



Australian Government

Australian Fisheries Management Authority



Ecological Risk Management

REPORT FOR THE NORTHERN PRAWN FISHERY
- TIGER AND BANANA PRAWN SUB-FISHERIES

July 2009

Summary of priority issues for managing the ecological effects of fishing in the Northern Prawn Fishery

The ecological risk assessment (ERA) process was designed to assess and rank the ecological effects of fishing in Commonwealth fisheries. The ERA process for the Northern Prawn Fishery (NPF) analysed the effect of commercial fishing, based on the effects on all organisms (protected species, by catch, byproduct and target species), habitats and ecological communities that occur in the area of the fishery.

The process provided a list of species, habitats and ecological communities that are at risk of ecological damage from the effects of fishing. The ecological effects of fishing in the NPF are largely due to the incidental capture of non-target species (including the capture of protected species). The methods of fishing employed in the NPF were found to have little to no detrimental impact on the physical marine environment.

The highest level of ERA assessment conducted on the NPF was a quantitative Level 2.5 assessment. The ERA identified seven species at high risk to the effects of fishing in the NPF:

Priority species list from the ERA process for the NPF on which AFMA will focus ERM efforts.

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score
Chondrichthyan	<i>Taeniura meyeni</i>	Blotched fantail ray	DI	SAFE	Extreme High Risk
	<i>Urogymnus asperrimus</i>	Porcupine ray	DI	SAFE	Extreme High Risk
Teleost	<i>Dendrochirus brachypterus</i>	Dwarf lionfish	DI	SAFE	Precautionary Extreme High Risk
	<i>Scorpaenopsis venosa</i>	Raggy scorpionfish	DI	SAFE	Precautionary Extreme High Risk
Invertebrate	<i>Solenocera australiana</i>	Prawn	BP	Level 2 PSA	High
	<i>Dictyosquilla tuberculata</i>	Mantis shrimp	BP	Level 2 PSA	High
	<i>Harpisquilla stephensoni</i>	Mantis shrimp	BP	Level 2 PSA	High

This ecological risk management (ERM) report outlines how AFMA will respond to these high risk environmental components in the NPF to reduce the effects of fishing on the species in the priority list.

No target species were assessed to be at high risk from the effects of fishing in the NPF. No protected species were considered to be at high risk, however consistent with AFMA's ERM process all protected species that are interacted with in the fishery are managed to minimise interactions and fatalities.

Priority issues for managing the ecological effects of fishing in the NPF will largely be captured by the actions of the *Northern Prawn Fishery Bycatch and Discard Workplan 2009*. There are however a number of other initiatives aimed at managing the ecological effects of fishing in the NPF, including compulsory bycatch reduction devices (BRDs) and turtle exclusion devices (TEDs), the NPF Harvest Strategy for key commercial species and Scientific and Crew Member Observer (CMO) programs.



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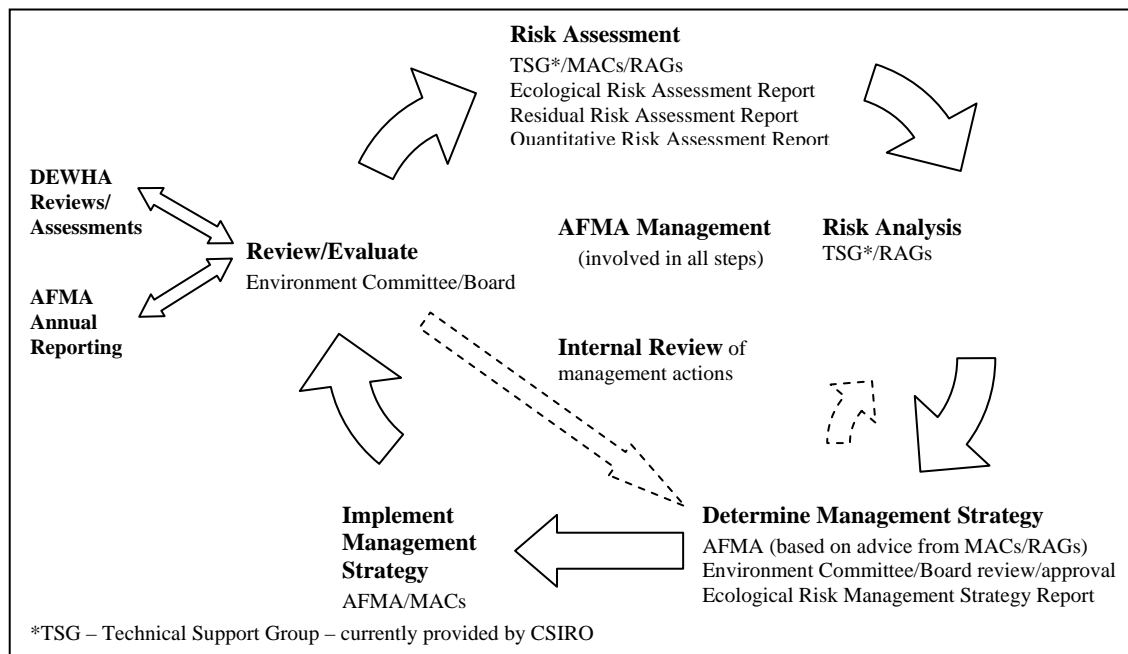
1. OVERVIEW

