



Australian Government

Australian Fisheries Management Authority



Ecological Risk Management

Report for the Western Tuna and Billfish
Fishery March 2010

Summary of priority issues for managing the ecological effects of fishing in the Western Tuna and Billfish Fishery

The Ecological Risk Assessment (ERA) process was designed to assess and rank the ecological effects of fishing in Commonwealth fisheries. The process provided a list of species and habitats or ecological communities that are at risk of ecological damage from the effects of fishing. This Ecological Risk Management (ERM) report provides how AFMA will respond to these high-risk environmental components.

The ecological effects of fishing in the Western Tuna and Billfish Fishery (WTBF) are currently minimal, which is in part due to the small amount of effort that is currently exercised in the fishery. The WTBF employs the same method to target species as in the Eastern Tuna and Billfish Fishery. As such there are similar management arrangements in place to deal with the incidental capture of non-target species and ecological effects.

The methods of fishing employed in the WTBF (pelagic longline, handline, trolling, polling and rod and reel) were found to have little or no direct impact on the physical marine environment.

The WTBF is a fishery which targets tuna and tuna-like species; however historical observer and logbook data show that between 30 and 40 species have been taken, many in small amounts, each year. AFMA aims to implement measures which ensure that the take of commercial species is sustainable and minimises the interactions and mortality of species that are not commercially utilised.

The ERA process analysed the effect of commercial fishing in the WTBF, based on the effects on five ecological components: protected species, bycatch, byproduct and target species, habitats and ecological communities that occur in the area of the fishery. The highest level of assessment conducted on the WTBF was a quantitative Level 3 Sustainability Assessment for Fishing Effects (SAFE) assessment.

The Level 3 SAFE assessment on chondrichthyans and teleosts identified no species to be at high risk to the effects of fishing. The Level 2 PSA identified 29 species at high risk (including two discard species, one byproduct species and 26 protected species) all of which were reduced to either low or medium risk through the Level 2 Residual Risk process.

Two hundred and sixty-four protected (TEP) species have been identified as occurring in the area of the fishery. Of these 107 are teleosts, 28 are reptiles, 50 marine mammals, 76 are seabirds, and three are chondrichthyans. No threatened, endangered and protected (TEP) species were found to be at high risk through the ERA process, however consistent with AFMA's objectives and good fisheries management practices all steps will be taken to minimise interactions with these species within the fishery.

The priority for the WTBF is to maintain the monitoring already conducted in the fishery even while effort is minimal. By continuing to monitor aspects of the fishery such as bycatch, discarding, interactions with TEP species and changes in effort, AFMA will be able to adequately respond to issues in the fishery in an effective and timely manner.



Priority issues for managing the ecological effects of fishing in the WTBF will largely be captured by the actions of the *Australian Tuna and Billfish Longline Fisheries bycatch and discard workplan 2008*. There are however other documents aimed at managing the ecological effects of fishing in the WTBF, these include:

- *Western Tuna and Billfish Fishery Management Plan 2005*
- Western Tuna and Billfish Fishery Harvest Strategy
- Threat Abatement Plan: for the incidental catch (or bycatch) of seabirds during oceanic longline operations
- Recovery Plan for Marine Turtles in Australia (under review as at December 2009)
- Recovery Plans for the Grey Nurse and White Sharks
- ERM action – AFMA to monitor the level of catch and interaction with shark species in the WTBF. If the landed amount of any one shark species reaches a predetermined level AFMA will review its management of shark interactions in this fishery.



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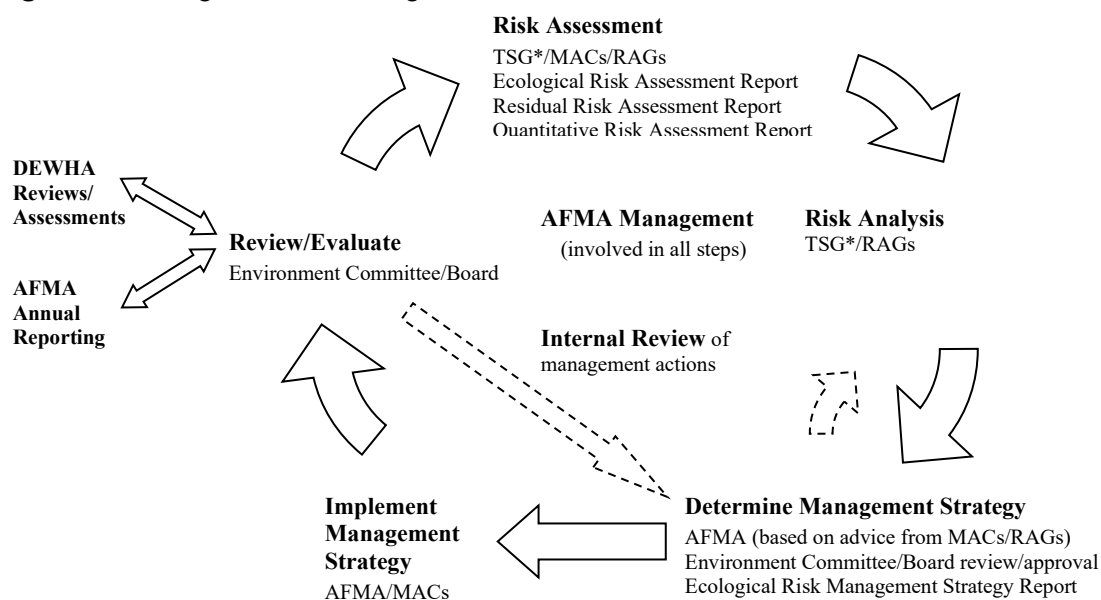
1. Overview of the ERA process

