



Australian Government

Australian Fisheries Management Authority

Residual Risk Assessment of the Level 2 Productivity Susceptibility Analysis

Non-Teleost and Non-Chondrichthyan Species

**Report for the Otter Board Trawl Method
of the Commonwealth Trawl Sector**



2012

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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 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 Level 2 PSA, the 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 quantitative 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 assessment, the residual guidelines are applied to non-teleost and non-chondrichthyan species that have been caught or interacted with in the 2009-2011 period. The guidelines are also applied to the non-teleost and non-chondrichthyan species assessed as at high risk in the 2010 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.

Six marine bird species and one marine mammal species were re-assessed as high risk species based on Level 2 PSA scores. Of these, two remained at high risk; Australian Fur Seals and an unidentified species of Albatross. Albatross will be considered a high risk species group.

Residual risk guidelines which consider management arrangements and low levels of interaction were used to reduce the risk scores for most 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 quantitative in nature, 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.

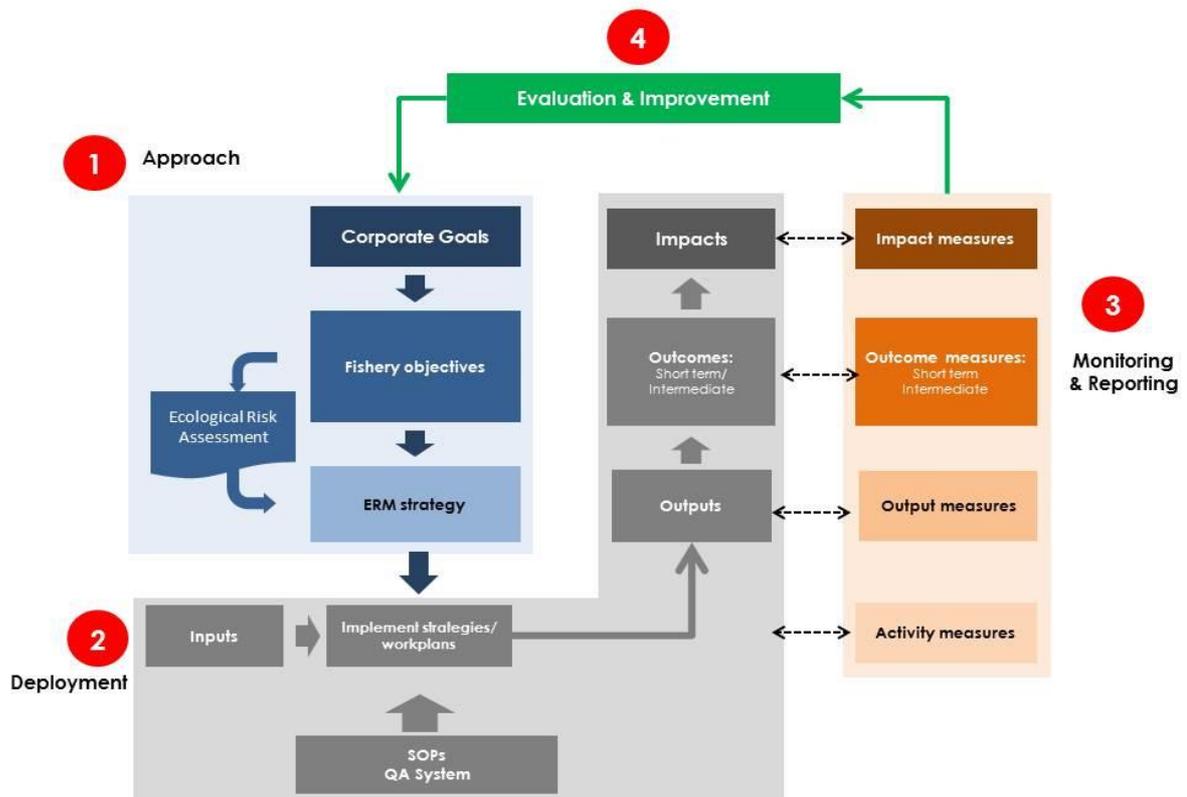


Figure 1 Ecological Risk Management Process Map

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

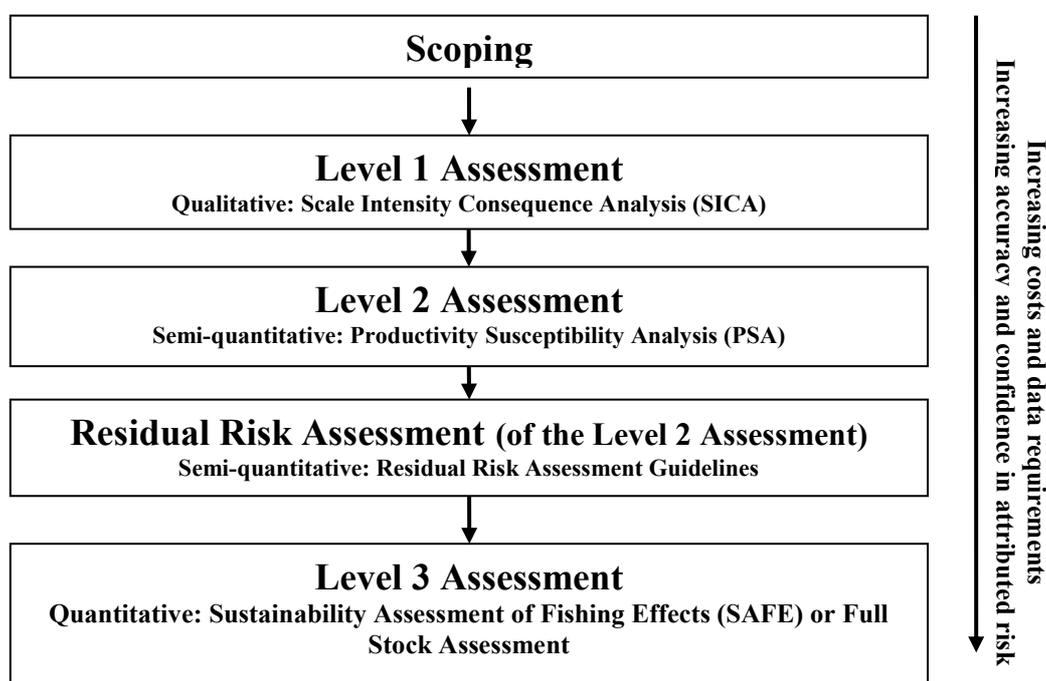


Figure 2 The different levels of risk assessment and the trend in confidence and cost

