Role of Science within a Risk Based, Regional Ecosystem Management Framework for Fisheries and Aquaculture in Western Australia.

Department of Fisheries, Western Australia

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SUMMARY

The Department of Fisheries, Western Australia is responsible for the management of most of the fisheries and other aquatic resources off WA out to the 200m depth contour and for the management of all aquaculture activities in the State.

Managing the fishery resources of WA is challenging. The WA coastline is approximately 12,800 km long, hosts at least 3,000 species of fish and a spectrum of tropical to temperate aquatic ecosystems.

To provide a sound foundation to support the conservation and sustainable use of the State's fish resources and aquatic ecosystems, the Department's Research Division is responsible for the provision of timely, quality scientific knowledge and advice.

Due to the large number of diverse scientific activities (including monitoring and assessments) directed towards fisheries, aquaculture, biodiversity and biosecurity, this paper provides a high-level overview of how decisions on what science to undertake is integrated into the Department's overall governance structure to ensure efficient use of government resources within the context of meeting public policy needs.

To enable this to be completed efficiently and effectively the Department has recently adopted a full risk based, regional level management system termed Ecosystem based Fisheries Management (EBFM).

This requires all research and monitoring activities, but especially the science undertaken internally or commissioned from other science providers, to be explicitly aligned to assist with the management of risks associated with one or more regional level fisheries (e.g. rock lobster, prawns) or other ecological assets (e.g. bycatch/habitat). Having a direct link between science activities and the risks to one or more ecological assets clearly illustrates that the purpose of a natural resource management agency is to (i) effectively manage the risks (ecological, social and economic) to the community's assets and outcomes and (ii) ensure that resourcing of the science conducted is appropriately focussed towards dealing with priority fisheries and aquaculture risks.

The first step in the annual budget planning cycle and other prioritisation processes undertaken by the Department is now a review of the ecological risks and community value scores for each ecological asset. Changes in these values affect the priority scores which can result in a shift in the level of resources directed to individual assets and regions. This process identified the need to invest more in dealing with the risks associated with invasive pests generated from the vastly increased level of shipping traffic in WA ports. It also identified longer term risks associated with potential shifts in species distributions that may arise from climate change and oceanic circulation patterns.

A key science activity is the annual assessments of risks to individual fishery resources and the cumulative risks to regional level assets, including up to the level of entire ecosystems.

These analyses are reported annually to the WA Parliament and community through the *State of Fisheries and Aquatic Resources report*. Based on these risks and prioritisation processes an updated five year plan for science is generated annually and documented in the *Research, Monitoring, Assessment and Development Plan*.

The RMAD plan demonstrates that the amount and complexity of the science undertaken for each of the fisheries and aquaculture sectors can differ dramatically. Based on short and long term risks and priorities the science undertaken can be very basic and routine to highly innovative requiring significant internal and external investment, sometimes involving multi-agency, collaborative projects.

The efficient use of science capacity available in the State and regionally has recently been assisted through the development of the National Research, Development and Extension Framework of which WA is part of both the northern and south western hubs, as well as national "hubs" on biosecurity and threatened, endangered and protected species.

BACKGROUND

Framework for the Management of Fisheries and Aquaculture in WA

Science plays a key role in the management and future of the fisheries and aquaculture resources that are the jurisdiction and responsibility of the Western Australia Government. The Western Australian Department of Fisheries is the agency responsible for the management of nearly all fisheries resources out to the 200 m depth contour under a combination of the Fish Resources Management Act (1994) and the Offshore Constitutional Settlement (1995). The FRMA requires the Department of Fisheries to "conserve fish and protect their environment" (including associated food chains and biodiversity) by ensuring that the use of these resources in all WA waters is undertaken in a sustainable manner.

To assist in the achievement of these broad marine sustainability goals, the Department has been operating for the past decade within Ecologically Sustainable Development (ESD) policy for the management of fisheries and aquaculture activities in WA (DoF, 2002)[1]. This policy, which is based upon the National ESD framework for fisheries and aquaculture (Fletcher et al., 2002[2]; 2005[3]), which incorporates the principles of ecosystem based fisheries management (EBFM[4]), not only covers management of target species, but also by-catch species, habitats, plus potential indirect impacts of these removals on the broader ecosystem. This broader ecosystem approach requires that biodiversity must also be maintained because this underpins the productivity of all fished stocks.

