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**Assessment of risks that commercial fishing
methods may pose to conservation values
identified in the Areas for Further Assessment
of the East Marine Region**

prepared by

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for the

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1. Introduction

Important aspects of Australia's marine bioregional planning process are the identification of regional conservation priorities and the identification of marine reserves to be included in Australia's National Representative System of Marine Protected Areas. As a precursor to the development of marine reserves in the East Marine Region (EMR) the Department of the Environment, Water, Heritage and the Arts (DEWHA) has identified Areas for Further Assessment (AFAs), large areas that encompass examples of the range of biodiversity and ecosystems within the region (for further information see <http://environment.gov.au/coasts/mbp/index.html>).

This report contains the results of an assessment of risks to Conservation Values (CVs) associated with commercial fishing methods in these EMR AFAs. The assessment was based on the following:

- A review of relevant information from a variety of sources, including principally the South-west Fisheries Risk Assessment, the North and North-west Fisheries Risk Assessment, the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Fisheries Assessments, relevant fisheries ecological risk assessments, IUCN reserve management principles as set out in Regulation 10.04 of EPBC Act, the East Marine Bioregional Profile (specifically the CVs identified in each), and first-hand knowledge of fisheries managers and fishers if necessary;
- Application of a Fisheries Risk Assessment (FRA) method in the East Marine Region that is consistent with the method employed by the South-west, North and North-west Fisheries Risk Assessments;
- Identification of fishing gear types used by all fisheries operating within the AFAs of the EMR (i.e. in Commonwealth waters offshore from the northern tip of Cape York to the southern New South Wales town of Bermagui);
- Analysis of the implications of specific fishing gear type interactions with the marine environment, and in particular the benthic environment;
- Analysis of implications of specific fishing gear type interactions on marine biodiversity including bycatch species;
- Analysis of existing management arrangements and their mitigation of risks associated with specific gear types on marine habitats and biodiversity; and
- Assessment of the compatibility of specific fishing activities with the CVs of the AFAs of the EMR.

This risk assessment, now termed a Fishing Gear Risk Assessment (FGRA), is expected to contribute to the marine bioregional planning process by providing essential information that will influence the location and zoning of new marine reserves in the EMR.

2. Policy Context

The Goals and Principles for the Establishment of the National Representative System of Marine Protected Areas (DEWR, 2007a) guide the design of Commonwealth marine reserves through the marine bioregional planning program, in accordance with the national Guidelines for establishing the National System of Marine Protected Areas (MPAs; ANZECC 1998). In Australia, MPAs are established and managed with the primary purpose being to:

“..contribute to the long-term ecological viability of marine systems, to maintain ecological processes and systems and to protect Australia’s biological diversity at all levels.” (ANZECC 1998)

In relation to the zoning of new reserves, where multiple activities are allowed, the Goals and Principles specify that zoning will be based on the IUCN Categories as interpreted in Schedule 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations). Additionally, Principles 19 and 20 (DEWR, 2007a) state:

“Zoning will be based on the consideration of the threat that specific activities pose to the conservation objectives of each MPA. Zoning of MPAs will seek to ensure that the conservation objectives of the area are protected, taking into account a precautionary approach to threats as well as the relative costs and benefits (economic, social and environmental) of different zoning arrangements.”.

The EPBC Regulations set out the management principles for each of the zone categories; for ‘managed resource protected areas’ (i.e. multiple-use zone Category VI), the zone is to be managed primarily for the sustainable use of natural ecosystems based on the principles that:

- The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term;
- Management practices should be applied to ensure ecologically sustainable use of the reserve or zone;
- Management of the reserve should contribute to regional and national development to the extent that this is consistent with these principles.

Against these broad policy goals and management principles, specific conservation objectives are set for the regional network and each of the component marine reserves. The conservation objectives will be informed by the understanding, based on best available data and knowledge, of the biological diversity and CVs that exist within each area.

Values¹ are identified in relation to:

- bioregional representativeness (i.e. the bioregional units that exist within region and the depth gradients, seafloor features and large scale ecological units known to occur within each bioregion); and
- CVs, including their key ecological features and functional groups of interest, and protected species that may benefit from spatial protection.

¹ The conservation values applicable to each Area for Further Assessment in the North and North-west Marine Regions can be found at: <http://www.environment.gov.au/coasts/mbp/publications/east/fs-afa.html>

For the EMR, 10 Key Ecological Features have been identified by DEWHA as the main CVs along with a suite of Functional Groups of Interest for each of these features (**Table 1**). In completing this FGRA, the risk that each fishing gear posed to each of the CVs and each of the elements of the Functional Groups of Interest was evaluated. Separate and specific attention was also paid to turtles, cetaceans, dugong, inshore dolphins, seabirds, sharks and shorebirds in every AFA.

Table 1. Conservation Values, functional groups of interest, and the relevant Areas for Further Assessment as identified for the EMR.

Conservation Values	Functional Groups of Interest	Areas for Further Assessment
Reefs, cays and herbivorous fish of the Queensland Plateau	Benthic fauna; herbivorous fish; demersal fish; predators; invertebrate feeders; turtles; seabirds; cetaceans; other	Coral Sea Conservation Zone
Reefs, cays and herbivorous fish of the Marion Plateau	Benthic fauna; herbivorous fish; demersal fish; predators; invertebrate feeders; turtles; seabirds	Coral Sea Conservation Zone
Canyons of the Eastern Continental slope	Hard substrate; sharks; demersal fish; invertebrates; coralline algae; corals detrital rain; soft substrate; rays; bivalves; zooplankton; phytoplankton	Fraser, Tweed, Clarence, Hunter, Batemans
Fraser shelf upwelling	Large diatoms; squid; predators; seabirds; cetaceans	Fraser
Shelf edge sponge gardens and rocky reefs	Benthic fauna; invertebrates; fish	Fraser, Tweed, Clarence, Hunter, Batemans
Lord Howe seamount chain	Benthic fauna; pelagic fish; seabirds	Tasmantid - Lord Howe
Elizabeth and Middleton temperate and tropical reef systems	Benthic fauna; herbivorous fish; reef fish; turtles; seabirds; predators; cetaceans	Tasmantid - Lord Howe
Tasman front	Squid; cold water predators; warm water predators; generalist predators; turtles; seabirds	Tasmantid - Lord Howe
Tasmantid seamount chain	Benthic fauna; pelagic fish; seabirds; benthic fauna	Coral Sea Conservation Zone, Tasmantid - Lord Howe
Norfolk Ridge	Benthic fauna; demersal fish; seabirds; cetaceans	Norfolk

Regional Conservation priorities (CPs) have also been identified for the East Marine Region as part of the marine bioregional planning process (**Table 2**). These priorities are based on an analysis of potential threats to the Region’s Conservation Values and the Government’s overall policy objectives. The CPs provide strategic direction for marine bioregional planning and for prioritizing marine research and monitoring and are intended to inform decision-making and investment by the Government over the life of the Plan..

Table 2. Draft Regional Conservation Priorities for the EMR that may have relevance for design and zoning of new Commonwealth marine reserves

Eastern Marine Region Draft Conservation Priorities	
1.	Understand, protect and conserve the habitat of protected species in the region (in particular, biologically important areas)
2.	Understand, protect and conserve key ecological features in the region
3.	Understand, protect and conserve the ecological role of sharks and rays in the region
4.	Understand climate change impacts on the habitat of seabirds, turtles and shorebirds
5.	Understand climate change impacts on tropical, temperate and deepwater coral reef systems (in particular, the Coral Sea KEFs, seamount KEFs, Elizabeth and Middleton reef KEF, and shelf edge rocky reef KEF)
6.	Ecologically sustainable fisheries that minimise impacts on non-target species (in particular, seabirds, turtles and sharks)
7.	Facilitate ecologically sustainable fisheries to minimise impacts on tropical, temperate and deepwater coral reef systems (in particular, the Coral Sea KEFs, seamount KEFs, and shelf edge rocky reef KEF).
8.	Provide information which supports OR Promote the Ecologically sustainable use of the marine environment by expanding and emerging industries and activities in the region
9.	Understand and prevent the impacts of marine debris on marine species (in particular, seabirds and turtles)
10.	Understand and prevent the impacts of maritime pollution on conservation values in the region (all KEFs and protected species)
11.	Understand and prevent the impact of noise on marine species (in particular, cetaceans, turtles, in-shore dolphins, dugong and sharks).
12.	Protect and conserve tropical and temperate reef systems vulnerable to invasive species introductions (in particular, the Coral Sea KEFs, Elizabeth and Middleton reef KEF)
13.	Support the traditional use of marine resources in an ecologically sustainable manner
14.	A representative network of marine protected areas

AFAs have been identified within each of the East Marine Region (**Figure 1**). The AFAs are not proposed reserves; instead they are intended to aid further analysis of information at a more detailed scale and in so doing assist in narrowing down the areas of focus for the location of new Commonwealth marine reserves. AFAs encompass representative examples of the range of biodiversity and ecosystems within Commonwealth waters and were identified through the assessment of information compiled using the Goals and Principles (DEWHA, 2010).

Based on the above, the key policy parameters that underpin the East FGRA, as well as the assessment of risk posed by activities other than fishing, can be summarized as follows:

- the acceptability of activities in a multiple-use reserve is to be based upon the consideration of risk (relying on best available information) to the area-specific conservation values, in the context of the overarching biodiversity conservation goal and the regional priorities;
- in attributing risk ratings and determining the overall acceptability of a given method, when information is incomplete and there is uncertainty, a precautionary approach is to be applied;
- the consideration of the legislative management purpose and principles for multiple-use zones requires careful consideration of the potential to mitigate risks to an ecologically sustainable level.

A final, important policy consideration is that the identification of new Commonwealth marine reserves is guided by the Goals and Principles, including minimization of socio-economic cost. The conduct of the FGRA allows for the potential impacts on fishing operations to be taken into account in the initial design of a network of new Commonwealth marine reserves in order to minimize that impact while ensuring that the ecological Goals and Principles are met.

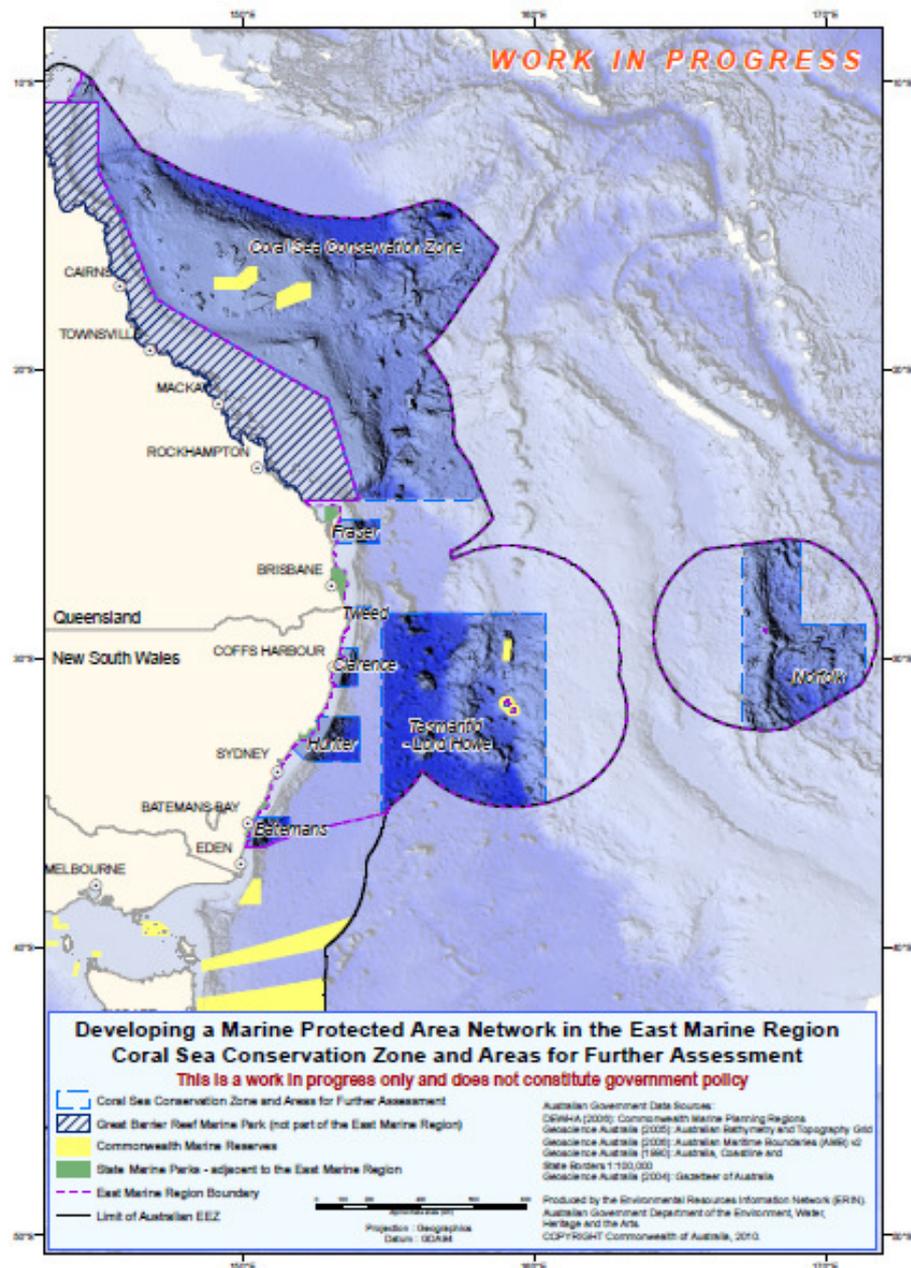


Figure 1. Areas for Further Assessment for the East Marine Region

3. Background

An assessment of the risk to Conservation Values posed by commercial fishing methods was first conducted as part of the development of the Network of Commonwealth Marine Reserves for the South-east Marine Region (SEMR) (E-Systems, 2005). This risk assessment (SEMR FRA) used workshops involving

industry and other stakeholders to determine the risks associated with various fishing methods.

