

OVERVIEW FROM THE DIRECTOR

GENERAL

The *Status Reports of the Fisheries and Aquatic Resources of Western Australia (SRFAR)* provide the public with an annual update on the state of the fish stocks and other aquatic resources of Western Australia (WA) managed by the Department of Fisheries (Department). These reports outline the most recent assessments of the cumulative risk status for each of the aquatic resources (assets) within WA's six Bioregions using an Ecosystem Based Fisheries Management (EBFM) approach. This world leading approach details all the fisheries and fishing-related activities within each of the Bioregions which now includes analyses and reports on the activities and processes undertaken by the Department to manage the broader aquatic environment, such as habitats, ecosystems and aquatic pests.

The *SRFAR* summarises the Departmental activities undertaken during 2012/13 and the outcomes generated by the preceding years. It documents recent changes to management or policy settings, compliance and education operations along with the assessments generated from the ongoing monitoring of stock levels and ecosystem condition. This document provides a comprehensive reference for the current status of all 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 only fisheries jurisdictions in the world to fully implement a comprehensive and practical EBFM framework. EBFM provides a thorough, risk based framework for the overall management of aquatic resources because it explicitly considers all ecological resources and community values within a Bioregion to determine which of these require direct management intervention. A key finding from this annual report is that the risks to most aquatic ecological resources in WA are currently at acceptable levels.

Given the comprehensive systems of management that are in place, fishing in WA does not present an unacceptable risk to the marine, estuarine and freshwater ecosystems underpinning them. The fishing methods that may affect the habitat (e.g. trawling) are highly regulated with over 90% of WA coastline unaffected from these types of activities. The overwhelming majority of Western Australian fisheries have also been assessed as posing only negligible or minor risks to bycatch species, protected species, habitats or the broader ecosystem. The small number of fisheries which have generated risks to these non- 'capture species', which therefore require direct management, continue to meet their annual performance targets or have targeted research programs to reduce their interactions. The only ecosystems and component species in WA that are considered to be at unacceptable levels continue to be the estuarine and river systems of the south west region. These risks are not the result of fishing related activities.

The report also documents that the vast majority of stocks that support Western Australia's significant fisheries continue to be in a healthy condition. Approximately 97% of

commercial fisheries are now targeting stocks where no additional management is required to either maintain or achieve an acceptable breeding stock level. A detailed investigation of Australian herring off the South Coast and West Coast Bioregions found that this stock has been declining over the past decade due to lower recruitment levels associated with increased water temperatures experienced over this period. To rebuild the stock, additional management actions will be developed over the coming year. A further three fisheries in the Gascoyne and northern part of the West Coast Bioregion (Shark Bay Scallops, Shark Bay Crabs and Abrolhos Island Scallops) were also assessed as having inadequate breeding stocks but this was generated solely from the negative impacts of the marine heatwave event that affected this entire region in 2011. These fisheries were all closed for the past season to protect residual stocks.

A summary of these status reports is included in the Department's *Annual Report* to Parliament, which includes the Department's non-financial (fishery) performance indicators. The *Annual Report* is available through the Department's website (www.fish.wa.gov.au).

The comprehensive set of information used to generate the bioregional and resource level status reports presented in this document has provided the Department with the basis to adopt a world leading methodology to implement the Government's third party certification initiative. All commercial fisheries in WA are now scheduled to undergo pre-assessment for the Marine Stewardship Council (MSC) certification system using a bioregional approach. The Gascoyne was the first bioregion to have an integrated set of reports compiled that covered the information relevant for all commercial fisheries in the Bioregion to enable their assessment against the three MSC principles (target species, ecosystem and governance). The set of reports for the Gascoyne have been submitted for assessment to an internationally accredited certifying body. A similar process will be undertaken for each of the three remaining marine bioregions in WA. Recommendations from these third party assessments will be incorporated within the management settings, monitoring programs and reporting systems over coming years.

I would like to take this opportunity to express my appreciation to all Departmental staff who contributed to this important, annual performance review of WA's aquatic resources. In addition, many commercial and recreational fishers, science collaborators and other stakeholders throughout the State are to be commended for their positive support for the Department's monitoring and research programs and management initiatives, without which such a high level of sustainability would not be achieved.



Stuart Smith
Director General

October 2013

EDITOR'S INTRODUCTION

The *Status Reports of the Fisheries and Aquatic Resources of Western Australia 2012/13* uses the Ecosystem Based Fisheries Management (EBFM) framework which is now the basis for management of Western Australia's aquatic resources (Fletcher, *et al.*, 2010, 2012¹). The format for this document is therefore consistent with the Department's full implementation of a risk-based approach to resource management (Fletcher 2012²). How this document fits within this process is outlined in Editor's Figure 1.

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 IMCRA³ 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. Given the increased activities and documentation within these categories that is occurring as part of the MSC initiative, these sections will all be updated progressively over the coming years with the Gascoyne Coast being the first bioregion to adopt the new standard.

Within each Bioregion the set of individual fishery reports are generally resource-based rather than activity (sector) based. 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) with each report containing descriptions of all the commercial and recreational activities. Taking this Bioregional approach to the management of ecological assets ensures that the aggregate catch harvested from each stock is identified to enable their cumulative effect to be assessed. This approach is consistent with the Department's IFM initiative and the proposed new Act. The structure of the reports should enable readers to more easily assess the interrelationships between fisheries and how the catch is shared among sectors.

1 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

Fletcher, W.J., Gaughan, D.J., Shaw, J. and Metcalf, S.J. (2012) *Ecosystem Based Fisheries Management: Case Study Report West Coast Bioregion*. Fisheries Research Report No. 212, Department of Fisheries, Western Australia 104p.

2 Fletcher, W.J., (2012) 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 Part 2. Fisheries Research Report No 235 Department of Fisheries, Western Australia.

3 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>

The long-standing involvement by our commercial, recreational and aquaculture stakeholders in specific research projects and monitoring programs is recognised. This includes the provision of logbook data, voluntary participation in recreational fishing surveys, biological samples, access to vessels and information which are essential to the generation of many of the status reports presented in this document. The input from other science groups from WA, other parts of Australia and internationally is also acknowledged. There has been an increasing trend over the past decade for collaborative research projects to be undertaken to assist in the development of new monitoring and assessment techniques or to help further our understanding of issues that affect management.

While the *Status Reports of the Fisheries and Aquatic Resources of Western Australia 2012/13* provides the general public, interested fishers and other stakeholders with a ready reference source, it also meets the reporting requirements of the Department, including the need to annually report on the 'state of fisheries managed under' the FRMA⁴ to the Western Australian Parliament and to the Commonwealth Government, on the performance of fisheries that are relevant under their EPBC Act. In addition, with the government initiative to have all WA commercial fisheries undergo per-assessment for Marine Stewardship Council (MSC) certification this has resulted in some slight changes in the terminology that may be used within some sections of these reports in order to match that used in the MSC assessment criteria.

The report is directly accessible on the Department's website (www.fish.wa.gov.au/docs/sof), where users are encouraged to download relevant sections for personal use. If quoting from the document, please give appropriate acknowledgment using the citation provided at the front of the report.