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.

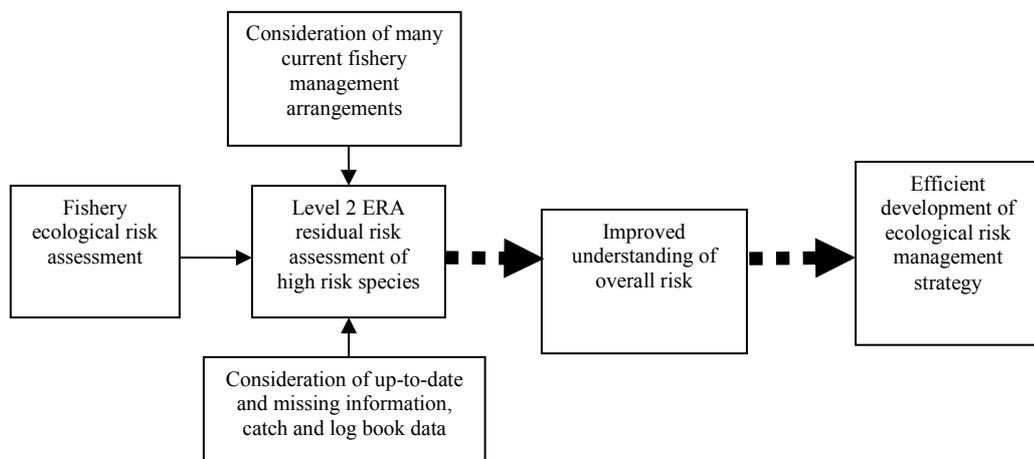


Figure 3. Flow diagram of the Level 2 ERA residual risk process

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 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 Report for the Otter Trawl Sub-Fishery of the Commonwealth Trawl 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 Otter Trawl Fishery* (AFMA, 2010a) was produced. This report uses the results from the Level 2 PSA table and the residual risk guidelines to determine the residual risk rating for the species impacted by otter board trawl in the CTS.

2012

For this 2012 Level 2 residual risk assessment, 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, 2010a). 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

This otter board trawl fleet forms part of the Commonwealth Trawl Sector (CTS) of the larger Southern and Eastern Scalefish and Shark Fishery (SESSF). The CTS covers the area of the Australian Fishing Zone extending southward from Barranjoey Point (north of Sydney) around the NSW, Victorian and Tasmanian coastlines to Cape Jervis in South Australia. The CTS is overlapped by parts of the Gillnet Hook and Trap (GHAT) sector of the SESSF.

The CTS is a demersal and midwater fishery which utilizes depths between 20 and 1300 metres. Main target species are Blue Grenadier, Tiger Flathead, Pink Ling and Silver Warehou. Otter board operators are required to use a minimum mesh size of 90 mm in the cod-end on their nets to facilitate small fish bycatch to escape. The primary landing ports for the CTS are Ulladulla, Lakes Entrance, Eden, Hobart and Portland.