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

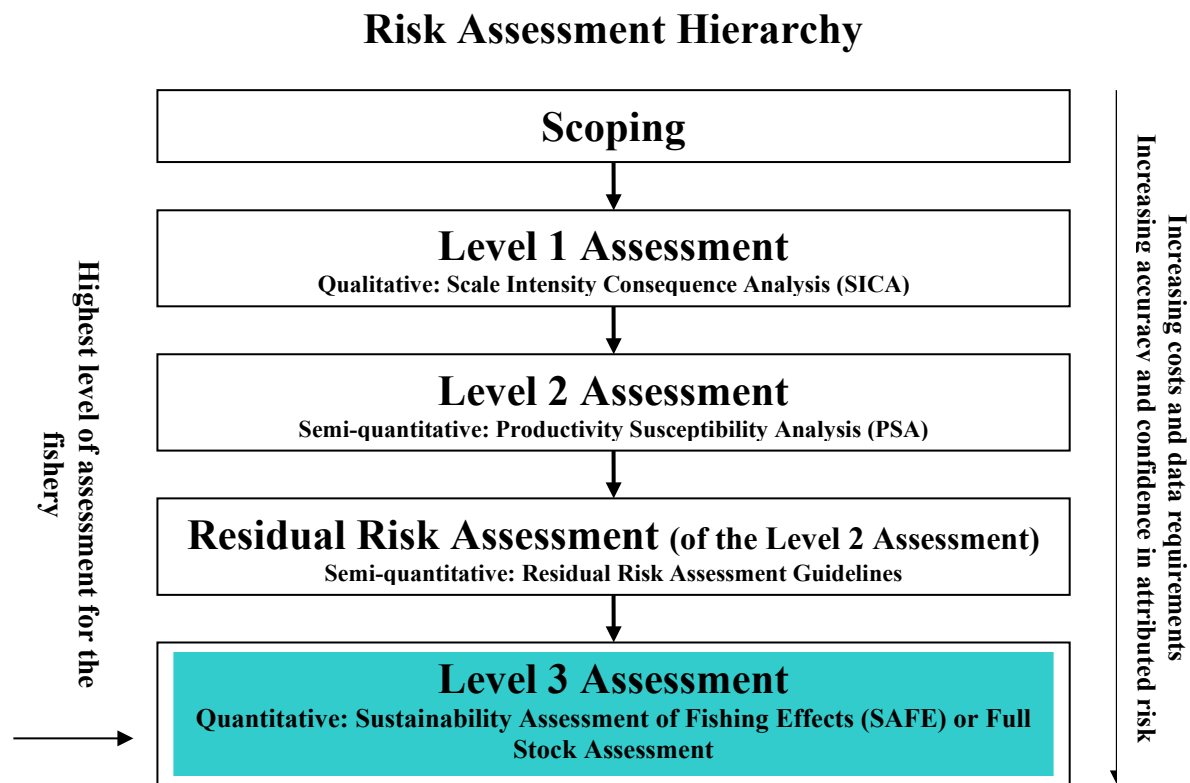
The ERM framework progresses through a number of steps and involves a hierarchy of risk assessment methodologies progressing from a comprehensive but largely qualitative analysis at Level 1 to a quantitative analysis at Level 3 (refer to Figure 2). This approach is a cost and time efficient means of 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 the WTBF was developed using:

- The SAFE methodology for any teleost or chondrichthyan species identified as being fished at a rate above maximum sustainable mortality; 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 TEP species which have been identified through the ERA process.

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

- WTBF Harvest Strategy
- Non-key Commercial Species (byproduct) Policy



- Australian Tuna and Billfish Longline Fisheries Bycatch and Discard workplan, and
- Protected species under various international plans of action, and recovery plans including:
 - The Threat Abatement Plan (2006) for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (TAP).
 - Recovery Plan for Marine Turtles in Australia.
 - Recovery Plans for the Grey Nurse and White Sharks.

The WTBF 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.



2. Description of the Western Tuna and Billfish Fishery

Area of the fishery

The Western Tuna and Billfish Fishery (WTBF) extends westward from Cape York Peninsula (142°30'E) off Queensland around the west coast of Western Australia and from there extends eastward across the Great Australian Bight to 141°E at the South Australian/Victorian border.

The WTBF also includes Australian waters outside of 12 nm off Christmas Island and Cocos Keeling Islands. The WTBF Management Plan also applies to Australian vessels fishing in the high seas within the IOTC's Area of Competence, which includes:

- the area of the Indian ocean west of longitude 150°E off the south coast of Australia and west of longitude 129°E off the northern coast of Australia and bound east of the line 29°E off south Africa.

Fishing methods

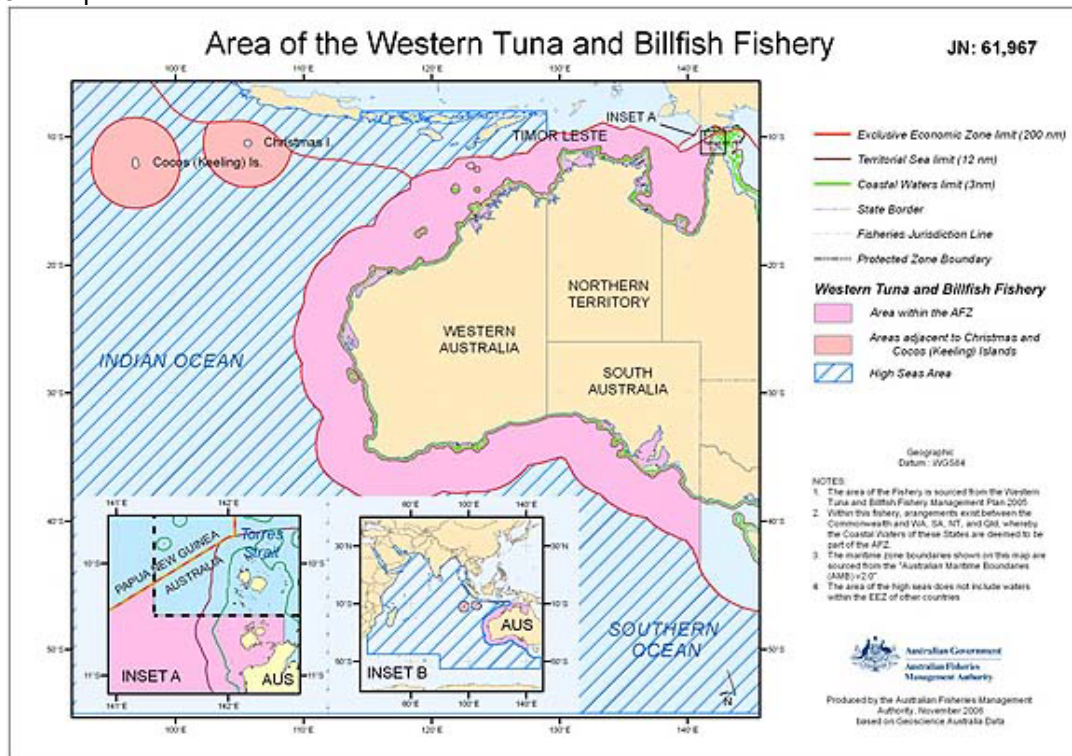
Target species in the WTBF are predominantly Broadbill Swordfish, Bigeye Tuna, and to a lesser extent Yellowfin Tuna. These species are predominantly taken using the pelagic longline method, however the minor line methods (pole, troll, hand line and rod and reel) are also permitted in the WTBF.

