Assessment of risks that commercial fishing methods may pose to conservation values identified in the Areas for Further Assessment of the North and North-west Marine Regions

prepared by

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for

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1. INTRODUCTION

This paper presents an assessment of the risks posed by commercial fishing methods to Conservation Values of the Areas for Further Assessment (AFAs) of the North Marine Region (NMR) and the North-west Marine Region (NWMR). This fishing risk assessment (FRA) will inform the determination of the location and nature of new Commonwealth marine reserves in these Regions.

An overview of the policy context in which new Commonwealth marine reserves are being developed and a description of the risk assessment methodology used is provided. The findings of the risk assessment for the NMR and NWMR respectively are then presented, together with information in support of that assessment.

2. POLICY CONTEXT

The Goals and Principles for the Establishment of the National Representative System of Marine Protected Areas in Commonwealth Waters (the Goals and Principles) (Department of the Environment and Water Resources (DEWR), 2007a) guide the design of new Commonwealth marine reserves through the marine bioregional planning program, in accordance with the national Guidelines for Establishing the National System of Marine Protected Areas (Australian and New Zealand Environment and Conservation Council (ANZECC), 1998). In Australia, Commonwealth Marine reserves 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 International Union for the Conservation of Nature and Natural Resources (IUCN) Categories as interpreted in Schedule 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 (EPBC Regulations). Additionally, Principles 19 and 20 state:

> "Zoning will be based on the consideration of the threat that specific activities pose to the conservation objectives of each new Commonwealth marine reserve.
>
> Zoning of new Commonwealth marine reserves 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" (DEWR, 2007a).

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; and
- 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 conservation values that exist within each area. Values[1] 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);
- conservation values including key ecological features and protected species that may benefit from spatial protection; and
- biologically important areas (BIAs) for threatened and migratory species. BIAs have been identified for protected species where, on the basis of sound scientific information, they are known or are likely to exhibit biologically important behaviour including breeding, foraging, aggregation and migration. Assessment of the risk that fishing gears pose to conservation values in BIAs is a component of the FRA.

Regional Conservation priorities (CPs) have also been identified across the two Marine Regions as part of the marine bioregional planning process. The priorities are based on an analysis of potential threats to the Regions' Conservation Values and the Government's overall policy objectives. The CPs provide strategic direction for marine bioregional planning and for prioritising marine research and monitoring and are intended to inform decision-making and investment by the Government over the life of the Plan. The *draft* CPs relevant to the FRA of the North and North-west Marine Regions are listed in Table 1.

Table 1: Draft Regional Conservation Priorities for the NMR and NWMR that may have relevance for design and zoning of new Commonwealth marine reserves

North Marine Region	North-west Marine Region
1. Understand and protect Glyphis and sawfish species that are under regional pressure 2. Understand and protect marine turtle species that are under regional pressure 3. Understand and protect regional dugong populations and their feeding and breeding habitats 4. Understand the ecological role of sharks and rays in the Region and the implications of their removal on ecosystem function to ensure sustainable management of these species 5. Understand and protect the Gulf of Carpentaria basin (key ecological feature) 6. Understand and protect the plateaux and saddle northwest of the Wellesley Islands (key ecological feature) 7. Understand and protect the carbonate terrace and bank system of the Van Diemen Rise (key ecological feature) 8. Understand and protect the coastal and shelf waters offshore from significant marine species breeding, feeding, nursery and aggregation sites (key ecological feature)	1. Ensuring the conservation of sawfish and Glyphis spp. 2. Ensuring the conservation of seasnakes 3. Ensuring the conservation of small cetaceans 4. Protecting biologically important habitats for species 5. Understand the ecological role of sharks and rays in the Region and the implications of their removal on ecosystem function to ensure sustainable management of these species 6. Working through established mechanisms to reduce interactions between fisheries and the Conservation Values of the North-west Marine Region

[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/north/publications/pubs/north-afa.pdf and http://www.environment.gov.au/coasts/mbp/north-west/north-west-afa.html respectively

AFAs have been identified within each of the North and North-west Marine Regions (see Figures 1 and 2). The AFAs are not proposed reserves but are large areas within which new Commonwealth marine reserves will be established. 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 (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2009a).

Based on the above, the key policy parameters that underpin the FRA in the NMR and NWMR can be summarised 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 CPs;
- 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; and
- the legislative management purpose and principles for multiple-use zones require 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 minimisation of socio-economic cost. The conduct of FRAs 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 minimise that impact while ensuring that the ecological Goals and Principles are met.

Figure 1: Areas for Further Assessment in the North Marine Region

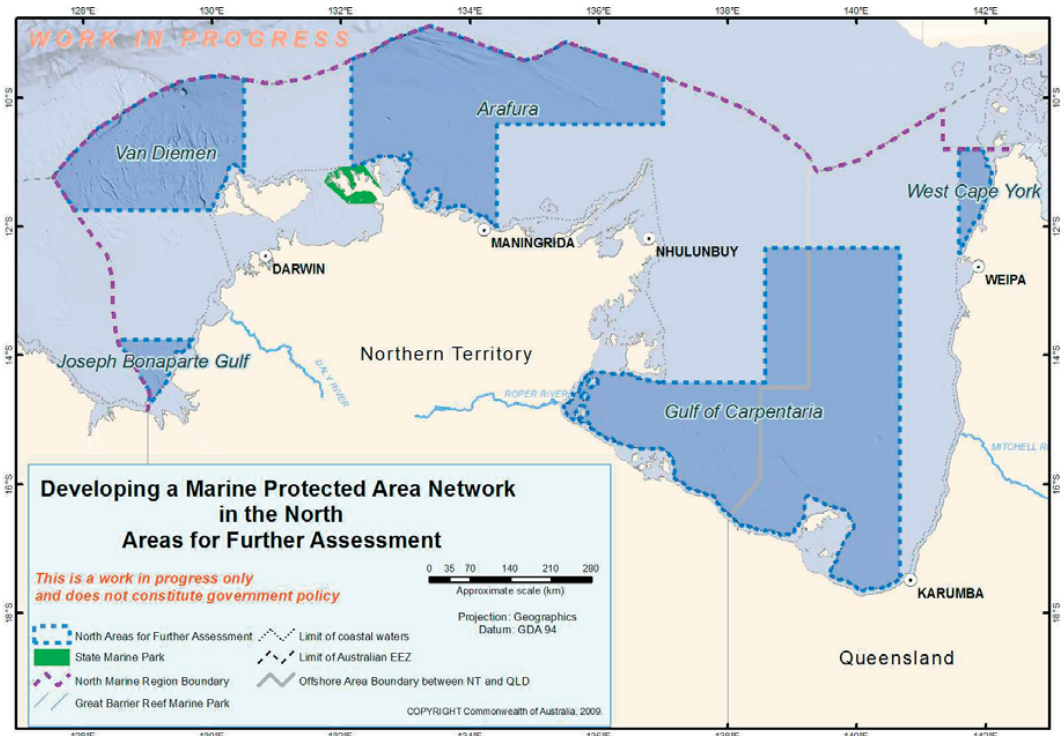
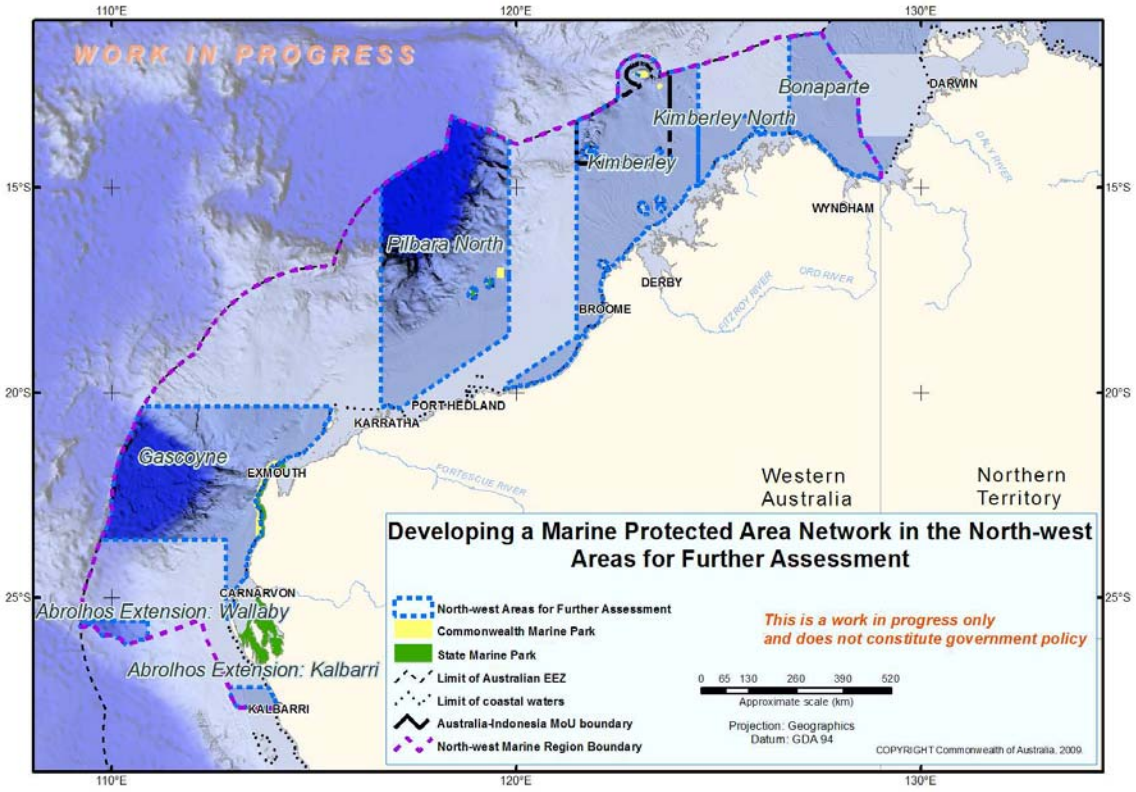


Figure 2: Areas for Further Assessment in the North-west Marine Region



3. BACKGROUND

An assessment of the risk to Conservation Values posed by commercial fishing methods was conducted as part of the development of the South-east Network of Commonwealth Marine Reserves (E-Systems, 2005). This risk assessment (SEFRA) used workshops involving industry and other stakeholders to determine the risks associated with various fishing methods.

Since the SEFRA was completed, the Australian Fisheries Management Authority (AFMA) has completed 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 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.

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*., 2007a). 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.

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 three assessment processes provide valuable information for the assessment of risks posed by fishing gears to Conservation Values in the NMR and NWMR.

DEWHA is currently finalising an FRA for the South-west Marine Region (SWFRA) and has developed a methodology which draws on the outcomes of the SEFRA and the information available from ERAs and other sustainability assessments to assess the risk posed by commercial fishing methods in that Region. The same basic methodology has been applied to the FRA for the NMR and NWMR.

4. METHODS AND APPROACH

The fishing risk assessment relates to fishing gear types used in commercial fisheries that operate solely or partially in Commonwealth waters in the North and North-west Marine Regions. 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 SWFRA, 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.

The methodology applied here also uses information from ESDAs and DEWHA EPBC Act assessment reports (including AFMA and State/NT government submissions to DEWHA) and the latest available information on the management and status of fisheries published by State/NT and Commonwealth agencies. However, it should be noted that the outputs from these processes vary in both their form and in the rigor underlying them. Some of the issues associated with the use of the outcomes of these processes include:

- some fisheries have only been subject to DEWHA assessments, which do not provide a risk rating;
- ESDA risk ratings for fisheries that utilise more than one gear did not always discriminate between gear types; and
- a very small number of fisheries have not been subject to any of the three assessment processes.

In the absence of risk ratings from ERAs or ESDAs, risks ratings arising from the SEFRA or SWFRA were utilised where they were considered relevant. However, in some cases no relevant risk ratings could be applied. Where no ERA results were available to inform the risk assessment, a more precautionary approach has been taken in interpreting the available information.

The fisheries authorized to operate in each Marine Region are listed in Attachment 1 together with an indication of the nature of the assessment information available. Level 3 ERAs (using the fully quantitative Sustainability Assessment for Fishing Effects (SAFE) method) which calculates *absolute* levels of risk, have been conducted for teleosts and chondrichthyans in all Commonwealth-managed fisheries authorized to operate in the North and North-west Marine Regions (Brewer *et al.,* 2007a and Zhou *et al.* 2009). Level 2 assessments, which lead to an assessment of *potential* risk, have been carried out for target species and in most cases for byproduct/bycatch, TEPS and habitats; although in some cases some of these elements were eliminated from further analysis in Level 1 (See Attachment 1). Both Level 2 and Level 3 ERAs have been used in the FRA. It is acknowledged that this results in a mixture of 'potential' and 'actual' risks being assessed. However, it also ensures that the best available information is used to inform the assessment.

The level of information available to determine the nature and extent of the interaction of particular gears with Conservation Values in areas within which new Commonwealth marine reserves (or AFAs) are being considered, varies by gear and by fishery. This necessarily means that the confidence in the information underlying the assessments varies. For example, in some cases it was possible to use data on the distribution of catch in a fishery, or other information available on the fishery, to determine whether the gear intersected with a particular Conservation Value in an AFA. In other cases it was necessary to assume that since a fishery operated, or in some cases was authorized to operate, in an AFA, the potential existed for an interaction with the Conservation Value in question.

The assessment was completed in three steps:

1. the gears able to be used in each of the commercial fisheries authorized to operate in the AFAs in each Region were identified and an assessment made as to whether that gear was actually in use in Commonwealth waters;
    - where a gear was not being utilized in Commonwealth waters, and there was no reasonable prospect of its utilization, the gear was eliminated from further analysis; and

- the remaining gears were reviewed and, using the results of previous assessments, those gears that had been assessed as having low to negligible risks were eliminated from further analysis (see Attachment 2);

2. gears which are in use in either the NMR or the NWMR and which had been identified as posing medium to high risks in previous FRAs, or had not been assessed in previous FRAs, were assessed to determine the risk they posed to the Conservation Values of the AFAs in the two Regions (see Attachments 3 and 4 respectively)

    - risk ratings were drawn from ERAs for fisheries operating in the region and supplemented where necessary by results from ERAs, FRAs and ESDAs for relevant gear types from other fisheries; and

3. the impact of existing measures to mitigate risks was considered to determine whether these measures rendered the risks posed by the gear acceptable

    - noting that Level 3 ERAs, apart from that for the Northern Prawn Fishery (NPF), take into account only those measures that affect the extent or distribution of effort, they do not reflect the impact, for example, of bycatch reduction devices (BRDs).

The "translation" from ERA/ESDA risk ratings to an assessment of acceptability of the method within the NMR and NWMR's AFAs is provided in Table 2. ERA/ESDA risk ratings informed, but did not dictate, the overall FRA risk rating.

Table 2: Relationship between ERA/ESD risk ratings and the North and North-west Marine Regions' acceptability rating

Overall Rating	ERA ratings comparison and policy considerations
Unacceptable	This overall assessment was given to fishing methods when ERAs or ESDAs found that: ▪ potential or actual high risk 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. Higher levels of precaution were used for those Conservation Values also identified as regional conservation priorities and where no ERA/FRA was available to inform the assessment.
Unacceptable pending further assessment	This overall assessment was given to fishing methods when ERAs or ESDAs found that: ▪ potential or actual high risk 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. Higher levels of precaution were used for those Conservation Values also identified as regional conservation priorities and where no ERA/FRA was available to inform the assessment.
Acceptable with mitigation measures and conditions	This overall assessment was given to fishing methods when ERAs or ESDAs found that: ▪ a range of risk levels 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. Higher levels of precaution were used for those Conservation Values also identified as regional conservation priorities and where no ERA/FRA was available to inform the assessment.
Acceptable (some conditions may be required)	This overall assessment was given to fishing methods assessed in the South-east or South-west FRAs, ERAs or ESDAs as having a low risk and were not further assessed in the NMR or NWMR

5. OUTCOMES OF THE FISHING RISK ASSESSMENT

5.1 Results of the North Marine Region Fishing Risk Assessment (NMRFRA)

Table 3 summarises the overall ratings for the 15 gear types relevant to the NMRFRA. Information underpinning the assessments is provided in Attachment 3. The results pertaining to the five methods rated as unacceptable (including "unacceptable pending further assessment") – demersal trawl, semi-demersal trawl, demersal longline, pelagic gillnet and set mesh nets- are outlined below in more detail.

