Guide to AFMA’s Ecological Risk Management Framework

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# Abbreviations

|  |  |
| --- | --- |
| **Abbreviation** | **Meaning** |
| AFMA | Australian Fisheries Management Authority |
| B | Biomass |
| BLIM | Biomass limit reference point |
| BMEY | Biomass that provides the maximum economic yield |
| BMSM | Biomass that provides the maximum sustainable fishing mortality |
| BMSY | Biomass that provides the maximum sustainable yield |
| BTARG | Target biomass |
| bSAFE | base Sustainability Analysis for Fishing Effects |
| CDR | Catch Disposal Record |
| BP | Commonwealth Fisheries Bycatch Policy 2018 |
| BP Guidelines | Guidelines for the Implementation of the Commonwealth Fisheries Bycatch Policy 2018 |
| CPUE | Catch Per Unit Effort |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DAFF | Department of Agriculture, Fisheries and Forestry |
| EBFM | Ecosystem Based Fisheries Management |
| EM | Electronic Monitoring |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* |
| ERA | Ecological Risk Assessment |
| ERAEF | Ecological Risk Assessment for the Effects of Fishing |
| ERA TWG | Ecological Risk Assessment Technical Working Group |
| ERM | Ecological Risk Management |
| ERMSG | Ecological Risk Management Steering Group |
| eSAFE | enhanced Sustainability Analysis for Fishing Effects |
| ESD | Ecologically Sustainable Development |
| ESMF Guidelines | Guidelines for the Ecologically Sustainable Management of Fisheries 2007 |
| F | Fishing Mortality |
| FAA | *Fisheries Administration Act 1991* |
| FIS | Fishery Independent Survey |
| FLIM | Fishing mortality limit reference point |
| FMA | *Fisheries Management Act 1991* |
| FMB | Fisheries Management Branch |
| FMP | Fisheries Management Plan |
| FRDC | Fisheries Research and Development Corporation |
| FTARG | Target fishing mortality rate |
| HSP | Commonwealth Fisheries Harvest Strategy Policy 2018 |
| HSP Guidelines | Guidelines for the Implementation of the Commonwealth Fisheries Harvest Strategy Policy 2018 |
| LRP | Limit Reference Point |
| M | Natural mortality |
| MAC | Management Advisory Committee |
| MEY | Maximum Economic Yield |
| MoU | Memorandum of Understanding |
| MSE | Management Strategy Evaluation |
| MSC | Marine Stewardship Council |
| NMFS | National Marine Fisheries Service |
| PEER | Policy, Environment, Economics and Research Section |
| PSA | Productivity Susceptibility Analysis |
| R | Intrinsic rate of population increase |
| RAG | Resource Assessment Group |
| RBC | Recommended Biological Catch |
| RRA | Residual Risk Analysis |
| SAFE | Sustainability Analysis for Fishing Effects |
| SICA | Scale Intensity Consequence Analysis |
| SLA | Service Level Agreement |
| TAC | Total Allowable Catch |
| TAE | Total Allowable Effort |
| TSSC | Threatened Species Scientific Committee |
| TSSC Guidelines | Threatened Species Scientific Committee Guidelines for assessing the conservation status of native species 2015 |
| UNCLOS | United Nations Convention on the Law of the Sea 1987 |
| UNFSA | United Nations Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks 1995 |
| VMS | Vessel Monitoring System |

# Foreword

## Purpose

This document (the “ERM Guide”) provides an overview of AFMA’s Ecological Risk Management (ERM) framework and a high-level guide for developing and implementing its processes at the fishery and Agency level. This framework will ensure consistency and transparency across all Commonwealth managed fisheries and will ensure that AFMA continues to meet its legislative requirements pertaining to ecological sustainability.

It addresses recommendations flowing from reviews of previous Ecological Risk Assessment (ERA) and ERM processes and aims to help AFMA ensure:

* improved ERM performance, accountability
* regular monitoring
* transparent reporting of outcomes and performance
* consistent and adaptive management
* world class scientific advice inputs
* stakeholder involvement, and
* regular evaluation and improvement of management processes.

The Guide does not prescribe arrangements for jointly managed fisheries (e.g. Torres Strait fisheries), however, it does articulate AFMA’s preferred approach. Where applicable, AFMA will seek to apply the Guide in negotiating and implementing joint management arrangements.

## Future development

This Guide reflects the Commonwealth Fisheries Harvest Strategy Policy (HSP2018) and Commonwealth Fisheries Bycatch Policy (BP2018) and their supporting guidelines (2018). It will be updated to take account of any reviews of these policies when they are complete. This Guide will continue to be reviewed and evolve over the coming years to take account of stakeholders’ needs and changes in supporting policies and procedures – key issues to address will be accounting for cumulative impacts and impacts of a changing climate.

# Guide to AFMA’s Ecological Risk Management Framework

## Introduction

AFMA is responsible for the efficient management and sustainable use of Commonwealth fisheries on behalf of the Australian community. AFMA’s legislated objectives are prescribed in the *Fisheries Administration Act 1991* (FAA) and the *Fisheries Management Act 1991* (FMA), and these objectives, along with those of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), are given effect by a number of subsequently developed fisheries policies and guidelines, principally the:

* Commonwealth Fisheries Bycatch Policy 2018 (BP) and Guidelines for the Implementation of the Commonwealth Fisheries Bycatch Policy 2018 (BP Guidelines)
* Commonwealth Fisheries Harvest Strategy Policy 2018 (HSP) and Guidelines for the Implementation of the Commonwealth Fisheries Harvest Strategy Policy 2018 (HSP Guidelines), and
* Guidelines for the Ecologically Sustainable Management of Fisheries (ESMF Guidelines 2007).

Commonwealth legislation requires that AFMA pursues Ecologically Sustainable Development[[1]](#footnote-2) (ESD) and as one part of this, ensure the ecological sustainability[[2]](#footnote-3) of species, populations, and ecosystems with which its fisheries interact[[3]](#footnote-4).

This requirement sits alongside other legislative objectives that AFMA pursues including those relating to:

* cost effective management
* maximising net economic returns
* having regard to Indigenous and recreational fishing interests
* accountability to industry
* optimal utilisation of living resources
* ensuring its fisheries take all reasonable steps to avoid killing or injuring EPBC Act‑listed species, and
* measures adopted must not be inconsistent with the preservation, conservation and protection of all species of whales.

AFMA, in collaboration with the fishing industry, pursues ecological sustainability through the implementation of:

* Ecological Risk Management (ERM) responses which provide for the management of fishing interactions with commercial species, bycatch species, habitats and communities, as well as supporting strategies for research, data and monitoring ([Chapter 2](#Chapter_2)), and
* A scientific risk assessment process (within ERM) referred to as the Ecological Risk Assessment for the Effects of Fishing (ERAEF) to identify and quantify these risks to ecological sustainability ([Chapter 3](#Chapter_3)).

[Figure 1](#Figure_1) outlines the linkages between legislation, policy, assessment, and management processes covered by ERM. ERM has multiple components and processes, which are described in subsequent chapters.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Legislation** | *Fisheries Management Act 1991* | | | | |
| *Environment Protection and Biodiversity Conservation Act 1999* | | | | |
|  | | | | | |
| **Policies** | Commonwealth Fisheries Harvest Strategy Policy 2018 | | Commonwealth Fisheries Bycatch Policy 2018 | |  |
|  | | | | | |
| **Ecological component** | Key commercial | Byproduct | General bycatch | EPBC Act‑listed species | Habitats and communities |
|  | | | | | |
| **Assessment** | Data rich  (e.g. Tiers 1–4) | | Data poor  (e.g. SAFE, PSA) | | Habitat and ecosystem models |
|  | | | | | |
| **Strategies** | Harvest Strategy | | Bycatch Strategy | | TBD |
| Research Strategy + Data and Monitoring Strategy | | | | |

Figure 1: AFMA’s ERM and its relationship with fisheries legislation and policies, ecological components and risk assessment tools which address ERM and other fisheries management objectives.

This guide provides direction for fisheries managers to implement the revised ERAEF for their fisheries (see 2017 ERM Guide for information on previous ERM processes). It describes the interaction between ecological sustainability and other fisheries management objectives, and the integration and role of ERA and ERM processes in pursuit of those objectives.

## Scope

AFMA’s ERM framework (including ERAEF) assesses and manages the impacts and risks[[4]](#footnote-5) posed by Commonwealth fisheries[[5]](#footnote-6) to the following ecological components:

Commercial species which include:

* key commercial species – defined in the HSP as species that are most relevant to the objective of maximising net economic returns to the Australian community from management of the fishery. Key commercial species are managed under the HSP
* Byproduct species – defined in the HSP as species that make some contribution to the value of the catch in a fishery but less than that of key commercial species. These stocks may be rarely encountered and usually retained, or frequently encountered and occasionally retained. Byproduct species are managed under the HSP, and

Bycatch species which include:

* general bycatch species – defined in the BP as all bycatch species that are not listed under the EPBC Act that are incidentally either taken in a fishery and returned to the sea or killed or injured as a result of interacting with fishing equipment in the fishery, but not taken. General bycatch species are managed under the BP, and
* EPBC Act-listed species[[6]](#footnote-7) – defined in the BP as species comprising all those protected under Part 13 of the EPBC Act including whales and other cetaceans and listed threatened, marine, and migratory species (except for conservation-dependent species which are managed through rebuilding strategies under the HSP). EPBC Act-listed species are managed primarily under the EPBC Act.

Habitats and communities:

* habitats – described as the biological and physical environments in which an organism lives (Sainsbury 2008, Hobday et al. 2011), and
* communities – described as assemblages of species in varying proportions doing different things and have properties that are the amalgam of the properties of individual populations and interactions among populations (Mangel and Levin 2005).

It should be noted that ERM has, to date, been largely focussed on assessing and managing fishery risks to species populations but will in the future include increased focus on habitats and communities as overarching policy guidance is provided.

## Objectives

The primary ecological sustainability objectives that AFMA pursues through its ERM framework mirror the sustainability objectives defined in existing fisheries and environmental legislation, policies, guidelines, and international agreements ([Attachment 2](#Attachment_2)). In summary, they are:

* to ensure that fishing (in Commonwealth commercial fisheries) does not reduce any commercial or bycatch species populations (that is, discrete biological units, commonly referred to as stocks in the BP and HSP) to or below a level at which the risk of recruitment impairment[[7]](#footnote-8) is unacceptably high
* where such fishing impacts have occurred to rebuild species populations to above that level to the extent fisheries management is able to do so
* to minimise fishing-related impacts on general bycatch and EPBC Act-listed species by ensuring the exploitation of fisheries resources is consistent with the principles of ESD, and
* to ensure broader habitat security for non-living ecological components[[8]](#footnote-9).

### *Consideration of other legislative objectives*

AFMA’s ERM related objectives address only one component of AFMA’s requirement to pursue ESD under the FMA which defines ESD as requiring decision processes to *“effectively integrate both long-term and short-term economic, environmental, social and equity considerations”*.

Under the FMA, the ESD objective also sits alongside other legislative requirements that AFMA pursues, including:

* efficient and cost-effective fisheries management – for commercial species managed under harvest strategies, risk-cost-catch principles are applied during their development. These principles effectively require the consideration of risk trade-offs between the failure, or success, of a fishery in achieving management objectives. For species which are not managed under harvest strategies (namely most by-product and general bycatch species), the hierarchical ERAEF framework is designed to filter out low and medium risk species and focus management attention on high-risk species in a cost-effective manner
* maximising net economic returns – the HSP gives effect to this objective
* accountability to the fishing industry and Australian community, and
* optimal utilisation of living resources.

Under the EPBC Act, AFMA must also ensure that Commonwealth fisheries are conducted in a manner that:

* requires persons engaged in fishing to take all reasonable steps to ensure that listed threatened species (other than conservation dependent species), listed migratory species, listed marine species and cetaceans are not killed or injured as a result of the fishing
* does not, or is not likely to, adversely affect the survival or recovery in nature of any listed threatened species, and
* does not, or is not likely to, adversely affect the conservation status of listed migratory species, listed marine species or cetaceans or a population of that species.

The BP states EPBC Act-listed species are managed separately to general bycatch species due to their special status under Australia’s national environmental legislation (i.e. the EPBC Act).

AFMA’s pursuit of the ESD Principles and other objectives can result in species being managed to biomass levels higher than required by the ERM related objectives alone. It is very important that managers understand the interactions between ERM and other fisheries management objectives when developing management arrangements.

### *Risk equivalency*

With respect to the above ERM objectives, it is AFMA’s intent to pursue risk equivalency. For general bycatch species, this means that species are not exposed to any greater risk than that accepted for commercial stocks managed under the HSP. Under the BP, general bycatch species are to be subject to an equivalent limit reference point (LRP) as commercial stocks and populations must be maintained above a limit where the risk of recruitment impairment is unacceptably high. Where evidence shows that a general bycatch population has fallen below that limit, the BP requires fishery managers respond in a way that facilitates recovery of that population to above the limit. Where the species is a key tropic species for the ecosystems such as an important prey species for certain predatory species, this species should be managed at a level that is appropriate for its status and the maintenance of the ecosystem.

However, in pursuing risk equivalency across species, it is important to recognise that for many species (particularly byproduct and general bycatch species), the ability to accurately quantify the risk of falling below the limit is highly dependent on data availability, assessment tools that can be used for a given species, and resources available for conducting simulation testing (e.g. MSE). The BP and BP Guidelines provide further guidance on operationalising risk equivalency.

### *Cumulative impacts*

It is also AFMA’s intent to pursue the cooperative assessment and management of species whose populations are impacted by both Commonwealth and non-Commonwealth fisheries, to account for and manage cumulative impacts[[9]](#footnote-10), to ensure ecological sustainability. The BP and BP Guidelines provide further guidance on how to take account of cumulative impacts. [Chapter 3.12](#Chapter_3_12) also provides guidance on assessing cumulative risks across multiple fisheries.

### *Climate Impacts*

It is also AFMA’s intent to more explicitly incorporate consideration of climate change impacts into its decisions and inform Objective 2 above, where impacts other than fishing may be impacting a species. The HSP and BP currently recognise that variability in ocean conditions, due to natural variability, climate change or other factors, can affect the productivity of stocks, and requires that fisheries account for this variability when developing and implementing harvest and bycatch strategies. Further guidance on taking account of climate impacts is provided in the HSP Guidelines and BP Guidelines. In addition, further work is underway on integrating the assessment of climate impacts into the ERM framework. This aspect will receive more detailed attention in future updates to this Guide. To deliver against this intent AFMA will:

* work with RAG and MACS to better understand and account for climate and ecosystem impacts at a fishery level including presenting a Climate and Ecosystem Status Report for key fisheries and a collation of climate studies for each species when advising stock status, and
* incorporate climate sensitivity analysis into species assessments as part of the risk and impacts for management.

## ERM framework

AFMA’s ERM framework is based on the following key elements:

* Ecological risk/stock assessments
* ERM responses – these take into account results from ecological risk/stock assessments (and other information) and outline the management processes required to address the risk and other key fishery management objectives on a per-fishery basis. Responses can take the form of harvest[[10]](#footnote-11), bycatch, research and, data and monitoring strategies. See here for current ERA and ERM responses by Fishery: <https://www.afma.gov.au/fisheries-management/management-tools/ecological-risk-management-strategies>

[Figure 2](#Figure_2) and the following sections highlight the key processes related to the ERM framework.



Figure 2: Examples of key ERA and ERM activities.

### *Ecological risk/stock assessments*

Ecological risk/stock assessments are used to assess ecological risks to species stocks/populations and to help evaluate potential management response options to mitigate risks where required.

### *ERM responses*

ERM responses to risks identified though ecological risk/stock assessments will be the primary means by which AFMA pursues its legislative and policy-based requirements, including those pertaining to ecological sustainability. ERM responses generally consist of the following key components: harvest, bycatch, research and, data and monitoring strategies.

[Table 1](#Table_1) describes the indicative timing of processes within each assessment and ERM responses cycle, based on an indicative five-year cycle. Depending on the timing (as guided by the stepped reassessment process) of the cycle for individual fisheries, the indicative years for completion of tasks may change.

Table 1: Indicative timing of processes within each assessment and ERM responses cycle, based on an indicative five-year cycle. Depending on the timing of the cycle for individual fisheries, the indicative years for completion of tasks may change. Red number in ‘Process’ relates to each step (detailed in sub-sections below).

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | **Year** | | | | | **Roles and responsibilities** | |  |
| **Stage** | **Process** | **Task** | **Y1** | **Y2** | **Y3** | **Y4** | **Y5** | **Lead role** | **Review/Endorse** | **Documentation** |
| **Planning** | **1. Assessment** | Funding / budget process / contracting |  |  |  | **X** | **X** | AFMA (Fishery Manager) | Research Provider | Fishery Budget Statements |
| Data collation |  |  |  | **X** |  | Research Provider | AFMA | Scoping and Level 1 ERA report |
| Scoping and Level 1 assessment |  |  |  |  | **X** | Research Provider | AFMA / RAG / ERMSG\* | Scoping and Level 1 ERA report; RAG minutes |
| Level 2 assessment |  |  |  |  | **X** | Research Provider | AFMA / RAG / ERMSG\* | Level 2 and RRA ERA report; RAG minutes |
| Residual risk analysis |  |  |  |  | **X** | AFMA, Research Provider, ERMSG | RAG / ERMSG\* | Level 2 and RRA ERA report; RAG minutes |
| trigger monitoring |  |  |  | **X** |  | AFMA, Research Provider, ERMSG | RAG / ERMSG\* | trigger analysis, RAG minutes |
| **2. Develop ERM responses** | Develop management options |  |  |  |  | **X** | AFMA | RAG / MAC | Management options paper to RAG and MAC; RAG and MAC minutes |
| Revise strategies (harvest, bycatch, research, data and monitoring strategies) |  |  |  |  | **X** | AFMA (Fishery Manager) | AFMA (Executive Manager) / RAG / MAC / Commission | Revised ERM responses; RAG and MAC minutes |
| **Implementation** | **3. Implementation** | Data collection | **X** | **X** | **X** | **X** | **X** | AFMA | AFMA (Fishery Manager) | Data and monitoring strategy |
| Research proposals / support | **When required** | | | | | AFMA (Fishery Manager) | Research Provider | Research proposals, AFMA Research Committee minutes |
| **Monitoring and Reporting** | **4. Initial outcomes (annual)** | Implementation of required management processes | **X** | **X** | **X** | **X** | **X** | AFMA (Fishery Manager) | AFMA (Senior Manager) | Internal reports |
| **4. Intermediate outcomes** | Industry compliance with management regulations; annual trigger monitoring |  | **X** | **X** | **X** | **X** | AFMA (Fishery Manager) | AFMA (Senior Manager) | Trigger analysis / other reports |
| **4. Long term outcomes (5 years)** | Ecological risk status |  |  |  |  | **X** | AFMA (Fishery Manager) | RAG (if required) | ERA report |
| **Evaluation and Improvement** | **5. Review, evaluate and improve** | Strategy evaluation and improvement |  |  |  | **X** | **X** | AFMA (Fishery Manager) | MAC / RAG / ERMSG | Other reports |

### *Operational implementation, Stepped Reassessment Triggers and process, monitoring and performance reporting*

Key ERM related activities are incorporated into annual fishery operational planning cycles and include:

* communication of management strategies, arrangements, and directions to the fishing industry usually prior to fishing season in the form of fisheries management arrangements and port meetings
* harvest strategy activities (e.g. TAC/TAE setting, by-product trigger monitoring etc) through RAG and MAC processes and recommendations to AFMA Commission for decision
* Bycatch strategy activities (e.g. EPBC Act-listed species interaction monitoring, ERA trigger monitoring, development of EPBC-Act listed species mitigation strategies and strategic assessments etc, species specific responses if not listed under EPBAC Act)
* data collection activities (e.g. logbooks, observers, electronic monitoring, surveys etc)
* compliance monitoring activities, and
* Research support activities (e.g. development of annual research plan, identification of research priorities and proposal reviews, logistical support, collaboration, RAG review of research; integration of research in management decisions/processes).

