# FINAL WAMSI PROJECT REPORT

## Project Details

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| Project Number and Title: | 4.1 Applying the EBFM framework |
| Node Leader: | Rick Fletcher |
| Project Leader: | Dan Gaughan |
| Project Team: | Selina Cranley, Rick Fletcher, Dan Gaughan, Sarah Metcalf, Jenny Shaw |
| Project Start Date: | 01/01/2007 |
| Project End Date: | 30/06/2011 |
| Due Date for Final Report: | 30/06/2011 |

**1. Project Objectives and Achievement Criteria**

The overall strategic purpose of WAMSI Node 4 was to develop methods and generate the information needed to assist with the management of the marine ecosystems of Western Australia, consistent with the principles of Ecologically Sustainable Development (ESD). Implementing these ESD principles in a practical manner for fisheries has involved the development of a management approach new to Western Australia (WA), which is termed Ecosystem Based Fisheries Management (EBFM)[1]. The purpose of Project 4.1 was to trial the implementation of EBFM as a means of assisting with marine ecosystem management in the two highest priority marine bioregions in Western Australia (in 2006/07), the West Coast Bioregion and the Gascoyne Bioregion.

EBFM is defined as the assessment and management of all ecological impacts and socio-economic outcomes related to any commercial, recreational, charter, indigenous fisheries, or "no-take" sector operating within an ecosystem or bioregion. It encompasses both individual fisheries and the cumulative impacts across multiple fisheries using a risk-based framework. The implementation of the approach has required supporting research that was, in many cases, very different in nature to traditional fisheries research programs. The research within this Project was designed to ensure all requirements to enable the implementation of EBFM for the State's fisheries resources were addressed.

One important problem that this Project addressed was how to undertake regional-level assessment and planning while avoiding the generation of an impossibly complex set of issues, systems, models and uncertainties. Specifically, the Project needed to address how to reduce complexity to a level that could be pragmatically used by management. In this context, the outputs for Project 4.1 were very closely aligned with the broader expectations of the entire Node 4 outputs.

The need to accept uncertainty and data limitations has been broadly recognised and integrated into management systems though the use of adaptive management and the precautionary approach. The next step, which has been undertaken in this study, was therefore to develop a framework for EBFM that is flexible, functional and easy to deal with to enable widespread implementation.

The project was extremely successfully on the trialling and implementation of EBFM as evidenced by the uptake of the EBFM risk system as the basis of the Department of Fisheries' Risk Register system and the extension of the EBFM risk assessments to each of the state's four marine bioregions.

The conceptual (qualitative) modelling components of this project successfully helped address identified risks and or areas of significant management or research uncertainty. A series of models have been published, including in leading international science and policy journals. The modelling skills provided by

[1] (Fletcher, W.J. (2006) Frameworks for managing marine resources in Australia through ecosystem approaches: do they fit together and can they be useful? *Bulletin of Marine Science* 78:691-704). EBFM is synonymous with Ecosystem Approaches to Fisheries Management.

Project 4.1 staff were also utilised in other Node 4 projects, including collaborative projects with direct relevance to high-priority fisheries management issues.

2. Overview

The aim of Project 4.1 was to develop a means of integrating EBFM into mainstream fisheries management, including the WA government's Integrated Fisheries Management (IFM) initiative, and to source, identify and integrate appropriate supporting research.

The first part of the project focused on trialling the nationally agreed EBFM framework for the West Coast Bioregion of Western Australia, the marine bioregion that adjoins the metropolitan region and lower west coast of the state. This is the most densely populated part of the state and therefore a region of high social and economic importance as well as potentially high impact; importantly, this is also the part of the state's marine jurisdiction that encompasses most of the available fisheries and ecological data. Trialling of EBFM therefore constituted a major subproject in its own right, and involved considerable stakeholder consultation to identify all relevant issues of concern, whether these involved ecological assets or management/governance issues. Together the assets and issues form the components whose risk levels needed to be examined.