Table 3 Summary of the NMRFRA results

Fishing method	NMR Assessment	Rationale
1. Demersal trawl	Unacceptable level of risk on: • 2 high risk species of rays in Van Diemen AFA • sawfishes (draft CP) in the Van Diemen and Gulf of Carpentaria AFAs • habitat types in the Van Diemen and Gulf of Carpentaria AFAs	The findings of the NPF ERA Level 2 habitat assessment are inconclusive in relation to the impact of demersal trawl gear on benthic habitats and communities. This results from potentially inappropriate assumptions about shallow habitats in the PSA model. (Griffiths *et al*., 2007). In addition, while not considered directly transferable to the NMR, findings of high risk to benthic habitats in other trawl fisheries in the SE and SWFRAs provide cause for concern as to the potential risk to benthic habitats in the NMR. These findings do, however, need to be considered in light of the findings of Pitcher *et al.* (2007) on the likely effects of trawling on benthos. The Level 2 NPF ERA found sawfishes to be at high risk. BRDs have been found to be ineffective in reducing interactions or improving survivorship of sawfish species, except for narrow sawfish. No specific mitigation measures for sawfishes have been identified in the *Chondrichthyan Guide for Fisheries Managers* (Patterson and Tudman, 2009). An assessment of the cumulative impact of all gear types is required to determine the risk posed to this species in the Van Diemen and Gulf of Carpentaria AFAs. The blotched fantail ray and the porcupine ray have been found to be at high risk in the Level 3 NPF ERA. There are no proven mitigation measures for these species.
2. Semi-demersal trawl	Unacceptable level of risk on: • sawfishes (draft CP) in the Gulf of Carpentaria AFA • habitat types in the Van Diemen and Arafura AFAs	The ESDA for the Gulf of Carpentaria found sawfish at medium risk. However, it is precautionary to take into account the high risk findings of the NPF ERA and to acknowledge that existing BRDs are unlikely to provide effective mitigation for sawfishes. An assessment of the cumulative impact of all gear types is required to determine the risk posed to this species in the Gulf of Carpentaria AFAs. There has been no habitat risk assessment conducted for this gear type. As noted above the findings of the NPF demersal trawl ERA results for habitats are inconclusive. More information about the actual grounds/habitats fished by the NT Finfish Trawl Fishery is required to inform the risk assessment.
3. Set mesh nets	Unacceptable level of risk on: • guitarfish in the Gulf of Carpentaria AFA • least sustainable species of sharks identified by the Salini *et al.* (2007) in the Gulf of Carpentaria AFA • marine turtles in the Gulf of Carpentaria and West Cape York AFAs • sawfishes in the Gulf of Carpentaria	There are no ERA ratings to inform the assessment of risk of set mesh nets to many of the Conservation Values in the NMR. guitarfish (Rhynchobatus spp.) was identified at high risk by the Gulf of Carpentaria (GoC) ESDA. Data are not yet available to detect trends in fishing mortality of guitarfish (DPIF, 2009a and 2009b) and there is no indication of the mitigation measures taken to reduce mortality. The GoC ESDA rates the risk to marine turtles (CP) as negligible and the risk to sawfishes (CP) as low to moderate. There is, however, a relatively low, and inconsistent level of observer coverage in the fishery and this provides little confidence in the levels of reported interactions with these species or in the data being collected on interactions with those shark species identified as 'least sustainable Salini *et al*., 2007. Application of the precautionary approach indicates that risks to these species should be regarded as high.
4. Demersal longline	Unacceptable level of risk (pending further assessment) on: • benthic habitats	The lack of information on the distribution of fishing effort, together with the lack of gear-specific information, creates major uncertainties in the level of risk posed to the Conservation Values of the NMR.

Fishing method	NMR Assessment	Rationale
	• 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	While the SEFRA assessed this gear type it did not assess the impact of the gear on conservation priorities in the NMR such as marine turtles and sawfish and its guidance on risks associated with the gear type were limited to habitat impacts. No high risk habitat impacts were identified. The ERA for auto-longline in the SESSF found a range of high risk and medium risk habitat impacts and identified some uncertainties about the impacts of demersal longline on benthic habitats, particularly on large, erect and fragile epifauna (Daley, *et al*., 2007a). However the results from the auto-longline EA are not directly transferable to the standard demersal longline used in the NMR and there is a lack of information on distribution of fishing effort by this gear in the NMR. It is therefore considered that further assessment of the impact of this gear on benthic habitats in the NMR is required. Until the risk assessment recommended by DEWHA (DEWR, 2007b) is undertaken, the level of risk to marine turtles and byproduct/bycatch species of sharks associated with Conservation Values in the NMR cannot be determined. An assessment of the cumulative impact of all gear types is required to determine the risk posed to sawfishes in the Van Diemen and Gulf of Carpentaria AFAs.
5. Pelagic gillnet	Unacceptable level of risk (pending further assessment) on: • 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	There are no relevant ERA or FRA findings for this gear type and no ESDA has been conducted for the fishery in which it is used. The lack of risk ratings for this gear type, together with lack of information on the distribution of fishing effort, creates major uncertainties in the level of risk posed to the Conservation Values of the NMR. Of particular concern are the potential impacts to protected species including marine turtles and sawfishes and other non-target species of chondrichthyans. Until the risk assessment recommended by DEWHA is undertaken the level of risk to marine turtles and byproduct/bycatch species of sharks associated with Conservation Values in the NMR cannot be determined. An assessment of the cumulative impact of all gear types is required to determine the risk posed to this species in the Van Diemen and Gulf of Carpentaria AFAs.
6. Droplines	Acceptable (some conditions may be required)	The nature of the fishing operations and the minimal level of bycatch and interaction with TEPS and benthic habitats, together with low risk ratings for this method in the SEFRA, underpin the assessment.
7. Fish traps	Acceptable (some conditions may be required)	The nature of the fishing operations and the minimal level of bycatch and interaction with TEPS and benthic habitats, together with low risk ratings for this method in the SEFRA, underpin the assessment. There remains a need for risk assessment of bycatch species and additional observer data on bycatch and interactions with protected species.
8. Trolling & Handlines	Acceptable (some conditions may be required)	The nature of the fishing operations and the minimal level of bycatch and interaction with TEPS, together with low risk ratings for this method in the SEFRA, underpin the assessment. There remains a need for risk assessment of bycatch and TEPS.
9. Cast nets	Acceptable (some conditions may be required)	Not assessed in NMRFRA: used only for bait collection in the NT Coastal Line Fishery and in the NT Aquarium Fishery; NT Aquarium Fishery ESDA indicated negligible to low risks.
10. Hand collection/diving	Acceptable (some conditions may be required)	Not assessed in NMRFRA: used only by the Queensland Tropical Rock Lobster Fishery which has a negligible level of operations and catch in that part of the fishery located in the NMR. The ERA for the Torres Strait Tropical Rock Lobster Fishery (AFMA, 2009a), which uses the same methods as the Queensland fishery, found no element needed to proceed past Level 1 assessment i.e. no high risks.
11. Scoop nets	Acceptable (some conditions may be required)	Not assessed in NMRFRA: used only within 2nm in the NT Coastal Line Fishery and in the NT Aquarium Fishery; NT Aquarium Fishery ESDA indicated negligible to low risks.

Fishing method	NMR Assessment	Rationale
12. Hand pumps	Acceptable (some conditions may be required)	Not assessed in NMRFRA: used only in the NT Aquarium Fishery and the ESDA indicated negligible to low risks.
13. Barrier nets	Acceptable (some conditions may be required)	Not assessed in NMRFRA: used only in the NT Aquarium Fishery and the ESDA indicated negligible to low risks.
14. Drag nets	Acceptable (some conditions may be required)	Not assessed in NMRFRA: used only in the NT Aquarium Fishery and the ESDA indicated negligible to low risks.
15. Skimmer nets	Acceptable (some conditions may be required)	Not assessed in NMRFRA: used only in the NT Aquarium Fishery and the ESDA indicated negligible to low risks.

5.1.1 Demersal and semi-demersal trawl

Two areas of concern arise from the analysis of the impact of demersal and/or semi-demersal trawl on the Conservation Values of the NMR:

1. risks associated with impacts on benthic habitats; and
2. risks posed to sawfishes and other chondrichthyans.

BENTHIC HABITATS

The NPF uses demersal trawl and the Northern Territory Finfish Trawl Fishery (NTFTF) and the Queensland Gulf of Carpentaria Developmental Finfish Trawl Fishery (GoCDFTF) use semi-demersal trawl in the NMR. Habitats impacts by demersal trawl gear were assessed in the Level 2 ERA for the NPF. There has been no specific risk assessment of habitat impacts of semi-demersal trawl gear. The latter method is designed to minimise benthic impacts and while the otter boards continue to have contact with the bottom (DEH, 2004a) the high profile fish trawl boards used are designed to fly in the waterway with little seabed contact in comparison to traditional otter boards (Sly, 2003). However the success of the gear in minimising benthic impacts relies in part on the skill and experience of the operator in deploying and using the gear (S. Hansford, Queensland Department of Employment, Economic Development and Innovation, pers. comm., November 2009). In accordance with the application of the precautionary approach, and in the absence of a specific assessment of the habitat impacts of semi-demersal trawl gear, the information available on habitat impacts in the NPF has been used to assess the impacts of both gear types.

The banana prawn sub-fishery of the NPF targets aggregations in waters generally less than 20m, is very selective and uses smaller trawl gear and shorter shots than the tiger prawn sub-fishery which trawls at night in waters of more than 20m depth, is less selective and uses heavier/larger gear and longer shots. Since the tiger prawn sub-fishery uses heavier gear, and the species it targets occur on or near the seabed, it poses higher risks to seabed habitat than does the banana prawn sub-fishery (Griffiths *et al*., 2007).

The Level 2 ERA for the NPF assessed 157 habitats and found 65 to be at medium risk and 92 at low risk. Of the medium risk habitats, 48 were found on the inner shelf (0-100m), including 17 in coastal margin depths (0-25m). Medium risk inner shelf habitats are dominated by flat to highly irregular unconsolidated sediments of mud to coarse grained biogenic gravels, with large erect sponges, hard and soft corals (of variable flexibility), complex communities of mixed fauna, and individual animals. The ERA did not identify any high risks to habitat types from demersal trawl gear in the NMR. However, the ERA report states that:

> "A complication of the construction of the PSA model means that no NPF habitats can appear at high risk from Prawn trawling. This is largely because of the way that the PSA calculation is influenced by the scoring of the Productivity attributes, with shallow

habitats assumed to be quite productive with good recovery rates." (Griffiths *et al.,* 2007)

The Level 1 scoping results for the ERA, as reported in Griffiths *et al*. (2007), confirm the uncertainty about the recovery of erect, rugose and inflexible octocorals, associated with soft muddy substratum, that are damaged through interaction with trawl gear, particularly the heavier and more intensive use of gear in the tiger prawn sub-fishery. The results indicate the need for data on resilience and recovery times of mud based habitats. The report notes that, regeneration times of damaged tissues will vary between species and that, while in coastal margin depths (0-25m) and inner shelf depths (25-100m) regeneration can be expected to be reasonably rapid as fauna are likely to be well adapted to frequent and considerable disturbance regimes (e.g. strong currents, runoff, cyclones), more structurally complex forms/ communities may take more than 1 year to recover. It might be inferred, therefore, that in areas where trawling is conducted annually there is potential for the gear to impede the recovery of more complex forms/communities. However, since the ERA was conducted, the results of the Great Barrier Reef Seabed Biodiversity Project (Pitcher *et al*., 2007) have been released. These results suggest that less than 7% of the 850 species (bycatch and benthic species) were significantly affected by trawl effort. These findings, if transferable to the areas fished by the NPF, may suggest that trawling poses less of a risk to benthic habitats and communities than implied by the qualitative assessment of the Level 1 ERA.

Further analysis is required to validate the Level 1 and Level 2 ERA findings on the impact of demersal trawl gear on benthic habitats in the NMR to ensure that there are no high risk impacts and a risk analysis of the habitat types fished with semi-demersal trawl gear is required in order to confirm the lower level of benthic impact that has been suggested.

SAWFISHES AND OTHER CHONDRICHTHYANS

As part of the ongoing refinement of the SAFE methodology, the need to differentiate between chondrichthyans and teleosts in determining reference points for exploitation rates was identified following the conduct of assessments for the NPF and two other Commonwealth fisheries. As a result, a more conservative relationship between reference points and life history parameters for chondrichthyans has been applied by Zhou *et al.* (2009) in the subsequent Level 3 ERAs for each of the other Commonwealth fisheries authorised for the NMR and NWMR. In accordance with the application of the precautionary approach, the Level 2 NPF risk ratings for chondrichthyans in the NPF fishery (Griffiths *et al.*, 2007), as well as the outcomes of the Level 2.5 SAFE findings for chondrichthyans (Brewer *et a*l., 2007a), as further refined in the NPF's Ecological Risk Management Report (AFMA, 2009a), have been taken into account in this analysis.

Green and freshwater sawfish are species of relevance to Conservation Values with which the NPF and the GoCDFTF interact. Sawfishes are identified as a draft CP in the NMR. Three of the five species are listed as Vulnerable under the EPBC Act and all five species are listed (four species on Appendix 1 and one species, freshwater sawfish, on Appendix II) on the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The use of turtle excluder devices (TEDs) in the NPF has been shown to be effective in reducing capture of elasmobranchs. However, with the exception of narrow sawfish (Brewer *et al.,* 2006), TEDs are not effective in reducing interactions or improving the survivorship of sawfishes, since their rostrum (their long saw-like snout) is generally either caught in the net before the sawfish reach these devices, or outside the net (Patterson and Tudman, 2009). TEDs are compulsory in the NPF but not in the GoCDFTF. Thus while BRDs are being trialed in the GoCDFTF, these are not likely to be effective in excluding the sawfish species of interest in the NMR, namely green sawfish and freshwater sawfish. The NPF's Bycatch and Discarding Workplan (AFMA, 2009b) includes a number of projects aimed at achieving ongoing reductions in bycatch but does not identify any actions aimed specifically at reducing

interactions with sawfishes. There are no sawfish specific mitigation measures under consideration in the GoCDFTF. While the species are 'no take' in the NPF and GoCDFTF this does not preclude or, necessarily, reduce interactions. *The Chondrichthyan Guide for Fisheries Managers* (Patterson and Tudman, 2009) provides no specific guidance on possible mitigation options for sawfishes.

In 2008, 458 interactions with sawfishes were recorded in NPF logbooks. The rate of logbook reported interactions was just over half the rate of interactions reported by the limited crew member observer program and about one-sixth of the rate of interactions reported by scientific observers (Evans, 2009). This suggests that the logbooks may significantly under-report sawfish interactions.

