



Selecting and assessing social objectives for Australian fisheries management



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ARTICLE INFO

Article history:

Received 11 September 2014

Received in revised form

24 November 2014

Accepted 24 November 2014

Keywords:

Social objectives

Indicators

Fisheries policy

Management assessment

Performance measures

ABSTRACT

This paper details Australian research that developed tools to assist fisheries managers and government agencies in engaging with the social dimension of industry and community welfare in fisheries management. These tools are in the form of objectives and indicators. These highlight the social dimensions and the effects of management plans and policy implementation on fishing industries and associated communities, while also taking into account the primacy of ecological imperatives. The deployment of these objectives and indicators initially provides a benchmark and, over the life of a management plan, can subsequently be used to identify trends in effects on a variety of social and economic elements that may be objectives in the management of a fishery. It is acknowledged that the degree to which factors can be monitored will be dependent upon resources of management agencies, however these frameworks provide a method for effectively monitoring and measuring change in the social dimension of fisheries management.

Essentially, the work discussed in this paper provides fisheries management with the means to both track and begin to understand the effects of government policy and management plans on the social dimension of the fishing industry and its associated communities. Such tools allow the consideration of these elements, within an evidence base, into policy arrangements, and consequently provide an invaluable contribution to the ability to address resilience and sustainability of fishing industries and associated communities.

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1. Introduction

Australia and the United Nations Food and Agricultural Organisation (FAO), amongst others, have in recent years invested in developing practical and useful tools to integrate the social dimension into resource management processes [1–13]. The role played by healthy and vibrant communities in resource sustainability is now recognised as integral to the creation and maintenance of healthy ecosystems and the industries that depend upon them [14,15]. While previously resource managers and implementers of policy have focused on ecological and economic dimensions of resource use, since 2000 a range of theoretical approaches have been developed to include social dimensions and resilience in government frameworks [12,16–20]. However, this theoretical development has only recently been

accompanied by the development of practical tools to enable the implementation of these concepts. Initially, endeavours in these areas focused on identifying indicators of social characteristics of fishing-dependent communities such as community health, wellbeing, vitality and resilience. This was an attempt to apply a triple bottom line approach to policy development and management assessments [15,20–25]. However, as these activities were unrelated to existing management objectives they failed to gain traction. In the marine sector, Australia and the FAO have progressed to the next step; identifying indicators that measure performance against specific social objectives of fisheries management, rather than measuring more generic social characteristics of fishing communities. This moves beyond descriptive indicators to answering the question of – “why?” or “to what end specifically are we using these indicators – why are we measuring them and how are we going to apply the results?”

Australian fisheries (like those of many other large countries), are characterised by multiple management jurisdictions. As such,

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if national ecologically sustainable development (ESD) goals are to be achieved, there is a need to develop a consistent approach to the identification of social, as well as ecological and economic, objectives for fishery management. Furthermore, consistent national social performance measures are important to align with international reporting processes such as those being developed by the FAO [26], NOAA [27] and UNESCO's IndiSeas project [28], facilitating engagement with international ecosystem management objectives.

This paper documents a study in Australia focused on generating benchmark social objectives and associated indicators, to be used as performance measures for fisheries management. The objectives and indicators developed from this enable managers and policy makers to gain insight into the social effects of fisheries policy implementation and management for industry and local/regional communities. The deployment of these objectives and indicators initially provide a benchmark for assessment. Over the life of a management plan, this helps to highlight trends in the effect of fisheries management and policy actions on income, participation, social capital, employment satisfaction, cultural maintenance, industry engagement and indigenous issues, amongst other areas. Further, in acknowledgement that one of the principal barriers to the incorporation of social objectives in management plans are the perceived costs, the study focused on developing cost effective indicators. The findings of the work provide a method for effectively framing, monitoring and measuring change in the state of the social dimensions of fisheries, and do so in a manner that is cost and resource efficient for the implementing entity.

2. Background

The call for triple bottom line assessments of government managed common resources was initiated in 1987 with the release of the Brundtland Report [29]. This is reflected in Australia (as elsewhere) with calls for management of the nation's natural resources under the principles of Ecologically Sustainable Development (ESD) in 1992. However, although recognised as a salient component, the social aspect of these calls has remained largely unaddressed. Until 2012, only limited reporting against seafood industry objectives has occurred in Australia [30], and none has explicitly been undertaken by fisheries management from the perspective of community stewardship of a common resource.

Symes and Phillipson [20] decried the lack of social objectives defined or used in fisheries policy throughout the developed world. They called for “government policy to instil confidence in the industry and set out explicit social objectives for attaining an equitable profitable and sustainable future”. This came at the same time as increasing recognition of a need to ensure communities are resilient and have the capacity to engage in successful resource stewardship – the latter need identified, in particular, through the Ecosystems Approach to Fisheries (EAF) management, dealt with extensively by the FAO and others [5,9–11,26,31–37]. These authors argue that resource management that negatively affects the welfare of communities or fishing industries (through degraded economic or social welfare or unstable food security) will also impact negatively on the ability of those communities to engage with effective EAF policies. This underlines the necessity to understand the human wellbeing implications of any fisheries management approach in order to improve marine ecosystems stewardship.

Various attempts to develop appropriate management targets that address both human benefits as well as ecological sustainability have been developed. In Australia, maximum economic yield (MEY) is identified as the target for species in Commonwealth managed fisheries [38,39]. While this captures the benefits of fishing to commercial fishers, it can negatively impact on recreational and traditional fishers who are seeking a greater share of the resource. In

addition, it does not account for changes to regional communities, which may be negative if fishing activity is reduced to achieve the economic target. In the United States, the main target is the “optimal yield”, which allows managers to consider social impacts along with economic and biological impacts through “balancing the various interests that comprise the greatest overall benefits to the Nation” (50 CFR – National Standard 1, §600.310, 2(ii)).¹ However, the process for doing so is not commonly agreed upon, often ad hoc, and potentially inconsistent from fishery to fishery. In Europe, target yields are currently determined “on the basis of available scientific advice, taking into account biological and socio-economic aspects whilst ensuring fair treatment between fishing sectors, as well as in the light of the opinions expressed during the consultation of stakeholders” (Council Regulation (EU) No 43/2014, 20 January 2014). However, this (again) ad hoc approach has resulted in substantial overfishing, and the reform of the common fisheries policy aims to move the target to maximum sustainable yield (MSY) from 2015 – modifying social and economic considerations [40]. Experience has shown that the components of a system cannot be optimised in isolation from all other elements interacting with it, or affecting it [41–44]. Consequently, MSY or similar approaches are not wholly effective in taking into account the economic dimensions and effects of fisheries management. They also provide no insights into the ability of communities interacting with a fishery resource to engage with stewardship of that resource or to derive non-market benefits.

