



Australian Government

Australian Fisheries Management Authority

Residual Risk Assessment of the Level 2 Productivity Susceptibility Assessment

Non-Teleost and Non-Chondrichthyan Species

**Report for the Shark Gillnet method of the
Gillnet Hook and Trap**



2012

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EXECUTIVE SUMMARY

The Australian Fisheries Management Authority (AFMA) has undertaken detailed ecological risk assessments (ERAs) for all major and minor Commonwealth managed fisheries as a key part of the move towards ecosystem-based fisheries management. 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 strategies 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 Productivity Susceptibility Analysis (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 the Commonwealth Scientific and Industrial Research Organisation (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 most current management arrangements. To assist managers, a clear set of decision rules are outlined that are to be applied to individual species.

A Sustainability Assessment for Fishing Effects (SAFE) has been undertaken by CSIRO but has only been applied to teleost and chondrichthyan species. This is primarily due to not being able to obtain essential growth parameters for non-teleost and non-chondrichthyan species. For this 2012 Level 2 Residual Risk ERA, the residual guidelines are applied to non-teleost and non-chondrichthyan species that have been caught or interacted with in the 2007-2011 period. The residual risk guidelines are also applied to the

non-teleost and non-chondrichthyan species assessed as at high risk in the 2008 residual risk assessment (AFMA, 2008). This is to take into account the quantity of the species/number of individuals caught over the period specified and to potentially identify trends.

Four seal species and the Australian Sea Lion were re-assessed as high risk species from the previous assessment. Two of the seal species, the Leopard Seal and the Southern Elephant Seal, had their risk scores reduced to zero due to low levels of interaction in the fishery. The Common Dolphin had previously been assessed as at medium risk in the shark gillnet sector. There were 55 recorded interactions in 2011 which increased the risk score for these species.

1. Overview

1.1 Ecological Risk Management Framework

A key component in the Australian Fisheries Management Authority's (AFMA's) move towards ecosystem based fisheries management (EBFM) has been the undertaking of ecological risk assessments (ERAs) for all major Commonwealth managed fisheries. By assessing the impacts of fishing on all components of the marine environment, the ERAs encompass an ecosystem-based assessment approach. The ERAs 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.

The ERA process is hierarchical, and currently includes three levels of assessment. The first is a Level 1 Scale Intensity Consequence Analysis (SICA), which is a qualitative assessment that broadly looks at which hazards (activities) could lead to a significant impact on species, habitats or communities. The next is a Level 2 Productivity Susceptibility Analysis (PSA) which is a semi-quantitative analysis. Under PSA, risk to a species, habitat or community is based on its susceptibility to fishing, and productivity, or the rate at which the unit can recover after an impact. Level 2 PSA has been completed for all major Commonwealth fisheries. The final Level 3 is a quantitative assessment, and can include assessments such as the CSIRO's sustainability assessment for fishing effects (SAFE), or stock assessments for commercially fished species.

Due to the semi-quantitative nature of the Level 2 PSA, not all risk scores are an accurate representation of actual risk. To account for this and to ensure management effort is not unnecessarily expended on 'false positives', an additional step called a residual risk assessment is included in the ERA process. The residual risk assessment is used to account for current management measures which reduce the level of risk posed by a fishery to species, and adjust risk scores where appropriate. During a detailed review of the ERA methodology, AFMA found that some ERAs did not include all existing management arrangements at the time of assessment. Furthermore, since the initial ERAs were completed in 2007, the management of some fisheries has changed and additional data and information may have become available to provide further detail on the actual level of risk of fishing on a species, habitat or community.

To assist with the implementation of EBFM across all fisheries AFMA has established a process for implementing ecological risk management (ERM) (see Figure 1). This process ensures that a consistent process is followed across fisheries when responding to the ERA outcomes. While this focuses on responding to the results of ERAs, it acknowledges that there are other initiatives contributing to the achievement of EBFM. The ERM framework

will streamline fisheries' responses to the results of ERAs and incorporate other initiatives such as bycatch and discard programs and species-specific management arrangements.