Managing the fishery resources of WA is challenging. The WA coastline is approximately 12,800 km long and hosts at least 3,000 species of fish and other captured species that come from tropical to temperate inshore and offshore ecosystems. To more effectively and efficiently manage the broad range of resources and issues found in the waters of WA, the Department has recently adopted a fully risk based, regional level approach termed Ecosystem Based Fisheries Management (EBFM). This requires undertaking assessments to ensure that the cumulative impacts of all fishing and aquaculture activities in each of the State's four major marine bioregions are not causing unacceptable impacts on the relevant

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[1] DoF (2002) Policy for the implementation of Ecologically Sustainable Development for Fisheries and Aquaculture within Western Australia. *Fisheries Management Paper*, Department of Fisheries, Western Australia. No. 157.

[2] Fletcher, W.J., Chesson, J., Fisher, M., Sainsbury, K.J., Hundloe, T., Smith, A.D.M. and Whitworth, B. 2002. National ESD reporting framework for Australian fisheries: The 'How To' guide for wild capture fisheries. Fisheries Research and Development Corporation (FRDC) project 2000/145, ESD Reporting and Assessment Subprogram, Fisheries Research and Development Corporation, Canberra.

[3] Fletcher, W.J., Chesson, J., Sainsbury, K.J., Fisher, M. & T. Hundloe (2005) A flexible and practical framework for reporting on ecologically sustainable development for wild capture fisheries. *Fisheries Research* 71:175-183

[4] 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

ecosystems and major environmental assets (Fletcher et al., 2010[5], 2012[6]). WA is the first jurisdiction in the world to adopt such a comprehensive holistic and integrated approach to management of aquatic resources.

DEPARTMENTAL RISK REGISTER

A critical part of the adoption of a risk based management approach is the construction of a comprehensive Departmental Risk Register that contains the full set of Departmental risks related to our implementation of the FRMA and other Government/Departmental commitments (Figure 1). This register includes the risks to:

- Bioregional Level Ecological assets/resources (Figure 2);
- Major Corporate assets/resources and,
- External services

Each of these risk register entries have their relevant risks (ecological, social, economic and political – see Attachment 1 for details) and these scores are combined together using a standard formula to generate their overall Departmental priority. The risks, and therefore the priority level for these issues, are reviewed and updated annually and form the basis of the budget planning process.

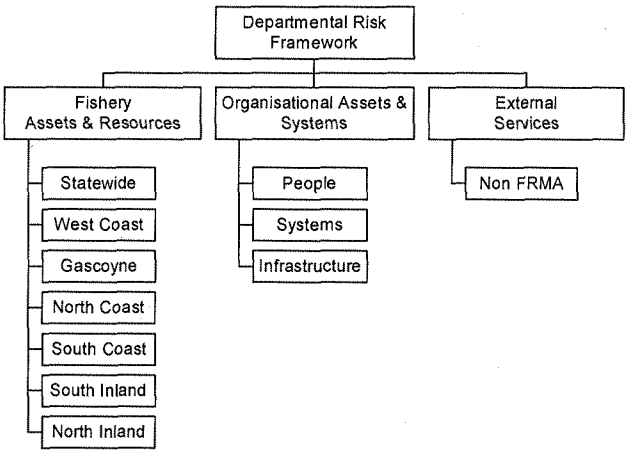

Figure 1 – Departmental Risk Framework - All activities undertaken by the agency must be aligned with ensuring risk levels are either maintained at acceptable levels or work is being undertaken to reduce risks to acceptable levels. Consequently, no activities are undertaken unless they assist with one or more of the risk controls.