During the initial development of an improved understanding of the potential risks to ecosystems that form a part of the West Coast Bioregion it was clear that some issues clearly needed immediate attention, or were of significant initial concern to warrant a more detailed investigation. Projects 4.1 used these initial high priorities to guide development of other research activities within Node 4; directions were provided to help generate additional data that would assist with more effectively assessing potential risk levels. In some cases this facilitated making decisions to undertake research in one ecosystem and not another, or to address one particular management issue of particular concern.

The complementary aspect of research undertaken in Project 4.1 was using qualitative modelling to help identify how variable in systems for which there were few actual data interact. The qualitative modelling addressed issues as varied as the response of recreational fisheries to management changes, identification of indicators to address potential trophic impacts of the western rock lobster fishery and the influence of governance arrangements on the health of the Peel-Harvey estuary.

3. Summary

The EBFM framework used the West Coast Bioregion as a case study and used a series of component trees to describe ecological, social, economic and governance assets and issues (Fletcher et al. 2010). The use of a series of component trees is designed to facilitate the capture of all possible issues or assets in an ecosystem. The trees were populated and, were necessary, further developed, during stakeholder workshops and each component (asset or issue) was subjected to a risk assessment. The use of component trees allowed for the reduction of ecosystem complexity by consolidating individual assets (e.g. individual species or benthic habitats) and their risks to a higher level (e.g. suites of species, regional-level habitats). This was undertaken because the separate management of these individual assets (in excess of 600 for the West Coast Bioregion) would not be feasible due to funding, time and efficiency issues.

A multi-criteria analysis was applied to integrate the different types of risk identified during the production of the component trees (Fletcher et al. 2010). Ecological, social and economic risks as well as scores for the risk to social amenity and Gross Value of Product (GVP) were included in this multi-criteria analysis. In addition, the level of influence of external factors, which were outside of the control of the Department of Fisheries, was taken into account as this affects the overall priority to the Department. The inclusion of the external factors in the multi-criteria analysis was important to provide a distinction between EBFM, where fisheries management is the main priority, and EBM where all ecosystem impacts are a priority.

The application of the EBFM framework to identify and assign risk to all elements of ecological, social and economic relevance for the West Coast Bioregion, and then consolidating these up to a level that is of practical management use, has not only assisted the Department of Fisheries in improving its planning processes for natural resource management, but has in fact constituted a revitalised approach to identifying risks within the portfolio of the Department. Because the EBFM framework was applied in a manner that formally captured all relevant elements of concern (or perceived concern) for the West Coast Bioregion, this allows more efficient use of government resources when addressing natural resource

management issues. For example, expenditure on research or policy projects directed towards low-risk elements could (and will) be redirected towards higher risk elements.

The complementary part of Project 4.1 was the use of qualitative models to integrate inputs from all stakeholders and sectors that would allow the investigation of ecosystem linkages and identify data gaps. Multiple stakeholder workshops were held to gather the appropriate information for inclusion in the qualitative models. An important data gap identified involved general economic information (e.g. influence of global economy, international demand, effect of changes in the Australian dollar) regarding export fisheries such as the rock lobster fishery (Metcalf et al. 2009). In addition, recreational fisher behaviour due to management changes was identified as a data gap (Metcalf et al. 2010) and was subsequently further investigated in Project 4.5. This technique has also directed research in other areas, such as the data collection of specific indicator species to assess the effects of deepwater (>40m) rock lobster fishing in Western Australia (Metcalf et al. 2011).

Other government departments and agencies could benefit from the use of qualitative models to investigate relevant social, ecological, economic and governance systems. The technique is highly intuitive and relatively quick to use in comparison to other data-intensive models so is cost-efficient and easily incorporates stakeholder input. Being able to produce models in real-time during workshops is beneficial to ensure agreement on model structure and to identify new links and variables of importance while in discussion with stakeholders. The assessment of alternative management strategies can be used to focus further investigation to potential strategies for improvement, thereby aiding the prioritisation of future resources. Such prioritisation can be difficult without a method of simplifying issues to their core drivers.

4. Discussion

This project focussed on developing a better system for holistic management of marine ecosystems and developing a clearer understanding of how both management systems and the ecosystems are structured. Ultimately, the challenge is to balance the available management resources against the range of management issues in a manner that maximises return to the community; this challenge is about risk assessment and risk management.