In Australia, the key objective of fisheries management across all jurisdictions is to manage fishing activities in a manner consistent with the principles of ESD, defined as the “use, conservation, development and enhancement of [...] resources in a way, and at a rate, that will enable people and communities to provide for their economic, social and physical well-being...”. The ‘social’ principle of ESD has not generally been addressed because (i) as mentioned above, the social impacts associated with fishing and fishing industries are poorly understood due to lack of information and (ii) there is lack of practical methodology to integrate social considerations into the roles and responsibilities of the different States’ fisheries management frameworks. Additionally, social issues have often been confused with economic issues and economic indicators have been presumed adequate proxies for social conditions reporting (e.g. employment). Economic indicators, even where associated with a particular objective, do not address issues of stewardship, compliance, non-economic livelihoods, barriers to participation, community engagement with management initiatives, protection and access to indigenous iconic species for indigenous community members, etc., all of which have a role in the effective management of the resource for long term sustainability. Consequently, although biological and some economic data have traditionally been collected at the fishery level, the social outcomes of fishing, which are more closely aligned with communities, have to-date remained largely unaddressed.

Attempts to employ triple bottom line assessments in Australian fisheries have been limited, largely due to a lack of clarity around the objectives of assessments beyond that of ecological sustainability. In a national triple bottom line assessment of 135 Australian industry sectors, including fisheries, Foran et al. [25] considered employment generation, income and government revenue as social indicators. These are, in fact, economic indicators (only one aspect of the social dimension) and did not guide management in relation to the many other social objectives that might be relevant to different management approaches, and which could affect the sustainability of a fishery. To this end, in 2005 and

¹ The full text of the Act is available from: <http://www.law.cornell.edu/cfr/text/50/600.310>.

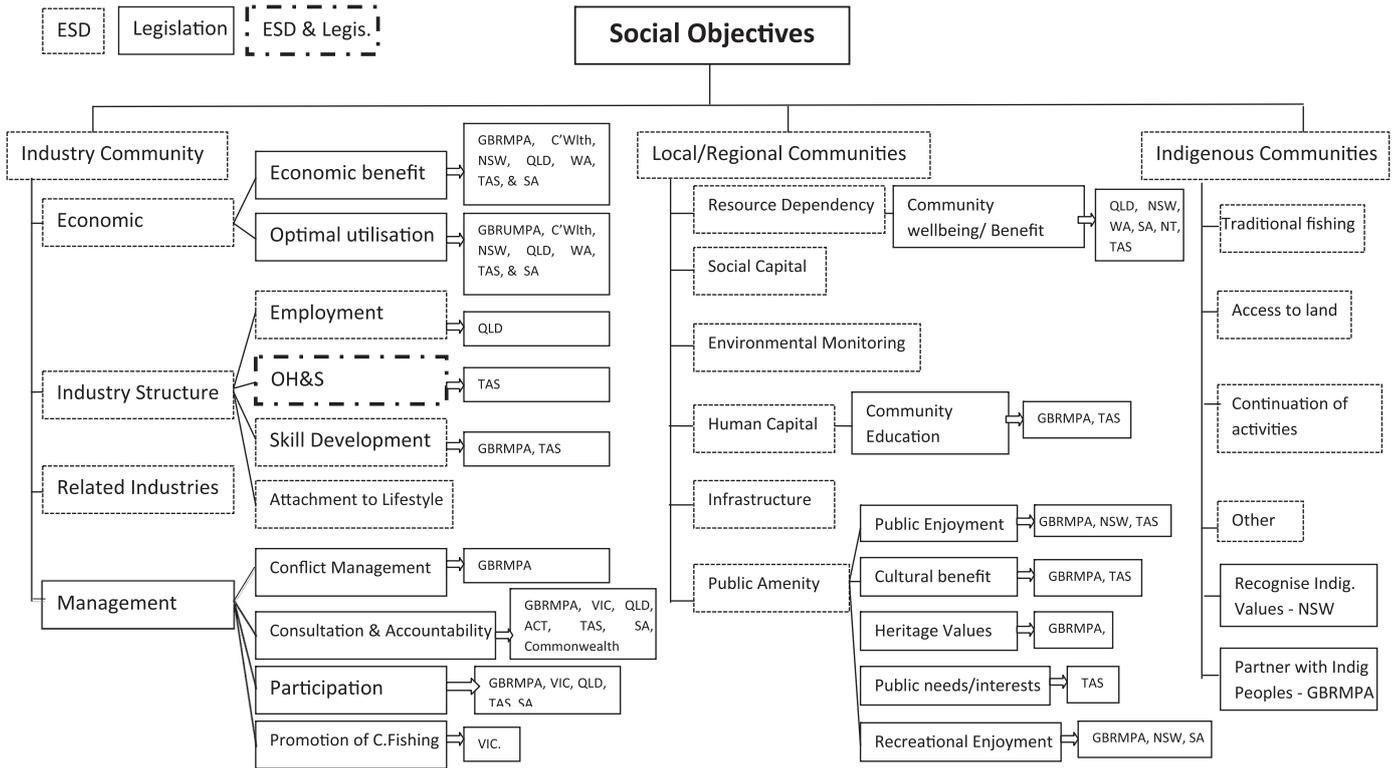


Fig. 1. Legislative Requirements.

Box 1–High level objectives for workshop review.

