Australian Government
Australian Fisheries Management Authority

Ecological Risk Management

REPORT FOR THE MIDWATER TRAWL SECTOR OF THE SMALL PELAGIC FISHERY

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Summary of priority issues for managing the ecological effects of midwater trawl fishing in the Small Pelagic Fishery

The priority list of species to be addressed in the midwater trawl sector of the Small Pelagic Fishery (SPF) appears below.

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score
Marine Mammal	Arctocephalus pusillus doriferus	Australian Fur Seal	TEP	Level 2 PSA Residual Risk	High
Marine Mammal	Grampus griseus	Risso's Dolphin	TEP	Level 2 PSA Residual Risk	High
Marine Mammal	Tursiops truncatus	Bottlenose Dolphin	TEP	Level 2 PSA Residual Risk	High
Marine Mammal	Tursiops aduncus	Indian Ocean bottlenose dolphin	TEP	Level 2 PSA Residual Risk	High
Marine Mammal	Lagenodelphis hosei	Fraser's Dolphin	TEP	Level 2 PSA Residual Risk	High
Marine Mammal	Lagenorhynchus cruciger	Hourglass dolphin	TEP	Level 2 PSA Residual Risk	High
Marine Mammal	Lissodelphis peronii	Southern Right Whale Dolphin	TEP	Level 2 PSA Residual Risk	High
Marine Mammal	Stenella coeruleoalba	Striped Dolphin	TEP	Level 2 PSA Residual Risk	High

The priority list was compiled from the highest level of assessment undertaken for the fishery and includes:

a) all teleost or chondrichthyan species identified as precautionary high risk or above under the Level 3 Assessment (SAFE methodology);
b) all other non protected species identified as high risk under the Level 2 PSA Residual Risk; and
c) all protected (TEP) species thought to occur within the area of the fishery identified at high risk through these processes.

Under the Level 2 PSA 26 species (or species groups) were assessed as being at high risk. After the application of the Level 2 Residual Risk Guidelines, 8 species remained at high risk.

Two hundred and eighteen threatened, endangered or protected (TEP) species are theoretically found within the waters of the fishery. These include 3 species of sharks/rays, 78 species of seabirds, 49 species of marine mammals, 10 species of marine reptile and 78 species of bony fish. In addition to addressing high risk species, as part of AFMA's Ecological Risk Management process, all reasonable steps will be taken to minimise interactions with those TEP species which are thought to occur in the area of the fishery.

The main management arrangements implemented in the Midwater Trawl sector to address risks identified by the Ecological Risk Assessment processes include the use of a Seal

Excluder Device (SED) by the predominant trawler in the fishery. A range of SEDs have been trialled in the fishery with mixed success. The current type of SED used within the SPF is bottom-opening with a large escape hole and steel grid. A top opening SED is preferable however one was trialled for about a month in February 2007 but did not work due to difficulties in retrieving it onto the net drum. A new research project to develop and trial new configurations of top-opening SEDs is under consideration.

High observer coverage has occurred in the sector since 2005 to monitor interactions with dolphins and seals. One phase of this observer coverage included underwater video monitoring surveys which found that whilst interactions with dolphins was relatively rare, fur seals were frequently observed entering and exiting the trawl nets with evidence of a higher level of mortality than what could be observed from the boat deck.

A Bycatch and Discard Workplan for the SPF trawl sector has also been developed and outlines the priorities to be addressed in the next two years. One of the key actions is to trial and test the use of a top-opening SED to mitigate seal and dolphin mortalities. Another priority is to develop Vessel Management Plans for every vessel in the SPF. These plans will be tailored to individual vessel requirements and aim to minimise TEP species interactions, and establish best practice procedures for reporting on catch and wildlife interactions. In addition, the SPF Management Advisory Committee will be developing triggers to identify shifts or expansion in effort within the fishery including increased interactions with TEP species.

Description of the Small Pelagic Fishery

The Small Pelagic Fishery includes Commonwealth waters extending from southern Queensland to southern Western Australia. Historically, the major fishing grounds of the SPF are off the south east corner of Australia, and in particular around Tasmania.

The Small Pelagic Fishery (SPF) comprises fishing activities in the Australian Fishing Zone, using the methods of purse seine and mid water trawl, to target a number of pelagic species. These include Jack Mackerels (*Trachurus declivis, T. murphyi*), Redbait (*Emmelichthys nitidus*), Blue Mackerel (*Scomber australasicus*) and Australian Sardines (*Sardinops sagax*). Catches can be used for several end purposes, including bait for fishing operations, fish meal for agricultural feed, and human consumption.