Risk-based frameworks to implement an ‘ecosystem approach’ have been developed in Australia for a number of different industries, including for individual fisheries. Whilst valuable, fishery level approaches do not address cumulative effects of fishing or align with regional level planning undertaken by other agencies, nor have they halted increasingly negative community perceptions about fishing. To address these issues, a regional level approach, termed Ecosystem Based Fisheries Management (EBFM), has been trialled. The purpose of this case study was to assess whether the EBFM framework can assist in providing natural resource management planning for the optimal management of marine resources at a bioregional level; i.e. a risk-assessment of the ecological assets and management issues for an entire bioregion. It was also the intention to ensure that the planning structures, to meet the legislative responsibilities of the Department of Fisheries, were being undertaken in a holistic manner. The EBFM framework that was developed through this case study was ultimately successful in meeting both of these objectives because a pragmatic, management focused approach was taken.

To avoid merely generating impossibly complex sets of regional issues, uncertainties and expectations, a hierarchical, risk-based framework was developed. In applying the EBFM framework to the West Coast Bioregion, stakeholder workshops identified over 600 ecological assets, social and economic issues, governance issues and external drivers. This complexity was reduced by consolidating these into 60 regional-level risks, with a multi-criteria analysis used to integrate related ecological, social and economic values and risks into 24 ‘Agency level’ priorities ranging from urgent to very low priorities. This framework has been applied to all six bioregions in WA with these priorities now used as the basis for the annual budget setting process. Furthermore, fully implement EBFM, WA is revising it’s 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.

The second part of this project investigated structures of a variety of systems (e.g. estuary ecosystems including governance arrangements, behaviour of recreational fishers, rock lobster fishery trophic paths) using qualitative modelling. This highly intuitive, expert–based modelling developed much better understanding of several systems for which data were limited and for which indirect interactions between

system components had hitherto not been anticipated or understood. This series of modelling exercises have ongoing benefits to management and sampling design across a variety of areas.

Problems encountered (if any) – Describe any major problems/issues encountered during the study and how they were addressed.

At the beginning of the study there was a high degree of misunderstanding of EBFM across the agency and therefore a high level of scepticism that this process would generate any useful outcomes and even concern about its potential drain on resources. The high level of scepticism continued largely until the steps that consolidated the issues down to a smaller group of asset categories and the methods to integrate the ecological social and economic factors into a single analysis to produce meaningful whole-of-agency priorities were developed. Without these it is highly likely that the outcome from this case study would have just been seen as another research project that involved high levels of data collection and consumed more than its fair share of resources, staff and stakeholder time.

New Research Directions (if any) – Identify new research directions pursued during the course of the project and reasons for modifying original research plans. Describe how the changed research agenda improved the project.

5. Overall Project Accomplishments

Not applicable.

PhD theses, Dissertations and Student Placement – Please give complete citation for theses and dissertations (student's name, month and year completed or expected, level of degree, institution). Please provide a copy of the abstract of the thesis or dissertation when complete.

None.

Publications - List in standard academic format the citations of literature produced during the reporting period. Include journal articles, book chapters, reports, etc. submitted, in press and printed. Please provide a paper and electronic version copy of each publication resulting from the project. If there is a link to the journal electronically, please also include this.

Dambacher, J.M., Gaughan, D.J., Rochet, M-J., Rossignol, P.A. and Trenkel, V.M. (2009) Qualitative Modelling and Indicators of Exploited Ecosystems. Fish and Fisheries 10(3): 305-322.

Fletcher, W.J., Gaughan, D.J., Metcalf, S.J. and Shaw, J. (in press). Using a regional level, risk based framework to cost effectively implement Ecosystem Based Fisheries Management (EBFM). In: 26th Lowell Wakefield Fisheries SymposiumEcosystems 2010: Global Progress on Ecosystem-based Fisheries Management.

Fletcher, W.J., Shaw, J., Metcalf, S.J. and Gaughan, D.J. (2010). An ecosystem based fisheries management framework: the efficient, regional-level planning tool for management agencies. Marine Policy 34: 1226 – 1238.
FRDC ASFB workshop report?