A Seal Excluder Device (SED) is required on freezer boats when fishing west of 148°E.

The CTS is one of the main sources of Australian fresh fish for the Sydney and Melbourne markets. Annual fishing effort in the CTS peaked in 2001 at 112 000 hours of trawling. After the removal of fishing concessions as part of the \$220 million Federal Government ‘Securing our Fishing Future’ structural adjustment program, trawl effort declined to 58 000 hours trawled in 2007 and has remained relatively constant since then.

Fishery Specifics

- Gear: Otter Trawl
- ≥90 mm mesh net, 115 mm mesh in net mouth & wings
- ≥ 90 mm cod-end, single twine mesh or 102 mm double twine mesh or 90 mm double twine mesh + one of the following Bycatch Reduction Devices (BRDs):
- Single square mesh (≥90 mm) panel in upper side of codend bag (15X20 bars) OR
 - A large rotated mesh (T90) (≥90 mm) in upper codend (15X18 meshes)

- A Seal Excluder Device (SED) is required on freezer boats when fishing west of 148°E.

Depth range: 20 m to 1300 m

Main target species: Blue Grenadier, Tiger Flathead, Silver Warehou and Pink Ling

Management: Input controls: limited entry, gear restrictions, species specific area closures

Output controls: Total Allowable Catch, Individual Transferable Quotas, trip limits

Observer program: Integrated Scientific Monitoring Program operating since the mid-1990s – collects biological information from catches at sea and in port and monitors TEP interactions.

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

	Fleet Size – Number of CTS Fishing Permits	Fleet Size – Number of Active Trawl Vessels	Effort - Number of Bottom Time Hours	Observer Program - Number of Trawl Shots Observed
2007-2008 Season	59	54	57,960	342
2008-2009 Season	59	53	61,240	462
2009-2010 Season	59	36	57,419	625
2010-2011 Season	59	35	64,651	627

2.1 Management Arrangements Introduced Since the last ERA

A Seabird Management Plan (SMP) was made compulsory for all otter board trawl vessels in the SESSF as of 1 November 2011. SMPs identify and set out individually tailored mitigation measures that help reduce seabird interactions with warp wires. SMPs include physical devices to reduce seabird interaction and measures to manage the discharge of biological waste from vessels to reduce seabird attraction and interaction.

The Upper-Slope Dogfish Management Strategy has been developed by AFMA in consultation with the fishing industry, scientific experts, conservation NGOs and other stakeholders. Revised in October 2012, the objectives of the strategy are to rebuild the populations of Harrison’s Dogfish (*Centrophorus harissoni*), and Southern Dogfish (*C. zeehaani*). The strategy also offers some level of protection for Greeneye Spurdog (*Squalus chloroculus*) and Endeavour Dogfish (*Centrophorus moluccensis*). The strategy relies on a network of spatial closures supplemented by a range of operational measures

including regulated handling practices, 100 per cent monitoring, move-on provisions and no retention of gulper sharks.

Since the residual risk assessment in 2010 there have been several additional closures in the SESSF. Closures directions for Pink Ling, Gulper Sharks, Australian Sea Lion, Deepwater Sharks and Dolphins describe areas closed to particular fishing methods with the aim of protecting populations of those species. For more information, the full closure directions can be found on the ComLaw website.

3. Results

Level 1 Scale Intensity Consequence Analysis (SICA)

The following results are derived from the Level 1 assessment undertaken in the *Ecological Risk Assessment for Effects of Fishing: Report for the Otter Trawl sub-fishery of the Commonwealth Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery* (Wayte *et al.* 2007):

Number of Ecological Units Assessed

Target species:	28
Byproduct species:	95
Bycatch (discard) species:	276
TEP species:	201
Habitats:	158
Communities:	33

No ecological components were eliminated at Level 1 (there was at least one risk score of 3 (moderate) or above for each component).

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 all 5 ecological components)
- gear loss (impact on TEP species)
- translocation of species (impact on habitats)
- discarding catch (impact on TEP species)
- navigation/steaming (impact on target species)
- activity/presence on water (impact on target species and communities).

Significant external hazard included other fisheries in the region, coastal development, and other extractive activities.

Risk rated as major or above (risk scores 4 or 5) were all related to direct or indirect impacts from primary fishing operations. Severe impacts (risk score 5) were confined to byproduct/bycatch species.

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

For more detail regarding scoring refer to *Ecological Risk Assessment for Effects of Fishing: Methodology* (Hobday *et al.* 2007).