The SPF is managed under the *Small Pelagic Fishery Management Plan 2009* (the Plan), which was determined by AFMA on 2 November 2009 and accepted by the Minister for Fisheries, Forestry and Conservation on 30 December 2009. AFMA is in the process of granting Statutory Fishing Rights (SFRs) under the Plan. For the purposes of pursuing stock based management under the Plan, the previous zonation will be superseded once SFRs are granted and the fishery for Jack Mackerels, Blue Mackerel and Redbait will be divided into two sub-areas east and west of longitude 146°30' E. The fishery will also be extended to include an Australian Sardine sub-area designated to accommodate activities currently authorised by Informally Managed Fishery Permits (IMFP).

Contents

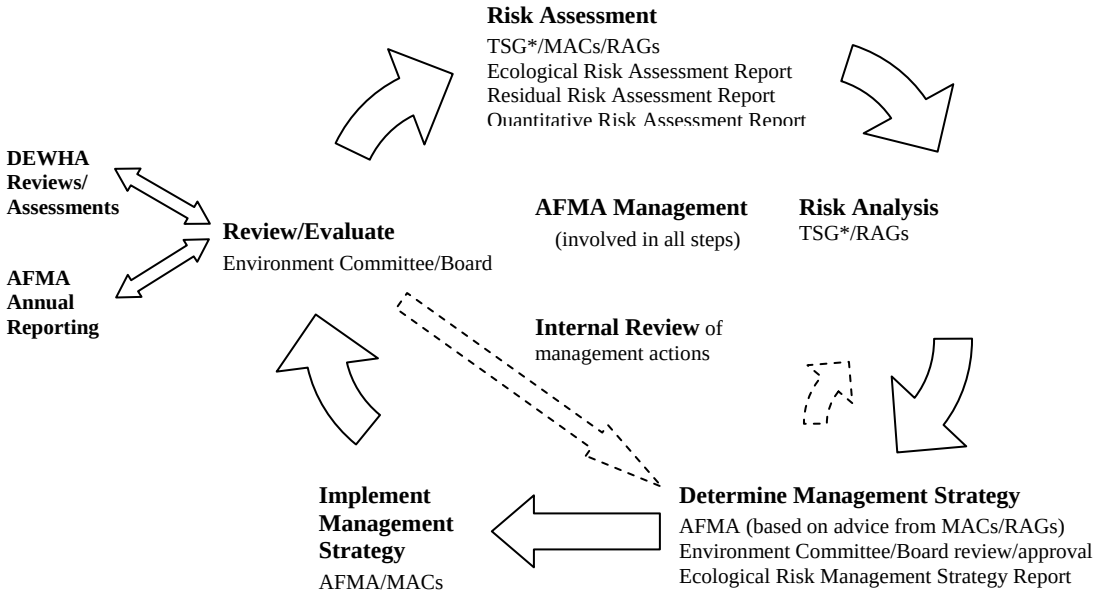
1. OVERVIEW

- **Implementing ecological risk management in Commonwealth managed fisheries**

AFMA aims to minimise the impacts of Commonwealth managed fisheries on all aspects of the marine ecosystem. AFMA's adoption of the ecological component of Ecologically Sustainable Development (ESD) is a significant departure from traditional fisheries management with the focus shifted from the direct management of target species to also considering the impacts on bycatch species, protected (TEP) species, habitats, and communities.

Key to AFMA's implementation of the ecological component of ESD has been to develop and implement an ecological risk management (ERM) framework (refer to **Figure 1**). The framework details a robust and transparent process to assess, analyse and respond to the ecological risks posed by Commonwealth managed fisheries.