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

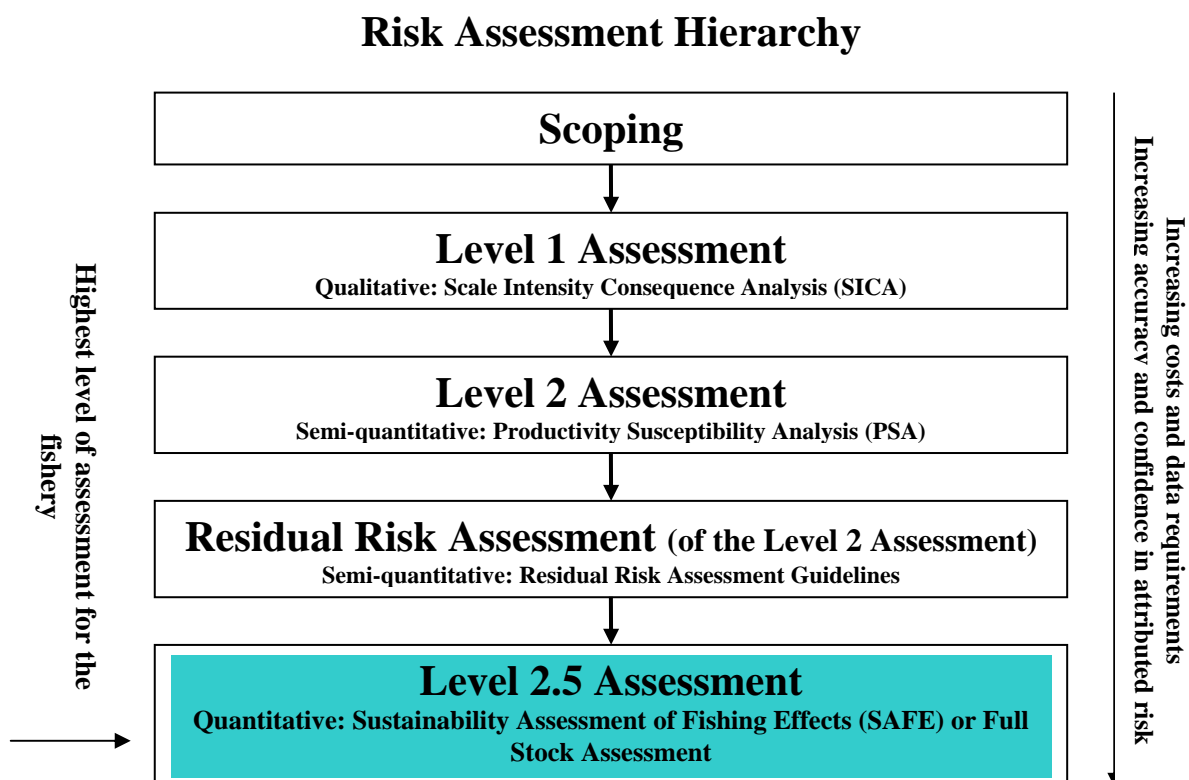


The ERM framework progresses through a number of steps and involves a hierarchy of risk assessment methodologies progressing from a comprehensive but largely qualitative analysis at Level 1 to a quantitative analysis at Level 3 (refer to Figure 2). This approach is a cost and time efficient means of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

The next stage of the assessment process involves the development of a residual risk assessment of the outcomes of the qualitative Level 2 PSA assessment for each individual fishery. Level 2 PSA Residual Risk assessments evaluate and refine ERA high risk outcomes by taking into account additional information not considered through the ERA process, in particular the mitigating effects of some current management arrangements. In addition to the residual risk process, a number of fisheries have also undergone further quantitative risk assessment (Level 3 assessment). (Note the Level 3 Assessment for the Northern Prawn Fishery is referred to as the 2.5 assessment – it was an earlier iteration of the SAFE method methodology).

Figure 2: Risk assessment hierarchy



The combined 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 (ERM) strategy

The priority list for the NPF fishery was developed using:

- the SAFE methodology (2.5 Level Assessment) for any teleost and chondrichthyan species identified as precautionary high risk or above; and
- Level 2 PSA Residual Risk for all other non protected species identified as high risk.

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



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

- Harvest Strategy Policy and Guidelines;
- Non-key Commercial Species (byproduct) Policy;
- Bycatch and Discard Workplan;
- Shark Policy and the Chondrichthyan Guide for Fisheries Managers; and
- Protected (TEP) species under various international plans of action, recovery plans including;
 - Recovery for Marine Turtles in Australia
 - National Plan of Action and Conservation and Management of Sharks, and
 - National Recovery Plan for Whale Sharks.

The NPF 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. ECOLOGICAL RISK MANAGEMENT PRIORITY LIST

The risks that the Northern Prawn Fishery (NPF) poses to the sustainability of the marine ecosystem have been assessed through the application of a progression of risk assessment methodologies, as described in Figure 2.

Assessments undertaken for the fishery include:

1. an individual ERA completed to Level 2 in June 2006;
2. a residual risk assessment completed in July 2007; and,
3. a rapid quantitative risk assessment completed in July 2007.

A summary of the results of each level of assessment for the fishery are provided in Attachment 1.

Priority Species List for the Northern Prawn Fishery

The outcomes of each assessment were compiled to form an initial priority species list for the fishery (Attachment 2). Following further evaluation and discussion by the NPF By-catch Subcommittee and scientific experts in 2009, 20 species were removed from the list. Seven species remain as priorities for the fishery.

The NPF priority list (Table 2) is made up of two chondrichthyans, two teleosts and three invertebrates, and comprises:

- 2 species identified through the level 2.5 assessment as extreme high risk
- 2 species identified through the level 2.5 assessment as precautionary extreme high risk
- 3 species identified through the level 2 residual risk assessment as high risk.

The nature of trawling operations means that it is difficult to design measures which mitigate the capture of single species. The aim of the NPF ERM is thus to mitigate against the capture of entire groups of like-species.



Table 2. Priority Species List for the NPF

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score	ERM Strategy to be applied
Chondrichthyan	<i>Taeniura meyeni</i>	Blotched fantail ray	DI	SAFE	Extreme High Risk	<ul style="list-style-type: none"> NPF Bycatch and Discard Workplan CMO and Observer program
	<i>Urogymnus asperrimus</i>	Porcupine ray	DI	SAFE	Extreme High Risk	<ul style="list-style-type: none"> NPF Bycatch and Discard Workplan CMO and Observer program
Teleost	<i>Dendrochirus brachypterus</i>	Dwarf lionfish	DI	SAFE	Precautionary Extreme High Risk	<ul style="list-style-type: none"> NPF Bycatch and Discard Workplan CMO and Observer program
	<i>Scorpaenopsis venosa</i>	Raggy scorpionfish	DI	SAFE	Precautionary Extreme High Risk	<ul style="list-style-type: none"> NPF Bycatch and Discard Workplan CMO and Observer program
Invertebrate	<i>Solenocera australiana</i>	prawn	BP	Level 2 PSA	High	<ul style="list-style-type: none"> NPF Bycatch and Discard Workplan CMO and Observer program Byproduct policy (proposed)
	<i>Dictyosquilla tuberculata</i>	mantis shrimp	BP	Level 2 PSA	High	<ul style="list-style-type: none"> NPF Bycatch and Discard Workplan CMO and Observer program Byproduct policy (proposed)
	<i>Harpiosquilla stephensoni</i>	mantis shrimp	BP	Level 2 PSA	High	<ul style="list-style-type: none"> NPF Bycatch and Discard Workplan CMO and Observer program Byproduct policy (proposed)

3. ECOLOGICAL RISK MANAGEMENT STRATEGY

The Northern Prawn Fishery (NPF) is currently managed through a series of effort controls including: temporal and spatial closures, limited entry and restrictions on gear (Statutory Fishing Rights). All fishers are also required to make use of turtle excluder and bycatch reduction devices (TEDs and BRDs) when fishing in the NPF. Priority species identified through the ERA process, and TEP species are monitored through a combination of AFMA Scientific and Crew Member Observers.