Level 2 Productivity Susceptibility Analysis

There were 600 species assessed at Level 2 using the Productivity Susceptibility Analysis (PSA). Of these, 159 were assessed to be at high risk, including 15 target species, 39 byproduct species, 99 bycatch species, and 6 TEP species. By taxa, the high risk species comprised of 58 chondrichthyans, 96 teleosts, 4 marine birds, and 1 marine mammal. Of the 159 species assessed to be at high risk, 4 had more than 3 missing attributes.

Of the six TEP species assessed to be at high risk, the four birds (Tahiti Petrel, Long-tailed Jaeger, Pacific Albatross and Chatham Albatross) were classified as high risk due to lack of information. The Australian Fur Seal is at high risk due to its low productivity and high susceptibility. Observer reports show that seals are frequently encountered in the fishery, but overall it appears that the total Australian Fur Seal population has increased in recent years (Stewardson and Knuckey, 2005).

For detailed results and methodology, refer to *Ecological Risk Assessment for the Effects of Fishing: Report for the Otter Trawl Sub-Fishery of the Commonwealth Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery* (Wayte *et al.* 2007)

Level 2 PSA residual risk

For this 2012 residual risk assessment the guidelines are applied to non-teleost and non-chondrichthyan species that have been caught or interacted with between 2009 and 2011. The guidelines are also applied to the non-teleost and non-chondrichthyan species assessed as at high risk in the 2010 residual risk assessment (AFMA, 2010). 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 2010 Level 2 PSA residual risk assessment for non-teleost and non-chondrichthyan species.

Appendix B shows the quantities of non-teleost and non-chondrichthyan species caught between 2007 and 2011 which were not assessed as part of this residual risk assessment.

These species were assessed as low risk under the Level 2 PSA from fishing pressure within the auto-longline sector and have not been caught in numbers which would be detrimental to the species.

17 species were re-assessed as part of this residual risk assessment. The Australian Fur Seal and four species of marine birds were carried over from the previous residual risk assessment as high risk species (Table 4). The Common Dolphin and 11 species of marine birds were included as species which have been interacted with since the last assessment (**Appendix C**).

Five marine bird species have had their risk scores reduced to medium under guideline 5 which considers low interaction levels across the fishery. Guideline 7, which considers management arrangements that successfully mitigate the risk to these species, was also used. A Seabird Management Plan became compulsory for all Otter Trawl Vessels in November 2011.

12 albatross (species unidentified) were caught or interacted with in 2010 and 16 in 2011; all except one animal were deceased. Considering that all seabirds are TEPs and the number of interactions that have occurred, the risk score could not be reduced for this group of species. All albatross species are now considered high risk in the otter trawl sector of the CTS.

Between 2009 and 2011 there 618 reported interaction with seals. Of those, the life status of 236 were reported as alive and vigorous when released. For the purposes of this assessment, all seals are categorised as ‘Australian Fur Seal/Eared Seal/Seal’. Observer reports indicate that seals are frequently encountered in the fishery, but overall it appears that the total Australian Fur Seal population has increased in recent years (Stewardson and Knuckey, 2005). The risk score for these species remains at high risk due to the number of interactions across the fishery.

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*	Level 2 (PSA) Risk Score	Productivity Result	Susceptibility Result	Previous Justification #	Previous Level 2 PSA Residual Risk Score #
Marine Mammal	Australian Fur Seal	<i>Arctocephalus pusillus doriferus</i>	TEP	High	2.29	3.00	Populations of this species are in the proximity of the SETF. Considering the susceptibility of this species to gear and the fact that it is a TEP species, the residual risk score remains High	High
Marine Bird	Tahiti Petrel	<i>Pseudobukweria rastrata</i>	TEP	High	1.44	3.00	The Level 2 PSA identified this species as having missing data and more than 3 missing attributes. This species is at risk and could interact with trawl vessel warp lines. AFMA expects that more accurate data on interactions with this species will be revealed in future research projects. There is ongoing work being performed by AFMA and industry to develop vessel management plans with a focus on seabird interaction mitigation devices.	High
Marine Bird	Long-tailed Jaeger	<i>Stercorius longicaudus</i>	TEP	High	1.44	3.00	The Level 2 PSA identified this species as having missing data and more than 3 missing attributes. This species is at risk and could interact with trawl vessel warp lines. AFMA expects that more accurate data on interactions with this species will be revealed in future research projects. There is ongoing work being performed by AFMA and industry to develop vessel management plans with a focus on seabird interaction mitigation devices.	High
Marine Bird	Pacific Albatross	<i>Thalassarche nov. sp.</i>	TEP	High	1.44	3.00	The Level 2 PSA identified this species as having missing data and more than 3 missing attributes. This species is at risk and could interact with trawl vessel warp lines. AFMA expects that more accurate data on interactions with this species will be revealed in future research projects. There is ongoing work being performed by AFMA and industry to develop vessel management plans with a focus on seabird interaction mitigation devices.	High
Marine Bird	Chatham Albatross	<i>Thalassarche eremite</i>	TEP	High	1.44	3.00	The Level 2 PSA identified this species as having missing data and more than 3 missing attributes. This species is at risk and could interact with trawl vessel warp lines. AFMA expects that more accurate data on interactions with this species will be revealed in future research projects. There is ongoing work being performed by AFMA and industry to develop vessel management plans with a focus on seabird interaction mitigation devices.	High

