



Australian Government

Australian Fisheries Management Authority



Ecological Risk Management

REPORT FOR THE SOUTHERN SQUID JIG FISHERY

April 2009

Summary of priority issues for managing the ecological effects of fishing in the Southern Squid Jig Fishery

Assessment of the Southern Squid Jig Fishery (SSJF) at Level 1 (SICA – Scale Intensity Consequence Analysis) resulted in no species (target, byproduct, bycatch or protected (TEP)) components, habitats or communities requiring assessment at Level 2 (PSA – Productivity Sustainability Analysis). All 5 ecological components were eliminated at Level 1 (SICA) for the internal fishing activities. Risk scores of 1 or 2 only were recorded. There were no hazards assessed to have a risk score of 3 or above for any of these internal fishing activities. A risk score of 3 or above would have resulted in the need for Level 2 (PSA) analysis.

216 threatened, endangered or protected species are theoretically found within the waters of the fishery. These include 3 species of sharks/rays, 83 species of seabirds, 50 species of marine mammals and 67 species of bony fish. None of these species were assessed as at risk from commercial fishing operations in the SSJF. But as part of AFMA's Ecological Risk Management process, we will take all reasonable steps to minimise interactions with those protected (TEP) species which are thought to occur in the area of the fishery.

Description of the Southern Squid Jig Fishery

The Southern Squid Jig Fishery includes Commonwealth waters adjacent to NSW, Victoria, South Australia, Tasmania and Queensland up to Sandy Cape (adjacent to Fraser Island). The major fishing grounds of the SSJF are off the south east corner of Australia.

Squid jig catches are mainly taken between Queenscliff and Portland, off the Victorian coastline, and south of Kangaroo Island off the South Australian coast with some historical activity reported from the waters around Tasmania. Most of the jig catch is taken between January and June each year, with the highest catches concentrated in March and April. Trawl catches of squid remain at a relatively constant level throughout the year.

The main species targeted is arrow squid, (*Nototodarus gouldi*), which is also taken as bycatch in the South East and Great Australian Bight Trawl fisheries. The SSJF is managed under the *Southern Squid Jig Fishery Management Plan 2005* which was determined by AFMA on 8 March 2005 and accepted by the Minister for Fisheries, Forestry and Conservation on 20 April 2005. AFMA granted Statutory Fishing Rights (SFRs) under the plan which commenced in 2006.



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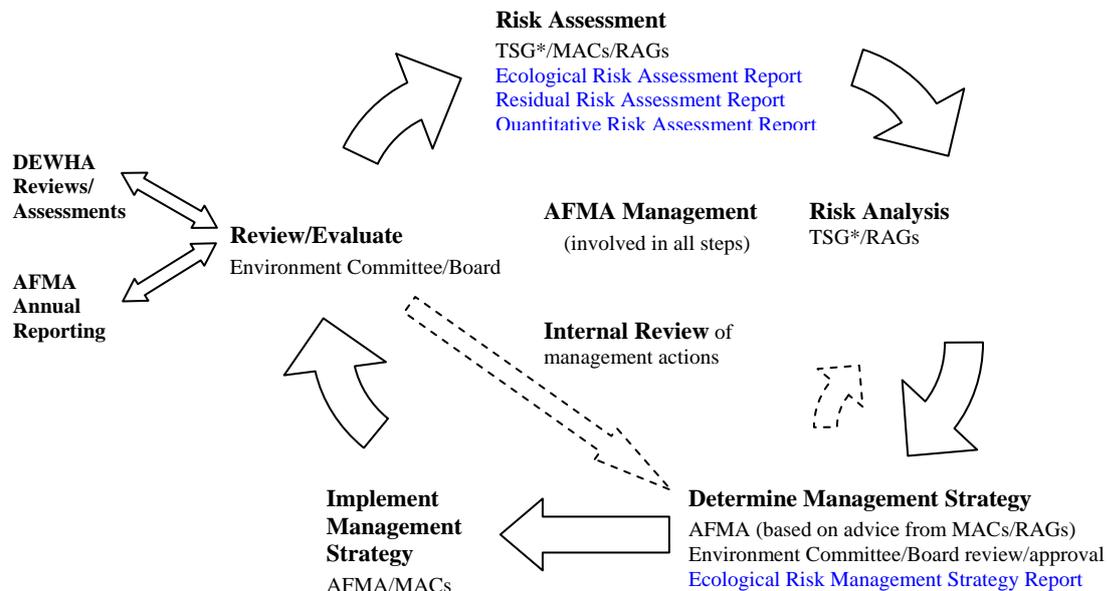
1. OVERVIEW

