



Australian Government

Australian Fisheries Management Authority

 Residual Risk Assessment of the
Level 2 Ecological Risk Assessment
Species Results
Report for the Northern Prawn Fishery



December 2008



EXECUTIVE SUMMARY

The Australian Fisheries Management Authority (AFMA) has undertaken detailed ecological risk assessments (ERAs) for all major Commonwealth managed fisheries as a key part of the implementation of the ecological component of Ecologically Sustainable Development (ESD). ERAs assess the risks that fishing poses to the ecological sustainability of the marine environment by considering the impact of fishing on all components of the marine environment. The main purpose of ERAs is to prioritise the management, research, data collection and monitoring needs for each fishery.

The ecological risk management (ERM) framework has been developed to ensure that a consistent process is followed across fisheries when responding to the ERA outcomes. This framework ties into current fishery management processes and structures so that it can be easily implemented by fisheries. To support implementation of the ERM framework, AFMA will fully document the risk management for each fishery. This will ensure transparency in the process and allow for easier co-ordination within and between fisheries. Using the results presented in this report, along with the results from any subsequent levels of assessment, appropriate management arrangements will be developed to address the high priority species as part of the ERM framework.

Due to the semi-quantitative nature of the risk assessment, the Level 2 PSA results do not directly account for all management measures, resulting in an over-estimation of the actual risk for some species. To better encompass this, the Level 2 PSA analysis has undergone further refinement by applying a set of residual risk guidelines.

In early 2007, the residual risk guidelines were developed in consultation with CSIRO and stakeholders to assist AFMA managers in refining the Level 2 PSA results. They have been developed to maintain the key features of objectivity and consistency from the ERA process, and to ensure a repeatable and transparent assessment process. These guidelines take into account methodology related matters and the most current management arrangements. To assist managers, a clear set of decision rules are outlined that are to be applied to individual species.

For the Northern Prawn Fishery (NPF), the results from the Level 2 PSA table are used here to determine the residual risk at this level of assessment. Overall 28 high risk species were assessed of which 26 remained high risk after applying the residual risk guidelines. These were mostly seasnake and sawfish species. Two cuttlefish species (*Sepia smithi* and *Sepia whitleyana*) were reduced from high risk because missing attribute scores could be borrowed from a closely related species which resulted in reduced productivity scores for these two species (application of guideline 1 refer to **Table 1**).



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1. OVERVIEW

1.1. Ecological Risk Management Process

A key component in the Australian Fisheries Management Authority's (AFMA's) implementation of the ecological component of ESD has been the undertaking of ecological risk assessments (ERAs) for all major Commonwealth managed fisheries. By assessing the impacts of fishing on all parts of the marine environment, the ERAs encompass an ecosystem-based assessment approach. The ERAs will help to prioritise research, data collection, monitoring needs and management actions for fisheries and provide information to assist the decision making process so that they can be managed both sustainably and efficiently.

To assist with the implementation of the ecological component of ESD across all fisheries AFMA has established an ecological risk management (ERM) framework (see **Figure 1**). This framework ensures that a consistent process is followed across fisheries when responding to the ERA outcomes. While this framework focuses on responding to the results of ERAs, it acknowledges that there are other initiatives contributing to the achievement of the ecological component of ESD. The ERM framework will streamline fishery's responses to the results of ERAs and incorporate other initiatives such as harvest strategies and bycatch and discard programs.

Due to the semi-quantitative nature of the level 2 ERAs, not all risk scores are an accurate representation of actual risk. The Level 2 PSA residual risk process is used to incorporate the effects of current management measures which impact on the level of risk posed by a fishery to species and adjust risk scores where appropriate. From a detailed methodology review, AFMA found that some ERAs did not include all existing management arrangements at the time of assessment. Furthermore, since the initial ERAs were conducted in 2005, the management of some fisheries has changed and additional data and information may have become available.

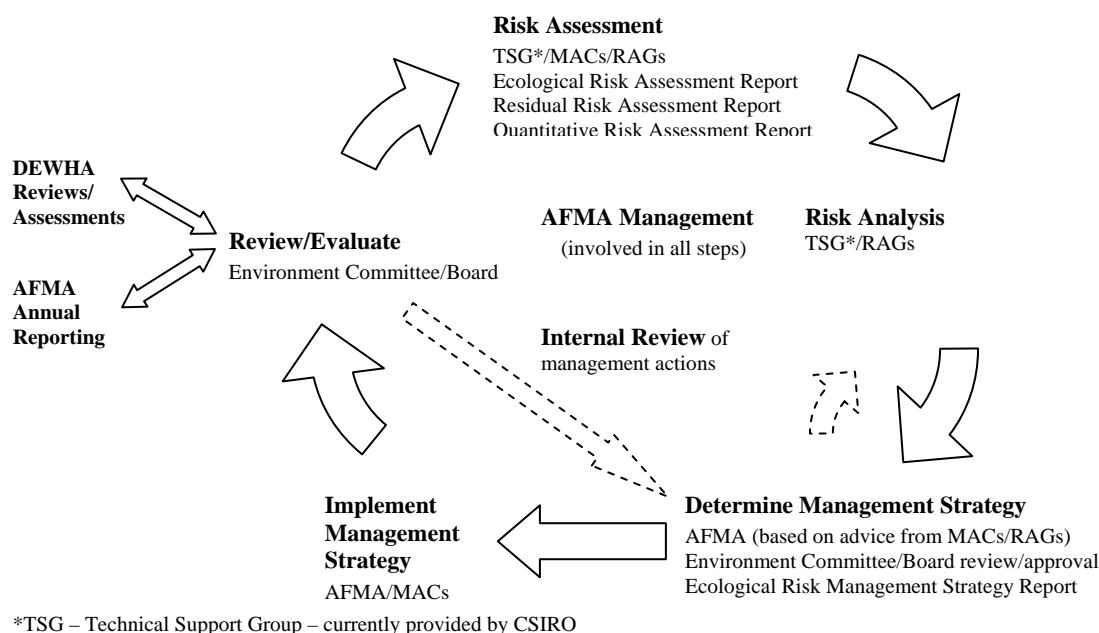


Figure 1 Ecological Risk Management framework



1.2. ERA Project

Since 2001, AFMA has been implementing ERAs. AFMA in collaboration with CSIRO developed the ERA methodology which has now been applied to all major Commonwealth managed fisheries. The aim of the ERA project is to assess both the direct and indirect impacts of a fishery's activity on *all* aspects of the marine ecosystem.

1.3. ERA Methodology

The ERA methodology is an adaptation of a traditional risk assessment to suit commercial fishing operations. The assessment evaluates the impact of fishing activities on all five major components of the marine ecosystem:

- target species (including bait species);
- byproduct and bycatch (discarded) species;
- threatened, endangered and protected (TEP) species;
- habitats; and
- ecological communities.

The ERA assessment adopts a hierarchical approach (refer to **Figure 2**). With every progressive level, the precision increases along with confidence in the risk scores (noting that not all components progress all the way through the assessment hierarchy). Each of these levels is outlined in more detail below.

Risk Assessment Hierarchy

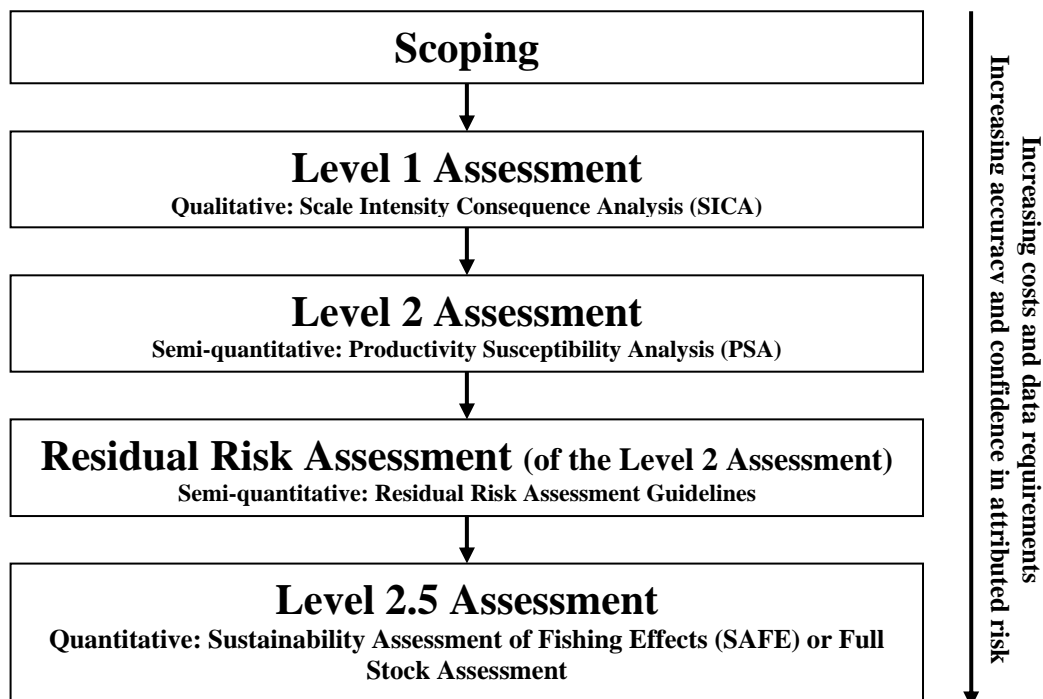


Figure 2 The different levels of risk assessment and the trend in confidence and cost



Scoping

At the **scoping** stage, a profile is developed for each of the fisheries being assessed. This includes gathering the information needed to complete more detailed level one and two assessments. Analysis focuses on the characteristics of the individual fishery, which may be divided into sub-fisheries based on fishing method and/or spatial coverage if this is more appropriate for assessment. At this stage, the general fishery characteristics are documented, and a list of all “units of analysis” (all species, habitat types and communities present in the fishery) is generated. Hazards and objectives for the fishery are also identified (for more detail refer to Hobday *et al.*, 2007).