AFMA's Residual Risk Assessment of the Level 2 ERA results left five sawfish species at high risk due to low fecundity and high susceptibility to being caught in nets (AFMA 2008a) and the Gulf of Carpentaria ESDA found sawfish to be at medium risk in the GoCDFTF (Zeller and Snape, 2006). The subsequent SAFE (Level 2.5) assessment for the NPF (Brewer *et al*., 2007a) did not find sawfishes as being "potentially at risk" from the impact of the NPF alone, since they are distributed across areas inshore and offshore of the trawl grounds. However, the assessment found that they could potentially be at risk from the cumulative impacts of other fishing including illegal fishing and that a cumulative ecological risk assessment is needed for these species to assess the full extent of the impact from all fisheries throughout their range. The report recommended that "In the meantime a precautionary approach is essential to ensure the viability of sawfish populations in Australian waters."

Other shark species are associated with Conservation Values in the Van Diemen AFA and are a draft Conservation priority. The NPF and NTFTF operate in this AFA. The SAFE assessment for the NPF (Brewer *et al*., 2007a), and subsequent incorporation of expert opinion, resulted in the blotched fantail ray and the porcupine ray being assessed as at extreme high risk in the NPF (AFMA, 2009b). It is acknowledged that the absence of fishery independent surveys of the distribution of species may result in the SAFE analyses, which rely on fishery dependent data, overstating the risk posed to a species by a fishery since there may be significant unknown refugia for the species outside the area of the fishery. However, until such information is available, it is precautionary to accept the findings of the SAFE analysis.

The Chondrichthyan Guide for Fisheries Managers (Patterson and Tudman, 2009) provides some guidance on potential mitigation measures for the blotched fantail ray and AFMA (2009c) has indicated that this will be used to guide management of interactions with this species. However, apart from reducing overall fishing effort and adopting improved, but unspecified, handling practices, the Guide identifies only mitigation measures that have the potential to, rather than have been proven to, reduce interactions and/or minimise discarding. These include unspecified spatial closures, deterrents and depth limits. No specific guidance was provided on management of interactions with the porcupine ray. There are, therefore, no proven mitigation measures available to specifically reduce interactions with these two high risk species. Further, no research has been proposed to provide additional fishery independent advice on the distribution of these species which might lead to a reassessment of the SAFE findings.

Sharks, including blacktip shark, and rays are taken as incidental catch in the NTFTF. High proportions of discarded species (by weight) are sharks and rays which cannot be retained (DRDPIFR, 2008). The use of a hopper allows the speedy release of the sharks, which are generally alive (Sly, 2003). The single operator has also installed a bycatch exclusion device to minimise the catch of sharks and rays. The device is modelled on the TED in the NPF but uses a 20mm high tensile stainless wire so it can roll onto the drum when the gear is winched up. When pulled tight inside a net the device forms bars across the cod end which allows fish to swim through but stops bigger sharks and rays, which fall into a trap door in the bottom of the net which opens when weight is

applied. Catches of sharks are reported to have been reduced by 80% and rays by 100% (NT Seafood Council, 2008).

FRA RATING

The application of the precautionary approach leads to a finding of "Unacceptable" for demersal and semi-demersal trawl gear. This finding reflects the:

- the need to apply the more precautionary, high risk, findings of the Level 2 assessment for sawfish species, given the acknowledgement that the Level 3 NPF assessment for chondrichthyans was not sufficiently conservative, and the lack of proven measures to mitigate this impact;
- the lack of proven measures to mitigate the impact on the high risk species of blotched fantail ray and porcupine ray; and
- uncertainties arising from the application of the PSA model to habitats in the NPF.

5.1.2 Set mesh nets

The Gulf of Carpentaria Inshore Finfish Fishery (GoCIFF) operates, using set mesh nets, in the Gulf of Carpentaria and West Cape York AFAs. No ERAs have been conducted for fisheries using this gear in the NMR. Queensland has conducted an ESDA for all of its fisheries, including the GOCIFF, which operate in the Gulf of Carpentaria.

The ESDA did not assess habitat types, however the findings of the SEFRA support the conclusion that the gear is not considered to pose a high risk to any of the benthic habitats in the NMR.

Two areas of concern arise from the analysis of the impact of demersal and/or semi-demersal trawl on the Conservation Values of the NMR:

1. risks associated with impacts on guitarfish (Rhynchobatus spp.); and
2. risks posed to protected species and other chondrichthyans.

GUITARFISH

Queensland has conducted an ESDA which has found high risks to guitarfish (Rhynchobatus spp.) and to grey mackerel. These species have been included in the Performance Management System for the Fishery. As a target species, grey mackerel is subject to specific management arrangements in the GoCIFF. However no reference point has been established for the high risk bycatch species, guitarfish, and the only indicator is a "decreasing trend in mortality in the most recent three-year period". No data are currently available to report against this indicator (Queensland Department of Primary Industries and Fisheries (DPIF), 2009a and 2009b) and there is no indication that specific bycatch mitigation measures have been introduced to achieve this objective. The performance management system does not include any firm management responses to the triggers.

PROTECTED SPECIES AND CHONDRICHTHYANS

In addition to the high risks identified by the ESDA there remains some uncertainty about the quality of the data underpinning the assessment, particularly as it relates to bycatch and interactions with protected species and species identified by the Fisheries Research and Development Corporation (FRDC) project *Northern Australian Sharks and Rays Phase II* (Salini *et al.,* 2007) as being least sustainable in the GoCIFF. This uncertainty arises because of the validation of logbook data concerning the quantity and species composition of catches in this fishery. DEWHA has recommended that the catch and catch rates of shark species including pigeye shark, bull shark,

blacktip shark, Australian blacktip shark, snaggletooth shark, great hammerhead shark and giant shovelnose ray be monitored and validated by observers. Logbooks have been revised to facilitate reporting of these species (DPIF, 2009a).

However, analysis by Stapley and Rose (2009) of observer data for the N9 fishery for the period 2000-2006 suggests that between 2000 and 2005 the average level of observer coverage was 7%, but that in 2006 it fell to between 1 and 2%. DPIF (2009a) reports that in 2007 only one observer trip was undertaken in the fishery. In 2008 effort in the N3 and N9 fisheries totalled 21,697 days and 53 observer days were conducted. A target of 50 days has been set for 2009 (DPIF, 2009b). Participation in the observer programme is voluntary. The low level of observer coverage, and inconsistency in the level of coverage across years, creates uncertainty in relation to interactions with the shark species identified as least sustainable in the fishery.

In 2008, 12 sawfish interactions (one with freshwater sawfish,one with narrow sawfish and 10 with wide/small-tooth sawfish) were reported respectively in the GoCIFF logbooks. However, DPIF believes that the location of capture of the reported wide sawfish suggests that these were likely to have been freshwater sawfish. DPIF therefore report that 11 freshwater sawfish (one released dead) were captured in the N3 fishery in 2008. In addition, interactions with 30 narrow sawfish (eight returned dead) and eight dwarf sawfish (two returned dead) were reported by observers. The number of sawfish taken therefore exceeded the trigger of 21 (DPIF, 2009b). However DPIF provides no indication of the management response to the trigger being exceeded. Since March 2009, sawfishes have been 'no take' species in Queensland fisheries but this does not preclude interactions. Given the high risk findings for sawfishes in the Gulf of Carpentaria by the NPF, the absence of any specific mitigation measures for use in set mesh nets, the recommendation by Brewer *et al*. (2007a) for a cumulative risk assessment of sawfishes, the conservation status of this species and its inclusion as a draft CP for the NMR, it is considered that set mesh nets must be considered to potentially pose a high risk to sawfishes.

Similarly, the GoCIFF is known to interact with turtles, with 10 interactions reported in 2007. However this cannot be considered validated data given the low level of observer coverage in the fishery. The NPF's previously high level of interactions with turtles was successfully addressed through the introduction of bycatch mitigation measures. However, no such measures are known to be available for set mesh nets. Given the lack of an ERA risk rating for this gear, the absence of any specific mitigation measures for use in set mesh nets, the conservation status of marine turtle species and their inclusion as a draft CP for the NMR, it is considered that set mesh nets must be considered to potentially pose a high risk to marine turtles.

FRA FINDINGS

The application of the precautionary approach leads to a finding of "Unacceptable" for set mesh nets. This finding reflects:

- the ESDA finding of high risk for Guitarfish and the absence of identified bycatch mitigation measures to reduce the impact of the gear on this species; and
- the uncertainties surrounding the impact of this gear on sawfishes, marine turtles and other chondrichthyans arising from under-reporting of interactions in logbooks and for relatively low and inconsistent levels of scientific observer coverage.

5.1.3 Demersal longline and pelagic gillnet

Demersal longlines and pelagic gillnets are used by the NT Offshore Net and Line Fishery (ONLF) which is authorized to operate in four of the five AFAs in the NMR. The actual distribution of fishing effort is unknown however, in broad terms the majority of fishing is undertaken within 12nm of the NT

coast or baseline, and immediately offshore in the Gulf of Carpentaria (NT Department of Regional Development, Primary Industry, Fisheries and Resources (DRDPIFR), 2008). Much of the available information on the fishery does not discriminate between the two gear types.

No ERAs have been conducted for standard demersal longline. While the SEFRA assessed demersal longline it did not assess the impact of the gear on conservation priorities relevant to the NMR such as marine turtles and sawfish and its guidance on risks associated with the gear type were limited to habitat impacts. No high risk habitat impacts were identified in the SEFRA for this gear. The SWFRA based its assessment of demersal longline on the ERA for the automatic longline sub-fishery of the Southern and Eastern Scalefish and Shark Fishery.

Pelagic gillnets have not been assessed in any ERAs or in the SE or SWFRAs.

DEWHA has recommended that an ERA be conducted on the impact of the fishery on target, byproduct, bycatch and protected species and that any identified risks are minimised (DEWR, 2007b) but, to date, this has not occurred. As a result, there are no available risk ratings in respect of the interactions between this gear and the Conservation Values of the NMR. Interactions potentially occur, with marine turtles, with geomorphic features including reefs, banks/shoals, tidal sandwave/sandbank, apron/fan and sill, and with key ecological features (KEFs) including the Bonaparte Basin, Canyons of the Arafura Depression and Submerged coral reefs of the Gulf of Carpentaria.

Three areas of concern arise from the analysis of the impact of demersal longline and pelagic gillnet on the Conservation Values of the NMR:

1. risks posed to benthic habitats'
2. risks posed to marine turtles; and
3. risks posed to chondrichthyans, including sawfishes.

BENTHIC HABITATS

The SEFRA for demersal longline gear identified interactions with the benthic habitat as comprising: contact of the weights and rope; dragging of gear and hooked fish; snagging lines on bottom species; snagging of gear on bottom; all impacts on the inner shelf were assessed as Low, with impacts on the outer shelf assessed as low to Medium (E-Systems, 2005).

The ERA for the auto-longline (ALL) sector of the SESSF did not assess inner shelf habitats but 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.*, 2007a).

These findings potentially place habitats in the Arafura AFA at high risk from this demersal longline. Although it is acknowledged that the footprint of automatic longline gear is likely to be larger than that of standard demersal longline gear given the longer length of line and greater number of hooks set in auto-longlining.

MARINE TURTLES

Marine turtles are a draft CP in the NMR and all six species are listed (two species as Endangered and four species as Vulnerable) under the EPBC Act. All six species are listed on Appendix I of CITES. In 2007 four interactions with turtles were reported in the ONLF and all were released alive. Bottom set gillnets have been prohibited in the ONLF to reduce interactions with turtles and literature detailing recovery methods and identification of turtles is provided to fishers (DRDPIFR, 2008). There is limited observer coverage in the fishery with between 4 and 6 observer trips, representing coverage of around 7% of the effort, undertaken each year (DRDPIFR, 2008). This level of coverage is likely to be inadequate to provide credible validation of relatively rare interactions with turtles (see Babcock and Pikitch, 2003).

CHONDRICHTHYANS

The ONLF targets blacktip sharks and takes a range of other sharks (including pig-eye shark and hammerhead sharks) as byproduct. Bycatch includes sharks, particularly tawny shark, sawfishes and Glyphis spp. and rays (DRDPIFR, 2008). Target shark species are fully fished (DEWR, 2007b). Sawfish are subject to a no-take policy. In 2007, 728 narrow sawfish, seven green sawfish and 10 freshwater sawfish were caught and released alive (DRDPIFR, 2008). Freshwater sawfish and green sawfish are listed as Vulnerable under the EPBC Act and all five Pristidae spp. are listed on CITES. The Glyphis spp. - speartooth shark and the northern river shark - are listed as Critically Endangered and Endangered respectively under the EPBC Act. Rays are an uncommon bycatch which are usually released alive (DEWR, 2007b). As noted above, the level of observer coverage is unlikely to be sufficient to validate the level of reported interactions with sawfishes and Glyphis spp. The status of other sharks taken as byproduct or bycatch in the fishery is unknown.

No risk assessment has been conducted of operations in the ONLF. However, The FRDC project, *Northern Australian Sharks and Rays: the Sustainability of Target and Bycatch species, Phase 2* identified 12 shark species as least likely to be sustainable in the ONLF. Based on their relative susceptibility to capture and the capacity to recover five species emerged as being the least sustainable species in the fishery (DEWR, 2007b). These species include: blacktip shark, great hammerhead and the three EPBC Act listed Pristidae species – dwarf, freshwater and green sawfish. The remaining seven species were winghead shark, nervous shark, graceful shark, blacktip reef shark, creek whaler, grey sharpnose shark and narrow sawfish. DEWR (2007b) recommended that the NT specifically consider the management of CITES listed species, in particular, members of the Pristidae family and investigate management options, and where appropriate, develop and implement management responses for the 12 species identified by the FRDC project. In addition, DEWHA has recommended that an ERA be conducted on the impact of the fishery on protected species, particularly Freshwater Sawfish and ensure that any identified risks are minimised (DEWR, 2007b). To date this has not occurred.

FRA FINDINGS

Application of the precautionary approach leads to a finding of “Unacceptable, pending further assessment” for both demersal longline and pelagic gillnet. 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 absence of relevant risk ratings for marine turtles, sawfishes and those chondrichthyan species considered to be least sustainable, for pelagic gillnet and demersal longline; and

- the inability to differentiate between the impacts of these two methods on Conservation Values given the information available.

5.1.4 Discussion

The key issues identified by the NMR FRA are:

- The potential risks posed to benthic habitats by demersal and semi-demersal trawling; and demersal longlining;
- the actual and potential risks posed to sawfishes by demersal and semi demersal trawling, demersal longline, set mesh nets and pelagic gillnet;
- the real and potential risks to other chondrichthyan species by demersal trawl, semi demersal trawl and set mesh nets; and
- the potential risks posed to marine turtles by demersal longline, set mesh nets, and pelagic gillnet.

BENTHIC HABITATS

Demersal trawling is recognised as one of the most destructive fishing methods in the world (see for example Nelleman, *et al*., 2008, Anon., 2004). Both the SE and SWFRAs have identified high risks to benthic habitat from demersal trawl gear. The impact of demersal trawling on habitat loss and degradation is a threat to biodiversity conservation since seafloor habitats provide some of the most productive marine environments. The impact of trawling will depend in part on the nature of the seafloor and the intensity of fishing.

As discussed above, there remains considerable uncertainty about the level of risk posed to habitats by demersal trawling in the NMR and there is no evidence to confirm the extent to which the use of semi-demersal trawl gear mitigates this risk.