Management arrangements

The WTBF is currently managed by the Australian Fisheries Management Authority (AFMA) according to transitional arrangements provided for in the *Western Tuna and Billfish Fishery Management Plan 2005* until Individual Transferrable Quota (ITQ) output controls in the form of Statutory Fishing Rights (SFRs) are granted. Under the transitional arrangements, commercial fishing is managed through a system of input controls based upon annually granted fishing permits which limit entry to the fishery, describe the area of operations, and impose limits on the take of bycatch species and the fishing gear which may be employed in the fishery.



Figure 1 Map of the area of the WTBF



International context and obligations

Australia has been a member of the Indian Ocean Tuna Commission (IOTC) since 1996 and as such is obliged to work by the management measures defined by IOTC, under resolutions adopted by IOTC.

A list of the resolutions adopted by the IOTC can be found at (www.iotc.org). Management plans, permit conditions and other associated policy documents incorporate management measures adopted by the IOTC.

3. Ecological risk management priority list

The risks that the WTBF pose to the sustainability of the marine ecosystem have been assessed through the application of a progression of risk assessment methodologies as listed below:

- a Level 2 PSA Risk Assessment completed in June 2007
- a Level 2 PSA Residual Risk assessment finalised in November 2009 for all species occurring in the fishery, and
- Level 3 Sustainability Assessment for Fishing Effects (SAFE) assessment completed in April 2009.



The results of these risk assessments have been consolidated with no species listed as being a high priority for management from the ERA process.

The risk assessment identified that 264 protected species occur within the area of the fishery (Level 2 PSA). In recent times there have been few interactions reported with protected species in the WTBF fishery. Of the TEP species, 107 are teleosts, 28 are reptiles, 50 marine mammals, 76 are seabirds and three are chondrichthyans. No protected species were found to be at high risk through the ERA process, however consistent with AFMA’s objectives and good fisheries management practices all steps will be taken to minimise interactions between these species and the fishery.

The priority for the ERM is to maintain monitoring of the fishery and respond to any interactions with protected species or increases in interaction rates with bycatch or byproduct species. Effort will continue to be monitored and AFMA will respond accordingly with management measures if effort increases significantly.

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)	4	4	4	3
Proceeded to Level 2 PSA Assessment (scores ≥ 3)	Y	Y	Y	Y
Level 2 PSA Assessment				
High Risk	0	1	2	26
Medium Risk	1	8	26	115
Low Risk	13*	14	20	123
Level 2 PSA Residual Risk Assessment				
High Risk	0	0	0	0
Medium Risk	1	7	26	130
Low Risk	13*	16	22	134
Level 3 SAFE Assessment				
$F_{cur} > F_{msm}$	0	0	0	0
$F_{cur} < F_{msm}$	6	23	48	110

*There were seven targeted bait species included in the assessment which have here been classified as target species.



4. Ecological Risk Management Strategy

The nature of pelagic fishing operations means that it is difficult to design measures which mitigate the capture of a single species. No species were found to be at high risk to the effects of fishing in the WTBF; hence the ERM strategy for the WTBF will address the 264 protected (TEP) species identified as occurring within the area of the fishery.

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.

Testing and verification of the Harvest Strategy for the WTBF is currently being conducted and results of this will be used when the fishery moves to quota-based management.

Effort within the WTBF is very low, and as such there is not enough data available to conduct the Harvest Strategy. The Harvest Strategy contains rules to deal with low effort in the fishery and has an effort trigger for when the Harvest Strategy will be implemented.

The straddling stock nature of target species and the lack of full understanding of the connectivity of local populations to the broader Indian Ocean mean that there are issues utilising broad scale stock assessments in the Harvest Strategy. The draft Harvest Strategy for the WTBF sets out relatively simple decision rules based on data inputs currently collected from the domestic fishery including Catch per Unit Effort and size class information.

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. As there are no byproduct species taken in the WTBF and any other species taken must be covered by a separate fishing permit, the management of non-key commercial species is not an issue in this fishery.

The catch of sharks in longline fisheries is of a worldwide concern, and as such AFMA sees the management of these in the sense of byproduct, bycatch and discarding is important. Currently in the WTBF there is little concern in relation to the capture and discarding of sharks, again mainly due to the low level of effort. However, if effort increases in the fishery then there is potential for the level of interaction to increase.

Action: AFMA to monitor the level of catch and interaction with shark species in the WTBF. If the landed amount of any one species reaches 50 tonnes, AFMA will review its management of shark interactions in this fishery.



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 stream approach for minimising and mitigating against capture of bycatch and protected species as well as strategies to minimise the discarding of target and quota species.

The WTBF has a bycatch and discarding workplan in the form of the *Australian Tuna and Billfish Longline Fisheries bycatch and discarding workplan* agreed on 1 November 2008. The main features of the work plan are to develop management measures to monitor and reduce interactions with high risk and protected species and discarding of key target species.

The workplan defines a range of actions to be undertaken specifically within the ATBLF (Table 6) to respond to the outcomes of the ERA/M process.