Level 1 – Scale, Intensity, Consequence Analysis

Level 1 is a qualitative assessment of scale, intensity, consequence analysis (**SICA**) that identifies which hazards (activities) lead to a significant impact on any species, habitat or community. This involves an assessment of the risk posed by each identified fishing **activity** on each of the ecosystem components. At this level, analysis is conducted on whole ecosystem components (target; bycatch and byproduct; TEP species; habitats and communities), not at the individual species level. Level 1 is used as a rapid screening tool, with a “worst case” approach used to ensure only genuine low risk elements (either activities or ecosystem components) are screened out. This analysis uses the most vulnerable sub-component and the most vulnerable unit of analysis within each component (e.g. the most vulnerable species, habitat type or community). Further to this, where judgements about risk are uncertain, the highest level of risk regarded as plausible is used (for more detail refer to Hobday *et al.*, 2007).

Level 2 – Productivity Susceptibility Analysis

Level 2 PSA is a semi-quantitative analysis of the risk posed by fishing to all individual species, habitats and communities identified in the scoping stage. Level 2 PSA allows all **units** (species, habitats or communities) within any of the ecological components to be effectively and comprehensively screened for risk. Level 2 PSA assesses the direct impact of fishing and is based on the assumption that risk to an individual unit is based on two characteristics of the unit:

- **Susceptibility:** where the extent of the impact on an ecological unit is determined by the susceptibility of the unit to the fishing activities; and
- **Productivity:** which determines the rate at which the unit can recover after potential depletion or damage by fishing activities.

For the Level 2 assessment, each unit within the ecological component is assessed for the risk it faces from the fishery. The Level 2 PSA approach examines a number of **attributes** of each unit that contribute to or reflect its *susceptibility* or *productivity*. A score on a three point scale (low, medium, high) is determined for each unit for both productivity and susceptibility which combined provides a relative measure of risk for each unit. The attributes used to assess productivity and susceptibility is given in **Appendix A**. The Level 2 PSA risk scoring system is precautionary in that, where there is no information known on a specific productivity or susceptibility attribute for a unit, it is given a default score of ‘high risk’.



Level 2 PSA Residual Risk Assessment

Further information on the Level 2 PSA residual risk process is detailed later in this document.

Level 3 – Quantitative Risk Assessment

At the conclusion of the Level 2 PSA assessment, a number of units may have been identified as being at high risk because of the activities of the fishery. At this stage a Level 3 analysis may be warranted. This can take various forms including a quantitative sustainability assessment for fishing effects (SAFE) recently developed by CSIRO to assess multiple species or a fully quantitative assessment of a specific species (similar to a standard stock assessment). Quantitative risk assessments constituting the equivalent of a Level 3 risk analysis currently exist for many species. Before proceeding to a fully quantitative Level 3 assessment, investigation of suitable existing information to further understand the risk scores for high risk units should be identified. This may help to overcome some of the constraints of the Level 2 PSA results (outlined below) prior to proceeding to more costly Level 3 analysis for the remaining high risk units.

Constraints of Level 2 PSA Results

The methodology used in the Level 2 PSA assessment results in risk scores of high, medium or low to reflect potential rather than actual risk. Quantifying the actual risk for any species requires a Level 3 assessment. Due to the semi-quantitative nature of the Level 2 PSA risk assessment, analysis does not take into account all management measures currently in place in fisheries, which may result in an over-estimate of the actual risk for some species. The management arrangements that are not accounted for in the Level 2 assessment include:

- Limits to fishing effort;
- Catch limits (such as Total Allowable Catches - TACs); and
- Other controls such as seasonal closures.

Management arrangements that *are* accounted for in the assessment include:

- Spatial management that limits the range of the fishery (affecting availability);
- Gear limits that affect the size of animals that are captured (selectivity); and
- Handling practices that may affect the survival of species after capture (post capture mortality).

As a result, the Level 2 PSA is intentionally designed to generate more **false positives** for high risk (species assessed have a high risk when they are actually low risk) than **false negatives** (species assessed to be low vulnerability when they are actually high vulnerability). This is due to the Level 2 PSA methodology adopting a **precautionary** approach to uncertainty. An example of this is when a species is missing information on its productivity and susceptibility attributes the risk score defaults to a higher risk.

In addition, TEP species are included within the assessment on the basis that they occur in the area of the fishery, whether or not there has been a recorded interaction with the fishery. For this reason there may be a higher proportion of false positives for high risk TEP species, unless there is a robust observer program that can verify that species do not interact with the fishing gear.

When AFMA reviewed the methodology using example fisheries, some additional concerns arose. Since the original Level 2 PSA results were produced there is now an improved understanding of: new or updated catch data available from log books and catch records; advances in scientific knowledge that may have become available; and more resolution on the spatial distribution of species etc. Each of these issues is discussed below.



Improved data

The ERA process adopts a precautionary approach if there is uncertainty about an attribute the higher risk score is used. At the Level 2 PSA when a species is missing either a productivity or susceptibility attribute the score defaults to a high risk category. Furthermore, species attributes that were originally calculated for the fishery may be out-of-date because additional or more precise information has become available.

Additional information

Since the time of the original ERA assessment, additional information may now be available as a result of other investigations and research etc.

Spatial assumptions

The Level 2 PSA utilises a precautionary approach when calculating susceptibility by assuming species distribution is only within the jurisdictional boundary of the fishery. While this is appropriate for species that form discrete populations or stocks, the risk score for species that extend beyond the boundary of the fishery such as pelagic and migratory species is not.

Interaction and catch data

Some species have a low to negligible level of interaction with the fishing gear. Species with very low biological productivity may however still be scored high or medium risk irrespective of their low susceptibility. Considering that the likelihood of interaction is already low there is little additional management that a fishery can introduce to mitigate the risk. Therefore the level of interaction or capture should be included as part of the Level 2 PSA residual risk process.

Management arrangements

As stated above, effort and catch limits for target and byproduct species are not taken into account in the ERA even though these arrangements may mitigate risk for some species. The Level 2 PSA residual risk process allows many of these management arrangements to be incorporated into the assessment.

Some management arrangements concerning the mitigation of bycatch have been incorporated into the initial ERA process; however, they may now be out-of-date since the initial ERA assessment. The Level 2 PSA residual risk process incorporates some of these management arrangements into the results to better represent the overall risk for a species.

There may be a beneficial overlap of management arrangements for individual species that were not a specific target of that arrangement if there is a high degree of association between the species. In some instances the initial ERA may not have considered the benefit of management arrangements between associated species.

Although seasonal, spatial and depth closures have been considered in the initial ERA, more recent management measures have not been accounted for. The Level 2 PSA residual risk process will consider some of these arrangements and will bring the assessment up-to-date.



2. LEVEL 2 ERA RESIDUAL RISK PROCESS

2.1. Level 2 ERA Residual Risk

All major fisheries have been assessed to Level 2 PSA where applicable. Before moving to a Level 3 assessment, the residual risk guidelines have been applied to account for some of the constraints of the Level 2 PSA assessment. The Level 2 PSA residual risk process (**Figure 3**) incorporates some of the concepts of a Level 3 assessment and is more cost effective than a full Level 3 assessment. Furthermore, the Level 2 PSA residual risk results more accurately represent overall risk within a fishery and will help clarify if further (Level 3) assessment is necessary.

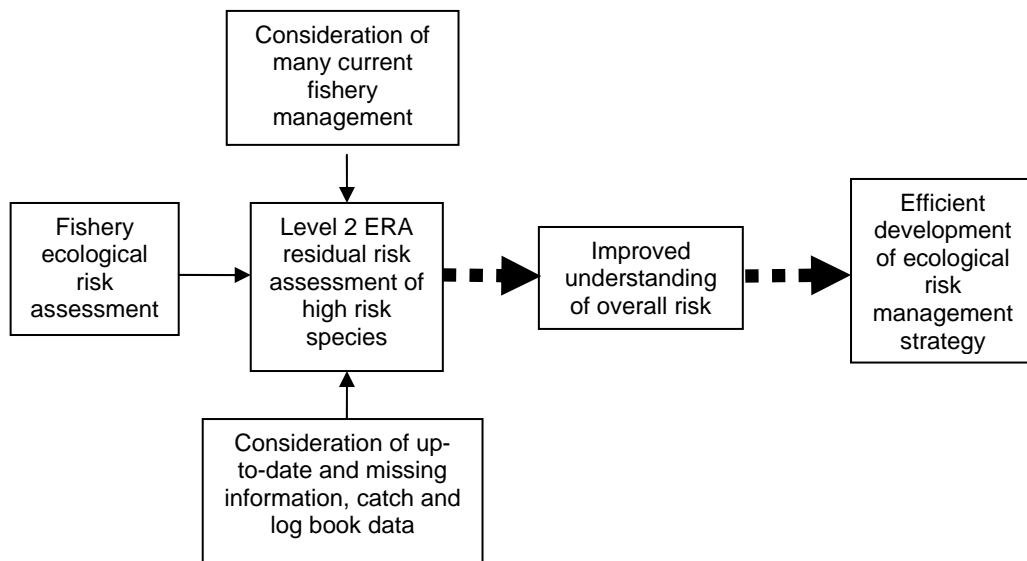


Figure 3 Flow diagram of the Level 2 ERA residual risk process

2.2. Level 2 PSA Residual Risk Process

In 2007 AFMA, with input from CSIRO and stakeholders, developed a set of guidelines to assess the residual risk for species identified as having a high potential risk based on the Level 2 analysis. The guidelines have been designed to ensure that a consistent, transparent and repeatable process is adopted across all fisheries. A summary of the guidelines is given in **Table 1**. Within each category there are clear decision rules that can be applied to a species (if relevant) to calculate Level 2 PSA residual risk. Each of the guidelines was applied on a species-by-species basis to determine the Level 2 PSA residual risk within the fishery.