*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 Otter Trawl Fishery, July 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	Australian Fur Seal/Eared Seals/Seals	<i>Arctocephalus pusillus doriferus</i>	TEP	High	Seal Excluder Devices (SEDs) Protected under the EPBC Act Industry Code of Practice to Minimise Interactions with Seals	None	<p>Australian Fur Seal – In 2009, 154 interactions occurred with the Australian Fur Seal – 143 remained alive and vigorous and 11 died. In 2010, 22 interactions with this species occurred – only 1 survived. In 2011, 60 interactions with this species occurred – nine animals remained alive and vigorous.</p> <p>Eared Seals – Thirty eight Eared Seals were caught or interacted with in 2009, 109 in 2010 and 209 in 2011. Of these, eight remained alive in 2009, 22 remained alive in 2010 and 51 remained alive in 2011.</p> <p>Seals - In 2009, five Seal (species unidentified) were caught or interacted with; three remained alive and two died. In 2010, 17 unidentified Seals were caught or interacted with which died and four unidentified seals were caught or interacted with in 2011 which died also.</p> <p>Based on the fact that it is a TEP species and the number of interactions have occurred, no guidelines were applied which means the risk rating remains the same.</p>	High
Marine Bird	Tahiti Petrel	<i>Pseudobukweria rastrata</i>	TEP	High	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	Guideline 7 and Guideline 5	<p>No captures or interactions with this specific species were recorded in either the bottom trawl or midwater trawl methods. However, it may have been the unidentified Petrel in the bottom trawl method.</p> <p>This species has a low susceptibility and was considered a potential high risk based primarily on its productivity score. It is considered that management arrangements have been imposed upon the fishery (Guideline 7) and when Guideline 5 is applied: Zero interactions have been recorded in the fishery – risk</p>	Medium

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
							score decreases to Medium.	
Marine Bird	Long-tailed Jaeger	<i>Stercorius longicaudus</i>	TEP	High	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	Guideline 7 and Guideline 5	No captures or interactions with this species were recorded in either the bottom trawl or midwater trawl methods. This species has a low susceptibility and was considered a potential high risk based primarily on its productivity score. It is considered that management arrangements have been imposed upon the fishery (Guideline 7) and when Guideline 5 is applied: Zero interactions have been recorded in the fishery – risk score decreases to Medium	Medium
Marine Bird	Pacific Albatross	<i>Thalassarche nov. sp.</i>	TEP	High	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	Guideline 7 and Guideline 5	No captures or interactions with this specific species were recorded in either the bottom trawl or midwater trawl methods. However, it may have been one of the unidentified Albatrosses in either the bottom trawl or midwater trawl methods. This species has a low susceptibility and was considered a potential high risk based primarily on its productivity score. It is considered that management arrangements have been imposed upon the fishery (Guideline 7) and when Guideline 5 is applied: Zero interactions have been recorded in the fishery – risk score decreases to Medium.	Medium
Marine Bird	Albatrosses – species unidentified	<i>Family - Diomedidae</i>	TEP	High	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	None	Twelve Albatrosses (species unidentified) were caught or interacted with in 2010 and 16 in 2011; all except one animal were deceased. It has been considered that it is a TEP species and the number of interactions that have occurred and no guidelines were applied which means the risk rating remains the same.	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 Bird	Black Browed Albatross	<i>Thalassarche melanophrys</i>	TEP	Medium	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	None	Ninety four Black Browed Albatrosses were caught or interacted with in 2010; 25 were considered as heavy contact whilst in the water and 69 were considered as light contact whilst in the water. All animals remained alive and vigorous. This number was reduced to one Black Browed Albatross being caught or interacted with in 2011 which also remained alive. It has been considered that management arrangements have been implemented. However, considering that it is a TEP species and the number of animals that were deceased, the residual risk score remains at Medium.	Medium
Marine Bird	Cape Petrel	<i>Daption capense</i>	TEP	Medium	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	Guideline 7	Eight Cape Petrels were caught or interacted with in 2010 which all remained alive and vigorous. Five were considered as light contact whilst the bird was in the water and three were considered as heavy contact whilst the bird was flying. It has been considered that because it is a TEP species, the number of animals that were deceased, and that management arrangements have been implemented, Guideline 7 can be applied which reduces the residual risk to Low.	Low
Marine Mammal	Common Dolphin	<i>Delphinus delphis</i>	TEP	Medium	None	None	Three Common Dolphins were caught or interacted with in 2011. All three were deceased. It has been considered that it is a TEP species and that there are no management arrangements for this species. No guidelines could be applied which means the risk rating remains the same.	Medium
Marine Bird	Flesh-footed Shearwater	<i>Puffinus carneipes</i>	TEP	Medium	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1	None	One Flesh-footed Shearwater was caught or interacted with in 2010. This bird remained alive and vigorous as light interaction occurred whilst the bird was flying. In 2011, 265 Flesh-footed Shearwaters were caught or interacted with. All animals remained	Medium