To address the seven species identified as priorities through the ERA assessment, the ERM strategy for the NPF will employ a number of fisheries management policies and measures to deliver appropriate actions to mitigate risk posed by the fishery. A summary of ERM strategies and actions for the NPF are provided in Table 3.

Table 3. ERM strategies and actions in the NPF

ERM Strategy	Action
Harvest Strategies for Key Commercial (Target and Some Byproduct) Species	<ul style="list-style-type: none"> • Annual implementation of decision rules for the banana and tiger prawn fisheries during the first and second seasons. This includes implementation of a 39.6 tonnes trigger limit for tiger prawns in the first (banana) season, which if exceeded will end the season. • All operators will adhere to byproduct limits specified in the harvest strategy.
Management of Non-Key Commercial (Byproduct) Species	<ul style="list-style-type: none"> • On completion, AFMA will implement the byproduct policy with specific focus given to three of the priority species.
Managing Bycatch and Discards	<ul style="list-style-type: none"> • Contractors to undertake and report on two projects during the 2009 tiger prawn season. If approved, implement and enforce the new bycatch reduction devices (BRDs) in the fishery. • All operators will adhere to current BRD and turtle exclusion devices (TEDs) requirements. • During the 2009 tiger prawn season specific attention will be given to promoting the use of BRDs and increasing industry uptake of new BRDs to reduce smaller bycatch.
Chondrichthyan Guide for Fisheries Managers	<ul style="list-style-type: none"> • AFMA to implement management measures described in CTWG guide for all interactions with chondrichthyans in particular the Blotched fantail ray (<i>Taeniura meyeni</i>).
Protected (TEP) Species	<ul style="list-style-type: none"> • Operators to continue to report all interactions with TEP species to AFMA (AFMA to report all interactions to Department of Environment, Water, Heritage and the Arts (DEWHA)). • All operators to adhere to current BRD and TED requirements, and continue to minimise interactions with all TEP species.
Additional Fishery Specific Management Arrangements	<ul style="list-style-type: none"> • CSIRO and AFMA to continue to monitor and analyse data collected through the AFMA Scientific and Crew Member Observer programs, with specific attention to filling knowledge gaps for bycatch species.



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. Target species are the most highly sought component of the catch taken in a fishery, and for the NPF target species make it the most valuable Commonwealth managed fishery.

Individual Harvest Strategies set out clear decision rules to manage fisheries in an environmentally sustainable manner while also ensuring maximum economic returns. In 2007, the *Northern Prawn Fishery (NPF) Harvest Strategy under Input Controls* was developed for nine target species and a number of byproduct species in the NPF. The document specifically provides an operating framework which will deliver stock sustainability and maximum economic return for the NPF.

Target Species: White banana, Red-legged banana, Grooved Tiger, Brown Tiger, Blue Endeavour, Red Endeavour, Western King, Red-spot King and Giant Tiger

Byproduct Species: Bugs, scampi, squid, mud crabs, ornate tropical rock lobster, northern saucer scallop, emperors, breams, trouts, cods, groupers, longtail tuna, snapper and mackerel.

Action: Annual implementation of decision rules for the banana and tiger prawn fisheries during the first and second seasons. This includes implementation of a 39.6 tonnes trigger limit for tiger prawns in the first (banana) season, which if exceeded will end the season.

All operators will adhere to byproduct limits specified in the harvest strategy.

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. Once developed, three of the seven priority species for the NPF will fall under this policy; one prawn (*Solenocera Australiana*) and two mantis shrimps (*Dictyosquilla tuberculata* and *Harpiosquilla stephensoni*). Other byproduct groups for the NPF, including some cuttlefish and squid species, will also fall under this policy.

Action: On completion, AFMA will implement the byproduct policy with specific focus given to three of the priority species.



Managing bycatch and discards

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 NPF has a bycatch and discarding workplan in the form of the *Northern Prawn Fishery bycatch and discarding workplan 2009*. The main features of the workplan are to specify management measures to monitor and reduce interactions with high risk and protected species, and prevent discarding of target species.

The NPF workplan defines a range of actions to be undertaken within the fishery to respond to the outcomes of the ERA and ERM processes. Common bycatch groups for the NPF include rays, scorpionfish, lionfish, bream, snapper and flatheads.

The workplan outlines a number of projects aimed at reducing bycatch across the fishery. Projects will incorporate a focus on reducing the impact on four of the seven priority species for the fishery; Blotched fantail ray (*Taeniura meyeni*), Porcupine ray (*Urogymnus asperrimus*), Dwarf lionfish (*Dendrochirus brachypterus*) and Raggy scorpionfish (*Scorpaenopsis venosa*).

Two projects in particular will be undertaken during the 2009 tiger prawn season aimed at reducing bycatch:

1. trial of lights on the headlines to reduce bycatch without compromising catch of target species; and
2. trial of Hills net grid extension and co-end to reduce bycatch, specifically species of teleosts, invertebrates and seasnakes.

If the devices prove successful and approved for use in the fishery, and if considerable uptake of the devices is reached, the fishery could see a successful reduction in bycatch.

Another key component of the bycatch and discarding workplan is to improve reporting of bycatch in the NPF. There are a range of reasons why species can be assessed as at risk or high risk in a fishery, including a lack of information. For example, the impact of the fishery on invertebrates is not well understood. There are critical information gaps on this group of species that when filled will inform the risk assessment process. Projects listed in the workplan will focus on gathering information on catch rates and biology for key bycatch species, such as the two teleost species that are potentially at risk.

Monitoring programs including the scientific and crew member observers programs will also focus on filling these information gaps.

Actions: Contractors to undertake and report on two projects during the 2009 tiger prawn season. If approved, implement and enforce the new bycatch reduction devices (BRDs) in the fishery.

All operators will adhere to current BRD and turtle exclusion devices (TEDs) requirements.

During the 2009 tiger prawn season specific attention will be given to promoting the use of BRDs and increasing industry uptake of new BRDs to reduce smaller bycatch.



Chondrichthyan Guide for Fisheries Managers

A practical guide has been released by a Chondrichthyan Technical Working Group (CTWG) to assist fishery managers and stakeholders to adopt and implement management arrangements for Chondrichthyan species. The CTWG utilised expert based advice to develop effective mitigation strategies and to identify gaps in research and data.

For the NPF the guide can be used for managing interactions with sharks, rays and sawfish. Specifically the Blotched fantail ray (*Taeniura meyeni*) and the Porcupine ray (*Urogymnus asperrimus*).

Actions: AFMA to implement management measures described in CTWG guide for all interactions with chondrichthyans in particular the Blotched fantail ray (*Taeniura meyeni*).