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[5] W.J. Fletcher, J. Shaw, S.J. Metcalf & D.J. Gaughan (2010) An Ecosystem Based Fisheries Management framework: the efficient, regional-level planning tool for management agencies. *Marine Policy* 34 (2010) 1226–1238

[6] Fletcher, W.J., Shaw, J., Gaughan, D.J. , Metcalf, S.J. (2012) Ecosystem Based Fisheries Management case study report West Coast Bioregion. Fisheries Research Report No. 225. Department of Fisheries, Western Australia. http://www.fish.wa.gov.au/docs/frr/frr225/frr225.pdf

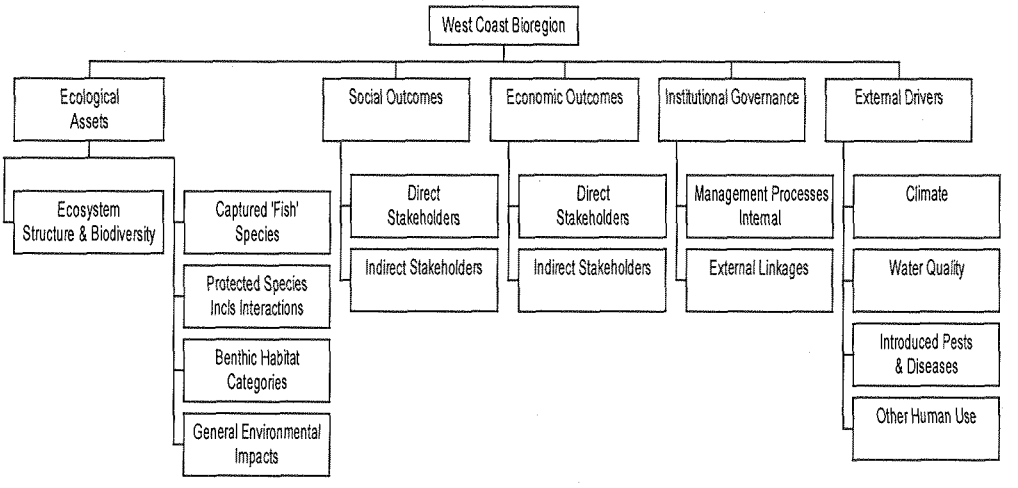

FIGURE 2 The basic EBFM component tree framework. Each of the Bioregions has their own tailored EBFM component tree in which each of the ecological components have been subdivided into the set of ecological resources/assets relevant to that Bioregion.

Role of Science in Fisheries and Aquaculture Management in WA

To provide a sound foundation to support the conservation and sustainable use of the State's fish resources and aquatic ecosystems, the Department's Research Division is responsible for the provision of timely, quality scientific knowledge and advice.

This role supports the statutory obligations of the Department of Fisheries and therefore differs from many other research bodies (especially universities) in WA which have primary goals to further science generally and/or provide training and educational opportunities but who may also conduct activities that assist fisheries or resource management. All research and monitoring activities, but especially the science undertaken internally or commissioned from other science providers must be explicitly aligned to assist with the management of risks associated with one or more regional level fisheries (e.g. rock lobster, prawns) or other ecological assets (e.g. bycatch/habitat).

Having a direct link between science activities and the risks to one or more ecological assets clearly illustrates that the purpose of a natural resource management agency is to (i) effectively manage the risks (ecological, social and economic) to the community's assets and outcomes and (ii) ensure that resourcing of the science conducted is appropriately focussed towards dealing with priority fisheries and aquaculture risks.

The key outputs from the Research Division are the annual production of the State of the Fisheries and Aquatic Resources Report[7] plus more detailed scientific reports and publications; most importantly, The Research Division provides the scientific, fishery and

[7] Fletcher, W.J. & Santoro, K. (2011) State of the Fisheries and Aquatic Resources Report 2010/11. Department of Fisheries, Western Australia http://www.fish.wa.gov.au/docs/sof/index.php?0706

resource assessment advice that assists with the management decision-making processes of the Department. The annual State of the Fisheries and Aquatic Resources Report includes the updated risk levels and community values and outcomes for each of the bioregional level ecological assets and individual fisheries.

The information generated by the Research Division contained within the State of the Fisheries and Aquatic Resources report underpins six of the Department's eight Key Performance Indicators (KPIs) that are presented in the Annual Report to Parliament[8]. These KPIs, which are subject to an annual audit by the Office of the Auditor General, describe the extent to which the Department is delivering on the community's objectives outlined in the *Fisheries Resources Management Act* (FRMA).

