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A flexible and practical framework for reporting on ecologically sustainable development for wild capture fisheries☆

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Abstract

The principles of sustainable development (or ecologically sustainable development as it is known in Australia) are now accepted as the foundation for natural resource management worldwide and there are increasing community expectations that they will be implemented explicitly. Previous attempts to assess sustainable development for fisheries have mostly failed because the methods have been too restrictive, often attempting to develop a single set of indicators. In 2000, all the fishery agencies and major stakeholder groups in Australia supported the development of a National ESD Framework. This initiative resulted in a practical system being generated through the results of a series of case studies and stakeholder workshops.

The Australian National ESD Framework divides ESD into eight major components within the three main categories of ecological well-being, human well-being and ability to contribute: Four main steps are used to complete an ESD report for a fishery: (1) identify relevant issues, (2) prioritise these using risk assessment, (3) complete appropriately detailed reports on each issue and (4) compile the material into a report. The tools to assist this process are now available and have been used to generate reports for many Australian fisheries.
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1. Introduction

Sustainable development (or ecologically sustainable development (ESD) as it is known in Australia) is the concept that seeks to integrate short and long-term economic, social and environmental effects and values in all decision making. The publication of the report by

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the WCED (1987) "Our Common Future" defined this concept as "development (which) meets the needs of the present without compromising the ability of future generations, to meet their own needs". It therefore represents a fundamental shift in public policy because it should affect the operations of all government departments and industry, at least to some degree (PC, 1999). Whilst a considerable level of thought and effort has occurred, the complexity of issues raised, which often extend beyond an agency's (or industries') traditional sphere of experience, has meant that sustainable development has been an elusive concept to both implement effectively and demonstrate achievement in a practical manner.

The expanding expectations of the general community, which are increasingly reflected in specific initiatives related to trade and markets, require concerted efforts to make sustainable development an explicit part of the daily activities of government and industry alike. This paper outlines a way forward through the description of a framework that allows the practical implementation of ESD for wild capture fisheries management.

The principles of sustainable development are highly relevant to fisheries management. Fishing is an important activity throughout the world, contributing to the livelihoods of 200 million people, providing in excess of 100 million tonnes of fish and fish products annually for which over a billion people are dependent for their protein, cultural and social needs (FAO, 1999). Moreover, the direct impacts of fishing (e.g. target stocks) combined with other human induced changes to the environment (e.g. pollution, habitat removal) and significant advances in technology have lead to many situations where these activities have clearly not been sustainable (Mace, 1997). Compounding this, the regulatory and access arrangements for fishing are often one of the more contentious areas of public policy.

Like all natural resource management issues, fisheries management involves far more than the mere setting of minimum biological limits for the affected species. Depending upon societal values, the acceptable level of exploitation (within biological limits) can range from 'do not harvest at all' to 'fully exploit them'. The development of effective fishery management arrangements, therefore, must deal with a highly complex labyrinth of environmental, social, economic and political values. It can be argued that fisheries management has for many years implicitly been integrating social, economic and ecological objectives within its decision making progress (Fletcher, 2001). Implementing sustainable development processes should assist agencies deal with these decisions and interactions to deliver more effective and transparent outcomes.

Over the past decade, various UN organisations and initiatives have worked on sustainable development issues. These have resulted in a Code of Conduct for Responsible Fisheries (FAO, 1995) and a set of technical guidelines to support this Code and facilitate its implementation (FAO, 1999). These guidelines brought together the available knowledge related to fisheries and proposed a set of practical approaches to develop and use a 'sustainable development reference system' (SDRS) to measure progress towards sustainable development (Garcia et al., 2000).

Within Australia, all fisheries agencies are committed to the process of implementing sustainable development, however, it is not yet obvious to the general public that these principles are being applied. Recently, changes to environmental legislation at the state and federal levels have meant that independent (i.e. non-fisheries agency) assessments of fisheries activities are now required. Moreover, there has been an increased focus on the potential for eco-labelling in the development or maintenance of export markets.

To facilitate the implementation of sustainable development principles within Australian fisheries in an efficient and consistent manner, an ESD Reference group was established. This included the heads of most fisheries agencies along with representatives of major industry and other stakeholder groups. One of the results of this initiative has been the development of a National ESD Framework for Australian Fisheries.