When determining the Level 2 PSA residual risk, all considerations included in the calculation process must be recorded, along with the guidelines applied with a detailed justification clearly stated. This ensures that a transparent process is maintained. In review of the ERA results, the guidelines have been applied to all high risk species by managers in consultation with MAC members and experts. Broadly the application processes involved the following steps:

- Sorting the ERA result by high risk, then grouping the high risk species by role within the fishery, then by taxonomic group;



- Creating a list of all management arrangements not included in the Level 2 PSA results for reference when applying the guidelines;
- Considering each management arrangement to relevant high risk species;
- Collating spatial information from experts, observer and logbook data for all high risk species for reference when applying the guidelines;
- Deciding if and what guideline applies to each of the high risk species by conducting a species-by-species application;
- Making changes to the necessary attributes, productivity and susceptibility scores to calculate the Level 2 PSA residual risk score;
- Recording all workings, guidelines used, how they have been applied and a justification for the Level 2 PSA residual risk score;
- Providing preliminary Level 2 PSA residual risk results to MACs for feedback; and
- Finalising the Level 2 PSA residual risk results for release.

Before the Level 2 PSA residual risk process was applied to all fisheries the guidelines were trialled in three fisheries, the Eastern Tuna and Billfish Fishery (ETBF), Southern and Eastern Scalefish and Shark Fishery (SESSF), and the Northern Prawn Fishery (NPF). These fisheries were selected for the Level 2 PSA residual risk pilot because they are key fisheries and provide a template for other fisheries. Developments in the application of the Level 2 PSA residual risk process are outlined in **Table 2**.



Table 1 Summary of Level 2 ERA Residual Risk Guidelines*

Guideline Number	Summary
<p>Guideline 1. Risk rating due to missing/incorrect information.</p>	<p>Considers if susceptibility and/or productivity attribute data for a species is missing or incorrect for the fishery assessment, and is corrected using data from a trusted source or another fishery.</p>
<p>Guideline 2. Additional scientific assessment.</p>	<p>Considers any additional rigorous scientific assessment (i.e. rapid Level 3 risk assessment, population viability analysis) that calculates the species level of risk from fishing, or considers any other scientific published assessments or results.</p>
<p>Guideline 3. At risk due to missing attributes.</p>	<p>When there are three or more missing productivity attributes, considers closely related species within a fishery that have those productivity attributes known.</p>
<p>Guideline 4. At risk with spatial assumptions.</p>	<p>Uses additional information on spatial distribution of species populations to better represent the species distribution overlap with the fishery.</p>
<p>Guideline 5. At risk in regards to level of interaction/capture with a zero or negligible level of susceptibility.</p>	<p>Considers observer or expert information to better calculate susceptibility for those species known to have a low likelihood or no record of interaction or capture with the fishery.</p>
<p>Guideline 6. Effort and catch management arrangements for target and byproduct species.</p>	<p>Considers current management arrangements based on effort and catch limits set using a scientific assessment for key species.</p>
<p>Guideline 7. Management arrangements to mitigate against the level of bycatch.</p>	<p>Considers management arrangements in place that mitigate against bycatch by the use of gear modifications, mitigation devices and catch limits.</p>
<p>Guideline 8. Limits on associated species through other management arrangements.</p>	<p>Considers the implications of management arrangements for a particular species on other associated species.</p>
<p>Guideline 9. Management arrangements relating to seasonal, spatial and depth closures.</p>	<p>Considers management arrangements based on seasonal, spatial and/or depth closures.</p>

* For the complete Residual Risk Guidelines, refer to http://www.afma.gov.au/environment/eco_based/eras/reports.htm



Table 2 Stakeholder Engagement

Guideline stage	Stakeholder interaction	Date of interaction	Stakeholder group	Summary of outcome
Draft Level 2 ERA residual risk assessment trial in SESSF	AFMA workshop	December 12 th , 2006	Trial application of draft Level 2 ERA residual risk guidelines.	Agreement much further work was needed.
Trial Level 2 ERA residual risk assessment using draft ERA results in the ETBF, SESSF and NPF	AFMA workshop	May 21 st , 2007	Fisheries managers in ETBF, SESSF and NPF and AFMA environment section.	Draft Level 2 ERA results presented and application of guidelines discussed. Catalyst for major revision of multiple areas in guidelines by AFMA.
CSIRO final ERA results available and application of draft Level 2 ERA residual risk guidelines continues	AFMA Emails	Late June 2007	Scientific experts on marine mammals, birds and turtles.	Information provided on biological attributes, spatial distributions and population dynamics for species Level 2 ERA residual risk assessment
Draft Level 2 residual risk assessment for the NPF using final ERA results	NORMAC	August 30 th -31 st 2007	MAC members, advisors and other observers.	Report provided on progress of ERA and current results. Noted work to commence on ERM following finalisation of ERA.
Review of the draft residual risk report by the Residual Risk Review Group	Residual Risk review Group	March 13 th 2008	Fisheries managers, BRS, DEWHA & an environment NGO representative.	Reviewed the consistency of, and sought clarification on aspects of the application of the <i>Residual Risk Guidelines</i> across 12 major fisheries and sub fisheries.
Level 2 residual risk assessment for Northern Prawn Fishery using final ERA results	AFMA Bycatch & Discard workshop	27 January 2009	Members and other observers.	Final ERA results to be disclosed and draft ERM provided for comment.



3. RESULTS

3.1. ERA Results

Gear:	Otter trawl
Area:	Cape York, Qld to Cape Londonderry, W.A.
Depth range:	14 to 70m
Fleet size:	52 vessels
Effort:	Approximately 35,334 shots per year
Landings:	4,310 t in 2007
Discard rate:	Target species <1%; byproduct unknown
Main target species:	White and red-legged banana prawns, grooved, brown and giant tiger prawns, blue and red endeavour prawns, western king and red spot king prawn.
Management:	Input control
Observer program:	Scientific and Crew Member Observer Programs

Ecological Units Assessed

Target species:	9
By-product species:	135
Discard Species:	516 (chondrichthyans and teleosts only)
TEP species:	128
Habitats:	157
Communities:	3

Level 1 Results

Only 1 ecological component (communities) was eliminated at Level 1 (there was at least one risk score of 3 – moderate – or above for other components).

A number of hazards (fishing activities) were eliminated at Level 1 (risk scores 1 or 2). Those remaining included:

- Fishing (direct and indirect impacts on 3 ecological components)
- Discarding catch (impact on 3 ecological components)
- Translocation (addition/ movement of biological material) (impact on 4 ecological components)
- Addition of non-biological material (impact on TEP species)
- External impacts (impact on 4 ecological components)

Significant external hazards included other fisheries in the region, coastal development, other extractive and non-extractive activities and other anthropogenic activities.

Risks rated as major or above (risk scores 4 or 5) were related to direct or indirect impacts from primary fishing operations, other fisheries and other non-extractive activities. Severe impacts (risk score 5) were confined to bycatch/byproduct and TEP species.

Impacts from fishing on all species components and on habitats were assessed in more detail at Level 2.



Level 2 Results

Species were assessed using one of two methods. Target, byproduct and protected (TEP) species were assessed using the Level 2 PSA methodology, while bycatch (discard) teleosts and chondrichthyans were assessed using a more quantitative method (refer to FRDC 2002/035 for methodology and results).

272 species were assessed at Level 2 using the Level 2 PSA analysis. In the tiger prawn sub-fishery, 25 were assessed to be at high risk, including 16 byproduct species, and 9 protected (TEP) species. By taxa, the high risk species comprised 8 invertebrates, 8 teleosts, 5 chondrichthyans (sharks and rays), and 4 marine reptiles. In the banana prawn sub-fishery, 27 were assessed to be at high risk, including 15 byproduct species, and 12 protected (TEP) species. By taxa, the high risk species comprised 8 teleosts, 7 invertebrates, 7 marine reptiles, and 5 chondrichthyans (sharks and rays).

The protected (TEP) species assessed to be at high risk, (9 and 12 in the tiger and banana prawn sub-fishery, respectively) have mostly been assessed at this level because of low productivity attributes. Most of these species have been recognised as an ecological issue for the fishery for many years. Turtles have previously been considered to have a high risk to fishing, but their risk status has now been reduced to medium risk due to their successful exclusion from the catch since turtle exclusion devices (TEDs) were introduced in the NPF in 2000.

Similarly, sea snakes were previously known to have high risk due to their tendency to drown in trawls, although only 7 of the 33 species who are known to occur in the area of this fishery were identified as high risk in this study.

Sawfish have also been previously recognised as potentially high risk species, and the Level 2 PSA revealed that all 5 were high risk. This is mainly due to a high overlap of the fishery with their distribution, their high degree of endemism, and their high susceptibility to capture and mortality due to their rostrum teeth entangling in the net mesh.

Of the 135 byproduct species impacted by the NPF, 16 and 15 were considered to be at high risk in the tiger and banana prawn sub-fisheries, respectively. These mainly comprise cephalopods, mantis shrimps and flatfishes (soles), for which there are taxonomic difficulties and/or a lack of biological information. A current Fisheries Research and Development Corporation (FRDC) funded project; *Assessing data poor resources: developing a management strategy for byproduct species in the Northern Prawn fishery (FRDC 2006/008)** will collect biological information, map species distributions and undertake a preliminary stock assessment of these species. As the mantis shrimps are rare and endemic to northern Australia, this contributes to these species having a high risk.

Of the 272 species assessed at Level 2 PSA, expert over rides were used on 83 species for the tiger prawn sub-fishery and for 16 species for the banana prawn sub-fishery. Of the 25 species assessed to be at high risk for the tiger prawn sub-fishery, 10 had more than 3 missing attributes while of the 27 species assessed to be at high risk for the banana prawn sub-fishery, 10 had more than 3 missing attributes.

