



Australian Government

Australian Fisheries Management Authority

 Residual Risk Assessment of the
Level 2 Ecological Risk Assessment
Species Results
Report for the Southern Bluefin Tuna Fishery



December 2009



EXECUTIVE SUMMARY

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

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

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

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

For the Southern Bluefin Tuna Purse Seine Fishery, the results from the Level 2 PSA table are used here to determine the residual risk at this level of assessment. Overall three high risk species were assessed of which none remained at high risk after applying the residual risk guidelines. The primary reasons why the three species were reduced from high risk after applying the guidelines was because these species had been assessed through a Rapid Level 3 analysis and were found to be at low risk at current fishing effort.



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1. OVERVIEW

1.1. Ecological Risk Management Process

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

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

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

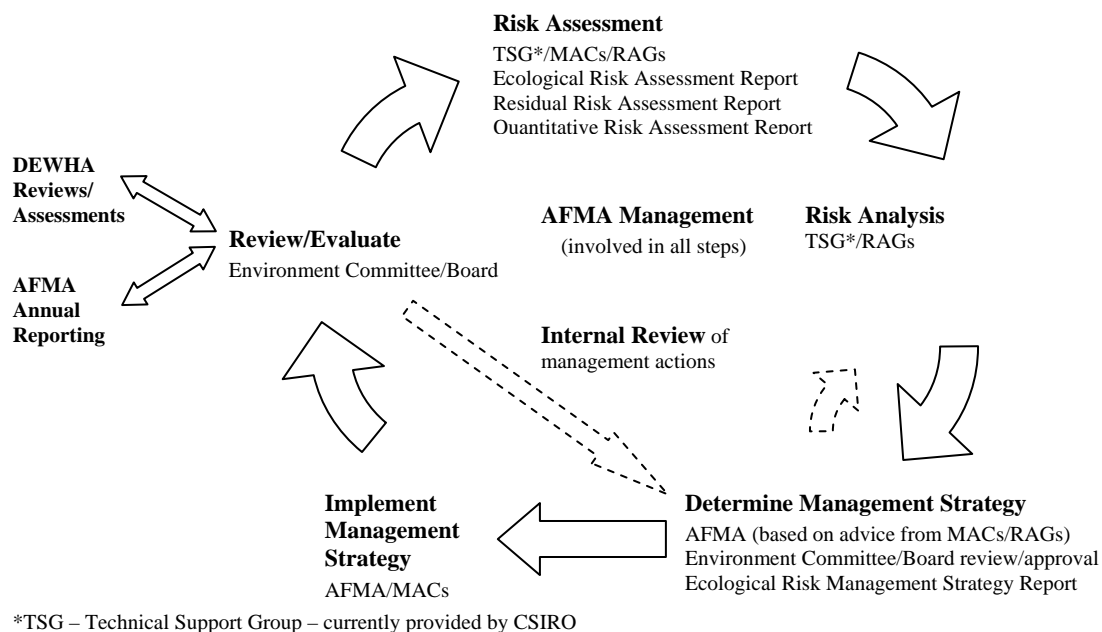


Figure 1 Ecological Risk Management framework



1.2. ERA Project

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

1.3. ERA Methodology

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

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

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

Risk Assessment Hierarchy

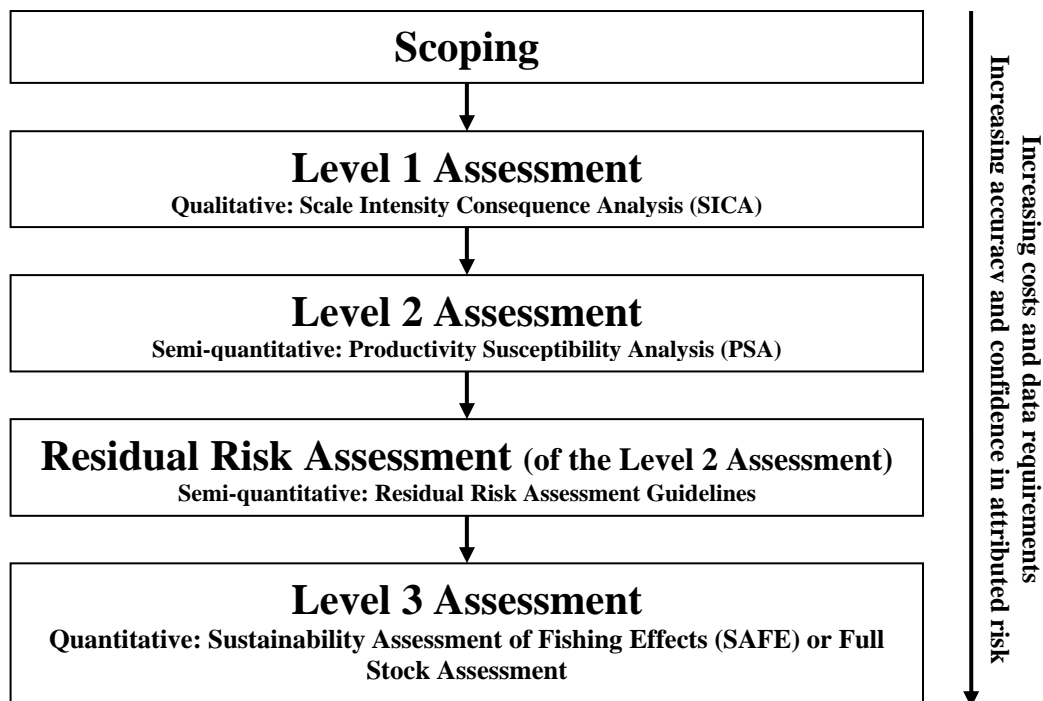


Figure 2 The different levels of risk assessment and the trend in confidence and cost



Scoping

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

Level 1 – Scale, Intensity, Consequence Analysis

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

Level 2 – Productivity Susceptibility Analysis

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

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

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

Level 2 PSA Residual Risk Assessment

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



Level 3 – Quantitative Risk Assessment

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

Constraints of Level 2 PSA Results

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

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

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

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

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

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

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

Improved data

The ERA process adopts a precautionary approach if there is uncertainty about an attribute the higher risk score is used. At the Level 2 PSA when a species is missing either a



productivity or susceptibility attribute the score defaults to a high risk category. Furthermore, species attributes that were originally calculated for the fishery may be out-of-date because additional or more precise information has become available.

Additional information

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

Spatial assumptions

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

Interaction and catch data

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

Management arrangements

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

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

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

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

2. LEVEL 2 ERA RESIDUAL RISK PROCESS

2.1. Level 2 ERA Residual Risk

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



represent overall risk within a fishery and will help clarify if further (Level 3) assessment is necessary.