- Initial POTENTIAL Objective Categories**
- INDUSTRY**
- Economic
 - Economic benefit
 - Optimal utilisation
 - Industry Structure
 - Employment
 - OH&S (Work related injuries)
 - Skill Development (use of technical knowledge)
 - Attachment to lifestyle
 - Management
 - Conflict management
 - Consultation, accountability and participation
 - Promotion of commercial fishing
- Local/Regional COMMUNITIES**
- Resource Dependency
 - Community wellbeing/benefit
 - Social Capital
 - Environmental monitoring
 - Human Capital
 - Community education
 - Infrastructure
 - Public Amenity
- Indigenous communities**
- Recognise indigenous values
 - Partner with indigenous communities

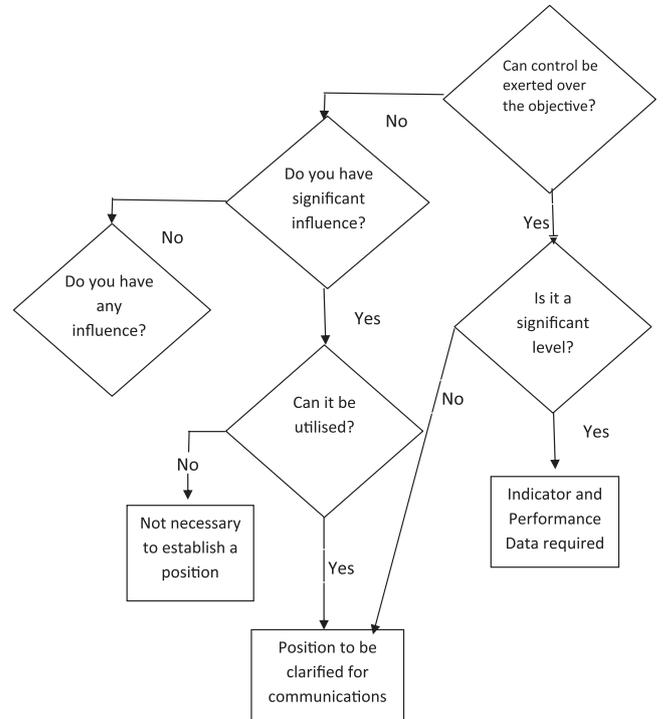


Fig. 2. Decision making flow chart regarding possible objectives.

2007, Australia's Fisheries Research and Development Corporation (FRDC) funded a review of the Marine Scalefish Fishery in South Australia, considering its restructure and effects from an environmental, economic and social perspective [12,45]. This was one of the first true attempts in Australia at undertaking a comprehensive

Table 1
Provision set of high level objectives.

Commercial, Recreational & Charter*
Industry structure
1 Maintenance of livelihoods
2 Skill development and participation in management
3 Maximisation of cultural, recreational and lifestyle benefits of fishing activities
Management
4 Undertake consultation with industry and ensure accountability for management decisions
5 Ensure industry participation in management decision making
6 Positive promotion of commercial fishing to ensure a positive perception by the community at large
7 Minimise the risk of non-compliance an increase public awareness of social responsibility
8 Ensure transparency of decision making
9 Ensuring that the management framework allows operators to make best decisions
10 Ensure equitable treatment and access
Local/regional communities
1 Positively influence fisheries related benefits for regional communities
2 Ensure flexible fishery management arrangements to facilitate and support the capacity of regional communities to adapt to change
3 To maximise community trust in fisheries agencies to manage fisheries
4 To facilitate and support the cohesion and connectedness of [fishers with their] regional communities through fisheries management
5 Increase regional community awareness of and confidence in fisheries agencies' monitoring and reporting on environmental performance.
6 Ensure fisheries collected data is available in a timely and publicly accessible manner
7 Facilitate capacity building for industry and community members to enhance stewardship of fishing activity
8 Ensure adequate access to infrastructure needed for successful operation o fishing activities
9 Ensure public benefit from use of fishing related infrastructure where this does not interfere with meeting other objectives of environmental sustainability or health and safety
10 Ensure maintenance of cultural and heritage values related to fishing activities
Indigenous communities
1 Ensure appropriate consultation to enable continuation of traditional activities and subsistence use of fisheries resources and respect of rights of Indigenous peoples to these resources
2 Ensure appropriate consultation in regard to fisheries management (e.g. Type of consultation about methods or participation in fisheries management activities)
3 Ensure fisheries management contributes positively to Indigenous community livelihoods, culture and activities
4 Ensure Indigenous communities are able to access income-earning opportunities related to fisheries marine and water resources

Note 1

* 'Economic' was dropped as a category as it was seen as a separate activity from identifying social objectives.

triple bottom line assessment of a commercial fishery. The project identified that, while the restructure had resulted in recovering fish stocks and positive economic outcomes for remaining fishers, the resultant social conditions did not create an environment that nurtured the continuation of the industry. Many fishers indicated that they would be looking to exit the industry, or not encouraging others into it [12]. This was generally due to constraints that fishery management arrangements placed on access to, and conditions for, family and social lives; difficulties in the arrangement of new entrant training; and issues with broader community engagement with the fishery, including the communication of positive environmental endeavours undertaken by fishers. While in the short term the ecological and economic outcomes appeared overwhelmingly positive, indications were that, despite this, the fishery would be in decline over the long term due to social factors resulting from the restructure [12]. The issue that became obvious in the review was that while the restructure had clear ecological and some economic goals/objectives, no social objectives had been identified in its implementation. It was, therefore, impossible to identify if this management action had been effective in regard to its intent for the long-term (triple bottom line) vision for the fishery. A number of Australian studies have subsequently 'nibbled' at the edges of establishing social objectives in fisheries from an industry perspective [46]. However, none have explicitly aimed to establish a set of social objectives for fisheries managers nationally, to assist in the development of management plans and actions.

These events have unfolded in Australia simultaneously with the increasing focus elsewhere on methods to identify and assess the importance of the social dimension in (fisheries) resource management. In particular, the FAO has been working on developing methods for assessing and integrating the governance and human wellbeing elements of resource use and its interaction

with ecosystem management for a number of years [6,10,11,26,28,34,35,47].

3. Methods

The study discussed here is the culmination of a suite of activities and was preceded by two other Australian studies. The first was undertaken by the aquaculture industry, seeking industry social objectives in its own management [30], and the second explored how a wild catch trawl industry might respond to and prioritise social objectives, in the context of economic and environmental objectives [46,48]. Building on these, this study focussed on the identification of social objectives that were within the control of fisheries management and relevant to the context of management's primary purpose - being to ensure environmental (and stock) sustainability. As a result, this project had three basic objectives:

1. Identify social objectives and indicators of relevance at the national level;
2. Test and verify applicability of social objectives and indicators using the Queensland commercial Trawl Fishery and both commercial and recreational sectors in South Australia as case studies; and
3. Review the case study social objectives and indicators for applicability to national fisheries management.

The methodology employed a mixed methods approach and was implemented over a three-year period. The basic structure adopted, due to previous work in the area and precedents set by the FAO, was an EAF approach embedded in an ESD framework

Table 2
Summary of survey methods trialled to collect data.