Table 2 Actions of the Bycatch and Discard Workplan and how they relate to the ERA/M process

Action	How does this respond to the outcomes of the ERM process?
1. Make the carriage of line cutters and de-hookers compulsory on ATBLF vessels.	To help in the release of hooked and tangled sharks, whales and turtles.
2. Analysis of the impacts of making circle hooks compulsory in the ATBLF (eg: quantifying the catch rates of turtles and sharks).	Possible reduction in risk to turtles and marlins, but one study indicates an increase in capture of sharks.
3. Investigate the variance in bycatch composition between "deep set" (albacore) and "shallow set" longline operations.	Deep setting technique has the possibility of decreasing interactions with birds and turtles. However, it is not understood how it might affect catches of other bycatch or non-target species.
4. Provision of a weather proof bycatch recording device (with attached identification guide) to all ATBLF vessels to provide convenient facility to record bycatch during hauling operations.	Address operational requirements to provide aids to recording accuracy of data to determine bycatch & discarding issues.
5. Review outcomes and recommendations from the Chondrichthyan Technical Working Group (CTWG) and implement formal CTWG recommendations.	Address shark mitigation on an all fisheries/all jurisdictions basis. Has relevance to the high-risk species associated with this fishery.
6. Develop and implement an education strategy for crew to be made aware of bycatch and discarding obligations.	More accurate reporting by crew. Develop an understanding of bycatch and protected species issues and address misreporting of interactions.
7. Analysing observer data in an attempt to quantify weight of discarded target species	Improves understanding of discarding issues in ALTBF particularly with regard quantity of released juveniles and damaged catch.



A key component to the bycatch and discarding work plan is to improve the reporting of bycatch in the ATBLF.

Chondrichthyan guide for fisheries managers

A guide has been developed to assist fishery managers and stakeholders to adopt and implement management arrangements for Chondrichthyan species. A Chondrichthyan Technical Working Group was formed and worked with the objective of providing practical advice on mitigation measures between shark species and Australian fisheries. They produced a guide for fisheries managers which is designed to be utilised as a tool in the decision-making process. The guide contains a list of practical measures that could be used for the mitigation of shark mortality.

Protected

All protected 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 plans of action including the:

- Threat Abatement Plan 2006: for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations
- National Plan Of Action for Conservation and Management of Sharks, and
- Recovery Plan for Marine Turtles in Australia.

There are very few interactions reported between the WTBF and protected species, however consistent with AFMA's objectives and obligations all steps will be taken to minimise the chance of interactions occurring. Two hundred and sixty-four TEP species have been identified as occurring in the area of the fishery under the level 2 PSA ERA analysis (Table 3).

Table 3 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	<i>Carcharodon carcharias</i>	White Shark	TEP	Level 3 SAFE	Low
Chondrichthyan	<i>Carcharias taurus</i>	Grey Nurse Shark	TEP	Level 3 SAFE	Low
Chondrichthyan	<i>Rhincodon typus</i>	Whale Shark	TEP	Level 3 SAFE	Low
Marine bird	<i>Phoebastria fusca</i>	Sooty Albatross	TEP	Level 2 residual risk	Low
Marine bird	<i>Thalassarche cauta</i>	Shy Albatross	TEP	Level 2 residual risk	Low



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Marine bird	<i>Thalassarche melanophrys</i>	Black-browed Albatross	TEP	Level 2 residual risk	Low
Marine bird	<i>Thalassarche bulleri</i>	Buller's Albatross	TEP	Level 2 residual risk	Low
Marine bird	<i>Puffinus pacificus</i>	Wedge-tailed Shearwater	TEP	Level 2 residual risk	Low
Marine bird	<i>Oceanites oceanicus</i>	Wilson's storm petrel (subantarctic)	TEP	Level 2 residual risk	Low
Marine bird	<i>Pelagodroma marina</i>	White-faced Storm-Petrel	TEP	Level 2 residual risk	Low
Marine bird	<i>Larus novaehollandiae</i>	Silver Gull	TEP	Level 2 residual risk	Low
Marine bird	<i>Larus pacificus</i>	Pacific Gull	TEP	Level 2 residual risk	Low
Marine bird	<i>Sterna albifrons</i>	Little tern	TEP	Level 2 residual risk	Low
Marine bird	<i>Sterna anaethetus</i>	Bridled Tern	TEP	Level 2 residual risk	Low
Marine bird	<i>Sterna dougallii</i>	Roseate tern	TEP	Level 2 residual risk	Low
Marine bird	<i>Eudyptula minor</i>	Little Penguin	TEP	Level 2 residual risk	Low
Marine bird	<i>Thalassarche chlororhynchos</i>	Yellow-nosed Albatross, Atlantic Yellow-	TEP	Level 2 residual risk	Med
Marine bird	<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Phoebetria palpebrata</i>	Light-mantled Albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Thalassarche carteri</i>	Indian Yellow-nosed Albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Puffinus carneipes</i>	Flesh-footed Shearwater	TEP	Level 2 residual risk	Med
Marine bird	<i>Diomedea exulans</i>	Wandering Albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Diomedea antipodensis</i>	Antipodean Albatross	TEP	Level 2 residual risk	Med



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Marine bird	<i>Diomedea epomophora</i>	Southern Royal Albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Diomedea gibsoni</i>	Gibson's Albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Diomedea sanfordi</i>	Northern Royal Albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Thalassarche eremita</i>	Chatham albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Thalassarche platei</i>	Pacific albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Thalassarche salvini</i>	Salvin's albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Thalassarche impavida</i>	Campbell Albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Diomedea amsterdamensis</i>	Amsterdam Albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Diomedea dabbenena</i>	Tristan Albatross	TEP	Level 2 residual risk	Med
Marine bird	<i>Fregata andrewsi</i>	Christmas frigatebird	TEP	Level 2 residual risk	Med
Marine bird	<i>Fregata ariel</i>	Lesser frigatebird	TEP	Level 2 residual risk	Med
Marine bird	<i>Fregata minor</i>	Great Frigatebird, Greater Frigatebird	TEP	Level 2 residual risk	Med
Marine bird	<i>Garrodia nereis</i>	Grey-backed storm petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Fregetta tropica</i>	Black-bellied Storm-Petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Fregetta grallaria</i>	White-bellied Storm-Petrel (Tasman Sea),	TEP	Level 2 residual risk	Med
Marine bird	<i>Anous tenuirostris</i>	Lesser noddy	TEP	Level 2 residual risk	Med
Marine bird	<i>Anous stolidus</i>	Common noddy	TEP	Level 2 residual risk	Med