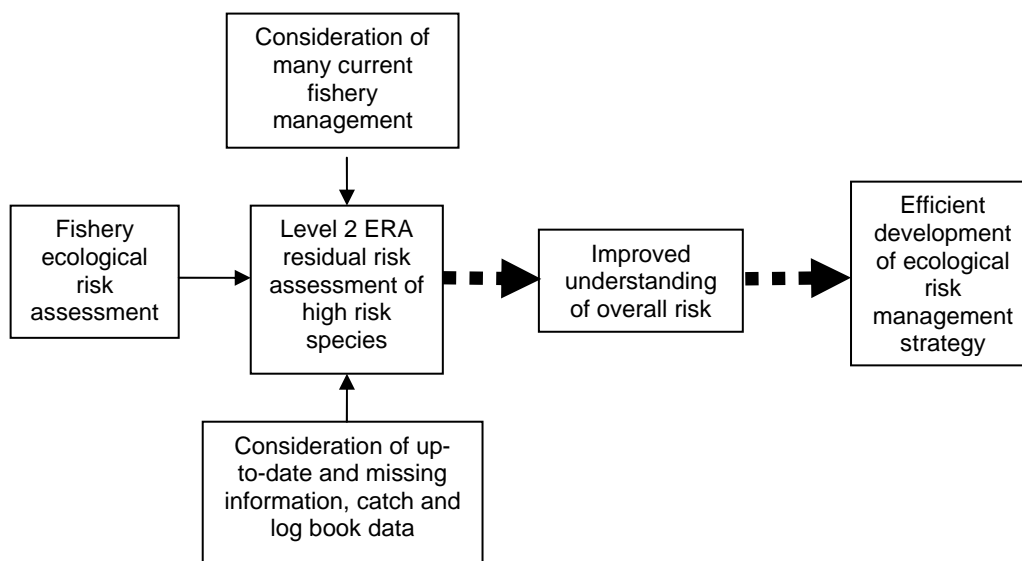


Figure 3 Flow diagram of the Level 2 ERA residual risk process

2.2. Level 2 PSA Residual Risk Process

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

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

- Sorting the ERA result by high risk, then grouping the high risk species by role within the fishery, then by taxonomic group;
- Creating a list of all management arrangements not included in the Level 2 PSA results for reference when applying the guidelines;
- Considering each management arrangement to relevant high risk species;
- Collating spatial information from experts, observer and logbook data for all high risk species for reference when applying the guidelines;
- Deciding if and what guideline applies to each of the high risk species by conducting a species-by-species application;
- Making changes to the necessary attributes, productivity and susceptibility scores to calculate the Level 2 PSA residual risk score;



- Recording all workings, guidelines used, how they have been applied and a justification for the Level 2 PSA residual risk score;
- Providing preliminary Level 2 PSA residual risk results to MACs for feedback; and
- Finalising the Level 2 PSA residual risk results for release.

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

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.

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



Table 2 Stakeholder Engagement

Guideline stage	Stakeholder interaction	Date of interaction	Stakeholder group	Summary of outcome
Draft Level 2 ERA residual risk assessment trial in SESSF	AFMA workshop	December 12 th , 2006	Trial application of draft Level 2 ERA residual risk guidelines	Agreement much further work was needed
Trial Level 2 ERA residual risk assessment using draft ERA results in the ETBF, SESSF and NPF	AFMA workshop	May 21 st , 2007	Fisheries managers in ETBF, SESSF and NPF and AFMA environment section	Draft Level 2 ERA results presented and application of guidelines discussed. Catalyst for major revision of multiple areas in guidelines by AFMA
Review of the draft residual risk report by the Residual Risk Review Group	Residual Risk review Group	March 13 th , 2008	Fisheries managers, BRS, DEWHA & an environment NGO representatives	Reviewed the consistency of ,and sought clarification on aspects of, application of the Residual Risk Guidelines across 12 major fisheries and sub fisheries.
CSIRO final ERA results available and application of draft residual risk guidelines continues	AFMA Emails	Late June 2007	Scientific experts on marine mammals, birds and turtles	Provided information on biological attributes, spatial distributions and population dynamics for species residual risk assessment
Preparation of draft ERA residual risk report for SBTF	SBTMAC 33	September 2009	SBTMAC members	Presented with draft residual risk report with final ERA results for the SBTF Comment sought from MAC on the report.
Finalisation of ERA residual risk report for the SBTF	Provided out-of-session to SBTMAC for final comment	December 2009	SBTMAC members	Presented with final Residual Risk report Comment sought from MAC on the report. No comments received.



3. RESULTS

3.1. ERA Results

Fishery Description

Gear:	Purse seine then transfer to tow cages of live fish
Area:	Currently concentrated on the shelf break in the eastern Great Australian Bight, to the point of transfer to growout cages at Port Lincoln
Depth range:	50 to 700m
Fleet size:	5-10 purse seine vessels, plus bait and tow boats
Effort:	Three month catch season
Landings:	~5,265 t in 2005
Discard rate:	Unknown, believed to be very low
Main target species:	Southern bluefin tuna
Management:	Quota management system
Observer program:	AFMA-run observer program on catch and tow vessels since summer of 2003/04.

Ecological Units Assessed

Target species:	1 and 10 bait species used in capture
Byproduct/bycatch species:	6 and 8 respectively
TEP species:	182 within fishery jurisdiction
Habitats:	209 benthic within fishery jurisdiction, 2 pelagic within current fishery area
Communities:	2 demersal, 2 pelagic within current fishery area

Level 1 Results

Two ecological components were eliminated at Level 1 (habitats and bycatch/byproduct species); there was at least one risk score of 3 – moderate – or above for three components.

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

- Fishing (direct and indirect impacts on 3 components, Target, TEP and communities)
- Translocation of species (impact on TEP species and communities)
- Discarding catch (impact on TEP species)
- Navigation and steaming (impact on communities)

Significant external hazards included other fisheries in the region, aquaculture, and other anthropogenic activities.

Risks rated as major (risk score of 4) were related to direct or indirect impacts from primary fishing operations, and the risk of impact to TEP species from translocation of species. There were no scenarios scored as severe (risk score of 5).