Protected (TEP) species

128 threatened, endangered or protected species (TEP) are theoretically found within the waters of the NPF. These include 8 species of sharks/rays, 12 species of seabirds, 23 species of marine mammals, 41 species of marine reptiles and 44 species of bony fish.

Consistent with good fisheries management and the specific requirements of the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*, AFMA will take all reasonable steps to ensure that interactions with these TEP species are minimised. All TEP species to be addressed in the NPF are listed in Attachment 3.

NPF operations interact with several groups of protected (TEP) species including sawfish, sea snakes, turtles, sharks, syngnathids and to a limited extent marine mammals and birds. All protected (TEP) species identified through the ERA process (as occurring in the area of the fishery) will automatically be a priority for the fishery. Many of these species are already managed under various international plans of action including the:

- Recovery Plan for Marine Turtles in Australia;
- National Plan of Action and Conservation and Management of Sharks, and
- National Recovery Plan for Whale Sharks.

Turtle mitigation has been successfully addressed with the mandatory introduction of turtle exclusion devices (TEDs) into the fishery in 2000. Development of these excluder devices will continue to pursue minimal interactions with marine turtles. Bycatch Reduction Devices (BRDs) have also been mandated into the fishery and are aimed at reducing fish volume bycatch. A new BRD that was legislated as an approved device has also shown excellent results in allowing the escapement of sea snakes from nets.

Actions: Operators to continue to report all interactions with TEP species to AFMA (AFMA to report all interactions to Department of Environment, Water, Heritage and the Arts (DEWHA)).

All operators to adhere to current BRD and TED requirements, and continue to minimise interactions with all TEP species.



Additional fishery specific management arrangements

In addition to the policies and measures detailed above, the NPF has also implemented a number of monitoring programs including Logbook monitoring, a Crew Member Observer program, AFMA Scientific Observers and Fishery Independent Surveys. These programs are designed to address deficiencies in scientific knowledge highlighted in the ERA process.

Actions: CSIRO and AFMA to continue to monitor and analyse data collected through the AFMA Scientific and Crew Member Observer programs, with specific attention to filling knowledge gaps for bycatch species.

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 the fishery. These individual mitigation measures will also be used when providing input to annual reporting requirements for the Department of the Environment, Water, Heritage and the Arts (DEWHA).

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.

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.

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 DEWHA.

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. 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.



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 (BP) and bycatch species (DI); protected (TEP) species; habitats; and ecological communities.
EBFM	Ecosystem-based fisheries management considers the impact that fishing has on all of the aspects of the broader marine ecosystem, not just the target species.
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 2.5 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



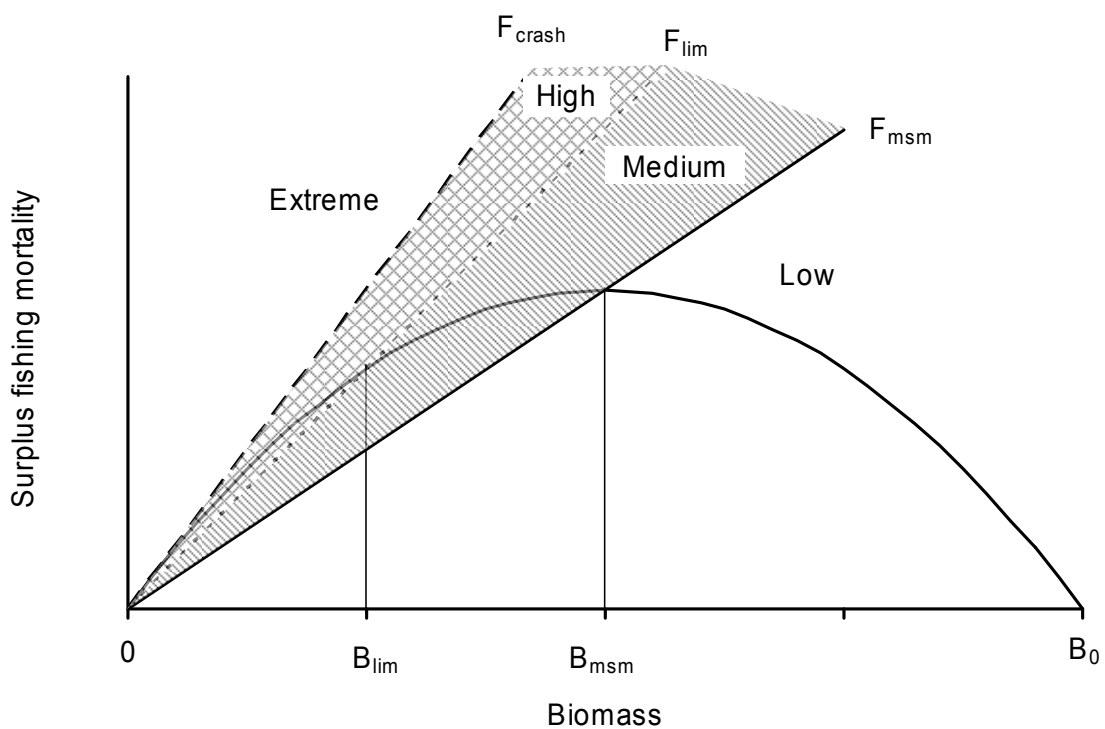
mortality rate plus a 90% confidence interval is greater than or equal to a fishing mortality rate corresponding to limit biomass

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 (fishing mortality rates that exceed the intrinsic reproductive rate for the species, and as such does represent risk of extinction (in the longer term)).

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

Precautionary categories (for medium, high and extreme risk) take uncertainty into account from the analyses.

A graphical representation of the Level 2.5 assessment risk definitions (ref: Tony Smith 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.



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AAD (2006) Threat abatement Plan 2006: for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations. Australian Antarctic Division, Australian Government Department of the Environment and Water Resources, Kingston, Australia.

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.

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

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Attachment 1

Table 1. Results at each level of assessment for the Tiger prawn sub-fishery.

Level of assessment and risk levels attributed	Target Species	Byproduct Species	Bycatch Species	TEP Species
Level 1 SICA Assessment				
Consequence score (for each species component)	4	4	4	5
Proceeded to Level 2 PSA Assessment (scores ≥ 3)	9	135	0	128
Level 2 PSA Assessment				
High Risk		16	N/A	9
Medium Risk	2	19	N/A	62
Low Risk	7	100	N/A	57
Level 2 PSA Residual Risk Assessment				
High Risk	0	14	N/A	9
Medium Risk	2	21	N/A	62
Low Risk	7	100	N/A	57
Level 2.5 SAFE Assessment				
Extreme High Risk	N/A	0	5	0
Precautionary Extreme High Risk	N/A	0	5	0
High Risk	N/A	0	1	0
Precautionary High Risk	N/A	0	4	0
Medium Risk	N/A	0	4	0
Precautionary Medium Risk	N/A	2	10	0
Low Risk	N/A	54	439	5
Overlap with Level 2 PSA Residual Risk Assessment	N/A	56	0	5

Table 2. Details the results at each level of assessment for the Banana prawn sub-fishery.