2. A conceptual ESD framework for fisheries

While the high-level objectives of sustainable development are relatively simple in concept, translation of these into operational objectives at the fishery management plan level has proved difficult to achieve (Garcia, 2000). Most fisheries agencies have measures for some components of sustainable development, particularly those related to the target species (Sainsbury et al.,

1998). However, without clear objectives, indicators and performance measures for all aspects of sustainable development, fisheries agencies and the industry risk being unable to demonstrate that they are achieving, or even pursuing this concept.

Most previous attempts to implement sustainable development principles for fisheries have failed, largely because the frameworks used have been too restrictive, often attempting to develop a single set of indicators that could be used across all fisheries (Staples, 1997). Given the high-level of disparity in the issues affecting fisheries, this approach usually results in the focus being at such a high-level that they cannot be effectively measured. Alternatively, a large number of indicators are developed many of which are irrelevant, redundant or not measurable.

The initial focus of attention should not be to find suitable indicators, but on the development of a set of effective operational objectives that specify the outcomes wanted for each fishery. Progress against each of these operational objectives should be measurable by an appropriate indicator (with its level of bias/robustness acknowledged), along with an explicit 'performance measure' that provides a clear statement of what is acceptable performance and what is not. Given that the issues and circumstances vary greatly among fisheries, this requires a flexible process is to systematically identify the relevant issues, develop suitable operational objectives and then work out what indicators (if any) need to be measured.

The ESD Reference group met in June 2000 and adapted the general sustainable development concepts, as stated in the National Strategy on ESD (CoA, 1992), into a series of high-level objectives specifically relevant to fisheries. In addition, this meeting developed a draft conceptual framework for reporting and assessing performance against these objectives. This conceptual framework included elements from the General Sustainability Framework, the Commission on Sustainable Development Framework, the BRS ESD Framework and the Pressure-State-Response Framework. The specific benefits and difficulties of each of these have been reviewed extensively (e.g. FAO, 1999; Garcia and Staples, 2000). The framework was further developed through the results of a series of case studies and stakeholder workshops covering a variety of fisheries and jurisdictions.

2.1. Objectives and components of sustainable development for fisheries

Using the general objectives of sustainable development, the ESD Reference group agreed that the core objectives for fisheries were to:

(1) protect biodiversity and maintain essential ecological processes;
(2) enhance individual and community well-being by following a path of economic development that safeguards the welfare of current and future generations; and
(3) provide effective legal, institutional and economic frameworks for ecologically sustainable development.

From these three core objectives, eight major components of sustainable development were identified that cover the ecological, social, economic and institutional areas to allow a full assessment of the sustainability of a fishery.

2.2. Contributions of the fishery to ecological well-being

(1) Retained species: what is the impact of the fishery on the species that the fishery wants to capture? These include all species that are kept and used at least some of the time even if caught incidentally.
(2) Non-retained species: what is the impact of the fishery on species that are caught or directly impacted by the fishery but are never kept/used?
(3) General ecosystem: what are the potential indirect and more general impacts of fishing—including effects on the habitat and trophic dynamics?

2.3. Contributions of the fishery to human well-being

(1) Indigenous well-being: how does the fishery affect indigenous communities?
(2) Community and regional well-being: are there local or regional communities that are dependent on or affected by the fishery and are they supportive of, or negative about, its operation?
(3) Social and economic well-being: how does the fishery contribute to the demands of consumers, the need for fishers and associated industries to earn

income and generate economic returns at the national level?

2.4. Factors affecting the ability of the fishery to contribute

(1) Impact of the environment on the fishery: are there issues that may reduce or improve performance of the fishery that are outside of the direct control of the management agency/industry?
(2) Governance arrangements: does the fishery have sufficient management processes and arrangements to enable an adequate level of performance?

2.5. Scope

The scope of the framework was defined as 'the contribution of the fishery to sustainable development', where the fishery is the legislative entity as defined by the management agency. Reporting at this level allows a direct link between the assessment of performance and the taking of management actions to improve performance (Chesson et al., 2000). It also minimises the difficulties in drawing boundaries of what to include in an assessment. This does not mean that impacts of other fisheries or other activities are ignored, but they are considered only in terms of their impacts on the ability of the fishery being examined to meet its agreed objectives.

3. The National ESD reporting framework for fisheries

The National ESD Reporting Framework uses a four-part process that involves (1) the identification of relevant issues, (2) prioritisation of these using risk assessment, (3) completing an appropriately detailed report on each issue and (4) compiling this material (including background information) into an appropriate format (See Fig. 1 for summary).