A need to updated fishery ERA assessments will be guided by a stepped process whereby Resource Assessment Groups (RAGs) and Management Advisory Committees (MACs) will assess the performance of their ERA against reassessment triggers every four years within a five-year cycle (Attachment 1) and provide advice to the ERMSG as to the need to update their ERA or seek approval to maintain their existing ERA for another 5 years. Noting the possibility of exceptional circumstances an ERA can be updated at any time in consultation with RAGs and MACs.

AFMA Management, in consultation with RAGs and MACs will identify priority action and responses to ERA outcomes in developing ERM responses. This in turn will be guided by AFMA’s annual corporate planning process with progress reported through the annual report. Fishery level performance is detailed in the annual ABARES Fishery Status Reports.

### *ERM governance, roles and responsibilities*

The following agencies, groups/committees, stakeholder groups and AFMA staff positions/staff ([Tables 2](#Table_1) and [3](#Table_2)) will interact to ensure that ERA and ERM processes are successfully implemented.

Table 2: ERA and ERM roles and responsibilities. Red – approval / endorsement; blue – responsible for development; orange – responsible for implementation; yellow – involvement; green – are consulted with.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Minister for Agriculture** | **Minister for the Environment** | **Department of Agriculture, Fisheries and Forestry** | **AFMA CEO / Commission** | **AFMA Management** | **ERM Steering Group** | **Management Advisory Committees** | **Resource Assessment Groups** | **Research providers** | **Industry** |
| **Planning and policy** | | | | | | | | | | |
| Commonwealth policies e.g. HSP and BP |  |  |  |  |  |  |  |  |  |  |
| ERM Guide |  |  |  |  |  |  |  |  |  |  |
| Development and review of ERA methodology |  |  |  |  |  |  |  |  |  |  |
| **Implementation** | | | | | | | | | | |
| Implementation of Commonwealth policies |  |  |  |  |  |  |  |  |  |  |
| Provide technical advice and guidance on ERA |  |  |  |  |  |  |  |  |  |  |
| Undertake ERAs |  |  |  |  |  |  |  |  |  |  |
| **Monitoring and reporting** | | | | | | | | | | |
| ERM performance monitoring / reporting |  |  |  |  |  |  |  |  |  |  |
| AFMA annual report |  |  |  |  |  |  |  |  |  |  |
| Data collection and monitoring |  |  |  |  |  |  |  |  |  |  |
| Re-assessment indicators and triggers |  |  |  |  |  |  |  |  |  |  |
| **Evaluation and Improvement** | | | | | | | | | | |
| EPBC Act accreditation |  |  |  |  |  |  |  |  |  |  |
| Internal/external auditing of ERM |  |  |  |  |  |  |  |  |  |  |
| MSC accreditation |  |  |  |  |  |  |  |  |  |  |

Table 3: ERM roles and responsibilities of AFMA staff and committees.

|  |  |
| --- | --- |
| **Role** | **Responsibilities** |
| AFMA CEO/Commission | * Endorsement of this Guide. * Overall performance and endorsement of ERM, including reviews of ERA methodology. |
| Deputy CEO, Fisheries | * Overall performance and endorsement of the ERM framework. |
| ERM Steering Group (ERMSG) | * Oversight of the ERM framework operation and ensure the application of a robust fisheries risk assessment and management framework continues for AFMA’s fisheries. * Review the performance of the ERM framework and make recommendations for any appropriate changes and enhancements. * Review of stepped reassessment checklist by RAGs and MACs. * Provide annual reports to the AFMA Commission, noting incremental changes applied in AFMA’s fisheries and international developments, and outlining recommendations for improvement. * Apply AFMA’s targets and objectives for sustainable environmental management by applying appropriate and up to date ERA methods and embed standards to ensure the consistent, robust, and cost appropriate assessment. * Further develop application of this Guide, consistent with objectives of relevant Commonwealth policies. * Identify gaps in research related to ERM and provide advice to the AFMA Research Committee on research required to fill these gaps. |
| Policy, Environment, Economics and Research (PEER) Section | Implementation of ERM including:   * supporting fishery managers in their implementation of ERM. * coordinate and support the implementation of ERM across fisheries, including contracting of ERAEF assessments / re‑assessments. * facilitate continuous improvement of ERM. * secretariat support for the ERMSG. |
| Fishery managers and senior managers | Within their fishery:   * development of scoping information for ERAEF assessments / re‑assessments. * overall performance of ERM (including planning, implementation, monitoring, review, and improvement). |
| RAGs | * Provide review and endorsement of the final results of ERAEF assessments / re-assessments. * Provide review of re-assessment indicators and triggers checklist. * Provide scientific/technical advice to assist in development of management options to mitigate risk for species. * Identify data and research gaps and priorities. |
| MACs | * Participate and contribute to the strategic planning stage, including management arrangements, development of expected outcomes, indicators, and reference points. * Provide management advice to assist in development of management options in response to ERAEF assessments / re‑assessments. * Review of ERM performance and providing recommendations for improvement. * Reporting to the AFMA Commission on fishery management outcomes. * Provide review of re-assessment indicators and triggers checklist. |

## Step by step guide to implementing the ERM framework

### *Introduction*

This section describes the key ERA and ERM processes and steps used to pursue ERM in Commonwealth fisheries.

It focuses on species components of ERM[[11]](#footnote-12). These species can be split into two groups depending on how they are assessed and managed for ecological risks:

* Key commercial species, typically managed through TACs (and quota) or TAEs under harvest strategies and associated harvest control rules, and
* By-product, general bycatch and EPBC Act-listed species[[12]](#footnote-13) which are assessed under the hierarchical ERAEF methodology but lacking prescriptive decision rules for catch and effort control. These species are more typically managed via monitoring indicators and triggers.

This step-by-step guide focuses primarily on byproduct, general bycatch and EPBC Act-listed species. It describes the key steps involved in planning, implementing, monitoring, reporting, and reviewing ERM for these species. These steps occur as described in [Figure 2](#Figure_2). Indicative timing of each of these processes is described in [Table 1](#Table_1). The timing of each ERM component for individual fisheries will differ. Depending on this timing, the indicative years for completion of tasks provided in the table may change but will be guided by pre-agreed triggers to require re-assessment or review of key ERM components ([Chapters 2.7.4](#Chapter_2_7_4) and [2.8.1](#Chapter_2_8_1)).

Guidance concerning the assessment and management of key commercial species is provided through the HSP and HSP Guidelines. Additional guidance on developing bycatch strategies for general bycatch species, is also provided in the BP and BP Guidelines.

## Assess (re-assess) ecological risk (STEP 1)

### *Introduction*

ERAs (and stock assessments) serve two purposes within the ERM framework, being:

* assessing the risk posed by fishing to species populations. For initial assessments, this occurs during a planning phase. Once management measures are in place to mitigate risks, subsequent re-assessments serve a monitoring role (and provide a measure of performance against the ERM objectives), and
* exploring the likely impact of alternative management responses upon high-risk species (during the ERM response phase) to assist in choosing an appropriate management strategy to reduce that risk to acceptable levels.

Noting this, ERA is presented here as the first step.

### *ERAEF methodology*

The ERAEF methodology is described in detail in [Chapter 3](#Chapter_3). The original hierarchical structure of the ERAEF methodology has been maintained ([Figure 3](#Figure_3)) and includes:

* Scoping: Establishing context and objectives
* Level 1: Scale Intensity Consequence Analysis (SICA)
* Level 2: Semi-quantitative assessment, and
* Level 3: Fully quantitative assessment.



Figure 3: Structure of the hierarchical ERAEF methodology. SICA – Scale Intensity Consequence Analysis; PSA – Productivity Susceptibility Analysis; bSAFE – base Sustainability Assessment for Fishing Effects; eSAFE – enhanced Sustainability Assessment for Fishing Effects; RRA – Residual Risk Analysis. eSAFE may be used for species classified as high risk by bSAFE.

There are however several changes to be aware of, including:

* revised and updated input databases and species lists
* revised Level 2 now includes Productivity-Susceptibility Analysis (PSA), Sustainability Analysis of Fishing Effects (SAFE) and the Residual Risk Analysis (RRA) processes
* SAFE is the preferred Level 2 tool where data and species biology allow
* no dual assessments. Where a Level 3 equivalent assessment already exists for a species (e.g. via a harvest strategy), Level 1 and 2 assessments will not be conducted, and
* species assessed as high risk under base SAFE (bSAFE) method may be further assessed using the enhanced SAFE (eSAFE) method.

Improvements to PSA input data and the PSA methodology ([Chapter 3.4](#Chapter_3_4)) should reduce the number of species requiring risk score adjustment through the RRA process. Results from PSA will be grouped into two categories (“robust” and “data deficient”) to further assist managers in considering the most appropriate management response. Further changes to the ERAEF may be made in future because of the ongoing development of automated ERAs, cumulative impacts, climate impacts and calibration of risk assessment tools and risk equivalency.

### *Assessment (and timing/triggers for Stepped re-assessment) planning and processes*

For initial ERAEF assessments, this occurs during a planning phase. Once management measures are in place to mitigate risks, subsequent re-assessments are driven by review of generic indicator checklist and fishery/sub fishery specific triggers where relevant as described in [Chapters 2.7.4](#Chapter_2_7_4) and [2.8.1](#Chapter_2_8_1) and below. A copy of the generic RAG/MAC/ERMSG check list is available at Attachment 1. The checklist considers things such as significant changes in effort, species, gear, climate effects etc impacting a fishery. Where relevant this is complemented by fishery/sub fishery specific indicators. This in turn drives responses and updates to bycatch, research, and data and monitoring strategies.

It is estimated that full re-assessment should take six months to complete, followed by the development of management responses/updates to the relevant strategies.

#### Budget planning

The AFMA fishery manager is responsible for budgeting for an ERAEF assessment / re‑assessment. Similarly, if further assessment is required, by eSAFE, based on bSAFE results, budgeting and contracting arrangements will need to be made, to enable assessment. This will also be the case if additional assessment work be required at the request of a RAG. Managers should follow budgeting processes outlined in AFMA’s budget cycle explanation papers.

#### Contracting

In coordination with the above budget planning process, the PEER Section will ensure that a research provider has been contracted to coordinate and provide the ERAEF assessment / re‑assessment. AFMA might wish to arrange a longer-term Service Level Agreement (SLA) or Memorandum of Understanding (MoU) with a research provider to ensure stability over time.

#### Preparation of scoping information

Scoping involves six key steps:

* Characterisation of the fishery
* Listing of units of analysis (e.g. species, habitats or community assemblages)
* Identification of objectives for components and sub-components
* Hazard identification
* Bibliography
* Decision rules to move to Level 1.

Additional background concerning each of the steps is provided in [Chapter 3.6](#Chapter_3_6).

AFMA has a role in the first two steps. The following details requirements for a fishery being assessed for the first time. It should be noted that for fisheries being re-assessed, scoping may comprise a more simplified updating of previously compiled information (e.g. provision of information on management changes and data collected since the last assessment):

* Characterisation of the fishery/sub-fishery – this step involves the development of general fishery characteristics documents for the selected fishery/sub-fishery. The information used to complete this step may come from a large range of management and research documents relevant to the fishery being assessed. The latest template to provide fishery/sub fishery information will be provided by the assessment team as part of the initial scoping discussion. Guidance on what characterises a fishery/sub-fishery is detailed below.
* Listing of units of analysis (e.g. species, habitats or community assemblages) – this step requires AFMA to provide an initial species list to assessor, including all observer, logbook, electronic monitoring, and any other relevant data from the entire time series for the fishery. Close collaboration will be needed between AFMA and the research provider to ensure data is provided in the form required. The remaining parts of this step will be undertaken by the research provider. A final species list will be presented to RAG/AFMA/expert groups for review and endorsement prior to commencement of the Level 1 and/or Level 2 assessment.

To prepare the general fishery characteristics documents, AFMA will first need to determine the fishery/sub-fishery to be assessed. What constitutes a fishery/sub-fishery is guided by how a fishery is defined in its plan of management or other description of management arrangements. A fishery may be assessed as a whole where the management arrangements (e.g. allowable methods, species, areas) are consistent across the fishery as a whole (e.g. the Bass Strait Central Zone Scallop Fishery). A fishery may be assessed at the sub-fishery level, where there are defined sectors (e.g. in a plan of management) and/or where management arrangements for different sectors of a fishery markedly differ in terms of allowable methods, species, areas, or other key characteristics (e.g. the Southern and Eastern Scalefish and Shark Fishery).

To facilitate the scoping process, it is recommended that AFMA and the research provider meet prior to commencing the scoping stage to confirm steps, roles, requirements, resourcing needs, timing and clarify any other issues and ensure that the latest templates and procedures are followed.

#### Assessment (re-assessment) and endorsement of results

The research provider will coordinate and undertake assessment/re-assessment from the Scoping stage (noting AFMA’s role in this stage outlined in [Chapter 2.6.3.3](#Chapter_2_6_3_3)) and then Level 1 and 2 (including RRA), in consultation with the PEER Section and AFMA fishery manager. The RAG will be provided opportunity to review and provide advice in relation to a written report by the research provider outlining draft results generated by each stage of the assessment process.

The RAG[[13]](#footnote-14) will consider and endorse the results and advise the MAC on the outcomes of its ERA review. Where resources are limited, ERMSG review can be requested. There may be several iterations of an assessment considered by a RAG prior to endorsement. Should additional assessment work be required, appropriate budgeting and contracting arrangements will need to be made to support this work. Endorsement of results by the RAG will occur prior to commencing the development/amendment of management strategies to address any identified potential high-risk species.

#### Public release of ERA reports

ERA reports that have been endorsed by the relevant RAG and MACs/ERMSG, are to be made available on the AFMA website. Status of / copies of the development/amendment of management strategies to address any identified potential high risk are to be detailed along with the release of the report. The current ERA and ERM responses are here: <https://www.afma.gov.au/fisheries-management/management-tools/ecological-risk-management-strategies>

ERA reports that are to be released publicly must meet AFMA’s information disclosure requirements, particularly concerning data confidentiality.

## Develop ERM responses (STEP 2)

### *Introduction*

Following assessment/re-assessment of fisheries under the ERAEF process, results will be considered by AFMA, RAG and MAC and appropriate ERM responses developed and documented within the relevant supporting strategies / legislation (e.g. EPBC Act-listed species mitigation strategies, harvest strategies, bycatch strategies, research strategies, data and monitoring strategies, legislation or permit conditions etc).

### *Developing ERM responses*

#### Introduction

The process of developing ERM responses (that may lead to the amendment of the strategies) needs to:

* be highly consultative with AFMA staff (e.g. fisheries management, compliance), and stakeholders via the RAG, MAC, and other relevant expert groups[[14]](#footnote-15), and
* consider a range of factors that will determine what an appropriate management response is, including the large range of management tools that can be used to mitigate fishing impacts and risks.

#### Consultation process

To consult:

* AFMA should develop a draft management options paper for consideration by the RAG and MAC and/or other expert groups
* The RAG and MAC and/or other expert groups will consider the preliminary options paper and provide advice to AFMA regarding which options might best mitigate risks to high-risk species, and
* Taking into consideration the advice received, the AFMA fishery manager will incorporate the management responses into updated strategies. Responsibility for final endorsement for any given management response is dependent upon the nature of the response itself, with some responses requiring an AFMA Commission decision, following advice from the relevant RAG and MAC.

#### Key considerations

In considering options to mitigate risks to species or species groups, AFMA and its key advisory groups should consider the following issues:

* Risk assessment ranking (e.g. low, medium, high)
* Key risk drivers
* Data status (e.g. deficiency)
* Risk-catch-cost considerations
* Other management objectives
* Existing mitigation/management measures
* Appropriate management tools/options
* Conservation status of the species, and
* Interactions with other fisheries (cumulative impacts).

##### *Risk assessment ranking*

ERM responses for low and medium ranked byproduct and bycatch species will in general be restricted to monitoring of fishery catch and effort levels and gear usage to monitor changes in fishery operations that might result in a change of risk to species. Generally, there is no need for explicit management measures to be developed. However, low and medium risk species might be subject to “non-ERM” management measures due to AFMA’s pursuit of other objectives.

High risk bycatch species are the focus of specific ERM responses, including additional data collection, higher level assessment, and development of measures to mitigate risk.

##### *Key risk drivers*

Risk assessments should identify the key attributes that result in a species being classified as high risk. Managers should identify whether risks are due to:

* spatial overlaps between species and fishery distribution
* gear selectivity
* catchability factors
* fishing effort levels
* species biology/productivity
* lack of data on key attributes, and
* other factors.

This information informs the development of targeted and appropriate management options to reduce risk, or in the case of data deficiency, helps identify the need for additional data.

##### *Data status*

If the risk assessment classifies a high-risk species as data deficient[[15]](#footnote-16), AFMA has the choice to either collect required data to allow re-assessment of the actual risk (and in the meantime assume high risk) or assume the species is at high risk and explore management options to mitigate assumed risk.

The choice will depend on whether the cost of required additional data collection and re‑assessment is greater than the cost of potential direct management of the risk. For example, assuming a species is at high risk may lead to management that minimises interactions and/or mortality, which may impact on the economics of the fishery.

##### *Risk-catch-cost*

Risk-catch-cost considerations play a role in management decisions for species deemed to be at high risk, and this consideration occurs at each level in the ERAEF. For example, for species assessed at Level 2 and determined to be at high risk (not data deficient), AFMA has the choice to either assume the assessment is correct and take management action to mitigate the risk or, seek re-assessment with a higher-level tool (e.g. eSAFE for bSAFE assessed species) to reduce uncertainty around the risk.

In either case, AFMA will need to consider the cost (both money and time) of undertaking a more quantitative assessment versus the cost of immediate direct management and whether this would represent an unacceptable level of risk to the population.

###### Other management objectives

The influence of other fisheries management objectives upon ERM decision making processes is discussed in [Chapter 2.3](#Chapter_2_3).

##### *Existing mitigation/management measures*

If existing management measures are in place to mitigate risk to the fishery for a particular species, then AFMA will need to consider and investigate:

* Whether they have had any effect upon risk?
* Are existing measures appropriately targeted at the key drivers of risk?
* Why have existing measures not mitigated the risk to the required level?
* What additional or alternative management actions will be required to mitigate the risk?
* Are there other factors at play (e.g. regime shifts, historically overfishing, interacting fisheries and cumulative impacts, etc)?

##### *Management tools/options*

AFMA employs a number of management tools for managing both commercial and bycatch species which broadly fall into two categories:

* Input controls – limits the amount of effort in a fishery, indirectly controlling species interactions (e.g. effort allocations, spatial/temporal closures, gear restrictions), and
* Output controls – directly limit the number/weight of species which can be taken from the water or interacted with (e.g. catch restrictions, catch triggers, trip limits, size limits).