Survey	Survey methods trialled	Number of surveys completed	Response rate	Recommended as a feasible method for collecting data in future?
South Australian and Queensland fisheries managers	Internet	4	100%	Yes
South Australian Marine Scalefish Fishery	Face-to-face	106	32%	Face-to-face – yes
	Mail			Mail – yes
Queensland East Coast Trawl Fishery	Internet	63	21%	Internet – no
	Face-to-face			Face-to-face – yes
South Australian Southern Zone Rock Lobster Fishery	Face-to-face	45	25%	Face-to-face – yes
	Mail			Mail – yes
South Australian Northern Zone Rock Lobster Fishery	Face-to-face	22	33%	Face-to-face – yes
	Mail			Mail – yes
Southern, Central and Western Zone Abalone fisheries of South Australia	Face-to-face	18	51%	Face-to-face – yes
	Mail			Mail – yes
South Australian Recreational Fishery	Internet	951	N/A	Internet – yes
	Mail	357		Mail – maybe (higher cost/ lower response)

developed for the Australian context (Fletcher 2012). The first step in the project was a literature review of all the relevant legislation across Australian jurisdictions (six States, two Territories and one Commonwealth²) for all fisheries activities. The review focused on identifying the obligations of the different jurisdictions in regard to social and economic outcomes. The key themes and issues identified in the legislation were organised and expanded under the headings identified in the ESD structures [2], and are shown in Fig. 1.

From this point, utilising the framework shown in Fig. 1 as a guide to what was essential to include in social objectives, a second literature review of all previous work on social objectives and indicators was undertaken to identify a comprehensive list of potential objectives (without necessarily identifying aligned indicators and performance measures). This was presented to a workshop of representatives of all Australian fisheries authorities, as well as other environmental government agencies and fisheries stakeholders from the commercial, recreational and indigenous communities. The inclusion of the industry at this point assisted in developing their understanding of the benefits generated by the inclusion of social objectives as measures of fisheries' performance. This was considered key to achieving industry, as well as management, commitment to this project.

The literature review of potential objectives was undertaken in three parts as defined by the ESD 'tree' (Fig. 1), (industry, indigenous and local/regional communities) and the high level objectives were developed from a variety of sources, both Australian and international [3–5,7,9,24–26,35,36,49–74]. These are identified in Box 1.

From these high level objectives, a further 40 potential operational objectives were identified (that is, more detailed objectives under the above high level objectives) across the three 'communities' (Industry – 23; Local/regional Communities – 11; Indigenous – 6). Participants in the national workshop were asked to assess each operational objective to identify if an objective could be effectively managed or at the least influenced by fisheries management, utilising the flow chart of decision-making shown in Fig. 2 (below). If the objective could not be influenced or managed by fisheries management, the objective was excluded.

Workshop participants also had the opportunity to return to their workplaces and discuss the work with colleagues and provide further comment. This consultative process, together with rewording and deletion of duplication, resulted in a refinement of the objectives to a list of 24 operational objectives. These 24 objectives related to the

commercial, charter and recreational fishing activities; local/regional communities; and Indigenous communities as per Table 1.

The next step was to assess whether the objectives identified could be adequately informed by indicators, or other performance measures, already existing or proposed. In addition, the level of priority or relevance that these had in relation to each other needed to be understood. These assessments ensured that the study was considerate of the broader context; effective and holistic fisheries management.

3.1. Data collection

Between one and six indicators were developed for each of the 24 objectives, and these indicators and their interpretation were tested in case studies in South Australia (3 commercial fisheries – Marine scalefish, Rock Lobster & Abalone; 1 recreational fishery, and 1 indigenous community) and Queensland (1 commercial fishery – East Coast Trawl Fishery). Indicators were designed to utilise existing data where possible; however, in many cases a lack of information meant it was necessary to collect new data in order to measure indicators. Where this was the case, cost effective approaches were achieved through adding questions to existing data collection vehicles and activities, such as existing surveys of fishers.³ This recognised the limited capacity of Australian fisheries management agencies to engage in additional data collection activities, and assisted transparency by drawing on publically available data, where possible.

For commercial fisheries, a survey instrument to collect data for social indicators was developed. This incorporated learning from previous surveys, as well as new questions that were developed as needed. The survey was delivered using a combination of telephone, mailed surveys and face-to-face interviews. The Queensland case study tested delivering the survey online, but this achieved a substantially lower response rate than the paper surveys used in the South Australian case studies. This lower response was likely due to low Internet use by commercial fishers, and in some cases low literacy amongst fishers. The Queensland study was subsequently completed with a series of face-to-face interviews, which provided a higher response rate.

A modified form of the commercial fisher survey was developed for recreational fishers, who were given the option of responding to it online or in a paper form. The survey was promoted using recreational fishing web forums, emails, flyers distributed at key

² Regional Fisheries Management Organisations (RFMOs) dedicated to issues in particular regions of international waters, or of highly migratory species, were beyond the scope of this study.

³ This was possible for the South Australian fisheries which are regularly surveyed. For the Queensland fishery, a specific survey for the study was undertaken.