Figure 1: Ecological Risk Management framework

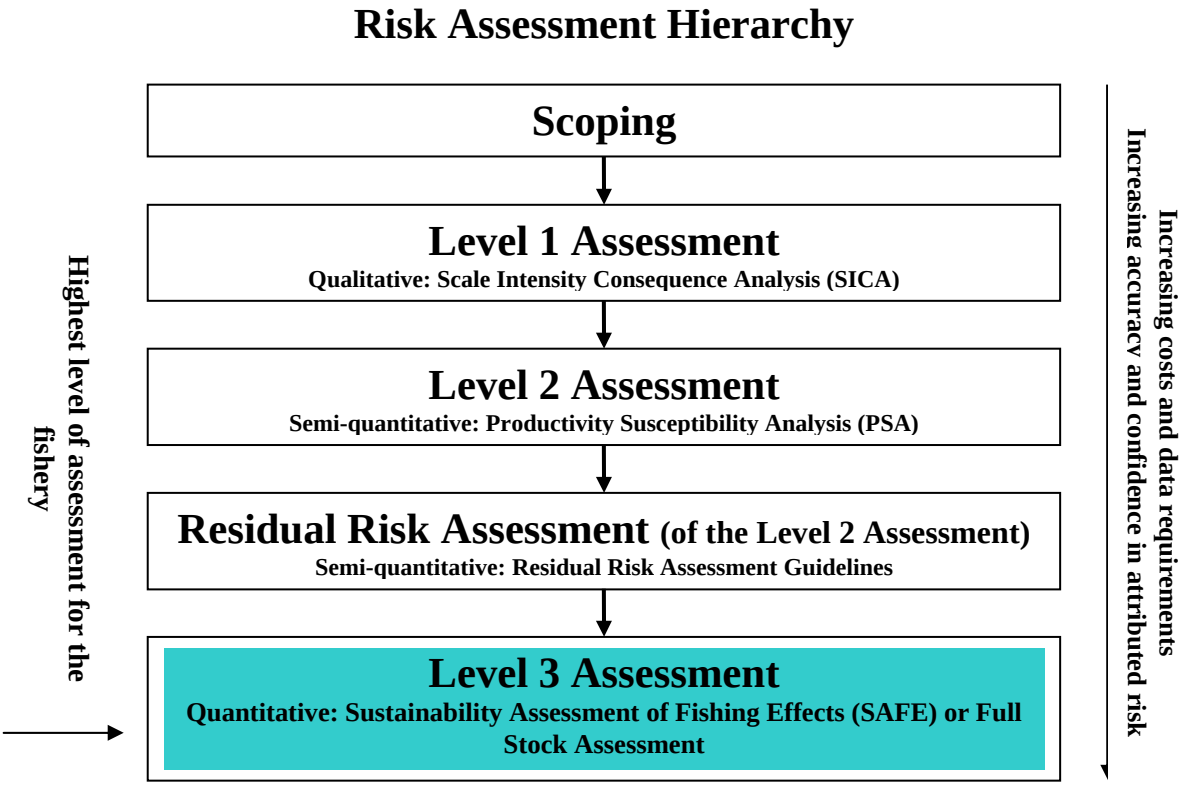


*TSG – Technical Support Group – currently provided by CSIRO

The ERM framework progresses through a number of steps and involves a hierarchy of risk assessment methodologies progressing from a comprehensive but largely qualitative analysis at Level 1 to a quantitative analysis at Level 3 (refer to **Figure 2**). This approach is a means of screening out low risk activities and focusing more intensive and quantitative analyses on those activities assessed as having a greater environmental impact on AFMA managed fisheries.

The initial assessment stage involves the development of a qualitative ecological risk assessment (ERA) for each individual fishery. ERAs assess the impact, direct and indirect, that a fishery's activities may have on the marine ecosystem. These assessments provide the foundation for further risk assessment and analysis. While it has been a long and complex process, ERAs have now been completed (to varying degrees – either Level 1, 2 or 3) for all major Commonwealth managed fisheries.

Figure 2: Risk assessment hierarchy



The results of the risk assessments are now the focus for the development and implementation of this ERM strategy. Further information on the risk assessment process and methodologies applied can be found on AFMA's website.

- **Developing an ecological risk management strategy**

The priority list for this fishery was developed using:

- the SAFE methodology for any teleost or chondrichthyan species identified as precautionary high risk or above; and
- Level 2 PSA Residual Risk for all other non protected species identified as high risk.

In addition, all reasonable steps will be taken to minimise interactions with protected (TEP) species which have been identified through the ERA process.

Once identified, species that form the priority list for each fishery will be managed either through fishery specific arrangements or under one or more of the following policies or measures:

- Harvest Strategy Policy and Guidelines;
- Non-key Commercial Species (byproduct) Policy;
- Bycatch and Discard Program;
- Shark Policy and the Chondrichthyan Guide for Fisheries Managers; and

- Protected (TEP) species under various international plans of action, recovery plans etc.

This SPF midwater trawl sector ERM strategy clearly identifies how each species or group of species may be managed under the policies or measures described above.

ERM strategies to address those remaining species identified as at medium or low risk may be implemented at a later date. Due to limitations in the ERA methodology, for assessing the impacts of fishing operations on habitats and communities, AFMA will defer the development of an ERM strategy for these components until more refined and meaningful results become available.

- **Measuring individual mitigation strategies**

In managing the priority species identified in each fishery we will prepare reports with clear performance measures which address both long and short term goals and aims. Ongoing monitoring and review of the mitigation measures will occur. In the medium to longer term these results will also be used when assessing any change of status of a species e.g. where a bycatch or byproduct species moves to become a target species. Mitigation actions can be taken for individual species or groups of species.

Fisheries are encouraged to consider “cross” fishery solutions when implementing measures for species that are identified as at risk across more than one fishery and/or where fishing methods cross fishery boundaries.

