

National Application of Sustainability Indicators for Australian Fisheries

Part 2: Ecosystem based frameworks for
aquaculture, multi-fishery and international
applications

FRDC Report – Project 2000/145

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FFA



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Fish for the future

This report for FRDC Project 2000/145 formed part of what has been an on-going process to develop an effective ESD reporting and assessment framework for fisheries and aquaculture within Australia. Whilst this project was originally initiated under the auspices of the Standing Committee for Fisheries and Aquaculture (SCFA), and was subsequently endorsed by the Australian Fisheries Management Forum (AFMF) it should not be taken as being the policy of any individual fisheries management agency.

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2000/145 National Application of Sustainability Indicators for Australian Fisheries – Part 2: Ecosystem based frameworks for aquaculture, multi-fishery and international applications

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Objectives:

1. Develop initial ESD reporting framework for the Aquaculture Sector
2. Initiate development of an ESD Framework for Cross Fishery and Marine Planning issues
3. Further refine and promote the international adoption of the concepts developed by the ESD national framework for wild capture fisheries

Non Technical Summary

Outcomes Achieved To Date:

Aquaculture ESD Framework - The ecosystem based framework developed for aquaculture was designed to function as a set of guidelines for coordinating activities and ensure due diligence within the planning and approval processes not just as a method for the generation of a report on ESD for an industry sector. The methods outlined in the ESD framework have now been directly applied to a number of aquaculture sectors in Australia (e.g. oysters in Tasmania and NSW, marine fish farming in WA and Qld, salmon in Tasmania; inland aquaculture in SA, prawns in WA and aquaculture precincts in Vic.). The principles are now included in the aquaculture policies of most Australian jurisdictions including WA, SA, NT and Vic.

Many of the methods and tools of the ESD framework for aquaculture, including the use of three levels of issue identification and assessment (farm, catchment and regional) using component trees with risk assessment to help prioritise what level of direct management intervention is required have also been adopted by the FAO within their guidelines for implementing the Ecosystem Approach to Aquaculture.

Cross Fishery-Marine Planning framework (EBFM/EBM) – Following the success of the ESD framework for individual fisheries, a practical, risk based framework for use with regional level management of marine resources was developed to enable cross/multiple fishery management at the bioregional level to fully implement Ecosystem Based Fisheries Management (EBFM). This was designed to replace the previous, disjointed fishery level, planning systems, with a single, coordinated risk based system to generate efficiencies for the use of Departmental (government) resources. The simple set of steps developed has enabled adoption of a fully regional, ‘ecosystem based’ approach in WA without material

increases in funding. Having such a cost effective process means that it can be applied in all circumstances, not just in those regions of the world where a large amount of resources and scientific data are available.

The WA tested framework was subsequently used by the Australian Fisheries Management Forum as a key input for developing national policy guidelines on the implementation of EBFM. Finally this system was also used as a key input for the development of a draft national framework for the implementation (through the Natural Resources Standing Committee) of multi-sectoral EBM

Refinement of the wildcapture fishery framework for international adoption (EAF – EAFM)

- The national ESD framework for wild capture fisheries was one of the main systems used by FAO to develop their original 2003 guidelines for implementing an Ecosystem Approach to Fisheries (EAF). Subsequently, a major objective of this project has been to work with FAO and other regional agencies (SPC FFA) to adapt the methods developed for Australia by expanding the available tools to be more relevant for data poor and low capacity situations common in developing countries. The project has therefore directly contributed to the initiatives to implement an ecosystem approach to the tuna fisheries of the Pacific and to the coastal fisheries of the African continent. Most recently it has assisted the FAO in the development of a toolbox of EAF based methods with the overall purpose being to enable EAF planning and implementation to be undertaken for any fishery in the world providing there is sufficient and sustained commitment by the relevant stakeholders (both government and industry).

Conclusion - This project in conjunction with a number of other related international initiatives, has directly and indirectly contributed to the creation of what is now the new paradigm for the management of fisheries and marine resources both in Australia and around the world. Contrary to many perceptions it has been demonstrated that implementing an ecosystem type of approach is possible for all types of fisheries and aquatic resource uses, including small scale fisheries that operate at a local level and have minimal data and few formal management resources, up to large multinational industrial fisheries with significant data sets and resources. The risk based methods and principles that have been generated are now generally accepted as best practice for the implementation of the ecosystem approach to all natural resource management to help meet government commitments to UNCLOS, Sustainable Development, Convention on Biological Diversity and the Code of Conduct for Responsible Fishing initiatives which were signed 20 – 30 year ago.

Background

Following the development and publishing in 2002 of a practical framework to implement the principles of Ecologically Sustainable Development (ESD) for wild capture fisheries by FRDC*, it was identified that additional frameworks were needed to enable implementation of ESD across all sectors. This required the development of specific frameworks that could be used for the assessment and management planning of aquaculture plus the implementation of ecosystem approaches for cross-fishery and cross-sectoral applications. It was also recognised that the

* Fletcher *et al.*, (2002) *National ESD Reporting Framework for Australian Fisheries: The 'How To' Guide for Wild Capture Fisheries*. FRDC Project 2000/145, Canberra, Australia. 120pp. http://www.fisheries-esd.com/a/pdf/WildCaptureFisheries_V1_01.pdf;

original wild capture fisheries framework would need to be refined based on experiences across different fisheries and to ensure that it could be appropriate to meet the contextual requirements associated with data and capacity poor situations including those found in developing countries.

Aquaculture

The ESD Framework for Aquaculture was generated by project staff in conjunction with ESD reference group members, the Aquaculture Committee of Australian Fisheries Managers Forum (AFMF) and the National Aquaculture Council (NAC). The framework developed for aquaculture had a number of similarities to the wild capture fisheries version - both help to identify all relevant environmental, social/economic and governance issues, use risk assessment to assist determine the appropriate level of management response and provide a reporting structure to document outcomes develop efficient and effective management systems. The most important differences are that the environmental components for aquaculture are structured into three different spatial levels: (1) Whole of industry issues, (2) Catchment/Regional issues, and (3) Within facility issues which is designed to show the linkages between what is imposed at the operator level and the outcomes wanted by government/community at the regional and whole of industry scales. This framework has been applied to a number of aquaculture sectors in Australia, it is contained in the aquaculture policies of most jurisdictions and has also contributed to the development of the FAO's ecosystem approach to aquaculture guidelines.

Multi-fishery/Multi-Sector

Given the confusion that surrounded the different terms and concepts that were in vogue for ecosystem initiatives, in 2003 the ESD reference group concluded that ESD was the overall goal for government and the other terms (e.g. EBM, EBFM, EAF) described strategies that were being used within or among sectors to work towards the overall goal of ESD. Given this clarification it was identified that there was a need to develop and test a framework that could extend the ESD initiative beyond the implementation at the individual fishery level. Using this hierarchical concept, in the ESD Reference group also drafted an ecosystem based framework for multiple fisheries and sectors with the initial expectation this would be trialled in conjunction with National Oceans Office (NOO) for the marine planning activities they were undertaking at the time. Unfortunately, despite a number of attempts to get collaborative activities underway, this exercise was abandoned in 2006.

Therefore, an alternative approach was undertaken using the West Coast bioregion of Western Australia in a joint 2006 project using co-funding from the WA Marine Science Institution (WAMSI). Through this project the multi-fishery EBFM framework was refined to become a hierarchical, risk-based process that avoided merely generating an impossibly complex set of regional level issues, uncertainties and stakeholder expectations. The initial case study identified over 600 ecological assets; social and economic outcomes; governance systems and external drivers through stakeholder workshops but using the procedures developed, this complexity was reduced by consolidation these into 60 regional level risks and, by using a multi-criteria analysis to integrate related ecological, social and economic values and risks, into just 24 'Agency level' priorities. A second national ESD workshop held in 2008 confirmed the need to address cumulative effects of fishing in a region and therefore the set of steps developed for WA was subsequently used by the Australian Fisheries Management Forum (AFMF) as the basis to generate national policy guidelines for the implementation of EBFM. These steps were also used by the Biodiversity Working Group of the NRMSC in the development of a draft national EBM (multi-sector) framework for the NRMSC.

International Applications

The framework and methods developed for the wild capture sector in Australia were trialled in different locations around the world in conjunction with regional fisheries agencies (e.g. FAO, FFA, SPC). This has resulted in the development of a much broader suite of tools and a simplification of the descriptions of the various steps involved in this process which are now all located in a web based toolbox on the FAO website. This work has also demonstrated that contrary to many perceptions, implementing an ecosystem approach is possible for all types of fisheries and aquatic resource uses, including those that have minimal data and few formal management resources and does not require an ecosystem model.

Conclusion

This project, in conjunction with a number of related FRDC and other Australian and international initiatives has increased the ability of managers and other stakeholders implement the 'ecosystem approach' to management. These efforts have helped turn 'ecosystem approaches' from a vague concept into practical outcomes across a number of different natural resource industries (fisheries, aquaculture, agriculture, etc).

Despite these technical successes, from the public policy perspective, the adoption and, more importantly stakeholder acceptance of the 'ecosystem approach' for the wild capture fisheries within Australia, has not been as effective as envisaged. Even with initial agreements from all jurisdictions to participate in a single national process, a number of alternative initiatives were subsequently progressed under different 'titles'. This resulted in a high degree of confusion within industry, an inefficient use of resources but most importantly it enabled a reduced level of acceptance by the various environmental sectors and confusion of stakeholder groups and is still affecting national policy development.

The major challenge in Australia and elsewhere is to now generate improvements to the governance systems used across the different jurisdictions and levels of government so these tools can be used more effectively and efficiently. This should improve public perceptions for aquatic resources management, but more importantly generate better long term community outcomes.

Keywords: Aquaculture, cumulative impacts, EAF, ESD, ecologically sustainable development, ecosystem approaches to management, risk assessment, triple bottom line reporting, social and economic assessments, ecosystem based management, EBM, ecosystem based fisheries management, EBFM, regional marine planning, EAF toolbox

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The Contributors Section specifies those people who played formal or major roles in one of more elements of this second stage of the ESD Framework project. In addition I would like to thank the various agencies and industry members who have contributed to the discussions and testing of the tools or frameworks.

Special thanks go to Mr Peter Millington who for many years was chair of the ESD Subprogram

and therefore had a major influence on the direction for this project and helped to ensure that the project remained relevant with outputs that were practical for use by management agencies.

Finally, I would like to acknowledge the patience of the FRDC staff in dealing with the multiple changes to the objectives and methods of this project and the inevitable delays in timelines as it has evolved over the past decade.

Acronyms

AFMF	Australian Fisheries Managers Forum
BRS	Bureau of Rural Sciences
CBD	Convention on Biological Diversity
CCRF	Code of Conduct for Responsible Fisheries
COFI	FAO Committee on Fisheries
DEH	Department of Environment and Heritage (Commonwealth)
EA	Ecosystem Approach
EAF	Ecosystem Approach to Fisheries
EAFM	Ecosystem Approach to Fisheries Management
EBFM	Ecosystem-Based Fishery Management
EBM	Ecosystem-Based Management
ERA	Ecological Risk Assessment
EMS	Environmental Management System
ESD	Ecologically Sustainable Development
FAO	Food and Agriculture Organization
FRDC	Fisheries Research and Development Corporation
ICAM	Integrated Coastal Areas Management
ICD	Integrated Conservation and Development
ICZM	Integrated Coastal Zone or Area Management
IMO	Integrated Ocean Management
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
MACC	Marine and Coastal Committee (of NRMSC)
MCDA	Multi-Criteria Decision Analysis
MPA	Marine Protected Area
MCFFMC	Ministerial Council for Forestry Fisheries and Aquaculture
NAC	National Aquaculture Council
NOO	National Oceans Office
NRMSC	Natural resources Management Standing Committee
RFMO	Regional Fishery Management Organization
SCFA	Standing Committee on Fisheries and Aquaculture
TMP	Tuna Management Plan
UNCED	UN Conference on Environment and Development

UNCLOS	UN Convention on the Law of the Sea
WAMSI	Western Australian Marine Science Institution
WCED	World Commission on Environment and Development
WCPFC	Western Central Pacific Fishery Commission
WCPO	Western Central Pacific Ocean

Background

Since the National Strategy for Ecologically Sustainable Development (NSES) was developed in 1992, ESD has been accepted as the foundation for natural resource management in Australia and has become explicitly or implicitly, a major objective of all fisheries legislation. State and Commonwealth fisheries management agencies are accountable for achieving the objectives and, importantly, to demonstrate that the objectives are being met. To do this, fisheries management agencies need to be able to measure and report on progress of performance.

The Standing Committee on Fisheries and Aquaculture (SCFA) in 1999 identified the need to actively progress the development of nationally agreed criteria and indicators that would enable fisheries managers to report against all the principles of ecologically sustainable development (ESD) given that an ESD objective was explicitly or implicitly part of State and Commonwealth fisheries management legislation. The urgency to progress this approach was raised at the ESD Stakeholder Workshop that was held in Geelong during March 2000. All stakeholder groups were represented at this workshop and they all recognized that there was a strong need to progress from the current situation to one where reporting on all components of ESD can be completed.

The initial conceptual framework that was generated identified 8 key components to ESD. These covered environmental wellbeing (which includes issues associated with the retained species, non-retained species and other environmental issues associated with fishing), human wellbeing (socio-economic issues at the local, regional and national levels) and governance (management and legislative arrangements). These draft objectives and frameworks were ratified at SCFA 43 in September 2000 and at MCFFA* in October 2000

The initial framework was refined using the results of case studies and workshops with this information subsequently expanded into a “*How To*” guide (Fletcher et al., 2002). This was designed to be sufficiently comprehensive that it could be used on its own, or with minimal instruction as the basis to complete an ESD report for any fishery (See Figure 3 for a summary of the process). A complete draft of this *Guide* was completed in September 2001. It was discussed at the November 2001 ESD Reference group meeting and final changes were completed in February 2002. It was published in March 2002 and officially launched at the Aquaculture ESD workshop held in Melbourne in July 2002. This essentially ended phase one of this project for which a final FRDC report has already been published (Fletcher, 2003).

Following the completion of the wild capture framework in 2002 it was identified that other frameworks were needed to enable full implementation of ESD across all sectors. This required the development of specific frameworks that could be used for the assessment and management planning of aquaculture plus a framework that could enable the implementation of ecosystem approaches for cross fishery and cross-sectoral applications.

* Ministerial Council for Forestry Fisheries and Aquaculture.