The assessment of risk posed by demersal longline may overstate the risks since they are based on auto- longline which is likely to have a more intense footprint give the longer length of line and greater number of hooks set. However, the ERA for ALL acknowledges the uncertainty about the impact of the mainline on large, erect and fragile epifaunua (Daley *et. al.,* 2007a). This uncertainty applies to both standard and auto-longlining and may be more of a concern in the outer shelf habitats in the NMR than in those slope habitats assessed in the auto-longline ERA. The absence of specific information about the demersal longline fishing grounds adds to the uncertainty surrounding the potential impact of this gear. Daley *et al*. (2007a) noted that “An important research priority would be to deploy camera gear to observe the movement and impact of ALL lines on benthic habitats.”

While these gear types are active across all AFAs in the NMR, the concerns in relation to benthic habitat relate to the Van Diemen, Gulf of Carpentaria and Arafura AFAs. The habitats most likely to be at risk are on the inner shelf (0-100m) which are dominated by flat to highly irregular unconsolidated sediments of mud to coarse grained biogenic gravels, with large erect sponges, hard and soft corals (of variable flexibility), complex communities of mixed fauna, and individual animals (Griffiths *et al.,* 2007).

Further assessment of the risk posed by demersal and semi-demersal trawling and demersal longlining to specific habitat types in the relevant AFAs would be required in order to underpin a review of the finding of “unacceptable impact”.

SAWFISHES

Like most chondrichthyans, sawfishes are particularly vulnerable to anthropogenic pressures on their populations, including pressure from fishing. Compared to most teleosts, they are slow to mature and have low fecundity. In addition, their morphology renders them particularly vulnerable to capture by some fishing gears due to their rostrum becoming entangled in the gear. Sawfishes are identified as a draft CP in the NMR. Three species (dwarf sawfish, freshwater sawfish and green sawfish) are listed as Vulnerable under the EPBC Act and all five species are listed on CITES (four species on Appendix 1 and one species, freshwater sawfish, on Appendix II).

Apart from some success in reducing interactions with the narrow sawfish, BRDs have not been found to be an effective mitigation measure for sawfishes. However, guides for the handling and release of sawfishes have been developed (see for example, DPIF, 2004 and Northern Territory Seafood Council, undated) and, if applied, these may improve the survivorship of captured individuals. In addition, sawfishes are no take species in Queensland fisheries and the NPF. While this will not reduce incidental interactions it does, if enforced, preclude the targeting of these species. There remains considerable uncertainty about the actual level of interactions with sawfishes by some fishing gears in the NMR. For example, while the GoCESDA rated the risk to sawfishes from this gear as moderate in the N3 component of the GoCIFF, the Freshwater Sawfish Expert Review Committee identified the N3 fishery as a major threat to the freshwater sawfish in the southern and western Gulf of Carpentaria (Freshwater Sawfish Expert Review Committee, 2009). The relatively low and inconsistent level of observe coverage in that fishery leads to increased uncertainty about the actual level of interactions with sawfishes.

The findings of Brewer *et al.* (2007a) are central to the consideration of risk posed to the sawfishes in the NMR. Those findings are that a “cumulative ecological risk assessment is needed for these species to assess the full extent of the impact from all fisheries throughout their range” and that "In the meantime a precautionary approach is essential to ensure the viability of sawfish populations in Australian waters."

The NMRFRA has found that demersal and semi-demersal trawl gear, demersal longline, pelagic gillnet and set mesh net gears pose, or potentially pose, unacceptable levels of impact on sawfishes. These findings are underpinned by the application of the precautionary approach given the high degree of uncertainty about the actual levels of interactions with sawfishes by some of these gears, the lack of ERA risk ratings attributable to these gears in relation to their interactions with sawfishes and the findings of Brewer *et al*. (2007a).

Cumulatively, the fisheries using these gears intersect each of the five AFAs in the NMR. This supports the need identified by Brewer *et al*. (2007a) for a cumulative ecological risk assessment of the impact of fisheries in the NMR on sawfishes. This assessment should include all fisheries/gears that interact with sawfishes in the NMR. In addition, there remains an urgent need for further research and development into effective mitigation measures for sawfishes.

OTHER CHONDRICHTHYANS

A noted above, chondrichthyans are relatively more vulnerable to fishing pressure than many other marine species. The 2008 IUCN Red list of Threatened Species lists 22 species of chondrichthyans as Critically Endangered, 29 as Endangered, 75 as Vulnerable, 107 as Near Threatened and 205 species as Data Deficient. There is increasing recognition of the deteriorating status of sharks stocks worldwide. Over the last decade, the United Nations General Assembly, the Food and Agriculture Organization (FAO) and Parties to the Convention on Migratory Species and CITES, and some regional fisheries management organisations have called for and/or taken action to address the impact of fishing on chondrichthyans.

Sharks are a draft CP in the NMR. The NMRFRA has found that gears including demersal trawl, semi demersal trawl and set mesh nets are, or potentially are, imposing an unacceptable level of risk to chondrichthyan species (in addition to the sawfishes discussed separately above).

Two species of rays - the porcupine ray and the blotched fantail fay - have been found by the NPF ERA to be at high risk from the demersal trawl and, potentially, this same risk applies to semi-demersal trawl gear. In addition, the GoCESDA has found the guitarfish (Rhynchobatus spp.) to be at high risk from set mesh nets.

Excluding sawfishes, based on the findings of the Salini *et al*. (2007) of species "least likely to be sustainable", the DPIF identified the following species taken by set mesh nets in the GoCIFF: pigeye shark, bull shark, blacktip shark, Australian blacktip shark, snaggletooth shark, great hammerhead shark and giant shovelnose ray (DPIF, 2009a). Blacktip shark and Australian blacktip shark are target species in the N9 set mesh net component of the GoCIFF. Data collection on the bycatch species was only begun in 2006 and trends in catch are not yet available to inform action under the Performance Management System for the fishery. There are no stock assessments for these species.

Most chondrichthyans are high order predators and removal of such predators can cause a 'top-down' effect on organisms lower in the food webs of the ecosystems they inhabit. Maintenance of biodiversity in the ecosystem of the NMR requires that chondrichthyan species are maintained at sustainable levels in order to both protect those species and to ensure the broader sustainability of ecosystems.

MARINE TURTLES

Marine turtles are a draft CP in the NMR. All six species of marine turtles are listed on Appendix 1 of CITES. BRDs have proven very effective in reducing interactions with marine turtles in demersal trawl gear. BRDs are not yet mandated for use in semi-demersal trawl gear.

The NMRFRA has found that there is a potentially unacceptable level of risk to marine turtles arising from demersal longline, pelagic gillnet and set mesh nets. This finding is underpinned by the application of the precautionary approach given the high degree of uncertainty about the actual levels of interactions with turtles by these gears and the lack of ERA risk ratings attributable to these gears in relation to their interactions with turtles. For example, the GoCESDA rated the risk to turtles from set mesh gear as negligible based on a limited number of interactions and the net attendance rules in place which facilitate the live release of turtles entangled in the gear. However, the data indicate that interactions are continuing with these protected species and there are no proven bycatch mitigation measures for set mesh gear available. The relatively low and inconsistent level of observer coverage in that fishery leads to increased uncertainty about the actual level of interactions with turtles.

5.1.5. Conclusions

In summary, the NMRFRA has identified three gears that are having "unacceptable" impacts on the Conservation Values of with the AFAs of the NMR. Those gears are demersal trawl, semi demersal trawl and set mesh nets. A further two gears have been found "unacceptable, pending further assessment". Those gears are demersal longline and pelagic gillnet.

Ten gear types have been found to pose a low risk to Conservation Values in the AFAs and, while some conditions may be required on their use, their impact has been found to be "acceptable". Those gears are dropline, fish traps, trolling and handlines, cast nets, hand collection/diving, scoop nets, hand pumps, barrier nets, drag nets, skimmer nets.

5.2 Results of the North-west Marine Region Fishing Risk Assessment (NWMRFRA)

Table 4 summarises the overall ratings for the 11 gear types relevant to the NWMRFRA. Information underpinning the assessments is provided in Attachment 4. More detail on the results pertaining to the six methods rated as unacceptable (including "unacceptable (pending further assessment)") – demersal trawl, pelagic longline, demersal longline, demersal gillnet, pelagic gillnet and fish traps – is provided below.

Table 4: Summary of the NWMRFRA results

Fishing method	North-west Assessment	Rational
1. Demersal trawl	Unacceptable level of risk on: • 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: • 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	Six fisheries use this gear in five of the AFAs in the NWMR. ERAs have been conducted for three of these fisheries. The Level 2 ERAs for the North West Slope Trawl Fishery (NWSTF) (Wayte *et al.*, 2007a) and the Western Deepwater Trawl Fishery (WDTF) (Wayte *et al*., 2007b) identified a number of high risk upper and mid-slope habitats associated with Conservation Values in the NWMR. The findings of the NPF ERA Level 2 habitat assessment are inconclusive in relation to the impact of demersal trawl gear on benthic habitats and communities. This results from potentially inappropriate assumptions about shallow habitats in the PSA model. (Griffiths *et al*., 2007). Level 2 ERAs for target species in the NWS and WDTF found scarlet prawn and gemfish, tang snapper and mirror dory at high risk with potential implications for demersal slope fish communities. The Level 2 NPF ERA found sawfishes (draft CP) to be at high risk. BRDs have been found to be ineffective in reducing interactions or improving survivorship of sawfish species, except for narrow sawfish. No specific mitigation measures for sawfishes have been identified in the *Chondrichthyan Guide for Fisheries Managers* (Patterson and Tudman, 2009). Sawfishes are also taken in the Pilbara Trawl Fishery. The Level 3 ERA for the NPF noted that an assessment of the cumulative impact of all gear types is required to determine the risk posed to sawfishes. The level 2 ERA for the WDTF fishery (Wayte *et al*., 2007b) and the subsequent residual risk assessment for the fishery (AFMA, 2008b) left 11 chondrichthyan species at high risk. The Level 3 ERA for teleosts and chondrichthyans (Zhou *et al*., 2009) found that the fishery posed only a low risk to shark species. However, given that there is a high level of latent effort in the fishery, together with the draft CP status of sharks in the NWMR it is considered precautionary to require further consideration of the threat to the 11 high risk species. Concerns remains for the ongoing level of interactions with, and mortality of, seasnakes and dolphins in the Pilbara North AFA. Further assessment of mitigation measures is required.
2. Pelagic longline	Unacceptable level of risk on: • small cetaceans (toothed whales) in Gascoyne AFA Unacceptable level of risk (pending further assessment) on • three species of sharks in Gascoyne AFA	This gear is used by one fishery across three of the seven AFAs of the NWMR. The Level 2 ERA (Webb *et al.,* 2007) and the subsequent residual risk assessment for the fishery left four species of toothed whales (draft CP) and three species of sharks (draft CP) at high risk. While the Level 3 ERA (Zhou *et al*., 2009) found that the fishery posed only a low risk to shark species (marine mammals were not assess at Level 3) there is a high level of latent effort in the fishery and together with the draft CP status of sharks in the NWMR it is considered precautionary to require further consideration of the threat to the three high risk species identified in the residual risk assessment.
3. Demersal longline	Unacceptable level of risk (pending further assessment) on: • banks and shoals in the Abrolhos Extension: Kalbarri AFA; and • small cetaceans in the Abrolhos Extension:	Three fisheries use this gear across four of the seven AFAs in the NWMR. While the SEFRA assessed this gear type it did not assess the impact of the gear on most Conservation Values of the NWMR and its guidance on risks associated with the gear type were limited to habitat impacts. No high risk habitat impacts were identified. The ERA for auto-longline in the SESSF found a range of high risk and medium risk habitat impacts and identified some uncertainties about the impacts of demersal longline on benthic habitats,

	Kalbarri and Kimberley AFAs; • sawfishes in the Kimberley AFA;	particularly on large, erect and fragile epifauna (Daley, *et al*., 2007a). However the results from the auto-longline EA are not directly transferable to the standard demersal longline used in the NWMR and it is considered, therefore, that further assessment of the impact of this gear on benthic habitats in the NWMR is required. The ERA for ALL (SESSF) found one whale species at high risk and all dolphin species assessed at medium risk. Given that dolphins are known to have interacted with the gear in the NWMR and that DEWHA has expressed concern about the quality of data on interactions with protected species (DEH, 2006a) there remains a need for further investigation of the risk posed to small cetaceans (draft CP). Given that there is no ERA available to inform the assessment of risk to sawfishes (draft CP) further analysis of the risks to these species is required.
4. Demersal gillnet	Unacceptable level of risk (pending further assessment) on: • banks and shoals in the Abrolhos Extension: Kalbarri AFA; and • dolphins in the Abrolhos Extension: Kalbarri AFA	This gear is used by one fishery and its operations intersect with only one AFA in the NWMR – the Abrolhos Extension: Kalbarri. It intersects with only two Conservation Values: Banks and Shoals (Geomorphic Feature) and a foraging area for pelagic dolphins. The SEFRA rated the risk to benthic habitats of demersal gillnet as low. However the ERA for the shark gillnet sector of the Southern and Eastern Scalefish and Shark Fishery (Walker *et al.,* 2007) identified 22 outer shelf habitats as at high risk. There remains uncertainty about the potential for the gear to impose high risks on habitats in the Abrolhos Extension: Kalbarri AFA and there is uncertainty surrounding the level of impact on dolphins, a draft CP, in this AFA.
5. Pelagic gillnet	Unacceptable level of risk (pending further assessment) on: • Turtles in the Kimberley North and Bonaparte AFAs • Cetaceans in the Kimberley North and Bonaparte AFAs	This gear is used by only one fishery in the NWMR. There are no ERAs or previous FRAs to inform this assessment. There is acknowledgement (e.g. Fletcher and Santoro, 2009) that the use of pelagic gillnets is likely to pose higher risk to species such as cetaceans and turtles. In addition, DEWHA has highlighted the lack of accurate reporting and validation of interactions in the fishery as a whole, with threatened species as posing a medium to high risk in itself. Further analysis of the potential risk posed by the gear and of the available mitigation measures is required in order to allow a reassessment of the overall finding of unacceptable (pending further assessment)
6. Fish traps	Unacceptable level of risk (pending further assessment) on: • demersal fish slope communities in the Kimberley AFA	The gear is used, or is authorized to be used by two fisheries across four NWMR AFAs. The nature of the fishing operations and the minimal level of bycatch and interaction with TEPS and benthic habitats result in negligible to low risk ratings from the ESDAs and the SEFRA. However, there is concern for the status of demersal stocks fished in one fishery using this gear that has potential implications for the Conservation Value: Demersal fish slope communities (WADF, 2009). This issue requires further consideration. In particular, the effectiveness of the management measures implemented in the NDSF in 2008 in reducing catch, and hence addressing concerns for the status of the stocks, requires assessment.
7. Purse seine	Acceptable (some conditions may be required)	This gear is authorized for use by four fisheries across the seven AFAs of the NWMR but is currently only actively used in one fishery. There is no reasonable expectation that the remaining three fisheries will apply the method in the NWMR (see Attachment 2). The extent of operation of the single operational fishery was not available so the assessment assumed the potential for interaction with all Conservation Values in the three AFAs for which the fishery is authorized. The overall assessment is that the gear poses an acceptable level of risk to the Conservation Values of the NWMR. This finding is based on findings for relevant Conservation Values of the ERAs for the Southern Bluefin Tuna Fishery (Hobday *et al*., 2007b) and the Skipjack Fishery (Daley *et al.,* 2007b) and the SEFRA and the minimal or lack of interaction with other Conservation Values of the NWMR.
8. Troll and handlines	Acceptable (some conditions may be required)	The gear is used, or is authorized to be used, by three fisheries across four NWMR AFAs. In the absence of information on the actual area of operation of the Mackerel Interim Managed Fishery it has been assumed that this fishery interacts with all Conservation Values in the AFAs for which the Fishery is authorized. This results in a precautionary assessment of the impact of the gear. While the gear has the potential to interact with a number of Conservation Values, in many cases there was no indication that such interactions occurred. Overall the gear was found to pose an acceptable level of risk to the Conservation Values of the NWMR. This finding was underpinned by the risk ratings of the SEFRA and

		findings of ESDAs for the Mackerel and Shark Bay Snapper Fisheries which identified risk as negligible to low.
9. Lobster pots	Acceptable (some conditions may be required)	The gear is used in only one AFA of the NWMR - Abrolhos Extension: Kalbarri. It intersects with only two of the identified Conservation Values and in both cases the risks have been identified as low (Burgman, 2005; Stoklosa, 2007; E-Systems, 2005).
10. Crab traps	Acceptable (some conditions may be required)	The nature of the gear, the low level of operators (limited entry in place), the minimal level of bycatch and the limited potential for interactions with TEPS, together with low risk ratings from the SEFRA (as applied in the SWFRA) and the ESDA, underpin the assessment.
11. Drift diving	Acceptable (some conditions may be required)	Not assessed. Used only in the Pearl Oyster fishery. ESDA rated all risks as negligible.

