This would be seen as a positive shift for the fishery allowing it to be more viable and profitable. By comparison, however the management costs increased 50% over the period. However, this was explained by the restructuring of the fishery in 2004, with subsequently increasing management costs, that by 2008 had begun to decline again. However when examined in the context of the net economic return of the fishery during the period management costs went from 63% to 34.5% during the period, indicating that the initial effort post the restructure was transient and the outcomes both for fishers and management were positive.

Decision Triggers and Management responses:

Identifying the impact and changes in that of fishery management and compliance costs for fishers contributes to understanding the source of pressures on fishers and the viability of the fishery. Increasing compliance costs relative to returns for fishers will decrease the viability of the occupation, and will therefore have effects on the community welfare not only of fishers but also their communities. If the costs to manage a fishery become too high relative to the community benefit being gained from it, then this would be a trigger to re-evaluate management structures and the fishery overall.

Sub component: Effort and Catch

What is this Operational Objective?

The objective is to improve productivity.

What is the indicator(s)?

The suggested indicator is Catch per Unit of Effort (CPUE), which can be expressed as boat days (or number of days fished); fishing time (hours) or area fished. For the purposes of managing an ecosystem it is suggested that using catch per unit of area fished is the most appropriate to monitor productivity relative to the ecosystem.

Note: It would be essential to consider this indicator in conjunction with achieving profitability in a sustainable context, to ensure productivity is not achieved at the cost of the biomass.

Why is it estimated?

This indicator tracks the level and changes (if any) in productivity of an area of a whole or part of a fishery and can very readily be applied to an ecosystem context. From the perspective of community wellbeing, the productivity of an ecosystem has a direct effect on the quality of life for fishers, and by extension the broader community in regard to both food source and economic benefits.

What data and/or information are needed?

The data required includes: the catch per number of days fished (or other time component) in a designated area. This can then be graphed for a particular area or ecosystem, with tons per day expressed on the vertical axis with time on the horizontal axis.

How is the indicator analysed and interpreted?

The indicator of catch per unit of effort is analysed by the movement in catch rate per unit of fishing (days/hours) fished over a period of time. The objective is to see that the catch rate is stable or increasing per unit of time fished, not decreasing.

Examples of indicator implementation:

The Australian Commonwealth Northern Prawn Trawl Fishery also provides a good example of how this indicator can be employed to track the movement in productivity, particularly in relation to a management change(Vieira et al. 2010,p.29). In this case the CPUE was calculated by dividing the catch of the key species in the fishery, by the total amount of boat days reported for the fishery. This particular fishery underwent a buyback of licences in 2006/07 and the CPUE data identified that while the buyback did result in a reduction of catch it was disproportionate to the reduction in effort – that is reduction in effort (boat days) was 11% but the reduction in catch was 33%.

Decision Triggers and Management responses:

Identifying the level and changes in CPUE is one valuable tool for management to track the likely health of an ecosystem, and also the viability of a fishery. Declining CPUE would be a trigger for a management review. Or in the case of the Northern Prawn Trawl a trigger to investigate other causes (than effort) for declines in catch rates. The human wellbeing benefit of such an indicator and objective is to ensure the ability to proactively manage the fishery to the benefit of both the ecosystem and fishers.

Sub component: Employment

What is this Operational Objective?

The objective is to maintain (or maximise) employment in the ecosystem fishery.

What is the indicator(s)?

The suggested indicator is the proportion of full time crew in relation to annual total employed. However it is also possible to use number of full time crew (or equivalents).

Why is it estimated?

This indicator tracks the level and changes (if any) in employment, and is directly related to the community wellbeing benefit derived from the industry, and the extended economic benefit that employment generates in a community.

What data and/or information are needed?

Commonly data collected on employment is represented as full time equivalent employees which may consistent of multiple part time or casual employees (full time crew or equivalents). However in communities where the seasonal fluctuation of fishing is an important component of the community and its lifestyle, monitoring full time crew as a proportion of total annual employed, if it is possible to collect this data, is a very useful means to identify the nature of employment in a fishery industry in relation to a particular ecosystem. In order to provide context, overall regional total employment or total regional employment by industry sector is also recommended.

How is the indicator analysed and interpreted?

The indicator of employment is simply analysed at three levels where the data is available. To identify the level of employment relative to overall employment in the regional community; to identify changes of the level in full time (or equivalents) employment in the fishery); and the structure of full time compared to seasonal employment for the fishery. In the instance of the first, high and/or increasing levels of employment in a fishery regionally (or nationally) indicate greater resource dependency and increase vulnerability to shocks or changes to the system. The level of employment in the fishing industry alone should be assessed in relation to the level of profitability and productivity and changes in those levels should be viewed in the context of the other two indicators. Changes in the component of full time employment

compared to seasonal or casual employment should be interpreted in the context of management and access arrangements and the need to consider other economic activities in the community that may be dependent on a part time or casual workforce.

Examples of indicator implementation:

A crude example of this for coastal Thailand would be that in 1995 the reported population figure of those living within 10km of the coastline was 7,740,000; of those, 354,495 (or 4.5%) were employed in commercial and subsistence fishing (including aquaculture)[21].

Decision Triggers and Management responses:

Shifts in the ratios of employment in fishing compared to broader employment contrary to economic objectives of a region or nation would be a trigger to review the management of a fishery. Equally, changes in regional fulltime and part time (or casual) employment in a fishery contrary to demand would be a trigger to review the broader economic climate of the industry and the effect it may have on the future viability of the fishery.

Sub component: Fisher lifestyle

What is this Operational Objective?

The objective is to consider the lifestyle of fishers with the outcome of maintaining or enhancing the lifestyle.

What is the indicator(s)?

The suggested indicators include levels of family fishing income; security of fishing rights and/or the average age of fishers.

Why is it estimated?

These indicators are 'proxies' for assessing the lifestyle circumstances of fishers. Family fishing income is aimed at assessing the contribution of fishing to the overall lifestyle of fishers and their families; security of fishing rights is assessing the level of stress and future security that fishers can expect; while the average age of fishers is a crude proxy for the attractiveness of the industry and lifestyle to potential entrants to the fishery.

[21] Source: World Resources Institute: EarthTrends, The Environmental Information Portal http://earthtrends.wri.org/searchable_db/index.php?theme=1&variable_ID=54&action=select_countries

What data and/or information are needed?

The data required will be dependent on the indicator utilised. Based on the indicators identified above, the data required will be either; family income derived from fishing; security of fishing access in terms of licence longevity/tenure; or average fisher age.

How is the indicator analysed and interpreted?

The indicator of family fishing income would be analysed in the context of the higher the component of family income derived from fishing the higher the level of importance that fishing is to the lifestyle of that fisher and their family. In regard to the security of fishing access – this is would be qualitatively assessed in terms of the level of security of the access – it is legislated and therefore relatively secure or open access with no licence or access arrangements that could quickly be reversed and therefore very insecure? Low levels of security are detrimental to both fisher lifestyle and therefore the security of the industry and equally changes in levels of security of access should be viewed in that light that generally lower security is detrimental to the industry and it associated community – both economically and socially. Lastly, an older than the community work age average, or an increasing average age of fishers indicates an ageing workforce in the industry and a lack of enticement for young entrants, which is again detrimental to the longevity of the industry and the welfare of those currently employed in it.

Examples of indicator implementation:

The Marinescale fishery in South Australia underwent a social and economic assessment in 2007. The data from that work indicated that the average age of fishers was 49 years compared to the regional average of 39 years according to the 2006 census (Hundloe et al. 2011,p.113).