Outcomes of the ERM strategies and measures described in each fishery’s various work plans and Harvest Strategies will flow into a number of processes including annual reporting to the Department of the Environment, Water, Heritage and the Arts.

It is expected that each fishery will be reassessed against the ERA methodology on a periodic basis in line with the review of any Wildlife Trade Operation (WTO) accreditation in place in the fishery.

2. ECOLOGICAL RISK MANAGEMENT PRIORITY LIST

The risks that the SPF midwater trawl sector poses to the sustainability of the marine ecosystem have been assessed through the application of a progression of risk assessment methodologies as listed below:

- an individual ERA completed to Level 2 in June 2007;
- a Level 2 PSA Residual Risk assessment completed in March 2010; and,
- a rapid quantitative risk assessment completed in June 2009.

Table 1 details the results at each level of assessment. Further information and reports for each level of assessment can be found on AFMA's website.

Level of assessment and risk levels attributed	Target Species	Byproduct Species	Bycatch Species	Protected (TEP) Species
Level 1 SICA Assessment				
Consequence score (for each species component)	3	3	3	3
Proceeded to Level 2 PSA Assessment (scores ≥ 3)	1	16	2	218
Level 2 PSA Assessment				
High Risk	0	0	0	26
Medium Risk	0	1	0	79
Low Risk	1	15	2	113
Level 2 PSA Residual Risk Assessment				
High Risk	0	0	0	8
Medium Risk	0	1	0	105
Low Risk	1	15	2	113
Level 3 SAFE Assessment				
F_{msm}	0	15	2	0
F_{lim}	0	0	0	0
F_{crash}	0	0	0	0

The results of these risk assessments have been consolidated to form a priority list for the fishery comprised of:

- 0 species identified at precautionary high risk or above, through the rapid quantitative risk assessment; and
- 8 species that have not undergone a further rapid quantitative risk assessment and are identified as high risk through the application of the residual risk assessment methodology; and,
- 218 protected (TEP) species identified through the ERA.

Table 2 details the priority species list for the SPF midwater trawl sector on which AFMA will focus ERM efforts. Overall 8 species were identified; all of which are protected (TEP) species.

Table 2: Priority species list for the SPF midwater trawl sector

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score
Marine Mammal	Arctocephalus pusillus doriferus	Australian Fur Seal	TEP	Level 2 PSA Residual Risk Assessment	HIgh
Marine Mammal	Grampus griseus	Risso's Dolphin	TEP	Level 2 PSA Residual Risk Assessment	High
Marine Mammal	Tursiops truncatus	Bottlenose Dolphin	TEP	Level 2 PSA Residual Risk Assessment	High
Marine Mammal	Tursiops aduncus	Indian Ocean bottlenose dolphin	TEP	Level 2 PSA Residual Risk Assessment	High
Marine Mammal	Lagenodelphis hosei	Fraser's Dolphin	TEP	Level 2 PSA Residual Risk Assessment	High
Marine Mammal	Lagenorhynchus cruciger	Hourglass dolphin	TEP	Level 2 PSA Residual Risk Assessment	High
Marine Mammal	Lissodelphis peronii	Southern Right Whale Dolphin	TEP	Level 2 PSA Residual Risk Assessment	High
Marine Mammal	Stenella coeruleoalba	Striped Dolphin	TEP	Level 2 PSA Residual Risk Assessment	High

The risk assessments identified 218 protected (TEP) species that are thought to occur within the waters of the fishery. Eight of these 218 protected (TEP) species were assessed as being at high ecological risk. However, consistent with good fisheries management and the specific requirements of the *Environment Protection and Biodiversity Conservation* (EPBC) *Act 1999*, all reasonable steps will be taken to ensure that interactions with all protected (TEP) species are minimised.

3. ECOLOGICAL RISK MANAGEMENT STRATEGY

The ERM strategy for the midwater trawl sector of the SPF will address the 8 species identified as priorities through the risk assessment process. Key current management arrangements in the SPF midwater trawl sector include:

- High observer coverage since 2003-04. Peak coverage in 2003/04 of 155 days (93% of days observed to days fished). The SPF Resource Assessment Group has set a target observer coverage of 20%. This has been maintained in every year except 2008/09 when only 12% observer coverage was achieved;
- Bycatch research which has included underwater video surveys to assess the type and frequency of interactions with seal and dolphins when midwater trawling in the SPF;
- Voluntary use of a seal excluder device (SEDs) by the predominant SPF midwater trawler in addition to a commitment not to set the gear if dolphins are sighted around the vessel and steam at least 10km away from areas where dolphins were present before setting gear.

o Harvest Strategies for key commercial (target and some byproduct) species

The implementation of Harvest Strategies for all Commonwealth managed fisheries is a key component of AFMA's management of key commercial species (target and some byproduct species). Individual fishery specific Harvest Strategies will set out clear decision rules to manage fisheries in an environmentally sustainable manner while also ensuring maximum economic returns.