- **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

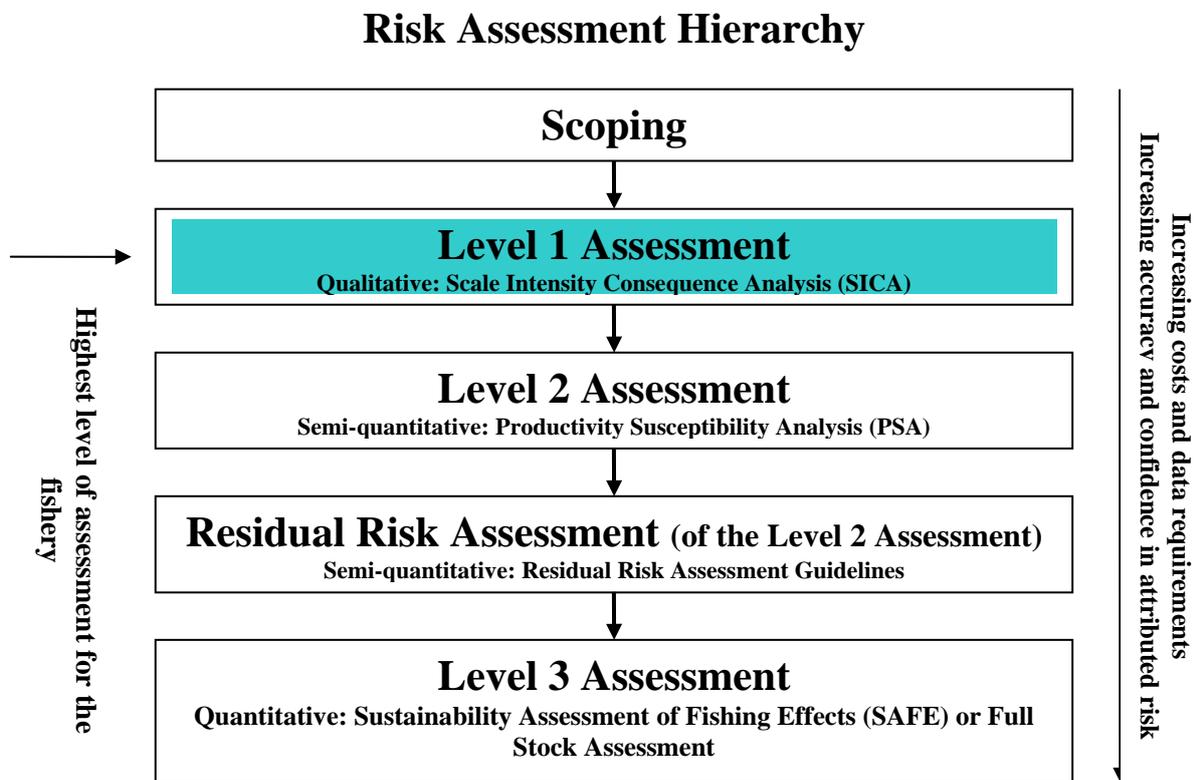
The ERM framework progresses through a number of steps and involves a hierarchy of risk assessment methodologies progressing from a comprehensive but largely qualitative analysis at Level 1 to a quantitative analysis at Level 3 (refer to **Figure 2**). This approach is a means of screening out low risk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

The SSJF was assessed at the Level 1, qualitative analysis as not requiring any further level of assessment. This Level 1 assessment involved the development of a qualitative ecological risk assessment which assessed the impact; direct and indirect, activities may have on the marine ecosystem.