Decision Triggers and Management responses:

Changes in the quality of lifestyle that fishing contributes to or engenders are flags for the management of a fishery in terms of the costs of entering the fishery; enticing new entrants to the fishery; the costs of operating in a fishery and long term security, if it is to be a viable industry. These indicators will also be influenced by profitability, employment, income and productivity factors as well.

Sub component: Conflict Minimisation

What is this Operational Objective?

The objective is to minimise the conflict that may arise in a fishery through management arrangements.

What is the indicator(s)?

The suggested indicators are qualitative and include the consideration of and measures for conflict minimisation in management plans through the acknowledgement of and provision for conflict management

and resolution in management plans; and /or the level of equity in access arrangements across operators in the fishery (a proxy for which can be the level of fisher engagement with access arrangements and conflict resolution plans).

Why is it estimated?

These indicators measure the level of potential conflict in a fishery, which could erode efficient operation and productivity of the industry and therefore the economic benefit to be derived from the resource.

What data and/or information are needed?

The data required will be dependent on the indicator utilised. Based on the indicators identified above, the data required will be the fishery management plan development and formalisation processes and qualitative assessments as to the level of engagement entailed in the plans.

How is the indicator analysed and interpreted?

The indicator of fisher engagement in a management plan development or review, can be analysed and evaluated to have not occurred/occurred adequately/ or right through to the level of co-management where the fishers take a high level of responsibility for management of the fishery and therefore any conflict that may arise out of the management arrangements. Alternatively it may be analysed through assessment of the existence and level of comprehensiveness of conflict resolution arrangements in management plans.

Examples of indicator implementation:

An example of implementing this indicator would hypothetically be the review of a management plan to quantitatively identify if a) there is any acknowledgement of potential conflict and if so between which parties; and b) if any conflict resolution arrangements exist in the management plan. The qualitative assessment of the existence of these elements would be in the detail that these elements are considered and actions identified to mediate conflict, from 'not at all', to 'existing', to 'considered and extensively catered for'.

Decision Triggers and Management responses:

Ideally this indicator will alert management to the need to address this issue prior to conflict occurring over access or other issues. Assessment of this objective via the indicators will trigger any possible requirement to implement or improve arrangements to minimise potential conflict in the fishery.

Sub component: Management Stability

What is this Operational Objective?

The objective is to maximise the effectiveness of management change through strategic and stable management.

What is the indicator(s)?

The suggested indicator is quantitative in terms of monitoring the number of management changes in a set period (i.e. the last year) and also the effective achievement of the intended outcomes from any changes implemented.

Why is it estimated?

These indicators measure the stability of the management and also how effective change is. In this context, it is important to also acknowledge that both too much and too little change can be detrimental to the stability and viability of a fishery. Consequently a focus is recommended on assessing not only the amount of change but the degree of effectiveness of change. The limitation with this indicator is that it does not asses a lack of management change that may in fact be required.

What data and/or information are needed?

The data required will be the fishery management plans, changes to it in a twelve month period; the objective of those changes; measures and assessments of the effectiveness of those changes.

How is the indicator analysed and interpreted?

The indicator of management change is both a quantitative and qualitative analysis. Quantitatively, the number of management changes can be recorded, while the analysis of the effectiveness of those changes may be either quantitative or qualitative dependent upon the change undertaken. The interpretation of both the number of changes and effectiveness is seeking to identify the least number of changes for the most effective implementation of management plans.

Examples of indicator implementation:

An example of implementing this indicator would hypothetically be the review of a fishery management plan to document a) the number of changes that have been implemented in the previous twelve months to the fishery management arrangements; b) what assessments of those changes, if any, were put in place; and c) on the basis of those assessment arrangements, how effective had the management change been in achieving the stated outcome. In many cases the last component will be able to be assessed quantitatively – i.e. levels of health and safety in the fishery have improved, stabilised, decreased/ catch rates have improved, stabilised, decreased by *x*% - however it may be a qualitative assessment of the effectiveness (such as fisher satisfaction; or engagement). In this last instance, these factors may be scored on a rating scale of 0 to 3 or 5, in order to come to a conclusion as to the level of achievement in relation to the objective of the change.

Decision Triggers and Management responses:

Ideally this indicator will alert management to any need to review practices to ensure that all management change should be effective, and to address areas where management changes have been ineffective and repetition of the use of such measures can be avoided in the future. Equally, excessive management changes without substantively positive outcomes should alert management to the destabilising influence such activities are likely to have on fishers and the industry, and therefore the longer term viability of the industry.

Sub component: Health and Safety

What is this Operational Objective?

The objective is to improve the occupational health and safety of the fishing industry.

What is the indicator(s)?

Suggested indicators include a quantitative assessment of the rates of fatal and non fatal injuries in a fishing industry; or a qualitative assessment of the development and implementation of health and safety standards for the industry.

Why is it estimated?

These indicators measure the actual and potential safety levels of the industry. In nation states where data is reliably collected on health and safety issues, it is most commonly on the basis of legislated standards of industry behaviour in the area of OH&S. However in nations where this may not be the case, the alternative is to assess the level of development and adoption of OH&S standards in an industry. Keeping an industry's workforce safe and healthy is both fundamental to the stability of the industry, but also has the added benefit of lessening the potential health care impost on the broader community by preventing industry generated injuries or fatalities.

What data and/or information are needed?

The data required will be either statistics on fishing industry fatal and non fatal incidents; or the existence of OHS standards and levels of implementation.

How is the indicator analysed and interpreted?

In the case of statistical data, the analysis is quantitative and is looking for the trend in injury rates; that they should be stable or decreasing. Alternatively, if the indicator is the existence and adoption of OH&S standards, the analysis will be quantitative in regard to the existence of them, and qualitative in terms of the adoption and implementation of them. As with the effectiveness of management changes, the level of adoption of OHS standards may be scored on a rating scale of 0 to 3 or 5, in order to come to a conclusion as to the level of adoption.

Examples of indicator implementation:

An example of implementing the indicator of statistical analysis of incident rates is demonstrated in the report 'Health and Safety in the Australian Fishing Industry'(Brooks 2011). This identified that although the incidence of fatal claims in the commercial fishing industry had fallen in the period from 1998 to 2008, the incidence rate of non fatal claims had increased in the same period (Ibid p.40-42).

Decision Triggers and Management responses:

Although implementing health and safety in the fishing industry may not be a direct concern to the management, it is a national concern in terms of both the long term viability of the industry in regard to maintaining a healthy labour force and attracting participants. Findings identifying declining levels of OH&S or lack of OH&S standards may be a trigger for management or other government agencies to work with the industry to address the issue.

6.2 Component/Sub (Sub) Component Implementation: Community Wellbeing – Associated Community

Sub component: Community Social Profile

What is this Operational Objective?

The objective is to monitor community demographics in order to understand the strengths and weakness inherent in the structure of a community in the context of a particular resource use.

What is the indicator(s)?

Suggested indicators include monitoring of censes population data, including total population, age structure, employment in fishing and other marine industries; gender ratios; youth and aged dependency and net migration, within a specified region, which would usually be in this case associated with use of a marine ecosystem. For example a regional community that is a bounded local government region for which population statistics (demographics) are regularly collected.

Why is it estimated?