To achieve these outputs the major activities undertaken by the Division are:

- Generation, collation or review of directly relevant and management-critical scientific knowledge for use in the sustainable management of the State's wild fish stocks and their associated commercial and recreational fisheries and non-extractive uses.
- Maintenance of long-term monitoring programs and databases to enable the scientific assessment of fish stocks and their associated ecosystems.
- Development of new assessment and governance techniques to assist in aquatic management within an integrated, ecosystem based framework.
- Generating an understanding of the Biosecurity and Biodiversity threats specifically associated with port activities, aquaculture activities and the marine and freshwater environments in general.
- Investigation of the effects of fishing on stocks, habitats, by-catch species, protected species plus the ecosystem in general.
- Adding basic knowledge to the understanding of aquatic resources and their associated environment.
- Undertaking research and development activities to assist with the expansion of the State's aquaculture industry.

Prioritisation of Science Activities

The first step in the annual budget planning cycle and other prioritisation processes undertaken by the Department of Fisheries WA is a review of the ecological risks and community value scores for each ecological asset. Changes in these values affect the priority scores which can result in a shift in the level of resources directed to individual assets and regions. Determining the priorities for research, monitoring and assessment projects are therefore based on a combination of the risk to individual fish stocks (e.g. rock lobster, prawns), the importance of the stock for economic (GVP) or social amenity purposes

[8] DoF (2011) Annual Report to Parliament. Department of Fisheries, Western Australia. http://www.fish.wa.gov.au/docs/ar/index.php

(e.g. recreational fishing) and the relative level of information that is needed for the management system to operate effectively (e.g. real time management of prawn fisheries requires a high level of input).

Through the regional, Ecosystem Based Fisheries Management (EBFM) initiative, the risk for each asset and species/suite is now assessed at the bioregional level. The ecological resources/assets in each Bioregion include the ecosystems and their constituent habitats, captured species and protected species. The potential complexity of EBFM is dealt with by using a step-wise, risk-based approach to integrate the individual issues identified and information gathered into a form that can be used by the Department. Similarly, the levels of knowledge needed for each of the issues only need to be appropriate to the risk and the level of precaution adopted by the management arrangements that are in place.

The completion of the State of the Fisheries and Aquatic Resources Report year by the Research Division is the main mechanism whereby emerging risks and issues are identified for fish stocks, ecosystem assets and each fishery "on behalf" of the whole agency (see more details below). These results are also communicated to Government and the broader community through the KPIs in the Department's Annual report (Figure 3). The identified risks and priorities are also entered into the Risk Register with the resultant Departmental priorities finalised through discussions with industry.

This results in an approved set of activities for the Research Division which are listed in the RMAD[9] plan (see more details below) that will be undertaken to generate specific or regular management advice to assist achieving priority Departmental objectives.

[9] DoF 2012 Research, Monitoring, Assessment and Development Plan 2011-2012. Fisheries Occasional Publication No 106, Department of Fisheries, Western Australia http://www.fish.wa.gov.au/docs/op/op106/index.php?0706