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Marine bird	<i>Catharacta skua</i>	Great Skua	TEP	Level 2 residual risk	Med
Marine bird	<i>Sterna bengalensis</i>	Lesser crested tern	TEP	Level 2 residual risk	Med
Marine bird	<i>Sterna bergii</i>	Crested Tern	TEP	Level 2 residual risk	Med
Marine bird	<i>Sterna caspia</i>	Caspian Tern	TEP	Level 2 residual risk	Med
Marine bird	<i>Sterna fuscata</i>	Sooty tern	TEP	Level 2 residual risk	Med
Marine bird	<i>Sterna hirundo</i>	Common tern	TEP	Level 2 residual risk	Med
Marine bird	<i>Sterna paradisaea</i>	Arctic tern	TEP	Level 2 residual risk	Med
Marine bird	<i>Sterna sumatrana</i>	Black-naped tern	TEP	Level 2 residual risk	Med
Marine bird	<i>Phaethon lepturus</i>	White-tailed Tropicbird	TEP	Level 2 residual risk	Med
Marine bird	<i>Anous minutus</i>	Black Noddy	TEP	Level 2 residual risk	Med
Marine bird	<i>Phaethon rubricauda</i>	Red-tailed Tropicbird	TEP	Level 2 residual risk	Med
Marine bird	<i>Phalacrocorax fuscescens</i>	Black faced cormorant	TEP	Level 2 residual risk	Med
Marine bird	<i>Macronectes giganteus</i>	Southern Giant-Petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Fulmarus glacialisoides</i>	Southern fulmar	TEP	Level 2 residual risk	Med
Marine bird	<i>Procellaria cinerea</i>	Grey petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Pterodroma lessoni</i>	White-headed petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Daption capense</i>	Cape Petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Halobaena caerulea</i>	Blue Petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Macronectes halli</i>	Northern Giant-Petrel	TEP	Level 2 residual risk	Med



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Marine bird	<i>Pachyptila turtur</i>	Fairy Prion	TEP	Level 2 residual risk	Med
Marine bird	<i>Procellaria aequinoctialis</i>	White-chinned Petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Procellaria parkinsoni</i>	Black Petrel; Parkinsons Petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Pterodroma leucoptera</i>	Gould's Petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Pterodroma macroptera</i>	Great-winged Petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Pterodroma mollis</i>	Soft-plumaged Petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Puffinus assimilis</i>	Little Shearwater (Tasman Sea)	TEP	Level 2 residual risk	Med
Marine bird	<i>Puffinus gavia</i>	Fluttering Shearwater	TEP	Level 2 residual risk	Med
Marine bird	<i>Puffinus griseus</i>	Sooty Shearwater	TEP	Level 2 residual risk	Med
Marine bird	<i>Puffinus huttoni</i>	Hutton's Shearwater	TEP	Level 2 residual risk	Med
Marine bird	<i>Puffinus tenuirostris</i>	Short-tailed Shearwater	TEP	Level 2 residual risk	Med
Marine bird	<i>Calonectris leucomelas</i>	streaked shearwater	TEP	Level 2 residual risk	Med
Marine bird	<i>Pterodroma arminjoniana</i>	Round Island Petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Pterodroma barau</i>	Barau's Petrel	TEP	Level 2 residual risk	Med
Marine bird	<i>Papasula abbotti</i>	Abbots booby	TEP	Level 2 residual risk	Med
Marine bird	<i>Sula leucogaster</i>	Brown boobies	TEP	Level 2 residual risk	Med
Marine bird	<i>Morus serrator</i>	Australasian Gannet	TEP	Level 2 residual risk	Med
Marine bird	<i>Sula dactylatra</i>	Masked Booby	TEP	Level 2 residual risk	Med



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Marine bird	<i>Sula sula</i>	Red-footed Booby	TEP	Level 2 residual risk	Med
Marine bird	<i>Morus capensis</i>	Cape gannet	TEP	Level 2 residual risk	Med
Marine mammal	<i>Globicephala melas</i>	Long-finned Pilot Whale	TEP	Level 2 residual risk	Low
Marine mammal	<i>Mesoplodon bowdoini</i>	Andrew's Beaked Whale	TEP	Level 2 residual risk	Low
Marine mammal	<i>Mesoplodon ginkgodens</i>	Ginkgo Beaked Whale	TEP	Level 2 residual risk	Low
Marine mammal	<i>Mesoplodon mirus</i>	True's Beaked Whale	TEP	Level 2 residual risk	Low
Marine mammal	<i>Delphinus delphis</i>	Common Dolphin	TEP	Level 2 residual risk	Low
Marine mammal	<i>Delphinus capensis</i>	Common dolphin, long-beaked	TEP	Level 2 residual risk	Low
Marine mammal	<i>Lagenorhynchus obscurus</i>	Dusky Dolphin	TEP	Level 2 residual risk	Low
Marine mammal	<i>Indopacetus pacificus</i>	Longman's Beaked Whale	TEP	Level 2 residual risk	Low
Marine mammal	<i>Caperea marginata</i>	Pygmy Right Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Eubalaena australis</i>	Southern Right Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Balaenoptera bonaerensis</i>	Antarctic Minke Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Balaenoptera acutorostrata</i>	Minke Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Balaenoptera borealis</i>	Sei Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Balaenoptera edeni</i>	Bryde's Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Balaenoptera musculus</i>	Blue Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Balaenoptera physalus</i>	Fin Whale	TEP	Level 2 residual risk	Med



