



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 Great Australian Bight 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 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.

The 2012 Level 2 Residual Risk ERA builds upon the 2008 Level 2 Residual Risk ERA noting new species caught or interacted with and re-assessing previous high risk 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. Therefore, the 2012 Level 2 Residual Risk ERA only assesses non-teleost and non-chondrichthyan species for residual risk. For the otter board trawl method of the Great

Australian Bight Trawl Sector (GABT), the results from the Level 2 PSA are used to determine the residual risk at this level of assessment. Overall two high risk species groups were re-assessed and both remained at high risk; octopods and cuttlefish. Five medium risk species were re-assessed and three of those were reduced to low risk. These species were reduced to low risk after application of residual risk guidelines because of increased management arrangements which have reduced the risk to these species in the fishery.

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 ERAs, 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.

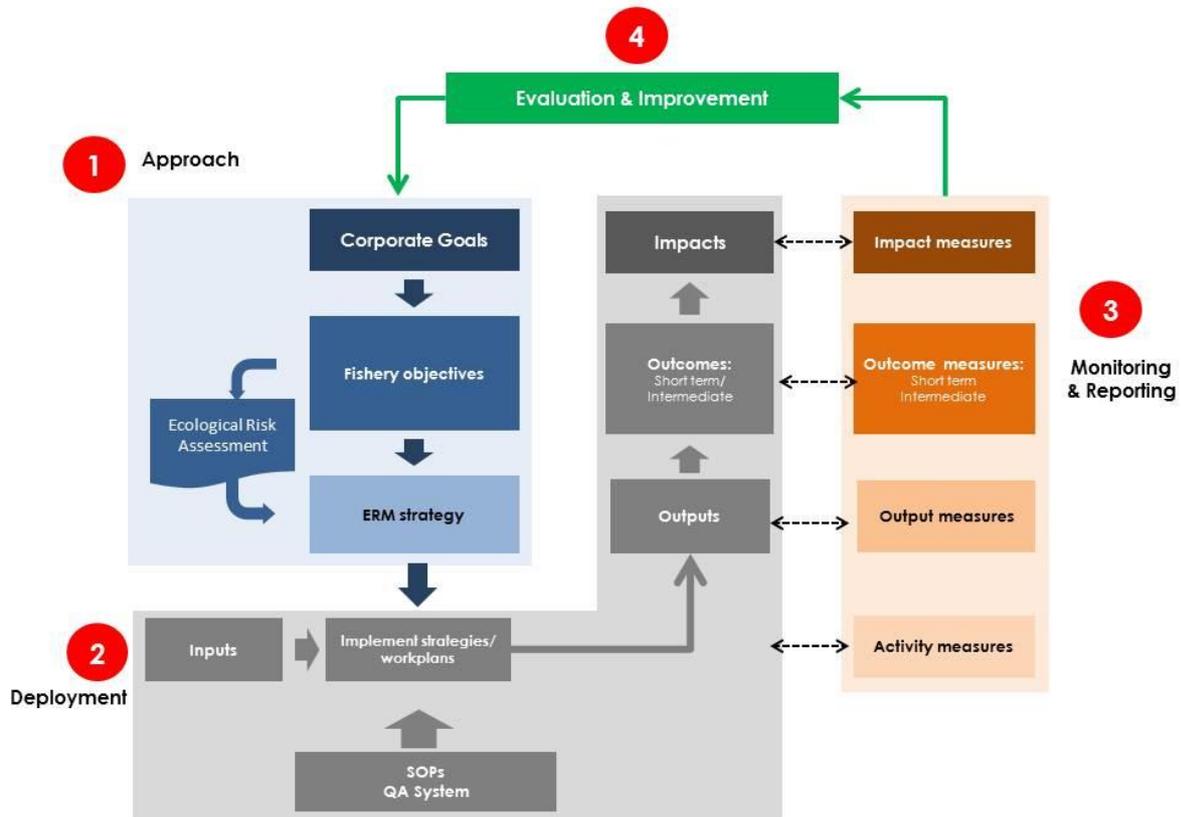


Figure 1 Ecological Risk Management Process Map

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).