Level 1 assessments provide the foundation for further risk assessment and analysis that has been applied in most other Commonwealth managed fisheries. 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 Level 1 SICA analysis.

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.

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.

- o **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 SSJF poses to the sustainability of the marine ecosystem have been assessed through the application of an individual ERA completed to Level 1 in April 2007. This is described in the table below.

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)	1	1	1	2
Proceeded to Level 2 PSA Assessment (scores ≥ 3)	N	N	N	N
Level 2 PSA Assessment (N/A)				
High Risk				
Medium Risk				
Low Risk				
Level 2 PSA Residual Risk Assessment (N/A)				
High Risk				
Medium Risk				
Low Risk				
Level 3 SAFE Assessment (N/A)				
Extreme High Risk				
Precautionary Extreme High Risk				
High Risk				
Precautionary High Risk				
Medium Risk				
Precautionary Medium Risk				
Low Risk				
Overlap with Level 2 PSA Residual Risk Assessment				

The results of the risk assessment have been consolidated to form a priority list for the fishery comprised of 216 protected (TEP) species identified through the ERA: 3 chondrichthyans, 83 marine birds, 50 marine mammals and 67 teleosts (refer to **Table 2**), which have been identified as occurring within the area of the fishery.

None of these 216 protected (TEP) species were assessed as being at high risk from the effects of commercial fishing operations. 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 these protected (TEP) species are minimised.



Table 2: Protected (TEP) species identified through the risk assessment process.

Taxonomic Group	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score
Chondrichthyan	3 species of sharks and rays	TEP	Level 1 SICA	N/A
Marine Bird	83 species of seabirds	TEP	Level 1 SICA	N/A
Marine Mammal	50 species of marine mammals	TEP	Level 1 SICA	N/A
Teleost	67 species of bony fish	TEP	Level 1 SICA	N/A

3. ECOLOGICAL RISK MANAGEMENT STRATEGY

The SSJF is managed using Statutory Fishing Rights (SFRs) which have been granted under the *Southern Squid Jig Fishery Management Plan 2005*. Once nominated to a boat, these SFRs authorise the holder to use a certain number of squid jigging machines during the year. The number of machines is determined by a Total Allowable Effort (TAE) limit, set annually.

Squid is also taken by operators in both the South East Trawl (SET) and the Great Australian Bight Trawl (GABT) Fisheries. However the impact of commercial fishing for squid by methods other than jig has not been considered by the specific ERA discussed here or addressed in this report. Separate ERA/ERM reports have been compiled for the SET and GABT fisheries that take squid by trawl.

The ERM strategy for the SSJF will address the 216 protected (TEP) species identified as occurring within the area of this fishery, with no associated risk.

- **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.

The SSJF has developed a Harvest Strategy for 1 target species (arrow squid, *Nototodarus gouldi*). Arrow squid has not been identified as a priority species. The SSJF Harvest Strategy outlines trigger limits as the management method for this species. **Table 3** details those priority species which will be addressed under this policy.

Table 3: Priority species to be addressed under Harvest Strategies.

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score
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None identified					
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- **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. A number of priority species/groups will fall under this policy once developed.

No non-key commercial species have been identified in the priority species list for this fishery.

Table 4: Priority species/groups to be addressed under Non-key Commercial Species Policy once developed.

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score
None identified					

- **Managing bycatch and discarding**

AFMA’s program for addressing bycatch and discarding in Commonwealth managed fisheries was released in March 2008. The program implements a two streamed approach for minimising and mitigating against capture of bycatch and protected (TEP) species as well as strategies to minimise the discarding of target and quota species.

The SSJF has developed a Bycatch Action Plan to ensure that the impacts of the fishery’s bycatch on the ecosystem are sustainable and consistent with legislative requirements. There have been no recorded interactions with protected species in this fishery, (as described under Section 13 of the EPBC Act – to kill, injure, take or trade). The most common bycatch recorded in the SSJF include Barracouta (*Thyrsites atun*), Garfish (*Hyporhamphus spp*) and Blue Shark (*Prionace glauca*), none of which are listed as high risk under the ERA assessment.

Table 5: Priority species/groups to be addressed under the Bycatch and Discard Program.