Since the SEMR FRA was completed, the Australian Fisheries Management Authority (AFMA) has undertaken ecological risk assessments (ERAs) for all major Commonwealth-managed fisheries using the methodology, Ecological Risk Assessments for Effects of Fishing (ERAEF), developed by the CSIRO. The methodology relies on stakeholder involvement at each stage in the process and stakeholders have provided expert judgement and fishery specific and ecological knowledge to the Ecological Risk Assessments (ERAs).

ERAEF uses a hierarchical, four stage approach involving:

- an initial scoping of the fishery;
- Level 1 assessment – a comprehensive, qualitative assessment of risks in the fishery;
- Level 2 assessment – a more focused, semi-quantitative assessment of the risk to species; and
- Level 3 assessment - a highly focused and fully quantitative risk assessment e.g. a stock assessment or a Sustainability Assessment for Fishing Effects (SAFE).

Application of the ERAEF method to a fishery can be thought of as a set of screening or prioritization steps that work towards a full quantitative ERA. At the start of the process, all components are assumed to be at high risk. Each step, or Level, potentially screens out issues that are of low concern. The initial scoping stage screens out activities that do not occur in the fishery. Level 1 (expert judgement-based analysis of scale, intensity and consequence) screens out activities that are judged to have low impact, and potentially screens out whole ecological components (target species; byproduct/bycatch species; threatened endangered and protected species (TEPS); habitats; or communities). Level 2 (an empirically based Productivity Susceptibility Analysis (PSA)) is a screening or prioritization process for individual species, habitats and communities at risk from direct impacts of fishing.

ERAs have now been completed to at least Level 2 for all major Commonwealth fisheries, although some reports have not yet been released publicly. The ERAs assess the direct and indirect impact that fishing activities may have on aspects of marine ecosystems including target species, bycatch and byproduct species, TEPS, habitats and communities (although community impacts have only been assessed using qualitative methods to date). The ERA work has resulted in detailed information about the level of risk to species and habitats which has not previously been available. However, the Level 2 methods do not provide absolute measures of risk. Instead they combine information on productivity and exposure to fishing to assess relative levels of potential risk. Because of the precautionary approach taken to uncertainty, there will be more false positives than false negatives at Level 2, and the list of high risk species or habitats should not be interpreted as all being at high risk from fishing. Level 2 is a screening process to identify species or habitats that require further investigation. Some of these may require only a little further investigation to identify them as a false positive; for some of them managers and industry may decide to implement a management response; others will require further analysis using Level 3 (quantitative, model-based analysis) methods, which do

assess absolute levels of risk (Hobday *et al.*, 2007). It is noted, however, that results from the earlier Level 3 SAFE analyses were based on the premise (used for the SESSF and ETBF) that the level of natural mortality (M) is a reasonable estimate of the maximum sustainable fishing mortality, F_{msm} (Zhou *et al.* 2007). More recent assessments have indicated that a more conservative approach is appropriate for chondrichthyans and a revised equation of $F_{msm} = 0.42 M$ was adopted (Zhou *et al.* 2009). This indicates that the original SAFE analyses may have underestimated the risks for chondrichthyans and that revised analyses using this more conservative target may identify additional species of chondrichthyans at high risk.

Further, it is acknowledged that different underlying models have been used in conducting the available productivity susceptibility analyses and this restricts the extent to which risk scores can be compared across fisheries. Despite these qualifications, the ERAs represent the most consistent and rigorous set of information available to inform fishing risk assessment for the purposes of marine bioregional planning. These ERAs form the basis of AFMA's ecological risk management framework and identify priorities to that are being addressed through strategies for Ecological Risk Management (ERM).

In addition, qualitative ecologically sustainable development assessments (ESDAs) have been conducted for many State/Northern Territory (NT)-managed fisheries using the National ESD Framework (Fletcher *et al.*, 2002). Like the ERAEF methodology, the conduct of the ESDAs involved substantial stakeholder engagement. In addition, all Commonwealth and most State/NT-managed fisheries have also been assessed against the Guidelines for the ecologically sustainable management of fisheries (DEWHA, 2007) of the EPBC Act (referred to here as DEWHA EPBC Act assessments). These assessments also provide opportunities for public input. Together these assessment processes provide valuable information for the assessment of risks posed by fishing gears to Conservation Values in the EMR.

DEWHA has completed FRAs for the South-west Marine Region (SWFR), the North-west Marine Region (NWMR) and the North Marine Region (NMR) following a method which draws on the outcomes of the SEMR FRA and the information available from ERAs and other sustainability assessments to assess the risk posed by commercial fishing methods in those Regions. The same basic methodology has been applied here to the FGRA for the EMR.

4. Methods and Approach

The fishing risk assessments relate to fishing gear types used in commercial fisheries that operate solely or partially in Commonwealth waters in the EMR². This report examines the risks associated with 27 fisheries including 8 that are managed by the Australian Government, 3 that are managed by the NSW Government and 16 that are managed by the Queensland Government (see

² Maps showing the boundaries of AFMA managed fisheries can be found by following the links to specific fisheries on the AFMA website at <http://www.afma.gov.au/fisheries/default.htm>. Maps showing the boundaries of specific Queensland fisheries are available on the Queensland Department of Employment, Economic Development and Innovation (DEEDI) website at <http://www2.dpi.qld.gov.au/fishweb/2939.html>.

Section 6, Abbreviations and Acronyms for a list). While some fisheries may be authorized to use a particular gear type in those waters this does not necessarily mean that the gear is being used or has been used in those waters. Where the data allows, the interaction of gear types with the Conservation Values identified in the AFAs has been determined on the basis of distribution of catch over the period 2002 to 2007. Where these data were not available, interaction, or the potential for interaction, was determined on the basis of the area of water for which that gear was authorized.

As in the FRA for the South-west Marine Region (SWMR), ERA results relevant to a particular gear type as the primary basis for assessment have been used. This approach is considered appropriate since CSIRO's ERA process is based on the best available science and expert input and also includes extensive stakeholder input. This analysis is structured around gear types but it is recognized that gear may be configured differently among and within fisheries to reflect different target species, local conditions and operator preferences. This variation may be considerable in the EMR which covers a large latitudinal range and where the species composition and conditions vary accordingly. Nevertheless, the variation in risk that this may produce is expected to be small compared to the variation between the different gear types.

The extent of an interaction between a gear type and a CV has been determined using the most recently published information and some confidential reports on the relevant fisheries. The results of previously conducted relevant risk assessments are used – ERAs for Commonwealth fisheries, Ecological Impact Statements (EISs) for NSW state fisheries and Risk Assessments for Queensland fisheries. The FGRA also uses the results of FRAs where the same gear type interacts with the same or a similar CV. A summary of the findings of previous FRAs is provided in Appendix 1. Other key documents relied upon are the DEWHA EPBC Act assessment reports (including any government submissions to DEWHA), the most recent Fishery Status Reports completed by the Bureau of Rural Sciences (BRS) (Wilson *et al.* 2009), the annual status reports provided by Queensland and New South Wales for fisheries under their management, and the report on the fishing activities in the EMR (Moore *et al.* 2007). Other references used are cited where appropriate. A list of the fisheries evaluated, the gear types used on those fisheries, and the main sources of information used in conducting these Fishing Risk Assessments for the CVs of the EMR are provided in Appendix 2.

Where there are no data available on the current or recent extent of a fishery, the extent of interaction has been estimated based on the area over which a gear type has been authorized to be used. This is the case for some fisheries where only a small portion of the fishery occurs within the EMR or where there are data confidentiality issues from there being a small number of operators in a fishery.

There are also situations where a published risk assessment for a multi-method fishery does not separate the risks for each gear type. In this situation, unless there are other data available, the risks attributed to the whole fishery were assumed to apply to each of the gear types.

The "translation" from ERA/EIS risk ratings to an assessment of acceptability of the method within the EMR's AFAs is provided in **Table 3**. ERA/EIS risk ratings informed, but did not dictate, the overall FGRA risk rating. These ratings are the

same as those used in the FRAs for the NMR and NWMR, except that the definition for the rating of “Acceptable (some conditions may be required)” has been extended to cover the situation where a gear had not been previously assessed in another FRA but was found in this assessment for the EMR to pose an acceptable risk.

Table 3. Relationship between ERA/EIS risk ratings and the acceptability rating used in the report for the East Marine Region.

Overall Rating	ERA ratings comparison and policy considerations
Unacceptable	<p>This overall assessment was given to fishing methods when ERAs or EISs found that:</p> <ul style="list-style-type: none"> ▪ <u>potential or actual high risk</u> exists for elements of the marine environment that are identified as Conservation Values to be protected, AND ▪ for which mitigation measures were not identified or are of limited effectiveness. <p>Higher levels of precaution were used for those Conservation Values also identified as regional conservation priorities and where no ERA/EIS was available to inform the assessment.</p>
Unacceptable pending further assessment	<p>This overall assessment was given to fishing methods when ERAs or ESDAs found that:</p> <ul style="list-style-type: none"> ▪ <u>potential or actual high risk</u> exists for elements of the marine environment that are identified as Conservation Values to be protected, AND ▪ there is uncertainty about the effectiveness of mitigation measures. <p>Higher levels of precaution were used for those Conservation Values also identified as regional conservation priorities and where no ERA/EIS was available to inform the assessment.</p>
Acceptable with mitigation measures and conditions	<p>This overall assessment was given to fishing methods when ERAs or ESDAs found that:</p> <ul style="list-style-type: none"> ▪ <u>a range of risk levels</u> exists for elements of the marine environment that are identified as Conservation Values to be protected, AND ▪ for which there are mitigation measures currently in place, or in the process of being implemented, which have been shown to have some effectiveness. <p>Higher levels of precaution were used for those Conservation Values also identified as regional conservation priorities and where no ERA/EIS was available to inform the assessment.</p>
Acceptable (some conditions may be required)	<p>This overall assessment was given to fishing methods that were EITHER assessed in the South-east, South-west, North or North-west FRAs, ERAs or ESDAs as having a <u>low risk</u> and were not further assessed in the EMR,</p> <p>OR were assessed on the basis of available information and found to pose a low risk to the CVs of the EMR.</p>

5. Outcomes of risk assessment

Table 4 summarizes the overall ratings for the 15 gear types relevant to the EMR FGRA. Information underpinning the assessments is provided in Attachment 1. In this attachment there is firstly a table showing which CVs are listed for which AFAs, secondly a table showing which gear types are authorized for use in each AFA, thirdly a table showing the potential interactions that may arise between each gear type and each CV, and fourthly a table for each gear type detailing the basis for the risk assessment for each interaction with a CV. In these last tables, the CV – AFA overlaps are shaded to show where an interaction is possible if there was an active fishery.

The results pertaining to the 9 methods rated as unacceptable (including “unacceptable pending further assessment”) – demersal trawl, Danish seine, mid-water trawl, beam trawl, pelagic longline, demersal longline, mesh nets, purse seine and fish traps – are outlined below in more detail.

Table 4. Summary of EMR FGRA results
(see Abbreviations and Acronyms for names of fisheries).