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Marine mammal	<i>Megaptera novaeangliae</i>	Humpback Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Lissodelphis peronii</i>	Southern Right Whale Dolphin	TEP	Level 2 residual risk	Med
Marine mammal	<i>Orcaella brevirostris</i>	Irrawaddy dolphin	TEP	Level 2 residual risk	Med
Marine mammal	<i>Feresa attenuata</i>	Pygmy Killer Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Globicephala macrorhynchus</i>	Short-finned Pilot Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Grampus griseus</i>	Risso's Dolphin	TEP	Level 2 residual risk	Med
Marine mammal	<i>Lagenodelphis hosei</i>	Fraser's Dolphin	TEP	Level 2 residual risk	Med
Marine mammal	<i>Orcinus orca</i>	Killer Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Peponocephala electra</i>	Melon-headed Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Pseudorca crassidens</i>	False Killer Whale	TEP	Level 2 residual risk	Med
Marine mammal	<i>Sousa chinensis</i>	Indo-Pacific Humpback Dolphin	TEP	Level 2 residual risk	Med
Marine mammal	<i>Stenella attenuata</i>	Spotted Dolphin	TEP	Level 2 residual risk	Med
Marine mammal	<i>Stenella coeruleoalba</i>	Striped Dolphin	TEP	Level 2 residual risk	Med
Marine mammal	<i>Stenella longirostris</i>	Long-snouted Spinner Dolphin	TEP	Level 2 residual risk	Med
Marine mammal	<i>Steno bredanensis</i>	Rough-toothed Dolphin	TEP	Level 2 residual risk	Med
Marine mammal	<i>Tursiops truncatus</i>	Bottlenose Dolphin	TEP	Level 2 residual risk	Med
Marine mammal	<i>Tursiops aduncus</i>	Indian Ocean bottlenose dolphin	TEP	Level 2 residual risk	Med



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Marine mammal	Dugong dugon	Dugong	TEP	Level 2 residual risk	Med
Marine mammal	Arctocephalus forsteri	New Zealand Fur-seal	TEP	Level 2 residual risk	Med
Marine mammal	Arctocephalus pusillus doriferus	Australian Fur Seal	TEP	Level 2 residual risk	Med
Marine mammal	Arctocephalus tropicalis	Subantarctic fur seal	TEP	Level 2 residual risk	Med
Marine mammal	Neophoca cinerea	Australian Sea-lion	TEP	Level 2 residual risk	Med
Marine mammal	Hydrurga leptonyx	Leopard seal	TEP	Level 2 residual risk	Med
Marine mammal	Kogia breviceps	Pygmy Sperm Whale	TEP	Level 2 residual risk	Med
Marine mammal	Kogia simus	Dwarf Sperm Whale	TEP	Level 2 residual risk	Med
Marine mammal	Physeter catodon	Sperm Whale	TEP	Level 2 residual risk	Med
Marine mammal	Berardius arnuxii	Arnoux's Beaked Whale	TEP	Level 2 residual risk	Med
Marine mammal	Hyperoodon planifrons	Southern Bottlenose Whale	TEP	Level 2 residual risk	Med
Marine mammal	Mesoplodon densirostris	Blainville's Beaked Whale	TEP	Level 2 residual risk	Med
Marine mammal	Mesoplodon grayi	Gray's Beaked Whale	TEP	Level 2 residual risk	Med
Marine mammal	Mesoplodon hectori	Hector's Beaked Whale	TEP	Level 2 residual risk	Med
Marine mammal	Mesoplodon layardii	Strap-toothed Beaked Whale	TEP	Level 2 residual risk	Med
Marine mammal	Tasmacetus shepherdi	Tasman Beaked Whale	TEP	Level 2 residual risk	Med



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Marine mammal	<i>Ziphius cavirostris</i>	Cuvier's Beaked Whale	TEP	Level 2 residual risk	Med
Marine reptile	<i>Hydrophis elegans</i>	Elegant seasnake	TEP	Level 2 residual risk	Low
Marine reptile	<i>Aipysurus laevis</i>	Olive Seasnake, Golden Seasnake	TEP	Level 2 residual risk	Low
Marine reptile	<i>Emydocephalus annulatus</i>	Turtle-headed Seasnake	TEP	Level 2 residual risk	Low
Marine reptile	<i>Enhydrina schistosa</i>	Beaked Seasnake	TEP	Level 2 residual risk	Low
Marine reptile	<i>Lapemis hardwickii</i>	Spine-bellied Seasnake	TEP	Level 2 residual risk	Low
Marine reptile	<i>Caretta caretta</i>	Loggerhead	TEP	Level 2 residual risk	Med
Marine reptile	<i>Chelonia mydas</i>	Green turtle	TEP	Level 2 residual risk	Med
Marine reptile	<i>Eretmochelys imbricata</i>	Hawksbill turtle	TEP	Level 2 residual risk	Med
Marine reptile	<i>Lepidochelys olivacea</i>	Olive Ridley turtle	TEP	Level 2 residual risk	Med
Marine reptile	<i>Natator depressus</i>	Flatback turtle	TEP	Level 2 residual risk	Med
Marine reptile	<i>Dermochelys coriacea</i>	Leathery turtle	TEP	Level 2 residual risk	Med
Marine reptile	<i>Acalyptophis peronii</i>	Horned Seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Aipysurus apraefrontalis</i>	Short-nosed Seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Aipysurus duboisii</i>	Dubois' Seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Aipysurus eydouxii</i>	Spine-tailed Seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Aipysurus fuscus</i>	Dusky Seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Aipysurus tenuis</i>	Brown-lined Seasnake	TEP	Level 2 residual risk	Med



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Marine reptile	<i>Disteira major</i>	Olive-headed Seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Hydrelaps darwiniensis</i>	Black-ringed Seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Hydrophis coggeri</i>	Slender-necked Seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Hydrophis mcdowelli</i>	seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Hydrophis ornatus</i>	seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Disteira kingii</i>	Spectacled seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Hydrophis czeblukovi</i>	Fine-spined seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Hydrophis atriceps</i>	Black-headed seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Hydrophis melanosoma</i>	Black-banded robust seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Hydrophis pacificus</i>	Large-headed Seasnake	TEP	Level 2 residual risk	Med
Marine reptile	<i>Parahydrophis mertoni</i>	Northern mangrove seasnake	TEP	Level 2 residual risk	Med
Teleost	<i>Heteroclinus perspicillatus</i>	Common weedfish	TEP	Level 3 SAFE	Low
Teleost	<i>Solenostomus cyanopterus</i>	Blue-finned Ghost Pipefish, Robust Ghost	TEP	Level 3 SAFE	Low
Teleost	<i>Corythoichthys intestinalis</i>	Australian Messmate Pipefish, Banded Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Bulbonaricus brauni</i>	Braun's Pughead Pipefish,	TEP	Level 3 SAFE	Low