5.2.1 Demersal trawl

Six fisheries use this gear in five of the AFAs in the NWMR: the NPF, the Western Deepwater Trawl (WDTF); the Pilbara Trawl Fishery (PTRLF); the North West Slope Trawl Fishery (NWSTF); the Broome Prawn Fishery (BPF); and the Kimberley Prawn Fishery (KPF). ERAs have been conducted for the NPF, the NWSTF and the WDTF.

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

1. risks associated with impacts on habitat types;
2. risks posed to demersal slope fish communities;
3. risks posed to sawfishes;
4. risks posed to other chondrichthyans; and
5. risks posed to seasnakes and small cetaceans.

HABITATS

The Level 2 ERA for the NPF assessed 157 habitats and found 65 to be at medium risk and 92 at low risk. Of the medium risk habitats, 48 were found on the inner shelf (0-100m), including 17 in coastal margin depths (0-25m). Medium risk inner shelf habitats are dominated by flat to highly irregular unconsolidated sediments of mud to coarse grained biogenic gravels, with large erect sponges, hard and soft corals (of variable flexibility), complex communities of mixed fauna, and individual animals. The ERA did not identify any high risks to habitat types from demersal trawl gear in the NWMR. However, the ERA report (Griffiths *et al.,* 2007) states that:

> "A complication of the construction of the PSA model means that no NPF habitats can appear at high risk from Prawn trawling. This is largely because of the way that the PSA calculation is influenced by the scoring of the Productivity attributes, with shallow habitats assumed to be quite productive with good recovery rates."

The Level 1 scoping results for the ERA, as reported in Griffiths *et al*. (2007), confirm the uncertainty about the recovery of erect, rugose and inflexible octocorals, associated with soft muddy substratum, that are damaged through interaction with trawl gear, particularly the heavier and more intensive use of gear in the tiger prawn sub-fishery. The results indicate the need for data on resilience and recovery times of mud based habitats. The report notes that, regeneration times of damaged tissues will vary between species and that, while in coastal margin depths (0-25m) and inner shelf depths (25-100m) regeneration can be expected to be reasonably rapid as fauna are likely to be well adapted to frequent and considerable disturbance regimes (e.g. strong currents, runoff, cyclones), more structurally complex forms/ communities may take more than 1 year to recover. It can be inferred,

therefore, that in areas where trawling is conducted annually there is potential for the gear to impede the recovery of more complex forms/communities.

Given the above qualification on the ERA results for habitats in the NPF, it remains a possibility that the NPF is a high risk to habitat types in the Kimberley North and Bonaparte AFAs

The Level 2 ERAs for the NWSTF (Wayte *et al*., 2007a) and the WDTF (Wayte *et al.,* 2007b) identified a number of high risk upper and mid-slope habitats associated with Conservation Values in the NWMR. The NWSTF fishes on the continental slope off North Western Australia, primarily targeting deepwater scampi and prawns at upper slope depths of 200-600m. Fishing is usually conducted along relatively flat mud or silt substrates and hard bottom areas. Rocky outcrops are avoided as they are not ideal scampi habitat and also lead to snaring and damage to nets (Zhou *et al.,* 2009). Active disturbance of the substratum is designed to stimulate sheltering crustaceans into gear, using modified demersal prawn trawling gear, stern towed twin or triple nets and tickler chains. The fishery may have intensely localised benthic impacts as target species form aggregations which are targeted. The most vulnerable habitats are those with large, erect, or fragile faunas, and serve as crustacean habitat. Habitat structure and function is at risk if substratum and epifauna are removed/ killed or relocated by the gear. Burrowing fauna (infauna) will be impacted in areas of semi consolidated sediments that are repeatedly trawled (Wayte *et al*., 2007a). Benthic taxa comprised 23% of the bycatch by weight of exploratory trawl in the NWSTF in 1998-2000 (Newman and Evans, 2002 reported in Wayte *et al*., 2007a) and observations of hexactinellid sponges have been made from heavily trawled areas in the fishery (Wallner and Phillips, 1995 reported in Wayte *et al*., 2007a). The Level 2 ERA for habitats took a precautionary approach which included assessment of upper slope habitats of geomorphic features canyons, trenches, troughs, seamounts, pinnacles, plateaux and terrace. Of the 76 habitat types, 22 were assessed to be at high risk. High risk habitats on the upper slope included several hard bottom types dominated by large sponges not seen on the mid slope (Wayte, *et al*., 2007a).

The WDTF fishery operates in the upper and mid-continental slopes at depths from 200m to >700m (Wayte, *et al.,* 2007b). The majority of fishing effort within the WDTF is concentrated along the 200m isobath (Moore *et al.,* 2007). Either demersal fish trawls (mesh size 90mm) or crustacean trawls (mesh size 45mm) are used (Zhou *et al*., 2009). The Level 2 ERA assessed 48 habitats of which 20 habitats at both the upper and mid-slope depths were assessed at high risk. These habitats include several categories of both hard and soft bottom with delicate erect epifauna. The spatial extent and location of these habitats is not well known. The large area fished and the limited amount of current effort, together with the extensive areas of untrawlable bottom in the region suggest that habitat impacts are not as urgent an issue as in some other trawl fisheries (Wayte *et al.,* 2007b).

No specific habitat risk assessments have been undertaken for the BPF and KPF. In the BPF fishing occurs mainly in waters of 30-60m but down to 100m (Western Australian Department of Fisheries (WADF), 2004a). Surveys undertaken prior to the establishment of the managed fishery showed that the sea floor in the trawl area was sand and mud, suggesting that there would be minimal impacts to infaunal communities. Similar habitat to that trawled in the BPF is interspersed throughout the region both inside and outside the gazetted fishing area (DEH, 2004b). DEH (2004c) noted that studies of the impacts of prawn trawling on mud and sand habitats similar to those regularly trawled in the KPF indicate only minimal impacts to infaunal communities.

Trawling in the PTRLF normally occurs over sand. Infauna associated with sand habitats may be disturbed by the actions of otter boards, sweeps, bobbins and ground rope (WADF, 2004b). There are a number of closed areas in the fishery that provide undisturbed, local refugia for sand-dwelling fauna and are probably a source of recruitment to trawled sand habitats in the fishery. WADF maintains that trawling has a limited negative impact on sand habitats since they are naturally

dynamic environments and resident infauna are adapted to cope with physical disturbances. The ESDA for the fishery rated the impact on sand infauna as low.

However the ESDA for the PTRLF rated the impact on large epibenthos as high, noting that research had estimated that communities of attached epibenthos in open areas of the fishery experienced annual rates of trawl induced mortality of between 0.5 and 20% (Moran and Stephenson. 2000 cited in WADF, 2004b). The ESDA noted that the high rating reflected, in part, uncertainty about the distribution of habitats in the Pilbara region and to a lesser degree the recovery rates of epibenthic communities after disturbance and proposed that until these uncertainties were reduced a precautionary approach should be taken (WADF, 2004b). However these uncertainties appear to persist as Fletcher and Santoro (2009) note that past research has indicated that approximately 10% of the sessile benthic fauna (e.g. sponges) is detached per year, with higher rates in Area 1 of the fishery where the effort is concentrated, and that it is not known whether the detachment rate exceeds the rate of re-growth.

Further analysis is required to investigate the implications of the Level 2 ERA findings on the impact of demersal trawl gear on benthic habitats related to the Conservation Values of the Gascoyne, Pilbara North, Kimberley, Kimberley North and Bonaparte AFAs.

DEMERSAL SLOPE FISH COMMUNITIES

Level 2 ERAs for target species found scarlet prawn at high risk in the NWSTF (Wayte *et al.,* 2007a) and gemfish, tang snapper and mirror dory at high risk in the WDTF (Wayte *et al.,* 2007b), with potential implications for demersal slope fish communities.

The NWSTF targets three species of scampi and four species of deepwater prawns at depths between 200 and 600m. A maximum mesh size applies to discourage targeting of demersal finfish (Zhou *et al.*, 2009). Bycatch is relatively low, totalling 203.5t between 2000 and 2006 and comprising mainly mixed fish (125t), mixed prawns (54t), mixed scampi (9t), crabs (5t), dogfishes (1t) and dealfish (1t). Byproduct and bycatch species were eliminated from the ERA at Level 1. The Level 2 ERA found scarlet prawn to be at high risk and other target species to be at low - medium risk (Wayte *et al*., 2007a). The Level 3 ERA assessed 64 byproduct/bycatch fish species, including nine chondrichthyan species and 56 teleosts, and found that the current fishing intensity imposes low risk to all byproduct/bycatch species assessed in this fishery. The Level 3 ERA did not assess target species.

Over the history of the WDTF, the main retained species have included orange roughy, deepwater bugs, ruby snapper, bar rockcod, boarfish, deepwater flathead, mirror flathead and tang's snapper (Wilson, Curtotti, Begg and Phillips, 2009). Sharks and dogfishes are an important, though not generally large, part of the overall catch in the WDTF (Moore *et al.,* 2007). The level 2 ERA identified (across both finfish and crustacean gears) 22 high risk species including four target species, 17 byproduct species and one bycatch species. These high risk species included 11 chondrichthyans, one invertebrate and 10 teleosts. The subsequent Level 3 assessment for bycatch and byproduct species found that the current fishing intensity imposes low risk to all non-target species assessed (Zhou *et al*., 2009).

These ERAs leave 4 target species at high risk. The gear may therefore impose unacceptable risks to demersal slope fish communities in the Gascoyne AFA where the NWSTF and WDTF operate.

SAWFISHES

Sawfishes are taken in both the NPF and the PTRLF. The NPF is known to interact with green and freshwater sawfish and the PTRLF with green and narrow sawfish. Sawfishes are identified as a draft CP in the NWMR. Three of the five species of sawfishes, including green and freshwater sawfish, are

listed as Vulnerable under the EPBC Act and all five species are listed (four species on Appendix 1 and one species, freshwater sawfish, on Appendix II) of CITES.

As part of the ongoing refinement of the SAFE methodology, the need to differentiate between chondrichthyans and teleosts in determining reference points for exploitation rates was identified following the conduct of Level 3 ERAs for the NPF and two other Commonwealth fisheries. As a result, a more conservative relationship between reference points and life history parameters for chondrichthyans has been applied by Zhou *et al.* (2009) in the subsequent Level 3 ERAs for each of the other Commonwealth fisheries authorised for the NMR and NWMR. At this stage, however, the NPF ERA has not been recalibrated to address this issue. In accordance with the application of the precautionary approach, the Level 2 NPF risk ratings for chondrichthyans in the NPF fishery (Griffiths *et al.*, 2007), as well as the outcomes of the Level 3 findings for chondrichthyans (Brewer *et a*l., 2007a), as further refined in the NPF's Ecological Risk Management Report (AFMA, 2009b), have been taken into account in this analysis.

The use of TEDs in the NPF has been shown to be effective in reducing capture of elasmobranchs. However, with the exception of narrow sawfish (Brewer *et al.,* 2006), TEDs are not effective in reducing interactions or improving the survivorship of sawfishes, since their rostrum (their long saw-like snout) is generally either caught in the net before the sawfish reach these devices, or outside the net (Patterson and Tudman, 2009). Thus, while TEDs are compulsory in the NPF and the PTRLF, these are not likely to be effective in excluding the sawfish species of interest in the NMR, namely green, dwarf and freshwater sawfish. The NPF's Bycatch and Discarding Workplan (AFMA, 2009c) includes a number of projects aimed at achieving ongoing reductions in bycatch but does not identify any actions aimed specifically at reducing interactions with sawfishes. There are no sawfish-specific mitigation measures under consideration in the PTRLF. While the species are 'no take' in both fisheries this does not preclude or, necessarily, reduce interactions. *The Chondrichthyan Guide for Fisheries Managers* (Patterson and Tudman, 2009) provides no specific guidance on possible mitigation options for sawfishes.

In 2008, 458 interactions with sawfishes were recorded in NPF logbooks. The rate of logbook-reported interactions was just over half the rate of interactions reported by the limited crew member observer program and about one-sixth of the rate of interactions reported by scientific observers (Evans, 2009). This suggests that the logbooks may significantly under-report sawfish interactions.

AFMA's Residual Risk Assessment of the NPF Level 2 ERA results left five sawfish species at high risk due to low fecundity and high susceptibility to being caught in nets (AFMA 2008a). The subsequent SAFE (Level 2.5/3) assessment for the NPF (Brewer *et al*., 2007a) did not find sawfishes as being "potentially at risk" from the impact of the NPF alone, since they are distributed across areas inshore and offshore of the trawl grounds. However, the assessment found that they could potentially be at risk from the cumulative impacts of other fishing including illegal fishing and that a cumulative ecological risk assessment is needed for these species to assess the full extent of the impact from all fisheries throughout their range. The report recommended that "In the meantime a precautionary approach is essential to ensure the viability of sawfish populations in Australian waters."

Twenty-one green sawfish (three dead) and 33 narrow sawfish (six dead) were reported as taken in the PTRLF in 2008 (Fletcher and Santoro, 2009). The ESDA risk rating for sawfish in the PTRLF was moderate (WADF, 2004b). However the findings of the NPF Level 3 ERA suggest that a cumulative assessment of impacts on sawfishes is required. In particular this assessment is required in the Pilbara North, Kimberley and Kimberley North AFAs of the NWMR.

OTHER CHONDRICHTHYANS

Between 2000 and 2006, 108t of sharks were taken as bycatch in the WDTF; this represented 25% of all bycatch (Moore *et al*., 2007). The level 2 ERA for the WDTF fishery (Wayte *et al.,* 2007b) and the

subsequent residual risk assessment for the fishery (AFMA, 2008b) left 11 chondrichthyan species at high risk. The Level 3 ERA for teleosts and chondrichthyans (Zhou *et al*., 2009) found that the fishery posed only a low risk to shark species. However, given that the Level 3 assessment is based on the current level of effort in the fishery, and that there is a high level of latent effort in the WDTF (less than half the permits are active) together with the draft CP status of sharks in the NWMR, it is considered precautionary to require further consideration of the threat to the 11 high risk species identified in the residual risk assessment: piked dogfish, endeavour dogfish, green-eyed dogfish, dusky shark, brier shark, platypus shark, bight ghost shark, ornate angel shark, school shark, whitefin chimaera and longspine chimaera. Wayte *et al.* (2007b) indicated that six of these species (endeavour dogfish, green eyed dogfish, ornate angel shark, whitefin chimaera, dusky shark and brier shark) are considered of particular concern since they are endemic to either Australia or southern and western Australia.