Summary

Despite a number of species from protected (TEP), byproduct and bycatch components being identified as high risk, the NPF has already taken steps to mitigate the risk to most of these species. For example, several species of sea snakes had the highest risk in the

* FRDC report 2006/008 is ongoing so no final report has been completed.



protected (TEP) group, however FRDC project (2005/051) trialled various BRDs to enhance sea snake escapement and undertook population modelling to quantify the risk of fishing on their populations.

Similarly, sawfishes have been assessed at high risk and FRDC project (2002/035) recommends continual monitoring of sawfishes in an on-going NPF bycatch monitoring program.

The status of byproduct species, mainly squid and cuttlefish, have been a concern in the NPF for a number of years due to the occasional targeting of spawning aggregations and a lack of biological information which has made stock assessments infeasible. As a consequence FRDC project (2006/008) is expected to address these issues.

Bycatch has also been a longstanding issue in the NPF due to the large biomass and diversity of species impacted. Until now, there have been no means to cost effectively assess the ecological sustainability of diverse and low value species in a quantitative manner. A quantitative risk assessment model has been used in the NPF (FRDC 2002/035) revealing few species to be at risk, with the majority of those identified likely to be misidentifications or rarer species that are sampled inadequately by trawls.

3.2. Level 2 ERA Residual Risk Results

The Level 2 ERA residual risk assessment summary for the Northern Prawn Fishery is given in **Table 3**. Overall 272 species were assessed: 9 target, 135 bycatch (discard), 128 protected (TEP) species. A summary of the number of species in each category of risk and the guidelines used for each component are given in **Table 4**. Guidelines 1 and 3 was used on two occasions to reduce the risk based on missing or incorrect information for *Sepia smithi* and *Sepia whitleyana* (reference: *Design, trial and implementation of an integrated, long-term bycatch monitoring program road tested in the Northern Prawn fishery Final report FRDC project No. 2002/035*).

The application of the guidelines resulted in an overall reduction from 28 high risk species prior to the Level 2 PSA residual risk assessment to 26 high residual risk species.



Table 3 Level 2 PSA Residual Risk Results

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Productivity	Susceptibility	Level 2 ERA Risk Category Score – Tiger Prawn Sub-fishery	Level 2 ERA Risk Category Score – Banana Prawn Sub-fishery	Current and Planned Management/Assessment	Guideline Applied	Justification	Level 2 ERA Residual Risk Score
Invertebrate	<i>Penaeus esculentus</i>	brown tiger prawn	TA	1.00	3.00	Med 3.16	Med 3.16	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 3.16
Invertebrate	<i>Metapenaeus endeavouri</i>	prawn	TA	1.00	3.00	Med 3.16	Med 3.16	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 3.16
Invertebrate	<i>Melicertus longistylus</i>	redspot king prawn	TA	1.00	1.67	Low 1.19	Low 1.19	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.19
Invertebrate	<i>Melicertus latisulcatus</i>	western king prawn	TA	1.00	1.67	Low 1.19	Low 1.19	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.19
Invertebrate	<i>Penaeus semisulcatus</i>	grooved tiger prawn	TA	1.00	1.67	Low 1.19	Low 1.19	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.19
Invertebrate	<i>Fenneropenaeus indicus</i>	redleg banana prawn	TA	1.00	1.67	Low 1.19	Low 1.19	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.19
Invertebrate	<i>Penaeus monodon</i>	black tiger prawn	TA	1.00	1.67	Low 1.19	Low 1.19	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.19
Invertebrate	<i>Metapeaeus ensis</i>	prawn	TA	1.00	1.67	Low 1.19	Low 1.19	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.19

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Productivity	Susceptibility	Level 2 ERA Risk Category Score – Tiger Prawn Sub-fishery	Level 2 ERA Risk Category Score – Banana Prawn Sub-fishery	Current and Planned Management/Assessment	Guideline Applied	Justification	Level 2 ERA Residual Risk Score
Invertebrate	<i>Penaeus merguensis</i>	prawn	TA	1.00	1.67	Low 1.19	Low 1.19	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.19
Teleost	<i>Zebrias quagga</i>	zebra sole	BP	1.29	3.00	High 3.26	High 3.26	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.26
Teleost	<i>Pardachirus pavoninus</i>	peacock sole	BP	1.57	3.00	High 3.38	High 3.38	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.38
Teleost	<i>Zebrias craticulus</i>	wicker-work sole	BP	1.57	3.00	High 3.38	High 3.38	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.38
Teleost	<i>Brachirus muelleri</i>	tufted sole	BP	1.57	3.00	High 3.38	High 3.38	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.38
Teleost	<i>Zebrias cancellatus</i>	sole	BP	1.57	3.00	High 3.38	High 3.38	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.38
Teleost	<i>Aesopia</i> sp. [in Sainsbury et al, 1985]	sole	BP	1.57	3.00	High 3.38	High 3.38	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.38
Teleost	<i>Aseraggodes</i> sp. [see Kuitert, 1993]	sole	BP	1.57	3.00	High 3.38	High 3.38	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.38
Teleost	<i>Upeneus</i> sp. 1 [in Sainsbury et al, 1985]	[a mullett]	BP	1.14	3.00	High 3.21	High 3.21	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs;	N/A		High 3.21

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Productivity	Susceptibility	Level 2 ERA Risk Category Score – Tiger Prawn Sub-fishery	Level 2 ERA Risk Category Score – Banana Prawn Sub-fishery	Current and Planned Management/Assessment	Guideline Applied	Justification	Level 2 ERA Residual Risk Score
								Hoppers			
Invertebrate	<i>Sepia smithi</i>	cuttlefish	BP	3.00	1.67	High 3.43	High 3.43	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	1	This species has 9 missing productivity attributes. Some of the missing attributes have been borrowed from a closely related species from the genus Sepiidae (Sepiidae - undifferentiated).	Med 3.06
Invertebrate	<i>Sepia whitleyana</i>	cuttlefish	BP	3.00	1.67	High 3.43	High 3.43	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	1	This species has 9 missing productivity attributes. Some of the missing attributes have been borrowed from a closely	Med 3.06

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Productivity	Susceptibility	Level 2 ERA Risk Category Score – Tiger Prawn Sub-fishery	Level 2 ERA Risk Category Score – Banana Prawn Sub-fishery	Current and Planned Management/Assessment	Guideline Applied	Justification	Level 2 ERA Residual Risk Score
										related species from the genus Sepiidae (Sepiidae - undifferentiated).	
Invertebrate	<i>Metasepia pfefferi</i>	cuttlefish	BP	3.00	1.67	High 3.43	High 3.43	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.43
Invertebrate	<i>Euprymna hoylei</i>	cuttlefish	BP	3.00	1.22	High 3.24	High 3.24	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.24
Invertebrate	<i>Dictyosquilla tuberculata</i>	mantis shrimp	BP	1.71	3.00	High 3.45	High 3.45	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.45
Invertebrate	<i>Harpisquilla stephensoni</i>	mantis shrimp	BP	1.71	3.00	High 3.45	High 3.45	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.45
Invertebrate	<i>Solenocera australiana</i>	prawn	BP	1.29	3.00	High 3.26	High 3.26	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		High 3.26
Invertebrate	<i>Photololigo</i> sp. 4	inshore squid 4	BP	1.57	3.00	High 3.38	Low 2.29	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Trigger limit for squid introduced in 2006	N/A		High 3.38
Teleost	<i>Lutjanus argentimaculatus</i>	Mangrove Jack	BP	1.71	2.33	Med 2.89	Med 2.89	Spatial and temporal closures; Reduction in fishing effort via SAP;	N/A		Med 2.89

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								Restricted net length; BRDs; Hoppers			
Invertebrate	Sepiidae - undifferentiated	cuttlefish	BP	2.57	1.22	Med 2.84	Med 2.84	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 2.84
Invertebrate	Sepia elliptica	cuttlefish	BP	2.43	1.22	Med 2.72	Med 2.72	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 2.72
Invertebrate	Sepia papuensis	cuttlefish	BP	2.43	1.15	Med 2.69	Med 2.69	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 2.69
Invertebrate	Sepia cottoni	cuttlefish	BP	2.43	1.44	Med 2.82	Med 2.82	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 2.82
Invertebrate	Panulirus polyphagus	tropical rock lobster	BP	2.29	1.67	Med 2.83	Med 2.83	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 2.83
Invertebrate	Carinosquilla australiensis	mantis shrimp	BP	1.71	2.33	Med 2.98	Med 2.89	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 2.89
Invertebrate	Carinosquilla carita	mantis shrimp	BP	1.71	2.33	Med 2.89	Med 2.89	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 2.89
Invertebrate	Carinosquilla redacta	mantis shrimp	BP	1.71	2.33	Med 2.89	Med 2.89	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 2.89

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Invertebrate	<i>Oratosquilla berentsae</i>	mantis shrimp	BP	1.71	2.33	Med 2.89	Med 2.89	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 2.89
Invertebrate	<i>Atypopenaeus formosus</i>	prawn	BP	1.29	2.33	Med 3.16	Med 3.16	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 3.16
Invertebrate	<i>Metapenaeopsis crassissima</i>	prawn	BP	1.00	3.00	Med 3.16	Med 3.16	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 3.16
Invertebrate	<i>Metapenaeopsis rosea</i>	prawn	BP	1.00	3.00	Med 3.16	Med 3.16	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 3.16
Invertebrate	<i>Metapenaeopsis wellsi</i>	prawn	BP	1.00	3.00	Med 3.16	Med 3.16	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 3.16
Invertebrate	<i>Metapenaeus demani</i>	prawn	BP	1.00	3.00	Med 3.16	Med 3.16	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 3.16
Invertebrate	<i>Metapenaeus eboracensis</i>	prawn	BP	1.00	3.00	Med 3.16	Med 3.16	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 3.16
Invertebrate	<i>Metapenaeus insolitus</i>	prawn	BP	1.00	3.00	Med 3.16	Med 3.16	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 3.16
Invertebrate	<i>Parapenaeopsis arafurica</i>	prawn	BP	1.00	3.00	Med 3.16	Med 3.16	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs;	N/A		Med 3.16