These indicators measure the status and trends in population profiles or structures. Understanding these assist in identifying either potential effects of ecosystem management and resultant population changes due to ecosystem access; or alternatively and perhaps more commonly it can be used to identify resilient or vulnerable communities to changes in resource access. For example, where there is a high youth dependency ratio in a community which also has high employment in commercial fishing, the closure of access to fishing areas may result in the movement of families out of a region and consequent removal of children from schools and potential a contraction of education provision in a region as an effect of resource access change.

What data and/or information are needed?

The data required will be population statistics gathered on a specified geographical basis.

How is the indicator analysed and interpreted?

GIS mapping of fisheries spatial data has extensively been used in fisheries management [22], and this methodology can just as easily be utilised to graphically identify population profiles (status and trends) utilising population statistical data. The data can be more easily interpreted using GIS mapping to represent vulnerable areas undertaken by analysis is quantitative and is looking for the trend in injury rates; that they should be stable or decreasing. Alternatively, if the indicator is the existence and adoption of OH&S standards, the analysis will be quantitative in regard to the existence of them, and qualitative in terms of the adoption and implementation of them. As with the effectiveness of management changes, the level of adoption of OHS standards may be scored on a rating scale of 0 to 3 or 5, in order to come to a conclusion as to the level of adoption.

Examples of indicator implementation:

An example of implementing the indicator of statistical analysis of population community profiles is the Australian Department of Agriculture, Fisheries and Forestry in the development of Marine Matters (*'Marine Matters, Atlas of Australian Marine Fishing and Coastal Communities'*, 2006) and its online companion tool [23]. This is regularly used by the Australian Fisheries Management Authority and the Australian federal government to guide marine access decisions in regard to commercial fishing, conservation, and general resource use.

Decision Triggers and Management responses:

Decision triggers around access arrangements may occur where an increase in population numbers employed in commercial fishing are occurring in a particular region. This may result in increased pressure on the resource and prompt a review of access arrangements and licence availability. Alternatively, where high levels of commercial fishing employment already exist, which are associated with high levels of overall youth and aged dependency, any decrease in commercial fishing access may have large impacts on the viability of the community and cause excessive social stress in regard to unemployment, family dislocation etc., and any access changes in management would have to be considered in the light of the potential accompanying mitigation measures that would be appropriate.

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[22] St.Martin,K., 2004, *GIS in Marine Fisheries Science and Decision-Making*, *W. L. Fisher and F. J. Rahel eds. (American Fisheries Society), pp. 237-258.* http://ioc3.unesco.org/marinesp/files/GIS%20in%20Science%20and%20Decision%20Making.pdf

[23] *PILOT - Atlas of Australian Marine Fishing and Coastal Communities* http://adl.brs.gov.au/mapserv/fishcoast/index.html accessed via http://www.daff.gov.au/brs/fisheries-marine/publications/atlas-fishing

Sub component: Community Consultation

What is this Operational Objective?

The objective is to engage, or increase the engagement of, the community in the stewardship of the resource through active consultation and discussion of management options with ecosystem associated communities.

What is the indicator(s)?

Consultation is a process whereby advice is given or procured; or information is discussed and exchanged. To maximise the opportunities to engage communities in resource stewardship the approach of 'information exchange' in a forum of ongoing dialogue is the most effective. Community consultation can take many forms, including; calls for submissions, community meetings; workshops; focus groups; and individual interviews; and the ongoing dialogue can involved one on one or group meetings, or after a level of understanding between the participants has been reached, email, mail, or online forums can also be used to exchange data and information on resource management use, and changes. The methods used will be dependent upon the complexity of the issues at hand, the general political climate, the technology available to a community, their familiarity with and access to it.

Consequently, indicators of community consultation include; the number of community meetings (workshops/focus groups/interviews etc) held and attendance levels or participant rates; submissions received; or the level (demonstrated as a percentage) of community participation in management committees.

Why is it estimated?

These indicators measure both the *opportunity* provided for communities to engage with resource management decision process (and thereby be aware of the issues at hand with ecosystem management and their potential impact on it) and the *level of engagement* undertaken or achieved. The reasons for monitoring this component of the fishery is twofold; the first being increase community awareness of the issues and engage them actively with the management process to achieve the best outcomes for all (eco and social systems); and secondly it has the added benefit of potentially decreasing conflict that may otherwise occur as a result of misinformation or marginalisation, thereby decreasing the transaction costs of resource management.

What data and/or information are needed?

The data required will be information on methods of consultation employed and the levels of participation or response.

How is the indicator analysed and interpreted?

Quantitative analysis can be undertaken on the basis of both the opportunity that is afforded the general community to engage with management decision making processes; and then of complexity of the level of engagement that consequently occurred (i.e. submissions through to one on one interviews). Further analysis

can also be undertaken as to the quality of that engagement, though assessment of the complexity of interaction that occurred; ongoing participation; or levels of satisfaction of all parties involved in the outcomes of the consultation process. The objective is to provide a report of both the opportunity that exists for the community to be consulted (yes/no) and the level of that (highly involved/minimal involvement) and then the quality of that engagement.

Examples of indicator implementation:

An example of implementing an indicator of community consultation is provided by the Australian state of Queensland's department of Primary Industry and Fisheries. As part of the Queensland's Fishery Strategy 2009 – 2014, this department undertook community consultation in the Burdekin region (

Appendix 1: on the issues of 'amending, reducing or introducing commercial netting closures in the region. The process involved submissions and on line feedback to community and allowed the community to post further comments on both the outcomes and the process.

Decision Triggers and Management responses:

Community consultation can be used in management to trigger a decision to either proceed with or identify an alternative course of action based on community feedback in relation to management proposals or ecosystem issues. It may identify that different management responses are required to achieve community engagement with or support of a particular approach and would provide information on the reasons why. Most importantly, it consultation can have the benefit of increasing the effectiveness of management actions through community support and potentially even enforcement of particular management responses to ecosystem issues.

Sub component: Resource Dependency

What is this Operational Objective?

The objective is to identify and monitor levels of community dependency on the resources of associated ecosystems.

What is the indicator(s)?

The indicator suggested is that of the economic contribution provided to the community from ecosystem reliant industries – in this instance, commercial fishing. It is an economic measure of the proportion of regional income contributed by an industry to a regional community.

Why is it estimated?

Assessing the economic contribution of and thereby the resource dependency on an ecosystem, identifies the level of vulnerability the community may be exposed to in relation to management changes to resource access, and may be used to assess the relative merit of alternative management options.

What data and/or information are needed?

The data required will be information on both regional income and income generated from specifically commercial fishing activity, for both the region and can also be analysed at the level of the average individual.

How is the indicator analysed and interpreted?

Quantitative analysis of the data can identify in the first instance the percentage of contribution that commercial fishing makes to the regional economy, and secondly, with trend data if that is increasing or declining, which can be compared with changes in management arrangements. Alternatively where data is available at the level of the average individual, it can be assessed to shed light on the contribution that the industry makes to individual's and their families welfare and quality of life, compared to individuals in other industries in the region, and therefore the potential impact on the region overall in terms of economic welfare.

Examples of indicator implementation:

An example of implementing this indicator of resource dependency is presented by a United Nations Project which looks at the regional resource dependency on Danish Fisheries and allied industries (2004). Through assessment of regional income by industry data, linked with fish price data, it identifies that "fish price increases due to outside effects it can be shown to cause a reduction of the production and under certain conditions a welfare loss to the community"(Ibid, p.22) .

