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Ecological Risk Assessment for the Effects of Fishing

Report for the Eastern Tuna and Billfish Fishery: Longline sub-fishery, data to 2015

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Report for the Australian Fisheries Management Authority

July 2019

[Insert ISBN or ISSN and cataloguing-in-publication (CiP) information if required]

[Insert Business Unit specific information if required]

Citation

Sporcic, M., Hobday, A., Bulman, C., Fuller, M. (2018). Ecological Risk Assessment for the Effects of Fishing: Eastern Tuna & Billfish Fishery: Longline Sub-fishery, data to 2015. Report for the Australian Fisheries Management Authority. 234 p.

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Notes to this document:

This fishery ERA Report document contains figures and tables with numbers that correspond to the full methodology document for the ERAEF method:

> Hobday, A. J., A. Smith, H. Webb, R. Daley, S. Wayte, C. Bulman, J. Dowdney, A. Williams, M. Sporcic, J. Dambacher, M. Fuller, T. Walker. (2007). Ecological Risk Assessment for the Effects of Fishing: Methodology. Report R04/1072 for the Australian Fisheries Management Authority, Canberra

Thus, table and figure numbers within the fishery ERA Report document are not sequential as not all are relevant to the fishery ERA Report results.

Additional details on the rationale and the background to the methods development are contained in the ERAEF Final Report:

> Smith, A., A. Hobday, H. Webb, R. Daley, S. Wayte, C. Bulman, J. Dowdney, A. Williams, M. Sporcic, J. Dambacher, M. Fuller, D. Furlani, T. Walker. (2007) Ecological Risk Assessment for the Effects of Fishing: Final Report R04/1072 for the Australian Fisheries Management Authority, Canberra.

This document also reflects some changes in methods that are detailed in AFMA's ERA guide (2017).

> Australian Fisheries Management Authority (2017). Guide to AFMA's Ecological Risk Management. 119 p. Commonwealth of Australia, Canberra.

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Acknowledgments

Thanks to John Garvey (AFMA) and Selvy Coundjidapadam (AFMA) for providing summary statistics from AFMA logbook and Observer data which were subsequently used in this report. Thanks also to Stephanie Martin (AFMA) and Natalie Rivero (AFMA) for providing initial species lists. Don Bromhead (AFMA), Stephanie Martin and Natalie Rivero also provided information on ETBF management and fishery operations. ABARES provided the ETBF effort spatial intensity map incorporated in this report. Thanks also to Rob Campbell (CSIRO) for his information, reports and discussions that were subsequently incorporated in both Scoping and Level 1 analyses. TTRAG members are also thanked for earlier reviews of this report. Finally, Rachel Alderman (Department of Primary Industries, Parks, Water and Environment, Tasmania) is thanked for her evaluation of protected species that were expanded from family group codes for inclusion into the final species list.

Executive summary

The “Ecological Risk Assessment for Effect of Fishing” ERAEF was developed jointly by CSIRO Marine and Atmospheric Research and the Australian Fisheries Management Authority (Hobday et al. 2007, 2011b). This assessment of the ecological impacts of the Eastern Tuna and Billfish Fishery: Longline Sub-fishery was undertaken using the ERAEF method version 9.2, with some additional modifications currently in final stages of development with AFMA. This revised ERAEF provides a hierarchical framework for a comprehensive assessment of the ecological risks arising from fishing, with impacts assessed against five revised ecological components –key commercial and secondary commercial species; byproduct and bycatch species; protected species; habitats; and (ecological) communities (see ERM Guide, AFMA, 2017).

The ERAEF proceeds through four stages of analysis: scoping; an expert judgement based Level 1 analysis (SICA – Scale Intensity Consequence Analysis); an empirically based Level 2 analysis (including PSA – Productivity Susceptibility Analysis and SAFE – Sustainability Assessment for Fishing Effects); and a model-based Level 3 analysis. This hierarchical approach provides a cost-efficient way of screening hazards, with increasing time and attention paid only to those hazards that are not eliminated at lower levels in the analysis. Risk management responses may be identified at any level in the analysis.

Application of the ERAEF methods to a fishery represents a set of screening or prioritization steps that work towards a full quantitative ecological risk assessment. At the start of the process, all components are assumed to be at risk. Each step, or Level, potentially screens out issues that are of low concern. The Scoping stage screens out activities that do not occur in the specific fishery. Level 1 screens out activities that are judged to have low impact, and potentially screens out components with all low impact scores. Level 2 is a screening or prioritization process for individual species, habitats and communities at risk from direct impacts of fishing, using either PSA or b-SAFE. The Level 2 methods do not provide absolute measures of risk. Instead they combine information on productivity and exposure to fishing to assess potential risk – the term used at Level 2 is risk. Because of the precautionary approach to uncertainty, there will be more false positives than false negatives at Level 2, and the list of high risk species or habitats should not be interpreted as all being at high risk from fishing. Level 2 is a screening process to identify species or habitats that require further investigation. Some of these may require only a little further investigation to identify them as a false positive; for some of them managers and industry may decide to implement a management response; others will require further analysis using Level 3 methods, which do assess absolute levels of risk.

This ETBF ERAEF assessment is based on analyses of data (to 2015) conducted in 2016. It should be noted that significant changes have occurred in the fishery after this assessment period, and therefore not reflected in this report (i.e., after the 2011 - 2015 assessment period). These include:

i. Revised stock assessments for the key commercial species (https://www.wcpfc.int/meeting-folders/scientific-committee);

ii. Implementation of electronic monitoring and improved protected species reporting;

iii. A revised Threat Abatement Plan for seabirds interacting with pelagic longline fisheries (http://www.antarctica.gov.au/environment/plants-and-animals/threat-abatement-plan-seabirds);

iv. The development of a comprehensive ETBF Fishery Management Strategy (FMS) that integrates and updates the ERM Strategy, ETBF Harvest Strategy, ETBF Bycatch Action Plan, Data strategy and Research Strategies (https://www.afma.gov.au/fisheries/eastern-tuna-and-billfish-fishery-page);

v. Revised Commonwealth Harvest Strategy Policy and Commonwealth Fisheries Bycatch Policies (See link) and incorporation of these into the ETBF FMS;

Commonwealth Fisheries Bycatch Policy and Guidelines 2018
Commonwealth Harvest Strategy Policy and Guidelines 2018

vi. Amendments to WCPFC CMMs that are now reflected in ETBF permit conditions (https://afma.govcms.gov.au/sites/default/files/2019_etbf_management_arrangements_booklet_-_final.pdf); and

vii. Revised Commonwealth Marine Parks arrangements: (https://parksaustralia.gov.au/marine/parks/)

This 2011-2015 assessment of the Eastern Tuna and Billfish Fishery: Longline sub-fishery consists of the following:

- Scoping
- Level 1 results for all components
- Level 2 PSA and SAFE results
- Residual risk for high risk PSA species and medium or high/extreme risk SAFE species

Fishery Description

Gear:	Pelagic longline
Area:	Cape York (Qld) to SA/Vic border
Depth range:	~30 to 550 m below the surface *cf.* 30 to 400m (2006)
Fleet size:	39 vessels fishing *cf.* 98 (2006)
Effort:	8.252 million hooks *cf.* 9.05 million hooks (2006)
Landings:	5442 t of 5 key commercial species *cf.* 6171 t (2006)
Discard rate:	fishery wide estimate unavailable
Key commercial species:	yellowfin tuna, bigeye tuna, broadbill swordfish, albacore tuna, striped marlin, southern bluefin tuna
Management:	Input and output controls
Observer program:	AFMA Observer Program (OP) operating since July 2003; Average Observer coverage rate: 5% over 2011-2015. OP replaced by E-Monitoring on 1 July 2015: 100% electronic monitoring coverage for vessels operating >30 days/year.

Ecological Units Assessed

Table ES1.1. Ecological units assessed in 2017 (* data to 2015) and 2006.

Ecological units assessed	2017*	2006
Key/secondary commercial species	6 (6 key; 0 secondary)	5
Commercial species/Bait	3	3
Byproduct and bycatch species	18, 146	44, 54
Protected species	94^	284
Habitats	309 (299 benthic, 10 pelagic)	274 (264 benthic, 10 pelagic)
Communities	68 (55 demersal, 13 pelagic)	64 (55 demersal, 9 pelagic)

^ Total number of protected species have significantly decreased compared to the previous list (i.e. 2006) due to the removal of species which have not been observed or interacted with the fishery or outside fishery boundary.

A total of 267 species across the three ecological components were assessed in this ERAEF compared to 390 species in 2006 (Table ES1.1).

The substantial decrease in the number of protected species between assessments is mainly due to the inclusion of only species that interacted with this sub-fishery (apart from any expansion of species groups identified from AFMA logbook, Observer or Electronic Monitoring data).

Level 1 Results

As a result of the SICA analysis, the components that are to be examined at Level 2 are those with any consequence scores of 3 or above. These components are:

- Byproduct and Bycatch species
- Protected species

The Communities component also triggered a Level 2 analysis but was not assessed. This SICA has removed the Habitat component from further analysis, as it was identified as low risk and consequence scores by the set of activities considered.

Most potential hazards (fishing activities) were eliminated at Level 1. Those remaining consist of:

- Direct impact of capture by fishing (byproduct/bycatch species, protected species and communities),
- Direct impact without capture by fishing (protected species) and
- Addition/movement of biological material by translocation of species (communities).

The direct impacts of fishing hazard was scored as moderate for Byproduct and Bycatch and Community components and major for the Protected species component. Confidence scores were high for the protected species component, but low for the other two components (i.e. Byproduct and Bycatch and Communities). A major risk (risk score 4) was also due to indirect fishing impacts on Protected species.

Chondrichthyan interactions with the ETBF activities based on Commonwealth Logbook data are noted as the dominant factors in the major risk and corresponding high confidence scoring for the protected species component, for both fishing with and without capture.

Translocation of species was considered to be a major risk (4) to Communities, due to the potential for the introduction of pathogens through the use of imported baits. Evidence of pathogens in other fishery areas has previously shown the consequence of this hazard (Gaughan 2002). Significant (i.e. risk score of at least moderate) external hazards included impacts from other fisheries in the region for all ecological components except habitats.

There have been many new management arrangements developed and implemented in the ETBF since the last ERAEF assessment was conducted for this sub-fishery (e.g. total allowable commercial quotas introduced for key commercial species; Bycatch Action Plans; Threat Abatement Plans to reduce marine bird interactions; spatial closures to protect species; reduction in fishing effort). In addition, there have been changes in (i) ERAEF methodology (ii) ERAEF species classification and (iii) availability of new information. Results of the two Level 1 ETBF SICA analyses (i.e. 2017 and 2006) showed that the same ecological components (except key/secondary commercial species) still have some units at high risk, despite the above management changes implemented in this fishery (Table ES1.4). For example, different species were identified as most vulnerable and at risk (i.e moderate for byproduct/bycatch species and Communities) for direct impact of capture by fishing between the 2017 and 2006 Level 1 assessments. There was a reduction in risk score for the protected species component with respect to both direct and indirect impact of capture by fishing (i.e. major in 2017 and severe in 2006) with the shortfin mako shark being most vulnerable in 2017 compared to to the flesh

footed shearwater and wandering albatross in 2006 (Table ES1.4). No other species were identified as high risk for protected species component in 2017, in contast to 2006 (i.e., bottlenose dolphin by translocation of species; and the great winged petrel from onboard processing and discarding catch). These results have been presented and discussed with stakeholders, an important step in the ERAEF process.

Table ES1.2. Outcomes of assessments for ecological components conducted or *triggered in 2017 and 2006.

Ecological component	Level attained in 2017	Level attained in 2006
Key/secondary commercial species	Level 1	Level 2
Byproduct and bycatch species	Level 2	Level 2
Protected species	Level 2	Level 2
Habitats	Level 1	Level 1
Communities	Level 2*	Level 2*

* triggered but not assessed

Table ES1.3. Stock and related assessments including status detail (where available) of key commercial species in the ETBF fishery. OF: overfished, NOF: not overfished, NSTOF: not subject to overfishing, STOF: subject to overfishing, UNC: uncertain as to overfishing. UNCM: uncertain, may be overfished.

Role in fishery	Common name, (*scientific name*; FAO code)	Stock status[1]	Year last assessed in ERA period	Data included and/or Source[2]
Key commercial	Albacore tuna (*Thunnus alalunga;* ALB)	NOF (Biomass), NSTOF (Fishing mortality)	2015	Southwest Pacific Harley et al. 2015
	Bigeye tuna (*Thunnus obesus,* BET)	OF (Biomass) and STOF (Fishing mortality)	2014	Western and central Pacific Harley et al. 2014
	Broadbill Swordfish (*Xiphias gladius,* SWO)	NOF (Biomass) and UNC (Fishing mortality)	2013	South-west Pacific; Davies et al. 2013
	Yellowfin tuna (*Thunnus albacares*, YFT)	NOF (Biomass) and NSTOF (Fishing mortality)	2014	Western and central Pacific; Davies et al. 2014
	Striped Marlin (*Kajikia audax,* STM)	UNCM (Biomass) and NSTOF (Fishing mortality)	2012	South-west Pacific; Davies et al. 2012
	Southern Bluefin tuna (*Thunnus maccoyii*, SBT)	OF (Biomass) and UNC (Fishing mortality)	2014	CCSBT(2014)

[1]: Source: (i) Larcombe et al. (2016). Eastern Tuna and Billfish Fishery. In: ABARES Fishery Status Reports 2016 and (ii) Patterson et al. (2016). Southern Bluefin tuna fishery. In ABARES Reports 2016.

[2]: Stock assessments are conducted over a broader region (Western and Central Pacific Ocean) and the reported status reflects the species status in this region.

Table ES1.4. Vulnerable units of analyses chosen in SICA in 2017 and 2006 with corresponding consequence/confidence scores, e.g. 3/1. Note: No activities in the Habitat component were identified as at least moderate and therefore not listed.

Year assessed	Fishing activity	Ecological component			
		Key/secondary commercial species	Byproduct/Bycatch species	Protected species	Communities
2017	Fishing with capture	-	Blue marlin; Black marlin 3/1	Shortfin mako shark 4/2	Eastern oceanic (2) pelagic; eastern oceanic (2) seamount 3/1
	Fishing without capture	-	-	Shortfin mako shark 4/2	-
	Translocation of species	-	-	-	Eastern coastal pelagic 4/1
2006	Fishing with capture	Swordfish 4/2	Southern bluefin tuna; blue shark 3/1	Wandering albatross, Flesh footed shearwater; turtles 5/2	Eastern oceanic (1) pelagic; Eastern oceanic (1) seamount 3/1
	Fishing without capture	-	-	Wandering albatross, Flesh footed shearwater 5/2	-
	Translocation of species	Blue mackerel; yellowtail scad 4/2	Prey species 3/1	Bottlenose dolphin 3/1	Eastern coastal pelagic 3/1
	Onboard processing	-	-	Great winged petrel 3/1	-
	Discarding catch	-	-	Great winged petrel 3/1	-

Level 2 Results

A total of 261 species were evaluated at Level 2. Under the revised ERAEF framework, the six key commercial species with higher level assessments (e.g. Level 3 stock assessments) were not assessed at Level 2.

PSA and residual risk

Bycatch species

A PSA performed on the nine unassessable bSAFE species resulted in none at high risk, seven at medium risk and two at low risk.

Protected species

Five of 85 species were assessed at high risk consisting of two whales and three dolphins. These were the Indian Ocean bottlenose dolphin *Tursiops aduncus*, bottlenose dolphin *Tursiops truncatus*, Risso's dolphin *Grampus griseus*, Longman's beaked whale *Indopacetus pacificus* and pygmy killer whale *Feresa attenuata*. These five high risk species were all reduced to low risk following a residual risk analysis, based on low levels of reported interactions (AFMA Logbook).

bSAFE and residual risk

Commercial bait species

All three commercial bait species were assessed at low risk in the bSAFE analysis.

Byproduct species

Sixteen of 18 species were assessed at low risk. The blue shark *Prionace glauca* was assessed at medium risk, while the dusky whaler *Carcharhinus obscurus* was assessed at high risk. The overall risk for the dusky whaler was reduced to medium-low following a residual risk analysis, based on revised post capture mortality estimates agreed by TTRAG (TTRAG Advice note No. 4818, September 2018).

The blue shark's medium risk score remained the same following a residual risk analysis. Both Logbook and Observer records suggest that more are discarded than retained, but there is limited information on stock status of this species in the area of the ETBF. This species is globally distributed and the stock status in the North and South Atlantic Oceans are uncertain (Anon 2015a), while the stock in the Indian Ocean is not overfished, overfishing could be occurring (Anon, 2015b).

Bycatch species

Of the assessable species, two species were assessed at high risk: largetooth cookiecutter shark *Isistius plutodus* and brier shark *Deania calceus*. These high risk species were reduced to low risk following a residual risk analysis based on low interaction/capture. A further four species were assessed at medium risk, consisting of the pelagic thresher shark *Alopias pelagicus*, scalloped hammerhead shark *Sphyrna lewini*, oceanic whitetip shark *Carcharhinus*

longimanus and sandbar shark *Carcharhinus plumbeus*. A residual risk analysis was performed on these four medium risk species, resulting in overall risk remaining the same. While, mitigation measures already exist for the oceanic whitetip shark (i.e., ban on retention since 2012), monitoring and recorded discards (e.g. in Logbooks) should continue, as population trend within the ETBF is unknown. The sandbar shark remained at medium risk as total removals from the fishery based on Logbook records were low.

Protected species

All nine assessable chondrithyan species were assessed at low risk.

Summary

Of the 261 species evaluated at Level 2 (PSA and bSAFE), eight species were assessed at high risk (one byproduct (bSAFE), two bycatch (bSAFE), five protected (PSA)), 69 species at medium risk and 184 species at low risk. No species remained at high risk a following a residual risk analysis.

1 Overview

1.1 Ecological Risk Assessment for the Effects of Fishing (ERAEF) Framework

1.1.1 The Hierarchical Approach

The Ecological Risk Assessment for the Effects of Fishing (ERAEF) framework involves a hierarchical approach that moves from a comprehensive but largely qualitative analysis of risk at Level 1, through a more focused and semi-quantitative approach at Level 2, to a highly focused and fully quantitative "model-based" approach at Level 3 (Figure 1.1). This approach is efficient because many potential risks are screened out at Level 1, so that the more intensive and quantitative analyses at Level 2 (and ultimately at Level 3) are limited to a subset of the higher risk activities associated with fishing. It also leads to rapid identification of high-risk activities, which in turn can lead to immediate remedial action (risk management response). The ERAEF approach is also precautionary, in the sense that risks will be scored high in the absence of information, evidence or logical argument to the contrary.

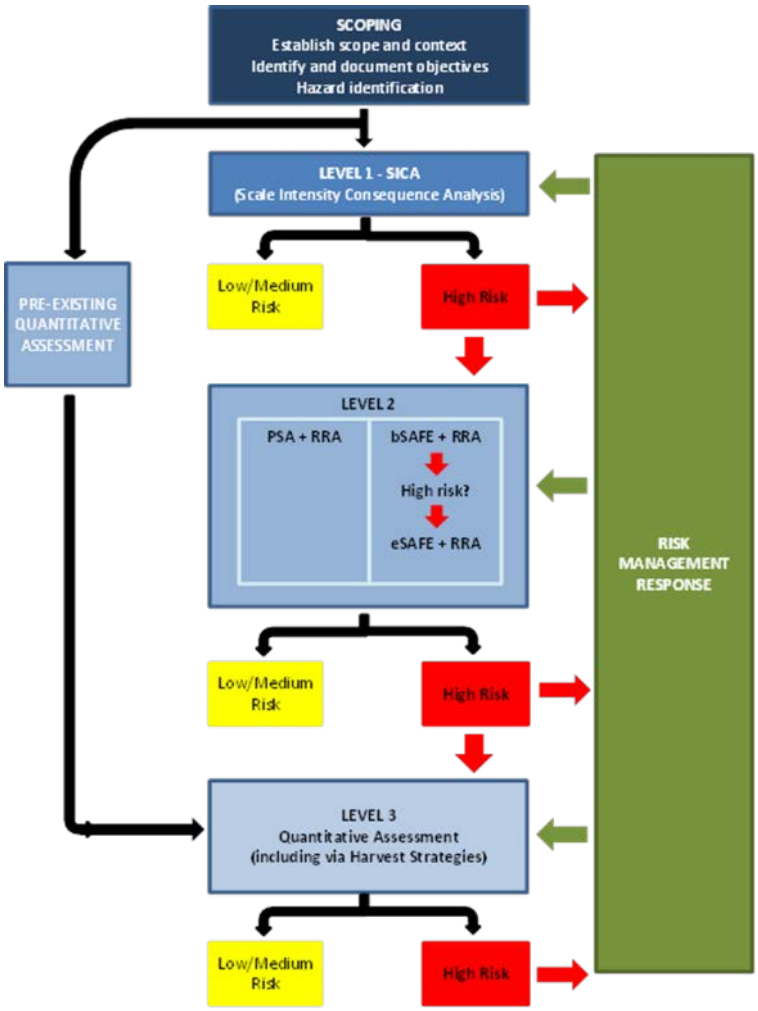


Figure 1.1. Structure of the 3 level hierarchical ERAEF methodology. SICA – Scale Intensity Consequence Analysis; PSA – Productivity Susceptibility Analysis; SAFE – Sustainability Assessment for Fishing Effects; RRA – Residual Risk Analysis. T1 – Tier 1. eSAFE may be used for species classified as high risk by bSAFE.

1.1.2 Conceptual Model

The approach makes use of a general conceptual model of how fishing impacts on ecological systems, which is used as the basis for the risk assessment evaluations at each level of analysis (Levels 1-3). For the ERAEF approach, five general ecological component are evaluated, corresponding to five areas of focus in evaluating impacts of fishing for strategic assessment under EPBC legislation. The five revised components are:

- Key commercial species and secondary commercial species
- Byproduct and bycatch species

- protected[1] species (formerly referred to as threatened, endangered and Protected[2] species or TEPs)
- Habitats
- Ecological communities

This conceptual model (Figure 1.2) progresses from *fishery characteristics* of the fishery or sub-fishery, → *fishing activities* associated with fishing and *external activities*, which may impact the five ecological components (target, byproduct and bycatch species, protected species, habitats, and communities); → *effects of fishing and external activities* which are the direct impacts of fishing and external activities; → *natural processes and resources* that are affected by the impacts of fishing and external activities; → *sub-components* which are affected by impacts to natural processes and resources; → *components*, which are affected by impacts to the sub-components. Impacts to the sub-components and components in turn affect achievement of management objectives.

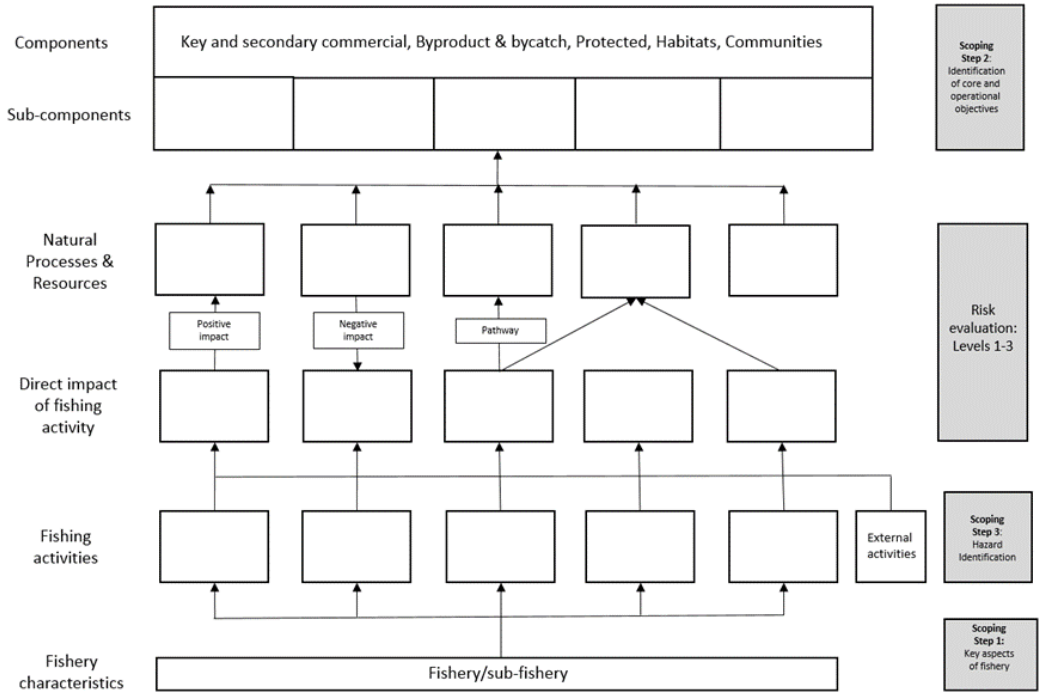


Figure 1.2. Generic conceptual model used in ERAEF.

[1] The term "protected species" refers to species listed under [Part 13] of the EPBC Act (1999) and replaces the term "Threatened, endangered and protected species (TEPs)" commonly used in past Commonwealth (including AFMA) documents.

[2] Note "protected" (with small "p") refers to all species covered by the EPBC Act (1999) while "Protected" (capital P) refers only to those protected species that are threatened (vulnerable, endangered or critically endangered).

The external activities that may impact the fishery objectives are also identified at the Scoping stage and evaluated at Level 1. This provides information on the additional impacts on the ecological components being evaluated, even though management of the external activities is outside the scope of management for that fishery.

The assessment of risk at each level takes into account current management strategies and arrangements. A crucial process in the risk assessment framework is to document the rationale behind assessments and decisions at each step in the analysis. The decision to proceed to subsequent levels depends on

- Estimated risk at the previous level
- Availability of data to proceed to the next level
- Management response (e.g. if the risk is high but immediate changes to management regulations or fishing practices will reduce the risk, then analysis at the next level may be unnecessary).

1.1.3 ERAEF stakeholder engagement process

A recognized part of conventional risk assessment is the involvement of stakeholders involved in the activities being assessed. Stakeholders can make an important contribution by providing expert judgment, fishery-specific and ecological knowledge, and process and outcome ownership. The ERAEF method also relies on stakeholder involvement at each stage in the process, as outlined below. Stakeholder interactions are recorded.

1.1.4 Scoping

In the first instance, scoping is based on review of existing documents and information, with much of it collected and completed to a draft stage prior to full stakeholder involvement. This provides all the stakeholders with information on the relevant background issues. Three key outputs are required from the scoping, each requiring stakeholder input.

1. Identification of units of analysis (species, habitats and communities) potentially impacted by fishery activities (Section 2.2.2; Scoping Documents S2A, S2B1, S2B2 and S2C1, S2C2).
2. Selection of objectives (Section 2.2.3; Scoping Document S3). The primary objective to be pursued for species assessed under ERAF is that of ensuring populations are maintained at biomass levels above which recruitment failure is likely, as stated in Chapter 2 (AFMA (2017), Ecological Risk Management (ERM) Guide). This is consistent with current legislation and fisheries policies and represents a change from when the ERAEF was first developed and there was less policy or legislation based guidance on sustainability objectives, with stakeholders able to choose from a range of "sustainability" objectives (eg: tables 5A-C in Hobday et al. 2007).
3. Selection of activities (hazards) (Section 2.2.4; Scoping Document S4) that occur in the sub-fishery is made using a checklist of potential activities provided. The checklist was developed following extensive review, and allows repeatability between fisheries. Additional activities raised by the stakeholders can be included in this checklist (and

would feed back into the original checklist). The background information and consultation with the stakeholders is used to finalize the set of activities. Many activities will be self-evident (e.g. fishing, which obviously occurs), but for others, expert or anecdotal evidence may be required.

1.1.5 Level 1. SICA (Scale, Intensity, Consequence Analysis)

The SICA analysis evaluates the risk to ecological components resulting from the stakeholder-agreed set of activities. Evaluation of the temporal and spatial scale, intensity, sub-component, unit of analysis, and credible scenario (consequence for a sub-component) should be prepared by the draft fishery ERAF report author and reviewed at an appropriate stakeholder meeting (e.g. Resource Assessment Group meeting). Due to the number of activities (up to 24) in each of five components (resulting in up to 120 SICA elements), preparation before involving the full set of stakeholders may allow time and attention to be focused on the uncertain or controversial or high risk elements. Documenting the rationale for each SICA element ahead of time for the straw-man scenarios is crucial to allow the workshop debate to focus on the right portions of the logical progression that resulted in the consequence score.

SICA elements are scored on a scale of 1 to 6 (negligible to extreme) using a "plausible worst case" approach (see ERAEF Methods Document for details; Smith et al. 2007). Level 1 analysis potentially result in the elimination of activities (hazards) and in some cases whole components. Any SICA element that scores 2 or less is documented, but not considered further for analysis or management response.

1.1.6 Level 2. PSA and SAFE (semi-quantitative and quantitative methods)

When the risk of an activity at Level 1 (SICA) on a species component is moderate or higher and no planned management interventions that would remove this risk are identified, an assessment is required at Level 2 (to determine if the risk is real and provide further information on the risk). The tools used to assess risk at Level 2 allow units (e.g. all individual species) within any of the ecological species components (e.g. key/secondary commercial, byproduct/bycatch, and protected species) to be effectively and comprehensively screened for risk. The analysis units are identified at the scoping stage. To date, Level 2 tools have been designed to measure risk from direct impacts of fishing only (i.e. risk of overfishing, leading to an overfished fishery), which in all assessments to date has been the hazard with the greatest risks identified at Level 1[3].

In the period since the first ERAEF was implemented across Commonwealth fisheries, much of the management focus has been on the assessment results associated with Level 2 and Level 2.5 or 3 risk assessment methods, which comprise semi-quantitative or rapid simple

[3] Future iterations of the methodology will include PSAs modified to measure the risk due to other activities, such as gear loss.

quantitative methods (e.g. PSA and SAFE). This level has been subject to the greatest level of change and improvement which are discussed in the following sections. Additional improvements are being developed for implementation in the near future (see Chapter 4.13 of AFMA ERM Guide, AFMA (2017)).

Level 2 was originally designed to rely on a single risk assessment methodology, the Productivity-Susceptibility Analysis (PSA) (see Chapter 4.9 of AFMA ERM Guide, AFMA (2017)), however a more quantitative method called the Sustainability Assessment for Fishing Effects (SAFE) (see Chapter 4.10 of AFMA ERM Guide, AFMA (2017)) was developed early in the implementation of the ERAEF and classed as a Level 2.5 or Level 3 tool.

Under the revised ERAEF:

- bSAFE has now been reclassified as the preferred Level 2 method (over PSA) where sufficient spatial and biological data (to support bSAFE) are available. Typically this has been used for teleost and chondricthyan species.
- Species estimated to be at high risk under bSAFE may then be assessed under eSAFE which may provide reduced estimates of uncertainty pertaining to the actual risk.
- Where either the data or species biological characteristics are insufficient to support bSAFE analyses, it is recommended that PSA be applied instead. This will be the case for many protected species, invertebrate bycatch species and some other species.
- At Level 2, either PSA or SAFE methods should be applied to any given species, not both.
- For high risk species it is a management choice whether to progress to eSAFE, pursue a Level 3 fully quantitative stock assessment, or to take more immediate management action to reduce the risk. The types of considerations required in making that choice (ie: moving up the ERAEF assessment hierarchy or taking direct management action) are outlined in Chapter 5.5 of the AFMA ERM Guide (AFMA (2017).

It is also recognised that a number of additional tools, including some of the “data poor” assessment tools that are used to inform harvest strategies, could potentially be included within the Level 2 toolkit. They are distinguished from Level 3 quantitative tools (i.e. stock assessment models) that are more data rich and able to more precisely quantify uncertainty.

1.1.6.1 PSA (Productivity Susceptibility Analysis)

Details of the PSA method are described in the accompanying ERAEF Methods Document and also summarised in Section 4.8.3 of the AFMA ERM Guide (AFMA 2017). Stakeholders can provide input and suggestions on appropriate attributes, including novel ones, for evaluating risk in the specific fishery. Attribute values for many of the units (e.g. age at maturity, depth range, mean trophic level) can be obtained from published literature and other resources (e.g. scientific experts) without initial stakeholder involvement. Stakeholder input is required after preliminary attribute values are obtained. In particular, where information is missing, expert opinion can be used to derive the most “reasonable” conservative estimate. For example, if species attribute values for annual fecundity have been categorized as low, medium or high on

the set (<5, 5-500, >500), estimates for species with no data can still be made. Also, estimated fecundity of a broadcast-spawning fish species with unknown fecundity is still likely to be greater than the high fecundity category (>500). Susceptibility attribute estimates, such as "fraction alive when landed", can also be made based on input from experts such as scientific observers. Feedback to stakeholders regarding comments received during the preliminary PSA consultations is considered crucial. The final PSA is completed by scientists and results are presented to the relevant stakeholder group (e.g. RAG and/or MAC) before decisions regarding Level 3 analysis are considered. The stakeholder group may also decide on priorities for analysis at Level 3.

1.1.6.2 Residual Risk Analysis

There were several limitations due to the semi-quantitative nature of a Level 2 PSA assessment. For example, certain management arrangements which mitigate the risks posed by a fishery, as well as additional information concerning levels of direct mortality, may not be easily taken into account in assessments. To overcome this, Residual risk analyses (RRA) are used to consider additional information, particularly mitigating effects of management arrangements that were not explicitly included in the ERAs or introduced after the ERA process commenced. Priority for this process has typically been focused on those species attributed a high risk rating (those likely to be most at risk from fishing activities). It could in theory be used to also determine if some species have been incorrectly classified as low risk.

Recently revised Residual risk guidelines have been developed (AFMA 2018) to assist in making accurate judgments of residual risk consistently across all fisheries. At the moment, they are applied to species and not applicable to habitats or communities.

These guidelines are not seen as a definitive guide on the determination of residual risk and it is expected they may not apply in a small number of cases. Care must also be taken when applying them to ensure residual risk results are appropriate in a practical sense. There are a number of conditions which underpin the residual risk guidelines and should be understood before the guidelines are applied:

- All assessments and management measures used within the residual risk assessment must be implemented prior to the assessment with sufficient data to demonstrate the effect. Any planned or proposed measures can be referred to in the assessment but cannot be used to revise the risk score.
- When applied, the guidelines generally result in changes to particular "attribute" scores for a particular species. Only after all of the guidelines have been applied to a particular species, should the overall risk category be re-calculated. This will ensure consistency, as well as facilitating the application of multiple guidelines.
- Unless there is clear and substantiated information to support applying an individual guideline, then the attribute and residual risk score should remain unchanged. All supporting information considered in applying these Guidelines must be clearly documented and referenced where applicable. This is consistent with the precautionary approach applied in ERAs, with residual risk remaining high unless there is evidence to the contrary ensuring a transparent process is applied.

The results (including supporting information and justifications) from residual risk analyses must be documented in "Residual Risk Reports" for each fishery (or can be integrated into the Level 2 risk assessment report). These will be publically available documents.

1.1.6.3 SAFE (Sustainability Assessment for Fishing Effects)

The SAFE method developed is split into two categories: base SAFE (bSAFE) and an enhanced SAFE (eSAFE). eSAFE has greater data processing requirements and is recommended to only be used to assess species estimated to be at high risk via the bSAFE. It is also able to more appropriately model spatial availability aspects when sufficient data are available.

bSAFE

Relative to the PSA approach, the bSAFE approach (Zhou and Griffiths, 2008; Zhou et al. 2007; Zhou et al. 2011):

- is a more quantitative approach (analogous to stock assessment) that is able to provide absolute measures of risk by estimating fishing mortality rates relative to fishing mortality rate reference points (based on life history parameters);
- requires less productivity data than the PSA;
- is able to account for cumulative risk and
- potentially out performs PSA in several areas, including strength of relationship to Tier 1 assessment classifications (Zhou et al. 2016).

Like PSA, the bSAFE method is a transparent, relatively rapid and cost effective process for screening large numbers of species for risk, and is far less demanding of data and much simpler to apply than a typical quantitative stock assessment.

As such it is recommended that bSAFE be used as the preferred Level 2 assessment tool for all fish species and some invertebrates and reptiles (eg: some sea snakes) with sufficient data.

In estimating fishing mortality, bSAFE utilises much of the same information as the PSA, to estimate:

- Spatial overlap between species distribution and fishing effort distribution
- Catchability resulting from the probability of encountering the gear and size-dependent selectivity
- Post-capture mortality

The fishing mortality is essentially the fraction of overlap between fished area and the species distribution area within the jurisdiction, adjusted by catchability and post-capture mortality. Uncertainty around the estimated fishing mortality is estimated by including variances in encounterability, selectivity, survival rate and fishing effort between years.

The three biological reference points are based on a simple surplus production model:

- $\mathbf{F_{MSY}}$ – instantaneous fishing mortality rate that corresponds to the maximum number of fish in the population that can be killed by fishing in the long term. The latter is the maximum sustainable fishing mortality (MSM) at B_{MSM}, similar to target species MSY.

- **F_{LIM}** – instantaneous fishing mortality rate that corresponds to the limit biomass B_{LIM} where B_{LIM} is a assumed to be half of the biomass that supports a maximum sustainable fishing mortality ($0.5B_{MSM}$)
- **F_{CRASH}** – minimum unsustainable instantaneous fishing mortality rate that, in theory, will lead to population extinction in the long term.

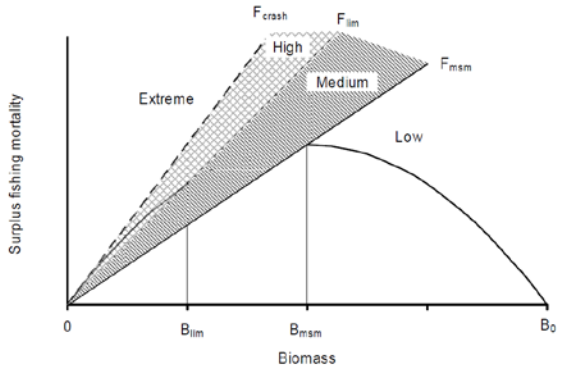


Figure 1.3. Stock productivity, biological reference points and ecological risk assessment for managing bycatch species.

This methodology produces quantified indicators of performance against fishing mortality based reference points and as such does allow calibration with other stock assessment and risk assessment tools that measure fishing mortality. It allows the risk of overfishing to be determined, via the score relative to the reference line. Uncertainty (error bars) are related to the variation in the estimation of the scores for each axis.

It is recommended that species assessed as being potentially at high risk under bSAFE are then progressed to analysis by eSAFE which is able to narrow uncertainties around the risk (but is more time and resource intensive than bSAFE).

Assumptions and issues to be aware of:

- Comparisons of PSA and SAFE analyses for the same fisheries and species support the claim that the PSA method generally avoids false negatives but can result in many false positives. Limited testing of SAFE results against full quantitative stock assessments suggest that there is less “bias” in the method, but that both false negatives and false positives can arise.
- SAFE analyses retain some of the key precautionary elements of the PSA method, including assumptions that fisheries are impacting local stocks (within the jurisdictional area of the fishery).
- Although the bSAFE analyses provide direct estimates of uncertainty in both the exploitation rate and associated reference points, they are less explicit about uncertainties arising from key assumptions in the method, including spatial distribution and movement of stocks.
- The method assumes there would be no local depletion effects from repeat trawls at the same location (ie: populations rapidly mix between fished and unfished areas). The fishing mortality will likely be overestimated if this assumption is not satisfied (ERA TWG 2015).

- The method also assumes that the mean fish density does not vary between fished area and non-fished area within their distributional range. Hence, the level of risk would be over-estimated for species found primarily in non-fished habitat, while risk would be under-estimated for species that prefer fished habitat (ERA TWG 2015).
- The SAFE methodology makes greater assumptions than Tier 1 stock assessments in coming to its F estimates (due to a lack of the data relative to that used in a Tier 1 assessment) and it is not capable of measuring risk of a stock being already overfished (so the type of risk it measures relates only to overfishing, which may then lead to future overfished state). The limitations of SAFE with respect to measuring overfished risks are the same essentially as for PSA.

eSAFE

Enhanced SAFE (eSAFE) appears, based on calibration with Level 3 assessments, to provide improved estimates of fishing mortality relative to the base SAFE (bSAFE) method. The eSAFE requires more spatially explicit data and takes more analysis time than bSAFE, and so might only be used to further assess species that were identified as at high risk using bSAFE (and which have not had further direct management action taken). The eSAFE enhances the bSAFE method by estimating varying fish density across their distribution range as well as species- and gear-specific catch efficiency for each species.

1.1.7 Level 3

This stage of the risk assessment is fully-quantitative and relies on in-depth scientific studies on the units identified as at medium or greater risk in the Level 2. It will be both time and data-intensive. Individual stakeholders are engaged as required in a more intensive and directed fashion. Results are presented to the stakeholder group and feedback incorporated, but live modification is not considered likely.

1.1.8 Conclusion and final risk assessment report

The conclusion of the stakeholder consultation process will result in a final risk assessment report for the individual fishery according to the ERAEF methods. It is envisaged that the completed assessment will be adopted by the fishery management group and used by AFMA for a range of management purposes, including to address the requirements of the EPBC Act as evaluated by Department of the Environment and Heritage.

1.1.9 Subsequent risk assessment iterations for a fishery

The frequency at which each fishery must revise and update the risk assessment is not fully prescribed. As new information arises or management changes occur, the risks can be reevaluated, and documented as before. The fishery management group or AFMA may take ownership of this process, or scientific consultants may be engaged. In any case the ERAEF should again be based on the input of the full set of stakeholders and reviewed by independent experts familiar with the process.

Fishery re-assessments for byproduct and bycatch species under the ERAEF will be undertaken every five years[4] or sooner if triggered by re-assessment triggers. The five year timeframe is based on a number of factors including:

- The time it takes to implement risk management measures; for populations to respond to those measures to a degree detectable by monitoring processes; and to collect sufficient data to determine the effectiveness of those measures.
- Alignment with other management and accreditation processes.
- The cost of re-assessments.
- The review period for Fishery Management Strategy (FMS).

For byproduct and bycatch species, in the periods between scheduled 5 year ERA reviews[5], AFMA will develop and monitor a set of fishery indicators and triggers, on an annual basis, so as to detect any changes (increase or decrease) in the level of risk posed by the fishery to any species. Where indicators exceed specified trigger levels, AFMA will investigate the causes and provide opportunity for RAG comment/advice during that process. Pending outcomes of that review, and RAG advice, AFMA can if necessary, request a species specific or full fishery re-assessment (ie: prior to the scheduled re-assessment dates).

The ERA TWG (September 2015) identified five key indicators upon which such triggers could be based, these being changes in:

- Gear type/use
- Mitigation measures (use or type)
- Area fished
- Catch or interaction rate
- Fishing effort

Where possible, the triggers should look to take into account additional sources of risk from interacting non-Commonwealth fisheries. In addition, if a major management change is planned for a fishery, such as a move from input to output controls, the fishery will need to be reassessed prior to that management change coming into effect. In considering each indicator and trigger level, the RAG should consider the following:

- The data upon which the indicator is based must be sufficiently representative of actual changes in catch, effort, area, gear or mitigation methods. Consideration should be given to the level of uncertainty associated with the data underpinning any prospective indicator.

[4] Based on a recommendation by the ERA Technical Working Group, September 2015.

[5] In contrast to key and secondary commercial species managed via catch/effort limits under Harvest Strategies, which depending on species and Harvest Strategy, can be re-assessed any time between 1 and 5 years.

- The trigger level chosen should not be overly sensitive to the normal inter-annual variance that is typical of the indicator and independent of fishing pressure, assuming such variance is unlikely to relate to a significant change in the risk posed by the fishery to any or all species.
- The trigger level should equate to the minimum level of change that the RAG (by its expert opinion) considers might potentially represent a significant change in the risk posed by the fishery.
- The trigger level could represent an absolute change (number/level) in an indicator or a percentage change in an indicator.
- The RAG should consider whether a "temporal" condition should be placed on the trigger (ie: the trigger is breached 2 years in a row) to further reduce the likelihood of natural population variance or data errors triggering a re-assessment unnecessarily.

The final set of indicators and triggers will be developed for each fishery by AFMA in consultation with its fishery RAG (or for fisheries lacking a RAG, the ERA TWG), in association with the next planned re-assessment (see Chapter 6 in AFMA ERM Guide, AFMA (2017)). A RAG may choose a subset of these indicators and triggers, or include an additional indicator/trigger(s), based on consideration of the availability and reliability of data upon which to base any of the above indicators/triggers, however justification of this must be provided.

Research is currently underway to develop specific guidance for RAG to aid in the selection of appropriate triggers, which will in the meantime be determined using RAG expert opinion. In the longer term it may be possible to refine indicators and triggers using the existing PSA and SAFE methods to test which attributes the end risk scores are most sensitive to (ERA TWG 2015)[6]. The RAG will record both the final set of indicators and triggers chosen, and a justification for those, in the RAG minutes. Once the final set of indicators and triggers is determined for a fishery, they will require implementation within the FMS and a monitoring and review process.

[6] ERA TWG recommendation, September 2015

2 Results

The focus of analysis is the fishery as identified by the responsible management authority (AFMA). The assessment area is defined by the fishery management jurisdiction within the Australian Fisheries Zone (AFZ). The fishery may also be divided into sub-fisheries on the basis of fishing method and/or spatial coverage. These sub-fisheries should be clearly identified and described during the scoping stage. Portions of the scoping and analysis at Level 1 and beyond are specific to a particular sub-fishery. The fishery is a group of people carrying out certain activities as defined under a management plan. Depending on the jurisdiction, the fishery/sub-fishery may include any combination of commercial, recreational, and/or indigenous fishers.

The results presented below are for the pelagic longline sub-fishery of the Eastern Tuna and Billfish Fishery (ETBF). A full description of the ERAEF method is provided in the methodology document (Hobday et al. 2007; Hobday et al. 2011b). This fishery report contains figures and tables with numbers that correspond to this methodology document. Thus, table and figure numbers within this fishery ERAEF report are not sequential, as not all figures and tables are relevant to the fishery risk assessment results.

2.1 Stakeholder Engagement

Table 2.1. Summary Document SD1. Summary of stakeholder involvement for sub-fishery: Eastern Tuna and Billfish Fishery: Longline sub-fishery.

Fishery ERA Report stage	Type of stakeholder interaction	Date of stakeholder interaction	Composition of stakeholder group (names or roles)	Summary of outcome
Scoping	Phone calls and emails	June/July 2016	AFMA contacts; Rob Campbell (CSIRO); ABARES	Various information supplied and reports sent to ERA Team Project discussed, methods for Scoping analysis.
Level 1 (SICA)	Phone calls and emails	June/July 2016	AFMA contacts; Rob Campbell (CSIRO); ABARES	Draft Level 1 completed
Level 1; Level 2		October 2016	AFMA, CSIRO, ABARES, Industry members	Draft report presented; Level 1 and Level 2 presented to TTRAG
Level 2		28 March 2017	AFMA, CSIRO, ABARES, Industry members	Revised L2 results presented to TTRAG
Level 2		12 July 2017	AFMA, CSIRO, ABARES, Industry members	Revised species list completed; revised L2 analysis completed. Results presented to TTRAG
Level 1; Level 2		October 2017	AFMA, CSIRO, ABARES, Industry members	Revised species list; revised L1 and L2 analysis completed. Results provided to TTRAG

Fishery ERA Report stage	Type of stakeholder interaction	Date of stakeholder interaction	Composition of stakeholder group (names or roles)	Summary of outcome
Level 1; Level 2		March 2018	AFMA, CSIRO, ABARES, Industry members	Revised draft final report submitted to TTRAG and AFMA
Level 2 and residual risk		September 2018	AFMA, CSIRO, ABARES, Industry members	Revised risk for dusky whaler shark presented to TTRAG based on alternative post-capture mortality scoring
Agreement on revised risk score for dusky whaler		October 2018	AFMA, CSIRO, Department of Agriculture and Water Resources, Consultants	Final risk score for dusky whaler endorsed by TTRAG and AFMA ERM Steering group
Report		April 2019	AFMA, CSIRO, Department of Agriculture and Water Resources, Consultants	Draft submitted to AFMA which includes a re-analysis conducted with corrected spatial input data
Report		July 2019	AFMA, CSIRO, Department of Agriculture and Water Resources, Consultants	Final report submitted

2.2 Scoping

The aim in the Scoping stage is to develop a profile of the fishery being assessed. This provides information needed at stakeholder meetings and to complete Levels 1 and 2. The focus of analysis is the fishery, which may be divided into sub-fisheries on the basis of fishing method and/or spatial coverage. Scoping involves six steps:

Step 1. Document the general fishery characteristics
Step 2. Generating "unit of analysis" lists (species, habitat types, communities)
Step 3. Selection of objectives
Step 4. Hazard identification
Step 5. Bibliography
Step 6. Decision rules to move to Level 1

2.2.1 General Fishery Characteristics (Step 1).

The information used to complete this step came from a range of documents such as the Fishery's Management Plan, Assessment Reports, Bycatch Action Plans, and any other relevant background documents.

Scoping Document S1 General Fishery Characteristics

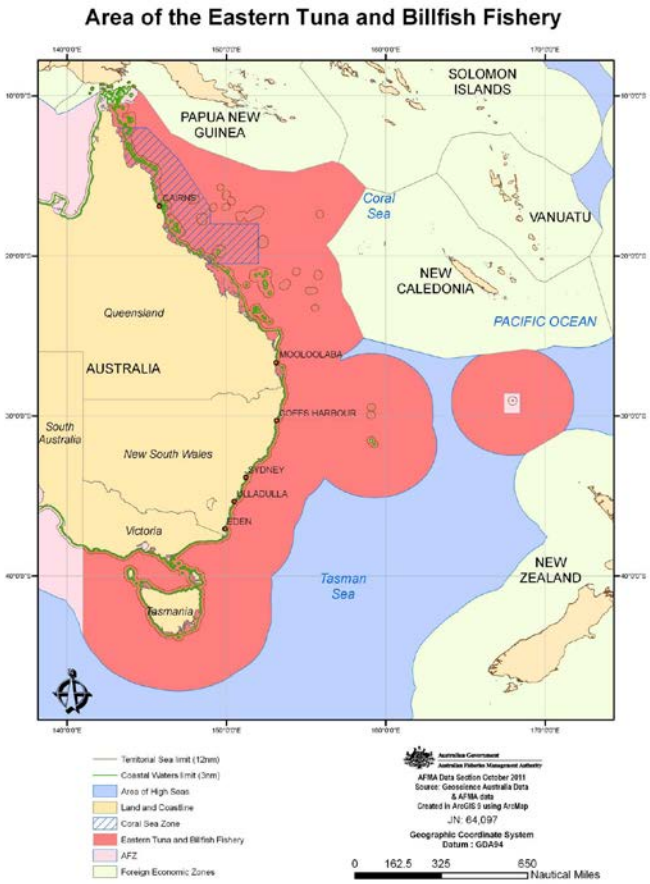
Fishery Name: Eastern Tuna and Billfish fishery – pelagic longline

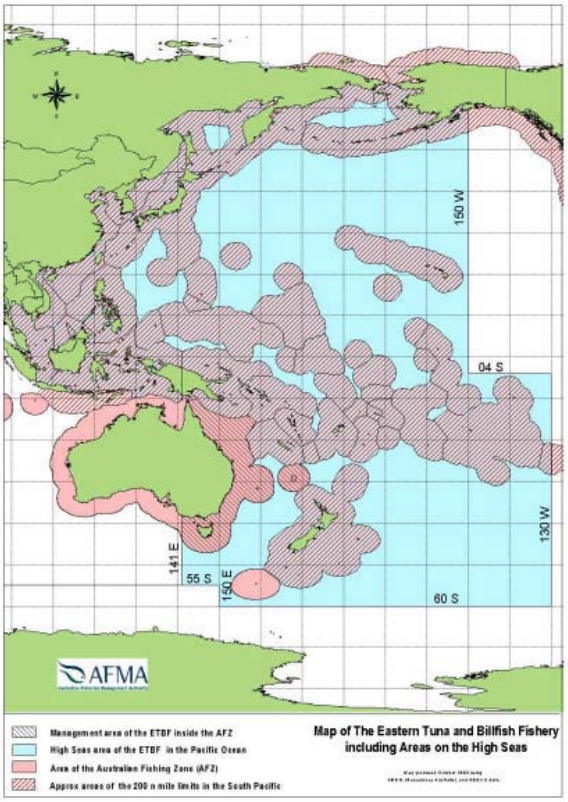
Date of revised ERAEF assessment: Oct 2017

Assessor: Miriana Sporcic

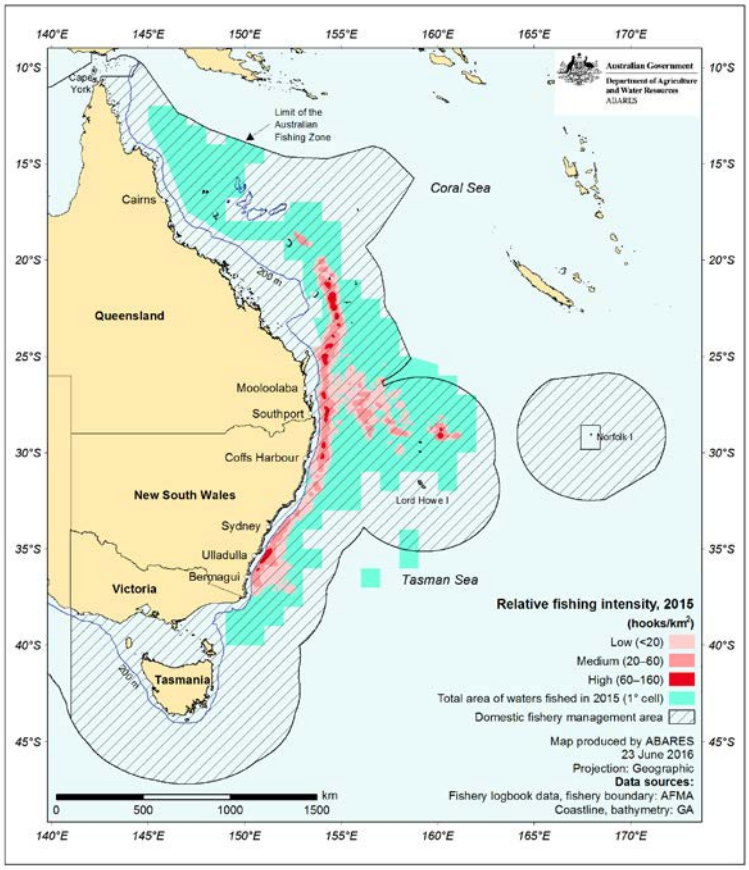
Table 2.2. General fishery characteristics.

General Fishery Characteristics	
Fishery Name	Eastern Tuna and Billfish Fishery
Sub-fisheries	The ETBF consists of three principal methods (see first three below). The predominant method is pelagic longlining. • Pelagic longlining • Pole and line • Minor line and • Bait fishing (inshore purse seining) is also used in the pelagic longline sub-fishery.
Sub-fisheries assessed	This risk assessment focuses on the pelagic longline sub-fishery of the ETBF.
Start date/ history	The Australian tuna fishing industry began with the experimental canning of southern bluefin tuna in 1939, however, commercial poling operations did not begin until the early 1950s off New South Wales, South Australia and (later) off Western Australia. The Japanese began pelagic longlining off the east coast of Australia in the early 1950s and continued until November 1997. The majority of this catch was taken to Japan. Australian commercial fishers began sporadically targeting yellowfin tuna off NSW from the mid-1950s. Over the past 50 years, Australia's tuna and billfish fisheries have expanded and developed to include several species and fishing methods, an extensive fishing area, a farming sector, and both domestic and international markets. The management of Australia's tuna and billfish fisheries has also changed throughout this period, with major changes such as the introduction of the Australian Fishing Zone in 1979 and the implementation of international management agreements.

Geographic extent of fishery	The eastern part of the Australian Fishing Zone (AFZ) from the tip of Cape York (142º31'49"E) to the South Australian/Victorian border (141ºE). It includes Commonwealth waters off Queensland, New South Wales, Victoria and Tasmania out to the 200 nautical miles limit of the AFZ and includes waters around Norfolk Island.  **Existing tuna and billfish fishery boundaries within the Australian Fishing Zone. Source: AFMA, Eastern Tuna and Billfish Fishery (ETBF) Management Arrangements Booklet 2016 Fishing Season.**



Eastern Tuna and Billfish Fishery Management Area including the High Seas. (AFMA ETBF Data summary 2004/05).



Effort Intensity (hooks/km^2) for 2015. Source: ABARES. The greatest intensity of fishing is distributed off the NSW and southern to middle Queensland coasts.

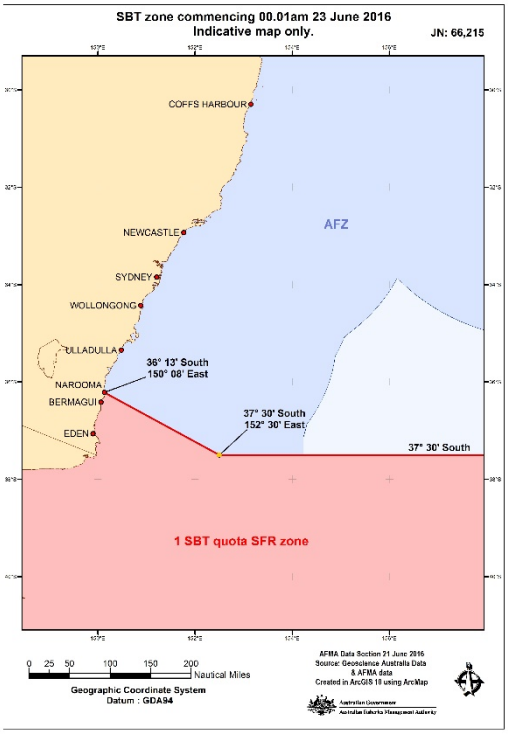
Regions or Zones within the fishery	As per ETBF Management Plan 2010: Area of the fishery: Part 1 AFZ area (other than the Coral Sea zone) The parts of the AFZ that are: (a) within the area bounded by a notional line beginning at the intersection of the eastern coastline of the mainland at low water with the meridian of longitude 141° E, in the vicinity of the border between Victoria and South Australia and running: • south along that meridian to its intersection with the outer limit of the AFZ; and • generally southerly, easterly and northerly along that outer limit to its intersection with the meridian of longitude 144° 28' E that is off the coast of Queensland; and • south along that meridian to its intersection with the parallel of latitude 9° 54' S; and • south-westerly along the geodesic to the point of latitude 10° 15' S, longitude 144° 12' E; and • southerly along the geodesic to the point of latitude 10° 28 S, longitude 144° 10' E; and • west along that parallel to its intersection with the meridian of longitude 142° 31' 49" E; and • south along that meridian to its intersection with the northern coastline of the mainland at low water, in the vicinity of Cape York; and • generally southerly along that coastline at low water to the point where the line began; and (b) adjacent to Norfolk Island, except the area bounded by a notional line beginning at the point of latitude 28° 35' S, longitude 167° 25' E, and running: • east along that parallel to its intersection with the meridian of longitude 168° 25' E; and • south along that meridian to its intersection with the parallel of latitude 29° 50' S; and • west along that parallel to its intersection with the meridian of longitude 167° 25' E; and • north along that meridian to the point where the line began. *Note:* If an arrangement about a particular fishery is made under Division 3 of Part 5 of the Act, State coastal waters may be taken to be part of the AFZ for the purposes of the management of the fishery: see section 76 of the Act. Part 2 Coral Sea zone The part of the AFZ that is within the area bounded by a notional line beginning at the intersection of the eastern coastline of the mainland at low water with the parallel of latitude 12° S, in the vicinity of Shelburne Bay, and running: • east along that parallel to its intersection with the meridian of longitude 145° E; and • southerly along the geodesic to the point of latitude 14° S, longitude 147° E; and • southerly along the geodesic to the point of latitude 17° S, longitude 149° E; and • south along that meridian to its intersection with the parallel of latitude 18° S; and • east along that parallel to its intersection with the meridian of longitude 152° E; and • south along that meridian to its intersection with the parallel of latitude 20° 28'49" S; and • west along that parallel to its intersection with the eastern coastline of the mainland at low water, in the vicinity of Proserpine; and • generally northerly along that coastline at low water to the point where the line began. Part 3 High seas zone The part of the Pacific Ocean, other than an area that is within the AFZ or the EEZ of a foreign country, that is within the area bounded by a notional line beginning at the intersection of the south coast of Australia and the meridian of longitude 141°E, and running: • south to its intersection with the parallel of latitude 55° S; and • east along that parallel to its intersection with the meridian of longitude 150° E; and

- south along that meridian to its intersection with the parallel of latitude 60° S; and
- east along that parallel to its intersection with the meridian of longitude 130° W; and
- north along that meridian to its intersection with the parallel of latitude 4° S; and
- west along that parallel to its intersection with the meridian of longitude 150° W; and
- north along that meridian.

Note: Under international law, the Exclusive Economic Zone (EEZ) of a country generally extends 200 nautical miles from the baseline of a country. However, the presence of islands and reefs may extend this limit. Holders of fishing permits should contact the coastal state (within the meaning it has in the *Seas and Submerged Lands Act 1973*) to determine the exact coordinates of its EEZ boundaries.

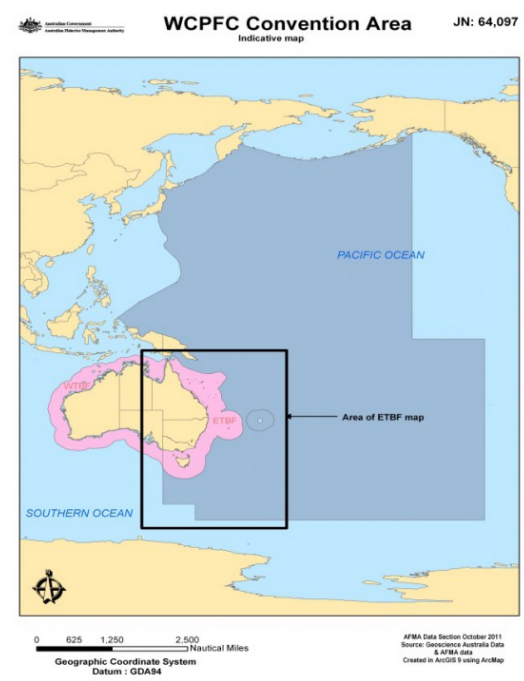
Between May and October, southern bluefin tuna (SBT) migrate through the cooler waters off NSW and Victoria. AFMA places specific zones in place which is reviewed weekly based on a CSIRO SBT habitat preference model, sea surface temperatures, landings data, observer and ICVMS data and industry advice. The SBT management zone[#] (as of 23 June 2016) is depicted below:

#: Note: SBT management zone habitat model was used during the period of this ERA assessment (2011-2015). This has since changed and is no longer used.



Source: http://www.afma.gov.au/fisheries/eastern-tuna-and-billfish-fishery-page/

The ETBF is also part of the Western and Central Pacific Fisheries Commission (WCPFC). The Australian fishery in relation to the WCPFC Area of Convention is depicted below:

	 Note: The left most solid black vertical line should be shifted to the SA/Vic border (i.e. shifted to the right). **Source: http://www.afma.gov.au/fisheries/eastern-tuna-and-billfish-fishery-page/**
Fishing season	Fishing occurs year round in the ETBF pelagic longline fishery. The current annual fishing season runs for 12 months commencing 1 March 2016 and ends on 28 February 2017. There are six key commercial species (see next section below) and the species targeted changes seasonally.
Key/second-ary commercial species and stock status	**Key commercial species:** • Albacore tuna (*Thunnus alalunga;* ALB) • Bigeye tuna (*Thunnus obesus,* BET) • Broadbill Swordfish (*Xiphias gladius,* SWO) • Yellowfin tuna (*Thunnus albacares*, YFT) • Striped Marlin (*Kajikia audax,* STM) • Southern Bluefin tuna (*Thunnus maccoyii*, SBT) Stock assessments are conducted over a broader region (Western and Central Pacific Ocean) and the reported status reflects the species status in this region. **Stock status:** Source: (i) Larcombe et al. (2016). Eastern Tuna and Billfish Fishery. In: ABARES Fishery Status Reports 2016 and (ii) Patterson et al. (2016). Southern Bluefin tuna fishery. In ABARES Reports 2016. See also individual stock assessment reports for each of the species (Albacore tuna: Harley et al. 2015; Bigeye tuna: Harley et al. 2014; Broadbill swordfish: Davies et al. 2013; Yellowfin tuna: Davies et al. 2014; Striped marlin: Davies et al. 2012; Southern bluefin tuna: CCSBT (2014). • Albacore tuna (*Thunnus alalunga*): not overfished (Biomass) and not subject to overfishing (Fishing mortality). Last assessed: 2015. South Pacific. • Bigeye tuna (*Thunnus obesus*): overfished (Biomass) and subject to overfishing (Fishing mortality). Last assessed: 2014. Western and central Pacific. • Broadbill swordfish (*Xiphias gladius*): not overfished (Biomass) and uncertain as to overfishing (Fishing mortality). Last assessed: 2013. South-west Pacific. • Yellowfin tuna (*Thunnus albacares*): not overfished (Biomass) and not subject to overfishing (Fishing mortality). Last assessed: 2014. Western and central Pacific. • Striped marlin (*Tetrapturus audax*): uncertain, may be overfished (Biomass) and not subject to overfishing (Fishing mortality). Last assessed: 2012. South-west Pacific. • Southern Bluefin tuna (*Thunnus maccoyii*): Last assessed: 2014. CCSBT. The 2014 assessment suggested that the SBT spawning biomass is at a very low fraction (9%) of its original biomass as well as below the level that could produce maximum sustainable yield (CCSBT (2014)). ABARES Fishery Status Report, Patterson et al. (2016): overfished (Biomass) and uncertain as to overfishing (fishing mortality). Both yellowfin and bigeye tuna are considered to be single stocks which extend across the western and central Pacific Ocean. From 2014 in both regional and Internationally managed fisheries, bigeye tuna is considered

overfished with respect to Biomass reference points and 'subject to overfishing' with respect to F_{MSY}, with catch in the broader Pacific – especially of juveniles – needs to be reduced. Reliability of assessment: reasonable for bigeye, yellowfin and albacore in WCPO; otherwise unknown. Unreliable for AFZ because interactions of stock components in the WCPO and AFZ are uncertain. However, it is believed that the Australian fishery is not believed to hinder recovery and rebuilding, based on the fixed TACC which accounts of less than 1% of the total catch on the stock. Therefore, the Australian system has a partial strategy in place (Gascoigne et al. 2015).