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score
None identified					

- **Chondrichthyan Guide for Fisheries Managers**

A practical guide is currently being developed to assist fishery managers and stakeholders to adopt and implement management arrangements for Chondrichthyan species. The Chondrichthyan Working Group will utilise expert based advice to develop effective mitigation strategies and to identify gaps in research and data.

No Chondrichthyans have been identified in the priority species list for this fishery.



Table 6: Priority species/groups to be addressed by utilising the Chondrichthyan Guide for Fisheries Managers and any associated policies.

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score
None identified					

o **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, regardless of their risk score. Many of these species are already managed under various international plans of action including the:

- Threat Abatement Plan 2006: for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations;
- 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.

No protected (TEP) species were rated above negligible or minor through the ERA process. Protected (TEP) species considered to overlap with the area of the fishery have been included in this report and all reasonable steps will be taken to minimise interactions with these species (Table 7).

Table 7: List of protected (TEP) species known to occur within the area of the SSJF.

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score
Chondrichthyan	<i>Carcharodon carcharias</i>	White Shark	TEP	Level 1 SICA	Negligible or minor
Chondrichthyan	<i>Carcharias taurus</i>	Grey Nurse Shark	TEP	Level 1 SICA	Negligible or minor
Chondrichthyan	<i>Rhincodon typus</i>	Whale Shark	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Thalassarche steadi</i>	White-capped Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Thalassarche bulleri</i>	Buller's Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Thalassarche cauta</i>	Shy Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Thalassarche chlororhynchos</i>	Yellow-nosed Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	TEP	Level 1 SICA	Negligible or minor



Marine bird	<i>Diomedea epomophora</i>	Southern Royal Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Diomedea exulans</i>	Wandering Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Thalassarche melanophrys</i>	Black-browed Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Phoebastria fusca</i>	Sooty Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Phoebastria palpebrata</i>	Light-mantled Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Diomedea gibsoni</i>	Gibson's Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Diomedea antipodensis</i>	Antipodean Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Diomedea sanfordi</i>	Northern Royal Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Thalassarche impavida</i>	Campbell Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Thalassarche carteri</i>	Indian Yellow-nosed Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Thalassarche salvini</i>	Salvin's albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Thalassarche eremita</i>	Chatham albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Diomedea amsterdamensis</i>	Amsterdam Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Diomedea dabbenena</i>	Tristan Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Fregetta grallaria</i>	White-bellied Storm-Petrel (Tasman Sea),	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Fregetta tropica</i>	Black-bellied Storm-Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Garrodia nereis</i>	Grey-backed storm petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Oceanites oceanicus</i>	Wilson's storm petrel (subantarctic)	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pelagodroma marina</i>	White-faced Storm-Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Anous stolidus</i>	Common noddy	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Catharacta skua</i>	Great Skua	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Larus dominicanus</i>	Kelp Gull	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Larus novaehollandiae</i>	Silver Gull	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Larus pacificus</i>	Pacific Gull	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Procelsterna cerulea</i>	grey ternlet	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Sterna albifrons</i>	Little tern	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Sterna anaethetus</i>	Bridled Tern	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Sterna bengalensis</i>	Lesser crested tern	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Sterna bergii</i>	Crested Tern	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Sterna caspia</i>	Caspian Tern	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Sterna fuscata</i>	Sooty tern	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Sterna hirundo</i>	Common tern	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Sterna paradisaea</i>	Arctic tern	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Sterna striata</i>	White-fronted Tern	TEP	Level 1 SICA	Negligible or minor