Use and selection of tools will be fishery and situation specific, and all should be considered when looking to implement a management response.

##### *Conservation status*

AFMA is required under the EPBC Act to ensure that its fisheries take all reasonable steps to avoid injuring or killing EPBC Act-listed species. Management measures which are incorporated into bycatch strategies or individual EPBC Act-listed species mitigation strategies, which are aimed at ensuring avoidance of harm to EPBC Act-listed species, should assist in reducing the risk posed by fishing to the ecological sustainability of species populations. However, where an assessment determines that fishing poses a high risk to the ecological sustainability of an EPBC Act-listed species population, AFMA, as soon as practicable, will develop and implement measures to reduce that risk to acceptable levels. It should be noted that the Threatened Species Scientific Committee (TSSC) uses the TSSC Guidelines to determine if a species is at risk of (threatened with) extinction. The TSSC Guidelines list criteria pertaining to the level of population change (decline) that would indicate if a species should be listed as a threatened species. ERA Level 2 tools used to assess EPBC Act-listed species do not provide such information, but rather are based on relative or actual changes in fishing-based mortality.

#### Developing management performance indicators

In developing management responses to mitigate risks to high-risk species, AFMA should also develop and specify within the relevant management instrument the indicators and performance measures that will be monitored to determine if the management arrangements are successful. Performance should be tracked and determined at several levels:

* management processes – auditing to ensure that implementation activities are being completed
* industry compliance – monitoring and reporting on compliance by industry with management arrangements designed to mitigate ecological risks, and
* ecological risk reductions – mitigation measures should be regularly reviewed to check that they are reducing ecological risks as expected, and that species at lower risk categories are being maintained in those categories.

### *Amending ERM responses*

#### General process

Following the initial development of ERM responses, it’s possible that aspects of the fishery may change or trigger a requirement to re-assess a component/s of the ERM response framework. For example, a change in gear that results in a different EPBC Act-listed species vulnerable to the fishery or a doubling in effort in a sector of a fishery.

#### Harvest strategy amendments

The timeframes for harvest strategy amendments will differ depending on whether the species are key commercial species with TAC/TAE based management (and assessed at one-to-five-year intervals) or byproduct species with monitoring triggers. Byproduct associated amendments within harvest strategies may typically occur in conjunction with bycatch strategy amendments as both byproduct and bycatch are generally subject to the same re-assessment methods (e.g. ERAEF Level 1 and 2) and timeframes. Further guidance on the incorporation of byproduct species into harvest strategies is detailed in the HSP.

#### Bycatch and Discard strategy amendments

The amendment of bycatch strategies will occur after each re-assessment (including after triggered re-assessments) and may also, where necessary, include revision of EPBC Act-listed species mitigation strategies or other species-specific strategies (e.g. seabird threat abatement plan, dolphin management strategies).

Bycatch strategies provide an overarching summary of bycatch management responses intended to address ecological risk and other bycatch objectives. Some fisheries may need to develop species specific management strategies. In these cases, the bycatch strategy would either provide a brief overview of the species-specific strategy but refer to the more detailed and separate species-specific strategy documents or, incorporate the detailed species specific strategy and performance indicators into the bycatch strategy. The choice will depend on the complexity of the species-specific strategy and other fishery specific factors.

#### Data and monitoring strategy amendments

AFMA (in consultation with RAGs and MACs) must identify the minimum level of data collection and monitoring required to maintain and support ERA and the ongoing implementation of ERM responses. AFMA must then implement programs to collect that data ([Table 4](#Table_4)). These requirements will be documented as part of a data and monitoring strategy.

Table 4: Data types used in each stage of ERA and ERM.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Data type** | | | | |
|  | **Catch / discards** (quantity, area, date, species) | **Fishing effort** (quantity, area, date) | **Fishing methods** (gear types, strategy, materials) | **Biological data** (e.g. age, growth, size, M, r, sex, maturity) | **Economic data** |
| **Scoping and Level 1** | **X** | **X** | **X** |  |  |
| **Level 2 (e.g. PSA, SAFE, RRA)** | **X** | **X** | **X** | **X** |  |
| **Level 3 (e.g. stock assessments)** | **X** | **X** | **X** | **X** | **X** |
| **Trigger monitoring** | **X** | **X** | **X** |  |  |
| **Management options analysis** | **X** | **X** | **X** | **X** | **X** |
| **Compliance with management arrangements** | **X** | **X** | **X** |  | **X** |
| **Performance monitoring** | **X** | **X** |  |  |  |
| **Research to support ERM** | **X** | **X** | **X** | **X** | **X** |

AFMA employs many different forms of data collection and monitoring to support the management of Commonwealth fisheries, including catch and effort logbooks, catch disposal records (CDRs), vessel monitoring systems (VMS), observer program and electronic monitoring (EM). Further research-based information collection also occurs, including via fishery independent surveys (FIS). The types of information collected must be sufficient to support ERM requirements, including:

* assessment – risk/stock assessments which inform ERM responses
* monitoring – monitoring of fishery triggers to alert managers of changes in the fishery which might result in changes to the risk posed by the fishery to some or all species
* management options analysis – the development of management options and measures to mitigate the impacts of fishing on high-risk species ([Step 2](#Step_2))
* compliance – monitoring of adoption/uptake of mitigation and management arrangements aimed at reducing risk
* performance – monitoring of species interaction levels before and after management measures have been put in place to reduce risks ([Step 4](#Step_4)), and
* research – research that may be used to develop advice on the management of high risk and other species.

However, decisions around data collection and monitoring should give due regard to:

* the legislative requirement for cost effective fisheries management, including risk-catch-cost principles, and
* data collection requirements for achieving other fishery management objectives.

AFMA fishery managers should briefly review data collection programs annually to ensure they are meeting the above requirements. A major review of the data and monitoring strategy should occur when a re-assessment is triggered. Updates to the data and monitoring strategy should also occur in conjunction with updates to harvest, bycatch and research strategies that may occur. In all cases, revisions would rely on consultation with the relevant RAG and MAC or, other expert group.

Additionally, there are two key ongoing data related processes that occur throughout each ERM cycle, being:

* collection of data to support ERA/ERM, and
* re-assessment indicators and triggers (based on that data).

#### Research strategy amendments

Five-year research strategies are required for each fishery and should consider information and data requirements for ERA and ERM processes (and other fishery management information needs), prioritising research towards addressing gaps in those requirements. Fishery-specific five-year research strategies should be made consistent with AFMA’s overarching Strategic Research Plan (SRP). Five-year research strategies should undergo a review at the end of their five-year period.

RAGs and MACs are actively involved in Specifically, each RAG, in close liaison with the relevant MAC, should take a leading role in the preparation of the following two plans that underpin AFMA’s overarching SRP:

* Fishery-specific five-year research strategy developed and costed in the RAG/MAC process, that translate the broad requirements of the SRP into fishery-specific plans, and
* Fishery-specific annual research statements, developed in the RAG/MAC process, which implement the fishery-specific research plan for each fishery (see [Chapter 2.7.5](#Chapter_2_7_5)).

AFMA’s three-stage research planning process.

### *Development of re-assessment indicators and triggers*

Initially AFMA required automatic re-assessment of all fisheries/sub-fisheries every five years. Since the initial implementation of this Guide in 2017, it has become apparent that this approach is not realistic or reflective of the level of risk posed by fisheries already assessed or the resources available to conduct ERAs. In fisheries where the level of effort, area, method, or species fished has not changed in many years, there is little justification or benefit in requiring a fishery to undergo an ERA re-assessment every five years. As a result, AFMA will no longer pursue five-year automatic re-assessments for all its fisheries. Rather the need for reassessment will be guided by assessment every four years of each ERA against a generic checklist, augmented with fishery/ sub fishery specific indicators where necessary and monitored by RAGs, MACs and the ERMSG. Noting the possibility of exceptional circumstances an ERA can be updated at any time in consultation with RAGs and MACs.

Following initial ERAEF assessment, the following principles will be followed to guide decision to update a fishery/ sub fishery ERA:

1. ERAs will be completed more often for those fisheries/sub fisheries where re-assessment checklist indicates the potential for an increase in risk.
2. Fisheries will be required to update their ERA every five years unless an assessment of Reassessment Checklist indicators supports continuation of current ERA (Re-assessment checklist to be applied in year four of the five-year period).
3. Fisheries/Sub fisheries will conduct a review of their fishery ERA in year four of each five-year period against the Reassessment Checklist to guide decisions to update their ERA or not.
4. Fisheries/sub fisheries which have not completed an updated ERA for five years or more will be required to seek approval from the ERMSG to maintain an older ERA.
5. All fisheries/sub fisheries will be assessed at least every 10 years and assessed against the latest ERA methodology within five years.

A copy of the generic RAG/MAC/ERMSG check list is at Attachment 1. The checklist considers things such as changes in:

* Gear type/use
* Mitigation measures (use or type)
* Area fished
* Catch or interaction rate, and
* Fishing effort.

If necessary, this is generic list can be complemented by additional fishery/sub fishery specific indicators. In considering each indicator and trigger level, AFMA and the RAG/MAC should consider the following:

* The data upon which the indicator is based must be sufficiently representative of actual changes in catch, effort, area, gear, or mitigation methods. Consideration should be given to the level of uncertainty associated with the data underpinning any prospective indicator
* The trigger level chosen should not be overly sensitive to the normal inter-annual variance that is typical of the indicator and independent of fishing pressure, assuming such variance is unlikely to relate to a significant change in the risk posed by the fishery to any or all species
* The trigger level should equate to the minimum level of change that AFMA and the RAG considers might potentially represent a significant change in the risk posed by the fishery
* The trigger level could represent an absolute change (number/level) in an indicator or a percentage change in an indicator, and
* AFMA and the RAG should consider whether a “temporal” condition should be placed on the trigger (i.e. the trigger is breached two years in a row) to further reduce the likelihood of natural population variance or data errors triggering a re-assessment unnecessarily.

*Guidelines for ERA re-assessment triggers for Commonwealth fisheries (*[Guidelines for ERA re-assessment](https://afmagovau.sharepoint.com/:b:/s/DMW-PROD/EVUcLn7yzeFAgIxa6gchzcoB-7quHS74mEAE-1_ejX9xrA?e=FPBIhZ)) have been developed to assist AFMA and RAGs decide on appropriate fishing effort and fished area trigger levels for all Commonwealth fisheries (Penney, 2018). These are intended to be adapted as required by AFMA and RAGs, to facilitate a consistent annual evaluation of triggers indicating change in fisheries related risk. In the longer term it may be possible to refine indicators and triggers using the existing PSA and SAFE methods to test which attributes the end risk scores are most sensitive to[[16]](#footnote-17).

## Implementing ERM (STEP 3)

The AFMA fishery manager is responsible for ensuring (in collaboration with other relevant AFMA staff and sections) the implementation of ERM responses. This will occur through implementing all agreed responses and include:

* Amendment of relevant management arrangements (e.g. relevant concession conditions and closure directions which give legal effect to any changes to management arrangements)
* Communication of amendments to management arrangements/strategies to the fishing industry prior to the commencement of the next fishing season. Communication of management arrangements may also occur mid-season (e.g. to enforce harvest control rules). This typically occurs through:
  + publication and distribution (via mail) to fishers (skippers and crew) of annual or seasonal management arrangements and information booklets and directions
  + letters and emails to industry (quota holders, skippers etc.)
  + direct communication to industry representatives (e.g. industry associations)
  + RAG, MAC, and industry meetings, and
  + port visits.
* Ongoing maintenance of data collection:
  + Logbook and CDR submissions are monitored by the Licensing and Data Services Section, in liaison with the AFMA VMS staff, and
  + Observer data collection is overseen by the AFMA Observer Program.
* Ongoing support of required research through annual research statements and associated research funding applications
* Monitoring management activities to detect when management processes and compliance are not occurring
* Monitoring and reporting on Stepped reassessment checklist for RAG/MAC/ERMSG assessment
* Four yearly inclusions of completed checklist to RAG/MAC/ agendas and comment prior to provision to ERMSG, and
* Planning and budgeting, in consultation with the RAG and MAC, for any re-assessment costs.

In co-managed fisheries the role of industry in some of the above elements may be significantly greater.

The template for four yearly re-assessment checklist, to enable ease of consideration by RAGs/MACs and ERMSG, is provided in [Attachment 1](#Attachment_1).

Development of management options for species re-assessed to be at high risk from fishing should follow the process outlined in [Step 2](#Step_2).

## Performance monitoring and reporting (STEP 4)

Monitoring refers to the routine review of performance results. It is a continuous process that involves the collection and analysis of information on specified indicators to provide fishery managers with an indication of the extent of progress towards the achievement of outcomes. Performance will be monitored and reported on an annual basis (unless otherwise required by legislation) basis in line with AFMA’s corporate reporting requirements which are directly linked to the ABARE Fishery Status reports.

The monitoring of AFMA’s progress in achieving its ERM (and other) objectives relies on monitoring:

* Implementation of required management processes (initial outcome) – this monitoring will be internally reported to senior managers annually
* Industry compliance with management arrangements (intermediate outcome) – AFMA monitors compliance by fishers with all management arrangements, including those aimed at reducing fishing risks to high-risk species. AFMA compliance officers and/or the specific AFMA fishery manager will be responsible for reporting annually to the senior manager and relevant MAC on an annual basis
* The Re-assessment checklist will be completed on a four yearly basis. Completed checklists will be provided to the RAG, MAC and ERMSG outlining indicator status and recommendation on need for reassessment or change in line with the five-year review requirement.
* Ecological risk (long term outcome) – determining if management measures aimed at reducing ecological risks have been successful should require:
  + re-assessment of ecological risk through time (i.e. conduct ERA), and
  + where possible (i.e. where sufficient data exists), the monitoring of interaction rates (and total fishing effort) in the fishery for high risk species. This will help to determine if interaction rates decrease after management action/mitigation is put in place, without increasing effort / total catch. In some fisheries, it may be that evidence from scientific mitigation trials is considered sufficient to demonstrate a reduction in risk.

### *Performance reporting*

Performance reporting will occur at and agency level as part of AFMA’s corporate reporting framework (e.g. AFMA Annual Report and ABARES Fishery Status Reports) and at a fishery level through the RAG and MACs. Copies of all ERA / ERM related documentation will be saved at a fishery level on AFMA Website here: <https://www.afma.gov.au/fisheries-management/management-tools/ecological-risk-management-strategies>

# Ecological Risk Assessment – Revised Methodology

## Purpose

This chapter provides fishery managers with an overview of the current Ecological Risk Assessment for the Effects of Fishing (ERAEF) methodology and process. It is primarily focused on the assessment of risk[[17]](#footnote-18) of Commonwealth commercial fisheries to species populations. Habitats and communities will receive more detailed attention in future updates to this Guide.

Further technical details of the current ERAEF methodology and process, including recent changes and improvements, are provided in a CSIRO technical summary which is updated regularly.

## Introduction

### *What is ERAEF?*

The ERAEF is the primary methodology underpinning AFMA’s Ecological Risk Management (ERM). The ERAEF was developed to assess and monitor the risk posed by Commonwealth fisheries to the ongoing sustainability of ecological components that interact with Commonwealth fisheries. AFMA uses results from the ERAEF to inform its ERM responses (see [Chapter 2](#Chapter_2)) which in turn are designed to assist AFMA in meeting its related legislative, corporate and policy objectives (e.g. EPBC Act) and assist its fisheries to gain certification against other standards/processes (e.g. MSC).

ERAEF was initially developed by CSIRO in collaboration with AFMA from 2000-2006 with the goal of providing an assessment framework by which to assess risks against ecological sustainability across five ecological components being:

* commercial species (including key commercial and byproduct species)[[18]](#footnote-19)
* bycatch species (including general bycatch and EPBC Act-listed species[[19]](#footnote-20))
* habitats, and
* ecological communities.

This holistic ERA approach was implemented predominantly because of:

* a shift in the 1990s and 2000s in Commonwealth government thinking towards implementing an ESD approach to fisheries management (as required by the FMA) and more recently Ecosystem Based Fisheries Management (EBFM), and
* a demonstrated need to assist in evaluating impacts of fishing for strategic assessments under the EPBC Act (Hobday et al. 2007).

The ERAEF was implemented during a period in which there was relatively little policy regarding how AFMA could meet its sustainability objectives. As a part of the ERAEF process, fisheries stakeholders were required to specify sustainability objectives and typically relate those objectives (for species) to avoiding fishing impacts that would lead to recruitment impairment. The ecological risk being assessed under the ERAEF and managed under ERM, along with the broader legislative and policy context, is discussed in detail in [Chapter 2](#Chapter_2).

Details of the design and history of the methodology are contained in Attachment 4.

# Habitats and Communities

## Purpose

This chapter provides an overview of ERAEF and ERM for habitats and ecological communities to date, including a review of relevant objectives, ERA methods, recent research, and future directions.

## Introduction

The original ERAEF (Hobday et al. 2007) was designed to include risk assessments for the impacts of fishing on marine habitats and ecological communities, in recognition of the fact that fishing has impacts beyond the direct effects of harvesting individual species. In accounting for impacts on these components, AFMAs ERA and ERM is consistent with the objectives of the FMA and EPBC Act, including the principles of ESD.

Under AFMAs ERA and ERM, habitats and communities are defined as:

* habitats – described as the biological and physical environments in which an organism lives (Sainsbury 2008, Hobday et al. 2011). More recently, these have also been defined by habitat assemblages (Pitcher et. al., 2016, 2018) for ERAs.
* communities – described as assemblages of species in varying proportions doing different things and have properties that are the amalgam of the properties of individual populations and interactions among populations (Mangel and Levin 2005).

## Management objectives

Specific overarching fisheries policy relating to fishing impacts on habitats and communities is yet to be developed. Subsequently, habitat and community objectives have historically been defined by AFMA and stakeholders within the scoping process of ERAEF. Typically, these were to:

* Habitats:
  + avoid negative impacts on the quality of the environment
  + avoid reduction in the amount and quality of habitat
* Communities:
  + avoid negative impacts on the composition, function, distribution, and structure of the community.

Future policy developments may provide further guidance on objectives which can be incorporated into future revisions of this document.

## Methods

In-depth methodological explanation of ERAEF for habitats and communities can be found in Hobday et al. (2007) for habitats and Hobday et al. (2011) for communities. Future versions of this guide will consider ERA methods for habitats and communities in more detail and reflect the development of specific policy guidance (where available) by the Australian Government.

Historically, it has proven challenging to implement the ERA methodology to habitats and communities due to a paucity of data. Recent development of ERA methodology has been undertaken to allow these ecological components to be assessed at Level 2. As such, analyses can be applied to habitats and communities in a similar fashion to other ecological components. Level 2 methods were developed for both habitats and communities using the PSA approach, occurring in 2009 for habitats (Hobday et al. 2007) and 2011 for communities (Hobday et al. 2011). Inclusion of residual risk analyses within the assessment framework is also similar for these non-species components. There is a need for improved data and methods to facilitate better use of current ERA methodologies.

### *Scoping*

The aim of the Scoping stage is to develop a profile of the fishery being assessed. This provides information needed to complete Levels 1 and 2 of the ERA. The challenge for both habitats and communities are a paucity of data and the identification of appropriate units (‘types’) within each fishery.

For habitats, there are two types of data that are used to inform habitat units based on data availability (Hobday et al. 2007). When available, habitat is identified using images from extensive video surveys (method 1). If not, a mixture of geophysical and GIS mapping has been incorporated to identify habitat units for assessment within ERAEF (method 2).