Need

The need to develop a separate ESD Framework for Aquaculture was generated by the FRDC subprogram in conjunction with the Aquaculture Committee of Australian Fisheries Managers Forum (AFMF) and the National Aquaculture Council (NAC). This initiative was added to meet the growing expectations of the community that all sectors of the seafood industry (including the aquaculture sectors) can clearly demonstrate that they are operating within the principles of Ecologically Sustainable Development. Given the major differences in the operations of aquaculture facilities and issues, the framework for wild capture fisheries was not considered suitable and a purpose built framework was required.

In addition to the need to develop a framework suitable for the aquaculture sector, after the original component of this initiative was begun in 2000, a high level of confusion began to be generated through the use of terms in addition to Ecologically Sustainable Development (ESD). These included Ecosystem Based Management (EBM), Ecosystem Based Fishery Management (EBFM), Integrated Oceans Management (IOM) and Environmental Management Systems (EMS). It was also becoming of increasing concern that some concepts were being promoted as better than others leading to unproductive and/or duplicative activities and projects.

As part of the ESD workshop held in April 2004, these specific terms, and the general problem of dealing with different terminology amongst groups and countries, were discussed. Resulting from this work there was subsequently better agreement about the various ESD definitions, being used by the Australian Fisheries Management Forum* and the then Marine & Coastal Committee of the Natural Resources Management Standing Committee (NRMSC). The ESD Reference Group determined that ESD was the overall goal and that the other terms (e.g. EBFM) described strategies that were being used to work towards the goal of ESD. Given this clarification there still was the need to develop and test a framework that could extend the ESD initiative beyond the implementation at the individual fishery level (Fletcher, 2006).

A second national ESD workshop (see Millington & Fletcher, 2008) concluded that whilst extremely valuable, applying an ecosystem approach at the fishery level did not address the cumulative effects of all fishing related activities in a region or deal with the conflicting objectives and allocation issues between fisheries or sectors (e.g. commercial and recreational). Managing only at this level was hindering linkages to other government planning processes that operate at a regional level (e.g. establishment of marine parks) and it had not halted the increasing community perception that fishers (especially commercial fishers) no longer have an automatic 'Social License' to operate. The workshop proposed that taking a regional level (multi-fishery) Ecosystem Based Fishery Management approach could assist in dealing with many of these issues.

Finally, it was recognised that the original wild capture fisheries framework would need to be refined based on experiences in applying this to a number of different fisheries. Furthermore, refinements would be required to ensure that it would be appropriate to meet the differing contextual requirements associated with being considered an internationally useful framework.

* Which includes the heads of each fisheries agency and jurisdiction in Australia

Objectives (Phase 2)

1. Develop the initial ESD reporting framework for the Aquaculture Sector
2. Initiate development of an ESD Framework for Cross Fishery and Marine Planning
3. Further refine and promote the international adoption of the concepts developed by the ESD national framework for wild capture fisheries

Methods

Objective 1. Aquaculture Framework

The ESD Framework for Aquaculture was developed as part of the activities within the Fisheries Research and Development Corporation (FRDC) subprogram for ESD Reporting and Assessment. The agencies responsible for the management of aquaculture in Australia and the relevant aquaculture sectors are committed to incorporating ESD into their management processes. The first step in this process is the documentation of the methods needed to enable the initial analyses of any aquaculture sector against the principles of ESD through the completion of a *How To Guide*.

This *How To Guide* was completed in collaboration with the Aquaculture Committee of Australian Fisheries Managers Forum (AFMF), the ESD Working group of the Marine and Coastal Committee of the NRMSC and the National Aquaculture Council (NAC). The initial draft *How To Guide* was further refined following consultation with relevant government agencies (including many fisheries/aquaculture agencies and environmental agencies across all jurisdictions), industry (e.g. NAC) and other stakeholders (e.g. ESD Reference Group) through a series of workshops held in late 2002 and early 2003.

The *How To Guide* was tested using a number of “Case Studies” completed in Qld, WA, SA and Victoria:

Qld Prawn farming (October 2000)

SA Bluefin Tuna Aquaculture (December 2001)

WA Black Pearls (mid 2002)

SA Marine finfish Aquaculture (September 2003)

Victorian Aquaculture Parks (October 2003)

Objective 2. Cross-fishery and Marine Planning

In July 2003, the ESD Working group developed an initial, multi-fishery/cross fishery framework as part of the recognition that there was a hierarchy in assessment frameworks (See Figure 1).

These specific terms, and the general problem of dealing with different terminology amongst groups and countries, were discussed by the ESD Reference Group at the ESD workshop held in 2004. Through this process there was an improved consistency about the ESD definitions used by the Australian Fisheries Management Forum* and the Marine & Coastal Committee of the Natural

* Which includes the heads of each fisheries agency in Australia

Resources Management Standing Committee (NRMSC). This was further developed to outline that the various concepts being proposed (such as Fishery ESD, EBFM and EBM) are all really just strategies that are assisting meeting the overall ESD goal of government (Fletcher, 2006).

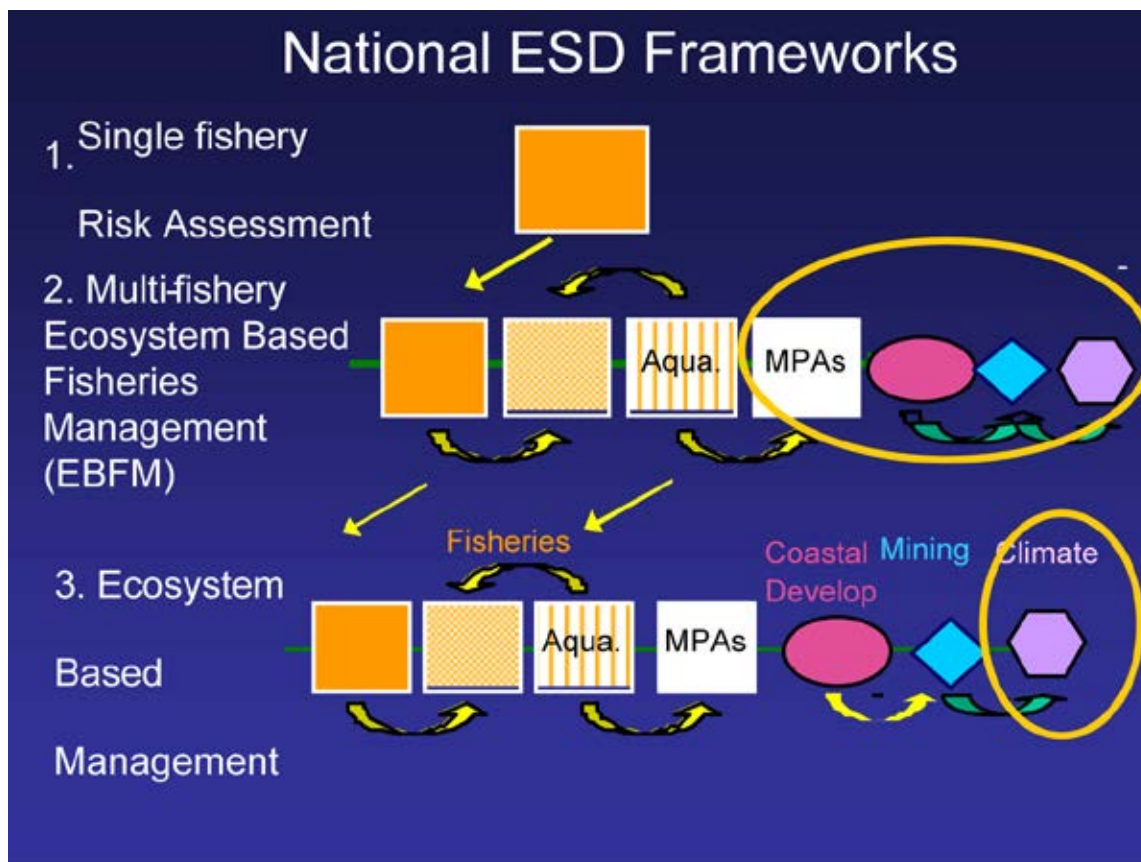


Figure 1.: Relationship between the three ESD framework levels. Level 1 is the assessment and management of each individual fishery; Level 2 (EBFM) is the cumulative assessment and management of all the fishery related activities in a region; Level 3 (EBM) is the cumulative assessment and management of all marine activities in a region. The elements included in the gold ovals represent the external drivers or influences that need to be accounted for by management at that level. What are treated as or are directly managed external drivers is the major difference between EBFM and EBM. From Fletcher (2006)

Attempting EBM

Using the hierarchical concept developed by the ESD Reference group, a draft framework for completing ESD based planning and assessments for multiple fisheries and sectors was developed in 2003. There was an expectation that it would be developed in conjunction with National Oceans Office (NOO) and trialed with the marine planning activities that this agency was undertaking at that time. In 2004 the planned meeting with NOO did not take place and this issue was to be raised at the ESD reference group meeting held in mid-2004 but no one from NOO attended. This matter, and whether NOO actually want this to occur, was then raised at the subsequent MACC meeting that was held in February 2005. It was considered that the entire initiative of getting adoption by multiple agencies and governments was getting complicated by external factors including the plethora of similar initiatives being pursued by various Australian government agencies as there was the ESD framework, the NRM process, the IOM process and the Integrated Coastal management process – all of which were variations on a theme. It was

considered unlikely that any real progress would be made unless there is some rationalisation of these processes- or at least a recognition that they are parts of a continuum.

At the ESD reference group meeting held on April 21 2005, one of the key agenda items was a discussion about whether there was merit in trying to facilitate the development of a cross sector ESD framework. It was agreed that unless there was a significant ‘buy on’ from NOO, that there was no other real “client” for this work. If this was the case it would not progress.

A presentation was subsequently given by NOO on the methods they were developing to implement marine planning in the remainder of the marine regions (after completion of the SE plan). This new approach was planned to be Strategic, Integrated, Regional, Participatory, Objectives-based, Risk-based which were all consistent with the approach that has been taken using the National ESD framework. There was therefore a discussion about the value of the ESD subprogram processes potentially assisting NOO in “operationalizing” this new approach. It was considered useful by the representatives of all jurisdictions (including NOO) that there was a clear meshing of the approaches at the individual fishery level up to the regional marine planning level. It was also recognized that the methods and tools developed for the ESD framework may be useful to assist in the development of effective marine plans. Thus offering to assist in, a formal manner, the completion of one of the marine plans being developed by NOO (the South West Region) as a case study to test this assertion was supported by the group.

The ESD reference group made three suggestions:

- i. NOO trial the use of the ESD framework – including the component tree approach as an engagement tool to assist achieve an outcome;
- ii. That the South West Region be used as the case study to trial the multi sector framework; and
- iii. That a subcommittee be formed with representatives from the Subprogram and NOO to determine the engagement process and size of subsequent project (which would then go back to FRDC board for validation).

The subcommittee of the ESD reference group and NOO met on this issue a number of times but there was no formal agreement from NOO or DEH executive to progress this initiative. Whilst this was investigated vigorously both by the PI and the reference group as a whole the changes in scope that were made to the NOO marine planning processes during 2006 meant that they were no longer similar enough to be considered viable. Subsequently, NOO did not return to any ESD project or reference group related meetings and the concept of using a collaborative approach to test this framework was therefore terminated.

WAMSI Project – Applying the EBFM Framework in Western Australia

In 2006 funding for the Western Australian Marine Science Institute (WAMSI) enabled the subsequent development of a series of projects to examine the potential benefits of implementing EBFM for a major region of Western Australia. This provided the best vehicle for undertaking a comprehensive case study and this FRDC project became a co-funder. Discussions were held with key DEH (NOO), CSIRO and BRS staff to ensure that they will be able to participate in this process.

Management Question: How can the EBFM framework assist in providing a Natural Resource Management planning structure for the optimal use of marine resources at the bioregional level?

Project Strategy - Develop, apply and update the EBFM framework for each of the specific bioregions by tailoring the general EBFM framework to the regional constituent components and incorporating the outputs from all related projects.

Specific Outputs:

- Using the national EBFM framework, generate a modified set of component trees that identifies all of the relevant EBFM (ecological, social and economic) issues for each of the priority bioregions.
- Generate a refined list of priority issues based on a risk assessment of each of the identified issues. These priorities can then be used to evaluate the current status of each issue and identify additional research that may be required.
- Produce a summary document that outlines all relevant EBFM information for each priority bioregion.
- Construct a qualitative model for each of the high priority bioregions (West Coast & Gascoyne) that links the major issues and provides an understanding of the relative strength of these relationships between the identified issues (e.g. between individual stock status and community structure; current resource allocation and socio-economic outcomes).

National Policy Guidelines on EBFM (for AFMF)

In 2008 the AFMF agreed to develop a national set of policy guidelines for the implementation of EBFM. A subcommittee was established to progress the development of these guidelines which had terms of reference that included to:

- Develop a draft national policy statement on Ecosystem Based Fisheries Management (EBFM) for consideration by AFMF.
- Assess current policy, legislation and management frameworks and provide recommendations on reforms required to efficiently deliver on the agreed EBFM policy statement

This group used the outcomes of the EBFM process used in the WAMSI case studies as the basis for the drafting of these guidelines.

National EBM Framework (for BWG of MACC)

In 2009 the Biodiversity Working Group of the marine and coastal committee of the Natural Resource management Council were tasked with the development of a National set of guidelines on EBM (multi-sector).

The steps developed by this MACC working group were for use in developing an EBM based plan for any region in Australia (MACC, 2010). This practical application of EBM was largely based on the EBFM framework outlined above (Fletcher et al., 2010) and a similar process adopted in South Australia and involved the use of a step-wise, risk based approach to identify the relevant issues and determine the appropriate level and focus for any management response or actions. Furthermore, where there was limited knowledge of the ecosystems or any other component this would not preclude initiating the planning process or taking early actions where there are clear measurable benefits.

Objective 3. International Adoption of Principles and Processes

Following the completion of the original 'how to' guide for ESD and the wildcapture sector in 2002, a large number of refinements have been made. These have arisen from further application of the framework to Australian fisheries but more so from the attempted application of this method to a number of fisheries in other countries to meet the different circumstances and objectives of management of these agencies and stakeholders.

There was a significant initiative in the Pacific made with the Forum Fisheries Agency (FFA) to implement the ecosystem concept (which they called Ecosystem Approach to Fisheries Management - EAFM) for the Western Central Pacific Tuna Fisheries. This resulted in a guide being developed to develop or update the tuna management plans (TMPs) to address the requirements of the WCPO convention.

A considerable amount of work was completed with the FAO of the UN, both in direct implementation of this concept (which they call the Ecosystem Approach to Fisheries - EAF) for fisheries in Africa (as part of the EAF-Nansen project). But there has also been considerable assistance provided in the development of a toolbox of methods that can assist in applying EAF for all fisheries, especially those in developing countries. Each of these initiatives is summarised below and collectively they have greatly improved the number of tools available and also the robustness of the tools originally published in the original How to Guide. The updated versions are all available on ESD website (www.eafm.com.au) and at the FAO website www.fao.org/fishery/eaf-net.