Level of assessment and risk levels attributed	Target Species	Byproduct Species	Bycatch Species	TEP Species
Level 1 SICA Assessment				
Consequence score (for each species component)	4	4	4	5
Proceeded to Level 2 PSA Assessment (scores ≥ 3)	9	135	0	128
Level 2 PSA Assessment				
High Risk	0	15	N/A	12
Medium Risk	2	19	N/A	58
Low Risk	7	101	N/A	58
Level 2 PSA Residual Risk Assessment				
High Risk	0	13	N/A	12
Medium Risk	2	21	N/A	58
Low Risk	7	101	N/A	58
Level 2.5 SAFE Assessment				
Extreme High Risk	N/A	0	5	0
Precautionary Extreme High Risk	N/A	0	5	0
High Risk	N/A	0	1	0
Precautionary High Risk	N/A	0	4	0
Medium Risk	N/A	0	4	0
Precautionary Medium Risk	N/A	2	10	0
Low Risk	N/A	54	439	5
Overlap with Level 2 PSA Residual Risk Assessment	N/A	56	0	5

Attachment 2

Highest Level of Assessment

This list below describes the highest level of assessment undertaken for the fishery thus far and included:

- all teleost or chondrichthyan species identified as high risk or above under the Level 2.5 Assessment (SAFE methodology);
- all other non protected species identified as high risk under the Level 2 PSA Residual Risk; noting that:

of the 128 protected (TEP) species thought to occur within the area of the fishery seven seasnake species were identified at high risk through these processes.

The list contained a total of 27 species comprising of five chondrichthyans, nine teleosts, six invertebrates and seven marine reptiles; comprising:

- 5 species identified through the level 2.5 assessment as extreme high risk;
- 5 species identified through the level 2.5 assessment as precautionary extreme high risk;
- 2 TEP species identified through the level 2.5 assessment as high risk;
- 4 species identified through the level 2.5 assessment as precautionary high risk;

11 species (5 of which are TEP species) have not undergone a further rapid quantitative risk assessment and are identified as high risk.

The table below lists, and provides justifications, for expert overrides applied to the species identified as at high risk from commercial fishing operations.



Attachment 2

Combined results following the outcomes of the highest level of assessment for the fishery and justifications for species removal

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score	Comments	Reference
Chondrichthyan	<i>Orcectolobus ornatus</i>	Banded wobbegong	DI	SAFE	Extreme High Risk	Distribution across eastern Australian coast, reef associated. Experts agreed species was not at risk as it did not occur in area of the fishery.	Expert opinion provided by Chondrichthyan Technical Working Group; May 2009. See Last and Stevens (2009) and Fishbase (2009)
	<i>Taeniura meyeni</i>	Blotched fantail ray	DI	SAFE	Extreme High Risk	To remain on list and continue to be addressed as part of the current monitoring program.	To be re-assessed in current CSIRO project – by December 2009.
	<i>Urogymnus asperrimus</i>	Porcupine ray	DI	SAFE	Extreme High Risk	To remain on list and continue to be addressed as part of the current monitoring program.	To be re-assessed in current CSIRO project – by December 2009.
	<i>Carcharhinus albimarginatus</i>	Silvertip shark	DI	SAFE	Extreme High Risk	Widely distributed outside of NPF; species has extensive distribution across tropical Indo-Pacific coastal waters; including Indonesian waters. Caught once in the fishery.	See Last and Stevens (2009) and Fishbase (2009).
	<i>Squatina</i> sp. A	Eastern angel shark	DI	SAFE	Extreme High Risk	Species only occurs along the east coast of QLD, and south to Lakes Entrance, Victoria.	See Last and Stevens (2009).
Teleost	<i>Dendrochirus brachypterus</i>	Dwarf lionfish	DI	SAFE	Precautionary Extreme High Risk	To remain on list and continue to be addressed as part of the current monitoring program.	To be re-assessed in current CSIRO project – by December 2009.
	<i>Scorpaenopsis venosa</i>	Raggy scorpionfish	DI	SAFE	Precautionary Extreme High Risk	To remain on list and continue to be addressed as part of the current monitoring program. Rarely caught and is only a perceived risk. There may issues with identification.	To be re-assessed in current CSIRO project – by December 2009.
	<i>Parascolopsis tosensis</i>	Tosa dwarf monocle bream	DI	SAFE	Precautionary Extreme High Risk	Distribution primarily outside the NPF; Western Pacific: Indonesia, Japan, Malaysia, Philippines, Taiwan, China and East Timor. Considered not at risk	See Fishbase (2009) and Russell (1990).

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Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score	Comments	Reference
	<i>Hemiramphus robustus</i>	Three-by-two garfish	DI	SAFE	Precautionary Extreme High Risk	Species primarily occupies coastal regions and estuaries. Pelagic species and slender body morphology result in extremely low selectivity by trawls. Highly unlikely to be at risk by NPF.	Expert opinion provided by Shane Griffiths; July 2009.
	<i>Lutjanus rufolineatus</i>	Yellowlined snapper	DI	SAFE	Precautionary Extreme High Risk	Reef associated, distribution primarily outside the NPF; Indo-West Pacific: Maldives, Japan to Indonesia and northern Australia east to Samoa and Tonga – but populations within the Gulf may be at risk.	See Fishbase (2009) and Allen (1995)
	<i>Onigocia spinosa</i>	Midget flathead	DI	SAFE	Precautionary high	Distribution primarily outside the NPF; Western Pacific: Japan, South China Sea, Philippines, northwest shelf of Australia through Timor and Arafura Sea – but populations within the Gulf may be at risk.	See Fishbase (2009) and Sainsbury et al (1985).
	<i>Bentosema pterotum</i>	Skinnycheek lanternfish	DI	SAFE	Precautionary high	Deepwater species; 10-300m, Bathypelagic species and small body morphology result in extremely low selectivity by trawls. Highly unlikely to be at risk by NPF. Extensive distribution primarily outside the NPF; Indo-west Pacific: Arabian Sea to West Pacific, southeast Atlantic, possibly northwest Pacific and eastern Indian Ocean – but populations within the Gulf may be at risk.	See Fishbase (2009) and Hulley (1986).