SEASNAKES AND SMALL CETACEANS

The PTRLF has an incidental capture of seasnakes and dolphins. Both seasnakes and small cetaceans (including dolphins) are protected species and are draft CPs in the NWMR. DEWHA has indicated its concerns about interactions of this fishery with protected species, including dolphins and seasnakes, through the EPBC Act assessment process and WADF has been working to reduce these interactions.

The data available indicate that the interactions of the fishery with seasnakes do not intersect with any of the Conservation Values of the NWMR. However the level of seasnake interactions remains high. In fact the data show that the between 2004 and 2008 annual reported interactions ranged from a low of 19 in 2005 to 164 in 2006 and in 2008 were 112. The number of seasnakes returned to the sea dead over the same period ranged from 2 (out of 45) in 2004 to 63[2] (out of 74) in 2007 (Fletcher and Santoro, 2008 and 2009; WADF, 2007). These data do not suggest that the current mitigation measures in the fishery have been successful in delivering ongoing reductions in seasnake interactions or mortalities. Given the ongoing level of interaction with seasnakes in the PTRLF, and the conservation status of seasnakes it is considered that further investigation of bycatch mitigation measures is required.

The level of interactions of the PTRLF with dolphins has declined from a recent peak of 56 in 2004 (of which 52 were dead) to 17 in 2008 (of which 11 were dead) (Fletcher and Santoro, 2008 and 2009; WADF, 2007). The ERA for the NWSTF was used to inform the assessment of risk posed to small cetaceans by otter trawl. However, the ERA for the NWSTF eliminated dolphins at Level 1 since there had been no reported interactions with dolphins. This is clearly not the case in the PTRLF and therefore, despite the absence of a high risk rating, it is considered appropriate to take a precautionary approach to the impact of the PTRLF on this protected group of species.

FRA RATING

The application of the precautionary approach leads to a finding of “Unacceptable risk” for demersal trawl gear in relation to its impacts on habitat types, sawfishes and some demersal slope fish species. In addition, it is considered that there is a need for further assessment of the risk posed to chondrichthyan species found to be at high risk in the WDTF. In particular, this investigation needs to determine the extent to which these species are taken in the Gascoyne AFA. The impact of the gear on small cetaceans and dolphins in the PTRLF also requires further assessment to determine whether refinement of mitigation measures is capable of delivering further and sustained reductions in interactions with and mortality of these species.

[2] Noting that where the condition was not reported the animal was considered dead.

5.2.2 Pelagic longline

The Western Tuna and Billfish Fishery (WTBF) is authorized to operate throughout the NWMR but, to date, has only used pelagic longline in three of the seven AFAs: Abrolhos Extension Kalbarri, Abrolhos Extension: Wallaby and Gascoyne. The level of effort in the fishery has been declining since around 2002 due to low prices and higher operating costs, however this situation could change in response to an improvement in economic conditions. The Southern Bluefin Tuna Fishery (SBTF) is also authorized to operate throughout the NWMR but there is no expectation that this will occur (see Attachment 2 for the rationale underlying this).

Two areas of concern arise from the analysis of the impact of pelagic longline on the Conservation Values of the NWMR:

1. risks posed to small cetaceans; and
2. risks posed to chondrichthyans.

SMALL CETACEANS

Small cetaceans, including toothed whales, are a draft CP in the NWMR. The Wallaby Saddle (KEF) in the Abrolhos Extension: Wallaby AFA is a feeding area for toothed whales and dolphins (Brewer *et al*., 2007b). While there are very few reports of whales becoming entangled in tuna longline gear, the Level 2 ERA, and subsequent residual risk assessment, left four whale species (long-finned pilot whale, Andrew's beaked whale, ginko beaked whale and True's beaked whale) at high risk from the fishery (Webb *et al.,* 2007 and AFMA, 2008c). These have been identified in the Bycatch and Discard Workplan for the fishery (AFMA, 2008c) although no specific mitigation measures for these species have been identified.

CHONDRICHTHYANS

Sharks are a draft CP in the NWMR. The WTBF takes a wide range of shark species as bycatch including: blue shark, crocodile shark, porbeagle shark, hammerhead sharks, shortfin mako shark, silky shark, thresher sharks, oceanic whitetip shark, dusky shark, bronze whaler shark and blacktip shark (Lynch, 2004). Observer records for the period 2003/04 to 2004/05 indicate that the shark species that are captured in greatest numbers in the WTBF and discarded include: crocodile shark (100%), dusky sharks (100%), blue sharks (90%) and shortfin mako (80%). 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, 2008c).

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, 2009d). The Bycatch and Discard Workplan for the fishery (AFMA, 2008c) proposes a range of additional actions to reduce interactions and improve the survivorship of shark species taken by pelagic longline. These include: compulsory carriage of line cutters and de-hookers, analysis of the impact of making use of circle hooks compulsory, review advice in the *Chondrichthyan Guide for Fisheries Managers* (Patterson and Tudman, 2009). These remain under consideration.

Six chondrichthyan species were found to be at high risk from the Level 2 ERA: dusky shark, porbeagle shark, thresher shark, sherwood's dogfish, smooth hammerhead and white shark (TEP) and three of these - dusky shark, porbeagle shark and white shark remained at high risk after the residual risk assessment (AFMA, 2008c). Thirty eight chondrichthyan species, including those six high risk species, were subject to a Level 3 ERA which found that, at 2004-2007 levels of fishing intensity, the fishery posed low risk to all non-target species assessed (Zhou *et al.,* 2009). However, the level of fishing effort underlying the Level 3 assessment represents less than half the level of effort

that was active in the fishery in the years 2000-2003 (AFMA 2009d). The potential exists for effort to return to these earlier, higher levels. Taking into account this high level of latent effort and the draft CP of sharks in the NWMR, it is considered precautionary to require further consideration of the threat to the three high risk species identified by the residual risk assessment.

FRA RATING

The application of the precautionary approach leads to a finding of "Unacceptable risk" for pelagic longline gear in the Gascoyne AFA in relation to its impacts on toothed whales. In addition, the risk to three chondrichthyan species in the Gascoyne AFA is considered "Unacceptable (pending further assessment)". These findings reflect the high risk findings of the level 2 ERA for toothed whales (the highest level ERA conducted for these species) and the application of the precautionary approach in relation to sharks as a draft CP in the NWMR.

5.2.3 Demersal longline

The West Coast Demersal Gillnet and Demersal Longline (WCDGDLF), the North Coast Shark Fishery (NCSF) and the Joint Authority Shark Fishery (JASF) are authorized to use demersal longline in the NWMR and the gear is used in four of the seven AFAs.

No ERAs have been conducted for standard demersal longline. While the SEFRA assessed demersal longline it did not assess the impact of the gear on many of the Conservation Values relevant to the NWMR and its guidance on risks associated with the gear type were limited to habitat impacts. No high risk habitat impacts were identified in the SEFRA for this gear. The SWFRA based its assessment of demersal longline on the ERA for the ALL sub-fishery of the SESSF.

Four areas of concern arise from the analysis of the impact of demersal longline on the Conservation Values of the NWMR:

1. risks associated with habitat impacts on banks and shoals;
2. risks posed to small cetaceans;
3. risks posed to sawfishes; and
4. risks posed to marine turtles.

HABITATS

The SEFRA for demersal longline gear identified interactions with the benthic habitat as comprising: contact of the weights and rope; dragging of gear and hooked fish; snagging lines on bottom species; and snagging of gear on the bottom. The SEFRA assessed all impacts on the inner shelf as low risk with impacts on the outer shelf assessed as low to medium risk (E-Systems, 2005).

The ERA for the ALL sector of the SESSF did not assess inner shelf habitats but 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 (Daley *et al.*, 2007). The ERA for ALL notes that, while the gear affects benthic habitats less than trawling, it can target bottom types that are not fishable by trawling and a key uncertainty is the effect of movement of the main line, by currents, on large, erect and fragile epifauna.

These findings potentially place banks and shoals in the Abrolhos Extension: Kalbarri at high risk from demersal longlining by the WCDGDLF which is the only one of the three active fisheries that operates in this AFA. Although it is acknowledged that the footprint of automatic longline gear is likely to be larger than that of standard demersal longline gear, given the longer length of line and greater number of hooks set in auto-longlining, it is considered that further assessment of the impact of demersal longline gear on benthic habitats, specifically banks and shoals, in the Abrolhos Extension: Kalbarri would be precautionary.

SMALL CETACEANS

Small cetaceans are a draft CP in the NWMR. Dolphins are known to have interacted with the WCDGDLF however the ESDA rated the risk to cetaceans as negligible (Fletcher and Santoro, 2009). It remains unclear whether the gear responsible for the interactions was demersal gillnet and demersal longline, both of which are used in the fishery

The SEFRA (E-Systems, 2005) did not identify any known interactions between whales and demersal longline but noted that while dolphins may swim in the vicinity of vessels there were no adverse interactions evident. There was considered no foreseeable threat to either whales or dolphins by demersal longlines. No risk rating was given.

The ERA for the ALL sector of the SESSF noted that there have been reports of several killer whales being hooked by Japanese longliners and that there was a report of one mortality. Pilot whales are commonly seen moving through the fishing grounds of the ALL sector of the SESSF but do not approach the boat or the fishing gear and dolphins are often seen around the vessel, particularly bow-riding but do not approach the gear (Daley *et al.,* 2007a). The ERA found one whale species (Hector's beaked whale) at high risk and all dolphin species were assessed as at medium risk.

Export approval for the JASF, under the EPBC Act, was revoked by the Commonwealth Minister for the Environment in 2008 as a result of the failure to implement formal management arrangements that will improve the ecological sustainability of the fishery. DEWHA considered interactions with threatened/listed species as medium to high risk due to lack of accurate reporting or validation measures in the fishery (DEH, 2006b). WADF report that resumption of fishing (and reassessment of the ecological sustainability) of both the NCSF and the JASF, is contingent on adequate funding for a comprehensive observer program (notionally 30% of effort coverage) to evaluate bycatch issues and interactions with TEPS. It is acknowledged that there are issues with logbook data validation but WADF notes that there are currently no resources to address these (WADF, 2008a).

Given these findings, the concerns about the reliability of reporting of interactions in the fishery and the draft CP status of small cetaceans it is considered that the level of risk posed to small cetaceans, and if necessary potential mitigation measures, requires further consideration

SAWFISHES

Sawfish are a draft CP in the NWMR. Sawfish are reported as an "occasional catch" in the NCSF and the JASF (DEH, 2006b). Since the fisheries generally operate some distance offshore they are considered to pose a negligible risk to sawfish which have primarily inshore, estuarine and riverine distributions (Fletcher and Santoro, 2008). In addition, waters in Pilbara North and BIAs for sawfish (adjacent to 80 mile beach) have been closed to these two fisheries since 2005 (Fletcher and Santoro, 2008). However, interactions with threatened species are considered medium to high risk in these fisheries due to lack of accurate reporting or validation measures (DEH, 2006b) and there is no ERA available to inform the assessment of risk by this gear to sawfishes. It is considered precautionary, therefore, to require further consideration of the likely level of interaction between demersal longlines and sawfishes in the Kimberley AFA which includes BIAs for dwarf, freshwater and

green sawfish. This consideration could be included in a cumulative impact assessment of sawfish in the NWMR.

FRA RATING

The application of the precautionary approach leads to a finding of "Unacceptable risk (pending further assessment)" for demersal longline gear in the Abrolhos Extension: Kalbarri in relation to its impacts on banks and shoals and small cetaceans. In addition it is considered that there is a need for further assessment of the risk posed to sawfishes in the Kimberley AFA. This finding reflects the high risk findings of the SESSF ERA outer shelf habitats and the application of the precautionary approach in relation to sawfishes and small cetaceans as draft Conservation Priorities in the NWMR.

5.2.4 Demersal gillnet

This gear is by the WCDGDLF, and its operations intersect with only one AFA, the Abrolhos Extension: Kalbarri. The ERA for the shark gillnet sector of the SESSF (Walker *et al.,* 2007) and the SEFRA for this gear were used to inform the assessment.

Two areas of concern arise from the analysis of the impact of demersal gillnet on the Conservation Values of the NWMR:

1. risks associated with habitat impacts on banks and shoals;
2. risks posed to dolphins.

HABITATS

SEFRA (E-Systems, 2005) identified the risks to benthic habitats from demersal gillnet as comprising disturbance of the bottom from the slight movement of the footrope against currents and a low incidence of tearing nets or breakage of gear from being caught on the bottom. The consequences of this impact were considered to be incidental damage to species such as sponges, tunicates, bryozoans, hydroids, ascidians and gorgonians in the immediate area of the footrope which have been dislodged or impacted by footrope. The vulnerability and survival of species was considered uncertain, especially below 60-70m. The SEFRA rated the risk to benthic habitats of demersal gillnet as low.

The Level 2 ERA for the shark gillnet sub-fishery of the SESSF noted that, while demersal gillnets are in contact with the benthic they are not thought to significantly damage it. However the ERA identified 22 outer shelf (200-200m) high risk habitat types; including13 hard bottom types (low relief gravels or outcrops) covered with large erect or delicate epifauna and nine soft bottom types covered with large, erect or delicate epifauna. The epifauna consisted of sponges, crinoids, octocorals sedimentary animals or communities of mixed fauna (Walker *et al.,* 2007).

These findings suggest that the there is potential for the gear to impose high risks on the banks and shoals, particularly in the deeper waters (80-150m), of the Abrolhos Extension: Kalbarri AFA.

DOLPHINS

Small cetaceans are a draft CP in the NWMR. There is no recent information available on the level of interactions with dolphins in the WCDGDLF. Between 1994 and 1999 WADF observed 8 dolphin captures in the demersal gillnet and demersal longline fisheries (i.e. the Southern and Western fisheries), although it is not clear about which gear or which fishery was responsible (WADF, 2005). McAuley and Simpfendorfer (2003) cited in DEWHA (2009b), found that marine mammals were captured at a rate of just over 1 per 10,000km of gillnet hours.

FRA RATING

The application of the precautionary approach leads to a finding of "Unacceptable risk (pending further assessment)" for demersal gillnet gear in the Abrolhos Extension: Kalbarri AFA in relation to its impacts on banks and shoals and dolphins. This finding reflects the high risk ratings of the SESSF ERA for this gear type for outer shelf habitat types and the application of the precautionary approach to small cetaceans as a draft CP for the NWMR.

5.2.5 Pelagic gillnet

This gear is used by the JASF. There are no ERAs or previous FRAs to inform the assessment of this gear type. The available information on the fishery is based largely on impacts of the primary gear in the fishery, i.e., demersal longline, and/or does not discriminate between the impact of the two gears and is therefore of minimal assistance to the assessment.

Two areas of concern arise from the analysis of the impact of pelagic gillnet on the Conservation Values of the NWMR:

1. risks posed to turtles; and
2. risks posed to cetaceans.

TURTLES AND CETACEANS

No turtle captures have been observed or reliably reported in the JASF (Fletcher and Santoro, 2009). It is considered that the lack of reported captures is because the amount of gear being used is low relative to the fisheries' operational area and as a result the likelihood of interactions is low (WADF, 2005). Fletcher and Santoro (2009) note that although turtles are possibly more susceptible to capture by pelagic gillnet than demersal longlines the amount of proposed effort is small relative to the operational area of the NCSF and the JASF and historical level levels of gillnet effort in the area and conclude that, at the potential levels of effort the risk of interactions is expected to remain low. However, interactions with threatened species is considered medium to high risk due to lack of accurate reporting or validation measures (DEH, 2006b). There is no recent information on interactions with protected species in the JASF. Fletcher and Santoro report that the risk to cetaceans in the JASF and NCSF has previously been rated as negligible but note that pelagic gillnets are likely to have a higher risk to cetaceans than demersal longlines. Given DEWHA's reservations about the quality of the data on interactions with such species in this fishery (DEH, 2006b), the negligible risk rating, which would in part have reflected the level of reported interactions, is questionable in any case.