The most recent stock assessment (2015) for albacore tuna, which is considered to be a single stock in the South Pacific, indicates that present catch levels are sustainable and that increases in fishing mortality and yields are possible. However, given the age specific mortality of the longline fleets, any significant increase in effort would reduce catch per unit effort (CPUE) to low levels with only moderate increases in yields. CPUE reductions may be more severe in areas of locally concentrated fishing effort. Both broadbill swordfish and striped marlin are considered to be single stocks within the southwest Pacific and the stocks status of both species remains uncertain relative to standard biological reference points F_{MSY} and B_{MSY} respectively.The estimates of stock status for broadbill swordfish relative to standard biological reference points (e.g. B_{MSY}) suggest that the stock is not overfished. For striped marlin several of the plausible model scenarios investigated indicate that current levels of fishing mortality may be below the reference level F_{MSY}.

Both albacore and yellowfin tuna have potential for increased harvesting. However, increasing effort for yellowfin tuna could lead to possible growth overfishing in AFZ. Uncertainty exists about the status of regional striped marlin and broadbill swordfish stocks. For striped marlin catch increased with the expansion of effort further offshore; and for broadbill swordfish caution is required as there is no reliable assessment (overwhelming source of uncertainty in the current stock assessment is attributable to the assumptions for growth, maturaity and mortality at age schedules).

Southern bluefin tuna is assessed every three years and was last assessed in 2014. The estimate of spawning biomass is well below 20% of unfished biomass and is therefore classified as overfished. However, given that there is uncertainty around the current level of fishing mortality and the impact on the recovery of the stock, the stock is classified as uncertain with regard to fishing mortality in 2014. The global TAC, set in line with the management procedure, should allow rebuilding. Also, significant uncertainty remains around unaccounted catch, which, if occurring, substantially reduces the probability of the stock rebuilding (Patterson et al. 2016. In: ABARES Fisheries Status Reports 2016 – Data to 2015.

Secondary commercial species:

There are no secondary commercial species in the ETBF.

Bait collection and usage

Bait used in the ETBF comes from a number of sources:

- fresh self-caught yellowtail scad and blue (slimy) mackerel;
- frozen local (WA) pilchards (small quantities), and imported squid and pilchards.

Most boats will use a combination of bait setting, alternating fresh live with thawed baits along the length of the line. Operators tend to identify squid bait with swordfish capture, and live bait with tuna and striped marlin.

Overall, the difference in CPUE between bought and self-caught baits appears to be very small. The type of species targeted influences the effectiveness of the bait used. Tuna and striped marlin have been shown to have a preference for self-caught (live bait) while swordfish tend to prefer bought bait (squid).

All boats using fresh bait, purse seine inshore for their own requirements, on state licences. Squid is not self-caught. Additionally AFMA requires contact (i.e. a phone call) prior to these operations. Catch must be recorded to enable some assessment of inshore stocks to be maintained.

Current entitlements

Entitlements over the last seven quota years.

Quota Year	No. Concession Card holders	No. Boat SFRs	No. active operators	No. inactive operators
2009-11^	76	76	52	24
2011-12	111	108	48	60
2012-13	111	103	44	59
2013-14	116	100	39	61
2014-15	112	100	39	61
2015-16	101	92	39	53
2016-17	94	90	36	54

^: extended season: 01/11/09 – 28/02/11.

Current and recent TACs, quota trends by method

The AFMA Commission agreed to move the ETBF from an input controlled system, controlling the number of hooks set to an output controlled system (i.e. limiting the catch of target species) based on Individual Transferrable Quotas (ITQs) in December 2008. This was implemented in 2011 for the first time.

Agreed Total Allowable Commercial Catch (TACC; t) and corresponding percent of the TACC caught[a] for five key commercial species by quota year 2011-12 through to 2016-17 inclusive. Source: AFMA Catchwatch reports. http://www.afma.gov.au/fisheries-services/catchwatch-reports/

Common name	Agreed Total Allowable Commercial Catch (TACC; t) (Percent of TACC caught; %) by quota year (fishing season)				
	2011-12 (t) (%)	2012-13 (t) (%)	2013-14 (t) (%)	2014-15 (t) (%)	2015-16 (t) (%)
ALB Albacore tuna	2500 (25)	2500 (27)	2500 (29)	2500 (27)	2500 (36)
BET Bigeye tuna	1056 (43)	1056 (48)	1056 (42)	1056 (44)	1056 (69)
YFT Yellowfin tuna	2200 (89)	2200 (57)	2200 (56)	2200 (73)	2200 (99)
SWO Broadbill swordfish	1550 (77)	1396 (70)	1396 (77)	1378 (76)	1381 (82)
STM Striped marlin	390 (83)	370 (63)	370 (61)	351 (76)	351 (85)

Under the ETBF management Plan 2010 (effective 1 March 2011), the ETBF is managed through output controls with a Total Allowable Commercial Catch (TACC) limit set for each of the five quota species (see above). All operators in the ETBF have been granted statutory fishing rights that allow them to fish in the fishery and catch a portion of the TACC for each quota species. These fishing rights are fully transferable and are also known as Individually Transferable Quota's. Under these arrangements each fisher is limited to catching up to the amount of quota (noting that there is a 10% under/over-catch provision) that they hold and the whole fishery is limited to the TACC that is set each season.

Current and recent fishery effort trends by method

Effort based on the total number of hooks set increased by 18% in 2015 relative to the previous year. This is due in part to increase in SBT quota availability and increased SBT targeting by ETBF vessels. A similar increase occurred based on the 2015-16 quota year relative to the 2014-15 (16%). The number of hooks per set has increased over the last five years (both calendar and quota years).

Total longline sets and hooks deployed by calendar and quota year. Source: Based on Campbell (2015) and Commonwealth logbook information from AFMA.

Year	Total sets	Total hooks (1000s)	Total hooks per set	Quota Year	Total sets	Total hooks (1000s)	Total hooks per set
1985	17	13	759	**85-86**	31	32	1023
1986	61	33	534	**86-87**	181	60	332
1987	1615	1001	620	**87-88**	1657	1005	606
1988	1642	1096	667	**88-89**	1714	1115	651
1989	2401	764	318	**89-90**	2384	785	329
1990	2272	1153	508	**90-91**	2478	1293	522
1991	3266	1798	551	**91-92**	3240	1802	556
1992	3370	2118	628	**92-93**	3159	1979	626
1993	2958	1685	570	**93-94**	3337	1996	598
1994	3980	2767	695	**94-95**	4121	2922	709
1995	5057	3838	759	**95-96**	5139	3907	760
1996	6377	4643	728	**96-97**	6788	4822	710
1997	8784	6314	719	**97-98**	9232	6792	736
1998	11450	9746	851	**98-99**	11256	9718	863
1999	11551	10293	891	**99-00**	11918	10642	893
2000	11051	9562	865	**00-01**	11020	9575	869
2001	12546	11299	9901	**01-02**	12652	11453	905
2002	12867	11938	928	**02-03**	13256	12350	932

2003	13227	12760	965	**03-04**	12447	11991	963	
2004	10676	10067	943	**04-05**	10681	10133	949	
2005	9118	9053	993	**05-06**	8862	8785	991	
2006	7688	8927	1161	**06-07**	7576	9081	1199	
2007	6845	8518	1244	**07-08**	6596	8199	1243	
2008	6416	8152	1271	**08-09**	6394	8227	1287	
2009	6633	8921	1345	**09-10**	6577	8882	1350	
2010	5812	7893	1358	**10-11**	5710	7730	1354	
2011	5016	6785	1353	**11-12**	4901	6632	1353	
2012	4715	6802	1443	**12-13**	4701	6837	1454	
2013	4593	6809	1482	**13-14**	4694	7009	1493	
2014	4645	6986	1504	**14-15**	4712	7107	1508	
2015	5324	8252	1550	**15-16**	5329	8268	1551	

Current and recent fishery catch trends by method

QUOTA YEAR:

(1) Total longline catch (tonnes) by quota year (fishing season; 1 March to 29 February each year) of the main target and selected by-product species is as follows:

Annual longline catches by (A) key commercial species (yellowfin tuna, YFT; bigeye tuna, BET; albacore tuna, ALB; broadbill swordfish, SWO and striped marlin, STM) and secondary commercial species (southern bluefin tuna, SBT); and (B) selected by-product species (rudderfish, RUD; dolphin fish, DOL and Ray's bream, POM) by quota year. Source: Based on Campbell (2015) and AFMA Commonwealth logbook data.

Quota Year	A. Key Commercial and Secondary Commercial Species Catch (t)						B. By-Product Species Catch (t)			TOTAL
	YFT	BET	ALB	SWO	STM	SBT	RUD	DOL	POM	
86-87	13	7	1	1	2	0				23
87-88	785	36	103	12	45	5				985
88-89	617	25	98	11	52	15				818
89-90	614	17	85	11	6	4				737
90-91	699	20	137	19	89	7				970
91-92	762	31	194	52	32	259				1330
92-93	825	30	184	36	21	161				1257
93-94	750	26	178	28	52	237				1272
94-95	963	120	351	41	64	342				1880
95-96	1196	171	489	151	101	287	1	1	0	2397
96-97	1848	383	460	749	213	363	81	43	8	4148
97-98	1904	1185	498	2374	338	419	79	61	15	6873
98-99	2390	1197	701	2511	641	571	114	165	6	8295
99-00	1905	1000	569	2984	822	170	173	91	7	7720
00-01	2089	841	586	2431	843	92	168	105	6	7161
01-02	2636	1321	969	2442	805	60	271	332	7	8844
02-03	3707	991	745	2356	689	34	270	211	10	9014
03-04	3330	905	661	1721	613	40	197	235	8	7711
04-05	2263	867	897	1880	457	214	200	304	7	7089
05-06	1723	832	1059	1649	407	37	150	171	29	6057
06-07	1901	535	2921	1108	431	6	131	98	7	7140
07-08	1265	978	1554	1277	345	7	147	112	61	5745
08-09	1692	1013	1338	1459	423	22	167	163	39	6317
09-10	1388	719	1537	1281	355	196	144	144	35	5799
10-11	1719	513	786	1141	287	153	78	312	13	5000

11-12	1954	458	737	1187	324	85	48	131	4	4928
12-13	1361	553	734	1064	254	57	52	63	20	4159
13-14	1349	491	784	1170	248	314	43	96	17	4512
14-15	1745	509	724	1141	295	343	37	262	20	5076
15-16 [c]	2376	803	984	1232	320	509	38	232	12	6506

(A): Catch Weight: Logbook-recorded retained whole weight, before 97/98; Processor-based whole weight, 97/98 - 05/06; CDR Receiver whole weight, 06/07-15/16.

(B): Catch Weight: Logbook recorded retained whole weight; c: to be confirmed, subject to change.

CALENDAR YEAR:

(2) Total longline catch (tonnes) by calendar year of the key commercial and selected by-product species is as follows:

Annual longline catches by (A) key commercial species (yellowfin tuna, YFT; bigeye tuna, BET; albacore tuna, ALB; broadbill swordfish, SWO and striped marlin, STM) secondary commercial species (southern bluefin tuna, SBT) and (B) selected byproduct species (rudderfish, RUD; dolphin fish, DOL and oilfish/escolar, BOF) by calendar year. Source: Based on Campbell (2015) and AFMA Commonwealth logbook data.

Year	A. Key Commercial and Secondary Commercial Species Catch (t)						B. Byproduct Species Catch (t)			TOTAL
	YFT	BET	ALB	SWO	STM	SBT	RUD	DOL	BOF	
1987	772	36	101	12	45	5				971
1988	610	31	99	11	52	15				817
1989	629	14	82	11	6	3				746
1990	680	22	138	18	77	7				942
1991	698	27	175	49	38	259				1246
1992	884	33	206	39	26	161				1350
1993	629	21	166	24	31	236				1106
1994	978	108	332	31	67	338				1854
1995	1255	177	477	159	111	280				2460
1996	1650	308	488	537	187	369	73	31	0	3643
1997	1889	1069	471	2252	289	424	72	40	0	6506
1998	2274	1301	724	2551	658	573	117	147	0	8345
1999	2072	1003	567	2823	783	170	159	124	0	7701
2000	1901	818	591	2689	824	92	163	80	3	7161
2001	2778	1341	942	2276	859	60	258	265	20	8799
2002	3465	959	744	2280	666	34	281	276	75	8780
2003	3639	982	685	2029	661	40	207	224	88	8555
2004	2204	833	887	1791	472	214	199	305	80	6986
2005	1876	866	1006	1715	389	37	157	187	85	6318
2006	1830	499	2592	1136	441	6	126	118	65	6814
2007	1390	1007	1925	1353	358	7	147	103	102	6392
2008	1650	1026	1276	1483	425	22	169	160	79	6292
2009	1387	726	1523	1315	361	196	148	136	80	5871
2010	1547	520	868	1160	277	153	89	260	81	4955
2011	2154	445	771	1080	330	85	42	207	82	5196
2012	1259	553	707	1157	262	57	60	63	83	4200
2013	1344	490	774	1064	251	314	38	82	84	4441
2014	1686	490	737	1183	273	343	39	258	85	5094

2015	2183	788	951	1153	347	509	31	211	86	6257

A): Catch Weight = Logbook recorded retained weight:1985-1996, Processor-based weight: 1997-2005, CDR Receiver weight: 2006-

(B): Catch Weight = Logbook recorded retained weight

Current and recent value of fishery ($)

The value of this sub-fishery is $49.6 million (2015-16) and $35.7 million (2016-17).

See link for details. http://www.agriculture.gov.au/abares/research-topics/fisheries/fishery-status/eastern-tuna-billfish-fishery

Relationship with other fisheries

Commercially targeted and bycatch species in Australia's tuna and billfish fisheries are also targeted or caught as bycatch in other fisheries which may share the same areas. Due to the highly migratory nature of tuna, the domestic fisheries share stocks with other nations, either operating within their national waters or on the high seas. International conventions and agreements are in place to manage these species through their entire range. Australia's tuna and billfish fisheries share waters with other fisheries, however there are few bycatch species caught while targeting tuna that are targeted by other managed fisheries. These may include the Southern Shark Fishery and the South East Non-Trawl Fishery. Tuna operators occasionally take dusky, gummy and bronze whaler sharks, which are the target of state-managed fisheries in coastal waters of southern and south-western Australia.

Recreational fishery

The recreational fishery, however, targets many species caught in the Commonwealth-managed tuna and billfish fisheries, including billfish species, marlin, yellowfin tuna, bigeye tuna and southern bluefin tuna. These recreational operators also target species that are bycatch or by-product species in Australia's tuna and billfish fisheries, such as Ray's bream and dolphin fish.

International Commercial Fisheries

Many of the species targeted in the ETBF are also captured by fisheries in the western and central Pacific Ocean. The level of exploitation for the Pacific Ocean stocks varies from overfished, not over-fished to uncertain.

The connectivity between fish caught in the ETBF and the large stocks of the central and western Pacific is poorly understood, and is the subject of ongoing research in Australia and the South Pacific.

Japanese fishing activity in the Australian Fishing Zone

In the early 1950s the Japanese began pelagic longlining off the east coast of Australia. This activity was managed under the Australia/Japan bilateral agreements. This activity spread and continued until November 1997. Japanese longliners operating in the north-eastern AFZ mainly targeted yellowfin tuna, averaging 35% of the reported catch. Other commercially important species included bigeye tuna (10%), striped marlin (5%) and broadbill swordfish (10%).

Commonwealth and State Fisheries

Commonwealth fisheries that operate in the same region as the ETBF include the Southern Bluefin Tuna Fishery, Small Pelagic Fishery, Southern and Eastern Scalefish and Shark Fishery and the Coral Sea Fishery. The Southern and Western Tuna and Billfish Fishery (SWTBF) operates in waters adjacent to the ETBF. Many State finfish fisheries operate adjacent to the waters of the ETBF, however direct interactions are relatively limited given that most pelagic species caught in the ETBF do not venture into near shore waters and only a few species of inshore fish are susceptible to capture on pelagic longlines. The table below identifies the relationship between the ETBF and other fisheries.

Characteristics of Commonwealth fisheries related to the ETBF.

Fishery	Key Commercial species	Interactions with ETBF	Gear
Southern Bluefin Tuna Fishery (SBT)	Southern bluefin tuna	Southern bluefin tuna- bycatch on pelagic longlines in the ETBF. Very small catches of bigeye and albacore in purse seining and poling operations	Purse seine, Pelagic longline
Southern and Western Tuna and Billfish Fishery (SWTBF)	Broadbill swordfish, Yellowfin tuna, Bigeye tuna, Albacore tuna	Broadbill swordfish are commonly caught across southern Australia. A number of studies have found no genetic differences between broadbill caught on the east and west coasts of Australia. There is a likelihood of some interchange between stocks of the Pacific and Indian Oceans, however it is not known how much mixing occurs. Scientific evidence indicates that stocks of yellowfin, bigeye, albacore and striped marlin are separate in the Pacific and Indian oceans. The level of mixing between them is likely to be very low but with current levels if knowledge this remains unclear (R. Campbell, CSIRO, pers. comm. 2016).	Pelagic longline, Purse seine, minor line

	Small Pelagics Fishery (SPF)	Peruvian jack mackerel, Greenback Common jack mackerel, Blue mackerel, Yellowtail scad, redbait	Small pelagic species caught for own use and/or as bait in the ETBF	Purse seine	
	Skipjack Fishery (SKF)	Skipjack tuna	Purse seine fishery for skipjack tuna can interact with species taken in the ETBF (yellowfin tuna and bigeye tuna), but has been inactive since 2009.		

Recreational and charter fisheries:

Recreational anglers fish in the same areas as ETBF longliners but generally much closer to shore. Recreational anglers use trolling lures or baits. Baits include small skipjack tuna, pilchards, mackerel, nannygai and redfish.

All Australian states now have some controls on recreational and charter fishing for tuna and billfish species. More information on the management of state recreational fisheries can be found at the individual states websites.

Queensland - www.daf.qld.gov.au/fisheries

NSW - www.dpi.nsw.gov.au/fishing

Victoria - www.agriculture.vic.gov.au/fisheries

Tasmania - www.dpipwe.gov.au

Gear

Fishing methods and gear

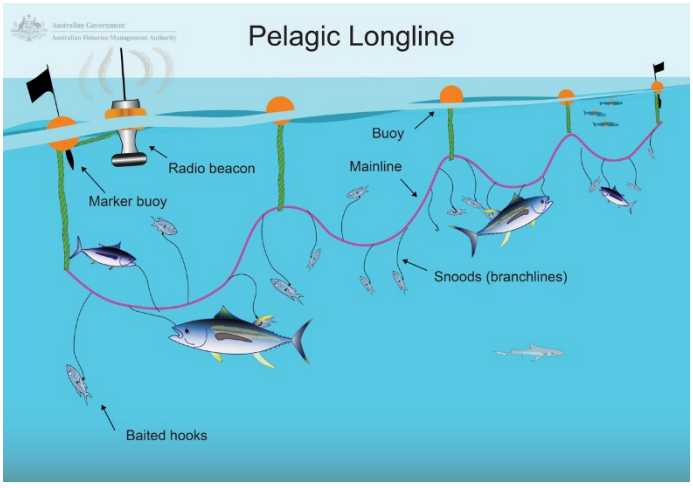
- Pelagic longlining (live, fresh & frozen bait, light sticks)

Longlining is the primary fishing method in the ETBF. Longline vessels in the ETBF vary in size, ranging from smaller inshore boats to larger, purpose built boats capable of high seas fishing. Historically, the majority of domestic operators carried out other types of commercial fishing operations in conjunction with their tuna and billfish fishing activity. While this still continues, a large number of longline operators are now committed to tuna fishing on a full-time basis. This is most evident in northern NSW and southern Queensland where a relatively large fleet has been established to fish for broadbill swordfish, yellowfin and bigeye tuna on a year-round basis.

Pelagic longlines are set near the surface of the water and comprise of:

- A mainline, which is suspended near the surface by a floatlines attached to a series of floats (bouys or bubbles).
- Branchlines (or snoods), which hang off the mainline in between each float, and to which are attached baited hooks (See figure below).

Longlines can be many kilometres long and carry thousands of hooks (though the average number of hooks deployed per set in the ETBF during 2015 was approximately 1550). Pelagic longlines are not anchored and are set to drift near the surface of the ocean with a radio beacon attached to some floats so that the vessel can track them to haul in the catch.



Source: http://www.afma.gov.au/portfolio-item/longlining/

<table>
<tr><td></td><td>Trips average 6-7 days, however where vessels fish in offshore grounds for swordfish, trips can be up to 20 days. The mean trip lengths (days) since 2011 are:
<table>
<tr><th>Year</th><th>Mean trip length (days)</th></tr>
<tr><td>2011</td><td>7.11</td></tr>
<tr><td>2012</td><td>7.10</td></tr>
<tr><td>2013</td><td>6.76</td></tr>
<tr><td>2014</td><td>6.32</td></tr>
<tr><td>2015</td><td>6.53</td></tr>
</table></td></tr>
<tr><td>Fishing gear restrictions</td><td>The 2014 Threat Abatement Plan to reduce incidental bycatch of marine birds, which requires longline operators to carry approved bird scaring tori line and to not discharge offal during line setting and hauling. See also (i) “Initiatives, strategies and incentives” of this scoping section and (ii) http://www.antarctica.gov.au/environment/plants-and-animals/albatrosses-and-giant-petrels/threat-abatement-plan-seabirds</td></tr>
<tr><td>Selectivity of fishing methods</td><td>Pelagic longline

In comparison to many other fishing methods, pelagic longlining is considered to be relatively selective. A lower diversity of species that are susceptible to longline gear are found in the upper water column in comparison to the range of species that may be impacted on by other methods such as demersal trawling. The species and size selectivity of the longline gear is dependent on a number of factors such as:

• the horizontal and vertical distribution of the gear given that certain species are found in selected areas and over selected substrates, and that species are found at various depths according to various environmental influences

• the variety of bait used since the gear is based on the foraging behaviour of fish and as feeding stimulants may be species-specific

• the hook and other gear design since the selectivity is related to the ability of the hook to penetrate the mouth of the fish.

However, in comparison to other tuna and tuna-like species fishing methods, longline fishing has the potential to interact with a wider range of species, some of which will be of high conservation value. In particular, these include environmentally protected seabirds and turtles, and commercially protected blue and black marlins and various shark species of concern.</td></tr>
<tr><td>Spatial gear zone set</td><td>Depending on the target species, the gear is set either continental shelf, shelf break or slope, seamounts and rises/ridges.</td></tr>
<tr><td>Depth range gear set</td><td>The gear is set from approximately between 30-500 metres below the surface depending on target species.</td></tr>
<tr><td>How gear set</td><td>A pelagic longline consists of a mainline with attached branch lines (snoods). Each branchline is fitted with one or more baited hooks or artificial lures. The longline is set so that the mainline, branch lines and hooks are suspended below the surface in the water column by floats at the sea surface (see above Figure). Longlines are deployed from the vessel and radio beacons are used to locate the gear after a period of time. Because the gear is set in the water column, pelagic longlining has no direct impact with the benthos.</td></tr>
<tr><td>Area of gear impact per set or shot</td><td>Gear is set in the water column, therefore pelagic longlining has no direct impact with the benthos.</td></tr>
<tr><td>Capacity of gear</td><td>Most Australian pelagic longline vessels are between 15 and 30 m long and set between 200 and 1200 hooks per fishing operation. Some longliners now routinely set more than 1200 hooks per day.

Australian longliners store their catch on ice, in ice slurry, brine or use brine spray systems.</td></tr>
<tr><td>Effort per annum all boats</td><td>Effort per annum of all vessels in fishery by sets and hooks.
<table>
<tr><th>Year</th><th>No. Vessels</th><th>Total sets</th><th>Total hooks (1000s)</th><th>Total Hooks/set</th></tr>
<tr><td>1985</td><td>2</td><td>17</td><td>12.9</td><td>759</td></tr>
<tr><td>1986</td><td>17</td><td>61</td><td>33</td><td>541</td></tr>
<tr><td>1987</td><td>70</td><td>1615</td><td>1001</td><td>620</td></tr>
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1990	100	2272	1153	507
1991	97	3266	1798	551
1992	105	3370	2118	628
1993	89	2958	1685	570
1994	90	3980	2767	695
1995	106	5057	3838	759
1996	129	6377	4643	728
1997	154	8784	6314	719
1998	162	11450	9746	851
1999	173	11551	10293	891
2000	156	11051	9562	865
2001	157	12546	11299	901
2002	151	12867	11938	928
2003	147	13227	12760	965
2004	129	10676	10067	943
2005	100	9118	9053	993
2006	82	7688	8927	1161
2007	61	6845	8518	1244
2008	54	6416	8152	1271
2009	56	6633	8921	1345
2010	52	5812	7893	1358
2011	49	5016	6785	1353
2012	46	4715	6802	1443
2013	41	4593	6809	1482
2014	40	4645	6986	1504
2015	39	5324	8252	1550

The number of hooks/set has increased by approximately 15% since 2011 (i.e. from 1358 to 1550 hooks/set).

Lost gear and ghost fishing	Radio beacons are used to locate the gear for hauling. However, some gear or parts of line may break free. If gear lost then it may drift for a while before balling up, baits usually fall off.
Issues	
Key/secondary commerical species issues and Interactions	Key commercial species: Albacore tuna, Bigeye tuna, Broadbill Swordfish, Yellowfin tuna, Striped Marlin, Southern Bluefin tuna The variety of tuna and billfish species targeted throughout Australia's tuna and billfish fisheries varies spatially and temporally. The status of the key target species in the longline fisheries is described above in Target species and stock status. While Offshore Constitutional Settlement arrangements are broadly in place for tuna and billfish, these species are taken in a number of other fisheries. Tuna and billfish are also important recreational fishing species. The collection and sharing of information across jurisdictions and sectors is a key jurisdictional issue. The link between fish caught in the ETBF and the large stocks of the central and western Pacific is poorly understood, and is the subject of ongoing research in Australia and the South Pacific.
Byproduct and bycatch issues and interactions	Based on records from AFMA Logbook database over the 2011-2015 period, the main byproduct species are mahi mahi, escolar, Ray's bream and shortbill spearfish. There main bycatch species over the 2011-2015 period include long-snouted lancetfishes, snake mackerel and squid. Blue marlin and black marlin are not permitted to be landed in the ETBF. Any catches must be reported to AFMA and recorded. There are reasonable levels of discarding occurring (see Discarding section in this scoping section). There is a spawning aggregation off the Great Barrier Reef (Domeier and Speare (2012)). Around 100 species of fish have been recorded as taken in Australia's tuna and billfish fisheries. Only a small number of species comprise the main target species of the fisheries. Many of the species taken are utilised as by-products, however some of the species taken in Australia's tuna and billfish fisheries are either unsuitable as commercial species or are taken in numbers too small to warrant the development of markets. Perhaps the most critical issue with respect to 'other fish' species taken in Australia's tuna and billfish fisheries is that of sustainability. The mortality of these animals when caught is likely to vary between species and according to other

factors such as length of time the fish remains hooked, predation by other fish or sharks, oceanographic and weather conditions at the time of capture, and method of release.

All Permit holders in the Commonwealth tuna and billfish fisheries are subject to the bycatch arrangements set out in the *Fisheries Management Regulations 1998* administered by AFMA under the *Fisheries Management Act 1991*. These regulations are consistent with the bycatch provisions set out in the Offshore Constitutional Settlement arrangements and the Memoranda of Understanding that have been established between the Commonwealth Government and each respective State and Territory for tuna and tuna-like species fisheries (South Australia, Western Australia, Queensland, New South Wales and the Northern Territory). They are also subject to the Threatened Abatement Plan, Bycatch Action Plans, ETBF ERM Strategy and the Commonwealth Bycatch Policy.

Protected species issues and interactions

Longline sector operators are required to complete the Australian Pelagic Longline Daily Fishing Log (AL06) on a shot by shot basis. Reporting of any interactions with any Protected species is a mandatory requirement of the EPBC Act 1999. The EPBC Act 1999 protects a number of marine species. The status of these species range from being at risk of extinction, threatened or at the least, requiring protection to ensure their long-term conservation. Operators in Australia's tuna and billfish fisheries therefore are legally required take all reasonable steps to ensure that EPBC listed species (other than conservation dependent species) are not killed or injured as a result of fishing. Where an interaction does occur, operators are required to report to it to AFMA.

Annual protected species interactions for the period 2010-2016^ inclusive. Cetacean (CET); Chondrichthyan (CHN); Marine bird (MB); Marine reptile (MR); Pinniped (PIN); Teleost (TEL). Source: AFMA Commonwealth logbook database.

Year	Species Group	Common name	Scientific name	Life status	No. animals
2010	MB	Albatrosses	Diomedeidae - undifferentiated	Alive	1
2010	MR	Green Turtle	*Chelonia mydas*	Alive	5
2010	MR	Green Turtle	*Chelonia mydas*	Dead	1
2010	MR	Green Turtle	*Chelonia mydas*	Unknown	1
2010	MR	Hawksbill Turtle	*Eretmochelys imbricata*	Alive	1
2010	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	11
2010	MR	Loggerhead Turtle	*Caretta caretta*	Alive	3
2010	MR	Loggerhead Turtle	*Caretta caretta*	Dead	1
2010	CHN	Longfin Mako	*Isurus paucus*	Dead	6
2010	CHN	Longfin Mako	*Isurus paucus*	Unknown	1
2010	CET	Melon-headed whale	*Peponocephala electra*	Dead	1
2010	CHN	Porbeagle	*Lamna nasus*	Dead	4
2010	CET	Short-finned pilot whale	*Globicephala macrorhynchus*	Alive	2
2010	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	1,907
2010	CHN	Shortfin Mako	*Isurus oxyrinchus*	Unknown	326
2010	MB	Sooty Shearwater	*Puffinus griseus*	Dead	2
2010	MR	Turtles	order Testudines (except fam. Testunididae) - undifferentiated	Alive	1
2010	MR	Turtles	order Testudines (except fam. Testunididae) - undifferentiated	Dead	1
2010	CET	Whales (mixed)	Whales - undifferentiated (order Cetacea, in part)	Dead	1
2010	CET	Whales (mixed)	Whales - undifferentiated (order Cetacea, in part)	Unknown	1
2010	MB	Yellow Nosed Albatross	*Thalassarche chlororhynchos*	Dead	1
2011	MR	Green Turtle	*Chelonia mydas*	Alive	4
2011	MR	Green Turtle	*Chelonia mydas*	Dead	3
2011	MR	Green Turtle	*Chelonia mydas*	Unknown	1

2011	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	2
2011	CHN	Longfin Mako	*Isurus paucus*	Dead	2
2011	CHN	Longfin Mako	*Isurus paucus*	Unknown	1
2011	CHN	Porbeagle	*Lamna nasus*	Dead	5
2011	CHN	Porbeagle	*Lamna nasus*	Unknown	1
2011	CET	Short-finned pilot whale	*Globicephala macrorhynchus*	Alive	2
2011	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	1,654
2011	CHN	Shortfin Mako	*Isurus oxyrinchus*	Unknown	355
2011	MR	Turtles	order Testudines (except fam. Testunididae) - undifferentiated	Alive	1
2012	MR	Green Turtle	*Chelonia mydas*	Alive	4
2012	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	4
2012	MR	Leatherback Turtle	*Dermochelys coriacea*	Unknown	1
2012	CHN	Longfin Mako	*Isurus paucus*	Dead	2
2012	CHN	Longfin Mako	*Isurus paucus*	Unknown	3
2012	CHN	Porbeagle	*Lamna nasus*	Dead	4
2012	CHN	Porbeagle	*Lamna nasus*	Unknown	2
2012	CHN	Shortfin Mako	*Isurus oxyrinchus*	Alive	4
2012	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	2,062
2012	CHN	Shortfin Mako	*Isurus oxyrinchus*	Unknown	400
2012	MR	Turtles	order Testudines (except fam. Testunididae) - undifferentiated	Dead	1
2013	PIN	Dolphins	Delphinidae - undifferentiated	Alive	1
2013	MR	Green Turtle	*Chelonia mydas*	Alive	3
2013	MR	Green Turtle	*Chelonia mydas*	Dead	2
2013	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	6
2013	MR	Leatherback Turtle	*Dermochelys coriacea*	Unknown	1
2013	MR	Loggerhead Turtle	*Caretta caretta*	Alive	4
2013	CHN	Longfin Mako	*Isurus paucus*	Dead	2
2013	CHN	Longfin Mako	*Isurus paucus*	Unknown	8
2013	PIN	New Zealand fur seal	*Arctocephalus forsteri*	Unknown	1
2013	CHN	Porbeagle	*Lamna nasus*	Dead	12
2013	CHN	Porbeagle	*Lamna nasus*	Unknown	3
2013	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	1,544
2013	CHN	Shortfin Mako	*Isurus oxyrinchus*	Unknown	448
2014	MB	Black Browed Albatross	*Thalassarche melanophrys*	Dead and flexible	1
2014	MR	Green Turtle	*Chelonia mydas*	Alive	5
2014	MR	Green Turtle	*Chelonia mydas*	Dead	1
2014	MR	Green Turtle	*Chelonia mydas*	Unknown	1
2014	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	4
2014	MR	Loggerhead Turtle	*Caretta caretta*	Alive	2
2014	CHN	Longfin Mako	*Isurus paucus*	Dead	3

2014	CHN	Longfin Mako	*Isurus paucus*	Unknown	7
2014	CHN	Porbeagle	*Lamna nasus*	Unknown	2
2014	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	1,234
2014	CHN	Shortfin Mako	*Isurus oxyrinchus*	Unknown	305
2014	MB	Shy Albatross	*Thalassarche cauta*	Dead	1
2014	MR	Turtles	order Testudines (except fam. Testunididae) - undifferentiated	Alive and vigorous	1
2015	MB	Albatrosses	Diomedeidae - undifferentiated	Dead	6
2015	CET	Baleen whales	Baleen whales - undifferentiated (suborder Mysticeti)	Alive	1
2015	MB	Birds	*Avians*	Dead	2
2015	MB	Black Browed Albatross	*Thalassarche melanophrys*	Alive	4
2015	MB	Black Browed Albatross	*Thalassarche melanophrys*	Dead	4
2015	PIN	Common dolphin	*Delphinus delphis*	Alive	3
2015	MB	Flesh Footed Shearwater	*Puffinus carneipes*	Dead	1
2015	MR	Green Turtle	*Chelonia mydas*	Alive	4
2015	MR	Green Turtle	*Chelonia mydas*	Alive and vigorous	1
2015	MR	Green Turtle	*Chelonia mydas*	Dead	1
2015	MR	Hawksbill Turtle	*Eretmochelys imbricata*	Dead	2
2015	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	12
2015	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive and vigorous	1
2015	MR	Loggerhead Turtle	*Caretta caretta*	Alive	2
2015	MR	Loggerhead Turtle	*Caretta caretta*	Alive and vigorous	1
2015	CHN	Longfin Mako	*Isurus paucus*	Dead	1
2015	CHN	Longfin Mako	*Isurus paucus*	Unknown	5
2015	CET	Melon-headed whale	*Peponocephala electra*	Alive and vigorous	1
2015	CHN	Porbeagle	*Lamna nasus*	Unknown	7
2015	CET	Short-finned pilot whale	*Globicephala macrorhynchus*	Alive	3
2015	CHN	Shortfin Mako	*Isurus oxyrinchus*	Alive	1
2015	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	1,016
2015	CHN	Shortfin Mako	*Isurus oxyrinchus*	Unknown	1,066
2015	MR	Turtles	order Testudines (except fam. Testunididae) - undifferentiated	Alive	4
2015	MR	Turtles	order Testudines (except fam. Testunididae) - undifferentiated	Dead	1
2015	MR	Turtles	order Testudines (except fam. Testunididae) - undifferentiated	Unknown	1
2015	CET	Whales (mixed)	Whales - undifferentiated (order Cetacea, in part)	Alive and vigorous	2

Annual protected species interactions for the period 2003-2015 inclusive. Cetacean (CET); Chondrichthyan (CHN); Marine bird (MB); Marine reptile (MR); Pinniped (PIN); Teleost (TEL). Source: AFMA Observer database.

Year	Species Group	Common name	Scientific name	Life status	No. animals
2003	MB	Shy Albatross	*Thalassarche cauta*	Alive	1
2003	MB	Black Browed Albatross	*Thalassarche melanophrys*	Alive	1
2003	MB	Wedge Tailed Shearwater	*Puffinus pacificus*	Alive	1
2003	MB	Crested Tern	*Sterna bergii*	Alive	6
2004	MB	Buller's Albatross	*Thalassarche bulleri*	Alive	1
2004	MB	Shy Albatross	*Thalassarche cauta*	Alive	1
2004	MB	Yellow Nosed Albatross	*Thalassarche chlororhynchos*	Alive	2
2004	MB	Westland Petrel	*Procellaria westlandica*	Alive	20
2004	MB	Great Winged Petrel	*Pterodroma macroptera*	Alive	62
2004	MB	Flesh Footed Shearwater	*Puffinus carneipes*	Alive	73
2004	MB	Sooty Shearwater	*Puffinus griseus*	Alive	226
2004	MB	Short Tailed Shearwater	*Puffinus tenuirostris*	Alive	11
2004	MB	Petrels	*Procellaria spp.*	Alive	42
2004	UNK	Unknown		Alive	1
2005	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	1
2005	MB	Yellow Nosed Albatross	*Thalassarche chlororhynchos*	Alive	4
2005	MB	Wandering Albatross	*Diomedea exulans*	Alive	4
2005	MB	Black Browed Albatross	*Thalassarche melanophrys*	Alive	8
2005	MB	White Chinned Petrel	*Procellaria aequinoctialis*	Alive	1
2005	MB	Great Winged Petrel	*Pterodroma macroptera*	Alive	12
2005	MB	Great Winged Petrel	*Pterodroma macroptera*	Dead	1
2005	MB	Flesh Footed Shearwater	*Puffinus carneipes*	Alive	73
2005	MB	Sooty Shearwater	*Puffinus griseus*	Alive	47
2005	MB	Wedge Tailed Shearwater	*Puffinus pacificus*	Alive	6
2005	MB	Petrels	*Procellaria spp.*	Alive	5
2005	MB	Crested Tern	*Sterna bergii*	Alive	1
2005	CET	Humpback whale	*Megaptera novaeangliae*	Alive	1
2006	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	1
2006	MB	Grey Headed Albatross	*Thalassarche chrysostoma*	Dead	1
2006	MB	Wandering Albatross	*Diomedea exulans*	Alive	1
2006	MB	Wandering Albatross	*Diomedea exulans*	Dead	1
2006	MB	Black Browed Albatross	*Thalassarche melanophrys*	Alive	4
2006	MB	Flesh Footed Shearwater	*Puffinus carneipes*	Alive	5
2006	MB	Masked booby	*Sula dactylatra*	Alive	1
2006	PIN	Australian fur seal	*Arctocephalus pusillus doriferus*	Alive	1
2006	UNK	Unknown		Alive	7
2007	CHN	White Shark	*Carcharodon carcharias*	Alive	1
2007	MR	Loggerhead Turtle	*Caretta caretta*	Alive	2
2007	MR	Green Turtle	*Chelonia mydas*	Alive	5

	2007	MR	Green Turtle	*Chelonia mydas*	Dead	1
	2007	MR	Hawksbill Turtle	*Eretmochelys imbricata*	Alive	1
	2007	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	3
	2007	MB	Albatrosses	Diomedeidae - undifferentiated	Alive	4
	2007	MB	Yellow Nosed Albatross	*Thalassarche chlororhynchos*	Dead	1
	2007	MB	Wandering Albatross	*Diomedea exulans*	Dead	1
	2007	MB	Black Browed Albatross	*Thalassarche melanophrys*	Alive	3
	2007	MB	Black Browed Albatross	*Thalassarche melanophrys*	Dead	2
	2007	MB	Sooty Shearwater	*Puffinus griseus*	Alive	7
	2007	MB	Terns	Terns	Alive	3
	2007	CET	Short-finned pilot whale	*Globicephala macrorhynchus*	Alive	1
	2008	TEL	Pinstripe Wrasse	*Pseudocheilinus evanidus*	Alive	1
	2008	MR	Loggerhead Turtle	*Caretta caretta*	Alive	1
	2008	MR	Loggerhead Turtle	*Caretta caretta*	Dead	1
	2008	MR	Green Turtle	*Chelonia mydas*	Alive	2
	2008	MR	Green Turtle	*Chelonia mydas*	Dead	1
	2008	MR	Pacific (Olive) Ridely Turtle	*Lepidochelys olivacea*	Alive	1
	2008	MR	Pacific (Olive) Ridely Turtle	*Lepidochelys olivacea*	Dead	1
	2008	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	3
	2008	MB	Yellow Nosed Albatross	*Thalassarche chlororhynchos*	Alive	2
	2008	MB	Wandering Albatross	*Diomedea exulans*	Alive	1
	2008	MB	Wandering Albatross	*Diomedea exulans*	Dead	2
	2008	MB	Black Browed Albatross	*Thalassarche melanophrys*	Alive	1
	2008	MB	Great Winged Petrel	*Pterodroma macroptera*	Alive	1
	2008	MB	Flesh Footed Shearwater	*Puffinus carneipes*	Alive	3
	2008	MB	Sooty Shearwater	*Puffinus griseus*	Alive	1
	2008	MB	Wedge Tailed Shearwater	*Puffinus pacificus*	Alive	1
	2008	MB	Petrels	*Procellaria spp.*	Alive	4
	2008	PIN	Australian sea lion	*Neophoca cinerea*	Alive	2
	2009	CHN	White Shark	*Carcharodon carcharias*	Alive	1
	2009	MR	Loggerhead Turtle	*Caretta caretta*	Alive	3
	2009	MR	Green Turtle	*Chelonia mydas*	Alive	1
	2009	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	5
	2009	MB	Shy Albatross	*Thalassarche cauta*	Alive	1
	2009	MB	Shy Albatross	*Thalassarche cauta*	Dead	1
	2009	MB	Yellow Nosed Albatross	*Thalassarche chlororhynchos*	Alive	2
	2009	MB	Black Browed Albatross	*Thalassarche melanophrys*	Alive	6
	2009	MB	Black Browed Albatross	*Thalassarche melanophrys*	Dead	2
	2009	MB	Petrels Prions and Shearwaters	Procellariidae - undifferentiated	Alive	1
	2010	CHN	Shortfin Mako	*Isurus oxyrinchus*	Alive	47
	2010	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	19
	2010	MR	Loggerhead Turtle	*Caretta caretta*	Alive	1

2010	MR	Green Turtle	*Chelonia mydas*	Alive	1
2010	MR	Hawksbill Turtle	*Eretmochelys imbricata*	Dead	1
2010	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	2
2010	MR	Yellow-Bellied Seasnake	*Pelamis platurus*	Alive	1
2010	MB	Buller's Albatross	*Thalassarche bulleri*	Alive	2
2010	MB	Yellow Nosed Albatross	*Thalassarche chlororhynchos*	Dead	1
2010	MB	Wedge Tailed Shearwater	*Puffinus pacificus*	Alive	2
2010	MB	Wilsons Storm Petrel	*Oceanites oceanicus*	Alive	189
2010	CET	Short-finned pilot whale	*Globicephala macrorhynchus*	Alive	3
2011	CHN	Shortfin Mako	*Isurus oxyrinchus*	Alive	63
2011	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	54
2011	CHN	Longfin Mako	*Isurus paucus*	Alive	1
2011	CHN	Porbeagle	*Lamna nasus*	Dead	1
2011	MR	Green Turtle	*Chelonia mydas*	Alive	8
2011	MR	Green Turtle	*Chelonia mydas*	Dead	2
2011	MR	Pacific (Olive) Ridely Turtle	*Lepidochelys olivacea*	Alive	1
2011	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	2
2011	CET	Long-finned pilot whale	*Globicephala melas*	Alive	1
2012	UNK	Unknown		Dead	1
2012	CHN	Shortfin Mako	*Isurus oxyrinchus*	Alive	89
2012	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	92
2012	CHN	Longfin Mako	*Isurus paucus*	Alive	1
2012	CHN	Longfin Mako	*Isurus paucus*	Dead	3
2012	CHN	Porbeagle	*Lamna nasus*	Alive	1
2012	TEL	Goldstripe sardinella	*Sardinella gibbosa*	Dead	2
2012	MR	Turtles	order Testudines (except fam. Testunididae) - undifferentiated	Alive	1
2012	MR	Green Turtle	*Chelonia mydas*	Alive	3
2012	MR	Green Turtle	*Chelonia mydas*	Dead	2
2012	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	3
2012	MB	Shy Albatross	*Thalassarche cauta*	Alive	2
2012	MB	Black Browed Albatross	*Thalassarche melanophrys*	Dead	1
2013	UNK	Unknown		Dead	1
2013	CHN	Shortfin Mako	*Isurus oxyrinchus*	Alive	68
2013	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	69
2013	CHN	Longfin Mako	*Isurus paucus*	Alive	1
2013	CHN	Longfin Mako	*Isurus paucus*	Dead	1
2013	CHN	Porbeagle	*Lamna nasus*	Alive	1
2013	CET	Giant Manta Ray	*Manta birostris*	Alive	5
2013	MR	Loggerhead Turtle	*Caretta caretta*	Alive	1
2013	MR	Green Turtle	*Chelonia mydas*	Alive	2
2013	MR	Green Turtle	*Chelonia mydas*	Dead	4
2013	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	2

2013	PIN	Common dolphin	*Delphinus delphis*	Alive	2
2013	PIN	Australian fur seal	*Arctocephalus pusillus doriferus*	Alive	2
2014	CHN	Shortfin Mako	*Isurus oxyrinchus*	Alive	25
2014	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	26
2014	CHN	Longfin Mako	*Isurus paucus*	Dead	2
2014	CHN	Giant Manta Ray	*Manta birostris*	Alive	1
2014	MR	Loggerhead Turtle	*Caretta caretta*	Alive	2
2014	MR	Green Turtle	*Chelonia mydas*	Alive	1
2014	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	1
2014	MB	Black Browed Albatross	*Thalassarche melanophrys*	Dead	2
2014	MB	Masked booby	*Sula dactylatra*	Alive	1
2014	CET	Short-finned pilot whale	*Globicephala macrorhynchus*	Alive	1
2015	CHN	Shortfin Mako	*Isurus oxyrinchus*	Alive	10
2015	CHN	Shortfin Mako	*Isurus oxyrinchus*	Dead	10
2015	CHN	Shortfin Mako	*Isurus oxyrinchus*	Unknown	13
2015	MR	Green Turtle	*Chelonia mydas*	Alive	1
2015	MR	Pacific (Olive) Ridely Turtle	*Lepidochelys olivacea*	Dead	1
2015	MR	Leatherback Turtle	*Dermochelys coriacea*	Alive	1
2015	MB	Wilson's Storm Petrel	*Oceanites oceanicus*	Alive	1

Teleosts

There were only two recorded interactions with protected teleosts during 2011-2015 inclusive based on the AFMA Observer database. Both goldstripe sardines were recorded dead.

Marine birds

There were 19 marine bird interactions recorded in the AFMA Commonwealth logbook database during 2011-2015 inclusive (4 alive; 15 dead). Of the 19 marine bird interactions, most consisted of the black browed albatross (9) and Diomedeidae (6; albatrosses). Similarly, seven marine bird interactions were recorded in the AFMA Observer database over the 2011-2015 period inclusive. These comprised the black browed albatross (3; all dead), shy albatross (2; all alive), a masked brooby (alive) and a Wilson's storm petrel (alive).

Chondrichthyans

There were 10,159 protected species shark interactions recorded in the AFMA Commonwealth logbook database during 2011-2015 inclusive (5 alive; 7541 dead; 2613 unknown). These comprised of three species, (i) shortfin mako (5 alive; 7510 dead; 2574 unknown), (ii) longfin mako (10 dead, 24 unknown) and porbeagle (21 dead; 15 unknown). There were 532 protected species shark interactions recorded in the AFMA Observer database over the period 2011-2015. These comprised mostly shortfin mako (519), of which 255 were alive, 251 were dead and 13 were unknown. The EPBC Act listing prohibits all targeted commercial fishing of this species in Commonwealth waters. Following this listing, new management arrangements were introduced that permit commercial fishers to retain shortfin mako individuals that are captured dead, but require any live sharks be returned to the water unharmed. All catches of these sharks, whether retained or released, must be reported in daily fishing logbooks (Wilson et al., 2010; DSEWPaC, 2011).

Marine mammals

Cetaceans

There were 9 whales recorded alive in the AFMA Commonwealth logbook database in the five year period: 2011-2015. These comprised of melon-headed whales (1 alive), short-finned pilot whales (5 alive), a baleen whale (1 alive) and whales recorded as undifferentiated (2 alive). There were four dolphins recorded in AFMA Commonwealth logbook database over the period 2011-2015 (4 alive). These comprised of the common dolphin (3 alive) and dolphins recorded as Delphinidae (1 alive). There were nine recorded cetacean interactions in the AFMA Observer database. These comprised the giant manta ray (5; all alive), a long-finned pilot whale (alive), a short-finned pilot whale (alive) and the common dolphin (2; both alive).

Seals and sea-lions

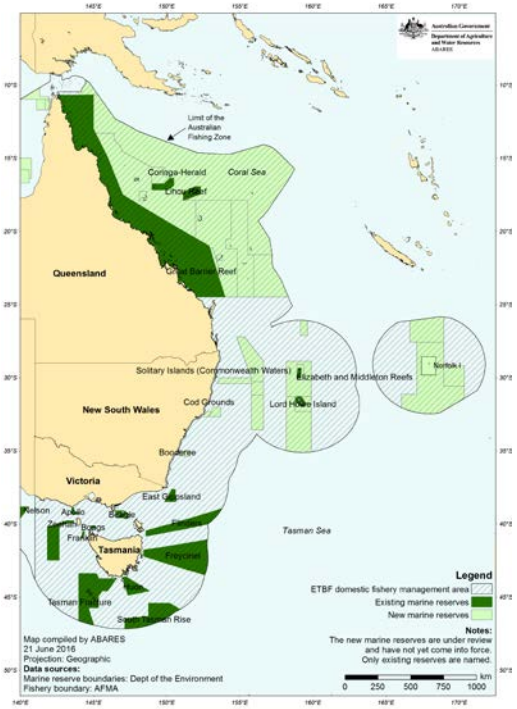
	There was one pinniped recorded in AFMA Commonwealth logbook database over the period 2011-2015 (1 unknown). It comprised a New Zealand fur seal. A total of two pinniped interactions were reported in the AFMA Observer database over the five year period (2011-2015). These consisted of the Australian fur seal (2; both alive). **Marine reptiles** There were 81 marine reptile interactions recorded in the AFMA Commonwealth logbook database over the 2011-2015 period. These consisted of the 31 leatherback turtle (29 alive; 2 unknown), 30 green turtles (21 alive; 7 dead; 2 unknown), nine loggerhead turtles (all alive), nine turtles-undifferentiated (6 alive; 2 dead; 1 unknown) and two hawksbill turtles (all dead). There were 38 turtle interactions recorded in the AFMA Observer database over the 2011-2015 period (29 alive; 9 dead). These consisted of 23 green turtles (15 alive; 8 dead), nine leatherback turtles (all alive), three loggerhead turtles (all alive), two Pacific (Olive) Ridley turtles (1 alive; 1 dead) and a turtle-undifferentiated (alive).
Habitat issues and interactions	No benthic habitat interactions have been identified, however over 50 seamounts are identified within the management area and are targeted due to the tendancy of pelagic fish species to aggregate around them.
Community issues and interactions	It is possible that the diversity of species, i.e., the bycatch/byproduct species in addition to the target species, captured in the fishery may be unsustainable and have some community effects. There is no information on the effects of fishing on (i) lower trophic levels, or (ii) competitors (e.g. sharks) of some of the main target species, in either the (i) offshore oceanic communities or in (ii) seamount communities. Fishing has the potential to influence the survival rate of some species by altering the rates of predation on juveniles of predators which might be impacted by the fishery. Seamount communities may potentially be at risk from high levels of fishing.
Discarding	Generally occurs because the species is of no value, or where the return in the catch would not be adequate to cover the costs of further handling, or where retention is not allowed by management arrangements. Discards may include juvenile or damaged target and non-target species, which are often discarded back into the sea during fishing operations. Blue and black marlin are not permitted to be taken in the ETBF. These species have been discarded in the ETBF over the 2011-2015^ period (see table below) based on the AFMA Commonwealth logbook database. In particular, a total of 7188 marlins (black marlin: 4008; blue marlin: 3180) were discarded over the 2011-2015 period. **Annual discarded (numbers) blue marlin and black marlin for the period 2010-2015^ inclusive. Teleost (TEL). Source: AFMA Commonwealth logbook database.**

Year	Species Group	Common name	Scientific name	Life status	No. animals
2010	TEL	Black Marlin	*Makaira indica*	Unknown	293
2010	TEL	Blue Marlin	*Makaira nigricans*	Unknown	254
2011	TEL	Black Marlin	*Makaira indica*	Unknown	270
2011	TEL	Blue Marlin	*Makaira nigricans*	Unknown	192
2012	TEL	Black Marlin	*Makaira indica*	Unknown	473
2012	TEL	Blue Marlin	*Makaira nigricans*	Unknown	314
2013	TEL	Black Marlin	*Makaira indica*	Unknown	800
2013	TEL	Blue Marlin	*Makaira nigricans*	Unknown	456
2014	TEL	Black Marlin	*Makaira indica*	Unknown	1,044
2014	TEL	Blue Marlin	*Makaira nigricans*	Unknown	776
2015	TEL	Black Marlin	*Makaira indica*	Unknown	1,421
2015	TEL	Blue Marlin	*Makaira nigricans*	Unknown	1,442

The AFMA Observer Program also records species retained and discarded (in numbers) in the ETBF. A total of 352 species were discarded over the 5 year period (unweighted to fishery), including 644 blue shark and 51 long snouted lancetfishes. Annual percentage coverage rates are listed below. Corresponding targets were unavailable.

Quota year	Coverage rate (%)
2010-11	3.6
2011-12	6.3
2012-13	6.2
2013-14	6.2

		2014-15 2.8	
Management: planned and those implemented			
Manage-ment objectives	The Eastern Tuna and Billfish Fishery Management Advisory Committee (Eastern Tuna MAC) provides the principal forum in which matters relating to the management of the Fishery are considered. Eastern Tuna MAC has advisory responsibility for tuna and broadbill species other than southern bluefin tuna within the area of waters outside the Southern and Western Tuna and Billfish Fisheries, including Australian Fishing Zone waters adjacent to Norfolk Island. Eastern Tuna MAC has developed a Management Plan designed to provide an appropriate mechanism to control the expanding level of effective fishing effort throughout the entire area of the Fishery. The management objectives for Eastern Tuna MAC are consistent with the AFMA's legislative objectives and help focus research activities within the ETBF on two main issues. These are to ensure the ecological sustainability of the resources and the pursuit of maximizing the economic efficiency of the fishery. In particular, the ETBF Management Plan 2010 was accepted on the 10 January 2011 by the Minister. The plan commenced the day after it was registered. The objectives of this Management Plan, and the objectives for AFMA to pursue when it is administering the Plan, are as follows: • to manage the fishery efficiently and cost-effectively for the Commonwealth; • to ensure that the exploitation of the resources of the fishery and the carrying on of any related activities are conducted in a manner consistent with the principles of ecologically sustainable development and the exercise of the precautionary principle, and, in particular, the need to have regard to the impact of fishing activities on by-catch species and the long-term sustainability of the marine environment; • to maximise the net economic returns to the Australian community from the management of the fishery; • to ensure AFMA's accountability to the fishing industry and to the Australian community in managing the resources of the fishery; • to reach Government targets for the recovery of the costs of AFMA in relation to the fishery; • to ensure that conservation and management measures taken in relation to the fishery implement Australia's obligations under relevant international agreements. The Commonwealth Government has management jurisdiction for all tuna and tuna-like species within the waters of the Australian Fishing Zone (up to the low water mark), except off New South Wales, where Offshore Constitutional Settlement arrangements are under review. AFMA manages the Australian tuna and billfish fisheries under the provisions of the *Fisheries Management Act 1991*, in partnership with all stakeholders. The management is consistent with the Offshore Constitutional Settlement arrangements in place between the Commonwealth and State Governments and, where necessary, under international agreements such as Convention for the Conservation of Southern Bluefin Tuna. The management of highly migratory species (such as tuna and billfish) that range far beyond the AFZ, requires that management arrangements apply to all operators targeting a specific stock under The Convention on the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific (https://www.wcpfc.int/doc/convention-conservation-and-management-highly-migratory-fish-stocks-western-and-central-pacific). For this reason it is important to identify the distribution of the stocks being exploited, allowing the rate of access to a particular stock to be monitored and controlled as required. The western limits of the Eastern Tuna and Billfish Fishery stocks and eastern limits of the Southern and Western Tuna and Billfish Fisheries stocks are generally consistent with the current northern boundary at 142º30'E and the southern boundary at 141ºE between the fisheries. These boundaries are consistent with what are thought to be the boundaries between Pacific and Indian Ocean tuna and billfish stocks.		
Fishery manage-ment plan	The fisheries Management Plan 2010 is a key document in managing the ETBF. It stipulates obligations, procedures and conditions when fishing in the ETBF. In particular, it covers information on: • Total allowable commercial catch (TACC) • Specific ecosystem requirements (e.g. information recorded on bycatch species; minimize interactions with marine mammals, marine reptiles, fish and seabirds • Availability and limits of Statutory fishing rights (SFRs) and fishing permits • Undercatch and overcatch obligations • Area of the fishery • Primary species of fish Southern bluefin tuna (*Thunnus maccoyii*) is also taken in the ETBF, but covered by quota under the Southern Bluefin Tuna Management Plan. The Commonwealth fisheries Harvest Strategy Policy (HSP; DAFF 2007) is not prescribed for fisheries under International agreements. However, a harvest strategy framework has been developed for the ETBF (Campbell 2012) and since then has been implemented for commercial catches of broadbill swordfish and striped marlin to calculate the Recommended Biological Commercial Catch (RBCC) for the 2016/17 quota year (Campbell 2016). These estimates are then used to inform the Tropical Tuna MAC and the AFMA board in determining the TACC. Tropical tuna species (yellowfin, bigeye and albacore tunas) TACC are determined based on assessment of fishery		

	indicators, stock status information and the position of the Australian Government. The harvest strategy is not applied to these species.
Input controls	The ETBF is managed by a range of input controls (see below). Commercial: • Limited entries • Gear restrictions • Area restrictions • Individual transferrable quotas Commercial fishing is managed through a system of input controls based on annually granted fishing permits which limit entry to the fishery, the area of operations, and impose limits on the take of bycatch species and the fishing gear employed in the fishery. *Area restrictions*: ETBF boats are not allowed to fish inside State and Commonwealth managed MPAs, however in some MPAs fishing may be permitted. It is the concession holder's responsibility to check if fishing is permitted. See the Department of Environment (DoE) website located at www.environment.gov.au/marinereserves/index.html.  **Marine reserves (both existing and proposed) which are contained within the ETBF boundary. Source: map compiled by ABARES, 21 June 2016.** Great Barrier Reef: No tuna fishing is permitted within the Great Barrier Reef Marine Park (GBRMP) without a permit issued by the GBRMP Authority. Coral Sea Zone: (Previously known as Area E; see map in *Geographic extent of the fishery* section): No longline fishing is permitted in this area unless one holds a Coral Sea boat SFR. A 500 hook limit per shot applies when fishing in the Coral Sea using pelagic longlines. This area was created to protect juvenile marlin species and their spawning grounds. Lord Howe Island: No fishing is permitted within 12 nm of Lord Howe Island unless authorization is gained. Norfolk Island: • ETBF SFR holders must not fish inside the Norfolk Island box with the co-ordinates: • Beginning at the point of latitude 28° 35' S, longitude 167° 25' East; and running • East along that parallel to its intersection with the meridian of longitude 168° 25' East; and • South along that meridian to its intersection with the parallel of latitude 29° 50' South; and • West along that parallel to its intersection with the meridian of longitude 167° 25' East; and • North along that meridian to the point where the line began. *Fishing in the High Seas*:

When conducting fishing operations on the High Seas, the concession holder must ensure that:

- The boat is clearly marked with its international radio call sign according to internationally recognised standards;
- They report to AFMA (vmsreporting@afma.gov.au) prior to entering the High Seas;
- All fishing gear is properly stowed when transiting through another country's Exclusive Economic Zone (EEZ); and
- They do not fish in another country's EEZ.

Output controls

The Eastern Tuna and Billfish Fishery is managed by a range of output controls (see below).

The AFMA Commission agreed to move the ETBF from an input controlled system, controlling the number of hooks set to an output controlled system based on Individual Transferrable Quotas (ITQs) in December 2008. This was implemented in 2011.

The primary ETBF tuna and billfish species are managed through total allowable commercial catches as individual transferable quotas (ITQs), i.e. albacore tuna, bigeye tuna, yellowfin tuna, broadbill swordfish and striped marlin. There are no size limits for the quota species in the ETBF. There are limits in catch and numbers of species and on the species taken commercially in the ETBF (see below).

Catch limits:

Species permitted to be taken in the ETBF.

Common name	Scientific Name	Restrictions
Yellowfin Tuna	*Thunnus albacares*	Quota species; set annually
Bigeye Tuna	*Thunnus obesus*	Quota species; annual TACC set
Albacore Tuna	*Thunnus alalunga*	Quota species; annual TACC set
Striped Marlin	*Tetrapturus audax*	Quota species; annual TACC set
Broadbill Swordfish	*Xiphias gladius*	Quota species; annual TACC set
Longtail Tuna	*Thunnus tonggol*	A maximum 35 tonne limit by the fleet per fishing year is in place for the ETBF and WTBF. A 10 fish trip limit per operator will be imposed should the 35 tonne trigger limit be reached in either fishery in any fishing year.
Skipjack Tuna	*Katsuwonus pelamis*	Unlimited
Northern Pacific Bluefin Tuna (NBT)	*Thunnus thynnus*	You must report to AFMA prior to landing NBT (via e-mail northernbluefin@afma.gov.au or fax 02 6225 5440) at least 1 hour before landing in port.
Southern Bluefin Tuna (SBT)	*Thunnus maccoyii*	Any take of SBT must be done in accordance with the quota arrangements under the Southern Bluefin Tuna Fishery Management Plan 1995. Zones of likely SBT catch (core and buffer zones) are put in place in the ETBF during the winter months when SBT are present in waters off the east coast of Australia.
Pomfrets and Rays Bream	Family Bramidae	Unlimited
Indo-Pacific Sailfish	Istiophorus platypterus	Unlimited
Shortbill Spearfish	*Tetrapusus angusirostris*	Unlimited
Moonfish	*Genus Lampris*	Unlimited
Rudderfish	*Genus Centrolophus*	Unlimited
Escolar/Oilfish	*Ruvettus pretiosus* and *Lepidocybium flavobrunneum*	Unlimited
Mahi Mahi	*Coryphaena hippurus*	Unlimited
Sharks (those that are not subject to limits elsewhere)	Class Chondrichthyes	No more than the number of tuna and billfish quota species taken per trip, not exceeding a maximum of 20 sharks per trip

Species not permitted to be taken in the ETBF.