Impacts from fishing on target and TEP species components were assessed in more detail at Level 2. Community impacts should also be examined in future iterations; time was insufficient to complete this analysis following development of the ERAEF Level 2 community analysis.



Level 2 Results

Species

A total of 193 species in the target species and TEP species components were assessed at Level 2 using the PSA analysis. Of these, 2 were assessed to be at high risk, including the target species southern bluefin tuna, and one TEP species (white shark). The remaining species were at medium or low risk. Of the 193 species assessed, expert overrides were used on 180 species. Of the 2 species assessed to be at high risk, none had more than 3 missing attributes.

The population status of southern bluefin tuna is agreed to be at 10% or less of the 1960 level; debate about the possibility of recruitment failure or stock collapse at the current level of harvest occurs within the CCSBT meetings. The current level of fishing (in total, including domestic and international fisheries) may be too high to allow recovery to the 1980's level, as specified in the international management plan. In the context of this assessment, identifying SBT as a high risk species at Level 2 means that assessment at Level 3 is recommended. A variety of Level 3 analyses occur at present, including a stock assessment, and so information to judge the risk in greater detail exists.

The targeted nature of the fishery, the depth at which it is conducted, and the fact that the catch is not crushed during harvest (fish are transferred live and in water to tow cages), minimizes risk of capture of non-target species, and those that might be captured, have the opportunity for escape or release. Interactions with white sharks have been reported, and releasing this species alive is challenging both logistically, and from an employee health and safety perspective. The status of white sharks is uncertain, and any incidental mortality is considered a risk at this time. Various operational strategies employed by industry – such as feeding/discarding practices on the tow boats – are advocated by industry as effective in minimizing the risk of interactions occurring, and that they suggest that interactions that do occur result in minimal or zero white shark mortality.

Habitats

The habitat component did not require assessment at Level 2 for the SBT purse seine fishery.

Communities

The community component could not yet be assessed at Level 2 for the SBT purse seine fishery, but should be considered in future assessments when the methods to do this are fully developed.

Managing identified risks

Using the results of the ecological risk assessment, the next steps for each fishery will be to consider and implement appropriate management responses to address these risks. To ensure a consistent process for responding to the ERA outcomes, AFMA has developed an Ecological Risk Management (ERM) framework.

3.2. Level 2 PSA Residual Risk Results

The Level 2 PSA residual risk assessment summary for SBT purse seine Fishery is given in **Table 3**. Overall 207 species were assessed: 1 target, 10 bait, 8 bycatch (discard), 6 byproduct and 182 TEP species. A summary of the number of species in each category of risk and the guidelines used for each component are given in **Table 4**. The most common guidelines used was guideline 2, which reduced risk based on a further scientific assessment being completed for the SBT purse seine fishery. Overall there has been a change from 3 high risk species prior to the Level 2 PSA residual risk assessment to zero high residual risk species.



Table 3 Level 2 PSA Residual Risk Results

Taxonomic Group	Scientific Name	Common Name	Role in Fishery*	Productivity	Susceptibility	Level 2 ERA Risk Category Score	Current and Planned Management/ Assessment	Level 2 ERA Residual Risk Guideline(s) Applied	Justification	Level 2 ERA Residual Risk Score
Chondrichthyan	Carcharhinus obscurus	Dusky Shark	DI	3.00	1.67	High	No recorded catch or interaction with this species in logbook or observer data.	Guideline 2	This species has been assessed through a SAFE Rapid Level 3, and was found to be at low risk given the current fishing intensity from the SBT purse seine fishery.	Low
Teleost	Thunnus maccoyii	Southern Bluefin Tuna	TA	2.00	3.00	High	TAC in place for this species	Guideline 6	SBT is managed internationally by CCSBT, which annually determines the global TAC for the species, based on a quantitative stock assessment. Each participating country is then given a national allocation, Australia's 2007-08 (1 Dec - 30 Nov) allocation was 5,265 tonnes	Med
Chondrichthyan	Carcharodon carcharias	White shark	TEP	2.86	1.67	High	No recorded catch or interaction with this species in logbook or observer data	Guideline 2	This species has been assessed through a SAFE Rapid Level 3, and was found to be at low risk given the current fishing intensity from the SBT purse seine fishery.	Low