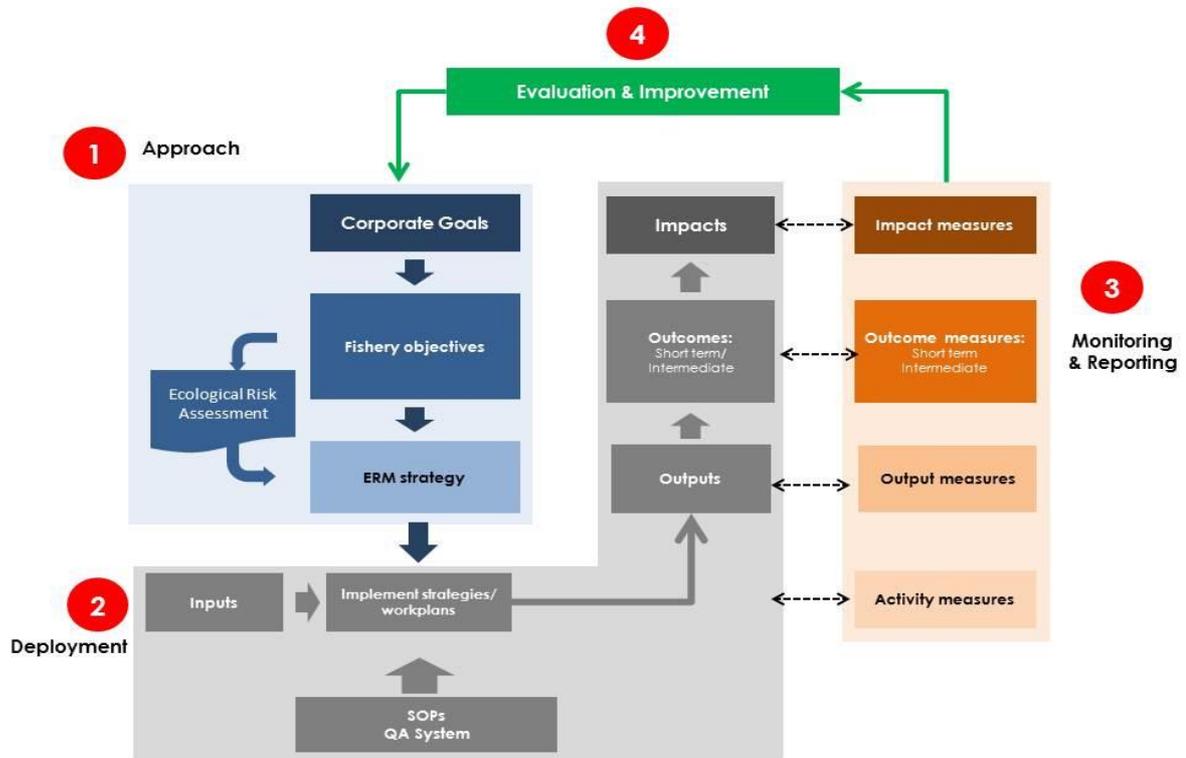


Figure 1 Ecological Risk Management Process Map

1.2 Ecological Risk Assessment Methodology

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

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

The ERA assessment adopts a hierarchical approach (**Figure 2**). With every progressive level, the precision increases along with confidence in the risk scores (noting that not all components of a system progress all the way through the assessment hierarchy). The Level

2 PSA, Residual Risk Assessment and SAFE assessments are detailed below. For the full ERA methodology, including Scoping and Level 1 Scale, Intensity, Consequence, Analysis (SICA), please refer to *Ecological Risk Assessment for Effects of Fishing: Methodology* (2007).

Risk Assessment Hierarchy

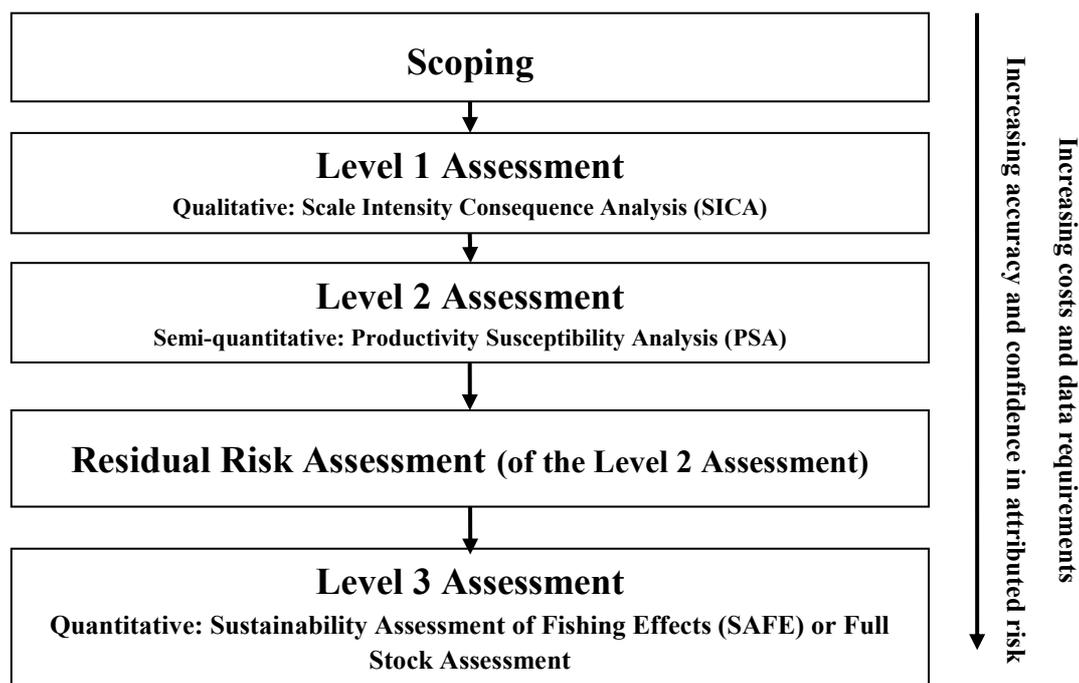


Figure 2 The different levels of risk assessment and the trend in confidence and cost

Level 2 Productivity Susceptibility Assessment (PSA)

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) 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:

- **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.

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 are 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’.

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.

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 the likelihood of interaction is already low there is little additional management that a fishery can introduce to mitigate the risk. The level of interaction or capture is therefore included as part of the Level 2 PSA residual risk process (see below).

Constraints of Level 2 PSA

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. 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, or false-positive, of the actual risk for some species. The management strategies 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 actions or strategies 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).

It may be the case that not all management actions are considered. 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). An example of

this is when a species is missing information on its productivity and susceptibility attributes the risk score defaults to high 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. Regardless of their risk scores, AFMA will take all reasonable steps to minimise any future interactions with TEP species through the ERM strategy.

When AFMA reviewed the methodology using example fisheries data in 2007, 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.

Level 2 - Residual Risk Analysis of PSA results

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 PSA. Before moving to a SAFE assessment, the residual risks are assessed to account for some of the constraints of the Level 2 PSA (mentioned above). The Level 2 PSA residual risk process incorporates some of the concepts of a Level 3 assessment and is more cost effective than a full SAFE assessment. Furthermore, the Level 2 PSA residual risk results more accurately represent overall risk within a fishery and will help clarify if a higher level assessment is necessary.