Common Name	Scientific Name
Blue Eye Trevalla	*Hyperoglyphe antarctica and Schedophilus labyrinthica*
Blue Grenadier	*Macruronus novaezelandiae*
Black Marlin	*Makaira indica*
Blue Marlin	*Makaira mazara*
Blue Warehou	*Seriolella brama*
Flathead	*Platycephalus and Neoplatycephalus sp.*
Gemfish	*Rexea solandri*
Jackass Morwong	*Nemadactylus macropterus*
John Dory	*Zeus faber*
Ling	*Genypterus blacodes*
Mirror Dory	*Zenopsis nebulosus*
Ocean Perch	*Helicolenus sp.*
Orange Roughy	*Hoplostethus atlanticus*
Redfish	*Centroberyx affinis*
Royal Red Prawn	*Haliporoides sibogae*
School Whiting	*Sillago findersi*
Silver Trevally	*Pseudocaranx dentex*
Spotted Warehou	*Seriolella punctata*
Black Cod	*Epinephelus daemelii*
Great White Shark	*Carcharodon carcharias*
Grey Nurse Shark	*Carcharias taurus*
School Shark	*Galeorhinus galeus*
Gummy Shark	*Mustelus antarcticus*
Elephant Fish	Families Callorhinchidae, Chimaeridae and Rhinochimaeridae
Sawshark	*Pristiophorus cirratus and Pristiophorus nudipinnis*
Deepwater Sharks	*Centroscymnus coelolepis*
	Centroscymnus crepidater
	Centroscymnus owstonii
	Centroscymnus plunketi
	Centroscyllium kamoharai
	Dalatias licha
	Dalatias calcea
	Dalatias quadrispinosa
	Etmopterus bigelwi
	Etmopterus dianthus
	Etmopterus dislineatus
	Etmopterus evansi
	Etmopterus fusus
	Etmopterus granulosus
	Etmopterus lucifer
	Etmopterus molleri
	Etmopterus pusillus
Oceanic Whitetip Shark	*Carcharhinus longimanus*
Silky Shark	*Carcharhinus falciformis*

Restricted species in Victorian waters with total maximum 200 kg per trip of all species combined.

Common Name	Scientific Name	Limits	Total limit
Barracouta	*Thyrsites atun*	200 kg	200 kg total per trip for all species combined
Leatherjackets – all species	Family Monocanthidae	200 kg	
Snapper	*Pagrus auratus*	50 kg per trip	
Striped Trumpeter	*Latris lineata*	20 kg per trip	

Yellowtail Kingfish	*Seriola lalandi*	10 fish per trip

Bycatch limits off Tasmania.

Common Name	Scientific Name	Limits
Australian Anchovy	*Engraulis australis*	
Australian Salmon/Tommy Ruff	*Genus Arripis*	
Banded Morwong	*Cheilodactylus spectabilis*	
Black Bream	*Acanthopagrus butcheri*	
Blue Sprat	*Spratelloides robustus*	
Dusky Morwong	*Dactylophora nigricans*	
Garfish	*Hyporhamphus melanochir*	
Grassy (rock) Flathead	*Platycephalus laevigatus*	
King Gar	*Scomberesox forsteri*	
King George Whiting	*Sillaginodes punctata*	No take
Luderick	*Girrella tricuspidata*	
Magpie Morwong	*Cheilodactylus nigripes*	
Mulloway	*Argyrosomus hololepidotus*	
Pilchard	*Sardinops neopilchardus*	
Red Mullet	*Upeneichthys vlamingii*	
Sea Sweep	*Scorpis aequipinnis*	
Snook	*Sphyraena novaehollandiae*	
Sprat	*Clupea bassensis*	
Wrasse	Family Labridae	
Yellow Eye Mullet	*Aldrichetta forsteri*	
Yellow-finned Whiting	*Sillago schomburgkii*	
Bastard Trumpeter	*Latidopsis forsteri*	20 kg per trip
Blue Groper	*Achoerodus gouldii*	50 kg per trip
Striped Trumpeter	*Latris lineata*	250 kg per trip
Yellowtail Kingfish	*Seriola lalandi*	250 kg per trip
Snapper	*Pagrus auratus*	250 kg per trip

Bycatch limits off Queensland.

Common Name	Scientific Name	State Limits
Yellowtail Kingfish	*Seriola lalandi*	Combined total of 2 fish per trip
Black Kingfish	*Rachycentron canadus*	
Amberjack	*Seriola dumerili*	
Australian Bonito	*Sardi australis*	Combined total of 10 fish per trip
Australian Spotted Mackerel	*Scomberomus munroi*	
Bar Cod	*Polyprion moeone*	
Cod	Family Serranidae, except *Epinephelus daemelii*	
Dog Toothed Tuna	*Gymnosarda unicolor*	
Emperor	Families Lethrinidae and Lutjanidae	
Frigate Mackerel	*Auxis thazard*	
Grouper	Family Serranidae Except *Epinephelus daemelii*	
Hapuku	*Polyprion oxygeneios*	
Leaping Bonito	*Cybiosarda elegans*	
Mackerel Tuna	*Euthynnus affinis*	
Oriental Bonito	*Sarda orientalis*	
Rainbow Runner	*Elagatis bipinnulata*	
Rake-Gilled Mackerel	*Rastrelliger kanagurta*	
Shark Mackerel	*Grammatorcynus bicarinatus, G.Bilineatus*	
Snapper	*Pagrus auratus*	
Spanish Mackerel	*Scomberomorus commerson*	

Trevally	Family Carangidae, except *Genus Seriola*	
Tropical Snapper	Families Lethrinidae and Lutjanidae	
Tuskfish	Family Labridae	
Wrasse	Family Labridae	
Shark	Subclass Elasmobranchii and Family Serranidae	Combined total of 20 fish per trip
Butterfly Mackerel	*Gasterochisma melampus*	
Slender Tuna	*Allothunnus fallai*	
Wahoo	*Acanthocybium solandri*	

Bycatch limits off New South Wales.

Common Name	Scientific Name	Limits
Finfish	Class Osteichthyes	Total of 200kg

For sharks, operators must not take more sharks than the number of fish of the quota species retained, up to a maximum of 20 sharks per trip. This excludes species that are subject to other catch limits (for example, white shark (*Carcharodon carcharias*) and other shark species that are no-take in the ETBF; see above table). AFMA has implemented a ban on retaining oceanic whitetip sharks (*Carcharhinus longimanus*) that was agreed by the WCPFC in early 2012. The use of wire trace leaders is prohibited in the ETBF. Source: ABARES Fish Status Report.

SBT catch in the ETBF:

The ETBF Management Plan does not permit fishing southern bluefin tuna (SBT). Any Take of SBT must be dine in accordance with the quota arrangements under the Southern Bluefin tuna Fishery Management Plan 1995. Therefore, only operators who hold SBT quota Statutory Fishing Rights (SFRs) are permitted to take SBT when fishing within the ETBF.

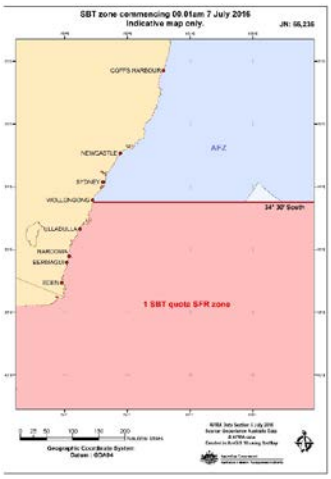
A single SBT Management Zone is implemented, usually during the winter months, when SBT are present in waters off the south-east coast of Australia, to ensure that no SBT is taken in the ETBF without being covered with quota.

The 2016 management arrangements for fishing SBT are:

- only a single SBT zone is implemented (i.e. no core or buffer zones like previous years)
- uncaught SBT quota must be held by operators to enter the SBT zone
- a fully operational e-monitoring system must be onboard the vessel
- when in the SBT zone, operators must carry a minimum 50 Catch Documentation Scheme (CDS) pages onboard the vessel
- operators are required to have and complete the CCSBT (CDS) logbook to enable more precise tracking of individual SBT.
- land and report all SBT taken except those released (i.e. in an alive and vigorous state). The release of these fish and any cut-offs must be performed at the tuna door in full view of an e-monitoring camera.
- carry an AFMA observer when notified by AFMA.
- SBT zone location is reviewed and updated weekly^

^: The location and timing of the SBT zone is determined by analyzing information from a range of sources; sea surface temperatures, landing data, observer and VMS data, advice from industry and the habitat preference model produced by CSIRO. This model provides AFMA with an indication of the area where SBT is likely to occur. The SBT zone location is set based on SBT temperature preferences from SBT tagging data with an ocean model producing the zones based on current sea surface temperatures.

The SBT fishing zone (implemented on 00.01 am, 7 July 2016) was:

	 For other SBT fishing zones, see: http://www.afma.gov.au/fisheries-services/sbt-zones/ **Recreational** The Australian Government does not manage recreational fishing in Commonwealth waters. Recreational fishing in Commonwealth waters is managed by the state or territory immediately adjacent to those waters, under its management regulations. Recreational and Indigenous fishing sectors include Victoria, Tasmania, New South Wales and Queensland. Bag limits apply (see above tables).
Technical measures	Processing fish: There are specific landing requirements for tuna in the ETBF: Tuna (except SBT and NBT) cannot be processed at sea except for the removal of fins (except the caudal fin), gilling and gutting. SBT and NBT can be landed gilled and gutted (also known as Australian cut). Please see 9ZO of the *Fisheries Management Regulations 1992* for more details. • Billfish (except Broadbill Swordfish) must be landed with the caudal keel, pectoral and anal fins still attached to the carcass. No other processing can be conducted. • Broadbill Swordfish can be processed at sea, either by filleting or the removal of all fins. Please see 9ZO of the *Fisheries Management Regulations 1992* for more details. • Bony fishes must not be landed in a form other than as a whole, gilled, gutted or headed fish or a combination of these forms. • Sharks must be landed with their fins still attached to the carcass and it is forbidden to carry, retain or land shark livers unless the carcass from which the liver was obtained is also landed.
Regulations	The Management Plan, is made under the *Fisheries Management Act 1991*, manages only commercial fishing for tuna and billfish species in the area of the fishery. The bycatch provisions set out in the *Fisheries Management Regulations 1998* apply to all Fishing Permits in the Eastern Tuna and Billfish Fishery. Also, other regulations and management plans exist: • Eastern Tuna and Billfish Fishery Management Plan 2010 (first implemented on 1 March 2011). • Eastern Tuna and Billfish Fishery Harvest Strategy Policy and Guidelines; • AFMA's broader Bycatch and Discard Program (AFMA 2011; 2014). • Australia's National Plan of Action for the management of Sharks and Shark Policy • Memorandum of Understanding with SEWPaC for reporting interactions with protected species; • Management plans and Bycatch and Discard Workplans for overlapping fisheries; • Eastern Tuna and Billfish Fishery Sea Turtle Mitigation Plan; • Threat Abatement Plans (TAP) 2014, 2018 reduce incidental bycatch of marine birds • Various international plans of action and recovery plans for Threatened, Endangered and Protected (TEP) species; and • Five year strategic research plan for the Australia and Tuna and Billfish Fisheries. Australia is also obliged to abide by the Management Measures and Resolutions implemented by the Western and Central Pacific Fisheries Commission (WCPFC) to conserve the populations of sharks, turtles and seabirds in the Western and Central Pacific Ocean. Australia must also abide by Measures adopted by the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) which state that Members should implement national plans of action to reduce the interactions between the fishery and non-target species, namely seabirds, sharks and turtles. Management plans and other policy measures for Commonwealth fisheries incorporate the conservation measures adopted by both CCSBT and WCPFC.

Initiatives, strategies and incentives	*BAPs;TEDs;Industry codes of conduct* ***Chondrichthyans*** **Logbook and observer data collection and e-monitoring data (mid 2015 onwards):** monitor bycatch species. **Bycatch action plans**: Australia's Tuna and Billfish Longline and Minor Line Fisheries Bycatch Action Plan. Includes a Code of Practice when dealing with chondrichthyans. **National Plan of Action (NPOA):** has been established to address priorities in conservation and management measures, including research and data collection and monitoring programs. **Recovery Plans:** exist for the Grey Nurse Shark (*Carcharias taurus*), and the Great White (*Carcharodon carcharias*) in Australia (Environment Australia, 2002). See also Environment Australia, 2013; 2014. ***Marine mammals*** All cetaceans are protected under the EPBC Act 1999, and within the boundaries of the Australian Whale Sanctuary https://www.environment.gov.au/marine/marine-species/cetaceans/australian-whale-sanctuary **Bycatch Action Plan:** Australia's Tuna and Billfish Longline and Minor Line Fisheries Bycatch Action Plan (AFMA 2013-2016) outlines AFMA's intended monitoring strategies, and management responses to address at risk species. The BAP Includes a Code of Practice when dealing with Seals: if a seal is caught on a tuna longline hook, fishers should attempt to remove the hook or, if this is not practical, cut the line as close to the hook as is practical. ***Seabirds*** The **Threat Abatement Plan** (2014) outlines the compulsory and voluntary mitigation measures that currently exist for vessels operating in the AFZ. Mandatory measures include: 1. AFMA will require all pelagic longline tuna fishers operating within either the Eastern Tuna and Billfish Fishery or the Western Tuna and Billfish Fishery, or both fisheries, southwards of the parallel of 25 degrees South to: • employ a line-weighting strategy approved by AFMA that enables the bait to be rapidly taken below the reach of most seabirds; • employ at least one bird-scaring line constructed to a specified standard approved by AFMA, or use another proven mitigation measure approved by AFMA for use without such a line; • not discharge offal during line setting; and • employ, as part of an adaptive management approach to seabird bycatch mitigation, such other mitigation measures as AFMA may stipulate following consultation with the Department of the Environment (including, but not limited to, use of bird exclusion devices and/or managing offal discharge during line hauling, night setting, and area closures). 2. AFMA will continue to require domestic and foreign vessels in all longline fisheries operating within Australian jurisdiction to adopt proven mitigation measures that ensure the performance criteria for each fishery are achieved in all areas and seasons. The seabird bycatch rate for the ETBF, based on the Threat Abatement Plan is less than 0.05 birds per 1000 hooks in each fishing area. The Bycatch and Discard Workplan (1 July 2013 to 30 June 2016) also details mitigation measures to minimise bycatch of seabirds, turtles, sharks and other protected species. These include: • Circle hooks to minimize incidental turtle mortality • Tori Lines • Line weighting regimes • No discharge of offal during setting and hauling; and • Mandatory carriage of line cutting and de-hooking devices on fishing vessels Mandatory Seabird Mitigation Measures for Longline Fishing at all times you must: • Carry an assembled tori line on-board; • Carry either: 1,000 weighted swivels each weighing at least 60 grams; or 1,000 weights each weighing at least 40 grams. • Not discharge offal while setting; • Not discharge offal while hauling (an exemption for small boats may be given by AFMA. To apply for an exemption, please contact Licensing at licensing@afma.gov.au). When you are fishing South of 25° S you must: • Deploy a tori line before commencing a shot; • Use only thawed bait; • Weight longlines with either a minimum of:

1.60g swivels at a distance of no more than 3.5m from each hook; or
2.98g swivels at a distance of no more than 4m from each hook; or
3.40g weights at each hook with dead, non-frozen baits; or

- At all times carry1,000 weighted swivels each weighing at least 60 grams or 1,000 weights to be used at each hook each weighing at least 40g;
- Not discharge offal while setting.

When you are fishing North of 25°S you must:

- Carry an assembled tori line on-board;
- At all times carry 1,000 weighted snoods each weighing at least 60g or 1,000 weights to be used at each hook each weighing at least 40g.

Note: The mandatory requirement to carry 1,000 weighted snoods does not apply to vessels permitted to operate inside the Coral Sea Zone. A holder can gain exemption from the requirements to carry a tori line and 1,000 weighted snoods if they agree not to fish south of latitude 25° South.

Tori line specifications:

Your tori line must be:

- At least 100m long;
- Set up from a position on the boat that allows it to stay above the water for at least 90m;
- Have streamers attached at least every 3.5m;
- Streamers should be maintained, ensuring that their lengths are as close to the water as possible.
- Have a drogue at the end of the line to give sufficient drag to meet the 90m aerial coverage criteria.

Observer program: currently a very small percentage (<10%) of line sets are observed for protected interactions, and rate of bycatch. Data collected may include life status, however species identification remains an issue.

Bycatch Action Plan: Australia's Tuna and Billfish Longline and Minor Line Fisheries Bycatch Action Plan (AFMA 2013-2016) outlines AFMA's intended monitoring strategies and management responses to address at risk species.

Recovery Plans: exist for a number of species and can be viewed via the DEH website (Recovery Plans), e.g. great white shark and grey nurse shark.

In addition to these compulsory measures some operators in the ATBLF have adopted

voluntary measures from their respective fishery's *Industry Code of Practice* to reduce

seabird bycatch including:

- Using a tori line north of 25 degrees in the ETBF
- Puncturing of the swim bladders of thawed baits to assist in sinking rate
- The use of bait casting machines
- Gear selection that minimises the probability of seabird bycatch
- Promoting safe handling and release of all seabirds caught alive on longlines
- Promoting night setting

Marine reptiles

Mandatory Turtle Mitigation Measures for Longline Fishing:

- Circle hooks
  Large circle hooks must be used if less than eight hooks per bubble are set.
- De-hooking device

At all times you must carry on board a minimum of one de-hooking device, with the following specifications:

- The device must enable the hook to be secured and the barb shielded so that the barb does not re-engage with the fish while the hook is being removed;
- The device must be blunt with all edges rounded;
- Where more than one size of hook is to be carried, a de-hooking device (or devices) must be carried that can be used with all hooks on the boat; and
- The shaft of the device must be a minimum of 1.5 metres in length

Line cutting device:

At all times you must carry on board a minimum of one line cutting device.

The line cutting device must be constructed and used in accordance with the following specifications:

- The device must be constructed to allow the line to be cut as close to the hook as possible;
- The blade of the device must be enclosed in a blunt rounded (arc-shaped) cover with the hook exposed on the inside of the arc; and
- The shaft of the device must be a minimum of 1.5 metres in length.

<table>
<tr><td></td><td>Bycatch Action Plan: Australia's Tuna and Billfish Longline and Minor Line Fisheries Bycatch Action Plan (AFMA 2004) requires further validation of turtle catch rates.

Recovery Plan: for marine turtles in Australia. (Environment Australia, 2003)

See also AFMA's 2016 Managemet arrangements booklet. http://www.afma.gov.au/wp-content/uploads/2014/08/ETBF-management-arrangements-booklet-2016.pdf

<u>Seasnakes</u>

Seasnakes are not covered by BAP specifically or any Action Plan.</td></tr>
<tr><td>Enabling processes</td><td>Monitoring, logbooks, observer data, scientific surveys); assessment stock assessments); performance indicators (decision rules, processes, compliance; education; consultation process.

See above.</td></tr>
<tr><td>Other initatives or agreements</td><td><u>MPAs</u>

There are four Commonwealth marine protected areas in the area of the ETBF (over the 2011-2015 ERA assessment period):

• Great Barrier Reef marine park
• Solitary Islands marine park
• Lord Howe Island marine park
• Tasmanian Seamounts marine Parks

There is a new marine reserve proposed called the "Coral Sea Commonwealth Marine Reserve" which includes the former Coral Sea Conservation Zone, Former Coringa-Herald Nature Reserve and former Lihou Reef National Nature Reserve).

There are two reserves

• Coringa-Herald national Nature Reserves
• Lihou Reef National Nature Reserves.

Existing transitional arrangements apply over the ERA 2011-2015 assessment period, should a management plan for the "Coral Sea Commonwealth Marine Reserve" come into effect, i.e.:

• Under the transitional arrangements, there are NO CHANGES ON THE WATER for users of new areas added to the Commonwealth marine reserves estate.
• NOTE: There are no changes to management arrangements in the marine reserves that existed prior to the establishment of the new reserves, that is, the same restrictions on activities will continue to apply even where those reserves have been incorporated into new reserves.

Source: http://www.environment.gov.au/topics/marine/marine-reserves/coral-sea/overview

Activities: The following table outlines activities allowed without an Approval (✓), allowed with a general approval in accordance with conditions (GA), allowed with an approval or a permit (A) or not allowed (✗) in the area of the former Coringa-Herald National Nature and Lihou Reef National Nature Reserves.

<table>
<tr><th colspan="2">Activities allowed in the Former Coringa-Herald National Nature Reserve:</th></tr>
<tr><td>General Access</td><td>✓</td></tr>
<tr><td>Commercial Activities</td><td></td></tr>
<tr><td>Fishing (including collecting)</td><td>✗</td></tr>
<tr><td>Filming and Photography</td><td>A</td></tr>
<tr><td>Tourism and Charters[1]</td><td>A</td></tr>
<tr><td>Other Commercial Activities</td><td>✗</td></tr>
<tr><td>Commercial vessel transit</td><td>GA</td></tr>
<tr><td>Recreational Activities</td><td></td></tr>
<tr><td>Scuba diving & snorkelling</td><td>✓</td></tr>
<tr><td>Camping</td><td>✗</td></tr>
<tr><td>Fishing (including collecting)</td><td>✗</td></tr>
<tr><td>Scientific Research</td><td>A</td></tr>
<tr><td colspan="2">Activities allowed in the former Lihou Reef National Nature Reserve:</td></tr>
<tr><td>General Access</td><td>✓</td></tr>
</table></td></tr>
</table>

	Commercial Activities:
	Fishing (including collecting) ✗
	Filming and Photography **A**
	Tourism and Charters[1] **A**
	Other Commercial Activities ✗
	Commercial vessel transit **GA**
	Recreational Activities:
	Scuba diving & snorkelling ✓
	Camping ✗
	Fishing (including collecting) ✗
	Scientific Research **A**

There are also State reserves within the range of the fishery.

International obligations:

Australia has signed (but not ratified) the Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. Once ratified, the Convention establishes a Commission, comprising coastal states and distant water fishing nations, which will manage the tuna and billfish stocks on a regional basis.

There is also a bilateral agreement between Japan and Australia under the Bilateral agreement, regarding the protection of wild flora and fauna, including endanagered species, and bycatch mitigation measures for sharks 2016. See http://dfat.gov.au/trade/agreements/tpp/official-documents/Documents/20-environment.pdf

Data

Logbook data

Verified logbook data; data summaries describe programme

AFMA Logbooks

Longline sector operators, and those operators who use both pelagic longline and minor line methods, are required to complete the 'Australian Pelagic Longline Daily Fishing Log' (AL06) by each set. Operators fill in catch and effort logbooks while fishing. They are required to send them to AFMA 14 days after the end of each month. The data is entered into AFMA's GENLOG database. AFMA observers collected data to verify logbook information and this role is now achieved via electronic monitoring.

Observer data

Objective observer programme; describe parameters, how many years run; coverage – random or full coverage; comments on interactions with species; observer training, species identification, and length of service; data summaries

The AFMA Observer Program and E-monitoring Program:

The Observer Program, which commenced in ~ 2003 has been replaced with e-monitoring Program since 1 July 2015. It is intended to achieve 100% Observer coverage for vessels operating more than 30 days per year. Video e-monitoring footage will help inform management on various aspects of the fishery such as species composition, bycatch and by-product species.

Annual percentage coverage rates are listed below. Corresponding targets were unavailable.

Quota year	Coverage rate (%)
2010/11	3.6
2011/12	6.3
2012/13	6.2
2013/14	6.2
2014/15	2.8

Up until 30 June 2015, observers conducted the following training before operating in the Observer Program:

- Sea safety (soon to be STCW95)
- Conflict resolution
- In house operational training

The retention rate is very high so almost all of AFMA observers having 5+ years experience in the role. Observers also produced a trip report at the end of every trip.

Other data

The ETBF has a five year Australian Strategic Research Plan 2012-2016 inclusive.

2.2.2 Unit of Analysis Lists (Step 2)

The units of analysis for the sub-fishery are listed by component:

- Species Components (key commercial and secondary commercial; byproduct/discards and protected species components). [Scoping document S2A Species]
- Habitat Component: habitat types. [Scoping document S2B1 and S2B2 Habitats]
- Community Component: community types. [Scoping document S2C1 and S2C2 Communities]

Ecological Units Assessed

Key commercial and secondary species:	6 (6 key; 0 secondary)
Commercial bait species	3
Byproduct and bycatch species:	18 and 146 respectively
Protected species:	94
Habitats:	309 (299 benthic, 10 pelagic)
Communities:	68 (55 demersal, 13 pelagic)

The above unit of analyses examined in this report has been confirmed by stakeholders through three review processes. As part of this process, it was decided by TTRAG to include species from Logbook and Observer databases prior to 2011, based on species accumulation curves and low Observer coverage rate in this fishery.

Scoping Document S2A. Species

Each species identified during the scoping is added to the ERAEF database for further analyses if required. A CAAB code (Code for Australian Aquatic Biota) is required to input the information. The CAAB codes for each species may be found at http://www.marine.csiro.au/caab/

Key commercial/secondary commercial species for the Eastern Tuna and Billfish Longline sub-fishery

- *Key commercial species* – defined in the Harvest Strategy Policy (HSP) Guidelines as a species that is, or has been, specifically targeted and is, or has been, a significant component of a fishery.
- *Secondary commercial species* – commercial species that, while not specifically targeted, are commonly caught and generally retained, and comprise a significant component of a fishery's catch and economic return. These can include quota species in some fisheries.

Table 2.3. Key commercial (C1) and commercial bait (CB) species list for the ETBF sub-fishery. ^ Special case: Southen Bluefin tuna caught in sub-fishery, but managed under different management plan and harvest straetegy.

ERA SPECIES ID	TAXA NAME	ROLE IN FISHERY	SCIENTIFIC NAME	CAAB CODE	FAMILY NAME	COMMON NAME	SOURCE
212	Teleost	C1	*Thunnus albacares*	37441002	Scombridae	Yellowfin tuna	AFMA
62	Teleost	C1	*Thunnus obesus*	37441011	Scombridae	Bigeye tuna	AFMA
895	Teleost	C1	*Thunnus alalunga*	37441005	Scombridae	Albacore	AFMA
213	Teleost	C1	*Xiphias gladius*	37442001	Xiphiidae	Broad billed swordfish	AFMA
884	Teleost	C1	*Tetrapturus audax*	37444002	Istiophoridae	Striped marlin	AFMA
255	Teleost	C1	*Thunnus maccoyii*	37441004	Scombridae	Southern bluefin tuna^	AFMA
	Teleost	CB	*Scomber australasicus*	37441001	Scombridae	Blue mackerel	CSIRO
	Teleost	CB	*Trachurus declivis*	37337002	Carangidae	Common jack mackerel	CSIRO
	Teleost	CB	*Trachurus novaezelandiae*	37337003	Carangidae	Yellowtail scad	CSIRO

Byproduct species for the Eastern Tuna and Billfish Longline sub-fishery

Byproduct species refers to any species that are retained for sale but comprise a minor component of the fishery catch and economic return. Byproduct are considered to be commercial species under the CPFB 2000. This list was generated by reviewing an initial list (obtained from AFMA) and available information from AFMA logbook and AFMA Observer data extracts. Where a family name was only provided, a representative species was added to the species list.

Table 2.4. Byproduct (BP) species list for the Eastern Tuna and Billfish Longline sub-fishery.

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	SCIENTIFIC NAME	CAAB CODE	FAMILY NAME	COMMON NAME	SOURCE
535	BP	Chondrichthyan	*Carcharhinus brachyurus*	37018001	Carcharhinidae	Bronze whaler	AFMA
808	BP	Chondrichthyan	*Carcharhinus obscurus*	37018003	Carcharhinidae	Dusky shark	AFMA
1039	BP	Chondrichthyan	*Prionace glauca*	37018004	Carcharhinidae	Blue shark	AFMA
551	BP	Chondrichthyan	*Galeocerdo cuvier*	37018022	Carcharhinidae	Tiger shark	AFMA
	BP	Chondrichthyan	*Carcharhinus amblyrhynchos*	37018030	Carcharhinidae	Grey reef shark	AFMA
814	BP	Teleost	*Coryphaena hippurus*	37338001	Coryphaenidae	Dolphin fish (mahi mahi)	AFMA
211	BP	Teleost	*Sarda australis*	37441020	Scombridae	Australian bonito	AFMA
259	BP	Teleost	*Acanthocybium solandri*	37441024	Scombridae	Wahoo	AFMA
842	BP	Teleost	*Lampris guttatus*	37268001	Lampridae	Spotted moonfish	AFMA
148	BP	Teleost	*Seriola lalandi*	37337006	Carangidae	Yellowtail kingfish	AFMA
152	BP	Teleost	*Brama brama*	37342001	Bramidae	Ray's bream	AFMA
204	BP	Teleost	*Ruvettus pretiosus*	37439003	Gempylidae	Oilfish	AFMA
845	BP	Teleost	*Lepidocybium flavobrunneum*	37439008	Gempylidae	Escolar or black oil fish	AFMA
64	BP	Teleost	*Katsuwonus pelamis*	37441003	Scombridae	Skipjack tuna	AFMA
897	BP	Teleost	*Thunnus orientalis*	37441026	Scombridae	Northern bluefin tuna	AFMA
836	BP	Teleost	*Istiophorus platypterus*	37444005	Istiophoridae	Sailfish	AFMA
	BP	Teleost	*Tetrapturus angustirostris*	37444007	Istiophoridae	Shortbill spearfish	AFMA
215	BP	Teleost	*Centrolophus niger*	37445004	Centrolophidae	Rudderfish	AFMA

Bycatch (discard) species for the Eastern Tuna and Billfish Longline sub-fishery

Bycatch species are species that are not retained (i.e. are discarded, and includes catch that does not reach the deck of the vessel but which nonetheless is killed (or effected) as a result of the interaction with the fishing gear) and as such make no contribution to the value of the fishery. The term bycatch does *not* include discards of commercial species. Bycatch species are divided, for management purposes, into general bycatch species and protected species:

- *Bycatch species* (i.e. species of fish, sharks, invertebrates, etc. that are never retained for sale).

This list was generated by reviewing an initial list (obtained from AFMA) and available information from AFMA Logbook and AFMA Observer data extracts.

Table 2.5. Bycatch (BC) species list for the Eastern Tuna and Billfish Longline sub-fishery.

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	SCIENTIFIC NAME	CAAB CODE	FAMILY NAME	COMMON NAME	SOURCE
365	BC	Chondrichthyan	*Hexanchus griseus*	37005005	Hexanchidae	Bluntnose sixgill shark	AFMA
317	BC	Chondrichthyan	*Odontaspis ferox*	37008003	Odontaspididae	Smalltooth sandtiger shark	AFMA
862	BC	Chondrichthyan	*Pseudocarcharias kamoharai*	37009003	Pseudocarchariidae	Crocodile shark	AFMA
179	BC	Chondrichthyan	*Alopias vulpinus*	37012001	Alopiidae	Common thresher	AFMA
462	BC	Chondrichthyan	*Alopias superciliosus*	37012002	Alopiidae	Bigeye thresher shark	AFMA
375	BC	Chondrichthyan	*Alopias pelagicus*	37012003	Alopiidae	Pelagic thresher shark	AFMA
490	BC	Chondrichthyan	*Furgaleus macki*	37017003	Triakidae	Whiskery shark	AFMA
629	BC	Chondrichthyan	*Carcharhinus plumbeus*	37018007	Carcharhinidae	Sandbar shark	AFMA
621	BC	Chondrichthyan	*Carcharhinus falciformis*	37018008	Carcharhinidae	Silky shark	AFMA
467	BC	Chondrichthyan	*Carcharhinus altimus*	37018012	Carcharhinidae	Bignose shark	AFMA
647	BC	Chondrichthyan	*Carcharhinus tilstoni*	37018014	Carcharhinidae	Australian blacktip shark	AFMA
469	BC	Chondrichthyan	*Carcharhinus leucas*	37018021	Carcharhinidae	Bull shark	AFMA
473	BC	Chondrichthyan	*Carcharhinus amboinensis*	37018026	Carcharhinidae	Pigeye shark	AFMA
474	BC	Chondrichthyan	*Carcharhinus albimarginatus*	37018027	Carcharhinidae	Silvertip shark	AFMA
625	BC	Chondrichthyan	*Carcharhinus longimanus*	37018032	Carcharhinidae	Oceanic whitetip shark	AFMA
477	BC	Chondrichthyan	*Carcharhinus amblyrhynchoides*	37018033	Carcharhinidae	Graceful shark	AFMA
480	BC	Chondrichthyan	*Carcharhinus melanopterus*	37018036	Carcharhinidae	Blacktip reef shark	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	SCIENTIFIC NAME	CAAB CODE	FAMILY NAME	COMMON NAME	SOURCE
482	BC	Chondrichthyan	*Triaenodon obesus*	37018038	Carcharhinidae	Whitetip reef shark	AFMA
880	BC	Chondrichthyan	*Sphyrna lewini*	37019001	Sphyrnidae	Scalloped hammerhead shark	AFMA
485	BC	Chondrichthyan	*Sphyrna mokarran*	37019002	Sphyrnidae	Great hammerhead shark	AFMA
552	BC	Chondrichthyan	*Sphyrna zygaena*	37019004	Sphyrnidae	Smooth hammerhead shark	AFMA
371	BC	Chondrichthyan	*Centrophorus moluccensis*	37020001	Centrophoridae	Endeavour dogfish	AFMA
604	BC	Chondrichthyan	*Deania calceus*	37020003	Centrophoridae	Brier shark	AFMA
1078	BC	Chondrichthyan	*Squalus megalops*	37020006	Squalidae	Piked spurdog	AFMA
963	BC	Chondrichthyan	*Isistius brasiliensis*	37020014	Dalatiidae	Smalltooth cookiecutter shark	AFMA
491	BC	Chondrichthyan	*Centroscymnus owstonii*	37020019	Somniosidae	Owston's dogfish	AFMA
6015	BC	Chondrichthyan	*Isistius plutodus*	37020043	Dalatiidae	Largetooth cookiecutter shark	AFMA
2153	BC	Chondrichthyan	*Echinorhinus brucus*	37022001	Echinorhinidae	Bramble shark	AFMA
660	BC	Chondrichthyan	*Squatina australis*	37024001	Squatinidae	Australian angel shark	AFMA
816	BC	Chondrichthyan	*Ptyeroplatytrygon violacea*	37035010	Dasyatidae	Pelagic stingray	AFMA
777	BC	Chondrichthyan	*Urolophus viridis*	37038007	Urolophidae	Greenback stingaree	AFMA
784	BC	Chondrichthyan	*Myliobatis australis*	37039001	Myliobatidae	Southern eagle ray	AFMA
532	BC	Chondrichthyan	*Rhinoptera neglecta*	37040001	Rhinopteridae	Australian cownose ray	AFMA
1759	BC	Chondrichthyan	*Kaupichthys hyoproroides*	37059003	Chlopsidae	False moray	AFMA
890	BC	Chondrichthyan	*Halieutaea brevicauda*	37212001	Ogcocephalidae	Shortfin seabat	AFMA
6222	BC	Teleost	*Geotria australis*	37003001	Petromyzontidae	Pouch lamprey	AFMA
6218	BC	Teleost	*Mordacia mordax*	37003002	Petromyzontidae	Australian lamprey	AFMA
932	BC	Teleost	*Figaro boardmani*	37015009	Scyliorhinidae	Australian sawtail catshark	AFMA
6227	BC	Teleost	*Aulohalaelurus labiosus*	37015029	Scyliorhinidae	Australian Blackspot catshark	AFMA
470	BC	Teleost	*Carcharhinus brevipinna*	37018023	Carcharhinidae	Spinner shark	AFMA
483	BC	Teleost	*Carcharhinus limbatus*	37018039	Carcharhinidae	Blacktip shark	AFMA
6216	BC	Teleost	*Elops hawaiensis*	37053001	Elopidae	Hawaiian giant herring	AFMA
1141	BC	Teleost	*Pellona ditchela*	37085009	Pristigasteridae	Indian pellona	AFMA
1140	BC	Teleost	*Sardinella gibbosa*	37085013	Clupeidae	Goldstripe sardinella	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	SCIENTIFIC NAME	CAAB CODE	FAMILY NAME	COMMON NAME	SOURCE
1153	BC	Teleost	*Thryssa setirostris*	37086004	Engraulidae	Longjaw thryssa	AFMA
1139	BC	Teleost	*Chirocentrus dorab*	37087001	Chirocentridae	Dorab wolf herring	AFMA
6230	BC	Teleost	*Lampanyctodes hectoris*	37122002	Myctophidae	Hector's lanternfish	AFMA
272	BC	Teleost	*Nannobrachium achirus*	37122096	Myctophidae	Cripplefin lanternfish	AFMA
373	BC	Teleost	*Alepisaurus ferox*	37128001	Alepisauridae	Long snouted lancetfish	AFMA
372	BC	Teleost	*Alepisaurus brevirostris*	37128002	Alepisauridae	Short snouted lancetfish	AFMA
6226	BC	Teleost	*Barbourisia rufa*	37134001	Barbourisiidae	Redvelvet whalefish	AFMA
6224	BC	Teleost	*Alabes parvulus*	37206010	Gobiesocidae	Pygmy shore-eel	AFMA
6219	BC	Teleost	*Allenichthys glauerti*	37210004	Antennariidae	Glauert's anglerfish	AFMA
6223	BC	Teleost	*Echinophryne crassispina*	37210005	Antennariidae	Prickly anglerfish	AFMA
933	BC	Teleost	*Genypterus blacodes*	37228002	Ophidiidae	Pink ling	AFMA
925	BC	Teleost	*Malacocephalus laevis*	37232007	Macrouridae	Softhead grenadier	AFMA
284	BC	Teleost	*Coryphaenoides subserrulatus*	37232016	Macrouridae	Longray whiptail	AFMA
718	BC	Teleost	*Lophotus lacepede*	37270001	Lophotidae	Crested oarfish	AFMA
86	BC	Teleost	*Trachipterus arawatae*	37271001	Trachipteridae	Southern ribbonfish	AFMA
562	BC	Teleost	*Regalecus glesne*	37272002	Regalecidae	Oarfish ("king of herrings")	AFMA
941	BC	Teleost	*Helicolenus percoides*	37287001	Sebastidae	Reef ocean perch	AFMA
2316	BC	Teleost	*Brachypterois serrulifer*	37287101	Pteroidae	Sawcheek scorpionfish	AFMA
109	BC	Teleost	*Pterygotrigla polyommata*	37288006	Triglidae	Latchet	AFMA
6213	BC	Teleost	*Aetapcus maculatus*	37292004	Pataecidae	Warty prowfish	AFMA
6214	BC	Teleost	*Ratabulus diversidens*	37296011	Platycephalidae	Orange-freckled flathead	AFMA
123	BC	Teleost	*Lepidoperca pulchella*	37311001	Serranidae	Eastern orange perch	AFMA
1038	BC	Teleost	*Polyprion oxygeneios*	37311006	Polyprionidae	Hapuku	AFMA
425	BC	Teleost	*Epinephelus malabaricus*	37311150	Serranidae	Malabar grouper / blackspotted rockcod	AFMA
429	BC	Teleost	*Epinephelus morrhua*	37311151	Serranidae	Comet grouper	AFMA
6215	BC	Teleost	*Labracinus cyclophthalmus*	37313026	Pseudochromidae	Firetail dottyback	AFMA
6210	BC	Teleost	*Belonepterygion fasciolatum*	37319002	Acanthoclinidae	Barred spiny basslet	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	SCIENTIFIC NAME	CAAB CODE	FAMILY NAME	COMMON NAME	SOURCE
140	BC	Teleost	*Epigonus denticulatus*	37327010	Epigonidae	White deepsea cardinalfish	AFMA
6217	BC	Teleost	*Sillago ciliata*	37330010	Sillaginidae	Sand whiting	AFMA
146	BC	Teleost	*Pomatomus saltatrix*	37334002	Pomatomidae	Tailor	AFMA
147	BC	Teleost	*Rachycentron canadum*	37335001	Rachycentridae	Cobia	AFMA
6232	BC	Teleost	*Remora remora*	37336002	Echeneidae	Remora	AFMA
6212	BC	Teleost	*Remora brachyptera*	37336005	Echeneidae	Spearfish remora	AFMA
591	BC	Teleost	*Seriola dumerili*	37337025	Carangidae	Amberjack	AFMA
593	BC	Teleost	*Elagatis bipinnulata*	37337029	Carangidae	Rainbow runner	AFMA
664	BC	Teleost	*Caranx sexfasciatus*	37337039	Carangidae	Bigeye trevally	AFMA
4938	BC	Teleost	*Naucrates ductor*	37337040	Carangidae	Pilotfish	AFMA
1121	BC	Teleost	*Parastromateus niger*	37337072	Carangidae	Black pomfret	AFMA
1175	BC	Teleost	*Mene maculata*	37340001	Menidae	Razor moonfish	AFMA
2453	BC	Teleost	*Nuchequula glenysae*	37341013	Leiognathidae	Twoblotch ponyfish	AFMA
4960	BC	Teleost	*Taractes asper*	37342008	Bramidae	Flathead pomfret	AFMA
594	BC	Teleost	*Brama australis*	37342010	Bramidae	Southern ray's bream	AFMA
4962	BC	Teleost	*Taractichthys steindachneri*	37342015	Bramidae	Sickle pomfret	AFMA
597	BC	Teleost	*Aphareus rutilans*	37346001	Lutjanidae	Rusty jobfish	AFMA
600	BC	Teleost	*Etelis carbunculus*	37346014	Lutjanidae	Ruby snapper	AFMA
680	BC	Teleost	*Lutjanus argentimaculatus*	37346015	Lutjanidae	Mangrove jack	AFMA
2309	BC	Teleost	*Symphorus nematophorus*	37346017	Lutjanidae	Chinamanfish	AFMA
601	BC	Teleost	*Aprion virescens*	37346027	Lutjanidae	Green jobfish	AFMA
682	BC	Teleost	*Pristipomoides filamentosus*	37346032	Lutjanidae	Rosy jobfish / King snapper	AFMA
2459	BC	Teleost	*Gerres filamentosus*	37349003	Gerreidae	Threadfin silverbiddy	AFMA
1157	BC	Teleost	*Gerres oblongus*	37349022	Gerreidae	Slender silverbiddy	AFMA
158	BC	Teleost	*Chrysophrys auratus*	37353001	Sparidae	Snapper	AFMA
159	BC	Teleost	*Acanthopagrus butcheri*	37353003	Sparidae	Black bream	AFMA
160	BC	Teleost	*Acanthopagrus australis*	37353004	Sparidae	Yellowfin bream	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	SCIENTIFIC NAME	CAAB CODE	FAMILY NAME	COMMON NAME	SOURCE
6229	BC	Teleost	*Acanthopagrus pacificus*	37353011	Sparidae	Pikey bream	AFMA
161	BC	Teleost	*Rhabdosargus sarba*	37353013	Sparidae	Tarwhine	AFMA
162	BC	Teleost	*Argyrosomus japonicus*	37354001	Sciaenidae	Mulloway	AFMA
605	BC	Teleost	*Tilodon sexfasciatus*	37361003	Kyphosidae	Moonlighter	AFMA
4680	BC	Teleost	*Platax orbicularis*	37362007	Ephippidae	Orbicular batfish	AFMA
1	BC	Teleost	*Paristiopterus labiosus*	37367002	Pentacerotidae	Giant boarfish	AFMA
1012	BC	Teleost	*Nemadactylus macropterus*	37377003	Cheilodactylidae	Jackass morwong	AFMA
879	BC	Teleost	*Sphyraena jello*	37382004	Sphyraenidae	Pickhandle barracuda	AFMA
614	BC	Teleost	*Sphyraena barracuda*	37382008	Sphyraenidae	Great barracuda	AFMA
2296	BC	Teleost	*Sphyraena qenie*	37382009	Sphyraenidae	Blackfin barracuda	AFMA
1168	BC	Teleost	*Xiphocheilus typus*	37384014	Labridae	Bluetooth tuskfish	AFMA
6225	BC	Teleost	*Brachynectes fasciatus*	37415001	Tripterygiidae	Barred threefin	AFMA
6220	BC	Teleost	*Bryaninops amplus*	37428075	Gobiidae	Large whip goby	AFMA
1087	BC	Teleost	*Thyrsites atun*	37439001	Gempylidae	Barracouta	AFMA
1066	BC	Teleost	*Rexea solandri*	37439002	Gempylidae	Gemfish	AFMA
618	BC	Teleost	*Gemphylus serpens*	37439010	Gempylidae	Snake mackerel	AFMA
4940	BC	Teleost	*Nesiarchus nasutus*	37439012	Gempylidae	Black gemfish	AFMA
4946	BC	Teleost	*Promethichthys prometheus*	37439013	Gempylidae	Singleline gemfish	AFMA
207	BC	Teleost	*Benthodesmus elongatus*	37440001	Trichiuridae	Elongate frostfish	AFMA
208	BC	Teleost	*Lepidopus caudatus*	37440002	Trichiuridae	Southern frostfish	AFMA
209	BC	Teleost	*Trichiurus lepturus*	37440004	Trichiuridae	Largehead hairtail	AFMA
620	BC	Teleost	*Scomberomorus commerson*	37441007	Scombridae	Spanish mackerel	AFMA
6221	BC	Teleost	*Cybiosarda elegans*	37441008	Scombridae	Leaping bonito	AFMA
908	BC	Teleost	*Auxis thazard*	37441009	Scombridae	Frigate mackerel	AFMA
63	BC	Teleost	*Euthynnus affinis*	37441010	Scombridae	Mackerel tuna	AFMA
899	BC	Teleost	*Thunnus tonggol*	37441013	Scombridae	Long-tail tuna	AFMA
830	BC	Teleost	*Gasterochisma melampus*	37441019	Scombridae	Butterfly mackerel	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	SCIENTIFIC NAME	CAAB CODE	FAMILY NAME	COMMON NAME	SOURCE
377	BC	Teleost	*Allothunnus fallai*	37441021	Scombridae	Slender tuna	AFMA
835	BC	Teleost	*Gymnosarda unicolor*	37441029	Scombridae	Dogtooth tuna	AFMA
624	BC	Teleost	*Luvarus imperialis*	37443001	Luvaridae	Louvar	AFMA
852	BC	Teleost	*Makaira nigricans*	37444003	Istiophoridae	Blue marlin	AFMA
851	BC	Teleost	*Istiompax indica*	37444006	Istiophoridae	Black marlin	AFMA
958	BC	Teleost	*Hyperoglyphe antarctica*	37445001	Centrolophidae	Blue eye trevalla	AFMA
1068	BC	Teleost	*Seriolella brama*	37445005	Centrolophidae	Blue warehou	AFMA
1069	BC	Teleost	*Seriolella punctata*	37445006	Centrolophidae	Silver warehou	AFMA
6211	BC	Teleost	*Cubiceps capensis*	37446017	Nomeidae	Cape cubehead	AFMA
233	BC	Teleost	*Nelusetta ayraudi*	37465006	Monacanthidae	Ocean jacket	AFMA
234	BC	Teleost	*Scobinichthys granulatus*	37465007	Monacanthidae	Rough leatherjackets	AFMA
1400	BC	Teleost	*Abalistes stellatus*	37465011	Balistidae	Starry triggerfish	AFMA
4901	BC	Teleost	*Aluterus scriptus*	37465045	Monacanthidae	Scrawled leatherjacket	AFMA
1199	BC	Teleost	*Lactoria cornuta*	37466004	Ostraciidae	Longhorn cowfish	AFMA
4928	BC	Teleost	*Lagocephalus lagocephalus*	37467023	Tetraodontidae	Oceanic puffer	AFMA
6231	BC	Teleost	*Arothron caeruleopunctatus*	37467066	Tetraodontidae	Bluespotted puffer	AFMA
250	BC	Teleost	*Allomycterus pilatus*	37469002	Diodontidae	Deepwater burrfish	AFMA
1533	BC	Teleost	*Mola ramsayi*	37470001	Molidae	Short sunfish	AFMA
252	BC	Teleost	*Mola mola*	37470002	Molidae	Ocean sunfish	AFMA
6228	BC	Teleost	*Masturus lanceolatus*	37470003	Molidae	Sharptail sunfish	AFMA
4951	BC	Teleost	*Ranzania laevis*	37470004	Molidae	Slender sunfish	AFMA

Protected species for the Eastern Tuna and Billfish Longline sub-fishery

A protected species[2] refers to all species listed/covered under the EPBC Act 1999, which include Protected[3] species (listed threatened species i.e. vulnerable, endangered or critically endangered), cetaceans, listed migratory species and listed marine species.

Protected species that occur in the area of the sub-fishery. Protected species are often poorly listed by fisheries due to low frequency of direct interaction. Both direct (capture) and indirect (e.g. food source captured) interaction are considered in the ERAEF approach.

Table 2.6. Protected species (PS) list for the Eastern Tuna and Billfish Longline sub-fishery. Not observed (NO).

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	SOURCE AND/OR RATIONALE
364	PS	Chondrichthyan	Centrophoridae	*Centrophorus harrissoni*	Harrisson's dogfish	37020010	AFMA
964	PS	Chondrichthyan	Lamnidae	*Isurus oxyrinchus*	Shortfin mako	37010001	AFMA
370	PS	Chondrichthyan	Lamnidae	*Isurus paucus*	Longfin mako	37010002	AFMA
315	PS	Chondrichthyan	Lamnidae	*Carcharodon carcharias*	White shark	37010003	AFMA
972	PS	Chondrichthyan	Lamnidae	*Lamna nasus*	Porbeagle	37010004	AFMA
313	PS	Chondrichthyan	Odontaspididae	*Carcharias taurus*	Grey nurse shark	37008001	AFMA
346	PS	Chondrichthyan	Cetorhinidae	*Cetorhinus maximus*	Basking shark	37011001	AFMA
853	PS	Chondrichthyan	Myliobatidae	*Manta birostris*	Giant manta ray	37041004	AFMA
936	PS	Chondrichthyan	Triakidae	*Galeorhinus galeus*	School shark	37017008	AFMA
1032	PS	Marine bird	Diomedeidae	*Thalassarche bulleri*	Buller's albatross	40040001	AFMA
1033	PS	Marine bird	Diomedeidae	*Thalassarche cauta*	Shy albatross	40040002	AFMA
1034	PS	Marine bird	Diomedeidae	*Thalassarche chlororhynchos*	Yellow-nosed albatross, Atlantic yellow-nosed albatross	40040003	AFMA

[2] The term “protected” species refers to species listed under [Part 13] the EPBC Act 1999 and replaces the term “Threatened, endangered and protected species (TEPS)” commonly used in past Commonwealth Government (including AFMA) documents.

[3] Note “protected” (with small “p”) refers to all species covered by the EPBC Act 1999 while “Protected” (capital P) refers only to those protected species that are threatened (vulnerable, endangered or critically endangered).

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	SOURCE AND/OR RATIONALE
1035	PS	Marine bird	Diomedeidae	*Thalassarche chrysostoma*	Grey-headed albatross	40040004	AFMA
753	PS	Marine bird	Diomedeidae	*Diomedea epomophora*	Southern royal albatross	40040005	AFMA
451	PS	Marine bird	Diomedeidae	*Diomedea exulans*	Wandering albatross	40040006	AFMA
1085	PS	Marine bird	Diomedeidae	*Thalassarche melanophrys*	Black-browed albatross	40040007	AFMA
1008	PS	Marine bird	Diomedeidae	*Phoebetria fusca*	Sooty albatross	40040008	Expanded from 40040000 (Diomedeidae). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:e729bcb1-02dc-43f5-9785-3c39ad484abc#records. See also Gales et al. 1998.
1009	PS	Marine bird	Diomedeidae	*Phoebetria palpebrata*	Light-mantled albatross	40040009	Expanded from 40040000 (Diomedeidae). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:77ae7029-0a5f-44fa-add6-b6b263e5ef36#overview. See also Gales et al. 1998 and Alderman (2003).
755	PS	Marine bird	Diomedeidae	*Diomedea gibsoni*	Gibson's albatross	40040010	Expanded from 40040000 (Diomedeidae). http://bie.ala.org.au/species/CAAB:40040010
628	PS	Marine bird	Diomedeidae	*Diomedea antipodensis*	Antipodean albatross	40040011	Expanded from 40040000 (Diomedeidae). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:63b9481d-8383-4927-b34d-f194dd7066e3#overview. See also Alerman (2003).
799	PS	Marine bird	Diomedeidae	*Diomedea sanfordi*	Northern royal albatross	40040012	Expanded from 40040000 (Diomedeidae). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:10ad42d9-9ba3-498b-b400-037e2e963c81
1084	PS	Marine bird	Diomedeidae	*Thalassarche impavida*	Campbell albatross	40040013	Expanded from 40040000 (Diomedeidae). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:2e38b9c5-c643-4985-ac21-a2cf6f01f0ba. See also Alderman (2003).
1031	PS	Marine bird	Diomedeidae	*Thalassarche carteri*	Indian yellow-nosed albatross	40040014	Expanded from 40040000 (Diomedeidae). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:a5e7b726-abf0-497a-bd22-7aded0ff6898. See also Trebilco et al. (2010) and Gales et al. (1998).
894	PS	Marine bird	Diomedeidae	*Thalassarche salvini*	Salvin's albatross	40040016	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	SOURCE AND/OR RATIONALE
889	PS	Marine bird	Diomedeidae	*Thalassarche eremita*	Chatham albatross	40040017	Expanded from 40040000 (Diomedeidae). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:cb1a3f64-b575-420e-9779-ba4accd9d6a8; Alderman (pers. comm).
1428	PS	Marine bird	Diomedeidae	*Diomedea amsterdamensis*	Amsterdam albatross	40040018	Expanded from 40040000 (Diomedeidae). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:c468312f-6615-419d-87fe-40a05749718e#overview; Alderman (pers. comm).
1086	PS	Marine bird	Diomedeidae	*Thalassarche steadi*	White-capped albatross	no CAAB	AFMA
556	PS	Marine bird	Hydrobatidae	*Oceanites oceanicus*	Wilson's storm petrel (subantarctic)	40042004	AFMA
325	PS	Marine bird	Laridae	*Catharacta skua*	Great skua	40128005	AFMA
1017	PS	Marine bird	Laridae	*Sterna bergii*	Crested tern	40128025	AFMA
1041	PS	Marine bird	Procellariidae	*Procellaria aequinoctialis*	White-chinned petrel	40041018	AFMA
494	PS	Marine bird	Procellariidae	*Procellaria cinerea*	Grey petrel	40041019	Expanded from 40041998 (*Procellaria* spp.)
1042	PS	Marine bird	Procellariidae	*Procellaria parkinsoni*	Black petrel	40041020	Expanded from 40041998 (*Procellaria* spp.)
1043	PS	Marine bird	Procellariidae	*Procellaria westlandica*	Westland petrel	40041021	AFMA
1047	PS	Marine bird	Procellariidae	*Pterodroma macroptera*	Great-winged petrel	40041031	AFMA
1055	PS	Marine bird	Procellariidae	*Puffinus carneipes*	Flesh-footed shearwater	40041038	AFMA
1057	PS	Marine bird	Procellariidae	*Puffinus griseus*	Sooty shearwater	40041042	AFMA
1059	PS	Marine bird	Procellariidae	*Puffinus pacificus*	Wedge-tailed shearwater	40041045	AFMA
1060	PS	Marine bird	Procellariidae	*Puffinus tenuirostris*	Short-tailed shearwater	40041047	AFMA
1433	PS	Marine bird	Sulidae	*Sula dactylatra*	Masked booby	40047004	AFMA
896	PS	Marine mammal	Balaenidae	*Eubalaena australis*	Southern right whale	41110001	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:99e19958-7c6e-4f22-ad50-44027af1e418#overview

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	SOURCE AND/OR RATIONALE
289	PS	Marine mammal	Balaenidae	*Caperea marginata*	Pygmy right whale	41110002	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:99e19958-7c6e-4f22-ad50-44027af1e418#overview
261	PS	Marine mammal	Balaenopteridae	*Balaenoptera borealis*	Sei whale	41112002	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:7487f1a7-d213-46be-ac63-36e1a5021b31
262	PS	Marine mammal	Balaenopteridae	*Balaenoptera edeni*	Bryde's whale	41112003	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:ec4289c4-6784-4b67-900f-899a43f39eae#overview
265	PS	Marine mammal	Balaenopteridae	*Balaenoptera musculus*	Blue whale	41112004	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:04788e73-25e2-472f-ad5e-65d7d93231dc#overview
268	PS	Marine mammal	Balaenopteridae	*Balaenoptera physalus*	Fin whale	41112005	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:bb0ec4bf-61d1-4850-b164-287731f8a1c3#overview
984	PS	Marine mammal	Balaenopteridae	*Megaptera novaeangliae*	Humpback whale	41112006	AFMA
1439	PS	Marine mammal	Balaenopteridae	*Balaenoptera bonaerensis*	Southern minke whale	41112007	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:66ce2ba9-f47e-41f0-b5df-db8fd4d8412b
612	PS	Marine mammal	Delphinidae	*Delphinus delphis*	Common dolphin	41116001	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	SOURCE AND/OR RATIONALE
902	PS	Marine mammal	Delphinidae	*Feresa attenuata*	Pygmy killer whale	41116002	Expanded from Delphinidae (dolphins). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:b2b8bf7b-cb32-437f-9e32-779ceb6cd4b5#overview
934	PS	Marine mammal	Delphinidae	*Globicephala macrorhynchus*	Short-finned pilot whale	41116003	AFMA
935	PS	Marine mammal	Delphinidae	*Globicephala melas*	Long-finned Pilot whale	41116004	AFMA
937	PS	Marine mammal	Delphinidae	*Grampus griseus*	Risso's dolphin	41116005	Expanded from Delphinidae (dolphins). Occurred within fishery area: ALA website (20/02/2017). https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:65e04f81-51ed-4a8e-b2de-1c92494754ce#overview
970	PS	Marine mammal	Delphinidae	*Lagenodelphis hosei*	Fraser's dolphin	41116006	Expanded from Delphinidae (dolphins). Occurred within fishery area: ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:fe54daf6-649a-4185-b16a-7a4ed9e774f7#overview
61	PS	Marine mammal	Delphinidae	*Lissodelphis peronii*	Southern right whale dolphin	41116009	Expanded from Delphinidae (dolphins). Occurred within fishery area; ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:fe42ee46-872a-4a4d-86c5-6f6643553faa#overview
860	PS	Marine mammal	Delphinidae	*Orcaella heinsohni*	Australian snubfin dolphin	41116010	Expanded from Delphinidae (dolphins). Occurred within fishery area: ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:9422ca0c-6848-4e30-a5ef-b42f0d3f5d7f#overview
1002	PS	Marine mammal	Delphinidae	*Orcinus orca*	Killer whale	41116011	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:f9eb6abb-6552-4b22-951e-0449fe824d6c#overview.

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	SOURCE AND/OR RATIONALE
1007	PS	Marine mammal	Delphinidae	*Peponocephala electra*	Melon-headed whale	41116012	AFMA
1044	PS	Marine mammal	Delphinidae	*Pseudorca crassidens*	False killer whale	41116013	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:5d33006c-bb68-40b8-8558-8b81183a6b11#overview.
1076	PS	Marine mammal	Delphinidae	*Sousa sahulensis*	Australian humpbacked dolphin	41116014	Expanded from Delphinidae (dolphins). Occurred within fishery area: ALA website (20/02/2017). http://bie.ala.org.au/species/ALA_Sousa_sahulensis#overview.
1080	PS	Marine mammal	Delphinidae	*Stenella attenuata*	Spotted dolphin	41116015	Expanded from Delphinidae (dolphins). Occurred within fishery area: ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:f1d2c5d9-00d6-4897-98b4-418f21fab89c#overview.
1081	PS	Marine mammal	Delphinidae	*Stenella coeruleoalba*	Striped dolphin	41116016	Expanded from Delphinidae (dolphins). Occurred within fishery area: ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:6a38c08f-e1c9-42d1-baa6-d0acb840068b#overview.
1082	PS	Marine mammal	Delphinidae	*Stenella longirostris*	Spinner dolphin	41116017	Expanded from Delphinidae (dolphins). Occurred within fishery area: ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:3f3a9272-12e8-442b-a668-b622bf1d79a7.
1083	PS	Marine mammal	Delphinidae	*Steno bredanensis*	Rough-toothed dolphin	41116018	Expanded from Delphinidae (dolphins). Occurred within fishery area: ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:328948b2-4269-4f7e-b50a-f26e145f5cd6#overview.

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	SOURCE AND/OR RATIONALE
1091	PS	Marine mammal	Delphinidae	*Tursiops truncatus*	Bottlenose dolphin	41116019	Expanded from Delphinidae (dolphins). Occurred within fishery area: ALA website (20/02/2017). https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:b61e9dd5-7259-4db2-87b9-0cb40eaba374#overview.
1494	PS	Marine mammal	Delphinidae	*Tursiops aduncus*	Indian Ocean bottlenose dolphin	41116020	Expanded from Delphinidae (dolphins). Occurred within fishery area: ALA website (20/02/2017). https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:855b5d35-26e8-46c1-b741-689150481595#overview.
216	PS	Marine mammal	Otariidae	*Arctocephalus forsteri*	New Zealand fur-seal	41131001	AFMA
253	PS	Marine mammal	Otariidae	*Arctocephalus pusillus doriferus*	Australian fur Seal	41131003	AFMA
1000	PS	Marine mammal	Otariidae	*Neophoca cinerea*	Australian sea-lion	41131005	AFMA
968	PS	Marine mammal	Physeteridae	*Kogia breviceps*	Pygmy sperm whale	41119001	CSIRO: expand from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:66ce2ba9-f47e-41f0-b5df-db8fd4d8412b.
969	PS	Marine mammal	Physeteridae	*Kogia sima*	Dwarf sperm whale	41119002	CSIRO: expand from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:66ce2ba9-f47e-41f0-b5df-db8fd4d8412b.
1036	PS	Marine mammal	Physeteridae	*Physeter catodon*	Sperm whale	41119003	AFMA
269	PS	Marine mammal	Ziphiidae	*Berardius arnuxii*	Arnoux's beaked whale	41120001	Expanded from 41000001 (whales). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:1c040529-c8c3-4e09-aa33-d520ae8f22f2#overview.
959	PS	Marine mammal	Ziphiidae	*Hyperoodon planifrons*	Southern bottlenose whale	41120002	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:66ce2ba9-f47e-41f0-b5df-db8fd4d8412b.

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	SOURCE AND/OR RATIONALE
1440	PS	Marine mammal	Ziphiidae	*Indopacetus pacificus*	Longman's beaked whale	41120003	Expanded from 41000001 (whales); Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:66ce2ba9-f47e-41f0-b5df-db8fd4d8412b.
985	PS	Marine mammal	Ziphiidae	*Mesoplodon bowdoini*	Andrew's beaked whale	41120004	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website. http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:37fd880e-d846-4cb5-ab31-feb8f7fcc29d.
986	PS	Marine mammal	Ziphiidae	*Mesoplodon densirostris*	Blainville's beaked whale	41120005	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:fd143f9c-14e3-4216-b4d8-2c6371562e89.
987	PS	Marine mammal	Ziphiidae	*Mesoplodon gingkodens*	Gingko beaked whale	41120006	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:8ad8f236-15ca-4cfa-b16b-ffc459a05a7c#.
988	PS	Marine mammal	Ziphiidae	*Mesoplodon grayi*	Gray's beaked whale	41120007	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:a14de374-38ab-4b72-8304-26f4e7b4cbc7.
989	PS	Marine mammal	Ziphiidae	*Mesoplodon hectori*	Hector's beaked whale	41120008	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:17cd2971-9cc3-4787-a484-a7dfd2f08578#tab_recordsView.