Results/Discussion

1.0 ESD Framework for Aquaculture

1.1 Overview of Framework

The ESD Framework for Aquaculture was generated in conjunction with the ESD Reference Group, the Aquaculture Committee of Australian Fisheries Managers Forum (AFMF) and the National Aquaculture Council (NAC). This initiative was undertaken to meet the growing expectations of the community that all sectors of the seafood industry (including the aquaculture sectors) can clearly demonstrate that they are operating within the principles of Ecologically Sustainable Development. The first step in this process was the documentation of the methods needed to enable the initial analyses of any aquaculture sector against the principles of ESD through the completion of a *How to Guide*.

How does the ESD framework fit with Aquaculture?

The ESD framework for aquaculture (Fletcher et al., 2004) has a number of similarities to the ESD framework for wild capture fisheries (Fletcher et al., 2002) both help to identify the relevant environmental, social/economic and governance issues, assist determine the appropriate level of management response using risk assessment techniques, and they provide a reporting and management system structure. There are, however, a number of important differences with the most obvious being the environmental components for aquaculture which are structured into three different spatial levels: (1) Whole of industry issues, (2) Catchment/Regional issues, and (3) Within facility issues. This hierarchical approach is designed to show the linkages between what is imposed at the operator level and the outcomes wanted by government/community at the regional and whole of industry scales.

Given that most aquaculture operations are assessed/approved at an individual venture level there are usually a large number of government agencies involved in the assessment of aquaculture proposals, the ESD framework for aquaculture was also designed to function as a set of guidelines for coordinating processes and ensuring due diligence rather than just a method for the generation of a single report on an industry.

Importantly, like the wild capture framework, the ESD Framework for aquaculture was not designed to add more regulations or steps to the process of approvals. Instead, it was designed to help minimise overlaps, redundancies and omissions in current procedures.

What are the major components of ESD for Aquaculture?

To enable ESD to be implemented in a practical manner, it was divided into eight major components, grouped within three main categories: (1) contributions to ecological wellbeing, (2) contributions to human wellbeing, and (3) ability to achieve. Each of these is split into a number of components relevant to aquaculture.

Contributions to Ecological Wellbeing

1. Impacts on the General Environment (Whole of industry)

Are there issues that need to be dealt with at the whole of industry level?

2. Impacts within Catchment/Region

This deals with the cumulative impacts that may occur from multiple facilities in the one region/catchment

3. Impacts within Facility

What issues need to be addressed within each facility?

Contribution to Human Wellbeing

4. Indigenous Wellbeing

How does the industry sector affect indigenous communities in the area where the industry operates?

5. Community Wellbeing

Are there local (including the industry itself) or regional communities that are dependent on the industry and/or are they supportive or negative about its operation?

6. National Wellbeing

How does the industry/sector contribute to national issues such as employment rates, supply of fish, economic returns, reductions in trade deficit etc?

Ability to Achieve

7. Governance.

Are the management processes and arrangements for the industry appropriate and efficient to enable the other elements to achieve an adequate level of performance?

8. Impacts of the Environment

Are there issues that may reduce or improve performance of the industry/sector that are outside of the direct control of the management agency/industry?

How does the ESD Framework operate?

There five key elements used in the process to complete an ESD report for an aquaculture sector:

1. identifying the issues relevant to the industry/sector;
2. prioritising these issues;
3. completing suitably detailed reports/management strategies for each issue (dependent upon their priority and complexity);
4. compiling summary background material on the industry (where relevant), the major species affected and the environments that the industry operates within. This enables the reader to put the material presented within any report into an appropriate context; and
5. using the generated material to assist individuals or industry (e.g. for use in generating EMS's, Codes of Practice) or by agencies as the basis for demonstrating they are achieving appropriate outcomes for government (e.g. Reports to Parliament).

How are the specific issues identified?

The first step in the ESD framework is to identify the relevant issues for the industry through the use and modification of a set of “*generic component trees*”.

See <http://www.fisheries-esd.com/a/doc/GenericCompTreesAquaculture07.doc>

There is one *generic component tree* for each of the eight components of ESD. Each of these trees was developed by consultation with the Aquaculture Committee, the NAC and the ESD Reference group to cover the suite of issues that are relevant to aquaculture.

These generic component trees are used as a starting point, tailoring them to suit individual industry circumstances, expanding some sub-components and collapsing or removing others, depending upon the farming methods, areas of operations and the species involved.

How are the issues prioritised?

Tailoring the component trees to an industry sector often results in a large number of issues being identified, the importance of which varies greatly. In many cases, it will be helpful to prioritise the issues so that the level of management actions and the details of the reports generated are aligned with the importance of the issue.

Risk assessment methodology (Fletcher et al., 2004; Fletcher, 2005, 2010) has been adapted to assist in determining the relative priority of each issue and specifying an appropriate level of management response.

The outcome of these risk assessment evaluations must include the justifications for the levels chosen. This enables third parties to review the logic and assumptions behind any decisions. It also facilitates future amendments if alternative information becomes available.

How can performance/management reports be completed?

Two levels of reporting are suggested, depending on the level of management response required:

1. Where specific management is not undertaken, reports only need to justify this conclusion.
2. Where specific management actions are needed, a report that details all elements of the management system is required. These performance reports should contain a series of headings, which includes identifying: operational objectives (what are you trying to achieve?), indicators (what will you measure to determine performance?), performance measures (how will you know if you are being successful?), and the management responses taken (what actions are/will be taken to achieve acceptable performance?). These form an integrated management system for each issue.

It is not expected that this process would result in the generation of a single, comprehensive ESD report that covered all levels. Rather, we anticipate that government agencies would only collate the ecological material for the whole of industry and catchment levels. Individual leaseholders would probably only generate facility level reports.

Who, and to what extent, social, economic and governance issue reports would need to be completed will vary amongst jurisdictions and industry sectors.

1.2 How does the ESD framework for aquaculture fit with EMSs and similar processes?

A major difference between an EMS and ESD is that the ESD framework is designed to encompass *all* aspects and issues that may affect the natural resources of the entire industry being assessed. An EMS may, however, be developed to only address a single issue for a single facility. ESD encompasses social and economic concerns whereas an EMS usually only includes environmental issues.

A certified EMS (e.g. ISO 14000) requires third party auditing but this only covers the processes, not the outcomes. Consequently, if there are no regulatory standards available for use as the targets within an EMS, these systems cannot guarantee that appropriate ecological outcomes will be generated.

The outputs from the ESD process, however, involve identifying the objectives and determining the levels/targets for acceptable performance using input from all relevant stakeholders. These could be used as the basis of an EMS developed by individuals to achieve acceptable performance for their facility. Consequently, the two systems are complementary not competing.

The aquaculture ESD framework was presented at the World Aquaculture Society conference held in Sydney in September 2004.

1.3 What progress has been made in the adoption of this framework?

The ESD framework for aquaculture has subsequently been used in a number of initiatives both within Australia and internationally these are outlined below.

Adoption of Framework in Jurisdictions

In Western Australia, the Department of Fisheries developed a policy statement in 2002 - Policy for the Implementation of Ecologically Sustainable Development for Fisheries and Aquaculture within Western Australia (Fletcher 2002) that described its direction to the Department on incorporating ESD within fisheries and aquaculture management. This used the draft ESD Framework for Aquaculture, that was available at that time. The national ESD framework for Aquaculture has also been adopted into the aquaculture policies of most Australian jurisdictions including South Australia (PIRSA, 2004), Victoria (DPI, 2005); Queensland (DEEDI, 2005) and the Northern Territory (2005).

Subsequently in Western Australia, the Department of Fisheries has used the National ESD Framework to conduct a series of risk assessment workshops for the identification of key issues associated with each of the main developing aquaculture sectors within WA. This included an assessment for the prawn aquaculture industry, which was completed in July 2006 (vom Berg, 2009a) with a similar application of the national framework which was applied to the WA Marine Fish farming sector (vom Berg, 2009b)

In Tasmania, an industry initiative was undertaken to develop environmental management systems (EMS) for the abalone, oyster and salmonid sectors through an FRDC funded project (2004/096; Marshall, 2006a, 2006b; 2007). This initiative used the National ESD framework for Aquaculture as the basis for development of the EMSs developed for each sector. Using the risk assessment approach outlined in national framework the environmental, social and economic impacts of the industry were critically evaluated. The risk assessments were determined by taking into consideration current management controls, valid scientific data and regulatory requirements. The risk assessments were undertaken by a working group from the relevant sector with appropriate expertise.

In South Australia, the National ESD framework has been used to assist in the completion of environmental audits of aquaculture within the State. For example the environmental risk assessments for marine finfish (de Jong & Tanner, 2004) and land based aquaculture (Theil et al., 2004) both used the component tree structures and risk assessment systems located within

the How to Guide for Aquaculture (Fletcher, 2004).

The Great Sandy Regional Marine Aquaculture Plan has been prepared by Fisheries Queensland (part of the Department of Employment, Economic Development and Innovation) based on the National ESD framework. The project is overseen by an Inter-Agency Working Group and the Aquaculture Inter-Departmental Committee. The risk assessment framework is based on the formal risk assessment process used in the National Ecologically sustainable development reporting framework, developed under the National strategy for ecologically sustainable development.

At the Commonwealth level, a review of a Best practice framework of regulatory arrangements for aquaculture in Australia completed by DAFF in 2005 recommended the adoption of the nationally recognised aquaculture Ecologically Sustainable Development (ESD) reporting framework. This should incorporate risk mitigation or management strategies arising from that process into conditions of the aquaculture licence, monitored through reporting by licence holders. This was to include sufficient details of any risk assessment and risk ranking undertaken so that it is understandable by the industry and the general public.

In Victoria the development of management plans for aquaculture precincts such as the Eastern Port Phillip Bay Aquaculture Fisheries Reserves (Department of Primary Industries, 2005a) was within the framework of Ecologically Sustainable Development (ESD). Therefore the key issues and risks around each objective of the Plan were identified through an ESD-based risk assessment that followed the National ESD Aquaculture Framework (Fletcher *et al.* 2004).

In NSW, the development of The NSW Oyster Industry Sustainable Aquaculture Strategy (NSW Gov. 2006) was developed with reference to the National How to guide for aquaculture (Fletcher *et al.* 2004). It has also been used to assist development of EMS's for individual oyster growing regions such as the Wapengo Lake Oyster Growers (2010).

Integration of Socio-Economic Sustainability Criteria into a Reporting Framework for the Australian Aquaculture Industry (FRDC Project 2007/010)

Given sparse nature of social and economic information available for the aquaculture sector in Australia and even a lack of clarity about what information would be useful an additional FRDC study was undertaken to test and refine the indicators and potential data collection questions that may be implemented by individual aquaculture enterprises to inform what ESD reporting would be most relevant for ongoing monitoring. The following is a revised version of the executive summary.

This project focused on developing the social and economic indicators for the Australian aquaculture industry as they relate to the Ecologically Sustainable Development (ESD) Guidelines (Fletcher *et al.* 2004) to identify the most appropriate indicators and questions, data collection, storage and communication methods to inform Australian ESD requirements. The final set of objectives were to:

- Identify a set of easily understood and defensible indicators and their underpinning questions to inform ESD Reporting Groups appropriate to each of the key Australian aquaculture sectors.
- Develop a system for presenting aquaculture information on these indicators that can be easily integrated within the existing reporting frameworks.

- Develop methods of use and communication that promotes the use of the ESD reporting framework as an essential tool for the aquaculture industry and its stakeholders

This project addressed the need to not only develop robust indicators, tailored to the aquaculture industry, to inform the ESD Framework, but a method of ongoing collection and analysis by individual sectors, and the national industry, to inform regulatory agencies of the industry's performance. To achieve this, industry needed to know what information to collect; how to provide the required data; appropriate storage and evaluation mechanisms for the data; and how these should be promulgated throughout the industry, regulatory agencies and the community.

The output from this project for the first objective is a review of indicators used elsewhere in aquaculture and other NRM industries, and what data is collected to inform these. In addition to this a list of suggested questions was developed that were applicable to the ESD Reporting Groups and Indicators, which might be used by the industry.

The second objective of the project resulted in a generic survey of social and economic questions that can be used by all sectors of the Australian Aquaculture industry to facilitate ESD reporting. It was also structured in such a way that reporting can, if required and appropriate, be broken down into sectoral, regional or national results.

For the third objective resulted in a 'tool box' of methods and resources for the industry to guide them in their collection, collation, interpretation, and presentation of the data, in their performance against ESD requirements. It also saw the outcome of an in-principle agreement from a majority of the industry's sector associations to collect the data on an annual basis, report against it as required, and provide a copy of it to the National Aquaculture Council for aggregation to national level.

The outcomes of the project are most visible in the means that are now provided to the industry to report against ESD Reporting Groups and associated indicators. The further and outcome has been, despite reticence to participate in some quarters, the drawing together of the sectors of an otherwise disparate industry in a common purpose, which has increased industry communication and collaboration. This will undoubtedly positively contribute to building industry capacity, flexibility and therefore sustainability, into the future.

The conclusions of the project were that discussions with industry at the final workshop identified both willingness and the potential vehicles with which to undertake annual collection of the data identified here, at the individual business level. This is an important and essential factor in the long term use of the tools and implementation of the framework identified here.

There is a need to remain cognisant of the cost effectiveness of different approaches to data acquisition. Though utilising existing data in the economic domain and to integrate the collection of social indicator data with other benchmarking and regular data collection activities, it is reasonable to aim for ongoing collection of data to inform ESD performance.

The collection and integration of both economic and social indicators appropriate to national collection, but not currently broadly or consistently collected, is essential to future successful implementation of ESD reporting. Negotiations regarding the ways in which to collect data to inform nationally applicable indicators, with agencies such as ABARE or State NRM Government agencies, needs to occur. The project has identified recommended indicators and the associated data for the aquaculture industry that needs to be addressed in such negotiations.

FAO Based Guidelines for Ecosystem Approach to Aquaculture

The principles and many of the concepts and tools outlined in the ESD framework have been adopted within the FAO's guidelines for implementing the Ecosystem Approach to Aquaculture (FAO, 2010). Most notably this includes the adoption of the use of three levels of assessment – farm, catchment and regional. The FAO guidelines have also adopted the use of component trees to assist identify issues and the use of risk assessment to prioritise issues.

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- Wapengo Lake Oyster Growers (2010) Wapengo Lake Oyster Growers' Environmental Management System. A report prepared by Dr A. Rubio (Environmental consultant) for Southern Rivers Catchment Management Authority. 46 pages.