For communities, units of analyses were devised using a food-web based “assemblage” (Hobday et al. 2011). This was achieved by grouping similar species based on their functional group and connecting them based on predator prey interactions. From this, a generic food-web was developed that could be applied to all fisheries. Data used to populate these food-webs was supplied from numerous sources, but primarily the bio-regionalisation studies of the Australian marine and coastal environment (Lyne et al. 2005).

### *Level 1 – Scale Intensity Consequence Analysis*

SICA aims to identify which hazards lead to a significant impact on any ecological component. Analysis at Level 1 is for whole components (commercial, bycatch and habitats and communities), not individual sub-components. This approach is precautionary, ensuring that elements determined to be ‘low risk’ can be confidently omitted from further steps.

### *Level 2 – Productivity Susceptibility Analysis*

When the risk of an activity at Level 1 (SICA) is identified and no existing management is in place to mitigate that risk, a Level 2 analysis is undertaken. PSA is a method of assessment which allows all units within any of the ecological components to be effectively and comprehensively screened for risk. The PSA approach is based on the assumption that risk to an ecological component will depend on two characteristics of the component units:

1. the extent of the impact due to the fishing activity, which will be determined by the susceptibility of the unit to the fishing activities (Susceptibility), and
2. the productivity of the unit (Productivity), which will determine the rate at which the unit can recover after potential depletion or damage by fishing.

#### Habitats

Development of Level 2 ERA for habitats occurred within AFMA’s initial ERAEF document (Hobday et al. 2007). Since its inception, ERA for habitats has been applied to nine AFMA managed fisheries. However, there has been a lag in the incorporation of these analyses within ERM. This occurred in a subsequent project that occurred in 2011.

Once habitat units have been identified through SICA, their resilience and susceptibility to fishing from specific activities is assessed. Two productivity attributes (e.g. rate of regeneration) and nine susceptibility attributes (e.g. selectivity of gear to habitat) are ranked from 1–3 representing low-high risk. From this, habitat units can be assessed as low, medium, or high risk. Sixteen habitats were assessed as at high risk on the mid-slope in waters between 700-1500 m. The 700 m depth closure was initially introduced to protect stocks of orange roughy and other deepwater species but has effectively eliminated trawling in that area. Further actions were deferred pending the outcomes of a CSIRO investigation of the representation of various habitats in closed areas and the effect of different trawl methods on the ecosystem (see below).

#### Communities

Each community is assessed based on a range of unique productivity and susceptibility attributes. These include productivity attributes such as fish species richness and mean trophic level, and susceptibility attributes such as spatial effort overlap, mean trophic level of catch and total catch percentage. Once these attributes are ranked and averaged for each community within the fishery, the level of risk can be assigned. For the Southern and Eastern Scalefish and Shark Fishery, a total of 27 communities were assessed with a total of 6 considered to be at high risk as a result of the PSA (Hobday et al. 2011). With this technique developed, it can now be progressively incorporated into AFMA’s fisheries and, subsequently, appropriate measures implemented to enable appropriate steps to be taken based on outcomes of the ERA.

# Future directions for ERA

## Cumulative impacts

There is a need to consider and assess the impact of fishing impacts on ecological components outside of single Commonwealth fisheries, which is the scale at which assessments are undertaken. Managers must consider the impact of fishing activities from other Commonwealth managed fisheries, state and Territory fisheries and international fisheries cumulatively. Where fishing impacts also occur outside of Commonwealth managed fisheries, managers should where possible pursue a collaborative approach to the assessment and management of relevant ecological components.

## Climate impacts

The HSP and BP currently recognise that variability in ocean conditions, due to natural variability, climate change or other factors, can affect the productivity of stocks, and requires that fisheries account for this variability when developing and implementing harvest and bycatch strategies. Further guidance on taking account of climate impacts is provided in the HSP Guidelines and BP Guidelines. In addition, further work is underway on integrating the assessment of climate impacts into the ERM framework. This aspect will receive more detailed attention in future updates to this Guide.

## Research and management development

It is AFMA’s intent to continue to develop and progress ERA and ERM for habitats and communities. As it stands, development of Level 3 methodologies has not been undertaken. Prior to the development of Level 3 techniques, there is a need for improved data collection at appropriate scales to better inform Level 1 and 2 analyses. Furthermore, research into the selection of appropriate reference points to inform ERM decisions is required (Smith et al. 2007). These values currently do not exist for these habitat and ecological community components or are somewhat arbitrarily determined (Hobday et al. 2011).

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# Attachment 1. ERM framework templates

## ERAEF templates

[https://research.csiro.au/cor/fisheries-domestic/ecological-risk-assessment/](https://aus01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fresearch.csiro.au%2Fcor%2Ffisheries-domestic%2Fecological-risk-assessment%2F&data=05%7C01%7CRyan.Murphy%40afma.gov.au%7C75ed6459cc484560168008da70618799%7Cd176b5937d9c41eda769f0f622e3b073%7C1%7C0%7C637945861452324992%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=smt27h7DaJN1mOyEnRnx8ZUmkMmWht2R0Lduk9kTciY%3D&reserved=0)

## ERM templates

Note all Fisheries have ERM response documents in place. These documents reflect previous guidance and requirements that have recently been updated with this version of the ERM Guidelines. To minimise needless duplication of work it is expected that as these documents are updated that they be modified to reflect the template requirements below. It is expected that all fisheries will be applying the consistent templates within five years of the publication of this guide.

## Template 1 – Five-year Strategic Research Plan

### *Introduction*

*[Brief description of the fishery and what the plan is doing, suggested text for modification as follows:*

*This research strategy outlines the key strategic research needs in the X Fishery. It is due for review in 2028.*

*The research strategy aims to assist AFMA and the X Advisory Committee (MAC) to identify and support research that will help achieve the management goals of these / this fisheries and AFMAs overall legislative objectives. It is aligned with the overarching AFMA Strategic Research Plan 2022–2027.*

*In addition to this plan, annual research statements will outline annual research priorities that have been identified by X MAC on an annual basis in consultation with the Y Resource Assessment Group (???RAG).*

### *AFMA Corporate goals and Strategies*

*Suggested words: Research activities funded by AFMA must focus on attaining the primary outcome specified by the AFMA Strategic Research Plan 2022–2027, being:*

* + *Ecologically sustainable and economically efficient Commonwealth fisheries.*

*Consideration of this overarching goal, the linked species-specific management objectives detailed in the ERA/ERM, as well as AFMA corporate objectives (link) can act as a guide for XXMAC in developing annual research plans, identifying research priorities for the annual call for research and assessing research proposals*

### *Identifying research needs*

*Suggested wording for fishery specific updating.*

*Noting that research activities must be consistent with AFMA’s pursuit of its legislative objectives, the key drivers of research can be considered to fall into four categories:*

1. *Xxx*
2. *Xxx*
3. *Xxx*
4. *Xxx*

#### Biological

*Biological fisheries information is essential to adequately assess the stocks and estimate the size of sustainable harvests from those stocks.*

#### Ecological

*Information about the impact of fisheries on the marine ecosystem is essential to assist AFMA achieve our objective of ensuring Commonwealth fisheries are ecologically sustainable. Ecological risk assessments (ERAs) are essential to the development of Ecological Risk Management (ERM) and are conducted on all Commonwealth fisheries. The results of ERAs assist in identifying and prioritising research needs regarding fishery impacts on species populations and the broader marine ecosystem, and in guiding research investment, data collection, monitoring, and future management decisions.*

#### Economic

*Many factors influence the overall economic performance of the fishery. AFMA requires an understanding of the effects of economic factors upon the X fisheries to manage these fisheries to maximise economic efficiency.*

#### Social

*Research into the social aspects of the fishery is important to maximise the social benefits of the fishery to the community. Social research aspects may include investigating access to the resource and resource allocation issues.*

*The success of fisheries management in the X fisheries should be monitored and measured through appropriate performance indicators. These performance indicators, together with appropriate reference points, must relate to the management objectives and have identified actions associated with them.*

### *Research priority areas and needs*

*The following research areas have been identified as high priority needs for the period 2023–2028 by XRAG and XMAC. These are consistent with AFMA’s strategic goals and priorities and are not listed in order of priority.*

#### Provision of data

* + *Provision of biological data to support relevant projects (stock assessments)*
  + *Provision of economic data to support relevant projects*
  + *Provision of environmental data to support relevant projects*
  + *Provision of recreational catch data to support relevant projects*

#### Biological research priorities

* + *Stock assessments*
  + *Ensure stock assessments are conducted on target species in Australia’s X Fishery.*
  + *Ensure appropriate assessments are conducted where required for other species caught in X Fishery.*
  + *Improve understanding of biological characteristics of species caught in X Fishery.*
  + *Develop harvest strategies for target and byproduct species as needed.*
  + *Evaluate the effectiveness of the harvest strategies for Australia’s X Fisheries.*

#### Ecological research priorities

* + *Bycatch and byproduct*
  + *Investigate measures to improve bycatch mitigation in fishing operations.*
  + *Investigate the effects of fishing in X Fisheries on non-target species.*
  + *Climate impacts*
  + *Measure the effects of climate change on key species and ecosystems in Australia’s X Fishery.*
  + *Investigate oceanographic and environmental factors impacting Australia’s X Fisheries.*
  + *Ecological risk assessment*
  + *Review the ecological risk assessment for the X fisheries.*
  + *Evaluate the relevance of certain species rated as high risk.*

#### Economic and social research priorities

* + *Spatial management measures*
  + *Investigate the economic and ecological impacts of Marine Protected Areas and closures.*
  + *Investigate the need for resource sharing between the Commonwealth and other jurisdictions or sectors.*
  + *Economic viability*
  + *Determine trends in the economic performance of X Fishery.*

*• Cost / Benefit Analysis of management costs (levies) versus the fishery outputs in Australia’s X Fisheries.*

*This research plan provides a framework for identifying the key research priorities in the X Fishery for 2023–2028 that will help achieve the management goals for X Fishery, and ensure that endorsed research projects fit within a strategic framework.*

#### Actions

*XRAG and XMAC should identify on an annual basis the research needs for management of the stocks consistent with the research priorities of this research strategy and reflect these in their annual research plan provided to the AFMA Research Committee.*

### *AFMA’s research program*

*See AFMA Five Year Strategic research plan for details of research prioritisation, funding and contractual processes [*[*here*](https://www.afma.gov.au/research)*]*

## Template 2 – Bycatch and discard plan

### *Introduction*

*[Brief description of the fishery and what the plan is doing, suggested text for modification as follows:*

*In carrying out its functions, the Australian Fisheries Management Authority (AFMA) must pursue objectives in the Fisheries Management Act 1991 (FMA 1991) including having regard to the impact of fishing activities on non-target species and the long-term sustainability of the marine environment.*

*Under the [insert management plan/ arrangements name here] (the Management Plan), AFMA is required to develop and implement a bycatch action plan (now referred to as a Bycatch and Discarding Workplan) to ensure that:*

*AFMA’s Ecological Risk Management Guide (ERM) 2022, (LINK) describes requirements and objectives for managing interactions with bycatch species {include reference to relevant aspect here for your fishery.*

*As articulated in the Commonwealth Bycatch Policy 2018 (the Bycatch Policy), the primary objective for bycatch management is to minimise fishing-related impacts on bycatch species in a manner consistent with the principles of ecologically sustainable development (ESD) with regard to the structure, productivity, function and biological diversity of the ecosystem. In delivering on this objective for Commonwealth fisheries, the Bycatch Policy requires AFMA to:*

* *draw on best-practice approaches to avoid or minimise all bycatch, and minimise the mortality of bycatch that cannot be avoided*
* *manage fishing-related impacts on general bycatch species to ensure that populations (that is, discrete biological units, commonly referred to as stocks in the Commonwealth Harvest Strategy Policy) are not depleted below a level where the risk of recruitment impairment is regarded as unacceptably high, and*
* *where fishing-related impacts have caused a bycatch population to fall below the level described, implement management arrangements to support those populations rebuilding to biomass levels above that level.*

*This workplan should be read in conjunction with the:*

* *Commonwealth Fisheries Bycatch Policy 2018*
* *Relevant fishery management plan / arrangements*
* *Ecological risk Assessment / management strategies for relevant fishery*
* *Commonwealth Fisheries Harvest Strategy Policy and Guidelines 2018*
* *AFMA protected species strategy (in preparation)*

### *Fishery description*

*Brief description of the fishery…*

### *Workplan development*

*The workplan is intended to address risks identified through the ERA process and to address impacts on the broader ecosystem, including to minimise interactions with species listed under the EPBC Act. The workplan also builds upon the progress made under details of the Previous Workplan).*

*The action items at Table 3 were developed in consultation with the Z MAC to address the risks identified in the Y ERAs for the period 2022–2017 (published June ?????) as well as broader bycatch and discard risks identified across the sector – can link to Website ERA/ERM documents*

### *Ecological risk assessment results*

*Summaries ERA results and include table of high-risk species.*

### *Existing measures to mitigate risk*

*Provide details of existing mitigation approaches for the fishery, e.g. gear requirements, management of protected species (Seal/Seabird Management Plans etc).*

*Details a particular approach for overfished/ conservation dependent species, use of area closures etc*

### *Bycatch workplan action items*

*Summarise action items to mitigate identified risks suggested text as follows:*

*The action items below have been developed to mitigate the risk to species identified as potentially high risk under the X ERA, as well as broader risks identified across the fishery with regards to general bycatch, improved discard reporting, and interactions with protected species. The table includes the actions to be pursued and a worked example for seabirds.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Action Item*** | ***Risk/Issue to be addressed*** | ***Timeframe*** | ***Cost*** | ***Responsible parties*** | ***Milestone*** | ***Performance indicators*** |
| *Investigate mitigation options to reduce seabird interactions* | *Reduce interaction with seabirds* | *2022/23 financial year* | *Low/medium –* | *Industry/AFMA* | *Effective mitigation options* | *Number of boats implementing identified solutions* |

*\* Cost: High >$200,000 / Medium $100,000 – $200,000 / Low <$100,000*

### *Summary*

*This workplan provides an overview of the actions identified to mitigate risks to species identified as potentially high risk under the XX Year ERA, as well as broader ecosystem impacts in the X Fishery. The outcomes of previous workplans are detailed in the annual reviews, and the progress against action items in this workplan will also be monitored and reported on (see Review Process below) Summarise and key areas of focus for the plan and previous achievements etc*

### *Review process*

*Bycatch and Discarding Workplans are largely output focused. The action items included here are only some of the measures AFMA undertakes as part of the Ecological Risk Management (ERM) Strategy and it is difficult to measure the specific contribution of an action item to the overall objectives of the ERM Strategy.*

*This workplan is effective as of* ***date*** *and will be formally reviewed as described below:*

* *every 12 months to:*
  + *ensure actions identified have progressed*
  + *determine if any further action items are required.*
* *final review and development of a new workplan after five years, or when the ERA is updated (whichever is sooner) to*
  + *ensure that action items identified at each annual review have been completed*
  + *report against performance indicators*
  + *determine actions for the subsequent workplan.*

*Outputs of this Workplan will be reported to the Department of Climate Change, Energy, The Environment and Water as part of the WTO annual report.*

### *Habitats and communities*

*This section outlines the key management arrangements that AFMA implements to pursue legislative and policy-based objectives relevant to the management of Fishery Name impacts upon ecological habitats and communities.*

#### Policy background and objectives

*Unlike for bycatch and commercial species, there is no specific Commonwealth policy yet that provides requirements and guidance relating to the interaction of Commonwealth fisheries with marine habitats and ecological communities. However, the FMA 1991 has relevant legislative objectives ensuring:*

* *the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of ESD in particular the need to have regard to the impact of fishing activities on non‑target species and the long-term sustainability of the marine environment.*
* *proper conservation and management measures, that the living resources of the AFZ are not endangered by over-exploitation.*

*In addition, the CPFB 2018 primary objective makes a clear connection between bycatch species sustainability and ecosystem function (which would encompass communities), with that objective:*

* *to minimise fishing-related impacts on general (not EPBC listed) bycatch species in a manner consistent with the principles ESD and with regard to the structure, productivity, function and biological diversity of the ecosystem.*

#### Assessments

*The [Fishery Ecological Risk Assessment Date] is the most recent assessment of the potential impact of the X fishery upon marine habitats and ecological communities. The assessment was carried out under Level 1 of the ERAEF framework which applies a Scale-Intensity-Consequence Analysis (SICA) in relation to Habitats and Communities. That assessment determined that:*

* *Habitats results –*
* *Ecological Communities results –*

#### Management arrangements

*Describe management arrangements e.g. area closure etc*

#### Actions

*To date, resources for quantitative assessments of fishery impacts have tended to have a species based focus but moving forward AFMA will be looking to further explore how to more quantitatively assess the ecological community-based risks posed by fishing (at a level higher than ERA SICA). Ecosystem model-based risk assessment methods are being developed by researchers and may assist in understanding this issue in future.*

## Template 3 – Data and monitoring plan

### *Introduction*

*[Brief description of the fishery and what the plan is doing, suggested text for modification as follows:]*

*The purpose of this section is to provide a review and plan for ongoing data collection needed to support evidence-based fishery management decisions in the Fishery Name, in particular as relates to the management of commercial species and bycatch species and the pursuit of related and broader management objectives.*

*The Strategy was developed following a review of current data collection processes against data needs (including consultation with industry, and MAC etc), with a focus on addressing data gaps and assumptions that might pose a risk to achievement of management objectives.*

*This data strategy complements (and supports) other information sources that are also used by AFMA in decision making processes including:*

* *fishery dependent or independent research*
* *expert opinion (including advisory committees), and*
* *other published information/research.*

*The data strategy is also designed to comply with the data related requirements of the:*

* *CHSP 2018 and Guidelines*
* *CPFB 2018 and Guidelines which requires general bycatch are identified, quantified and verified with data collection to support appropriate risk assessments (of fishery impacts), inform effective management options, monitor bycatch interactions and industry compliance, enable assessment of the efficacy (performance) of any management measures against objectives and be aligned with risk-cost catch principles. It also states independent verification of fishing activity supports an effective reporting and monitoring framework and data collection, reporting and monitoring should meet EPBC Act requirements.*
* *AFMA Science Quality Assurance Policy, and*
* *AFMA Data and Information Dissemination Policy.*

*and the data needs to address high risk species identified through ERA.*

### *Purpose of data collection*

*The data collected through AFMA fishery data collection programs is used to:*

* *inform management decisions that ensure appropriate and cost-efficient management systems and arrangements that best pursue/achieve AFMAs legislative and policy objectives (either indirectly by supporting/underpinning research that provides management advice or directly by providing data for indicators of key processes).*
* *monitor compliance with management decisions by the fishery (e.g. TAC limits, mitigation use etc.) and ultimately achieve the fishery’s operational objectives.*
* *measure and report on AFMAs progress/performance against those objectives.*

### *Objectives*

*Detail any specific objectives for collection of data from the fishery but generally reflective of AFMA pursuit of its legislative objectives is the key focus.*

### *Drivers of data needs*

*Describe key drivers of the fishery data needs.*

### *Data description and information sources*

*Each fishery and sub fishery will have different data drivers and needs. All the major fisheries have data and monitoring plans in place already and should draw on these plans (the tables and information contained in them) to populate this section and the following section of the template. This section needs to reflect the details of key/ data information sources to support assessment and management tools used in the fishery and describe key tools used to collect data in the fishery.*