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 is applied on a species-by-species basis to determine the 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 are applied to all high risk species by managers in consultation with Resource Assessment Groups (RAGs) and Management Advisory Committees (MACs) and fishery experts. Broadly the application processes involved the following steps:

- Sorting the ERA result by high risk, then grouping the high risk species by role (e.g. target, byproduct or discarded species) within the fishery, then by taxonomic group;
- Creating a list of all management arrangements not included in the ERA results for reference when applying the guidelines;
- 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 RAGs and MACs for feedback; and
- Finalising the Level 2 PSA residual risk results for release.

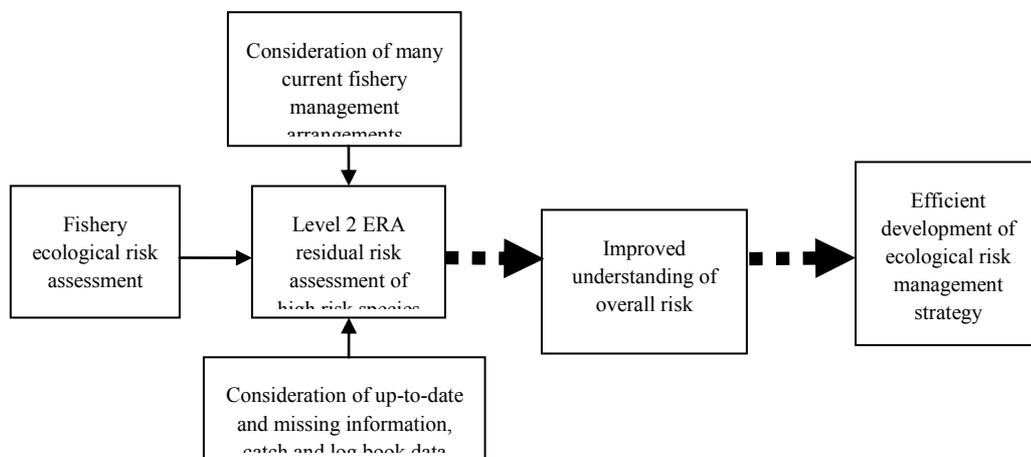


Figure 3. Flow diagram of the Level 2 ERA residual risk process

Table 1 Summary of Level 2 ERA Residual Risk Guidelines

Guideline Number	Summary
Guideline 1. Risk rating due to missing/incorrect information.	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.
Guideline 2. Additional scientific assessment.	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.
Guideline 3. At risk due to missing attributes.	When there are three or more missing productivity attributes, considers closely related species within a fishery that have those productivity attributes known.
Guideline 4. At risk with spatial assumptions.	Uses additional information on spatial distribution of species populations to better represent the species distribution overlap with the fishery.
Guideline 5. At risk in regards to level of interaction/capture with a zero or negligible level of susceptibility.	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.
Guideline 6. Effort and catch management arrangements for target and byproduct species.	Considers current management arrangements based on effort and catch limits set using a scientific assessment for key species.
Guideline 7. Management arrangements to mitigate against the level of bycatch.	Considers management arrangements in place that mitigate against bycatch by the use of gear modifications, mitigation devices and catch limits.
Guideline 8. Limits on associated species through other management arrangements.	Considers the implications of management arrangements for a particular species on other associated species.
Guideline 9. Management arrangements relating to seasonal, spatial and depth closures.	Considers management arrangements based on seasonal, spatial and/or depth closures.

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) developed by CSIRO to assess multiple species or a fully quantitative assessment of a specific species (similar to a standard stock assessment).

The SAFE methodology can only be applied to teleost (fish) and chondrichthyan (sharks and rays) species as it is difficult to obtain essential growth parameters for other species. For non-teleost and non-chondrichthyan species, the Level 2 PSA residual risk analysis is the highest level of assessment currently available.

1.3 ERA Milestones and Previous ERA Assessments

2001

Funding was received to invest into ecological risk assessments (ERA's). The methodology was developed to be applied to Australian Commonwealth fisheries across 6 years in 2 stages. The first stage (Hobday et al. 2004) occurred between 2001 and 2004 and developed the basic methods and approach and applied them to several fisheries managed by the Australian Fisheries Management Authority (AFMA). Stage 2 (Smith et al. 2007) occurred between 2004 and 2007 and extended the Ecological Risk Assessment (ERA) methods, particularly for Level 2 PSA assessments, and applied the methods to 31 sub-fisheries within 13 of AFMA's managed fisheries.

2007

The report *Ecological Risk Assessment for Effects of Fishing: Report for the Shark Gillnet Sub-Fishery of the Commonwealth Gillnet Hook and Trap Sector of the Southern and Eastern Scalefish and Shark Fishery* (Walker et al. 2007) was produced. This report completes 4 stages of the ERA method: Scoping, Level 1, Level 2 and a model based Level 3 analysis.

The residual risk guidelines were developed in consultation with CSIRO and stakeholders to assist AFMA managers in refining the Level 2 PSA results. They were developed to maintain the key features of objectivity and consistency from the ERA process, and to ensure a repeatable and transparent assessment process.

The Level 3 Sustainability Assessment for Fishing Effects (SAFE) method was initially developed for the SESSF in 2007 and applied to teleost and chondrichthyan species impacted by five fishing methods across the SESSF: otter board trawl and Danish seine in the Commonwealth Trawl Sector, otter board trawl in the Great Australian Bight trawl sector, shark gillnet and scalefish automatic longline in the Gillnet, Hook and Trap Sector (Zhou et al. 2007).

2010

The report *Residual Risk Assessment of the Level 2 Ecological Risk Assessment Species Results: Report for the Gillnet Sector of the Gillnet Hook and Trap Fishery* (AFMA, 2010b) was produced. This report used the results from the Level 2 PSA table and the residual risk guidelines to determine the residual risk category for the species impacted by shark gillnet method.