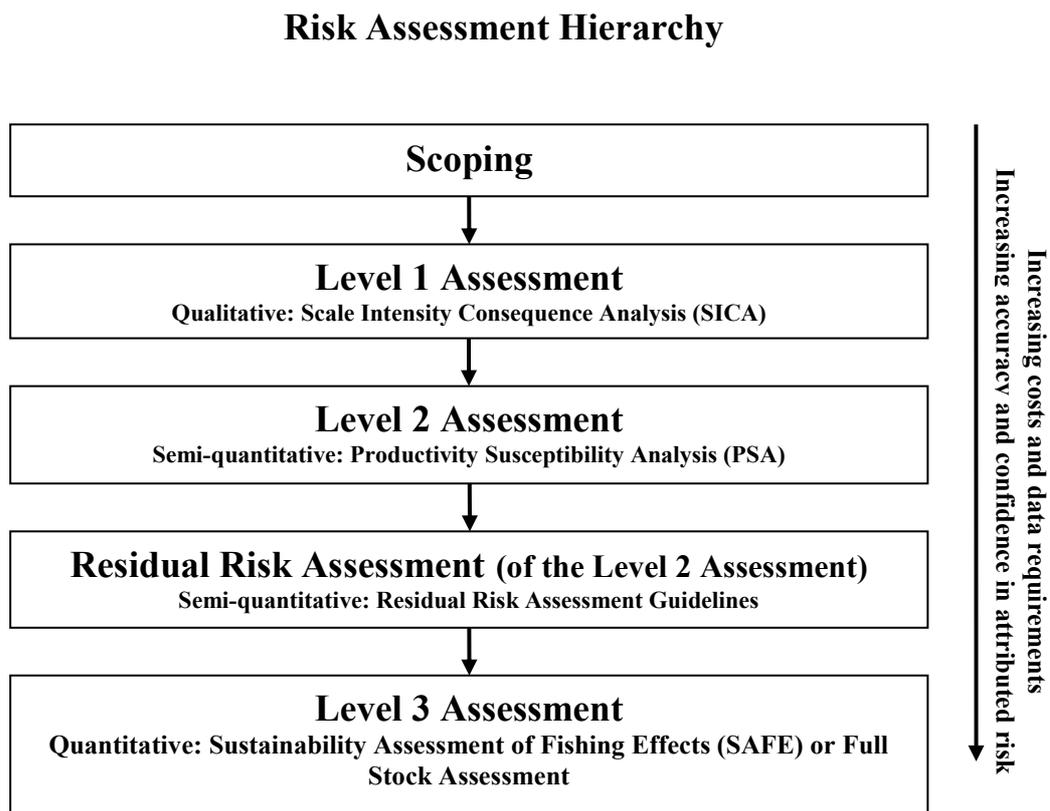


Figure 2 The different levels of risk assessment and the trend in confidence and cost

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.
- **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)
- 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)
- 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.
- Finalising the Level 2 PSA residual risk results for release.