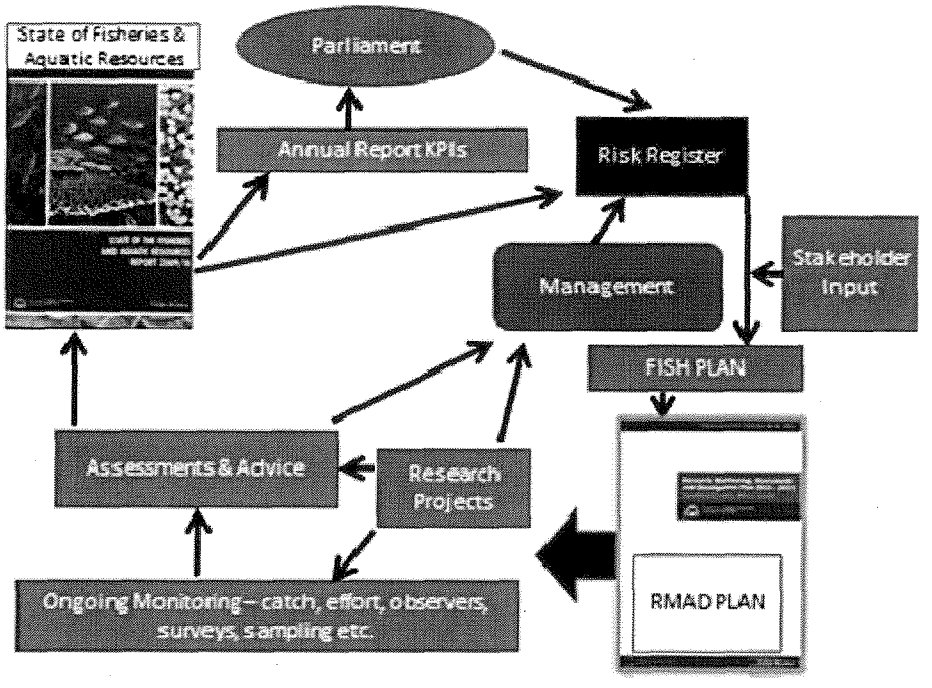

Figure 3 An outline of the planning cycle used for determining research, monitoring and assessment activities

One area where this risk based process was successful in finding a mismatch between the priority scores and the level of Departmental activity that was underway at the time was for introduced pests and diseases generated from the vastly increased level of shipping traffic in WA ports. This scored a medium to high priority but there were originally few resources assigned to this issue. Having been identified, this situation has now been addressed through reprioritisations of existing resources and from successful submissions to the WA government to cover this expanding risk area.

Another area where this process has led to additional activities are the longer term risks associated with potential shifts in species distributions that may arise from climate change and oceanic circulation patterns. There are now a number of strategic initiatives to identify the potential for our major fisheries to be affected by such changes.

Research Monitoring Assessment and Development Plan (RMAD)

The Department generates an Annual Plan that specifically outlines the RMAD activities that are underway, currently planned within the next five years or have already been identified which will directly contribute to the effective management of the aquatic resources of Western Australia. Consequently, this not only documents the research, monitoring and assessment activities being done directly by the Department, but covers any relevant activities being done by other agencies that have been identified as being directly relevant to a particular fishery/sector/asset or issue. Given the dynamic nature of aquatic resource management, this plan is updated on an annual basis based on current priorities and risks. This plan is a companion to the most recent State of the Fisheries and Aquatic Resources report where comprehensive analyses of the current status of each of WA's fisheries and other aquatic resources (assets) are described (see below).

The focus for the monitoring, assessment or research activities currently being undertaken within each of the sectors documented in this plan have been the result of deliberations and discussions by internal Departmental committees and, for some sectors, with direct input from relevant industry/sector bodies. Thus, where specific industry/advisory group research plans exist, this document will have utilised this information.

Given the diverse levels of risk and differing relative community values associated with each of the various assets and sectors covered by the Department, there are large differences in the level of research, monitoring and assessment activities planned among the different fisheries and ecosystems. These differences also reflect differential levels of ongoing information required to enable each of the current management processes to operate effectively and generate acceptable, cost effective outcomes.

The plan provides the mechanism to identify and track any major gaps in knowledge, resources and expertise which assists capacity planning, future funding applications and planning in a broader context. Each of the reports identifies what needs to be done, but also summarises what has already been done. This should minimise the development of unnecessary research proposals for issues already adequately covered by previous research or for issues where no management risks have been identified. Consequently, the current risk levels for each of the bioregional resource assets relevant to each report are now listed and updated annually.

The introductory section of the plan also includes a report that outlines, from the Department's perspective, what new or additional research, assessment or monitoring initiatives will be needed for the management of Western Australia's aquatic resources in the coming few years. The introductory section also contains the consolidated list of projects and activities that have a material attribution to assisting manage the recreational sector. Finally, in recognition of the large number of collaborative projects that are underway, funded or proposed in WA, there is a list of the collaborative projects which will be used in management considerations. This includes all multi-agency projects for which the Department is principal investigator (PI), and those where the lead agency is not the Department but we are a collaborator.