As noted above, the export approval for this fishery has been revoked as a result of failure to implement management to improve the sustainability of the fishery. Product can still be sold on the domestic market. Since 2005, WADF has been encouraging a shift from the use of demersal longlines to pelagic gillnets in both the JASF and the NCSF, however fishers have so far been reluctant or unable to reconfigure vessels for gillnetting and there has been negligible effort in the fisheries between 2005 and 2008 (WADF, 2008a). WADF acknowledges that there is considerable uncertainty in relation to the impact on TEPS from a full-scale resumption of targeted shark fishing activities in the JASF (and in the NCSF) (WADF, 2008a).

There is acknowledgement (e.g. Fletcher and Santoro, 2009) that the use of pelagic gillnets is likely to pose higher risk to species such as cetaceans and turtles. In addition, DEWHA has highlighted the lack of accurate reporting and validation of interactions with threatened species, in the fishery as a whole, as posing a medium to high risk in itself (DEH, 2006b). Further analysis of the potential risk

posed by the gear, and of the available mitigation measures, is required in order to allow a reassessment of the overall finding of unacceptable (pending further assessment).

FRA RATING

The application of the precautionary approach leads to a finding of "Unacceptable risk (pending further assessment)" for pelagic gillnet gear in the Kimberley North and Bonaparte AFAs in relation to its potential impacts on marine turtles and small cetaceans. This finding reflects the acknowledgement that pelagic gillnetting is likely to pose higher risks to these species than the current primary fishing method, the uncertainty about the current level of impact on these species and the application of the precautionary approach to these TEPS, one of which, small cetaceans, is a draft CP for the NWMR.

5.2.6 Fish traps

The gear is used by the Pilbara Trap Fishery (PTRF) and the Northern Demersal Scalefish Fishery (NDSF) and is used across four NWMR AFAs. The findings of the SEFRA have been used to inform the assessment where the findings were considered transferable. ESDA reports for the two fisheries were also available.

One area of concern arises from the analysis of the impact of fish traps on the Conservation Values of the NWMR and that is the risk posed to demersal fish slope communities in the Kimberley AFA.

DEMERSAL SLOPE FISH COMMUNITIES

The NDSF targets demersal species of goldband snapper (35%) and red emperor (23%) and by-product species primarily comprise scarlet perch, spangled emperor and cod and grouper species. The 2008 catch of goldband snapper was above the acceptable levels for the fifth consecutive year. Similarly, the 2008 catch of the cod/grouper complex was above the acceptable level. The catch of red emperor in that year did not exceed the acceptable level (Fletcher and Santoro, 2009). The latest stock assessment has indicated that the breeding stock levels for the two indicator species (goldband snapper and red emperor) were continuing to trend down and that if catches remained at the 2007 level, or increased, for these two species their virgin spawning stock biomass would be likely to fall below the internationally accepted reference point of 40% of virgin biomass sometime in the future. This finding has recently been broadly confirmed by an independent review of the inputs to the stock assessment model (WADF, 2009).

The deteriorating status of these two, long-lived, demersal fish stocks poses a risk to the demersal slope communities of the Kimberley AFA. WADF has introduced a management package for the 2009 licensing period including a formal effort determination of 1144 standard fishing days in Area 2 (the same level as in 2006-2008) and conditions relating to the calculation of fishing time and more accurate recording of fishing time (WADF, 2009). However the impact of these measures on catch levels is not yet known.

FRA RATING

The application of the precautionary approach leads to a finding of "Unacceptable risk (pending further assessment)" for traps in the Kimberley AFA. This finding reflects the acknowledgement of concern for the level of spawning biomass of two key, long-lived demersal stocks is at risk of falling below the limit reference point, that the capacity of the existing management measures to address this issue is not yet known and that alternative management arrangements have not yet been proposed. It is considered therefore, that the outcomes of the 2009 fishing season and any

alternative/additional management responses be evaluated in order to re-assess the potential risk posed by the NDSF trap fishery to demersal slope fish communities in the Kimberley AFA.

5.2.7 Discussion

The key issues identified by the NWMRFRA are:

- the risks posed to benthic habitats by demersal trawling and demersal longline;
- the actual and potential risks posed to sawfishes by demersal trawling and demersal longline
- the real and potential risks to other chondrichthyan species by demersal trawl and pelagic longlines;
- the potential risks posed to demersal slope fish communities by demersal trawl and traps and the need to review the effectiveness of management measures implemented for the NDSF in 2008 in addressing concerns for the status of some stocks in that fishery; and
- potential risks to small cetaceans by demersal longline and pelagic gillnet.

BENTHIC HABITATS

Demersal trawling is recognised as one of the most destructive fishing methods in the world (see for example Nelleman, *et al.*, 2008, Anon., 2004). Both the SE and SWFRAs have identified high risks to benthic habitat from demersal trawl gear. The impact of demersal trawling on habitat loss and degradation is a threat to biodiversity conservation since seafloor habitats provide some of the most productive marine environments. The impact of trawling will depend in part on the nature of the seafloor and the intensity of fishing.

As discussed above, there remains considerable uncertainty about the level of risk posed to habitats by demersal trawling in the NWMR and there is no evidence to confirm the extent to which the use of semi-demersal trawl gear mitigates this risk.

The assessment of risk posed by demersal longline may overstate the risks since they are based on auto- longline which is likely to have a more intense footprint give the longer length of line and greater number of hooks set. However, the ERA for auto-longline acknowledges the uncertainty about the impact of the mainline on large, erect and fragile epifaunua (Daley *et. al*., 2007). This uncertainty applies to both standard and auto-longlining and may be more of a concern in the outer shelf habitats in the NWMR than in those slope habitats assessed in the auto-longline ERA. Daley *et al*. (2007) noted that “An important research priority would be to deploy camera gear to observe the movement and impact of ALL lines on benthic habitats.”

Concerns about the potential risk to benthic habitats associated with demersal trawling relate to five of the AFAs of the NWMR (Gascoyne, Pilbara North, Kimberley, Kimberley North and Bonaparte). Conservation Values potentially at risk include the Montebello Trough, Cape Range/Cloates Canyons, Commonwealth waters surrounding Ningaloo Reef, the Rowley Shoals, Scott and Seringapatam reefs, Ashmore and Cartier Island and adjacent to Quondong Point, and holothuria banks and shoals. Concern about demersal longlining relates to the Abrolhos Extension: Kalbarri: with particular concern for the impact on banks and shoals in this AFA.

Further assessment of the risk posed by demersal and demersal longlining to specific habitat types in the relevant AFAs would be required in order to underpin a review of the findings of “unacceptable impact” and “unacceptable impact (pending further assessment)” respectively.

SAWFISHES

Like most chondrichthyans, sawfishes are particularly vulnerable to anthropogenic pressures on their populations, including pressure from fishing. Compared to most teleosts, they are slow to mature and have low fecundity. In addition, their morphology renders them particularly vulnerable to capture by some fishing gears due to their rostrum becoming entangled in the gear. Sawfishes are identified as a draft CP in the NWMR. Three species of particular interest in the NWMR (dwarf sawfish, freshwater sawfish and green sawfish) are listed as Vulnerable under the EPBC Act and all five species are listed on CITES (four species on Appendix 1 and one species, freshwater sawfish, on Appendix II).

Apart from some success in reducing interactions with the narrow sawfish, BRDs have not been found to be an effective mitigation measure for sawfishes. However, advice on the handling and release of sawfishes is available (see for example, WADF, 2008b) and, if applied, these may improve the survivorship of captured individuals. In addition, sawfishes are no take species in WA fisheries and the NPF. While this will not reduce incidental interactions it does, if enforced, preclude the targeting of these species.

The findings of Brewer *et al.* (2007a) are relevant to the consideration of risk posed to the sawfishes in the NWMR. Those findings are that a “cumulative ecological risk assessment is needed for these species to assess the full extent of the impact from all fisheries throughout their range” and that "In the meantime a precautionary approach is essential to ensure the viability of sawfish populations in Australian waters."

The NWMRFRA has found that demersal trawl gear and demersal longline pose, or potentially pose, unacceptable levels of impact on sawfishes. These findings are underpinned by the application of the precautionary approach given the lack of effective mitigation measures, high degree of uncertainty about the actual levels of interactions with sawfishes by some of these gears, the lack of relevant ERA risk ratings attributable demersal longline in relation to its interactions with sawfishes, draft CP status of sawfishes in the NWMR and the findings of Brewer *et al.* (2007a).

Cumulatively, the fisheries using these gears intersect six of the seven AFAs in the NWMR. This supports the application of the need identified by Brewer *et al*. (2007a) in relation NMR for a cumulative ecological risk assessment of the impact of fisheries on sawfishes, in the NWMR. This assessment should include all fisheries/gears that interact with sawfishes in the NMR. In addition, there remains an urgent need for further research and development into effective mitigation measures for sawfishes.

OTHER CHONDRICHTHYANS

A noted above, chondrichthyans are relatively more vulnerable to fishing pressure than many other marine species. The 2008 IUCN Red list of Threatened Species lists 22 species of chondrichthyans as Critically Endangered, 29 as Endangered, 75 as Vulnerable, 107 as Near Threatened and 205 species as Data Deficient. There is increasing recognition of the deteriorating status of sharks stocks worldwide. Over the last decade, the United Nations General Assembly, the FAO and Parties to the Convention on Migratory Species and CITES, and some regional fisheries management organisations have called for and/or taken action to address the impact of fishing on chondrichthyans.

Sharks are a draft CP in the NWMR. The NWMRFRA has found that demersal trawl, and pelagic longline are, or potentially are, imposing an unacceptable level of risk to chondrichthyan species (in addition to the sawfishes discussed separately above). Level 2 ERAs for the WDTF and the WTBF and the subsequent Residual Risk assessments, left a total of 14 species at high risk. While subsequent Level 3 ERAs, which take into account the current level and distribution of fishing effort, found that the fishery posed only a low risk to these species, there exists considerable latent effort in each fishery and it is considered precautionary to require further consideration of the high risks posed

to these species by these gears and the potential for mitigation measures to specifically address those risks.

Most chondrichthyans are high order predators and removal of such predators can cause a 'top-down' effect on organisms lower in the food webs of the ecosystems they inhabit. Maintenance of biodiversity in the ecosystem of the NWMR requires that chondrichthyan species are maintained at sustainable levels in order to both protect those species and to ensure the broader sustainability of ecosystems.

DEMERSAL FISH SLOPE COMMUNITIES

The NWMRFRA has found that demersal trawl and fish traps are, or potentially are, causing an unacceptable level of risk to a number of species that are part of demersal slope communities. This is of concern in the Gascoyne and Kimberley AFAs where demersal slope fish communities are characterised by high endemism and species diversity (DEWHA, 2008). Overfishing of individual fish species potentially compromises the trophic relationships underpinning such ecosystems.

Some demersal finfish species are long lived and are characterised by relatively long life spans, slow growth rates and late age of maturity and hence are more vulnerable to overfishing. For example, two species at risk from trap gear are red emperor and goldband snapper. These species have a mean age at maturity of 8 years and can live for up to 40 and 30 years respectively (WADOF, 2004). To date there is no indication that management measures in either the NWS, where scarlet prawn is at high risk, or in the NDSF where demersal scalefish are at risk, are capable of addressing the risk to these stocks.

SMALL CETACEANS

All cetaceans are protected under the EPBC Act and small cetaceans (toothed whales and dolphins) have been identified as a draft CP in the NWMR.

The NWMRFRA has found that pelagic longline, demersal longline, demersal gillnet and pelagic gillnet pose, or potentially pose an unacceptable risk to species of toothed whales and dolphins. These risks relate to the Gascoyne, Abrolhos Extension: Kalbarri, Kimberley, Kimberley North and Bonaparte AFAs.

The findings are underpinned by high ERA risk ratings in some instances together with uncertainty about the level of interaction in some fisheries and the draft CP status of small cetaceans in the NWMR.

5.2.8 Conclusions

In summary, the NWMRFRA has found two gears that are having "unacceptable" impacts on at least one Conservation Value of the AFAs of the NMR. Those gears are demersal trawl and pelagic longline. Six gears - demersal trawl, pelagic longline, demersal longline, demersal gillnet, pelagic gillnet and fish traps - have been found to pose an "unacceptable risk, pending further assessment" in relation to one or more Conservation Values.

Five gear types have been found to pose a low risk to Conservation Values in the AFAs and, while some conditions may be required on their use, their impact has been found to be "acceptable". Those gears are purse seine, troll and handlines, lobster pots, crab traps and drift diving.

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ABBREVIATIONS AND ACRONYMS

AFA	Area for further assessment
AFMA	Australian Fisheries Management Authority
ALL	Automatic longline
ANZECC	Australian and New Zealand Environment and Conservation Council
BIA	Biologically important area
BPF	Broome Prawn Fishery
BRD	Bycatch reduction device
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CP	CP
CSIRO	Commonwealth Scientific and Industrial Research Organisation
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)
DRDPIFR	Department of Regional Development, Primary Industry, Fisheries and Resources
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPBC Regulations	*Environment Protection and Biodiversity Conservation Regulations*
ERA	Ecological risk assessment
ERAEF	Ecological Risk Assessment for Effects of Fishing
ESDA	Ecologically sustainable development assessment
FAO	United Nations Food and Agriculture Organization
FRA	Fishing risk assessment
FRDC	Fisheries Research and Development Corporation
GoC	Gulf of Carpentaria
GoCDFTF	Gulf of Carpentaria Developmental Finfish Trawl Fishery
GoCIFF	Gulf of Carpentaria Inshore Finfish Fishery
IUCN	International Union for the Conservation of Nature and Natural Resources (World Conservation Union)
JASF	Joint Authority Shark Fishery
KEF	Key ecological feature
KPF	Kimberley Prawn Fishery
NCSF	North Coast Shark Fishery

NDSF	Northern Demersal Scalefish Fishery
NMR	North Marine Region
NMRFRA	North Marine Region Fishing Risk Assessment
NPF	Northern Prawn Fishery
NT	Northern Territory
NTFTF	Northern Territory Finfish Trawl Fishery
NWMR	North-west Marine Region
NWMRFRA	North-west Marine Region Fishing Risk Assessment
NWSTF	North West Slope Trawl Fishery
ONLF	Offshore net and Line Fishery (NT)
PSA	Productivity susceptibility analysis
PTRF	Pilbara Trap Fishery
PTRLF	Pilbara Trawl Fishery
SAFE	Sustainability Assessment for Fishing Effects
SBTF	Southern Bluefin Tuna Fishery
SEFRA	South-east Marine Region fishing risk assessment
SESSF	Southern and Eastern Scalefish and Shark Fishery
SWFRA	South-west Marine Region fishing risk assessment
TED	Turtle excluder device
TEPS	Threatened, endangered or protected species
WA	Western Australia
WADF	Western Australian Department of Fisheries
WCDGDLF	West Coast Demersal Gillnet and Demersal Longline Fishery
WDTF	Western Deepwater Trawl Fishery
WTBF	Western Tuna and Billfish Fishery

GLOSSARY[3]

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.

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

[3] Sourced from the North-west Marine Bioregional Plan Bioregional Profile (DEWHA, 2008)

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 (molluscs) and chitons molluscs feed on coralline algae.