2012

For this 2012 Level 2 Residual Risk ERA, the guidelines are applied to non-teleost and non-chondrichthyan species that have been caught or interacted with in the 2009-2011 period. The residual risk guidelines are also applied to the non-teleost and non-chondrichthyan species assessed as at high risk in the 2010 residual risk assessment (AFMA, 2010b). This is to take into account the quantity of the species/number of individuals caught over the period specified and to potentially identify trends.

The Level 3 SAFE methodology was updated to include the most recent fishery distribution and effort data, new species from logbook and observer data and the introduction of Danish seine method into the Great Australian Bight Trawl Sector (GABT). The assessment was applied to six fishing methods from different sectors in the SESSF: otter board trawl and Danish seine in the Commonwealth Trawl Sector and the Great Australian Bight Trawl Sector, shark gillnet and scalefish auto-longline in the Gillnet, Hook and Trap Sector (Zhou *et al.* 2012).

2. Fishery Description

The shark gillnet method is used in the gillnet hook and trap sector (GHAT) of the larger Southern and Eastern Scalefish and Shark Fishery (SESSF). The sector covers an area from the NSW/Victorian border to the South Australian/Western Australian border including waters around Tasmania; from the low water mark to the extent of the Australian Fishing Zone (AFZ).

The shark gillnet sector sets demersal gillnets to target Gummy Shark. Current management arrangements restrict all gillnet operations to waters shallower than 183 m to protect large School Shark found in deeper waters. Gillnet operators in the GHAT are permitted to use up to 6,000 metres (outside 3 nm) with the exception of waters adjacent to South Australia where the maximum gillnet length is 4,200 metres. All mesh sizes must be greater than or equal to 15 centimetres and less than or equal to 16.5 centimetres (6-6½ inches).

The shark fishery has traditionally supplied fish for local markets with a large proportion of the catch sold in southern Australia. The fishing license buy back, as part of the \$220 million Federal Government ‘*Securing our Fishing Future*’ Package, bought out 26 of the 88 permits. There are currently 62 Commonwealth gillnet boat concessions and 43 South Australian and Tasmanian Coastal Waters Permits that allow gillnetting.

Fishery Specifics

Gear: Monofilament gillnet with a maximum length of 6,000 metres with the exception of waters adjacent to South Australia where the maximum gillnet length is 4,200 metres.

Area:	On the continental shelf from Western Australia-South Australian border to Victorian-New South Wales border including waters around Tasmania.
Depth range:	10 m to 183 m (96% of gummy shark taken <80 m)
Discard rate:	Quota species ~2% by number are discarded; 3% of all chondrichthyan species and 2% of teleost species by number are discarded; most bycatch is Port Jackson Shark, Draughtboard Shark, Piked Dogfish and Eagle Rays, discarded live.
Main target species:	Gummy Shark
Management:	Input Controls: Gear restrictions, spatial closures Output Controls: Individual transferable quotas for the four main species; trigger limits for bycatch species
Observer program:	In place since 2007; observer or camera coverage levels are 100% in South Australia and 10% in the remainder of the area being fished, scientific surveys conducted 1973-76, 1986-87, 1998-01 and 2007-2008.

Table 3. Fleet Size, Fishing Effort and Observer Input – 2007-2011. Data Source: ABARES Fish Status Reports 2008 and 2010.

	Fleet Size – Number of Active GHAT Vessels	Effort - Number of Lifts Per Year (km)	Observer Program - Number of Lifts (km)
2007-2008 Season	66	34,870	154
2008-2009 Season	62	35,163	155
2009-2010 Season	63	37,396	1015
2010-2011 Season	59	40,226	2097

2.1. New management arrangements introduced since the 2010 Level 2 Residual Risk ERA

In June 2010 AFMA implemented the Australian Sea Lion Management Strategy. The Strategy was developed to reduce and monitor the interactions between Australian Sea Lions and gillnets used by Commonwealth shark fishers in the area of the fishery off South Australia. The measures implemented under the Strategy included formal closures around more than 40 Australian Sea Lion colonies in South Australian waters; the setting of Australian Sea Lion mortality limits that trigger additional closures if unacceptable levels of ongoing Australian Sea Lion interaction occur; and a review of gillnet fishing practices.

On 1 May 2011 additional areas of the fishery were closed to fishing by gillnets, the use of hooks by affected eligible gillnet concession holders was allowed in the closed areas and the Australian Sea Lion Management Zone and mandatory monitoring through onboard observers or electronic monitoring of all fishing operations using gillnets in the areas of waters adjacent to the closed areas was implemented.

On 21 December 2011 AFMA approved the recommendations to reduce the trigger limits for Australian Sea Lions. The revised triggers means that if a trigger limit is reached in a zone, that zone will be closed to gillnetting for a period of 18 months, or if the overall trigger limit is reached, the overall ASL Management Zone will be closed to gillnetting for a period of 18 months.

Given the growing significance of dolphin interactions, on 22 September 2011, AFMA closed an area of approximately 27,300 square kilometres east of Kangaroo Island to gillnet fishing, and requires 100 per cent observer coverage or cameras in an area adjacent to the closure.

The total headrope length of gillnet, or, if more than one net is used, the total combined headrope length of gillnet that may be deployed from a boat at any one time (that is, that may be in the water at any one time) must not exceed 6,000 metres. This has been increased from a previous total of 4200 metres.