Fishing method	East Assessment	Rationale
1. Demersal trawl	<p>Unacceptable level of risk on:</p> <ul style="list-style-type: none"> benthic fauna in all AFAs except Norfolk high risk species of chondrichthyans in Batemans, Clarence and Tweed AFAs turtles (at potential risk) in Clarence and Tweed AFA seabirds in Batemans AFA 	<p>A range of habitats have been identified as being at risk from the impacts of trawling in all fisheries except the ECSWF.</p> <p>In the CSF a qualitative Level 2 ERAEF for chondrichthyan and TEPS species assessed demersal trawling as posing a medium to high level of risk to all TEP and chondrichthyan species and a high risk to marine turtles and bathyl shark species (AFMA 2009d). After consideration of current management arrangements no additional mitigation measure were considered necessary for turtles and chondrichthyans (AFMA 2009d). Observers are required on 25% of trips, covering at least 25% of shots over a year. Operators are also required to report interactions with protected species. There have been no interactions with turtles reported in either logbook records or by AFMA observers in the CSF and no logbook reports of interactions with other TEPS in the CSF to date.</p> <p>The SESSF ERM report for the Level 2 ERA findings identifies 5 species of chondrichthyans still at high risk. Revised level 3 SAFE assessment for chondrichthyans not yet undertaken. Additional chondrichthyan species are identified at high risk in the OTF.</p> <p>There are few data available and TEDs are not used in the OTF. A precautionary approach indicates that turtles should currently be regarded as being at an unacceptable risk.</p> <p>Four species of seabirds identified at high risk in the ERM for the SESSF and two others are frequently caught. No mitigation strategies in place.</p>
2. Danish seine	<p>Unacceptable level of risk (pending further assessment) on:</p> <ul style="list-style-type: none"> TEPS (including including turtles, cetaceans, dugong, dolphins, seabirds and sharks) in the Fraser AFA 	<p>A range of TEPS have been reported to interact with the Danish seine sector of the SESSF but were rated as being at moderate risk. The same groups may also interact with Danish seine gear in the ECSWF, but there are no data available to permit an assessment of the potential risks to these groups. As a precaution, the risks are deemed to be high.</p>

3. Mid-water trawl	<p>Unacceptable level of risk (pending further assessment) on:</p> <ul style="list-style-type: none"> • Turtles in the CSCZ • Dolphins in all AFAs where the gear operates, and • Seabirds in all AFAs where the gear operates. 	<p>Mid-water trawl gear has had no or limited use in the CSF, SPF and SESSF in any AFA. The overall assessment is that the gear poses an unacceptable level of risk to the Conservation Values of the EMR is based on the non-mandatory use of TEDs in the CSF, the high risk findings for 7 species of dolphins in the SPF, and the high risk findings for 4 species of seabirds (at risk to demersal trawling) in the SESSF. The ability of current or proposed management arrangements to mitigate these identified or potential risks requires demonstration..</p>
4. Beam trawl	<p>Unacceptable level of risk (pending further assessment) on:</p> <ul style="list-style-type: none"> • benthic fauna in CSCZ. 	<p>Beam trawls have been reported to have larger impacts than prawn trawls but they have not been subject to a separate risk assessment in any Australian fishery and no data were available on bycatch levels or other impacts. The current effort levels suggest a low level of risk (there was no trawl effort reported on either the Queensland or Marion plateaux (2002-2006)). Nevertheless, the impact of beam trawls on benthic fauna is likely to be unacceptable if there was a change to current fishing practices and effort levels became high within the EMR.</p>
5. Longline, Pelagic	<p>Unacceptable level of risk (pending further assessment) on:</p> <ul style="list-style-type: none"> ▪ shark species across all areas for further assessment ▪ cetacean species across all areas for further assessment ▪ leatherback turtles- high risk found in residual risk assessment; mitigation plan being implemented 	<p>This gear is used by the ETBF across the EMR AFAs. Driftlines used by the OTLF in the Tweed, Hunter, Clarence and Batemans AFAs also operate in a manner similar to pelagic longline.</p> <p>Underpinning the overall risk rating are multiple high & medium-high risk ratings by the ETBF ERA (Webb, <i>et al</i>, 2007). 23 seabirds, 5 whale species & 1 turtle species were classified as high risk at L2 ERA. Following residual risk assessment, 2 whale species and 1 turtle species continue to be given high risk ratings. Several shark & teleost species were classified high risk following L3 ERA (Zhou <i>et al.</i>, 2007) but risks to other chondrichthyans may have been underestimated. Oceanic longline fishing is listed as "Key Threatening Process" for seabirds under the EPBC Act but Threat Abatement Plan is in place.</p> <p>Risks identified for sharks, cetaceans and turtles by the OTLF (NSW DPI, 2006) operating across Tweed, Hunter, Clarence, Tasmantid-Lord Howe and Batemans AFAs. Information is lacking and it is considered precautionary to require further evaluation of these risks.</p> <p>Note: Sunfish (<i>Mola mola</i> and <i>M. ramsayi</i>) have also been identified as high risk across southern areas for further assessment (Hunter, Tasmantid-Lord Howe, Norfolk, Batemans); mitigation measures are not in place but trigger limits adopted. Sunfish, however, are not a protected species or specifically an element of the CVs for the EMR.</p>
6. Longline, Demersal	<p>Unacceptable (pending further assessment) on:</p> <ul style="list-style-type: none"> ▪ the high risk findings for benthic habitat impacts by the ERA for auto-longline gear ▪ lack of information about the nature and extent of the grounds fished by these methods; and ▪ the high risk findings for several chondrichthyan species including deepwater shark which are considered to be least sustainable. 	<p>Together, four fisheries use this gear or are authorized to use the gear across the EMR AFAs (excluding Norfolk where exploratory permits expired in 2003). The ERA for autolongline in the SESSF found a range of high and medium risk habitat impacts and expressed uncertainty about the impact of demersal longline on benthic habitats, particularly on large, erect and fragile epifauna (Daley <i>et al.</i>, 2007). The ERA for the CSF also found potential for habitat damage by bottom set gear.</p> <p>The CSF ERA found the demersal and autolongline sector to represent a high risk to marine turtles and to all chondrichthyan species (AFMA, 2009d). Residual risk assessment and L3 SAFE ERA for the SESSF ALL identified 9 species (2 teleosts, 2 skates and 5 deepwater sharks) at high ecological risk but risks to other chondrichthyans may have been underestimated. These species are a high priority for ecological risk management. Detailed catch composition of shark catches is lacking across the fisheries using this gear.</p>

7. Handline and dropline	Acceptable (some conditions may be required)	The impact of these line methods on the CVs of the EMR is assessed as acceptable. Fishing using these gears is authorized across all AFAs. Risk assessments in other bioregions generally suggest low levels of risk for the gear. ERA for CSF suggests some high risks on the CSCZ, largely due to a lack of information. There is potential for localized targeting and depletion of target species (Furlani <i>et al.</i> , 2007) which may warrant further monitoring of potential impacts.
8. Trolling	Acceptable (some conditions may be required)	The impact of these line methods on the CVs of the EMR is assessed as acceptable. Fishing using these gears is authorized across AFAs. Risk assessments in other bioregions generally suggest low levels of risk for the gear.
9. Mesh nets (gill nets)	Unacceptable level of risk (pending further assessment) on: <ul style="list-style-type: none"> ▪ the potential interaction with marine turtles and the absence of identified bycatch mitigation measures; and ▪ the uncertainties surrounding the impact of this gear on chondrichthyans arising from inadequate information on historical catches and a poor understanding of their status in the region. 	The use of mesh gear by the ECIFFF in the Fraser AFA is authorized. The level of interaction with turtles and sharks and the impact of fishing on them in the region are poorly understood. Interaction with sharks has been an area of particular concern for the fishery and quality of the data on the quantity and species composition of shark catches has been poor and levels of observer coverage have been low. Environmental assessment has required improved catch validation and observer coverage. Environmental assessment has required improved catch validation and observer coverage, however, the level of compliance with these requirements is not clear from published information.
10. Purse seine	Unacceptable level of risk (pending further assessment) on: <ul style="list-style-type: none"> ▪ cetacean species (regional conservation priority) across the Batemans AFA 	This gear is authorized for use by three fisheries across the AFAs of the EMR but is currently only actively used in two fisheries in one of the AFAs. The ESTF is authorized to fish throughout most of the EMR, though purse seine fishing for skipjack in the region has only taken place off south-eastern NSW in the Batemans AFA. The SPF has operated only off southern NSW in the EMR, potentially in the Batemans AFA but with the majority of effort in 2001-2004 south of Bermagui. There is no reasonable expectation that there will be expansion to apply the method elsewhere in the EMR. The overall assessment is that the gear poses an unacceptable level of risk to the Conservation Values of the EMR in the Batemans AFA. This finding is based on high risk findings for 29 marine mammals in the SPF. These species are identified as high priority species for ecological risk management for the fishery (AFMA, 2010b). Few specific management arrangements are in place to mitigate the risk. The ecological risk management strategy requires an observer coverage rate of 10% of shots in the fishery. A voluntary industry code of practice requires that nets are designed to minimise the possibility of harm to captured marine mammals and other TEPS.
11. Squid jig	Acceptable (some conditions may be required)	ERA assessment for this method was not progressed beyond Level 1, which found risk associated with this method to be low.
12. Shell dredge	Acceptable (some conditions may be required)	The gear is used, or is authorized to be used, by one fishery (MSSCF) in two AFAs (Coral Sea Conservation Zone and Fraser). Small shell dredges (max 600mm gape) are towed behind small dinghies in areas between reefs or in channels and usually used for collecting sand dwelling shell species. They are not generally used in areas with complex epibenthic habitat (e.g. reefs) as dredge loss can occur and the gear efficiency is much reduced due to fouling. (Roelofs <i>et al.</i> 2009). The use of dredges is considered to be of low impact on the broader ecosystem due to its small size, limited use

		<p>and limitation on habitats where it can be used (Roelofs <i>et al.</i> 2009).</p> <p>In 2008 only one commercial license was accessing the fishery and the total take was 4 shells (DEEDI 2009e).</p> <p>Dredges are unlikely to be used in the Coral Sea Conservation Zone and if used in the Fraser AFA are not expected to interact with its CVs.</p>
13. Fish traps	<p>Unacceptable level of risk (pending further assessment) on:</p> <ul style="list-style-type: none"> demersal fish species in the CSCZ, Tweed, Clarence, Hunter and Batemans AFAs 	<p>Precautionary high risk to demersal fish in the CSF.</p> <p>Moderately high to high risks identified for 5 demersal fish species/groups taken in the OTLF.</p>
14. Crab and lobster traps	<p>Acceptable (some conditions may be required)</p>	<p>The gear is used, or is authorized to be used, by four fisheries across six EMR AFAs.</p> <p>In the RLF, wobbegong were identified as being at high risk of being overfished but the RLF accounts for only 12% of total catch across all NSW commercial fisheries (NSW DPI, 2004).</p> <p>The application of the Level 1 ERAEF method to the ECSCF and ECBSCF identified no high or moderate to high risks in these fisheries. Moderate risks were identified for 11 combinations of activities and impacted groups (target, bycatch and TEPS) (Hill and Garland, 2009). No risks were identified for seabirds or cetaceans.</p> <p>No areas of concern arise from the analysis of the impact of crab and lobster pots on the CVs of the EMR.</p>
15. Hand collection/diving	<p>Acceptable (some conditions may be required)</p>	<p>The gear is used, or is authorized to be used, by nine fisheries (CSF, ECBDMF, ECTF, MSSCF, ECPF, MAFF, CF, TRLF and RLF) in six AFAs (Coral Sea Conservation Zone, Fraser, Tweed, Clarence, Hunter and Batemans).</p> <p>Overall, based on the limited fishing effort and catch, and the selective nature of the fisheries, no areas of concern arise from the analysis of the impact of hand collection/diving methods on the CVs of the EMR.</p>

5.1. Demersal trawl

Five fisheries use this gear in seven of the eight AFAs in the EMR (demersal trawl gear is not currently being used in the Norfolk AFA): the AFMA managed CSF and SESSF, the NSW managed OTF, and the Queensland managed ECOTF and ECSWF. Some form of ecological risk assessment has been conducted for all these fisheries but they vary in approach and in how recently they have been completed.

A wide range of finfish and crustaceans are targeted and the type of trawl gear and the areas in which it is used vary between whether fish or crustaceans (mainly prawns) are the target. The impacts of prawn trawling on inter-reefal areas of the GBR have been well described and are likely to be similar for prawn trawling on these habitats in the EMR. Single trawl shots have little impact but repeated trawling has a cumulative effect and can remove the majority of highly susceptible species (e.g. Burrige *et al.* 2003; Pitcher *et al.* 2009). The impacts of fish trawling in the EMR have not been studied in any detail, but studies on similar habitats elsewhere (such as seamounts) are also likely to be reflective of the impacts of trawling in the EMR. In general, research indicates that the impacts of trawling are related to the distribution and intensity of fishing effort,

the resilience of taxa to removal by the gear, and the ability of the taxa to recover after impact. Prawn trawls have been reported to have smaller effects sizes than fish trawls and beam trawls (Pitcher *et al.* 2009).

In the SEMR FRA demersal trawl was found to pose high risks to habitats on soft and hard bottom types at all depths from 25 m to 1500 m including canyons and seamounts. In the SWMR FRA demersal trawling was rated as posing an unacceptable level of risk on benthic and demersal communities and habitats across all areas for further assessment, and on threatened, endangered & protected species (TEPS). In the NWMR FRA demersal trawl was rated as an unacceptable level of risk on habitat types in 6 AFAs, 4 target species in one AFA, and sawfishes in 3 AFAs. It was also rated as unacceptable (pending further assessment) of the risk on 11 chondrichthyan species in one AFA, and on small cetaceans and sea snakes in one AFA.

Four areas of concern arise from the analysis of the impact of demersal trawl on the Conservation Values of the EMR:

1. risks from direct fishing impacts on shelf edge sponge gardens and rocky reefs, and other outer shelf, mid slope and upper slope habitats,
2. risks from capture for sawfishes and other chondrichthyans,
3. risks from bycatch impacts on turtles, and
4. risks from bycatch impacts on seabirds.