Marine bird	<i>Sterna sumatrana</i>	Black-naped tern	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Anous minutus</i>	Black Noddy	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Phaethon rubricauda</i>	Red-tailed Tropicbird	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Phalacrocorax carbo</i>	Black cormorant	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Phalacrocorax fuscescens</i>	Black faced cormorant	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Phalacrocorax melanoleucos</i>	Little pied cormorant	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Phalacrocorax sulcirostris</i>	Little black cormorant	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Sula dactylatra</i>	Masked Booby	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Calonectris leucomelas</i>	streaked shearwater	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Daption capense</i>	Cape Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Fulmarus glacialoides</i>	Southern fulmar	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Halobaena caerulea</i>	Blue Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Lugensa brevirostris</i>	Kerguelen Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Macronectes giganteus</i>	Southern Giant-Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Macronectes halli</i>	Northern Giant-Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pachyptila turtur</i>	Fairy Prion	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pelecanoides urinatrix</i>	Common Diving-Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Procellaria aequinotialis</i>	White-chinned Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Procellaria cinerea</i>	Grey petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Procellaria parkinsoni</i>	Black Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Procellaria westlandica</i>	Westland Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pseudobulweria rostrata</i>	Tahiti Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pterodroma cervicalis</i>	White-necked Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pterodroma lessoni</i>	White-headed petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pterodroma leucoptera</i>	Gould's Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pterodroma macroptera</i>	Great-winged Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pterodroma mollis</i>	Soft-plumaged Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pterodroma neglecta</i>	Kermadec Petrel (western)	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pterodroma nigripennis</i>	Black-winged Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pterodroma solandri</i>	Providence Petrel	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Puffinus assimilis</i>	Little Shearwater (Tasman Sea)	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Puffinus bulleri</i>	Buller's Shearwater	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Puffinus carneipes</i>	Flesh-footed Shearwater	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Puffinus gavia</i>	Fluttering Shearwater	TEP	Level 1 SICA	Negligible or minor



Marine bird	<i>Puffinus griseus</i>	Sooty Shearwater	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Puffinus huttoni</i>	Hutton's Shearwater	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Puffinus pacificus</i>	Wedge-tailed Shearwater	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Puffinus tenuirostris</i>	Short-tailed Shearwater	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Eudyptula minor</i>	Little Penguin	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Morus capensis</i>	Cape gannet	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Morus serrator</i>	Australasian Gannet	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Sula leucogaster</i>	Brown boobies	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Thalassarche nov. sp.</i>	Pacific Albatross	TEP	Level 1 SICA	Negligible or minor
Marine bird	<i>Pterodroma heraldica</i>	Herald Petrel	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Eubalaena australis</i>	Southern Right Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Caperea marginata</i>	Pygmy Right Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Balaenoptera bonaerensis</i>	Antarctic Minke Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Balaenoptera acutorostrata</i>	Minke Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Balaenoptera borealis</i>	Sei Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Balaenoptera edeni</i>	Bryde's Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Balaenoptera musculus</i>	Blue Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Balaenoptera physalus</i>	Fin Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Megaptera novaeangliae</i>	Humpback Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Delphinus delphis</i>	Common Dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Feresa attenuata</i>	Pygmy Killer Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Globicephala macrorhynchus</i>	Short-finned Pilot Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Globicephala melas</i>	Long-finned Pilot Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Grampus griseus</i>	Risso's Dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Lagenodelphis hosei</i>	Fraser's Dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Lagenorhynchus cruciger</i>	Hourglass dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Lagenorhynchus obscurus</i>	Dusky Dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Lissodelphis peronii</i>	Southern Right Whale Dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Orcaella brevirostris</i>	Irrawaddy dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Orcinus orca</i>	Killer Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Peponocephala electra</i>	Melon-headed Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Pseudorca crassidens</i>	False Killer Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Sousa chinensis</i>	Indo-Pacific Humpback Dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Stenella attenuata</i>	Spotted Dolphin	TEP	Level 1 SICA	Negligible or minor