3. Results

Level 1 Scale Intensity Consequence Analysis (SICA)

The following results are derived from the *Ecological Risk Assessment for Effects of Fishing: Report for the Shark Gillnet Sub-Fishery of the Commonwealth Gillnet Hook and Trap Sector of the Southern and Eastern Scalefish and Shark Fishery* (Walker et al. 2007):

Number of Ecological Units Assessed

Target species:	1
Byproduct species:	80
Discard species:	56
TEP species:	192
Habitats:	102 (98 demersal, 4 pelagic)
Communities:	11 (9 demersal, 2 pelagic)

Most activities associated with within-fishery hazards (direct impacts) are eliminated at Level 1 (risk scores 1 or 2). Two remaining activities include:

- ‘fishing’ associated with capture direct impact (for target species, byproduct & bycatch species, TEP species, and habitat components)
- ‘incidental behaviour’ associated with capture direct impact (for TEP species component)

Three activities associated with external hazards also remain:

- ‘coastal development’ (byproduct & bycatch species)
- ‘other extractive activities’ (byproduct & bycatch species component)
- ‘other anthropogenic activities’ (TEP species component)

There is only one severe consequence (risk score 5) associated with within-fishery activities; this is ‘fishing’ from capture direct impact on the byproduct and bycatch species component. All other activities with consequence scores rated as major or severe (risk scores 4 or 5, respectively) are associated with external hazards.

Three components (target species, byproduct and bycatch species and TEP species) have within-fishery activities with consequences rated as moderate or above and are therefore assessed in more detail at Level 2.

Level 2 Productivity Susceptibility Analysis

329 species were assessed under Level 2 PSA. 21 were assessed to be at high risk (1 target species, 11 byproduct species, 3 bycatch species and 6 TEP species). By taxa, the high risk species comprise 16 chondrichthyans and 5 marine mammals. Of the 329 species assessed at Level 2, expert over rides were used on 151 species (mainly marine birds, mammals and reptiles in the TEP component). Of the 21 species assessed at high risk, only one (byproduct) species had more than three missing attributes.

The 6 TEP species assessed as high risk were; White Shark, Leopard Seal, New Zealand Fur Seal, Australian Sea Lion, Australian Fur Seal, Elephant Seal.

For detailed results and methodology, refer to *Ecological Risk Assessment for Effects of Fishing: report for the shark gillnet sub-fishery of the Commonwealth gillnet hook and trap sector of the Southern and Eastern Scalefish and Shark Fishery* (Walker et al., 2007).

Level 2 PSA residual risk

For this 2012 Level 2 Residual Risk ERA, the guidelines are applied to non-teleost and non-chondrichthyan species that have been caught or interacted with in the 2009-2011 period. The residual risk guidelines are also applied to the non-teleost and non-chondrichthyan species assessed as at high risk in the 2010 residual risk assessment (AFMA, 2010b). This is to take into account the quantity of the species/number of

individuals caught over the period specified and to potentially identify trends. **Table 4** is a summary of the non-teleost and non-chondrichthyan species/species groups considered in the 2010 residual risk assessment.

Appendix B shows the quantities of non-teleost and non-chondrichthyan species caught or interacted with between 2009 and 2011. From the data provided, species identification could not be obtained for 18 of the species caught, so species groups are used and several are recorded more than once, e.g. ‘Octopoda – Order Octopoda’ and Octopuses – Octopodidae’. These were identified to the lowest discernible taxonomic group (i.e. Class, Order, Family etc) and the PSA score was determined from species that are members of that group with similar attributes. None of these species were assessed as at high risk using PSA attribute scores. Catch and observer records indicate low levels of catch with these species, at a level which is not considered detrimental to the population.

Twelve TEP species were included in this re-assessment. Five of those were marine mammals carried over as species assessed as at high risk in the previous residual risk assessment. The Common Dolphin was also added to the assessment due to 55 recorded interactions in 2011. Six species of seabirds were also added to the assessment as species caught or interacted with since the previous assessment.

Table 5 is a summary of this 2012 Level 2 PSA residual risk assessment. Risk scores for those species also assessed in 2010 have been re-evaluated to take into account changes to management strategies and changes to catch, discard and interaction data.

Guideline 5 considers low levels of interaction or catch and was used to reduce the risk score for the Leopard Seal and Southern Elephant Seal. The susceptibility score was reduced to 1 which resulted in a low residual risk score.

The Common Dolphin was previously assessed as at medium risk from gillnet methods in the GHAT. The populations of these species are in the proximity of the gillnet fishery. When the original scientific surveys were conducted and the productivity and susceptibility scores were produced, the Common Dolphin had never been observed in 6-6½ inch mesh size shark gillnets. Therefore, the selectivity was assumed low for this species. There have been 55 interactions with this species recorded in 2011, which suggests that selectivity is higher than once assumed. The number of interactions has been considered in addition to the fact that it is a TEP species and the residual risk score was increased to high.

Since the introduction of the Australian Sea Lion Management Strategy, observer coverage has increased to 100 per cent within the ASL management zone and to 10 per cent throughout the rest of the gillnet sector. As a result, reported dolphin and seabird interactions have increased since the strengthening of these observer requirements.

Table 4. Level 2 PSA Residual Risk Results from the 2010 Ecological Risk Assessment for Non-Teleost and Non-Chondrichthyan Species