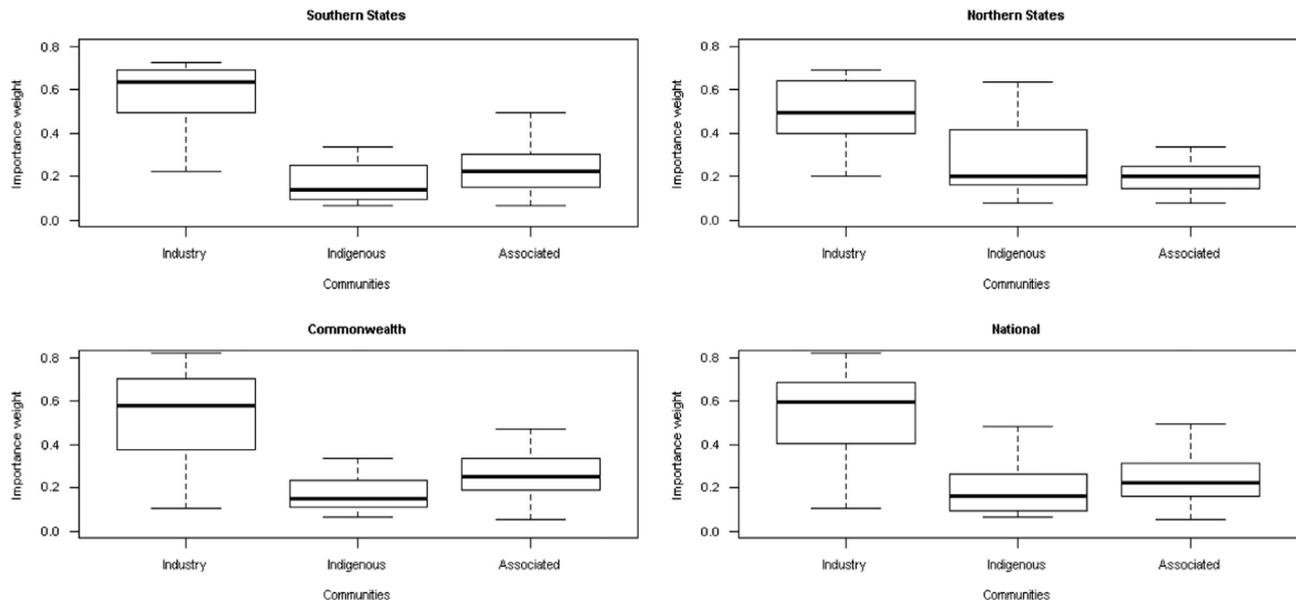


Fig. 3. AHP Results of objective prioritisation by region.

fishing spots and tackle shops, and also via face to face interviews. An incentive was provided to recreational fishers for participation in the form of a prize draw. An overall valid response rate of 39.6% in South Australia and 21% in Queensland was achieved for the commercial fisheries (after removing invalid responses); and 1308 valid recreational fisher responses were received (72.7% by internet and 27.3% by hard copy). A further survey was also developed for those indicators that could be measured using data held by fisheries managers. This was delivered to managers of the case study fisheries in both South Australia and Queensland.

Some indicators were measured using data that were readily available in the public domain, such as census data. This was particularly the case for indicators measuring social outcomes for regional communities who depend on fishing, which fisher or fisheries manager surveys do not address. The primary focus with this group was to identify data that would not require extensive new collection from the general public. The key limitation of these data were that they could not readily be used to identify causality: social trends in a community may be a result of changes in fisheries management, or of many other causes, and data from sources such as the national census cannot be readily used to identify the specific influence of fisheries management. A summary of the methods used for to collect data for the indicators in each of the community categories can be found in Table 2.

The lack of work undertaken on social objectives and indicators in relation to fisheries management for Indigenous communities in Australia meant that there was a lower level of outcome expected for the identification of these objectives. Rather than expecting to be able to identify and test indicators for objectives nationally, the aim with this group was identify a set of objectives and potential indicators with one community group. These could then be used as a basis from which to explore applicability with other communities in other States and regions, in future projects. The task in this case was approached utilising qualitative techniques in a focus/workshop group format. A coastal community was identified that already had a well-established cultural connection with a marine resource, and a relationship with fisheries management. Meetings were undertaken with the elders and community selected leaders who were introduced the study to seek agreement to undertake discussions with the community. Two workshops were then held with leaders and community members to

explore potential options for both objectives and indicators. The same decision framework used for commercial and recreational fishing groups was utilised (Fig. 2) to assess the 'reasonableness' of each of the objectives.

3.2. Objective prioritisation and indicator verification

Concurrently with the collection of data to inform indicators and assess them in relation to the objectives, two other processes were undertaken. The first of these was an Analytic Hierarchic Process (AHP) to compare and prioritise the objectives. This was completed by a cross section of fisheries managers in all Australian jurisdictions, to identify those objectives and communities that were deemed of highest priority, utilising an AHP analysis [74]. The prioritisation of community objectives was, on the whole, consistent across all jurisdictions. The industry community was of the highest priority, followed by regional and then indigenous community groups. The only variations to this were the northern States (Queensland and Northern Territory) where indigenous communities represent a greater proportion of the general community, which ranked indigenous communities of higher importance. In regard to the weighting of the individual objectives within each community group, these were largely consistent across all regions and at a national level (Fig. 3). Further details on the analysis are given in Triantafillos et al. [75] and Pascoe et al. [76].

The aim in undertaking the AHP was to determine which objectives were of highest priority in managing social issues associated with a fishery, and so to facilitate the recommendation of a set of objectives that had a level of consistent relevance across all jurisdictions. The ultimate aim was to identify objectives of relevance for all jurisdictions, which may in the future be able to be aggregated at regional and national levels of reporting. The results of the AHP process was also reviewed in smaller direct line manager workshops in South Australia to review the summary findings and ensure that aggregated data had not lost important elements for them at the base managerial level.

In addition to this, a Bayesian Belief Network (BBN) analysis was undertaken to identify the most influential indicators in informing the objectives under each of the three 'communities' [75]. The BBN findings were combined with the AHP analysis to