BENTHIC HABITATS

For the SESSF 158 habitats were assessed at Level 2 using the habitat PSA analysis (Wayte *et al.*, 2006a). Of these, 46 were assessed to be at high risk, 58 medium, and 54 low. Of the high risk habitats, none were found on the inner shelf (0-100m), 18 were on the outer shelf (100-200m), 12 were on the upper slope (200-700m), and 16 were on the mid slope (700-1500m). Not all these habitat types are necessarily found within the EMR as the area covered by the ERA for the SESSF extends beyond the boundaries of the EMR. High risk habitats include several categories of both hard and soft substrates with delicate epifauna that may include octocorals, crinoids, sponges, bryozoan communities or other erect or delicate epifauna.

For the CSF, both demersal and mid-water trawl gears are reportedly used, but the impacts were not assessed separately in the Level 1 SICA analysis (Furlani *et al.* 2007). Mid-water trawl gear may have a lower level of benthic impact as has been suggested for the NMR (Lack, 2010) and are assessed separately. The SICA analysis did identify fishing activity, both with and without capture, as a habitat hazard, due to the nature of trawl gear used and the lack of age, growth and regeneration information for tropical deep-waters habitats.

For the OTF, three habitat types were assessed as being at a high level of risk – hard-ground low vertical reef, sessile animals and plants living on low level reef, and sessile animals and plants living in soft ground (sand, mud and gravel) (NSW DPI, 2004). These habitats are readily accessible to trawling and suffer permanent (low level reef) or long-term damage due to the slow growth of many of the sessile animals making up these habitats. Soft ground habitat, such as sand, mud and gravel were at moderately high risk as the intensity and

frequency of trawling on these habitats is unknown. Hard ground reef greater than 2 metres high and its associated biota were assessed at intermediate risk from trawling due to the greater difficulty trawlers have in accessing this type of habitat.

Available assessments for the ECOTF evaluate the fishery as a whole but most of the fishery and fishing activity takes place within the Great Barrier Reef Marine Park (GBRMP) (Moore *et al.*, 2007). Recent mapping of the seabed biodiversity on the continental shelf of the GBR also allowed the calculation of the area of nine different 'habitat clusters' that were exposed to trawling of different levels of intensity and estimation of the impacts of trawling on benthic invertebrates under different management scenarios (Pitcher *et al.*, 2007). Most of the studied area lies within the GBRMP, however, and the proportion in the EMR is not known. Also, there are likely to be other habitats from deeper areas of the EMR that are affected by trawling. There is, therefore, no specific assessment of the impacts of the ECOTF fishery on habitats within the EMR. To the extent that the habitats and types of fishing activity are similar, however, the risks assessed for the fishery as a whole should be generally applicable to the EMR. Nevertheless, risks to habitats within the GBRMP have been mitigated to a large degree by management measures specific to that area including the rezoning in 2004 which prevented trawling from occurring in over 66% of the Park.

Despite the lack of a qualitative or quantitative risk assessment for habitats specifically in the EMR, analyses for similar gears and habitats elsewhere indicate that it is highly likely that habitats with erect or delicate epifauna are at risk from trawl gear used in the ECOTF where effort overlaps these habitats.

The ECSWF has been assessed as posing no significant threat to any particular habitats within its area of operations (DEWR, 2007b) and has no significant interactions with the habitat CVs in the AFAs with which it overlaps.

CHONDRICHTHYANS

In the CSF, a qualitative Level 2 ERAEF conducted for chondrichthyan species assessed demersal trawling as posing a medium to high level of risk to bathyl shark and other chondrichthyan species (AFMA 2009d). A residual risk report after consideration of current management arrangements has not been published but no additional mitigation measures were considered necessary for chondrichthyans (AFMA 2009d).

Five species of chondrichthyans have been identified as being at high risk from otter trawling in the SESSF in the residual risk assessment report on the Level 2 ERA results (following application of the residual risk guidelines that take into account methodology related matters and the most current management arrangements): Nilson's deepsea dogfish (leafscale gulper shark) *Centrophorus squamosus*, Harrison's dogfish *C. harrissoni*, southern dogfish *C. uyato* (east), Platypus shark *Deania quadrispinosa*, and Greeneye Spurdog *Squalus chloroculus*. All these species are found within the EMR. Level 3 SAFE analyses also found that all these species were at high risk (Zhou *et al.* 2007). More recent assessments, however, have indicated that a more conservative approach is appropriate for chondrichthyans (Zhou *et al.* 2009) and additional high risk chondrichthyans may be identified as being at high risk in a re-analysis using the revised estimates of sustainable fishing mortality.

In the OTF, all the species with the highest level of risk were chondrichthyans: fiddler sharks (*Aptychotrema rostrata* and *Trygonorrhina* sp. A), angel sharks (*Squatina australis*, *Squatina* ' species A'), saw sharks (*Pristiophorus* spp.), greeneye dogfish (*Squalus* spp.) and Endeavour dogfishes (*Centrophorus* spp.).

No other chondrichthyans were identified as being at risk in other trawl fisheries.

TURTLES

In the CSF, a qualitative Level 2 ERAEF conducted for turtles assessed demersal trawling as posing a high level of risk to marine turtles (AFMA 2009d). A residual risk report after consideration of current management arrangements has not been published but no additional mitigation measures were considered necessary for turtles (AFMA 2009d). Observers are required on 25% of trips, covering at least 25% of shots over a year. Operators are also required to report interactions with protected species. There have been no interactions with turtles reported in either logbook records or by AFMA observers in the CSF. After consideration of current management arrangements no additional mitigation measure were considered necessary for turtles and chondrichthyans (AFMA 2009d).

For the OTF turtles have been assessed as being of low to moderate risk, with a low frequency of interactions, but it has also been reported that there are limited quantitative data available (NSW DPI 2004). Turtle excluder devices (TEDs) are also not required in the OTF. There is, therefore, the potential for significant interactions between trawl gear and turtles in the Clarence and Tweed AFAs where this fishery operates. Application of the precautionary approach indicates that risks to turtles should be regarded as high.

Other trawl fisheries either require the use of TEDs (CSF, ECOTF, and ECSWF) or have demonstrated a low level of interactions with turtles (SESSF).

SEABIRDS

Four species of seabirds have been identified as being at high risk from trawling in the SESSF (AFMA, 2010a). Two additional species were caught in much larger numbers in the trawl sector of the SESSF in 2006 than in all other Commonwealth fisheries (Phillips *et al.*, 2010) and are also potentially at high risk, particularly since there was no mitigation of seabird bycatch in this sector. In the context of this fishing risk assessment, however, trawling in the SESSF only has a significant overlap with the Batemans AFA and seabirds are not listed as one of functional groups of interest for this AFA. Nevertheless, risks to seabirds should be regarded as high.

FGRA RATING

The overall assessment is that the demersal trawls are rated as an "Unacceptable" risk to the CVs of the EMR. These findings are based on risks posed to benthic fauna in all AFAs except Norfolk, to high risk species of chondrichthyans in Batemans, Clarence and Tweed AFAs, to turtles (at potential risk) in Clarence and Tweed AFAs, and to seabirds in Batemans AFA.

5.2. Danish Seine

Danish seines are authorized to be used in the Fraser (ECSWF), Tweed, Clarence, Hunter (all OTF) and Batemans (SESSF) AFAs but have been used only by the ECSWF on a trial basis (in 2006). There is no reasonable expectation that the other two fisheries will apply the method in the EMR (see Attachment 1).

Danish seine in the SEMR FRA was assessed as posing either a medium or high risk to soft bottom habitats on the inner and outer shelf areas (25-200 m) (E-Systems 2005). The gear type is not used in any fisheries assessed in other FRAs.

In the ERAEF for Danish seine in the SESSF (Wayte *et al.* 2006b) of the 82 habitat types assessed, 3 were assessed to be at high risk, 20 medium and 59 low. Of the high risk habitats, none were found on the inner shelf (0-100m), 3 were on the outer shelf (100-200m) and none were on the upper slope (200-700m). High risk habitats on the outer shelf include soft sediment seabed types interspersed with harder bottom supporting large sponges, mixed epifauna, and the bryozoan communities at the shelf break.

After application of residual risk guidelines for the Danish Seine ERA, one TEP species remained at high risk: Australian fur seal (AFMA, 2010b). This was the only species identified as being at high risk after the Level 2 (PSA) analysis. Interactions with a range of TEPS including turtles, cetaceans, dugong, seabirds and shark were noted but rated as not being above moderate risk.

No information was available on the extent of the trial operation in the ECSWF and no risk assessment was available for this gear type in this fishery. Fishing occurs on the continental shelf at depths of less than 92 m (50 fathoms), however, so there are no interactions with CVs or functional groups found at depths greater than this such as canyon, seamount and shelf edge habitats and fauna.

As noted above, the Level 2 ERAEF for the SESSF indicates that Danish seine gear may interact with a range of TEPS that are functional groups of interest in the EMR. If Danish seine were to be used more extensively in other fisheries the risks specific to the TEPS found in those areas should be evaluated.

The lack of information available on Danish seine in the ECSWF and the application of the precautionary approach lead to one area of concern arising from the potential for Danish seining to impact on the CVs of the EMR:

1. risks posed by direct capture or bycatch impacts on TEPS (including turtles, cetaceans, dugong, dolphins, seabirds and sharks).

TEPS

The risks to TEPS may be no higher if Danish seining were to be used in the ECSWF than was found for the method in the Danish seine sector of the SESSF. The different TEPS found in Queensland and potential differences in the way the gear may be used, however, indicate that data specific to that fishery is needed for the risk to be correctly evaluated.

FGRA RATING

The overall assessment is that the gear poses an “Unacceptable level of risk (pending further investigation)” to the Conservation Values of the EMR for the Fraser AFA only. This finding is the application of the precautionary approach and the lack of information on the results of the trial use of the gear in the ECSWF. The gear is considered to pose an acceptable level of risk to CVs in the other AFAs based on the lack of activity within any AFAs for which the gear is authorized

5.3. Mid-water trawl

Mid-water trawls are authorized to be used in the CSCZ (CSF), Tweed, Clarence, Hunter (SPF), Tasmantid-Lord Howe and Batemans (SESSF & SPF) AFAs but there has been no or limited recent activity in any fishery with this gear in any AFA.

Dolphins were considered to be at medium (acceptable) risk to mid-water trawl in the SEMR FRA. Mid-water trawl was considered to pose an “acceptable risks with mitigation measures” in the SWMR FRA. Semi-demersal trawl gear (interpreted here as being the same as mid-water trawling) was assessed as posing as unacceptable level of risk on sawfishes and habitat types in the NMR RFA.

Three areas of concern arise from the potential for mid-water trawling to impact on the Conservation Values of the EMR:

1. risks to turtles in the CSCZ,
2. risks to dolphins in all AFAs where the gear is employed, and
3. risks to seabirds in all AFAs where the gear is employed.

TURTLES

TEDs are required in the CSF when fishing for crustacean but mid-water trawling that targets fish may pose a risk to turtles if TEDs are not used.

DOLPHINS

The residual risk report for mid-water trawl gear in the SPF found that it posed high risks to 8 marine mammals (the Australian fur seal and 7 species of dolphins). This finding is potentially relevant to the risks posed to dolphins in the CSF and SESSF.

SEABIRDS

Seabirds were not assessed as being at high risk in the SPF. Bird scaring devices are required when automatic or random baiting equipment is used in the CSF but information on their effectiveness was not available. Mid-water trawl gear has not been separately assessed in the SESSF ERAEF, but the finding that seabirds are at high risk for demersal trawl in the SESSF is potentially relevant for mid-water trawl if effective mitigation measures are not employed. Seabirds

are therefore assessed here as being at high risk pending further investigation for mid-water trawling in both the CSF and SESSF.

FRA RATING

The overall assessment is that the gear poses an “Unacceptable level of risk (pending further investigation)” to the Conservation Values of the EMR in the CSCZ (CSF), Tweed, Clarence, Hunter (SPF), Tasmanid-Lord Howe and Batemans (SESSF & SPF).

5.4. Beam trawl

Beam trawls are only used in the ECOTF and have interactions with one AFA. They are deployed as small ‘try’ gear when locating commercial quantities of target species and currently account for about 5% of the total trawl harvest.

This gear has not been assessed in any other FRAs.

Beam trawls have been reported to have larger impacts than prawn trawls (Pitcher *et al.* 2009) but it is uncertain whether the gear referred is similar to the beam trawls used to catch prawns in the ECOTF. They have not been subject to a separate risk assessment, however, and no data were available on bycatch levels or other impacts. The current effort levels in the ECOTF suggest a low level of risk. There was no trawl effort reported on either the Queensland or Marion plateaux (2002-2006). Nevertheless, the impact of beam trawls on benthic fauna is likely to be unacceptable if there was a change to current fishing practices and effort levels became high within the EMR.

One areas of concern arises from the analysis of the impact of beam trawls on the CVs of the Coral Sea Conservation Zone:

1. risks to benthic fauna in the CSCZ.