Decision Triggers and Management responses:

Where this measure of contribution to the community identifies a decreasing economic contribution of commercial fishing to the overall region, it acts as a trigger to review fisheries management to identify if the effect is in fact an intended or unintended consequence of some action. Or alternatively, if it is due to some external factor, it may be a trigger to review the management arrangements to assess if the opportunity exists to increase the contribution of fishing to the regional economy to offset external factors.

Sub component: Contribution to Social Capital

What is this Operational Objective?

The objective is to track mutually beneficial relationship networks between the industry and community, which are thereby of benefit to the overall regional community.

What is the indicator(s)?

The indicator suggested is the existence of regional lending and/or finance co-operatives that explicitly deal with the commercial fishing sector.

Why is it estimated?

Assessing the existence of networks that support the industry to the benefit of the overall region, identifies a level of interdependence that can positively benefit the community through facilitating growth and inter

community support, increasing the resilience of the industry and its associated community to withstand shocks and changes in circumstance.

What data and/or information are needed?

The data required will be quantitative data on the number of financial cooperatives in a region, the level of membership they have, and the amount of interaction these have with the commercial fishing sector. Qualitative data could also be sought on the nature of the lending arrangements in regard to the relative interest rates/ repayment schedules etc, to evaluate levels of cooperation or alternatively any advantage that may be being taken of the industry in the absence of alternative funding sources.

How is the indicator analysed and interpreted?

Despite the contestable nature of social capital indicators discussed earlier in this text, the indicators suggested here are to be interpreted in a the context of how active lending organisations are and to what extent they bring individuals in the community (from diverse industries) in contact with one another, hence building social capital. Further the existence, level of activity, and nature of that activity can indicate the potential additional resilience a community may have through this network to withstand changes in circumstance that financing may be able to mitigate.

Examples of indicator implementation:

At this time it was not possible to identify an existing example where this indicator has been employed .

Decision Triggers and Management responses:

Where strong social capital is identified between the industry and associated community, it underlines for management the fact that the industry plays an important role in the community. If this level of social capital is weak, it may trigger a management response to attempt to provide circumstances that may facilitate industry strengthening its social capital, or alternatively it may point to the fact that the industry has little interaction with the regional community and that contraction of the industry may not necessarily be detrimental to the regional community.

It must be noted that this indicator should be assessed by management in the context of the indicators of other associated and fishing specific community sub components.

Sub component: Health and Safety

(Note: The details of this component are the same as detailed in Section 6.1 for fishing industry communities, but are used here in the context of the flow on benefits to be derived by the industry's associated communities**)**

What is this Operational Objective?

The objective is to improve the occupational health and safety of the fishing industry to the benefit of the regional associated community.

What is the indicator(s)?

Suggested indicators include a quantitative assessment of the rates of fatal and non fatal injuries in a fishing industry; or a qualitative assessment of the development and implementation of health and safety standards for the industry.

Why is it estimated?

These indicators measure the actual and potential safety levels of the industry. In nation states where data is reliably collected on health and safety issues, it is most commonly on the basis of legislated standards of industry behaviour in the area of OH&S. However in nations where this may not be the case, the alternative is to assess the level of development and adoption of OH&S standards in an industry. While keeping an industry's workforce safe and healthy is fundamental to the stability of the industry, it has the associated regional community benefit of lessening the potential health care impost on the broader community by preventing industry generated injuries or fatalities. Additionally, where fishing provides seasonal employment, increasing the health and safety of industry employment will have the benefit of preserving this labour force for off season other industry employment in the community.

What data and/or information are needed?

The data required will be either statistics on fishing industry fatal and non fatal incidents; or the existence of OHS standards and levels of implementation.

How is the indicator analysed and interpreted?

In the case of statistical data, the analysis is quantitative and is looking for the trend in injury rates; that they should be stable or decreasing. Alternatively, if the indicator is the existence and adoption of OH&S standards, the analysis will be quantitative in regard to the existence of them, and qualitative in terms of the adoption and implementation of them. As with the effectiveness of management changes, the level of adoption of OHS standards may be scored on a rating scale of 0 to 3 or 5, in order to come to a conclusion as to the level of adoption.

Examples of indicator implementation:

An example of implementing the indicator of statistical analysis of incident rates is demonstrated in the report 'Health and Safety in the Australian Fishing Industry'(Brooks 2011). This identified that although the incidence of fatal claims in the commercial fishing industry had fallen in the period from 1998 to 2008, the incidence rate of non fatal claims had increased in the same period (Ibid p.40-42).

Decision Triggers and Management responses:

Although implementing health and safety in the fishing industry may not be a direct concern to the management, it is a national concern in terms of both the long term viability of the industry in regard to maintaining a healthy labour force and attracting participants. Findings identifying declining levels of OH&S or lack of OH&S standards may be a trigger for management or other government agencies to work with the industry to address the issue.

6.3 Component/Sub (Sub) Component Implementation: Community Wellbeing – National Community

Sub component: Food Source

What is this Operational Objective?

The objective is ensuring the provision of protein for human consumption.

What is the indicator(s)?

The indicator suggested is the level of protein for human consumption that is sourced from seafood.

Why is it estimated?

Seafood provides an important alternative source of protein for the world's population, and more so in some nations than others, where it may be the staple source of protein. To identify the contribution seafood is making to human protein consumption is an important indicator of commercial fishing's contribution to a nation's welfare.

What data and/or information are needed?

The data required is the percentage of protein for human consumption that is provided by seafood. This can be sources from the Food and Agriculture Organisation (refer Footnote: 15).

How is the indicator analysed and interpreted?

The data provided can be analysed both at a static point in time, to assess the level of seafood contribution to human protein consumption, and also as a time series, to identify the trend of seafood contribution to human protein sources.

Examples of indicator implementation:

While it is regularly monitored and the data ostensibly referenced regularly by government agencies, examples of its use could not be clearly and explicitly identified at this time.

Decision Triggers and Management responses:

Where levels of protein sourced from seafood are identified as declining in a nation, it would be a trigger for government to identify if protein levels overall were declining, and therefore some mitigation measures need to be put in place to offset decreased protein consumption, or alter resource management plans to increase the availability of fish, animal and legume proteins. From a fishery management perspective, decreases in seafood protein for human consumption, may be a reference point to the effectiveness or otherwise of management arrangements.

Sub component: Community Development

What is this Operational Objective?

The objective is to maintain or improve community development.

What is the indicator(s)?

The indicator suggested is the relative change in the Human Development Index (HDI; refer to footnote: 16).

Why is it estimated?

Changes in the Index of Human Development provide both information on national trends of development as measured by a global benchmark, but also provide a globally relative reference point in regard to the development of a nation, and the welfare it is affording its communities.

What data and/or information are needed?

The data required includes; life expectancy, education levels; mean and expected years of schooling; and income. Details on HDI's for specific regions are detailed at: http://hdr.undp.org/en/data/build/

How is the indicator analysed and interpreted?

The data provided can be analysed both at a static point in time, to assess the level of development for a nation, and also as a time series, to identify the trend of development both within the nation and in comparison to other nations to assess the relative success of development programs from the national perspective.

Examples of indicator implementation:

While it is regularly monitored and the data ostensibly referenced regularly by government agencies, examples of its use could not be clearly and explicitly identified at this time.

Decision Triggers and Management responses:

Where the Development Index are identified as declining in a nation, it would be a trigger for government to review policies and programs in relation to development, to identify points of weakness or opportunity for

improvement. This particular indicator is a very high level one and has little direct relevance from a fishery management perspective in terms of direct actions that could be taken to affect it.