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
					November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.		alive and vigorous and were interacted with whilst on/in the water - 125 birds with heavy contact and 140 with light contact. It has been considered that management arrangements have been implemented and that none of the interactions resulted in a deceased animal, but the fact that it is a TEP species and the number of interactions that have occurred in the last year, no guidelines were applied and the risk rating remains the same.	
Marine Bird	Grey Headed Albatross	<i>Thalassarche chrysostoma</i>	TEP	Medium	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	None	One Grey Headed Albatross was caught or interacted with in 2010 and one was caught or interacted with in 2011. Both were deceased. It has been considered that management arrangements have been implemented. However, considering it is a TEP species and the number of interactions that occurred, the residual risk score remains at Medium.	Medium
Marine Mammal	New Zealand Fur Seal	<i>Arctocephalus forsteri</i>	TEP	Medium	Seal Excluder Devices (SED's) Protected under the EPBC Act Industry Code of Practice to Minimise Interactions with Seals	None	Thirteen New Zealand Fur Seals were caught or interacted with in 2010. All interactions were that the wildlife was caught or entangled in the net. Of these, three remained alive and vigorous. Nine New Zealand Fur Seals were caught in 2011 which were deceased. It has been considered that it is a TEP species and the number of interactions that have occurred and no guidelines were applied which means the risk rating remains the same.	Medium
Marine Bird	Petrels	<i>Family - Procellariidae</i>	TEP	High	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1	Guideline 7	One Petrel (species unidentified) was caught in 2011 which died with heavy contact whilst on/in the water. It has been considered that it is a TEP species, the number of interactions that occurred, and the fact	Medium

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
					November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.		that management arrangements have been implemented. Guideline 7 can be applied which reduces the residual risk to Medium.	
Maine Bird	Short-tailed Shearwater	<i>Puffinus tenuirostris</i>	TEP	Medium	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	Guideline 7	One Short-tailed Shearwater was caught and died in 2011. It has been considered that it is a TEP species, the number of interactions that occurred, and the fact that management arrangements have been implemented. Guideline 7 can be applied which reduces the residual risk to Low.	Low
Marine Bird	Shy Albatross	<i>Thalassarche cauta</i>	TEP	Medium	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	None	In 2009, four interactions were recorded with Shy Albatrosses – three animals remained alive and vigorous and one died. In 2010, 349 interactions were recorded with Shy Albatrosses – 336 remained alive and vigorous and 13 died. The main type of interaction in 2010 was either light or heavy contact whilst the animal was on or in the water. In 2011, 13 interactions were recorded with Shy Albatrosses – six remained alive and vigorous and seven died. The main interaction type in 2011 either light or heavy contact whilst the animal was on or in the water. Five interactions of this type resulted in death. It has been considered that it is a TEP species and the number of interactions that have occurred. No guidelines were applied which means the risk rating remains the same.	Medium
Marine Bird	Sooty Shearwater	<i>Puffinus griseus</i>	TEP	Medium	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in	Guideline 7	Two Sooty Shearwaters were caught or interacted with in 2010. Both animals remained alive and vigorous as the interaction type was light while the animal was on/in the water.	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
					the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.		It has been considered that it is a TEP species, the number of interactions that occurred, and the fact that management arrangements have been implemented. Guideline 7 can be applied which reduces the residual risk to Low.	
Marine Bird	Yellow Nosed Albatross	<i>Thalassarche chlororhynchos</i>	TEP	Medium	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	Guideline 7	<p>One Yellow Nosed Albatross was caught or interacted with in 2011. The animal remained alive and vigorous as interaction type was light while the animal was on/in the water.</p> <p>It has been considered that it is a TEP species, the number of interactions that occurred, and the fact that management arrangements have been implemented. Guideline 7 can be applied which reduces the residual risk to Low.</p>	Low
Marine Bird	Chatham Albatross	<i>Thalassarche eremite</i>	TEP	High	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF from 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	Guideline 7 and Guideline 5	<p>No captures or interactions with this species were recorded in either the bottom trawl or midwater trawl methods. However, it may have been one of the unidentified Albatrosses in either the bottom trawl or midwater trawl methods.</p> <p>This species has a low susceptibility and is considered a potential high risk based primarily on its productivity score. It is considered that management arrangements have been imposed upon the fishery (Guideline 7) and when Guideline 5 is applied: Zero interactions have been recorded in the fishery – risk score decreases to Medium</p>	Medium

*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	5	0	4	2	11	4
Total	5	0	4	2	11	4

4. Conclusion

The purpose in applying the Level 2 PSA residual risk guidelines was to take into account additional information. Refinements were considered to either increase or reduce the risk as appropriate.