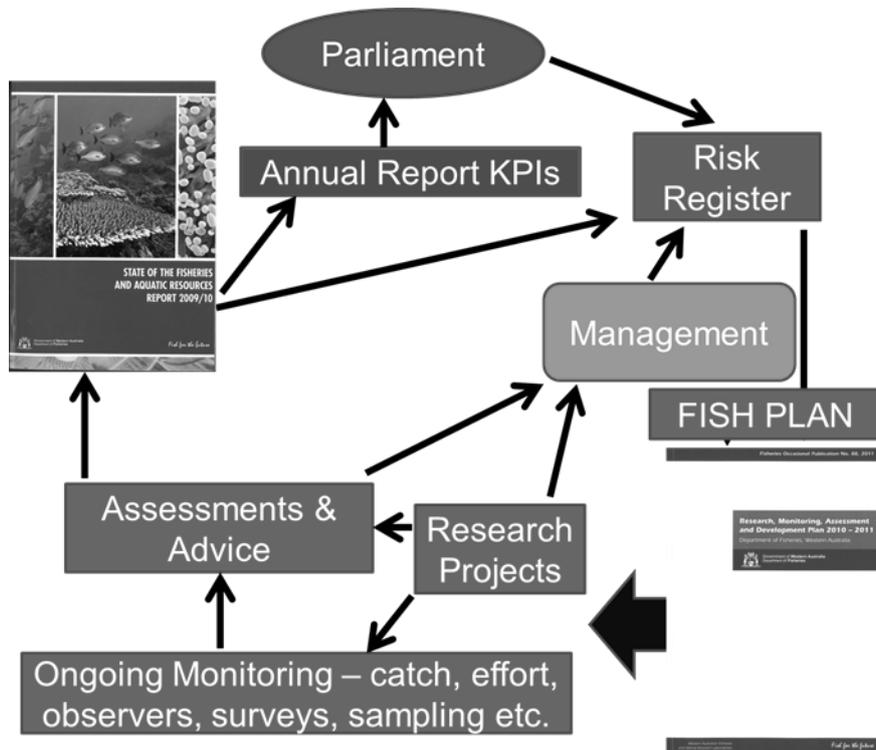
Finally, I would like to thank all of my Departmental colleagues across all Divisions who have assisted in the production of this volume and its many status reports. Thanks are once again due to Ms Karen Santoro who has managed both the coordination and publication processes to enable the production of this important report.



Dr Rick Fletcher
Executive Director Research

October 2013.

4 Section 263 of the FRMA.



EDITOR'S FIGURE 1

An outline showing how the SRFAR fits within the risk based annual planning cycle now used for determining Departmental priorities and activities.

HOW TO USE THIS VOLUME

To obtain full benefit from the information provided in this edition of the *Status Reports of Fisheries and Aquatic Resources of Western Australia*, readers need to understand various terms and headings used in the text and summarised in the fishery status overview table (which also appeared in the Department of Fisheries *Annual Report 2012/13* to Parliament) and especially those associated with the ecological resource level reports.

The terms and headings are a combination of the reporting structures first outlined in the national Ecologically Sustainable Development (ESD) reporting structure (Fletcher *et al.* 2002)¹, plus the more recent Ecosystem Based Fisheries Management (EBFM) framework (Fletcher *et al.* 2010, 2012)² and Resource Assessment Framework (DoF, 2011)³. As part of implementing the Marine Stewardship Council (MSC) initiative and the development of the pre-assessment material on each of the fisheries within each of the four marine bioregions, in some cases the terminology that is used in reports has been updated to be consistent with the MSC criteria. In addition to the explanations provided below, acronyms are expanded at their first occurrence in a section of the text and are also listed in a glossary at the end of the volume.

Bioregions

As noted above, with the adoption of the EBFM approach, readers need to note the fully bioregional structure of this report. A 'Bioregion' refers to a region defined by common oceanographic characteristics in its marine environment or by climate/rainfall characteristics in its inland river systems.

The marine bioregional boundaries used here are broadly consistent with "A *guide to The Integrated Marine and*

Coastal Regionalisation of Australia" - version 4.0 June 2006 (IMCRA v4.0)⁴ except for the inclusion of the Gascoyne Coast as a separate Bioregion, reflecting its nature as the transition zone between tropical and temperate waters.

The precise boundaries of the Bioregions reflect functional geographic separations and data recording systems. Each individual Bioregion has been provided with a general introduction outlining the main features of its aquatic environment, plus the major commercial and recreational fisheries and aquaculture industries that operate in the area. It now also has a section that outlines the current risk status of each of the high level, ecological resources/assets located within each Bioregion (see below).

Assessment of Regional Level Ecological Resources (Assets) in each Bioregion

Consistent with the adoption of the EBFM framework for each bioregion we have identified the high level set of ecological resources/assets that are to be managed under the FRMA (see Introduction Figure 1). 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 management. Implementing EBFM does not, therefore, automatically generate the need to collect more ecological, social or economic data or require the development of complex 'ecosystem' models, it only requires the consideration of each of these elements to determine which (if any) required direct management to achieve acceptable performance. Full details of how the EBFM process is undertaken are presented in Fletcher *et al.* (2012)⁵ with a summary description outlined below.

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 (Introduction Figure 2).

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.

1 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.

2 Fletcher, W.J., Shaw, J., Metcalf, S.J. & 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

Fletcher, W.J., Gaughan, D.J., Metcalfe, S.J., Shaw, J. 2012. Using a regional level, risk-based framework to cost effectively implement Ecosystem Based Fisheries Management (EBFM). In: Kruse, G.H., Browman, H.I., Cochrane, K.L., Evans, D., Jamieson, G.S., Livingston, P.A., Woodby, D., Zhang, C.I. (eds) *Global Progress on Ecosystem-Based Fisheries Management*. pp. 129-146. Alaska Sea Grant College Program. doi: 10.4027/gpebfm.2012.07

³ Department of Fisheries (2011) Resource Assessment Framework for Finfish Resources in Western Australia. Fisheries Occasional Publication. No. 85 24p.

⁴<http://www.environment.gov.au/coasts/mbp/publications/imcra/pubs/imcra4.pdf>

5 Fletcher, W.J., (2012) 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 Part 2. Fisheries Research Report No 235 Department of Fisheries, Western Australia.

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).

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

Risk Assessment Status

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)¹ and Fletcher *et al.* (2011)². This enables the analysis of risk (using a five year time horizon) for objectives related to captured species, habitat and community structure/ecosystem sustainability, plus social and economic outcomes to be completed in a practical and consistent manner (Introduction Table 1).

The accepted international definition of risk is “*the uncertainty associated with achieving objectives*” (ISO, 2009)³, 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 both current level of activities and management controls already in place or planned.

Risk Category	Description
Negligible	Not an issue
Low	Acceptable; no specific control measures needed
Moderate	Acceptable; with current risk control measures in place (no new management required)
High	Not desirable; continue strong management actions OR new and/or further risk control measures to be introduced in near future
Significant	Unacceptable; major changes required to management in immediate future

1 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

2 Fletcher, W.J., Shaw, J., Gaughan, D.J. and Metcalf, S.J. (2011). Ecosystem Based Fisheries Management case study report – West Coast Bioregion. Fisheries Research Report No. 225. Department of Fisheries, Western Australia. 116 pp.

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

Within each Bioregion, the EBFM process initially identified hundreds of separate ecological assets, social, economic and governance issues and risks (Fletcher *et al.* (2011)). 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.

Recreational Fishing Estimates

To cost effectively monitor recreational fisheries in WA the Department of Fisheries has developed an integrated system of survey methods to provide a robust approach for obtaining annual estimates of recreational catch by boat-based fishers at both the state-wide and bioregional levels. These surveys utilise the Recreational Fishing from Boat Licence (RFBL) as the basis for sampling. They not only provide estimates of catch and effort but provide the information for the validation of these estimates by enabling comparisons across the various methods.

The integrated survey includes three complementary components: (i) off-site phone surveys encompassing an initial Screening Survey, a 12-month Phone-Diary Survey, followed by post-enumeration surveys; (ii) on-site boat-ramp surveys (including a state-wide Biological Survey and a Perth metropolitan Validation Survey); and (iii) a remote Camera Survey. This first survey was undertaken for the 12-month period from 1 March 2011 to 29 February 2012.

Estimates of recreational catch and effort at state-wide and bioregional levels from the surveys have been presented in Ryan *et al.* (2013)⁴, and provide data for the catch and effort by the recreational sector throughout this report. These estimates will be examined against previous recreational surveys, whilst noting differences in survey methodology, to determine if there have been any material changes in recreational catch levels. This approach will particularly focus on the indicator species used to monitor the status of each of the bioregional level suites.

The state-wide survey of boat-based recreational fishing will be repeated every second year and the next series of surveys are currently underway with a census period from 1 May 2013 to 30 April 2014.

Harvey Strategy

A Harvest Strategy Policy is under development. A harvest strategy articulates all performance levels and the management actions designed to achieve the agreed objectives. These objectives articulate what is to be achieved, and why, both for the resource and the relevant fisheries.