2.0 Objective 2 - Development of a Multi-Fishery, Marine Planning Framework

2.1 WAMSI Project – Applying the EBFM Framework in Western Australia

It was recognised that to enable adoption of a multi-sectorial approach that could actually be implemented by all sectors was to ensure there was a common basis for assessment and planning processes. It was agreed, therefore, that the basis for all sectors and jurisdictions to undertake an EBM approach would be by using the set of ecosystem units developed through the Integrated Marine and Coastal Regionalisation of Australia process (IMCRA - CoA, 2006). This divided the marine environment of Australia into a series of bioregions that each represents a relatively distinct high level ecosystem. Where necessary, finer levels of assessment or planning in which an operational ecosystem boundary is able to be defined in terms that are logical and practical for use in management of activities could ‘roll-up’ to one of these IMCRA bioregions to enable reporting on these environmental units at a national level.

Using this draft national EBFM framework, with structured stakeholder input, over 600 ecological, social, economic and governance issues were initially identified for the West Coast bioregion. There were also agreements obtained across government on the main ecosystems located within this system and risk analyses identifies the issues that need specific management beyond what was currently being done based on the single fishery management arrangements.

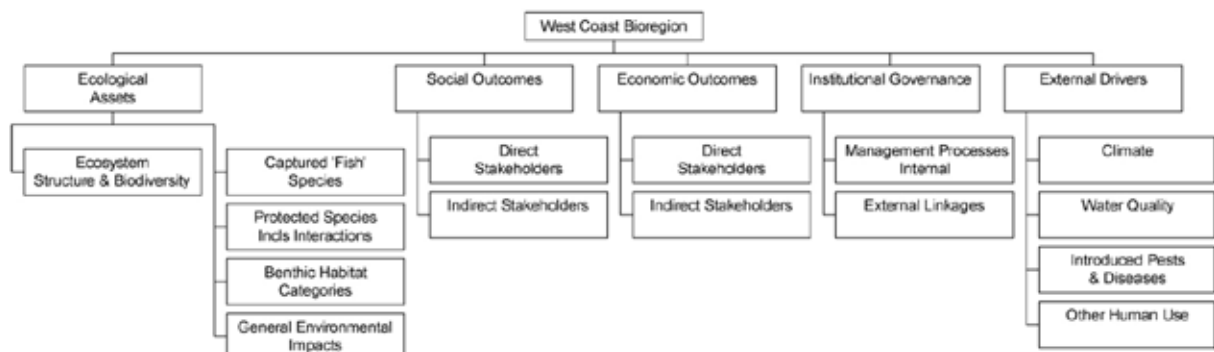


Figure 2.1. High level component tree for EBFM – each of these boxes has its own generic tree

This complexity was reduced to a level useful for management by consolidating the individual risks into 60 regional-level risks, with a multi-criteria analysis used to integrate the ecological, social and economic risks into just 24 Departmental-level priorities, which ranged from very low to urgent (Fletcher et al., 2012a). Given this success, EBFM-based priorities now form the basis for the Department’s budget planning process, plus the framework is providing a critical link between fishery level issues and the broader processes undertaken by other marine based agencies (Fletcher et al., 2010). The EBFM framework is a significant step forward for the integrated management of natural resources by enabling all assets and issues relevant to stakeholders and government to be holistically considered at a regional level.

This framework has now been applied to all six aquatic bioregions in WA with the resultant 88 agency priorities now used as the basis for all annual budget setting decisions made by the Department. To fully implement EBFM, WA is currently revising the fisheries legislation and governance arrangements to facilitate creation of regional level strategies to coordinate the

management of all individual fisheries/activities and simplify the Department's engagement in future multi-sector (EBM), regional planning processes (Fletcher et al., 2012b).

In conclusion, initiating implementation of EBFM did not require detailed data on ecosystems; it only required the holistic consideration of the risk to each ecological asset and the associated stakeholder benefits to determine which assets have the greatest requirement for direct management. The cost effective steps for a regional level, ecosystem-based approach using only currently available data combined with expert opinion make implementation of this management planning framework viable in any location.

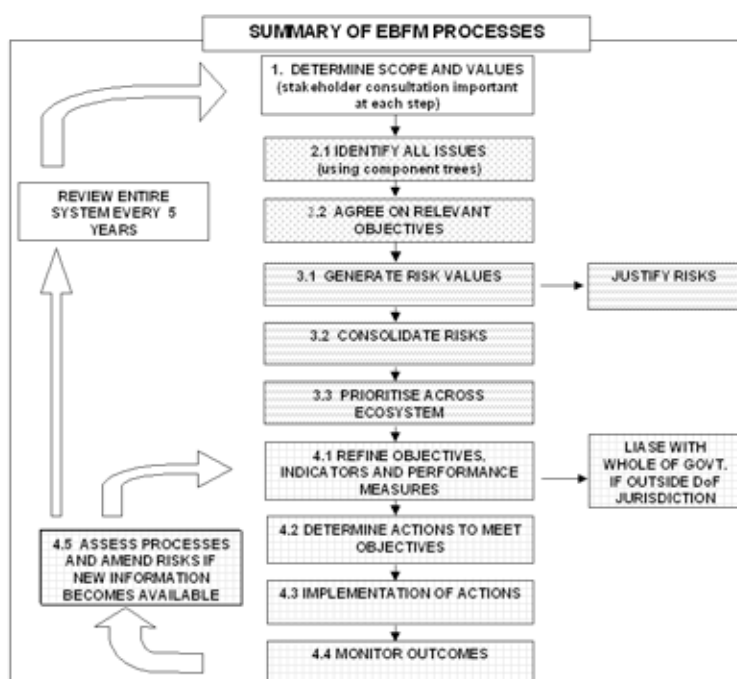


Figure 2.2. Summary of Steps used in the EBFM Process (see Fletcher et al. 2010 for details)

The executive summary of this project is located in Appendix 1.

Major Message for WA Government – This project developed a world class, risk based management framework that has been adopted by the Department.

Key Outputs:

- Improved priority setting and budget allocation – efficient use of government resources.
- System was being adopted nationally by MACC.
- Changing the way management and research understand and utilize risk
- Used qualitative models to integrate across ecological, social and economic issues and allow effective stakeholder input.
- Demonstrated that the streamlining of information flow from stakeholders generated a better system for the governance of marine resources.

2.2 National Policy Guidelines on EBFM (for AFMF)

The following presents the shortened version of this policy and the full policy statement is located in Appendix 2.

AFMF 'One Pager' on EBFM

It is now recognised that a “whole of ecosystem” or “bioregional approach” is the appropriate scale to deal with the environmental and social issues generated by human population pressure. Ecosystem Based Fisheries Management (EBFM) is the approach that will be used to holistically manage commercial, recreational, charter and customary fishing at this regional or ecosystem level by considering their cumulative impacts on the environment while taking into account the social, economic and other fisheries management objectives. This integrated approach will assist reach more balanced decisions on the appropriate use of resources, consistent with the principles for ecologically sustainable development (ESD).

Comprehensive ‘ESD’ based assessments are now completed for most individual fisheries and EBFM will integrate these into regional level assessments for each specified region. EBFM will therefore provide an essential linkage between the fishery-level management arrangements and the regional-level planning generally undertaken by other government agencies that operate in the coastal and marine environments which collectively would be called Ecosystem Based Management (EBM).

The practical application of EBFM involves use of a step-wise, risk based approach to identify all the individual fishery issues and consolidate these into regional level assets and using risk assessment determine the appropriate level of management response for each of these. The EBFM approach recognises that the level of knowledge available for an issue only needs to be appropriate given the risk level and the proposed level of precaution in the management arrangements. Implementing EBFM will not, therefore, automatically generate a requirement to collect more ecological data or directly manage everything. Additional management or data collection is only needed if this assists the management of an unacceptable risk.

Key Elements and Scope of EBFM

- Regional level, multi-fishery and, where relevant, includes aquaculture and freshwater fisheries.
- Integrated decision making process, using a holistic risk management approach.
- Incorporates management of the effects of all fishing activities on the ecosystem including any cumulative impacts.
- Integrates social and economic outcomes in decision making to generate the best overall outcomes for the community
- Assists influence or the recognition of the management of impacts on fisheries caused by external factors (this is the critical link to broader EBM processes)

2.3 National EBM Framework (for BWG of MACC)

The steps outlined below define the key elements of the National EBM framework which were developed by the MACC working group for use in developing an EBM based plan for any region in Australia (MACC, 2010).

- i. **Establish a group with overall responsibility for implementing EBM.** A governing body is required that includes government and community representatives that have a clear mandate from government or under regulations. The group could be supported by advisory groups such as an ecosystem coordination board or a science group.
- ii. **Define the scope, including the boundaries of the ecosystem, and establish the overall ecological, social and economic values.** What are the specific IMCRA4 ecosystems that are covered? Identify what are the ecological assets within each IMCRA ecosystem and their associated social/economic issues. The component assets of the ecosystem include the exploited species, habitats and other species and processes that maintain ecosystem functioning.
- iii. **Agree on relevant objectives for the ecosystem and each asset based on the values.** Objectives can be established for each asset and the ecosystem as a whole. Activities within the ecosystem will be managed towards achieving the objectives established. This step will ensure the integration of impacts of different activities as they are taken into account as cumulative impacts on the ecosystem.
- iv. **Generate individual risk values and consolidate to asset level.** Complete risk assessments of the ecological, social or economic objectives associated with each of the identified issues. Consolidate the individual issues and risks into broader asset categories at a level that can be used for regional management planning purposes.
- v. **Prioritise assets across the ecosystem.** Integrate the various ecological, social and economic risks and value scores associated with each of the regional level asset into a set of overall priorities for the whole ecosystem. Criteria for prioritisation must be determined as a first step to this process.
- vi. **Determine actions to meet the objectives of the governing body and establish a monitoring evaluation and reporting framework for the ecosystem and assets.** For each of the priority issues, a set of actions to achieve clear operational objectives which have measureable specified targets need to be developed. These management systems should outline the methods to review performance and include what actions will be taken if performance is not acceptable.
- vii. **Develop and implement an action plan.** Based on all the management systems developed, generate a work plan and priorities for implementation that outlines the specific activities that will need to be done by each of the relevant agencies and sectors to deliver the EBM outcomes.
- viii. **Regularly review outcomes, make necessary changes and communicate.** At appropriate intervals, review the management system for each of the ecological assets and the entire EBM framework to ensure it is continuing to deliver the required outcomes for both government and the community.

To support the progress of EBM implementation, the MACC was asked to endorse the completion and evaluation of a series of pilot studies to demonstrate how effective EBM would be when implemented by various sectors in State, Territory, and Federal Government jurisdictions and what were the benefits and costs for stakeholders and environments involved. In completing these case studies it was considered important that they explicitly recognise the links between and among the different elements and hierarchical levels of the ecosystems involved and how easy it was for EBM to consider how an activity in one sector can affect other sectors and

all levels of the ecosystem to accommodate these links when setting objectives and during decision-making.

In early 2011 a review of all national committees was undertaken by the Council of Australian Governments which resulted in the MACC and its parent group, the NRMMC, being disbanded. The replacement group has yet to be established so national based actions on EBM have slowed. While some formal bi-lateral progress on EBM continues to be made, the most likely path to the wider adoption of EBM principles will probably come from the natural evolution of multi-fishery level, EBFM frameworks expanding to cover multi-sectoral issues where these are deemed to provide clear and direct benefits to all the sectors involved.

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3.0 Refinements for international adoption of Wild capture Framework

3.1 Implementing Ecosystem Approach to Fisheries Management (EAFM) for the tuna fisheries of the Western and Central Pacific Region

- For full details see Fletcher (2010) Planning processes for the management of the tuna fisheries of the Western and Central Pacific Region using an Ecosystem Approach. FFA Honiara Solomon Islands.

<http://www.fisheries-esd.com/a/pdf/EAFM%20BASED%20GUIDE%20FOR%20TMP%20DEVELOPMENT%20v6%201.pdf>

The entire national ESD framework has been adopted by the Western Central Pacific Tuna Commission as the model to implement Ecosystem Approaches to Fisheries management for their tuna fisheries. Oceanic tuna fisheries are one of the major components of a complex marine ecosystem that exists in the western and central Pacific region. Pacific island countries who are influenced by their obligations to various international and regional management regimes and treaties, have been involved in the development of viable management arrangements that will be effective in addressing issues such as resource sustainability, fishing capacity and effort control, maximizing benefits from resource utilization and mitigating impacts on the environment and non-target species. These issues are specifically covered by the objective of the Convention on the Conservation and management of highly migratory fish stock in the western and central Pacific Ocean (WCPO) which is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stock in the WCPO in accordance with the United Nations Convention on the Law of the Sea (1982), and also many of the articles within this convention.

The issues outlined in the WCPO Convention (1995) are fully consistent with implementing EAFM. Article 5 of the convention outlined what is expected for “*target species, non target species, other dependent species within the ecosystem, minimising waste and pollution, endangered species, biodiversity, optimum utilisation, the welfare of the various states involved including the interests of artisanal and subsistence fishers*”. Thus, the implementation of EAFM should not be seen as either a major change in direction for the WCPO Commission nor will it require adding EXTRA elements. Rather, it is largely a framework that should help coordinate current activities, making them clearer by giving a ‘home’ to many of the strategies and monitoring programs already being undertaken.

Given the success of the National ESD system in meeting the needs of Australian fisheries (e.g. Fletcher et al., 2012), this approach was chosen as the basis for the development of a system specifically designed for use in the tuna fisheries of the Pacific region. Whilst a number of changes have been made to the framework which relate both to the specific circumstances of fisheries management in the Pacific but also from further experiences using the system, it is essentially the same process but the pathways and the levels used have been suitably adjusted.

One of the key issues covered was that the scope of some issues were difficult to define given that these fisheries deal with tuna which are trans-boundary and highly migratory species- therefore the fisheries operate at island, country and region levels. There was also a need to have increased emphasis on the social and economic analyses in the system as this is crucial in

the decision making process especially in co-management regimes that are currently practised in most fisheries of the Pacific countries. There were also different concepts of acceptability for some elements, particular interactions with species of customary importance both among countries and regions.

Ecosystem Approach to Fisheries Management (EAFM) is one of a number of concepts being developed to more comprehensively manage natural resources, but with a specific focus on fisheries. It deals with all the ecological consequences of fishing plus it recognises the social and economic implications of fishing and its management arrangements. It also assists in understanding how these activities interact and can affect the other.