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								Hoppers			
Invertebrate	Panulirus Versicolor	Green Cray	BP	2.29	1.44	Low 2.63	Med 2.70	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 2.70
Invertebrate	Scylla sp.	mud crab	BP	1.43	2.33	Med 2.73	Low 2.03	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Med 2.73
Invertebrate	Thenus orientalis	bug	BP	1.29	1.67	Low 2.11	Low 2.11	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.11
Teleost	Sillago analis	sand whiting	BP	1.14	1.67	Low 2.02	Low 2.02	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.02
Teleost	Sillago lutea	Mud Whiting	BP	1.14	1.67	Low 2.02	Low 2.02	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.02
Teleost	Epinephelus heniochus	rock cod	BP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.20
Teleost	Epinephelus malabaricus	rock cod	BP	1.57	1.67	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.23
Teleost	Epinephelus sexfasciatus	rock cod	BP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.20
Teleost	Epinephelus areolatus	yellow-spotted rock cod	BP	1.29	1.67	Low	Low	Spatial and temporal closures;	N/A		Low

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						2.11	2.11	Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers			2.11
Teleost	Epinephelus quoyanus	Honeycomb Cod / Longfin Grouper	BP	1.57	1.22	Low 1.99	Low 1.99	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.99
Teleost	Plectropomus leopardus	Northern Cod / Leopard Coralgrouper	BP	1.57	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.20
Teleost	Pristipomoides multidens	Gold Band Snapper	BP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.88
Teleost	Lutjanus sebae	Red Emperor	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Teleost	Lethrinus miniatus	Red Finned Emperor	BP	1.29	1.22	Low 1.77	Low 1.77	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.77
Teleost	Scomberomorus commerson	Spanish Mackerel	BP	1.71	1.44	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.23
Teleost	Scomberomorus munroi	Australian Spotted Mackerel-DoggySchol	BP	1.57	1.22	Low 1.99	Low 1.99	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.99
Teleost	Scomberomorus semifasciatus	Broad-barred Mackerel - Grey Mack	BP	1.71	1.44	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.23

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Teleost	Gymnocranius elongatus	sea bream	BP	1.29	1.22	Low 1.77	Low 1.77	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.77
Teleost	Lethrinus laticaudis	Grass Emperor	BP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.88
Teleost	Lethrinus lentjan	Red Spot Emperor	BP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.88
Teleost	Lutjanus erythropterus	Saddle-tailed Sea Perch	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Teleost	Lutjanus malabaricus	Scarlet Sea Perch / Large Mouth Nannygai	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Teleost	Lethrinus genivittatus	emperor	BP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.88
Teleost	Epinephelus coioides	estuary rock cod	BP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.20
Teleost	Thunnus tonggol	Long-tail tuna	BP	1.57	1.44	Low 2.13	Low 2.13	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.13
Teleost	Parastromateus niger	black pomfret	BP	1.14	1.67	Low 2.02	Low 2.02	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs;	N/A		Low 2.02

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								Hoppers			
Teleost	<i>Sardinella gibbosa</i>	goldstripe sardine	BP	1.29	1.22	Low 1.77	Low 1.77	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.77
Teleost	<i>Pellona ditchela</i>	Indian pellona	BP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.88
Teleost	<i>Herklotsichthys koningsbergeri</i>	large-spotted herring	BP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.88
Teleost	<i>Dussumieria elopsoides</i>	sharp nosed sprat	BP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.88
Teleost	<i>Upeneus sundaicus</i>	dark-finned goatfish	BP	1.14	1.67	Low 2.02	Low 2.02	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.02
Teleost	<i>Upeneus asymmetricus</i>	gold band orange bar goatfish	BP	1.14	1.67	Low 2.02	Low 2.02	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.02
Teleost	<i>Upeneus moluccensis</i>	gold-band goatfish	BP	1.14	1.67	Low 2.02	Low 2.02	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.02
Teleost	<i>Upeneus luzonius</i>	saddle goatfish	BP	1.14	1.67	Low 2.02	Low 2.02	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.02
Teleost	<i>Upeneus tragula</i>	spotted goatfish	BP	1.14	1.67	Low	Low	Spatial and temporal closures;	N/A		Low

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						2.02	2.02	Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers			2.02
Teleost	Upeneus sulphureus	yellow goatfish	BP	1.14	1.67	Low 2.02	Low 2.02	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.02
Teleost	Scomberomorus queenslandicus	school mackerel	BP	1.57	1.44	Low 2.13	Low 2.13	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.13
Teleost	Sillago sihama	silver whiting	BP	1.57	1.67	Low 2.29	Low 2.29	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.29
Teleost	Sillago burrus	western trumpeter whiting	BP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.20
Invertebrate	Parapenaeopsis sculptilis	Coral prawn	BP	1.00	1.67	Low 1.95	Low 1.95	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.95
Invertebrate	Panulirus ornatus	Tropical Rock Lobster	BP	1.71	1.30	Low 2.15	Low 2.15	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.15
Invertebrate	Marsupenaeus japonicus	Kuruma prawn	BP	1.00	1.67	Low 1.95	Low 1.95	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.95
Invertebrate	Loliginidae - undifferentiated	squids	BP	1.71	1.22	Low 2.10	Low 2.10	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.10

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Invertebrate	Amusium pleuronectes	northern saucer scallop	BP	1.57	1.44	Low 2.13	Low 2.13	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.13
Teleost	Cephalopholis boenak	[a rockcod]	BP	1.71	1.44	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.23
Teleost	Plectropomus maculatus	[a rockcod]	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Teleost	Argyrops spinifer	[a bream]	BP	1.71	1.22	Low 2.10	Low 2.10	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.10
Teleost	Parupeneus barberinoides	[a mullett]	BP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.20
Teleost	Parupeneus heptacanthus	[a mullett]	BP	1.57	1.67	Low 2.29	Low 2.29	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.20
Teleost	Sillago ingenuua	[a whiting]	BP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.20
Teleost	Aseraggodes melanostictus	sole	BP	1.57	1.67	Low 2.29	Low 2.29	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.29
Teleost	Ilisha lunula	herring	BP	1.43	1.44	Low 2.03	Low 2.03	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs;	N/A		Low 2.03

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								Hoppers			
Teleost	Amblygaster sirm	herring	BP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.88
Teleost	Anodontostoma chacunda	herring	BP	1.29	1.22	Low 1.77	Low 1.77	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.77
Teleost	Sardinella albella	herring	BP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.88
Teleost	Herklotsichthys lippa	herring	BP	1.43	1.44	Low 2.03	Low 2.03	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.03
Teleost	Escualosa thoracata	herring	BP	1.29	1.22	Low 1.77	Low 1.77	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.77
Invertebrate	Thenus indicus	bug	BP	1.29	1.44	Low 1.93	Low 1.93	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.93
Invertebrate	Loligo chinensis	squid	BP	2.29	1.22	Low 1.77	Low 1.77	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.77
Invertebrate	Sepioteuthis lessoniana	squid	BP	1.71	1.22	Low 2.10	Low 2.10	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.10
Invertebrate	Photololigo sp. 1	inshore squid 1	BP	1.57	1.44	Low	Low	Spatial and temporal closures;	N/A		Low

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Productivity	Susceptibility	Level 2 ERA Risk Category Score – Tiger Prawn Sub-fishery	Level 2 ERA Risk Category Score – Banana Prawn Sub-fishery	Current and Planned Management/Assessment	Guideline Applied	Justification	Level 2 ERA Residual Risk Score
						1.90	1.90	Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers			1.90
Invertebrate	Loliolus noctiluca	squid	BP	1.71	1.44	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.23
Invertebrate	Sepia pharaonis	cuttlefish	BP	1.71	1.15	Low 2.06	Low 2.06	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.06
Invertebrate	Harpiosquilla harpax	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Invertebrate	Acanthosquilla multifasciata	mantis shrimp	BP	1.71	1.44	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.23
Invertebrate	Lenisquilla lata	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Invertebrate	Harpiosquilla annandalei	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Invertebrate	Harpiosquilla melanoura	mantis shrimp	BP	1.71	1.44	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.23
Invertebrate	Manningia notialis	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39

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Invertebrate	<i>Annculamys flabellate</i>	fan scallop	BP	1.86	1.67	Low 2.50	Low 2.50	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.50
Invertebrate	<i>Photololigo</i> sp3 – (previous: <i>Photololigo chinensis</i> or <i>Photololigo ethreridgei</i>)	squid	BP	1.57	1.67	Low 2.29	Low 2.29	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.29
Invertebrate	<i>Carinosquilla thailandensis</i>	mantis shrimp	BP	1.71	1.44	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.23
Invertebrate	<i>Clorida wassenbergi</i>	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Invertebrate	<i>Erugosquilla grahami</i>	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Invertebrate	<i>Erugosquilla woodmasoni</i>	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Invertebrate	<i>Kempina mikado</i>	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Invertebrate	<i>Miyakea nepa</i>	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Invertebrate	<i>Oratosquillina gravieri</i>	mantis shrimp	BP	1.71	1.44	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs;	N/A		Low 2.23