State of the Fisheries and Aquatic Resources Report

Each year this report provides the public with an update on the status of all the fish and fisheries resources of Western Australia that are managed by the Department. The report outlines the current risk status for the ecological resources (assets) within each of WA's six Bioregions by taking a bioregional, Ecosystem-Based Fisheries Management (EBFM) approach. This world leading approach not only details all the fisheries and fishing-related activities within each of the Bioregions but includes analyses and reports on the activities and processes undertaken by the Department to manage the broader aquatic environment, such as habitats and ecosystems.

The State of the Fisheries and Aquatic Resources Report essentially summarises the outcomes of Departmental activities undertaken during 2010/11 and preceding years. It documents recent changes to management or policy settings, compliance and education operations, the assessment and monitoring of stock levels and ecosystem condition. This document should, therefore, provide a valuable reference point for the current status of

Western Australian aquatic resources including those of major importance to the commercial and recreational fishing sectors, the aquaculture industry, the tourism industry, and for those in the community interested in the overall health of the aquatic environment.

Western Australia is one of the first fisheries jurisdictions in the world to fully implement a comprehensive and practical EBFM framework. The move to adopt a holistic, regional approach to management planning and assessments is the logical extension from the 'Ecologically Sustainable Development (ESD) based' assessments that the Department has now completed for each of WA's major fisheries for the past decade. EBFM provides a more thorough basis for the overall management of aquatic resources because it explicitly considers all ecological resources and community values within a Bioregion to determine which may require direct management intervention. The use of the EBFM framework is also expected to help facilitate development of regional marine plans and coordination with other State and Commonwealth government agencies.

The structure of the report reflects that the adoption by the Department of Fisheries of an Ecosystem Based Fisheries Management (EBFM) framework as the basis for management of Western Australia's aquatic resources. Consequently, the format for this document is fully consistent with implementing a risk-based approach to resource management.

The introductory section for each Bioregion outlines each of the key ecological resources (assets) within the region and summarises their current overall (cumulative) risk status. The assets that are examined in each bioregion include each of the IMCRA2[10] meso-scale ecosystems plus the key habitats, captured species and protected species categories. There is also a section for the external drivers, such as climate change, coastal development and introduced pests/diseases, which may affect the Department's ability to effectively manage WA's aquatic resources.

For each Bioregion, the set of individual fishery reports are resource-based rather than activity (sector) based, with each report containing descriptions of all the commercial and recreational activities that are accessing a particular ecological resource (asset). Each of the different fisheries accessing the same category of ecological assets is now covered in a single report (e.g. West Coast Nearshore and Estuarine Finfish). This is consistent with taking a Bioregional approach to the management of ecological assets and ensures that the aggregate catch harvested from each stock is clear and shows how it is being shared among fishing sectors. In addition to the reports based on the harvested resources, the following ecological assets are also considered.

> Ecosystems: Within each Bioregion, one or more ecosystems, as defined by the IMCRA process, were identified with some of these further divided into estuarine and marine ecosystems where relevant.
>
> Habitats: The habitat assets in each Bioregion were divided into estuarine and marine categories and again where necessary the latter category was further divided into nearshore and offshore components.

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[10] Commonwealth of Australia (2006) A guide to the Integrated Marine and Coastal Regionalisation of Australia - version 4.0 June 2006 (IMCRA v4.0).
http://www.environment.gov.au/coasts/mbp/publications/imcra/pubs/imcra4.pdf

Captured Fish: The captured fish were subdivided into finfish, crustaceans and molluscs with each of these further divided into estuarine/embayments, nearshore, inshore and offshore demersal and pelagic (finfish only) suites (see also DoF, 2011[11]).

Protected Species: This category was subdivided into protected 'fish' (e.g. Great White Sharks) and protected 'non-fish' as defined in the FRMA (e.g. mammals).

Efficiency of Science Delivery and Cooperation with other Jurisdictions

To improve the effective utilisation of research expertise and enhance the outcomes generated for management and the community in general, many projects now involve more than one agency. The proportion of collaborative projects undertaken to meet Departmental objectives has increased dramatically in the last decade and especially through the formation and funding by the WA State Government of the WA Marine Science Institution (WAMSI)[12]. The Department is a supporter of collaborative projects where there are clear benefits either in terms of efficiency or where the scope and comprehensiveness of the problem requires a broader range of expertise.