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 whiplike, 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".

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.

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.”

ATTACHMENT 1

Authorized fisheries/main methods and key information available

North Marine Region		North-west Marine Region	
Fishery	**Risk assessment Information**	**Fishery**	**Risk assessment information**
Northern Prawn Fishery (NPF) (AFMA) Demersal trawl	ERA: Level 1 – communities eliminated Level 2 - target, byproduct/bycatch and TEP species and habitats Residual Risk analysis of the 28 high risk species Level 2.5(earlier version of Level 3) analysis of 26 high residual risk species Level 3 SAFE for seasnakes	NPF Demersal otter trawl	ERA: Level 1 – communities eliminated Level 2 - target, byproduct/bycatch and TEP species and habitats Residual Risk analysis of the 28 high risk species Level 2.5 (earlier version of Level 3) analysis of 26 high residual risk species Level 3 SAFE for seasnakes
Western Tuna and Billfish Fishery (WTBF) (AFMA) Pelagic Longline	ERA (Pelagic longline): Level 1 - habitats eliminated Level 2 – target, byproduct/bycatch and TEPS assessed; communities not assessed Level 3 SAFE for chondrichthyan and teleost byproduct, discards or TEPS (excludes invertebrates, reptiles, birds and mammals)	WTBF Pelagic longline	ERA (pelagic longline): Level 1 - habitats eliminated Level 2 – target, byproduct/bycatch and TEPS assessed; communities not assessed Level 3 SAFE- for chondrichthyan and teleost byproduct, discards or TEPS (excludes invertebrates, reptiles, birds and mammals)
Western Skipjack Tuna Fishery (AFMA) Purse seine	ERA: Level 1 – habitats, communities and target species eliminated Level 2 – Byproduct/bycatch and TEPS assessed Level 3 SAFE for chondrichthyan and teleost byproduct, discards or TEPS (excludes invertebrates, reptiles, birds and mammals)	Western Skipjack Tuna Fishery Purse Seine	ERA: Level 1 – habitats, communities and target species eliminated Level 2 – Byproduct/bycatch and TEPS assessed Level 3 SAFE for chondrichthyan and teleost byproduct, discards or TEPS (excludes invertebrates, reptiles, birds and mammals)
Southern Bluefin Tuna Fishery (AFMA) Purse seine	ERA (Purse seine): Level 1 – habitats and byproduct/bycatch eliminated Level 2 Target and TEPS assessed; communities not assessed Level 2 Residual Risk Assessment for all species Level 3 SAFE for chondrichthyan and teleosts byproduct, discards or TEPS (excludes invertebrates, reptiles, birds and mammals)	Southern Bluefin Tuna Fishery Purse seine	ERA (Purse seine): Level 1 – habitats and byproduct/bycatch eliminated Level 2 Target and TEPS assessed; communities not assessed Level 2 Residual Risk Assessment for all species Level 3 SAFE for chondrichthyan and teleosts byproduct, discards or TEPS (excludes invertebrates, reptiles, birds and mammals)
Aquarium Fishery (Northern Territory Fisheries Joint Authority (NTFJA)) Various nets	ESDA	North West Slope Trawl Fishery (NWS) (AFMA) Demersal otter trawl	ERA: Level 1 – byproduct/bycatch and TEPS eliminated Level 2 – target species and habitats assessed; communities not assessed. Level 3 SAFE for chondrichthyan and teleosts byproduct, discards or TEPS (excludes invertebrates, reptiles, birds and mammals)
Coastal Line Fishery (NT) Drop lines Traps	NT Status Report	Western Deepwater Trawl Fishery (WDWT) (AFMA) Demersal otter trawl	ERA: Level 1 – TEPS eliminated Level 2 – target, byproduct/bycatch, habitats and communities assessed Level 3 SAFE for chondrichthyan and teleost byproduct, discards or TEPS (excludes invertebrates, reptiles, birds and mammals)
Demersal Fishery (NTFJA)	ESDA	Broome Prawn (WA) Demersal otter trawl	ESDA

North Marine Region		North-west Marine Region	
Fishery	**Risk assessment Information**	**Fishery**	**Risk assessment information**
Droplines Traps			
Northern Finfish Trawl Fishery (NTFJA) Semi-demersal otter trawl (Wendy/Champion net)	DEWHA Assessment	Joint Authority Northern Shark (WAFJA) Demersal longline Pelagic Gillnet	DEWHA EPBC Act Assessment (not currently active)
Offshore Net and Line Fishery (NTFJA) Pelagic gillnets Demersal longlines	ESDA	Kimberley Prawn (WA) Demersal otter trawl	EPBC Act
Spanish Mackerel Fishery (NT) Troll, handlines	ESDA	Mackerel (WA) Troll lines	ESDA
Timor Reef Fishery (NT) Droplines Fish traps	ESDA	North Coast Shark (WA) Demersal longline Gillnets	DEWHA EPBC Act Assessment
Blue Swimmer Crab Fishery (Qld) Crab pots Traps	ERA Level 1	Northern Demersal Scalefish (WA) Handline Dropline Trap	ESDA
Gulf of Carpentaria Developmental Finfish Trawl Fishery (QFJA) Semi-demersal otter trawl (Wendy/Champion net)	ESDA	Pearl Oyster (WA) Diving/hand collection	ESDA
Gulf of Carpentaria Line (QFJA) Troll Handlines	ESDA	Pilbara Trap (WA)	ESDA
Gulf of Carpentaria Inshore Finfish – Net (QFJA) Set mesh nets Trap (I permit) Dropline (3 permits)	ESDA	Pilbara Trawl (WA) Otter trawl	ESDA
Mud Crab Fishery (Qld) Crab pots	ERA Level 1	Shark Bay Snapper (Gascoyne Demersal Scalefish) (WA) Mechanized handlines	ESDA (reassessed in 2009)
Spanner Crab Fishery (Qld) Dillies	ERA Level 1	West Coast Demersal Gillnet and Demersal Longline (WA)	DEWHA EPBC Act Assessment
Tropical Rock Lobster Fishery (Qld) Hand collection/diving	DEWHA EPBC Act Assessment	West Coast Rock Lobster (WA) Lobster pots	ESDA 2007 review of ESDA and Level 2 ERA of any medium or high residual risks arising from the review

North Marine Region		North-west Marine Region	
Fishery	**Risk assessment Information**	**Fishery**	**Risk assessment information**
Torres Strait Turtle Fishery (Torres Strait Protected Zone Joint Authority – TSPZJA) Traditional spear, manual capture	AFMA submission to DEWHA (but gear not assessed – see Attachment 2)	West Coast Demersal Scalefish (Kalbarri zone) (WA) Hand and drop lines	WA Status Report only
Torres Strait Dugong Fishery (TSPZJA) Traditional spear	AFMA Submission to DEWHA (but gear not assessed – see Attachment 2)	West Coast Purse Seine (Northern Development Zone) (WA)	ESDA
Torres Strait Pearl Shell Fishery (TSPZJA) Diving/hand collection	No assessment material available (not currently active)	West Coast Deep Sea Crab Crab pots	ESDA

ATTACHMENT 2

Review of gear used in fisheries authorized to operate in the NMR and/or the NWMR

Gear	Fisheries in NMR	Fisheries in NWMR	Gear Assessed in SEFRA	Gear Assessed in SWFRA	Gear assessed in ERAs	Comments	Assess in FRA
Demersal trawl	NPF	WDWT Broome Prawn Kimberley Prawn	Medium to High risk on benthic habitats	As per SEFRA: Unacceptable risk on benthic and demersal communities and habitats across all AFAs	**NWS**: Level 3 rapid assessment all low impact on chondrichthyan and teleost bycatch and byproduct. **WDWT**: Level 3 rapid assessment all low impact on chondrichthyan and teleost bycatch and byproduct. **Broome and Kimberley Prawn**: ESDAs **NPF**: Level 2 and 3 ERA		NMR NWMR
Semi-demersal otter trawl	Qld GoC Developmental Finfish Trawl Northern Finfish Trawl		No	No	No		NMR
Pelagic longline	Potentially WTBF and SBTF; NT Offshore Net and Line (ONLF) (previously) NT Shark Fishery)	WTBF and potentially SBTF	SEFRA: Medium risk to seabirds	SWFRA: Unacceptable risk (pending further assessment) to shark and ray species across all AFAs and to threatened and otherwise listed seabirds off the Abrolhos Islands)	**WTBF:** Level 3 rapid assessment – low risk to all non-target species of teleosts and chondrichthyans assessed	NWMR: low probability that longline fishing for SBT will occur in the NWMR; most catch is by purse seine for farming; the method will be assessed in the NWMR because of the presence of the WTBF; NMR: no indication that SBT occurs; a remote possibility that WTBF would begin operations in these waters; Operators in the ONLF are not utilizing pelagic longline.	NWMR
Demersal longline	NT ONLF	West Coast Demersal Gillnet and Demersal Longline; North Coast Shark/Joint Authority Shark	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	No		NMR NWMR
Pelagic gillnets	NT ONLF	Joint Authority Shark (WA)	No	No	No		NMR NWMR

Gear	Fisheries in NMR	Fisheries in NWMR	Gear Assessed in SEFRA	Gear Assessed in SWFRA	Gear assessed in ERAs	Comments	Assess in FRA
Demersal gillnet		West Coast Demersal Gillnet and Demersal Longline	Sea lions - Medium risk	Potentially high risk to 22 types of outer shelf seafloor habitats, 5 seals and sea lions, 15 sharks and chimaeras	No		NWMR
Purse seine	Potentially Skipjack, WTBF and SBT	West Coast Purse seine (Northern Development Zone) Potentially skipjack, WTBF and SBT;	All impacts low: • 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	**Skipjack fishery**: Level 3 rapid assessment all low impact on chondrichthyan and teleost bycatch and byproduct. **Small Pelagic fishery**: Level 3 rapid assessment all low impact on chondrichthyan and teleost bycatch and byproduct. **SBT**: Level 3 rapid assessment all low impact on chondrichthyan and teleost bycatch and byproduct.	NMR: no WTBF activity by any method and purse seine not used anywhere in that fishery; no catch of SBT recorded in the NMR by any method by domestic of foreign vessels, and no indication, given that purse seining for bluefin is for farm purposes, that the method would be used in the Region: no history of skipjack fishing in the Region and given the low value of the species and the need to deliver to a cannery (only located in Port Lincoln) there is little likelihood that fishing would occur . NWMR: SBT is known to occur in this region since catch by foreign vessels is recorded; there is however, for the reasons given above for the NMR, little possibility of purse seining for SBT in these waters; purse seining for skipjack and WTBF species is also unlikely in these waters. However the method should be assessed because of the presence of the West Coast Purse Seine fishery.	NWMR
Droplines	NT Demersal; NT Coastal Line; NT Timor Reef Gulf of	West Coast Demersal Scalefish (Kalbarri Zone) Northern Demersal Scalefish (no line effort since 2002)	All impacts low risk: essentially limited to damage to invertebrates crushed by the weight (typically 10kg) at the bottom	As per SEFRA: noted as a minor line method; no further assessments conducted; determined as Acceptable noting the possible need for some conditions		While impacts are likely to be minor the method is used in several fisheries in the NMR. Only used since 2002 in one fishery in the NWMR	NMR

Gear	Fisheries in NMR	Fisheries in NWMR	Gear Assessed in SEFRA	Gear Assessed in SWFRA	Gear assessed in ERAs	Comments	Assess in FRA
	Carpentaria Inshore Finfish (QFJA permits)						
Fish traps	NT Demersal NT Coastal Line NT Timor Reef GoC Inshore Finfish Net Fishery	Pilbara Trap; Northern Demersal Scalefish;	Fish trap: all low impacts • settling of trap may damage fragile species	No		While impacts are likely to be minor the method is used in several fisheries in each region. Only 1 QFJA permit in the GoC Inshore Finfish Net Fishery is authorized to use traps (3 traps) and this gear has not been used to date.	NMR NWMR
Troll lines/ handlines	NT Spanish Mackerel; GoC Line Fishery NT Timor Reef NT Coastal Line WTBF	Mackerel Fishery; Coast Demersal Scalefish (Kalbarri Zone); Northern Demersal Scalefish (no line effort since 2002) Shark Bay Snapper (Gascoyne West Demersal Scalefish)	No	Acceptable noting the possibility of need for some conditions		While impacts are likely to be minor the method is used in several fisheries in each region The method is one of a number of minor line methods authorized for use in the WTBF. However the latest data available indicate that between 1998 and 2003 all minor line methods accounted for a maximum of 5% of the catch.	NMR NWMR
Lobster Pots		West Coast Rock Lobster	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	West Coast Lobster ESDA Burgman (2005) Stoklosa (2007)		NWMR
Crab Pots and collapsible traps	Qld Blue Swimmer Crab Qld Mud Crab;	West Coast Deep Sea Crab	All low risk	As per SEFRA Acceptable (some conditions may be required)	ERA Level 1 for Blue Swimmer and Mud Crab	The operations of neither the Queensland Blue Swimmer or Mud Crab fisheries intersects with Conservation Values in the NMR	NWMR
Set mesh nets	Gulf of Carpentaria Inshore Finfish - Net		No	No		Mesh nets can be classified as either demersal or pelagic depending on the depth of water in which they are used.	NMR

Gear	Fisheries in NMR	Fisheries in NWMR	Gear Assessed in SEFRA	Gear Assessed in SWFRA	Gear assessed in ERAs	Comments	Assess in FRA
Cast nets	NT Coastal Line NT Aquarium					Cast nets used for bait collection only in the NT coastal line; ESDA indicated negligible to low risks	No
Hand collection/ diving	Qld Tropical rock lobster Qld Shell Fishery Torres Strait Pearl		No	No		Negligible catch by tropical rock lobster in the NMR; No activity in Gulf of Carpentaria under the Shell Fishery Symbol; No activity in the Torres Strait Pearl Shell Fishery	No
Scoop nets	NT Coastal Line; NT Aquarium					NT aquarium -ESDA indicated negligible to low impacts; Scoop nets used only within 2nm in Coastal line fishery	No
Hand pumps	NT Aquarium		No				
Barrier nets	NT Aquarium					NT aquarium - ESDA	No
Drag nets	NT Aquarium					NT aquarium - ESDA	
Skimmer nets	NT Aquarium					NT Aquarium fishery ESDA conducted in 2006. All risks rated as negligible to low.	
Drift diving		Pearl Oyster				ESDA rated all risks as negligible	No
Jigs		Mackerel Fishery;	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		WA Status reports indicate that jigs are used to take grey mackerel however WADF is that jigs are not used in the Fishery (E. Bunbury pers. comm., December 2009)	No - gear not relevant
Gaff	NT Coastal Line					Gaff used only with 2nm in Coastal line fishery	No – NR
Dillies	Qld Spanner Crab				ERA for Spanner Crab	No fishing in the NMR; apparatus highly selective; generally deployed on sandy substrate; bycatch of echinoderms which have a high post-release survival	No – NR
Pole and line	Potentially WTBF, SBT	Potentially WTBF, SBT and skipjack				Gear not used to date in the Region and used rarely in	No - NR

Gear	Fisheries in NMR	Fisheries in NWMR	Gear Assessed in SEFRA	Gear Assessed in SWFRA	Gear assessed in ERAs	Comments	Assess in FRA
	and skipjack					the main catching grounds of these three fisheries	
Traditional spear (wap)	Torres Strait Turtle and Dugong Fisheries					The Turtle and Dugong Fisheries are non-commercial indigenous fisheries; therefore not included in FRA	No- NR
NR= method not currently used in Commonwealth waters of the NMR or NWMR							