### *Action items*

*Detail (in table format preferably) area of focus for new data program / data collection to support ERM in the fishery.*

### *Review*

*Data plans and needs should be reviewed annually. These meetings should identify and prioritise data needs and gaps for quota species, bycatch species and protected species to ensure the data collected is sufficient to inform research, stock assessment and management decisions.*

## Template 4 – Generic fishery check list to guide decision to update ERA – RAGs and MAC to complete fourth year of five-year cycle

### *Attachment 1 – generic fishery check list to guide decision to update ERA – RAGs*

#### Resource Assessment Group and Management Advisory Committee review of ecological risk Assessment reassessment indicators for [fishery/sub-fishery]

***Purpose****: The purpose of this checklist is to guide Resource Assessment Groups (RAGs) and Management Advisory Committees (MACs) through a review of the generic Ecological Risk Assessment (ERA) reassessment indicators. This checklist informs RAG and MAC advice to the Ecological Risk Assessment Steering Group / AFMA Management on the need, or not, to update and complete a new ERA for their fishery / sub fishery at the five-year review mark. Noting the possibility of exceptional circumstances an ERA can be updated at any time in consultation with RAGs and MACs.*

*For those fisheries which have not completed an updated ERA for more than five years this checklist provides additional information to seek approval to the ERMSG to maintain an older ERA.*

***Responsibility****: This document is to be completed by the relevant RAG and MAC for each fishery/sub-fishery; (ii) discussed / endorsed by the RAG and MAC and provided to the Ecological Risk Management Steering Group (ERMSG) for consideration / approval. The information will be used to report on the status of fishery / sub fishery ERA on AFMA’s web site. ERMSG advice is needed by October to allow budget planning and included in the research priority request for new ERA to be completed in the following financial year. AFMA Management will support respective RAGS and MAC with appropriate information to inform the discussion/assessment.*

#### ERA details

|  |  |  |
| --- | --- | --- |
| ***Process*** | ***Details*** | ***RAG Comments*** |
| *Fishery / Sub‑Fishery Name* | *[Name of fishery/sub‑fishery e.g. Gillnet, Hook and Trap (GHAT) manual longline sub-fishery]* | *[RAG comments e.g. The RAG noted that this assessment combines the shark and scalefish hook sectors and that the most recent logbook data was used to better reflect effort changes in the fishery when last assessed]* |
| *Date of assessment*  *Including date of last data used* | *[Date of assessment e.g. November 2019]*  *Using data from 20??* | *[RAG comments e.g. The RAG noted that this assessment was delayed due to waiting on the latest data.]* |
| *High Risk Species list* | *[Version of species list]* | *[RAG comments e.g. treatment of species group.]* |
| *Version for scoping* | *[Version]* | *[RAG comments e.g. Nil.]* |
| *Version for SICA* | *[Version]* | *[RAG comments e.g. Nil.]* |
| *Version for PSA* | *[Version]* | *[RAG comments e.g. Nil.]* |
| *Version for SAFE* | *[Version]* | *[RAG comments e.g. Nil.]* |

#### RAG assessment of annual risk indicator for their fisheries (From Penney. A 2018)

|  |  |  |
| --- | --- | --- |
| ***Susceptibility*** | | ***YES/NO*** |
| *Overlap: Annual Fishing Effort* | *Has annual or seasonal fishing effort (number of operations) increased or decreased outside the 90% confidence intervals around effort over latest assessment period (last five years)?*  *The degree of inter-annual variability in fishing effort differs between fisheries and is considered in ERAs. Where fishing effort variability remains within expected ranges, no updating of ERAs is indicated. Where fishing effort increases or decreases outside these ranges, the need to update the ERA may need to be considered. Number of operations is a useful and easily calculable effort index for all fisheries, and calendar years are used in ERAs, However, fishing season and other effort (RAGs should ensure they identify the effort indicator most relevant to consideration of fishing mortality/interactions) measures could be used, provided the appropriate reference level and confidence intervals are calculated. For fisheries with 2012-2016 90% CIs < 20% of the reference level, the reference level +20% should be used as the trigger levels.* | *[RAG advice]* |
| *Overlap: Annual Fished Area* | *Has fished area (number of 0.1° fished blocks) increased or decreased outside the 90% confidence intervals around effort over the latest assessment period (last five years)?*  *There is a close correlation between fishing effort and fished area for stable fisheries. Where fishing effort has not changed outside expected ranges for such fisheries, it may not be necessary to evaluate changes in fished area. For fisheries where fishing effort and fished area are not closely correlated (such as developing or exploratory fisheries where effort is shifting to new areas), changes in fished area should be evaluated* |  |
| *Encounterability: Fished depth range* | *Has there been a substantial change in the depth range fished, outside depths fished over the latest assessment period (last five years)??*  *Fished depth range is usually fairly constant for a fishery but may change in response to market-related changes in species targeting, or introduction of depth closures. Changes in fished depth would need to be significant in relation to depth distribution ranges of species of interest to affect an ERA. Depending on the change, fished depth changes may affect the entire fishery or only a few individual species* |  |
| *Selectivity: Gear changes* | *Has a new gear type been introduced, or have there been significant changes to aspect of gear configuration that substantially increase or decrease the selectivity of gear for bycatch species?*  *Factors affecting selectivity of gear will depend on the fishery. They may include the introduction of a new method in a fishery, a substantial increase in fishing using a previous minor method, a change in mesh size for a net fishery, or a change in hook size, shape or baiting in a line fishery or a change in fishing time.* |  |
| *Post capture mortality* | *Has new information been obtained indicating estimates of post capture mortality used in the previous ERAs were incorrect?*  *This may occur, for example, where high post capture mortality was assumed in the absence of information, whereas new data have shown there to be high survival. This would usually only apply to one or a few species and would not indicate the need to update the entire ERA. Risk scores for individual species may require updating. This would usually be done during the residual risk assessment* |  |
| *Mitigation measures* | *Have new or improved mitigation measures been implemented that have been demonstrated to reduce the capture or post capture mortality of important bycatch/protected species?* |  |
| *Mitigation implementation* | *Has there been an improvement or a worsening in implementation of mitigation measures, resulting in a decrease or an increase in capture and post capture mortality of bycatch/protected species?* |  |
| ***Productivity*** | | ***YES/NO*** |
| *New information on species biology* | *Has new information been obtained indicating a significant change in productivity characteristics of bycatch species?*  *For information used in ERAs, such as: Growth rate [r, K, L\_inf]; Natural mortality; Average maximum size; Average maximum age; Average size at maturity; Average age at maturity; Fecundity; Trophic level. Changes in productivity will usually only apply to one or a few species, and do not indicate the need to update the entire ERA. Risk scores for individual species may require updating. This would usually be done during the residual risk assessment* |  |
| *Other Indicators* | | *YES/NO* |
| *Other indicators of change in risk(Including consideration of Environmental changes)* | *Have there been changes in any other risk indicator that may indicate the need to consider updating the ERA?*  *If so, what indicators: Only changes in risk factors that could potentially affect the existing ERA risk scores for a species, using existing ERA methodology, should be considered. These should all have been considered in the sections above, but this question provides an opportunity for any other unforeseen information to be noted. If available information relating to cumulative impact and Climate change impact can be provided here. This section should take consider impacts of environmental change over time in the fishery, taking account of any RAG Assessment/development of relevant ecosystem indices.* |  |
| *Conclusions* | | *YES/NO* |
| *Overall ERA update required* | *Do changes in the above indicators warrant consideration of updating the ERA for the entire fishery?*  *Substantial changes in indicators of overall risk (such as fishing effort, fished area, fished depth range or gear selectivity), outside of ranges considered during the previous ERA, may warrant consideration of an ERA update. If so, this information would be forwarded to the relevant MAC for further consideration* |  |
| *Individual species risk score update required* | *Do changes in the above indicators warrant consideration of updating of ERA risk scores for individual species? Changes in indicators of risk for individual species (such as species productivity parameters, interaction rates, post capture mortality), from values used in the previous ERA, may require updating of the ERA risk scores for these species. If so, this information would be forwarded to the relevant MAC for further consideration* | *If yes for which Species?* |

#### MAC Comment on RAG trigger assessment

|  |  |  |
| --- | --- | --- |
| ***Action*** | ***Comment*** | ***Recommendation from MAC***  ***YES/NO*** |
| *MAC comment on the RAG review of ERA Triggers* | *E.g. The MAC noted the RAG assessment of the triggers and recommended that that the ERA be updated as a priority and that funding be included in the x year research budget to update the ERA* |  |
| *Support for current ERA (if ERA is 5 year or older specific details of the consideration and justification for extending the ERA need to be included here)* | *[General observations from MAC on RAG assessment of reassessment checklist e.g. The MAC noted RAG advice and supported the assessment of the ERA.]* | *[MAC recommendation e.g. The MAC supports the current ERA for [Fishery/sub fishery] and seeks approval from the ERMSG to maintain this ERA for the following reasons:]* |

#### MAC Assessment of ecological risk management responses

|  |  |  |
| --- | --- | --- |
| ***ERM Action and Comments*** | ***Comment*** | ***MAC Advice*** |
| *Effectiveness of ERM response* | *[Details of MAC advice concerning the effectiveness of current ERM responses under current ERA if relevant e.g.*   * *Annual Research plan updated x and in place* * *Harvest Strategies in place for x/y species* * *Bycatch and Discard Work plan updated x and in place* * *Data and Monitoring strategy updated x and in place* | *[MAC recommendation e.g. The MAC supports the retention of the current ERM response and that all plans facilitating the ERM response are up to date and in place…..* |

#### Ecological Risk Management Steering Group consideration

*Eg[The ERMSG considered the RAG Checklist Assessment and MAC review. The ERMSG also noted advice from the MAC as to the status of ERM responses to the current ERA.*

*[It noted and supported RAG/ MAC advice that no significant change has occurred in the fishery to trigger a revised ERA. Or It noted and supported RAG/ MAC advice that x/y change has occurred in the fishery to trigger the need for a revised ERA and that the ERA is planned for 2022–23 and costed as part of the budget etc]. This results to be recorded on the AFMA Web site.]*

# Attachment 2. Legislative and policy background to the ERM objectives

## Introduction

The requirement for the Commonwealth Government to ensure “ecological sustainability” of species populations which interact with Commonwealth fisheries is a common and consistent theme throughout the key legislation, policies and guidelines that define AFMA’s fisheries management objectives and processes/activities. In each of these the language used to describe that requirement varies, but nonetheless AFMA interprets these as expressing a consistent requirement[[20]](#footnote-21).

AFMA’s “species level” ecological sustainability objective under ERM ([Chapter 2.3](#Chapter_2_3)), has been developed to reflect that consistent theme. It recognises that species (commercial and general bycatch) which interact with Commonwealth fisheries, regardless of economic and other objectives that also influence their management, must as a minimum be maintained at biomass levels above that at which there is an unacceptable risk of recruitment impairment. This objective effectively defines AFMA’s interpretation of ecological “sustainability” for species populations.

Other objectives may result in management decisions that ensure that species populations are maintained at biomass levels significantly higher than that required by AFMA’s ERM objectives (e.g. the MEY objective of the HSP).

The following sections summarises how AFMA’s ecological sustainability objective is aligned with sustainability objectives and requirements associated with key legislation, policies, and guidelines.

## Commercial species

For commercial species, the requirement to ensure that species populations are maintained above a level at which recruitment impairment occurs, flows from the following key drivers:

* 2005 Ministerial Direction
* HSP and HSP Guidelines, and
* EPBC Act and its associated TSSC Guidelines and ESFM Guidelines.

The 2005 Ministerial Direction clearly states that AFMA will manage its fisheries to avoid overfishing and overfished stocks, including a requirement that fishing mortality rates are to be reduced if a population declines below BMSY or 40%B0, and fishing would cease if population levels reached 20%B0.

The HSP and HSP Guidelines (2018) define overfishing and overfished as follows:

* Overfished – A fish stock with a biomass below its biomass limit reference point or below its specified indicator limit reference point.

According to the HSP Guidelines, the limit reference point (LRP) that equates to overfished is the biomass level where the risk to the stock (in terms of recruitment impairment) is regarded as unacceptably high.

* Overfishing – A stock that is experiencing too much fishing. The rate of removals from a stock is likely to result in the stock becoming overfished. For a stock that is overfished, overfishing is a rate of removals that will prevent stock recovery in accordance with its rebuilding strategy.

To ensure clarity in the use of this Guide, AFMA restricts its terminology to “overfishing” and “overfished”, noting that under the above definition, overfished and recruitment overfishing are effectively analogous. Furthermore, AFMA interprets overfishing as occurring when the fishing mortality rate exceeds the limit fishing mortality rate (FLIM). This is a rate which, if not reduced, would result in the fishery eventually becoming overfished (biomass <BLIM).

The HSP and HSP Guidelines also require that all commercial fish stocks, including byproduct, are maintained above a biomass limit where the risk to the stock is regarded as unacceptable (BLIM), at least 90 per cent of the time. The HSP prescribes a proxy value for the LRP of 20% of the unfished spawning biomass (20%B0 or B20). The HSP also prescribes 20%B0 as a minimum level, with no LRPs to be designated below B20. Recognising the wide biological diversity of commercial species, the HSP provides for the designation of an LRP above 20%B0 where this has been estimated or is deemed appropriate (for example, for low productivity stocks or in acknowledgment of the role of a species in the ecosystem). The development of constant escapement strategies (for example to regularly adjust fishing mortality to maintain a constant stock size) may be considered for highly variable stocks, provided it can be demonstrated that these can deliver on the policy objectives.

For commercial species, AFMA must also have regard to requirements stemming from the EPBC Act in combination with the TSSC Guidelines (2015). The TSSC Guidelines state population size (in numbers of individuals) thresholds that trigger listing of species as Conservation Dependent or threatened. The population size thresholds are:

* Less than 50 per cent if the cause is reversible and ceased.
* 30 per cent if it’s uncertain whether causes are reversible, or have ceased, or this decline is projected/suspected to occur in future.

While these thresholds are significantly higher than the 20%B0 threshold of the HSP (and are only one set of multiple criteria for listing), the TSSC Guidelines have two important provisions relevant to commercial species:

Part F: Thresholds for assessing commercially harvested marine fish

*“The Committee is informed, but not bound, by a series of limit and target biological reference trigger points (commonly referred to as Blim and Btarg) provided in the [Commonwealth Harvest Strategy] policy for management intervention for species that decline below 60% of their pre-fishing biomass. These interventions include listing assessments.”*

Part C: Conservation dependent (section 197(6))

This section effectively states that if a fish species is managed under a legislated plan that provides for *“management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long-term survival in nature are maximised”* and where cessation of the plan *“would adversely affect the conservation status of the species”* then the species is listed as Conservation Dependent.

Part F allows for HSP settings to be used to assess (for listing) commercially harvested fish stocks (i.e. including commercial species). Part F and Part C combined infer that commercial fish species might become “conservation dependent” if they go below 20%B0, providing the TSSC applies settings of the HSP.

### General bycatch species

For bycatch species, the requirement to ensure that species populations are maintained above a level at which recruitment impairment occurs, flows from the following key drivers:

* BP and BP Guidelines, and
* EPBC Act and its associated TSSC Guidelines and ESFM Guidelines.

As for the HSP and HSP Guidelines (2018) overfishing and overfished is defined similarly in the BP and BP Guidelines.

Unlike the HSP and HSP Guidelines, the BP and BP Guidelines do not prescribe a proxy value for a biomass level where the risk to a stock (in terms of recruitment impairment) would be regarded as unacceptably high. However, the BP does prescribe that no general bycatch species should be exposed to any greater risk than that faced by a commercial species managed under the HSP (referred to as risk equivalency). General bycatch species are to be subject to an equivalent LRP as commercial stocks and general bycatch populations must be maintained above a limit where the risk of recruitment impairment is unacceptably high. Where evidence shows that a general bycatch population has fallen below that limit, the BP requires fishery managers respond in a way that facilitates recovery of that population to above the limit.

### EPBC Act-listed species

With regard to EPBC Act-listed species, the objective to avoid depleting populations to the point of recruitment impairment (or an analogous reduction in reproductive capacity) is consistent with requirements under the EPBC Act for gaining fishery accreditation, whereby:

* For listed threatened species, fisheries must not “adversely affect the survival or recovery in nature of the species”.
* For non-threated species they must not “adversely affect the conservation status of a listed migratory species or a population of that species”.

However, AFMA’s management of EPBC Act-listed species interactions under the EPBC Act requires that AFMA ensures its fisheries *“take all reasonable steps to ensure that [protected[[21]](#footnote-22)] species[[22]](#footnote-23) are not killed or injured as a result of the fishing”*.

This approach reflects the special status given to these species under the EPBC Act noting that the objectives of the EPBC Act go beyond ecological sustainability.

Thus, while the ERM objectives ensures a minimum biomass level is maintained to protect sustainability, the EPBC Act requirements can result in EPBC Act-listed species population sizes being managed to attain significantly higher levels than required by the ERM objectives alone.

It should be noted that for EPBC Act-listed species (\*not including any commercially harvested fish), the TSSC criteria and thresholds are intended to be directly applied when considering species for listing, and the “risk being managed” would seem to be effectively defined by the criteria thresholds for vulnerable listing. (e.g. avoid > 30% or > 50% depletion in population size in numbers, plus thresholds for the other four criteria). The TSSC thresholds are set at levels that signal population depletions that may indicate risks to the reproductive capacity of EPBC Act-listed species populations (and signal an initial risk of future extinction if depletion processes are not managed), and as such are not inconsistent with the intent of the ERM objectives.

### Conclusion

AFMA’s ERM was implemented to ensure that AFMA could meet legislative and policy requirements for achieving ecologically sustainable fisheries, which at a species level is achieved by ensuring populations stay above the point at which recruitment impairment is likely.

# Attachment 3. Secondary objectives that may be pursued under ERAEF

The following secondary (core) objectives may apply under ERAEF:

|  |  |
| --- | --- |
| **Component** | **Core Objective** |
| Key commercial species | Maintain key commercial stocks at ecologically sustainable levels  Avoid recruitment impairment of key commercial species  Avoid negative consequences for species or population sub‑components |
| Byproduct species | Avoid recruitment impairment of the byproduct species  Avoid negative consequences for species or population sub‑components |
| General bycatch species | Avoid recruitment impairment of the general bycatch species  Avoid negative consequences for bycatch species or population sub‑components |
| EPBC Act-listed species | Avoid recruitment impairment of EPBC Act-listed species  Avoid negative consequences for EPBC Act-listed species or population sub-components  Avoid negative impacts on EPBC Act-listed species or population sub‑components from fishing |
| Habitats | Avoid negative impacts on the quality of the environment  Avoid reduction in the amount and quality of habitat |
| Communities | Avoid negative impacts on the composition/ function/ distribution/ structure of the community |

# Attachment 4. ERAEF Methodology details

## Original design

In its original form, the ERAEF framework involves a hierarchical approach ([Figure 3](#Figure_3)) to assessing risk across each of the 5 ecological components. The original methodology is described in detail in two key documents, Hobday et al. (2007) and Hobday et al. (2011). Assessment occurs sequentially through the following phases:

* Scoping – This phase identifies the fishery context, species lists, ecological sustainability objectives, and hazards (fishery activities that may impact the ecosystem);
* Level 1 (SICA) – A comprehensive but qualitative analysis of risk in which the most vulnerable “unit”[[23]](#footnote-24) in each component (e.g. group of species) is assessed. This phase serves to exclude “low risk” components from analysis at Level 2, as if the most vulnerable species is low risk, so will all the less vulnerable species;
* Level 2 (PSA) – A species specific (or habitat/community specific) semi-quantitative approach which assesses fishery risks to each unit (e.g. species) carried forward from Level 1. Units assessed to be at high risk at Level 2 can either be managed directly or carried forward to Level 3 for fully quantitative assessment; and
* Level 3 – A unit-specific, quantitative “model-based” approach that accounts for spatial and temporal dynamics of units and fisheries and quantifies uncertainties around stock status.