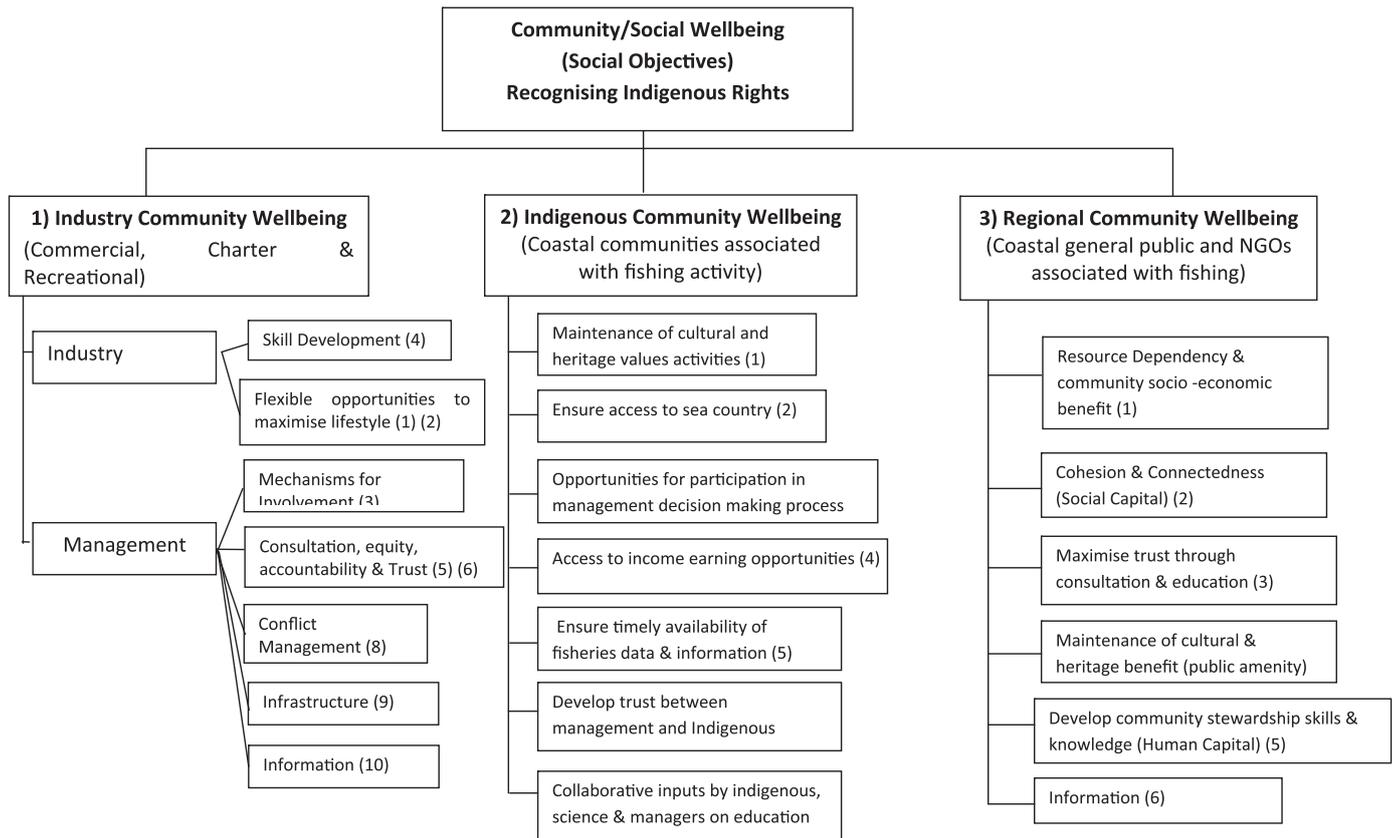


Fig. 4. ESD tree formal final set of high-level objectives (NB: Numbers beside objective boxes identify the operational objectives as detailed in the Appendices).

inform, both the relevance of the indicators, and the objectives. This resulted in the removal of a large number of potential indicators. The case study results; information on weightings from the BBN analysis; and rankings from the AHP, were presented at an Australian Seafood Industry workshop in October 2012. This workshop then further reviewed and refined the objectives and indicators with the outcome being a set of social objectives with performance measurement indicators, with the latter able to be collected and interpreted by fisheries managers. Further to this, they were deemed acceptable by fisheries managers, industry and other stakeholders, and were applicable across all States and Territories. A draft of the guide to the implementation of the objectives and indicators was also presented for discussion, with all comments and suggestions reviewed and where beneficial, incorporated.

4. Results

The resultant set of high-level objectives was articulated in the ESD tree (Fig. 4). These were further broken down into operational objectives and indicators, which were as follows:

Industry community:

- Ten operational objectives
- 32 possible⁴ performance measurement indicators

⁴ The term 'possible' is used here as more than one indicator can be used dependent upon the resources of the fishery, and issues or factors at play in the fishery. The final list of potential performance measurement indicators are listed in the guide, from most robust and recommended to least.

Indigenous community

- Seven operational objectives
- 5 possible performance measurement indicators

Local Regional community

- Six operational objectives
- Nine possible performance measurement indicators

It must be noted that the set of Indigenous 'community' objectives and indicators were not comprehensively subjected to AHP and BBN analysis. These processes were, due to factors outside the control of the project team, undertaken simultaneously with the community consultation to develop the Indigenous objectives. As some new objectives and indicators were added as a result of this consultation, not all were subject to the AHP and BBN processes. The objectives and indicators identified for Indigenous communities are preliminary only and require extensive further testing for applicability across the variety of Indigenous communities around Australia.

A final 'Guide' was developed using the objectives and indicators. This provides full details of each, along with explanations of the application of the indicator for each objective, with examples. It also suggests methods for interpreting an indicator as a performance measure [74]. This guide (which is in two parts – an overview and detailed descriptive process) provides the 'tool' for fisheries managers to engage with the social dimension of fisheries management as more than a theoretical concept. (See Appendices A–C for the Objectives and Indicators contained in the Guide).

The Guide is not intended to be a prescriptive text to be adopted without flexibility, but to be used as a common framework, applied as appropriate to fisheries management needs. It is considered one

foundation stone in the ongoing work of incorporating social objectives and indicators into fisheries management and supports the Australian National Harvest strategy framework [77] and development of national reporting of the status of Australian Fisheries [78].

5. Discussion

The engagement of all jurisdictions in this study worked particularly well. This may be reflective of the high level of perceived need for the outputs of this study, in order to deliver greater triple bottom line outcomes in fisheries management.

The challenges that remain are several. In the first instance these revolve around resourcing to expand the activities of fisheries management to deliver on the requirement of triple bottom line reporting. With global economic conditions, Australian governments have not been immune to the reductions in resources available to undertake existing commitments, let alone increase the scope of activities. It was with this in mind that a conscious effort was made to include indicators that could be measured with relative ease and minimal cost. In addition to this, the skills and capacity of fisheries managers, who are often trained in ecology, needs to be developed to utilise and interpret social objectives and indicators and understand what management responses might be needed in response to findings. Lastly, the challenge remains to engage in the broader debate about shifting from theoretical high-level social objectives to concrete, measurable objectives that can be used in fisheries management practice. How these are integrated into overall ecosystem management must also be engaged with. Ultimately, in Australia, the aim is to achieve an outcome of nationally aggregated data, of agreed common reporting criteria/objectives (stock status/fishery/region etc.) and data points.

Although it would have been ideal to be able to also offer a set of objectives and indicators for the inclusion of indigenous communities that could be confidently applied at the national level, it was recognised that this ambition was unrealistic. The little work that had been undertaken in this particular area and the structure of Australian Indigenous communities limited the achievements of this study. However, it is hoped that this work will result in further active research with Indigenous communities, utilising these foundations, to develop and increase engagement between fisheries management and Indigenous communities in a respectful and educated manner.