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Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score	Comments	Reference
	<i>Scomberoides commersonianus</i>	Talang queenfish	DI	SAFE	Precautionary high	Species has wide distribution outside the Gulf of Carpentaria, occupying coastal regions and estuaries across southern hemisphere tropical waters (very common species). Members confident that species is not at high risk. Pelagic distribution result in extremely low selectivity by trawls. Highly unlikely to be at risk by NPF	Expert opinion provided by Shane Griffiths; July 2009. See Griffiths et al (2006).
	<i>Sphyræna jello</i>	Giant seapike	DI	SAFE	Precautionary High	Pelagic species with a wide distribution outside NPF. Most common around reefs. Extremely low selectivity by trawls, rarely caught in the fishery. Highly unlikely to be at risk by NPF.	Expert opinion provided by Shane Griffiths; July 2009.
Invertebrate	<i>Euprymna hoylei</i>	Cuttlefish (Bobtail squid)	BP	Level 2 PSA	High	Extremely rare in trawl catches. David Milton examined family level assessment and they were never caught. Reported around the Philippines and northwestern Australia (max 3-4 cm ML). Unlikely to be retained in prawn trawl nets.	Expert opinion provided by Malcolm Dunning and David Milton; May 2009.
	<i>Metasepia pfefferi</i>	Cuttlefish (Flamboyant cuttlefish)	BP	Level 2 PSA	High	Widespread but nowhere abundant in trawl catches throughout northern Australian waters to at least Moreton Bay, on the east coast. Occurs from shallow coral and rocky reefal areas to mid shelf depths. This is a small species (max ~10 cm ML) that probably only lives for a few months.	Expert opinion provided by Malcolm Dunning; May 2009.
	<i>Solenocera australiana</i>	prawn	BP	Level 2 PSA	High	To remain on list and continue to be addressed as part of the current monitoring program.	To be re-assessed in current CSIRO project – by December 2009.

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Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score	Comments	Reference
	<i>Photololigo sp. 3 and sp 4 of Yeatman (1993)</i>	broad squid and slender squid	BP	Level 2 PSA	High	Major squid species in trawl byproduct. Species are wide spread across northern Australia (central NSW to Shark Bay WA); catchability in prawn trawls lower at night when squid move up into the water column. However, egg clusters and adults highly susceptible to trawling in spawning grounds (Dunning et al (2000). Current catch at acceptable biological catch limit; see Milton Byproduct Assessment (FRDC 2006/008).	Expert opinion provided by Malcolm Dunning; May 2009. Expert opinion provided by Milton. See Byproduct Assessment (FRDC 2006/008). See Dunning et al (2000).
	<i>Dictyosquilla tuberculata</i>	mantis shrimp	BP	Level 2 PSA	High	To remain on list and continue to be addressed as part of the current monitoring program.	To be re-assessed in current CSIRO project – by December 2009.
	<i>Harpisquilla stephensoni</i>	mantis shrimp	BP	Level 2 PSA	High	To remain on list and continue to be addressed as part of the current monitoring program.	To be re-assessed in current CSIRO project – by December 2009.
Marine Reptile	<i>Hydrophis belcheri</i>	a seasnake	TEP	Level 2 PSA	High	One individual found in northern Papua New Guinea and not found in Australia.	Expert opinion provided by David Milton; May 2009. See Cogger (1992).
	<i>Parahydrophis mertoni</i>	Northern mangrove seasnake	TEP	Level 2 PSA	High (Tiger only)	Found in Mudflats and mangroves and not in depth zone of NPF.	Expert opinion provided by David Milton; May 2009. See Cogger (1992)
	<i>Hydrophis ornatus</i>	seasnake	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)	Trawl mortality was below reference points. Remove from list as per Milton seasnake assessment (FRDC 2005/051).	Expert opinion provided by David Milton; May 2009. See Seasnake Assessment (FRDC 2005/051).
	<i>Hydrophis pacificus</i>	Large-headed seasnake	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)	Remove from list as per Milton seasnake assessment (FRDC 2005/051).	Expert opinion provided by David Milton; May 2009. See Seasnake Assessment (FRDC 2005/051).

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Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score	Comments	Reference
	<i>Hydrophis vorisi</i>	A seasnake	TEP	Level 2 PSA	High (Banana only)	Trawl mortality was below reference points. Remove from list as per Milton seasnake assessment (FRDC 2005/051).	Expert opinion provided by David Milton; May 2009. See Cogger (1992).
	<i>Ephalophis greyi</i>	North-western Mangrove seasnake	TEP	Level 2 PSA	High	Found in eastern Torres Strait only and not in NPF.	Expert opinion provided by David Milton; May 2009. See Cogger (1992).
	<i>Hydrophis coggeri</i>	Slender-necked seasnake	TEP	Level 2 PSA	High	Found in mudflats and mangroves along WA coast and not in depth zone or distributed within NPF.	Expert opinion provided by David Milton; May 2009. See Cogger (1992).

Note. In cases where species have known widespread distributions primarily outside the NPF, the species is deemed not at risk. However, potential existence of sub-population/genetically distinct local populations, and how to manage this issue will need to be discussed by the bycatch subcommittee.

Species remaining on the list will be re-assessed by CSIRO under *Assessing sustainability of the NPF bycatch from annual monitoring data 2008* (P/N: 2008/826). The project is focused on long term data collection and monitoring of bycatch to assist in developing appropriate management options for at-risk species.

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Attachment 3

Protected (TEP) species for the Northern Prawn Fishery identified through the risk assessment process.

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Highest Level of Assessment	Risk Score
Chondrichthyan	<i>Anoxypristis cuspidata</i>	Narrow Sawfish	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)
Chondrichthyan	<i>Glyphis sp C</i>	Speartooth Shark	TEP	Level 2 PSA	Medium
Chondrichthyan	<i>Glyphis sp. A [in Last & Stevens, 1994]</i>	Speartooth Shark	TEP	Level 2 PSA	Medium
Chondrichthyan	<i>Pristis clavata</i>	Dwarf Sawfish	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)
Chondrichthyan	<i>Pristis microdon</i>	Freshwater Sawfish	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)
Chondrichthyan	<i>Pristis pectinata</i>	Wide Sawfish	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)
Chondrichthyan	<i>Pristis zijsron</i>	Green Sawfish	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)
Chondrichthyan	<i>Rhincodon typus</i>	whale shark	TEP	Level 2 PSA	Medium
Marine bird	<i>Anous minutus</i>	Black Noddy	TEP	Level 2 PSA	Low
Marine bird	<i>Anous stolidus</i>	Common noddy	TEP	Level 2 PSA	Low
Marine bird	<i>Calonectris leucomelas</i>	streaked shearwater	TEP	Level 2 PSA	Medium
Marine bird	<i>Fregata ariel</i>	Lesser frigatebird	TEP	Level 2 PSA	Low
Marine bird	<i>Fregata minor</i>	Great Frigatebird,	TEP	Level 2 PSA	Low
Marine bird	<i>Larus novaehollandiae</i>	Silver Gull	TEP	Level 2 PSA	Low
Marine bird	<i>Sterna anaethetus</i>	Bridled Tern	TEP	Level 2 PSA	Low
Marine bird	<i>Sterna bengalensis</i>	Lesser crested tern	TEP	Level 2 PSA	Low