3.1. Identifying issues—using component trees (step 1)

To be useful, the eight components of sustainable development have to be divided into sub-components down to the level where operational objectives can be developed. The method adopted to facilitate this flexibility (and visibility) is the BRS component tree design (Chesson et al., 1999). This design has been improved by developing a set of generic component trees, one for each of the eight major components of sustainable development as the starting point for each assessment. An example of these trees is shown in Fig. 2 and all eight

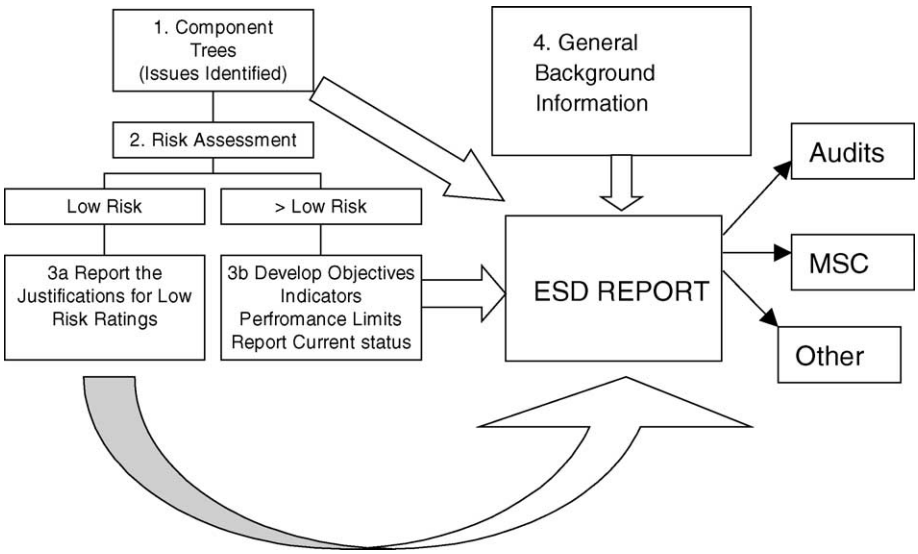

Fig. 1. Summary of the National ESD Reporting Framework.

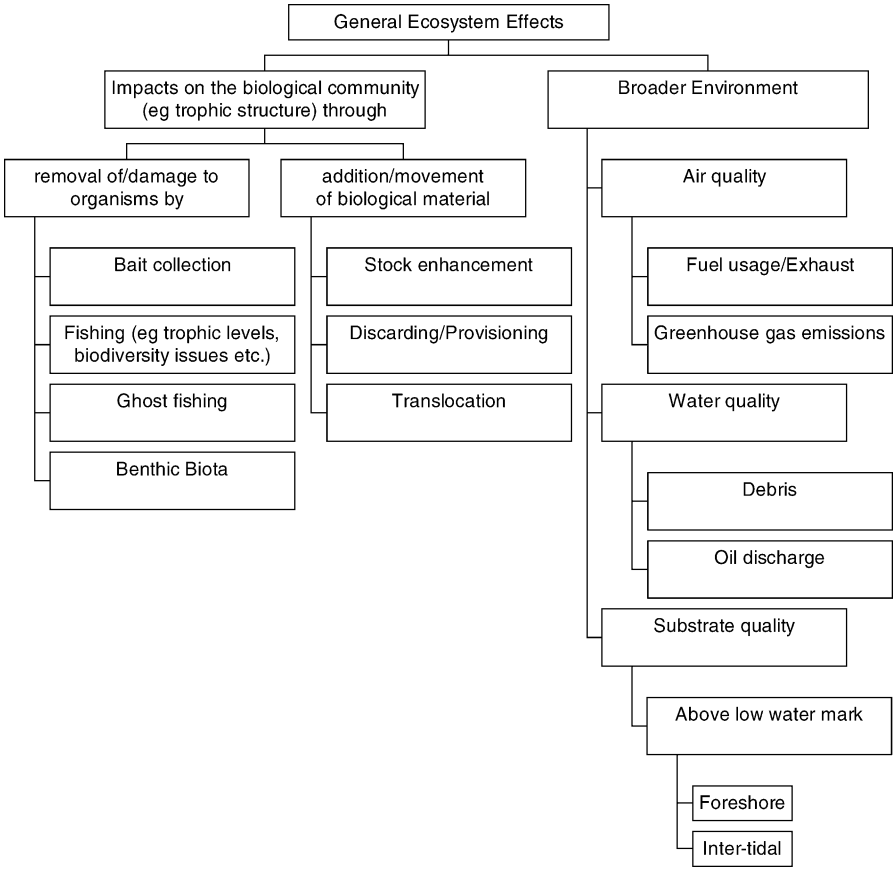

Fig. 2. An example of one of the eight generic component trees (general ecosystem tree).

trees can be found in the 'How to' guide (Fletcher et al., 2002).