Overall the most common guideline used to assess residual risk was Guideline 7. Nine species were reduced under Guideline 7 as management strategies have been implemented that mitigate the risk of fishing to these species.

This ERA and the 2010 ERA results highlight the 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 risk species as part of the ERM framework. The ERAs will be updated periodically to capture how effective the ERM strategy is in addressing the risk of fishing 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 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	<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.
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 Otter Trawl Method 2009-2011 – Logbook Data

Caab Code	Common Name	Scientific Name	Fin Year (Catch Weight (kg))		
			2008 - 2009	2009 - 2010	2010 - 2011
24207000	Bailer shell	<i>Volutidae</i>	2,607	3,626	4,307
28821000	Bugs - Shovel nosed and slipper lobsters	<i>Scyllaridae</i>	16,145	12,318	6,275
23617000	Calamari	<i>Loliginidae</i>	4,548	2,782	2,477
28730000	Carid prawns	<i>Caridea</i>	380	1,025	3,270
28850000	Crabs	<i>Brachyura</i>	2,419	3,530	2,999
23607000	Cuttlefishes	<i>Sepiidae</i>	28,914	30,366	39,613
28925001	Giant crab	<i>Pseudocarcinus gigas</i>	476	336	551
28712008	Giant scarlet prawn	<i>Aristaeopsis edwardsiana</i>	80		
23629001	Giant Squid	<i>Architeuthis kirki</i>		400	
23636004	Gould's squid - Arrow squid	<i>Nototodarus gouldi</i>	580,450	382,567	553,865
23650000	Octopuses	<i>Octopoda</i>	8,829	11,334	13,265
28712001	Red prawn	<i>Aristaeomorpha foliacea</i>			
28714005	Royal red prawn	<i>Haliporoides sibogae</i>	55,954	85,822	92,509
23999999	Shells	<i>Shells</i>	3,897	2,669	2,615
23615000	Squids	<i>Teuthoidea</i>	387	247	789

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

Caab Code	Common Name	Scientific Name	Fin Year (Catch Weight (kg))		
			2008 - 2009	2009 - 2010	2010 - 2011
28825000	Anomurans	Infraorder Anomura - undifferentiated	204	139	
35000000	Ascidians	Ascidacea - undifferentiated			119
37003002	Australian lamprey	<i>Mordacia mordax</i>			45
24207000	Bailer shells	<i>Volutidae</i> - undifferentiated	2	9	404
24207900	Bailer shell (mixed)	<i>Zidoninae</i> spp		25	20
28820007	banded whip lobster	<i>Puerulus angulatus</i>			

			Fin Year (Catch Weight (kg))		
Caab Code	Common Name	Scientific Name	2008 - 2009	2009 - 2010	2010 - 2011
28911005	Blue Swimmer Crab	Portunus pelagicus			8
28821000	Bugs - Shovel nosed and slipper lobsters	Scyllaridae - undifferentiated	1		89
25416065	Chalkfish (sea cucumber)	Bohadschia similis		1	
24155000	Cowries	Cypraeidae - undifferentiated			4
28850000	Crabs	Brachyura - undifferentiated	677	2,513	80
27000000	Crustaceans	Subphylum Crustacea - undifferentiated			4
23607000	Cuttlefishes	Sepiidae - undifferentiated		4	
23607901	Cuttlefish (mixed)	Sepia spp	589	1,165	897
28821001	Deepwater Bug	Ibacus alticrenatus		519	
25416001	Deepwater redfish	Actinopyga echinites			23
28821004	Eastern Balmain Bug	Ibacus peronii	1,254	79	4
28820002	Eastern Rocklobster	Jasus verreauxi			2
23636000	Flying squids	Ommastrephidae	1,363	3,872	139
24000000	Gastropods	Class Gastropoda - undifferentiated		130	
28910000	Geryonid Crabs	Geryonidae - undifferentiated	7		
28915002	Giant Crab	Pseudocarcinus gigas		11	92
23636004	Gould's Squid	Nototodarus gouldi	5,537	2,916	7,013
28880010	Great Spider Crab	Leptomithrax gaimardii			5
37004000	Hagfishes	Myxinidae - undifferentiated		1	4
28827000	Hermit crabs	Diogenidae - undifferentiated			157
25400000	Holothurians	Class Holothuroidea - undifferentiated	19	101	141
11000000	Hydroids	Class Hydrozoa - undifferentiated			6
11120000	Jellyfish	Scyphozoa spp - undifferentiated	98	12	15
28836000	King crabs	Lithodidae - undifferentiated	254	455	34
28836900	King crabs (mixed)	Lithodes spp	53		
28784000	Lobsters	Astacidea & Palinura - undifferentiated		3	
28030000	Mantis shrimp	Order Stomatopoda - undifferentiated			3
23000000	Molluscs	Phylum Mollusca - undifferentiated			24
28821903	Moreton Bay Bugs	Thenus spp			3
24420000	Nudibranchs	Order Nudibranchia - undifferentiated			1