Hall, N.G. and Wise, B.S. (2011). Development of an ecosystem approach to the monitoring and management of Western Australian fisheries. FRDC Report – Project 2005/063. Fisheries Research Report No. 215. Department of Fisheries, Western Australia. 112pp.

Metcalf, S., Gaughan, D. (in press) WAMSI Project 4.3.1b Marine demersal food webs. Fisheries Research Report.

Metcalf, S., Gaughan, D. and Shaw, J. (2009). Conceptual models for Ecosystem Based Fisheries Management (EBFM) in Western Australia. Fisheries Research Report 194, Department of Fisheries Government of Western Australia, pp. 36.

Metcalf, S.J., Dambacher, J.M. (draft). Qualitative modelling of the Peel Harvey estuary. To be published as a Fisheries Research Report.

Metcalf, S.J., Moyle, K. and Gaughan, D.J. (2010). Qualitative analysis of recreational fisher response

and the ecosystem impacts of management strategies in a data-limited situation. Fisheries Research. doi:10.1016/j.fishres.2010.08.008

Metcalf, S.J., Pember, M.B. and Bellchambers, L.M. (2011). The identification of indicators of the effects of fishing using alternative models, uncertainty and aggregation error. ICES Journal of Marine Science; doi:10.1093/icesjms/fsr050

Shaw, J., Metcalf, S., Gaughan, D. and Fletcher, R. (2011). Ecosystem based fisheries management case study report: West Coast Bioregion. Fisheries Research Report.

Viera, S., Schirmer, J. and Loxton, E. (2009). Social and economic evaluation methods for fisheries: a review of the literature. Fisheries Research Contract Report 21, Department of Fisheries Government of Western Australia, pp. 90.

Presentations - Cite any presentations resulting from the project, including conferences, symposiums, etc.

Oral presentations have been made at numerous workshops/meetings (e.g. EBFM stakeholder meetings, Ningaloo Symposium, WASMI Show & Tell, South West Catchment Council Marine Reference Group, Marine Policy Stakeholders Group, Marine Futures Resource Condition Targets meetings).

Two workshops on ecosystem change in the Peel Harvey estuary have been held at Hillarys and Mandurah.

Two presentations were made at the Wakefield Symposium 'Ecosystems 2010: Progress on Ecosystem Based Fisheries Management' in Anchorage.

One presentation was made at the 2008 World Fisheries Congress in Yokohama.

Two presentations were made at the 2009 Indo-Pacific Fish Conference in Fremantle.

Other Communications Achievements - Interviews, press releases, etc.

6. Overall Project Benefits Please note: Benefits go beyond Results and Accomplishments to provide information on direct physical, environmental, economic or social gains realised as a result of a research project or outreach activity.

Discovery and Application of New Products and Processes (if applicable) - Describe any actual or anticipated products or processes discovered or developed in the project.

Given the large scale of the region covered and the potentially limitless issues that could be covered, the approach taken to apply the EBFM principles was necessarily pragmatic. The decisions on what would be the specific consolidated assets and categories determined by the process sometimes had to involve compromises, but the alternatives probably would not noticeably affect the overall outcome. Similarly, some of the risk and value scores could be refined, but generally not by a degree that would materially change the overall priority for an asset Finally, the scoring system used in the multi-criteria system needed to be sufficiently simple so it could be applied in all circumstances. If the system was too complex it is unlikely to have been adopted.

The process of explicitly articulating how priorities are effectively determined was itself a very useful exercise as this step had previously used an implicit process, which is likely to have been applied inconsistently. A valuable outcome was the explicit recognition that we had been implicitly discounting the risks being largely generated by activities under other legislative management systems when determining priorities. Hence, this was not only useful for setting our internal priorities for direct management actions but also for discussions with other agencies, plus government more broadly, about whether the current jurisdictional and management responsibilities are appropriate. This is a major governance and efficiency benefit.