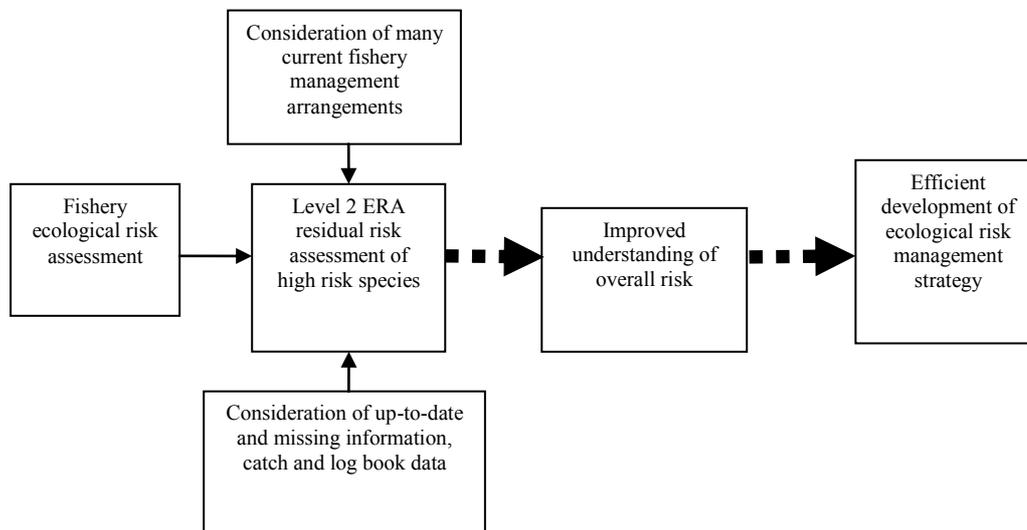


Figure 3. Flow diagram of the Level 2 ERA residual risk process

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 for Effects of Fishing (ERAEF) 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 Great Australian Bight Trawl sub-fishery of the Southern and Eastern Scalefish and Shark Fishery* (Daley *et al.* 2007) was produced. This report completes four 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).

2008

The report *Residual Risk Assessment of the Level 2 Ecological Risk Assessment Species Results: Report for the Great Australian Bight Trawl Sub-Fishery of the Southern and Eastern Scalefish and Shark Fishery* (AFMA, 2008) was produced. This report uses the results from the Level 2 PSA table and the residual risk guidelines to determine the residual risk category for the species impacted by otter trawl fishing.

2012

For this 2012 Level 2 Residual Risk ERA, the guidelines are applied to non-teleost and non-chondrichthyan species 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 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.

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 otter board trawl fleet is part of the Great Australian Bight trawl sector (GABT) of the larger Southern and Eastern Scalefish and Shark Fishery (SESSF). The GABT extends from Cape Leeuwin, Western Australia, to Cape Jervis near Kangaroo Island, South Australia. The sector excludes State (SA and WA) fishery shelf waters to the east and west.

The GABT is primarily a demersal fishery and is based on catches from three distinct depth regions: the shelf/upper slope fishery, slope fishery and the deepwater fishery. The shelf fishery extends to approximately 250 m and is where the majority of the catch is taken. The predominant shelf species taken are Deepwater Flathead and Bight Redfish. The slope fishery extends from about 300 to 750 m depth with sporadic targeting of Blue Grenadier, Western Gemfish and other such species. The deepwater fishery is in waters deeper than 750 m and in the past mainly targeted Orange Roughy. Otter board operators are required to use a minimum mesh size of 90 mm in the cod-end on their nets. The primary landing ports for the GABT are Port Lincoln and Adelaide.

Fishery Specifics

Gear:	otter trawl - minimum 90mm mesh size on cod-end, 115mm mesh in net mouth and wings
Area:	Cape Jervis, South Australia to Cape Leeuwin, Western Australia
Depth range:	100 to 1300 m (majority 120-250 m)
Main target species:	Bight Redfish, Blue Grenadier, Deepwater Flathead, Jackass Morwong, Ocean Jacket, Western Gemfish
Management:	Input controls: limited entry, species specific area closures, gear restrictions

Output controls: TACs, ITQs, trip limits and species specific trigger limits

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

	Fleet Size – Number of GAB 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	10	9	22,932	952
2008-2009 Season	10	7	16,205	718
2009-2010 Season	10	4	16,870	0 ¹
2010-2011 Season	10	4	15,887	721

2.1 New management arrangements introduced since the previous ERA

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

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 Great Australian Bight Trawl sub-fishery of the Southern and Eastern Scalefish and Shark Fishery (Daley *et al.* 2007).

Number of Ecological Units Assessed

Target species:	3
Byproduct species:	108
Bycatch (discard) species:	61
TEP species:	135
Habitats:	77

¹ Data collection for every second year in the GABT now occurs using crew-collected data rather than the AFMA Observers.

Communities: 6 demersal, 3 pelagic

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 related activities) were eliminated at Level 1 (risk scores 1 or 2). Those remaining for the GABT included:

- Fishing (direct impacts on all ecological components)
- Activity/presence on water (impact on TEP species)

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

Risks rated as major (risk scores 4) were related to direct or indirect impacts from primary fishing operations on target species. No severe impacts (risk score 5) were recorded for any activities associated with the GABT.