4 Ryan, K.L., Wise, B.S., Hall, N.G., Pollock, K.H., Sulin, E.H. and Gaughan, D.J. (2013). An integrated system to survey boat-based recreational fishing in Western Australia 2011/12. Fisheries Research Report No. 249, Department of Fisheries, Western Australia. 162 pp.

Breeding Stock Status

The assessments of breeding stock for captured species are undertaken using a number of techniques (see below) to determine if the stock is considered to be at an adequate level or not. The stock status levels are defined as:

Adequate: reflects levels and structure of parental biomass for a stock where annual variability in recruitment of new individuals (recruits) to the stock is considered to be mostly a function of environmental effects or recruit survival, not the level of the egg production.

Recovering: reflects situations where the egg production has previously been depleted to unacceptable levels by fishing or some other event (e.g. pilchard herpes virus in the 1990s) but is now considered to be recovering at an acceptable rate due to the implementation of effective management actions and/or natural processes.

Inadequate: reflects situations where excessive fishing pressure (catch) or some external event (e.g. the marine heat wave that affected the Gascoyne region in 2011) has caused parental biomass to fall to levels where the egg production are depleted to levels that may affect recruitment (often called recruitment overfished if caused by fishing) and revised management of the stock is not currently in place to generate an acceptable rate of recovery.

Retained Species (Stock Assessment Methods)

A stock assessment is the collection and analysis of fisheries data needed to underpin the harvest strategy and determine stock status and fishery performance.

In only some cases is the egg production by the breeding stock directly measured. In most cases a variety of indirect measures are used. Each of the status reports clearly identifies what type of stock assessment method(s) have been used to determine the status of stocks. The specific methods used for monitoring and assessment vary among stocks and indicator species. The choice of methods is affected by many factors including the level of ecological risk, the biology and the population dynamics of the relevant species; the type, size and value of the fishery exploiting the species; data availability and historical level of monitoring and the level of precaution in management settings. The methods therefore vary from the relatively simple analysis of catch levels and catch rates, through to more sophisticated analyses that involve sampling of the catch (fishing mortality), direct surveys up to highly complex and expensive age structured simulation models.

The range of methods have been categorised into five broad levels and these are often used together with a 'weight of evidence' approach:

Level 1	Catch data only
Level 2	Level 1 plus fishery-dependent effort
Level 3	Levels 1 and/or 2 plus fishery-dependent biological sampling of landed catch (e.g. average size; fishing mortality, etc. estimated from representative samples)

Level 4 Levels 1, 2 or 3 plus either fishery-independent surveys of relative abundance, exploitation rate, recruitment; or standardised fishery-dependent relative abundance data.

Level 5 Levels 1 to 3 and/or 4 integrated within a simulation, stock assessment model.

Multi species assessments: For each marine bioregion, all species of finfish and invertebrate are now allocated to one of five 'suites' estuarine, nearshore, inshore demersal, offshore demersal or pelagic (DoF, 2011¹). For each of these suites one or more 'indicator species' (which in general includes the most popular and/or vulnerable species in the suite) have been selected to reflect the status of the entire suite. If one or more indicator species is considered to be at risk, the entire suite is considered to be at risk and additional management actions are indicated.

Non-retained species

This refers to any species caught during a fishing operation which are not the target of, or retained by, the fishing operation, and can include both potential impact on unwanted 'bycatch' species and any interaction with 'protected' species. In each case, an explanation is provided of the situation and the level of risk to the stock from fishing operations. This section does not include release of target species for reasons such as under size, over bag limits etc. these issues are already covered in the assessments of retained species.

Ecosystem effects

This refers to the indirect impacts generated by removing fish from the ecosystem, and direct physical interactions of fishing gear with the sea floor. Each fishery is considered in terms of its potential/relative effects on the food chain and the habitat, and an outline of the assessment of current ecological risk ('negligible', 'low', 'medium,' 'high' or 'significant') is provided. More details on the information used within these risk assessments will generally be available in the EBFM reports for each bioregion (e.g. Fletcher *et al* 2011²).

Economic Effects

As part of the EBFM framework we have categorised the different levels of Gross Value of Product (GVP) for commercial fisheries into six levels. This provides a mechanism for reporting on all fisheries including those where the small number of operators would not allow specific values to be provided. It also covers situations where the calculation method for GVP are currently under review and specific values may not be appropriate

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

2 Fletcher. W.J., Shaw, J., Gaughan, D.J. Metcalf, S.J. (2011). Ecosystem based fisheries management case study report West Coast Bioregion. Fisheries Research Report 225, Department of Fisheries, Western Australia. 116 pp.

Level 0	nil
Level 1	< \$1 million
Level 2	\$1 – 5 million
Level 3	\$5 -10 million
Level 4	\$10 - 20 million
Level 5	> \$20 million

Target catch (or effort) range (Current fishing level)

A target catch or effort range has been determined for each of the major commercial fisheries. This indicator provides an assessment of the success of the Department's management plans and regulatory activities in keeping fish catches at appropriate levels (including those in a recovery phase). This identifies if the stock is being subjected to overfishing or not.

The catch or effort for each major fishery is assessed annually and if the catch or effort remains inside the acceptable range it is defined as having acceptable performance. Where the annual catch or effort for a fishery falls outside of this range and the rise or fall cannot be adequately explained (e.g. environmentally-induced fluctuations in recruitment levels – like prawns, or low market prices reduce desired catch levels – e.g. pearl oysters), a management review or additional research to assess the underlying cause is generally required.

Target catch range: the expected range in annual catch levels, taking into account natural variations in recruitment to the fished stock, which can be expected under a fishing-effort-based management plan.

For most of the fisheries in WA, the management plan seeks to directly control the amount of fishing effort applied to stocks, with the level of catch taken providing an indication of the effectiveness of the plan. Where the plan is operating effectively, the catch by the fishery should fall within a projected range. The extent of this range reflects the degree to which normal environmental variations affect the recruitment of juveniles to the stock which cannot be 'controlled' by the management plan.

Target effort range: the expected range in annual fishing effort, assuming natural variability in stock abundance, required to achieve a total allowable catch under a catch quota management plan.

For quota-managed fisheries, the measure of success for the management arrangements is firstly that the majority of the Total Allowable Catch (TAC) is achieved, but additionally, that it has been possible to take this catch using an acceptable amount of fishing effort. If an unusually large expenditure of effort is needed to take the TAC, or the industry fails to achieve the TAC by a significant margin, this may indicate that the abundance of the stock is significantly lower than

anticipated. For these reasons, an appropriate range of fishing effort to take the TAC has also been incorporated for assessing the performance of quota-managed fisheries.

External factors

This refers to known factors outside of the direct control of the fishery legislation which impact on fish stocks or fishing. An understanding of these factors, which are typically environmental (cyclones, ocean currents) but might also include, for example, market factors or coastal development, is necessary to interpret changes in catch and/or effort and therefore fully assess the performance of the fishery.

Season reported

Readers should also be aware that the individual fishery and aquaculture production figures relate to the latest full year or season for which data are available, noting the inevitable time-lags involved between collection and analysis.

Therefore, the statistics in this volume refer either to the financial year 2011/12 or the calendar year 2012, whichever is more appropriate. This includes estimates of the value of the fishery which may vary from published estimates of GVP due to differences between financial year and entitlement year for a fishery, estimated value of secondary by products for individual sectors, and estimating the total value of several fisheries operating on a single resource.

Similarly, the statistics on compliance and educational activities are also for 2011/12, following the analysis of data submitted by Fisheries and Marine Officers.

In contrast, the sections on departmental activities in the areas of fishery management, new compliance activities and research summaries are for the current year, and may include information up to June 2013.