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								Hoppers			
Invertebrate	<i>Oratosquilla inornata</i>	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Invertebrate	<i>Oratosquilla interrupta</i>	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Invertebrate	<i>Oratosquilla manningi</i>	mantis shrimp	BP	1.71	1.44	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.23
Invertebrate	<i>Oratosquilla quinquedentata</i>	mantis shrimp	BP	1.71	1.67	Low 2.39	Low 2.39	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.39
Invertebrate	<i>Quollastria gonyptes</i>	mantis shrimp	BP	1.71	1.44	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.23
Invertebrate	<i>Quollastria subtilis</i>	mantis shrimp	BP	1.71	1.44	Low 2.23	Low 2.23	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.23
Invertebrate	<i>Atyopenaeus stenodactylus</i>	prawn	BP	1.29	1.22	Low 1.77	Low 1.77	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.77
Invertebrate	<i>Metapenaeopsis lamellate</i>	prawn	BP	1.00	1.44	Low 1.75	Low 1.75	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.75
Invertebrate	<i>Metapenaeopsis mogiensis</i>	prawn	BP	1.00	1.44	Low	Low	Spatial and temporal closures;	N/A		Low

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						1.75	1.75	Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers			1.75
Invertebrate	<i>Metapenaeopsis novaeguineae</i>	prawn	BP	1.00	2.33	Low 2.53	Low 2.53	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.53
Invertebrate	<i>Metapenaeopsis palmensis</i>	prawn	BP	1.00	1.44	Low 1.75	Low 1.75	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.75
Invertebrate	<i>Parapenaeopsis cornuta</i>	prawn	BP	1.00	1.67	Low 1.95	Low 1.95	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.95
Invertebrate	<i>Parapenaeopsis tenella</i>	prawn	BP	1.00	1.44	Low 1.75	Low 1.75	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.75
Invertebrate	<i>Penaeus canaliculatus</i>	prawn	BP	1.00	1.67	Low 1.95	Low 1.95	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.95
Invertebrate	<i>Penaeus marginatus</i>	prawn	BP	1.00	1.67	Low 1.95	Low 1.95	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.95
Invertebrate	<i>Trachypenaeus anchoralis</i>	prawn	BP	1.00	2.33	Low 2.53	Low 2.53	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.53
Invertebrate	<i>Trachypenaeus curvirostris</i>	prawn	BP	1.00	1.44	Low 1.75	Low 1.75	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.75

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Invertebrate	Trachypenaeus fulvus	prawn	BP	1.00	1.44	Low 1.75	Low 1.75	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.75
Invertebrate	Trachypenaeus gonospinifer	prawn	BP	1.00	2.33	Low 2.53	Low 2.53	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.53
Invertebrate	Trachypenaeus granulosis	prawn	BP	1.00	1.44	Low 1.75	Low 1.75	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 1.75
Invertebrate	Sicyonia cristata	prawn	BP	1.57	1.44	Low 2.13	Low 2.13	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.13
Invertebrate	Panulirus homarus	rock lobster	BP	2.00	1.44	Low 2.46	Low 2.46	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.46
Invertebrate	Photololigo sp2	squid	BP	1.57	1.44	Low 2.13	Low 2.13	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers	N/A		Low 2.13
Chondrichthyan	Pristis zijsron	Green Sawfish	TEP	2.86	1.67	High 3.31	High 3.31	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		High 3.31
Chondrichthyan	Anoxypristis cuspidata	Narrow Sawfish	TEP	2.86	1.67	High 3.31	High 3.31	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		High 3.31

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								section to record species, condition and numbers); CMOs; No-take species			
Chondrichthyan	Pristis microdon	Freshwater Sawfish	TEP	2.71	1.67	High 3.18	High 3.18	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		High 3.18
Chondrichthyan	Pristis clavata	Dwarf Sawfish	TEP	2.71	1.67	High 3.18	High 3.18	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		High 3.18
Chondrichthyan	Pristis pectinata	Wide Sawfish	TEP	2.86	1.67	High 3.31	High 3.31	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		High 3.31
Marine reptile	Ephalophis greyi	North-western Mangrove Seasnake	TEP	3.00	1.44	High 3.33	High 3.33	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		High 3.33
Marine reptile	Hydrophis coggeri	Slender-necked Seasnake	TEP	3.00	1.44	High 3.33	High 3.33	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		High 3.33

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								section to record species, condition and numbers); CMOs; No-take species			
Marine reptile	Hydrophis belcheri	seasnake	TEP	2.71	2.33	High 3.57	High 3.57	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		High 3.57
Marine reptile	Parahydrophis mertoni	Northern mangrove seasnake	TEP	3.00	1.44	High 3.33	High 3.33	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		High 3.33
Marine reptile	Hydrophis pacificus	Large-headed Seasnake	TEP	2.71	3.58	Med 3.07	High 4.49	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		High 4.49
Marine reptile	Hydrophis vorisi	seasnake	TEP	2.71	3.58	Med 3.07	High 4.49	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		High 4.49
Marine reptile	Hydrophis ornatus	seasnake	TEP	2.71	3.58	Med 3.07	High 4.49	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		High 4.49

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								section to record species, condition and numbers); CMOs; No-take species			
Chondrichthyan	Glyphis sp. A [in Last & Stevens, 1994]	Speartooth Shark	TEP	2.43	1.15	Med 2.68	Med 2.68	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.68
Chondrichthyan	Rhincodon typus	whale shark	TEP	2.71	1.15	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.94
Marine mammal	Balaenoptera edeni	Bryde's Whale	TEP	2.86	1.07	Med 3.05	Med 3.05	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.05
Marine mammal	Balaenoptera musculus	Blue Whale	TEP	2.57	1.07	Med 2.78	Med 2.78	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.78
Marine mammal	Dugong dugon	Dugong	TEP	2.71	1.15	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 2.94

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								section to record species, condition and numbers); CMOs; No-take species			
Marine mammal	<i>Orcaella brevirostris</i>	Irrawaddy dolphin	TEP	2.57	1.22	Med 2.84	Med 2.84	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.84
Marine mammal	<i>Feresa attenuata</i>	Pygmy Killer Whale	TEP	2.86	1.22	Med 3.11	Med 3.11	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.11
Marine mammal	<i>Globicephala macrorhynchus</i>	Short-finned Pilot Whale	TEP	2.86	1.22	Med 3.11	Med 3.11	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.11
Marine mammal	<i>Grampus griseus</i>	Risso's Dolphin	TEP	2.86	1.22	Med 3.11	Med 3.11	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.11
Marine mammal	<i>Kogia breviceps</i>	Pygmy Sperm Whale	TEP	2.86	1.07	Med 3.05	Med 3.05	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 3.05

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								section to record species, condition and numbers); CMOs; No-take species			
Marine mammal	<i>Kogia simus</i>	Dwarf Sperm Whale	TEP	2.71	1.22	Med 2.97	Med 2.97	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.97
Marine mammal	<i>Orcinus orca</i>	Killer Whale	TEP	2.86	1.22	Med 3.11	Med 3.11	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.11
Marine mammal	<i>Peponocephala electra</i>	Melon-headed Whale	TEP	2.57	1.22	Med 2.84	Med 2.84	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.84
Marine mammal	<i>Physeter catodon</i>	Sperm Whale	TEP	2.86	1.07	Med 3.05	Med 3.05	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.05
Marine mammal	<i>Pseudorca crassidens</i>	False Killer Whale	TEP	2.86	1.22	Med 3.11	Med 3.11	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 3.11

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								section to record species, condition and numbers); CMOs; No-take species			
Marine mammal	<i>Sousa chinensis</i>	Indo-Pacific Humpback Dolphin	TEP	2.71	1.22	Med 2.97	Med 2.97	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.97
Marine mammal	<i>Stenella attenuata</i>	Spotted Dolphin	TEP	2.57	1.22	Med 2.84	Med 2.84	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.84
Marine mammal	<i>Stenella coeruleoalba</i>	Striped Dolphin	TEP	2.71	1.22	Med 2.97	Med 2.97	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.97
Marine mammal	<i>Stenella longirostris</i>	Long-snouted Spinner Dolphin	TEP	2.43	1.22	Med 2.72	Med 2.72	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.72
Marine mammal	<i>Steno bredanensis</i>	Rough-toothed Dolphin	TEP	2.71	1.22	Med 2.97	Med 2.97	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 2.97

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								section to record species, condition and numbers); CMOs; No-take species			
Marine mammal	Tursiops truncatus	Bottlenose Dolphin	TEP	2.86	1.22	Med 3.11	Med 3.11	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.11
Marine mammal	Ziphius cavirostris	Cuvier's Beaked Whale	TEP	2.86	1.15	Med 3.08	Med 3.08	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.08
Marine reptile	Astrotia stokesii	Stokes' seasnake	TEP	2.71	1.44	Med 3.07	Med 3.07	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.07
Marine reptile	Caretta caretta	Loggerhead	TEP	2.57	1.22	Med 2.84	Med 2.84	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.84
Marine reptile	Chelonia mydas	Green turtle	TEP	2.57	1.22	Med 2.84	Med 2.84	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 2.84

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								section to record species, condition and numbers); CMOs; No-take species			
Marine reptile	<i>Dermochelys coriacea</i>	Leathery turtle	TEP	2.57	1.22	Med 2.84	Med 2.84	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.84
Marine reptile	<i>Eretmochelys imbricata</i>	Hawksbill turtle	TEP	2.43	1.67	Med 2.95	Med 2.95	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.95
Marine reptile	<i>Lepidochelys olivacea</i>	Olive Ridley turtle	TEP	2.43	1.67	Med 2.95	Med 2.95	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.95
Marine reptile	<i>Natator depressus</i>	Flatback turtle	TEP	2.29	1.67	Med 2.83	Med 2.83	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.83
Marine reptile	<i>Pelamis platurus</i>	yellow-bellied seasnake	TEP	2.71	1.44	Med 3.07	Med 3.07	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 3.07