6. Conclusions

Prior to this work being completed it was extremely difficult for fisheries managers to explicitly incorporate social objectives into

Table A1
Recommended Industry/Recreational and Charter Social operational and indicators.

Operational objective number and name	Indicator number and name	Measurement method/s	Measurement costs	Measurement complexity	Relevance of indicator to objective ^a
1.1 Provide flexible opportunities to ensure fishers can maintain or enhance their livelihood, within the constraints of ecological sustainability.	1.1.1 Provision of livelihood opportunities: cost of entry and access to fisheries (CC ^b only).	Management agency	Low	Low	High
	1.1.2 Perception of flexibility: fisher belief that management processes are flexible enough to allow them to adapt to changing conditions.	Fisher survey	Medium*	Low	High
	1.1.3 Existence of transferable property or use rights that allow access to marine and aquatic resources (CC only).	Management agency	Low	Low	Medium
	1.1.4 Proportion of fishers accessing a livelihood from fishing (CC only).	Management agency	Low	Medium	Medium
			Low	Low	Low

decision-making processes, due to a lack of knowledge around which social objectives were best or what they actually meant. This was mainly due to the primary focus to date having been on ecological objectives and indicators. This work now provides explanations and guidance in regard to the meaning and implication of a number of social objectives as well as knowledge about how to incorporate them into the decision making process with confidence. The key conclusion from this study is that it is possible to identify a set of objectives that can be used by fisheries managers to assess the social state of a fishery and the ongoing social and community effects of management decisions. This is contrary to the position that many have taken over the years, which considered this too difficult to undertake and deliver. This study also identified a set of objectives with associated performance measurement indicators that can be selected dependent upon the resources of the management agency and circumstances of the fishery.

Despite the expressed need for this work and the legislated requirement for it, it is still in the infancy of uptake by fisheries agencies in Australia. To this end ongoing work in the extension of the outputs is critical to its adoption and an outcome of integrated triple bottom line reporting. The outputs of this study provide a solid basis from which to ascertain the best management options for a fishery, with consideration of the ecological, economic and social effects, and, further to that, an ability to engage the broader public in the potential benefits of fishing activities beyond species maintenance and economic return.

Acknowledgement

The Australian Fisheries Research and Development Corporation is gratefully acknowledged for their financial support of this project (FRDC Project: 2010/040), along with in-kind support provided by the agencies of the Primary Industry and Resources South Australia & Queensland Department of Agriculture, Fisheries and Forestry; CSIRO and KAL Analysis Pty Ltd. In addition, the authors would like to acknowledge and express their thanks for the very generous support in time and collaboration, of the Australian seafood industry, Indigenous and recreational fishing communities, fisheries managers and management from all jurisdictions, that made this research possible.

Appendix A

See Table A1.

Table A1 (continued)

Operational objective number and name	Indicator number and name	Measurement method/s	Measurement costs	Measurement complexity	Relevance of indicator to objective ^a
1.2 Maximise cultural, recreational and lifestyle benefits (including health benefits) of fishing for those who participate in fishing activities, within the constraints of ecological sustainability.	1.1.5 Constraints on access to livelihood opportunities imposed by fisheries management (CC only).	Management agency			
	1.2.1 Level of satisfaction fishers have with their fishing activities.	Fisher survey	Medium	Low	High
	1.2.2 Level of satisfaction fishers are achieving the cultural, recreational and lifestyle benefits important to them from fishing.	Fisher survey	Medium	High	High
	1.2.3 Level of satisfaction fishers have with their fishing-derived income (CC only).	Fisher survey	Medium	Low	High
	1.2.4 Perceived importance of fishing activities to fisher's life.	Fisher survey	Medium	Medium	High
1.3 Ensure appropriate mechanisms exist for fisher involvement in development of fisheries management advice.	1.2.5 Fishers plans to leave fishing (CC only).	Fisher survey	Medium	Low	High
	1.3.1 Level of satisfaction fishers have with the amount of consultation undertaken by fisheries managers.	Survey of fishers involved in consultation processes	Medium	Low	High
	1.3.2 Proportion of fishers actively participating in fisheries management and advisory groups.	Management agency &/or fisher survey	Medium	Low	Medium-High
	1.3.3 Presence of fisher representatives on fisheries management advisory groups.	Management agency	Low	Low	Low
	1.3.4 Existence of formal documented processes for providing feedback to stakeholders about fisheries management decisions, and how stakeholder input was used in those decisions.	Management agency	Low	Low	Medium
	1.3.5 Level of fisher awareness of methods to have input into fisheries management processes.	Management agency & fisher survey	Medium	Low	High
1.4 Improve the ability of fishers to participate effectively in fisheries management advisory processes.	1.3.6 Level of knowledge fishers have on how to contact their representatives in fisheries management/ advisory processes.	Fisher survey	Medium	Low	High
	1.4.1 Level of satisfaction fisher representatives have with their overall representation skills and resources.	Survey of members of advisory committees	Low	Low	High
	1.4.2 Provision of support for stakeholders to effectively participate in fisheries management processes.	Management agency	Low	Low-Medium	Medium
1.5 Industry stakeholders have a high level of trust in the management of fisheries.	1.5.1 Level of fisher trust in the fisheries agency responsible for the fishery.	Fisher survey	Medium	Low	High
	1.5.2 Fisher perception of the outcomes of fisheries management.	Fisher survey	Medium	Low	High
1.6 Maximise stewardship of fisheries resources.	1.6.1 Trends in fisheries infringements.	Management agency	Low	Low	High
	1.6.2 Proportion of fishers who believe that, overall, most fishers comply with fishing rules and regulations.	Fisher survey	Medium	Low	Medium
	1.6.3 Fisher understanding of rules and regulations	Fisher survey	Medium	Low	High
	1.6.4 Level of ease of fisher compliance with rules and regulations.	Fisher survey	Medium	Low	High
	1.6.5 Level of fisher perception of the availability of adequate training and advice regarding good fishing practices.	Fisher survey	Medium	Low	High
	1.7 Ensure transparent decision-making process by fisheries agencies.	1.7.1 Level of perceived transparency by fishers of fisheries management decision-making processes.	Fisher survey	Medium	Low
	1.7.2 Documentation of fisheries management decision-making processes.	Management agency	Low	Low	Low-Medium
1.8 Ensure equitable treatment and access for fishers.	1.8.1 Level of fisher perceived equity/ fairness of the processes and outcomes of fisheries management.	Fisher survey	Medium	Low	High
1.9 Ensure adequate access to infrastructure needed for successful operation of fishing activities, within the constraints of ecological sustainability.	1.9.1 Gaps in availability of infrastructure needed by fishers.	Management agency	Low	Medium	Medium
	1.9.2 Level of satisfaction fishers have with access to different types of fishing infrastructure.	Fisher survey	Medium	Low	High
1.10 Ensure fisheries information is available in a timely and publicly accessible manner.	1.10.1 Access to fisheries information about the fishery	Fisher survey	Medium	Low	High
	1.10.2 Level of currency, independence and accessibility of information about the fishery	Management agency	Low	Low	High

^a This was determined using Bayesian Belief Network analysis.^b 'CC' refers to 'Commercial' and 'Charter' operators

Appendix B

See Table B1.