Marine mammal	<i>Stenella coeruleoalba</i>	Striped Dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Stenella longirostris</i>	Long-snouted Spinner Dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Steno bredanensis</i>	Rough-toothed Dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Tursiops truncatus</i>	Bottlenose Dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Tursiops aduncus</i>	Indian Ocean bottlenose dolphin	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Dugong dugon</i>	Dugong	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Arctocephalus forsteri</i>	New Zealand Fur-seal	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Arctocephalus pusillus doriferus</i>	Australian Fur Seal	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Arctocephalus tropicalis</i>	Subantarctic fur seal	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Neophoca cinerea</i>	Australian Sea-lion	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Hydrurga leptonyx</i>	Leopard seal	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Mirounga leonina</i>	Elephant seal	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Kogia breviceps</i>	Pygmy Sperm Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Kogia simus</i>	Dwarf Sperm Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Physeter catodon</i>	Sperm Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Berardius arnuxii</i>	Arnoux's Beaked Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Hyperoodon planifrons</i>	Southern Bottlenose Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Mesoplodon bowdoini</i>	Andrew's Beaked Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Mesoplodon densirostris</i>	Blainville's Beaked Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Mesoplodon ginkgodens</i>	Gingko Beaked Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Mesoplodon grayi</i>	Gray's Beaked Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Mesoplodon hectori</i>	Hector's Beaked Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Mesoplodon layardii</i>	Strap-toothed Beaked Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Mesoplodon mirus</i>	True's Beaked Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Tasmacetus shepherdi</i>	Tasman Beaked Whale	TEP	Level 1 SICA	Negligible or minor
Marine mammal	<i>Ziphius cavirostris</i>	Cuvier's Beaked Whale	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Caretta caretta</i>	Loggerhead	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Chelonia mydas</i>	Green turtle	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Eretmochelys imbricata</i>	Hawksbill turtle	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Lepidochelys olivacea</i>	Olive Ridley turtle	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Natator depressus</i>	Flatback turtle	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Dermochelys coriacea</i>	Leathery turtle	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Acalyptophis peronii</i>	Horned Seasnake	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Astrotia stokesii</i>	Stokes' seasnake	TEP	Level 1 SICA	Negligible or minor



Marine reptile	<i>Disteira kingii</i>	spectacled seasnake	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Hydrophis elegans</i>	Elegant seasnake	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Hydrophis ornatus</i>	Seasnake	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Hydrophis ornatus</i>	Seasnake	TEP	Level 1 SICA	Negligible or minor
Marine reptile	<i>Pelamis platurus</i>	Yellow-bellied Seasnake	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Heteroclinus perspicillatus</i>	Common weedfish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Solenostomus cyanopterus</i>	Blue-finned Ghost Pipefish, Robust Ghost	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Solenostomus paradoxus</i>	Harlequin/ Ornate Ghost Pipefish	TEP	Level 1 SICA	Negligible or minor
teleost	<i>Hippocampus abdominalis</i>	Big-bellied / southern potbellied seahorse	TEP	Level 1 SICA	Negligible or minor
teleost	<i>Hippocampus kelloggi</i>	Kellogg's Seahorse	TEP	Level 1 SICA	Negligible or minor
teleost	<i>Hippocampus kuda</i>	Spotted Seahorse, Yellow Seahorse	TEP	Level 1 SICA	Negligible or minor
teleost	<i>Idiotropiscis australe</i>	Southern Pygmy Pipehorse	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Phycodurus eques</i>	Leafy Seadragon	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Phyllopteryx taeniolatus</i>	Weedy Seadragon, Common Seadragon	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Solegnathus robustus</i>	Robust Spiny Pipehorse	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Trachyrhamphus bicoarctatus</i>	Bend Stick Pipefish, Short-tailed Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Urocampus carinirostris</i>	Hairy Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Lissocampus runa</i>	Javelin Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Histiogamphelus briggsii</i>	Briggs' Crested Pipefish, Briggs' Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hypselognathus rostratus</i>	Knife-snouted Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Leptoichthys fistularius</i>	Brushtail Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Kaupus costatus</i>	Deep-bodied Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Mitotichthys semistriatus</i>	Half-banded Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Lissocampus caudalis</i>	Australian Smooth Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Stigmatopora argus</i>	Spotted Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Stigmatopora nigra</i>	Wide-bodied Pipefish, Black Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Stipecampus cristatus</i>	Ring-backed Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Pugnaso curtirostris</i>	Pug-nosed Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Mitotichthys mollisoni</i>	Mollison's Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Vanacampus phillipi</i>	Port Phillip Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Vanacampus poecilolaemus</i>	Australian Long-snout/Long-snouted Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Mitotichthys tuckeri</i>	Tucker's Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hippocampus breviceps</i>	Short-head Seahorse, Short-snouted Seaho	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hippocampus whitei</i>	White's Seahorse	TEP	Level 1 SICA	Negligible or minor