Each of the generic trees is modified to make it specific to the fishery being examined by expanding (splitting) or contracting (removing/lumping) the number of sub-components as required. Preferably, this is done in an open consultative process to obtain input from all stakeholder groups. The outcome from this process can result in very different trees depending upon the fishery. For example, an abalone fishery is unlikely to require assessment of a number of the sub-components shown in Fig. 2 (e.g. bait collection, ghost fishing) whereas a trawl fishery may need to separately assess their impacts on a number of different benthic habitat categories.

Using these generic component trees provides a consistent mechanism for determining whether an issue is relevant for a fishery. Thus, it requires both the specification and discussion of what are not issues as much as determining what are issues. This should result in fewer relevant issues being omitted. A further advantage is that the tree structure helps focus peoples attention and deal with the different types of issues in a structured manner (i.e., helps to separate discussions of environmental issues from 'moral' issues).

3.2. Prioritisation process using risk assessment tools (step 2)

The number of potential issues that may be identified for any fishery can be large. The importance of these will often vary from relatively insignificant to critical, and therefore a process to prioritise these is needed. For the environmental components, a prioritisation process, using qualitative risk assessment methods (based on the Australian standard AS/NZS 4360

1999), is completed to determine the appropriate level of management response.

Risk assessment involves the examination of the potential consequences for each issue and determining how likely these are to occur from the activities of the fishery. To assist in obtaining realistic and consistent estimates of risk, five consequence tables specific to fisheries management issues have been developed. These tables cover the potential range of impacts of a fishery on (1) retained species, (2) byproduct species, (3) the benthic habitat, (4) the broader ecosystem plus, (5) a generic table for all other situations. Each table specifies five qualitative levels that range from negligible (e.g. no measurable effect) up to catastrophic/irreversible (e.g. species extinction) consequences (see Fletcher et al., 2002 for full details).

To determine the likelihood of any particular consequence actually occurring, the process identifies one of six levels ranging from remote to likely, based upon the collective wisdom of the participants. From the multiplication of the scores for consequence and likelihood, the overall risk level is calculated (total scores vary from 0–30) which are separated into one of five risk categories: negligible, low moderate, high, and extreme (see Table 1 for details).

Only issues of sufficient risk (moderate, high and extreme), or those that require specific management actions to achieve a low risk rating, need to have full performance reports completed. For issues classified as low or even negligible risk, the system still requires that the justifications for arriving at these low scores be documented as part of the report. The description of why each of the risk assessment scores were assigned is much more important than the scores themselves. This allows all stakeholders and interested parties to see why issues were accorded these ratings. It also assists the effectiveness of any future reviews of the risks because it will be easier to recognise if there has been any change in either the status and/or understanding of the issue if the original justifications are recorded.

3.3. Completing component reports (step 3)

For issues that require explicit management, a detailed performance report is generated. A set of standard headings has been developed (Table 2) which ensures that there is a consistency of focus and attention across all issues. They also allow for the separation of the discussions concerning performance measures from the discussions about the actual indicator and the adequacy of their measurement etc.

The first step in developing these performance reports is to specify an operational objective. The operational objective needs to have a direct and practical interpretation in the context of the management of the fishery and, most importantly, performance needs to be measurable and auditable. It should also be consistent with, and clearly linked to any higher-level objectives that might appear in legislation, policy statements or management plans (i.e. provide the justification for selecting this objective compared to any other given higher-level objectives).

The indicator is the measure that is to be used to track changes with respect to an operational objective. The performance measure, however, must specify how to interpret the indicator by outlining one or more reference points (e.g. biomass should remain as close as possible to x but no lower than y) or simply in terms of a trend (e.g. increasing is desirable, decreasing is undesirable). Thus, the operational objective, indicator and performance measure are a package. All three are needed before any one of them is useful.