Marine bird	<i>Sterna bergii</i>	Crested Tern	TEP	Level 2 PSA	Low
Marine bird	<i>Sterna dougallii</i>	Roseate tern	TEP	Level 2 PSA	Low
Marine bird	<i>Sterna sumatrana</i>	Black-naped tern	TEP	Level 2 PSA	Low
Marine bird	<i>Sula leucogaster</i>	Brown boobies	TEP	Level 2 PSA	Low
Marine mammal	<i>Balaenoptera bonaerensis</i>	Antarctic Minke Whale	TEP	Level 2 PSA	Medium
Marine mammal	<i>Balaenoptera edeni</i>	Bryde's Whale	TEP	Level 2 PSA	Medium
Marine mammal	<i>Balaenoptera musculus</i>	Blue Whale	TEP	Level 2 PSA	Medium
Marine mammal	<i>Delphinus delphis</i>	Common Dolphin	TEP	Level 2 PSA	Low
Marine mammal	<i>Dugong dugon</i>	Dugong	TEP	Level 2 PSA	Medium
Marine mammal	<i>Feresa attenuata</i>	Pygmy Killer Whale	TEP	Level 2 PSA	Medium
Marine mammal	<i>Globicephala macrorhynchus</i>	Short-finned Pilot Whale	TEP	Level 2 PSA	Medium
Marine mammal	<i>Grampus griseus</i>	Risso's Dolphin	TEP	Level 2 PSA	Medium
Marine mammal	<i>Kogia breviceps</i>	Pygmy Sperm Whale	TEP	Level 2 PSA	Medium
Marine mammal	<i>Kogia simus</i>	Dwarf Sperm Whale	TEP	Level 2 PSA	Medium
Marine mammal	<i>Orcaella brevirostris</i>	Irrawaddy dolphin	TEP	Level 2 PSA	Medium
Marine mammal	<i>Orcinus orca</i>	Killer Whale	TEP	Level 2 PSA	Medium
Marine mammal	<i>Peponocephala electra</i>	Melon-headed Whale	TEP	Level 2 PSA	Medium
Marine mammal	<i>Physeter catodon</i>	Sperm Whale	TEP	Level 2 PSA	Medium
Marine mammal	<i>Pseudorca crassidens</i>	False Killer Whale	TEP	Level 2 PSA	Medium
Marine mammal	<i>Sousa chinensis</i>	Indo-Pacific Humpback Dolphin	TEP	Level 2 PSA	Medium
Marine mammal	<i>Stenella attenuata</i>	Spotted Dolphin	TEP	Level 2 PSA	Medium
Marine mammal	<i>Stenella coeruleoalba</i>	Striped Dolphin	TEP	Level 2 PSA	Medium



Marine mammal	<i>Stenella longirostris</i>	Long-snouted Spinner Dolphin	TEP	Level 2 PSA	Medium
Marine mammal	<i>Steno bredanensis</i>	Rough-toothed Dolphin	TEP	Level 2 PSA	Medium
Marine mammal	<i>Tursiops aduncus</i>	Indian Ocean bottlenose dolphin	TEP	Level 2 PSA	Medium
Marine mammal	<i>Tursiops truncatus</i>	Bottlenose Dolphin	TEP	Level 2 PSA	Medium
Marine mammal	<i>Ziphius cavirostris</i>	Cuvier's Beaked Whale	TEP	Level 2 PSA	Medium
Marine reptile	<i>Acalyptophis peronii</i>	Horned Seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Aipysurus apraefrontalis</i>	Short-nosed Seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Aipysurus duboisii</i>	Dubois' Seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Aipysurus eydouxii</i>	Spine-tailed Seasnake	TEP	SAFE	Medium
Marine reptile	<i>Aipysurus foliosquama</i>	Leaf-scaled Seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Aipysurus fuscus</i>	Dusky Seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Aipysurus laevis</i>	Olive Seasnake, Golden Seasnake	TEP	SAFE	Medium
Marine reptile	<i>Aipysurus tenuis</i>	Brown-lined Seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Astrotia stokesii</i>	Stokes' seasnake	TEP	SAFE	Medium
Marine reptile	<i>Caretta caretta</i>	Loggerhead	TEP	SAFE	Medium
Marine reptile	<i>Chelonia mydas</i>	Green turtle	TEP	SAFE	Medium
Marine reptile	<i>Crocodylus johnstoni</i>	freshwater crocodile	TEP	Level 2 PSA	Medium
Marine reptile	<i>Crocodylus porosus</i>	saltwater crocodile	TEP	Level 2 PSA	Medium
Marine reptile	<i>Dermochelys coriacea</i>	Leathery turtle	TEP	SAFE	Medium
Marine reptile	<i>Disteira kingii</i>	spectacled seasnake	TEP	SAFE	Medium
Marine reptile	<i>Disteira major</i>	Olive-headed Seasnake	TEP	SAFE	Medium



Marine reptile	<i>Emydocephalus annulatus</i>	Turtle-headed Seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Enhydrina schistosa</i>	Beaked Seasnake	TEP	Level 2 PSA	Low
Marine reptile	<i>Ephalophis greyi</i>	North-western Mangrove Seasnake	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)
Marine reptile	<i>Eretmochelys imbricata</i>	Hawksbill turtle	TEP	SAFE	Medium
Marine reptile	<i>Hydrelaps darwiniensis</i>	Black-ringed Seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Hydrophis atriceps</i>	Black-headed seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Hydrophis belcheri</i>	a seasnake	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)
Marine reptile	<i>Hydrophis caeruleus</i>	Dwarf seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Hydrophis coggeri</i>	Slender-necked Seasnake	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)
Marine reptile	<i>Hydrophis czeblukovi</i>	fine-spined seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Hydrophis elegans</i>	Elegant seasnake	TEP	SAFE	Low
Marine reptile	<i>Hydrophis gracilis</i>	Slender seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Hydrophis inornatus</i>	Plain seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Hydrophis mcdowellii</i>	seasnake	TEP	SAFE	Medium
Marine reptile	<i>Hydrophis melanosoma</i>	Black-banded robust seasnake	TEP	Level 2 PSA	Medium
Marine reptile	<i>Hydrophis ornatus</i>	seasnake	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)
Marine reptile	<i>Hydrophis pacificus</i>	Large-headed Seasnake	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)
Marine reptile	<i>Hydrophis vorisi</i>	A seasnake	TEP	SAFE	Fished less than maximum sustainable mortality (MSM)
Marine reptile	<i>Lapemis hardwickii</i>	Spine-bellied Seasnake	TEP	SAFE	Medium
Marine reptile	<i>Laticauda colubrina</i>	Banded wide faced Sea krait	TEP	Level 2 PSA	Medium
Marine reptile	<i>Laticauda laticaudata</i>	Large scaled sea krait	TEP	Level 2 PSA	Medium