A Harvest Strategy was developed for the SPF which includes the midwater trawl target species. This species has not been identified as a priority species through this ERA process.

o Management of non-key commercial (byproduct) species

AFMA is currently developing a policy to address any gaps in the management of byproduct species in Commonwealth fisheries. No priority species/groups have been identified for the midwater trawl sector of the SPF under this policy.

o Managing bycatch and discarding

AFMA's program for addressing bycatch and discarding in Commonwealth managed fisheries was released in September 2009. The main features of the work plan for the midwater trawl sector are to address the risk of interactions with seals and dolphins which include further development of top-opening SEDs. In addition, future development of individual vessel management plans (VMPs) for each trawl vessel in the fishery to minimise interactions with seabirds and other TEP species.

o Chondrichthyan Guide for Fisheries Managers

A practical guide has been developed to assist fishery managers and stakeholders to adopt and implement management arrangements for Chondrichthyan species. The Chondrichthyan Working Group utilised expert based advice to develop effective mitigation strategies and to identify gaps in research and data. No chondrichthyan species have been identified as priority species in the SPF midwater trawl sector through this ecological risk process.

- **Protected (TEP)**

All protected (TEP) species identified through the ERA process (as occurring in the area of the fishery) will automatically be included in the priority list for each fishery. Many of these species are already managed under various international plans of action including the:

- National Strategy to Address Interactions between Humans and Seals: Fisheries, Aquaculture and Tourism;
- Recovery Plan for Marine Turtles in Australia; and,
- Draft Recovery Plan for the Australian Sea Lion.

Table 4: List of protected (TEP) species which were not found to be at high ecological risk, but which were considered to overlap with the area of the fishery. All reasonable steps will be taken to minimise interactions with these species.

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score
Chondrichthyan	*Carcharias taurus*	Grey Nurse Shark	TEP	Level 3 SAFE	Low
Chondrichthyan	*Carcharodon carcharias*	White Shark	TEP	Level 3 SAFE	Low
Chondrichthyan	*Rhincodon typus*	Whale Shark	TEP	Level 3 SAFE	Low
Marine bird	*Thalassarche cauta*	Shy Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine Bird	Thalassarche melanophrys	Black browed Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Thalassarche eremita*	Chatham Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Thalassarche nov. sp.*	Pacific Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Diomedea epomophora*	Southern Royal Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Diomedea exulans*	Wandering Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Diomedea gibsoni*	Gibson's Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Diomedea antipodensis*	Antipodean Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Diomedea sanfordi*	Northern Royal Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Thalassarche impavida*	Campbell Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Thalassarche carteri*	Indian Yellow-nosed Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium

Marine bird	*Thalassarche salvini*	Salvin's albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Diomedea amsterdamensis*	Amsterdam Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Diomedea dabbenena*	Tristan Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Calonectris leucomelas*	Streaked Shearwater	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Pachyptila turtur*	Fairy Prion	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Puffinus tenuirostris*	Short-tailed Shearwater	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Pterodroma cervicalis*	White-necked Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Pterodroma solandri*	Providence Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Puffinus bulleri*	Buller's Shearwater	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Phalacrocorax fuscescens*	Black faced Cormorant	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Thalassarche steadi*	White-capped Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Procellaria aequinoctialis*	White-chinned Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Thalassarche bulleri*	Buller's Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Thalassarche chrysostoma*	Grey-headed Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Phoebetria palpebrata*	Light-mantled Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Fulmarus glacialoides*	Southern Fulmar	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Halobaena caerulea*	Blue Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Lugensa brevirostris*	Kerguelen Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Procellaria parkinsoni*	Black Petrel; Parkinsons Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Procellaria westlandica*	Westland Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Pterodroma leucoptera*	Gould's Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Pterodroma macroptera*	Great-winged Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Pterodroma mollis*	Soft-plumaged Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium

Marine bird	*Pterodroma nigripennis*	Black-winged Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Puffinus assimilis*	Little Shearwater (Tasman Sea)	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Puffinus carneipes*	Flesh-footed Shearwater	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Puffinus pacificus*	Wedge-tailed Shearwater	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Fregetta grallaria*	White-bellied Storm-Petrel (Tasman Sea),	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Fregetta tropica*	Black-bellied Storm-Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Garrodia nereis*	Grey-backed Storm Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Catharacta skua*	Great Skua	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Thalassarche chlororhynchos*	Yellow-nosed Albatross, Atlantic Yellow-	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Phoebetria fusca*	Sooty Albatross	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Daption capense*	Cape Petrel	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine bird	*Macronectes giganteus*	Southern Giant-Petrel	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Macronectes halli*	Northern Giant-Petrel	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Procellaria cinerea*	Grey Petrel	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Pseudobulweria rostrata*	Tahiti Petrel	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Pterodroma lessoni*	White-headed Petrel	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Pterodroma neglecta*	Kermadec Petrel (western)	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Puffinus griseus*	Sooty Shearwater	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Phaethon rubricauda*	Red-tailed Tropicbird	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Morus capensis*	Cape Gannet	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Morus serrator*	Australasian Gannet	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Sula dactylatra*	Masked Booby	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Anous stolidus*	Common Noddy	TEP	Level 2 PSA Residual Risk Assessment	Low