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

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

Level 2 Productivity Susceptibility Analysis

Of the 307 species assessed at Level 2 using the PSA analysis, expert/observer over-rides were used on 102 species. A total of 58 species were found to be at high risk. Of these, three species had more than three missing attributes. Of the 58 high risk species 2 were target species, 39 byproduct species, 15 bycatch species and 2 TEP species. By taxa, the high risk species comprised 32 chondrichthyans (sharks and rays), 23 teleosts and 3 invertebrates.

Both of the major target species are managed through the quota system, and the introduction of strict harvest strategies for this group will ensure catches are sustainable into the future. Of the two TEP species assessed to be at high risk, both are listed under the EPBC Act (Grey Nurse Shark and White Shark).

Of the TEP species assessed at Level 2 (PSA Analysis), four marine birds were assessed as medium risk and one marine mammal was assessed as medium risk.

For detailed results and methodology refer to *Ecological Risk Assessment for the Effects of Fishing. Report for the Great Australian Bight Trawl Sub-Fishery of the Southern and Eastern Scalefish and Shark Fishery* (Daley *et al.*, 2007)

Level 2 PSA residual risk assessment

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 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. **Table 4** is a summary of the non-teleost and non-chondrichthyan species/species groups considered in the 2008 residual risk assessment.

Appendix B shows the quantities of non-teleost and non-chondrichthyan species caught or interacted with between 2007 and 2011. Species identification could not be obtained for most of these records 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. All except three of these groups were found to be at low risk from the impacts of trawl fishing in the GABT. Octopods, Cuttlefish and Shovel-nosed/Slipper Lobsters were assessed as high risk using Level 2 PSA scores and so were assessed as part of this residual risk assessment. These are the same three species groups assessed in the previous residual risk assessment.

In addition to the three invertebrate species, five TEP species or species groups were added to the assessment as TEP species which had been interacted with between 2007 and 2011; Flesh-footed Shearwater, Shy Albatross, Shearwaters (species unidentified), Albatrosses (species unidentified), Seals (species unidentified).

Table 5 is a summary of this 2012 Level 2 PSA residual risk assessment. Risk scores for those species also assessed in 2008 have been re-evaluated to take into account changes to management strategies and changes to catch, discard and interaction data.

Guideline 7 was used to reduce the risk score for the Shearwater species from medium to low considering the fact that Seabird Management Plans are compulsory for all trawl vessels in the GABT. Records of interactions in the GABT also indicate that these animals remained alive after contact with the fishing gear.

Guideline 5 was used to reduce the risk score for the Shovel-nosed/Slipper Lobster which considers low levels of interaction or catch. The susceptibility score was reduced to 1 which resulted in a low residual risk score.

Guideline 5 was also used to reduce the risk score for the unidentified seal species. One seal was interacted with in 2011 and records indicate it may have already been dead. It was considered that it is a TEP species in the proximity of the fishery but when Guideline 5 is

applied, the level of interaction or capture of this species is negligible and the residual risk score is reduced to Low.

Cuttlefish were assessed as high risk under the PSA because of missing productivity data. That data was found, which reduces the productivity score from 3.00 to 2.00. However, the susceptibility is still too high and cuttlefish remain as a high risk species.

There has been a negligible amount octopods caught in the GABT, with only 6kg being reported in observer records in the 2009/10 fishing season. The susceptibility score was reduced to 2, however due to missing data, the productivity score remains at 3 and the risk score remains high.

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 PSA Residual Risk Score #
Invertebrate	Shovel-nosed/Slipper Lobster	<i>Scollaridae – undifferentiated</i>	BP	3.00	1.00	High	There has been no recorded catch of lobsters (scyllaridae) either landed or in the ISMP data or log book catch. The cryptic mortality is thought to be negligible. Key consideration D applies, therefore the susceptibility risk scores was reduced to 1, which reduced the species to medium.	Medium
Invertebrate	Cuttlefish	<i>Sepiidae – undifferentiated</i>	BP	2.00	3.00	High	Missing productivity attributes were found, which reduces the productivity score from 3.00 to 2.00. However, the susceptibility is still too high and therefore this species is not reduced under this guideline.	High
Invertebrate	Octopods	<i>Order Octopoda - Undifferentiated</i>	BP	3.00	3.00	High	No Change	High

*Role in Fishery – BP (Byproduct).