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								section to record species, condition and numbers); CMOs; No-take species			
Marine reptile	<i>Acalyptophis peronii</i>	Horned Seasnake	TEP	2.71	1.44	Med 3.07	Med 3.07	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.07
Marine reptile	<i>Aipysurus apraefrontalis</i>	Short-nosed Seasnake	TEP	2.57	1.44	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.94
Marine reptile	<i>Aipysurus duboisii</i>	Dubois' Seasnake	TEP	2.71	1.44	Med 3.07	Med 3.07	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.07
Marine reptile	<i>Aipysurus eydouxii</i>	Spine-tailed Seasnake	TEP	2.57	1.44	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.94
Marine reptile	<i>Aipysurus foliosquama</i>	Leaf-scaled Seasnake	TEP	2.57	1.44	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 2.94

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								section to record species, condition and numbers); CMOs; No-take species			
Marine reptile	<i>Aipysurus fuscus</i>	Dusky Seasnake	TEP	2.57	1.44	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.94
Marine reptile	<i>Aipysurus laevis</i>	Olive Seasnake, Golden Seasnake	TEP	2.29	1.44	Med 2.70	Med 2.70	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.70
Marine reptile	<i>Aipysurus tenuis</i>	Brown-lined Seasnake	TEP	2.71	1.44	Med 3.07	Med 3.07	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.07
Marine reptile	<i>Disteira major</i>	Olive-headed Seasnake	TEP	2.71	1.44	Med 3.07	Med 3.07	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.07
Marine reptile	<i>Emydocephalus annulatus</i>	Turtle-headed Seasnake	TEP	2.29	1.44	Med 2.70	Med 2.70	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 2.70

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								section to record species, condition and numbers); CMOs; No-take species			
Marine reptile	Hydrelops darwiniensis	Black-ringed Seasnake	TEP	2.57	1.44	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.94
Marine reptile	Hydrophis mcdowelli	seasnake	TEP	2.57	1.44	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.94
Marine mammal	Balaenoptera bonaerensis	Antarctic Minke Whale	TEP	2.86	1.07	Med 3.05	Med 3.05	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.05
Marine mammal	Tursiops aduncus	Indian Ocean bottlenose dolphin	TEP	2.86	1.22	Med 3.11	Med 3.11	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.11
Marine reptile	Disteira kingii	spectacled seasnake	TEP	2.71	1.44	Med 2.19	Med 2.19	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 2.19

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								section to record species, condition and numbers); CMOs; No-take species			
Marine reptile	<i>Hydrophis czeblukovi</i>	fine-spined seasnake	TEP	2.57	1.44	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.94
Marine bird	<i>Calonectris leucomelas</i>	streaked shearwater	TEP	2.57	1.22	Med 2.84	Med 2.84	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.84
Marine reptile	<i>Laticauda colubrina</i>	Banded wide faced Sea krait	TEP	2.43	1.44	Med 3.07	Med 3.07	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.07
Marine reptile	<i>Laticauda laticaudata</i>	Large scaled sea krait	TEP	2.29	1.44	Med 2.70	Med 2.70	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.70
Marine reptile	<i>Hydrophis atriceps</i>	Black-headed seasnake	TEP	2.71	1.44	Med 3.07	Med 3.07	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 3.07

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								section to record species, condition and numbers); CMOs; No-take species			
Marine reptile	<i>Hydrophis caeruleus</i>	Dwarf seasnake	TEP	2.57	1.44	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.94
Marine reptile	<i>Hydrophis gracilis</i>	Slender seasnake	TEP	2.57	1.44	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.94
Marine reptile	<i>Hydrophis inornatus</i>	Plain seasnake	TEP	2.57	1.44	Med 2.94	Med 2.94	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.94
Marine reptile	<i>Hydrophis melanosoma</i>	Black-banded robust seasnake	TEP	2.71	1.44	Med 3.07	Med 3.07	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.07
Chondrichthyan	<i>Glyphis</i> sp C	Speartooth Shark	TEP	2.43	1.44	Med 2.82	Med 2.82	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 2.82

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								section to record species, condition and numbers); CMOs; No-take species			
Marine reptile	Crocodylus johnstoni	freshwater crocodile	TEP	2.43	1.22	Med 2.82	Med 2.82	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.82
Marine reptile	Crocodylus porosus	saltwater crocodile	TEP	2.71	1.07	Med 2.91	Med 2.91	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.91
Marine reptile	Lapemis hardwickii	Spine-bellied Seasnake	TEP	2.14	2.33	Low 2.58	Med 3.16	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 3.16
Teleost	Hippocampus spinosissimus	Hedgehog Seahorse	TEP	1.43	2.33	Med 2.73	Low 2.03	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Med 2.73
Teleost	Solenostomus cyanopterus	Blue-finned Ghost Pipefish, Robust Ghost	TEP	2.14	1.67	Med 2.71	Low 2.47	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Med 2.71

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								section to record species, condition and numbers); CMOs; No-take species			
Marine bird	Anous stolidus	Common noddy	TEP	2.29	1.22	Low 2.59	Low 2.59	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.59
Marine bird	Fregata ariel	Lesser frigatebird	TEP	2.29	1.22	Low 2.59	Low 2.59	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.59
Marine bird	Sula leucogaster	Brown boobies	TEP	2.29	1.22	Low 2.59	Low 2.59	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.59
Marine bird	Larus novaehollandiae	Silver Gull	TEP	2.14	1.22	Low 2.46	Low 2.46	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.46
Marine bird	Sterna anaethetus	Bridled Tern	TEP	2.00	1.22	Low 2.34	Low 2.34	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Low 2.34

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								section to record species, condition and numbers); CMOs; No-take species			
Marine bird	<i>Sterna bengalensis</i>	Lesser crested tern	TEP	2.14	1.22	Low 2.46	Low 2.46	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.46
Marine bird	<i>Sterna bergii</i>	Crested Tern	TEP	2.29	1.22	Low 2.59	Low 2.59	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.59
Marine bird	<i>Sterna dougallii</i>	Roseate tern	TEP	2.00	1.22	Low 2.34	Low 2.34	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.34
Marine bird	<i>Sterna sumatrana</i>	Black-naped tern	TEP	2.14	1.22	Low 2.46	Low 2.46	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.46
Marine bird	<i>Fregata minor</i>	Great Frigatebird, Greater Frigatebird	TEP	2.14	1.22	Low 2.46	Low 2.46	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Low 2.46

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								section to record species, condition and numbers); CMOs; No-take species			
Marine bird	Anous minutus	Black Noddy	TEP	2.14	1.22	Low 2.46	Low 2.46	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.46
Marine mammal	Delphinus delphis	Common Dolphin	TEP	2.29	1.22	Low 2.59	Low 2.59	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.59
Marine reptile	Hydrophis elegans	Elegant seasnake	TEP	2.14	1.44	Low 2.58	Low 2.58	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.58
Marine reptile	Enhydrina schistosa	Beaked Seasnake	TEP	2.00	1.44	Low 2.46	Low 2.46	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.46
Teleost	Corythoichthys intestinalis	Australian Messmate Pipefish, Banded Pipefish	TEP	1.43	1.44	Low 2.03	Low 2.03	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Low 2.03

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								section to record species, condition and numbers); CMOs; No-take species			
Teleost	<i>Halicampus brocki</i>	Brock's Pipefish	TEP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 1.88
Teleost	<i>Doryrhamphus janssi</i>	Cleaner Pipefish, Janss' Pipefish	TEP	1.57	1.67	Low 2.29	Low 2.29	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.29
Teleost	<i>Bhanotia fasciolata</i>	Corrugated Pipefish, Barbed Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	<i>Acentronura breviperula</i>	Hairy Pygmy Pipehorse	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	<i>Solegnathus guentheri</i>	Indonesian Pipefish, Gunther's Pipehorse	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Low 2.20

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								section to record species, condition and numbers); CMOs; No-take species			
Teleost	<i>Trachyrhamphus longirostris</i>	Long-nosed Pipefish, Straight Stick Pipefish	TEP	1.43	1.44	Low 2.03	Low 2.03	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.03
Teleost	<i>Halicampus dunckeri</i>	Red-hair Pipefish, Duncker's Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	<i>Haliichthys taeniophorus</i>	Ribboned Seadragon, Ribboned Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	<i>Dunckerocampus dactyliophorus</i>	Ringed Pipefish	TEP	1.57	1.67	Low 2.29	Low 2.29	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.29
Teleost	<i>Choeroichthys brachysoma</i>	Pacific Short-bodied Pipefish, Short-bodied pipefish	TEP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Low 1.88

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								section to record species, condition and numbers); CMOs; No-take species			
Teleost	Choeroichthys suillus	Pig-snouted Pipefish	TEP	1.43	1.15	Low 1.83	Low 1.83	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 1.83
Teleost	Cosmocampus banneri	Roughridge Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	Corythoichthys schultzi	Schultz's Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	Hippocampus jugumus	Spiny Seahorse	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	Halicampus spinirostris	Spiny-snout Pipefish	TEP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Low 1.88

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								section to record species, condition and numbers); CMOs; No-take species			
Teleost	<i>Campichthys tricarinatus</i>	Three-keel Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	<i>Micrognathus micronotopterus</i>	Tidepool Pipefish	TEP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 1.88
Teleost	<i>Hippocampus angustus</i>	Western Spiny Seahorse	TEP	1.43	1.15	Low 1.83	Low 1.83	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 1.83
Teleost	<i>Corythoichthys amplexus</i>	Fijian Banded Pipefish, Brown-banded Pipefish	TEP	1.43	1.15	Low 1.83	Low 1.83	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 1.83
Teleost	<i>Corythoichthys conspicillatus</i>	Yellow-banded Pipefish, Network Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Low 2.20

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Productivity	Susceptibility	Level 2 ERA Risk Category Score – Tiger Prawn Sub-fishery	Level 2 ERA Risk Category Score – Banana Prawn Sub-fishery	Current and Planned Management/Assessment	Guideline Applied	Justification	Level 2 ERA Residual Risk Score
								section to record species, condition and numbers); CMOs; No-take species			
Teleost	<i>Doryrhamphus melanopleura</i>	Bluestripe Pipefish	TEP	1.57	1.67	Low 2.29	Low 2.29	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.29
Teleost	<i>Corythoichthys ocellatus</i>	Orange-spotted Pipefish, Ocellated Pipefish	TEP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 1.88
Teleost	<i>Festucalex cinctus</i>	Girdled Pipefish	TEP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 1.88
Teleost	<i>Filicampus tigris</i>	Tiger Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	<i>Halicampus grayi</i>	Mud Pipefish, Gray's Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Low 2.20