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	SOURCE AND/OR RATIONALE
990	PS	Marine mammal	Ziphiidae	*Mesoplodon layardii*	Strap-toothed beaked whale	41120009	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:c81e165a-8472-4a74-a3ca-ccd60884c132.
991	PS	Marine mammal	Ziphiidae	*Mesoplodon mirus*	True's beaked whale	41120010	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). http://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:fc4aba0b-039d-46b9-9ad1-c56eb6c67d74.
1030	PS	Marine mammal	Ziphiidae	*Tasmacetus shepherdi*	Tasman beaked whale	41120011	AFMA
1098	PS	Marine mammal	Ziphiidae	*Ziphius cavirostris*	Cuvier's beaked whale	41120012	Expanded from 41000001 (whales). Occurred within fishery area based on ALA website (20/02/2017). https://bie.ala.org.au/species/urn:lsid:biodiversity.org.au:afd.taxon:ec880d6b-91fc-4089-86c7-7acf615a34b2.
324	PS	Marine reptile	Cheloniidae	*Caretta caretta*	Loggerhead turtle	39020001	AFMA
541	PS	Marine reptile	Cheloniidae	*Chelonia mydas*	Green turtle	39020002	AFMA
822	PS	Marine reptile	Cheloniidae	*Eretmochelys imbricata*	Hawksbill turtle	39020003	AFMA
844	PS	Marine reptile	Cheloniidae	*Lepidochelys olivacea*	Olive Ridley turtle	39020004	AFMA
857	PS	Marine reptile	Cheloniidae	*Natator depressus*	Flatback turtle	39020005	Expanded from 39001001
613	PS	Marine reptile	Dermochelyidae	*Dermochelys coriacea*	Leatherback turtle	39021001	AFMA
1410	PS	Marine reptile	Hydrophiidae	*Aipysurus duboisii*	Reef shallows seasnake	39125003	AFMA
1414	PS	Marine reptile	Hydrophiidae	*Aipysurus laevis*	Golden seasnake	39125007	AFMA
1424	PS	Marine reptile	Hydrophiidae	*Lapemis hardwickii*	Spine-bellied seasnake	39125031	AFMA
1005	PS	Marine reptile	Hydrophiidae	*Pelamis platurus*	Yellow-bellied seasnake	39125033	AFMA

Scoping Document S2B1. Benthic Habitats

Risk assessment for benthic habitats considers both the seafloor structure and its attached invertebrate fauna. Because data on the types and distributions of benthic habitat in Australia's Commonwealth fisheries are generally sparse, and because there is no universally accepted benthic classification scheme, the ERAEF methodology has used the most widely available type of data – seabed imagery – classified in a similar manner to that used in bioregionalization and deep seabed mapping in Australian Commonwealth waters. Using this imagery, benthic habitats are classified based on an SGF score, using sediment, geomorphology, and fauna. Where seabed imagery is not available, a second method (Method 2) is used to develop an inferred list of potential habitat types for the fishery. For details of both methods, see Hobday et al. (2007).

Table 2.7. Benthic habitats that occur within the jurisdictional boundary of the Eastern Tuna and Billfish Fishery. Shading denotes habitats over which no effort occurs.

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4153	306	coastal margin	shelf	mud, irregular, mixed faunal community	033	0-25	N	
4154	308	coastal margin	shelf	mud, irregular, octocorals	035	0-25	Y	GoC Image data
4155	312	coastal margin	shelf	mud, subcrop, small sponges	052	0-25	Y	GoC Image Data
4156	314	coastal margin	shelf	mud, subcrop, mixed faunal community	053	0-25	N	
4157	317	coastal margin	shelf	mud, subcrop, low encrusting mixed fauna	056	0-25	N	
4158	330	coastal margin	shelf	Gravel, directed scour, no fauna	310	0-25	Y	GoC Image data
4159	334	coastal margin	shelf	Gravel, irregular, no fauna	330	0-25	Y	GoC Image data
4160	340	coastal margin	shelf	Gravel, subcrop, mixed faunal community	353	0-25	Y	GoC Image data
4161	342	coastal margin	shelf	Gravel, subcrop, octocorals	355	0-25	Y	GoC Image data
4162	**345**	coastal margin	shelf	Biogenic, subcrop, no fauna	750	0-25	Y	GoC Image Data
4163	364	coastal margin	shelf	Biogenic, subcrop, large sponges	751	0-25	Y	GoC Image Data
4164	365	coastal margin	shelf	Biogenic, subcrop, mixed faunal community	753	0-25	Y	GoC Image Data
4165	367	coastal margin	shelf	Biogenic, subcrop, Octocorals	755	0-25	Y	GoC Image Data

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4166	369	coastal margin	shelf	Biogenic, subcrop, small/ low encrustors	756	0-25	Y	GoC Image Data
4167	372	coastal margin	shelf, fringing reef	Biogenic, low outcrop, large erect sponges	761	0-25	Y	GoC Image Data
4168	373	coastal margin	shelf, fringing reef	Biogenic, low outcrop, mixed faunal community	763	0-25	Y	GoC Image Data
4169	374	coastal margin	shelf, fringing reef	Biogenic, low outcrop, octocorals	765	0-25	Y	GoC Image Data
4170	376	coastal margin	shelf, fringing reef	Biogenic, low outcrop, encrustors	766	0-25	Y	GoC Image Data
4171	378	coastal margin	shelf, fringing reef	Biogenic, low outcrop, large sponges	771	0-25	Y	GoC Image Data
4172	380	coastal margin	shelf, fringing reef	Biogenic, low outcrop, mixed faunal community	773	0-25	Y	GoC Image Data
4173	382	coastal margin	shelf, fringing reef	Biogenic, low outcrop, octocorals	775	0-25	Y	GoC Image Data
4174	384	coastal margin	shelf, fringing reef	Biogenic, low outcrop, encrustors	776	0-25	Y	GoC Image Data
4175	386	coastal margin	shelf, fringing reef	Biogenic, low outcrop, sedentary	777	0-25	Y	GoC Image Data
4176	388	coastal margin	shelf, fringing reef	Biogenic, high outcrop, octocorals	785	0-25	Y	GoC Image Data
4177	391	coastal margin	shelf, fringing reef	Biogenic, high outcrop, mixed faunal community	787	0-25	Y	GoC Image Data
4178	394	coastal margin	shelf	mud, directed scour, seagrass	01SG	0-25	N	f
4179	395	coastal margin	shelf	mud, wave rippled, seagrass	02SG	0-25	N	f
4180	396	coastal margin	shelf	mud, irregular, seagrass	03SG	0-25	N	f
4181	398	coastal margin	shelf	mud, subcrop, bivalve beds	05BV	0-25	N	g
4182	400	coastal margin	shelf	mud, subcrop, hard corals	05HC	0-25	N	
4183	401	coastal margin	shelf	mud, subcrop, seagrass	05SG	0-25	N	f
4184	402	coastal margin	shelf	fine sediments, directed scour, seagrass	11SG	0-25	N	f
4185	403	coastal margin	shelf	fine sediments, wave rippled, seagrass	12SG	0-25	N	f
4186	405	coastal margin	shelf	fine sediments, irregular, seagrass	13SG	0-25	N	f
4187	406	coastal margin	shelf	fine sediments, subcrop, seagrass	15SG	0-25	N	f
4188	408	coastal margin	shelf	coarse sediments, directed scour, seagrass	21SG	0-25	N	f

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4189	409	coastal margin	shelf	coarse sediments, wave rippled, seagrass	22SG	0-25	N	f
4190	411	coastal margin	shelf	coarse sediments, irregular, seagrass	23SG	0-25	N	f
4191	413	coastal margin	shelf	Coarse sediments, subcrop, bivalve beds	25BV	0-25	N	g
4192	414	coastal margin	shelf	coarse sediments, subcrop, seagrass	25SG	0-25	N	f
4193	418	coastal margin	shelf	Gravel, irregular, seagrass	33SG	0-25	Y	f
4194	420	coastal margin	shelf	Gravel, subcrop, hard corals	35HC	0-25	Y	GoC Image data
4195	422	coastal margin	shelf	Biogenic, subcrop, hard corals	65HC	0-25	Y	GoC Image Data
4196	423	coastal margin	shelf	Biogenic, subcrop, seagrass	65SG	0-25	N	f
4197	425	coastal margin	shelf, fringing reef	Biogenic, low outcrop, hard corals	66HC	0-25	Y	GoC Image Data
4198	426	coastal margin	shelf, fringing reef	Biogenic, low outcrop, seagrass	66SG	0-25	N	f
4199	428	coastal margin	shelf, fringing reef	Biogenic, high outcrop, hard corals	68HC	0-25	Y	GoC Image Data
4200	429	coastal margin	shelf, fringing reef	Biogenic, high outcrop, seagrass	68SG	0-25	N	f
4201	432	coastal margin	shelf	Biogenic, subcrop, bivalve beds	75BV	0-25	N	g
4202	435	coastal margin	shelf	Biogenic, low outcrop, bivalve beds	76BV	0-25	N	g
4203	299	inner shelf	shelf	mud, flat, no fauna	000	25- 100	N	
4204	300	inner shelf	shelf	mud, flat, low encrusting sponges	002	25- 100	N	
4205	301	inner shelf	shelf	mud, flat, octocorals	005	25- 100	Y	GoC Image Data
4206	302	inner shelf	shelf	mud, flat, sedentary (eg seapens)	007	25- 100	Y	GoC Image Data
4207	303	inner shelf	shelf	mud, directed scour, no fauna	010	25- 100	Y	GoC Image Data
4208	304	inner shelf	shelf	mud, directed scour, mixed faunal community	013	25- 100	Y	GoC Image Data
4209	305	inner shelf	shelf	mud, directed scour, bioturbators	019	25- 100	Y	GoC Image Data
4210	307	inner shelf	shelf	mud, irregular, mixed faunal community	033	25- 100	Y	GoC Image Data
4211	309	inner shelf	shelf	mud, irregular, bioturbators	039	25- 100	Y	GoC Image Data

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4212	310	inner shelf	shelf	mud, subcrop, erect sponges	051	25- 100	Y	GoC Image Data
4213	311	inner shelf	shelf	mud, subcrop, small sponges	052	25- 100	Y	GoC Image Data
4214	313	inner shelf	shelf	mud, subcrop, mixed faunal community	053	25- 100	Y	GoC Image Data
4215	315	inner shelf	shelf	mud, subcrop, octocorals	055	25- 100	Y	GoC Image Data
4216	316	inner shelf	shelf	mud, subcrop, low encrusting mixed fauna	056	25- 100	Y	GoC Image Data
2198	094	inner shelf	shelf	Fine sediments, unrippled, small sponges	102	25- 100	Y	Norfanz Image Collection
4217	318	Inner shelf	shelf	fine sediments, irregular, no fauna	130	25- 100	Y	GoC Image Data
4218	092	inner shelf	shelf	fine sediments, irregular, small sponges	132	25- 100	Y	GoC Image Data
4219	319	inner shelf	shelf	fine sediments, irregular, octocorals	135	25- 100	Y	GoC Image Data
4220	320	inner shelf	shelf	fine sediments, irregular, low encrustings	136	25- 100	Y	GoC Image Data
4221	321	inner shelf	shelf	fine sediments, irregular, bioturbators	139	25- 100	Y	GoC Image Data
4222	013	inner shelf	shelf	coarse sediments, flat, large sponges	201	25- 100	Y	GoC Image Data
4223	322	inner shelf	shelf	Coarse sediments, flat, mixed faunal community	203	25- 100	Y	GoC Image Data
4224	234	inner shelf	shelf	Coarse sediments, flat, solitary epifauna	207	25- 100	Y	GoC Image Data
1992	191	inner shelf	shelf	coarse sediments, wave rippled, small sponges	222	25- 100	N	
2081	200	inner shelf	shelf	coarse sediments, wave rippled, encrustors	226	25- 100	N	
4225	323	inner shelf	shelf	coarse sediments, irregular, small sponges	232	25- 100	Y	Goc Image Data
4226	324	inner shelf	shelf	coarse sediments, irregular, octocorals	235	25- 100	Y	Goc Image Data
4228	006	inner shelf	shelf	coarse sediments, subcrop, large sponges	251	25- 100	Y	GoC Image Data
2219	282	inner shelf	shelf	Coarse sediments, subcrop, mixed faunal community	253	25- 100	Y	Norfanz Image Collection
4230	325	inner shelf	shelf	gravel, flat, large sponges	301	25- 100	Y	GoC Image Data
4231	326	inner shelf	shelf	gravel, flat, mixed faunal community	303	25- 100	Y	GoC Image Data
4232	327	inner shelf	shelf	gravel, flat, octocorals	305	25- 100	Y	GoC Image Data

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4233	328	inner shelf	shelf	gravel, flat, encrustors	306	25- 100	Y	GoC Image Data
4234	329	inner shelf	shelf	gravel, flat, sedentary	307	25- 100	Y	GoC Image Data
4235	331	inner shelf	shelf	gravel/ pebble, directed scour, large sponges	311	25- 100	Y	GoC Image data
4236	001	inner shelf	shelf	gravel/ pebble, directed scour, mixed faunal community	313	25- 100	Y	GoC Image data
4237	332	inner shelf	shelf	gravel/ pebble, directed scour, octocorals	315	25- 100	Y	GoC Image data
4238	333	inner shelf	shelf	gravel/ pebble, directed scour, sedentary	317	25- 100	Y	GoC Image data
4239	242	inner shelf	shelf	Gravel, irregular, no fauna	330	25- 100	Y	GoC Image Data
4240	335	inner shelf	shelf	Gravel, irregular, small sponges	332	25- 100	Y	GoC Image Data
4241	336	inner shelf	shelf	Gravel, irregular, octocorals	335	25- 100	Y	GoC Image Data
4242	337	inner shelf	shelf	Gravel, irregular, low encrustings	336	25- 100	Y	GoC Image Data
4243	338	inner shelf	shelf	gravel/ pebble, subcrop, large sponges	351	25- 100	Y	GoC Image Data
4244	339	inner shelf	shelf	gravel/ pebble, subcrop, mixed faunal community	353	25- 100	Y	GoC Image Data
4245	341	inner shelf	shelf	gravel/ pebble, subcrop, octocorals	355	25- 100	Y	GoC Image Data
4246	343	inner shelf	shelf	gravel/ pebble, subcrop, sedentary	357	25- 100	Y	GoC Image Data
2068	199	inner shelf	shelf	cobble, wave rippled, low/ encrusting mixed fauna	426	25- 100	N	
4247	344	inner shelf	shelf	Sedimentary rock (?), subcrop, no fauna	650	25- 100	Y	GoC Image Data
4248	345	inner shelf	shelf	Sedimentary rock (?), Subcrop, large sponges	651	25- 100	Y	GoC Image Data
4249	346	inner shelf	shelf	Sedimentary rock (?), subcrop, mixed faunal community	653	25- 100	Y	GoC Image Data
4250	347	inner shelf	shelf	Sedimentary rock (?), Subcrop, Octocorals	655	25- 100	Y	GoC Image Data
4251	348	inner shelf	shelf	Sedimentary rock (?), subcrop, small/ low encrustors	656	25- 100	Y	GoC Image Data
4252	349	inner shelf	shelf	Sedimentary Rock (?), subcrop, sedentary	657	25- 100	Y	GoC Image Data
4253	350	inner shelf	shelf, bioherm	Sedimentary rock (?), low outcrop, large sponges	661	25- 100	Y	GoC Image Data
4254	351	inner shelf	shelf, bioherm	Sedimentary rock (?), low outcrop, mixed faunal community	663	25- 100	Y	GoC Image Data

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4255	352	inner shelf	shelf, bioherm	Sedimentary rock (?), low outcrop, octocorals	665	25- 100	Y	GoC Image Data
4256	353	inner shelf	shelf, bioherm	Sedimentary rock (?), low outcrop, encrustors	666	25- 100	Y	GoC Image Data
4257	354	inner shelf	shelf, bioherm	Sedimentary rock (?), low outcrop, sedentary	667	25- 100	Y	GoC Image Data
4258	004	inner shelf	shelf, bioherm	Sedimentary rock (?), low outcrop, large sponges	671	25- 100	Y	GoC Image Data
4259	355	inner shelf	shelf, bioherm	Sedimentary rock (?), low outcrop, mixed faunal community	673	25- 100	Y	GoC Image Data
4260	356	inner shelf	shelf, bioherm	Sedimentary rock (?), low outcrop, octocorals	675	25- 100	Y	GoC Image Data
4261	357	inner shelf	shelf, bioherm	Sedimentary rock (?), low outcrop, encrustors	676	25- 100	Y	GoC Image Data
4262	358	inner shelf	shelf, bioherm	Sedimentary rock (?), low outcrop, sedentary	677	25- 100	Y	GoC Image Data
4263	359	inner shelf	shelf, bioherm	Sedimentary rock (?), high outcrop, mixed faunal community	683	25- 100	Y	GoC Image Data
4264	360	inner shelf	shelf, bioherm	Sedimentary rock (?), high outcrop, octocorals	685	25- 100	Y	GoC Image Data
4265	361	inner shelf	shelf, bioherm	Sedimentary rock (?), high outcrop, encrustors	686	25- 100	Y	GoC Image Data
4266	003	inner shelf	shelf, bioherm	Sedimentary rock (?), high outcrop, mixed faunal community	693	25- 100	Y	GoC Image Data
4267	362	inner shelf	shelf, bioherm	Sedimentary rock (?), high outcrop, octocorals	695	25- 100	Y	GoC Image Data
4268	363	inner shelf	shelf, bioherm	Sedimentary rock (?), high outcrop, encrustors	696	25- 100	Y	GoC Image Data
4269	273	inner shelf	shelf, fringing reef, bioherm	Biogenic, subcrop, large sponges	751	25- 100	Y	GoC Image Data
4270	366	inner shelf	shelf, fringing reef, bioherm	Biogenic, subcrop, mixed faunal community	753	25- 100	Y	GoC Image Data
4271	368	inner shelf	shelf, fringing reef, bioherm	Biogenic, subcrop, octocorals	755	25- 100	Y	GoC Image Data
4272	274	inner shelf	shelf, fringing reef, bioherm	Biogenic, subcrop, small/ low encrustors	756	25- 100	Y	GoC Image Data
4273	370	inner shelf	shelf, fringing reef, bioherm	Biogenic, subcrop, sedentary	757	25- 100	Y	GoC Image Data
4274	371	inner shelf	shelf, fringing reef, bioherm	Biogenic, low outcrop, large sponges	761	25- 100	Y	GoC Image Data
4275	275	inner shelf	shelf, fringing reef, bioherm	Biogenic, low outcrop, mixed faunal community	763	25- 100	Y	GoC Image Data
4276	276	inner shelf	shelf, fringing reef, bioherm	Biogenic, low outcrop, octocorals	765	25- 100	Y	GoC Image Data
4277	375	inner shelf	shelf, fringing reef, bioherm	Biogenic, low outcrop, encrustors	766	25- 100	Y	GoC Image Data

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4278	377	inner shelf	shelf, fringing reef, bioherm	Biogenic, low outcrop, sedentary	767	25- 100	Y	GoC Image Data
4279	379	inner shelf	shelf, fringing reef, bioherm	Biogenic, low outcrop, large sponges	771	25- 100	Y	GoC Image Data
4280	277	inner shelf	shelf, fringing reef, bioherm	Biogenic, low outcrop, mixed faunal community	773	25- 100	Y	GoC Image Data
4281	381	inner shelf	shelf, fringing reef, bioherm	Biogenic, low outcrop, octocorals	775	25- 100	Y	GoC Image Data
4282	383	inner shelf	shelf, fringing reef, bioherm	Biogenic, low outcrop, encrustors	776	25- 100	Y	GoC Image Data
4283	385	inner shelf	shelf, fringing reef, bioherm	Biogenic, low outcrop, sedentary	777	25- 100	Y	GoC Image Data
4284	387	inner shelf	shelf, fringing reef, bioherm	Biogenic, high outcrop, mixed faunal community	783	25- 100	Y	GoC Image Data
4285	389	inner shelf	shelf, fringing reef, bioherm	Biogenic, high outcrop, octocorals	785	25- 100	Y	GoC Image Data
4286	390	inner shelf	shelf, fringing reef, bioherm	Biogenic, high outcrop, encrustors	786	25- 100	Y	GoC Image Data
4287	278	inner shelf	shelf, fringing reef, bioherm	Biogenic, high outcrop, mixed faunal community	793	25- 100	Y	GoC Image Data
4288	392	inner shelf	shelf, fringing reef, bioherm	Biogenic, high outcrop, octocorals	795	25- 100	Y	GoC Image Data
4289	393	inner shelf	shelf, fringing reef, bioherm	Biogenic, high outcrop, encrustors	796	25- 100	Y	GoC Image Data
4290	397	inner shelf	shelf	mud, subcrop, bivalve beds	05BV	25- 100	N	g
4291	399	inner shelf	shelf	mud, subcrop, hard corals	05HC	25- 100	Y	Npf Image Data
4292	404	Inner shelf	shelf	fine sediments, irregular, hard corals	13HC	25- 100	Y	GoC Image Data
4293	407	inner shelf	shelf	Coarse sediments, flat, hard corals	20HC	25- 100	Y	GoC Image Data
4294	410	inner shelf	shelf	coarse sediments, irregular, hard corals	23HC	25- 100	Y	Goc Image Data
4295	412	inner shelf	shelf	Coarse sediments, subcrop, bivalve beds	25BV	25- 100	N	g
4296	415	inner shelf	shelf	gravel, flat, hard corals	30HC	25- 100	Y	GoC Image Data
4297	416	inner shelf	shelf	gravel/ pebble, directed scour, hard corals	31HC	25- 100	Y	GoC Image data
4298	417	inner shelf	shelf	Gravel, irregular, Hard corals	33HC	25- 100	Y	GoC Image Data
4299	419	inner shelf	shelf	gravel/ pebble, subcrop, hard corals	35HC	25- 100	Y	GoC Image Data
4300	421	inner shelf	shelf	Sedimentary Rock (?), subcrop, hard corals	65HC	25- 100	Y	GoC Image Data

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4301	424	inner shelf	shelf, bioherm	Sedimentary rock (?), low outcrop, hard corals	66HC	25- 100	Y	GoC Image Data
4302	427	inner shelf	shelf, bioherm	Sedimentary rock (?), high outcrop, hard corals	68HC	25- 100	Y	GoC Image Data
4303	430	inner shelf	shelf, bioherm	Sedimentary rock (?), high outcrop, hard corals	69HC	25- 100	Y	GoC Image Data
4304	431	inner shelf	shelf	Biogenic, subcrop, bivalve beds	75BV	25- 100	N	g
4305	433	inner shelf	shelf, fringing reef, bioherm	Biogenic, subcrop, hard corals	75HC	25- 100	Y	GoC Image Data
4306	434	inner shelf	shelf	Biogenic, low outcrop, bivalve beds	76BV	25- 100	N	g
4307	436	inner shelf	shelf, fringing reef, bioherm	Biogenic, low outcrop, hard corals	76HC	25- 100	Y	GoC Image Data
4308	437	inner shelf	shelf, fringing reef, bioherm	Biogenic, high outcrop, hard corals	78HC	25- 100	Y	GoC Image Data
4309	438	inner shelf	shelf, fringing reef, bioherm	Biogenic, high outcrop, hard corals	79HC	25- 100	Y	GoC Image Data
2239	283	inner shelf	shelf	Bryozoan communities	XX6	25- 100	Y	Norfanz Image Collection
0123	012	inner-shelf	shelf	fine sediments, unrippled, large sponges	101	25- 100	Y	
0159	016	inner-shelf	shelf	fine sediments, unrippled, mixed faunal community	103	25- 100	Y	
0895	093	inner-shelf	shelf	fine sediments, unrippled, bioturbators	109	25- 100	N	
0147	014	inner-shelf	shelf	fine sediments, wave rippled, large sponges	111	25- 100	Y	
0919	095	inner-shelf	shelf	fine sediments, wave rippled, no fauna	120	25- 100	N	
0931	096	inner-shelf	shelf	fine sediments, wave rippled, small sponges	122	25- 100	N	
0871	091	inner-shelf	shelf	fine sediments, irregular, large sponges	131	25- 100	N	
0098	010	inner-shelf	shelf	coarse sediments, current rippled, no fauna	210	25- 100	Y	
0859	090	inner-shelf	shelf	coarse sediments, current rippled, bioturbators	219	25- 100	N	
0110	011	inner-shelf	shelf	coarse sediments, wave rippled, large sponges	221	25- 100	Y	
0086	009	inner-shelf	shelf	coarse sediments, wave rippled, sedentary	227	25- 100	Y	
0847	089	inner-shelf	shelf	coarse sediments, irregular, encrustors	236	25- 100	N	
0956	098	inner-shelf	shelf	gravel, wave rippled, no fauna	320	25- 100	Y	SE Image Collection

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
0944	097	inner-shelf	shelf	gravel, wave rippled, bioturbators	329	25- 100	Y	SE Image Collection
0074	007	inner-shelf	shelf	gravel, debris flow, mixed faunal community	343	25- 100	Y	
0050	005	inner-shelf	shelf	cobble, debris flow, large sponges	441	25- 100	Y	
0968	099	inner-shelf	shelf	Igneous rock, high outcrop, large sponges	591	25- 100	N	
0014	002	inner-shelf	shelf	Sedimentary rock, outcrop, large sponges	691	25- 100	Y	
4360	173	outer shelf	shelf-break	mud, unrippled, no fauna	000	100- 200, 200- 700	N	SE Image Collection
4384	219	outer shelf	shelf	mud, unrippled, small or large sponges	001	100- 200	Y	WA Image Collection
4364	177	outer shelf	shelf	mud, unrippled, low encrusting sponges	002	100- 200	N	SE Image Collection
4385	220	outer shelf	shelf	Mud, flat, octocorals	005	100- 200	Y	WA Image Collection
4361	174	outer shelf	shelf-break	mud, unrippled, sedentary	007	100- 200, 200- 700	N	SE Image Collection
4365	178	outer shelf	shelf	mud, unrippled, bioturbators	009	100- 200	N	SE Image Collection
4400	279	outer shelf	shelf	mud, current rippled, no fauna	010	100- 200	Y	WA Image Collection
4386	223	outer shelf	shelf	mud, current rippled, bioturbators	019	100- 200	Y	WA Image Collection
4387	224	outer shelf	shelf	mud, wave rippled, no fauna	020	100- 200	Y	WA Image Collection
4388	225	outer shelf	shelf	Mud, irregular, bioturbators	039	100- 200	Y	WA Image Collection
4366	179	outer shelf	shelf	mud, subcrop, erect sponges	051	100- 200	N	SE Image Collection
4350	125	outer shelf	shelf	mud, subcrop, small sponges	052	100- 200	Y	SE Image Collection
4389	226	outer shelf	shelf	Mud, subcrop, mixed faunal community	053	100- 200	Y	WA Image Collection
4367	180	outer shelf	shelf	mud, subcrop, low encrusting mixed fauna	056	100- 200	N	SE Image Collection
4357	170	outer shelf	shelf-break	fine sediments, unrippled, no fauna	100	100- 200, 200- 700	N	SE Image Collection
2258	113	outer shelf	shelf	Fine sediments, unrippled, small sponges	102	100- 200	Y	Norfanz Image Collection

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4358	171	outer shelf	shelf-break	fine sediments, unrippled, octocorals	105	100- 200, 200- 700	N	SE Image Collection
4368	181	outer shelf	shelf	fine sediments, unrippled, encrustors	106	100- 200	N	SE Image Collection
4335	110	outer shelf	shelf	fine sediments, unrippled, bioturbators	109	100- 200	Y	SE Image Collection
4356	169	outer shelf	shelf-break	fine sediments, unrippled, bioturbators	109	100- 200, 200- 700	N	SE Image Collection
4369	183	outer shelf	shelf	fine sediments, current rippled, no fauna	110	100- 200	N	SE Image Collection
4370	184	outer shelf	shelf	fine sediments, current rippled, low/ encrusting sponges	112	100- 200	N	SE Image Collection
4342	117	outer shelf	shelf	fine sediments, wave rippled, no fauna	120	100- 200	N	SE Image Collection
4341	116	outer shelf	shelf	fine sediments, wave rippled, large sponges	121	100- 200	N	SE Image Collection
4344	119	outer shelf	shelf	fine sediments, wave rippled, small sponges	122	100- 200	N	SE Image Collection
4340	115	outer shelf	shelf	fine sediments, wave rippled, encrustors	126	100- 200	N	SE Image Collection
4343	118	outer shelf	shelf	fine sediments, wave rippled, sedentary	127	100- 200	N	SE Image Collection
4339	114	outer shelf	shelf	fine sediments, wave rippled, bioturbators	129	100- 200	Y	SE Image Collection
4331	106	outer shelf	shelf	fine sediments, irregular, no fauna	130	100- 200	N	SE Image Collection
4330	105	outer shelf	shelf	fine sediments, irregular, large sponges	131	100- 200	N	SE Image Collection
4332	107	outer shelf	shelf	fine sediments, irregular, small sponges	132	100- 200	N	SE Image Collection
4355	168	outer shelf	shelf-break	fine sediments, irregular, small sponges	132	100- 200, 200- 700	N	SE Image Collection
4371	185	outer shelf	shelf	fine sediments, irregular, low encrusting mixed fauna	136	100- 200	N	SE Image Collection
4354	167	outer shelf	shelf-break	fine sediments, irregular, bioturbators	139	100- 200, 200- 700	N	SE Image Collection
4372	187	outer shelf	shelf	fine sediments, irregular, bioturbators	139	100- 200	N	SE Image Collection
4373	188	outer shelf	shelf	fine sediments, rubble banks, low encrusting sponges	142	100- 200	N	SE Image Collection

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4310	017	outer shelf	shelf	fine sediments, subcrop, large sponges	151	100- 200	Y	SE Image Collection
4334	109	outer shelf	shelf	fine sediments, subcrop, small sponges	152	100- 200	Y	SE Image Collection
4333	108	outer shelf	shelf	fine sediments, subcrop, mixed faunal community	153	100- 200	N	SE Image Collection
4374	189	outer shelf	shelf	fine sediments, subcrop, mixed low fauna	156	100- 200	N	SE Image Collection
4375	190	outer shelf	shelf	coarse sediments, unrippled, no fauna	200	100- 200	N	SE Image Collection
4322	030	outer shelf	shelf	coarse sediments, unrippled, mixed faunal community	203	100- 200	Y	SE Image Collection
4390	233	outer shelf	shelf	Coarse sediments, unrippled, octocoral/ and bryozoans??	205	100- 200	Y	WA Image Collection
4318	026	outer shelf	shelf	coarse sediments, unrippled, encrustors	206	100- 200	Y	SE Image Collection
4319	027	outer shelf	shelf	coarse sediments, current rippled, no fauna	210	100- 200	Y	SE Image Collection
4317	025	outer shelf	shelf	coarse sediments, wave rippled, no fauna	220	100- 200	Y	SE Image Collection
4328	103	outer shelf	shelf	coarse sediments, wave rippled, small sponges	222	100- 200	N	SE Image Collection
4327	102	outer shelf	shelf	coarse sediments, wave rippled, encrustors	226	100- 200	N	SE Image Collection
4321	029	outer shelf	shelf	coarse sediments, irregular, large sponges	231	100- 200	Y	SE Image Collection
4312	019	outer shelf	terrace, shelf	coarse sediments, subcrop, large sponges	251	100- 200	Y	SE Image Collection
4326	101	outer shelf	shelf	coarse sediments, subcrop, small sponges	252	100- 200	N	SE Image Collection
4383	209	Outer shelf	terrace	Coarse sediments, Subcrop, Mixed faunal community	253	100- 200	Y	GAB Image Collection
4376	192	outer shelf	shelf	gravel/ pebble, current rippled, large sponges	311	100- 200	N	SE Image Collection
4377	193	outer shelf	shelf	gravel/ pebble, current rippled, mixed low fauna	316	100- 200	N	SE Image Collection
4345	120	outer shelf	shelf	gravel, current rippled, bioturbators	319	100- 200	N	SE Image Collection
4349	124	outer shelf	shelf	gravel, wave rippled, no fauna	320	100- 200	N	SE Image Collection
4348	123	outer shelf	shelf	gravel, wave rippled, large sponges	321	100- 200	N	SE Image Collection
4378	194	outer shelf	shelf	gravel/ pebble, wave rippled, low encrusting sponges	322	100- 200	N	SE Image Collection
4347	122	outer shelf	shelf	gravel, wave rippled, encrustors	326	100- 200	N	SE Image Collection

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4379	195	outer shelf	shelf	gravel, wave rippled, encrustors	326	100- 200	N	SE Image Collection
4346	121	outer shelf	shelf	gravel, wave rippled, bioturbators	329	100- 200	Y	SE Image Collection
4316	024	outer shelf	shelf	gravel, irregular, encrustors	336	100- 200	Y	SE Image Collection
4380	196	outer shelf	shelf	gravel, wave rippled, encrustors	346	100- 200	N	SE Image Collection
4320	028	outer shelf	shelf	cobble, unrippled, large sponges	401	100- 200	Y	SE Image Collection
4381	197	outer shelf	shelf	cobble, unrippled, low/ encrusting mixed fauna	406	100- 200	N	SE Image Collection
4382	198	outer shelf	shelf	cobble, current rippled, low/ encrusting mixed fauna	416	100- 200	N	SE Image Collection
4323	032	outer shelf	shelf	cobble, subcrop, crinoids	454	100- 200	Y	SE Image Collection
4313	020	outer shelf	shelf	cobble, outcrop, crinoids	464	100- 200	Y	SE Image Collection
4391	246	outer shelf	shelf	cobble/boulder (slab), outcrop, mixed low encrustors	466	100- 200	Y	WA Image Collection
4359	172	outer shelf	shelf-break	Igneous rock, high outcrop, no fauna	590	100- 200, 200- 700	N	SE Image Collection
4352	127	outer shelf	shelf	Sedimentary rock, subcrop, small sponges	652	100- 200	Y	SE Image Collection
4363	176	outer shelf	shelf-break	Sedimentary rock, subcrop, small sponges	652	100- 200, 200- 700	N	SE Image Collection
4314	022	outer shelf	shelf	Sedimentary rock, subcrop, mixed faunal community	653	100- 200	Y	SE Image Collection
4362	175	outer shelf	shelf-break	Sedimentary rock, subcrop, crinoids	654	100- 200, 200- 700	N	SE Image Collection
4392	254	outer shelf	shelf	Sedimentary rock (?), low outcrop, large erect sponges	661	100- 201	Y	WA Image Collection
4393	255	outer shelf	shelf	Sedimentary rock (?) low outcrop, mixed faunal community	663	100- 200	Y	WA Image Collection
4315	023	outer shelf	shelf	Sedimentary rock, outcrop, large sponges	671	100- 200	Y	SE Image Collection
4394	258	outer shelf	shelf	Sedimentary rock (?), low outcrop, mixed faunal community	673	100- 200	Y	WA Image Collection
4395	259	outer shelf	shelf	Sedimentary rock (?), low outcrop, encrustors	676	100- 200	Y	WA Image Collection
4396	260	outer shelf	shelf	Sedimentary rock (?), outcrop, solitary	677	100- 200	Y	WA Image Collection

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4401	280	outer shelf	shelf	Sedimentary rock (?), high outcrop, solitary	681	100- 201	Y	WA Image Collection
4397	263	outer shelf	shelf	Sedimentary rock (?), high outcrop, ?small sponges	682	100- 200	Y	WA Image Collection
4398	266	outer shelf	shelf	Sedimentary rock (?), high outcrop, large sponges	691	100- 200	Y	WA Image Collection
4399	268	outer shelf	shelf	Sedimentary rock (?), high outcrop, mixed faunal community	693	100- 200	Y	WA Image Collection
4311	018	outer shelf	shelf	Sedimentary rock, outcrop, encrustors	696	100- 200	Y	SE Image Collection
4402	281	outer shelf	shelf	Rock/ biogenic matrix, low outcrop, mixed faunal community	763	100-200	Y	WA Image Collection
2331	166	outer shelf	shelf-break	Bryozoan based commmunities	XX6	100- 200	Y	Norfanz Image Collection
0980	100	outer-shelf	shelf	mud, unrippled, sedentary	007	100- 200	Y	SE Image Collection
1130	112	outer-shelf	shelf	fine sediments, unrippled, no fauna	100	100- 200	Y	SE Image Collection
1118	111	outer-shelf	shelf	fine sediments, unrippled, large sponges	101	100- 200	Y	SE Image Collection
1030	104	outer-shelf	shelf	fine sediments, current rippled, bioturbators	119	100- 200	Y	SE Image Collection
1243	121	outer-shelf	shelf	gravel, wave rippled, bioturbators	329	100- 200	Y	SE Image Collection
1307	126	outer-shelf	shelf	Sedimentary rock, subcrop, large sponges	651	100- 200	Y	SE Image Collection
0667	065	outer-shelf	canyon	Sedimentary rock, outcrop, small sponges	672	100- 200	Y	SE Image Collection
4443	202	upper slope	terrace	Mud, Unrippled, No fauna	000	200-700	Y	GAB Image Collection
4438	143	upper slope	slope	mud, unrippled, large sponges	001	200- 700	N	SE Image Collection
4447	227	upper slope	slope	Fine sediments, unrippled, sponges	101	200- 700	Y	WA Image Collection
2340	137	upper slope	slope	Fine sediments, unrippled, small sponges	102	200- 700	Y	Norfanz Image Collection
4448	231	upper slope	slope	Fine sediments, irregular, glass sponge	137	200- 700	Y	WA Image Collection
4409	041	upper slope	slope	fine, irregular, bioturbators	139	200- 700	3	WA Image Collection
4408	040	upper slope	slope	fine sediments, subcrop, sedentary	157	200- 700	Y	SE Image Collection
2351	284	upper slope	slope	Coarse sediments, unrippled, large sponges	201	200- 700	Y	Norfanz Image Collection
2352	285	upper slope	slope	Coarse sediments, unrippled, octocorals	205	200- 700	Y	Norfanz Image Collection

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4410	043	upper slope	slope	coarse sediments, unrippled, low mixed encrustors	206	200- 700	Y	SE Image Collection
4449	235	upper slope	slope	Coarse sediments, rippled, no fauna	210	200- 700	Y	WA Image Collection
4450	236	upper slope	slope	Coarse sand, rippled, solitary epifauna	217	200- 700	Y	WA Image Collection
4451	237	upper slope	slope	Coarse sand, wave rippled, bryozoan turf	226	200- 700	Y	WA Image Collection
4452	238	upper slope	slope	Coarse sediments, irregular, octocorals	235	200- 700	Y	WA Image Collection
4453	239	upper slope	slope	Coarse sediments, subcrop, large sponges	251	200- 700	Y	WA Image Collection
4454	240	upper slope	slope	Sedimentary, subcrop, octocorals	255	200- 700	Y	WA Image Collection
4455	241	upper slope	slope	Coarse sediments, subcrop, low encrusting community	256	200- 700	Y	WA Image Collection
4434	139	upper slope	slope	gravel, debris flow, no fauna	340	200- 700	N	SE Image Collection
4433	138	upper slope	slope	gravel, debris flow, encrustors	346	200- 700	Y	SE Image Collection
2370	286	upper slope	slope	Cobble/ boulder, debris, sedentary	447	200- 700	Y	Norfanz Image Collection
2372	247	upper slope	slope	Boulders, low outcrop, no fauna	470	200- 700	Y	Norfanz Image Collection
2373	287	upper slope	slope	slabs and boulders, low outcrop, octocorals	475	200- 700	Y	Norfanz Image Collection
2374	288	upper slope	slope	Igneous Rock (?), low outcrop, octocorals	565	200- 700	Y	Norfanz Image Collection
2375	289	upper slope	slope	Igneous Rock (?), low outcrop, mixed faunal community	573	200- 700	Y	Norfanz Image Collection
2376	290	upper slope	slope	Igneous Rock (?), high outcrop, no fauna	590	200- 700	Y	Norfanz Image Collection
2377	291	upper slope	slope	Igneous Rock (?), high outcrop, mixed faunal community	593	200- 700	Y	Norfanz Image Collection
4457	251	upper slope	slope	Sedimentary, subcrop, no fauna	650	200- 700	Y	WA Image Collection
4403	033	upper slope	slope	Sedimentary rock, subcrop, mixed faunal community	653	200- 700	Y	SE Image Collection
4442	148	upper slope	terrace, slope	Sedimentary rock, Subcrop, Octocorals (gold corals / seawhips)	655	200-700	Y	GAB Image Collection
4406	036	upper slope	slope	Sedimentary, subcrop, small encrustors	656	200- 700	Y	WA Image Collection
2384	292	upper slope	slope	Sedimentary Rock (?), subcrop, sedentary	657	200- 700	Y	Norfanz Image Collection
4458	256	upper slope	slope	Sedimentary, outcrop, octocorals	665	200- 700	Y	WA Image Collection

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4405	035	upper slope	slope	Sedimentary rock, outcrop, encrustors	666	200- 700	Y	SE Image Collection
4459	257	upper slope	shelf break	Sedimentary, low outcrop, no fauna	670	200- 700	3	WA Image Collection
4440	145	upper slope	slope, canyon	Sedimentary, low outcrops on steep slope, large sponges	671	200- 700	2	WA Image Collection
4444	216	upper slope	canyon	Sedimentary rock, low outcrop, Octocorals	675	200-700	Y	GAB Image Collection
4460	261	upper slope	slope	Sedimentary, outcrop, sedentary (anemones)	677	200- 700	Y	WA Image Collection
4461	264	upper slope	slope	Sedimentary, high outcrop, octocoral	683	200- 700	Y	WA Image Collection
4407	039	upper slope	slope	Sedimentary rock, outcrop, crinoids	684	200- 700	Y	SE Image Collection
4445	217	upper slope	canyon	Sedimentary rock, High Outcrop, Small encrustors	686	200-700	Y	GAB Image Collection
4446	218	upper slope	canyon	Sedimentary rock, High Outcrop, Sedentary	687	200-700	Y	GAB Image Collection
4462	265	upper slope	slope	Sedimentary rock (mudstone?), high outcrop, no fauna	690	200- 700	3	WA Image Collection
4463	267	upper slope	slope	Sedimentary rock (mudstone?), high outcrop, small sponges	692	200- 700	Y	WA Image Collection
4464	269	upper slope	slope	Sedimentary, outcrop, octocorals	695	200- 700	Y	WA Image Collection
4404	034	upper slope	slope	Sedimentary rock, outcrop, encrustors	696	200- 700	Y	SE Image Collection
4465	270	upper slope	slope	Sedimentary, high outcrop, solitary epifauna	697	200- 700	Y	WA Image Collection
2400	293	upper slope	slope	Rock/ biogenic matrix, low outcrop, mixed faunal community	763	200- 700	Y	Norfanz Image Collection
2401	128	upper slope	slope	Bryozoan based communities	XX6	200- 700	Y	Norfanz Image Collection
1488	142	upper-slope	slope	mud, unrippled, encrustors	006	200- 700	Y	SE Image Collection
1512	144	upper-slope	slope	mud, unrippled, sedentary	007	200- 700	Y	SE Image Collection
1476	141	upper-slope	slope	mud, unrippled, bioturbators	009	200- 700	Y	SE Image Collection
1464	140	upper-slope	slope	mud, irregular, bioturbators	039	200- 700	Y	SE Image Collection
0463	046	upper-slope	slope	fine sediments, unrippled, no fauna	100	200- 700	Y	SE Image Collection
1416	136	upper-slope	slope	fine sediments, unrippled, encrustors	106	200- 700	Y	SE Image Collection
0787	078	upper-slope	canyon	fine sediments, unrippled, sedentary	107	200- 700	Y	SE Image Collection

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
0439	044	upper-slope	slope, canyon	fine sediments, unrippled, bioturbators	109	200- 700	Y	SE Image Collection
1392	133	upper-slope	slope	fine sediments, current rippled, no fauna	110	200- 700	N	
0751	073	upper-slope	canyon	fine sediments, irregular, encrustors	136	200- 700	Y	SE Image Collection
1404	134	upper-slope	slope	fine sediments, subcrop, large sponges	151	200- 700	N	
0775	077	upper-slope	canyon, slope	fine sediments, subcrop, small sponges	152	200- 700	Y	SE Image Collection
0451	045	upper-slope	slope	coarse sediments, unrippled, sedentary	207	200- 700	Y	SE Image Collection
0763	076	upper-slope	canyon, slope	coarse sediments, irregular, low mixed encrustors	236	200- 700	Y	SE Image Collection
0739	072	upper-slope	canyon	coarse sediments, irregular, bioturbators	239	200- 700	Y	SE Image Collection
1356	130	upper-slope	slope	cobble, debris flow, no fauna	440	200- 700	Y	SE Image Collection
1380	132	upper-slope	slope	cobble, debris flow, small sponges	442	200- 700	Y	SE Image Collection
1368	131	upper-slope	slope	cobble, debris flow, octocorals	445	200- 700	N	
1344	129	upper-slope	slope	cobble, debris flow, encrustors	446	200- 700	Y	SE Image Collection
0703	069	upper-slope	canyon	cobble, outcrop, crinoids	464	200- 700	Y	SE Image Collection
0811	081	upper-slope	seamount	Sedimentary rock, unrippled, no fauna	600	200- 700	Y	SE Image Collection
0835	085	upper-slope	seamount	Sedimentary rock, unrippled, encrustors	606	200- 700	Y	SE Image Collection
0691	067	upper-slope	canyon, slope	Sedimentary rock, subcrop, large sponges	651	200- 700	Y	SE Image Collection
0715	070	upper-slope	canyon	Sedimentary rock, subcrop, small sponges	652	200- 700	Y	SE Image Collection
1536	146	upper-slope	slope	Sedimentary rock, low outcrop, small sponges	672	200- 700	Y	SE Image Collection
0727	071	upper-slope	canyon	Sedimentary rock, outcrop, encrustors	676	200- 700	Y	SE Image Collection
0799	080	upper-slope	seamount	Sedimentary rock, outcrop, encrustors	676	200- 700	Y	SE Image Collection
0679	066	upper-slope	canyon	Sedimentary rock, outcrop, crinoids	694	200- 700	Y	SE Image Collection
4508	161	mid-slope	slope	mud, unrippled, small sponges	002	700- 1500	N	SE Image Collection
4520	221	mid-slope	slope	Mud, irregular, crinoids	005	700-1500	Y	WA Image Collection

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4521	222	mid-slope	slope	Mud, flat, solitary	007	700-1500	Y	WA Image Collection
4505	158	mid-slope	slope	mud, current rippled, bioturbators	019	700- 1500	N	SE Image Collection
4507	160	mid-slope	slope	mud, irregular, sedentary	037	700- 1500	N	SE Image Collection
4506	159	mid-slope	slope	Mud, irregular, bioturbators	039	700-1500	Y	WA Image Collection
2408	156	mid-slope	slope	Fine sediments, unrippled, no fauna	100	700- 1500	Y	Norfanz Image Collection
0643	063	mid-slope	slope	fine sediments, unrippled, octocorals	105	700- 1500	Y	SE Image Collection
4522	228	mid-slope	slope	Fine, unrippled, solitary	107	700-1500	Y	WA Image Collection
2411	294	mid-slope	slope	Fine sediments, unrippled, bioturbators	109	700- 1500	Y	Norfanz Image Collection
4523	230	mid-slope	slope	fine sediments, irregular, no fauna	130	700-1500	Y	WA Image Collection
0619	061	mid-slope	slope	fine sediments, irregular, bioturbators	139	700- 1500	Y	SE Image Collection
0571	057	mid-slope	slope	fine sediments, subcrop, bioturbators	150	700- 1500	Y	SE Image Collection
4524	232	mid-slope	slope	Fine sediments, subcrop, octocorals	155	700-1500	Y	WA Image Collection
2416	295	mid-slope	slope	Fine sediments, subcrop, encrustors	156	700- 1500	Y	Norfanz Image Collection
4499	153	mid-slope	slope	coarse sediments, unrippled, no fauna	200	700- 1500	N	SE Image Collection
0631	062	mid-slope	slope	coarse sediments, unrippled, octocorals	205	700- 1500	Y	SE Image Collection
4496	150	mid-slope	slope	coarse sediments, current rippled, no fauna	210	700- 1500	N	SE Image Collection
4497	151	mid-slope	slope	coarse sediments, current rippled, octocorals	215	700- 1500	N	SE Image Collection
4512	207	mid-slope	terrace	Coarse sediments, directed scour, Small encrustors / erect forms (including bryozoans)	216	700-1500	Y	GAB Image Collection
2421	152	mid-slope	slope	Coarse sediments, current rippled, sedentary	217	700- 1500	Y	Norfanz Image Collection
4498	152	mid-slope	slope	coarse sediments, current rippled, sedentary	217	700- 1500	N	SE Image Collection
2422	296	mid-slope	slope	Coarse sediments, irregular, no fauna	230	700- 1500	Y	Norfanz Image Collection
4513	208	mid-slope	seamount	Coarse sediments, Highly irregular, Mixed faunal community	233	700-1500	Y	GAB Image Collection

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
0595	059	mid-slope	slope	coarse sediments, irregular,low encrusting	236	700- 1500	Y	SE Image Collection
2424	297	mid-slope	slope	Coarse sediments, subcrop, no fauna	250	700- 1500	Y	Norfanz Image Collection
2425	298	mid-slope	slope	Coarse sediments, low outcrop, no fauna	260	700- 1500	Y	Norfanz Image Collection
4525	243	mid-slope	slope	Gravel, irregular, low encrustings	336	700-1500	2	WA Image Collection
0583	058	mid-slope	slope	cobble, unrippled, small sponges	402	700- 1500	Y	SE Image Collection
4526	244	mid-slope	slope	Igneous rock/boulder, rubble bank, none	440	700-1500	Y	WA Image Collection
4500	154	mid-slope	slope	cobble, debris flow, crinoids	444	700- 1500	N	SE Image Collection
4501	155	mid-slope	slope	slabs/ boulders, debris flow, octocorals	445	700- 1500	Y	SE Image Collection
0487	050	mid-slope	slope	cobble, debris flow, encrustors	446	700- 1500	Y	SE Image Collection
4514	210	mid-slope	seamount	Cobble/ boulder, Debris flow / rubble banks, Sedentary: e.g. seapens	447	700-1500	Y	GAB Image Collection
4527	245	mid-slope	slope	boulders and slabs, subcropping, octocorals	455	700-1500	Y	WA Image Collection
0499	051	mid-slope	slope	cobble, outcrop, no fauna	460	700- 1500	Y	SE Image Collection
0607	060	mid-slope	slope	cobble, outcrop, crinoids	464	700- 1500	Y	SE Image Collection
0655	064	mid-slope	slope	Sedimentary slab and mud boulders, outcrop, crinoids	464	700- 1500	Y	SE Image Collection
4528	248	mid-slope	slope	Igneous rock, rubble bank, no fauna	540	700-1500	Y	WA Image Collection
4529	249	mid-slope	seamount	Igneous rock, rubble bank, octocorals	545	700-1500	Y	WA Image Collection
4515	211	mid-slope	seamount	Igneous / metamorphic rock, Subcrop, Small encrustors	556	700-1500	Y	GAB Image Collection
4516	212	mid-slope	seamount	Igneous / metamorphic rock, Subcrop, Sedentary: e.g. seapens	557	700-1500	Y	GAB Image Collection
0523	053	mid-slope	slope	Igneous rock, low outcrop, sedentary	567	700- 1500	Y	SE Image Collection
4530	250	mid-slope	seamount	Igneous rock, low outcrop, no fauna	570	700-1500	Y	WA Image Collection
4517	213	mid-slope	seamount	Igneous / metamorphic rock, Low Outcrop, Octocorals	575	700-1500	Y	GAB Image Collection
4518	214	mid-slope	seamount	Igneous / metamorphic rock, Low Outcrop, Small encrustors	576	700-1500	Y	GAB Image Collection

ERAEF record No.	ERAEF Habitat Number	Sub-biome	Feature	Habitat type	SGF Score	Depth (m)	Image available	Reference image location
4519	215	mid-slope	seamount	Igneous / metamorphic rock, Low Outcrop, Sedentary	577	700-1500	Y	GAB Image Collection
4476	049	mid-slope	slope	Igneous rock, high outcrop, crinoids	594	700- 1500	Y	SE Image Collection
4504	157	mid-slope	slope	Igneous rock, high outcrop, octocoral	595	700-1500	Y	WA Image Collection
0547	055	mid-slope	slope	Sedimentary rock, unrippled, sedentary	607	700- 1500	Y	SE Image Collection
4509	162	mid-slope	slope	Sedimentary rock, debris flow, crinoids	644	700- 1500	N	SE Image Collection
4511	164	mid-slope	slope	Sedimentary rock, subcrop, crinoids	654	700- 1500	Y	SE Image Collection
1740	165	mid-slope	slope	Sedimentary rock, subcrop, octocorals	655	700- 1500	Y	SE Image Collection
4531	252	mid-slope	slope	Sedimentary, subcrop, small encrustors	656	700-1500	2	WA Image Collection
4532	253	mid-slope	slope	rock (conglomerate/sedimentary), subcrop, bioturbators	659	700-1500	Y	WA Image Collection
0559	056	mid-slope	slope, canyons, seamounts	Sedimentary rock, outcrop, mixed faunal community	673	700- 1500	Y	SE Image Collection
0511	052	mid-slope	slope	Sedimentary rock, outcrop, octocorals	675	700- 1500	Y	SE Image Collection
0823	084	mid-slope	seamount	Sedimentary rock, outcrop, sedentary	677	700- 1500	Y	SE Image Collection
4533	262	mid-slope	slope	sedimentary/mudstone, high outcrop, no fauna	680	700-1500	Y	WA Image Collection
0535	054	mid-slope	slope	Sedimentary rock, outcrop, crinoids	694	700- 1500	Y	SE Image Collection
4510	163	mid-slope	terrace	Sedimentary rock, High Outcrop, Octocorals	695	700-1500	Y	GAB Image Collection

Scoping Document S2B2. Pelagic Habitats

Table 2.8. Pelagic habitats for the Eastern Tuna and Billfish sub-fishery. Shading denotes habitats occurring within the jurisdictional boundary of the fishery that are not subject to effort from Pelagic Longlining methods. Bolded text refers to pelagic habitats where fishing effort has has occurred.

ERAEF Habitat Number	Pelagic Habitat type	Depth (m)	Comments	Reference
P1	**Eastern Pelagic Province - Coastal**	0 – 200		dow167A1, A2, A4
P2	**Eastern Pelagic Province - Oceanic**	0 – > 600	this is a compilation of the range covered by Oceanic Community (1) and (2)	dow167A1, A2, A4
P4	**North Eastern Pelagic Province - Oceanic**	0 – > 600	this is a compilation of the range covered by Oceanic Community (1) and (2)	dow167A1, A2, A4
P5	**Northern Pelagic Province - Coastal**	0 – 200		dow167A1, A2, A4
P7	Southern Pelagic Province - Coastal	0 – 200	this is a compilation of the range covered by Coastal pelagic Tas and GAB	dow167A1, A2, A4
P8	Southern Pelagic Province - Oceanic	0 – > 600	this is a compilation of the range covered by Oceanic Communities (1, 2 and 3)	dow167A1, A2, A4
P9	Southern Pelagic Province - Seamount Oceanic	0 – > 600	this is a compilation of the range covered by Seamount Oceanic Communities (1, 2 and 3)	dow167A1, A2, A4
P12	**Eastern Pelagic Province - Seamount Oceanic**	0 – > 600	this is a compilation of the range covered by Seamount Oceanic Communities (1) and (2)	dow167A1, A2, A4
P14	North Eastern Pelagic Province - Coastal	0 – 200		dow167A1, A2, A4
P15	North Eastern Pelagic Province - Plateau	0 – > 600	this is a compilation of the range covered by the Northeastern Plateau Community (1) and (2)	dow167A1, A2, A4
P16	North Eastern Pelagic Province - Seamount Oceanic	0 – > 600		dow167A1, A2, A4

Scoping Document S2C1. Demersal Communities

In ERAEF, communities are defined as the set of species assemblages that occupy the large scale provinces and biomes identified from national bioregionalisation studies. The biota includes mobile fauna, both vertebrate and invertebrate, but excludes sessile organisms such as corals that are largely structural and are used to identify benthic habitats. The same community lists are used for all fisheries, with those selected as relevant for a particular fishery being identified on the basis of spatial overlap with effort in the fishery. The spatial boundaries for demersal communities are based on IMCRA boundaries for the shelf, and on slope bioregionalisations for the slope (IMCRA 1998; Last et al. 2005). The spatial boundaries for the pelagic communities are based on pelagic bioregionalisations and on oceanography (Condie et al. 2003; Lyne and Hayes 2004). Fishery and region specific modifications to these boundaries are described in detail in Hobday et al. (2007) and briefly outlined in the footnotes to the community Tables below.

Table 2.9. Demersal communities that underlie the pelagic communities in which fishing activity can occurs in the ETBF (x). Shaded cells indicate all communities within the province. Bold crosses refer to communities that underlie where fishing occurred in the ETBF.

Demersal community	Cape	North Eastern Transition	North Eastern	Central Eastern Transition	Central Eastern	South Eastern Transition	Central Bass	Tasmanian	Western Tas Transition	Southern	South Western Transition	Central Western	Central Western Transition	North Western	North Western Transition	Timor	Timor Transition	Heard & McDonald Is	Macquarie Is
Inner Shelf 0 – 110m [1,2]		x	x	x	x			x											
Outer Shelf 110 – 250m [1,2,]		x	x	x	x			x											
Upper Slope 250 – 565m [3]	x	x	x	x	x			x		x									
Mid–Upper Slope 565 – 820m[3]	x	x	x	x	x			x		x									
Mid Slope 820 – 1100m[3]	x	x	x	x	x			x		x									
Lower slope/ Abyssal > 1100m[6]	x	x	x	x	x			x											
Reef 0 -110m[7, 8]			x																
Reef 110-250m[8]																			
Seamount 0 – 110m	x		x																

Demersal community	Cape	North Eastern Transition	North Eastern	Central Eastern Transition	Central Eastern	South Eastern Transition	Central Bass	Tasmanian	Western Tas Transition	Southern	South Western Transition	Central Western	Central Western Transition	North Western	North Western Transition	Timor	Timor Transition	Heard & McDonald Is	Macquarie Is
Seamount 110- 250m	x		x																
Seamount 250 – 565m	x		x																
Seamount 565 – 820m	x		x																
Seamount 820 – 1100m	x		x																
Seamount 1100 – 3000m			x	x															
Plateau 0 – 110m			x																
Plateau 110- 250m[4]			x																
Plateau 250 – 565m[4]			x																
Plateau 565 – 820m[5]			x																
Plateau 820 – 1100m[5]			x																

[1] Four inner shelf communities occur in the Timor Transition (Arafura, Groote, Cape York and Gulf of Carpentaria) and three inner shelf communities occur in the Southern (Eyre, Eucla and South West Coast). At Macquarie Is: [2]inner & outer shelves (0-250m), and [3]upper and midslope communities combined (250-1100m). At Heard/McDonald Is: [4]outer and upper slope plateau communities combined to form four communities: Shell Bank, inner and outer Heard Plateau (100-500m) and Western Banks (200-500m), [5]mid and upper plateau communities combined into 3 trough (Western, North Eastern and South Eastern), southern slope and North Eastern plateau communities (500-1000m), and [6] 3 groups at Heard Is: Deep Shell Bank (>1000m), Southern and North East Lower slope/abyssal, [7]Great Barrier Reef in the North Eastern Province and Transition and [8] Rowley Shoals in North Western Transition.

Scoping Document S2C2. Pelagic Communities

Table 2.10. Pelagic communities in which fishing activity occurs in the ETBF (red; x). Pelagic communities in which fishing activity can occur in the ETBF (black; x). Shaded cells indicate all communities that exist in the province.

Pelagic community	Northeastern	Eastern	Southern	Western	Northern	Northwestern	Heard and McDonald Is[2]	Macquarie Is
Coastal pelagic 0-200m[1,2]	x	x			x			
Oceanic (1) 0 – 600m	x	x						
Oceanic (2) >600m	x	x						
Seamount oceanic (1) 0 – 600m	x	x						
Seamount oceanic (2) 600–3000m		x						
Oceanic (1) 0 – 200m			x					
Oceanic (2) 200-600m			x					
Oceanic (3) >600m								
Seamount oceanic (1) 0 – 200m								
Seamount oceanic (2) 200 – 600m								
Seamount oceanic (3) 600–3000m								
Oceanic (1) 0-400m								
Oceanic (2) >400m								
Oceanic (1) 0-800m								
Oceanic (2) >800m								
Plateau (1) 0-600m	x							
Plateau (2) >600m								
Heard Plateau 0-1000m[3]								
Oceanic (1) 0-1000m								
Oceanic (2) >1000m								
Oceanic (1) 0-1600m								
Oceanic (2) >1600m								

[1] Northern Province has five coastal pelagic zones (NWS, Bonaparte, Arafura, Gulf and East Cape York) and Southern Province has two zones (Tas, GAB). [2] At Macquarie Is: coastal pelagic zone to 250m. [3] At Heard and McDonald Is: coastal pelagic zone broadened to cover entire plateau to maximum of 1000

2.2.3 Identification of objectives for components and sub-components (Step 3)

Objectives are identified for each sub-fishery for the five ecological components (key/secondary commercial, bycatch/byproduct, protected species, habitats, and communities) and sub-components, and are clearly documented. It is important to identify objectives that managers, the fishing industry, and other stakeholders can agree on, and that scientists can quantify and assess. The criteria for selecting ecological operational objectives for risk assessment are that they:

- be biologically relevant;
- have an unambiguous operational definition;
- be accessible to prediction and measurement; and
- that the quantities they relate to be exposed to the hazards.

For fisheries that have completed Ecological Sustainable Development (ESD) reports, use can be made of the operational objectives stated in those reports.

Each 'operational objective' is matched to example indicators. **Scoping Document S3** provides suggested examples of operational objectives and indicators. Where operational objectives are already agreed for a fishery (Existing Management Objectives) and/or provided by existing fisheries legislation, policies or Guidelines, those should be used (e.g. AFMA ERM Guide objective). The objectives need not be exactly specified, with regard to numbers or fractions of removal/impact, but should indicate that an impact in the sub-component is of concern/interest to the sub-fishery. The rationale for including or discarding an operational objective is a crucial part of the table and must explain why the particular objective has or has not been selected for in the (sub) fishery. Only the operational objectives selected for inclusion in the (sub) fishery are used for Level 1 analysis (**Level 1 SICA Document L1.1**).

Scoping Document S3. Components and sub-components identification of objectives

Table 2.11. Components and sub-components identification of operational objectives and rationale. Operational objectives that are eliminated are shaded out. EMO: Existing Management Objective; AMO: Existing AFMA Objective.

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
	"What is the general goal?"	*As shown in sub-component model diagrams at the beginning of this section.*	*"What you are specifically trying to achieve"*	*"What you are going to use to measure performance"*	*Rationale flagged as 'EMO' where Existing Management Objective in place, or 'AMO' where there is an existing AFMA Management Objective in place for other Commonwealth fisheries (assumed that squid fishery will fall into line).*
Key commercial and secondary commercial species	Avoid recruitment failure of the key/secondary commcercial species Avoid negative consequences for species or population sub-components	1. Population size	1.1 No trend in biomass 1.2 Maintain biomass above a specified level 1.3 Maintain catch at specified level 1.4 Species do not approach extinction or become extinct	Biomass, numbers, density, CPUE, yield	1.1 Increases in biomass of the key/secondary commcerical species would be acceptable. 1.2. To ensure that population at acceptable level by the assessment. 1.3. TACC levels are specified. 1.4. This is a general objective for all AFMA fisheries as per Fisheries Management Act 1991 (objective (b)). In general these objectives underlie the sustainable management of the Fishery, for both target bait and target species.
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity does not change outside acceptable bounds	Presence of population across the known distribution range	2.1 Not currently monitored. No specific management objective based on the geographic range of key/secondary commercial species.
		3. Genetic structure	3.1 Genetic diversity does not change outside acceptable bounds	Frequency of genotypes in the population, effective population size (N_e), number of spawning units	3.1 Genetic studies have identified multiple stocks of striped marlin in Pacific Ocean. Stock assessment split by north and south Pacific Ocean. Genetic studies also conducted for bigeye tuna (1 stock) and swordfish (low genetic diversity – but assessed as two stocks (North Pacific and south Pacific)
		4. Age/size/sex structure	4.1 Age/size/sex structure does not change outside acceptable bounds (e.g. more than X% from reference structure)	Biomass, numbers or relative proportion in age/size/sex classes Biomass of spawners	4.1 Covered in general by 1.2 EMO and AMO.

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
				Mean size, sex ratio	
		5. Reproductive Capacity	5.1 Fecundity of the population does not change outside acceptable bounds (e.g. more than X% of reference population fecundity) 2 Recruitment to the population does not change outside acceptable bounds	Egg production of population Abundance of recruits	5.1. Covered by 1.2 EMO and AMO. Reproductive capacity in terms of egg production may be easier to monitor via changes in Age/size/sex structure. 5.2. Covered by 1.2 EMO and AMO. May be easier to monitor via changes in Age/size/sex structure in the fishery.
		6. Behaviour /movement	6.1 Behaviour and movement patterns of the population do not change outside acceptable bounds	Presence of population across space, movement patterns within the population (e.g. attraction to bait, lights)	6.1. Changes Behaviour that are deleterious to the species and populations are to be avoided. Covered by 1.2 EMO and AMO.
Byproduct and Bycatch	Avoid recruitment failure of the byproduct and bycatch species Avoid negative consequences for species or population sub-components	1. Population size	1.1 No trend in biomass 1.2 Species do not approach extinction or become extinct 1.3 Maintain biomass above a specified level 1.4 Maintain catch at specified level	Biomass, numbers, density, CPUE, yield	1.1 Increases in biomass of the key/secondary commcerical species would be acceptable. 1.2. To ensure that population at acceptable level by the assessment. 1.3. TACC levels are specified. 1.4. This is a general objective for all AFMA fisheries as per Fisheries Management Act 1991 (objective (b)).
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity does not change outside acceptable bounds	Presence of population across space	2.1 Not currently monitored. No specific management objective based on the geographic range of byproduct/bycatch species.
		3. Genetic structure	3.1 Genetic diversity does not change outside	Frequency of genotypes in the population, effective	3.1 Not currently monitored. No reference levels established. No specific management objective based on the genetic structure of bycatch species.