Data taken from *Residual Risk Assessment of the Level 2 Ecological Risk Assessment Species Results: Report for the Great Australian Bight Fishery of the Southern and Eastern Scalefish and Shark Fishery, December 2008.*

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
Invertebrate	Shovel-nosed/Slipper Lobster	<i>Scollaridae – undifferentiated</i>	BP	High	Maximum trip limit of 50kg in Tasmania, South Australian and Victoria of “other crustaceans” as per management arrangements. No species specific arrangements.	Guideline 5	No Shovel-nosed/Slipper Lobsters were recorded as caught or interacted with in 2009, 2010 or 2011. When Guideline 5 is applied: Zero interactions have been recorded in the fishery, the susceptibility risk score reduces to 1, which reduces the residual risk score to Low.	Low
Invertebrate	Cuttlefish	<i>Sepiidae – undifferentiated</i>	BP	High	Maximum trip limit of	None	Missing productivity attributes were found, which reduces the productivity score from 3.00 to 2.00. However, the	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
					500kg in Tasmania, South Australian and 50kg in Victoria of “other molluscs” as per management arrangements. No species specific arrangements		susceptibility is still too high and therefore this species is not reduced under this guideline. It has been considered that there is a maximum take for this species. However, considering the amount caught, the residual risk score remains the same.	
Invertebrate	Octopod	<i>Order Octopoda - Undifferentiated</i>	BP	High	It has been considered that this likely a low risk species or group of species and has only been classified as high risk due to missing productivity attribute data.	Guideline 5	There has been a negligible amount of catch in the GABT, with only 6kg being reported in observer records in the 2009/10 fishing season. The susceptibility score is therefore reduced to 2. The productivity score remains at 3 due to missing attribute data and the risk rating remains high.	High
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 as of 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	Guideline 7	Four Flesh-footed Shearwaters were caught or interacted with in 2010. All animals remained alive and vigorous as they were on/in the water with light contact with the fishing vessel and/or equipment. Considering the number caught/interacted with and that a management plan is compulsory for all vessels, the risk rating has been reduced 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 as of 1 November 2011. The SMP requires a physical device as well as well as management of discharge of biological waste.	None	Thirty two Shy Albatrosses were caught or interacted with in 2010. Twenty four of these remained alive and vigorous as the interaction was light contact whilst the animals were on/in the water. Seven of these animals also remained alive and vigorous but the interaction was of heavy contact whilst the animals were on/in the water. One animal was dead and in rigour as the animal was caught or entangled in the net. It has been considered that a management plan is compulsory but considering that it is a TEP species and the number caught in relation to observer coverage, the risk rating remains at Medium.	Medium
Marine Bird	Shearwaters – species unidentified	<i>Genus - Puffinus</i>	TEP	Medium	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl	Guideline 7	One Shearwater (species unidentified) was caught or interacted with in 2010, which remained alive.	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
					Vessels in the SESSF as of 1 November 2011. The SMP requires a physical device as well as management of discharge of biological waste.		Considering the number caught/interacted with and that a management plan is compulsory for all vessels, the risk rating has been reduced to Low.	
Marine Bird	Albatrosses – species unidentified	<i>Family - Diomedidae</i>	TEP	Medium	A Seabird Management Plan (SMP) is compulsory for all Otter Board Trawl Vessels in the SESSF as of 1 November 2011. The SMP requires a physical device as well as management of discharge of biological waste.	None	One Albatross (species unidentified) was caught or interacted with in 2009 and one in 2010. Both animals died. Considering the number caught/interacted with in respect to population size and that it is a TEP species, the residual risk remains at Medium.	Medium
Marine Mammal	Seals – species unidentified	<i>Family – Otariidae</i>	TEP	Medium	No Management Arrangements Protected under the EPBC Act	Guideline 5	One Seal (species unidentified) was caught or interacted with in 2011 which was pre-deceased. It has been considered that it is a TEP species and in the proximity of the fishery but when Guideline 5 is applied: the level of interaction or capture of this species is negligible; the residual risk score is decreased to Low.	Low

*Role in Fishery – BP (Byproduct), 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
Byproduct	0	1	0	2	0	1
TEP	0	0	3	0	2	3
Total	0	1	3	2	2	4

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 guidelines used to assess residual risk were Guideline 5 and Guideline 7. Two species were reduced under Guideline 7 as management strategies had been implemented which reduce the catch of these species. Two species were reduced under Guideline 5 as minimal interactions/capture had been recorded and it was considered that the fishery had negligible impact on them.