Marine bird	*Larus pacificus*	Pacific Gull	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Sterna bergii*	Crested Tern	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Sterna caspia*	Caspian Tern	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Eudyptula minor*	Little Penguin	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Puffinus gavia*	Fluttering Shearwater	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Puffinus huttoni*	Hutton's Shearwater	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Anous minutus*	Black Noddy	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Anous tenuirostris*	Lesser Noddy	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Larus dominicanus*	Kelp Gull	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Larus novaehollandiae*	Silver Gull	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Procelsterna cerulea*	GreyTternlet	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Sterna fuscata*	Sooty Tern	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Sterna hirundo*	Common Tern	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Sterna paradisaea*	Arctic Tern	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Sterna sumatrana*	Black-naped Tern	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Oceanites oceanicus*	Wilson's Storm Petrel (subantarctic)	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Pelagodroma marina*	White-faced Storm-Petrel	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Sterna albifrons*	Little Tern	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Sterna anaethetus*	Bridled Tern	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Sterna striata*	White-fronted Tern	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine bird	*Pelecanoides urinatrix*	Common Diving-Petrel	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine mammal	*Feresa attenuata*	Pygmy Killer Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Globicephala macrorhynchus*	Short-finned Pilot Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium

Marine mammal	*Globicephala melas*	Long-finned Pilot Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Pseudorca crassidens*	False Killer Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Mesoplodon bowdoini*	Andrew's Beaked Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Mesoplodon densirostris*	Blainville's Beaked Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Mesoplodon gingkodens*	Gingko Beaked Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Mesoplodon hectori*	Hector's Beaked Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Mesoplodon mirus*	True's Beaked Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Hyperoodon planifrons*	Southern Bottlenose Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Mesoplodon grayi*	Gray's Beaked Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Mesoplodon layardii*	Strap-toothed Beaked Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Ziphius cavirostris*	Cuvier's Beaked Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Hydrurga leptonyx*	Leopard Seal	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Mirounga leonina*	Elephant Seal	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Orcinus orca*	Killer Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Berardius arnuxii*	Arnoux's Beaked Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Tasmacetus shepherdi*	Tasman Beaked Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Balaenoptera acutorostrata*	Minke Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Peponocephala electra*	Melon-headed Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Stenella attenuata*	Spotted Dolphin	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Balaenoptera borealis*	Sei Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Balaenoptera edeni*	Bryde's Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Balaenoptera physalus*	Fin Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Balaenoptera bonaerensis*	Antarctic Minke Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium

Marine mammal	*Kogia breviceps*	Pygmy Sperm Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Physeter catodon*	Sperm Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Megaptera novaeangliae*	Humpback Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Sousa chinensis*	Indo-Pacific Humpback Dolphin	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Steno bredanensis*	Rough-toothed Dolphin	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Kogia simus*	Dwarf Sperm Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Dugong dugon*	Dugong	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Caperea marginata*	Pygmy Right Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Stenella longirostris*	Long-snouted Spinner Dolphin	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Arctocephalus forsteri*	New Zealand Fur-seal	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Neophoca cinerea*	Australian Sea-lion	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Eubalaena australis*	Southern Right Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Delphinus delphis*	Common Dolphin	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Arctocephalus tropicalis*	Subantarctic fur seal	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Balaenoptera musculus*	Blue Whale	TEP	Level 2 PSA Residual Risk Assessment	Medium
Marine mammal	*Lagenorhynchus obscurus*	Dusky Dolphin	TEP	Level 2 PSA Residual Risk Assessment	Low
Marine reptile	*Disteira kingii*	Spectacled Seasnake	TEP	Level 2 PSA Residual Risk Assessment	Med
Marine reptile	*Dermochelys coriacea*	Leathery Turtle	TEP	Level 2 PSA Residual Risk Assessment	Med
Marine reptile	*Acalyptophis peronii*	Horned Seasnake	TEP	Level 2 PSA Residual Risk Assessment	Med
Marine reptile	*Astrotia stokesii*	Stokes' Seasnake	TEP	Level 2 PSA Residual Risk Assessment	Med
Marine reptile	*Hydrophis ornatus*	Seasnake	TEP	Level 2 PSA Residual Risk Assessment	Med
Marine reptile	*Pelamis platurus*	Yellow-bellied Seasnake	TEP	Level 2 PSA Residual Risk Assessment	Med
Marine reptile	*Caretta caretta*	Loggerhead	TEP	Level 2 PSA Residual Risk Assessment	Med