The Department is currently involved in over 40 collaborative projects with other research groups and providers. This includes those agencies based in WA but also in other states and in some cases international researchers and agencies.

The efficient use of science capacity available in the State and regionally has recently been assisted through the development of the National Research, Development and Extension Framework[13] of which WA is part of both the northern and south western hubs. This framework includes participation by all fisheries jurisdictions in Australia along with the major providers of fisheries and aquaculture related science.

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[11] Department of Fisheries (2011) Resource Assessment Framework for Finfish Resources in Western Australia. Fisheries Occasional Publication. No. 85 24pp.

[12] Western Australian Marine Science Institution. http://www.wamsi.org.au/

[13] CoA (2010) Working Together: the National Fishing and Aquaculture RD&E Strategy 2010 http://www.frdc.com.au/research/national-framework

ATTACHMENT 1 Risk Assessment and Departmental Prioritisation Process

The risks associated with each individual ecological asset are examined separately using formal qualitative risk assessment (consequence x likelihood) or more-simple problem assessment processes, as detailed in Fletcher (2005[14], 2010[15]). This enables the analysis of risk (using a five year time horizon) for objectives related to species, habitat and community structure/ecosystem sustainability, plus social and economic outcomes to be completed.

The accepted international definition of risk is "the uncertainty associated with achieving objectives" (ISO, 2009)[16], therefore any uncertainties from a lack of specific data are explicitly incorporated into the assessment enabling the calculation of risk to be completed with whatever data are available. All risk scoring considers the level of current activities and management controls already in place or planned.

Within each Bioregion, the EBFM process identified hundreds of separate ecological assets, social, economic and governance issues and risks. This complexity has been addressed by first assessing each of the individual risks and then consolidating these into bioregional or category level risks. The Department's primary objective is to manage the sustainability of the community's ecological assets from which economic or social outcomes are generated. Therefore the various ecological, social and economic risks and values associated with each of these ecological assets are integrated using a multi-criteria analysis into approximately 80 Departmental-level priorities distributed across the six Bioregions.

CURRENT SET OF RISK LEVELS, LIKELIHOOD AND CONSEQUENCE LEVELS IN RISK REGISTER PLUS THE RANKINGS OF COMMUNITY VALUES

RISK LEVELS

Description	Risk Score (C x L)	Risk Level
Negligible	0 - 2	1
Low	2 - 6	2
Medium	6 - 10	3
High	11- 16	4
Severe	17 -25	5

[14] Fletcher W.J. (2010) Planning processes for the management of the tuna fisheries of the Western and Central Pacific Region using an Ecosystem Approach. *Forum Fisheries Agency*, Honiara. Facilitators version 6.1 January 2010, http://www.fisheries-esd.com/a/pdf/EAFM%20BASED%20GUIDE%20FOR%20TMP%20DEVELOPMENT%20v6%201.pdf

[15] Fletcher W.J. (2005) Application of Qualitative Risk Assessment Methodology to Prioritise Issues for Fisheries Management. *ICES Journal of Marine Research* 2005; 62:1576-1587

[16] AS/NZS ISO 31000 (2009) Risk management – Principles and guidelines. Sydney, Australia: Standards Australia.

Risk Outcomes

Risk Category/Level	Description	Likely Reporting Requirements	Likely Management Response
1 Negligible	Not an issue	Minimal	Nil
2 Low	Acceptable; no specific control measures needed	Justification required	None specific
3 Medium	Acceptable; with current risk control measures in place (no new management required)	Full performance report	Specific management and/or monitoring required
4 High	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
5 Severe	Unacceptable; major changes required to management in immediate future	Full performance report	Increases to management activities needed urgently

COMMUNITY VALUES

SCORE	GVP Commercial	Social Amenity Recreational etc..
0	No Commercial use	n/a
1	< $1 million	Minimal – there is no recreational fishing for the asset and no specific broader community interests.
2	$1 – 5 million	Some – the asset may be caught recreationally &/or there is some specific interest in the asset by the broader community.
3	$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	$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	> $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

RISK ASSESSMENT CATEGORIES AND LEVELS

LIKELIHOOD LEVELS

1. Never heard of but not impossible here. (<5% probability)
2. May occur here, but only in exceptional circumstances. (>5%)
3. Clear evidence to suggest this is possible in this situation. (>30%)
4. It is likely, but not certain, to occur here. (>50%)
5. It is almost certain to occur here (>90%)

CONSEQUENCE LEVELS

FISH STOCKS (target and non-target)

1. Measurable but minor levels of depletion to fish stocks.
2. Maximum acceptable level of depletion of stock.
3. Level of depletion unacceptable but still not affecting recruitment levels of stock
4. Level of depletion of fish stocks are already (or will definitely) affect future recruitment potential/levels of stock.
5. Permanent or widespread and long term depletion of key fish stocks, close to extinction levels.