BENTHIC FAUNA

Risks that beam trawls post to benthic fauna in the EMR have not been specifically evaluated, but are likely to be similar to the high risks posed by demersal trawl to benthic habitats. Current fishing effort with beam trawls in the EMR is not considered a threat to CVs but there are no measures in place to prevent an increase in effort by this gear. If this was to occur, it would lead to unacceptable impacts on benthic fauna.

FRA RATING

The overall assessment is that the gear poses an “Unacceptable level of risk (pending further investigation)” to the Conservation Values of the EMR in the CSCZ (ECOTF) AFA.

5.5. Pelagic longline

The Eastern Tuna and Billfish Fishery (ETBF) is authorized to operate throughout the EMR. Pelagic longlining has been undertaken by the ETBF in all eight AFAs of

the EMR, with the lowest level of effort in the Norfolk AFA (based on map in Moore *et al.*, 2007). The level of effort in the fishery has declined from a peak of 12.4 million hooks in 2003 to 8.04 million hooks in 2008, largely due to the strength of the Australian dollar and increased operating costs (Wilson *et al.*, 2009). A decision has been made to introduce individual transferable quotas for the major target species in 2011 and this may influence future effort levels and the spatial distribution of effort. There is overfishing of bigeye tuna and yellowfin tuna across the broader Pacific and the status of striped marlin is assessed as uncertain (Wilson *et al.*, 2009).

The Southern Bluefin Tuna Fishery (SBTF) catch is predominantly with purse seine gear and the fishery also authorized to operate throughout the EMR, but there is no expectation that this will occur (see Attachment 1 for the rationale underlying this). Southern bluefin tuna are taken on pelagic longline by the ETBF in the southern waters of the EMR, hence comments on the ETBF are relevant to this species. The SBTF, however, is not considered further in the report.

The NSW Offshore Trap and Line Fishery (OTLF) is a multi-species, multi-gear fishery operating in waters off NSW out to the 4000 m isobath (approximately 60 to 80 nm offshore). The fishery is authorized to operate in the Tweed, Clarence, Hunter, Tasmanid-Lord Howe and Batemans AFAs. Key concerns for the fishery have been the need to address the adverse impacts of fishing on grey nurse sharks and the excessive levels of fishing effort. One of the line gears used in the fishery is driftline which can operate in a manner similar to pelagic longline and target pelagic species. Driftlines are generally used to target spotted and Spanish mackerel, sharks, snapper and kingfish (NSW DPI, 2006). Published information examined for this report does not present detailed catch information by line type so the level of catch taken by driftline is not available.

Four areas of concern arise from the analysis of the impact of pelagic longline on the CVs of the EMR:

1. risks posed to cetaceans,
2. risks posed to chondrichthyans,
3. risks posed to turtles, and
4. risks posed to teleosts.

CETACEANS

Cetaceans, including toothed whales, are a CV across all AFAs in the EMR. Though more than 30 species of whales and dolphins are known to occur in the EMR, the level and distribution of potential interaction in the various AFAs is not well known. There are very few reports of whales becoming entangled in tuna longline gear. Logbook data from 1999/00 to 2005/06 indicates 15 whale and dolphin interactions where the captured species was released alive, and one interaction resulting in the death of the captured species (Evans, 2007). Improved species identification for sightings and gear interactions by observers would help reduce the level of uncertainty in the ERA for marine mammals. The Level 2 ERA identified four whale species (short-finned pilot whale, Ginko beaked whale, pygmy killer whale and false killer whale) at high risk from the fishery (Webb *et al.*, 2007). A number of other whale species were identified as at medium risk by the Level 2 ERA (Webb *et al.*, 2007). Residual risk assessment of

the Level 2 ERA resulted in 2 high risk marine mammal species (short-finned pilot whale and false killer whale) (AFMA, 2009a). These species have been identified in the Ecological Risk Management Report for the ETBF (AFMA, 2009b). AFMA reports that in most cases where there is an interaction there is only light contact with the gear and that tangled animals can easily be cut free; line cutters and de-hookers were supplied to vessels in 2005 and are to be made compulsory in 2010 (AFMA, 2009b).

There is a lack of direct information on interactions with OTLF fishing operations and the EIS risk analysis was based on similar fisheries operating in other areas (NSW DPI, 2006). The EIS found a low-moderate risk level for marine mammal interactions by the fishery.

CHONDRICHTHYANS

Sharks are a CV in the EMR. The ETBF takes a wide range of shark species as bycatch including: blue shark, shortfin mako, bronze whaler, hammerhead sharks, silky shark, thresher sharks and oceanic whitetip shark (Evans, 2007). Some sharks are retained as byproduct, but high numbers are discarded, potentially alive. There remains a large amount of uncertainty in the species composition of shark catch due to identification issues that arise because of similarities between certain species (AFMA, 2009a). ETBF observer data for 2005/06 reports more than 20 species in catches, with blue shark, short-fin mako and bronze whaler shark reported in highest numbers (Evans, 2007). A ban on the use of wire traces was introduced in 2005 to reduce the capture of shark species and in domestic waters operators are restricted to a 20 shark trip limit. Observer coverage is maintained at a minimum of 5% (AFMA, 2009b).

Four chondrichthyan species were found to be at high risk from the Level 2 ERA: longfin mako shark, dusky shark, porbeagle shark and white shark (TEP) and two of these - longfin mako and dusky shark remained at high risk after the residual risk assessment (AFMA, 2009a). Thirty four chondrichthyan species, including the four Level 2 high risk species, were subject to a Level 3 ERA which found that at recent levels of fishing intensity the fishery posed precautionary high risk to 3 of the species assessed (longfin mako, pelagic thresher shark and crocodile shark) (Zhou *et al.*, 2007). More recent assessments, however, have indicated that a more conservative approach is appropriate for chondrichthyans (Zhou *et al.* 2009) and additional high risk chondrichthyans may be identified as being at high risk in a re-analysis using the revised estimates of sustainable fishing mortality. The Ecological Risk Management report (AFMA, 2009b) identifies these 3 species as a high priority, as well as dusky shark. Potential mitigation methods are identified in the *Chondrichthyan Guide for Fisheries Managers* (Patterson and Tudman, 2009). In January 2010, longfin mako, shortfin mako and porbeagle sharks were added to the list of migratory species under the EPBC Act following their listing under the international Convention on Migratory Species. This listing requires all captured live sharks to be returned to the water.

Several shark species were identified as high risk by the NSW Offshore Trap and Line Fishery (OTLF) environmental impact statement. Greatest concern is over potential interaction with grey nurse shark, though this risk is likely to be greater for bottom set gear than driftlines.

MARINE TURTLES

A number of marine turtle species nest and forage in areas of the EMR. Leatherback turtles have east coast nesting sites concentrated in the GBR, with some smaller sites in southern Queensland and northern NSW (DEWHA, 2009). The loggerhead turtle nests on northern NSW and southern Queensland beaches while hawksbill turtles and green turtles have nesting sites on Coringa Herald Islets in the Coral Sea Conservation Zone. Between 1999/00 and 2005/06 245 turtles were reported in ETBF logbooks as caught, with 233 reported alive at capture. Of these, 109 were leatherback turtles; 21 were loggerheads, 12 hawksbills, 1 olive ridleys and 102 were unidentified.

Of the six turtle species examined in the Level 2 ERA, 1 was classified as high risk (leatherback turtle) and 5 as medium (loggerhead, hawksbill, green, olive ridley and flatback turtles). Leatherback turtles were also rated as high risk following residual risk assessment and are a priority species for ecological risk management (AFMA, 2009b). All vessels in the ETBF were supplied with de-hookers and line cutters in 2005 and it is intended to require them to be on boats in 2010.

There are no quantitative data on the number of turtle mortalities associated with the OTLF (NSW DPI, 2006). The EIS assessed the risk of interactions for green, hawksbill, leatherback and loggerhead turtles as low-medium.

FGRA RATING

The application of the precautionary approach leads to a finding of “Unacceptable (pending further assessment)” across all AFAs in the EMR for pelagic longline gear owing to the risk posed to two cetacean species, three chondrichthyan species and one turtle species is considered. These findings reflect the high risk findings of the Level 2 ERA for short-finned pilot whales and false killer whales, and for leatherback turtles and the precautionary high risk findings of the level 3 ERA for longfin mako, pelagic threshers and crocodile sharks. Mitigation measures have been introduced to limit shark catches overall but not targeting high risk species and the effectiveness of these measures has not yet been assessed.

5.6. Demersal longline (including auto-longline)

Demersal longlines or trotlines are authorized for use in several fisheries across the EMR. Most of these fisheries are entitled to use a variety of line gears (as well as other gears) and information is often lacking on the distribution of effort and how much of the catch is taken by each line type. Line fisheries entitled to use demersal longline methods in the EMR are:

The Coral Sea Fishery (CSF)—a multi-gear and multi-species fishery overlapping with the Coral Sea Conservation Zone. Gears used include demersal longline, autolongline, trotline, dropline and handline. Limited information on target species results in status being assessed as uncertain (Wilson *et al.*, 2009). Level 1 ERA assessments were undertaken for the line sectors of the CSF and no

ecological components were eliminated at this level (i.e. there was at least one moderate risk score for each of the components, including habitat with potential damage by bottom set gear. Further qualitative risk analyses (equivalent to Level 2) examined the risks that the CSF poses to chondrichthyans and to TEP species across the various sectors. One hundred and nine TEP species were identified as possibly occurring in the area of the CSF, including 13 birds; 44 sea horses and pipefish; 23 reptiles; 28 cetaceans and 110 chondrichthyans. The Demersal and Autolongline sector was assessed and found to represent a high risk to marine turtles and, given the targeting of sharks by the sector, a high risk to all chondrichthyan species (AFMA, 2009d).

The Southern and Eastern Scalefish and Shark—Scalefish Hook Sector - line fishing methods authorised for use in the scalefish hook sector are demersal longline (including auto-longline), dropline and trotline. The fishery has a well-established harvest strategy, with management predominantly through quotas but also with input controls such as hook limits and extensive spatial and depth closures. The majority of effort by line fishing methods takes place in waters to the south of the EMR, though there has been a small amount of exploratory activity in the Tasmantid-Lord Howe AFA. SESSF ALL: L2 ERA examined 149 habitat types and found 17 at high risk, predominantly on the upper continental slope (200-700m) (Daley *et al.*, 2007b). Risk arises partly from ability of ALL fishing to target bottom types not fishable by trawling. A key uncertainty is the effect of movement of the main line itself on large, erect and fragile epifauna. L2 ERA found 56 species at high risk, mostly shark and seabird species (2 target species, 13 by-product species, 14 bycatch species, and 27 TEP species). Residual risk assessment and L3 SAFE ERA identified 9 species (2 teleosts, 2 skates and 5 deepwater sharks) at high ecological risk. These species are a high priority for ecological risk management. The species are blueeye trevalla, hapuku, bight skate, grey skate, blackbelly lantern shark, Harrison's dogfish, greeneye dogfish, platypus shark and southern dogfish (AFMA, 2010d).

The NSW Offshore Trap and Line Fishery (OTLF)—a multi-species, multi-gear fishery operating in waters off NSW out to approximately 80 nm. Gears used include fish trap, crab net, trotline, dropline, driftline, handline and troll line. A comprehensive environmental impact statement was prepared in 2006 (NSW, 2006). The fishery is authorized to operate in the Tweed, Clarence, Hunter, Tasmantid-Lord Howe and Batemans AFAs. The EIS for the fishery indicates 5 target species at high risk (bar cod, blackspot pigfish, wobbegong shark, gummy shark and 'mixed' shark) (NSW DPI, 2006). Key concerns for the fishery have been the need to address potential adverse impacts of fishing on grey nurse sharks and the excessive levels of fishing effort. The EIS also found that of the 18 threatened species where interactions were possible, grey nurse shark were at high risk and great white shark were at moderate risk. The risk of the OTLF to seabirds, marine mammals and reptiles was assessed as moderately low. Revised management arrangements have been introduced since the EIS to address concerns. There is a lack of direct information on interactions with OTLF fishing operations and the EIS risk analysis was based on similar fisheries operating in other areas (NSW DPI, 2006). The EIS found a low-moderate risk level for marine mammal interactions by the fishery. An observer program has been initiated to improve available information (Anon., 2009). More than 200 observer trip have been undertaken since 2007 (Anon., 2009). In addition, dedicated shark-fishing observer trips are done on an opportunistic basis. One

interaction with great white shark has been reported, with the animal released alive and healthy (Anon., 2009).