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

Table 4 Summary of Level 2 PSA Residual Risk Results

Component	Changed from high to medium	Changed from high to low	Changed from medium to low	High Residual Risk	Medium Residual Risk	Low Residual Risk
Target	1	0	0	0	1	0
Target Bait	0	0	0	0	1	9
Bycatch (discard)	0	1	0	0	4	4
Byproduct	0	0	0	0	4	2
TEP	0	1	0	0	87	95
Total	1	2	0	0	97	110



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 guidelines used to assess residual risk were guideline 2 and 6. Guideline 2 could be used as a further level of scientific assessment, a Rapid Level 3 analysis, had been completed on the SBT purse seine fishery. Guideline 6 was used as Southern Bluefin Tuna is managed international by the Commission for the Conservation of Southern Bluefin Tuna (CCSBT). The global TAC for SBT is set by CCSBT, using a quantitative scientific assessment. Australia is then granted an annual national allocation, setting the level of catch permitted by Australian operators.

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



GLOSSARY

Activity	Refers to any fishing activity.
Actual risk	The real risk posed for a species from fishing activities.
Attribute	A general term for a set of properties relating to the productivity or susceptibility of a particular unit of analysis.
Availability	Used in Level 2 PSA assessment to calculate the impact on an ecological component due to a fishing activity. Considers overlap of fishing effort with a species distribution.
Bycatch	<p>That part of fisher's catch which is returned to the sea either because it has no commercial value or regulations preclude it from being retained and;</p> <p>that part of the catch that does not reach the deck of the fishing vessel but is affected by the interaction with the fishing gear.</p>
Byproduct	A non-target species captured in a fishery, that has value to the fisher and be retained for sale.
Catch limit	The vessel catch limit is a limit on the quantity each individual vessel can land per trip or short period of time.
Component	The marine ecosystem is broken down into five components for the risk assessment: target species (TA); byproduct (BI) and bycatch species (DI); threatened, endangered and protected species (TEP); habitats; and ecological communities.
Effort	The total fishing gear in use for a specified period of time.
Encounterability	Used in Level 2 PSA assessment to calculate the impact on an ecological component due to a fishing activity. Considers the likelihood that a species will encounter fishing gear that is deployed within the geographic range of that species (based on two attributes: adult habitat and bathymetry).
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act (Cth) 1999</i>
ERA	Ecological risk assessment for the effects of fishing as developed by AFMA and CSIRO.
ERM Framework	Ecological risk management process outlined by AFMA.
False negative	Species assessed to be low risk when they are actually high risk.
False positive	Species assessed to have a high risk when they are actually low risk
Fishery	A related set of fish harvesting activities regulated by an authority (e.g. South-East Trawl Fishery).



Gear	The equipment used for fishing, e.g. gillnet, Danish seine, pelagic longline, midwater trawl, purse seine, trap etc.
Level 1	The level of the ERA assessment which includes a qualitative assessment of scale, intensity, consequence analysis (SICA).
Potential risk	Possible risk as a result of fishing activities
Post Capture Mortality	Used in Level 2 PSA assessment to calculate the impact on an ecological component due to a fishing activity. Considers the condition and subsequent survival of a species that is captured and released (or discarded).
Precautionary	The approach whereby, if there is uncertainty about the risk, risk is assumed to be high, unless there is advice to the contrary.
PSA	Productivity susceptibility analysis for Level 2 assessment of the ecological assessment.
Productivity	This determines the rate at which the unit can recover after potential depletion or damage by the fishing.
Level 2 PSA Residual Risk	In the context of this document residual risk means the residual risk after the Level 2 PSA assessment.
Scoping	A general step in an ERA or the first step in the ERAEF involving the identification of the fishery history, management, methods, scope and activities.
Selectivity	Used in Level 2 PSA assessment to calculate the impact on an ecological component due to a fishing activity. Considers the potential of the gear to capture or retain species.
SICA	Scale, intensity, consequence analysis for the Level 1 assessment.
Spatial management	Fisheries management that encompasses spatial arrangements such as depth closures or area closures.
Susceptibility	Used in Level 2 PSA assessment to calculate the impact on an ecological component due to a fishing activity. The extent of the impact due to the fishing activity, determined by the affect of the fishing activities on the unit.
Unit	The entities for which attributes are scored in the Level 2 analysis. For example, the units of analysis for the Target Species component are individual "species".



APPENDIX A - SUMMARY OF PRODUCTIVITY AND SUSCEPTIBILITY SCORING

Productivity

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

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

Susceptibility

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

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

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



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