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
		Pug-headed Pipefish			
Teleost	<i>Halicampus brocki</i>	Brock's Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Doryrhamphus janssi</i>	Cleaner Pipefish, Janss' Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Bhanotia fasciolata</i>	Corrugated Pipefish, Barbed Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Halicampus nitidus</i>	Glittering Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Acentronura australe</i>	Southern Pygmy Pipehorse	TEP	Level 3 SAFE	Low
Teleost	<i>Acentronura breviperula</i>	Hairy Pygmy Pipehorse	TEP	Level 3 SAFE	Low
Teleost	<i>Campichthys galei</i>	Gale's Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Campichthys tryoni</i>	Tryon's Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus spinosissimus</i>	Hedgehog Seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Acentronura larsonae</i>	Helen's Pygmy Pipehorse	TEP	Level 3 SAFE	Low
Teleost	<i>Solegnathus guentheri</i>	Indonesian Pipefish, Gunther's Pipehorse	TEP	Level 3 SAFE	Low
Teleost	<i>Festucalex scalaris</i>	Ladder Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Trachyrhamphus longirostris</i>	Long-nosed Pipefish, Straight Stick Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Halicampus dunckeri</i>	Red-hair Pipefish, Duncker's Pipefish	TEP	Level 3 SAFE	Low



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Teleost	<i>Haliichthys taeniophorus</i>	Ribboned Seadragon, Ribboned Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Dunckerocampus dactyliophorus</i>	Ringed Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Phoxocampus belcheri</i>	Rock Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Dunckerocampus pessuliferus</i>	Many-banded Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Choeroichthys latispinosus</i>	Muiron Island Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Choeroichthys brachysoma</i>	Pacific Short-bodied Pipefish, Short-bodied pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Choeroichthys suillus</i>	Pig-snouted Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Lissocampus fatiloquus</i>	Prophet's Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Cosmocampus banneri</i>	Roughridge Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Corythoichthys schultzi</i>	Schultz's Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Halicampus spinirostris</i>	Spiny-snout Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Campichthys tricarinatus</i>	Three-keel Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Micrognathus micronotopterus</i>	Tidepool Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus subelongatus</i>	West Australian Seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus angustus</i>	Western Spiny Seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Corythoichthys amplexus</i>	Fijian Banded Pipefish, Brown-	TEP	Level 3 SAFE	Low



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
		banded Pipefish			
Teleost	<i>Corythoichthys conspicillatus</i>	Yellow-banded Pipefish, Network Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Doryrhamphus malus</i>	Flagtail Pipefish, Negros Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Doryrhamphus melanopleura</i>	Bluestripe Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Corythoichthys ocellatus</i>	Orange-spotted Pipefish, Ocellated Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Festucalex cinctus</i>	Girdled Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Filicampus tigris</i>	Tiger Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Halicampus grayi</i>	Mud Pipefish, Gray's Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Heraldia nocturna</i>	Upside-down Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Hippichthys cyanospilos</i>	Blue-speckled Pipefish, Blue-spotted Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Hippichthys heptagonus</i>	Madura Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Hippichthys penicillus</i>	Beady Pipefish, Steep-nosed Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus bleekeri</i>	Pot bellied seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus breviceps</i>	Short-head Seahorse, Short-	TEP	Level 3 SAFE	Low



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
		snouted Seaho			
Teleost	<i>Hippocampus taeniopterus</i>	Spotted Seahorse, Yellow Seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus planifrons</i>	Flat-face Seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Histiogamphelus briggsii</i>	Briggs' Crested Pipefish, Briggs' Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Histiogamphelus cristatus</i>	Rhino Pipefish, Macleay's Crested Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Hypselognathus horridus</i>	Shaggy Pipefish, Prickly Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Hypselognathus rostratus</i>	Knife-snouted Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Kaupus costatus</i>	Deep-bodied Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Leptoichthys fistularius</i>	Brushtail Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Lissocampus caudalis</i>	Australian Smooth Pipefish, Smooth Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Lissocampus runa</i>	Javelin Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Maroubra perserrata</i>	Sawtooth Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Mitotichthys semistriatus</i>	Half-banded Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Mitotichthys tuckeri</i>	Tucker's Pipefish	TEP	Level 3 SAFE	Low



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Teleost	<i>Notiocampus ruber</i>	Red Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Phycodurus eques</i>	Leafy Seadragon	TEP	Level 3 SAFE	Low
Teleost	<i>Phyllopteryx taeniolatus</i>	Weedy Seadragon, Common Seadragon	TEP	Level 3 SAFE	Low
Teleost	<i>Stigmatopora argus</i>	Spotted Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Stigmatopora nigra</i>	Wide-bodied Pipefish, Black Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Stipecampus cristatus</i>	Ring-backed Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Syngnathoides biaculeatus</i>	Double-ended Pipehorse, Alligator Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Pugnaso curtirostris</i>	Pug-nosed Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Solegnathus</i> sp. 1 [in Kuitert, 2000]	Pipehorse	TEP	Level 3 SAFE	Low
Teleost	<i>Solegnathus robustus</i>	Robust Spiny Pipehorse, Robust Pipehorse	TEP	Level 3 SAFE	Low
Teleost	<i>Solegnathus spinosissimus</i>	Spiny pipehorse	TEP	Level 3 SAFE	Low
Teleost	<i>Trachyrhamphus bicoarctatus</i>	Bend Stick Pipefish, Short-tailed Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Urocampus carinirostris</i>	Hairy Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Vanacampus margaritifer</i>	Mother-of-pearl Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Vanacampus phillipi</i>	Port Phillip Pipefish	TEP	Level 3 SAFE	Low



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Teleost	<i>Vanacampus poecilolaemus</i>	Australian Long-snout Pipefish, Long-snouted Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Vanacampus vercoi</i>	Verco's Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Nannocampus subosseus</i>	Bony-headed Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Mitotichthys meraculus</i>	Western Crested Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Heraldia</i> sp. 1 [in Kuitert, 2000]	Western upsidedown pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Choeroichthys cinctus</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Corythoichthys haematopterus</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Cosmocampus maxweberi</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Halicampus macrorhynchus</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Halicampus mataafae</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Hippichthys spicifer</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus alatus</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus bargibanti</i>	Pygmy seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus dahli</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus multispinus</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus zebra</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Micrognathus pygmaeus</i>	[a pipefish]	TEP	Level 3 SAFE	Low