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
			acceptable bounds	population size (N_e), number of spawning units	
		4. Age/size/sex structure	4.1 Age/size/sex structure does not change outside acceptable bounds (e.g. more than X% from reference structure)	Biomass, numbers or relative proportion in age/size/sex classes Biomass of spawners Mean size, sex ratio	4.1. There are trip limits for some species
		5 Reproductive Capacity	5.1 Fecundity of the population does not change outside acceptable bounds (e.g. more than X% of reference population fecundity) Recruitment to the population does not change outside acceptable bounds	Egg production of population Abundance of recruits	5.1 Beyond the generality of the EMO "Fishing is conducted in a manner that does not threaten stocks of byproduct / bycatch species", reproductive capacity is not currently measured for bycatch/byproduct species and is largely covered by other objectives.
		6. Behaviour /movement	6.1 Behaviour and movement patterns of the population do not change outside acceptable bounds	Presence of population across space, movement patterns within the population (e.g. attraction to bait, lights)	6.1 This may occur, as baited hooks can attract movement of species in the vicinity of longlines.
Protected species	Avoid recruitment failure of protected species Avoid negative consequences for protected species or population sub-components Avoid negative impacts on the population from fishing	1. Population size	1.1 Species do not further approach extinction or become extinct 1.2 No trend in biomass 1.3 Maintain biomass above a specified level 1.4 Maintain catch at specified level	Biomass, numbers, density, CPUE, yield	1.1 EMO - The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species. 1.2 A positive trend in biomass is desirable for protected species. 1.3 Maintenance of protected species biomass above specified levels not currently a fishery operational objective. 1.4 The above EMO states '.must avoid mortality/injury to protected species.
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity	Presence of population across space	2.1 Change in geographic range of Protected species may have serious consequences e.g. population fragmentation and/or forcing species into sub-optimal areas.

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
			does not change outside acceptable bounds		
		3. Genetic structure	3.1 Genetic diversity does not change outside acceptable bounds	Frequency of genotypes in the population, effective population size (N_e), number of spawning units	3.1 Because population size of Protected species is often small, protected species are sensitive to loss of genetic diversity. Genetic monitoring may be an effective approach to measure possible fishery impacts.
		4. Age/size/sex structure	4.1 Age/size/sex structure does not change outside acceptable bounds (e.g. more than X% from reference structure)	Biomass, numbers or relative proportion in age/size/sex classes Biomass of spawners Mean size, sex ratio	4.1 Monitoring the age/size/sex structure of Protected species populations is a useful management tool allowing the identification of possible fishery impacts and that cross-section of the population most at risk.
		5. Reproductive Capacity	5.1 Fecundity of the population does not change outside acceptable bounds (e.g. more than X% of reference population fecundity) Recruitment to the population does not change outside acceptable bounds	Egg production of population Abundance of recruits	5.1 The reproductive capacity of Protected species is of concern to the ETBF Fishery because potential fishery induced changes in reproductive ability (e.g. reduction in prey items may critically affect seabird brooding success) may have immediate impact on the population size of Protected species.
		6. Behaviour /movement	6.1 Behaviour and movement patterns of the population do not change outside acceptable bounds	Presence of population across space, movement patterns within the population (e.g. attraction to bait, lights)	6.1 Longlining operations may attract Protected species and alter behaviour and movement patterns, resulting in the habituation of Protected species to fishing vessels The overall effect may be to prevent juveniles from learning to fend for themselves therefore increasing the animals' reliance on fishing vessels. Subsequently this could substantially increase the risk of injury/mortality by collision, entrapment or entanglement with a vessel or fishing gear.
		7. Interactions with fishery	7.1 Survival after interactions is maximised 7.2 Interactions do not affect the viability of the population	Survival rate of species after interactions Number of interactions, biomass or numbers in population	7.1, 7.2, EMO – The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species. Includes the prohibition on discarding offal (bycatch, fish processing waste, unwanted dead fish), gear restrictions and reduced lighting levels to minimise interactions and attraction of the vessel to Protected species.

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
			or its ability to recover		
Habitats	Avoid negative impacts on quality of environment Avoid reduction in the amount and quality of habitat	1. Water quality	1.1 Water quality does not change outside acceptable bounds	Water chemistry, noise levels, debris levels, turbidity levels, pollutant concentrations, light pollution from artificial light	1.1 EMO control the discharge or discarding of waste (fish offal) and limit lighting on the vessels. MARPOL regulations prohibit discharge of oils, discarding of plastics.
		2. Air quality	2.1 Air quality does not change outside acceptable bounds	Air chemistry, noise levels, visual pollution, pollutant concentrations, light pollution from artificial light	2.1 Not currently perceived as an important habitat sub-component, longlining operations not believed to strongly influence air quality.
		3. Substrate quality	3.1 Sediment quality does not change outside acceptable bounds	Sediment chemistry, stability, particle size, debris, pollutant concentrations	3.1 EMO – The fishery is conducted, in a manner that minimises the impact of fishing operations on benthic habitat The current MPA and conservation areas reserve large areas of the known habitat types from fishing disturbance.
		4. Habitat types	4.1 Relative abundance of habitat types does not vary outside acceptable bounds	Extent and area of habitat types, % cover, spatial pattern, landscape scale	4.1 Longlining activities is not likely to result in changes to the local habitat types on fishing grounds. The current MPA and conservation areas reserve large areas of the known habitat types from fishing disturbance.
		5. Habitat structure and function	5.1 Size, shape and condition of habitat types does not vary outside acceptable bounds	Size structure, species composition and morphology of biotic habitats	5.1 Longlining activities may result in local disruption to pelagic and benthic processes.
Communities	Avoid negative impacts on the composition/function/distribution/structure of the community	1. Species composition	1.1 Species composition of communities does not vary outside acceptable bounds	Species presence/absence, species numbers or biomass (relative or absolute) Richness Diversity indices Evenness indices	1.1 EMO – The fishery is conducted, in a manner that minimises the impact of fishing operations on the ecosystem generally.
		2. Functional group composition	2.1 Functional group composition does not change outside acceptable bounds	Number of functional groups, species per functional group (e.g. autotrophs, filter feeders, herbivores, omnivores, carnivores)	2.1 The presence/abundance of 'functional group' members may fluctuate widely, however in terms of maintenance of ecosystem processes it is important that the aggregate effect of a functional group is maintained.
		3. Distribution	3.1 Community range does not vary outside	Geographic range of the community,	3.1 Pelagic longlining operations have unknown impacts on the benthos in the fishing grounds. The current MPA and

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
		of the community	acceptable bounds	continuity of range, patchiness	conservation areas reserve large areas of the known habitat types from fishing disturbance.
		4. Trophic/size structure	4.1 Community size spectra/trophic structure does not vary outside acceptable bounds	Size spectra of the community Number of octaves, Biomass/number in each size class Mean trophic level Number of trophic levels	4.1 Longlinling activities for key/secondary commercial species have the potential to remove a significant component of the predator functional group. Increased abundance of the prey groups may then allow shifts in relative abundance of higher trophic level organisms.
		5. Bio- and geo-chemical cycles	5.1 Cycles do not vary outside acceptable bounds	Indicators of cycles, salinity, carbon, nitrogen, phosphorus flux	5.1 Trawling operations not perceived to have a detectable effect on bio and geochemical cycles.

2.2.4 Hazard Identification (Step 4)

Hazards are the activities undertaken in the process of fishing, and any external activities, which have the potential to lead to harm.

The effects of fishery/sub-fishery specific hazards are identified under the following categories:

- capture
- direct impact without capture
- addition/movement of biological material
- addition of non biological material
- disturbance of physical processes
- external hazards

These fishing and external activities are scored on a presence/absence basis for each fishery/sub-fishery. An activity is scored as a zero if it does not occur and as a one if it does occur. The rationale for the scoring is also documented in detail and must include if/how the activity occurs and how the hazard may impact on organisms/habitat.

Scoping Document S4. Hazard Identification Scoring Sheet

This table is completed once for each sub-fishery. See Table 2.13 provides a set of examples of fishing activities for the effects of fishing to be used as a guide to assist in scoring the hazards.

Fishery name: Eastern Tuna and Billfish Fishery
Sub-fishery name: Pelagic Longlining
Date completed: July 2016

Table 2.12. Hazard identification, score and rationale(s) for the Eastern Tuna and Billfish Longline sub-fishery.

Direct impact of Fishing	Fishing Activity	Score (0/1)	Documentation of Rationale
Capture	Bait collection	1	Coral Sea sector – bait is frozen squid and pilchards (imported). Sthn QLD, NSW - Frozen squid and pilchards and live mackerel, and scad. An increasing live bait ratio, although >70% bait used is still frozen stock. Operators choose bait to target specific species (i.e. squid vs live). All operators using live bait self catch; small purse seining occurs inshore for fresh baits. Tasmania – frozen and fresh bait.
	Fishing	1	Occurs, resulting in capture of animals
	Incidental behaviour	1	Crew may handline or dropline while anchored. Trolling may occur while steaming after line setting
Direct impact without capture	Bait collection	1	See notes above in same category. Bait collection occurs and could impact species without capture through interactions with the gear and subsequent escape, cryptic mortality.
	Fishing	1	Direct impact without capture is likely, not all fish hooked are retrieved, may fall off hook, or be eaten while on the hook. Longlining is unlikely to impact benthic habitats and animals as the

Direct impact of Fishing	Fishing Activity	Score (0/1)	Documentation of Rationale
			gear does not contact seafloor. Purse-seining for bait may contact the bottom and thus have an impact.
	Incidental behaviour	1	Fish may escape capture while hand-lining in down time. Firearms are present on boats.
	Gear loss	1	Lost gear may interact with animals, including benthic species and habitats.
	Anchoring/ mooring	1	Occurs and when anchoring on seafloor may impact benthic species, suggestion that in oceanic fishing there is little benthic habitat to hook up on, and so boats are not anchored in most of the fishing grounds.
	Navigation/steaming	1	Occurs throughout the fishery grounds.
Addition/ movement of biological material	Translocation of species	1	Reballasting or use of brine tanks for stability may result in discharge of water at sea. Movement of species due to movement of boats between areas of the fishery is a possibility. Quarantine of a boat with green crab infestation is a past example. Quarantine regulations involving use of imported baits.
	On board processing	1	Heading and gutting – some of the catch is cleaned at sea and discarded.
	Discarding catch	1	Target and byproduct species are occasionally discarded. Commercial fish are damaged by shark and discarded, while small fish <12 - 15 kg bigeye and yellowfin are discarded; these are often alive. Bycatch species are discarded.
	Stock enhancement	0	Does not occur in this fishery
	Provisioning	1	Bait is used in the fishery, sometimes berley, this may be lost from the hooks, or captured fish may be taken from the line by toothed whales, dolphins and sharks.
	Organic waste disposal	1	Food scraps etc. from fishing fleet are discarded at sea.
Addition of non-biological material	Debris	1	Debris from the fishing process: cardboard gets thrown over from bait boxes, light sticks lost from lines (although some lights can be reused), straps and netting bags are kept on board. Debris from non-fishing activities e.g. Crew rubbish – discarding regulations, plastics must be retained under MARPOL Convention.
	Chemical pollution	1	Possible oil spills, detergents other cleaning agents or chemicals.
	Exhaust	1	Occurs through steaming and engine operations.
	Gear loss	1	Loss of hooks is regular, light sticks are also lost, but New light stick clip improvements means less light sticks lost overboard. Line may be lost infrequently, if so fishers try and retrieve it. Every discard including some line and hook may remain after organic component breaks down. Quantity uncertain, depending on the amount of discarding.
	Navigation/ steaming	1	A vessel is in the water as a part of regular fishing activity
	Activity/ presence on water	1	Noise and movement, visual stimuli may be a cue to some species attracting them to the vessel or a part of the fishing operation
Disturb physical processes	Bait collection	1	Possible that if gear contacts the seafloor it may disturb sediment, only in shallow water, as nets for bait collection via purse seining are shallow.
	Fishing	1	Fishing gear may mix the water column, as does boat movement during regular operations.

Direct impact of Fishing	Fishing Activity	Score (0/1)	Documentation of Rationale
	Boat launching	0	Occurs in marinas and ports which are outside the scope of the ERAEF
	Anchoring/ mooring	1	May have a localized effect on sediment, anchoring only occurs on the shelf in shallow waters.
	Navigation/ steaming	1	Has potential to mix waters, disturb sediments in shallow locations
External Hazards (specify the particular example within each activity area)	Other capture fishery methods	1	Other fisheries operate in the same region, e.g. Skipjack, SBT, SPF, WCPO Tuna fisheries, recreational fisheries, state inshore fisheries (NSW).
	Aquaculture	0	No operations that are known to interfere with this fishery or the species targeted.
	Coastal development	1	There are major coastal development along Australia's east coast. However, given this is an offshore fishery, assumed to be independent from coastal activities.
	Other extractive activities	1	Fishery covers a large area there are activities such as oil and gas exploration in the eastern Bass Strait that may be close to the shelf where fishing occurs.
	Other non-extractive activities	1	Fishery covers a large area examples of activities includes use by the navy (live ammunition testing). Commercial shipping also common throughout the region
	Other anthropogenic activities	1	Fishery covers a large area wide range of uses and so activities like whale watching and recreational boating may cause impacts in the same region. Probably too far offshore for overlap with the majority of other anthropogenic activities

Table 2.13. Examples of fishing activities (Modified from Fletcher et al. 2002).

Direct Impact of Fishing	Fishing Activity	Examples of Activities Include
Capture		Activities that result in the capture or removal of organisms. This includes cryptic mortality due to organisms being caught but dropping out prior to the gear's retrieval (i.e. They are caught but not landed)
	Bait collection	Capture of organisms due to bait gear deployment, retrieval and bait fishing. This includes organisms caught but not landed.
	Fishing	Capture of organisms due to gear deployment, retrieval and actual fishing. This includes organisms caught but not landed.
	Incidental behaviour	Capture of organisms due to crew behaviour incidental to primary fishing activities, possible in the crew's down time; e.g. crew may line or spear fish while anchored, or perform other harvesting activities, including any land-based harvesting that occurs when crew are camping in their down time.
Direct impact, without capture		This includes any activities that may result in direct impacts (damage or mortality) to organisms without actual capture.
	Bait collection	Direct impacts (damage or mortality) to organisms due to interactions (excluding capture) with bait gear during deployment, retrieval and bait fishing. This includes: damage/mortality to organisms through contact with the gear that doesn't result in capture, e.g. Damage/mortality to benthic species by gear moving over them, organisms that hit nets but aren't caught.
	Fishing	Direct impacts (damage or mortality) to organisms due to interactions (excluding capture) with fishing gear during deployment, retrieval and fishing. This includes: damage/mortality to organisms through contact with the gear that doesn't result in capture, e.g. Damage/mortality to benthic species by gear moving over them, organisms that hit nets but are not caught.
	Incidental behaviour	Direct impacts (damage or mortality) without capture, to organisms due to behaviour incidental to primary fishing activities, possibly in the crew's down time; e.g. the use of firearms on scavenging species, damage/mortality to organisms through contact with the gear that the crew use to fish during their down time. This does not include impacts on predator species of removing their prey through fishing.
	Gear loss	Direct impacts (damage or mortality), without capture on organisms due to gear that has been lost from the fishing boat. This includes damage/mortality to species when the lost gear contacts them or if species swallow the lost gear.
	Anchoring/ mooring	Direct impact (damage or mortality) that occurs and when anchoring or mooring. This includes damage/mortality due to physical contact of the anchor, chain or rope with organisms, e.g. An anchor damaging live coral.
	Navigation/ steaming	Direct impact (damage or mortality) without capture may occur while vessels are navigating or steaming. This includes collisions with marine organisms or birds.
Addition/ movement of biological material		Any activities that result in the addition or movement of biological material to the ecosystem of the fishery.
	Translocation of species (boat movements, reballasting)	The translocation and introduction of species to the area of the fishery, through transportation of any life stage. This transport can occur through movement on boat hulls or in ballast water as boats move throughout the fishery or from outside areas into the fishery.

Direct Impact of Fishing	Fishing Activity	Examples of Activities Include
	On board processing	The discarding of unwanted sections of target after on board processing introduces or moves biological material, e.g. heading and gutting, retaining fins but discarding trunks.
	Discarding catch	The discarding of unwanted organisms from the catch can introduce or move biological material. This includes individuals of target and byproduct species due to damage (e.g. shark or marine mammal predation), size, high grading and catch limits. Also includes discarding of all non-retained bycatch species. This also includes discarding of catch resulting from incidental fishing by the crew. The discards could be alive or dead.
	Stock enhancement	The addition of larvae, juveniles or adults to the fishery or ecosystem to increase the stock or catches.
	Provisioning	The use of bait or berley in the fishery.
	Organic waste disposal	The disposal of organic wastes (e.g. food scraps, sewage) from the boats.
Addition of non-biological material		Any activities that result in non-biological material being added to the ecosystem of the fishery, this includes physical debris, chemicals (in the air and water), lost gear, noise and visual stimuli.
	Debris	Non-biological material may be introduced in the form of debris from fishing vessels or mother ships. This includes debris from the fishing process: e.g. cardboard thrown over from bait boxes, straps and netting bags lost. Debris from non-fishing activities can also contribute to this e.g. Crew rubbish – discarding or food scraps, plastics or other rubbish. Discarding at sea is regulated by MARPOL, which forbids the discarding of plastics.
	Chemical pollution	Chemicals can be introduced to water, sediment and atmosphere through: oil spills, detergents other cleaning agents, any chemicals used during processing or fishing activities.
	Exhaust	Exhaust can be introduced to the atmosphere and water through operation of fishing vessels
	Gear loss	The loss of gear will result in the addition of non-biological material, this includes hooks, line, sinkers, nets, otter boards, light sticks, buoys etc.
	Navigation /steaming	The navigation and steaming of vessels will introduce noise and visual stimuli into the environment. Boat collisions and/or sinking of vessels. Echo-sounding may introduce noise that may disrupt some species (e.g. whales, orange roughy)
	Activity /presence on water	The activity or presence of fishing vessels on the water will noise and visual stimuli into the environment.
Disturb physical processes		Any activities that will disturb physical processes, particularly processes related to water movement or sediment and hard substrate (e.g. boulders, rocky reef) processes.
	Bait collection	Bait collection may disturb physical processes if the gear contacts seafloor-disturbing sediment, or if the gear disrupts water flow patterns.

Direct Impact of Fishing	Fishing Activity	Examples of Activities Include
	Fishing	Fishing activities may disturb physical processes if the gear contacts seafloor-disturbing sediment, or if the gear disrupts water flow patterns.
	Boat launching	Boat launching may disturb physical processes, particularly in the intertidal regions, if dredging is required, or the boats are dragged across substrate. This would also include foreshore impacts where fishers drive along beaches to reach fishing locations and launch boats. Impacts of boat launching that occurs within established marinas are outside the scope of this assessment.
	Anchoring /mooring	Anchoring/mooring may affect the physical processes in the area that anchors and anchor chains contact the seafloor.
	Navigation /steaming	Navigation /steaming may affect the physical processes on the benthos and the pelagic by turbulent action of propellers or wake formation.
External hazards		Any outside activities that will result in an impact on the component in the same location and period that the fishery operates. The particular activity as well as the mechanism for external hazards should be specified.
	Other capture fishery methods	Take or habitat impact by other commercial, indigenous or recreational fisheries operating in the same region as the fishery under examination
	Aquaculture	Capture of feed species for aquaculture. Impacts of cages on the benthos in the region
	Coastal development	Sewage discharge, ocean dumping, agricultural runoff
	Other extractive activities	Oil and gas pipelines, drilling, seismic activity
	Other non-extractive activities	Defense, shipping lanes, dumping of munitions, submarine cables
	Other anthropogenic activities	Recreational activities, such as scuba diving leading to coral damage, power boats colliding with whales, dugongs, turtles. Shipping, oil spills

2.2.5 Bibliography (Step 5)

All references used in the scoping assessment are included in the References section.

Key documents can be found on the AFMA web page at www.afma.gov.au and include the following:

- Assessment Report
- Management Plan https://www.legislation.gov.au/Details/F2011L00120
- Management Regulations
- Management Plan and Regulation Guidelines
- AFMA At a glance web page http://www.afma.gov.au/fisheries/etbf/at_a_glance.php
- Bycatch Action Plans
- Ecological Risk Management Report (AFMA 2012)

Other publications that provided information include

- ABARES Fishery Status Reports
- Strategic Plans

2.2.6 Decision rules to move to Level 1 (Step 6)

Any hazards that are identified at Step 4 Hazard Identification as occurring in the fishery are carried forward for analysis at Level 1.

In this case, 24 out of 26 possible internal activities were identified as occurring in this fishery. Five out of six external activities were identified. Thus, a total of 32 activity-component scenarios will be considered at Level 1. This results in 145 total scenarios (of 160 possible) to be developed and evaluated using the unit lists (species, habitats, communities).

2.3 Level 1 Scale, Intensity and Consequence Analysis (SICA)

Level 1 aims to identify which hazards lead to a significant impact on any species, habitat or community. Analysis at Level 1 is for whole components (key and secondary; bycatch and byproduct; protected species; habitat; and communities), not individual sub-components. Since Level 1 is used mainly as a rapid screening tool, a "worst case" approach is used to ensure that elements screened out as low risk (either activities or components) are genuinely low risk. Analysis at Level 1 for each component is accomplished by considering the most vulnerable sub-component and the most vulnerable unit of analysis (e.g. most vulnerable species, habitat type or community). This is known as credible scenario evaluation (Richard Stocklosa e-systems Pty Ltd (March 2003) Review of CSIRO Risk Assessment Methodology: ecological risk assessment for the effects of fishing) in conventional risk assessment. In addition, where judgments about risk are uncertain, the highest level of risk that is still regarded as plausible is chosen. For this reason, the measures of risk produced at Level 1 cannot be regarded as absolute.

At Level 1 each fishery/sub-fishery is assessed using a scale, intensity and consequence analysis (SICA). SICA is applied to the component as a whole by choosing the most vulnerable sub-component (linked to an operational objective) and most vulnerable unit of analysis. The rationale for these choices must be documented in detail. These steps are outlined below. Scale, intensity, and consequence analysis (SICA) consists of thirteen steps. The first ten steps are performed for each activity and component, and correspond to the columns of the SICA table. The final three steps summarise the results for each component.

Step1. Record the hazard identification score (absence (0) presence (1) scores) identified at step 3 at the scoping level (Scoping Document S3) onto the SICA table
Step 2. Score spatial scale of the activity
Step 3. Score temporal scale of the activity
Step 4. Choose the sub-component most likely to be affected by activity
Step 5. Choose the most vulnerable unit of analysis for the component e.g. species, habitat type or community assemblage
Step 6. Select the most appropriate operational objective
Step 7. Score the intensity of the activity for that sub-component
Step 8. Score the consequence resulting from the intensity for that sub component
Step 9. Record confidence/uncertainty for the consequence scores
Step 10. Document rationale for each of the above steps
Step 11. Summary of SICA results
Step 12. Evaluation/discussion of Level 1
Step 13. Components to be examined at Level 2

2.3.1 Record the hazard identification score (absence (0) presence (1) scores) identified at step 3 in the scoping level onto the SICA Document (Step 1)

Record the hazard identification score absence (0) presence (1) identified at Step 3 at the scoping level onto the SICA sheet. A separate sheet will be required for each component (key/secondary commercial, bycatch and byproduct, and protected species, habitat, and communities). Only those activities that scored a 1 (presence) will be analysed at Level 1.

2.3.2 Score spatial scale of activity (Step 2)

The greatest spatial extent must be used for determining the spatial scale score for each identified hazard. For example, if fishing (e.g. capture by longline) takes place within an area of 200 nm by 300 nm, then the spatial scale is scored as 4. The score is then recorded onto the SICA Document and the rationale documented.

Table 2.14. Spatial scale score of activity.

<1 nm:	1-10 nm:	10-100 nm:	100-500 nm:	500-1000 nm:	>1000 nm:
1	2	3	4	5	6

Maps and graphs may be used to supplement the information (e.g. sketches of the distribution of the activity relative to the distribution of the component) and additional notes describing the nature of the activity should be provided. The spatial scale score at Step 2 is not used directly, but the analysis is used in making judgments about level of intensity at Step 7. Obviously, two activities can score the same with regard to spatial scale, but the intensity of each can differ vastly. The reasons for the score are recorded in the rationale column of the SICA spreadsheet.

2.3.3 Score temporal scale of activity (Step 3)

The highest frequency must be used for determining the temporal scale score for each identified hazard. If the fishing activity occurs daily, the temporal scale is scored as 6. If oil spillage occurs about once per year, then the temporal scale of that hazard scores a 3. The score is then recorded onto the SICA Document and the rationale documented.

Table 2.15. Temporal scale score of activity.

Decadal (1 day every 10 years or so)	Every several years (1 day every several years)	Annual (1-100 days per year)	Quarterly (100-200 days per year)	Weekly (200-300 days per year)	Daily (300-365 days per year)
1	2	3	4	5	6

It may be more logical for some activities to consider the aggregate number of days that an activity occurs. For example, if the activity “fishing” was undertaken by 10 boats during the same 150 days of the year, the score is 4. If the same 10 boats each spend 30 non-overlapping

days fishing, the temporal scale of the activity is a sum of 300 days, indicating that a score of 6 is appropriate. In the case where the activity occurs over many days, but only every 10 years, the number of days by the number of years in the cycle is used to determine the score. For example, 100 days of an activity every 10 years averages to 10 days every year, so that a score of 3 is appropriate.

The temporal scale score at Step 3 is not used directly, but the analysis is used in making judgments about level of intensity at Step 7. Obviously, two activities can score the same with regard to temporal scale, but the intensity of each can differ vastly. The reasons for the score are recorded in the rationale column.

2.3.4 Choose the sub-component most likely to be affected by activity (Step 4)

The most vulnerable sub-component must be used for analysis of each identified hazard. This selection must be made on the basis of expected highest potential risk for each 'direct impact of fishing' and 'fishing activity' combination, and recorded in the 'sub-component' column of the SICA Document. The justification is recorded in the rationale column.

2.3.5 Choose the unit of analysis most likely to be affected by activity and to have highest consequence score (Step 5)

The most vulnerable 'unit of analysis' (i.e. most vulnerable species, habitat type or community) must be used for analysis of each identified hazard. The species, habitats, or communities (depending on which component is being analysed) are selected from **Scoping Document S2 (A – C)**. This selection must be made on the basis of expected highest potential risk for each 'direct impact of fishing' and 'fishing activity' combination, and recorded in the 'unit of analysis' column of the SICA Document. The justification is recorded in the rationale column.

2.3.6 Select the most appropriate operational objective (Step 6)

To provide linkage between the SICA consequence score and the management objectives, the most appropriate operational objective for each sub-component is chosen. The most relevant operational objective code from **Scoping Document S3** is recorded in the 'operational objective' column in the SICA document. Note that SICA can only be performed on operational objectives agreed as important for the (sub) fishery during scoping and contained in **Scoping Document S3**. If the SICA process identifies reasons to include sub-components or operational objectives that were previously not included/eliminated then these sub-components or operational objectives must be re-instated.

2.3.7 Score the intensity of the activity for the component (Step 7)

The score for intensity of an activity considers the direct impacts in line with the categories shown in the conceptual model (Figure 2) (capture, direct impact without capture, addition/movement of biological material, addition of non-biological material, disturbance to

physical processes, external hazards). The intensity of the activity is judged based on the scale of the activity, its nature and extent. Activities are scored as per intensity scores below.

Table 2.16. Intensity score of activity (Modified from Fletcher et al. 2002).

Level	Score	Description
Negligible	1	remote likelihood of detection at any spatial or temporal scale
Minor	2	occurs rarely or in few restricted locations and detectability even at these scales is rare
Moderate	3	moderate at broader spatial scale, or severe but local
Major	4	severe and occurs reasonably often at broad spatial scale
Severe	5	occasional but very severe and localized or less severe but widespread and frequent
Catastrophic	6	local to regional severity or continual and widespread

This score is then recorded on the **Level 1 (SICA) Document** and the rationale documented.

2.3.8 Score the consequence of intensity for that component (Step 8)

The consequence of the activity is a measure of the likelihood of not achieving the operational objective for the selected sub-component and unit of analysis. It considers the flow on effects of the direct impacts from Step 7 for the relevant indicator (e.g. decline in biomass below the selected threshold due to direct capture). Activities are scored as per consequence scores defined below. A more detailed description of the consequences at each level for each component (key/secondary commercial, bycatch and byproduct, protected species, habitats, and communities) is provided as a guide for scoring the consequences of the activities in the description of consequences table (see Table AC1-AC5 Appendix A).

Table 2.17. Consequence score for ERAEF activities (Modified from Fletcher et al. 2002).

Level	Score	Description
Negligible	1	Impact unlikely to be detectable at the scale of the stock/habitat/community
Minor	2	Minimal impact on stock/habitat/community structure or dynamics
Moderate	3	Maximum impact that still meets an objective (e.g. sustainable level of impact such as full exploitation rate for a target species).
Major	4	Wider and longer term impacts (e.g. long-term decline in CPUE)
Severe	5	Very serious impacts now occurring, with relatively long time period likely to be needed to restore to an acceptable level (e.g. serious decline in spawning biomass limiting population increase).
Intolerable	6	Widespread and permanent/irreversible damage or loss will occur-unlikely to ever be fixed (e.g. extinction)

The score should be based on existing information and/or the expertise of the risk assessment group. The rationale for assigning each consequence score must be documented. The conceptual model may be used to link impact to consequence by showing the pathway that was considered. In the absence of agreement or information, the highest score (worst case scenario) considered plausible is applied to the activity.

2.3.9 Record confidence/uncertainty for the consequence scores (Step 9)

The information used at this level is qualitative and each step is based on expert (fishers, managers, conservationists, scientists) judgment. The confidence rating for the consequence score is rated as 1 (low confidence) or 2 (high confidence) for the activity/component. The score is recorded on the SICA Document and the rationale documented. The confidence will reflect the levels of uncertainty for each score at steps 2, 3, 7 and 8.

Table 2.18. Description of Confidence scores for Consequences. The confidence score appropriate to the rationale is used, and documented on the SICA Document.

Confidence	Score	Rationale for the confidence score
Low	1	Data exists, but is considered poor or conflicting
		No data exists
		Disagreement between experts
High	2	Data exists and is considered sound
		Consensus between experts
		Consequence is constrained by logical consideration

2.3.9.1 Document rationale for each of the above steps (Step 10)

The rationale forms a logical pathway to the consequence score. It is provided for each choice at each step of the SICA analysis.

SICA steps 1-10. Tables of descriptions of consequences for each component and each sub component provide a guide for scoring the level of consequence (see Tables above).

Level 1 (SICA) Document L1.1 Key commercial/secondary commercial species. Commercial bait species are also included here.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
Capture	Bait collection	1	4	5	Population size	Blue (slimy) mackerel, yellowtail scad	1.1, 1.3, 1.4	3	2	2	Bait fishing for live bait is restricted to inshore locations, by small purse seining. Intensity: moderate, reflects the scale at which bait fishing occurs. Consequence for the population of baitfish species is monitored by reported catch as a requirement of state licence, and AFMA. Confidence: high, constrained by logical consideration.
	Fishing	1									There are no key commercial species that are not assessed. No further action required for this activity.
	Incidental behaviour	1	4	5	Population size	Yellowfin tuna	1.1, 1.3, 1.4	1	1	2	Recreational fishing for key commercial and secondary commercial species such as yellowfin or other bait fishing considered to be non-existent or so minor compared with commercial fishing levels, may not even be occurring. Consequence: negligible. Confidence high, constrained by logical consideration.
Direct impact without capture	Bait collection	1	4	5	Behaviour and movement	Blue (slimy) mackerel, yellowtail scad	6.1	2	2	1	Bait fishing for live bait is restricted to inshore locations, by small purse seining. Attraction of predator species to the area where baitfish are escaping is unlikely, may lead to some dispersal of schools due to baiting activities. Consequence: minor. Confidence: low due to lack of data, information and expertise.
	Fishing	1	6	6	Population size	Bigeye tuna	1.1, 1.3, 1.4	2	1	1	Escaping key commercial species such as bigeye tuna not expected to die as a result of hook ingestion, thus impacts on population size minimal. Consequence: negligible as unlikely to occur. Confidence: low, the amount of escaping of key commercial species is not well known.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Incidental behaviour	1	6	5	Behaviour and movement	Yellowfin tuna	6.1	1	1	2	This species used as an example of the key commercial species that may be targeted by incidental Behaviour. Fishing could cause a school to aggregate around bait or disperse, but those that are not caught are likely to return to her normal behaviour quickly. Consequence: negligible, as it is unlikely to be detectable. Confidence: high, constrained by logical consideration.
	Gear loss	1	6	6	Population size	Bigeye tuna	1.1, 1.3, 1.4	1	1	2	Lost gear may drift for a while before balling up, or entangling benthic relief. Baits soon fall off, longline gear unlikely to ghost fish. Swallowing of light sticks may have some incidental mortality. Consequence: negligible. Confidence: high, constrained by logical consideration.
	Anchoring/mooring	1	5	5	Behaviour and movement	Blue (slimy) mackerel, yellowtail scad	6.1	1	1	2	Anchoring only takes place in shallow waters. Very unlikely that these species would be adversely affected by the process of anchoring or mooring. Intensity: negligible as the likelihood of direct interaction with anchoring/mooring lines is unlikely. Consequence: negligible. Confidence: high, logical consideration of interactions.
	Navigation/steaming	1	6	6	Behaviour and movement	Yellowfin tuna	6.1	1	1	1	This key commercial species is not known for reacting to vessels and/or following them or changing Behaviour in response to them. Consequence: negligible as unlikely to occur. Confidence: low, no information.
Addition/ movement of biological material	Translocation of species	1	6	6	Population size	Southern bluefin tuna	1.3	3	2	1	Translocation of species can have major effects on local communities through imported bait; i.e. the introduction of an exotic pathogen in frozen imported bait. SBT are known the eat bait species such as slimy mackerel in the GAB. The population size of SBT may reduce should they eat diseased bait. Bait and foreign feed usage needs to be carefully monitored. Consequence: minor, if it occurs. Confidence that the consequence would be minor is low.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	On board processing	1	6	6	Behaviour and movement	Yellowfin tuna	6.1	1	1	2	This species is not known to follow vessels such that they could respond and feed on materials processed on board. Yellowfin tuna considered the most likely of an unlikely set of species. Confidence high due to logical consideration.
	Discarding catch	1	6	6	Behaviour and movement	Yellowfin tuna	6.1	1	1	2	This species are not known to follow vessels to feed on materials processed on board. Yellowfin tuna considered the most likely of an unlikely set of species. Main discards are unlikely to affect yellowfin tuna. Consequence: negligible, as unlikely to occur. Confidence: high due to logical consideration.
	Stock enhancement	0									
	Provisioning	1	6	6	Behaviour and movement	Yellowfin tuna	6.1	1	1	2	Provisioning occurs through bait lost during manual or automatic baiting. This species is not known to feed on lost baits from the vessel. Yellowfin tuna considered the most likely of an unlikely set of species. Thus any impact on the Behaviour and movement of these fish considered remote. Consequence: negligible. Confidence: high due to logistical constraints.
	Organic waste disposal	1	6	6	Behaviour and movement	Yellowfin tuna	6.1	1	1	2	Vessels adhere to MARPOL regulations. Disposal of organic waste (e.g. some food scraps or dishwashing detergent) may have a minor risk on the Behaviour and movement of yellowfin tuna via attraction (food scraps) or repulsion (raw sewage). Impact is considered negligible because although the hazard is considered over a large range, each disposal unit is considered to effect only a small area (<1nm^2). Given that this species is highly mobile, strong avoidance ability is expected. Thus any impact on the Behaviour and movement of these fish considered remote. Consequence: negligible, unlikely to occur. Confidence: high due to logistical constraints.
Addition of non-biological material	Debris	1	6	6	Population size	Bigeye tuna	1.1, 1.3, 1.4	3	1	2	Bigeye tuna may be the most likely species to interact with debris, through ingestion of light-sticks discarded as gear is recovered. Consequence: negligible, even if widespread, the impact on population

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
											size (i.e. mortality) is expected to be negligible. Confidence: high through logical consideration.
	Chemical pollution	1	6	6	Behaviour and movement	Blue (slimy) Mackerel, yellowtail scad	6.1	2	2	1	Chemical pollution is considered likely to occur when vessels are in shallow water anchored up, and cleaning of the vessel is underway, thus impacts on the bait species that inhabit coastal waters is more likely than for the pelagic key/secondary commercial species. These species may be attracted to chemical slicks in the water. Consequence: minor. Confidence: low, no real information or logical considerations.
	Exhaust	1	6	6	Behaviour and movement	Yellowfin tuna	6.1	1	1	2	The impact of exhaust on any of the target species is considered so remote that no pathway can be specified. The impact is therefore scored as negligible even though the hazard is likely to occur over a large range/scale, these highly mobile species are likely to avoid the area affected by exhaust fumes. Consequence: negligible. Confidence: high, at current fishing levels, exhaust does not affect the surface ocean in a way that can be detected at this time.
	Gear loss	1	6	6	Behaviour and movement	Yellowfin tuna	6.1	2	2	2	Fishery management plan requires that operators take all reasonable steps to minimise gear loss. If a line breaks off, it generally is retrieved by hauling from the other end, without substantial loss to the gear. Double break-offs are rare for experienced skippers. Consequence: minor. Confidence: high.
	Navigation/steaming	1	6	6	Behaviour and movement	Yellowfin Tuna	6.1	1	1	1	Navigation/steaming by introducing noise into the environment is not believed to be an issue for this species. Yellowfin tuna used as the most vulnerable, because they are surface orientated, and noise may interfere with their orientation of school forming Behaviour. Consequence: negligible as unlikely to occur. Confidence: low, and no reasonable alternative scenarios can be provided.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Activity/presence on water	1	6	6	Behaviour and movement	Yellowfin Tuna	6.1	1	1	1	Activity not believed to be an issue for this species. Yellowfin tuna considered most vulnerable, because they are surface orientated, but any short-term disturbance unlikely to change Behaviour and movement. Consequence: negligible. Confidence: low, cannot be evaluated without data.
Disturb physical processes	Bait collection	1	4	5	Behaviour and movement	Blue (slimy) Mackerel, yellowtail scad	6.1	2	2	2	Disruption of the sediments may occur when bait fishing is undertaken through the contact of purse nets with the bottom. This may create feeding opportunities for the bait species, and thus aggregate them, or resuspend materials that reduce the ability to detect predators. The scale of this relative to natural disturbance is considered very low. Confidence: high, due to logical consideration.
	Fishing	1	6	6	Behaviour and movement	Striped marlin	6.1	2	2	1	The gear is heavily weighted at both ends so there could be a disturbance and damage to benthic habitat including sediments, which may affect physical processes. Also, recovering or deploying gear may disrupt the warm surface layer that marlins bask in. The detection of such effects is considered to be almost impossible. Intensity: minor depending on the spatial and temporal coverage. Consequence: minor if intensity is minor. Confidence: low, no data.
	Boat launching	0									
	Anchoring/mooring	1	5	5	Behaviour and movement	Blue (slimy) Mackerel, yellowtail scad	6.1	2	2	2	Disruption of the sediments may occur anchoring through the contact with the bottom. This may re-suspend materials that reduce the ability to detect predators. The scale of this relative to natural disturbance is considered very low (minor). Consequence: minor. Confidence: high (AFMA Observer Program).
	Navigation/steaming	1	6	6	Behaviour and movement	Yellowfin tuna	6.1	1	1	2	Disruption of the surface waters through steaming may result in mixing that enhances local productivity. The scale of this relative to natural disturbance is considered negligible. Consequence: negligible, unlikely to disturb physical processes. Confidence: high, due to logical consideration.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
External Impacts (specify the particular example within each activity area)	Other fisheries: Southern Bluefin Tuna Fishery (SBT), Small Pelagics Fishery (SPF), SESSF, Skipjack Fishery (SKJ).	1	5	6	Population size	Bigeye tuna	1.1, 1.3, 1.4	4	4	1	Bigeye tuna stocks are considered to be overfished (locally and international waters). The impact of that level of fishing from other fisheries is believed to have an influence on the population size. The level of catch is known from assessments with some confidence. Fishing mortality by recreational fishing is considered minor as these are controlled by bag limits. Intensity: major given the likely scale. Consequence: major, given the scale of the activity. Confidence: low, uncertain of interactions and long term cumulative impacts.
	Aquaculture	0									
	Coastal development	1	5	6	Behaviour and movement	Blue (slimy) Mackerel, yellowtail scad	6.1	2	2	1	Both large and small centres along the coast and ongoing coastal development is likely to have minor impact as the fishery operates offshore and most stocks are offshore, well away from these developments. Sewage outfall is considered to be minor given the level of ocean mixing. This outfall may increase in primary productivity and attract the species. Consequence: minor, given the scale of the activity. Confidence: low, little data on cumulative impacts.
	Other extractive activities	1	5	6	Behaviour and movement	Bigeye tuna	6.1	2	2	1	Ongoing oil and gas exploration by seismic survey and expansion of pipelines in Bass Strait may affect the Behaviour and movement of the key/secondary commercial species in this fishery. Bigeye tuna used because most vulnerable in Australian waters as this species is overfished. However, fishing does not occur in Bass Strait and therefore such an activity is unlikely to impact this species. Consequence: minor. Confidence: low, as information on cumulative impacts due to seismic surveys is unclear (Thomson et al. 2014).
	Other non-extractive activities	1	6	6	Behaviour and movement	Bigeye tuna	6.1	2	2	1	Ongoing shipping, naval activities and ocean dumping is likely to have minor effects on the movement and Behaviour of this species. Intensity: minor. Consequence: minor. Confidence: low, little information on potential effects.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Other anthropogenic activities	1	4	5	Behaviour and movement	Bigeye tuna	6.1	1	1	1	Major shipping routes, tourism, recreational boating and oil spills are likely to have minor effects on the behaviour and movement of this species. These effects are considered to be localized and only impact a small proportion of the population. Intensity: minor, activities could impact a wide range. Consequence: minor, restricted area rare event short term effects. Confidence low, limited information.

Level 1 (SICA) Document L1.2 - Byproduct and Bycatch Component.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
Capture	Bait collection	1	4	5	Behaviour and movement	Bronze whaler shark	6.1	2	2	1	Bronze whalers attracted to burley. The inshore sharks may by captured within the bait sets and incidentally captured. Confidence: low, lack of data.
	Fishing	1	6	6	Population size	Blue marlin; black marlin	1.1, 1.3, 1.4	4	3	1	These species are not permitted to be landed in the ETBF. There are reasonable catches taken each year (and discarded), noting a spike in 2015 (AFMA logbook data). Consequence: moderate given the likely scale of impact. Confidence: low, as there is insufficient information on the population size of these species and whether these levels of discarding adversely impacts both stocks.
	Incidental behaviour	1	4	5	Population size	Blue shark	1.1, 1.3, 1.4	1	1	1	This species may be captured during trolling or hand lining within its depth range to 1000 m, but little impact expected. Consequence: negligible, given the likely scale of the impact. Confidence: low, due to lack of data.
Direct impact without capture	Bait collection	1	4	5	Behaviour and movement	Bronze whaler shark	6.1	1	1	1	This inshore shark species (depth range <100 m) may be entangled and then escape with injuries. Consequence: minor, given the likely scale of impact. Confidence: low, no information of this type of interaction with purse seine nets.
	Fishing	1	6	6	Population size	Blue marlin; black marlin	1.1, 1.3, 1.4	3	2	1	Black and blue marlin have a no-take commercially, but interact with the gear, and escape, but impaired capacity to recover from stress of capture may result in subsequent mortality. Intensity: moderate, at a broader spatial scale. Consequence: minor, given the scale of likely impact and each species wide distributional range, and minimal impact on population as a result of this activity. Confidence: low, due to lack of data.
	Incidental behaviour	1	6	5	Population size	Blue shark	1.1, 1.3, 1.4	1	1	1	Fishing with recreational gear might lead to hooking and escape of animals. Intensity considered negligible as downtime at sea is low for longline crews. Mouth hooking likely to be of little consequence, but

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
											might be some internally hooked animals that later die. Confidence: low, due to lack of data.
	Gear loss	1	6	6	Population size	Bronze whaler shark	1.1, 1.3, 1.4	1	1	1	Loss of gear may lead to ghost fishing, as it drifts lower to the bottom, or in inshore regions, might capture sharks, such as the bronze whaler. Ghost fishing considered rare for this gear, and gear is recovered if fitted with radio beacons. Consequence: negligible, given the scale of the likely impact. Confidence: low, due to lack of data.
	Anchoring/ mooring	1	5	5	Behaviour and movement	Bronze whaler shark	6.1	1	1	2	Anchors may attract sharks (metallic objects). Sharks may bite, altering ability to forage. Intensity: negligible, as anchoring is rare and confined to shallow locations. Sharks replace teeth frequently. Confidence: high, due to logical consideration.
	Navigation/steaming	1	6	6	Behaviour and movement	Blue shark	6.1	1	1	1	Navigation and steaming may lead to a change in the movement patterns and/or Behaviour of scavenging species. The impact of this on overall movement patterns is considered negligible. Consequence: negligible, given it may not be detectable at scale of impact. Confidence: low, due to lack of data.
Addition/ movement of biological material	Translocation of species	1	6	6	Population size	Bronze whaler shark	1.1, 1.3, 1.4	2	2	1	The ingestion of diseased imported bait may affect bycatch/byproduct species. Intensity: minor providing bait dispersed, and AQIS regulations are followed. Consequence: minor, impact for bycatch and byproduct species, if pathogen is spread via ingestion. Confidence: low due, to lack of data on possible species affected.
	On board processing	1	6	6	Behaviour and movement	Blue shark	6.1	3	2	1	Processing of catch can attract scavenging species. Processing of catch is common in the area of the fishery (moderate intensity), and the consequence is considered greatest with regard to movement and Behaviour. Consequence: is considered minor at most. Confidence low, due to lack of data.
	Discarding catch	1	6	6	Behaviour and movement	Blue shark	6.1	2	2	2	Discarding of catch can attract scavenging species. Processing of catch is common in the area of the fishery, but apparently limited volumes (minor intensity). Consequence: is considered greatest with regard to

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
											movement and Behaviour, and considered minor at most. Confidence: high, based on AFMA Observer data.
	Stock enhancement	0									
	Provisioning	1	6	6	Behaviour and movement	Blue shark	6.1	1	2	1	Provisioning occurs through bait lost during manual or automatic baiting. Baiting the hooks can attract species that benefit by eating the provided food. They may aggregate in the area of fishing activity, with modified Behaviour or movement patterns. There is a limited volume of additional food from such sources (negligible intensity). Consequence: minor (at most), and is considered greatest with regard to movement and Behaviour. Confidence: low, due to lack of data.
	Organic waste disposal	1	6	6	Behaviour and movement	Blue shark	6.1	1	1	1	Organic waste disposal can attract species, however, the limited volume of additional food from such sources and the area over which a single disposal event might occur is negligible (intensity). The consequence is considered greatest with regard to movement and Behaviour, however the consequence is considered negligible at most. Confidence: low, due to lack of data, but logical consideration also constrains the consequence score to a low value.
Addition of non-biological material	Debris	1	6	6	Population size	Blue shark	1.1, 1.3, 1.4	1	1	1	Debris lost from boats likely to be accidental because boats are subject to MARPOL regulations which specify all items such as bait-box straps, not to be discarded at sea. Intensity and Consequence: deemed to be negligible as loss should be accidental not intentional. Confidence low due to lack of data, so conservative score used.
	Chemical pollution	1	6	6	Population size	Blue shark	1.1, 1.3, 1.4	1	1	1	While the potential for chemicals to enter the environment from vessels is acknowledged, most cleaning and painting does not occur at sea, and dilution quickly reduces the impact of any materials entering the open sea. Consequence: for population size of this species considered negligible. Confidence: low, due to lack of data.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Exhaust	1	6	6	Behaviour and movement	Blue shark	6.1	1	1	2	The bycatch and byproduct species are marine, and the exhaust is mostly gas that enters the atmosphere directly, or from engines just below the surface. Dissolving exhaust particulates in the water are diluted very quickly, with the ability to detect such pollution considered extremely low at the current activity levels. This activity is occurring over a wide area, with negligible intensity and consequence. Confidence: high due to logical consideration.
	Gear loss	1	6	6	Behaviour and movement	Blue shark	6.1	1	1	1	Gear that is lost may eventually settle on substrate, however lost gear may act as FADs to bycatch/byproduct species if it floats at the surface. Most gear that remains floating is light sticks and perhaps balls of lost line. While gear loss may potentially occur over a wide geographic area, the actual volume of material lost, while unknown, is not believed to be large. Aggregation around lost material, a change in Behaviour by aggregating species, was considered a greater consequence (but still negligible) than changes to population size through availability of new structure, or loss of natural. Confidence low due to lack of data.
	Navigation/ steaming	1	6	6	Behaviour and movement	Bronze whaler shark	6.1	1	1	2	Introduction of light, noise by vessels considered negligible consequence for any bycatch or byproduct species. Confidence: high, due to logical consideration.
	Activity/ presence on water	1	6	6	Behaviour and movement	Bronze whaler shark	6.1	1	1	2	Vessels do attract animals, but effects on the Behaviour and movement (worst case) considered negligible. Confidence high due to logical consideration.
Disturb physical processes	Bait collection	1	4	5	Behaviour and movement	Bronze whaler shark	6.1	1	1	1	Inshore light purse seine is used as major bait collection technique. Some disruption of sediments may occur, unlikely to have significant footprint, and disturbance would be short term. Intensity and Consequence considered negligible. Confidence: low due to lack of data.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Fishing	1	6	6	Behaviour and movement	Blue shark	6.1	1	1	1	This fishery is a pelagic fishery using longlines believed to have little disrupting effect to the water column processes. Intensity: negligible unlikely to have measurable/detectable impact spatially or temporally on physical processes because once the gear is removed water conditions expected to return to usual state. Consequence: negligible because considered to have remote impact on physical processes that might change behaviour and movement of non target species Confidence: recorded as low because of insufficient knowledge for this fishery
	Boat launching	0									
	Anchoring/ mooring	1	5	5	Behaviour and movement	Bronze whaler shark	6.1	1	1	2	Longline vessels rarely anchor or moor in anchorages. Intensity: negligible, unlikely to directly effect non-target species but may affect benthic processes which may indirectly effect non target species. Consequence: negligible because considered to have remote impact on physical processes that might change behaviour and movement of non target species. Confidence: high, constrained by logic.
	Navigation/steaming	1	6	6	Behaviour and movement	Dusky shark	6.1	1	1	2	Navigation/ steaming occurs throughout the year over the entire fishery. Intensity: negligible because unlikely to have measurable/detectable impact on physical processes, water mixing may occur and in shallow water stir up sediments but expected to return to normal state quickly after disturbance. Consequence: negligible because considered to have remote impact on physical processes that might affect conditions that then change behaviour or movement non target species. Confidence was scored as high because it was considered unlikely for there to be strong interactions between Navigation/steaming, physical processes and non target species, constrained by logic

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
External Impacts (specify the particular example within each activity area)	Other fisheries: Southern Bluefin Tuna Fishery (SBT), Small Pelagics Fishery (SPF), SESSF, Skipjack Fishery (SKJ).	1	5	6	Population size	Blue shark	1.1, 1.3, 1.4	4	4	1	Fishery covers a large spatial area in which many other state fisheries occur using wide range targeting methods and catch a variety of species. Some species migratory and interact with international fishing operations in Pacific ocean. Uncertainties re mixing between Pacific Ocean and Australian EEZ, and re stock assessments these catches may affect domestic fishery, and domestic catches can affect these stocks (links). Intensity: could have measurable major impact both direct and indirect on non-target species once linkages understood. Consequence: cumulative effects could be major and affect population size of non-target species. Confidence: Until there is better information difficult to score therefore low confidence.
	Aquaculture	0									
	Coastal development	1	5	6	Behaviour and movement	Bronze whaler shark	6.1	2	2	1	Both large and small centres along the coast and ongoing coastal development is likely to have minor impact as the fishery operates offshore and most stocks are offshore, well away from these developments. Sewage outfall is considered to be minor given the level of ocean mixing. This outfall may increase in primary productivity and attract the species. Consequence: minor, given the scale of the activity. Confidence: low, little data on cumulative impacts.
	Other extractive activities	1	5	6	Behaviour and movement	Bronze whaler shark	6.1	1	1	1	Fishery covers a large spatial area and occurs throughout the year. Oil and gas industry off eastern Victoria and Queensland. May be pollution from petrochemical industry in both shallow and deep water. Intensity: assumed to have negligible impact both direct and indirect on non target species, but linkages need to be better understood. Consequence: cumulative effects expected to be negligible and not affect Behaviour of non target species. Confidence: Until there is better information difficult to score, therefore low confidence.
	Other non-extractive activities	1	6	6	Behaviour and movement	Tiger shark	6.1	1	1	1	Fishery covers a large spatial area and occurs throughout the year. Other shipping and cable laying occurs in the area. Intensity: assumed to have negligible impact (direct and indirect) on non target species. Consequence: cumulative effects expected to be negligible and not

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
											affect population size. Confidence: low, until there is better information difficult to score.
	Other anthropogenic activities	1	4	5	Behaviour and movement	Tiger shark	6.1	1	1	1	Fishery covers a large spatial area and occurs throughout the year. Species may be disturbed by tourism (whale watching) and charter boats operating inshore. Intensity: assumed to have negligible impact both direct and indirect on non target species, but linkages need to be better understood. Consequence: cumulative effects expected to be negligible. Confidence: Until there is better information difficult to score therefore low confidence.

Level 1 (SICA) Document L1.3 - Protected Species Component.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
Capture	Bait collection	1	4	5	Population size	Black browed albatross	1.1, 1.3, 1.4	1	2	1	Bait collection is permitted for own use in fishing for key/secondary commercial species. Purse seining, may occur at night. Use of lights at night may attract albatrosses, which can collide with vessel structures. Intensity: negligible because current live bait catch is relatively low, and purse seine shots are quick so time for other protected species to aggregate on gear is short. However there is need to monitor risks to species if collection of live bait increases. Consequence: considered minor because scale and intensity currently low. Level of bait catch it is unlikely to impact protected species in terms population size, unless substantial removal of prey species targeted as bait. Confidence: low because of insufficient knowledge on live bait fish distribution, and capture.
	Fishing	1	6	6	Population size/Interactions with fishery	Shortfin mako	1.1, 1.3, 1.4, 7.1, 7.2	3	4	2	ETBF fishing occurs throughout year and covers a large area. Approximately 10,159 chondrichthyans interactions were reported over the 2011-2015 period. Of these, 10,089 were shortfin mako sharks (5 alive; 7510 dead; 2574 unknown). Since, shortfin mako have a low population rates (e.g. slow growth rate, late maturing and low fecundity), it is particularly vulnerable to fishing pressure. Consequence: major given its spatial and temporal scale. Confidence: high (Commonwealth Logbook database).
	Incidental behaviour	1	4	5	Behaviour and movement	Australian fur seal; Common dolphin	6.1	2	1	2	Offshore, during discarding or recovery of gear, seals may be attracted to boat and fishing operations, rarely take caught fish from hooks. Intensity: occurs infrequently in space and time. Consequence: potential injury to seals, but of a negligible consequence over the scale of the fishery. Confidence: high (Commonwealth Logbook and Observer data).
Direct impact without capture	Bait collection	1	4	5	Population size	Black browed albatross	1.1, 1.3, 1.4, 7.1, 7.2	1	1	1	Removal of baitfish which may be food source (indirect interaction), although species might be contacted with gear resulting in injury/ stress, when bait collecting is closest to coast. Intensity: negligible (with caution) because reported incidents of interaction with bait fishery are unknown and live bait catch is relatively small scale. Consequence: considered negligible because current bait catch is not primary prey species, and current level of bait catch

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
											assumed to have undetectable impact on population size of the black browed albatross. Confidence: low due to insufficient knowledge on trophic relationships.
	Fishing	1	6	6	Population size/Interaction with fishery	Shortfin mako	1.1, 1.3, 1.4, 7.1, 7.2	3	4	2	Fishing occurs throughout year in the ETBF and covers a large area. The post interaction effect on this species is unclear, however it is likely that interactions could result in impairment of function/ prey capture ability and unobserved mortality through delayed effects. Impact could influence population size in those species threatened by reduced population sizes or sustain heavy mortality via other means. Intensity: moderate over the spatial scale of the fishery. Consequence: major, reproductive maturity approximately eight years (males; Fishbase (2016)) and approximately 20 years (females; Fishbase (2016)) delaying recovery of species. Consequence: high (Commonwealth Logbook database).
	Incidental behaviour	1	6	5	Population size	Australian fur seal	1.1, 1.3, 1.4	2	2	1	Seals are known to be inquisitive, and may be attracted by visual stimuli or discards from occasional recreational fishing during crew down-time. Entanglement with fishing lures or swallowing while stealing fish, or injuries from scaring techniques may result in subsequent mortality. Intensity: minor because recreational activities are limited and such interactions a rare part of these. Consequence: minor with regard to population size of the Protected species in question (precautionary scoring). Confidence: low, due to lack of data.
	Gear loss	1	6	6	Population size	Leatherback turtle	1.1, 1.3, 1.4	2	2	1	Turtles most at risk of mortality associated with the ingestion of lost light sticks (glow mimics jellyfish prey). Longline gear is occasionally lost, although GPS radio beacons assist gear recovery. Protected species may be entangled or caught as gear drifts. Lost gear tends to ball up reducing likelihood of entanglement. The use of circle hooks has aided the reduction of seabird mortality. Intensity: considered minor because only occurs occasionally, gear is recovered whenever possible. Consequence: minor because although it can

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
											continue to fish/entangle, it soon forms a ball. Confidence: low, given lack of data on this interaction type.
	Anchoring/ mooring	1	5	5	Behaviour and movement	Leatherback turtle	6.1	1	1	2	Anchoring only takes place in shallow waters. Very unlikely that these species would be adversely affected by the process of anchoring or mooring. Intensity: low likelihood of direct interaction with anchoring/ mooring lines. Consequence: low. Confidence: high, logical consideration of interactions.
	Navigation/steaming	1	6	6	Behaviour and movement	Humpback whale; southern right whale; other whales	6.1	1	1	2	Navigation/ steaming occurs throughout the year over the entire fishery. Intensity: negligible because it is unlikely to have measurable/detectable impact e.g. collisions with whales. Consequence: negligible because interactions remote, and impact on population size or behaviour and movement of Protected species unlikely. Confidence: high due to logical consideration.
Addition/ movement of biological material	Translocation of species	1	6	6	Population size	Bottlenose dolphin	1.1, 1.3, 1.4	2	2	1	Frozen imported bait could carry disease that might spread to local baitfish populations. Intensity: minor, as both squid and local bait is used more often in the fishery. Consequence: minor because translocation of species and transmission of disease to local bait species. This could affect population size of Protected species dependent on these as a food source. The fishery is offshore where contact with local bait species is reduced. Confidence was scored as low because of a lack of data and understanding of pathogens and marine diseases
	On board processing	1	6	6	Behaviour and movement	Black browed albatross	6.1	3	2	1	On board processing occurs. TAP regulations prohibit discharge of offal during line setting or hauling to reduce attractiveness to seabirds. Intensity moderate; waste expected to be taken up quickly by opportunistic scavengers or sink to benthos and be scavenged by benthic species. Protected species in the area might also scavenge and change Behaviour, increasing opportunity of harmful interactions. Boat-following Behaviours are common. Consequence: minor as unlikely to affect behaviour movement of Protected species for more than a few days while boats in the area. Confidence: low due to uncertainty about the volume of on board processing and the time birds spend around vessels.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Discarding catch	1	6	6	Behaviour and movement	Black browed albatross	6.1	3	2	1	Discarding of target species due to high grading and damage by sharks or marine mammals, byproduct species of low value or lack of markets, & bycatch species occurs. Intensity: moderate. Consequence: minor as behaviour movement of Protected species modified only while vessels in the area and waste expected to be taken up quickly by opportunistic scavengers and/or sink to benthos. Confidence: low because of a lack of data on effects of discarding on Protected species.
	Stock enhancement	0									
	Provisioning	1	6	6	Behaviour and movement	Killer whale	6.1	2	2	1	Toothed cetaceans (whales and dolphins) swim along lines and pick off tuna; this Behaviour can result in fishers moving to a new area. Intensity can be locally important, but minor overall. The consequence on Behaviour and movement is temporary, although some areas appear to have animals that do this a lot. Confidence was scored as low because of a lack of verified observer data.
	Organic waste disposal	1	6	6	Behaviour and movement	Black browed albatross	6.1	1	2	2	Fishing activity occurs throughout the year in the ETBF. Domestic boats are generally at sea for 3-7 days (or greater). Organic waste disposal possible over this scale on a daily basis. Disposal of organic waste was expected to pose greatest potential risk for the Behaviour/movement of Protected species. Seabirds were chosen because they were considered to be readily attracted toward fishing vessels dispensing organic waste. Boats subject to MARPOL. Intensity: negligible because there was remote likelihood of seabirds being adversely affected (aggregation during feeding frenzy a natural process). Organic waste disposal in its own right was considered to have minimal consequence on seabirds, however, it was considered that disposal of organic waste is likely to increase chances of other negative interactions e.g. collision or entanglement. Confidence: high because organic waste disposal considered unlikely to have detectable impacts on seabirds.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
Addition of non-biological material	Debris	1	6	6	Population size	All turtles; seabirds	1.1, 1.3, 1.4	2	2	2	Addition of debris by this fishery expected to be accidental not routine. Vessels subject to MARPOL rules. Plastic bits consumed by turtles and seabirds can cause intestinal obstruction, transfer to chicks, death through starvation. Turtles swallow light sticks (mimic prey), may lead to subsequent mortality. Entanglement is also possible. Intensity: minor if MARPOL rules adhered to, and with new light stick clip modification to reduce loss. Consequence: minor against background of other impacts, detectable only on autopsy, but well documented. Confidence: high.
	Chemical pollution	1	6	6	Population size	Leatherback turtle; green turtle	1.1, 1.3, 1.4	1	1	2	Accidental discharge anticipated. Chemicals used during fishing activities, such as lubricants for line hauling gear, may be an issue as boats maybe out at sea for days and maintenance may be required. Protected species unlikely to be affected unless there is a major spill, but then localized impact. Dilution of chemicals expected to occur quickly. Boats subject to MARPOL regulations for disposal of chemicals (prohibited). Light sticks with chemicals may also be ingested particularly by turtles mistaking them for prey. Intensity: negligible if MARPOL rules adhered to. Consequence: negligible due to dilution and mixing of materials. Confidence: high (AFMA).
	Exhaust	1	6	6	Population size	Black browed albatross	1.1, 1.3, 1.4	1	1	2	Exhaust from running engine hazard occurs over a large range/scale. Air quality most likely affected, which may affect the Behaviour and movement. Intensity: negligible because exhaust considered low impact to Protected species i.e. not physically affected, unlikely to be measurable, effects more likely to be short term and effect air quality. Consequence: negligible because species unlikely to avoid fumes so unlikely to affect behaviour and movement of target species. Confidence: high because exhaust unlikely to impact on behaviour/movement of Protected species
	Gear loss	1	6	6	Population size	Leatherback turtle	1.1, 1.3, 1.4	2	2	1	Turtles most at risk of mortality associated with the ingestion of lost light sticks (glow mimics jellyfish prey). Longline gear is occasionally lost, although GPS radio beacons assist gear recovery. Protected species may be entangled or caught as gear drifts. Lost gear tends to ball up reducing likelihood of entanglement. Intensity: minor because only occurs occasionally, gear is

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
											recovered whenever possible. Consequence: minor because although it can continue to fish/entangle, it soon forms a ball. Confidence: low, due to insufficient data on this interaction type.
	Navigation/ steaming	1	6	6	Behaviour and movement	Black browed albatross	6.1	2	2	1	Birds follow boats, and navigation/ steaming occurs throughout the year over the entire fishery. Navigation/steaming is a large component of the operations and will introduce noise and visual stimuli into the environment. Intensity: minor, because type of impact on behaviour and movement of species may lead to a temporary move to/away at the time but no change to long-term patterns. Consequence: minor impacts on Behaviour and movement. Confidence: low, due to lack of information.
	Activity/ presence on water	1	6	6	Behaviour and movement	Black browed albatross	6.1	3	2	1	The environment will be impacted by noise and visual stimuli which does affect Behaviour and movement. Intensity: moderate impact on behaviour and movement of Protected species due to scale of fishing. Consequence: minor, Behaviour modified only for hours while vessels present, animals disperse each night, may visit same area next day and then move on. Confidence: low, no good data on time of perturbed Behaviour, and therefore conservatively scored.
Disturb physical processes	Bait collection	1	4	5	Behaviour and movement	Black browed albatross	6.1	2	2	1	Disturbance of the sediments might lead to temporary reduction in visibility that impacts the feeding Behaviour (reduced efficiency), prey detection by birds. Consequence: minor. Confidence: low, insufficient knowledge on live bait fish distribution, and capture, and possible effects on the physical processes.
	Fishing	1	6	6	Behaviour and movement	Leatherback turtle	6.1	1	1	2	This fishery a pelagic fishery using longlines, believed to have little disrupting effect to the water column processes. Intensity: negligible unlikely to have measurable/detectable impact spatially or temporally on physical processes because once the gear is removed water conditions expected to return to usual state. Consequence: negligible, no changes to physical processes. Confidence: high; logical consideration.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Boat launching	0									
	Anchoring/ mooring	1	5	5	Behaviour and movement	Leatherback turtle	6.1	1	1	2	Longline vessels rarely anchor or moor in anchorages. Intensity: Expected to be negligible. Intensity likely to be related to time at sea. However unlikely to directly affect protected species but may effect benthic processes which may indirectly effect protected species. Consequence: negligible. Confidence: high; logical consideration.
	Navigation/steaming	1	6	6	Behaviour and movement	Whales (e.g. blue whale)	6.1	2	1	2	Navigation/ steaming occurs throughout the year over the entire fishery. Intensity: minor, water mixing may occur and in shallow water stir up sediments but expected to return to normal state quickly after disturbance. Consequence: negligible because considered to have no impact on physical processes that might affect conditions that then change behaviour or movement of Protected species. Confidence: high, logical consideration.
External Impacts (specify the particular example within each activity area)	Other fisheries: Southern Bluefin Tuna Fishery (SBT), Small Pelagics Fishery (SPF), SESSF, Skipjack Fishery (SKJ).	1	5	6	Population size	Turtles (e.g. leatherback turtle); Seabirds (e.g. black browed albatross)	1.1, 1.3, 1.4	4	4	1	Other fisheries operate in the same region, e.g. SBT, SPF, SKJ, WCPO Tuna fisheries, recreational fisheries NSW. Some protected species are migratory and interact with international fishing operations in Pacific ocean. Uncertainties re mixing between offshore and the Australian fishery area. Intensity: major, these Protected species are captured over broad spatial scales, although seabird Bycatch action plans and Turtle Mitigation Plans (TMPs) in other fisheries would mitigate against this. Consequence: cumulative effects could be major and affect population size, populations currently declining (e.g. for seabirds and mammals). Confidence: low, not clear where main consequence is expressed.
	Aquaculture	0									
	Coastal development	1	5	6	Behaviour and movement	Turtles (e.g. leatherback turtle); Seabirds (e.g. black browed albatross)	6.1	2	2	1	Both large and small centres along the coast and ongoing coastal development is likely to have minor impact as the fishery operates offshore and most stocks are offshore, well away from these developments. Sewage outfall is considered to be minor given the level of ocean mixing. This outfall may increase in primary productivity and attract the species. Consequence: minor, given the scale of the activity. Confidence: low, little data on cumulative impacts.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Other extractive activities	1	5	6	Behaviour and movement	Seabirds (e.g. black browed albatross); Whales (blue whale)	6.1	2	2	1	Oil and gas industry in Bass Strait, East coast of Victoria and Queensland. There may be pollution from petrochemical industry in both shallow and deep water. Also, noise and visual stimuli as a part of operations may affect migratory species. Intensity: minor with regard to Protected species, but linkages need to be better understood. Consequence: cumulative effects expected to be minor and not affect population size or behaviour or movement of these species. Confidence: low, until there is better information difficult score.
	Other non-extractive activities	1	6	6	Population size	Whales (e.g. blue whale)	1.1, 1.3, 1.4	3	2	1	Fishery covers a large spatial area and occurs throughout the year. Lots of other shipping activities in the area (e.g. off Gladstone - LNG export terminal), boat propellers, collisions could surfacing whales. Intensity: moderate due to scale of shipping. Consequence: effects expected to be minor and not affect population size of Protected species. Confidence: low, until there is better information difficult to score.
	Other anthropogenic activities	1	4	5	Behaviour and movement	Whales (e.g. blue whale)	6.1	2	2	1	Species may be disturbed by tourism (e.g. whale watching) charter boats, as collisions are reported. Intensity: minor. Consequence: minor. Confidence: low confidence due to lack of information.