Performance measures

Many of the State's significant fisheries have now undergone assessment and achieved environmental certification under the Commonwealth Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

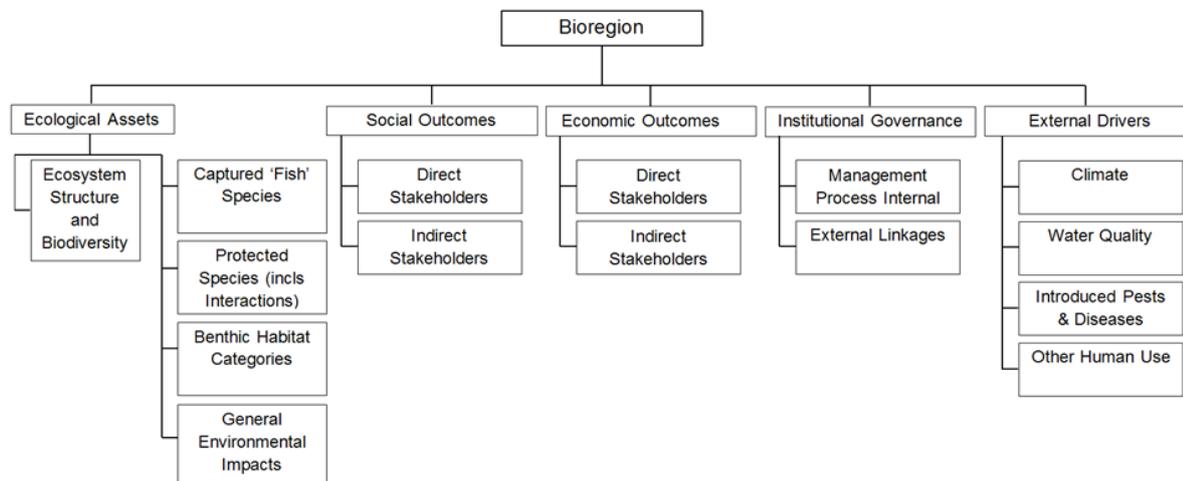
Consequently, the *State of Fisheries and Aquatic Resources Report* also reports on the ecological performance of the relevant fisheries against the specific performance measures used or developed during the EPBC Act assessment process. These may vary among future editions as EPBC conditions change and individual fisheries determine the need and value of maintaining and resourcing such accreditation.

Within the individual fishery status reports, each of these performance measures is shown in a highlighted box to assist the reader. The results are also summarised in Appendix 4.

INTRODUCTION TABLE 1

Risk Categories, descriptions and likely management responses (modified from Fletcher 2005, Fletcher *et al.* 2011¹).

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

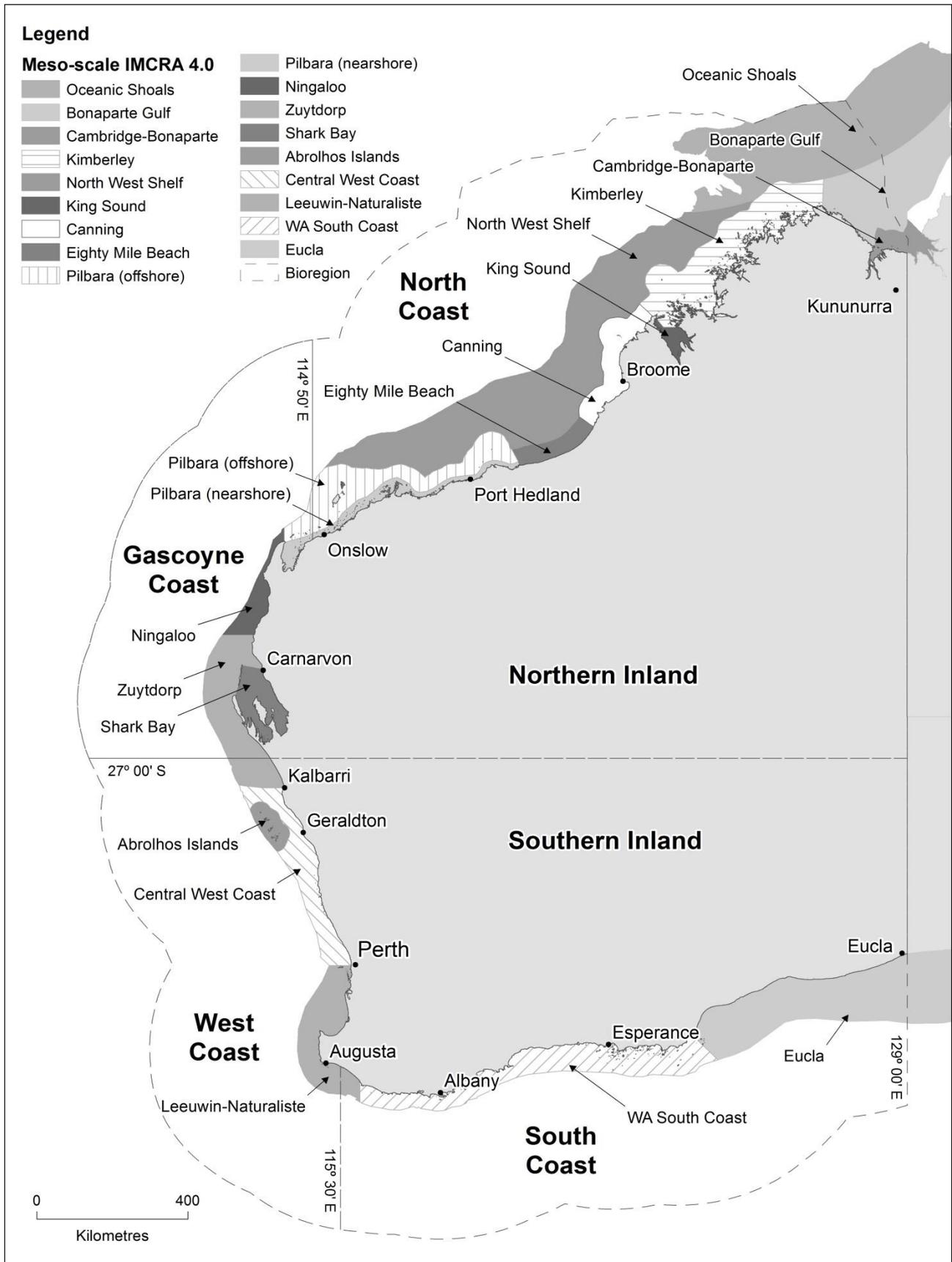


INTRODUCTION FIGURE 1

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.

1 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

Fletcher, W.J., Shaw, J., Gaughan, D.J. and Metcalf, S.J. (2011). Ecosystem Based Fisheries Management case study report – West Coast Bioregion. Fisheries Research Report No. 225. Department of Fisheries, Western Australia. 116 pp.



INTRODUCTION FIGURE 2

Map of Western Australia showing the general boundaries of the Bioregions referred to throughout this document and the meso-scale ecosystems based on IMCRA 4.0 boundaries¹.

¹ <http://www.environment.gov.au/coasts/mbp/publications/imcra/pubs/imcra4.pdf>

OVERVIEW OF THE STATUS OF KEY ECOLOGICAL RESOURCES (ASSETS)

ECOSYSTEM STRUCTURE AND BIODIVERSITY

Fisheries and Stocks

Annual stock assessments, including analyses of trends in catch and fishing activity, are used each year to determine the status of each of the State's most significant fisheries and are presented in detail in the rest of this document. This section provides an overview of the outcomes of the Department's management systems by collectively examining the status of all the commercial fisheries and commercially harvested fish stocks in WA. The material presented in this section is based on the analyses and text presented in the Key Performance Indicators section of the Department of Fisheries Annual Report to the Parliament 2012/13.

The proportion of fish stocks identified as being at risk or vulnerable through exploitation

To measure the performance of management, the proportion of fisheries for which the breeding stocks of each of their major target or indicator species are being maintained at acceptable levels (or they are now recovering from a depleted state at an appropriate rate following management intervention), is measured annually.

For the 38 fisheries reviewed, the 'Stock Status and Catch Ranges for Major Commercial Fisheries' in the Outcomes section of the Annual Report records that breeding stock assessments are available for the major species taken in 36 (95%) of these fisheries. For the other two fisheries, insufficient data were available on the target species to make a critical assessment. In situations where unmonitored stocks are assessed as having the potential to become overfished, they are given priority for new research and/or management.