Table B1
Indigenous Community operational objectives and indicators (non- tested).

Operational objective number and name	Indicator number and name	Measurement method/s	Measurement costs	Measurement complexity	Relevance of indicator to Objective.
2.1 Fisheries management actions support the maintenance of cultural and heritage values related to fishing activities in Aboriginal and Torres Strait Islander communities (NB: Indicator 2.2.1 must be undertaken to effectively implement Indicators under 2.1)	2.1.1 Level of recognition and protection of both iconic species and habitat in fisheries management plans	Management agency	Low-Medium	Low	Low
	2.1.2 Existence of continued access to identified community iconic species through habitat protection and catch management	Management agency & discussions with community representatives	Medium-High	High	High
	2.1.3 Level of Indigenous community satisfaction with management impacts on access to iconic species over time	Survey of Indigenous community or advice from advisory group	Medium-High	Medium-High	High
2.2 Ensure access to 'Country' ^a to enable continuation of cultural fishing activities, respecting the rights of Aboriginal and Torres Strait Islander peoples to these resources.	2.2.1 Identification of 'Country' relevant to the fishery	Survey of Indigenous community or advice from advisory group	Medium-High	High	Very high
	2.2.2 Level of management arrangement support for cultural practices included in management considerations	Consultation with Indigenous community & advice from advisory group	Medium-High	High	Very high
2.3 Provide opportunities for Aboriginal and Torres Strait Islander communities to participate in fisheries management decision making processes.	2.3.1 Level of Indigenous community representation in fisheries management decision making processes	Consultation with Indigenous community & advisory group	Medium-High	Medium	Very high
	2.3.2 Level of active participation by nominated community representatives associated with 'Country' and a fishery, in fisheries management decision making processes.	Management agency or advice from advisory group	Low-Medium	Medium	Very high
	2.3.3 Community sign off is obtained on fisheries management arrangements	Management agency	Low-Medium	Medium-High	High
2.4 Optimise access to income earning opportunities for Aboriginal and Torres Strait Islander community members related to the management of fisheries.	2.4.1 Level of income-earning opportunities available to Aboriginal and Torres Strait Islanders related to the fishery, marine and/or water resources	Management agency	Low	Low	Low
	2.4.2 Number of procurement processes that allow for the select tendering of Indigenous community members from the communities associated with the fishery's identified 'Country'.	Management agency	Low	Low	Not available
	2.4.3 Number of fishery-related training and capacity-building opportunities available to the Indigenous communities associated with the fishery	Management agency	Low	Low	Not available
2.5 Make fisheries collected data available in a timely and publicly accessible manner.	2.5.1 Acceptance by community of fisheries information provided by their fishery management nominee as being relevant, inclusive of their concerns, and within the constraints of confidentiality.	Management agency & signoff by Indigenous community	Low	High	Not available
2.6 Aboriginal and Torres Strait Islander communities associated with 'Country' aquatic resources have a high level of trust in the management of fisheries.	2.6.1 Level of community nominee's participation in the evaluation process of fisheries management arrangements.	Management agency and/or advice from advisory group	Low	High	Not available
	2.6.2 Level of collaborative, cultural and scientific research undertaken to ensure fisheries management is consistent with, and supportive of, cultural and customary take.	Management agency & discussions with community representatives	Low	High	Not available
2.7 Ensure collaborative inputs by Aboriginal and Torres Strait Islander communities, regional and industry sectors on the benefits each sector offers to fisheries management.	2.7.1 Level of Aboriginal and Torres Strait Islander groups' participation with other sectors and management in any fisheries ESD education processes.	Management agency	Low	High	Not available

^a 'Country' is used to describe the family or community origins and relations to particular parts of Australia. Access in this case is based on legislative requirements.

Appendix C

See Table C1.

Table C1
Local/Regional Community Social Operational objectives and Indicators.

Operational objective number and name	Indicator number and name	Measurement method/s	Measurement costs	Measurement complexity	Relevance of indicator to objective
3.1 Positively influence fisheries related socio-economic benefits for regional communities, within the constraints of ecological sustainability.	3.1.1 Level of contribution of fisheries to direct employment in defined communities.	Fisher survey followed by expert economic modelling and analysis	Very high	Very high	Medium
	3.1.2 Proportion of direct and indirect employment in a region dependent on fishing.	Fisher survey followed by expert economic modelling and analysis.	Very high	Very high	High
3.2 Facilitate and support the cohesion and connectedness of fishers with their regional communities through fisheries management.	3.2.1 Level of recognition of key social and community needs in fisheries management processes.	Management agency	Low	Medium	Medium-High
3.3 Maximise community trust in fisheries agencies to manage fisheries.	3.3.1 Level of fisheries management agency involvement in community education/ outreach activities.	Management agency	Low	Low	High
3.4 Ensure fisheries management contributes to the maintenance of cultural and heritage values related to fishing activities.	3.4.1 Number of cultural and heritage values associated with fishing are identified and managed as part of fisheries management.	Management agency	Low	Low	Medium
	3.4.2 Importance of fishing to the culture and heritage of a community/region.	Consultation with local experts or survey of general public	Low-High	Medium-High	Medium-High
3.5 Facilitate capacity building (through skills and knowledge development) for community members to enhance stewardship of fisheries resources.	3.5.1 Number of fisheries management agency training and educational opportunities provided to the general public.	Management agency	Low	Low	High
	3.5.2 Level of satisfaction of community members with their participation in training and educational opportunities.	Survey of training course participants	Medium	Medium	High
3.6 Ensure fisheries information is available in a timely and publicly accessible manner.	3.6.1 Community satisfaction with access to fisheries management information.	Survey of general public	High	Medium	High

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