Taxonomic Group	Common Name	Scientific Name	Role in Fishery*	Productivity Result	Susceptibility Result	Level 2 (PSA) Risk Score	Previous Justification #	Previous Level 2 ERA Residual Risk Score Obtained #
Marine Mammal	New Zealand Fur Seal	<i>Arctocephalus forsteri</i>	TEP	2.43	3.00	High	Populations of these species are in the proximity of the gillnet fishery and considering the susceptibility of seals to gear and the fact that it is a TEP species, Residual Risk score remains High	High
Marine Mammal	Austrlian Sea Lion	<i>Neophoca cinerea</i>	TEP	2.43	3.00	High	The populations of this species are in the proximity of the gillnet fishery and considering the level of interactions, the species biology and the fact that it is a TEP species, the Residual Risk score remains High	High
Marine Mammal	Australian Fur Seal	<i>Arctocephalus Pusillus doriferus</i>	TEP	2.29	3.00	High	The populations of these species are in the proximity of the gillnet fishery and considering the susceptibility of seals to gear and the fact that it is a TEP species, the Residual Risk score remains High	High
Marine Mammal	Leopard Seal	<i>Hydrurga leptonyx</i>	TEP	2.71	3.00	High	Guideline 5 applies: Zero interactions have been recorded in the fishery. The cryptic mortality is thought to be negligible. The gillnet fishery is known to be on the outer edge of the range of the Leopard Seal. Leopard Seals breed on the Antarctic pack ice and range from the Antarctic coast to the sub-Antarctic and sub tropical seas. An average of five Leopard Seals visit the coast off Tasmania each year, but up to 18 have been sighted in one year (1990). In 1999, four Leopard Seals were reported (DPIWE TAS)> Therefore the overall susceptibility score was reduced to one, which reduces the species to medium	Medium
Marine Mammal	Southern Elephant Seal	<i>Mirounga leonine</i>	TEP	2.71	1.67	High	Guideline 5 applies: Zero interactions have been recorded in the fishery. Cryptic mortality is likely to be negligible. 70,000 individuals known to occur on Macquarie Island – possibly 600,000 individuals worldwide. The Recovery Plan (DEWHA) states that historically, the main threat to the Southern Elephant seal has been hunting and over-harvest. Neither activity currently occurs. Among the many potential threats to both seal populations are competition and interaction with legal and illegal fisheries, marine pollution of various kinds including oil and non-biodegradable debris. Climatic and oceanographic change, increased predation, disease outbreaks, and direct disturbance from tourism, research or ignorant interference. At present, none of these, with the possible exception of climatic and oceanographic change, appear to present a significant threat to populations of Southern Elephant seals, but they may pose real risks to some individuals. Susceptibility risk score is reduced from 3 to 1, which reduces the species to medium	Medium

*Role in Fishery – TEP (Threatened, Endangered or Protected)

Data taken from *Residual Risk Assessment of the Level 2 Ecological Risk Assessment Species Results: Report for the Gillnet sector of the Gillnet Hook and Trap Fishery, April 2010*

Table 5. Revised Level 2 PSA Residual Risk Results for Non-Teleost and Non-Chondrichthyan Species (Total Table) - Collation of 2010 and 2012 Species to Establish 2012 PSA Residual Risk Results

Taxonomic Group	Common Name	Scientific Name	Role in Fishery*	Level 2 (PSA) Risk Score	Current and Planned Management/ Assessment	Level 2 PSA Residual Risk Guideline(s) Applied	Justification	Revised Level 2 PSA Residual Risk Score
Marine Mammal	New Zealand Fur Seal	<i>Arctocephalus forsteri</i>	TEP	High	None – other than a small proportion of the population inhabiting within a similar area as the Australian Sea Lion closures. Protected under the EPBC Act.	None	Logbook reports identified 2 interactions with this species in 2011 but none in the prior 4 years. The populations of this species are in the proximity of the gillnet fishery and considering the level of interactions, the susceptibility of the species to the gear, the species biology and the fact that it is a TEP species, the residual risk score remains High.	High
Marine Mammal	Australian Sea Lion	<i>Neophoca cinerea</i>	TEP	High	The Australian Sea Lion Management Strategy – implications include: spatial closures of approximately 18,500 square kilometres for an 18 month period around South Australia, mandatory 100% observer or camera coverage, discharging offal from the vessel while setting gear is prohibited and trigger levels have been reduced to 15 animals over 7 zones – updated January 2012. This is a rolling closure arrangement and no permanent closure decisions have been made. Provision allows some fishers to use hooks in South Australia. Protected under the EPBC Act. Electronic Monitoring Program	None	Stage 2 closures - implemented in July 2010 - prevents fishing with Gillnet methods in the areas where 67% of all observed sea lion fishing mortalities occurred to date (AFMA, 2010a). The populations of this species are in the proximity of the gillnet fishery and considering the level of interactions, the susceptibility of the species to the gear, the species biology and the fact that it is a TEP species, the residual risk score remains High.	High

Taxonomic Group	Common Name	Scientific Name	Role in Fishery*	Level 2 (PSA) Risk Score	Current and Planned Management/ Assessment	Level 2 PSA Residual Risk (Guideline(s) Applied)	Justification	Revised Level 2 PSA Residual Risk Score
Marine Mammal	Australian Fur Seal	<i>Arctocephalus Pusillus doriferus</i>	TEP	High	None – other than a small proportion of the population inhabiting within a similar area as the Australian Sea Lion closures. Protected under the EPBC Act.	None	From observer and logbook data, there were 4 interactions with this species in 2011 – 1 alive and 1 dead. No interactions were recorded in the 4 years prior to this. The populations of this species are in the proximity of the gillnet fishery and considering the level of interactions, the susceptibility of the species to the gear, the species biology and the fact that it is a TEP species, the residual risk score remains High.	High
Marine Mammal	Leopard Seal	<i>Hydrurga leptonyx</i>	TEP	High	No management arrangements - Protected under the EPBC Act.	Guideline 5	Selectivity was originally increased from 1 to 3 as high selectivity was assumed for seals based on fur seal observations (Walker et al 2005). There have been no interactions with this species recorded. Guideline 5 applies: Zero interactions have been recorded in the fishery. The gillnet fishery is known to be on the outer edge of the range of the Leopard Seal. The overall susceptibility score was reduced back to 1. Based on the distribution of the species, the fact that there's been no recorded interactions and advice given from the SESSG RAG members, residual risk decreases to low.	Low
Marine Mammal	Southern Elephant Seal	<i>Mirounga leonina</i>	TEP	High	No management arrangements – listed as vulnerable under the EPBC Act.	Guideline 5	Selectivity was originally increased from 1 to 3 as high selectivity was assumed for seals based on fur seal observations (Walker et al 2005). There have been no interactions with this species recorded. Guideline 5 applies: Zero interactions have been recorded in the fishery. The Recovery Plan (DEWHA) states that historically, the main threat to the Southern Elephant Seal has been hunting and over-harvest. Neither activity currently occurs. Susceptibility risk score was reduced back to 1. Based on the distribution of the species, the fact that there's been no recorded interactions and advice given from the SESSG RAG members, residual risk decreases to low.	Low