The Tuna Management Plan (TMP) should be the central document in the management of all tuna fisheries. This guide is part of the initiative by the Forum Fisheries Agency to assist countries introduce EAFM into their management of the tuna fisheries of the Western and Central Pacific Fisheries Commission (WCPFC) when they update their TMP (Fletcher 2008, 2010). Given the high economic and social importance of the tuna fisheries within this region of the Pacific, it is expected that taking an EAFM approach will help ensure that the communities in this region will benefit from the optimal utilisation of these resources.

The guide outlines the five steps required to update the TMP using EAF approach:

- Step 1** Determine the scope of the assessment – develop a clear description of the tuna fishery that you are trying to manage/assess – for e.g. does it cover all the EEZ or just industrial tuna activities? This also includes identifying the relevant high level objective (e.g. species sustainability, economics etc) to be addressed and the responsibilities of the agencies involved.
- Step 2** Based on the scope, identify issues across all five EAFM components (target species, non target species, the ecosystem, community outcomes and fishery administration) and determine what objectives are to be achieved for each issue given any treaties, convention, country needs, local requirements and global attitudes. These can, therefore, be based on ecological concerns, economic realities or social attitudes.
- Step 3** Prioritise issues using some form of problem or risk assessment, utilising a pragmatic approach, determine if specific direct actions are unnecessary, already covered by current actions, or if specific additional actions are necessary. This selection must also recognise resource constraints.
- Step 4** Where direct actions are required, clear management systems (that recognise the linkages/interactions among objectives) are developed that include clear operational objectives and the ability to assess performance. They should also include the monitoring and review of performance and what actions will be taken if performance is not acceptable. These systems should form the basis of the updated TMP.
- Step 5** Based on the TMP, develop a work plan that outlines the specific activities that will need to be done by all parties to deliver the outcomes needed for TMP and other related documents

For members of the WCPFC, this EAFM based initiative will assist put into practice the concepts outlined in Article 5 of the WCPO Convention into their tuna management plans. Thus, the EAFM approach covers issues related to target species, non target species, other dependent species within the ecosystem, minimising waste and pollution, endangered species,

biodiversity, optimum utilisation, the welfare of the various states involved including the interests of artisanal and subsistence fishers. Consequently, adopting EAFM principles should not be seen as an additional burden for member countries, instead, this framework should help to plan, coordinate and prioritise current and proposed activities, making them clearer by giving a ‘home’ to the many strategies and monitoring programs underway. This should, therefore, help with the overall efficiency and effectiveness of the management agency.

3.2 FAO Nansen Project - Application to the implementation of EAF in Africa

- See for more details -
 - Fletcher et al., (2012) A Guide to Implementing an Ecosystem Approach (EAF) for the fisheries in Africa (in prep)

The Ecosystem Approach to Fisheries (EAF), and other related concepts (e.g. Ecosystem Based Management, EBM), have developed over the past 20 or more years in response to the need to implement, in a practical manner, the principles of sustainable development (WCED, 1987), the Convention on Biological Diversity (CBD) and, more recently, the Code of Conduct for Responsible Fisheries (FAO, 1995). EAF is consistent with all these principles and has been adopted by the FAO Committee on Fisheries (COFI) as the appropriate approach for use in the management of fisheries. Consequently, it deals with all the ecological consequences of fishing plus it recognises the social and economic implications of fishing and its management arrangements. It also assists in understanding how these activities interact and can affect the other.

The development of this guide to EAF is part of the initiative by the FAO to assist countries from Africa introduce EAF to the management of their fisheries. Given the high social and economic importance of the fisheries within this region it is expected that this approach will help ensure that the communities in this region will benefit from the optimal utilisation of these resources.

The EAF covers issues related to target species, non target species, other dependent species within the ecosystem, minimising waste and pollution, endangered species, biodiversity, optimum utilisation, the welfare of the various states involved including the interests of artisanal and subsistence fishers. Consequently, EAF should not be seen as an additional burden for member countries, instead, this framework should help to plan, coordinate and prioritise current and proposed activities, making them clearer by giving a ‘home’ to the many strategies and monitoring programs underway. This should, therefore, help with the overall efficiency and effectiveness of the management agency.

The set of guidelines outlined in this publication has been developed to be read in conjunction with the other FAO publications on EAF. In particular, the EAF toolbox outlines the full range of methods and tools that can be used to progress through each of the steps. What is presented here is the most likely set of methods that will be applicable to the completion of the EAF process in this region with some accompanying local examples from case studies and some more detailed instructional material on some of the steps. The methods outlined here should not, however be viewed as the only way to accomplish the EAF planning process.

3.3 FAO - EAF Toolbox and Technical Guidelines

- See for more details -
 - EAFnet Website <http://www.fao.org/fishery/eaf-net/en>
 - Fletcher et al., (2012) The Ecosystem Approach to Fisheries (EAF) management planning and implementation: A technical guide and supporting tools for project leaders, decision-makers and advisors. FAO Fisheries Technical Papers (in press)

The Ecosystem Approach to Fisheries (EAF), and other related concepts (e.g. Ecosystem Based Management, EBM), have developed in response to the need to implement, in a practical manner, the principles of sustainable development (WCED, 1987), the Convention on Biological Diversity (CBD, 1992) and the Code of Conduct for Responsible Fisheries (FAO, 1995). EAF is consistent with all these principles (including ESD) and has been adopted by the FAO Committee on Fisheries (COFI) as the appropriate approach to implement these principles for the management of fisheries.

Based on work already completed on sustainable development and fisheries in Australia (Chesson et al., 1999; Fletcher et al., 2002; 2004, 2005) and elsewhere (Charles, 2001), the FAO defined and outlined the basic principles and processes needed for the implementation of EAF (FAO, 2003, 2005). While many countries have subsequently adapted this approach to meet their local conditions, and the principles and technical guidelines having been available for nearly a decade, many fishery managers still see EAF as difficult to implement, especially without access to expert guidance. The problem has been exacerbated by the fact that many managers perceive (incorrectly) that EAF as a largely academic or scientific (ecosystem modelling) exercise. Therefore, the rate of adoption has been much lower than desirable especially if countries are to meet their various international commitments

Workshop on a Toolbox for the Ecosystem Approach to Fisheries (EAF) was held in Rome, Italy, from 26 to 29 February 2008 (FAO, 2009). This workshop was designed to initiate the development of toolbox to assist with the implementation of EAF to all fisheries. The process identified that the National ESD framework is a major component of such a toolbox and it is central to the FAO's own EAF guidelines.

The workshop determined that EAF is not about understanding in detail the functioning of the ecosystem and it is not necessarily about increasing knowledge about the functioning of the ecosystem. It is now recognised as the appropriate framework for fisheries management. It has been found in practice that the best way to dispel misunderstandings about the EAF is to actually go through the process of implementing the EAF using a risk based approach similar to that developed in Australia for the implementation of Ecologically Sustainable Development.

The Australian framework to implement the EAF is one way of conceptualising the fishery in an ecosystem context. It is a tool to identify and clarify issues, identify areas where there are tensions, as well as agree on objectives and potential management responses. It allows the identification of the major risks of not achieving the objectives and the identification of measures to mitigate these risks. In less developed management systems, there may be a gap between prioritisation and the development of appropriate management measures: the process will identify the issues, but insufficient human and financial capacity may hinder the implementation of solutions.

The structure of the EAF planning and implementation process is comparable to that used for risk management systems (ISO 31000: 2009) which reflects that managing a fishery is just a specific application of risk management principles. The four main steps in the EAF planning

process for fisheries are outlined below and in Table 3.3.1.

Step 1 Initiation and Scope - Based on government and stakeholder input generate an agreed and clear definition of the fishery (scale and type) plus a shared understanding of the social, economic and ecological objectives to be achieved.

Step 2 Identification of Assets, Issues and Priorities - Identify all relevant resource 'assets', community outcomes and the issues affecting their management (generated either by the fishery or external factors) and determine priorities for direct action to best achieve objectives.

Step 3 Development of Management System - Develop a management system to cost-effectively and holistically deal with all high priority issues that includes clear operational objectives and the ability to monitor and assess performance.

Step 4 Implementation, Monitoring and Performance Review - Document the actions to implement the management system, monitor their completion plus evaluate and report on their performance in delivering acceptable community outcomes.

Despite having outlined the basic principles and processes for the EAF (FAO, 2003, 2005, 2009), fishery managers have often see it as too difficult to undertake without access to expert guidance, some have incorrectly perceived it as just an academic or scientific exercise. Therefore, the rate of adoption has been much lower than desirable.

Implementing EAF for most fisheries should not be complex and for many it could be quite simple given there are already a large number of tested tools available to assist in completing the process. Many of these tools may not be easy to find and their relevance and applicability to particular situations could also be unclear. Managers and other stakeholders may benefit if they receive assistance to find the appropriate tools for their situation. This web based system developed for the EAFnet Toolbox is the first attempt to provide a guide that is structured to assist with this selection for each of the different steps of EAF, not merely providing a long list of potentially useful tools.

The EAFNet toolbox outlines a range of alternatives that can be used for each step covering a range of resources, technical capacity and knowledge. It is not possible (or even necessary) to use the most sophisticated or expensive methods. The toolbox can help select the most appropriate tool(s) given the level of uncertainty and risk, the value of the fishery and, most importantly, staff capacity and the financial resources available (Table 3.3.2). Having access to this set of options at each step should enable full implementation of the EAF for all fisheries, irrespective of their particular circumstances.

The web based toolbox and technical guidelines operate in a hierarchical manner with each of the four EAF steps explained with increasing levels of detail. Each step has an overview; they are then divided into the series of key activities which enable their completion in an efficient manner. Each key activity is described separately in detail including a list of relevant questions and key actions that help explain what needs to be done along with short outlines of relevant tools. Finally, complete descriptions of each EAF tool are available from the web-based EAF Toolbox located on the FAO EAFNet website.

The EAF tool factsheets include how the tool works plus information that should assist determine if it will be the most appropriate for use with a particular fishery. The criteria include the costs, level of background information, resources and capacity and the level of stakeholder

engagement required plus some tips based on previous EAF uses. At least one easy tool has been included for each of the key activities to ensure that EAF planning can be applied for any fishery regardless of the information, capacity or resources available (table 3.3.3). So the only real requirement for the completion of EAF for a fishery is sufficient stakeholder, institutional and political commitment.

Table 3.1. Outline of each of the four steps of EAF and their associated key activities and outputs

Step	Key Activities	Outputs
Step 1 Planning Initiation and Scope	<p>1.1 Initial process planning and stakeholder support</p> <p>1.2 Defining the fishery, societal values and high level objectives</p> <p>1.3 Finalise a scoping (EAF baseline) report</p>	<ul style="list-style-type: none"> • An EAF project team with a team leader is formed • A roadmap outlining the planning process, stakeholders, participants, resources, timing involved • A formal decision to proceed or not at this time. • If proceeding, document the scope and objectives of the fishery plus relevant background information
Step 2 Identification of Assets Issues and Priorities	<p>2.1 Asset and Issue Identification</p> <p>2.2 Asset and Issue Prioritisation (including Risk Assessment)</p>	<ul style="list-style-type: none"> • Identify all EAF-related issues including ecological assets, social and economic outcomes, governance systems and the threats, drivers and impacts relevant to the fishery. • Based on their risk and priority, clarify what issues require direct management intervention.
Step 3 Development of a management system	<p>3.1 Determine operational objectives</p> <p>3.2 Indicator and Performance Measure selection</p> <p>3.3 Management option evaluation and selection</p>	<ul style="list-style-type: none"> • Develop operational objectives for each issue requiring management • Identify indicators and performance measures to monitor performance for each operational objective • Select cost effective management arrangements to generate acceptable performance
Step 4 Implementation, monitoring and performance review.	<p>4.1 Develop an Operational Plan and monitor its progress</p> <p>4.2 Formalization of the management 'plan'</p> <p>4.3 Review performance of the management system</p> <p>4.4. Reporting, communication and auditing of performance</p>	<ul style="list-style-type: none"> • Develop a detailed operational (implementation) plan • Formal adoption of the EAF based management 'plan' • Monitor if the activities to execute the operational plan are completed • Regularly review and report on the performance of the entire management system

Table 3.2. Criteria developed to assist in the selection of appropriate tools for completing EAF.

User Tips	Based on previous experiences using the tool in what situations is it likely to work well and when is it unlikely to work well?
Difficulty of Use	How easy or hard is the tool to use?
Costs	How expensive in terms of dollars, people and time is the tool to use?
Capacity Required	How complex is the tool and what formal technical capacity/training is needed to use it?
Background Required	What level of formal background knowledge, datasets or preparatory work must be available and completed to effectively use the tool?
Participation	What level of community participation is possible/required or encouraged when applying the tool?
Time Range	How long would it take to apply the tool in a specific situation?

Table 3.3.3. List of Tools Referred to in the Toolbox. Note some tools are listed in more than one location

CONSULTATION	Project meetings
	Stakeholder Workshops
	EAF Presentation materials
	Surveys and Questionnaires
	Focus Groups
	Team Building Methods
	Consensus Workshops
	Conflict management
	Facilitation tools
STEP 1	EAF Roadmap Template
	Project Planning guides and courses
	Project Management software
	EAF Guidelines
	Brainstorming
	Stakeholder Analyses
	Institutional Analyses
	Participatory Community Rapid Assessment
	Visioning exercises
	SWOT analysis
	Social and Economic Assessments
	Quantitative Stock Assessments
	GIS Tools for data synthesis
	Communication templates
	Fishery Scoping Check Lists
Outline for Baseline Report	

STEP 2	Component Trees
	Component Lists
	Brain Storming
	Card Storming
	Objective – Impact matrices
	Resource use patterns and trends
	Simple conceptual models
	Informal Risk Categories
	Vote Ranking Methods
	Meta-Analyses
	Qualitative Risk Assessment
	Productivity Susceptibility Analysis (PSA)
	Quantitative risk analysis
	Ecological Modelling
	Multi-criteria Decision Analysis
STEP 3	EAF Meta-Analyses and Reviews
	Fishery management manuals
	Indicator Reviews
	Topic Reviews (Bycatch, MPAs, etc)
	Traditional knowledge
	Community based management
	Expert judgement
	GIS Based Decision Support
	Quantitative Stock Assessment
	Social and Economic assessment
	Management Strategy Evaluation (MSE)
	Integrated Ecosystem Assessments
	STEP 4
Project planning and management	
Management plan examples and case studies	
Formal planning guides	
Legal Expert Assistance	
Communication plans / templates	
Expert judgement / panel	
Cost Benefit Analysis	
Multi-criteria Decision Analysis (MCDA)	
Management Strategy Evaluation (MSE)	
Co-Management	
Trade regulations	
Eco-labelling/Eco-certification	
Fishery authority bulletins	
Formal reports to Parliament	
Radio and TV reports/interviews	
Newspaper reports	

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Benefits

The project was successful in developing a practical set of frameworks, tools and planning systems that can allow the practical implementation of the ecosystem approach for use in the holistic risk based management of all fishery and aquatic resources. It has also helped demystify these concepts and shown that the myths of it being too complex and expensive do not have to be the case if a pragmatic, objective approach is taken.