Queensland line fisheries: Rocky Reef Fin Fish Fishery (RRFFF), Deep Water Fin Fish Fishery (DWFFF), Coral Reef Fin Fish Fishery (CRFFF), and East Coast Spanish Mackerel Fishery (ECSMF) utilize a variety of line fishing methods operating in the Coral Sea Conservation Zone and Fraser AFAs, including rod and reel, and line, troll, dropline and trotline. Only the DWFFF operates with demersal longline gear. The DWFFF is a commercial operator only fishery using vertically set drop lines or bottom set trotlines. Primary target species are bar cod, deep water snapper, ruby and goldband snapper, rosy jobfish and hapuku (QDPI, 2007a). Unspecified shark species are a significant component of the catch. The area of the DWFFF consists of all tidal waters deeper than 200 metres and includes areas of the GBRMP as well as areas of the CSCZ and Fraser AFAs. DWFFF operators are based predominantly in the southern section of the state. Ecosystem impacts are thought to be low as line fisheries are less likely to impact on habitats and substrate compared to other fishing methods (DEWHA, 2008). One interaction was recorded in the 2008–09 period with a white shark which was released alive (DEEDI, 2009d). This is the first interaction reported in this fishery since the Species of Conservation Interest (SOI) logbook was introduced in 2002. Since 2005, there has been 10 days observer coverage in the DWFFF fishery (DEEDI, 2009d).

Two key issues emerge from the available analyses of demersal longline fisheries in the EMR. These issues are consistent with the findings for risk analyses in other regions. Both are related to direct impacts from fishing;

- potential damage to seafloor habitats by the longline gear, and
- potential impacts on turtles and impacts on sharks and rays (in particular, deepwater shark species).

BENTHIC HABITATS

The ERA for the auto-longline sector of the SESSF identified high risks to some hard and soft bottom habitats on the outer shelf (100-200m), the upper slope (200-700m) and upper slope canyons (100-1500m). High risk habitats on the outer shelf include soft sediment seabed types over hard bottom characterized by sediment veneers interspersed with sub-cropping, friable sedimentary rocks or cobbles characterized by large sponges. High risk upper slope habitats include several categories of hard bottom (but still accessible to trawl gear) with large, erect or delicate epifauna consisting of octocorals, crinoids, large sponges, and mixed epifaunal communities. Also ranked high were sediment veneers over hard bottom and sediment bottoms characterized by large sponges and sedentary epifauna. Habitats of the shelf break, and canyon features occur at this depth zone (Daley *et al.*, 2007b).

The CSF ERA also acknowledges potential risks to habitats from demersal longlines. These findings potentially place habitats in the EMR at risk where demersal longline gear is used.

MARINE TURTLES

All six species of marine turtles are listed (two species as Endangered and four species as Vulnerable) under the EPBC Act and all are listed on Appendix I of CITES. Interaction with turtles is identified as a high risk in the CSF demersal

line sector (observer coverage to evaluate interactions has been limited. A minimum 25% observer coverage now specified on all line fishing permits. The OTLF EIS acknowledges potential interaction with turtles but there is a lack of direct information from the fishery.

CHONDRICHTHYANS

Chondrichthyans are a common component of the catch of demersal longline fishing, including the fisheries using these methods in the EMR. Catches of shark are often poorly documented and limited information is available detailing where shark catches are taken and which species are taken. Several species have been identified at high risk in assessments across the EMR demersal longline fisheries and the risks assessed for chondrichthyans using the Level 3 SAFE method (Zhou *et al.* 2007) are now thought to have been underestimated (Zhou *et al.* 2009).

FGRA FINDINGS

Application of the precautionary approach leads to a finding of “Unacceptable level of risk (pending further assessment)” for demersal longline. This finding is underpinned by:

- The high risk findings for benthic habitat impacts by the ERA for auto-longline gear;
- lack of information about the nature and extent of the grounds fished by these methods; and
- the high risk findings for several chondrichthyan species including deepwater shark which are considered to be least sustainable, and potential interaction with grey nurse shark.

5.7. Mesh nets

Mesh nets (or gillnets) are used in the East Coast Inshore Finfish Fishery (ECIFFF). The ECIFFF is a complex multispecies, multi gear (multiple net types and line) fishery with more than 400 commercial fishers and some 750,000 recreational and charter fishers (Gunn *et al.*, 2008). Areas of the fishery extend into the Great Barrier Reef Marine Park. Overlap with the EMR occurs in the CSCZ and Fraser AFAs. The fishery is divided into the Northern Inshore Fishery and the Southern Inshore Fishery. The Southern Inshore Fishery (south of 24.5°S) overlaps with the Fraser AFA. There has been no fishing activity in the parts of the Northern Inshore Fishery that overlap with the CSCZ. The ECIFFF commercial sector contributes the most to the total harvest of mullet and shark on the Queensland east coast, whereas the recreational sector substantially exceeds the commercial catch of a number of species notably tailor, bream and trevally (QDPI, 2008). Much of the reported catch is taken in inshore waters, i.e. outside the Fraser AFA boundaries. Mesh nets are used as drift nets or ring nets in southern areas for most of the species caught in the larger estuaries and bays, such as mullet and lesser mackerels but must not be used as drift nets in Dugong Protection Areas. A logbook to record interactions with species of conservation interest (SOCI) was introduced in 2003. The ECIFFF has been

approved as a wildlife trade operation and its management regime has been accredited under the EPBC Act, subject to a number of conditions. A number of these conditions relate to the lack of information on interactions with threatened species and poor information on shark catches and require improved catch validation and extended fishery observer coverage. The level of detail in the fishing effort data, in particular for gillnet fishing, is insufficient for monitoring, catch rate interpretation and management (Gunn *et al.*, 2008). Gillnets are set at different heights in the water column depending on which species are being targeted, but this information is lacking in available reports. Risks for the fishery should be re-evaluated when additional information is available.

Queensland has conducted an ecological assessment of the ECIFFF (Zeller and Snape, 2005). The study indicated that damage to the physical environment is minimal as mesh nets fish passively with only minor disturbance of the sea floor. Further, sensitive habitats (e.g. seagrass and coral reefs) are protected from potential ecological change through a system of permanent fishing closures. These findings, along with those of the SEMR FRA, support the conclusion that the gear is not considered to pose a high risk to the benthic habitats in the EMR.

Two areas of concern arise from the analysis of mesh nets on the CVs of the Fraser AFA within the EMR:

1. risks associated with impacts on turtles; and
2. risks posed to chondrichthyans.

There are also potential interactions with cetaceans. Fisheries are required to complete a Species of Conservation Interest (SOCI) logbook. Cetacean interactions for the whole ECIFF reported in the SOCI logbook were: 5 in 2006 and 16 in 2007, with all released alive (QDPI, 2008). There is no indication where these interactions took place. Cetaceans are more likely to be caught in surface set gillnets, but there is a lack of information on the depth at which nets are set.

TURTLES

Turtle interactions for the whole ECIFFF reported in the SOCI logbook were: 397 in 2005, 219 in 2006 and 180 in 2007, with all but 2 released alive. The majority of turtle interactions occur in tunnel net operations where operators use turtle excluder devices to release the turtles unharmed (QDPI, 2008). There is the potential for interactions within the Fraser AFA and, given the absence of specific mitigation measures for use in mesh nets, this gear must be considered to potentially pose a high risk to marine turtles.

CHONDRICHTHYANS

Interaction with sharks has been an area of concern for the fishery and quality of the data on the quantity and species composition of shark catches has been poor and levels of observer coverage have been low. Hammerhead sharks, whaler sharks and white-spotted guitarfish are considered to be at moderate to high risk across the fishery (DEH, 2006). Increased targeting of shark has also been an issue. The Fraser-Burnett region (24°30'S to 26°00'S) was the east coast's top shark producing area in 1996 with 142t (27% of the east coast catch) (Gribble *et al.*, 2004). Catches remained close to that level in subsequent years but catches increased in more northern areas from 2003 to become the prime

shark producing regions on the east coast. A number of changes have been required as part of environmental accreditation to improve management of shark catches. Fishers taking shark are required to have a new symbol ('S'), designed to provide better information on shark catch including the species composition and the product form of retained catches. Other requirements include a total allowable commercial catch (not species specific) and the development of a harvest strategy for sharks. Closures are in place for known grey nurse aggregation sites (Zeller *et al.*, 2006) but there is possible interaction elsewhere. Much of the fishing effort in the Fraser AFA takes place in State waters and it is not clear from available information how much of the ECIFFF shark catch is taken in waters of the Fraser AFA. Nevertheless, the susceptibility of sharks to overfishing and the poor level of information on their status in the region and the generic nature of the management arrangements lead to a conclusion that fishing poses a high risk.

FGRA RATING

The application of the precautionary approach leads to a finding of "Unacceptable level of risk (pending further assessment)" for mesh nets in the Fraser AFA. This finding reflects:

- the potential interaction with marine turtles and the absence of identified bycatch mitigation measures; and
- the uncertainties surrounding the impact of this gear on chondrichthyans arising from inadequate information on historical catches and a poor understanding of their status in the region.

5.8. Purse seine

The Eastern Skipjack Tuna Fishery (ESTF) is authorized to operate throughout the EMR. The fishery targets skipjack tuna using purse seine gear. Some catches of skipjack tuna are also taken on pole-and-line and by the minor line component of the ETBF. Skipjack tuna are widely distributed throughout the Australian Fishing Zone though they are at the edge of the species' range in the Pacific Ocean and their annual availability varies considerably in response to environmental conditions. The reporting of catches and effort in the fishery is restricted because of the small number of vessels operating. The fishery has only been active in the Batemans AFA, with little or no activity in this region in recent years. Only one vessel was active in the fishery in the 2007-08 season (Wilson *et al.*, 2009).

The major target species of the Small Pelagic Fishery (SPF) purse seine sector are Australian sardine, blue mackerel, jack mackerels and redbait. There are more than 75 permits in the fishery but only 2 or 3 vessels have operated in recent years. Within the EMR the fishery has operated only off southern NSW, potentially in the Batemans AFA but with the majority of effort in 2001-2004 south of Bermagui (Daley *et al.*, 2007b). Mid-water trawling is also used to target the same species.

The Southern Bluefin Tuna Fishery (SBTF) is also authorized to operate throughout the EMR but there is no expectation that this will occur (see Attachment 1 for the rationale underlying this).

There has been no purse seine activity by the ESTF and the SPF in the majority of the EMR, hence the level of risk on the CVs by this method for the region is generally acceptable. One area of concern arises from the analysis of the impact of purse seine gear:

1. risks posed to cetaceans;

CETACEANS

Cetaceans, including toothed whales, are a CV in the EMR. Though more than 30 species of whales and dolphins are known to occur in the EMR, the level and distribution of potential interaction in the various AFAs is not well known. Level 2 residual risk assessment of the SPF resulted in 29 marine mammals rated as high risk. These 29 marine mammals are identified as high priority species for ecological risk management for the fishery (AFMA, 2010c). Many of these high risk ratings result from lack of information. There were no interactions with TEP species reported in either logbooks or by observers over the period 2004-2009 (AFMA, 2010c) but the level of observer information is low. Specific management arrangements to mitigate the risk are not identified. It is suggested that if a marine mammal is enclosed by a purse seine then the species can usually be readily released by lowering of part of the net (AFMA, 2010c). The ecological risk management strategy for the SPF requires an observer coverage rate of 10% of shots in the fishery.

FGRA RATING

The application of the precautionary approach leads to a finding of "Unacceptable level of risk (pending further assessment)" for purse seine gear in the Batemans AFA in relation to potential impact on cetaceans. Although the level of fishing effort in the Batemans AFA has been low, this finding reflects the Level 2 residual risk assessment high risk outcomes for 29 marine mammals and the lack of specific mitigation measures to date. No interactions have been reported (AFMA, 2010c), however, observer information is needed to reduce the high risk outcomes.

5.9. Fish Traps

The gear is used, or is authorized to be used, by three fisheries (CSF, SESSF and OTLF) across six AFAs. Fish traps were rated as being low risk to all CVs in SEMR FRA, as low risk for habitats, medium for seals & sea lions, and low for cetaceans in the SWMR FRA, and as "Unacceptable (pending further assessment)" in NW because of potential impact on demersal fish slope communities.

In the CSF, there were 9 line and trap and 2 trawl and trap permits in 2009. The total catch across all sectors in 2007-08 was 132 t, but the proportion taken by traps is likely to be small and most of the catch for this fishery comes from the Great Barrier Reef area which is not included in the East Marine Bioregion (Moore et al. 2007). All traps must have a sacrificial anode to avoid ghost fishing

if the traps are lost. There is no clear distinction between target and bycatch species in the sectors entitled to use traps which is reflected in a variable catch compositions over time. Many of the main species caught are demersal species but none are herbivorous. All fishing permits authorizing the use of demersal finfish traps now require all non finfish species taken with this method to be released in a manner that best ensures their survival.

In the CSF, the trap sectors have been assessed using a qualitative Level 2 ERAEF as representing a low to medium risk to TEP and chondrichthyan species (AFMA 2009d). Information on risks to target, bycatch and by-product species is not yet available. Observers are required on 25% of trips, covering at least 25% of trap lifts over a year. Operators are required to report interactions with protected species in their Commonwealth logbook. No protected species interactions have been reported in the CSF to date.

In the SESSF, there are 2 trap concessions but no recent activity and little likelihood of the fishery becoming active.