This ERA and the 2008 ERA results highlighted the species that the fishery needs to focus on. This residual risk process brings the ERA assessment up-to-date with most of the current management initiatives in 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 impact to high risk 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 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 Bottom Otter Trawl Method 2000-2011 – Logbook Data

Caab Code	Common Name	Scientific Name	Fin Year (Catch Weight (kg))		
			2008 - 2009	2009 - 2010	2010 - 2011
28821000	Bugs - Shovel nosed and slipper lobsters	<i>Scyllaridae</i>			
23617000	Calamari	<i>Loliginidae</i>	13,879	6,981	6,619
23607000	Cuttlefishes	<i>Sepiidae</i>	13,405	1,592	1
28925001	Giant crab	<i>Pseudocarcinus gigas</i>	5		
23636004	Gould's squid - Arrow squid	<i>Nototodarus gouldi</i>	35,826	16,688	13,098
11120000	Jellyfish	<i>Schizophzoa</i>			17,000
23650000	Octopuses	<i>Octopoda</i>			
23617005	Southern Calamari	<i>Sepioteuthis australis</i>			972
10000000	Sponges	<i>Porifera</i>	16,545	13,285	6,140
23615000	Squids	<i>Teuthoidea</i>			

Table 8: Catches for All Non-Teleost and Non-Chondrichthyan Byproduct and Discard Species Caught in the Bottom 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	<i>Infraorder Anomura - undifferentiated</i>			
28850000	Crabs	<i>Brachyura - undifferentiated</i>	2	15	
25001000	Crinoids	<i>Crinoidea - undifferentiated</i>	32		18
23607901	Cuttlefish (mixed)	<i>Sepia spp</i>	61	87	52
28821004	Eastern Balmain Bug	<i>Ibacus peronii</i>			
28910000	Geryonid Crabs	<i>Geryonidae - undifferentiated</i>	143		
23636004	Gould's Squid	<i>Nototodarus gouldi</i>	243		850
25400000	Holothurians	<i>Class Holothuroidea - undifferentiated</i>			
11120000	Jellyfish	<i>Scyphozoa spp - undifferentiated</i>			15
28836900	King crabs (mixed)	<i>Lithodes spp</i>	20		
23650000	Octopoda	<i>Order Octopoda - undifferentiated</i>		6	
23659000	Octopuses	<i>Octopodidae - undifferentiated</i>			
23617011	opalescent inshore squid	<i>Loligo opalescens</i>			
28821008	Sandbug	<i>Thenus australiensis</i>	19		1
23999999	Shells	<i>Shells</i>			
23617005	Southern Calamari	<i>Sepioteuthis australis</i>			5

			Fin Year (Catch Weight (kg))		
Caab Code	Common Name	Scientific Name	2008 - 2009	2009 - 2010	2010 - 2011
10114000	Spongiid sponges	<i>Spongiidae - undifferentiated</i>	615	1,128	1,663
23615000	Squids	<i>Order Teuthoidea - undifferentiated</i>	885	1,258	23615000
25102000	Starfish	<i>Class Asteroidea - undifferentiated</i>			

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 2007-2011 in the Otter Trawl Method – Logbook and Observer Data

		Calendar Year (Number of Interactions)		
Common Name	Scientific Name	2009	2010	2011
Flesh-footed Shearwater	<i>Puffinus carneipes</i>		4	
Shy Albatross	<i>Thalassarche cauta</i>	3	32	
Shearwaters – species unidentified	<i>Genus - Puffinus</i>		1	
Albatrosses – species unidentified	<i>Family - Diomedidae</i>	1	1	
Seals – species unidentified	<i>Family – Otariidae</i>			1

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