HABITATS

1. Measurable impacts to habitats but still not considered to impact on habitat dynamics or system
2. Maximum acceptable level of impact to habitat with no long term impacts on region wide habitat dynamics
3. Above acceptable level of loss/impact with region wide dynamics or related systems may begin to be impacted
4. Level of habitat loss clearly generating region wide effects on dynamics and related systems
5. Total region wide loss of habitat and associated systems

ECOSYSTEMS

1. Measurable but minor change in the environment or ecosystem structure but no measurable change to function
2. Maximum acceptable level of change in the environment/ecosytem structure with no material change in function.
3. Ecosystem function altered to an unacceptable level with some function or major components now missing &/or new species are prevalent.
4. Long term, significant impact with an extreme change to both ecosystem structure and function. Different dynamics now occur with different species/groups now the major targets of capture or surveys.
5. Permanent or widespread long term damage to the environment. Total collapse or complete shift of ecosystem processes.

PROTECTED/THREATENED SPECIES

1. The level of capture is common but will not further impact on stock and well below that which will generate public concern
2. Level of capture is the maximum that will not impact on recovery or cause unacceptable public concern
3. Recovery may be being affected &/or some clear but short term public concern will be generated
4. Recovery of times are clearly being impacted &/or pubic concern is widespread (refer R&I)
5. Further declines in threatened stocks are occurring or major public concern is ongoing (refer R&I).

ECONOMIC (Commercial) IMPACT

1. A small measurable but temporary impact on economic sustainability of some fishers in relevant fisheries
2. A minor ongoing impact on economic sustainability of all/most fishers in relevant fisheries
3. Temporary significant impact on economic sustainability, or ongoing moderate impact on economic performance for industry
4. Long term major reductions in economic sustainability for relevant fisheries and their related industries
5. Permanent and widespread complete cessation of economic sustainability for the fisheries and their related industries

SOCIAL (recreational) IMPACT

1. Temporary and minor additional stakeholder restrictions or expectations (< 1 year)
2. Some minor ongoing restrictions or loss of expectations
3. Some important expectations suspended or severely restricted in the medium term (> 2 year)
4. Long term suspension or restriction of expectations in some key recreational activities
5. Permanent loss of all key expectations for recreational activities on this asset

PUBLIC REPUTATION AND IMAGE

1. Negligible negative impact and news profile.
2. Low negative impact, low news profile
3. Some public embarrassment, moderate impact & news profile, Minor Ministerial involvement.
4. High public embarrassment, high impact & news profile, Third Party actions, public and significant Ministerial involvement.
5. Extreme public embarrassment, very high multiple impacts, high widespread news profile. Third Party actions, public and prolonged Ministerial involvement, Government censure, Upper House enquiry.

SAFETY AND HEALTH (Staff)

1. First Aid Only
2. Some minor medical treatment required, eg visit to doctor's surgery. Less than a week off work.
3. Hospitalisation and/or intensive and extended treatment period required.
4. Serious or extensive injuries / disease. Hospitalisation and extended recuperation period > 1 month
5. Death or multiple severe permanent disability.

FINANCIAL LOSS (Department/Govt).

1. < $$20, 000
2. < $100,000
3. < $500,000
4. < $1 million
5. > $1 million

OPERATIONAL EFFECTIVENESS

1. Minor delay in achievement of a key deliverable.
2. Minor element of one key deliverable unable to be achieved on time.
3. Significant delay in achievement of key deliverable.
4. Non-achievement of more than one key deliverable or major delay to entire strategic directive.
5. Non-achievement of an entire strategic directive