			Fin Year (Catch Weight (kg))		
Caab Code	Common Name	Scientific Name	2008 - 2009	2009 - 2010	2010 - 2011
11169000	Octocorals - Soft Corals	Subclass Octocorallia - undifferentiated			111
23650000	Octopoda	Order Octopoda - undifferentiated	4	245	84
23659000	Octopuses	Octopodidae - undifferentiated	159	463	262
28734000	Oplophorid Carid Prawns	Oplophoridae - undifferentiated			1150
28711000	Penaeid prawns	Penaeidae - undifferentiated	6		3
25202000	Pencil Urchins	Cidaridae - undifferentiated			41
25416020	Pinkfish (sea cucumber)	Holothuria edulis			
28710000	Prawns (mixed)	Penaeoidea & Caridea - undifferentiated		70	
25417003	Prickly Redfish	Thelenota ananas			10
28712001	Red Prawn	Aristaeomorpha foliacea		375	
28714005	Royal Red Prawn	Haliporoides sibogae	0	1,764	4,246
28821008	Sandbug	Thenus australiensis	6	1	12
25262000	Sand Dollars	Clypeasteridae - undifferentiated			12
11229000	Sea anemones	Order Actinaria - undifferentiated			5
25200000	Sea Urchins	Class Echinoidea - undifferentiated		3	114
23999999	Shells	Shells	2	737	445
24207072	southern bailer shell	Melo miltonis		28	45
23617005	Southern Calamari	Sepioteuthis australis		21	20
28865001	Spanner crab	Ranina ranina			
28880000	Spider Crabs (All families)	Majidae & related families - undifferentiated			178
28860000	Spider Crabs (Homolidae)	Homolidae - undifferentiated		125	175
28880911	Spider Crabs (Majidae)	Majidae - undifferentiated			386
23606000	Spirulidae	Spirulidae - undifferentiated			29
10114000	Spongiid sponges	Spongiidae - undifferentiated	317	344	656
28840000	Squat lobsters	Galatheidae - undifferentiated			3
23615000	Squids	Order Teuthoidea - undifferentiated	7,524	8,878	12,198
25102000	Starfish	Class Asteroidea - undifferentiated	41	638	141
35032041	Stolonifera conjuvoi	Pyura stolonifera	267	27	
25416009	Stonefish	Actinopyga lacerora			5
11290000	Stony corals	Order Scleractinia - undifferentiated			26

			Fin Year (Catch Weight (kg))		
Caab Code	Common Name	Scientific Name	2008 - 2009	2009 - 2010	2010 - 2011
28911000	Swimming crabs	Portunidae - undifferentiated		1,000	453
25416006	White teatfish	Holothuria fuscogilva	2		

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 Otter Trawl Method – Logbook and Observer Data

		Calendar Year (Number of Interactions)		
Common Name	Scientific Name	2009	2010	2011
Australian Fur Seal/Eared Seals/Seals	<i>Arctocephalus pusillus doriferus</i>	197	148	273
Albatrosses – species unidentified	Family - <i>Diomedeidae</i>		12	16
Black Browed Albatross	<i>Thalassarche melanophrys</i>	1	94	1
Cape Petrel	<i>Daption capense</i>		8	
Common Dolphin	<i>Delphinus delphis</i>			3
Flesh-footed Shearwater	<i>Puffinus carneipes</i>		1	265
Grey Headed Albatross	<i>Thalassarche chrysostoma</i>		1	1
New Zealand Fur Seal	<i>Arctocephalus forsteri</i>		13	9
Petrels	Family - <i>Procellariidae</i>			1
Short-tailed Shearwater	<i>Puffinus tenuirostris</i>			1
Shy Albatross	<i>Thalassarche cauta</i>	4	349	13
Sooty Shearwater	<i>Puffinus griseus</i>		2	
Yellow Nosed Albatross	<i>Thalassarche chlororhynchos</i>			1

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