Level 1 (SICA) Document L1.4 - Habitat Component

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
Capture	Bait collection	1	4	5	Habitat structure and function	Eastern Pelagic Province - Coastal; Inner shelf (fine sediments, wave rippled, large sponges)	5.1	2	2	1	Bait collection using purse seine method will mix water, may touch bottom but any damage expected to recover quickly, as on soft bottom. Maybe some mixing of water; benthic habitats unlikely to be disturbed in the process. Intensity: minor; restricted locations. Consequence: minor; scale and intensity low, level of bait catch it is unlikely to impact water quality or habitats long term. Given the inshore nature of bait fishing and the resilience of habitats in these depths and areas of frequent nature disturbance, benthic habitats that may be disturbed are likely to recover relatively rapidly. Confidence: low because of insufficient knowledge on live bait fish distribution and the occasional gear interactions with benthos.
	Fishing	1	6	6	Habitat structure and function	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	5.1	1	1	2	Pelagic habitat, mixing of water may occur during fishing. Intensity: negligible, water expected to return to usual state once gear removed from water. Consequence: negligible fishing not likely to affect habitat structure. Confidence: high due to logical constraints.
	Incidental behaviour	1	4	5	Water Quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	2.1	1	2	2	Recreational activity offshore unlikely to impact pelagic habitats, although impacts on inshore benthic habitats may be possible, there was no information to assess this risk at this time. Consequence: minor as a conservative score. Confidence: high, given logic based on the scale and intensity of these activities.
Direct impact without capture	Bait collection	1	4	5	Habitat structure and function	Eastern Pelagic Province - Coastal	5.1	2	2	1	Bait collection using purse seine method will mix water, might touch bottom but any damage expected to recover quickly, as on soft bottom. Intensity: minor; current live bait catch is low and unlikely to be any effects from water mixing, benthic habitats maybe disturbed or damaged. Consequence: minor given scale and intensity. Confidence: low because of insufficient knowledge on live bait fish distribution and the occasional gear interactions with benthos.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Fishing	1	6	6	Habitat structure and function	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	5.1	1	1	2	Pelagic habitat, mixing of water may occur during fishing. Intensity: negligible, water expected to return to usual state once gear removed from water. Consequence: negligible fishing not likely to affect habitat structure. Confidence: high due to logical constraints.
	Incidental behaviour	1	6	5	Water Quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	2.1	1	2	2	Recreational activity offshore unlikely to impact pelagic habitats, although impacts on inshore benthic habitats may be possible, there was no information to assess this risk at this time. Consequence: minor as a conservative score. Confidence: high given logic based on the scale and intensity of these activities.
	Gear loss	1	6	6	Habitat structure and function	Eastern Pelagic Province -seamount Oceanic	5.1	2	2	1	Longline gear may be lost although GPS radio beacons assist recovery of large sets of gear. Gear may drift in pelagic water, if it sinks can litter benthic habitats. Intensity: minor; rare in space and time. Consequence: minor; some benthic habitats may be damaged by gear if attached to reefs or sponge gardens. However, while gear is floating it may modify the pelagos, hence this scenario considered most vulnerable. Confidence: low because of a lack of data on extent of gear loss and breakdown times.
	Anchoring/mooring	1	5	5	Habitat structure and function	Inner-shelf (fine sediments, wave rippled, large sponges)	5.1	2	2	2	Longline vessels rarely anchor or moor in anchorages. Direct impact (damage or mortality) that occurs when anchoring or mooring most likely to affect habitat structure of inner-shelf sponge beds and algal communities by physical contact with anchor. Intensity: minor as anchoring/mooring is not daily, and more likely to occur on soft bottom. Consequence: minor as anchoring considered to affect only a very small percentage of the area of the habitat. Confidence: high, because it is considered very unlikely for there to be lasting damage to a large area of inner-shelf habitat caused by anchoring/mooring.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Navigation/steaming	1	6	6	Water quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	2.1	2	1	2	Navigation/ steaming occurs throughout the year over the entire fishery, and does mix the water vessels are active in, but really small impacts expected. Intensity: minor. Consequence: negligible because unlikely to affect air or water structure. Confidence: high because it was considered unlikely for there to be strong interactions between Navigation/steaming and habitat structure.
Addition/ movement of biological material	Translocation of species	1	6	6	Water quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	2.1	2	2	1	Introduction of disease via frozen imported pilchards has resulted in infection of local bait species in SA/ WA. Might result in disturbed biogeochemical cycling in pelagic and to a lesser degree in deep water, benthic habitats, if accumulation of carcasses should lead to anoxic conditions. Intensity and consequence for habitats considered minor, as previous examples of fish kill have not impacted the habitats. Confidence: low, little information available.
	On board processing	1	6	6	Water quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	2.1	1	1	2	On board processing occurs. Intensity: negligible impacts expected because waste expected to be taken up quickly by opportunistic scavengers if sink to benthos scavenged by benthic species, vessel is underway as processing occurs, thus a scattered trail results, and not concentrated pulses, especially as water is deep. Consequence: negligible Unlikely to impact habitats because of scavenging. Confidence: high, expert consensus.
	Discarding catch	1	6	6	Water quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	2.1	1	1	2	Discarding catch as on board processing leads to high grading. Discarding of bycatch and byproduct species of low value or lack of markets occurs. This may result in short term declines in water quality due to decomposition. Intensity: negligible impacts expected because waste expected to be taken up quickly by opportunistic scavengers, if sinks to benthos, scavenged by benthic species. Consequence: negligible. Unlikely to impact pelagic habitats for long because of scavenging and scales of mixing. Confidence: high, expert consensus.
	Stock enhancement	0									

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Provisioning	1	6	6	Water quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	2.1	1	1	2	Provisioning occurs through use bait and discarding. Shark and cetacean predation on longline fish relatively common. Intensity: negligible impacts expected because waste expected to be taken up quickly by opportunistic scavengers if sink to benthos scavenged by benthic species, lost bait may drift for a while, but again, scavenging expected. Consequence: negligible. Confidence: high, expert consensus.
	Organic waste disposal	1	6	6	Water quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	2.1	1	1	2	Domestic boats commonly spend 3-7 days or up to approximately 3 weeks at sea. Boats subject to MARPOL rules. Intensity: negligible if MARPOL rules adhered to. Consequence: negligible because organic waste likely to be scavenged or break down quickly so unlikely to affect habitats.Confidence: high (AFMA Observer information).
Addition of non-biological material	Debris	1	6	6	Habitat structure and function	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	5.1	1	1	2	Plastics may be an issue and are the most common debris item. Chemical light sticks may also be a litter issue. Boats subject to MARPOL regulations. Intensity: negligible if MARPOL rules adhered to. Consequence: negligible because debris by this fishery expected to be accidental not routine. Confidence: high (AFMA Observer information).
	Chemical pollution	1	6	6	Water quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	2.1	2	2	2	Chemicals and light sticks used during fishing activities may be an issue as boats maybe out at sea for many days. Habitats unlikely to be affected unless a major spill, but localized impact may resolve over natural mixing scale. Boats subject to MARPOL rules. Intensity: minor if MARPOL rules adhered to. Consequence: minor because chemical pollution impacts expected to be minimal and therefore unlikely to directly affect habitats. Confidence: high, (AFMA Observer information).
	Exhaust	1	6	6	Air Quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	3.1	1	1	2	Exhaust from running engine hazard occurs over a large range/scale. Intensity: negligible over broad spatial and temporal scales. Consequence: considered negligible because air quality likely to re-establish over very short time scales. Confidence: high because exhaust

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
											unlikely to impact air quality due to intensity and mixing of air column and therefore not impact these pelagic habitats.
	Gear loss	1	6	6	Habitat structure and function	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	5.1	2	2	1	Longline gear is lost although GPS radio beacons assist recovery of large sets of gear. Gear may drift in pelagic water. If it sinks, may contact the bottom and litter benthic habitats. Lost gear tends to ball up reducing likelihood of entanglement. Intensity: minor, because some benthic habitats may be damaged by gear if it attaches to reefs or sponge gardens. Consequence: minor but there could be cumulative impacts overtime, build up of litter, as materials may remain in environment for extended periods, with minimal break down. Confidence: low, because of a lack of data on extent of gear loss and breakdown times.
	Navigation/steaming	1	6	6	Air Quality, Water quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	3.1, 2.1	3	1	2	Navigation/ steaming occurs throughout the year over the entire fishery. Intensity: moderate at broad spatial scale. Consequence: negligible because unlikely to affect water or air quality for a period of more than a few hours. Confidence: high logical consideration.
	Activity/presence on water	1	6	6	Air Quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	3.1	3	1	2	The environment will be impacted by noise and visual stimuli temporarily Intensity: moderate, vessels common over broad scale. Consequence: negligible because unlikely to impact habitats. Confidence: high logical consideration.
Disturb physical processes	Bait collection	1	4	5	Habitat structure and function	fine sediments, wave rippled, large sponges, inner-shelf	5.1	1	1	2	Bait collection is permitted for own use in fishing for scheduled species. During purse seining; may be some mixing of water, benthic habitats will experience disturbance of the sediment layer if purse-seine net contacts the bottom. Intensity: negligible because current live bait catch is low and unlikely to be any effects from water mixing, recovery time in benthic habitats is related to depth and community structure, and is variable. Consequence: negligible because scale and intensity low,

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
											physical impact of nets on bottom uncommon, and unlikely given the level of live bait capture. Confidence: high, logical consideration.
	Fishing	1	6	6	Habitat structure and function	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	5.1	1	1	2	This fishery is a pelagic fishery using longlines which do not contact the benthos, and have little detectable effect on water flow patterns. Intensity: negligible unlikely to have measurable/detectable impact spatially or temporally on physical processes because once the gear is removed water conditions expected to returon to usual state rapidly. Consequence: considered to have remote impact on physical processes that may change habitats. Confidence: high, logical consideration.
	Boat launching	0									
	Anchoring/mooring	1	5	5	Substrate quality	Inner-shelf (fine sediments, wave rippled, large sponges)	1.1	2	2	1	Longline vessels rarely anchor or moor in anchorages. Anchoring may disturb fine sediments in quiescent environments and to a lesser degree, coarser sediments generally. Most inner shelf sediments in anchoring depths are disturbed regularly by wave, swell and current action. Intensity: minor as anchoring/mooring is not daily, and most likely to occur over 'soft' bottom, recovery would likely to occur within hours to days. It is considered very unlikely for there to be lasting damage to a large area of inner-shelf habitat caused by anchoring/mooring. Consequence: minor as anchoring considered to affect only a very small percentage of the area of the habitat. Confidence: low, lack of information.
	Navigation/steaming	1	6	6	Air Quality, Water quality	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	3.1, 2.1	3	1	2	Navigation/ steaming occurs throughout the year over the entire fishery. Intensity: moderate at broad spatial scale. Consequence: negligible because unlikely to affect water or air quality for a period of more than a few hours. Confidence: high logical consideration.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
External Impacts (specify the particular example within each activity area)	Other fisheries: Southern Bluefin Tuna Fishery (SBT), Small Pelagics Fishery (SPF), SESSF, Skipjack Fishery (SKJ).	1	5	6	Habitat Structure	Eastern Pelagic Province -seamount Oceanic	5.1	3	1	2	Cumulative effects on pelagic habitat of activities associated with fishing are unlikely to be detectable over the spatial scale of the fishery. Inshore purse seining for bait is more likely to be overlaid by a cumulative effect, but is not considered here as occurs within state waters. Confidence: high.
	Aquaculture	0									
	Coastal development	1	5	5	Habitat structure and function	Eastern Pelagic Province - Coastal	5.1	2	2	1	Both large and small centres along the coast and ongoing coastal development is likely to have minor impact as the fishery operates offshore and most stocks are offshore, well away from these developments. Sewage outfall is considered to be minor given the level of ocean mixing. This outfall may increase in primary productivity and attract the species. Consequence: minor, given the scale of the activity. Confidence: low, little data on cumulative impacts.
	Other extractive activities	1	5	6	Habitat structure and function	Eastern Pelagic Province - Oceanic	5.1	2	2	1	Activities such as oil drilling and cable laying may have impact that exceeds fishing. Consequence: minor, based on the spatail and temporal scale of the activity. Confidence: low.
	Other non-extractive activities	1	6	6	Habitat structure and function	Eastern Pelagic Province - Oceanic; Eastern Pelagic Province -seamount Oceanic	5.1	3	2	1	The impact of other non-extractive activities, such as shipping, may have some impacts, but expected to be minor in the region of the fishery. Confidence: low, due to lack of information.
	Other anthropogenic activities	1	4	5	Habitat structure and function	Inner shelf benthic habitats	5.1	2	1	1	The fishery takes place offshore, away from the tourism and recreational activities associated with tourism. Consequence: minor. Confidence: low, due to lack of data.

Level 1 (SICA) Document L1.5 - Community Component.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
Capture	Bait collection	1	4	5	Species composition	Central Eastern Province inner shelf	4.1	2	2	1	Bait collection is permitted for own use in fishing for scheduled species. May affect bait fish communities but at these levels unlikely to affect communities (food source). Intensity: minor because current live bait catch is low impact, unlikely to be detectable against background variability. Consequence: minor, unlikely to impact species composition more than 5%. Confidence: low because of insufficient knowledge on live bait fish distribution, and capture. Need to consider overall stock status of bait fish with regard to capture by other fisheries.
	Fishing	1	6	6	Functional group composition	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	4.1	4	3	1	Fishery occurs throughout year and covers a large area. Most target and non target species taken are high trophic level pelagic species. Intensity: major the domestic fishery. This level of fishing may affect the state of the Eastern oceanic pelagic (2) community (~40% effort overlap with this communituy over the last five years) and the Eastern oceanic (2) seamount community (29% effort overlap with community over the last five years). Also, the intensity of fishing over Eastern oceanic (2) seamount seamount community appears to be relatively high (GIS and logbook analyses). Consequence: moderate because of the intensity and spatial scale of the fishery. Need to establish whether this level of catch is sustainable so that communities, particularly seamounts are not affected over time. Fishing targets apex predators and might result in functional group composition. Confidence: low. No community studies with information at this stage.
	Incidental behaviour	1	4	5	Species composition	Central Eastern Province outer shelf	4.1	1	1	1	Offshore fishery unlikely that activities might impact communities. Intensity: at this stage assumed negligible. Consequence: negligible at this stage assumed unlikely to affect communities. Confidence: high (AFMA logbook and and related information).

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
Direct impact without capture	Bait collection	1	4	5	Species composition	Central Eastern Province inner shelf	4.1	1	2	1	Bait collection is permitted for own use in fishing for scheduled species. Fishery occurs throughout year and covers a large area "Purse seine" method. Much fewer individuals will escape and impact the community. Intensity: negligible because current live bait catch is low, impact expected to be negligible, unlikely to be detectable against background variability. Consequence: minor because scale and intensity low, level of bait catch it is unlikely to impact community composition. Confidence: low because of insufficient knowledge on live bait fish distribution, and capture. Need to consider overall stock status of bait fish with regard to capture by other fisheries.
	Fishing	1	6	6	Functional group composition	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	4.1	2	2	1	Fishery occurs throughout the year and covers a large area, including seamounts. Intensity: minor, as fishing activity unlikely to affect the state of communities when animals are not captured, although see some of the specific fishery activities below. Consequence: considered minor because of the intensity and spatial scale of the fishery. Need to establish this level of catch is sustainable so that communities are not affected over time. Confidence: low due to insufficient data.
	Incidental behaviour	1	6	5	Species composition	Central Eastern Province outer shelf	4.1	1	1	2	Offshore fishery unlikely that activities occur that might impact communities. Intensity: negligible. Consequence: negligible at this stage assumed unlikely to affect communities Confidence high due to consensus.
	Gear loss	1	6	6	Species composition	Central Eastern Province outer shelf	4.1	1	2	1	A variety of longline gear is lost although GPS radio beacons assist recovery of major parts of gear. Key/secondary commercial and non-targetted species may be caught as gear drifts. Lost gear tends to ball up reducing likelihood of entanglement. Intensity: negligible even though lost gear can continue to fish once lost, for this fishery direct impact expected to be minimal unlikely to be detectable against background variability. Consequence: minor, level unlikely to impact species composition. Confidence: low because of a lack of data on interactions.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Anchoring/mooring	1	5	5	Species composition	Central Eastern Province outer shelf	1.1	1	1	1	Longline vessels rarely anchor or moor in anchorages. If it occurs, it is unlikely to impact communities. Intensity: negligible because the likelihood of impact is expected to be very unlikely, to be detectable against background variability. Consequence: negligible because the scale and intensity is considered negligible, it is unlikely to impact communities. Confidence: high because activity itself is unlikely, and consensus opinion.
	Navigation/steaming	1	6	6	Species composition	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	2	2	2	Navigation/steaming occurs throughout the year over the entire fishery, including seamounts. Intensity: minor impact, may lead to some animals following the vessel, changing the distribution of those animals. Consequence: minor impact on communities. Confidence: high because it was considered unlikely for there to be strong interactions between navigation/steaming and communities given expert opinion.
Addition/ movement of biological material	Translocation of species	1	6	6	Species composition	Eastern coastal pelagic	1.1	2	4	1	Broadbill swordfish and bigeye targeted using squid, other target species use scalefish, which may be frozen imports. If dead bait imported disease could be a problem as occurred in SBT, which may impact communities. Intensity: considered minor. Consequence: major as the translocation of disease could possibly affect communities. This risk is high for all fisheries importing baitfish. Confidence: low because of a lack of data or information.
	On board processing	1	6	6	Distribution of community	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	2	1	2	On board processing occurs throughout the fishery. Intensity: minor as waste expected to be taken up quickly by opportunistic scavengers or sink to benthos and scavenged by benthic species, will be scattered as vessel is underway and water very deep. Consequence: negligible. Confidence: high, consensus.
	Discarding catch	1	6	6	Distribution of community	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	1	1	1	Discarding target species due to high grading and damage by sharks or marine mammals, and discarding non-target species of low value or lack of markets occurs. Intensity: negligible impacts expected because waste expected to be taken up quickly by opportunistic scavengers or sink to benthos and scavenged by benthic species. Consequence: negligible for

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
											communities in terms of addition of biological material. Confidence: high (AFMA Observer information).
	Stock enhancement	0									
	Provisioning	1	6	6	Distribution of community	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	3	1	1	Provisioning occurs through use of bait and discarding. Intensity: moderate, occurs for every shot. Consequence: negligible, waste expected to be taken up quickly by opportunistic scavengers or sink to benthos and scavenged by benthic species. Confidence: low because of a lack of information.
	Organic waste disposal	1	6	6	Distribution of community	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	1	1	2	Boats subject to MARPOL rules Intensity: negligible if MARPOL rules followed. Consequence: negligible because organic waste likely to be scavenged or break down quickly. Confidence: high, observer data indicate crews diligent re waste.
Addition of non-biological material	Debris	1	6	6	Species composition	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	1.1	1	1	2	Plastics may be an issue, entanglement, ingestion, litter, however vessels are subject to MARPOL regulations. Intensity: negligible if MARPOL rules followed. Consequence: negligible community effect, if rare species were killed then might get a change in species composition in a region. Debris by this fishery expected to be accidental and not routine. Confidence: high, domestic AFMA Observer data indicated crews are diligent re waste.
	Chemical pollution	1	6	6	Species composition	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	1	1	2	Light sticks may be ingested. Chemicals used during fishing activities may be an issue as boats may be out at sea up to approximately three weeks. Communities unlikely to be affected unless a major spill, but localized impact as small vessels. Boats subject to MARPOL rules. Intensity: negligible if MARPOL rules followed. Consequence: negligible because chemical pollution impacts expected to be minimal and therefore unlikely to directly impact communities. Confidence: high, domestic Observer data indicated crews are diligent with regard to waste.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Exhaust	1	6	6	Distribution of community	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	1	1	2	Exhaust from running engine hazard occurs over a large range/scale. Intensity: negligible because exhaust considered low impact to pelagic communities including seamounts i.e. physically affected, unlikely to be measurable, effects more likely to be short term and effect air quality. Consequence: considered negligible because distribution communities not likely to be affected. Confidence: high, logical consensus.
	Gear loss	1	6	6	Distribution of community	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	1	1	2	A variety of longline gear is lost although GPS radio beacons assist recovery of major parts of gear. Target and non target species may be caught as gear drifts. Lost gear tends to ball up reducing likelihood of entanglement. Intensity: negligible. Consequence: negligible in terms of impact on community composition or change distribution of communities Confidence: high due to logical consideration.
	Navigation/steaming	1	6	6	Distribution of community	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	3	2	1	Navigation/steaming is a large component of the operations. Intensity: moderate, occurs frequently in all locations. Consequence: minor, seabirds follow boats, but changes not persistent beyond a day. Confidence: low, limited information.
	Activity/presence on water	1	6	6	Distribution of community	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	3	2	1	The environment will be impacted by noise and visual stimuli that could temporarily effect distribution of some community members such as seabirds. Intensity: moderate, is frequent. Consequence: minor, limited persistence of effect. Confidence: low, limited data.
Disturb physical processes	Bait collection	1	4	5	Distribution of community	Central Eastern Province outer shelf	1.1	2	2	1	Bait collection is with small purse seine nets, mixing of water may occur, gear may touch bottom. Intensity: minor disturbance of physical processes. Consequence: minor because considered to have minimal impact on physical process that might impact communities. This is precautionary scoring as confidence is low because of insufficient knowledge on live bait fish distribution, and capture, and possible effects on the physical processes.

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
	Fishing	1	6	6	Distribution of community	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	1	1	2	Fishery occurs throughout year and covers a large area, which includes seamounts. Intensity: negligible detectable effect on the physical processes important to the pelagic communities. Consequence: negligible. Confidence: high, logical consideration.
	Boat launching	0									
	Anchoring/mooring	1	5	5	Distribution of community	Central Eastern Province outer shelf	3.1	1	1	2	Longline vessels rarely anchor or moor in anchorages.Intensity: negligible. Consequence: negligible because scale and intensity physical processes expected to recover after disturbance. Confidence: high, logical consideration given scale of some other natural processes.
	Navigation/steaming	1	6	6	Distribution of community	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	3.1	1	1	2	Navigation/steaming occurs throughout the year over the entire fishery including seamounts. Intensity: negligible. Consequence: negligible. Confidence: high because it was considered unlikely for there to be strong interactions between Navigation/steaming and communities.
External Impacts (specify the particular example within each activity area)	Other fisheries: Southern Bluefin Tuna Fishery (SBT), Small Pelagics Fishery (SPF), SESSF, Skipjack Fishery (SKJ).	1	5	6	Trophic size structure	Eastern oceanic (2) pelagic; Eastern oceanic (2) seamount	4.1	3	3	1	Fishery covers a large spatial area in which many other state fisheries occur using wide range targeting methods and catch species. Some species migratory and interact with international fishing operations in the Pacific Ocean. Uncertainties re mixing between Pacific Ocean and Australian EEZ, and re. stock assessments these catches may affect domestic fishery, and domestic catches can affect these stocks (links). Intensity: moderate could have measurable major impact both direct and indirect on communities once linkages understood. Consequence: moderate cumulative effects could be major and affect many communities. Confidence: low, until there is better information.
	Aquaculture	0									
	Coastal development	1	6	5	Species composition	Southern coastal pelagic	1.1	3	2	1	Coatal development occurs across the range of the fishery, beyond the boundaries of current effort but not in all areas (e.g. central Bass Strait). Frequent, local impacts at small spatial scales should have most obvious impact on the species composition of the areas affected, the impacts should

Direct impact of fishing	Fishing Activity	Presence (1) Absence (0)	Spatial scale of Hazard (1-6)	Temporal scale of Hazard (1-6)	Sub-component	Unit of analysis	Operational objective (S2.1)	Intensity Score (1-6)	Consequence Score (1-6)	Confidence Score (1-2)	Rationale
											be local and their consequences only minor to the entire Eastern oceanic Pelagic community. Intensity: moderate - moderate at broader spatial scale, or severe but local. Consequence: minor, impacted species do not play a keystone role – only minor changes in relative abundance of other constituents. Confidence: low because of a lack of data.
	Other extractive activities	1	5	6	Distribution of community	Central Eastern Province outer shelf	3.1	1	1	1	Fishery covers a large area where there are activities such as oil and gas exploration in the eastern Bass Strait, eastern Victoria and Queensland, but does not occur where actual fishery effort occurs. There may be pollution from petrochemical industry in both shallow and deep water, and associated noise and visual stimuli. Intensity: assumed to have negligible effect on communities, but linkages need to be better understood. Consequence: cumulative effects may exist, but minor at this time given offshore area. Confidence: low, until there is better information.
	Other non-extractive activities	1	6	6	Distribution of community	Eastern coastal pelagic	3.1	3	2	1	Shipping and other similar activities not believed to play an important role in this offshore area. Moderate intensity, as shipping lanes are important in the area, but the consequence expected to be minor. Confidence: low, due to limited information for the group to consider.
	Other anthropogenic activities	1	4	5	Distribution of community	Eastern coastal pelagic	3.1	2	2	1	Fishery covers a large spatial area and occurs through out the year. Communities may be disturbed by tourism (whale watching) charter boats. Intensity: minor, as main fishery is offshore. Consequence: even cumulative effects expected to be minor and not affect communities. Confidence: low, until there is better information.

2.3.10 Summary of SICA results

A summary table (**Level 1 (SICA) Document L1.6);** of consequence scores for all activity/component combinations and a table showing those that scored 3 or above for consequence (shaded), and differentiating those that did so with high confidence (in bold) is outlined below (Table 2.19).

Table 2.19. Level 1 (SICA) Document L1.6. Summary table of consequence scores for all activity/component combinations. Those that scored ≥3 are highlighted grey and bolded if high confidence. * existing stock assessment for all species within component – assessment not required. Note: external hazards are not considered at Level 2.

Direct impact	Activity	Key/secondary commercial species	Byproduct & bycatch species	Protected species	Habitats	Communities
Capture	Bait collection	2	2	2	2	2
	Fishing	*	3	**4**	1	3
	Incidental behaviour	1	1	1	2	1
Direct impact without capture	Bait collection	2	1	1	2	2
	Fishing	1	2	**4**	1	2
	Incidental behaviour	1	1	2	2	1
	Gear loss	1	1	2	2	2
	Anchoring/ mooring	1	1	1	2	1
	Navigation/ steaming	1	1	1	1	2
Addition/ movement of biological material	Translocation of species	2	2	2	2	4
	On board processing	1	2	2	1	1
	Discarding catch	1	2	2	1	1
	Stock enhancement					
	Provisioning	1	2	2	1	1
	Organic waste disposal	1	1	2	1	1
Addition of non-biological material	Debris	1	1	2	1	1
	Chemical pollution	2	1	1	2	1
	Exhaust	1	1	1	1	1
	Gear loss	2	1	2	2	1
	Navigation/ steaming	1	1	2	1	2
	Activity/ presence on water	1	1	2	1	2
Disturb physical processes	Bait collection	2	1	2	1	2
	Fishing	2	1	1	1	1
	Boat launching					
	Anchoring/mooring	2	1	1	2	1
	Navigation/steaming	1	1	1	1	1
Note: external hazards are not considered at Level 2 in the PSA analysis						
External Impacts	Other fisheries	4	4	4	1	3
	Aquaculture					
	Coastal development	2	2	2	2	2
	Other extractive activities	2	1	2	2	1
	Other non-extractive activities	2	1	2	2	2
	Other anthropogenic activities	1	1	2	1	2

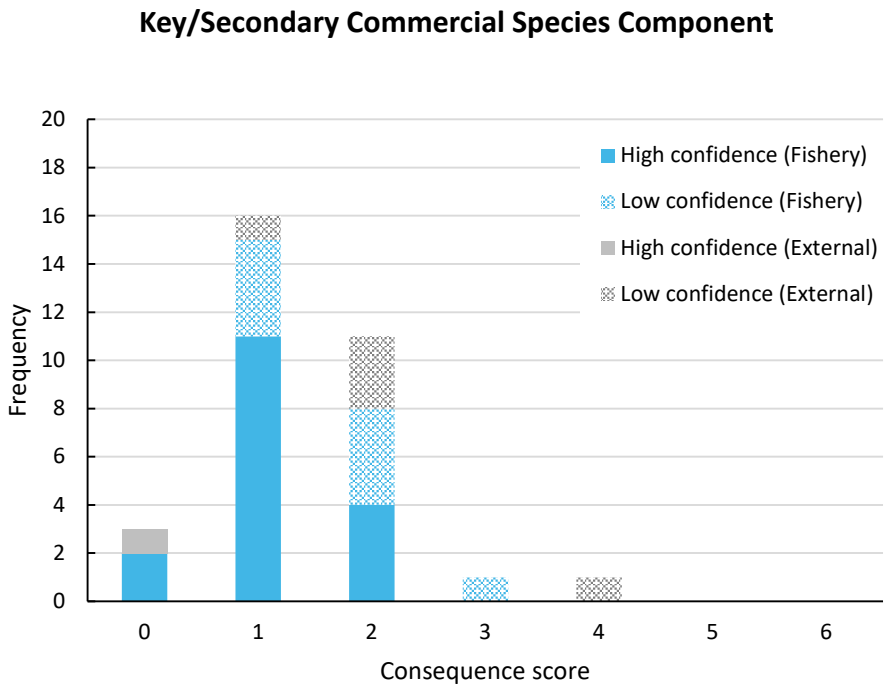


Figure 2.1. Key/secondary commercial species: Frequency of consequence score by high and low confidence.

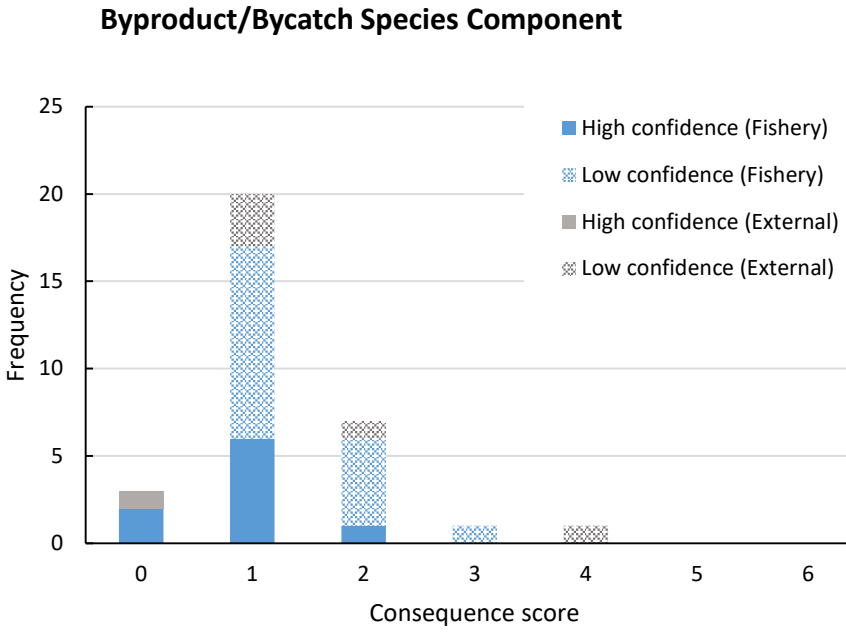


Figure 2.2. Byproduct and bycatch species: Frequency of consequence score by high and low confidence.

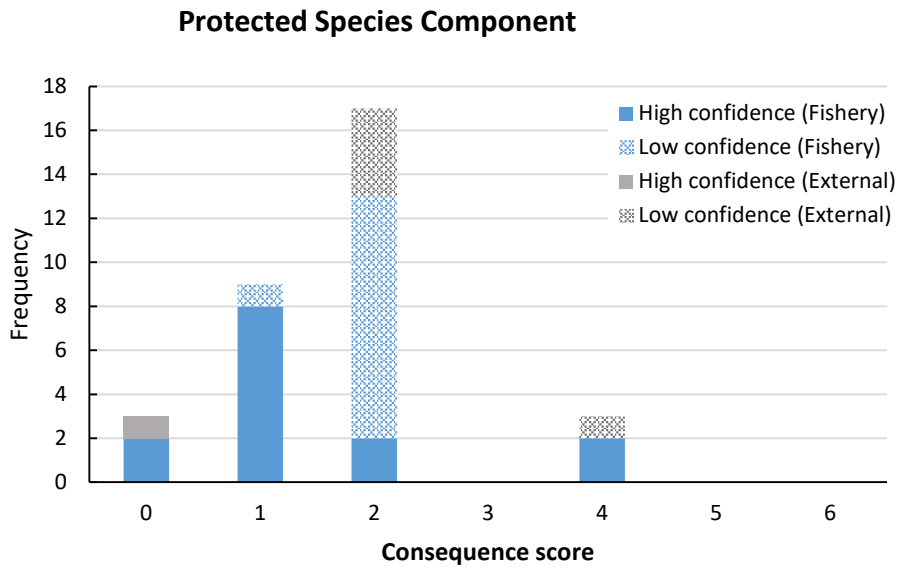


Figure 2.3. Protected species: Frequency of consequence score by high and low confidence.

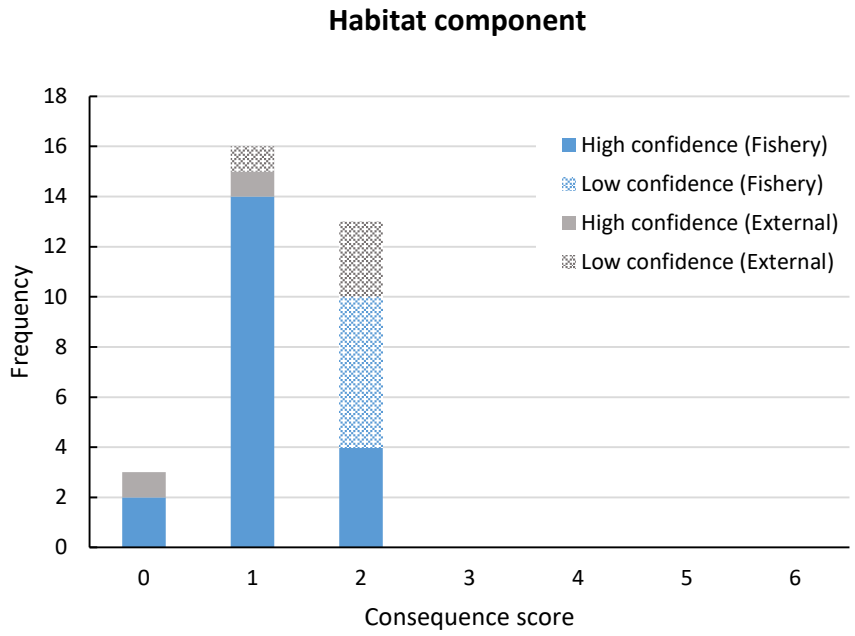


Figure 2.4. Habitat: Frequency of consequence score by high and low confidence.

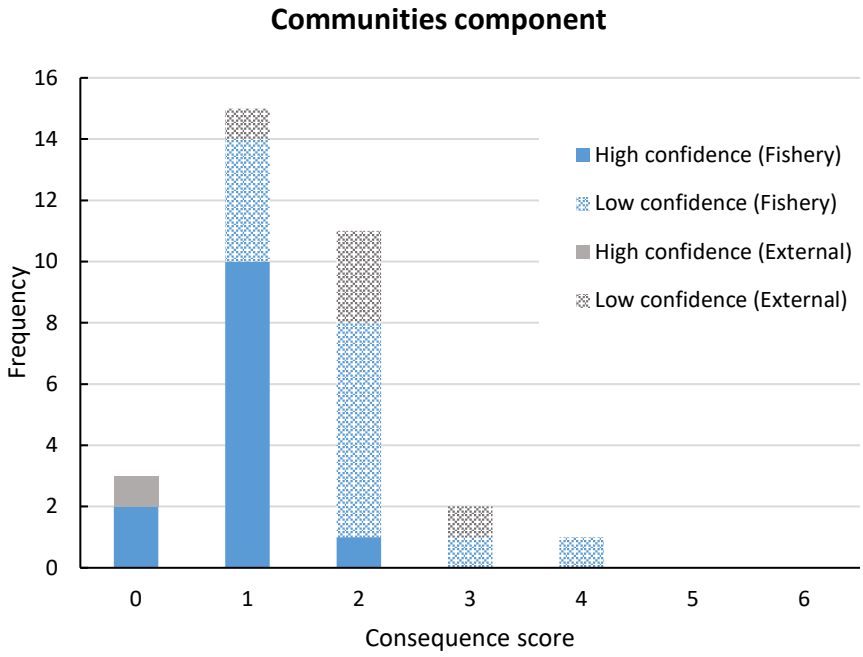


Figure 2.5. Communities: Frequency of consequence score by high and low confidence.

2.3.11 Evaluation/discussion of Level 1

Most hazards (fishing activities) were eliminated at Level 1 (risk scores 1 or 2; Table 2.19; Figure 2.1-Figure 2.5). Those remaining consist of:

- Direct impact of capture by fishing (byproduct/bycatch species, protected species and communities),
- Direct impact without capture by fishing (Protected species) and
- Addition/movement of biological material by translocation of species (Communities).

The direct impacts of fishing hazard was scored as moderate for Byproduct and Bycatch and Community components and major for the Protected species component. Confidence scores were high for the Protected species component, but low for the other two components (i.e. Byproduct and Bycatch and Communities). A major risk (risk score 4) was also due to indirect fishing impacts on Protected species.

The major risk and high confidence scores for the Protected species component (i.e., shortfin mako), for both fishing with and without capture was based on reported interactions from the Commonwealth Logbook database.

Translocation of species was considered to be a major risk (4) to Communities, due to the potential for the introduction of pathogens through the use of imported baits. Evidence of pathogens in other fishery areas has previously shown the consequence of this hazard.

Hazards assessed as majorly affected from external impacts consisted of other fisheries in the region also capturing the same Key/secondary commercial species, or Byproduct/Bycatch

species and on protected species. The Community ecological component was moderately impacted by other fisheries.

2.3.12 Components to be examined at Level 2

As a result of the preliminary SICA analysis, the components that are to be examined at Level 2 are those with any consequence scores of 3 or above. These components are:

- Byproduct and Bycatch
- Protected species

The Communities component also triggered a Level 2 analysis but was not assessed.

This SICA has removed the Habitat component from further analysis, as it was judged to be impacted with low risk consequence scores ≤ 3 by the set of activities considered.

2.4 Level 2 Productivity and Susceptibility Analysis (PSA)

When the risk of an activity at Level 1 (SICA) on a component is moderate or higher and no planned management interventions that would remove this risk are identified, an assessment is required at Level 2. The PSA approach is a method of assessment which allows all units within any of the ecological components to be effectively and comprehensively screened for risk. The units of analysis are the complete set of species habitats or communities identified at the scoping stage. The PSA results in sections 2.4.2 and 2.4.3 of this report measure risk of direct impacts of fishing only. Future iterations of the methodology will include PSAs modified to measure the risk due to other activities, such as gear loss.

The PSA approach is based on the assumption that the risk to an ecological component will depend on two characteristics of the component units: (1) the extent of the impact due to the fishing activity, which will be determined by the susceptibility of the unit to the fishing activities (Susceptibility) and (2) the productivity of the unit (Productivity), which will determine the rate at which the unit can recover after potential depletion or damage by the fishing. It is important to note that the PSA analysis essentially measures potential for risk, hereafter denoted as "risk". A measure of absolute risk requires some direct measure of abundance or mortality rate for the unit in question, and this information is generally lacking at Level 2.

The PSA approach examines attributes of each unit that contribute to or reflect its productivity or susceptibility to provide a relative measure of risk to the unit. The following section describes how this approach is applied to the different components in the analysis. Full details of the methods are described in Hobday et al. (2007).

Species

The following Table outlines the seven attributes that are averaged to measure productivity, and the four aspects that are multiplied to measure susceptibility for all the species components.

Table 2.20. Attributes that measure productivity and suscepability.

	Attribute
Productivity	Average age at maturity
	Average size at maturity
	Average maximum age
	Average maximum size
	Fecundity
	Reproductive strategy
	Trophic level
Susceptibility	Availability considers overlap of fishing effort with a species distribution
	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)
	Selectivity considers the potential of the gear to capture or retain species

	Attribute
	Post capture mortality considers the condition and subsequent survival of a species that is captured and released (or discarded)

The productivity attributes for each species are based on data from the literature or from data sources such as FishBase. The four aspects of susceptibility are calculated in the following way:

Availability considers overlap of effort with species distribution. For species without distribution maps, availability is scored based on broad geographic distribution (global, southern hemisphere, Australian endemic). Where more detailed distribution maps are available (e.g. from BIOREG data or DEH protected species maps), availability is scored as the overlap between fishing effort and the portion of the species range that lies within the broader geographical spread of the fishery. Overrides can occur where direct data from independent observer programs are available.

Encounterability is the likelihood that a species will encounter fishing gear deployed within its range. Encounterability is scored using habitat information from FishBase, modified by bathymetric information. Higher risk corresponds to the gear being deployed at the core depth range of the species. Overrides are based on mitigation measures and fishery independent observer data.

For species that do encounter gear, **selectivity** is a measure of the likelihood that the species will be caught by the gear. Factors affecting selectivity will be gear and species dependent, but body size in relation to gear size is an important attribute for this aspect. Overrides can be based on body shape, swimming speed and independent observer data.

For species that are caught by the gear, **post capture mortality** measures the survival probability of the species. Obviously, for species that are retained, survival will be zero. Species that are discarded may or may not survive. This aspect is mainly scored using independent filed observations or expert knowledge.

Overall susceptibility scores for species are a product of the four aspects outlined above. This means that susceptibility scores will be substantially reduced if any one of the four aspects is considered to be low risk. However the default assumption in the absence of verifiable supporting data is that all aspects are high risk.

Habitats

Similar to species, PSA methods for habitats are based around a set of attributes that measure productivity and susceptibility. Productivity attributes include speed of regeneration of fauna, and likelihood of natural disturbance. The susceptibility attributes for habitats are described in the following Table.

Table 2.21. Description of susceptibility attributes for habitats.

Aspect	Attribute	Concept	Rationale
Susceptability			
Availability	General depth range (Biome)	Spatial overlap of subfishery with habitat defined at biomic scale	Habitat occurs within the management area

Aspect	Attribute	Concept	Rationale
Encounterability	Depth zone and feature type	Habitat encountered at the depth and location at which fishing activity occurs	Fishing takes place where habitat occurs
	Ruggedness (fractal dimension of substratum and seabed slope)	Relief, rugosity, hardness and seabed slope influence accessibility to different sub-fisheries	Rugged substratum is less accessible to mobile gears. Steeply sloping seabed is less accessible to mobile gears
	Level of disturbance	Gear footprint and intensity of encounters	Degree of impact is determined by the frequency and intensity of encounters (inc. size, weight and mobility of individual gears)
Selectivity	Removability/ mortality of fauna/ flora	Removal/ mortality of structure forming epifauna/ flora (inc. bioturbating infauna)	Erect, large, rugose, inflexible, delicate epifauna and flora, and large or delicate and shallow burrowing infauna (at depths impacted by mobile gears) are preferentially removed or damaged.
	Areal extent	How much of each habitat is present	Effective degree of impact greater in rarer habitats: rarer habitats may maintain rarer species.
	Removability of substratum	Certain size classes can be removed	Intermediate sized clasts (~6 cm to 3 m) that form attachment sites for sessile fauna can be permanently removed
	Substratum hardness	Composition of substrata	Harder substratum is intrinsically more resistant
	Seabed slope	Mobility of substrata once dislodged; generally higher levels of structural fauna	Gravity or latent energy transfer assists movement of habitat structures, eg turbidity flows, larger clasts. Greater density of filter feeding animals found where currents move up and down slopes.
Productivity			
	Regeneration of fauna	Accumulation/ recovery of fauna	Fauna have different intrinsic growth and reproductive rates which are also variable in different conditions of temperature, nutrients, productivity.
	Natural disturbance	Level of natural disturbance affects intrinsic ability to recover	Frequently disturbed communities adapted to recover from disturbance

Communities

There are seven steps for the PSA undertaken for each component brought forward from Level 1 analysis (see Hobday et al. 2007 for full details).

Step 1. Identify the units excluded from analysis and document the reason for exclusion
Step 2. Score units for productivity
Step 3. Score units for susceptibility
Step 4. Plot individual units of analysis onto a PSA Plot
Step 5. Ranking of overall risk of each unit
Step 6. Evaluation of the PSA analysis
Step 7. Decision rules to move from Level 2 to Level 3

2.4.1 Units excluded from analysis (Step 1)

Species lists for PSA analysis are derived from recent observer data where possible or, for fisheries with no observer programs, from logbook and scientific data. In some logbook data, there may only be family level identifications. Where possible these are resolved to species level by cross-checking with alternative data sources and discussion with experts. In cases where this is not possible (mainly invertebrates) the analysis may be based on family average data.

Table 2.22. Species/species groups/taxa excluded from the PSA because they were either not identified at the species level, not interacted in the fishery or outside the fishery's jurisdictional boundary. No obs/ints: No obervations or interactions. These entries have been excluded from the protected species list since the last ERA assessment because they have not been observed within the fishery and/or occur outside the depth range of the fishery. AFMA: AFMA data

ERA species ID	Role in fishery	Taxa	Family name	Scientific name	Common name	CAAB code	Rationale
BP excluded from list due to insufficient taxonomic resolution or other:							
169	BP	Teleost	*Paristiopterus gallipavo*	Pentacerotidae	Yellow-spotted boarfish	37367001	Not in AFZ
	BP	Teleost	*Bramidae - undifferentiated*	Bramidae	Pomfret	37342000	AFMA
	BP	Teleost	*Syncomistes kimberleyensis*	Terapontidae	Kimberley grunter	37321029	Unlikely, inhabits rivers and rock pools
	BP	Teleost	*Tetrapturus pfluegeri*	Istiophoridae	longbill spearfish	37444752	Not in AFZ
	BP	Teleost	*Lumiconger arafura*	Congridae	Luminous conger	37067005	Outside ETBF
	BP	Teleost	*Loligo opalescens*	Loliginidae	Opalescent inshore squid	23617011	Outside ETBF
	BP	Teleost	*Micromesistius australis*	Gadidae	Southern blue whiting	37226795	Not in AFZ
	BP	Teleost	*Eumecichthys fiski*	Lophotidae	Unicorn crestfish	37270002	Outside ETBF
BC excluded from list due to insufficient taxonomic resolution or other:							
1758	BC	Chondrichthyan	Sphyrnidae	Sphyrnidae	Hammerhead sharks	37019000	AFMA
1359	BC	Chondrichthyan	*Carcharhinus*, *Loxodon* & *Rhizoprionodon* spp	Carcharhinidae	Blacktip sharks	37018901	AFMA
	BC	Teleost	*Epigonus* spp	Epigonidae	Deepsea cardinalfish	37327900	AFMA
	BC	Teleost	Diodontidae - undifferentiated	Diodontidae	Porcupine fish	37469000	
	BC	Teleost	*Sorosichthys ananassa*	Trachichthyidae	Little pineapple fish	37255010	Outside ETBF
	BC	Teleost	*Lutjanus* spp	Lutjanidae	Sea perch	37346905	AFMA

ERA species ID	Role in fishery	Taxa	Family name	Scientific name	Common name	CAAB code	Rationale
58	BC	Chondrichthyan	Hexanchidae - undifferentiated	Hexanchidae	Seven gilled shark	37005000	AFMA
	BC	Chondrichthyan	Alopiidae	Alopiidae	Thresher sharks	37012000	AFMA
	BC	Chondrichthyan	Carcharhinidae, Hemigaleidae - undifferentiated	Carcharhinidae, Hemigaleidae	Whaler and weasel sharks	37018000	AFMA
	BC	Chondrichthyan	*Centroscymnus* and *Deania* spp		Roughskin dogfishes (mixed)	37020904	AFMA
2046	BC	Chondrichthyan	Dasyatidae - undifferentiated	Dasyatidae	Stingrays	37035000	AFMA
2145	BC	Chondrichthyan	Skates & rays, unspecified	Multi-family group	Skates and rays	37990018	AFMA
1998	BC	Invertebrate	Order Teuthoidea - undifferentiated	Order Teuthoidea	Squid	23615000	AFMA
	BC	Teleost	Rhinidae - undifferentiated	Rhinidae	Guitarfishes unspecified	37026000	AFMA
2066	BC	Teleost	Alepisauridae - undifferentiated	Alepisauridae	Lancetfishes	37128000	AFMA
	BC	Teleost	Melanonidae, Moridae, Euclichthyidae - undifferentiated	Melanonidae, Moridae, Euclichthyidae	Pelagic morid and eucla cods	37224000	AFMA
	BC	Teleost	Hemiramphidae - undifferentiated	Hemiramphidae	Garfish unspecified	37234000	AFMA
	BC	Teleost	Zeidae, Cyttidae - undifferentiated	Zeidae, Cyttidae	Dories & lookdown dories	37264000	AFMA
810	BC	Teleost	*Lampris guttatus* and *Lampris immaculatus*	Lampridae	Moonfish	37268900	AFMA
	BC	Teleost	Percichthyidae, Serranidae - undifferentiated	Percichthyidae, Serranidae	Temperate basses & rockcods	37311000	AFMA
	BC	Teleost	*Plectropomus* spp and *Variola* spp	Serranidae	Coral trout (mixed)	37311905	AFMA
	BC	Teleost	*Epinephelus ergastularius* and *Epinephelus septemfasciatus*	Serranidae	Bar rockcod	37311910	AFMA
2093	BC	Teleost	Apogonidae, Dinolestidae - undifferentiated	Apogonidae, Dinolestidae	Cardinalfishes & long-finned pikes	37327000	AFMA
	BC	Teleost	Carangidae	Carangidae - undifferentiated	Trevallies and scads	37337000	AFMA
	BC	Teleost	Bramidae	Bramidae	Pomfrets	37342000	AFMA

ERA species ID	Role in fishery	Taxa	Family name	Scientific name	Common name	CAAB code	Rationale
2141	BC	Teleost	Sparidae - undifferentiated	Sparidae	Breams	37353000	AFMA
	BC	Teleost	Pentacerotidae - undifferentiated	Pentacerotidae	Boarfishes	37367000	AFMA
	BC	Teleost	*Scombridae* spp *(*tribes *Scomberomorini* and *Scombrini)*	Scombridae	Mackerel (mixed)	37441911	AFMA; Mackerel spp already in list
2119	BC	Teleost	Istiophoridae - undifferentiated	Istiophoridae	Marlins	37444000	AFMA
	BC	Teleost	Centrolophidae - undifferentiated	Centrolophidae	Trevalla	37445000	AFMA
	BC	Teleost	Balistidae, Monacanthidae - undifferentiated	Balistidae, Monacanthidae	Leatherjackets	37465000	AFMA
1764	BC	Teleost	Tetraodontidae - undifferentiated	Tetraodontidae	Toadfishes	37467000	AFMA
	BC	Teleost	Diodontidae - undifferentiated	Diodontidae	Porcupine fish	37469000	AFMA
	BC	Teleost	Cynoglossidae and Soleidae spp	Cynoglossidae, Soleidae	Sole (mixed)	37990015	AFMA
	BC	Teleost	Mixed reef fish		Fish (mixed)	37999999	AFMA
PS excluded from species list based on observations and/or interactions recorded in this assessment:							
	PS	Marine birds		Avians	Birds		AFMA
	PS	Marine mammal		Whales-undiiferentiated	Whales	41000001	AFMA
	PS	Marine reptile		Testudines - undifferentiated (turtles)	Turtles	39001001	AFMA
	PS	Marine mammal	Delphinidae	Delphinidae - undifferentiated	Dolphins	40040000	AFMA
	PS	Marine birds	Procellariidae	Procellariidae	*Procellaria* spp	40041998	AFMA
	PS	Marine mammal	Phocidae	*Lobodon carcinophagus*	Crab-eater seal	41136003	AFMA; Not in AFZ
	PS	Chondrichthyan	Squalidae	*Squalis* spp	Greeneye dogfishes (mixed)	37020901	AFMA
	PS	Chondrichthyan	Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae - undifferentiated		Gulper sharks, Sleeper sharks, Dogfishes	37020000	AFMA
	PS	Teleost	Hippocampus spp	*Hippocampus* spp	Seahorses - Hippocampidae	37282900	AFMA
	PS	Marine mammal	Phocidae	*Mirounga leonina*	Southern elephant seal	41136004	AFMA; Outside ETBF

ERA species ID	Role in fishery	Taxa	Family name	Scientific name	Common name	CAAB code	Rationale
	PS	Marine mammal	Phocoenidae	*Australophocoena dioptrica*	Spectacled porpoise	41117001	AFMA; Outside ETBF
	PS	Marine mammal	Otariidae	*Arctocephalus tropicalis*	Subantarctic fur seal	41131004	AFMA; Outside ETBF
PS excluded from species list since the last ERA assessment:							
1673	PS	Marine bird	Diomedeidae	*Thalassarche nov.* sp.	Pacific albatross	no CAAB	No obs/ints with fishery
829	PS	Marine bird	Fregatidae	*Fregata ariel*	Lesser frigatebird	40050002	No obs/ints with fishery
1435	PS	Marine bird	Fregatidae	*Fregata minor*	Great frigatebird, greater frigatebird	40050003	No obs/ints with fishery
918	PS	Marine bird	Hydrobatidae	*Fregetta grallaria*	White-bellied storm-petrel (Tasman Sea),	40042001	No obs/ints with fishery
917	PS	Marine bird	Hydrobatidae	*Fregetta tropica*	Black-bellied storm-petrel	40042002	No obs/ints with fishery
555	PS	Marine bird	Hydrobatidae	*Garrodia nereis*	Grey-backed storm petrel	40042003	No obs/ints with fishery
1004	PS	Marine bird	Hydrobatidae	*Pelagodroma marina*	White-faced storm-petrel	40042007	No obs/ints with fishery
595	PS	Marine bird	Procellariidae	*Daption capense*	Cape petrel	40041003	No obs/ints with fishery
939	PS	Marine bird	Procellariidae	*Halobaena caerulea*	Blue petrel	40041005	No obs/ints with fishery
1052	PS	Marine bird	Procellariidae	*Lugensa brevirostris*	Kerguelen petrel	40041006	No obs/ints with fishery
73	PS	Marine bird	Procellariidae	*Macronectes giganteus*	Southern giant-petrel	40041007	No obs/ints with fishery
981	PS	Marine bird	Procellariidae	*Macronectes halli*	Northern giant-petrel	40041008	No obs/ints with fishery
1006	PS	Marine bird	Procellariidae	*Pelecanoides urinatrix*	Common diving-petrel	40041017	No obs/ints with fishery
1003	PS	Marine bird	Procellariidae	*Pachyptila turtur*	Fairy prion	40041013	No obs/ints with fishery
1691	PS	Marine bird	Procellariidae	*Pseudobulweria rostrata*	Tahiti petrel	40041022	No obs/ints with fishery
1045	PS	Marine bird	Procellariidae	*Pterodroma cervicalis*	White-necked petrel	40041025	No obs/ints with fishery
504	PS	Marine bird	Procellariidae	*Pterodroma lessoni*	White-headed petrel	40041029	No obs/ints with fishery
1046	PS	Marine bird	Procellariidae	*Pterodroma leucoptera*	Gould's petrel	40041030	No obs/ints with fishery
1048	PS	Marine bird	Procellariidae	*Pterodroma mollis*	Soft-plumaged petrel	40041032	No obs/ints with fishery
1049	PS	Marine bird	Procellariidae	*Pterodroma neglecta*	Kermadec petrel (western)	40041033	No obs/ints with fishery
1050	PS	Marine bird	Procellariidae	*Pterodroma nigripennis*	Black-winged petrel	40041034	No obs/ints with fishery
1051	PS	Marine bird	Procellariidae	*Pterodroma solandri*	Providence petrel	40041035	No obs/ints with fishery

ERA species ID	Role in fishery	Taxa	Family name	Scientific name	Common name	CAAB code	Rationale
1610	PS	Marine bird	Procellariidae	*Pterodroma heraldica*	Herald petrel	no CAAB	No obs/ints with fishery
263	PS	Marine mammal	Otariidae	*Arctocephalus tropicalis*	Subantarctic fur seal	41131004	No obs/ints with fishery
295	PS	Marine mammal	Phocidae	*Hydrurga leptonyx*	Leopard seal	41136001	No obs/ints with fishery
993	PS	Marine mammal	Phocidae	*Mirounga leonina*	Elephant seal	41136004	No obs/ints with fishery
1408	PS	Marine reptile	Hydrophiidae	*Acalyptophis peronii*	Horned seasnake	39125001	No obs/ints with fishery
1409	PS	Marine reptile	Hydrophiidae	*Aipysurus apraefrontalis*	Short-nosed seasnake	39125002	No obs/ints with fishery
1410	PS	Marine reptile	Hydrophiidae	*Aipysurus duboisii*	Dubois' seasnake	39125003	No obs/ints with fishery
1411	PS	Marine reptile	Hydrophiidae	*Aipysurus eydouxii*	Spine-tailed seasnake	39125004	No obs/ints with fishery
1412	PS	Marine reptile	Hydrophiidae	*Aipysurus foliosquama*	Leaf-scaled seasnake	39125005	No obs/ints with fishery
1413	PS	Marine reptile	Hydrophiidae	*Aipysurus fuscus*	Dusky seasnake	39125006	No obs/ints with fishery
1414	PS	Marine reptile	Hydrophiidae	*Aipysurus laevis*	Olive seasnake, golden seasnake	39125007	No obs/ints with fishery
1415	PS	Marine reptile	Hydrophiidae	*Aipysurus tenuis*	Brown-lined seasnake	39125008	No obs/ints with fishery
254	PS	Marine reptile	Hydrophiidae	*Astrotia stokesii*	Stokes' seasnake	39125009	No obs/ints with fishery
1530	PS	Marine reptile	Hydrophiidae	*Disteira kingii*	spectacled seasnake	39125010	No obs/ints with fishery
1416	PS	Marine reptile	Hydrophiidae	*Disteira major*	Olive-headed seasnake	39125011	No obs/ints with fishery
1417	PS	Marine reptile	Hydrophiidae	*Emydocephalus annulatus*	Turtle-headed seasnake	39125012	No obs/ints with fishery
1418	PS	Marine reptile	Hydrophiidae	*Enhydrina schistosa*	Beaked seasnake	39125013	No obs/ints with fishery
1419	PS	Marine reptile	Hydrophiidae	*Ephalophis greyi*	North-western mangrove seasnake	39125014	No obs/ints with fishery
1420	PS	Marine reptile	Hydrophiidae	*Hydrelaps darwiniensis*	Black-ringed seasnake	39125015	No obs/ints with fishery
1681	PS	Marine reptile	Hydrophiidae	*Hydrophis atriceps*	Black-headed seasnake	39125016	No obs/ints with fishery
1682	PS	Marine reptile	Hydrophiidae	*Hydrophis belcheri*	A seasnake	39125017	No obs/ints with fishery
1683	PS	Marine reptile	Hydrophiidae	*Hydrophis caerulescens*	Dwarf seasnake	39125018	No obs/ints with fishery
1421	PS	Marine reptile	Hydrophiidae	*Hydrophis coggeri*	Slender-necked seasnake	39125019	No obs/ints with fishery
1531	PS	Marine reptile	Hydrophiidae	*Hydrophis czeblukovi*	fine-spined seasnake	39125020	No obs/ints with fishery
957	PS	Marine reptile	Hydrophiidae	*Hydrophis elegans*	Elegant seasnake	39125021	No obs/ints with fishery
1684	PS	Marine reptile	Hydrophiidae	*Hydrophis gracilis*	Slender seasnake	39125023	No obs/ints with fishery