6.4 Summary

Although there are a number of suggestions in the preceding boxes, the selection of specific indicator (or adaptation of the suggested ones) and the analysis and interpretation, along with management triggers and actions would need to be developed in the context of the specific ecosystem and fishery, and the policies of the nation state in which the assessment was occurring. However the sub components and operational objectives should still stand. Some examples of these are provided in Appendices 2 (p.87) and 3 (p.89).

7.0 Conclusion

The focus of this analysis of the human wellbeing aspects of EAF has been on the benefits that can be derived and valuing of ecosystems that can occur from EAF management. With that focus it has reviewed previously discussed and developed approaches to management that have contributed to the development of EAF and where EAF is situated in that suite of theories and approaches. Human wellbeing is universally identified as an essential element in ecosystem approaches to management, due to the need for humans to be able (through the meeting of their basic needs) to have greater engagement with issues beyond sustenance, and to engage with environmental issues. From that it further identified that the ESD hierarchical tree framework was the most appropriate around which to develop an ESD approach for assessment of community wellbeing. The discussion subsequently developed around the three elements identified in the hierarchical tree of, ecosystem dependent fishing industry community; associated communities, and the broader national community. These three are inextricably intertwined and interdependent, drawing on the requirement for an integrated management approach.

In relation to the previous literature on identifying objectives for the management of these concepts of human wellbeing in fisheries management, the discussion identified variation in the depth of previous work into the elements of human wellbeing. In some components of human wellbeing there were many instruments and indicators, both quantitative and qualitative, identified for the assessment of the status of components. However in others, while conceptual information is available and broadly discussed and agreed, little work has been undertaken into the development of specific operational objectives and associated indicators. Further to this, and in the context of the FAO EAF-Nansen project, many objectives and indicators that have been developed have been undertaken at a localised level, the specificity of which disallowing the scaling up to the multinational focus and comparison required for this project.

This work then turned to selecting from the literature review those operational objectives and indicators that could be applied to the conceptual objectives (Ecosystem dependent communities and National Community) and Components (Ecosystem fishery communities; associated communities and national community). Aligned with these indicators,

monitoring actions have been suggested, along with measurement scales. In the selection and development of these, cognisance was taken of the overriding requirement to provide standardised and repeatable assessments of performance on the basis of these operational objectives that suited the scope of the FAO EAF-Nansen project. As with the assessment of governance in EAF, this approach also highlights the importance of the capacity to, and the importance of, assessing management arrangements contributions to human wellbeing, against the need to address policy imperatives. The inclusion of explicit human wellbeing objectives in management goes beyond a purely functionalist approach to management implementation and confronts many traditional individualist paradigms.

It is important to note that, despite the best intentions to maximise human wellbeing in the implementation of EAF management, many exogenous factors will influence the success of such programs. These will include, as with governance, national priorities, regional commitments and international obligations that affect policies with implications for ecosystem management and the people utilising its resources. While an emphasis on the performance of human wellbeing factors in EAF can provide a more holistic outcome orientated approach to the achievement of results, these must always be viewed in the equally holistic context of the unmanageable external factors that will inevitably influence those outcomes at times. However, the mere process of engaging with the conceptual and operational objectives through the implementation and monitoring of human wellbeing indicators will increase the success of EAF management. This is purely through a raising awareness of the benefits potentially, if not fully, derived from the activity of fishing and utilising the resource in this form, and consequently the increased likelihood of the ecosystem being valued by not only the industry but its associated communities, both regionally and nationally.

The operational goals and indicators identified here for assessing human wellbeing have been selected from the range of work that has previously been undertaken, and will need to be assessed and tested in the specific FAO EAF-Nansen context to ensure the adaptability of the various objectives and indicators across the range of jurisdictions. While, as previously noted, implementing EAF will require extending or developing new capacity in most fisheries agencies and associated stakeholders, it is suggested that the greatest adjustment for the implementation of human wellbeing components will be in the

paradigm shift to a holistic consideration of human wellbeing beyond that of industry economics. However the achievement of this paradigm shift is the key to realising the greatest benefits offered by EAF which is the preservation of our ecosystems and the sustenance they provide, which will be most acutely appreciated by those individuals at the local level to whom, in many cases, the responsibility for fisheries management has fallen.

8.0 References

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(2004). Regional income generation and fisheries sector linkages in a Danish region. IME-SDU, PECHDEV: EU Funded RTD Project QLRT-2000-02277. **Working Paper No. 12**.

Ahmed, M. (2006). Allocation Issues in Marine Environment: Managing Conflicts between Commercial, Artisanal, and Tourism in Tropical Fisheries. Sharing Fish 2006 Conference Esplanade Hotel, Fremantle, Perth, Australia, WA Fisheries.

Allison, E. H. and F. Ellis (2001). "The livelihoods approach and management of small-scale fisheries." Marine Policy **25**(5): 377-388.

Arnason, R., K. Kelleher, et al. (2009). The Sunken Billions: The Economic Justification for Fisheries Reform. Joint publication of the World Bank and the FAO. Washington DC, The World Bank.

Arthur, R., G. Macfadyen, et al. (2011). Regional social and economic impacts of change in fisheries-dependent communities. Socio-economic dependency project, Final Report. E. F. Fund, European Fisheries Fund.

Australian Centre for Corporate Social Responsibility (2011). Upper Hunter Mining Dialogue. Report for NSW Minerals Council. Melbourne, Australian Centre for Corporate Social Responsibility 39.

Barrow, C. J. (2000). Social Impact Assessment: An introduction. London, Arnold.

Bennett, E. and P. Bannerman (2006). The Management of Conflict in Tropical Fisheries (R7334) Final Technical Report. The Management of Conflict in Tropical Fisheries. CEMCARE Fisheries Management Science Programme. Portsmouth, UK, University of Portsmouth.

Bianchi, G. (2006). The Ecosystem Approach to Fisheries in FAO. Implementing an Ecosystem Approach in Fisheries. Bergen, Norway, FAO Fisheries Resources Division.

Bianchi, G. (2008). The concept of ecosystem approach to fisheries in FAO. The ecosystem approach to fisheries. G. Bianchi and H. R. Skjoldal. United Kingdom, CABI Publishing.

Boutilier, R. and I. Thomson (2009). How to measure the Socio-Political Risk in Project. XXVIII Convención Minera Internacional. Veracruz, AIMMGM AC.

Brooks, K. (2009). Rural resilience and Prosperity: the relevance of government and community networks Saarbucken, VDM Verlag.

Brooks, K. (2010a). Scoping social indicators for the aquaculture industry. Armadale, Victoria, KAL Analysis.

Brooks, K. (2010b). "Sustainable development: Social outcomes of structural adjustments in a South Australian fishery." Marine Policy **34**: 671-678.

Brooks, K. (2011). Health and Safety in the Australian Fishing Industry. Canberra, Rural Industries Research and Development Corporation**:** 113.

Brooks, K., J. Marshall, et al. (2010). Integration of Socio-Economic Sustainability Criteria into a Reporting Framework for the Australian Aquaculture Industry. Fisheries Research and Development Corporation Report 2007/010. Canberra, National Aquaculture Council.

Brooks, K., S. Pascoe, et al. (2011). Developing and Testing Social Objectives and Indicators for Fisheries Management (Project in progress). FRDC Project 2010/040. Adelaide, PIRSA.

Campbell, B., J. A. Sayer, et al. (2001) "Assessing the performance of natural resource systems." Conservation Ecology **Volume**, 22 DOI:

Carney, D. (1999). "Approaches to Sustainable Livelihoods for the Rural Poor." ODI Poverty Briefing 2nd January Retrieved 4 April 2011, 2011, from http://www.odi.org.uk/resources/download/2276.pdf.