Within the group of 36 assessed fisheries, 29 involve stocks that were considered to have adequate breeding stock levels and a further three (West Coast Demersal Scalefish Fishery, the Southern and Northern Shark Fisheries) to have breeding stocks considered to be recovering at acceptable rates (89 per cent of fisheries). All of these recovering fisheries target relatively long lived species so their recovery is expected to take a number of years to complete. The management generated reductions in catch levels for all sectors of the West Coast Demersal Scalefish Fishery have now been in place for a number of years and the detailed reassessment completed in 2012/13 determined that these actions appear to be successful in initiating a recovery for this suite of species. For the Southern Shark Fishery the most recent assessments also showed continued recovery of dusky and whiskery sharks. The Northern Shark Fishery continues not to operate, therefore there has been no catch of sandbar sharks by this fishery for the past four years

Of the remaining fisheries, only the Australian Herring Fishery has been assessed as having stock levels that are not

considered adequate to ensure catches could be sustained at desirable levels given effort levels and normal environmental conditions. A detailed investigation of Australian herring off the South Coast and West Coast Bioregion found that this stock has been declining over the past decade due to lower recruitment levels associated with increased water temperatures experienced over this period. A further three fisheries were also assessed as having inadequate breeding stocks solely resulting from the negative impacts of environmental perturbations, not fishing. The increased mortality of adults and extremely poor recruitment levels observed for Shark Bay crabs, Shark Bay scallops and scallops in the Abrolhos Island region was initiated by the marine heat wave event which began in 2011. Consequently, these fisheries were all closed for the past season to protect residual stocks. Therefore, while a total of 11 per cent of fisheries have stock levels that are not considered adequate, only one fishery (or 3% of those assessed) is considered inadequate as a result of exploitation (Overview Figure 1).

The proportion of commercial fisheries where acceptable catches (or effort levels) are achieved

A target catch or effort range has been determined for each of the major commercial fisheries (see Overview Table 1) by the Department's Research Division. This indicator provides an assessment of the success of the Department's management plans and regulatory activities in keeping fish catches at appropriate levels (including those in a recovery phase). The Department's 2012/13 Budget Papers state that the target is eighty eight percent (88%).

For most of the fisheries in WA, each management plan seeks to directly control the amount of fishing effort applied to stocks, with the level of catch taken providing an indication of the effectiveness of the plan. Where the plan is operating effectively, the catch by the fishery should fall within a projected range. The extent of this range reflects the degree to which normal environmental variations affect the recruitment of juveniles to the stock which cannot be 'controlled' by the management plan. Additional considerations include market conditions, fleet rationalisation or other factors that may result in ongoing changes to the amount of effort expended in a fishery which will in turn influence the appropriateness of acceptable catch ranges for certain fisheries.

For quota-managed fisheries, the measure of success for the management arrangements is firstly that the majority of the Total Allowable Catch (TAC) is achieved, but additionally, that it has been possible to take this catch using an acceptable amount of fishing effort. If an unusually large expenditure of effort is needed to take the TAC, or the industry fails to achieve the TAC by a significant margin, this may indicate that the abundance of the stock is significantly lower than anticipated. For these reasons, an appropriate range of fishing effort to take the TAC has also been incorporated for assessing the performance of quota-managed fisheries (see

Overview Table 1).

The Major Commercial Fisheries which have target catch or effort ranges account for most of the commercial value of WA's landed catch. Comparisons between the actual catches (or effort) with the target ranges have been undertaken for 29 of the 38 fisheries referred to in 'Stock Status and Catch Ranges for Major Commercial Fisheries' section, three less than the number used last year. The increase in the number of fisheries not assessed was generated by a combination of environmentally induced stock issues in some regions (see above) and poor economic conditions for some fisheries which meant a number of fisheries were either closed or did not have material levels of catches during this reporting period. Three fisheries (Shark bay crabs, Shark Bay scallops, Abrolhos Islands and mid-west trawl) which were affected by unusual environmental conditions that impacted their recruitment to the extent that the fisheries were set to zero (0) catches. The setting of zero catches in these fisheries highlights the significant management interventions of the Department to reduce further impacting of the stocks by fisheries, permitting the recovery and rebuilding of these stocks. These stocks are being closely monitored by the Research Division to allow their reopening when stocks have rebuilt to the level to support sustainable fishing.

Of the 29 fisheries where 'target ranges' were available and a material level of fishing was undertaken in 2011/12, ten were catch-quota managed [through a TAC allocated through Individually Transferable Quotas (ITQ)] with 19 subject to effort control management.

All of the ITQ-managed fisheries operated within their target effort/catch ranges or were acceptably below the effort range (Roe's abalone, pearl oysters, purse seine fisheries). In the 19 effort-controlled fisheries, all but one produced catches that were within (13) or acceptably above (1) or below (4) their target catch ranges. The catch of snapper in the West Coast Demersal was unacceptably above the range for this species in some management areas, although the overall fishery catch was within the range. Management of this fishery is currently being reviewed.

In summary, 28 of the 29 fisheries assessed (97%) were considered to have met their performance criteria, or were affected by factors outside the purview of the management plan/arrangements (Overview Figure 2), which is well above the target level.

Benthic Habitat and Biodiversity

Monitoring

A number of monitoring tools is used to assess the condition of ecosystems and associated biodiversity within the context of Ecosystem Based Fisheries Management. Detailed assessments of risk to the structure and benthic habitat of specific ecosystems can be found within each bioregional risk assessment of ecological assets. Across the marine bioregions, risks to benthic habitat and ecosystem structure and biodiversity have been generally assessed as ranging from negligible to at most only moderate. The exceptions to this are the estuarine ecosystems of the West Coast Bioregion which are identified as being at significant risk due to pressures from external (non-fishing) pressures largely associated with deteriorating water quality.

Management

Based on the results of marine ecosystem monitoring coupled to specifically identified management objectives, different degrees of protection are afforded to areas in accordance with categories established by the International Union for the Conservation of Nature (IUCN; http://www.iucn.org/about/work/programmes/pa/pa_products/wcpa_categories/). These categories range from sustainably managed multiple use categories (Category VI) to complete no take areas where no extractive activity is permitted (Category I). Spatial closures are identified following a risk based assessment of ecological parameters within a defined bioregion, and can involve total or partial closures to fishing activity. Closures can be used alone, but are often used in combination with other fisheries management tools to achieve specific objectives.

Mechanisms in use for the protection of marine habitats in Western Australian state waters include:

- Spatial closure to trawl-based fisheries under the Fish Resources Management Act 1994 (IUCN management category IV)
- Establishment of Fish habitat Protection Areas (FHPAs; IUCN management category I)
- Closures to fishing under section 43 of the Fish Resources Management Act 1994 (IUCN management category III)
- Establishment of marine parks through the Conservation and Land Management Act 1984 (CALM Act) and the Fish Resources Management Act 1994 (IUCN management categories I-VI)
- Marine protected areas off WA can also be created in Commonwealth waters under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC).

A summary of the effective habitat protection afforded to shelf waters off WA is detailed in Overview Table 2.

Protected Species

In accordance with EBFM principles, risk-based assessment of the impact of commercial and recreational fishing activities on protected fish and non-fish species is undertaken. Specific detail may again be found within each bioregional risk assessment of ecological assets. Risks associated with interactions with protected species were generally assessed as being negligible to low with the exception of risks to mammals (dolphins) resulting from the Pilbara trawl fishery. Dolphin exclusion devices have reduced the incidence to acceptable levels and further refinements to net design are in progress. Risks associated with birds and mammals (sea lions) in the South coast bioregion were also assessed as moderate and appropriate management measures are being undertaken to attempt to mitigate these risks. Most recently the level of entanglements of whales in pot ropes has required establishment of a steering group and initiation of research projects for mitigation.

GENERAL ENVIRONMENTAL IMPACTS

Introduced Pests and Diseases

The Department of Fisheries is the lead state government agency responsible for the management of aquatic biosecurity in Western Australia. Aquatic biosecurity threats include disease outbreaks in wild and farmed fish and the introduction of marine and freshwater pest species that are not native to WA.