Marine reptile	<i>Lepidochelys olivacea</i>	Olive Ridley turtle	TEP	SAFE	Medium
Marine reptile	<i>Natator depressus</i>	Flatback turtle	TEP	SAFE	Medium
Marine reptile	<i>Parahydrophis mertoni</i>	Northern mangrove seasnake	TEP	SAFE	High
Marine reptile	<i>Pelamis platurus</i>	yellow-bellied seasnake	TEP	Level 2 PSA	Medium
Teleost	<i>Acentronura breviperula</i>	Hairy Pygmy Pipehorse	TEP	SAFE	Low
Teleost	<i>Bhanotia fasciolata</i>	Corrugated Pipefish, Barbed Pipefish	TEP	SAFE	Low
Teleost	<i>Campichthys tricarinatus</i>	Three-keel Pipefish	TEP	SAFE	Low
Teleost	<i>Choeroichthys brachysoma</i>	Pacific Short-bodied Pipefish, Short-bodied pipefish	TEP	SAFE	Low
Teleost	<i>Choeroichthys suillus</i>	Pig-snouted Pipefish	TEP	SAFE	Low
Teleost	<i>Corythoichthys amplexus</i>	Fijian Banded Pipefish, Brown-banded Pipefish	TEP	SAFE	Low
Teleost	<i>Corythoichthys conspicillatus</i>	Yellow-banded Pipefish, Network Pipefish	TEP	SAFE	Low
Teleost	<i>Corythoichthys haematopterus</i>	[a pipefish]	TEP	SAFE	Low
Teleost	<i>Corythoichthys intestinalis</i>	Australian Messmate Pipefish, Banded Pipefish	TEP	SAFE	Low
Teleost	<i>Corythoichthys ocellatus</i>	Orange-spotted Pipefish, Ocellated Pipefish	TEP	SAFE	Low
Teleost	<i>Corythoichthys schultzi</i>	Schultz's Pipefish	TEP	SAFE	Low
Teleost	<i>Cosmocampus banneri</i>	Roughridge Pipefish	TEP	SAFE	Low



Teleost	<i>Cosmocampus maxweberi</i>	[a pipefish]	TEP	SAFE	Low
Teleost	<i>Doryrhamphus janssi</i>	Cleaner Pipefish, Janss' Pipefish	TEP	SAFE	Low
Teleost	<i>Doryrhamphus melanopleura</i>	Bluestripe Pipefish	TEP	SAFE	Low
Teleost	<i>Dunckerocampus dactyliophorus</i>	Ringed Pipefish	TEP	SAFE	Low
Teleost	<i>Festucalex cinctus</i>	Girdled Pipefish	TEP	SAFE	Low
Teleost	<i>Filicampus tigris</i>	Tiger Pipefish	TEP	SAFE	Low
Teleost	<i>Halicampus brocki</i>	Brock's Pipefish	TEP	SAFE	Low
Teleost	<i>Halicampus dunckeri</i>	Red-hair Pipefish, Duncker's Pipefish	TEP	SAFE	Low
Teleost	<i>Halicampus grayi</i>	Mud Pipefish, Gray's Pipefish	TEP	SAFE	Low
Teleost	<i>Halicampus macrorhynchus</i>	[a pipefish]	TEP	SAFE	Low
Teleost	<i>Halicampus spinirostris</i>	Spiny-snout Pipefish	TEP	SAFE	Low
Teleost	<i>Haliichthys taeniophorus</i>	Ribboned Seadragon, Ribboned Pipefish	TEP	SAFE	Low
Teleost	<i>Hippichthys cyanospilos</i>	Blue-speckled Pipefish, Blue-spotted Pipefish	TEP	SAFE	Low
Teleost	<i>Hippichthys heptagonus</i>	Madura Pipefish	TEP	SAFE	Low
Teleost	<i>Hippichthys parvicarinatus</i>	Short-keeled Pipefish	TEP	SAFE	Low
Teleost	<i>Hippichthys penicillus</i>	Beady Pipefish, Steep-nosed Pipefish	TEP	SAFE	Low
Teleost	<i>Hippichthys spicifer</i>	[a pipefish]	TEP	SAFE	Low
Teleost	<i>Hippocampus angustus</i>	Western Spiny Seahorse	TEP	SAFE	Low
Teleost	<i>Hippocampus jugumus</i>	Spiny Seahorse	TEP	SAFE	Low



Teleost	<i>Hippocampus planifrons</i>	Flat-face Seahorse	TEP	SAFE	Low
Teleost	<i>Hippocampus spinosissimus</i>	Hedgehog Seahorse	TEP	SAFE	Low
Teleost	<i>Hippocampus taeniopterus</i>	Spotted Seahorse, Yellow Seahorse	TEP	SAFE	Low
Teleost	<i>Hippocampus zebra</i>	[a pipefish]	TEP	SAFE	Low
Teleost	<i>Micrognathus micronotopterus</i>	Tidepool Pipefish	TEP	SAFE	Low
Teleost	<i>Micrognathus pygmaeus</i>	[a pipefish]	TEP	SAFE	Low
Teleost	<i>Microphis brachyurus</i>	[a pipefish]	TEP	SAFE	Low
Teleost	<i>Solegnathus guentheri</i>	Indonesian Pipefish, Gunther's Pipehorse	TEP	SAFE	Low
Teleost	<i>Solegnathus sp. 1 [in Kuitert, 2000]</i>	Pipehorse	TEP	SAFE	Low
Teleost	<i>Solenostomus cyanopterus</i>	Blue-finned Ghost Pipefish, Robust Ghost	TEP	SAFE	Low
Teleost	<i>Syngnathoides biaculeatus</i>	Double-ended Pipehorse, Alligator Pipefish	TEP	SAFE	Low
Teleost	<i>Trachyrhamphus bicoarctatus</i>	Bend Stick Pipefish, Short-tailed Pipefish	TEP	SAFE	Low
Teleost	<i>Trachyrhamphus longirostris</i>	Long-nosed Pipefish, Straight Stick Pipefish	TEP	SAFE	Low