In the OTLF, demersal fish were assessed as being as high risk. Also, taking a precautionary approach, biodiversity and aspects of ecological processes (food webs, nutrient cycling and species interactions) had been identified as being at high risk of disruption by direct harvesting for sale or bait (NSW DPI 2006). In our view, ecological processes and biodiversity are not equivalent to the functional groups identified for the CVs in the EMR, but may impact on all of them. Nevertheless, the specific impacts on, and level of risk to, the CVs of the EMR that is attributable to the trap sector of the OTL could not be assessed with the available information. Also, this high risk rating was in part the result of the non-selective nature of the gear and the wide variety of species harvested. They would seem to be no higher than for other fisheries that catch a similarly wide variety of species. There are also arguments that fisheries that take a wide variety of species are less likely to cause disruptions to ecological processes (Zhou 2008). We have therefore assessed the gear as not creating a high risk for CVs other than demersal fish.

One area of concern arises from the analysis of the impact of fish traps on the CVs of the EMR: the risks posed to demersal fish in the Tweed, Clarence, Hunter and Batemans AFAs.

DEMERSAL FISH

In the CSF many of the main species caught are demersal species but information on risks to target, bycatch and by-product species is not yet available. Stock status has been assessed as uncertain in the BRS Stock Status Reports (Woodhams *et al.* 2009). A precautionary approach would rate demersal fish as being at high risk at present, but this may be reduced when a Level 2 or Level 3 ERAEF is completed.

In the OTLF one species of teleost which is mainly taken in the trap sector was rated as high risk: the Black-spot pigfish *Bodianus vulpinus* (NSW DPI, 2006). Four species or species groups, which are taken mainly in the trap fishery or in similar quantities in both the trap and line sectors, were rated as being at moderately high risk: leatherjackets Family Monacanthidae, rubberlip morwong *Nemadactylus douglasii*, pearl perch *Glaucosoma scapulare* and snapper *Pagrus auratus*.

In addition a high level of risk is assigned to the threat that discarding poses to the sustainability of commercial species, as a precautionary rating because of the lack of information available on the species composition, fish sizes and quantities of discards, and on their post-release survival.

FGRA RATING

Trap fisheries are rated as “Unacceptable level of risk (pending further assessment)” in the CSCZ, Tweed, Clarence, Hunter and Batemans AFAs because of the high risk assigned to the impact of traps on a number of demersal fish species and the lack of information available on discards in some fisheries.

6. Abbreviations & Acronyms

AFA	Area for further assessment
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
ALL	Automatic longline
ANZECC	Australian and New Zealand Environment and Conservation Council
BIA	Biologically important area
BRD	Bycatch reduction device
BRS	Bureau of Rural Sciences
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CP	Conservation Priority
CSCZ	Coral Sea Conservation Zone
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CV	Conservation value
DEEDI	Department of Employment, Economic Development and Innovation (Qld)
DEH	Department of the Environment and Heritage
DEWR	Department of the Environment and Water Resources
DEWHA	Department of the Environment, Water, Heritage and the Arts
DPIF	Department of Primary Industries and Fishery (Queensland)
EMR	East Marine Region
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
EPBC Regulations	<i>Environment Protection and Biodiversity Conservation Regulations</i>
ERA	Ecological risk assessment
ERAEF	Ecological Risk Assessment for Effects of Fishing
ERM	Ecological Risk Management
ESDA	Ecologically sustainable development assessment
FAO	United Nations Food and Agriculture Organization
FGRA	Fishing gear risk assessment
FRA	Fisheries risk assessment
FRDC	Fisheries Research and Development Corporation
GBR	Great Barrier Reef
GBRMP	Great Barrier Reef Marine Park
GBRMPPA	Great Barrier Reef Marine Park Authority
IUCN	International Union for the Conservation of Nature and Natural Resources (World Conservation Union)
KEF	Key ecological feature
MBP	Marine Bioregional Planning
nm	Nautical mile
NMR	North Marine Region
NWMR	North-west Marine Region
OCS	Offshore Constitutional Settlements
PSA	Productivity Susceptibility Analysis (ERAEF Level 2)
SAFE	Sustainability Assessment for Fishing Effects (ERAEF Level 3)
SBTf	Southern Bluefin Tuna Fishery
SEMR	South-east Marine Region
SESSF	Southern and Eastern Scalefish and Shark Fishery
SICA	Scale Intensity Consequence Analysis (ERAEF Level 1)
SOCI	Species of Conservation Interest (one of the logbooks required in Qld fisheries)
SWMR	South-west Marine Region
TED	Turtle excluder device
TEPS	Threatened, endangered or protected species

Fisheries

Commonwealth Managed Fisheries	
CSF	Coral Sea Fishery
ESTF	Eastern Skipjack Tuna Fishery
ETBF	East Coast Tuna & Billfish Fishery
NIF	Norfolk Island Fishery
SBTF	Southern Bluefin Tuna Fishery
SESSF	Southern and Eastern Scalefish & Shark Fishery
SPF	Small Pelagics Fishery
SSJF	Southern Squid Jig Fishery

New South Wales Managed Fisheries	
OTF	Ocean Trawl Fishery
OTLF	Ocean Trap and Line Fishery
RLF	Rock lobster Fishery

Queensland Managed Fisheries	
CF	Coral Fishery
CRFFF	Coral Reef Fin Fish Fishery
DWFFF	Deepwater Finfish Fishery
ECBDMF	East Coast Bêche de Mer Fishery
ECBSCF	East Coast Blue Swimmer Crab Fishery
ECIFFF	East Coast Inshore Finfish Fishery
ECOTF	East Coast Otter Trawl Fishery
ECPF	East Coast Pearl Fishery
ECSMF	East Coast Spanish Mackerel
ECSWF	East Coast Stout Whiting Fishery
ECTF	East Coast Trochus Fishery
MAFF	Marine Aquarium Fish Fishery
MCF	Mud crab Fishery
MSSCF	Marine Specimen Shell Collection Fishery
RRFFF	Rocky Reef Finfish Fishery
SCF	Spanner crab Fishery

7. Glossary

Abyssal plain: The flat, relatively featureless bottom of the deep ocean at a depth greater than 2000 m. The average depth of the abyssal floor is about 4000 m.

Anthropogenic: Of human origin or resulting from human activity.

Ascidians: Members of the class Ascidiacea (sea squirts).

Bathymetry: The measurement of ocean depths to determine the sea floor topography.

Bêche-de-mer: See trepang/sea cucumber.

Benthic/benthos: Refers to all marine organisms living on or within the seafloor.

Biodiversity: The totality of genes, species, and ecosystems in a region or the world. The variability among living organisms from all sources (including terrestrial, marine and other ecosystems), which includes diversity within species and between species and diversity of ecosystems.

Biological or ecological productivity The ability of an ecosystem to produce, grow or yield products such as food.

Biomass: The quantity of organic matter within an ecosystem (usually expressed as dry weight for unit area or volume).

Biota: All of the organisms at a particular locality.

Bycatch: Species taken incidentally in a fishery where other species are the target.

Bryozoans: Sessile, filter-feeding marine animals. The majority are encrusting, forming flat sheets that spread out over the substrate, but others grow upwards into the water column.

Carbonate reefs/banks: Reefs or banks whose structure primarily consists of calcium carbonate.

Cetaceans: Members of the mammalian group Cetacea, including whales, dolphins and porpoises.

Chondrichthyan: Members of the group of fish with cartilaginous skeletons that includes sharks, rays and skates (elasmobranchs) and the chimaeras (holocephalans) (cf Teleost).

Commonwealth waters: The Commonwealth marine area, which includes 'Commonwealth waters' is defined in the EPBC Act as any part of the sea, including the waters, seabed, and airspace, within Australia's Exclusive Economic Zone and/or over the continental shelf of Australia, excluding State and Northern Territory coastal waters. Generally, the Commonwealth marine area stretches from three nautical miles from the territorial sea baseline to the outer limit of the Exclusive Economic Zone, 200 nautical miles from the baseline. The territorial sea baseline is normally the low water mark along the coast.

Conservation values: Marine conservation values are defined for the purpose of marine bioregional planning as including:

(a) Protected species and communities, including: (i) species and communities listed as threatened under the EPBC Act; (ii) species listed as migratory under the EPBC Act; (iii) cetaceans (including all whales, dolphins and porpoises) under the EPBC Act; and (iv) species listed as marine species under the EPBC Act;

(b) Key ecological features of the marine environment, including: (i) species and communities considered to play an important ecological role in the Region; and (ii) habitats or areas considered to be ecologically important at a regional scale; and

(c) Protected places, including: (i) heritage places (including World Heritage, National Heritage and Commonwealth Heritage); (ii) historic shipwrecks; (iii) Commonwealth marine reserves; and (iv) listed critical habitats.

Continental slope: The region of the outer edge of a continent between the relatively shallow continental shelf and the deep ocean.

Continental shelf: The section of the seabed from the shore to the edge of the continental slope.

Coralline algae: Coralline algae are red algae characterized by a body that is hard as a result of calcareous deposits contained within the cell walls. Many are typically encrusting and rock-like, found in tropical marine waters all over the world. They play an important role in the ecology of coral reefs. Sea urchins, parrot fish, limpets and chitons feed on coralline algae.

Crinoids: Members of the group of invertebrates (Class Crinoidea) known as sea lilies or feather-stars. In the Phylum Echinodermata which also includes brittle stars, basket stars, sea urchins, sand dollars and sea cucumbers.

Critically endangered (see also: threatened species): The definition of a critically endangered species in the EPBC Act (Section 179) is: "A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria."

Demersal: Living on or near the bottom of the sea.

Elasmobranch: A cartilaginous fish of the subclass Elasmobranchii, which includes skates, rays and sharks.

Endangered species (see also: threatened species): The definition of an endangered species in the EPBC Act (Section 179) is: "A native species is eligible to be included in the endangered category at a particular time if, at that time:

(a) it is not critically endangered; and

(b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria."

Endemic/endemism: Native to a particular area and found nowhere else. Uniqueness.

Epibenthic: Living on top of the sea floor. Epibenthic organisms may be freely moving (motile) or permanently attached to a surface (sessile).

Epifauna: Animals living attached to rocky reefs or on the seafloor. They include hydroids, sea-pens, small bryozoans and sponges. (Compare to infauna).

Finning: The practice of removing the fins from shark species and discarding the bodies into the sea.

Gorgonians: A gorgonian, also known as sea whip or sea fan, is a marine invertebrate animal, belonging to the phylum Cnidaria. Gorgonians are found throughout the oceans of the world, especially in the tropics and subtropics, and form colonies that are normally erect, flattened, branching, and reminiscent of a fan. Others may be whip-like, bushy, or even encrusting. A colony can be several feet high and across but only a few inches thick.

Infauna: Animals that inhabit the sandy or muddy surface layers of the ocean bottom, i.e., those that live buried or dig into the substrate. (Compare to epifauna).

Invertebrates: An animal without a backbone composed of vertebrae (e.g. insects, worms, snails, mussels, prawns and cuttlefish).

Key ecological features: Conservation values identified within Commonwealth waters to help inform decisions affecting the marine environment in each Marine Region. Key ecological features are those features of the marine environment that are not specifically protected under the EPBC Act, but which are considered to be important or unique characteristics of the Region that are potentially deserving of conservation, monitoring or management.

Marine reserve: A marine protected area that is highly protected, and is effective as a complete sanctuary; no extractive uses are permitted, and very few (or no) other human uses (including scientific research) are permitted.

Marine species (listed): A marine species included in the list referred to in Section 248 of the EPBC Act. The list contains the following:

- (a) all species in the family Hydrophiidae (sea-snakes);
- (b) all species in the family Laticaudidae (sea-snakes);
- (c) all species in the family Otariidae (eared seals);
- (d) all species in the family Phocidae ("true" seals);
- (e) all species in the genus *Crocodylus* (crocodiles);
- (f) all species in the genus *Dugong* (dugong);
- (g) all species in the family Cheloniidae (marine turtles);
- (h) the species *Dermochelys coriacea* (leatherback turtles);
- (i) all species in the family Syngnathidae (seahorses, sea-dragons and pipefish);
- (j) all species in the family Solenostomidae (ghost pipefish); and

(k) all species in the class Aves (birds) that occur naturally in Commonwealth marine areas.

Migratory species (listed): A migratory species included in the list referred to in Section 209 of the EPBC Act. Under the Act, migratory species has the meaning given by Article 1 of the Bonn Convention: "the entire population, or any geographically separate part of the population, of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries".

Octocorals: Soft corals including seafans and seawhips.

Pelagic: Associated with the surface or middle depths of the water column, e.g. fish swimming freely in the open sea.

Sessile: Sessile animals are fixed and immobile. They are usually permanently attached to a solid substrate of some kind, such as a rock or the hull of a ship in the case of barnacles. Other sessile animals such as corals lay down their own substrate. Sessile animals typically have a free-moving (motile) phase in their development.

State/Territory waters: State or Territory waters are a belt of water that extends from the territorial sea baseline for three nautical miles seawards, and are under the jurisdiction of the adjacent Australian State or Territory. The normal territorial sea baseline is the low water mark measured along the coast.

Stock: A group of individuals of a species, usually occupying a particular spatial range. Stocks are used as a unit for managing and assessing fisheries.