Teleost	<i>Solegnathus spinosissimus</i>	Spiny Pipehorse	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Halicampus grayi</i>	Mud Pipefish, Gray's Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hippocampus taeniopterus</i>	Spotted Seahorse, Yellow Seahorse	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Acentronura australe</i>	Southern Pygmy Pipehorse	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Acentronura breviperula</i>	Hairy Pygmy Pipehorse	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Campichthys galei</i>	Gale's Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Campichthys tryoni</i>	Tryon's Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Corythoichthys amplexus</i>	Fijian Banded/ Brown-banded	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Corythoichthys ocellatus</i>	Orange-spotted Pipefish, Ocellated Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Cosmocampus howensis</i>	Lord Howe Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Festucalex cinctus</i>	Girdled Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Filicampus tigris</i>	Tiger Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Halicampus macrorhynchus</i>	[a pipefish]	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Heraldia nocturna</i>	Upside-down Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hippichthys cyanospilos</i>	Blue-speckled/Blue-spotted Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hippichthys heptagonus</i>	Madura Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hippichthys penicillus</i>	Beady Pipefish, Steep-nosed Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hippocampus planifrons</i>	Flat-face Seahorse	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Histiogamphelus cristatus</i>	Rhino Pipefish, Macleay's Crested Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hypsognathus horridus</i>	Shaggy Pipefish, Prickly Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Kimblaeus bassensis</i>	Trawl Pipefish, Kimbla Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Maroubra perserrata</i>	Sawtooth Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Micrognathus andersonii</i>	Anderson's Pipefish, Shortnose Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Micrognathus pygmaeus</i>	[a pipefish]	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Microphis manadensis</i>	Manado River Pipefish, Manado Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Nannocampus subosseus</i>	Bony-headed Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Notiocampus ruber</i>	Red Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Solegnathus dunckeri</i>	Duncker's Pipehorse	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Solegnathus sp. 1 [in Kuiter, 2000]</i>	Pipehorse	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Syngnathoides biaculeatus</i>	Double-ended Pipehorse, Alligator Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Vanacampus margaritifer</i>	Mother-of-pearl Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Vanacampus vercoi</i>	Verco's Pipefish	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hippocampus minotaur</i>	Bullneck Seahorse	TEP	Level 1 SICA	Negligible or minor



Teleost	<i>Halicampus boothae</i>	[a pipefish]	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hippocampus queenslandicus</i>	Kellogg's Seahorse	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hippocampus tristis</i>	[a pipefish]	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Hippocampus procerus</i>	[a pipefish]	TEP	Level 1 SICA	Negligible or minor
Teleost	<i>Heraldia</i> sp. 1 [in Kuitert, 2000]	Western upsidedown pipefish	TEP	Level 1 SICA	Negligible or minor

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 with its goal being to produce 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

Low risk	where the fishing mortality rate is less than the maximum fishing mortality rate
Medium risk	where the fishing mortality rate is greater than or equal to the maximum fishing mortality rate but less than the minimum biomass limit (where the biomass limit is defined as half of the biomass that supports a maximum sustainable mortality)
Precautionary Medium risk	where the fishing mortality rate is greater than or equal to the minimum sustainable fishing mortality or the fishing mortality rate plus a 90% confidence interval is greater than or equal to maximum fishing mortality
High risk	where the fishing mortality rate is greater than or equal to the minimum biomass limit (where the biomass limit is defined as half of the biomass that supports a maximum sustainable mortality) but less than the minimum unsustainable fishing mortality rate that, in theory, may lead to population extinction



Precautionary High risk	where the fishing mortality rate is greater than or equal to the minimum biomass limit (where the biomass limit is defined as half of the biomass that supports a maximum sustainable mortality) or where the fishing mortality rate plus a 90% confidence interval is greater than or equal to a fishing mortality rate corresponding to limit biomass
Extreme high risk	where the fishing mortality rate is greater than or equal to the minimum unsustainable fishing mortality rate that, in theory, may lead to population extinction
Precautionary Extreme high risk	where the fishing mortality rate is greater than or equal to the minimum unsustainable fishing mortality rate that, in theory, may lead to population extinction or where the fishing rate plus a 90% confidence interval is greater than or equal to the minimum unsustainable fishing mortality rate that, in theory, may lead to population extinction
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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