Introduced marine species are organisms that have moved, or been moved from their natural environment to another area. Many of these organisms remain inconspicuous and innocuous causing no known adverse effects. However, some can potentially threaten human health, economic values or the environment, in which case they are then referred to as marine pests. Introduced marine species are a global problem, and second only to habitat change and loss in reducing global biodiversity (Millennium Ecosystem Assessment, 2005)¹.

The introduction of marine species into a new region can be deliberate or accidental. Deliberate introductions may result from aquaculture practices or releases from aquariums. Accidental introductions are primarily due to shipping and recreational craft moving from country to country, with the pests being transported in ballast water, on ship hulls, or within a vessel's internal seawater pipes. Introduced marine species also arrive naturally via marine debris and ocean currents.

In recognition of an increasing risk presented by aquatic pests and diseases to WA associated with increasing international travel, transport and trade, the Department has developed the capacity for rapid detection and identification of aquatic pests and diseases. Rapid detection of introduced aquatic pests and diseases is important in preventing their spread and establishment. This section provides an overview of the Department's activities with respect to marine pests and diseases monitoring in the state in 2012/13. Further detail is reported at the bioregional level and further information on Departmental activity in this field may be found in the

appendix (Activities of the Fish Health Unit during 2012/13 and Activities of the Biosecurity Research Group 2012/13).

The Marine Biosecurity Research group has implemented a system to monitor high risk ports around the state for the presence of marine pests. As an ocean bound nation Australia relies heavily on maritime transport, with over 95% of our imports and exports carried by sea. The large ocean going vessels that transport these goods represent one of the largest vectors of introduced species, while recreational vessels represent the major secondary vector that can spread pests from ports and marinas around the coastline. For these reasons our ports and marinas become high risk areas for the introduction of a marine pest. The Commonwealth Government, together with the states and territories have developed a national system of policies and procedures to try and reduce the risk of marine pests arriving in Australian waters. Part of this system includes the monitoring of high risk ports, which are those ports that receive large numbers of vessels, high risk vessels (such as dredges) or are geographically close to areas with known invasive marine species. This section details the results of the monitoring conducted in 2012/13 for detection of introduced marine pests (Overview Table 3).

The Department provides the Federal Department of Agriculture Forestry and Fisheries with a quarterly report on nationally notifiable aquatic diseases detected in Western Australia. This information is compiled with that of other Australian jurisdictions and is provided quarterly to the World Organisation for Animal Health (OIE). Summary data is available at <http://www.oie.int/>

The Department coordinates the fish kill response program within Western Australia. This program forms part of a national program endorsed by Primary Industries Standing Committee and Natural Resource Management Standing Committee in December 2006. The number and cause of fish kills is also a key indicator in the "State of the Environment Report" (SOE) issued from time to time by the environmental protection authority (IW19 Number and location of significant fishkills). The number of significant fishkills investigated in Western Australia since the last SOE report is shown in Overview Table 4.

¹ Millennium Ecosystem Assessment (2005) Ecosystems and human well-being: Biodiversity synthesis. World Resources Institute, Washington DC. 86 pp.

OVERVIEW TABLE 1

Stock Status, Catch & Effort Ranges for the Major Commercial Fisheries

NA - Not assessed, Q - Quota management, TAC - Total Allowable Catch, TACC - Total Allowable Commercial Catch

Fishery/ Resource	Stock assessment method and level	Breeding stock assessment	Target catch (and effort) range in tonnes (days)	Catch (tonnes) and Effort (days/hours) for season reported1- 2011/12 or 2012	Catch (or effort) level acceptable and explanation if needed
WEST COAST BIOREGION					
West coast rock lobster	Size-structured Population Model (Level 5)	Adequate	6,938 (Q)	6,647	Acceptable A Total Allowable Commercial Catch (TACC) of 6,938 t was set for the 2011/13 extended season. The entire TACC was not landed because a number of operators, especially in the southern zone, ran out of time to obtain their entire quota.
Roe's abalone	Catch Rates & Direct Survey (Level 4)	Adequate	92.8 (Q) (530 – 640 days)	67.0 (372 days)	Acceptable Catch was less than the quota due to significant reductions in commercial effort (days fished) in all regions except Area 2 driven by economic reasons (low value of catch) and concern over potential negative effects on growth in the Perth metro fishery resulting from the 2011 marine heatwave.
Octopus	Catch Rates (Level 2)	Adequate	50 - 250	208	Acceptable Fishery in developing phase. Target range to be reviewed following completion of current study.
Abrolhos Islands and mid west trawl	Direct Survey & Catch Rates (Level 4)	Inadequate (non - fishing)	95 – 1,830	0	NA The fishery was not opened due to annual survey indicating low scallop abundance resulting from low recruitment due to the extreme environmental conditions of early 2011. The low recruitment has resulted in a very low spawning stock despite no fishing activity.
Cockburn Sound crab	Direct Survey (Level 4)	Adequate	Under Review	46	NA The catch was relatively low due to a large number of sub-legal sized crabs not moulting during summer, potentially due to density dependent growth or resource competition.

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Fishery/ Resource	Stock assessment method and level	Breeding stock assessment	Target catch (and effort) range in tonnes (days)	Catch (tonnes) and Effort (days/hours) for season reported1- 2011/12 or 2012	Catch (or effort) level acceptable and explanation if needed
WEST COAST BIOREGION (continued)					
Estuarine finfish (west coast)	No Assessment	N/A	75 – 220 (Peel-Harvey only)	99	Acceptable Catches of west coast estuarine finfish have been stable since 2000.
West coast beach bait	Catch (Level 1)	Adequate	60 – 275 (whitebait only)	83	Acceptable Annual whitebait catch fluctuates in response to environmental variations.
West coast purse seine	Catch (Level 1)	Adequate	0 – 3,000 (Q)	219 t (scaly mackerel and pilchard combined)	NA Continued low catches compared to pre-2005 due to low fishing effort levels. 2012 catch was highest since 2006.
West coast demersal scalefish	Catch by sector (Level 1) Fishing Mortality (F) (Level 3)	Recovering	< 450 (Demersal Suite)	407	Not Acceptable While the total catch of the demersal suite by all relevant commercial fisheries (West Coast Demersal Scalefish (Interim) Managed Fishery WCDSIM; SouthWest Trawl Managed Fishery SWTMF; Cockburn Sound Line and Pot Fishery CSLPF; West Coast Rock Lobster Managed Fishery WCRLF; Demersal Gillnet and Demersal Longline Fishery DGDLF) was within acceptable levels, the combined rec and commercial catch of snapper in the Mid-west and Kalbarri areas was too high and the combined catch of Baldchin groper in Abrolhos Islands also exceeded acceptable levels.
Shark Bay prawn	Direct Survey/Catch Rate (Level 4)	Adequate	1,501 – 2,330	1,592	Acceptable King and tiger prawn catches were both within their historical target ranges however this range is being reviewed. Both species were within the predicted catch range.

Fishery/ Resource	Stock assessment method and level	Breeding stock assessment	Target catch (and effort) range in tonnes (days)	Catch (tonnes) and Effort (days/hours) for season reported1- 2011/12 or 2012	Catch (or effort) level acceptable and explanation if needed
GASCOYNE COAST BIOREGION					
Exmouth Gulf prawn	Direct Survey/Catch rate (Level 4)	Adequate	771 – 1,276	288	Acceptable The total catch was well below the target range as a result of poor recruitment due to environmental conditions. King prawns were below the target catch range but within the catch prediction.
Shark Bay scallop	Catch Rates and Direct Survey (Level 4)	Inadequate (non - fishing)	1,250 – 3,000	0	NA The fishery was not opened due to very low stock abundance resulting from the low recruitment due to the extreme environmental conditions (marine heatwave and floods) in late 2010/early 2011 in Shark Bay. The two years of low recruitment also means that the spawning stock in 2013 will be well below average despite no fishing.
Shark Bay Crabs	Catch Rates/Size Distributions (Level 3)	Inadequate (non - fishing)	Under development	113 (59 trap; 54 trawl)	NA The marine heat wave and floods over the 2010/11 summer have negatively impacted on the crab stock available for the 2012 season. Due to low stock levels, a voluntary closure commenced in April 2012 for both the trawl and trap sectors.
Shark Bay beach seine and mesh net	Catch Rates (Level 2)	Adequate	235 – 335	188	Acceptable Catch declined to below target range due to large reduction in effort and associated decline in sea mullet catch; catches of other target species were maintained at 2011 levels. Catch rates of species other than sea mullet moderately increased.