ERA species ID	Role in fishery	Taxa	Family name	Scientific name	Common name	CAAB code	Rationale
1685	PS	Marine reptile	Hydrophiidae	*Hydrophis inornatus*	Plain seasnake	39125024	No obs/ints with fishery
1422	PS	Marine reptile	Hydrophiidae	*Hydrophis mcdowelli*	seasnake	39125025	No obs/ints with fishery
1686	PS	Marine reptile	Hydrophiidae	*Hydrophis melanosoma*	Black-banded robust seasnake	39125027	No obs/ints with fishery
1423	PS	Marine reptile	Hydrophiidae	*Hydrophis ornatus*	seasnake	39125028	No obs/ints with fishery
1687	PS	Marine reptile	Hydrophiidae	*Hydrophis pacificus*	Large-headed seasnake	39125029	No obs/ints with fishery
1688	PS	Marine reptile	Hydrophiidae	*Hydrophis vorisi*	A seasnake	39125030	No obs/ints with fishery
1424	PS	Marine reptile	Hydrophiidae	*Lapemis hardwickii*	Spine-bellied seasnake	39125031	No obs/ints with fishery
1689	PS	Marine reptile	Hydrophiidae	*Parahydrophis mertoni*	Northern mangrove seasnake	39125032	No obs/ints with fishery
1679	PS	Marine reptile	Laticaudidae	*Laticauda colubrina*	Banded wide faced sea krait	39124001	No obs/ints with fishery
1680	PS	Marine reptile	Laticaudidae	*Laticauda laticaudata*	Large scaled sea krait	39124002	No obs/ints with fishery
308	PS	Teleost	Clinidae	*Heteroclinus perspicillatus*	Common weedfish	37416013	Outside fishery depth range
1074	PS	Teleost	Solenostomidae	*Solenostomus cyanopterus*	Blue-finned ghost pipefish, Robust ghost pipefish	37281001	Outside fishery depth range
1075	PS	Teleost	Solenostomidae	*Solenostomus paradoxus*	Harlequin ghost pipefish, Ornate ghost pipefish	37281002	Outside fishery depth range
1010	PS	Teleost	Syngnathidae	*Phycodurus eques*	Leafy seadragon	37282001	Outside fishery depth range
1011	PS	Teleost	Syngnathidae	*Phyllopteryx taeniolatus*	Weedy seadragon, common seadragon	37282002	Outside fishery depth range
1072	PS	Teleost	Syngnathidae	*Solegnathus robustus*	Robust spiny pipehorse, robust pipehorse	37282004	Outside fishery depth range
549	PS	Teleost	Syngnathidae	*Hippocampus angustus*	Western spiny seahorse	37282005	Outside fishery depth range
1089	PS	Teleost	Syngnathidae	*Trachyrhamphus bicoarctatus*	Bend stick pipefish, short-tailed pipefish	37282006	Outside fishery depth range
360	PS	Teleost	Syngnathidae	*Haliichthys taeniophorus*	Ribboned seadragon, ribboned pipefish	37282007	Outside fishery depth range
1092	PS	Teleost	Syngnathidae	*Urocampus carinirostris*	Hairy pipefish	37282008	Outside fishery depth range
980	PS	Teleost	Syngnathidae	*Lissocampus runa*	Javelin pipefish	37282009	Outside fishery depth range
946	PS	Teleost	Syngnathidae	*Hippocampus bleekeri*	Pot bellied seahorse	37282010	Outside fishery depth range
953	PS	Teleost	Syngnathidae	*Histiogamphelus briggsii*	Briggs' crested pipefish, Briggs' pipefish	37282011	Outside fishery depth range

ERA species ID	Role in fishery	Taxa	Family name	Scientific name	Common name	CAAB code	Rationale
961	PS	Teleost	Syngnathidae	*Hypselognathus rostratus*	Knife-snouted pipefish	37282012	Outside fishery depth range
978	PS	Teleost	Syngnathidae	*Leptoichthys fistularius*	Brushtail pipefish	37282013	Outside fishery depth range
966	PS	Teleost	Syngnathidae	*Kaupus costatus*	Deep-bodied pipefish	37282014	Outside fishery depth range
995	PS	Teleost	Syngnathidae	*Mitotichthys semistriatus*	Half-banded pipefish	37282015	Outside fishery depth range
979	PS	Teleost	Syngnathidae	*Lissocampus caudalis*	Australian smooth pipefish, smooth pipefish	37282016	Outside fishery depth range
1026	PS	Teleost	Syngnathidae	*Stigmatopora argus*	Spotted pipefish	37282017	Outside fishery depth range
1027	PS	Teleost	Syngnathidae	*Stigmatopora nigra*	Wide-bodied pipefish, black pipefish	37282018	Outside fishery depth range
1028	PS	Teleost	Syngnathidae	*Stipecampus cristatus*	Ring-backed pipefish	37282019	Outside fishery depth range
1061	PS	Teleost	Syngnathidae	*Pugnaso curtirostris*	Pug-nosed pipefish	37282021	Outside fishery depth range
994	PS	Teleost	Syngnathidae	*Mitotichthys mollisoni*	Mollison's pipefish	37282022	Outside fishery depth range
1094	PS	Teleost	Syngnathidae	*Vanacampus phillipi*	Port Phillip pipefish	37282023	Outside fishery depth range
1095	PS	Teleost	Syngnathidae	*Vanacampus poecilolaemus*	Australian long-snout pipefish, long-snouted pipefish	37282024	Outside fishery depth range
996	PS	Teleost	Syngnathidae	*Mitotichthys tuckeri*	Tucker's pipefish	37282025	Outside fishery depth range
947	PS	Teleost	Syngnathidae	*Hippocampus breviceps*	Short-head seahorse, short-snouted seahorse	37282026	Outside fishery depth range
952	PS	Teleost	Syngnathidae	*Hippocampus whitei*	White's seahorse	37282027	Outside fishery depth range
1073	PS	Teleost	Syngnathidae	*Solegnathus spinosissimus*	spiny pipehorse	37282029	Outside fishery depth range
938	PS	Teleost	Syngnathidae	*Halicampus grayi*	Mud Pipefish, Gray's pipefish	37282030	Outside fishery depth range
566	PS	Teleost	Syngnathidae	*Corythoichthys conspicillatus*	Yellow-banded pipefish, Network pipefish	37282032	Outside fishery depth range
949	PS	Teleost	Syngnathidae	*Hippocampus taeniopterus*	Spotted seahorse, yellow seahorse	37282033	Outside fishery depth range
114	PS	Teleost	Syngnathidae	*Acentronura breviperula*	Hairy pygmy pipehorse	37282035	Outside fishery depth range
1583	PS	Teleost	Syngnathidae	*Bulbonaricus davaoensis*	A pipefish	37282038	Outside fishery depth range
546	PS	Teleost	Syngnathidae	*Campichthys tricarinatus*	Three-keel pipefish	37282040	Outside fishery depth range
288	PS	Teleost	Syngnathidae	*Campichthys tryoni*	Tryon's pipefish	37282041	Outside fishery depth range

ERA species ID	Role in fishery	Taxa	Family name	Scientific name	Common name	CAAB code	Rationale
388	PS	Teleost	Syngnathidae	*Choeroichthys brachysoma*	Pacific short-bodied pipefish, short-bodied pipefish	37282042	Outside fishery depth range
1584	PS	Teleost	Syngnathidae	*Choeroichthys cinctus*	A pipefish	37282043	Outside fishery depth range
1585	PS	Teleost	Syngnathidae	*Choeroichthys sculptus*	A pipefish	37282045	Outside fishery depth range
389	PS	Teleost	Syngnathidae	*Choeroichthys suillus*	Pig-snouted pipefish	37282046	Outside fishery depth range
563	PS	Teleost	Syngnathidae	*Corythoichthys amplexus*	Fijian banded pipefish, Brown-banded pipefish	37282047	Outside fishery depth range
1586	PS	Teleost	Syngnathidae	*Corythoichthys haematopterus*	A pipefish	37282048	Outside fishery depth range
52	PS	Teleost	Syngnathidae	*Corythoichthys intestinalis*	Australian Messmate pipefish, Banded pipefish	37282049	Outside fishery depth range
578	PS	Teleost	Syngnathidae	*Corythoichthys ocellatus*	Orange-spotted pipefish, Ocellated pipefish	37282050	Outside fishery depth range
1587	PS	Teleost	Syngnathidae	*Corythoichthys paxtoni*	A pipefish	37282051	Outside fishery depth range
452	PS	Teleost	Syngnathidae	*Corythoichthys schultzi*	Schultz's pipefish	37282052	Outside fishery depth range
1588	PS	Teleost	Syngnathidae	*Cosmocampus darrosanus*	A pipefish	37282054	Outside fishery depth range
580	PS	Teleost	Syngnathidae	*Cosmocampus howensis*	Lord Howe pipefish	37282055	Outside fishery depth range
1589	PS	Teleost	Syngnathidae	*Cosmocampus maxweberi*	A pipefish	37282056	Outside fishery depth range
361	PS	Teleost	Syngnathidae	*Dunckerocampus dactyliophorus*	Ringed pipefish	37282057	Outside fishery depth range
569	PS	Teleost	Syngnathidae	*Doryrhamphus melanopleura*	Bluestripe pipefish	37282058	Outside fishery depth range
55	PS	Teleost	Syngnathidae	*Doryrhamphus janssi*	Cleaner pipefish, Janss' Pipefish	37282059	Outside fishery depth range
568	PS	Teleost	Syngnathidae	*Doryrhamphus malus*	Flagtail pipefish, Negros pipefish	37282060	Outside fishery depth range
904	PS	Teleost	Syngnathidae	*Festucalex cinctus*	Girdled pipefish	37282061	Outside fishery depth range
1590	PS	Teleost	Syngnathidae	*Festucalex gibbsi*	A pipefish	37282062	Outside fishery depth range
914	PS	Teleost	Syngnathidae	*Filicampus tigris*	Tiger pipefish	37282064	Outside fishery depth range
54	PS	Teleost	Syngnathidae	*Halicampus brocki*	Brock's pipefish	37282065	Outside fishery depth range
359	PS	Teleost	Syngnathidae	*Halicampus dunckeri*	Red-hair pipefish, Duncker's pipefish	37282066	Outside fishery depth range
1592	PS	Teleost	Syngnathidae	*Halicampus macrorhynchus*	A pipefish	37282067	Outside fishery depth range

ERA species ID	Role in fishery	Taxa	Family name	Scientific name	Common name	CAAB code	Rationale
1593	PS	Teleost	Syngnathidae	*Halicampus mataafae*	A pipefish	37282068	Outside fishery depth range
57	PS	Teleost	Syngnathidae	*Halicampus nitidus*	Glittering pipefish	37282069	Outside fishery depth range
454	PS	Teleost	Syngnathidae	*Halicampus spinirostris*	Spiny-snout pipefish	37282070	Outside fishery depth range
942	PS	Teleost	Syngnathidae	*Heraldia nocturna*	Upside-down pipefish	37282071	Outside fishery depth range
943	PS	Teleost	Syngnathidae	*Hippichthys cyanospilos*	Blue-speckled pipefish, Blue-spotted pipefish	37282072	Outside fishery depth range
944	PS	Teleost	Syngnathidae	*Hippichthys heptagonus*	Madura pipefish	37282073	Outside fishery depth range
945	PS	Teleost	Syngnathidae	*Hippichthys penicillus*	Beady pipefish, steep-nosed pipefish	37282075	Outside fishery depth range
1595	PS	Teleost	Syngnathidae	*Hippichthys spicifer*	A pipefish	37282076	Outside fishery depth range
951	PS	Teleost	Syngnathidae	*Hippocampus planifrons*	Flat-face seahorse	37282078	Outside fishery depth range
1603	PS	Teleost	Syngnathidae	*Hippocampus zebra*	A pipefish	37282080	No obs/ints with fishery
954	PS	Teleost	Syngnathidae	*Histiogamphelus cristatus*	Rhino pipefish, Macleay's crested pipefish	37282081	No obs/ints with fishery
967	PS	Teleost	Syngnathidae	*Kimblaeus bassensis*	Trawl pipefish, Kimbla pipefish	37282083	No obs/ints with fishery
983	PS	Teleost	Syngnathidae	*Maroubra perserrata*	Sawtooth pipefish	37282085	No obs/ints with fishery
992	PS	Teleost	Syngnathidae	*Micrognathus andersonii*	Anderson's pipefish, shortnose pipefish	37282086	No obs/ints with fishery
1604	PS	Teleost	Syngnathidae	*Micrognathus pygmaeus*	A pipefish	37282087	No obs/ints with fishery
547	PS	Teleost	Syngnathidae	*Micrognathus micronotopterus*	Tidepool pipefish	37282088	No obs/ints with fishery
1605	PS	Teleost	Syngnathidae	*Micrognathus natans*	A pipefish	37282089	No obs/ints with fishery
1606	PS	Teleost	Syngnathidae	*Microphis brachyurus*	A pipefish	37282090	No obs/ints with fishery
798	PS	Teleost	Syngnathidae	*Microphis manadensis*	Manado river pipefish, Manado pipefish	37282091	No obs/ints with fishery
1607	PS	Teleost	Syngnathidae	*Nannocampus lindemanensis*	A pipefish	37282093	No obs/ints with fishery
1001	PS	Teleost	Syngnathidae	*Notiocampus ruber*	Red pipefish	37282095	No obs/ints with fishery
1608	PS	Teleost	Syngnathidae	*Phoxocampus diacanthus*	A pipefish	37282096	No obs/ints with fishery
1609	PS	Teleost	Syngnathidae	*Siokunichthys breviceps*	A pipefish	37282097	No obs/ints with fishery
1070	PS	Teleost	Syngnathidae	*Solegnathus dunckeri*	Duncker's pipehorse	37282098	No obs/ints with fishery

ERA species ID	Role in fishery	Taxa	Family name	Scientific name	Common name	CAAB code	Rationale
1071	PS	Teleost	Syngnathidae	*Solegnathus sp. 1 [in Kuiter, 2000]*	Pipehorse	37282099	No obs/ints with fishery
1029	PS	Teleost	Syngnathidae	*Syngnathoides biaculeatus*	Double-ended pipehorse, alligator pipefish	37282100	No obs/ints with fishery
322	PS	Teleost	Syngnathidae	*Trachyrhamphus longirostris*	Long-nosed pipefish, straight stick pipefish	37282101	No obs/ints with fishery
1093	PS	Teleost	Syngnathidae	*Vanacampus margaritifer*	Mother-of-pearl pipefish	37282102	No obs/ints with fishery
950	PS	Teleost	Syngnathidae	*Hippocampus minotaur*	Bullneck seahorse	37282105	No obs/ints with fishery
1597	PS	Teleost	Syngnathidae	*Hippocampus bargibanti*	pygmy seahorse	37282106	No obs/ints with fishery
1591	PS	Teleost	Syngnathidae	*Halicampus boothae*	A pipefish	37282107	No obs/ints with fishery
948	PS	Teleost	Syngnathidae	*Hippocampus queenslandicus*	Queenland seahorse	37282110	No obs/ints with fishery
1598	PS	Teleost	Syngnathidae	*Hippocampus dahli*	A pipefish	37282114	No obs/ints with fishery
1602	PS	Teleost	Syngnathidae	*Hippocampus tristis*	A pipefish	37282117	No obs/ints with fishery
1596	PS	Teleost	Syngnathidae	*Hippocampus alatus*	A pipefish	37282118	Outside fishery depth range
1664	PS	Teleost	Syngnathidae	*Hippocampus abdominalis*	Big-bellied / southern potbellied seahorse	37282120	Outside fishery depth range
1601	PS	Teleost	Syngnathidae	*Hippocampus procerus*	A pipefish	37282122	Outside fishery depth range
1600	PS	Teleost	Syngnathidae	*Hippocampus multispinus*	A pipefish	37282124	Outside fishery depth range
1599	PS	Teleost	Syngnathidae	*Hippocampus hendriki*	A pipefish	37282125	Outside fishery depth range
1548	PS	Teleost	Syngnathidae	*Heraldia sp. 1 [in Kuiter, 2000]*	Western upsidedown pipefish	37282130	Outside fishery depth range
318	PS	Teleost	Syngnathidae	*Hippocampus spinosissimus*	Hedgehog seahorse	no CAAB	Outside fishery depth range
1665	PS	Teleost	Syngnathidae	*Hippocampus histrix*	Spiny seahorse	37282134	Outside fishery depth range
1666	PS	Teleost	Syngnathidae	*Hippocampus kelloggi*	Kellogg's seahorse	no CAAB	Outside fishery depth range
1667	PS	Teleost	Syngnathidae	*Hippocampus kuda*	Spotted seahorse, yellow seahorse	no CAAB	Outside fishery depth range

2.4.2 Level 2 PSA (Steps 2 and 3)

The results in the Tables below provide details of the PSA assessments for each species, separated by role in the fishery, and by taxa where appropriate. These assessments are limited to direct impacts from fishing, and the operational objective is to avoid over-exploitation due to fishing, either as over-fishing or becoming over-fished. The risk scores and categories (high, medium or low) reflect potential rather than actual risk using the Level 2 (PSA) method. For species assessed at Level 2, no account is taken of the level of catch, the size of the population, or the likely exploitation rate. To assess actual risk for any species requires a Level 3 assessment which does account for these factors. However, recent fishing effort distributions are considered when calculating the availability attribute for the Level 2 analysis, whereas the entire jurisdictional range of the fishery is considered at Level 1.

The PSA analyses do not fully take account of management actions already in place in the fishery that may mitigate for high risk species. Some management actions or strategies, however, can be accounted for in the analysis where they exist. These 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). Management strategies that are not reflected in the PSA scores include limits to fishing effort, use of catch limits (such as TACs), and some other controls such as seasonal closures.

It should be noted that the PSA method is likely to generate more false positives for high risk (species assessed to be high risk when they are actually low risk) than false negatives (species assessed to be low risk when they are actually high risk). This is due to the precautionary approach to uncertainty adopted in the PSA method, whereby attributes are set at high risk levels in the absence of information. It also arises from the nature of the PSA method assessing potential rather than actual risk, as discussed above. Thus some species will be assessed at high risk because they have low productivity and are exposed to the fishery, even though they are rarely if ever caught and are relatively abundant.

In the PSA Tables below, the “Risk Score following Residual Risk” column is used to provide information on one or more of the following aspects of the analysis for each species: use of overrides to alter susceptibility scores (for example based on use of observer data, or taking account of specific management measures or mitigation); data or information sources or limitations; and information that supports the overall scores. The use of over-rides is explained more fully in Hobday et al. (2007).

The PSA Tables also report on “missing information” (the number of attributes with missing data that therefore score at the highest risk level by default). There are seven attributes used to score productivity and four aspects (availability, encounterability, selectivity and post capture mortality) used to score susceptibility (though encounterability is the average of two attributes). An attribute or aspect is scored as missing if there are no data available to score it, and it has defaulted to high risk for this reason. For some species, attributes may be scored on information from related species or other supplementary information, and even though this information is indirect and less reliable than if species specific information was available, this is not scored as a missing attribute.

There are differences between analyses for protected species and the other species components. In particular, target, by-product and by-catch species are included on the basis that they are known to be caught by the fishery (in some cases only very rarely). However protected species are included in the analysis on the basis that they occur in the area of the fishery, whether or not there has ever been an interaction with the fishery recorded. For this reason there may be a higher proportion of false positives for high vulnerability for protected species, unless there is a robust observer program that can verify that species do not interact with the gear.

Observer data and observer expert knowledge are important sources of information in the PSA analyses, particularly for the bycatch and protected components. The level of observer data for this fishery is regarded as medium. An AFMA observer program has been operating since July 2003, and coverage varies depending on the fishing location. Information on target and byproduct species is well collected, and bycatch attempts are made, but may be compromised by taxonomic difficulties. Interactions with protected species are recorded, although again, taxonomic resolution is weak for some taxa (e.g. whales and seabirds).

Summary of Habitat PSA results

The Habitat component was eliminated at Level 1.

Summary of Community PSA results

The Community component was eliminated at Level 1.

2.4.3 PSA results for individual units of analysis (Step 4-6)

The average productivity and susceptibility scores for each unit of analysis (e.g. for each species) are then used to place the individual units of analysis on 2D plots (as below). The relative position of the units on the plot will determine relative risk at the unit level as per PSA plot below. The overall risk value for a unit is the Euclidean distance from the origin of the graph. Units that fall in the upper third of the PSA plots are deemed to be at high risk. Units with a PSA score in the middle are at medium risk, while units in the lower third are at low risk with regard to the productivity and susceptibility attributes. The divisions between these risk categories are based on dividing the area of the PSA plots into equal thirds. If all productivity and susceptibility scores (scale 1-3) are assumed to be equally likely, then 1/3rd of the Euclidean overall risk values will be greater than 3.18 (high risk), 1/3rd will be between 3.18 and 2.64 (medium risk), and 1/3rd will be lower than 2.64 (low risk).

The PSA output allows identification and prioritization (via ranking the overall risk scores) of the units (e.g. species, habitat types, communities) at greatest risk to fishing activities. This prioritization means units with the lowest inherent productivity or highest susceptibility, which can only sustain the lowest level of impact, can be examined in detail. The overall risk of an individual unit will depend on the level of impact as well its productivity and susceptibility.

The overall risk value for each unit is the Euclidean distance from the origin to the location of the species on the PSA plot. The units are then divided into three risk categories, high, medium and low, according to the risk values described above.

2.4.4 Uncertainty analysis ranking of overall risk (Step 5)

The final PSA result for a species is obtained by ranking overall risk value resulting from scoring the productivity and susceptibility attributes. Uncertainty in the PSA results can arise when there is imprecise, incorrect or missing data, where an average for a higher taxonomic unit was used (e.g. average genera value for species units), or because an inappropriate attribute was included. The number of missing attributes, and hence conservative scores, is tallied for each unit of analysis. Units with missing scores will have a more conservative overall risk value than those species with fewer missing attributes, as the highest score for the attribute is used in the absence of data. Gathering the information to allow the attribute to be scored may reduce the overall risk value. Identification of high-risk units with missing attribute information should translate into prioritisation of additional research (an alternative strategy).

A second measure of uncertainty is due to the selection of the attributes. The influence of particular attributes on the final result for a unit of analysis (e.g. a habitat unit) can be quantified with an uncertainty analysis, using a Monte Carlo resampling technique. A set of productivity and susceptibility scores for each unit is calculated by removing one of the productivity or susceptibility attributes at a time, until all attribute combinations have been used. The variation (standard deviation) in the productivity and susceptibility scores is a measure of the uncertainty in the overall PSA score. If the uncertainty analysis shows that the unit would be treated differently with regard to risk, it should be the subject of more study.

The validity of the ranking can also be examined by comparing the results with those from other data sources or modelling approaches that have already been undertaken in specific fisheries. For example, the PSA results of the individual species (target, byproduct and bycatch and protected) can be compared against catch rates for any species or against completed stock assessments. These comparisons will show whether the PSA ranking agrees with these other sources of information or more rigorous approaches.

2.4.5 PSA results and discussion

a) Key/secondary commercial species

Under the revised ERAEF (AFMA 2017), key commercial species were not assessed at Level 2.

b) Commercial bait species

There were no commercial bait species considered in this PSA. Instead, the three species were all assessed using the bSAFE method.

c) Byproduct species

There were no byproduct teleost species considered in this PSA. Instead, the 18 species were all assessed using the bSAFE method.

d) Bycatch species

There were nine bycatch species considered in this PSA, as they were unassessable in bSAFE, resulting in seven at medium risk and at two low risk (Table 2.23). The remaining 137 species were analysed in bSAFE.

Table 2.23. Summary of the PSA scores on the set of productivity and susceptibility attributes for bycatch species and residual risk (RR) for high risk species. Note: Key commercial, secondary commercial, byproduct and bycatch component PSAs not examined for this sub-fishery, if the overall risk score was not extreme. Productivity attributes (P1-P7) are listed in Table 2.25 (in report). Susceptibility attributes (S1-S4) are listed in Susceptibility attributes Table 2.26 (in report). Missing attributes are highlighted (red). Productivity score (Prod. score); Susceptibility score (Susc. score). No. interactions (No. Int. 2011-2015) reported for high risk scores only (source: Commonwealth logbook and observer (Obs) databases). Residual risk guidelines drawn from document "Revision of residual risk guidelines to reflect updated Ecological Risk Assessment Methodology – version Oct 12, 2016. See numbers at the foot of this table. NE: not entered. Ret: retained; dis: discarded.

CAAB code	Scientific name	Common name	P1	P2	P3	P4	P5	P6	P7	S1	S2	S3	S4	Prod. score	Susc. score	Missing attrib-utes	PSA 2D	Risk Category	No. Int. (2011 - 2015)	Risk score following Residual Risk	Final risk score
The following 9 species were unassessable in bSAFE:																					
37053001	*Elops hawaiensis*	Hawaiian Giant Herring	3	3	3	3	2	3	3	1	1.72	3	2	2.86	1.23	6	3.11	Medium	NE	This species was un-assessable in SAFE and medium in PSA. No RR required.	Medium
37059003	*Kaupichthys diodontus*	False moray; Plain False Moray	3	3	3	3	1	3	3	1	3	3	2	2.71	1.43	6	3.06	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37336005	*Remora brachyptera*	Spearfish Remora	3	3	3	1	2	3	3	1	3	2	2	2.57	1.28	6	2.87	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37336002	*Remora remora*	Remora	3	3	3	1	2	3	3	1	3	2	2	2.57	1.28	5	2.87	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium

CAAB code	Scientific name	Common name	P1	P2	P3	P4	P5	P6	P7	S1	S2	S3	S4	Prod. score	Susc. score	Missing attrib-utes	PSA 2D	Risk Category	No. Int. (2011 - 2015)	Risk score following Residual Risk	Final risk score
37270001	*Lophotus lacepede*	Crested Oarfish; Crested Bandfish	3	3	3	2	2	1	3	1	3	3	2	2.43	1.43	3	2.82	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37272002	*Regalecus glesne*	Oarfish ("king of herrings")	3	3	3	3	3	1	2	1	2.81	1	2	2.57	1.12	3	2.8	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37466004	*Lactoria cornuta*	Longhorn Cowfish	3	3	3	1	1	3	3	1	3	2	2	2.43	1.28	4	2.75	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37443001	*Luvarus imperialis*	Louvar	3	3	1	2	2	1	3	1	3	3	2	2.14	1.43	2	2.57	Low	NE	This species was un-assessable in SAFE, and low risk in PSA. No RR required.	Low
37271001	*Trachipterus arawatae*	Southern Ribbonfish	3	3	1	2	2	1	2	1	2.75	3	2	2	1.39	2	2.44	Low	NE	This species was un-assessable in SAFE, and low risk in PSA. No RR required.	Low

Risk ranking guidelines:

1	Risk rating due to missing, incorrect or out of date information	4	Effort and catch management arrangements for target and byproduct species
2	At risk due to external factors (cumulative risks)	5	Management arrangements to mitigate against the level of bycatch
3	At risk in regards to level of interaction/capture with a zero or negligible level of susceptibility	6	Management arrangements relating to seasonal, spatial and depth closures

e) Protected species

A total of 85 out of 94 protected species were assessed in this PSA, consisting of five high risk, 57 medium risk and 23 low risk species (Table 2.24; Figure 2.6a, b). Also, there were two data deficient species yellow-bellied seasnake *Pelamis platurus* and Longman's beaked whale *Indopacetus pacificus* (Figure 2.6b). Of the high risk species, two were whales and three were dolphins, which were expanded species from either "whales" or "Delphinidae". There were either none or four missing attributes for each of the high risk species, with four out of five of these species missing no attributes. A residual risk analysis was performed on the five high risk species (Table 2.24; see also Section 2.9).

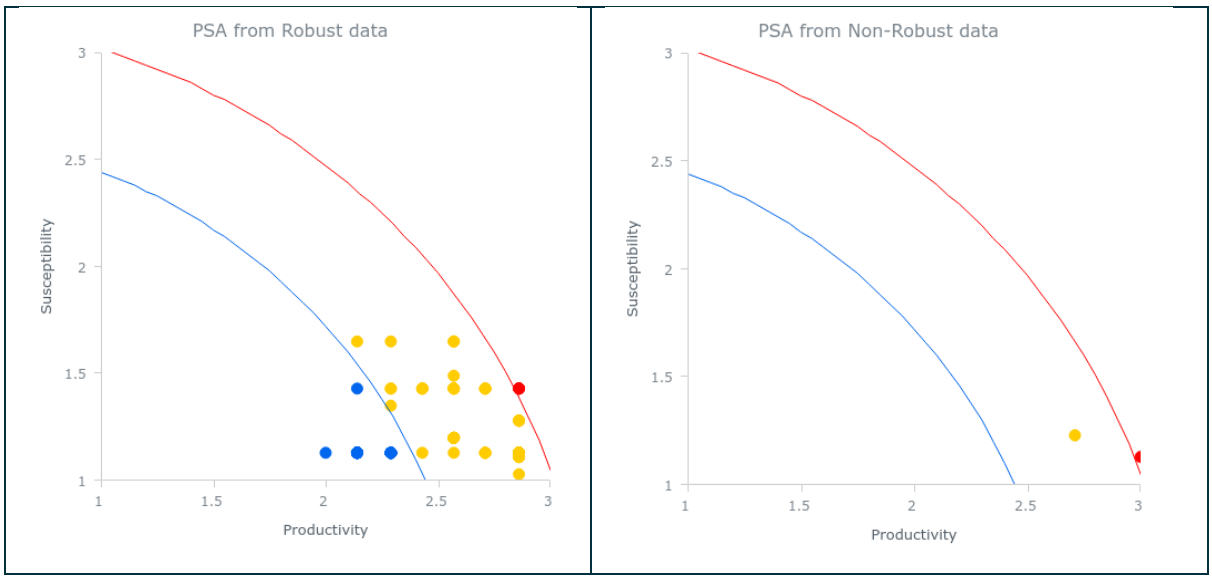


Figure 2.6. PSA plot for protected species in the ETBF longline fishery for a) robust [left] and (b) data deficient [right] species. Note many species fall on some points.

Table 2.24. Summary of the PSA scores on the set of productivity and susceptibility attributes for protected species and residual risk (RR) for high risk species. Note: Key commercial, secondary commercial, byproduct and bycatch component PSAs not examined for this sub-fishery, if the overall risk score was not extreme. Productivity attributes (P1-P7) are listed in Table 2.25 (in report). Susceptibility attributes (S1-S4) are listed in Susceptibility attributes Table 2.26 (in report). Missing attributes are highlighted (red). Productivity score (Prod. score); Susceptibility score (Susc. score). No. interactions (No. Int. 2011-2015) reported for high risk scores only (source: Commonwealth logbook and observer (Obs) databases). Residual risk guidelines drawn from document "Revision of residual risk guidelines to reflect updated Ecological Risk Assessment Methodology – version Oct 12, 2016. See numbers at the foot of this table. NE: not entered. Ret: retained; dis: discarded.

CAAB code	Scientific name	Common name	P1	P2	P 3	P4	P5	P6	P7	S1	S2	S3	S4	Prod. score	Susc. score	Missing attrib-utes	PSA 2D	Risk Category	No. Int. (2011-2015)	Risk score following Residual Risk	Final risk score
41120003	*Indopacetus pacificus*	Longman's Beaked Whale	3	3	3	3	3	3	3	1	3	1	2	3	1.13	4	3.21	High	LOG: Whales (order Cetacea): 2 alive	Expanded from "whales" 3 –Low interaction/capture. Four productivity attributes are not available. Based on low interaction rate and life status, risk category is reduced to low.	Low
41116002	*Feresa attenuata*	Pygmy killer whale	2	3	3	3	3	3	3	1	3	3	2	2.86	1.43	0	3.2	High	LOG: Whales (order Cetacea): 2 alive	Expanded from "whales". 3 – Low interaction/capture. Based on low interaction rate and life status (alive), risk category is reduced to low.	Low
41116020	*Tursiops aduncus*	Indian Ocean Bottlenose Dolphin	2	3	3	3	3	3	3	1	3	3	2	2.86	1.43	0	3.2	High	LOG: Dolphins (Delphinidae): 1 alive	Expanded from "Delphinidae". 3 –Low interaction/capture. Based on	Low

CAAB code	Scientific name	Common name	P1	P2	P 3	P4	P5	P6	P7	S1	S2	S3	S4	Prod. score	Susc. score	Missing attrib-utes	PSA 2D	Risk Category	No. Int. (2011-2015)	Risk score following Residual Risk	Final risk score
																				low interaction rate, risk category is reduced to low.	
41116019	*Tursiops truncatus*	Bottlenose Dolphin	2	3	3	3	3	3	3	1	3	3	2	2.86	1.43	0	3.2	High	LOG: Dolphins (Delphinidae): 1 alive	Expanded from "Delphinidae". 3 –Low interaction/capture. Based on low interaction rate and life status (alive), risk category is reduced to low.	Low
41116005	*Grampus griseus*	Risso's dolphin	2	3	3	3	3	3	3	1	3	3	2	2.86	1.43	0	3.2	High	LOG: Dolphins (Delphinidae): 1 alive	Expanded from "Delphinidae". 3 –Low interaction/capture. Based on low interaction rate and life status (alive), risk category is reduced to low.	Low
41120004	*Mesoplodon bowdoini*	Andrew's Beaked Whale	2	3	3	3	3	3	3	1	3	2	2	2.86	1.28	0	3.13	Medium	NE	No RR required.	Medium
41120008	*Mesoplodon hectori*	Hector's Beaked Whale	2	3	3	3	3	3	3	1	3	2	2	2.86	1.28	0	3.13	Medium	NE	No RR required.	Medium
41120006	*Mesoplodon gingkodens*	Gingko Beaked Whale; Gingko-	2	3	3	3	3	3	3	1	3	2	2	2.86	1.28	0	3.13	Medium	NE	No RR required.	Medium

CAAB code	Scientific name	Common name	P1	P2	P 3	P4	P5	P6	P7	S1	S2	S3	S4	Prod. score	Susc. score	Missing attrib-utes	PSA 2D	Risk Category	No. Int. (2011-2015)	Risk score following Residual Risk	Final risk score
		Toothed Beaked Whale																			
41120005	*Mesoplodon densirostris*	Blainville's Beaked Whale	2	3	3	3	3	3	3	1	3	2	2	2.86	1.28	0	3.13	Medium	NE	No RR required.	Medium
41112002	*Balaenoptera borealis*	Sei whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	0	3.08	Medium	NE	No RR required.	Medium
41120010	*Mesoplodon mirus*	True's Beaked Whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	0	3.08	Medium	NE	No RR required.	Medium
41120009	*Mesoplodon layardii*	Strap-toothed Beaked Whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	0	3.08	Medium	NE	No RR required.	Medium
41120007	*Mesoplodon grayi*	Gray's Beaked Whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	0	3.08	Medium	NE	No RR required.	Medium
41120002	*Hyperoodon planifrons*	Southern Bottlenose Whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	1	3.08	Medium	NE	No RR required.	Medium
41120001	*Berardius arnuxii*	Arnoux's Beaked Whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	0	3.08	Medium	NE	No RR required.	Medium
41119001	*Kogia breviceps*	Pygmy Sperm Whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	0	3.08	Medium	NE	No RR required.	Medium
41116013	*Pseudorca crassidens*	False Killer Whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	1	3.08	Medium	NE	No RR required.	Medium
41116011	*Orcinus orca*	Killer whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	0	3.08	Medium	NE	No RR required.	Medium
41116003	*Globicephala macrorhynchus*	Short-finned Pilot Whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	0	3.08	Medium	NE	No RR required.	Medium
41112007	*Balaenoptera bonaerensis*	Southern Minke Whale;	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	0	3.08	Medium	NE	No RR required.	Medium

CAAB code	Scientific name	Common name	P1	P2	P 3	P4	P5	P6	P7	S1	S2	S3	S4	Prod. score	Susc. score	Missing attrib-utes	PSA 2D	Risk Category	No. Int. (2011-2015)	Risk score following Residual Risk	Final risk score
		Antarctic Minke Whale																			
41112005	*Balaenoptera physalus*	Fin Whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	0	3.08	Medium	NE	No RR required.	Medium
41112003	*Balaenoptera edeni*	Bryde's whale	2	3	3	3	3	3	3	1	3	1	2	2.86	1.13	0	3.08	Medium	NE	No RR required.	Medium
41116004	*Globicephala melas*	Long-finned Pilot Whale	2	3	3	3	3	3	3	1	2.75	1	2	2.86	1.11	0	3.07	Medium	NE	No RR required.	Medium
41120012	*Ziphius cavirostris*	Cuvier's Beaked Whale	2	3	3	3	3	3	3	1	2.75	1	2	2.86	1.11	0	3.07	Medium	NE	No RR required.	Medium
41120011	*Tasmacetus shepherdi*	Tasman Beaked Whale	2	3	3	3	3	3	3	1	2.75	1	2	2.86	1.11	1	3.07	Medium	NE	No RR required.	Medium
41116006	*Lagenodelphis hosei*	Fraser's dolphin	2	3	3	2	3	3	3	1	3	3	2	2.71	1.43	1	3.06	Medium	NE	No RR required.	Medium
41119002	*Kogia sima*	Dwarf Sperm Whale	2	3	3	2	3	3	3	1	3	3	2	2.71	1.43	0	3.06	Medium	NE	No RR required.	Medium
41116018	*Steno bredanensis*	Rough-toothed Dolphin	2	3	3	2	3	3	3	1	3	3	2	2.71	1.43	0	3.06	Medium	NE	No RR required.	Medium
41116009	*Lissodelphis peronii*	Southern Right Whale Dolphin	2	3	3	2	3	3	3	1	3	3	2	2.71	1.43	1	3.06	Medium	NE	No RR required.	Medium
41119003	*Physeter catodon*	Sperm Whale	2	3	3	3	3	3	3	1	1	1	2	2.86	1.03	0	3.04	Medium	NE	No RR required.	Medium
39020001	*Caretta caretta*	Loggerhead Turtle	3	3	2	2	2	3	3	1	3	3	3	2.57	1.65	1	3.05	Medium	NE	No RR required.	Medium
39020002	*Chelonia mydas*	Green turtle	3	3	2	2	2	3	3	1	3	3	3	2.57	1.65	1	3.05	Medium	NE	No RR required.	Medium

CAAB code	Scientific name	Common name	P1	P2	P 3	P4	P5	P6	P7	S1	S2	S3	S4	Prod. score	Susc. score	Missing attrib-utes	PSA 2D	Risk Category	No. Int. (2011-2015)	Risk score following Residual Risk	Final risk score
39125033	*Pelamis platurus*	Yellow-bellied Seasnake	3	3	3	2	2	3	3	1	1.67	2	3	2.71	1.23	3	2.98	Medium	NE	No RR required.	Medium
39021001	*Dermochelys coriacea*	Leatherback turtle; Leathery Turtle	3	3	2	2	2	3	3	1	2.29	3	3	2.57	1.49	1	2.97	Medium	NE	No RR required.	Medium
39020004	*Lepidochelys olivacea*	Olive Ridley turtle; Pacific Ridley turtle	3	3	3	1	2	3	3	1	3	2	3	2.57	1.43	1	2.94	Medium	NE	No RR required.	Medium
41116016	*Stenella coeruleoalba*	Striped Dolphin	2	3	3	2	2	3	3	1	3	3	2	2.57	1.43	0	2.94	Medium	NE	No RR required.	Medium
41116015	*Stenella attenuata*	Spotted Dolphin	2	3	3	2	2	3	3	1	3	3	2	2.57	1.43	0	2.94	Medium	NE	No RR required.	Medium
41116014	*Sousa sahulensis*	Australian Humpbacked Dolphin	2	3	3	2	3	3	3	1	1	3	2	2.71	1.13	0	2.94	Medium	NE	No RR required.	Medium
41116012	*Peponocephala electra*	Melon-headed Whale	2	2	3	2	3	3	3	1	3	3	2	2.57	1.43	1	2.94	Medium	NE	No RR required.	Medium
41116010	*Orcaella heinsohni*	Australian Snubfin Dolphin	1	3	3	2	3	3	3	1	3	3	2	2.57	1.43	1	2.94	Medium	NE	No RR required.	Medium
41112006	*Megaptera novaeangliae*	Humpback Whale	1	3	3	3	3	3	3	1	3	1	2	2.71	1.13	0	2.94	Medium	NE	No RR required.	Medium
41110002	*Caperea marginata*	Pygmy Right Whale	2	3	3	3	3	3	2	1	3	1	2	2.71	1.13	1	2.94	Medium	NE	No RR required.	Medium
41110001	*Eubalaena australis*	Southern Right Whale	2	3	3	3	3	3	2	1	3	1	2	2.71	1.13	0	2.94	Medium	NE	No RR required.	Medium
64462	*Thalassarche steadi*	White-capped Albatross	2	3	3	2	2	3	3	1	1	3	3	2.57	1.2	1	2.84	Medium	NE	No RR required.	Medium

CAAB code	Scientific name	Common name	P1	P2	P 3	P4	P5	P6	P7	S1	S2	S3	S4	Prod. score	Susc. score	Missing attrib-utes	PSA 2D	Risk Category	No. Int. (2011-2015)	Risk score following Residual Risk	Final risk score
40040018	*Diomedea amsterdamensis*	Amsterdam Albatross	2	3	3	2	2	3	3	1	1	3	3	2.57	1.2	1	2.84	Medium	NE	No RR required.	Medium
40040013	*Thalassarche impavida*	Campbell Albatross	2	3	3	2	2	3	3	1	1	3	3	2.57	1.2	1	2.84	Medium	NE	No RR required.	Medium
40040012	*Diomedea sanfordi*	Northern Royal Albatross	2	3	3	2	2	3	3	1	1	3	3	2.57	1.2	1	2.84	Medium	NE	No RR required.	Medium
40040011	*Diomedea antipodensis*	Antipodean Albatross	2	3	3	2	2	3	3	1	1	3	3	2.57	1.2	1	2.84	Medium	NE	No RR required.	Medium
40040010	*Diomedea gibsoni*	Gibson's Albatross	2	3	3	2	2	3	3	1	1	3	3	2.57	1.2	1	2.84	Medium	NE	No RR required.	Medium
40040006	*Diomedea exulans*	Wandering Albatross	2	3	3	2	2	3	3	1	1	3	3	2.57	1.2	1	2.84	Medium	NE	No RR required.	Medium
40040005	*Diomedea epomophora*	Southern Royal Albatross	2	3	3	2	2	3	3	1	1	3	3	2.57	1.2	1	2.84	Medium	NE	No RR required.	Medium
39020003	*Eretmochelys imbricata*	Hawksbill Turtle	3	3	2	1	2	3	3	1	3	2	3	2.43	1.43	1	2.82	Medium	NE	No RR required.	Medium
41131005	*Neophoca cinerea*	Australian Sea-lion	2	2	3	2	2	3	3	1	3	3	2	2.43	1.43	0	2.82	Medium	NE	No RR required.	Medium
41131001	*Arctocephalus forsteri*	New Zealand Fur-seal	2	2	3	2	2	3	3	1	3	3	2	2.43	1.43	0	2.82	Medium	NE	No RR required.	Medium
41116017	*Stenella longirostris*	Spinner Dolphin	2	2	3	2	2	3	3	1	3	3	2	2.43	1.43	0	2.82	Medium	NE	No RR required.	Medium
39125003	*Aipysurus duboisii*	Reef Shallows Seasnake	1	2	3	2	2	3	3	1	3	3	3	2.29	1.65	1	2.82	Medium	NE	No RR required.	Medium
41112004	*Balaenoptera musculus*	Blue Whale	1	3	3	3	3	3	2	1	3	1	2	2.57	1.13	0	2.81	Medium	NE	No RR required.	Medium

CAAB code	Scientific name	Common name	P1	P2	P 3	P4	P5	P6	P7	S1	S2	S3	S4	Prod. score	Susc. score	Missing attrib-utes	PSA 2D	Risk Category	No. Int. (2011-2015)	Risk score following Residual Risk	Final risk score
39125031	*Lapemis hardwickii*	Spine-bellied Seasnake	1	1	3	2	2	3	3	1	3	3	3	2.14	1.65	1	2.7	Medium	NE	No RR required.	Medium
41131003	*Arctocephalus pusillus doriferus*	Australian Fur Seal	1	2	3	2	2	3	3	1	3	3	2	2.29	1.43	0	2.7	Medium	NE	No RR required.	Medium
41116001	*Delphinus delphis*	Common Dolphin	1	2	3	2	2	3	3	1	3	3	2	2.29	1.43	0	2.7	Medium	NE	No RR required.	Medium
39020005	*Natator depressus*	Flatback turtle	2	3	3	1	2	3	3	1	1	2	3	2.43	1.13	2	2.68	Low	NE	No RR required.	Low
39125007	*Aipysurus laevis*	Golden Seasnake	1	2	3	2	2	3	3	1	1.67	3	3	2.29	1.35	1	2.66	Medium	NE	No RR required.	Medium
40041038	*Puffinus carneipes*	Flesh-footed Shearwater	1	3	3	1	1	3	3	1	3	2	3	2.14	1.43	1	2.57	Low	NE	No RR required.	Low
40128025	*Thalasseus bergii*	Crested tern	1	3	3	1	2	3	3	1	1	2	3	2.29	1.13	1	2.55	Low	NE	No RR required.	Low
40128005	*Catharacta skua*	Great Skua	2	3	3	1	1	3	3	1	1	2	3	2.29	1.13	1	2.55	Low	NE	No RR required.	Low
40041047	*Puffinus tenuirostris*	Short-tailed Shearwater	2	3	3	1	1	3	3	1	1	2	3	2.29	1.13	1	2.55	Low	NE	No RR required.	Low
40041031	*Pterodroma macroptera*	Great-Winged Petrel	2	2	3	1	2	3	3	1	1	2	3	2.29	1.13	1	2.55	Low	NE	No RR required.	Low
40040017	*Thalassarche eremita*	Chatham Albatross	2	3	3	1	1	3	3	1	1	2	3	2.29	1.13	1	2.55	Low	NE	No RR required.	Low
40040016	*Thalassarche salvini*	Salvin's Albatross	2	3	3	1	1	3	3	1	1	2	3	2.29	1.13	1	2.55	Low	NE	No RR required.	Low
40040009	*Phoebetria palpebrata*	Light-mantled Albatross; Light-mantled Sooty Albatross	2	3	3	1	1	3	3	1	1	2	3	2.29	1.13	1	2.55	Low	NE	No RR required.	Low
40040007	*Thalassarche melanophrys*	Black-browed Albatross	2	3	3	1	1	3	3	1	1	2	3	2.29	1.13	1	2.55	Low	NE	No RR required.	Low

CAAB code	Scientific name	Common name	P1	P2	P 3	P4	P5	P6	P7	S1	S2	S3	S4	Prod. score	Susc. score	Missing attrib-utes	PSA 2D	Risk Category	No. Int. (2011-2015)	Risk score following Residual Risk	Final risk score
40040004	*Thalassarche chrysostoma*	Grey-headed Albatross	2	3	3	1	1	3	3	1	1	2	3	2.29	1.13	1	2.55	Low	NE	No RR required.	Low
40040001	*Thalassarche bulleri*	Buller's Albatross	2	3	3	1	1	3	3	1	1	2	3	2.29	1.13	1	2.55	Low	NE	No RR required.	Low
40040002	*Thalassarche cauta*	Shy Albatross	2	3	3	1	1	3	3	1	1	2	3	2.29	1.13	1	2.55	Low	NE	No RR required.	Low
40040003	*Thalassarche chlororhynchos*	Yellow-nosed Albatross; Atlantic Yellow-nosed Albatross	2	2	3	1	1	3	3	1	1	2	3	2.14	1.13	1	2.42	Low	NE	No RR required.	Low
40047004	*Sula dactylatra*	Masked Booby	1	3	3	1	1	3	3	1	1	2	3	2.14	1.13	1	2.42	Low	NE	No RR required.	Low
40040008	*Phoebetria fusca*	Sooty Albatross	2	2	3	1	1	3	3	1	1	2	3	2.14	1.13	1	2.42	Low	NE	No RR required.	Low
40040014	*Thalassarche carteri*	Indian Yellow-nosed Albatross	1	3	3	1	1	3	3	1	1	2	3	2.14	1.13	1	2.42	Low	NE	No RR required.	Low
40041018	*Procellaria aequinoctialis*	White-chinned Petrel	1	3	3	1	1	3	3	1	1	2	3	2.14	1.13	1	2.42	Low	NE	No RR required.	Low
40041019	*Procellaria cinerea*	Grey Petrel	2	2	3	1	1	3	3	1	1	2	3	2.14	1.13	1	2.42	Low	NE	No RR required.	Low
40041020	*Procellaria parkinsoni*	Black Petrel	2	2	3	1	1	3	3	1	1	2	3	2.14	1.13	1	2.42	Low	NE	No RR required.	Low
40041021	*Procellaria westlandica*	Westland Petrel	2	2	3	1	1	3	3	1	1	2	3	2.14	1.13	1	2.42	Low	NE	No RR required.	Low
40041042	*Puffinus griseus*	Sooty Shearwater	1	3	3	1	1	3	3	1	1	2	3	2.14	1.13	1	2.42	Low	NE	No RR required.	Low

CAAB code	Scientific name	Common name	P1	P2	P 3	P4	P5	P6	P7	S1	S2	S3	S4	Prod. score	Susc. score	Missing attrib-utes	PSA 2D	Risk Category	No. Int. (2011-2015)	Risk score following Residual Risk	Final risk score
40041045	*Puffinus pacificus*	Wedge-tailed Shearwater	1	3	3	1	1	3	3	1	1	2	3	2.14	1.13	1	2.42	Low	NE	No RR required.	Low
40042004	*Oceanites oceanicus*	Wilson's storm petrel (subantarctic)	1	2	3	1	1	3	3	1	1	2	3	2	1.13	1	2.3	Low	NE	No RR required.	Low

Risk ranking guidelines:

1	Risk rating due to missing, incorrect or out of date information	4	Effort and catch management arrangements for target and byproduct species
2	At risk due to external factors (cumulative risks)	5	Management arrangements to mitigate against the level of bycatch
3	At risk in regards to level of interaction/capture with a zero or negligible level of susceptibility	6	Management arrangements relating to seasonal, spatial and depth closures

Productivity attributes

Table 2.25. Productivity attribute names and cutoff scores for the ERAF L2 PSA method. These cutoffs have been determined from analysis of the distribution of attribute values for species in the ERAF database, and are intended to divide the attribute values into low, medium and high productivity categories.

Attribute number	Attribute name	Low productivity (risk score: 3)	Medium productivity (risk score: 2)	High productivity (risk score: 1)
P1	Average age at maturity	> 15 years	5 – 15 years	< 5 years
P2	Average max age	> 25 years	10-25 years	< 10 years
P3	Fecundity	< 100 eggs per years	100-20,000 eggs per year	> 20,000 eggs per year
P4	Average max size	> 300 cm	100-300 cm	< 100 cm
P5	Average size at Maturity	> 200 cm	40-200 cm	< 40 cm
P6	Reproductive strategy	Taxa is “Marine bird" or "Marine mammal"	Family is : "Syngnathidae" or "Solenostomidae" Or Reproductive Strategy is: “Demersal Spawner” Or “Brooder”	Reproductive Strategy is “Broadcast Spawner”
P7	Trophic level	> 3.25	2.75-3.25	< 2.75

Susceptibility attributes

Table 2.26. Susceptibility attribute names and cutoff scores for the ERAF L2 PSA method. These cutoffs have been determined from analysis of the distribution of attribute values for species in the ERAF database, and are intended to divide the attribute values into low, medium and high susceptibility categories.

Attribute number	Attribute name	Low susceptibility (risk score: 1)	Medium susceptibility (risk score: 2)	High susceptibility (risk score: 3)
S1	Availability	< 10% overlap	Continuous [1,3]	> 30% overlap
S2	Encounterability (habitat and bathymetry based)	Fishery Specific	Fishery Specific	Fishery Specific
S3	Selectivity (size based)	Fishery Specific	Fishery Specific	Fishery Specific
S4	Post-Capture Mortality (role in fishery based, protected Species based)	Some Protected (Live)	Byproduct or bycatch Some protected (generally alive)	Key or secondary commercial Some protected (likely to be dead)

Post Capture Mortality

The following rules were used to assign a risk score to Post Capture Mortality (PCM), based on each species ERAEF classification (see also Table 2.27):

- Commercial, secondary commercial, commercial bait or byproduct species: score is 3.
- Bycatch species: score is 2
- Protected species (which are discarded), PCM is based on taxa, i.e.,
    - marine birds and marine reptiles: score is 3
    - marine mammals and chondricthyans: score is 2
    - sygnathids: score is 1

Table 2.27. Post capture mortality attribute risk score for the ETBF- pelagic longline subfishery for the ERAEF L2 PSA and bSAFE methods. High: H; M: medium; Low: L. Risk scores that are not assigned by taxa (not specific) for each ERAEF classification are shaded.

Role in fishery	Taxa	Rationale	Risk category	Risk score
Key commercial	Not specific	Retained, therefore dead	H	3
Secondary commercial	Not specific	Retained, therefore dead	H	3
Commercial bait	Not specific	Retained, therefore dead	H	3
Byproduct	Not specific	Retained, therefore dead	H	3
Bycatch	Not specific	Discarded alive or dead	M	2
Protected Species	Marine birds	long duration set, if caught, highly likely to drown	H	3
	Marine reptiles	long duration set, if caught, highly likely to drown	H	3
	Marine mammals	large enough/strong swimming to have a chance of survival	M	2
	Chondrichthyans	large enough/strong swimming to have a chance of survival	M	2
	All others (e.g. sygnathids, invertebrates (if any))	Do not get hooked	L	1

2.5 bSAFE results and discussion

Each of the reference points (MSM, LIM, and CRASH) were evaluated. If the biological reference point mean was higher than the estimated F attributed to this sub-fishery, then the species was categorised as 'Below'. When the biological reference point mean was lower than the estimated F attributed to the sub-fishery, then the species was categorised as 'Above' for that species and reference point measure. The overall risk is a summary of the three reference point measures (Table 2.28). If all reference points are categorised as 'Below', then the overall risk is low.

Table 2.28 Overall risk summary against each of the three reference point measures.

MSM	LIM	CRASH	Overall risk
Below	Below	Below	Low
Above	Below	Below	Medium
Above	Above	Below	High
Above	Above	Above	Extreme

2.5.1 bSAFE – Key/secondary commercial species

Under the revised ERAEF (AFMA 2017), key commercial species were not assessed at Level 2.

2.5.2 bSAFE - Commercial bait species

There were three commercial bait species assessed in this SAFE (Figure 2.7a, b). No species were above the limit (SAFE-LIM) reference points. (Table 2.29).

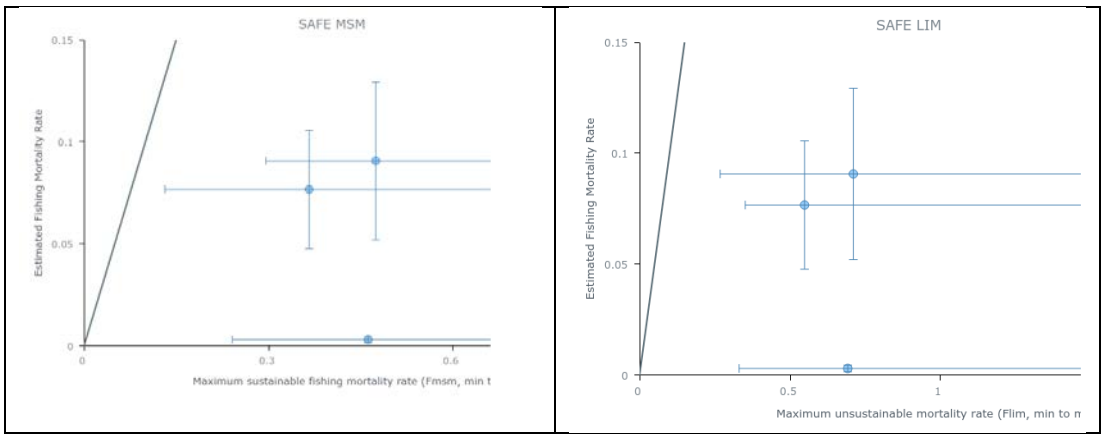


Figure 2.7. SAFE plot for commercial bait species in the ETBF longline fishery for (a) SAFE-MSM reference point [left] and (b) SAFE limit (LIM) [right] reference point.

Table 2.29. bSAFE risk categories for commercial bait species ecological component for F_MSM, F_Lim and F_crash.

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk
37337002	*Trachurus declivis*	Common Jack Mackerel	0.091	0.47	Below	0.71	Below	0.95	Below	Low
37337003	*Trachurus novaezelandiae*	Yellowtail Scad	0.003	0.46	Below	0.69	Below	0.92	Below	Low
37441001	*Scomber australasicus*	Blue Mackerel	0.077	0.37	Below	0.55	Below	0.73	Below	Low

2.5.3 bSAFE - Byproduct species

There were 18 byproduct species assessed in this SAFE (Figure 2.8a, b). Sixteen species were below the three reference points (low risk), one was high risk (i.e. above the SAFE-MSM and SAFE-LIM reference points; Dusky whaler *Carcharhinus obscurus*; Table 2.30) and one was medium risk (i.e. above the SAFE-MSM and below SAFE-LIM reference points; Blue shark *Prionace glauca*; Table 2.30). A residual risk analysis was performed on the Dusky whaler and blue shark (Table 2.30; see also Section 2.9).

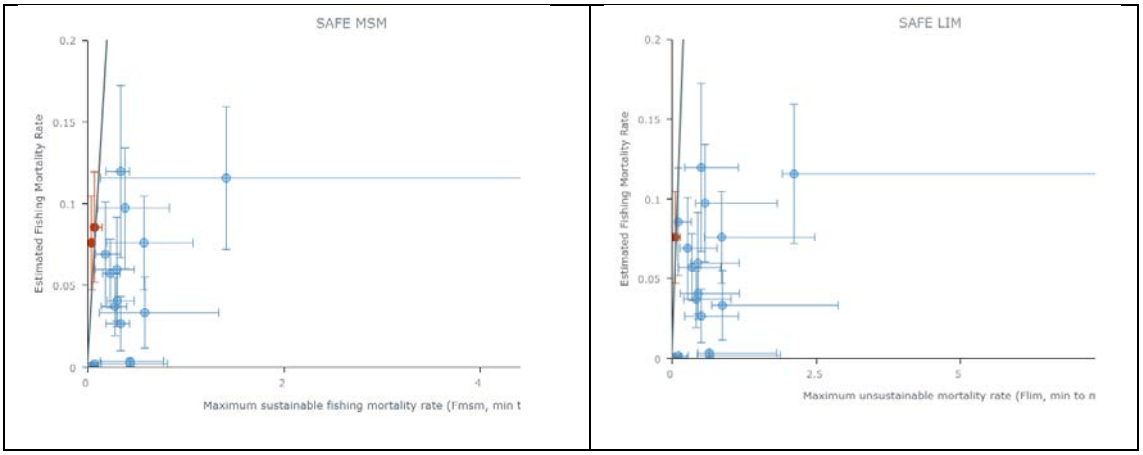


Figure 2.8. SAFE plot for Byproduct species in the ETBF longline fishery for (a) SAFE-MSM reference point [left] and (b) SAFE limit (LIM) reference point [right].

Table 2.30. bSAFE risk categories for byproduct species ecological component for F_MSM, F_Lim and F_crash. A residual risk (RR) analysis conducted for high and medium risk species. Catch (numbers) from Commonwealth logbook (LOG) and observer (OBS) databases. Residual risk guidelines drawn from document "Revision of residual risk guidelines to reflect updated Ecological Risk Assessment Methodology – version Oct 12, 2016. See numbers at the foot of this table. NE: not entered. Ret: retained; dis: discarded.

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Catch (2011-2015) and other information	Risk score following Residual Risk	Final risk score
37018003	*Carcharhinus obscurus*	Dusky Shark; Dusky Whaler	0.076	0.04	Above	0.06	Above	0.08	Below	High	LOG: 302 ret; 2874 dis. OBS: 30 ret; 18 dis, or 268 dis [cut free (232); jerked free (7); dis (18); escaped (11)] Dusky sharks are one of the slowest-growing and latest-maturing sharks, not reaching adulthood until around 20 years of age. Fishery stock assessments for this species are limited to Western Australian waters; McAuley et al. (2005).	Given the post capture mortality estimates agreed by TTRAG (see also Advice Note No. 4818 by TTRAG-3/09/2018), and the corresponding F overall risk score, the final risk score is reduced to medium-low.	Medium – Low (see Table 2.31)
37018004	*Prionace glauca*	Blue Shark	0.086	0.08	Above	0.11	Below	0.15	Below	Medium	LOG: 1247 ret; 27776 dis. OBS: 126 ret; 644 dis or 2652 dis [escaped (56); jerked free (100); cut free (1852); discarded (644)].	Population trend is unknown within ETBF. Medium	Medium
37018001	*Carcharhinus brachyurus*	Bronze Whaler	0.001	0.04	Below	0.06	Below	0.08	Below	Low	NE	No RR required	Low
37018022	*Galeocerdo cuvier*	Tiger Shark	0.001	0.07	Below	0.11	Below	0.14	Below	Low	NE	No RR required	Low
37018030	*Carcharhinus amblyrhynchos*	Grey Reef Shark	0.002	0.08	Below	0.12	Below	0.15	Below	Low	NE	No RR required	Low

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Catch (2011-2015) and other information	Risk score following Residual Risk	Final risk score
37268001	*Lampris guttatus*	Spotted moonfish; Opah	0.057	0.23	Below	0.35	Below	0.47	Below	Low	NE	No RR required	Low
37337006	*Seriola lalandi*	Yellowtail Kingfish	0.002	0.44	Below	0.66	Below	0.88	Below	Low	NE	No RR required	Low
37338001	*Coryphaena hippurus*	Dolphin Fish; Mahi Mahi	0.116	1.41	Below	2.12	Below	2.83	Below	Low	NE	No RR required	Low
37342001	*Brama brama*	Ray's Bream	0.037	0.28	Below	0.47	Below	0.63	Below	Low	NE	No RR required	Low
37439003	*Ruvettus pretiosus*	Oilfish	0.12	0.34	Below	0.51	Below	0.68	Below	Low	NE	No RR required	Low
37439008	*Lepidocybium flavobrunneum*	Escolar	0.027	0.34	Below	0.51	Below	0.68	Below	Low	NE	No RR required	Low
37441003	*Katsuwonus pelamis*	Skipjack Tuna	0.076	0.58	Below	0.87	Below	1.16	Below	Low	NE	No RR required	Low
37441020	*Sarda australis*	Australian bonito	0.004	0.43	Below	0.65	Below	0.87	Below	Low	NE	No RR required	Low
37441024	*Acanthocybium solandri*	Wahoo	0.034	0.59	Below	0.88	Below	1.17	Below	Low	NE	No RR required	Low
37441026	*Thunnus orientalis*	Pacific Northern Bluefin Tuna; Pacific bluefin tuna; Northern Bluefin Tuna	0.069	0.18	Below	0.28	Below	0.37	Below	Low	NE	No RR required	Low
37444005	*Istiophorus platypterus*	Sailfish	0.097	0.38	Below	0.58	Below	0.77	Below	Low	NE	No RR required	Low
37444007	*Tetrapturus angustirostris*	Shortbill Spearfish	0.06	0.30	Below	0.45	Below	0.60	Below	Low	NE	No RR required	Low
37445004	*Centrolophus niger*	Rudderfish	0.041	0.30	Below	0.46	Below	0.61	Below	Low	NE	No RR required	Low

Risk ranking guidelines:

1	Risk rating due to missing, incorrect or out of date information	4	Effort and catch management arrangements for target and byproduct species
2	At risk due to external factors (cumulative risks)	5	Management arrangements to mitigate against the level of bycatch
3	At risk in regards to level of interaction/capture with a zero or negligible level of susceptibility	6	Management arrangements relating to seasonal, spatial and depth closures

Table 2.31. bSAFE risk categories for byproduct species Dusky whaler *Carcharhinus obscurus* based on three post capture mortality (PCM) values (%). See TTRAG Advice note No. 4818 (September 2018) for further details on PCM.

CAAB code	Scientific name	Common name	PCM (%)		Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Final risk score	Comment(s)
37018003	*Carcharhinus obscurus*	Dusky Shark; Dusky Whaler	52.6	Mean	0.047	0.04	Above	0.06	Below	0.08	Below	Medium	Medium-low	See Table 2.30
			40.5	Lower	0.040	0.04	Below	0.06	Below	0.08	Below	Low		
			61.2	Upper	0.031	0.04	Below	0.06	Below	0.08	Below	Low		

2.5.4 bSAFE - Bycatch species

There were 146 bycatch species considered in this SAFE (Figure 2.9a, b). Nine species were unassessable due to missing biological attributes employed in the SAFE method (Table 2.32, classified as NA - not assessable), therefore a PSA was conducted on these species (see Table 2.23). Of the remaining 137 species, two were high risk, four were medium risk and 131 species were low risk. A residual risk analysis was conducted on the high and medium risk species (Table 2.32; see also Section 2.9).