The development of the aquaculture ESD framework has highlighted that the planning for aquaculture should be hierarchical and not only consider the impacts at the individual farm level but also at the catchment and whole of industry levels.

With respect to the multi-fishery framework, this project in conjunction with WAMSI has developed a world class, risk based framework for the regional management of marine resources.

This framework has been adopted by the Department of Fisheries in Western Australia to fully implement EBFM at a bioregional level. This framework has improved priority setting and budget allocation process in the Department to make better and more efficient use of government resources.

The simple set of steps developed for the EBFM framework has enabled adoption of a fully regional, 'ecosystem based' approach in WA without material increases in funding. It has successfully replaced the previous, disjointed planning systems, with a single, coordinated risk based system that is already generating efficiencies for the use of Departmental (government) resources. Having a cost effective process means that it can be applied in all circumstances, not just in those regions of the world where a large amount of resources and scientific data are available.

The adoption of risk based approaches at a regional level as the overarching basis for fisheries management planning, combined with the wider adoption of similar steps to implement EBM should facilitate more efficient linkages and harmonisation with other government policies and processes. Consequently, there are clear and positive benefits from the implementation of this 'ecosystem approach' to assist with fisheries management planning and decision making. The system was also in the process of being adopted nationally through the MACC of Natural Resources Standing Committee to enable implementation of EBM.

Initiating implementation of ecosystem based approaches does not require detailed data on ecosystems or complex models; it only required the holistic consideration of the risk to each ecological asset and the associated stakeholder benefits to determine which assets have the greatest requirement for direct management. The cost effective steps for a regional level, ecosystem-based approach using only currently available data combined with expert opinion make implementation of this management planning framework viable in any location.

Trialling and implementing the wild capture fishery framework in different locations around the world in conjunction with other agencies has resulted in the development of a much broader suite of tools and a simplification of the descriptions of the various steps involved in this process. Contrary to many perceptions, implementing an ecosystem type of approach is possible for all types of fisheries and aquatic resource uses, including small scale fisheries that operate at a local level and have minimal data and few formal management resources, up to large multinational industrial fisheries with significant data sets and resources.

Finding the most appropriate tool has been made simpler through development of the EAF toolbox and associated expert system can be used to identify, based on a set of standard criteria related to the cost, capacity and complexity of the specific tool the most suitable options given the local capacity available.

The number of tools that have been identified highlights that the EAF process is not a one-size-fits-all approach with an almost limitless number of ways that can be used to move through each of the required steps. While different tools associated with the one activity may, potentially deliver outcomes with different levels of precision and robustness, the more complex and costly tools may not always be the one to generate the best results. Methods used for industrial fisheries managed by a developed country will generally be inappropriate for a small scale fishery in a remote community. But methods for small-scale fisheries are, however, often applicable to both developed and developing countries.

Further Development

In terms of the tools and frameworks available for the implementation of an ecosystem approach, a large number have now been generated for use across a wide range of situations. These will, however, continue to be refined through time as more experiences are gained through their use. Within the Australian context there is a need develop agreed national standards that can be used to certify the management arrangements for wild capture fisheries to alleviate the growing, but generally unfounded public perceptions that fisheries in this region are not well managed. To enable efficient certification processes, especially if this is to be done by third parties, will require having a set of standards for which there is general agreement (including NGOs) that can be used to represent acceptable performance.

Another critical element missing is the development of governance systems that will enable the move beyond the management of individual fisheries to more formally develop multi-fishery (EBFM), regional level management plans. While a number of jurisdictions have discussed this option, and there are a few initiatives in place to adjust legislation to facilitate this, plus there is no doubt that the actual implementation will require development of new systems to deal with the added complexities.

The ultimate goal will be to have governance systems that produce true multi-sector, EBM based marine plans that can effectively and efficiently integrate the management of all sectors. These should be based on the generation of the most optimal outcomes for the community and not, as is currently the case, merely have one layer of planning that has one set of objectives, overlap all the other functioning sectoral based systems.

For aquaculture there has been a high level of uptake of the National ESD framework into the aquaculture planning policies of most Australian jurisdictions – (Western Australia, South Australia, NT, Victoria, Qld and NSW).

Planned Outcomes

The planned outcomes from the original application funded in 2000 were:

- The overall outcome from the SCFA initiative is for nationally agreed criteria and indicators to report on and demonstrate that fisheries management agencies are meeting ESD objectives

A major part of this outcome was achieved through the development of the various ESD criteria, indicators and frameworks. The final element of having nationally agreed standards for the various criteria has yet to be completed. This is the final element in this process and is currently being examined by another FRDC funded process.

- A major outcome of this initiative will be fisheries agencies being able to report on ESD for all their fisheries using practical, cost effective indicators

This was successfully achieved, all jurisdictions have the tools to enable practical reporting ESD for all their fisheries. Most jurisdictions have adopted this or equivalent methods.

- It will assist each jurisdiction meet their individual requirements with respect to ESD

This was also successfully achieved, this framework has assisted in meeting the EPBC requirements for a number of jurisdictions.

- The assessments should also assist identify areas that can be addressed by the Seafood

Services project to increase the efficiency and efficacy of industries wishing to attain external certification for their environmental practices.

The assessments developed using the national ESD frameworks identified a number of issues that were subsequently addressed through industry based initiatives including those which involved the development of an EMS

- The project will provide a staged series of outputs that will progressively provide more comprehensive and robust information with which to report on ESD for Australian fisheries.

There were multiple stages and outputs in this project with approximately 30 publications produced over the past decade including a series of guidelines, reports, brochures and scientific papers produced. These outputs are all available on the ESD website www.eafm.com.au and the key elements of this system is also now located at the FAO toolbox website www.fao.org/fishery/eaf-net

Furthermore, this system was outlined in detail in case studies that were held in every jurisdiction. The overall system was outlined in a number of industry, sectoral, scientific and management focused conferences and meetings over the past ten years.

Conclusion

Over the past decade, this project, in conjunction with a number of related FRDC and other Australian and international initiatives has resulted in substantial improvements in the ability of fisheries agencies and industry undertake and implement ‘ecosystem approaches’ to management. These efforts have helped turn these vague concepts into practical outcomes across a number of different natural resource industries (fisheries, aquaculture, agriculture, etc.). From this work four principles have been identified that ensure an ‘ecosystem’ approach is taken irrespective of the industry or resource being managed.

Four Universal Principles for Ecosystem Approaches to Management*

- What impacts are the activities I control having on the assets that I manage?
- What impacts are these activities having on the assets that someone else manages?
- What economic/social benefits and costs are generated from these activities and the use of my assets?
- What activities managed by others affect me and my assets?

In applying these principles, the ‘I/me/my’ can be an individual, a company, a sector, a region, a government department, a State, a Country or even an entire continent. But depending upon what the ‘I’ represents, the scope and complexity covered by the management system can vary dramatically. It is also recognised that the methods needed to apply these principles are largely just an adaptation of the international standard for risk management.

With respect to applying these principles there is now a wide variety of information and tools that can be used covering the full range of technical capabilities and resources available in fisheries management agencies. The ecosystem based tools and frameworks have gained international

* Modified from Fletcher and Chesson (2008)

recognition through their adoption by FAO and other international agencies, consequently from a technical perspective, this project and other related initiatives can be deemed to have been highly successful.

Despite these technical successes, from the public policy perspective, the adoption and, more importantly stakeholder acceptance of the 'ecosystem approach' for the wild capture fisheries sector within Australia, has not been as effective as was envisaged for either streamlining assessments to meet EPBC requirements or improving public attitudes (Millington & Fletcher, 2010). While initial agreements were obtained from all jurisdictions to participate in a single national process, a number of alternative initiatives were subsequently progressed that used different 'titles' The accompanying text and announcements appeared to highlight relatively minor differences in specific technical aspects compared to the significant similarities in the underlying frameworks. This situation resulted in a high degree of confusion within industry, an inefficient use of resources but most importantly it enabled a reduced level of acceptance by the various environmental sectors (government and non-government) that perceived, interpreted or welcomed the lack of consistency as evidence of deficiencies. This was unfortunate as there should have been recognition that the underlying frameworks were essentially identical no matter what the situation or specific methods used as all the system developed were essentially just refinements on risk management methodologies. The legacy of not having a unified framework and terminology (this is not the same as using identical technical methods), including the perception that these were competing rather than complementary systems, has continued to negatively affect national level policy decisions associated with potential improvements in the integration of fisheries portfolio management outcomes with the assessment and planning activities of other environment and NRM portfolios. As we move towards the path of adopting greater levels of third party certification it is hoped that the lessons that being 'divided leads to being conquered' are recognised.

At a world level, the methods developed have now been adapted, refined and expanded to enable application of ecosystem based approaches across a variety of different types of fisheries in a variety of different countries, including third world countries. This has demonstrated that the implementation of an ecosystem approach does not have to be as complex as many groups perceived, nor does it necessarily require large amounts of data or sophisticated models. It must be remembered that the ecosystem approach is essentially a management planning process, not a synonym for ecosystem modelling. This doesn't mean that it is always simple, any management planning that involves a consultative and interactive process where the livelihoods and activities of individuals may potentially be affected is seldom without its difficulties. It is also rare for this process to identify major problems that were not already evident for which there is often a reluctance to deal with effectively. The structured, consultative and risk based processes used in these ecosystem approaches provide the tools to best address these difficult problems but the mere adoption of a process called ecosystem based planning will not magically fix problems if they result from the lack of political will or the lack of institutional commitment to do what should be done.

While there has been reasonable progress in the implementation of ecosystem approaches at the individual fisheries level in Australia, and increasingly in some other parts of the world, the rate of progress at implementing multi fishery (EBFM) has been much slower. Moreover, there are few (or no) examples of the implementation of true multi-sectoral EBM in the world (Fletcher, 2006; Cochrane et al., 2012). This situation is not caused from a lack of awareness of EBM nor a lack of an appropriate operational framework. The main obstacles appear to have arisen from the difficulties integrating objectives across a diverse set of stakeholders, interest groups and agencies; the different levels of commitment and potential impacts on stakeholders and existing

institutions. It also needs to be recognised that some may view the status quo as more beneficial than having a transition to a more integrated, partnership approach in which their influence and direct decision making powers could be reduced.

Despite the inevitable problems that have been encountered in trying to facilitate major shifts in the systems of governance used by multiple layers of government and their agencies, this (and other related projects) have, nonetheless, directly and indirectly contributed to the creation of what is fast becoming the new benchmark for the management of fisheries and marine resources both in Australia and around the world. The methods and principles that have been generated are now considered best practice for the implementation of the ecosystem approach to all natural resource management which meets government commitments to UNCLOS, Sustainable Development, Convention on Biological Diversity, Code of Conduct for Responsible Fishing initiatives signed 20 -30 year ago. The major challenge is to now have the governance systems across the different jurisdictions and levels of government catch up so these tools can be used more effectively to improve public perceptions, but more importantly generate better long term community outcomes.

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Appendix 2. Intellectual Property

There are no intellectual property issues associated with the materials generated during this project. All the material is freely available from the Website www.fisheries-esd.com and www.fao.org/fishery/eaf-net .

Appendix 3. Executive Summary of West Coast EBFM Case Study Report

The EBFM framework developed in this case study (based on an initial system developed by Chesson (2000) outlined a step-wise risk assessment process to generate reports on all relevant ESD issues for a fishery; including impacts on the target species and the broader ecosystem and the potential social and economic outcomes, as well as current governance systems (Fletcher

et al., 2002, 2005). The process involves a series of steps (Fig. A 1) that are consistent with the standard risk management process (AS/NZ 4360, 2004; ISO 39000, 2009).

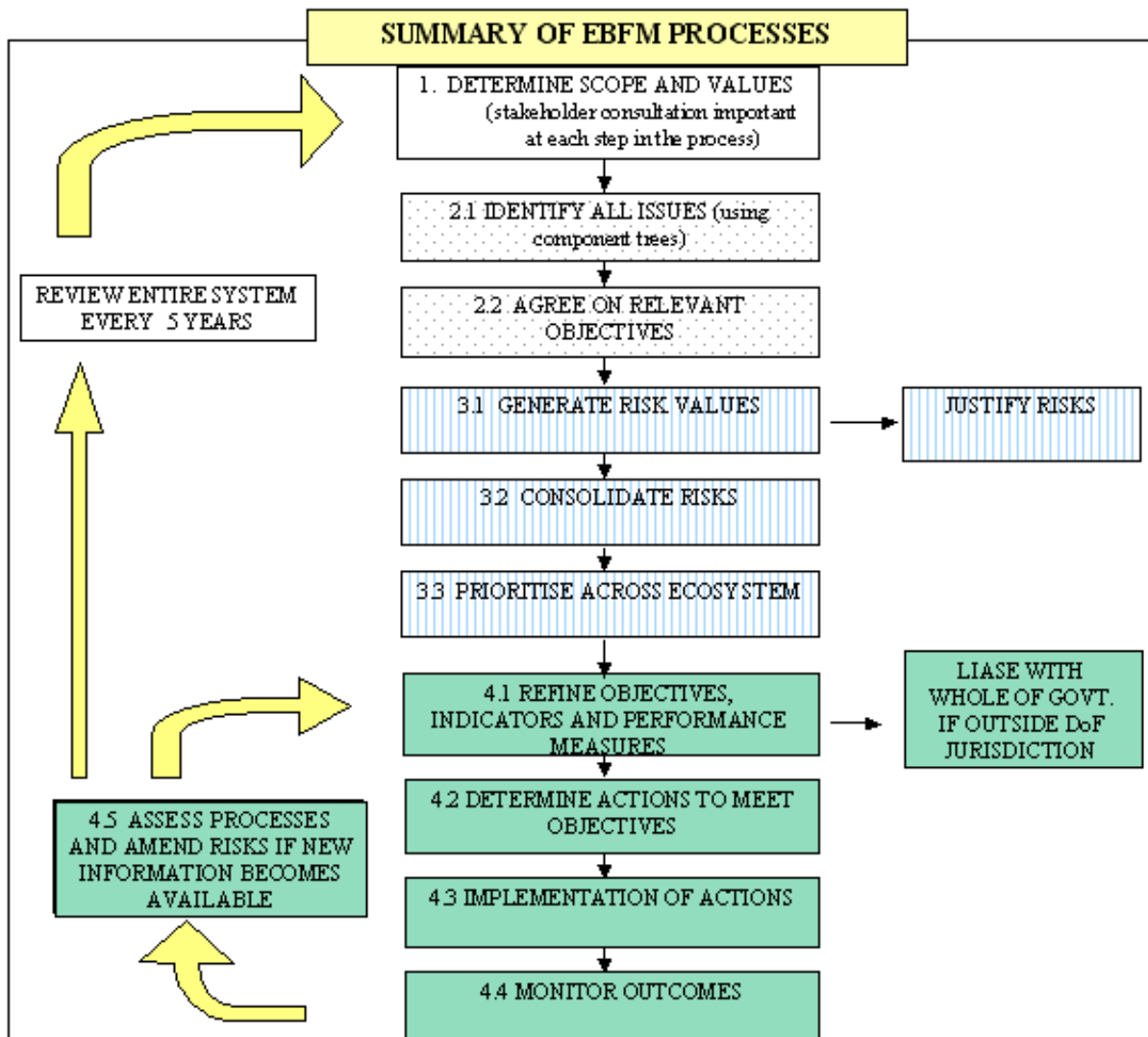


Figure A 1. Outline of the EBFM Process.