Chesson, J., H. Clayton, et al. (1999). "Evaluation of fisheries-management systems with respect to sustainable development." ICES Journal of Marine Science **56**(6): 980-984.

Cheung, W. W. L. and U. R. Sumaila (2008). "Trade-offs between conservation and socio-economic objectives in managing a tropical marine ecosystem." Ecological Economics **66**(1): 193-210.

Christie, P., D. L. Fluharty, et al. (2007). "Assessing the feasibility of ecosystem-based fisheries management in tropical contexts." Marine Policy **31**(3): 239-250.

Claytor, R. R. (2000). "Conflict resolution in fisheries management using decision rules: an example using a mixed-stock Atlantic Canadian herring fishery." ICES Journal of Marine Science **57**: 1110-1127.

Corvalan, C., S. Hales, et al. (2005). Ecosystems and human well-being: health synthesis: a report of the Millennium Ecosystem Assessment. Geneva, Switzerland, WHO.

Cox, A. (2000). Cost Recovery in Fisheries Management. The Australian Experience. IIFET 2000 Conference. International Institute of Fisheries Economics and Trade. Oregon USA, Australian Bureau of Resource Economics,. **ABARE Conference Paper 2000.18**.

De Young, C., A. Charles, et al. (2008). Human dimensions of the ecosystem approach to fisheries: an overview of context, concepts, tools and methods. FAO Fisheries Technical Paper. No. 489. Rome, Food and Agricultural Organisation**:** 152.

DeFilippis, J. (2001). "The Myth of Social Capital in Community Development." Housing Policy Debate **12**(4): 781-806.

Department of Human Resources and Skills Development Canada. (2011, 28/07/2011). "Canadians in Context — Aboriginal Population " Indicators of Well-being in Canada Retrieved 29/07/2011, 2011, from http://www4.hrsdc.gc.ca/.3ndic.1t.4r@-eng.jsp?iid=36.

Dichmont, C. M., S. Pascoe, et al. (2010). "On implementing maximum economic yield in commercial fisheries." Proceedings of the National Academy of Sciences **107**(1): 16-21.

Douthwaite, B., J. M. Ekboir, et al. (2004). The Concept of Integrated Natural Resource Management (INRM) and its Implications for Developing Evaluation Methods. Natural Resource Management in Agriculture: Methods for Assessing Economic and Environmental Impacts. B. Shiferaw, H. A. Freeman and S. M. Swinton. Oxfordshire, UK, ©CAB INTERNATIONAL.

Duda, A. M. (2003). "Integrated management of land and water resources based on a collective approach to fragmented international conventions." Philosophical Transactions of the Royal Society of London - Series B: Biological Sciences **358**(1440): 2051-2062.

Ellis, F. (2000). Rural Livelihoods and Diversity in Developing Countries. Oxford, Oxford University Press.

Ellis, F. (2003a). Human Vulnerability and Food Insecurity: Policy Implications, Forum for Food Security in Southern Africa. Theme Paper No. 3. London, Overseas Development Institute.

Ellis, F. (2003b). A Livelihoods Approach to Migration and Poverty Reduction. Paper Commissioned by the Department for International Development (DFID), Overseas Development Group, University of East Anglia.

FAO (1995). FAO. Code of Conduct for Responsible Fisheries. ROME, FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS**:** 41.

FAO (2009a). Fisheries Management. 2. The ecosystem approach to fisheries. 2.2 Human Dimensions of the ecosystem approach to fisheries. FAO Technical Guidelines for Responsible Fisheries, No. 4, Suppl 2, Add. 2. Rome, Food and Agriculture Organisation**:** 88.

FAO (2009b). Report of the Expert Workshop on the Development and Use of Indicators for An Ecosystems Approach to Fisheries. EAF-Nansen Project: "Strengthening Knowledge base for and Implementing an Ecosystem Approach to Marine Fisheries in Developing Countries". Rome, FAO**:** 63.

FAO Fisheries Department (2003). The Ecosystems Approach to Fisheries. FAO Technical Guidelines for Responsible Fisheries. Rome, FAO (Food and Agriculture Organization of the United Nations),. **No. 4, Suppl. 2:** 112

Fletcher, R., J. Chesson, et al. (2002). "National ESD Reporting Framework for Australian Fisheries: The 'How To' Guide for Wild Capture Fisheries." **1.01**.

Fulton, E. A., A. D. M. Smith, et al. (2007). Alternative Management Strategies for Southeast Australian Commonwealth Fisheries: Stage 2: Quantitative Management Strategy Evaluation. Report to the Australian Fisheries Management Authority and the Fisheries Research and Development Corporation. . Hobart, CSIRO Marine and Atmospheric Research**:** 400.

Gable, F. J. (2004). A Large Marine Ecosystem Approach to Fisheries Management and Sustainability: Linkages and Concepts towards Best Practices. NOAA Technical Memorandum 184, University of Rhode Island, The Coastal Institute,**:** 84.

Garcia, S. M., A. Zerbi, et al. (2003). The ecosystem approach to fisheries. Issues, terminology, principles, institutional foundations, implementation and outlook. FAO Fisheries Technical Paper. No. 443. Rome, Food and Agricultural Organisation**:** 71.

Glaser, M. and K. Diele (2004). "Asymmetric outcomes: assessing central aspects of the biological, economic and social sustainability of a mangrove crab fishery, Ucides cordatus (Ocypodidae), in North Brazil." Ecological Economics **49**(3): 361-373.

Gómez-Limón, J. A. and I. Atance (2004). "Identification of public objectives related to agricultural sector support." Journal of Policy Modelling **26**(8-9): 1045-1071.

Gómez-Limón, J. A. and L. Riesgo (2009). "Alternative approaches to the construction of a composite indicator of agricultural sustainability: An application to irrigated agriculture in the Duero basin in Spain." Journal of Environmental Management **90**(11): 3345-3362.

Gunningham, N., R. Kagan, et al. (2002). Social Licence and Environmental Protection: why businesses go beyond compliance. London, Centre for Analysis of Risk and Regulation, London School of Economics and Political Science

Gutierrez, N. L., R. Hilborn, et al. (2011). "Leadership, social capital and incentives promote successful fisheries." Nature **470**(7334): 386-389.

Hilborn, R. (2007). "Defining success in fisheries and conflicts in objectives." Marine Policy **31**(2): 153-158.

Hundloe, T., J. Morrison, et al. (2011). Fishing for Sustainability: Do you want your grandchildren to have the right to eat Seafood?, Bond University Press.

Hussein, K. (2002). Livelihoods Approaches Compared: A Multi-Agency Review of Current Practice. London, Department For International Development (DFID) & Overseas Development Institute (ODI).

IndiSeas. (2011). "Status of Marine Ecosystems." 2011, from http://www.indiseas.ird.fr/indiSeas/ShowEcosystemsList.action.

Jones, G. (2009). Tasmania's adaptive management system: A 30 year retrospective. 9th World Wilderness Congress, Merida Mexico, 9-13 November 2009.

Joyce, S. (2000). "Earning a Social Licence to Operate: Social Acceptability and Resource Development in Latin America." The Canadian Mining and Metallurgical Bulletin **93**(1037).

Karjala, M. K., E. E. Sherry, et al. (2004). "Criteria and indicators for sustainable forest planning: a framework for recording Aboriginal resource and social values." Forest Policy and Economics **6**(2): 95-110.