Substrate: A surface on which organisms live.

Teleost: A fish with a bony skeleton (cf Chondrichthyans).

Threatened species: Threatened species are listed under the EPBC Act (Section 178) in six categories:

- (a) extinct;
- (b) extinct in the wild;
- (c) critically endangered;
- (d) endangered;
- (e) vulnerable; and
- (f) conservation dependent.

The definitions for these categories of listing are detailed in Section 179 of the EPBC Act.

Trophic level: The position an organism occupies in a food chain; levels include primary producers, herbivores, primary, secondary and tertiary carnivores, and decomposers.

Upwelling: The phenomenon of deep ocean water rising to the surface, usually bringing nutrients that can increase biological productivity.

Vulnerable species (see also: threatened species): The definition of a vulnerable species in the EPBC Act (Section 179) is:

"A native species is eligible to be included in the vulnerable category at a particular time if, at that time:

- (a) it is not critically endangered or endangered; and
- (b) it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria."

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9. Appendices

Appendix 1 Previous FGRAs for gear used in fisheries authorized to operate in the EMR.

Gear	Assessment in SEMR FRA	Assessment in SWMR FRA	Assessment in NMR	Assessment in NWMR
Demersal trawl	Medium to High risk on benthic habitats	As per SEMR FRA: Unacceptable risk on benthic and demersal communities and habitats across all AFAs	Unacceptable level of risk on: 2 high risk species of rays in Van Diemen AFA <ul style="list-style-type: none"> sawfishes (draft CP) in the Van Diemen and Gulf of Carpentaria AFAs habitat types in the Van Diemen and Gulf of Carpentaria AFAs 	Unacceptable level of risk on: <ul style="list-style-type: none"> habitat types in Gascoyne, Pilbara North, Kimberly, Kimberly North and Bonaparte AFAs target species of scarlet prawn, gemfish, tang snapper and mirror dory in Gascoyne AFA sawfishes in the Pilbara North, Kimberley and Kimberley North AFAs Unacceptable (pending further assessment) of the risk on: <ul style="list-style-type: none"> the 11 chondrichthyan species (draft CP) assessed at high risk in the residual risk assessment in the Gascoyne AFA; small cetaceans and seasnakes in the Pilbara North AFA
Semi-demersal otter trawl	Not assessed	Not assessed	Unacceptable level of risk on: <ul style="list-style-type: none"> sawfishes (draft CP) in the Gulf of Carpentaria AFA habitat types in the Van Diemen and Arafura AFAs 	Not assessed
Pelagic longline	SEMR FRA: Medium risk to seabirds	SWMR FRA: Unacceptable risk (pending further assessment) to shark and ray species across all AFAs and to threatened and otherwise listed seabirds off the Abrolhos Islands)	Not assessed	Unacceptable level of risk on: <ul style="list-style-type: none"> small cetaceans (toothed whales) in Gascoyne AFA Unacceptable level of risk (pending further assessment) on three species of sharks in Gascoyne AFA

Gear	Assessment in SEMR FRA	Assessment in SWMR FRA	Assessment in NMR	Assessment in NWMR
Demersal longline	Medium risk to some benthic habitats	Unacceptable level of risk on shark and ray species across all AFA and on benthic and demersal communities and habitats	Unacceptable level of risk (pending further assessment) on: <ul style="list-style-type: none"> benthic habitats marine turtles (draft CP) in the Joseph Bonaparte Gulf, Van Diemen, Arafura and Gulf of Carpentaria AFAs; sawfishes in Van Diemen AFA; and chondrichthyans taken as bycatch/byproduct in the Van Diemen AFA 	Unacceptable level of risk (pending further assessment) on: <ul style="list-style-type: none"> banks and shoals in the Abrolhos Extension: Kalbarri AFA; and small cetaceans in the Abrolhos Extension: Kalbarri and Kimberley AFAs; sawfishes in the Kimberley AFA;
Pelagic gillnets	Not assessed	Not assessed	Unacceptable level of risk (pending further assessment) on: <ul style="list-style-type: none"> marine turtles (draft CP) in the Joseph Bonaparte Gulf, Van Diemen, Arafura and Gulf of Carpentaria AFAs; sawfishes (draft CP) in Van Diemen AFA; and chondrichthyans taken as bycatch/byproduct in the Van Diemen AFA 	Unacceptable level of risk (pending further assessment) on: <ul style="list-style-type: none"> Turtles in the Kimberley North and Bonaparte AFAs Cetaceans in the Kimberley North and Bonaparte AFAs
Demersal gillnet	Sea lions - Medium risk	Potentially high risk to 22 types of outer shelf seafloor habitats, 5 seals and sea lions, 15 sharks and chimaeras	Not assessed	Unacceptable level of risk (pending further assessment) on: <ul style="list-style-type: none"> banks and shoals in the Abrolhos Extension: Kalbarri AFA; and dolphins in the Abrolhos Extension: Kalbarri AFA
Mesh nets	Not assessed	Not assessed	Unacceptable level of risk on: <ul style="list-style-type: none"> guitarfish in the Gulf of Carpentaria AFA least sustainable species of sharks identified by the Salini <i>et al.</i> (2007) in the Gulf of Carpentaria AFA 	

Gear	Assessment in SEMR FRA	Assessment in SWMR FRA	Assessment in NMR	Assessment in NWMR
			<ul style="list-style-type: none"> marine turtles in the Gulf of Carpentaria and West Cape York AFAs sawfishes in the Gulf of Carpentaria 	
Purse seine	<p>All impacts low:</p> <ul style="list-style-type: none"> occasional contact of gear on bottom during retrieval at shallow depth Seals and sea lions attracted to net but escape at will Adverse dolphin interactions unlikely since gear is recovered slowly and dolphins are not entangled in net 	Acceptable level of risk with mitigation measures for sea lions, seals and other TEPS	Not assessed	Acceptable (some conditions may be required)
Droplines	All impacts low risk: essentially limited to damage to invertebrates crushed by the weight (typically 10kg) at the bottom	As per SEMR FRA: noted as a minor line method; no further assessments conducted; determined as Acceptable noting the possible need for some conditions	Acceptable (some conditions may be required)	Not assessed
Fish traps	<p>Fish trap: all low impacts</p> <ul style="list-style-type: none"> settling of trap may damage fragile species 	Not assessed	Acceptable (some conditions may be required)	<p>Unacceptable level of risk (pending further assessment) on:</p> <ul style="list-style-type: none"> demersal fish slope communities in the Kimberley AFA
Troll lines/handlines	Not assessed	Acceptable noting the possibility of need for some conditions	Acceptable (some conditions may be required)	Acceptable (some conditions may be required)
Lobster Pots	Medium risk to sea lions	Acceptable risk with mitigation measures to minimize interactions with Australian sea lions, seals and other TEPS and to reduce mortality of juvenile seals	Not assessed	Acceptable (some conditions may be required)

Gear	Assessment in SEMR FRA	Assessment in SWMR FRA	Assessment in NMR	Assessment in NWMR
Crab Pots and collapsible traps	All low risk	As per SEMR FRA Acceptable (some conditions may be required)	Not assessed	Acceptable (some conditions may be required)
Cast nets	Not assessed	Not assessed	Acceptable (some conditions may be required). Not assessed in NMR FRA.	Not assessed
Hand collection/ diving	Not assessed	Not assessed	Acceptable (some conditions may be required). Not assessed in NMR FRA.	Not assessed
Scoop nets	Not assessed	Not assessed	Acceptable (some conditions may be required). Not assessed in NMR FRA.	Not assessed
Hand pumps	Not assessed	Not assessed	Acceptable (some conditions may be required). Not assessed in NMR FRA.	Not assessed
Barrier nets	Not assessed	Not assessed	Acceptable (some conditions may be required). Not assessed in NMR FRA.	Not assessed
Drag nets	Not assessed	Not assessed	Acceptable (some conditions may be required). Not assessed in NMR FRA.	Not assessed
Skimmer nets	Not assessed	Not assessed	Acceptable (some conditions may be required). Not assessed in NMR FRA.	Not assessed
Drift diving	Not assessed	Not assessed	Not assessed	Acceptable (some conditions may be required). Not assessed in NWMR FRA.
Jigs	Squid Jig: all impacts low Mutton birds attracted to strong lights	Squid Jig: Acceptable some conditions may be required - based on decision not to progress ERA past Level 1	Not assessed	Not assessed
Gaff	Not assessed	Not assessed	Not assessed	Not assessed
Dillies	Not assessed	Not assessed	Not assessed	Not assessed
Pole and line	Not assessed	Not assessed	Not assessed	Not assessed
Traditional spear (wap)	Not assessed	Not assessed	Not assessed	Not assessed

Appendix 2. Fisheries assessed including gear used, main risk assessment documents used, and other key information.

Fishery	Abbreviation	Gear used	Risk Assessments & other key information
Commonwealth			
Coral Sea Fishery	CSF	Hand collection, line, trap and trawl	Level 1 SICA; Annual Status Report
East Coast Tuna & Billfish Fishery	ETBF	Pelagic longline, minor line	Level 2 ERAEF, Residual Risk assessment and Level 3 (SAFE) analysis, Ecological Risk Management Report, AFMA data summaries
Eastern Skipjack Tuna Fishery	ESTF	Purse seine	Level 2 ERAEF, Level 3 (SAFE) analysis; Ecological Risk Management Report
Southern Bluefin Tuna Fishery	SBTF	Purse seine	Level 2 ERAEF, Residual Risk assessment and Level 3 (SAFE) analysis
Southern and Eastern Scalefish & Shark Fishery -C'wealth Trawl sector	SESSF -CTS	Demersal and mid-water trawl and Danish seine	Level 2 ERAEF, Draft Residual Risk assessment and Level 3 (SAFE) for mainly bycatch species for otter trawl and Danish Seine. Draft Ecological Risk Management Report
-East Coast Deepwater Trawl Sector	ECDWTS	Demersal and mid-water trawl and Danish seine	Level 2 ERAEF, Draft Residual Risk assessment and Level 3 (SAFE) for mainly bycatch species
-Scalefish Hook Sector	SHS	Hook methods (auto longline)	Level 2 ERAEF, Draft Residual Risk assessment and Level 3 (SAFE), Ecological Risk Management Report, Chondrichthyan Guide for Fisheries Managers
Southern Squid Jig Fishery	SSJF	Jig	Level 1 SICA; Ecological Risk Management Report
Small Pelagics Fishery	SPF	Purse seine, mid-water trawl	Level 2 ERAEF, Draft Residual Risk assessment and Level 3 (SAFE), Ecological Risk Management Report, Chondrichthyan Guide for Fisheries Managers
Norfolk Island Fishery	NIF	Inshore: recreational Offshore: trawl, demersal line	BRS Fishery Status Reports 2008
New South Wales			
Rock lobster fishery	RLF	Trap/pot, Hand collection	NSW EIS, Fishery Status Report
OceanTrap and Line Fishery	OTLF	Demersal fish traps, spanner crab nets, set line, trotline,	NSW EIS, Fishery Status Report

		driftline, poling, handlines, jigging, dropline, trolling	
Ocean Trawl Fishery	OTF	Otter trawl and Danish seine	NSW EIS, Fishery Status Report
Queensland			
East Coast Otter Trawl Fishery	ECOTF	Otter trawl and beam trawl	Qld submission to DEWHA, Annual Status Report
Blue swimmer crab fishery	BSCF	Crab pots & collapsible traps	ERA, Annual Status Report
Spanner crab fishery	SCF	Crab pots, collapsible traps & dillies	ERA, Annual Status Report
East Coast Inshore Finfish Fishery	ECIFFF	A variety of net methods and hook and line	Independent Fishery Review of Proposed Management Arrangements,, Annual Status Report, Sustainability Assessment, QDPI Background Paper on Sharks and Rays
East Coast Stout Whiting Fishery	ECSWF	Hand collection or small shell dredges towed by dinghies	ERA, Annual Status Report
Marine Specimen Shell Collection Fishery	MSSCF	Hand collection by scuba or hookah	ERA, Annual Status Report
Bech de mer	ECBDMF	Line	Performance Measures Report, Annual Status Report
Spanish mackerel	ECSMF	Line and net methods	Sustainability Assessment, Annual Status Report
Marine Aquarium Fish Fishery	MAFF	Line	Sustainability Assessment, Annual Status Report
Coral Reef Fin Fish Fishery	CRFFF	Dropline or trotline	ERA, Sustainability Assessment, Annual Status Report
Deepwater finfish fishery	DWFFF	Traps and crab pots	Sustainability Assessment, Annual Status Report
Pearl fishery	ECPF	Hook and line	Annual Status Report
Rocky Reef Finfish Fishery	RRFFF	Hand collection on scuba and hookah	Sustainability Assessment, Annual Status Report
East Coast Trochus Fishery	ECTF	Hand collection with spears and noose rods	Annual Status Report
Tropical Rock Lobster Fishery	TRLF		Annual Status Report
Coral Fishery	CF	Otter trawl and beam trawl	Vulnerability Assessment, ERA, Annual Status Report