This approach had several significant advantages over previous more ad-hoc approaches to managing for ecological sustainability, including:

* being comprehensive
* being consistent – it allows managers to provide a sound and consistent “best available evidence” based means to justify management responses for any given species (reducing the risk of perception or assumption driven decision making)
* being resource and cost efficient – any potential activities/hazards are screened out at Level 1, so that the more intensive and quantitative analyses at Level 2, and ultimately at Level 3, are limited to a subset of the higher risk activities associated with fishing
* identifying high-risk activities – which in turn can lead to immediate remedial action (risk management response) where it may be inappropriate to delay action pending further analysis, and
* being precautionary – in the sense that fishing activities are assumed to pose high risks in the absence of information, evidence, or logical argument to the contrary.

Following the development of the original ERAEF and the progression of species component ERA assessments to Level 2 across Commonwealth fisheries, two further developments occurred that improved the species-specific assessments of risk. The first was the development and application of RRA for the PSA, in recognition that the PSA methodology was unable to account for some management arrangements that mitigate risk. The second was the development of a more quantitative rapid risk assessment tool called ‘SAFE’, which ultimately was used in addition to PSA for some species groups and was often referred to as “Level 2.5”.

In the period since the initial development of the ERAEF, additional fisheries policies (e.g. HSP and BP) and other Guidelines (e.g. ESMF Guidelines (2007)) have been developed and/or implemented. The interaction between these and the ERAEF and ERM are explained further in [Chapter 2](#Chapter_2) and [Attachment 2](#Attachment_2).

## Application of ERAEF

The majority of AFMA’s fisheries underwent ERA to Level 2 by 2007 and subsequently RRA and in many cases further quantitative risk assessment via SAFE. As at the end of 2021, AFMA’s major fisheries have undergone or are undergoing re-assessment, with minor fisheries scheduled for re assessment in coming years.

Since completing development of the method described above, the ERAEF approach has been used and modified for specific purposes by a range of international groups (Hobday et al. 2011), including MSC, the International Commission for the Conservation of Atlantic Tunas working group on ecosystems, the Western and Central Pacific Fisheries Commission, the Caribbean Regional Fisheries Mechanism, the National Marine Fisheries Service (NMFS) in the US (Patrick et al. 2009, 2010), as well as in south east Asian fisheries (Leadbitter et al. 2013), in Atlantic tuna fisheries (Cortes et al. 2010, Arrizabalaga et al. 2011) amongst others (e.g. Gallagher et al. 2012, Micheli et al. 2014,). Some groups have chosen to use only some elements within the ERAEF, in particular the PSA approach (Patrick et al. 2009) and have further modified the selection of attributes and cut-offs for the particular situation.

## Reviews and recommendations for improving the ERAEF

Credibility of the science and analyses underpinning the ERAEF and ultimately the ecological risk management of fisheries is critical to general stakeholder acceptance, as well as to meeting the objectives of fisheries management. Methods need to be able to withstand stakeholder scrutiny and technical peer review. As such, the ERAEF should be subject to periodic review and a continual improvement process (Hobday et al. 2011).

AFMA undertook a review of its ERA/ERM approach in 2013/14, with the subsequent Australian Continuous Improvement Group report (2014) recommending several improvements to ERAEF. Subsequently, AFMA established an ERA TWG to assist in dealing with recommendations from that report, as well as improvements identified by CSIRO and AFMA.

AFMA also engaged CSIRO in 2014 to undertake technical work to address these issues and improve the ERAEF methodology. CSIRO submitted a draft report to AFMA in September 2014 outlining proposed revisions to the ERAEF. It recommended:

* a simplified risk assessment and management process
* refining the species list considered in the ERAEF assessment
* incorporation of current management arrangements in the ERAEF including accounting for residual risk in the Level 2 tools
* PSA updates and improvements including:
  + continuous scoring for availability attribute
  + careful screening of the list of species – reduce false positive species
  + evaluate the number and choice of the productivity attributes used – based on new data (e.g. consider using growth, R, etc.) plus other data revision as new information is available
  + refinement of the cut-off scores – calibration
  + differentiate data deficient species (missing > 2 attributes, and hence potentially a false positive) versus robustly assessed species (no missing attribute data)
* improvements to SAFE: default approach and enhancement, and
* online simulation testing of possible management responses.

The suite of proposed changes were designed to improve both the credibility and cost effectiveness of ERAEF and ensure that it is an adaptable approach going forward that can allow for consideration of new information, species, reference points, methods/tools or adaptation to new standards and policy developments.

In September 2015, AFMA engaged the ERA TWG to review recent research relevant to the ERAEF methodology and summarise the status of ERAEF methods, to inform the drafting of this Guide. The ERA TWG focused, on work relating to 7 key areas of improvement, being:

* more explicitly defining the risk being assessed and managed via ERM (now defined in [Chapter 2.2](#Chapter_2_2))
* a revised ERAEF methodology, focusing on Level 2 tools, but including clarification of interactions with Level 3 assessments already undertaken as part of harvest strategies ([Chapter 3.4.2](#Chapter_3_4_2))
* clarifying the explanation of PSA and SAFE methods, including limitations with respect to assessing the risk of fisheries being overfished ([Chapters 3.8](#Chapter_3_8), [3.9](#Chapter_3_9) and [3.10](#Chapter_3_10))
* development of a PSA “management axis” to help automate and standardise how residual risk is accounted for[[24]](#footnote-25)
* international approaches to assessing cumulative risk via PSA
* ERA re-assessment timeframes and triggers, and
* ERA roles and responsibilities under AFMA’s revised ERM ([Chapter 2.4.5](#Chapter_2_4_5)).

As part of the FRDC Project 2018–020 Cumulative Impacts Across Fisheries in Australia’s Marine Environment a comprehensive review of global approached to ERA were conducted. Outputs of that research with recommendation for improvement to AFMA ERA methodology were presented to the March 2022 meeting of the ERMSG. Key aspect under further investigation for future incorporating into the AFMA ERA methodology are options to incorporate cumulative risk across fisheries and taking account of climate change. As project to support this work develop the guide and process will be updated accordingly.

## Revised methodology

The overall three-tiered hierarchical structure (i.e. Levels 1, 2, 3) of the ERAEF is maintained under the revised methodology ([Figure 3](#Figure_3)). A relatively detailed description of each of these levels is provided below. In addition, the five general ecological ‘components’ that are intended to be evaluated are also maintained (i.e. key commercial species, byproduct/bycatch species, EPBC Act‑listed species, habitats, ecological communities). ERAEF will be undertaken at regular intervals, including monitoring reassessment triggers with assessors investigating at least the previous five years of fishery (and other relevant) data to best reflect the current management of each fishery. Some circumstances may permit investigation of fisheries data from greater than five years during ERAEF to also be considered.

## Key changes to ERAEF

In relation to species-specific risk assessments (the focus of this chapter), there are several important changes to processes within the tiered structure that should be noted, and which are reflected in [Figure 3](#Figure_3). These are as follows:

Scoping and Level 1

* Selection of ERA objectives – as stated in [Chapter 2.3](#Chapter_2_3), the primary objectives to be pursued for species assessed under ERA is:
  + to ensure that fishing (in Commonwealth commercial fisheries) does not reduce any commercial or bycatch species populations (that is, discrete biological units, commonly referred to as stocks in the BP and HSP) to or below a level at which the risk of recruitment impairment is unacceptably high
  + where such fishing impacts have occurred to rebuild species populations to above that level to the extent fisheries management is able to do so
  + to understand and inform strategies to minimise fishing-related impacts on general bycatch and EPBC Act-listed species by ensuring the exploitation of fisheries resources is consistent with the principles of ESD, and
  + to ensure broader habitat security for non-living ecological components.
* This is consistent with current legislation and fisheries policies and represents a change from when the ERAEF was first developed and there was less policy or legislation-based guidance on sustainability objectives. A range of secondary objectives remain available to stakeholders for selection where in some instances they may also be appropriate, and particularly provide guidance for assessing habitats and ecological communities (e.g. tables 5A-C in Hobday et al. 2007). These are contained in [Attachment 3](#Attachment_3).
* Re-assessments will look to cost-effectively review and update the previous scoping information, and utilise existing consultation forums and meetings (principally RAG, MAC, ERMSG and the Commission).
* Species list generation – with increased observer and EM coverage and improved ERA methodology, there is now scope to improve methods involved with the generation of species lists to enable improved time and resource efficiency, without sacrificing the precautionary nature of ERA. Within the scoping process, the use of species-accumulation-curves may now be used as a tool for developing the species list. As assessment of these curves will inform assessors and AFMA as to whether the species list is adequate, or if it is likely to be missing species. If it is deemed adequate, species lists will be compiled using only the species included in the curve. Where the curve is not considered to be mature, the species list must be based on all species with a range and depth overlap with the fishery.
* Expansion of generic species listings – traditionally, all generic species groups (e.g. albatross) have been expanded to all species within that group. However, this leads to the ballooning of the number of species that require assessment, many of which likely do not interact with the fishery. To improve this process, only those species that have a range and depth overlap with the fishery will now be included. Interactions recorded in logbooks at the species level will be included within the species list. Final lists are based on observer data (if available) and/or expert advice.
* Assigning of species to ecological components – it is important that species are assigned to the correct component. MACs and RAGs are responsible for providing advice as to how species are categorised.
* Species list for Level 1 (SICA) – once the scoping species list is developed, species which already have re-occurring Level 3 Quantitative assessments (e.g. in association with harvest strategies, rebuilding strategies or other management processes) are not evaluated further as there is another assessment available for them. Species with Level 3 assessments or equivalent (including conservation dependent species with such assessments) should not be included in Level 1 or Level 2 analyses. There may be some cases where a harvest strategy-based assessment is not available, but the RAG considers other available and recent assessments/indicators for a particular species to provide a more robust assessment of risk than Level 2 ERA assessment tools.
* Level 1 bypass mechanism – a mechanism whereby fishery RAGs can request to bypass Level 1 for species components ONLY, and directly undertake Level 2 has been developed by CSIRO. This will reduce costs and improve the efficiency of the ERA process without compromising outcomes for fisheries that are likely to be assessed as ‘at-risk’ as a result of Level 1. This option has been developed for any fishery that is likely to always require assessment of species at Level 2 given the level of interaction with certain species and the precautionary nature of SICA.
* An automated Level 1 assessment has also been developed by CSIRO, that can assess a particular ecological component of interest and/or applicability. This modular flexible approach enables a Level 1 assessment of one or more ecological component(s) to be undertaken.

Level 2

* This includes both PSA and SAFE methods (noting the latter has been previously described as Level 2.5 or 3), with the preferred assessment tool being bSAFE (base SAFE, rather than eSAFE, enhanced SAFE). SAFE is considered more robust due to its use of explicit reference points and a continuous scale for attributes (greater sensitivity relative to PSA) and greater utility for assessing management responses (Smith et al. 2014).
* PSA should be applied for species with insufficient data (e.g. distributional data) or having biological characteristics (e.g. colonial breeders) that are not suitable for assessment by bSAFE (CSIRO 2015). Typically this has been the case for EPBC Act-listed species (especially mammals, reptiles, and seabirds) and invertebrates.
* It should be noted that PSA and SAFE are only two of a spectrum of tools that might appropriately be used at Level 2 and at this level a merger with the tier structure of harvest strategies or the addition of any equivalent other tool might be possible in future.
* It is recommended that species assessed to be at high risk via bSAFE analyses should then be assessed via eSAFE, providing AFMA does not wish to take management action based on bSAFE alone or the required data is not available.
* SAFE has been further developed to be able to account for cumulative risk across multiple fisheries.
* Residual Risk Guidelines have been revised to reflect updates to the ERA methodology and a review of the original Guidelines.
* Residual Risk Guidelines will be applied to species assessed as high risk via PSA and species assessed as high/medium risk via SAFE due to the increased possibility of false negatives via the SAFE method.

## Moving between ERAEF Levels

The rationale that needs to be applied when determining whether to progress species between levels of the ERAEF (Hobday et al. 2011) remains essentially the same in the revised process. Such decisions depend on:

* estimated risk at the current level (i.e. low risk species will not be assessed at the next level)
* risk-catch-cost principles – is the cost of assessing at the next level greater than the cost of managing directly (with appropriate precaution) at the current level
* whether the “high risk” estimate may be due to a lack of data
* availability of data to proceed to the next level (e.g. data collection may be required first, or may not be cost justified, and management action might be taken without higher level assessment), and
* management response to risks identified at the current level. For example, if the risk is high but immediate changes to management regulations or fishing practices will reduce the risk (without unacceptable economic impacts on industry), then analysis at the next level may be unnecessary.

## Precautionary elements

The ERAEF approach has several features that result in a precautionary or conservative approach to identifying and ranking ecological risk. Principal among these is assuming potential high risk in the absence of data or information to the contrary. This feature provides an incentive to collect data to support future assessments. In general, the precautionary approach will result in more false positives (units identified at higher risk than would occur when assessed at a higher level with more data) than false negatives (units scored at a lower risk than would occur when assessed at a higher level with more data). This bias is important, as false positive results can be screened out at higher levels in the ERAEF hierarchy, while false negatives result in improper elimination of a hazard or unit, with no further opportunity to consider it at later stages in the ERAEF. While no error would be preferable, the uncertainty associated with the qualitative and semi-quantitative risk assessments at Levels 1 and 2 argues in favour of maintaining a bias against false negative results (Hobday et al. 2011). Although this may reduce the efficiency of this process in some instances, it increases the likelihood of ERAEF identifying all components that are at risk which is its most important function.

## ERAEF performance criteria

It is intended that the revised ERAEF meet, to the greatest extent possible (recognising there are trade-offs between some factors below), the following criteria (Hobday et al. 2011):

* comprehensive (identify and analyse all potential hazards)
* flexible (applicable to all types of fishery, irrespective of size, fishing method, species)
* understandable (easy for stakeholders to grasp) and clearly articulated/communicated. This includes clarifying its role/interaction with other processes, such as harvest and bycatch strategies
* transparent and repeatable (be clear about the methods, data and assumptions used in the analyses)
* cost effective (make use of existing knowledge, information, and data within realistic limits of time and resources)
* scientifically defensible (be able to withstand independent scientific peer review)
* useful for management (inform appropriate risk management responses)
* take a precautionary approach to uncertainty, and
* where possible ensure risk equivalency across tools and levels.

A key to success of the new framework and methods will be greater acceptance and transparency for stakeholders. This will be facilitated by improved credibility of the methods and assessments themselves, as well as by having a more cost and time-efficient process (Smith et al. 2014).

## Key processes in the ERAEF

Full details of the ERAEF methods, including a step-by-step user guide, are in Hobday et al. (2007) and the CSIRO technical summary and these should be referred to when undertaking a fishery re assessment, but in conjunction with the changes to that process highlighted in this chapter.

The following overview is presented here to highlight the key principles, features and most importantly, changes to the processes initially described in Hobday et al. (2007). The following sections provide an overview of the five key phases/processes of the ERAEF:

* Stakeholder consultation.
* Scoping.
* Level 1 SICA (qualitative risk assessment).
* Level 2 (semi-quantitative and quantitative methods).
* Level 3 (fully quantitative methods).

## Stakeholder consultation

Participation of stakeholders is an important feature of ERAEF and is particularly important in the more qualitative levels of the hierarchy (Scoping and Level 1). Stakeholders are defined as those people who have a direct interest in a fishery, and can include commercial fishers, managers, recreational fishers, Indigenous fishers, conservation focused non-government organisations, fishery scientists, and experts in particular taxa (Hobday et al. 2011).

Stakeholder participation in the process not only improves the assessments, but also increases the chance of uptake of results and helps in identifying suitable management responses. In many fisheries in Australia, a wide range of stakeholders are already involved in the management process. Without a good representation of stakeholders, issues may not be correctly identified or evaluated, particularly at Level 1 in the ERAEF. Most often, stakeholders are engaged through face-to-face meetings, usually after initial draft documents have been prepared (Hobday et al. 2011). A record of stakeholder involvement is kept as part of the ERAEF process, via a proforma: *Summary Document SD1. Summary of stakeholder involvement for fishery* (Hobday et al. 2007).

## Scoping

Scoping involves six key steps. The following is a brief overview of these steps, relevant to a fishery being assessed for the first time. It should be noted that for fisheries being re-assessed, Scoping may comprise a more simplified updating of previously compiled information. These steps are described in more detail in Hobday et al. (2007) and the CSIRO technical summary.

Step 1 – Characterisation of the fishery

This step involves the development of a general fishery characteristics document which provides a reference for discussions and clarification of analysis for Levels 1 and 2 at stakeholder meetings. The information used to complete this step may come from a large range of management and research documents relevant to the fishery being assessed. The information obtained is used to complete a fishery characterisation proforma: *Scoping Document S1 General Fishery Characteristics* (Hobday et al. 2007) and also on the following CSIRO [https://research.csiro.au/cor/fisheries-domestic/ecological-risk-assessment/](https://aus01.safelinks.protection.outlook.com/?url=https%3A%2F%2Fresearch.csiro.au%2Fcor%2Ffisheries-domestic%2Fecological-risk-assessment%2F&data=05%7C01%7CRyan.Murphy%40afma.gov.au%7C75ed6459cc484560168008da70618799%7Cd176b5937d9c41eda769f0f622e3b073%7C1%7C0%7C637945861452324992%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=smt27h7DaJN1mOyEnRnx8ZUmkMmWht2R0Lduk9kTciY%3D&reserved=0)

Step 2 – Listing of units of analysis (e.g. species, habitats or community assemblages)

A revised process for developing species lists for assessment has been developed. With increased observer (and electronic monitoring) coverage and a revised ERAEF methodology, there is scope to improve the efficiency of this process. A step-by-step process will now be applied when developing species lists as follows:

* AFMA to provide initial species list to assessor, including all observer, logbook, electronic monitoring, and any other relevant data from the entire time series for the fishery
* remove any mis-identified species that do not have a spatial or depth overlap with the fishery
* undertake statistical Species Accumulation Curve to inform decision on whether or not existing sampling levels have provided an adequate species list. i.e. it contains all/most species likely interacting with the fishery. Fishery managers should consider issues such as the level of observer coverage, percentage of total species expected and how many species would be expected in the next year to make a judgement on the “maturity” of the curve:
  + If the curve is considered to be “mature”, it forms the species list.
  + If the curve is not “mature” the species list includes all species that have a spatial and depth overlap with the fishery.
* all species inclusions and exclusions must be fully justified in the ERA report
* expand generic species listings (e.g. albatross): Where interactions are recorded in logbooks to the species level, these species are to be included in the list. Final lists are based on observer data (if available) and/or expert advice, and
* the final list will be presented to RAG/AFMA/expert groups for review and endorsement. Ideally, this information is provided before the assessment is undertaken, to increase efficiencies in this process.