Taxonomic Group	Common Name	Scientific Name	Role in Fishery*	Level 2 (PSA) Risk Score	Current and Planned Management/ Assessment	Level 2 PSA Residual Risk (Guideline(s) Applied)	Justification	Revised Level 2 PSA Residual Risk Score
Marine Mammal	Common Dolphin	<i>Delphinus delphis</i>	TEP	Medium	In September 2011, a Dolphin Gillnet Temporary Order was implemented which closed approximately 27,300 square km east of Kangaroo Island to gillnet fishing. This also requires 100% observer or camera coverage in an area adjacent to the closure. A Temporary Order in March 2012 extended these conditions for an extra 6 months.	None	The populations of these species are in the proximity of the gillnet fishery. When the original scientific surveys were conducted and the productivity and susceptibility scores were produced, <i>D. delphis</i> was never observed in 6-6½ inch mesh size shark gillnets. Therefore, the selectivity was assumed low for this species. However, there have been 55 interactions with this species recorded in 2011, which could suggest that selectivity is higher than once assumed. The number of interactions has been considered in addition to the fact that it is a TEP species and the fact that the management arrangements are temporary. Therefore, the residual risk score increases to High.	High
Marine Bird	Flesh Footed Shearwater	<i>Puffinus carneipes</i>	TEP	Medium	No management arrangements - Protected under the EPBC Act.	None	Low productivity was a major factor causing this species to have a risk level of Medium. There were 11 captures or interactions with the Flesh Footed Shearwater in 2010 – two animals remained alive and vigorous. In 2011, there were six interactions with the Flesh Footed Shearwater – all of which remained alive and vigorous as the interaction was light contact whilst the bird was flying. Considering that the species is in the proximity of the fishery and that it is a TEP species in addition to the number of interactions, the residual risk score remains at Medium.	Medium
Marine Bird	Little Penguin	<i>Eudyptula minor</i>	TEP	Medium	No management arrangements - Protected under the EPBC Act.	None	Low productivity was a major factor causing this species to have a risk level of Medium. There were 2 captures of little penguin recorded in 2011 but no interactions or captures have been recorded in the previous 4 years. Considering that this species is in the proximity of the fishery and that it is a TEP species, the residual risk score remains at Medium.	Medium
Marine Bird	Pacific Gull	<i>Larus pacificus</i>	TEP	Medium	No management arrangements - Protected under the EPBC Act.	Guideline 5	In 2011, 1 animal was caught and recorded but none have been listed as caught or interacted with in the previous 4 years. When Guideline 5 is applied: the level of interaction or capture of this species is negligible	Low

Taxonomic Group	Common Name	Scientific Name	Role in Fishery*	Level 2 (PSA) Risk Score	Current and Planned Management/ Assessment	Level 2 PSA Residual Risk Guideline(s) Applied	Justification	Revised Level 2 PSA Residual Risk Score
							and the residual risk score is decreased to Low.	
Marine Bird	Shy Albatross	<i>Thalassarche cauta</i>	TEP	Medium	No management arrangements - Protected under the EPBC Act.	None	Low productivity was a major factor causing this species to have a risk level of Medium. One animal was recorded as caught in the net in 2010 and 1 animal was recorded as interacted with in 2011. The interaction was light contact whilst the animal was in the water. Considering that this species is in the proximity of the fishery and that it is a TEP species, the residual risk score remains at Medium.	Medium
Marine Bird	Short-tailed Shearwater	<i>Puffinus tenuirostris</i>	TEP	Medium	No management arrangements - Protected under the EPBC Act.	None	Low productivity was a major factor causing this species to have a risk level of Medium. Three animals were recorded as caught in 2010. Considering that this species is in the proximity of the fishery and that it is a TEP species, the residual risk score remains at Medium.	Medium
Marine Bird	Wilson's Storm Petrel	<i>Oceanites oceanicus</i>	TEP	Low	No management arrangements - Protected under the EPBC Act.	None	Category is already low and does not require increasing. Two interactions were recorded in 2011 and both were light contact whilst the birds were flying. Therefore, residual risk score remains Low.	Low

*Role in Fishery – TEP (Threatened, Endangered or Protected)

Table 6. Summary of Level 2 PSA Residual Risk Results for Non-Teleost and Non-Chondrichthyan Species

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
TEP	2	0	1	4	6	2
Total	2	0	1	4	6	2

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.

Overall the most common guideline used to assess residual risk was guideline 5. Three species were reduced under guideline 5 where minimal interactions/capture had been recorded and were considered to have a negligible effect upon the fishery in the Gillnet sector.

This ERA and the 2010 ERA results highlighted the important species that the fishery needs to focus on. This residual risk process brings the ERA assessment up-to-date with the most current management initiatives within the fishery. Using the results presented here, an appropriate management response will be developed to address the high priority species as part of the ERM framework. The ERAs will be updated periodically and this will capture how effective the ERM strategy is in addressing risk to high priority species.