Lane, D. E. (1989). "Operational research and fisheries management." European Journal of Operational Research **42**(3): 229-242.

Leones, J., G. Schluter, et al. (1994). "Redefining Agriculture in Interindustry Analysis." American Journal of Agricultural Economics **76**(5): 1123-1129.

Leung, P., J. Muraoka, et al. (1998). "Evaluating fisheries management options in Hawaii using analytic hierarchy process (AHP)." Fisheries Research **36**(2-3): 171-183.

Leung, P. and S. Pooley (2002). "Regional Economic Impacts of Reductions in Fisheries Production: A Supply-Driven Approach." Marine Resource Economics **16**: 251-262.

Mardle, S., S. Pascoe, et al. (2002). "Objectives of fisheries management: case studies from the UK, France, Spain and Denmark." Marine Policy **26**(6): 415-428.

Mardle, S., S. Pascoe, et al. (2004). "Management objective importance in fisheries: An evaluation using the analytic hierarchy process (AHP)." Environmental Management **33**(1): 1-11.

Marshall, N. A. (2007). "Can policy perception influence social resilience to policy change?" Fisheries Research **86**(2-3): 216-227.

Marshall, N. A. (2010). "Understanding social resilience to climate variability in primary enterprises and industries." Global Environmental Change **20**(1): 36-43.

Marshall, N. A., D. M. Fenton, et al. (2007a). "How Resource Dependency Can Influence Social Resilience within a Primary Resource Industry." Rural Sociology **72**(3): 359-389.

Marshall, N. A. and P. A. Marshall (2007b). "Conceptualizing and operationalizing social resilience within commercial fisheries in northern Australia." Ecology and Society **12**(1): 1 [online] URL: http://www.ecologyandsociety.org/vol12/iss1/art1/.

Mascia, M. B. (2003). "The human dimension of coral reef marine protected areas: recent social science research and its policy implications." The Journal of the Society for Conservation Biology **17**(2): 630-632.

Medema, W., B. S. McIntosh, et al. (2008). "From premise to practice: a critical assessment of integrated water resources management and adaptive management approaches in the water sector." Ecology and Society **13**(2).

Norman-López, A. and S. Pascoe (2011). "Net economic effects of achieving maximum economic yield in fisheries." Marine Policy **35**(4): 489-495.

Onyx, J. and P. Bullen (2000). "Measuring Social Capital in Five Communities." The Journal of Applied Behavioural Science **36**(1): 23-42.

Paracchini, M. L., C. Pacini, et al. (2011). "An aggregation framework to link indicators associated with multifunctional land use to the stakeholder evaluation of policy options." Ecological Indicators **11**(1, , Pages): 71-80.

Parks and Wildlife Service (2010). Evaluating Management Effectiveness: the Monitoring and Reporting System for Tasmania's National Parks and Reserves. Draft Report, Department of Primary Industries, Parks, Water and Environment.

Pascoe, S., R. Bustarnante, et al. (2009a). "Spatial fisheries management: A framework for multi-objective qualitative assessment." Ocean & Coastal Management **52**(2): 130-138.

Pascoe, S., W. Proctor, et al. (2009b). "Stakeholder objective preferences in Australian Commonwealth managed fisheries." Marine Policy **33**(5): 750-758.

Pham, T. (2010). Australian fisheries statistics 2009. Australian Bureau of Agricultural and Resource Economics – Bureau of Rural Sciences. Canberra, Department of Agriculture, Fisheries and Forestry, Australia.

Potts, T. and M. Haward (2001). "Sustainability Indicator Systems and Australian Fisheries Management." Maritime Studies **117**(1).

Putnam, R. (1993). "The Prosperous Community. Social capital and public life." The American Prospect **4**(13): 35-42.

Putnam, R., R. Leonardi, et al. (1993). Making Democracy Work: Civic Traditions In Modern Italy. Princeton, Princeton University Press.

Rogers, P. P., K. F. Jalal, et al. (2008). An Introduction to Sustainable Development. London, Earthscan.

Rossing, W. A. H., P. Zander, et al. (2007). "Integrative modelling approaches for analysis of impact of multifunctional agriculture: A review for France, Germany and The Netherlands." Agriculture, Ecosystems & Environment **120**(1): 41-57.

Sainsbury, K. (2009). Review of Indicators of 'Ecological Well-Being', Report for FAO EAF-Nansen Expert Meeting 'Strengthening the Knowledge Base For And Implementing An Ecosystem Approach To Marine Fisheries In Developing Countries. FAO EAF-Nansen Project, Rome, 20-24 April 2009, Food and Agricultural Organisation.

Sayer, J. A. and B. Campbell. (2001) "Research to integrate productivity enhancement, environmental protection, and human development. ." Conservation Ecology **Volume**, 32 DOI:

Schirmer, J. and A. M. Casey (2005a). Social Assessment Handbook. A guide to methods and approaches for assessing the social sustainability of fisheries in Australia FRDC ESD Reporting and Assessment Subprogram. FRDC. Canberra, Bureau of Rural Sciences.

Schirmer, J. and J. Pickworth (2005b). Social Impacts of the South Australian Marine Scalefish Fishery. Social Assessment Handbook for the Australian Fishing Sector. Bureau of Rural Sciences. Canberra.

Scoones, I. (1998). Sustainable Rural Livelihoods: A Framework for Analysis. IDS Working Paper 72.

Singh, R. K., H. R. Murty, et al. (2007). "Development of composite sustainability performance index for steel industry." Ecological Indicators **7**(3): 565-588.

Slee, B. (2001). "Resolving production-environment conflicts: the case of the Regional Forest Agreement Process in Australia." Forest Policy and Economics **3**: 17 - 30.

Slee, B. (2007). "Social indicators of multifunctional rural land use: The case of forestry in the UK." Agriculture, Ecosystems & Environment **120**(1): 31-40.

Soma, K. (2003). "How to involve stakeholders in fisheries management - a country case study in Trinidad and Tobago." Marine Policy **27**(1): 47-58.

Stamatopoulou, E. and S. Raj (2006). Report of the Meeting on Indigenous Peoples and Indicators Wellbeing. F. a. A. O. D. o. N. R. a. Environment. Rome, Food and Agricultural Organisation**:** 22.

Symes, D. and J. Phillipson (2009). "Whatever became of social objectives in fisheries policy?" Fisheries Research **95**(1): 1-5.

Taylor, J. (2008). "Indigenous Peoples and Indicators of Well-being: Australian Perspectives on United Nations Global Frameworks." Social Indicators Research **81**(1): 111-126.

The World Bank. "Indigenous Peoples: Still among the poorest of the poor." from http://siteresources.worldbank.org/EXTINDPEOPLE/Resources/407801-1271860301656/HDNEN_indigenous_clean_0421.pdf.

Tobin, R. C., S. G. Sutton, et al. (2009). Baseline Socio-Economic Data for Queensland East-Coast Inshore and Rocky Reef Fishery Stakeholders. Part A: Commercial Inshore and Rocky Reef Fishers. Fishing and Fisheries Research Centre Technical Report No 5. Townsville, James Cook University.

UNHCR (2000). Refugee Operations and Environmental Management: Key Principals for Decision Making Switzerland, United Nations High Commissioner for Refugees**:** 83.

Vieira, S., C. Perks, et al. (2010). Impact of the structural adjustment package on the profitability of Commonwealth fisheries. Department of Agriculture Fisheries and Forestry - Australia. Canberra.