Marine reptile	*Chelonia mydas*	Green Turtle	TEP	Level 2 PSA Residual Risk Assessment	Med
Marine reptile	*Eretmochelys imbricata*	Hawksbill Turtle	TEP	Level 2 PSA Residual Risk Assessment	Med
Marine reptile	*Hydrophis elegans*	Elegant Seasnake	TEP	Level 2 PSA Residual Risk Assessment	Low
Teleost	*Heteroclinus perspicillatus*	Common Weedfish	TEP	Level 3 SAFE	Low
Teleost	*Solenostomus cyanopterus*	Blue-finned Ghost Pipefish, Robust Ghost	TEP	Level 3 SAFE	Low
Teleost	*Solenostomus paradoxus*	Harlequin Ghost Pipefish, Ornate Ghost Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus kuda*	Spotted Seahorse, Yellow Seahorse	TEP	Level 3 SAFE	Low
Teleost	*Heraldia sp. 1 [in Kuiter, 2000]*	Western Upsidedown Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus kelloggi*	Kellogg's Seahorse	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus subelongatus*	West Australian Seahorse	TEP	Level 3 SAFE	Low
Teleost	*Idiotropiscis australe*	Southern Pygmy Pipehorse	TEP	Level 3 SAFE	Low
Teleost	*Phycodurus eques*	Leafy Seadragon	TEP	Level 3 SAFE	Low
Teleost	*Phyllopteryx taeniolatus*	Weedy Seadragon, Common Seadragon	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus taeniopterus*	Spotted Seahorse, Yellow Seahorse	TEP	Level 3 SAFE	Low
Teleost	*Doryrhamphus melanopleura*	Bluestripe Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Maroubra perserrata*	Sawtooth Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Solegnathus guentheri*	Indonesian Pipefish, Gunther's Pipehorse	TEP	Level 3 SAFE	Low
Teleost	*Solegnathus robustus*	Robust Spiny Pipehorse, Robust Pipehorse	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus angustus*	Western Spiny Seahorse	TEP	Level 3 SAFE	Low
Teleost	*Trachyrhamphus bicoarctatus*	Bend Stick Pipefish, Short-tailed Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Urocampus carinirostris*	Hairy Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Lissocampus runa*	Javelin Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus bleekeri*	Pot-bellied Seahorse	TEP	Level 3 SAFE	Low
Teleost	*Histiogamphelus briggsii*	Briggs' Crested Pipefish, Briggs' Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Hypselognathus rostratus*	Knife-snouted Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Leptoichthys fistularius*	Brushtail Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Kaupus costatus*	Deep-bodied Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Mitotichthys semistriatus*	Half-banded Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Lissocampus caudalis*	Australian Smooth Pipefish, Smooth Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Stigmatopora argus*	Spotted Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Stigmatopora nigra*	Wide-bodied Pipefish, Black Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Stipecampus cristatus*	Ring-backed Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Pugnaso curtirostris*	Pug-nosed Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Mitotichthys mollisoni*	Mollison's Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Vanacampus poecilolaemus*	Australian Long-snout Pipefish, Long-snouted Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Mitotichthys tuckeri*	Tucker's Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus whitei*	White's Seahorse	TEP	Level 3 SAFE	Low