Species Accumulation Curve plots show the rate of accumulation of new species observed within a fishery over time ([Figure 5](#Figure_5)). If this curve plateaus, then the occurrence of new species in the fishery is rare, and therefore, all species that are likely to interact with the fishery have been recorded, assuming no major changes in the fishery (e.g. spatial effort, gear). If this plot has not plateaued, and the number of new species being recorded is still occurring on a common basis, then species recorded in the period chosen for re-assessment may not sufficiently represent all those that are interacting with the fishery. If this is the case, species not recorded should also be considered for assessment.

Although this revised technique may be considered less precautionary, it is also important to note that any new species observed in intervening years will be immediately assessed using the new Level 2 online PSA/SAFE tool during annual reporting and review of fisheries. Therefore, the likelihood of a species that is interacting with the fishery significantly remaining unassessed is very low, maintaining the precautionary nature of ERAEF.

The set of habitats is based on geo-morphology (Williams et al. 2011) and more recently on habitat assemblages (Pitcher et al., 2016, 2018). Substratum and faunistic characters and the community units are either qualitative or model-based food-web descriptions. These are recorded via Scoping Documents S2A, S2B and S2C (Hobday et al. 2007). Development of improved habitat and community data is an ongoing priority.

Graphical user interface, chart, scatter chart

Description automatically generated

Figure 4: A comparison of Species Accumulation Curves for two AFMA fisheries. A) Small Pelagic Fishery and B) Heard and Macquarie Island Fishery. The rate of species accumulation in the HIMI is much lower due to 100% observer coverage and the longevity of the fishery. In contrast, the SPF, a relatively new fishery, is still interacting with new species commonly despite 100% observer coverage. Therefore, species not observed in the SPF should be considered for assessment, whereas the HIMI seems to have adequate observer coverage with just six new species observed throughout the last two thirds of sampled trips.

Step 3 – Identification of objectives for components and sub-components

Management objectives need to be identified for each component (core objectives) and sub‑component (operational objectives), with the latter expressed as limits to acceptable change (what is “acceptable” needs to be defined in each case). Core objectives (also called endpoints) identify what you are trying to achieve. Operational objectives (or measurement endpoints) are objectives stated in ways that can be measured. It is important to identify objectives that managers, the fishing industry, and other stakeholders can agree on, and that scientists can quantify and assess. The identified objectives are used as part of the Level 1 SICA analysis. For species, it is important that the objectives chosen are consistent with those in fisheries policies, guidelines, and this Guide. The key species level risk being managed for under the ERM objective is avoiding recruitment impairment ([Chapter 2.3](#Chapter_2_3)). Other optional objectives are contained in [Attachment 3](#Attachment_3). These may be used where applicable and measurable.

Step 4 – Hazard identification

The set of activities is selected from a comprehensive checklist. Formally, these activities are known as hazards (Burgman 2005). In ERAEF, hazards are the activities undertaken in the process of fishing, together with any external activities, which have the potential to adversely impact on ecological components (i.e. species, habitats, communities). The fishery-specific hazards are divided into the following categories based on the major effect of the activity.

* Capture/removal.
* Direct impact without capture.
* Addition/movement of biological material.
* Addition of non-biological material.
* Disturbance of physical processes.
* External hazards.

These categories are then subdivided into fishing activities (of the fishery being evaluated) and external activities (including other fisheries) (Hobday et al., 2007). These fishing and external activities are scored on a presence/absence basis for each fishery. Only those activities that are scored as present in a fishery are then carried forward for analysis in subsequent levels.

Step 5 – Bibliography

All references are to be included in the ERA Results Report bibliography.

Step 6 – Decision rules to move to Level 1

Any hazards that are identified at “Step 4 Hazard Identification” as occurring in the fishery are carried forward for analysis at Level 1 (Hobday et al. 2007).

## Level 1 – Scale Intensity Consequence Analysis (qualitative risk assessment)

Scale Intensity Consequence Analysis (SICA) uses an exposure-effects risk assessment approach that is only applied to the “most vulnerable” unit (i.e. species) of an ecological component. This makes SICA an efficient screening process of low-risk components as those deemed to be low risk are rejected at Level 1. It scores each fishing activity (hazard) for impact against a core objective. The scale and intensity of the activity are each scored (≈exposure), and then the consequence score (≈effect) is selected from a component-specific set of scoring Guidelines (Hobday et al. 2007). These scoring tables, adapted from Fletcher et al. (2002), reflect a range of impact levels from negligible (score 1) to extreme (score 6). Scores of 3 or higher within a component result in that component being examined at Level 2.

The scale and intensity scoring reflects potential changes in the catch/removal term of the logistic model (q and E) due to the hazard, while the consequence scoring reflects the effect the hazard will have on the intrinsic rate of increase (R). For example, a high intensity score would indicate that “removal” is highly likely, while a high consequence score indicates that the rate of increase or carrying capacity would be greatly reduced by this activity. The effort term (E) is approximated by the spatial and temporal scale of the activity, which is an important consideration in evaluating the risk for particular activities.

SICA relies on expert judgement and stakeholder input. Stakeholders provide feedback on three key components of SICA initially compiled by the assessor. Stakeholders and experts provide input during selection of the “most vulnerable” unit of an ecological component for subsequent assessment. Once agreed upon, assessors will undertake the analysis. Draft results are then presented to stakeholders to provide input on scale and intensity scores and overall risk rankings. Lastly, stakeholders provide input detailing appropriate rationale of overall risk scores which is important for the broader public uptake of results and to increase transparency.

### Uncertainty and precautionary elements

SICA employs a “plausible worst case” approach to evaluation of risk, rather than considering all possible interactions. In assigning a consequence score for each activity/component combination, the highest-scoring (worst case) plausible scenario is selected. For example, in scoring the direct impact of fishing on the bycatch component, the stakeholders would consider the relative vulnerability to the gear among the bycatch species and select the most vulnerable species based on the combination of exposure to the gear and potential rate of recovery of the species to impact. The highest score consistent with a plausible scenario is reported. If the plausible worst-case scenario is not assessed to be at significant risk, then all other hazards will be at even lower risk. This leads to considerable efficiency in screening out low risks. The level of consequence that is deemed “significant” can also be selected with precaution in mind. In Australian applications to date, any consequence level above “minor” (score of 2) either elicits a management response or is analysed further at a higher level in the hierarchy.

Inclusion of current management arrangements can be incorporated into SICA because these are based on expert judgement that can include knowledge of such arrangements (Smith et al. 2014).

### Issues to be aware of

* For fisheries that have significant bycatch components and are likely to require assessment at Level 2, a mechanism has now been developed whereby stakeholders/AFMA can decide to bypass Level 1 for species components only (habitats and communities still assessed at Level 1) and be directly assessed at Level 2. This will reduce costs and improve the efficiency of the ERA process without compromising outcomes for fisheries that are likely to be assessed as ‘at-risk’ because of Level 1. This may also aid fisheries in attaining external sustainability certification (e.g. MSC);
* An automated Level 1 assessment has also been developed by CSIRO, that can assess a particular ecological component of interest and/or applicability. This modular flexible approach enables a Level 1 assessment of one or more ecological component(s) to be undertaken. There is a possibility that results of a Level 2 could lead to false-positive risks, particularly for data-limited fisheries/sub-fisheries, should a Level 1 assessment be bypassed.
* Where an external hazard (e.g. coastal development) is considered to be a high risk activity at Level 1, it must be appropriately handled. Because this is an external hazard and not within the jurisdiction of AFMA, this will not move to Level 2 and a management response will likely be ineffective. Therefore, it is the responsibility of AFMA fishery managers to make the relevant authority (e.g. Department of Agriculture, Water and the Environment) is aware of such risks.

## Level 2 (semi-quantitative and lower tier quantitative methods)

When the risk of an activity at Level 1 (SICA) on a species component is moderate or higher and no planned management interventions that would remove this risk are identified, an assessment is required at Level 2 (to determine if the risk is real and provide further information on the risk). The tools used to assess risk at Level 2 allow units (e.g. all individual species) within any of the ecological species components (e.g. commercial, bycatch, and EPBC Act-listed species) to be effectively and comprehensively screened for risk. The units of analysis are identified at the scoping stage. To date, Level 2 tools have been designed to measure risk from direct impacts of fishing only (i.e. risk of overfishing, leading to an overfished fishery), which in all assessments to date has been the hazard with the greatest risks identified at Level 1[[25]](#footnote-26).

### Changes to Level 2 since the original ERAEF

In the period since ERAEF was initially implemented across Commonwealth fisheries, much of the management focus has been on the assessment results associated with Level 2 and 3 risk assessment methods, which comprise semi-quantitative or rapid simple quantitative methods (e.g. PSA and SAFE). This level has been subject to the greatest level of change and improvement, and these are discussed in the following sections. Additional improvements are being developed for implementation in the near future ([Chapter 3.13](#Chapter_3_13)).

Level 2 was originally designed to rely on a single risk assessment methodology, the Productivity Susceptibility Analysis (PSA) ([Chapter 3.9](#Chapter_3_9)), however a more quantitative method called the Sustainability Assessment for Fishing Effects (SAFE) ([Chapter 3.10](#Chapter_3_10)) was developed early in the implementation of the ERAEF and is now the preferred Level 2 methodology. SAFE has been developed in two forms, base SAFE (bSAFE) and enhanced SAFE (eSAFE). eSAFE has greater data and resourcing (time/money) requirements than bSAFE but can more appropriately model spatial availability aspects when sufficient data are available.

Under the revised ERAEF:

* bSAFE has now been re-classified as the preferred Level 2 method (over PSA) where sufficient spatial and biological data (to support bSAFE) are available. Typically, this has been used for teleost and chondrichthyan species
* species estimated to be at high risk under bSAFE may then be assessed under eSAFE which may provide reduced estimates of uncertainty pertaining to the actual risk
* where either the data or species biological characteristics are insufficient to support bSAFE analyses, it is recommended that PSA be applied instead. This will be the case for many EPBC Act-listed species, invertebrate bycatch species and some other species
* at Level 2, either PSA or SAFE methods should be applied to any given species, not both
* for high risk species it is a management choice whether to progress to eSAFE, pursue a Level 3 fully quantitative stock assessment, or to take more immediate management action to reduce the risk. The types of considerations required in making that choice (i.e. moving up the ERAEF assessment hierarchy or taking direct management action) are outlined in [Chapter 2.7.2](#Chapter_2_7_2)
* RRA will be undertaken for high-risk species for both SAFE and PSA, with some medium risk species also considered under SAFE, where applicable, due to the increased possibility of false negatives
* it is also recognised that several additional tools, including some of the “data poor” assessment tools that are used to inform harvest strategies, could potentially be included within the Level 2 toolkit, and
* they are distinguished from Level 3 quantitative tools (i.e. stock assessment models) that are more data rich and able to more precisely quantify the uncertainty.

### Productivity-Susceptibility Analyses (PSA)

The PSA approach used under the ERAEF follows on from an approach developed by Stobutzki et al. (2002) and is based on the assumption that the risk to a unit (e.g. species, habitat or community) will depend on two characteristics of that unit:

* The extent of the impact due to the fishing activity, which will be determined by the susceptibility of the unit to the fishing activities (Susceptibility);
* The productivity of the unit (Productivity), which will determine the rate at which the unit can recover after potential depletion or damage by fishing.

It is important to note that the PSA essentially measures relative potential risk of overfishing (hereafter noted as risk) and does not provide a measure of absolute risk, which requires some direct measure of abundance or mortality rate for the unit (i.e. species) in question. The PSA approach examines attributes of each unit that contribute to or reflect its productivity or susceptibility to provide a relative measure of risk to the unit. Full details of the methods are described in Hobday et al. (2007).

PSA is designed to be precautionary in how it assigns risk (Hobday et al. 2011), because:

* attributes default to high-risk values if there is missing information
* independently verified information can be used to modify scores
* some assumptions are precautionary e.g. assuming that the spatial extent of stocks doesn’t extend outside a fishery when estimating spatial overlaps.

Thus, PSA is designed to be more likely to produce “false positive” results (classify species as high risk when they are not) than false negative results (classify species as low risk when they are high risk). The RRA process was put in place largely to reduce the number of false positive results but could be used to assess false negatives in future.

The PSA process involves nine key steps. The following is a brief overview of these steps.

Step 1

Identify the units excluded from analysis and document the reason for exclusion (Hobday et al. 2007)

Step 2 – Score units for productivity

The level of fishing impact a unit (e.g. species population) can sustain will depend on its inherent productivity. Productivity determines how rapidly a species can recover from depletion or impact due to fishing. The productivity of a unit such as a species or population is determined by species attributes such as longevity, growth rate, fecundity, recruitment, and natural mortality. The attributes used to score productivity for the three species components (i.e. commercial, bycatch, EPBC Act‑listed species) are described in [Table 5](#Table_5). A recent improvement has been, with more data available, some of the previously neglected indicators (e.g. growth) may be used, as may the direct measure of recruitment (R). There has also been a refinement of the cut-off scores ([Table 5](#Table_5)) to decrease the frequency of false positives and false negatives. While units have inherent productivity, fishing can also affect productivity of the unit depending on the size of reduction in the unit and the life stage of a species taken by a fishery (Hobday et al. 2011).

Table 5: Productivity cut off scores for species attributes for the ERAEF Level 2 PSA method. These cut offs have been determined from analysis of the distribution of attribute values for species in the ERAEF database and are intended to divide the attribute values into low, medium, and high productivity categories.

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute** | **Low productivity**  **(high risk, score = 3)** | **Medium productivity**  **(medium risk, score = 2)** | **High productivity**  **(Low risk, score = 1)** |
| Average age at maturity | > 15 years | 5–15 years | < 5 years |
| Average maximum age | > 25 years | 10–25 years | < 10 years |
| Fecundity | < 100 eggs per year | 100–20,000 eggs per year | > 20,000 eggs per year |
| Average maximum size | > 300 cm | 100–300 cm | < 100 cm |
| Average size at maturity | > 200 cm | 40–200 cm | < 40 cm |
| Reproductive strategy | Live bearer  (and birds) | Demersal egg layer | Broadcast spawner |
| Trophic level | > 3.25 | 2.75–3.25 | < 2.75 |

Step 3 – Score units for susceptibility

The level of fishing impact that a unit can sustain depends on its susceptibility to capture or damage by fishery activities. Following Walker et al. (2005), susceptibility is estimated as the product of the following four independent aspects:

* Availability – considers overlap of the fishing effort with a species distribution. Where a fishery overlaps a large proportion of a species range the risk is high because the species has no refuge, and the potential for impact is high. A recent improvement has been continuous scoring for the availability attribute which will allow more continuous measurement of on-water changes.
* Encounterability – considers the likelihood that a species will encounter fishing gear that is deployed within the geographic range of that species. The main component of encounterability considered for each species is its adult habitat. This habitat is also checked to determine if it lies within a bathymetric zone where fishing is permitted.
* Selectivity – for species that encounter fishing gear, selectivity considers the potential of gear to capture or retain the species.
* Post Capture Mortality – evaluates the case that, if captured, a species would be released in a condition that would permit subsequent survival.

The cut-off scores associated with each of these attributes are presented in [Table 6](#Table_6). These have been recently refined to decrease the frequency of false positives and false negatives. A multiplicative approach is considered more appropriate for susceptibility because low risk for any single aspect acts to reduce the overall risk to a low value.

The treatment of these aspects has been tailored to utilize original datasets (e.g. FishBase), and incorporate additional information, such as outputs from the BIOREG Project (Lyne et al., 2005), and additional distributional information compiled specifically for EPBC Act-listed species that represents an improvement over previous datasets.

Table 6: Susceptibility cut off scores for species attributes for the ERAEF Level 2 PSA method. These example cut offs have been determined from analysis of the distribution of attribute values for species in the ERAEF database and are intended to divide the attribute values into low, medium, and high susceptibility categories. A choice of attributes exists for some susceptibility aspects, such as availability; where data are available, Availability 1 is preferred over Availability 2, while for Encounterability, the maximum score of the two attribute choices (Encounterability 1 and Encounterability 2) is used. More specific detail is provided in the PSA spreadsheets.

|  |  |  |  |
| --- | --- | --- | --- |
| **Attribute** | **Low susceptibility**  **(low risk, score=1)** | **Medium susceptibility**  **(medium risk, score=2)** | **High susceptibility**  **(High risk, score=3)** |
| Availability 1. Overlap of species range with fishery | <10% overlap | 10–30% overlap | >30% overlap |
| Availability 2. Global distribution. Also need to consider stock proxies | Globally distributed | Restricted to same hemisphere/ocean basin as fishery | Restricted to same country as fishery |
| Encounterability 1 –Habitat (scores vary by fishery) | Low overlap with fishing gear | Medium overlap with fishing gear | High overlap with fishing gear |
| Encounterability 2 – Depth check (scores vary by fishery) | Low overlap with fishing gear | Medium overlap with fishing gear | High overlap with fishing gear |
| Selectivity (scores vary by gear type, this example is for set gillnets) | Species < mesh size, or >5 m in length | Species 1–2 times mesh size, 4–5 m in length | Species >2 times mesh size, to say, 4 m in length |
| Post-capture mortality (scores vary by fishery) | Evidence of post-capture release and survival | Released alive | Retained species, or majority dead when released |

Step 4 – Plot individual units of analysis onto a PSA Plot

The productivity and susceptibility attributes in Steps 2 and 3 are scored as 1 (low), 2 (medium) or 3 (high). Missing attributes are scored as a 3. The average productivity and multiplied susceptibility scores for each unit of analysis (e.g. for each species) are then displayed on a PSA plot ([Figure 6](#Figure_6)). The relative position of the units on the plot will determine relative risk at the unit level as per the PSA plot. An overall risk score is the Euclidean distance from the origin, which allows a single risk ranking (Hobday et al. 2007, 2011).

* Units that fall in the upper third of the PSA plots are deemed to be at high risk.
* Units with a PSA score in the middle are at medium risk.
* Units in the lower third are at low risk regarding the productivity and susceptibility attributes.

Chart

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Figure 5: Example PSA plot showing the paired productivity/susceptibility scores for example species, relative to the low, medium and high-risk areas of the plot.

The divisions between these risk categories are based on dividing the area of the PSA plots into equal thirds. If all productivity and susceptibility scores (scale 1–3) are assumed to be equally likely, then 1/3rd of the Euclidean overall risk values will be greater than 3.18 (high risk), 1/3rd will be between 3.18 and 2.64 (medium risk), and 1/3rd will be lower than 2.64 (low risk). It is important to note that these risk values are mostly determined by “intrinsic” properties of the species (productivity), and while the relative fishery interactions are measured through the susceptibility attributes, assessment of the actual impact of the fishery on the species is not made. None of these risk thresholds relate directly to actual population status reference points.

Step 5 – Uncertainty ranking of overall risk to each unit

The uncertainty is due to missing attributes, which is partly handled by the division into data deficient and robust categories.

Step 6 – RRA

Due to the semi-quantitative nature of a Level 2 PSA assessment, there is a number of limitations. In particular, certain management arrangements which mitigate the risks posed by a fishery, as well as additional information concerning levels of direct mortality, may not be easily taken into account in the assessments. Further, the number of interactions recorded for each unit is purposefully not included within PSA due to historical issues of low observer coverage and how to define risk based on interaction numbers given the large variation in population abundance for different species.