The system also includes headings for evaluation, data quality and availability, robustness of the indicator and/or performance measure, the management responses, and any external drivers (see Table 2). The

Table 1
Risk ranking definitions

Risk	Score	Likely management response	Reporting
Negligible	0	Nil	Short justification only
Low	1–6	None specific	Full justification needed
Moderate	7–12	Specific management needed	Full performance report
High	13–20	Possible increases to management activities needed	Full performance report
Extreme	20–36	Likely additional management activities needed	Full performance report

Table 2
Descriptions of headings for performance reports

Performance report heading	Description
Rationale for inclusion	Why is this considered an issue? What was the outcome of the risk assessment?
Operational objective (plus justification)	What outcome are your trying to achieve and why?
Indicator	What are you going to use to measure performance?
Performance measure/limit plus (justification)	What levels define acceptable and unacceptable performance and why?
Data requirements/availability	What monitoring programs are needed?
Evaluation	What is the current performance of the fishery for this issue?
Robustness	How robust is the indicator and/or the performance measure in assessing performance against the objective?
Fisheries management response	
Current	What are the management actions currently being used to achieve acceptable performance?
Future	What extra management is to be introduced?
Actions if performance limit is exceeded	What will happen if the indicator suggests performance is not acceptable?
Comments and action	Summarise what actions will happen in the coming years
External drivers	What factors, outside of the fisheries agency control may affect performance against the objective?

inclusion of the management responses, particularly in relation to the data presented, makes the explicit link between the operational objective, the measurement and reporting of performance and the action to be taken to maintain or improve that performance. This is an important distinction, and is an advantage of this framework, compared to other systems (Chesson et al., 2000). This allows for the assessment of whether the management strategy outlined is appropriate given the level of understanding of an issue and the level of precaution currently being applied.

3.4. Compile a report (step 4)

The final step is to compile the information into a comprehensive report that provides a description of the fishery and the environment within which the fishery operates. This allows the other sections of the report to be put in context. The background material should include:

- the history of the fishery;
- where the fishery operates;
- the kind of fishing methods used;
- summaries of the biological characteristics of the major species, habitats and environment that could be affected; and
- the social and economic environments that the fishery operates within.

The material contained within this report can then be used to generate applications or submissions to third party auditors and other agencies.

4. Discussion

The National ESD Reporting Framework examines the contribution to sustainable development of an activity, (in this case fishing). This differs from other reporting frameworks many of which have tended to examine the impact of all activities on a locality or a particular resource (such as forests). Furthermore, the ESD reports on fisheries are not designed to show that a fishery will continue indefinitely or how it can remain viable, which is the intention of some other reporting frameworks. Instead, the framework is designed to show how a fishery currently contributes to sustainable development, whether this contribution is positive or negative.

The approach taken has resulted in a practical system that should allow reports on all elements of sustainable development to be generated for a fishery. The system not only covers all the issues required for ecosystem-based management but also those needed for social and economic assessments. The outcomes from the initial case studies (see Whitworth et al., 2002 for details) and the subsequent application of this process for over 20 fisheries in Western Australia (e.g. DoF,

2002a, 2002b, 2002c) have proved the system capable of operating across many types of fisheries.

The key elements of the framework include the allowance for flexibility whilst ensuring a rigorous and disciplined approach is taken. Further, the incorporation of risk assessment techniques within the framework should allow the broad spectrum of issues that are associated with each fishery to be dealt with in an appropriate and efficient manner.

The framework can be used as more than a reporting tool, it can outline a whole system of management because it describes what you are trying to achieve, how you will measure your success, whether this is being achieved or not and what you plan to do in the future to meet these objectives. Therefore, the high-level of discipline required to complete this task should lead to a process of continuous improvement and therefore the achievement of 'best practice' performance for fisheries management. Moreover, the high-levels of transparency in the decision making processes that are a major part of this process should significantly reduce the level of routine enquiries about regulatory decisions that currently consume considerable levels of management resources.

The information generated by this process can be used for a number of purposes. Thus, a full ESD report can be considered as curriculum vitae for a fishery with the information contained able to meet most internal requirements (such as reports to Government/Parliament) and external requirements (e.g. applications to a relevant environment agency, or external auditors (such as the Marine Stewardship Council, etc.). What is not explored in the current framework is the relative benefit of one fishery compared to another fishery or to another industry/sector. Ultimately when each fishery has been assessed in a bioregion, examinations that assess the relative contributions and costs of all fisheries will be possible. Similarly, when all fisheries (and their interactions) have been assessed, comparisons with and interactions among other sectors can be explored. Modified frameworks to deal with these types of assessments are currently being developed and tested.

There has already been interest in the application of suitably modified versions of this framework to report on ESD for other natural resource management sectors (e.g. aquaculture and agriculture). Furthermore, some non-natural resource management agencies (e.g. transport departments) have also seen the potential benefits of this system. This demonstrates the basic value of the framework as a methodology for assisting in the operation and management of any activity.

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