Woolcock, M. (1998). "Social capital and economic development: Toward a theoretical synthesis and policy framework." Theory and Society **27**: 151 - 208.

Appendix 1: Community Consultation Implementation

Burdekin Regional fisheries Management consultation (copied from http://www.dpi.qld.gov.au/28_20171.htm; access date: 16/8/2011)

Consultation on this review has now closed.

Progress in regional management in the Burdekin

Regional management in the Burdekin is progressing, with the first stage of consultation under way. Community members were invited to return response forms regarding 'amending, reducing or introducing commercial netting closures', and have a say in the management of their area. Fisheries Queensland received more than 400 responses, showing high community interest and involvement in the region.

Fisheries Queensland collated the responses and forwarded the results (numbers and comments) to the Burdekin Sustainable Fisheries Alliance (formerly the Burdekin Regional Fisheries Management Committee) to enable further discussion on the issues raised by the community. The group has also considered issues and suggestions that were raised at the public consultation meeting held at Ayr on 18 March 2011, and from the peak body submissions.

The Burdekin Sustainable Fisheries Alliance has now considered all the information and submitted their recommendations to Fisheries Queensland.

Fisheries Queensland is now formulating this information into the appropriate format to enable the process to continue.

Regional co-management

Many coastal communities have argued that certain general fishing rules do not suit their region. To address this, Fisheries Queensland has been considering options for managing Queensland's fisheries through regional co-management. The first issue to be considered is amending, reducing or introducing commercial netting closures.

Through co-management, the responsibilities and obligations for sustainable fisheries management are negotiated, shared and delegated between the government, fishers and other interest groups and stakeholders.

Burdekin Sustainable Fisheries Alliance (formerly the Burdekin Regional Fisheries Management Committee)

The Burdekin Regional Fisheries Management Committee was formed to consider regional fisheries issues. The committee included recreational fishers, commercial fishers, fish shop owners and government (including local government).

The committee considered fishing issues in the region and developed solutions that ensure a fair and equitable outcome for recreational and commercial fishers and the environment.

The four priorities for the committee are:

- amending, reducing or introducing commercial netting closures
- adopting best-practice commercial netting to minimise the impact on protected species and address ongoing issues with recreational fishers
- amending marine park arrangements regarding yellow zones
- implementing an education program for recreational fishers on appropriate fishing practices in the Burdekin region.

Following the public consultation meeting held at the Ayr Catholic Parish Hall on 18 March 2011, it was decided to dissolve the Burdekin Regional Fisheries Management Committee and to form a community-elected group to carry the process forward. This was in justified recognition that while the committee was broad in coverage, the community itself had not been afforded an opportunity to select the membership or the chair.

A public meeting to select new membership was held on the 8 April 2011. All existing members of the steering committee were advised that all positions would be vacant including the chair, and a new committee created. Approximately 30 or 40 people attended the meeting, including the local member and local council representatives. The meeting was asked to suggest the breadth of representation (e.g. the sectors), as well as the number of representatives that were a workable number but that still could cover a cross-section of interests.

The meeting resulted in the formation of the community-elected Burdekin Regional Management Committee. The new committee voted to change the name of the group to the Burdekin Sustainable Fisheries Alliance at a meeting on 13 May 2011.

Port meeting - Ayr

The Ayr port meeting was held at the Ayr Catholic Parish Hall on Friday 18 March 2011, where attendees were invited to have their say on the proposed changes. View the consultation meeting summary.

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Appendix 2: Application of Human Wellbeing Indicators – Queensland East Cast Inshore and Rocky Reef Fishery (Australia) (Tobin et al. 2009)

This project investigated objectives and indicators for the commercial, charter and recreational fishing participants and seafood consumers in relation to the Queensland East Coast Inshore and Rocky Reef Fishery. No examinations were undertaken of the national community. The following identifies indicators that were utilised by Tobin (Ibid), which can be related to the EAF operational objectives identified in this report.

Sub Component: Fishing Industry Community

Operational Objective: Improve Economic Performance

Indicator: Selling Practices

Data/Information: Location of sales regionally sourced from fisher surveys, before and after management plan implementation.

Performance Assessment: As a set goal of management, identify if these practices changed after the implementation of the management plan.

Indicator: Economics of the number of operators

Data Information: Value of licence, symbols and vessels (Return On Invested Capital) sourced from fisher surveys

Performance Assessment: As a set goal of management, identify if these practices changed after the implementation of the management plan.

Operational Objective: Efficient Use of the resource (improve productivity)

Indicator: Level of catch in quota fisheries

Data/Information: Fisheries Queensland (FQ) from log book data

Performance Assessment: None identified

Indicator: Markets for Byproduct

Data/Information: Information on available markets and volume sourced from Queensland Seafood Marketing Association (QSMA)

Performance Assessment: None identified.

Operational Objective: Minimise conflict

Indicator: Fair Access

Data/Information: Perception of fishers regarding access to areas; competition within and between sectors; income; CPUE; costs of fishing; threats to fishing. These were sourced through fisher surveys.

Performance Assessment: None identified.

Indicator: Proportion of fishable areas, shared verses commercial only versus closed areas:

Data/Information: Sourced from Fisheries Queensland data

Performance Assessment: None identified.

Operational Objective: Provide stability, certainty and security of fishing access

Indicator: Property rights

Data/Information: Existence and transferability of access rights. Data sourced from Fisheries Queensland.

Performance Assessment: None Identified.

Operational Objective: Maximise Health and Safety

Indicator: Workplace Safety

Data/Information: Number of workplace injuries and accidents, sourced from Marine Safety Queensland.

Performance Assessment: The data should be examined for trends related to if fishers are operating in sub optimal conditions due to management limitations, and adjust management plans accordingly.

Sub Component: Associated Communities

Operational Objective: Acknowledge industry role in regional context

Indicator: Regional distribution of operations

Data Information: Fisher surveys and Fisheries Queensland Data

Performance Assessment: None identified

Indicator: Employment

Data Information: Number of crew identified from fisher surveys

Performance Assessment: None identified

Indicator: Location of Sales

Data Information: Regional distribution of sales, sourced from fisher surveys.

Performance Assessment: None identified.

Appendix 3: Application of Human Wellbeing Indicators: Northern Brazil (Glaser et al. 2004)

The project this information is selected from, investigated the central aspects of sustainability, incorporating biological, economic and social criteria, of a mangrove crab fishery in the Caete estuary, Para, North Brazil. With the exception of child labour, the investigations were centred around fishers only and no examination was undertaken of associated communities or the national community. The following identifies those indicators utilised that have relevance to the suggested EAF operational objectives identified in this report.

Sub Component: Fishing Industry Community

Operational Objective: Profitability through the stabilising or increase of real incomes.

Indicator: Real Income (RI) and Real Income of the Poorest (RIP)

Data/Information: Real Income (RI) and Real Income of the Poorest (RIP) data sourced from fisher surveys.

Performance Assessment: Identification of trends in Real Income levels after adjustment for operating costs to identify if real income levels were increasing, and having the effect of decreasing poverty.

Operational Objective: Maintain or enhance (quality of) lifestyle through the stabilising or increase of real incomes.

Indicator: Real Income (RI) and Real Income of the Poorest (RIP)

Data/Information: Real Income (RI) and Real Income of the Poorest (RIP) data sourced from fisher surveys.

Performance Assessment: Identification of trends in Real Income levels after adjustment for operating costs, on the premise that quality of life would be unchanged, improved or decrease in line with trends of real income.