RRA is used to consider additional information, particularly the mitigating effects of management arrangements that were not explicitly included in the attributes. RRA also considers factors such as the number of interactions recorded by observers/logbook data and whether new or missing data is available that may influence a species risk status. RRA is undertaken for species assessed as high risk under PSA due to its bias towards false positives. However, in theory RRA could also be used to determine if some species have been incorrectly classified as low/medium risk.

The Residual Risk Assessment is conducted by applying the following guidelines. At the moment, the guidelines are applied to species and are not applicable to habitats and communities. They are:

* Guideline 1. Risk rating due to missing, incorrect or out of date information
* Guideline 2. At risk due to external factors (cumulative risks)
* Guideline 3. At risk in regards to level of interaction/capture with a zero or negligible level of susceptibility
* Guideline 4. Effort and catch management arrangements for key and secondary commercial and byproduct species
* Guideline 5. Management arrangements to mitigate against the level of bycatch, and
* Guideline 6. Management arrangements relating to seasonal, spatial and depth closures.

The residual risk guidelines are not seen as a definitive guide on the determination of residual risk, and it is expected that in a small number of cases, the guidelines may not apply. Care must also be taken when applying the guidelines to ensure residual risk results are appropriate in a practical sense. There are several conditions which underpin the guidelines and should be understood before the Guidelines are applied:

* All assessments and management measures used within the RRA must be implemented prior to the assessment with sufficient data to demonstrate the effect. Any planned or proposed measures can be referred to in the assessment but cannot be used to revise the risk score.
* When applied, the Guidelines generally result in changes to particular "attribute" scores for a particular species. Only after all Guidelines have been applied to a particular species, should the overall risk category be re-calculated. This will ensure consistency, as well as facilitating the application of multiple Guidelines.
* Unless there is clear and substantiated information to support applying an individual guideline, then the attribute and residual risk score should remain unchanged. All supporting information considered in applying these Guidelines must be clearly documented and referenced where applicable. This is consistent with the precautionary approach applied in ERAs, with residual risk remaining high unless there is evidence to the contrary ensuring a transparent process is applied.
* The results (including supporting information and justifications) from RRA must be documented in “Residual Risk Reports” for each fishery (or can be integrated into the Level 2 risk assessment report). These will be publicly available documents.

Step 7 – Evaluation of reasons for “high” risk rankings

Following the Level 2 PSA and RRA, the high and medium risk species can be divided into five categories that highlight potential reasons for the higher risk scores. These categories should also help identify any remaining areas of uncertainty and assist decisions regarding possible management responses for these species. The categories are independent, and species are allocated to each category in the order the categories are presented below:

* Category 1: Missing attributes data.
* Category 2: Spatial overlap (widely distributed or low overlap).
* Category 3: Very low (susceptibility) attribute score outweighed by low productivity.
* Category 4: Spatial uncertainty (unreliable distributional data).
* Category 5 Other: risk score not affected by 1–4 considered above.

Step 8 – Evaluation of the PSA analysis after RRA

This involves the summarisation and reporting of PSA results to stakeholders via a template report format specified in Hobday et al. (2007).

Step 9 – Management response to risk assessments

Following RRA (or in future, the application of a PSA with management axis) those species identified as potentially being at high risk are expected to be the focus of further work, either through:

* Implementing a management response to address the risk to the vulnerable species
* Collection of missing attribute information and re-assessment at Level 2 (for species where high-risk ranking may be due to missing attribute data), and
* Further examination for risk within the particular ecological component at Level 3.

Units at low risk will be deemed not at risk from the sub-fishery and the assessment is concluded for these units. Units at medium risk may not be a focus of initial management attention but may receive attention where resources allow and high-risk units have been addressed to the extent possible.

The ERM processes in [Chapter 2](#Chapter_2) outline how AFMA intends to ensure all fisheries follow a consistent process in reporting on and responding to the results of ERA.

### Issues to be aware of

PSA provides a measure of relative potential risk, rather than absolute risk. It helps fishery managers to understand which species, amongst a group of species caught in a fishery, is at a relatively higher potential risk of overfishing. In situations where the fishery has not been overfished in the past (or currently) it may also provide an indication of the relative potential risk of the population becoming overfished in future (assuming constant values for susceptibility and or productivity attributes).

However, the methodology as it currently stands has several limitations:

* Unlike Level 3 stock assessments, PSA cannot quantify the probability that overfishing is occurring.
* PSA cannot estimate any measure of biomass, nor can it indicate either the relative or absolute risk of a fish stock being overfished;
* Furthermore, where an overfished fishery has occurred and is still current, it may be that the relationship between “susceptibility” and risk (of overfishing) is also modified. This point requires further exploration ([Chapter 3.13](#Chapter_3_13)).
* PSA is designed to be biased towards false positive results (i.e. it’s precautionary) and in addition, is unable to take account of some management measures, such as catch or effort restrictions, which might lower the inherent susceptibility of a given species. It is for this reason that an additional process, RRA, was developed.
* RRA has also been subject to criticism that it may be prone to inconsistent application. Subsequently, CSIRO is investigating the possible development of a more automated approach to dealing with residual risk.
* It should be noted that PSA is now used on a much smaller subset of species (EPBC Act-listed species and invertebrates mainly) than occurred when the ERAEF was developed.
* PSA is not currently configured to allow for the assessment of cumulative risk across multiple fisheries ([Chapter 3.13](#Chapter_3_13)).

AFMA and CSIRO will need to give consideration to the development of Level 2 methods that might be able to indicate the relative risk of a species population or stock having been or already being in an overfished state (e.g. investigating a retrospective PSA that takes into account historical shifts in fishing distribution, selectivity and availability).

Finally, if consistency and clear links to reference points used in assessments are a priority, quantitative reference point methods (such as SAFE) may need to be developed for species currently required to be assessed by PSA (e.g. marine mammals, seabirds, and remaining invertebrates), including estimated fishing impact and reference points.

### Sustainability Analysis for Fishing Effects (SAFE)

SAFE has been developed in two forms, base SAFE (bSAFE) and an enhanced SAFE (eSAFE). eSAFE has greater data and resourcing (time/$) requirements and is recommended to only be used to assess species estimated to be at high risk via bSAFE.

### bSAFE

Relative to the PSA approach, the bSAFE approach (Zhou and Griffiths, 2008; Zhou et al. 2011) is:

* a more quantitative approach (analogous to stock assessment) that is able to provide an absolute measure of risk of overfishing by estimating fishing mortality rates relative to fishing mortality rate reference points (based on life history parameters)
* requires less productivity data than PSA
* is able to account for cumulative risk, and
* potentially outperforms PSA in several areas, including consistency with Tier 1 overfishing assessment classifications (Zhou et al. 2016).

Like PSA, the bSAFE method is a transparent, relatively rapid and cost-effective process for screening large numbers of species for risk and is far less demanding of data and much simpler to apply than a typical quantitative stock assessment.

As such it is recommended that bSAFE be used as the preferred Level 2 assessment tool for all fish species and some invertebrates and reptiles (e.g. some sea snakes) with sufficient data.

In estimating fishing mortality, bSAFE utilises much of the same information as PSA, to estimate:

* spatial overlap between species distribution and fishing effort distribution
* catchability resulting from the probability of encountering the gear and size-dependent selectivity
* post-capture mortality.

Fishing mortality is essentially the fraction of overlap between fished area and the species distribution, adjusted by catchability and post-capture mortality. Uncertainty around the estimated fishing mortality is estimated by including variances in encounterability, selectivity, survival rate and fishing effort between years.

The three biological reference points are based on a simple surplus production model:

* FMSM – instantaneous fishing mortality rate that corresponds to the maximum number of fish in the population that can be killed by fishing in the long term. The latter is the maximum sustainable fishing mortality (MSM) at BMSM, similar to target species MSM. Species assessed to be below this line will be considered to be at low risk;
* FLIM – instantaneous fishing mortality rate that corresponds to the limit biomass BLIM where BLIM is assumed to be half of the biomass that supports a maximum sustainable fishing mortality (0.5BMSM). Species assessed to be below this line, but above FMSM, will be considered to be at medium risk;
* FCRASH – minimum unsustainable instantaneous fishing mortality rate that, in theory, will lead to population extinction in the long term. Species assessed to be above this line, but above FLIM, will be considered to be at high risk ([Figure 7](#Figure_7)).

Diagram

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Figure 6: Stock productivity, biological reference points and ecological risk assessment categories for managing bycatch species.

This methodology produces quantified indicators of performance against fishing mortality-based reference points ([Figure 8](#Figure_8)) and as such does allow calibration with other stock assessment and risk assessment tools that measure fishing mortality. It allows the risk of overfishing to be determined, via estimates of fishing mortality relative to reference points. Uncertainty (error bars) are related to the variation in the estimation of the scores for each axis.



Figure 7: Example comparison of estimated “recent” fishing mortality FCUR and the reference fishing mortality corresponding to the maximum sustainable mortality.

### eSAFE

Enhanced SAFE (eSAFE) appears, based on calibration with Level 3 assessments, to provide improved estimates of fishing mortality relative to bSAFE (Zhou et al. 2016). eSAFE requires more spatially explicit data and takes more analysis time than bSAFE, and so might only be used to further assess species that were identified at high risk using bSAFE (and which have not had further direct management action taken). eSAFE enhances the bSAFE method by estimating varying fish density across their distribution range as well as species- and gear-specific catch efficiency for each species.

### Issues to be aware of

* Comparisons of PSA and SAFE for the same fisheries and species support the claim that PSA generally avoids false negatives but can result in many false positives. Limited testing of SAFE results against full quantitative stock assessments suggests that there is less “bias” in the method, but that both false negatives and false positives can arise (Zhou et al. 2016).
* SAFE analyses retain some of the key precautionary elements of PSA, including assumptions that fisheries are impacting local stocks (within the jurisdictional area of the fishery).
* Although bSAFE provides direct estimates of uncertainty in both the exploitation rate and associated reference points, they are less explicit about uncertainties arising from key assumptions in the method, including spatial distribution and movement of stocks.
* For bSAFE, the method assumes there would be no local depletion effects from repeat trawls at the same location (i.e. populations rapidly mix between fished and unfished areas). The fishing mortality will likely be overestimated if this assumption is not satisfied.
* The method also assumes that the mean fish density does not vary between fished area and non-fished area within their distributional range. Hence, the level of risk would be overestimated for species found primarily in non-fished habitat, while risk would be underestimated for species that prefer fished habitat (ERA TWG, 2015).
* The SAFE methodology makes greater assumptions than Tier 1 stock assessments in coming to its F estimates (due to a lack of the data relative to that used in a Tier 1 assessment) and it is not capable of measuring risk of a stock being already overfished (so the type of risk it measures relates only to overfishing, which may then lead to future overfished state). The limitations of SAFE with respect to measuring overfished risks are the same essentially as for PSA.
* RRA will be applied to species identified by SAFE as medium or high risk. The assessment of medium risk species is due to the increased likelihood of false negatives occurring relative to PSA.

### Level 3 (fully quantitative risk assessments)

Level 3 is the point in the ERAEF hierarchy where a fully quantitative assessment is first undertaken (Hobday et al. 2011). A range of methods and approaches already exists at this level, but there remain challenges in finding methods that can work within the constraints of limited data and time for analysis. Application of Level 3 assessments can occur via two mechanisms:

* There is a pre-existing and re-occurring Level 3 quantitative assessment already run as part of a harvest strategy or other research (e.g. EPBC Act-listed species population assessments) or management processes.
* Management decision to develop a new Level 3 assessment following determination of high-risk status for a given species at Level 2.

### Spatial considerations and assessing cumulative risks

In assessing ecological risks of fishing to species, the assessments need, where possible, to take account of:

* Species stock structure and overlaps with the spatial extent of the fishery, and
* Interactions and cumulative impacts with adjacent fisheries. In many Commonwealth fisheries there are species taken which are also caught in other Commonwealth fisheries, State/Territory fisheries and/or international fisheries.

The following text describes four different scenarios relating to these two issues and provides guidance as to how these scenarios may be assessed and managed.

Scenario A

The area of the fishery and the stock are the same (complete overlap) or the stock area lies entirely within the Commonwealth fishery area. Under this scenario, only the Commonwealth fishery impacts the stock and available assessment tools (e.g. stock assessment, SAFE, PSA etc) work relatively well.

Scenario B

The area of the fishery encompasses the area of two separate stocks of the same species. Where there is no information on population structure, the ERA process assumes by default that species comprise a single stock. However, in conducting risk assessments it is important to identify and consider all information pertaining to stock structure and where there is evidence to support the existence of two or more stocks, then each stock should be assessed separately. Failure to assess stocks separately (where separate stocks exist) can potentially lead to fishing pressure on one stock becoming too high, but not being picked up by the combined assessment. Even where the evidence may be weak, it may be more precautionary to assume separate stocks.

Scenario C

The area of the stock overlaps two (or more) adjacent Commonwealth fisheries which all interact with (i.e. catch from) the stock. Under this scenario, a cumulative risk assessment should be conducted which identifies the fishery specific impacts/risk and the total cumulative risk. Such cumulative risk assessment is currently possible using the Level 2 SAFE tool (used to assess most byproduct and bycatch species) but is not possible using PSA (used to assess EPBC Act-listed birds, mammals, reptiles, and some invertebrates). Redevelopment of the PSA to assess cumulative risk, or adaptation of SAFE to assess species currently assessed via PSA, will be required in future to address this issue.

Scenario D

The area of the stock overlaps the area of both the Commonwealth fishery and adjacent (or distant) non-Commonwealth fisheries, which can include state commercial or recreational fisheries or international fisheries, which also interact with (i.e. catch from) the stock. Under this scenario:

* every effort should be made to identify, obtain, and use data that will allow assessment of the impacts of all fisheries upon the stock. This will require cooperation between the agencies monitoring/managing each fishery. Ideally, an assessment would identify the impacts of each fishery (including Commonwealth) upon the stock and of the combined fishery impacts on the stock. It is often the case however that information pertaining to other fishery catches is not available, and
* it should not be assumed that low local (Commonwealth) fishing mortality means that there is a low risk of overfishing or an overfished stock, as other fisheries may be imparting significantly higher impacts, or the cumulative impacts may be high.

In all the scenarios above, it may often be the case that information is not available pertaining to stock structure, stock spatial distribution, of total fishing mortality/catches, creating uncertainty in the risk assessment results. In such cases, the assumptions underpinning the assessments must be clearly documented.

### Evaluation and review of the ERAEF

Evaluation and review of the ERAEF methodology should occur in conjunction with the review of the ERM Guide (see [Chapter 2](#Chapter_2)). The evaluation and review are facilitated by the ERMSG which is tasked with this role as part of tis terms of reference.

1. Ecological sustainability is only one component of ESD principles, which require decision processes to *“effectively integrate both long-term and short-term economic, environmental, social and equity considerations”* (FMA). [↑](#footnote-ref-2)
2. The term “*ecologically sustainable*” is defined in the ESMF Guidelines as *the “use of natural resources within their capacity to sustain natural processes while maintaining the life-support systems of nature and ensuring that the benefit of the use to the present generation does not diminish the potential to meet the needs and aspirations of future generations”*. AFMA’s operational interpretation of this term is defined by its ERM framework. [↑](#footnote-ref-3)
3. Similarly, the FMA also requires that AFMA fisheries avoid overexploitation of living resources, consistent with ESD. [↑](#footnote-ref-4)
4. Under AFMA’s ERM, the term “risk” is defined as “the probability that a [specified] fisheries management objective is not achieved” (Hobday et al. 2011). However, operationally, AFMA’s ERM focuses on “ecological risk”, in other words “the probability that fisheries management objectives relating to ecological sustainability are not achieved” (Hobday et al. 2011). [↑](#footnote-ref-5)
5. The Australian Government will seek an equitable allocation of catch and management costs for Commonwealth fishers in negotiations with other jurisdictions that share in the management of a stock. [↑](#footnote-ref-6)
6. The term “EPBC Act-listed species” replaces the terms “Threatened, Endangered and Protected species (TEPs)” and “protected species” commonly used in past Commonwealth (including AFMA) documents. [↑](#footnote-ref-7)
7. *“Recruitment impairment”* describes a sustained and significant reduction in recruits to below average levels. Typically associated with recruitment overfishing. *“Recruitment overfishing”* describes recruitment impairment that results from fishing (BP). [↑](#footnote-ref-8)
8. Habitat and community objectives are pending Australian government policy guidance and will be articulated in future revisions of this Guide. [↑](#footnote-ref-9)
9. For key commercial and byproduct species, the HSP requires that all sources all known sources of fishing mortality on a stock are taken into account under harvest strategies, including recreational and Indigenous fishing, discards, and fishing under the management of another jurisdiction. For bycatch species, the BP requires that the assessment and management of bycatch species account for all sources of mortality. [↑](#footnote-ref-10)
10. Including rebuilding strategies where required. [↑](#footnote-ref-11)
11. Habitat and community assessment and management processes are pending Australian government policy guidance and will be articulated in future revisions of this Guide. [↑](#footnote-ref-12)
12. But can include target species in small and developing fisheries which lack data for stock assessment, and which have (often catch and CPUE) based triggers to control fishery development rather than TACs/TAEs. [↑](#footnote-ref-13)
13. The terms *“RAG”* and *“MAC”* should be taken to include, for fisheries that do not have these committees, or have additional advisory committees, any relevant or equivalent fishery advisory committee/group. [↑](#footnote-ref-14)
14. In addition to the RAG and MAC, there are several other expert advisory groups that AFMA uses during the development of management options. The term *“expert groups”* refers to these other entities. [↑](#footnote-ref-15)
15. Lacking the required data to determine a more reliable estimate of risk. [↑](#footnote-ref-16)
16. ERA Technical Working Group recommendation, September 2015. [↑](#footnote-ref-17)
17. Under AFMA’s ERM, the term *“risk”* is defined as *“the probability that a [specified] fisheries management objective is not achieved”* (Hobday et al. 2011). However, operationally, AFMA’s ERM focuses on *“ecological risk”*, in other words *“the probability that fisheries management objectives relating to ecological sustainability are not achieved”* (Hobday et al. 2011). [↑](#footnote-ref-18)
18. Previously the term “Target” was used to describe “Commercial” species. [↑](#footnote-ref-19)
19. *“EPBC Act-listed species”* is defined in the BP as species comprising all those protected under Part 13 of the EPBC Act including whales and other cetaceans and listed threatened, marine, and migratory species (except for conservation-dependent species which are managed through rebuilding strategies under the HSP). This term replaces the terms *“Threatened, endangered and protected species (TEPs)”* and *“protected species”* commonly used in past Commonwealth (including AFMA) documents. [↑](#footnote-ref-20)
20. This interpretation was endorsed by the ERA Technical Working Group at its meeting in September 2015. [↑](#footnote-ref-21)
21. The EPBC Act repeats this statement in four sections (208A/222A/245/265) for each of the following species groups: listed threatened species, cetaceans, listed migratory species and listed marine species. [↑](#footnote-ref-22)
22. Other than conservation dependent species. [↑](#footnote-ref-23)
23. Unit is a generic term, and refers to an individual species, habitat, or community type. [↑](#footnote-ref-24)
24. The final development of this method has been delayed pending other improvements to databases and methods, which may preclude the need for a “management axis”. [↑](#footnote-ref-25)
25. Future iterations of the methodology will include PSAs modified to measure the risk due to other activities, such as gear loss. [↑](#footnote-ref-26)