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Productivity	Susceptibility	Level 2 ERA Risk Category Score – Tiger Prawn Sub-fishery	Level 2 ERA Risk Category Score – Banana Prawn Sub-fishery	Current and Planned Management/Assessment	Guideline Applied	Justification	Level 2 ERA Residual Risk Score
								section to record species, condition and numbers); CMOs; No-take species			
Teleost	Hippichthys cyanospilos	Blue-speckled Pipefish, Blue-spotted Pipefish	TEP	1.43	1.44	Low 2.03	Low 2.03	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.03
Teleost	Hippichthys heptagonus	Madura Pipefish	TEP	1.43	1.44	Low 2.03	Low 2.03	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.03
Teleost	Hippichthys penicillus	Beady Pipefish, Steep-nosed Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	Hippocampus taeniopterus	Spotted Seahorse, Yellow Seahorse	TEP	1.57	1.22	Low 1.99	Low 1.99	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 1.99
Teleost	Hippocampus planifrons	Flat-face Seahorse	TEP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific	N/A		Low 1.88

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Productivity	Susceptibility	Level 2 ERA Risk Category Score – Tiger Prawn Sub-fishery	Level 2 ERA Risk Category Score – Banana Prawn Sub-fishery	Current and Planned Management/Assessment	Guideline Applied	Justification	Level 2 ERA Residual Risk Score
								section to record species, condition and numbers); CMOs; No			
Teleost	<i>Syngnathoides biaculeatus</i>	Double-ended Pipehorse, Alligator Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	<i>Solegnathus</i> sp. 1 [in Kuitert, 2000]	pipehorse	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	<i>Trachyrhamphus bicoarctatus</i>	Bend Stick Pipefish, Short-tailed Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	<i>Corythoichthys haematopterus</i>	pipefish	TEP	1.43	1.44	Low 2.03	Low 2.03	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.03
Teleost	<i>Cosmocampus maxweberi</i>	pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition	N/A		Low 2.20

Taxonomic Group	Scientific Name	Common Name	Role in Fishery	Productivity	Susceptibility	Level 2 ERA Risk Category Score – Tiger Prawn Sub-fishery	Level 2 ERA Risk Category Score – Banana Prawn Sub-fishery	Current and Planned Management/Assessment	Guideline Applied	Justification	Level 2 ERA Residual Risk Score
								and numbers); CMOs; No-take species			
Teleost	<i>Halicampus macrorhynchus</i>	pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	<i>Hippichthys spicifer</i>	Pipefish	TEP	1.43	1.44	Low 2.03	Low 2.03	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.03
Teleost	<i>Hippocampus zebra</i>	Pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 2.20
Teleost	<i>Micrognathus pygmaeus</i>	Pipefish	TEP	1.43	1.22	Low 1.88	Low 1.88	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	N/A		Low 1.88
Teleost	<i>Microphis brachyurus</i>	pipefish	TEP	1.43	1.67	Low 2.20	Low 2.20	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition	N/A		Low 2.20

Level 2 ERA Residual Risk Score	Justification	Guideline Applied	Current and Planned Management/Assessment	Level 2 ERA Risk Category Score – Banana Prawn Sub-fishery	Level 2 ERA Risk Category Score – Tiger Prawn Sub-fishery	Susceptibility	Productivity	Role in Fishery	Common Name	Scientific Name	Taxonomic Group
			and numbers); CMOs; No-take species								
Low 2.03		N/A	Spatial and temporal closures; Reduction in fishing effort via SAP; Restricted net length; BRDs; Hoppers; Logbooks (specific section to record species, condition and numbers); CMOs; No-take species	Low 2.03	Low 2.03	1.44	1.43	TEP	Short-keeled Pipefish	Hippichthys parvicarinatus	Teleost

*Role in Fishery – TA (target), TB (target bait), BP (byproduct), DI (discard/bycatch), TEP (threatened, endangered or protected).

Table 4 Summary of Level 2 PSA Residual Risk Results

Component	Changed from high to medium	Changed from high to low	Changed from medium to low	High Residual Risk	Medium Residual Risk	Low Residual Risk
Target	0	0	0	0	2	7
Target Bait	0	0	0	0	0	0
Bycatch (discard)	0	0	0	0	0	0
Byproduct	2	0	0	14	31	90
TEP	0	0	0	12	64	52
Total	2	0	0	26	97	149

4. CONCLUSION

The purpose in applying the Level 2 PSA residual risk guidelines was to take into account additional information and to ensure that the assessment was refined appropriately. Refinements were considered in either increasing or reducing the risk as appropriate.

Only two species had their risk score adjusted using the residual risk guidelines. A number of missing attributes were able to be assessed by borrowing details from a closely related species. Guideline 1 was then used to reduce the risk score for these two species from high to medium.

Overall 26 species remain at high risk. There are seven seasnake species that remain at high risk due to low fecundity, and a high susceptibility to drowning in trawls. The low fecundity and high susceptibility to being caught in nets has also maintained a high risk score for five Sawfish species. The remaining 14 species are scored at high risk primarily due to missing attributes however, FRDC project 2005/051 has recently re-evaluated sea snakes and FRDC 2006/008 is currently underway to address shortfalls in knowledge relating to other species of relevance to the NPF.

The residual risk process brings the ERA assessment up-to-date with most of the current management initiatives within the fishery. Using the results presented here, an appropriate management strategy will be developed to address the high priority species as part of the ERM framework.



GLOSSARY

Activity	Refers to any fishing activity.
Actual risk	The real risk posed for a species from fishing activities.
Attribute	A general term for a set of properties relating to the productivity or susceptibility of a particular unit of analysis.
Availability	Used in Level 2 PSA assessment to calculate the impact on an ecological component due to a fishing activity. Considers overlap of fishing effort with a species distribution.
Bycatch	<p>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;</p> <p>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.</p>
Byproduct	A non-target species captured in a fishery, that has value to the fisher and be retained for sale.
Catch limit	The vessel catch limit is a limit on the quantity each individual vessel can land per trip or short period of time.
Component	The marine ecosystem is broken down into five components for the risk assessment: target species (TA); byproduct (BI) and bycatch species (DI); threatened, endangered and protected species (TEP); habitats; and ecological communities.
Effort	The total fishing gear in use for a specified period of time.
Encounterability	Used in Level 2 PSA assessment to calculate the impact on an ecological component due to a fishing activity. Considers the likelihood that a species will encounter fishing gear that is deployed within the geographic range of that species (based on two attributes: adult habitat and bathymetry).
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act (Cth) 1999</i>
ERA	Ecological risk assessment for the effects of fishing as developed by AFMA and CSIRO.
ERM Framework	Ecological risk management process outlined by AFMA.
False negative	Species assessed to be low risk when they are actually high risk.
False positive	Species assessed to have a high risk when they are actually low risk
Fishery	A related set of fish harvesting activities regulated by an authority (e.g. South-East Trawl Fishery).
Gear	The equipment used for fishing, e.g. gillnet, Danish seine, pelagic longline, midwater trawl, purse seine, trap etc.



Level 1	The level of the ERA assessment which includes a qualitative assessment of scale, intensity, consequence analysis (SICA).
Potential risk	Possible risk as a result of fishing activities
Post Capture Mortality	Used in Level 2 PSA assessment to calculate the impact on an ecological component due to a fishing activity. Considers the condition and subsequent survival of a species that is captured and released (or discarded).
Precautionary	The approach whereby, if there is uncertainty about the risk, risk is assumed to be high, unless there is advice to the contrary.
PSA	Productivity susceptibility analysis for Level 2 assessment of the ecological assessment.
Productivity	This determines the rate at which the unit can recover after potential depletion or damage by the fishing.
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.
Selectivity	Used in Level 2 PSA assessment to calculate the impact on an ecological component due to a fishing activity. Considers the potential of the gear to capture or retain species.
SICA	Scale, intensity, consequence analysis for the Level 1 assessment.
Spatial management	Fisheries management that encompasses spatial arrangements such as depth closures or area closures.
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.
Unit	The entities for which attributes are scored in the Level 2 analysis. For example, the units of analysis for the Target Species component are individual "species".



APPENDIX A - SUMMARY OF PRODUCTIVITY AND SUSCEPTIBILITY SCORING

Productivity

The productivity of a unit determines the rate at which the unit can recover after potential depletion or damage by fishing. The productivity score is the average of the following attributes:

1. Average age of species at maturity;
2. Average size of species at maturity;
3. Average maximum age of species;
4. Average maximum size of species;
5. Fecundity of species;
6. Reproductive strategy of species; and
7. Trophic level: organisms position in the food chain.

Susceptibility

Susceptibility is the extent of the impact on an ecological component due to a fishing activity. The susceptibility score is the product of the following attributes:

1. **Availability:** considers overlap of fishing effort with a species distribution;
2. **Encounterability:** considers the likelihood that a species will encounter fishing gear that is deployed within the geographic range of that species (based on two attributes: adult habitat and bathymetry);
3. **Selectivity:** considers the potential of the gear to capture or retain species; and
4. **Post Capture Mortality:** considers the condition and subsequent survival of a species that is captured and released (or discarded).

Based on the Level 2 results, if a unit is assessed at low risk from fishing, the rationale is documented and it is not assessed at a higher level. For units assessed at medium or high risk, management arrangements to mitigate the risks are to be further investigated and implemented. If there are no planned or agreed management arrangements, the assessment moves to Level 3 (for more detail, refer to Hobday *et al.*, 2007).



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