Taxonomic group	Scientific name	Common name	Role in fishery	Highest level of assessment	Risk score
Teleost	<i>Micrognathus natans</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Microphis brachyurus</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Nannocampus lindemanensis</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Phoxocampus diacanthus</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Siokunichthys breviceps</i>	[a pipefish]	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus abdominalis</i>	Big-bellied / southern potbellied seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus histrix</i>	Spiny Seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus kuda</i>	Spotted Seahorse, Yellow Seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus subelongatus</i>	West Australian Seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Idiotropiscis larsonae</i>	Helen's Pygmy Pipehorse	TEP	Level 3 SAFE	Low
Teleost	<i>Hippichthys parvicarinatus</i>	Short-keeled Pipefish	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus biocellatus</i>	False-eyed seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus tuberculatus</i>	Knobby Seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Hippocampus grandiceps</i>	Bighead Seahorse	TEP	Level 3 SAFE	Low
Teleost	<i>Idiotropiscis australe</i>	Southern Pygmy Pipehorse	TEP	Level 3 SAFE	Low

In recent times there have been very few interactions reported with protected species in the WTBF (four turtles, two released alive, and one Toothed whale released alive in 2008). Again, this is due to the low level of effort; AFMA will maintain adequate levels of monitoring of



interactions with protected species to ensure compliance with relevant documents and the EPBC Act.

Action: AFMA will maintain the prescribed level of observer coverage in the fishery to continue to monitor the impacts of the fishery on TEP species.

5. 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. Review of the ERM policy will be based around review of the above documents, including review of the ERA.

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.

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.

The ERA process for the WTBF will be reviewed if effort in the fishery reaches 2 million hooks per annum, up from current levels of around 200,000 to 400,000 hooks per annum. This is around 30 per cent of the historical peak effort and around 25 per cent of the current Eastern Tuna and Billfish Fishery effort. A review at this level of effort will be precautionary, providing data to better enable the analysis of the effect of the fishery on species that occur in the area of the fishery as effort increases.



6. 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: <ul style="list-style-type: none">• 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 species, habitats, and ecological communities.
ESD	Ecologically Sustainable Development is the ecological component of the development of a resource, based around the precautionary principle. In implementing the ecological component of ESD, AFMA considers the impact that fishing has on the following ecosystem elements, target and byproduct species, bycatch, protected species, and community and habitat interactions.
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.
TEP	Threatened, Endangered and Protected species
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
WTBF	Western Tuna and Billfish Fishery
ATBLF	Australian Tuna and Billfish Longline Fishery

Level 3 SAFE risk categories

F_{msm}	“instantaneous fishing mortality corresponding to the maximum sustainable death due to fishing (maximum sustainable mortality of fishing, <i>MSM</i>) at B_{msm} (biomass that supports <i>MSM</i>). This is similar to the F_{msy} that supports a maximum sustainable yield for target species. For simplicity we call F_{msm} “maximum sustainable (instantaneous) fishing mortality (rate)”.”(Zhou <i>et al</i> 2009)
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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 ($0.5B_{msm}$). We refer F_{lim} as “limit fishing mortality (rate)”” (Zhou <i>et al</i> 2009)
F_{rash}	“minimum unsustainable fishing mortality that, in theory, will lead to population extinction in the longer term.” (Zhou <i>et al</i> 2009)
F_{cur}	estimated current fishing mortality (Zhou <i>et al</i> 2009)

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.



7. References

AFMA (2008) AFMA's Program for Addressing Bycatch and Discarding in Commonwealth Fisheries: an Implementation Strategy. Australian Fisheries Management Authority, Canberra, Australia.

AFMA (2008) Ecological Risk Assessment: Residual Risk Assessment for Eastern Tuna and Billfish Fishery

DAFF (2006) National Strategy to Address Interactions between Humans and Seals: Fisheries, Aquaculture and Tourism. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra, Australia.

DAFF (2007) Commonwealth Fisheries Harvest Strategy: Policy and Guidelines. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra, Australia.

Environment Australia (2003) Recovery Plan for Marine Turtles in Australia. Approvals and Wildlife Division, Environment Australia, Canberra, Australia.

Evans, S (2007) Eastern Tuna and Billfish Fishery Data summary 2005-2006, Australian Fisheries Management Authority, Canberra, Australia

Gilman, E., Clarke, S., Brothers, N., Alfaro-Shigueto-J., Mandelman, J., Mangel, J., Petersen, S., Piovano, S., Thomson, N., Dalzell, P., Donoso, M., Goren, M., Werner, T. (2007) *Shark Depredation and Unwanted Bycatch in Pelagic Longline Fisheries: Industry Practices and Attitudes, and Shark Avoidance Strategies*. Western Pacific Regional Fishery

Hobday, A.J., Smith, A, Webb, H., Daley, R., Wayte, S., Bulman, C., Dowdney, J., Williams, A., Sporcic, M., Dambacher, J., Fuller, M., Walker, T. (2007) Ecological Risk Assessment for the Effects of Fishing: Methodology. Report R04/1072 for the Australian Fisheries Management Authority, Canberra, Australia.

Hobday, A. J., J. Dowdney, C. Bulman, M. Sporcic, M. Fuller, S. Ling (2007) Ecological Risk Assessment for the Effects of Fishing: Southern Bluefin Tuna Purse Seine Fishery. Report for the Australian Fisheries Management Authority.

Zhou, S., Smith, T., Fuller, M. (2007) Rapid Quantitative Risk Assessment for Fish Species in Selected Commonwealth Fisheries. Report for the Australian Fisheries Management Authority, Canberra, Australia.

Zhou, S., Smith, T., Fuller, M. (2009) Rapid Quantitative Risk Assessment for Fish Species in Additional Seven Commonwealth Fisheries. Report for the Australian Fisheries Management Authority, Canberra, Australia.