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Fishery/ Resource	Stock assessment method and level	Breeding stock assessment	Target catch (and effort) range in tonnes (days)	Catch (tonnes) and Effort (days/hours) for season reported1- 2011/12 or 2012	Catch (or effort) level acceptable and explanation if needed
GASCOYNE COAST BIOREGION (continued)					
West Coast Deep sea crab	Catch Rate (Level 2)	Adequate	154 (Q) (50,000 - 80,000 potlifts)	139.5 (138.7 crystal crab) (54,301 potlifts)	Acceptable The catch is within the target catch range, with the standardised catch rate of legal crabs is at the highest level in a decade with effort within its target range. Nominal effort estimate at the lower end of the target range.
Gascoyne Demersal Scalefish (Snapper only)	Composite Assessment (Level 5)	Adequate	277 (Q) (380 – 540 days)	235 (362 days) plus 40 recreational catch	Acceptable Spawning biomass is above the threshold level and at the current TACC, is projected to reach the target level by 2014- 15. Catch rate is well above the threshold level.
NORTH COAST BIOREGION					
Onslow prawn	Catch (Level 1)	Adequate	60 – 180	0	NA No fishing occurred in 2012.
Nickol Bay prawn	Catch (Level 1)	Adequate	90 – 300	129	Acceptable Catch of banana prawns were slightly lower than the projected catch range but within the target catch range.
Broome prawn	Catch (Level 1)	Adequate	55 – 260	12	NA The very low level of effort continued because of the cost of fishing, high fuel prices and long distances to steam and low returns.
Kimberley prawn	Catch (Level 1)	Adequate	240 – 500	329	Acceptable The banana prawn catches were slightly above the catch prediction but within the target range.

Fishery/ Resource	Stock assessment method and level	Breeding stock assessment	Target catch (and effort) range in tonnes (days)	Catch (tonnes) and Effort (days/hours) for season reported1- 2011/12 or 2012	Catch (or effort) level acceptable and explanation if needed
NORTH COAST BIOREGION (continued)					
Kimberley gillnet and barramundi	Catch Rates (Level 2)	Adequate	32 – 45 (barramundi)	40	Acceptable The catch of barramundi is within the acceptable range. The acceptable catch ranges need to be reviewed.
Northern demersal scalefish	Catch and Catch Rates/ Integrated Model (Level 2 & 5)	Adequate	Total 600 – 1,000 (goldband < 488) (red emperor < 149)	Total 1,107 (goldband 487) (red emperor 134)	Acceptable Total catch is above the upper limit across the fishery due to an increase in catch in Zone B. Catches of goldband snapper and red emperor were both within the acceptable catch range. Full assessments and review of catch ranges are scheduled over next two years.
Pilbara fish trawl	Catch and Catch Rates/ Fishing Mortality/ Integrated Model (Level 2, 3 & 5)	Adequate	2,000 – 2,800	1,312	NA Reduced catch due to reductions in effort since 2009. Full assessment and review of catch range scheduled over the next two years.
Pilbara demersal trap and line	Catch and Catch Rates/ Fishing Mortality/ Integrated Model (Level 2, 3 & 5)	Adequate	400 – 600 (trap) 50 – 115 (line)	416 (trap) 86 (line)	Acceptable Both the trap and line catch were within acceptable ranges.
Mackerel	Catch (Level 1)	Adequate	246 – 410 (Q, Spanish Mackerel)	318	Acceptable Catch rates are stable or increasing in all three management areas.
Northern shark	Sandbar shark: Catch (relative to previous direct survey) (Level 3) Blacktip sharks: Catch (Level 1)	Sandbar shark: Recovering Blacktip shark: Acceptable	< 20 (sandbar)	0	NA No fishing effort continued for this year. Sandbar sharks are now considered to be recovering The black tip assessment is based on NT analysis

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Fishery/ Resource	Stock assessment method and level	Breeding stock assessment	Target catch (and effort) range in tonnes (days)	Catch (tonnes) and Effort (days/hours) for season reported1- 2011/12 or 2012	Catch (or effort) level acceptable and explanation if needed
NORTH COAST BIOREGION (continued)					
Pearl oyster	Catch rate predictions, standardised CPUE (Level 3)	Adequate	754,800 oysters (Q) (14,071 – 20,551 dive hours)	685,888 oysters (15,589 dive hours)	Acceptable Quota this year also included 150,000 large MOP (Mother-of- Pearl) oysters fished under an R&D permit to explore the potential for an MOP fishery.
Beche-de- mer	Catch Rate (Level 2)	Adequate	Sandfish 20 – 100 Redfish 40 - 150	Sandfish 13 Redfish 0	Acceptable No fishing occurred for Redfish in 2012. Sandfish catch below historical range due to low effort (413 hours fished compared to historical average of 2,200)
SOUTH COAST BIOREGION					
South Coast crustacean	No	NA	50 – 80 (southern rock lobster)	51.2 southern rock lobster (21.7 of deep sea crab)	Acceptable The management arrangements, including the acceptable catch range, are currently being reviewed.
Abalone (greenlip/ brownlip)	Standardised Catch Rate/ Fishing Mortality (Level 3)	Adequate	209 (Q) (907 – 1,339 days)	202 (1,438 days)	Acceptable Effort range slightly exceeded due to operational developments in the fishery such as use of 2 divers per day on some vessels and new divers with lower catching efficiency. Effort ranges will be reviewed in 2013.
Estuarine finfish (south coast)	Catch Rates (Level 2)	Adequate	200 – 500	186 (finfish) 14 (crab)	Acceptable Stock levels of key species are considered adequate.
WA salmon	Catch Rates (Level 2)	Adequate	1,200 – 2,800	117	Acceptable Recent catches continue to be low relative to historic levels, due to low effort from limited market demand. A review of the target catch range needs to be undertaken.

Fishery/ Resource	Stock assessment method and level	Breeding stock assessment	Target catch (and effort) range in tonnes (days)	Catch (tonnes) and Effort (days/hours) for season reported ¹ - 2011/12 or 2012	Catch (or effort) level acceptable and explanation if needed
SOUTH COAST BIOREGION (continued)					
Australian herring	Fishing mortality (Level 3)	Inadequate	475 – 1,200 (south coast only)	85	NA Formal stock assessment completed in late 2012. Historically low commercial catch reflects poor recent recruitment and low stock abundance. A review of acceptable catch range is under revision.
Albany/King George Sound purse seine	Catch (Level 1)	Adequate	2,683 (Q)	1,641	Acceptable Higher catch in 2011/12 due to increased effort.
Bremer Bay purse seine	Catch (Level 1)	Adequate	1,500 (Q)	Less than three licences operated	Acceptable Catch levels similar to previous years and acceptable given effort levels.
Esperance purse seine	Catch (Level 1)	Adequate	1,500 (Q)	Three licences operated	Acceptable Catch levels lower than in previous years but acceptable given effort levels.
Southern and West Coast demersal gillnet and longline	Gummy shark - CPUE (relative to previous Level 5 assessment) (Level 2) Dusky shark - CPUE (relative to previous Level 4 assessment) (Level 2) Sandbar shark - CPUE (relative to previous Level 4 assessment) (Level 2) Whiskery shark - Age Structured Model (Level 5)	Gummy and whiskery sharks: Adequate. Dusky and sandbar sharks are likely to now be recovering.	725 – 1,095 (key species only)	720	Acceptable Total catch was slightly below its target range, as were catches of whiskery sharks. Whiskery catches have been maintained below their historical target range due to reductions in effort and the intended effects of the seasonal closure.
NORTHERN INLAND BIOREGION					
Lake Argyle catfish	Catch (Level 1)	Adequate	90 – 155	119	Acceptable Catch is within the acceptable range.

¹ Catch figures supplied for latest year/ season available.