Step 1 – Determine the scope of the assessment.

Implementing EBFM in the West Coast bioregion required the development of a very clear description of each fishery as well as other activities being managed in the region. It included identifying and obtaining a shared understanding of the relevant social, economic and ecological values desired by the various stakeholder groups – effectively, what did the WA community want to achieve from undertaking management of the West Coast Bioregion’s resources? These community values (e.g. stock sustainability, economic benefits etc.) were refined such that they could form the basis of operational objectives.

Given that the main intersection of EBFM with EBM will be at the level of the ecosystem, to successfully integrate EBFM with broader EBM or other regional marine planning processes, all relevant agencies must agree on the specific ecosystems present within the region.

The final part of this step was to document the roles and responsibilities of each of the agencies and stakeholders involved. This involved discussions with stakeholders and, importantly,

obtaining agreements from other government agencies in multi-agency forums to clarify jurisdictional arrangements or objectives.

Step 2 – Asset and Issue Identification

Using the agreed scope and values for the West Coast Bioregion, the next step was to identify all the potential assets (ecological) and issues (social, economic, governance and external drivers) across each of the five EBFM components (dashed line, Fig. A 2). The component tree structure sets out the values that need to be considered for EBFM, which includes the environmental (ecological assets), social and economic assets as well as the ability to achieve management outcomes (institutional governance and external drivers). The assets and issues identified across each of the five EBFM components were reported in the form of detailed component trees for each of the lower branches (e.g. ecosystem structure & biodiversity, captured ‘fish’ species etc.) of the West Coast Bioregion tree below (Fig. A 2). All assets and issues that have detailed component trees are surrounded by ovals in Figure 3.

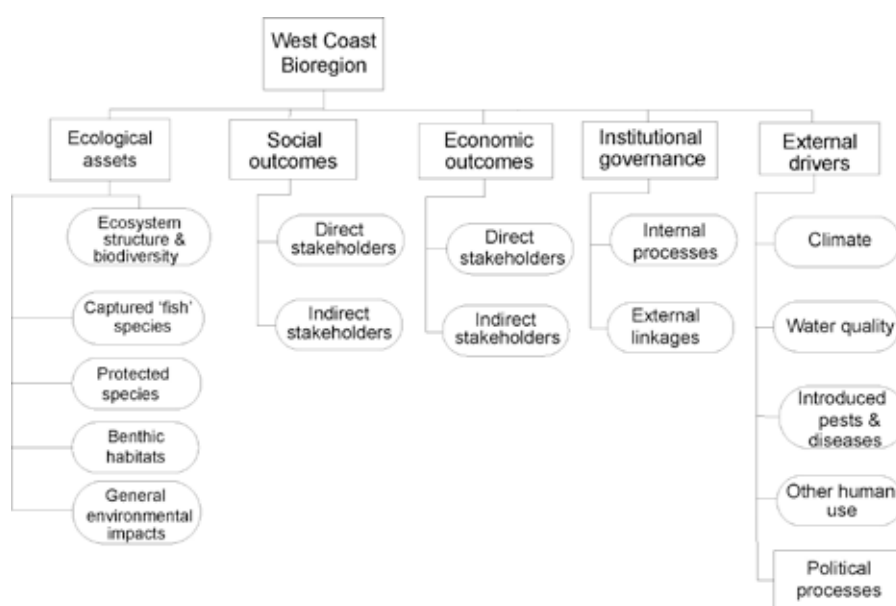


Figure A 2. EBFM Component Tree Structure. The five EBFM components are circled by the dashed line.

These trees help to structure the assignment of issues into a hierarchy of related groups, which assists with their later consolidation. The use of the generic component trees within this framework maximises consistency and minimises the chances of missing issues. These trees can also be beneficial for implementing EBFM or EBM in other regions as they can be tailored to suit individual circumstances.

A series of workshops with the participation of relevant stakeholders examined each of the high level EBFM components and specifically tailored each of the detailed trees by adding relevant assets and issues not already included and deleting those that were considered by the group to be irrelevant (not to be confused with having minimal knowledge).

The major difference in the EBFM component tree structure compared to the individual fishery assessments is that the EBFM process has the ecological assets as the primary focus for management, rather than the activity of fishing as the primary focus. In addition, the EBFM tree has a separate Ecosystem Structure and Biodiversity branch, which recognises that each

of the individual assets that are directly or indirectly impacted (e.g. habitats, target species, protected species) combine together to form ecosystems. These higher-level assets usually link to the activities and objectives of other stakeholders and agencies through EBM and the broader community.

Objectives to be achieved given any local, regional or national requirements or global attitudes were determined. These objectives could have been based on ecological concerns, economic realities or social attitudes (see Table A 1) with some assets having more than one associated objective.

Step 3 – Prioritising Issues

A three-part prioritisation process based on risk assessment principles was used to determine what issues needed direct management actions, and the level of action that should be taken from a whole of agency perspective. Table 1 details the common levels of risk that were used in this process.

There are a number of different risk assessment methods available for use in prioritising issues (Scandol et al., 2010). The methods used can operate with minimal levels of data and can be completed within a workshop environment. The determination of the most appropriate risk assessment methodology (or priority setting process) in any one circumstance may vary based upon the level of information available and the type of issue being examined.

Table A 1. Risk categories, descriptions and likely management responses (modified from Fletcher 2008).

Risk Category	Risk Value	Description	Likely Reporting Requirements	Likely Management Response
Negligible	1 - 2	Not an issue	Minimal	Nil
Low	3 - 4	Acceptable; no specific control measures needed	Justification required	None specific
Medium	6 - 8	Acceptable; with current risk control measures in place (no new management required)	Full performance report	Specific management and/or monitoring required
High	9	Not desirable; continue strong management actions OR new and/or further risk control measures to be introduced in near future	Full performance report	Increases to management activities needed
Severe	12 - 16	Unacceptable; major changes required to management in immediate future	Full performance report	Increases to management activities needed urgently

Individual Risks - The risks associated with each objective (see Table A 1) for each individual asset or issue were examined separately using formal qualitative risk (consequence x likelihood) or problem assessment processes outlined in Fletcher (2005, 2009). These methods enabled the analysis of risk (using a five year time horizon) for the objectives related to species, habitat and community structure/ecosystem sustainability, plus social and economic risk outcomes to be completed. Risk is now defined as “the uncertainty associated with achieving objectives” (AS/

NZS ISO 31000: 2009), therefore any lack of specific data for an issue/objective was explicitly incorporated into the calculation of the relevant consequence and likelihood scores such that the calculation of risk could be completed with whatever data were available.

Each issue was placed into the appropriate combination of consequence and likelihood levels (Fig. A 4) based upon the information available and the collective wisdom of the people involved in the process. If more than one combination is considered appropriate, the combination with the highest risk score should be chosen (i.e. this takes a precautionary approach).

The combination was based on the risk over a defined time period - not the risk of change occurring at any point in the future. As this process is assessing risks to objectives based on a management plan, a convenient time frame to use is the timeframe of the management plan - which was considered to be in the vicinity of five years.

In the formal system described previously, the risk level for each issue is calculated as the product of the scores for consequence and likelihood combination chosen as being the most appropriate for the issue. The possible values are between 1 – 16 (Fig. A 4).

		Consequence Level			
		Minor 1	Moderate 2	Major 3	Severe 4
Likelihood	Remote 1	1	2	3	4
	Unlikely 2	2	4	6	8
	Possible 3	3	6	9	12
	Likely 4	4	8	12	16

Figure A 3. Risk Matrix.

Consolidating Risks –

The number of individual risk values generated across the EBFM framework for the entire bioregion was too large for use in undertaking sensible management planning. Furthermore, many of the individual assets, issues and objectives were already the subject of specific management actions and planning processes at the individual fishery level. To ensure that the EBFM process recognised and preferably added value to the existing fishery level activities, not merely duplicated them, it was necessary to combine issues and risks to a regional or category level assets.

The consolidation of the individual risks into broader asset categories utilised the branch structure present in the component trees (Fig. 5). In addition, the consolidation of risks corresponds with an existing Departmental process whereby all captured species are assigned to one of a relatively small number of ‘species suites’ that are consistent with the key ecosystem sub-branches (e.g. near shore, inshore, offshore etc. – see Department of Fisheries 2009). The same principles were applied to each of the other trees in the framework with the risks for each branch of the component trees consolidated in two ways:

- For ecological assets, specific indicator species or components were identified with the risk value assigned to the entire ‘suite’ of species or functional group using the highest risk value of any of the indicator species. This reflects that many fishery management arrangements only operate at the entire suite level rather than only affecting a single species;
- For the non-ecological issues, the consolidated risk value was the average of the risk ratings for each of the elements in the sub-branch and, where relevant, each sub-branch within a branch. Thus, a hierarchical approach was used such that consolidation could operate at a number of different levels within each tree.

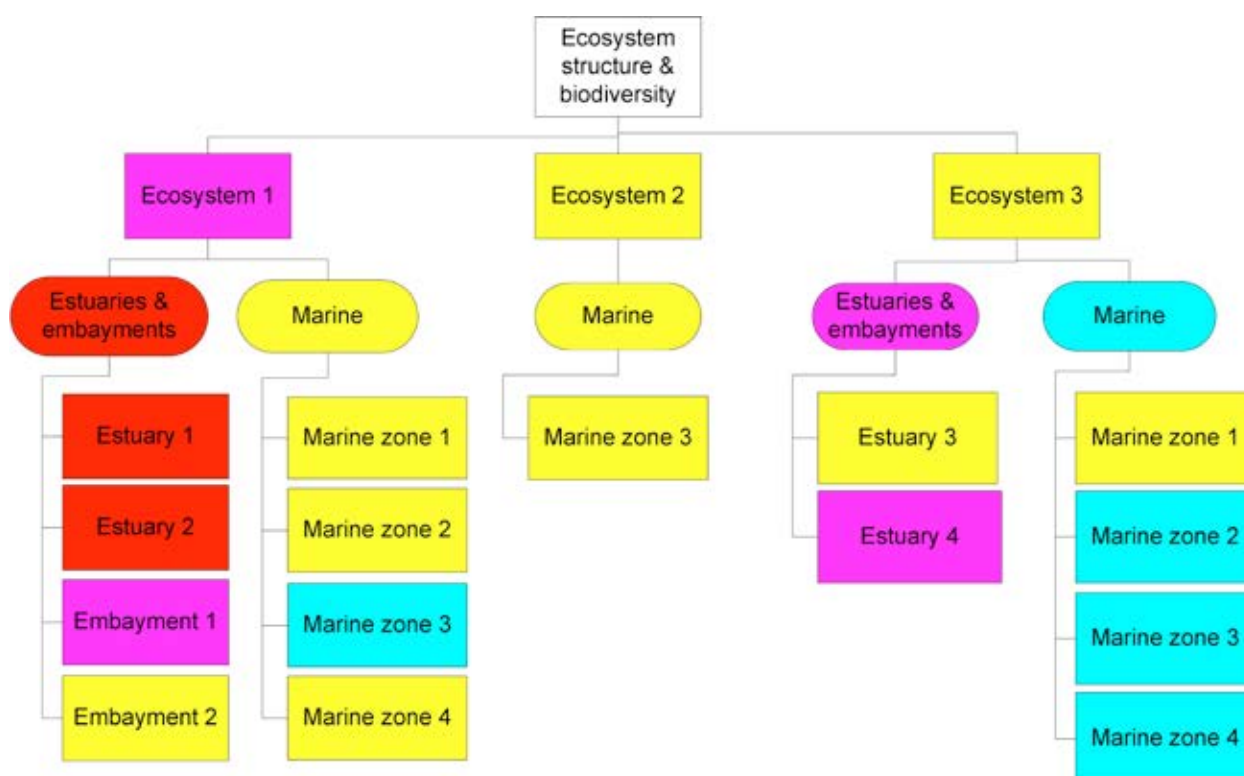


Figure A 4. Generic ecosystem structure and biodiversity component tree showing three larger ecosystems, which break down into smaller systems and components at the sub-branch levels. The consolidation of individual risks occurs at the mid-tree level (ovals). Sub-branch risks are consolidated into these components. Here the average risk has been used during consolidation as no specific indicator for each ecosystem has been identified.

Agency/Bioregional Priority Setting –

The final, and arguably most important part of the EBFM process was to generate a whole of agency priority for each of the consolidated ecological assets within the bioregion. These agency priorities include the associated social and economic risks and can be used to prioritise agency investment.

The integration of the various risk and value scores into Departmental priorities was achieved using a simple multi-criteria function including risk, Gross Value of Product (GVP) and social amenity. The criteria for assigning the GVP and social amenity scores are located in Table A2. The risk scores were based on the qualitative risk assessment process (Fletcher, 2009) with

the criteria for the value scores modified from those developed to assess the value of research proposals (Fletcher et al., 2003). All of the scoring included the level of current activities or management controls that are in place or underway. Hence, some of the scores may appear to be relatively low because of the current high level of controls that operate.

Table A 2. Criteria used to assess the relative economic (Gross Value Product) and social amenity value associated with each ecological asset in the West Coast Bioregion.