5. Consultation and clearance

The residual risk assessment commenced in May 2012 and was finalised in August 2012. As part of the consultation process, AFMA presented preliminary results at the August 2012 meeting of the Southern and Eastern Scalefish and Shark RAG (SESSFRAG) which includes representatives from industry, science and management. Final results were presented to the Shark Resource Assessment Group in December 2013 and at the March 2014 SESSFRAG meeting. Final clearance has been approved by George Day, Senior Manager of Demersal and Midwater Fisheries at AFMA.

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	That part of fisher's catch which is returned to the sea either because it has no commercial value or regulations preclude it from being retained and; That part of the catch that does not reach the deck of the fishing vessel but is affected by the interaction with the fishing gear.
Byproduct	A non-target species captured in a fishery that has value to the fisher and 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.
EBFM	Ecosystem-based fisheries management considers the impact that fishing has on all of the aspects of the broader marine ecosystem, not just the target species.
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 strategies to mitigate the risks are to be further investigated and implemented. If there are no planned or agreed management responses, the assessment moves to Level 3 (for more detail, refer to Hobday *et al.*, 2007).

APPENDIX B – BYCATCH AND DISCARD SPECIES AND QUANTITIES CAUGHT BETWEEN 2007 AND 2011

Table 7: Catches for All Non-Teleost and Non-Chondrichthyan Byproduct and Discard Species Caught in the Gillnet Method 2009-2011 – Logbook Data

Caab Code	Common Name	Scientific Name	Fin Year (Catch Weight (kg))		
			2008 - 2009	2009 - 2010	2010 - 2011
24,207,000	Bailer shells	<i>Volutidae - undifferentiated</i>	92	28	29
23,617,000	Calamari	<i>Loliginidae - undifferentiated</i>			
28,850,000	Crabs	<i>Brachyura - undifferentiated</i>	77	155	486
23,607,901	Cuttlefish (mixed)	<i>Sepia spp</i>			2
28,915,002	Giant Crab	<i>Pseudocarcinus gigas</i>	6	11	
23,636,004	Gould's Squid	<i>Nototodarus gouldi</i>	2		
23,650,000	Octopoda	<i>Order Octopoda - undifferentiated</i>	31	37	19
23,999,999	Shells	<i>Shells</i>	3	2	4

Table 8: Catches for All Non-Teleost and Non-Chondrichthyan Byproduct and Discard Species Caught in the Gillnet Method 2009-2011 – Observer Data

Caab Code	Common Name	Scientific Name	Fin Year (Catch Weight (kg))		
			2008 - 2009	2009 - 2010	2010 - 2011
35,000,000	Ascidians	<i>Ascidacea - undifferentiated</i>			17.6
24,207,000	Bailer shells	<i>Volutidae - undifferentiated</i>			31.9
28,850,000	Crabs	<i>Brachyura – undifferentiated</i>	43	8.05	
25,001,000	Crinoids	<i>Crinoidea - undifferentiated</i>		0.3	10.4
25,200,000	Echinoidea	<i>Class Echinoidea - undifferentiated</i>			1.8
25,154,011	Eleven-arm Seastar	<i>Coscinasterias muricata</i>			1
28,827,000	Hermit Crabs	<i>Diogenidae – undifferentiated</i>			0.5

			Fin Year (Catch Weight (kg))		
Caab Code	Common Name	Scientific Name	2008 - 2009	2009 - 2010	2010 - 2011
28,836,000	King Crabs	<i>Lithodidae – undifferentiated</i>		38	21.2
28,784,000	Lobsters	<i>Astacidea & Palinura - undifferentiated</i>			
23,000,000	Molluscs	<i>Phylum Mollusca - undifferentiated</i>			0.1
23,650,000	Octopoda	<i>Order Octopoda - undifferentiated</i>			
23,659,000	Octopuses	<i>Octopodidae - undifferentiated</i>	2		1
23,257,000	Ostreid Oysters	<i>Ostreidae - undifferentiated</i>			105
28,911,901	Sand Crab	<i>Ovalipes spp</i>			0.2
23,999,999	Shells	<i>Shells</i>			0.7
24,207,072	Southern Bailer shell	<i>Melo miltonis</i>			2
28,820,001	Southern Rocklobster	<i>Jasus edwardsii</i>	8.5	11	11.1
28,860,000	Spider Crabs (Homolidae)	<i>Homolidae - undifferentiated</i>			0.9
28,880,000	Spider Crabs (Majidae)	<i>Majidae & related families - undifferentiated</i>			0.1
10,114,000	Spongiid sponges	<i>Spongiidae - undifferentiated</i>	40.6		441.6
25,102,000	Starfish	<i>Class Asteroidea - undifferentiated</i>			9.4
11,290,000	Stony corals	<i>Order Scleractinia – undifferentiated</i>			70.8

APPENDIX C – SUMMARY OF THREATENED, ENDANGERED AND PROTECTED (TEP) SPECIES INTERACTIONS BETWEEN 2007 AND 2011

Table 9: Summary of Threatened, Endangered and Protected (TEP) Species Interactions Between 2009-2011 in the Gillnet Method – Logbook and Observer Data

		Calendar Year (Number of Interactions)		
Common Name	Scientific Name	2009	2010	2011
Australian Fur Seal	<i>Arctocephalus Pusillus doriferus</i>			4
Common Dolphin	<i>Delphinus delphis</i>	2	7	55
Flesh Footed Shearwater	<i>Puffinus carneipes</i>		11	6
Little Penguin	<i>Eudyptula minor</i>			2
Pacific Gull	<i>Larus pacificus</i>			1
Shy Albatross	<i>Thalassarche cauta</i>		1	1
Short-tailed Shearwater	<i>Puffinus tenuirostris</i>		3	
New Zealand Fur Seal	<i>Arctocephalus forsteri</i>			2
Australian Sea Lion	<i>Neophoca cinerea</i>		4	4
Wilson's Storm Petrel	<i>Oceanites oceanicus</i>			2

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