Tools, Technologies and Information for Improved Ecosystem Management - Describe how project results are being (or will be) translated into sustainable use and management of coastal and ocean ecosystems. Tools might include benthic habitat maps or environmental sensitivity indicators. Technologies might include remote and bio-sensing, genetic markers, and culture systems. Information

might include technical assistance, training and educational materials.

The most important outcome from Project 4.1 was the adoption of the framework by the Department of Fisheries. The method of risk assessment and structure of component trees has been incorporated into the Department's risk register, which enables strategic priority setting to occur on an EBFM basis. This type of management system is a world-first and could be adopted by other jurisdictions and countries worldwide using the data and funding that are currently available to them. Any future data collection and results can be used to reassess risks and management plans, through adaptive management, as well as the applicability of the component tree structure (i.e. do any components need to be removed or included) at approximately 5-year intervals.

Forecasting for Natural Resource Management Decisions - Describe how results already are being used - or are expected to be used after project completion - by natural resource management to make decisions based on project forecasts. Forecasts may be due to field and laboratory studies and models. Examples include hypoxia forecast models, algal bloom alerts, forecasts of fishery harvest, and prediction of impacts from ecosystem stressors such as pollutants or invasive species.

Not applicable in the intended context.

Impacts - Impacts are higher order, usually long-term results of a project's activities that have significant scientific, economic or social benefits. Impacts may involve behavioural, policy or economic changes. Describe impacts (anticipated or realized. These impacts may involve behavioural, policy or economic changes. Seminal contributions to science are considered impacts especially if the research findings lead to major progress in a particular field, implementation of new technologies or have a substantive bearing on an economic or societal issue.

The application and consolidation of the EBFM framework to identify and assign risk to all elements of ecological, social and economic relevance for the West Coast Bioregion, has not only assisted in improving the planning processes for natural resource management, but has revitalised the entire approach to identifying and managing the risks across the entire portfolio of the Department. It has further reinforced the formal adoption of risk management principles as the appropriate basis for natural resource management agencies.

Following the successful completion of the EBFM process for the West Coast Bioregion (which effectively took 2 years to complete), the same principles have subsequently been applied to the other bioregions in Western Australia. Now that a clear format has been generated and there are detailed examples from the West Coast to use as a guide, the time taken to undertake these assessments has been substantially shorter (a few months). Updating the risks is now planned to occur on an annual basis as a formal part of the Departments planning cycle.

The potential benefits and impacts of the EBFM approach now adopted by the Department of Fisheries applies not only to other Western Australian government agencies but also to natural resource management jurisdictions in other states as the relevant Commonwealth government departments.

7. Project Metadata and Data Generated

These must be available at an open access repository/data centre/iVEC.

8. Linkages to Associated Projects – can be WAMSI and non-WAMSI

Project 4.1 has been strongly associated with the other Node 4 projects to reinforce the need to generate new data that was relevant for re-assessing risk of assets in the bioregions (e.g. the health status of estuaries), or to generate benchmark understanding of issues of particular concern (e.g. demersal fish communities). This has included a substantial overlap in the area of recreational fishing, which has a significant social value. Thus, there has been links to the Project 4.4 work on recreational fishing catch and to Project 4.5 on behaviour of recreational fishers. Staff from Project 4.1 also made a major contribution to the report by Viera et al. (2009) on social and economic evaluation methods for fisheries.

9. Other Comments and General Discussion

It is significant that none of the individual processes used within the EBFM framework are particularly novel or complicated. To start with, a comprehensive set of issues was identified across the spectrum of ecological, social economic and governance components and their associated risks calculated. These

were consolidated to a set of higher level, regional risks using a pragmatic process that was already being used to deal with multi-species fisheries. Finally, the various ecological, social and economic risks associated with the regional level assets were combined into a single score reflecting its overall Departmental priority. The combination of relatively simple steps has, nonetheless, proven particularly powerful and effective in generating regional level management outcomes, an accomplishment that has previously proven to extremely difficult to generate.

The next phase in the development of this process is to identify the mechanisms to further engage other agencies involved in the management of activities within the marine environment and to determine how their processes can link to the EBFM framework. Given that we already have agreement on the key ecosystems in the region this should facilitate the process.

10. Annexures

- Sub-project reports presented
- Additional attachments