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OVERVIEW TABLE 2 - EFFECTIVE PROTECTION STATUS OF BENTHIC HABITAT IN WESTERN AUSTRALIAN STATE WATERS

The areas and proportions of the West Coast Bioregion making up continental shelf waters (< 200 m depth) where habitats are protected from the physical disturbance of trawl fishing. The areas which are formally closed to trawling would be equivalent to meet the IUCN criteria for classification as marine protected areas as category IV. The area of habitat effectively protected refers to the area where trawling doesn't occur. This table does not yet include the closures that will be implemented by the Commonwealth in 2014.

Bioregion	Total Area of Shelf (sq nm)	Area of shelf equivalent to IUCN marine protected area ≤Category IV (sq nm) (%)	Maximum area of Actual trawling activity (sq nm)	Total area of habitat effectively protected (%)
West Coast	19600	11000 (56%)	300	19300 (98%)
Gascoyne	15800	5600 (35%)	1100	14700 (93%)
North Coast	98600	40700 (41%)	10500	88100 (89%)
South Coast	31800	-	500	31200 (98%)
TOTAL	165800	57300 (35%)	12400	153300 (92%)

OVERVIEW TABLE 3 - DETECTION OF MARINE PEST SPECIES IN 2012/13 RESULTING FROM SURVEILLANCE AT MAJOR PORTS

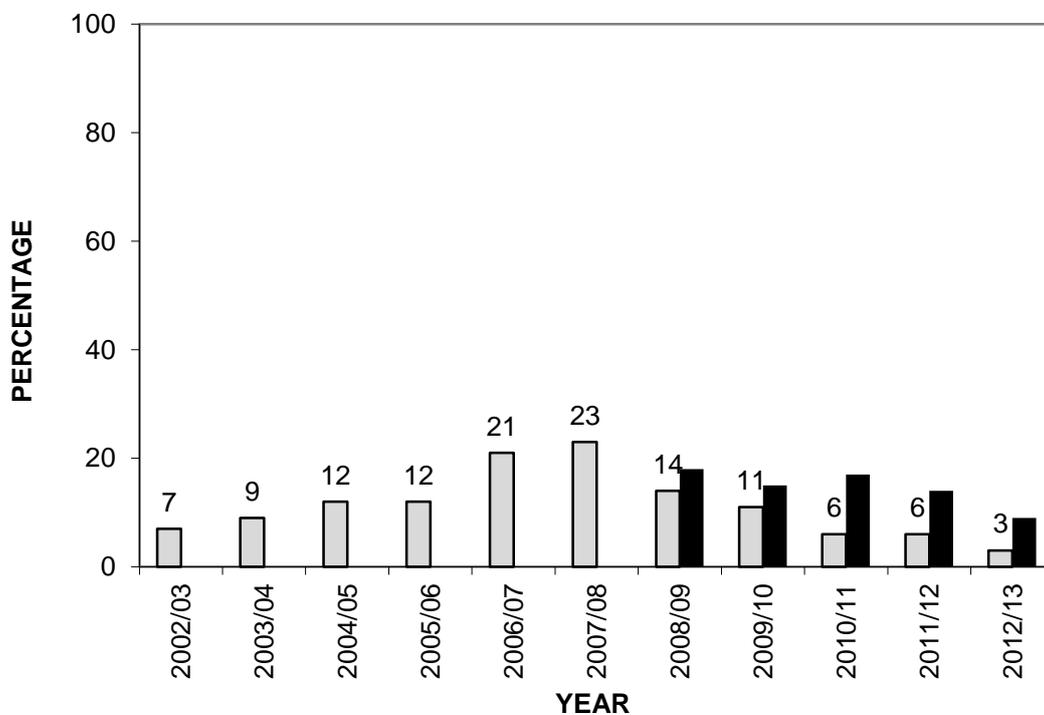
No pest monitoring was conducted in the Gascoyne or South Coast Bioregions in 2012/13.

Bioregion	Common Name	Scientific Name	Type of Organism	Pest status
West Coast	Mediterranean fanworm	<i>Sabella spallanzanii</i>	Polychaete	Pest
	Scallop	<i>Scaechlamys livida</i>	Mollusc	Introduced species
	Aeolid nudibranch	<i>Godiva quadricolor</i>	Mollusc	Introduced species
		<i>Alexandrium catanella</i>	Dinoflagellate	Pest
	Ciona	<i>Ciona intestinalis</i>	Ascidian	Introduced species
	Asian paddle crab	<i>Charybdis japonica</i>	Crab	Pest
	Ivory barnacle	<i>Balanus improvisus</i>	Barnacle	Pest
		<i>Balanus pulchellus</i>	Barnacle	Introduced species
	Asian green mussel	<i>Perna viridis</i>	Mussel	Pest
	Asian date mussel	<i>Musculista senhousia</i>	Mussel	Pest
		<i>Didemnum perlucidum</i>	Ascidian	Introduced species – likely pest
North Coast		<i>Theora fragilis</i>	Mollusc	Introduced species
		<i>Didemnum perlucidum</i>	Ascidian	Introduced species – pest-like characters

OVERVIEW TABLE 4

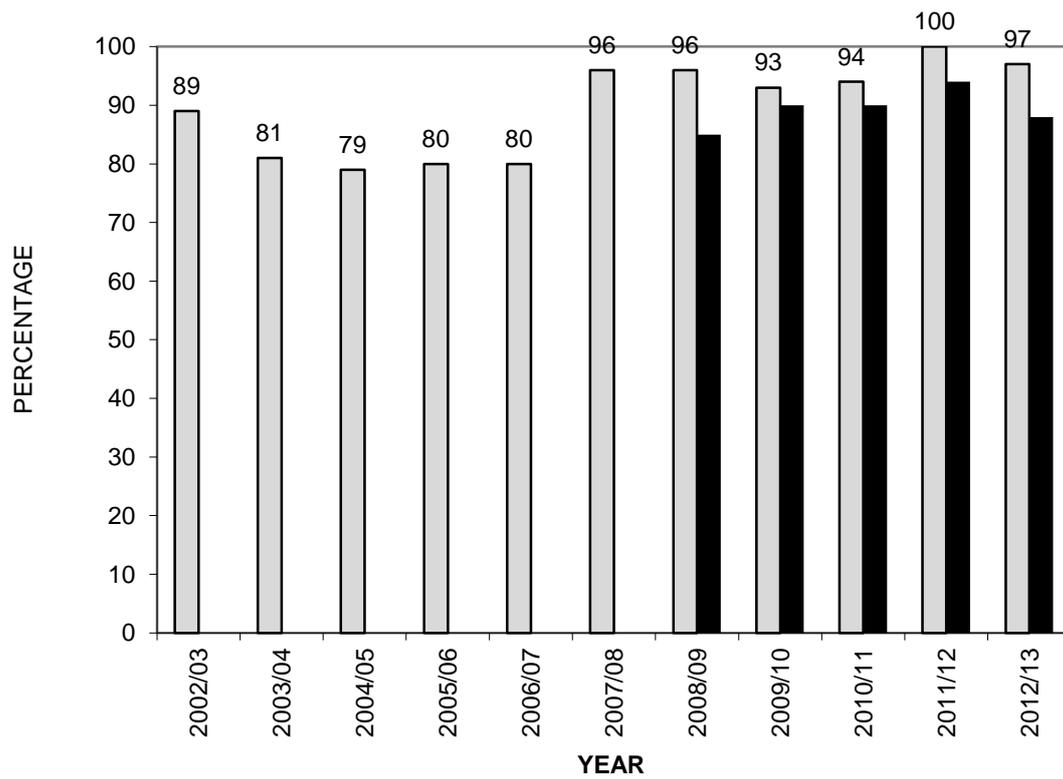
The number of significant fishkills investigated in Western Australia since the last SOE report

Year	Number of FishKills
2007	23
2008	36
2009	18
2010	18
2011	29
2012	17



OVERVIEW FIGURE 1

The proportion (%) of commercial fisheries where breeding stocks of the major target species are both assessed and considered to be at risk from fishing related impacts. Dark bars indicate target levels.



OVERVIEW FIGURE 2

The proportion (%) of commercial fisheries where the catch or effort reported is acceptable relevant to the management range being applied. Dark bars indicate target levels.