SCORE	Risk	Economic Value	Social Amenity
0	None	No Commercial use	n/a
1	Negligible	< \$1 million	Minimal – there is no recreational fishing for the asset and no specific broader community interests.
2	Low	\$1 – 5 million	Some – the asset may be caught recreationally &/ or there is some specific interest in the asset by the broader community.
3	Moderate	\$5 -10 million	Important – this is an important asset locally &/or the use or existence of the asset is important to the broader community
4	High	\$10- 20 million	Major – the asset provides a major source the catch by recreational fishers for the entire region &/ or the asset generates major interest for some of the general community.
5	Severe	> \$20 million	Iconic – this is a primary asset targeted by recreational fishers across the region &/or it is an asset that is considered iconic by most in the general community

Agency Priority = ('Stock' Risk – External Impact)*((Economic Risk*GVP) + (Social Risk*Social Amenity))

The Agency Priority Formula utilises the various risk and value scores associated with each asset and recognises that the level of Departmental activity should be mostly related to the current ecological risk for the asset. It also recognises that if the majority of this stock or ecological risk is generated by factors that are outside Departmental control (e.g. pollution), the overall priority for direct Departmental activity is likely to be reduced accordingly. A formula for use within an 'EBM' assessment would differ, as the roles of all management agencies would be included and this 'discounting' would not be required.

In addition to the ecological risk, the formula recognises that the priority for undertaking activities will be affected by the value the community places on each asset. This value will be based on the direct economic benefit (GVP) and from indirect benefits such as social amenity, importance to recreational fishers, existence value for non-users. The reason for independently assessing the risk and the value for the social and economic elements is that the individuals involved may clearly be facing a high risk of impact to their objectives, which can be explicitly recognised, but if the overall value to the community is low, this is likely to reduce the priority to expend significant agency resources. Thus, an asset will generate a high score and priority if its ecological sustainability risk is high, plus it is valuable economically and/or socially to the community.

Step 4 – Generating Management Systems

Where direct actions are required, develop clear management systems that include operational objectives and the ability to assess performance.

Step 5 – Assess processes and amend risks if new information becomes available

Appendix 4. EBFM Approach: Guidelines for Adoption Policy Agreed by AFMF

(Adopted by AFMF October 2010)

EBFM - What is it?

Ecosystem Based Fisheries Management (EBFM) is a holistic approach for the management of fishing activities, be they commercial, recreational, charter or customary fishing, at the regional or ecosystem level. EBFM considers the cumulative impacts on the environment from all fisheries-related activities operating in a region while taking into account the social, economic and other fisheries management objectives. Taking an integrated approach should assist reach more balanced and well-considered decisions on the appropriate use of resources, consistent with the principles for ecologically sustainable development (ESD – see Attachment 1).

The environmental impacts considered by EBFM include those generated from the capture of target and non-target species, plus any direct or indirect impacts on fish habitats and ecosystems. Importantly, EBFM also explicitly considers the social and economic benefits (and costs) derived from the mix of these activities. Finally, where relevant, it takes account of any material impacts on fish and aquatic resources (including fish stocks, habitats, ecosystems) and economic outcomes (including costs, markets) generated by ‘external’ sources including climate shifts and, importantly, non-fishing activities and processes (such as land use and run-off) that are managed by other (non-fishery) agencies.

By taking a regional level approach, EBFM builds upon the extensive fishery-level, ESD based work that has been undertaken during the past decade. While there are now comprehensive ‘ESD’ assessment for most individual fisheries, EBFM integrates these into a regional level assessment of all fisheries activities within a specified region. Consequently, EBFM provides the essential linkage between the fishery-level management arrangements used by fisheries agencies and the regional-level planning generally undertaken by other government agencies that deal with coastal development, ports and shipping, MPAs, mining/petroleum etc (see Figure 1). The integrated consideration of all these interests and activities is generally termed Ecosystem Based Management (EBM).

Key Elements and Scope of EBFM

- Regional level, multi-fishery and, where relevant, includes aquaculture and freshwater fisheries.
- Integrated decision making process, using a holistic risk management approach.
- Incorporates management of the effects of all fishing activities on the ecosystem including any cumulative impacts.
- Integrates social and economic outcomes in decision making to generate the best overall outcomes for the community
- Assists influence or the recognition of the management of impacts on fisheries caused by external factors (this is the critical link to broader EBM processes)

To be effective and efficient, each of the various management systems used by government should form an integrated hierarchy within an overall ESD context, with each level providing the building blocks for the next level (see Figure A5.) EBFM is, therefore, just one of the strategies needed to enable the full implementation of ESD across government.

EBFM – How does it work?

The practical application of EBFM* generally involves a step-wise, risk based approach to identify the relevant issues (see Figure A6) and the appropriate level of management response. Importantly, the EBFM process essentially involves the same set of steps that have recently been proposed by MACC to implement EBM (See Attachment 3 and CARF system). Having a consistent approach for EBFM and EBM will be essential to ensure that there is compatibility of processes and outcomes across government.

The EBFM approach recognises that the level of knowledge available for an issue only needs to be appropriate given the risk level and the proposed level of precaution in the management arrangements. Implementing EBFM will not, therefore, automatically generate a requirement to collect more ecological data. Additional data collection is only needed if this assists the management of an unacceptable risk. Where the risk is deemed low, even direct or additional management may not be required.

Why is an EBFM approach needed?

During the past decade there has been a worldwide recognition that taking a “whole of ecosystem” or a “bioregional approach” provides a more appropriate scale to deal with the environmental and social issues that flow from growing human population pressure. This shift has been reflected through increasing community and market expectations and the generation of a number of national and international government obligations to begin applying these principles.

Expanding the scope of fisheries management to cover regional level issues reflects a natural progression from the initial focus just on target stocks to the more recent completion of holistic fishery assessments that individually examined their broader impacts on the ecosystem and any social and economic implications. Each of these levels needs to be addressed to ensure we are managing the fisheries resources effectively.

Adopting a regional focus will also better align fisheries management with the scale at which EBM and other regional marine planning processes operate. Many of the difficult issues that face government are generated by allocation decisions among different fishing sectors (EBFM) and with other potential uses (EBM) within a region. As outlined above, a similar approach has been undertaken by MACC to initiate the implementation of EBM, with the process that has been developed being essentially identical to that developed for EBFM. Only the scope of issues that can be directly managed differs.

Finally, many of the impacts of external sources on meeting fishery objectives, such as climate change, regime shifts or pollution, are likely to be felt regionally so we need to develop and implement strategies to influence or cope with these impacts at this level.

What is the policy outcome sought - what will be achieved?

The adoption of an EBFM approach seeks to achieve a range of outcomes, including:

* A full description of the key elements of EBFM is provided in Attachment 2.

- more informed decision making in the ecologically sustainable use of aquatic resources.
- greater consistency in how EBFM is interpreted and applied across the different jurisdictional boundaries in Australia, leading to more efficient and effective management of fisheries;

but also...

- educating the public to dispel some of the myths about EBFM and to describe how it is being used in Australia to meet community expectations;
- helping to gain accreditation for fisheries under the requirements of the Environment Protection and Biodiversity Conservation Act 1999 and any other third party certification program that assesses ecosystem approaches to fisheries management;
- clarifying how fisheries management fits in relation to the range of other planning activities that manage the non-fishing activities that can impact on fisheries ecosystems, such as coastal development, shipping, mineral exploration, marine protected areas, etc.

Who is responsible for implementing the EBFM approach?

Implementation of EBFM can be largely undertaken by fisheries agencies and the fishers that harvest fisheries resources, whereas the implementation of EBM will require the involvement of a range of government agencies across Australia and the community in general.

Governments have a clear and ongoing role to ensure their decision making processes deliver the best overall community outcomes in accordance with principles of ESD. Fisheries agencies, in collaboration with stakeholders, have a central role in ensuring the fishing activities they are responsible for managing are not only vibrant, but are carried out in a way that their impacts on the overall ecosystem are acceptable and appropriate.

In some jurisdictions, fisheries agencies also have a direct role in protecting and rehabilitating fish habitat which is essential for healthy ecosystems. Although beyond the direct control of fisheries managers, other government agencies (such as local councils, environmental protection agencies, marine park authorities) should regulate non-fishing uses in catchments and aquatic environments to ensure their impacts on ecosystems that support fisheries are minimised.

Fishers can use non-regulatory ways of minimising their impacts on ecosystems through individual actions and by becoming properly informed of, and complying with, relevant fisheries laws and industry codes of practice.

The community plays a significant role in EBFM by undertaking their activities, whether they are for commercial, recreational or for traditional purposes, in ways that avoid or minimises impacts to aquatic environments (e.g. correct litter disposal). The community is also well placed to report suspected incidences of illegal fishing activity, enabling enforcement officers to respond. The community's role is assisted by an improved awareness of EBFM and the strong linkages between catchment-based activities, aquatic environments and fish.

All Australian jurisdictions are currently pursuing Ecologically Sustainable Development (ESD) as a fundamental part of managing fisheries. The Australian Fisheries Managers Forum (AFMF) supported the Fisheries Research and Development Corporation (FRDC) Sub-Program, which provided a common approach to implementing ESD in fisheries. This initiative successfully generated a number of implementation tools and supporting documents which are still available at <http://www.fisheries-esd.com/c/subprogram/index.cfm>. Implementing EBFM across Australia will, therefore, build on the range of existing processes and current activities

that are already available or underway.

The Australian Fisheries Managers Forum (AFMF) will monitor progress across jurisdictions and identify any significant gaps between our current work and the requirements of EBFM.

AFMF is linking with the Marine and Coastal Committee (MACC) to report on progress with EBFM implementation, to identify emerging issues and is ensuring that ongoing links are maintained with broader work on Ecosystem Based Management (EBM) that spans both terrestrial and marine environments.

What are the costs of implementing the EBFM approach and who pays?

These guidelines provide a contemporary focus for demonstrating how ESD fits with EBFM, although it is not expected to generate significant additional work or impose significant additional costs. There may, however, be some legislative or policy amendments or changes needed in some jurisdictions. These costs would be borne by Government and/or Industry, depending on the cost recovery arrangements that apply in each jurisdiction. Where such changes are required, there may need to be changes in the priorities of the relevant fisheries agency to achieve these outcomes.

When will the approach start?

The move towards an EBFM approach is already underway in Australia. The ongoing move towards EBFM by fisheries agencies and EBM by natural resource management agencies has involved a gradual broadening of the focus of fisheries management – from initially being solely on target species and gear based fisheries management approaches to more comprehensive, regionally based, management approaches covering all species interactions and the ecosystems that support fisheries. This trend is expected to continue.

The EBFM approach captures a range of national and jurisdictional initiatives that have occurred during the past decade to assist implementation of ESD objectives for fisheries management. The implementation of a national approach to utilise risk assessment as the basis of management has underpinned the move to an EBFM approach by helping fisheries agencies and stakeholder groups to improve identification and management of the broader risks posed to marine ecosystems, both from fishing activities and from activities that are external to fisheries. Hence, EBFM does not represent a radical change in monitoring and assessment but rather builds upon current approaches used in fisheries such as fishery-level ESD. It also enables the approach to be adopted even in the frequent situations where data are limited.

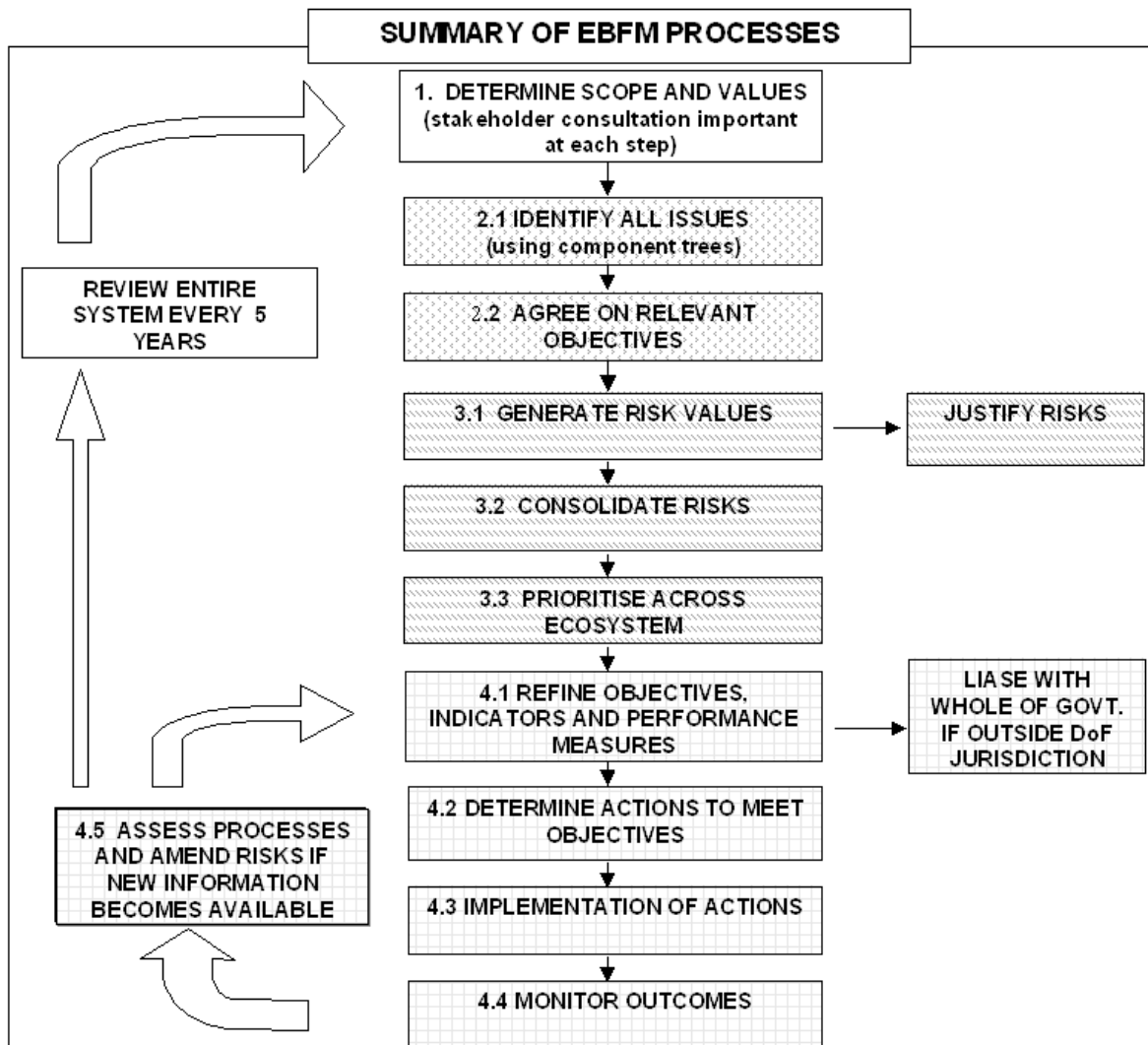


Figure A 6. Summary of Steps used in the EBFM Process (see Fletcher et al. 2010 for details)