Teleost	*Solegnathus spinosissimus*	Spiny Pipehorse	TEP	Level 3 SAFE	Low
Teleost	*Halicampus grayi*	Mud Pipefish, Gray's Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Acentronura breviperula*	Hairy Pygmy Pipehorse	TEP	Level 3 SAFE	Low
Teleost	*Corythoichthys ocellatus*	Orange-spotted Pipefish, Ocellated Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Cosmocampus banneri*	Roughridge Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Cosmocampus howensis*	Lord Howe Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Festucalex cinctus*	Girdled Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Festucalex scalaris*	Ladder Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Filicampus tigris*	Tiger Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Halicampus brocki*	Brock's Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Halicampus macrorhynchus*	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	*Heraldia nocturna*	Upside-down Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Hippichthys cyanospilos*	Blue-speckled Pipefish, Blue-spotted Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Hippichthys heptagonus*	Madura Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Hippichthys penicillus*	Beady Pipefish, Steep-nosed Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus planifrons*	Flat-face Seahorse	TEP	Level 3 SAFE	Low
Teleost	*Histiogamphelus cristatus*	Rhino Pipefish, Macleay's Crested Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Hypselognathus horridus*	Shaggy Pipefish, Prickly Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Kimblaeus bassensis*	Trawl Pipefish, Kimbla Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Lissocampus fatiloquus*	Prophet's Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Micrognathus andersonii*	Anderson's Pipefish, Shortnose Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Micrognathus pygmaeus*	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	*Microphis manadensis*	Manado River Pipefish, Manado Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Mitotichthys meraculus*	Western Crested Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Nannocampus subosseus*	Bony-headed Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Notiocampus ruber*	Red Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Solegnathus dunckeri*	Duncker's Pipehorse	TEP	Level 3 SAFE	Low
Teleost	*Solegnathus sp. 1 [in Kuiter, 2000]*	Pipehorse	TEP	Level 3 SAFE	Low
Teleost	*Syngnathoides biaculeatus*	Double-ended Pipehorse, Alligator Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Vanacampus margaritifer*	Mother-of-pearl Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Vanacampus vercoi*	Verco's Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus minotaur*	Bullneck Seahorse	TEP	Level 3 SAFE	Low
Teleost	*Halicampus boothae*	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus queenslandicus*	Kellogg's Seahorse	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus tristis*	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus abdominalis*	Big-bellied / southern potbellied seahorse	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus subelongatus*	West Australian Seahorse	TEP	Level 3 SAFE	Low
Teleost	*Hippocampus breviceps*	Short-head Seahorse, Short-snouted Seaho	TEP	Level 3 SAFE	Low
Teleost	*Acentronura australe*	Southern Pygmy Pipehorse	TEP	Level 3 SAFE	Low

Teleost	*Campichthys galei*	Gale's Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Campichthys tryoni*	Tryon's Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Choeroichthys suillus*	Pig-snouted Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Corythoichthys amplexus*	Fijian Banded Pipefish, Brown-banded Pipefish	TEP	Level 3 SAFE	Low
Teleost	*Vanacampus phillipi*	Port Phillip Pipefish	TEP	Level 3 SAFE	Low

4. REPORTING AND REVIEW

The reporting mechanisms and frameworks that are in place within each of the policies and measures detailed above will form the principal ERM strategy review components for each fishery. They will also be used when providing input to annual reporting requirements for the Department of the Environment, Water, Heritage and the Arts.

A full review of the risk assessments undertaken for each Commonwealth managed fishery will be completed periodically. Outcomes of the ERM strategies and measures described in each fishery's various work plans and Harvest Strategies will flow into a number of processes including annual reporting to the Department of the Environment, Water, Heritage and the Arts. Individual fishery Harvest Strategies and Bycatch and Discard Work Plans contain annual and longer term review timeframes and it is expected that the Non-key Commercial Species Policy will do likewise. The Chondrichthyan Working Group has met once and produced a generic guide of mitigation measures suitable for use across all Commonwealth managed fisheries.

On a broader scale the outputs from the annual reviews will be used to form the response to any Wildlife Trade Operation (WTO) accreditation or exemption in place in the fishery.

5. GLOSSARY

Attribute	A general term for a set of properties relating to the productivity or susceptibility of a particular unit of analysis.
Bycatch	That part of fisher's catch which is returned to the sea either because it has no commercial value or regulations preclude it from being retained and; that part of the catch that does not reach the deck of the fishing vessel but is affected by the interaction with the fishing gear.
Byproduct	A non-target species captured in a fishery that has value to the fisher and may be retained for sale.
Component	The marine ecosystem is broken down into five components for the risk assessment: target species (TA); byproduct (BI) and bycatch species (DI); protected (TEP) species; habitats; and ecological communities.
ERA	Ecological risk assessment for the effects of fishing as developed by AFMA and CSIRO.
Gear	The equipment used for fishing, e.g. gillnet, Danish seine, pelagic longline, midwater trawl, purse seine, trap etc.

Level 3 SAFE risk categories

F_{msm}	instantaneous fishing mortality corresponding to the maximum sustainable death due to fishing (maximum sustainable mortality of fishing, MSM) at B_{msm} (biomass that supports MSM). This is similar to the F_{msy} that supports a maximum sustainable yield for target species.
F_{lim}	instantaneous fishing mortality corresponding to limit biomass B_{lim} where B_{lim} is defined as half of the biomass that supports a maximum sustainable fishing mortality ($0.5B_{msm}$).
F_{crash}	minimum unsustainable fishing mortality that, in theory, will lead to population extinction in the longer term.
Level 2 PSA Residual Risk	In the context of this document residual risk means the residual risk after the Level 2 PSA assessment.
Scoping	A general step in an ERA or the first step in the ERAEF involving the identification of the fishery history, management, methods, scope and activities.
Susceptibility	Used in Level 2 PSA assessment to calculate the impact on an ecological component due to a fishing activity. The extent of the impact due to the fishing activity, determined by the affect of the fishing activities on the unit.

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