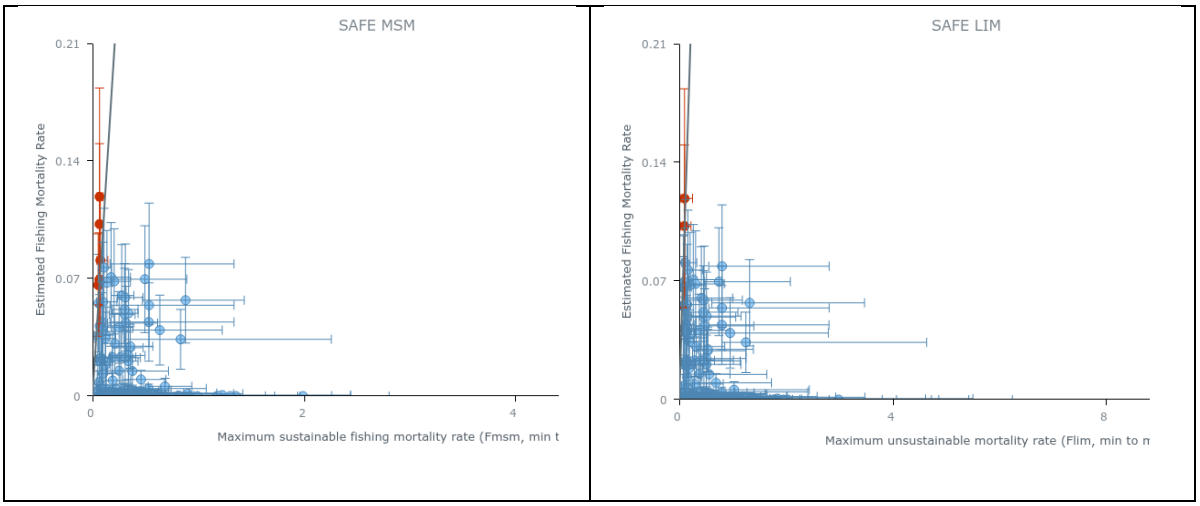


Figure 2.9. SAFE plot for Bycatch species in the ETBF longline fishery for (a) SAFE-MSM reference point [left] and (b) SAFE limit (LIM) reference point [right].

Table 2.32. bSAFE risk categories for bycatch species ecological component for F_MSM, F_Lim and F_crash. A residual risk (RR) analysis conducted for high and medium risk species. Catch (numbers) from Commonwealth logbook (LOG) and observer (OBS) databases. Residual risk guidelines drawn from document "Revision of residual risk guidelines to reflect updated Ecological Risk Assessment Methodology – version Oct 12, 2016. See numbers at the foot of this table. NE: not entered for low risk species. NA: not assessable. Ret: retained, dis: discarded. ^ Based on hammerhead sharks group code (logbook data).

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Catch (2011-2015)	Risk score following Residual Risk	Final risk score
The following 9 species have been analysed in the PSA (see Table 2.24).													
37466004	*Lactoria cornuta*	Longhorn Cowfish	0.001	-	NA	-	NA	-	NA	NA	-	-	See PSA (Table 2.23)
37443001	*Luvarus imperialis*	Louvar	0.044	-	NA	-	NA	-	NA	NA	-	-	See PSA (Table 2.23)
37336005	*Remora brachyptera*	Spearfish Remora	0.034	-	NA	-	NA	-	NA	NA	-	-	See PSA (Table 2.23)
37336002	*Remora remora*	Remora	0.042	-	NA	-	NA	-	NA	NA	-	-	See PSA (Table 2.23)
37272002	*Regalecus glesne*	Oarfish ("king of herrings")	0.023	-	NA	-	NA	-	NA	NA	-	-	See PSA (Table 2.23)
37271001	*Trachipterus arawatae*	Southern Ribbonfish	0.068	-	NA	-	NA	-	NA	NA	-	-	See PSA (Table 2.23)
37270001	*Lophotus lacepede*	Crested Oarfish; Crested Bandfish	0.091	-	NA	-	NA	-	NA	NA	-	-	See PSA (Table 2.23)
37059003	*Kaupichthys diodontus*	False moray; Plain False Moray	0.000	-	NA	-	NA	-	NA	NA	-	-	See PSA (Table 2.23)
37053001	*Elops hawaiensis*	Hawaiian Giant Herring	0.000	-	NA	-	NA	-	NA	NA	-	-	See PSA (Table 2.23)
Other BC species:													
37020043	*Isistius plutodus*	Largetooth Cookiecutter Shark	0.119	0.07	Above	0.1	Above	0.13	Below	High	OBS: 1 cut free	IUCN redlist: least concern. 3- Low interaction/capture. Therefore risk reduced to low.	Low
37020003	*Deania calceus*	Brier Shark	0.102	0.07	Above	0.1	Above	0.13	Below	High	OBS: 1 ret.	IUCN redlist: least concern. 3- Low interaction/capture. Therefore risk reduced to low.	Low

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Catch (2011-2015)	Risk score following Residual Risk	Final risk score
37012003	*Alopias pelagicus*	Pelagic Thresher Shark	0.069	0.06	Above	0.10	Below	0.13	Below	Medium	OBS: 0 ret; 7 dis or 76 dis [cut free (66); dis (7); ecaped (1); jerk free (2)]. Unknown (2).	Decreasing population trend (IUCN redlist). Unknown population trend within ETBF. Risk remains medium Therefore risk remains medium.	Medium
37019001	*Sphyrna lewini*	Scalloped Hammerhead Shark	0.066	0.06	Above	0.09	Below	0.12	Below	Medium	LOG^: 452 ret; 695 dis. OBS: 0 ret; 1 dis or 24 dis [dis (1); cut free (23)].	The eastern central and southeast pacific sub-population is decreasing (IUCN redlist). Unknown population trend within ETBF. Risk remains medium	Medium
37018032	*Carcharhinus longimanus*	Oceanic Whitetip Shark	0.081	0.07	Above	0.11	Below	0.15	Below	Medium	LOG: 311 ret; 2719 dis. OBS: 12 ret; 8 dis or 180 dis [cut free (163); dis (8); escaped (3); jerked free (6)].	Decreasing population trend (IUCN redlist). Unknown population trend within the ETBF. Not permitted to be retained in ETBF since early 2012. Risk remains medium.	Medium
37018007	*Carcharhinus plumbeus*	Sandbar Shark	0.066	0.05	Above	0.08	Below	0.11	Below	Medium	LOG: 7 ret; 4 dis. OBS: 0 ret; 2 dis or 11 dis [cut free (9); dis (2)].	Decreasing population trend (IUCN redlist). Two distinct biological stocks exist in Australia (i.e., Western and Eastern). Western stock is recovering. Eastern stock status is unknown.	Medium

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Catch (2011-2015)	Risk score following Residual Risk	Final risk score
												Therefore risk remains medium.	
37003001	*Geotria australis*	Pouch Lamprey	0.000	-	Below	-	Below	-	Below	Low	NE	No RR required	Low
37003002	*Mordacia mordax*	Australian Lamprey	0.000	-	Below	-	Below	-	Below	Low	NE	No RR required	Low
37005005	*Hexanchus griseus*	Bluntnose Sixgill Shark	0.013	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37008003	*Odontaspis ferox*	Smalltooth Sandtiger Shark; Sandtiger Shark	0.021	0.09	Below	0.13	Below	0.18	Below	Low	NE	No RR required	Low
37009003	*Pseudocarcharias kamoharai*	Crocodile Shark	0.018	0.12	Below	0.18	Below	0.24	Below	Low	NE	No RR required	Low
37012001	*Alopias vulpinus*	Common Thresher	0.023	0.08	Below	0.12	Below	0.16	Below	Low	NE	No RR required	Low
37012002	*Alopias superciliosus*	Bigeye Thresher Shark	0.055	0.06	Below	0.09	Below	0.11	Below	Low	NE	No RR required	Low
37015009	*Figaro boardmani*	Australian Sawtail Catshark; Sawtail Catshark	0.021	0.12	Below	0.18	Below	0.25	Below	Low	NE	No RR required	Low
37015029	*Aulohalaelurus labiosus*	Australian Blackspot Catshark	0.000	0.27	Below	0.4	Below	0.54	Below	Low	NE	No RR required	Low
37017003	*Furgaleus macki*	Whiskery Shark	0.000	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37018008	*Carcharhinus falciformis*	Silky Shark	0.022	0.07	Below	0.1	Below	0.13	Below	Low	NE	No RR required	Low
37018012	*Carcharhinus altimus*	Bignose Shark	0.002	0.07	Below	0.11	Below	0.15	Below	Low	NE	No RR required	Low
37018014	*Carcharhinus tilstoni*	Australian Blacktip Shark	0.000	0.1	Below	0.15	Below	0.20	Below	Low	NE	No RR required	Low
37018021	*Carcharhinus leucas*	Bull Shark	0.001	0.06	Below	0.08	Below	0.11	Below	Low	NE	No RR required	Low
37018023	*Carcharhinus brevipinna*	Spinner Shark	0.001	0.08	Below	0.12	Below	0.16	Below	Low	NE	No RR required	Low
37018026	*Carcharhinus amboinensis*	Pigeye Shark	0.001	0.07	Below	0.10	Below	0.13	Below	Low	NE	No RR required	Low
37018027	*Carcharhinus albimarginatus*	Silvertip Shark	0.042	0.07	Below	0.10	Below	0.13	Below	Low	NE	No RR required	Low
37018033	*Carcharhinus amblyrhynchoides*	Graceful Shark	0.000	0.07	Below	0.10	Below	0.13	Below	Low	NE	No RR required	Low
37018036	*Carcharhinus melanopterus*	Blacktip Reef Shark	0.000	0.07	Below	0.10	Below	0.13	Below	Low	NE	No RR required	Low

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Catch (2011-2015)	Risk score following Residual Risk	Final risk score
37018038	*Triaenodon obesus*	Whitetip Reef Shark	0.001	0.08	Below	0.12	Below	0.16	Below	Low	NE	No RR required	Low
37018039	*Carcharhinus limbatus*	Blacktip shark; Common Blacktip Shark	0.002	0.1	Below	0.15	Below	0.19	Below	Low	NE	No RR required	Low
37019002	*Sphyrna mokarran*	Great hammerhead Shark	0.044	0.09	Below	0.13	Below	0.17	Below	Low	NE	No RR required	Low
37019004	*Sphyrna zygaena*	Smooth Hammerhead Shark	0.04	0.08	Below	0.13	Below	0.18	Below	Low	NE	No RR required	Low
37020001	*Centrophorus moluccensis*	Endeavour Dogfish	0.004	0.05	Below	0.08	Below	0.11	Below	Low	NE	No RR required	Low
37020006	*Squalus megalops*	Piked Spurdog; Spikey Dogfish	0.003	0.06	Below	0.09	Below	0.11	Below	Low	NE	No RR required	Low
37020014	*Isistius brasiliensis*	Smalltooth Cookiecutter Shark	0.008	0.06	Below	0.1	Below	0.13	Below	Low	NE	No RR required	Low
37020019	*Centroscymnus owstonii*	Owston's Dogfish	0.021	0.05	Below	0.08	Below	0.10	Below	Low	NE	No RR required	Low
37022001	*Echinorhinus brucus*	Bramble Shark	0.000	0.06	Below	0.09	Below	0.12	Below	Low	NE	No RR required	Low
37024001	*Squatina australis*	Australian Angel Shark	0.000	0.07	Below	0.11	Below	0.15	Below	Low	NE	No RR required	Low
37035010	*Pteroplatytrygon violacea*	Pelagic Stingray	0.077	0.11	Below	0.16	Below	0.22	Below	Low	NE	No RR required	Low
37038007	*Urolophus viridis*	Greenback Stingaree	0.003	0.15	Below	0.23	Below	0.31	Below	Low	NE	No RR required	Low
37039001	*Myliobatis tenuicaudatus*	Southern Eagle Ray	0.001	0.17	Below	0.11	Below	0.14	Below	Low	NE	No RR required	Low
37040001	*Rhinoptera neglecta*	Australian Cownose Ray	0.000	0.08	Below	0.12	Below	0.16	Below	Low	NE	No RR required	Low
37085009	*Pellona ditchela*	Indian pellona; Ditchelee	0.000	0.90	Below	1.35	Below	1.80	Below	Low	NE	No RR required	Low
37085013	*Sardinella gibbosa*	Goldstripe Sardinella	0.001	0.90	Below	1.35	Below	1.80	Below	Low	NE	No RR required	Low
37086004	*Thryssa setirostris*	Longjaw Thryssa	0.000	1.36	Below	2.04	Below	2.71	Below	Low	NE	No RR required	Low
37087001	*Chirocentrus dorab*	Dorab Wolf Herring	0.001	0.23	Below	0.35	Below	0.46	Below	Low	NE	No RR required	Low
37122002	*Lampanyctodes hectoris*	Hector's lanternfish	0.000	0.68	Below	1.03	Below	1.37	Below	Low	NE	No RR required	Low
37122096	*Nannobrachium achirus*	Cripplefin Lanternfish	0.006	1.13	Below	1.7	Below	2.26	Below	Low	NE	No RR required	Low

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Catch (2011-2015)	Risk score following Residual Risk	Final risk score
37128001	*Alepisaurus ferox*	Long snouted Lancetfish; Longnose Lancetfish	0.022	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37128002	*Alepisaurus brevirostris*	Short Snouted Lancetfish; Shortnose Lancetfish	0.000	0.19	Below	0.28	Below	0.37	Below	Low	NE	No RR required	Low
37134001	*Barbourisia rufa*	Redvelvet whalefish	0.000	-	Below	-	Below	-	Below	Low	NE	No RR required	Low
37206010	*Alabes parvulus*	Pygmy Shore-eel	0.000	-	Below	-	Below	-	Below	Low	NE	No RR required	Low
37210004	*Allenichthys glauerti*	Glauert's Anglerfish	0.000	-	Below	-	Below	-	Below	Low	NE	No RR required	Low
37210005	*Echinophryne crassispina*	Prickly Anglerfish	0.000	-	Below	-	Below	-	Below	Low	NE	No RR required	Low
37212001	*Halieutaea brevicauda*	Shortfin Seabat	0.01	0.46	Below	0.69	Below	0.92	Below	Low	NE	No RR required	Low
37228002	*Genypterus blacodes*	Pink Ling	0.009	0.19	Below	0.29	Below	0.38	Below	Low	NE	No RR required	Low
37232007	*Malacocephalus laevis*	Softhead grenadier; Smooth Whiptail	0.023	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low
37232016	*Coryphaenoides subserrulatus*	Longray Whiptail	0.023	0.19	Below	0.28	Below	0.38	Below	Low	NE	No RR required	Low
37287001	*Helicolenus percoides*	Reef Ocean Perch	0.002	0.23	Below	0.35	Below	0.46	Below	Low	NE	No RR required	Low
37287101	*Brachypterois serrulifer*	Sawcheek Scorpionfish	0	0.33	Below	0.5	Below	0.67	Below	Low	NE	No RR required	Low
37288006	*Pterygotrigla polyommata*	Latchet	0.002	0.44	Below	0.65	Below	0.87	Below	Low	NE	No RR required	Low
37292004	*Aetapcus maculatus*	Warty Prowfish	0.000	-	Below	-	Below	-	Below	Low	NE	No RR required	Low
37296011	*Ratabulus diversidens*	Orange-freckled Flathead	0.003	0.39	Below	0.59	Below	0.79	Below	Low	NE	No RR required	Low
37311001	*Lepidoperca pulchella*	Eastern Orange Perch	0.004	0.34	Below	0.51	Below	0.69	Below	Low	NE	No RR required	Low
37311006	*Polyprion oxygeneios*	Hapuku	0.004	0.13	Below	0.20	Below	0.26	Below	Low	NE	No RR required	Low
37311150	*Epinephelus malabaricus*	Malabar grouper; Blackspotted Rockcod	0.001	0.27	Below	0.40	Below	0.53	Below	Low	NE	No RR required	Low
37311151	*Epinephelus morrhua*	Comet Grouper	0.003	0.26	Below	0.40	Below	0.53	Below	Low	NE	No RR required	Low

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Catch (2011-2015)	Risk score following Residual Risk	Final risk score
37313026	*Labracinus cyclophthalmus*	Firetail Dottyback	0.000	-	Below	-	Below	-	Below	Low	NE	No RR required	Low
37319002	*Belonepterygion fasciolatum*	Barred Spiny Basslet	0.000	-	Below	-	Below	-	Below	Low	NE	No RR required	Low
37327010	*Epigonus denticulatus*	White Deepsea Cardinalfish	0.056	0.10	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37330010	*Sillago ciliata*	Sand Whiting	0.000	0.57	Below	0.86	Below	1.14	Below	Low	NE	No RR required	Low
37334002	*Pomatomus saltatrix*	Tailor	0.002	0.38	Below	0.57	Below	0.76	Below	Low	NE	No RR required	Low
37335001	*Rachycentron canadum*	Cobia	0.044	0.32	Below	0.48	Below	0.63	Below	Low	NE	No RR required	Low
37337025	*Seriola dumerili*	Amberjack	0.015	0.38	Below	0.56	Below	0.75	Below	Low	NE	No RR required	Low
37337029	*Elagatis bipinnulata*	Rainbow Runner	0.07	0.50	Below	0.74	Below	0.99	Below	Low	NE	No RR required	Low
37337039	*Caranx sexfasciatus*	Bigeye Trevally	0.001	0.41	Below	0.62	Below	0.83	Below	Low	NE	No RR required	Low
37337040	*Naucrates ductor*	Pilotfish	0.034	0.83	Below	1.25	Below	1.67	Below	Low	NE	No RR required	Low
37337072	*Parastromateus niger*	Black Pomfret	0.000	0.55	Below	0.82	Below	1.10	Below	Low	NE	No RR required	Low
37340001	*Mene maculata*	Razor Moonfish	0.000	0.99	Below	1.49	Below	1.98	Below	Low	NE	No RR required	Low
37341013	*Nuchequula glenysae*	Twoblotch Ponyfish	0.000	1.99	Below	2.99	Below	3.98	Below	Low	NE	No RR required	Low
37342008	*Taractes asper*	Flathead Pomfret	0.015	0.25	Below	0.38	Below	0.50	Below	Low	NE	No RR required	Low
37342010	*Brama australis*	Southern Ray's Bream	0.049	0.30	Below	0.46	Below	0.61	Below	Low	NE	No RR required	Low
37342015	*Taractichthys steindachneri*	Sickle Pomfret	0.041	0.25	Below	0.38	Below	0.50	Below	Low	NE	No RR required	Low
37346001	*Aphareus rutilans*	Rusty Jobfish	0.000	0.28	Below	0.41	Below	0.55	Below	Low	NE	No RR required	Low
37346014	*Etelis carbunculus*	Ruby Snapper	0.004	0.29	Below	0.44	Below	0.59	Below	Low	NE	No RR required	Low
37346015	*Lutjanus argentimaculatus*	Mangrove Jack	0.001	0.24	Below	0.36	Below	0.47	Below	Low	NE	No RR required	Low
37346017	*Symphorus nematophorus*	Chinamanfish	0.000	0.28	Below	0.43	Below	0.57	Below	Low	NE	No RR required	Low
37346027	*Aprion virescens*	Green Jobfish	0.002	0.36	Below	0.55	Below	0.73	Below	Low	NE	No RR required	Low
37346032	*Pristipomoides filamentosus*	Rosy Jobfish; King Snapper; Rosy Snapper	0.003	0.33	Below	0.50	Below	0.66	Below	Low	NE	No RR required	Low

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Catch (2011-2015)	Risk score following Residual Risk	Final risk score
37349003	*Gerres filamentosus*	Threadfin Silverbiddy	0.001	1.23	Below	1.84	Below	2.46	Below	Low	NE	No RR required	Low
37349022	*Gerres oblongus*	Slender Silverbiddy	0.000	1.18	Below	1.76	Below	2.35	Below	Low	NE	No RR required	Low
37353001	*Chrysophrys auratus*	Snapper	0.002	0.28	Below	0.41	Below	0.55	Below	Low	NE	No RR required	Low
37353003	*Acanthopagrus butcheri*	Black bream	0.000	0.29	Below	0.43	Below	0.57	Below	Low	NE	No RR required	Low
37353004	*Acanthopagrus australis*	Yellowfin Bream	0.001	0.37	Below	0.56	Below	0.74	Below	Low	NE	No RR required	Low
37353011	*Acanthopagrus pacificus*	Pikey Bream	0.000	0.36	Below	0.54	Below	0.72	Below	Low	NE	No RR required	Low
37353013	*Rhabdosargus sarba*	Tarwhine	0.002	0.21	Below	0.32	Below	0.43	Below	Low	NE	No RR required	Low
37354001	*Argyrosomus japonicus*	Mulloway	0.002	0.2	Below	0.3	Below	0.4	Below	Low	NE	No RR required	Low
37361003	*Tilodon sexfasciatus*	Moonlighter	0.000	0.31	Below	0.46	Below	0.61	Below	Low	NE	No RR required	Low
37362007	*Platax orbicularis*	Orbicular Batfish; Round Batfish	0.000	-	Below	-	Below	-	Below	Low	NE	No RR required	Low
37367002	*Paristiopterus labiosus*	Giant Boarfish	0.002	0.30	Below	0.45	Below	0.60	Below	Low	NE	No RR required	Low
37377003	*Nemadactylus macropterus*	Jackass Morwong	0.004	0.22	Below	0.32	Below	0.43	Below	Low	NE	No RR required	Low
37382004	*Sphyraena jello*	Pickhandle Barracuda	0.001	0.42	Below	0.63	Below	0.83	Below	Low	NE	No RR required	Low
37382008	*Sphyraena barracuda*	Great Barracuda	0.001	0.40	Below	0.60	Below	0.80	Below	Low	NE	No RR required	Low
37382009	*Sphyraena qenie*	Blackfin Barracuda	0.000	0.34	Below	0.51	Below	0.67	Below	Low	NE	No RR required	Low
37384014	*Xiphocheilus typus*	Bluetooth Tuskfish	0.000	0.53	Below	0.79	Below	1.06	Below	Low	NE	No RR required	Low
37415001	*Brachynectes fasciatus*	Barred Threefin	0.000	1.30	Below	1.95	Below	2.60	Below	Low	NE	No RR required	Low
37428075	*Bryaninops amplus*	Large Whip Goby	0.000	1.19	Below	1.78	Below	2.38	Below	Low	NE	No RR required	Low
37439001	*Thyrsites atun*	Barracouta	0.029	0.36	Below	0.54	Below	0.71	Below	Low	NE	No RR required	Low
37439002	*Rexea solandri*	Gemfish	0.06	0.28	Below	0.41	Below	0.55	Below	Low	NE	No RR required	Low
37439010	*Gempylus serpens*	Snake Mackerel	0.049	0.34	Below	0.51	Below	0.68	Below	Low	NE	No RR required	Low
37439012	*Nesiarchus nasutus*	Black Gemfish	0.021	0.34	Below	0.51	Below	0.68	Below	Low	NE	No RR required	Low
37439013	*Promethichthys prometheus*	Singleline Gemfish	0.052	0.3	Below	0.46	Below	0.61	Below	Low	NE	No RR required	Low

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Catch (2011-2015)	Risk score following Residual Risk	Final risk score
37440001	*Benthodesmus elongatus*	Slender Frostfish	0.024	0.34	Below	0.51	Below	0.68	Below	Low	NE	No RR required	Low
37440002	*Lepidopus caudatus*	Southern Frostfish; Frostfish	0.03	0.36	Below	0.54	Below	0.71	Below	Low	NE	No RR required	Low
37440004	*Trichiurus lepturus*	Largehead Hairtail	0.005	0.53	Below	0.79	Below	1.06	Below	Low	NE	No RR required	Low
37441007	*Scomberomorus commerson*	Spanish Mackerel	0.002	0.48	Below	0.72	Below	0.96	Below	Low	NE	No RR required	Low
37441008	*Cybiosarda elegans*	Leaping Bonito	0.044	0.53	Below	0.80	Below	1.07	Below	Low	NE	No RR required	Low
37441009	*Auxis thazard*	Frigate Mackerel	0.039	0.64	Below	0.95	Below	1.27	Below	Low	NE	No RR required	Low
37441010	*Euthynnus affinis*	Mackerel Tuna	0.001	0.62	Below	0.93	Below	1.24	Below	Low	NE	No RR required	Low
37441013	*Thunnus tonggol*	Long-tail Tuna	0.023	0.31	Below	0.46	Below	0.62	Below	Low	NE	No RR required	Low
37441019	*Gasterochisma melampus*	Butterfly Mackerel	0.079	0.54	Below	0.80	Below	1.07	Below	Low	NE	No RR required	Low
37441021	*Allothunnus fallai*	Slender tuna	0.000	0.54	Below	0.80	Below	1.07	Below	Low	NE	No RR required	Low
37441029	*Gymnosarda unicolor*	Dogtooth Tuna	0.054	0.54	Below	0.80	Below	1.07	Below	Low	NE	No RR required	Low
37444003	*Makaira nigricans*	Blue Marlin	0.071	0.18	Below	0.26	Below	0.35	Below	Low	NE	No RR required	Low
37444006	*Istiompax indica*	Black Marlin	0.068	0.20	Below	0.31	Below	0.41	Below	Low	NE	No RR required	Low
37445001	*Hyperoglyphe antarctica*	Blue-Eye Trevalla	0.031	0.21	Below	0.32	Below	0.42	Below	Low	NE	No RR required	Low
37445005	*Seriolella brama*	Blue Warehou	0.059	0.31	Below	0.47	Below	0.62	Below	Low	NE	No RR required	Low
37445006	*Seriolella punctata*	Silver Warehou	0.002	0.33	Below	0.5	Below	0.66	Below	Low	NE	No RR required	Low
37446017	*Cubiceps capensis*	Cape Cubehead	0.057	0.88	Below	1.32	Below	1.76	Below	Low	NE	No RR required	Low
37465006	*Nelusetta ayraud*	Ocean Jacket	0.003	0.38	Below	0.56	Below	0.75	Below	Low	NE	No RR required	Low
37465007	*Scobinichthys granulatus*	Rough leatherjacket	0.000	0.41	Below	0.61	Below	0.82	Below	Low	NE	No RR required	Low
37465011	*Abalistes stellatus*	Starry Triggerfish	0.000	0.82	Below	1.22	Below	1.63	Below	Low	NE	No RR required	Low
37465045	*Aluterus scriptus*	Scrawled Leatherjacket	0.001	0.42	Below	0.62	Below	0.83	Below	Low	NE	No RR required	Low
37467023	*Lagocephalus lagocephalus*	Oceanic puffer; Ocean Puffer	0.001	0.40	Below	0.60	Below	0.81	Below	Low	NE	No RR required	Low
37467066	*Arothron caeruleopunctatus*	Bluespotted Puffer	0.000	0.42	Below	0.63	Below	0.84	Below	Low	NE	No RR required	Low

CAAB code	Scientific name	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F overall risk	Catch (2011-2015)	Risk score following Residual Risk	Final risk score
37469002	*Allomycterus pilatus*	Australian Burrfish	0.003	0.45	Below	0.68	Below	0.9	Below	Low	NE	No RR required	Low
37470001	*Mola ramsayi*	Short Sunfish	0.036	0.12	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37470002	*Mola mola*	Ocean Sunfish	0.034	0.12	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37470003	*Masturus lanceolatus*	Sharptail Sunfish	0.000	0.12	Below	0.17	Below	0.23	Below	Low	NE	No RR required	Low
37470004	*Ranzania laevis*	Slender Sunfish	0.068	0.14	Below	0.20	Below	0.27	Below	Low	NE	No RR required	Low

Risk ranking guidelines:

1	Risk rating due to missing, incorrect or out of date information	4	Effort and catch management arrangements for target and byproduct species
2	At risk due to external factors (cumulative risks)	5	Management arrangements to mitigate against the level of bycatch
3	At risk in regards to level of interaction/capture with a zero or negligible level of susceptibility	6	Management arrangements relating to seasonal, spatial and depth closures

2.5.5 bSAFE - Protected species

There were nine protected species considered in this SAFE (Figure 2.10a, b). All species were below the MSM or LIM reference points and all overall risk values were low (Table 2.33).

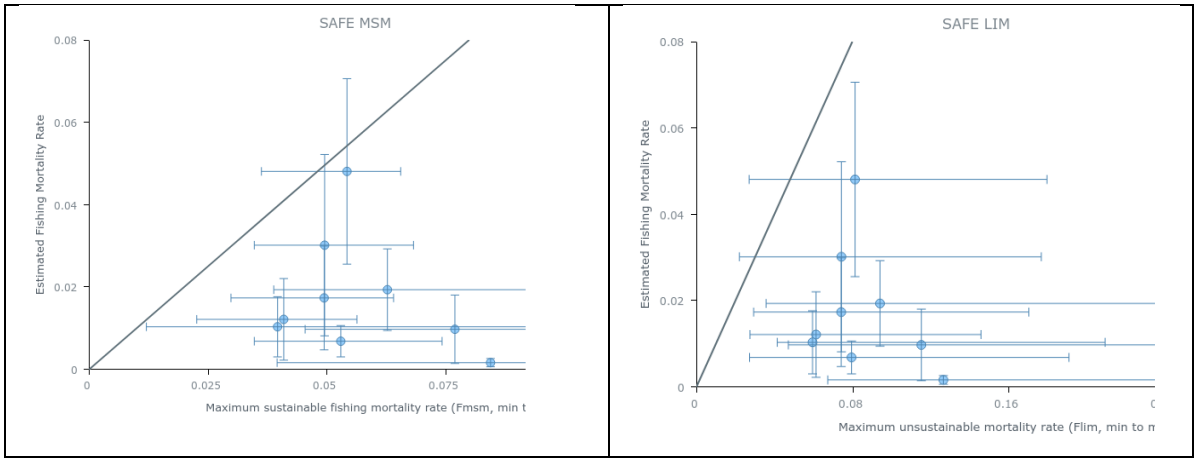


Figure 2.10. SAFE plot for protected species in the ETBF longline fishery for a) SAFE-MSM reference point and (b) SAFE limit [left] (LIM) reference point [right].

Table 2.33. bSAFE risk categories for protected species ecological component for F_MSM, F_Lim and F_crash and overall risk.

CAAB code	*Scientific name*	Common name	Susceptibility	F MSM	F MSM risk	F Lim	F Lim risk	F Crash	F Crash risk	F Over-all risk
37008001	*Carcharias taurus*	Grey Nurse Shark	0.002	0.08	Below	0.13	Below	0.17	Below	Low
37010001	*Isurus oxyrinchus*	Shortfin Mako	0.048	0.05	Below	0.08	Below	0.11	Below	Low
37010002	*Isurus paucus*	Longfin Mako	0.017	0.05	Below	0.07	Below	0.10	Below	Low
37010003	*Carcharodon carcharias*	White Shark	0.012	0.04	Below	0.06	Below	0.08	Below	Low
37010004	*Lamna nasus*	Porbeagle	0.007	0.05	Below	0.08	Below	0.11	Below	Low
37011001	*Cetorhinus maximus*	Basking Shark	0.010	0.04	Below	0.06	Below	0.08	Below	Low
37017008	*Galeorhinus galeus*	School Shark	0.019	0.06	Below	0.09	Below	0.13	Below	Low
37020010	*Centrophorus harrissoni*	Harrisson's Dogfish	0.030	0.05	Below	0.07	Below	0.10	Below	Low
37041004	*Manta birostris*	(Giant) Manta Ray	0.01	0.08	Below	0.12	Below	0.15	Below	Low

2.6 Habitat Component

The Habitat component was eliminated at Level 1.

2.7 Community Component

The Community component was not evaluated in this assessment.

2.8 Decision rules to move from Level 2 to Level 3 (Step 7)

For the PSA overall risk values, units that fall in the upper third (risk value > 3.18) and middle third (2.64 < risk value < 3.18) of the PSA plots are deemed to be at high and medium risk respectively. For the SAFE method, species that fall above the SAFE-MSM or limit reference point (SAFE-LIM) are considered to be at risk of overfishing (Table 2.28). Species identified from either method need to be the focus of further work, either through implementing a management response to address the risk to the vulnerable species or by further examination for risk within the particular ecological component at Level 3. PSA-units at low risk, (i.e. in the lower third), or at SAFE where units were below the overfishing limit point (i.e. SAFE-LIM) will be deemed not at risk from the sub-fishery and the assessment is concluded for these units.

The output from the Level 2 analysis will result in four options:

- The risk of a unit of analysis within a component (e.g. single species or habitat type) is not high, the rationale is documented, and the impact of the fishing activity on this unit need not be assessed at a higher level unless management or the fishery changes.
- The risk of a unit is high but management strategies are introduced rapidly that will reduce this risk, this unit need not be assessed further unless the management or the fishery changes.
- The risk of a unit is high but there is additional information that can be used to determine if Level 3, or even a new management action is required. This information should be sought before action is taken
- The risk of a unit is high and there are no planned management interventions that would remove this risk, therefore the reasons are documented and the assessment moves to Level 3.

At the conclusion of the Level 2 analysis, a fishery can decide to further investigate the risk of fishing to the species via a Level 3 assessment or implement a management response to mitigate the risk. To ensure all fisheries follow a consistent process in responding to the results of the risk assessment, AFMA has developed an ecological risk management framework. The framework (Figure 2.11) makes use of the existing AFMA management structures to enable the ERAs to become a part of normal fisheries management, including the involvement of fisheries consultative committees. A separate document, the ERM report, will be developed that outlines the reasons why species are at high risk and what actions the fishery will implement to respond to the risks.

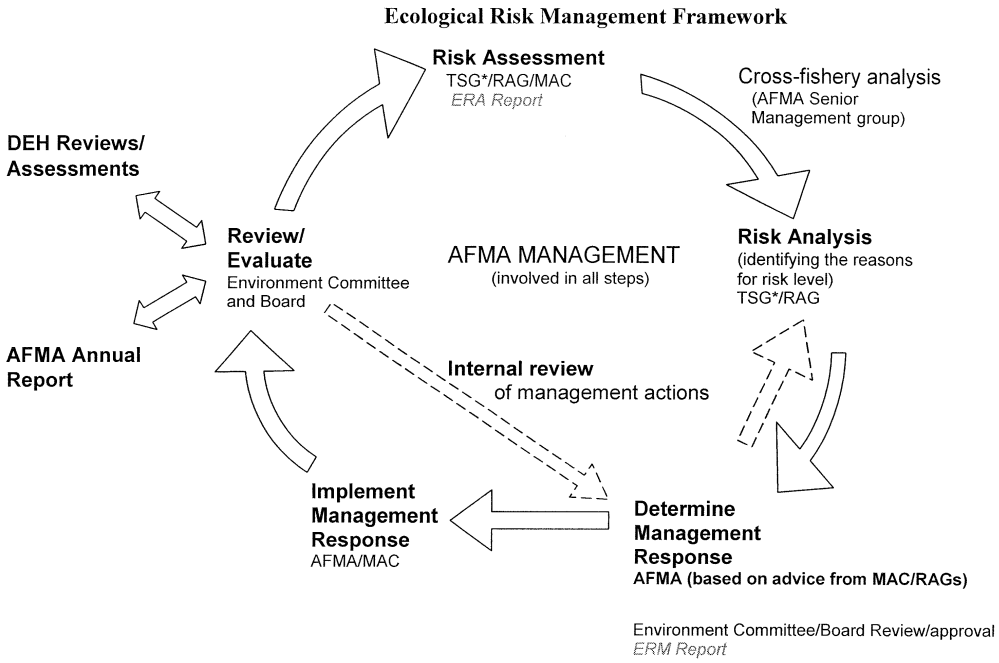


Figure 2.11. Schematic of of the Ecological risk management cycle. TSG – Technical Support Group.

2.9 High and medium risk categorisation (Step 8) Update with Residual Risk information

PSA

Protected species

A residual risk analysis has been performed for all (five) high risk species (two whales and three dolphin species) following a PSA analysis (see Section 2.4.3; Table 2.24). All high risk species were reduced to low risk, based on the rationale provided (Table 2.24).

bSAFE

Byproduct species

Sixteen of 18 species were assessed at low risk. The blue shark *Prionace glauca* was assessed at medium risk, while the dusky whaler *Carcharhinus obscurus* was assessed at high risk. The overall risk for the dusky whaler was reduced to medium-low following a residual risk analysis, based on the revised post capture mortality estimates agreed by TTRAG (TTRAG Advice note No. 4818, September 2018).

The blue shark's medium risk score remained the same following a residual risk analysis. Both Logbook and Observer records suggest that more are discarded than retained, but there is limited information on stock status of this species in the area of the ETBF. This species is globally distributed and the stock status in the North and South Atlantic Oceans are uncertain

(Anon 2015a), while the stock in the Indian Ocean is not overfished, overfishing could be occurring (Anon, 2015b).

Bycatch species

Of the assessable species, two species were assessed at high risk: largetooth cookiecutter shark *Isistius plutodus* and brier shark *Deania calceus*. These high risk species were reduced to low risk following a residual risk analysis based on low interaction/capture. A further four species were assessed at medium risk, consisting of the pelagic thresher shark *Alopias pelagicus*, scalloped hammerhead shark *Sphyrna lewini*, oceanic whitetip shark *Carcharhinus longimanus* and sandbar shark *Carcharhinus plumbeus*. A residual risk analysis was performed on these four medium risk species, resulting in overall risk remaining the same. While, mitigation measures already exist for the oceanic whitetip shark (ban on retention since 2012), recorded discards (e.g. Logbook) should continue to be monitored, population trend within the ETBF is unknown. The sandbar shark remained at medium risk as total removals from the fishery based on Logbook records were low.

3 General discussion and research implications

3.1 Level 1

Most hazards (fishing activities) were eliminated at Level 1 (risk scores 1 or 2; Table 2.19; Figure 2.1-Figure 2.5). Those remaining consist of:

- Direct impact of capture by fishing (byproduct/bycatch species, protected species and communities),
- Direct impact without capture by fishing (protected species) and
- Addition/movement of biological material by translocation of species (Communities).

The direct impacts of fishing hazard was scored as moderate for Byproduct and Bycatch and Community components and major for the Protected species component. Confidence scores were high for the protected species component, but low for the other two components (i.e. Byproduct and Bycatch and Communities). A major risk (risk score 4) was also due to indirect fishing impacts on Protected species.

The major risk and high confidence scores for the Protected species component (i.e., shortfin mako), for both fishing with and without capture was based on reported interactions from the Commonwealth Logbook database.

Translocation of species was considered to be a major risk (4) to Communities, due to the potential for the introduction of pathogens through the use of imported baits. Evidence of pathogens in other fishery areas has previously shown the consequence of this hazard (Gaughan 2002). The Communities component triggered a Level 2 analysis but was analysed in this assessment. This SICA has removed the Habitat component from further analysis, as it was identified as low risk based on consequence scores by the set of activities considered.

Significant (i.e. risk score of at least moderate) external hazards included impacts from other fisheries in the region for all ecological components except habitats.

There have been many new management arrangements developed and implemented in the ETBF since the last ERAEF assessment was conducted for this sub-fishery (e.g. total allowable commercial quotas introduced for key commercial species; Bycatch Action Plans; Threat Abatement Plans to reduce marine bird interactions; spatial closures to protect species; reduction in fishing effort). In addition, there have been changes in (i) ERAEF methodology (ii) ERAEF species classification and (iii) availability of new information. Results of the two Level 1 ETBF SICA analyses (i.e. this assessment and 2006) showed that the same ecological components (except key/secondary commercial species) still have some units at high risk, despite the above management changes implemented in this fishery. For example, different species were identified as most vulnerable and at risk (i.e moderate for byproduct/bycatch species and Communities) for direct impact of capture by fishing between the 2017 and 2006 Level 1 assessments. There was a reduction in risk score for the protected species component

with respect to both direct and indirect impact of capture by fishing (i.e. major in 2017 and severe in 2006) with the shortfin mako shark being most vulnerable in 2017 compared to to the flesh footed shearwater and wandering albatross in 2006. No other species were identified as high risk for protected species component in 2017, in contast to 2006 (i.e., bottlenose dolphin by translocation of species; and the great winged petrel from onboard processing and discarding catch).

3.2 Level 2

3.2.1 Species at risk

PSA and residual risk

Bycatch species: A PSA performed on the nine unassessable bSAFE species resulted in seven at medium risk and two at low risk.

Protected species: There were five high risk, 57 medium risk and 23 low risk species. Of the high risk protected species two were whales and three were dolphins. All high risk species were expanded species from either "whales" or "Delphinidae". There were either none or four missing attributes for each of the high risk species, with four out of five of these species missing no attributes. These were the Indian Ocean bottlenose dolphin *Tursiops aduncus*, bottlenose dolphin *Tursiops truncatus*, Risso's dolphin *Grampus griseus*, Longman's beaked whale *Indopacetus pacificus* and pygmy killer whale *Feresa attenuata*. All five high risk species were reduced to low risk, due to the small number of interactions and/or catch over the 2011-2015 period, following a residual risk analysis.

bSAFE and residual risk

Byproduct species: The blue shark *Prionace glauca* was assessed at medium risk, while the dusky whaler *Carcharhinus obscurus* was assessed at high risk. The overall risk for the dusky whaler was reduced to medium-low following a residual risk analysis, based on revised post capture mortality estimates agreed by TTRAG (TTRAG Advice note No. 4818, September 2018).

The blue shark's medium risk score remained the same following a residual risk analysis. Both Logbook and Observer records suggest that more are discarded than retained, but there is limited information on stock status of this species in the area of the ETBF. This species is globally distributed and the stock status in the North and South Atlantic Oceans are uncertain (Anon 2015a), while the stock in the Indian Ocean is not overfished, overfishing could be occurring (Anon, 2015b).

Bycatch species: Of the assessable species, two species were assessed at high risk: largetooth cookiecutter shark *Isistius plutodus* and brier shark *Deania calceus*. These high risk species were reduced to low risk following a residual risk analysis based on low interaction/capture. A further four species were assessed at medium risk, consisting of the pelagic thresher shark *Alopias pelagicus*, scalloped hammerhead shark *Sphyrna lewini*, oceanic whitetip shark *Carcharhinus longimanus* and sandbar shark *Carcharhinus plumbeus*. A residual risk analysis was performed on these four medium risk species, resulting in overall risk remaining the same.

While, mitigation measures already exist for the oceanic whitetip shark (ban on retention since 2012), recorded discards (e.g. Logbook) should continue to be monitored, population trend within the ETBF is unknown. The sandbar shark remained at medium risk as total removals from the fishery based on Logbook records were low.

3.2.2 Residual risk

As discussed elsewhere in this report (Section 1), the ERAEF methods are both hierarchically structured and precautionary. The Level 1 (SICA) analyses are used to identify potential hazards associated with fishing and which broad components of the ecological system they apply to. The Level 2 (PSA and SAFE) analyses consider the direct impacts of fishing on individual species and habitats (rather than whole components), but the large numbers of species that need to be assessed and the nature of the information available for most species in the L2 analyses limits these analyses in several important respects. These include that some existing management measures are not directly accounted for, and that no direct account is taken of the level of mortality associated with fishing. Both these factors are taken into account in the ERAEF framework at Level 3, but the analyses reported here stop at Level 2. This means that the risk levels for species must be regarded as identifying potential rather than actual risk, and due to the precautionary assumptions made in the PSA analyses, in particular, there will be a tendency to overestimate absolute levels of risk from fishing.

In moving from ERA to ERM, AFMA will focus resources on the highest priority species and habitats (those likely to be most at risk from fishing). To that end, and because Level 3 analyses are not yet available for most species, AFMA (with input from CSIRO and other stakeholders) has developed guidelines to assess “residual risk” for those species identified as being at high potential risk based on the PSA analyses. The residual risk guidelines will be applied on a species by species basis, and include consideration of existing management measures not currently accounted for in the PSA analyses, as well as additional information about the levels of direct mortality. These guidelines will also provide a transparent process for including more precise or missing information into the PSA analysis as it becomes available.

3.2.3 Habitats at risk

Not relevant; eliminated at Level 1.

3.2.4 Community assemblages at risk

The community component was not assessed at Level 2 for this sub-fishery to date.

3.3 Key Uncertainties/Recommendations for Research and Monitoring

In assessing risk to byproduct, bycatch and protected species, it is not possible to assess absolute risk without supplementary information on either abundance or total mortality rates,

and such data are not available for the vast majority of such species. However it may be possible to draw inferences from information that may be available for some species, either from catch records of occurrence from other fisheries, from fishery independent survey data, or from examination of trends in CPUE from Observer data. Such data was used and examined for the high risk PSA species and high and medium risk SAFE species identified in this assessment.

Specific recommendations arising from this assessment include further consideration of the following medium risk species:

1) Oceanic whitetip shark and blue shark - recorded discards (e.g. Logbook) should continue to be monitored.

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Glossary of Terms

Assemblage	A subset of the species in the community that can be easily recognized and studied. For example, the set of sharks and rays in a community is the Chondricythian assemblage.
Attribute	A general term for a set of properties relating to the productivity or susceptibility of a particular unit of analysis.
Bycatch species	A non-target species captured in a fishery, usually of low value and often discarded (see also Byproduct).
Byproduct species	A non-target species captured in a fishery, but it may have value to the fisher and be retained for sale.
Community	A complete set of interacting species.
Component	A major area of relevance to fisheries with regard to ecological risk assessment (e.g. target species, bycatch and byproduct species, threatened and endangered species, habitats, and communities).
Component model	A conceptual description of the impacts of fishing activities (hazards) on components and sub-components, linked through the processes and resources that determine the level of a component.
Consequence	The effect of an activity on achieving the operational objective for a sub-component.
Core objective	The overall aim of management for a component.
End point	A term used in risk assessment to denote the object of the assessment; equivalent to component or sub-component in ERAEF
Ecosystem	The spatially explicit association of abiotic and biotic elements within which there is a flow of resources, such as nutrients, biomass or energy (Crooks, 2002).
External factor	Factors other than fishing that affect achievement of operational objectives for components and sub-components.
Fishery method	A technique or set of equipment used to harvest fish in a fishery (e.g. long-lining, purse-seining, trawling).
Fishery	A related set of fish harvesting activities regulated by an authority (e.g. South-East Trawl Fishery).
F_MSM	Maximum sustainable fishing mortality
F_Lim	limit fishing mortality which is half of the maximum sustainable fishing mortality
F_Crash	minimum unsustainable fishing mortality rate that may lead to population extinction in the longer term
Habitat	The place where fauna or flora complete all or a portion of their life cycle

Hazard identification	The identification of activities (hazards) that may impact the components of interest.
Indicator	Used to monitor the effect of an activity on a sub-component. An indicator is something that can be measured, such as biomass or abundance.
Likelihood	The chance that a sub-component will be affected by an activity.
Operational objective	A measurable objective for a component or sub-component (typically expressed as “the level of X does not fall outside acceptable bounds”)
Precautionary approach	The approach whereby, if there is uncertainty about the outcome of an action, the benefit of the doubt should be given to the biological entity (such as species, habitat or community).
PSA	Productivity-Susceptibility Analysis. Used at Level 2 in the ERAEF methodology.
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.
SICA	Scale, Impact, Consequence Analysis. Used at Level 1 in the ERAEF methodology.
Sub-component	A more detailed aspect of a component. For example, within the target species component, the sub-components include the population size, geographic range, and the age/size/sex structure.
Sub-fishery	A subdivision of the fishery on the basis of the gear or areal extent of the fishery. Ecological risk is assessed separately for each sub-fishery within a fishery.
Sustainability	Ability to be maintained indefinitely
Target species	A species or group of species whose capture is the goal of a fishery, sub-fishery, or fishing operation.
Trophic position	Location of an individual organism or species within a foodweb.
Unit of analysis	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”, while for Habitats, they are “biotypes”, and for Communities the units are “assemblages”.

Appendix A: Level 1 Description of consequences for each component

Table AC.1. Key/secondary commercial species. Description of consequences for each component and each sub-component. Use table as a guide for scoring the level of consequence for target species (Modified from Fletcher et al. 2002).

Sub-component	Score/level 1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Population size	**1. Population size** Insignificant change to population size/growth rate (r). Unlikely to be detectable against background variability for this population.	**1. Population size** Possible detectable change in size/growth rate (r) but minimal impact on population size and none on dynamics.	**1. Population size** Full exploitation rate but long-term recruitment dynamics not adversely damaged.	**1. Population size** Affecting recruitment state of stocks and/or their capacity to increase	**1. Population size** Likely to cause local extinctions if continued in longer term	**1. Population size** Local extinctions are imminent/immediate
Geographic range	**2. Geographic range** No detectable change in geographic range. Unlikely to be detectable against background variability for this population.	**2. Geographic range** Possible detectable change in geographic range but minimal impact on population range and none on dynamics, change in geographic range up to 5 % of original.	**2. Geographic range** Change in geographic range up to 10 % of original.	**2. Geographic range** Change in geographic range up to 25 % of original.	**2. Geographic range** Change in geographic range up to 50 % of original.	**2. Geographic range** Change in geographic range > 50 % of original.
Genetic structure	**3. Genetic structure** No detectable change in genetic structure. Unlikely to be detectable against background variability for this population.	**3. Genetic structure** Possible detectable change in genetic structure. Any change in frequency of genotypes, effective population size or number of spawning units up to 5%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 10%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 25%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units, change up to 50%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units > 50%.
Age/size/sex structure	**4. Age/size/sex structure** No detectable change in age/size/sex structure. Unlikely to be detectable against background	**4. Age/size/sex structure** Possible detectable change in age/size/sex structure but minimal impact on population dynamics.	**4. Age/size/sex structure** Impact on population dynamics at maximum sustainable level, long-term	**4. Age/size/sex structure** Long-term recruitment dynamics adversely affected. Time to recover to original structure up to 5	**4. Age/size/sex structure** Long-term recruitment dynamics adversely affected. Time to recover to original structure up to	**4. Age/size/sex structure** Long-term recruitment dynamics adversely affected. Time to recover to original structure > 100

Sub-component	Score/level 1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
	variability for this population.		recruitment dynamics not adversely affected.	generations free from impact.	10 generations free from impact.	generations free from impact.
Reproductive capacity	**5. Reproductive capacity** No detectable change in reproductive capacity. Unlikely to be detectable against background variability for this population.	**5. Reproductive capacity** Possible detectable change in reproductive capacity but minimal impact on population dynamics.	**5. Reproductive capacity** Impact on population dynamics at maximum sustainable level, long-term recruitment dynamics not adversely affected.	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to recovery up to 5 generations free from impact.	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to recovery up to 10 generations free from impact.	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to recovery > 100 generations free from impact.
Behaviour/movement	**6. Behaviour/ movement** No detectable change in behaviour/ movement. Unlikely to be detectable against background variability for this population. Time taken to recover to pre-disturbed state on the scale of hours.	**6. Behaviour/ movement** Possible detectable change in behaviour/ movement but minimal impact on population dynamics. Time to return to original behaviour/ movement on the scale of days to weeks.	**6. Behaviour/ movement** Detectable change in behaviour/ movement with the potential for some impact on population dynamics. Time to return to original behaviour/ movement on the scale of weeks to months.	**6. Behaviour/ movement** Change in behaviour/ movement with impacts on population dynamics. Time to return to original behaviour/ movement on the scale of months to years.	**6. Behaviour/ movement** Change in behaviour/ movement with impacts on population dynamics. Time to return to original behaviour/ movement on the scale of years to decades.	**6. Behaviour/ movement** Change to behaviour/ movement. Population does not return to original behaviour/ movement.

Table AC.2. Bycatch species. Description of consequences for each component and each sub-component. Use table as a guide for scoring the level of consequence for bycatch/byproduct species (Modified from Fletcher et al. 2002).

Sub-component	Score/level 1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Population size	**1. Population size** Insignificant change to population size/growth rate (r). Unlikely to be detectable against background variability for this population.	**1. Population size** Possible detectable change in size/growth rate (r) but minimal impact on population size and none on dynamics.	**1. Population size** No information is available on the relative area or susceptibility to capture/ impact or on the vulnerability of life history traits of this type of species Susceptibility to capture is suspected to be less than 50% and species do not have vulnerable life history traits. For species with vulnerable life history traits to stay in this category susceptibility to capture must be less than 25%.	**1. Population size** Relative state of capture/susceptibility suspected/known to be greater than 50% and species should be examined explicitly.	**1. Population size** Likely to cause local extinctions if continued in longer term	**1. Population size** Local extinctions are imminent/immediate
Geographic range	**2. Geographic range** No detectable change in geographic range. Unlikely to be detectable against background variability for this population.	**2. Geographic range** Possible detectable change in geographic range but minimal impact on population range and none on dynamics, change in geographic range up to 5 % of original.	**2. Geographic range** Change in geographic range up to 10 % of original.	**2. Geographic range** Change in geographic range up to 25 % of original.	**2. Geographic range** Change in geographic range up to 50 % of original.	**2. Geographic range** Change in geographic range > 50 % of original.
Genetic structure	**3. Genetic structure** No detectable change in genetic structure. Unlikely to be detectable against background variability for this population.	**3. Genetic structure** Possible detectable change in genetic structure. Any change in frequency of genotypes, effective population size or number of spawning units up to 5%.	**3. Genetic structure** Detectable change in genetic structure. Change in frequency of genotypes, effective population size or number of spawning units up to 10%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 25%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 50%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units > 50%.
Age/size/sex structure	**4. Age/size/sex structure** No detectable change in age/size/sex structure.	**4. Age/size/sex structure** Possible detectable change in age/size/sex structure	**4. Age/size/sex structure** Detectable change in age/size/sex structure.	**4. Age/size/sex structure** Long-term recruitment dynamics adversely	**4. Age/size/sex structure** Long-term recruitment dynamics adversely	**4. Age/size/sex structure** Long-term recruitment dynamics adversely

Sub-component	Score/level 1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
	Unlikely to be detectable against background variability for this population.	but minimal impact on population dynamics.	Impact on population dynamics at maximum sustainable level, long-term recruitment dynamics not adversely damaged.	affected. Time to recover to original structure up to 5 generations free from impact.	affected. Time to recover to original structure up to 10 generations free from impact.	affected. Time to recover to original structure > 100 generations free from impact.
Reproductive capacity	**5. Reproductive capacity** No detectable change in reproductive capacity. Unlikely to be detectable against background variability for this population.	**5. Reproductive capacity** Possible detectable change in reproductive capacity but minimal impact on population dynamics.	**5. Reproductive capacity** Detectable change in reproductive capacity, impact on population dynamics at maximum sustainable level, long-term recruitment dynamics not adversely damaged.	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to recovery up to 5 generations free from impact.	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to recovery up to 10 generations free from impact.	**5. Reproductive capacity** Change in reproductive capacity adversely affecting long-term recruitment dynamics. Time to recovery > 100 generations free from impact.
Behaviour/movement	**6. Behaviour/ movement** No detectable change in behaviour/ movement. Unlikely to be detectable against background variability for this population. Time taken to recover to pre-disturbed state on the scale of hours.	**6. Behaviour/ movement** Possible detectable change in behaviour/ movement but minimal impact on population dynamics. Time to return to original behaviour/ movement on the scale of days to weeks.	**6. Behaviour/ movement** Detectable change in behaviour/ movement with the potential for some impact on population dynamics. Time to return to original behaviour/ movement on the scale of weeks to months.	**6. Behaviour/ movement** Change in behaviour/ movement with impacts on population dynamics. Time to return to original behaviour/ movement on the scale of months to years	**6. Behaviour/ movement** Change in behaviour/ movement with impacts on population dynamics. Time to return to original behaviour/ movement on the scale of years to decades.	**6. Behaviour/ movement** Change to behaviour/ movement. Population does not return to original behaviour/ movement.

Table AC.3. Protected species. Description of consequences for each component and each sub-component. Use table as a guide for scoring the level of consequence for protected species (Modified from Fletcher et al. 2002).

Sub-component	Score/level 1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Population size	**1. Population size** Almost none are killed.	**1. Population size** Insignificant change to population size/growth rate (r). Unlikely to be detectable against background variability for this population.	**1. Population size**. State of reduction on the rate of increase are at the maximum acceptable level. Possible detectable change in size/ growth rate (r) but minimal impact on population size and none on dynamics of protected species.	**1. Population size** Affecting recruitment state of stocks or their capacity to increase.	**1. Population size** Local extinctions are imminent/immediate	**1. Population size** Global extinctions are imminent/immediate
Geographic range	**2. Geographic range** No interactions leading to impact on geographic range.	**2. Geographic range** No detectable change in geographic range. Unlikely to be detectable against background variability for this population.	**2. Geographic range** Possible detectable change in geographic range but minimal impact on population range and none on dynamics. Change in geographic range up to 5 % of original.	**2. Geographic range** Change in geographic range up to 10% of original.	**2. Geographic range** Change in geographic range up to 25% of original.	**2. Geographic range** Change in geographic range up to 25% of original.
Genetic structure	**3. Genetic structure** No interactions leading to impact on genetic structure.	**3. Genetic structure** No detectable change in genetic structure. Unlikely to be detectable against background variability for this population.	**3. Genetic structure** Possible detectable change in genetic structure but minimal impact at population level. Any change in frequency of genotypes, effective population size or number of spawning units up to 5%.	**3. Genetic structure** Moderate change in genetic structure. Change in frequency of genotypes, effective population size or number of spawning units up to 10%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 25%.	**3. Genetic structure** Change in frequency of genotypes, effective population size or number of spawning units up to 25%.
Age/size/sex structure	**4. Age/size/sex structure** No interactions leading to change in age/size/sex structure.	**4. Age/size/sex structure** No detectable change in age/size/sex structure. Unlikely to be detectable against background variability for this population.	**4. Age/size/sex structure** Possible detectable change in age/size/sex structure but minimal impact on population dynamics.	**4. Age/size/sex structure** Detectable change in age/size/sex structure. Impact on population dynamics at maximum sustainable level, long-term	**4. Age/size/sex structure** Severe change in age/size/sex structure. Impact adversely affecting population dynamics. Time to recover to original structure up to 5	**4. Age/size/sex structure** Impact adversely affecting population dynamics. Time to recover to original structure > 10 generations free from impact

Sub-component	Score/level 1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
				recruitment dynamics not adversely damaged.	generations free from impact	
Reproductive capacity	**5. Reproductive capacity** No interactions resulting in change to reproductive capacity.	**5. Reproductive capacity** No detectable change in reproductive capacity. Unlikely to be detectable against background variability for this population.	**5. Reproductive capacity** Possible detectable change in reproductive capacity but minimal impact on population dynamics.	**5. Reproductive capacity** Detectable change in reproductive capacity, impact on population dynamics at maximum sustainable level, long-term recruitment dynamics not adversely damaged.	**5. Reproductive capacity** Change in reproductive capacity, impact adversely affecting recruitment dynamics. Time to recover to original structure up to 5 generations free from impact	**5. Reproductive capacity** Change in reproductive capacity, impact adversely affecting recruitment dynamics. Time to recover to original structure > 10 generations free from impact
Behaviour/movement	**6. Behaviour/ movement** No interactions resulting in change to behaviour/ movement.	**6. Behaviour/ movement** No detectable change in behaviour/ movement. Time to return to original behaviour/ movement on the scale of hours.	**6. Behaviour/ movement** Possible detectable change in behaviour/ movement but minimal impact on population dynamics. Time to return to original behaviour/ movement on the scale of days to weeks	**6. Behaviour/ movement** Detectable change in behaviour/ movement with the potential for some impact on population dynamics. Time to return to original behaviour/ movement on the scale of weeks to months	**6. Behaviour/ movement** Change in behaviour/ movement, impact adversely affecting population dynamics. Time to return to original behaviour/ movement on the scale of months to years.	**6. Behaviour/ movement** Change in behaviour/ movement. Impact adversely affecting population dynamics. Time to return to original behaviour/ movement on the scale of years to decades.
Interaction with fishery	**7. Interactions with fishery** No interactions with fishery.	**7. Interactions with fishery** Few interactions and involving up to 5% of population.	**7. Interactions with fishery** Moderate level of interactions with fishery involving up to10 % of population.	**7. Interactions with fishery** Major interactions with fishery, interactions and involving up to 25% of population.	**7. Interactions with fishery** Frequent interactions involving ~ 50% of population.	**7. Interactions with fishery** Frequent interactions involving the entire known population negatively affecting the viability of the population.

Table AC.4. Habitats. Description of consequences for each component and each sub-component. Use table as a guide for scoring the level of consequence for habitats. Note that for sub-components Habitat types and Habitat structure and function, time to recover from impact scales differ from substrate, water and air. Rationale: structural elements operate on greater timeframes to return to pre-disturbance states (Modified from Fletcher et al. 2002).

Sub-component	Score/level 1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Substrate quality	**1. Substrate quality** Reduction in the productivity (similar to the intrinsic rate of increase for species) on the substrate from the activity is unlikely to be detectable. Time taken to recover to pre-disturbed state on the scale of hours.	**1. Substrate quality** Detectable impact on substrate quality. At small spatial scale time taken to recover to pre-disturbed state on the scale of days to weeks, at larger spatial scales recovery time of hours to days.	**1. Substrate quality** More widespread effects on the dynamics of substrate quality but the state are still considered acceptable given the percent area affected, the types of impact occurring and the recovery capacity of the substrate. For impacts on non-fragile substrates this may be for up to 50% of habitat affected, but for more fragile habitats, e.g. reef substrate, to stay in this category the % area affected needs to be smaller up to 25%.	**1. Substrate quality** The level of reduction of internal dynamics of habitats may be larger than is sensible to ensure that the habitat will not be able to recover adequately, or it will cause strong downstream effects from loss of function. Time to recover from local impact on the scale of months to years, at larger spatial scales recovery time of weeks to months.	**1. Substrate quality** Severe impact on substrate quality with 50 - 90% of the habitat affected or removed by the activity which may seriously endanger its long-term survival and result in changes to ecosystem function. Recovery period measured in years to decades.	**1. Substrate quality** The dynamics of the entire habitat is in danger of being changed in a major way, or > 90% of habitat destroyed.
Water quality	**2. Water quality** No direct impact on water quality. Impact unlikely to be detectable. Time taken to recover to pre-disturbed state on the scale of hours.	**2. Water quality** Detectable impact on water quality. Time to recover from local impact on the scale of days to weeks, at larger spatial scales recovery time of hours to days.	**2. Water quality** Moderate impact on water quality. Time to recover from local impact on the scale of weeks to months, at larger spatial scales recovery time of days to weeks.	**2. Water quality** Time to recover from local impact on the scale of months to years, at larger spatial scales recovery time of weeks to months.	**2. Water quality** Impact on water quality with 50 - 90% of the habitat affected or removed by the activity which may seriously endanger its long-term survival and result in changes to ecosystem function. Recovery period measured in years to decades.	**2. Water quality** The dynamics of the entire habitat is in danger of being changed in a major way, or > 90% of habitat destroyed.
Air quality	**3. Air quality** No direct impact on air quality. Impact unlikely to be detectable. Time taken	**3. Air quality** Detectable impact on air quality. Time to recover from local impact on the	**3. Air quality** Detectable impact on air quality. Time to recover from local impact on the	**3. Air quality** Time to recover from local impact on the scale of months to years, at larger	**3. Air quality** Impact on air quality with 50 - 90% of the habitat affected or removed by the	**3. Air quality** The dynamics of the entire habitat is in danger of being changed in a major

Sub-component	Score/level 1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
	to recover to pre-disturbed state on the scale of hours.	scale of days to weeks, at larger spatial scales recovery time of hours to days.	scale of weeks to months, at larger spatial scales recovery time of days to weeks.	spatial scales recovery time of weeks to months.	activity .which may seriously endanger its long-term survival and result in changes to ecosystem function. Recovery period measured in years to decades.	way, or > 90% of habitat destroyed.
Habitat types	**4. Habitat types** No direct impact on habitat types. Impact unlikely to be detectable. Time taken to recover to pre-disturbed state on the scale of hours to days.	**4. Habitat types** Detectable impact on distribution of habitat types. Time to recover from local impact on the scale of days to weeks, at larger spatial scales recovery time of days to months.	**4. Habitat types** Impact reduces distribution of habitat types. Time to recover from local impact on the scale of weeks to months, at larger spatial scales recovery time of months to < one year.	**4. Habitat types** The reduction of habitat type areal extent may threaten ability to recover adequately, or cause strong downstream effects in habitat distribution and extent. Time to recover from impact on the scale of > one year to < decadal timeframes.	**4. Habitat types** Impact on relative abundance of habitat types resulting in severe changes to ecosystem function. Recovery period likely to be > decadal	**4. Habitat types** The dynamics of the entire habitat is in danger of being changed in a catastrophic way. The distribution of habitat types has been shifted away from original spatial pattern. If reversible, will require a long-term recovery period, on the scale of decades to centuries.
Habitat structure and function	**5. Habitat structure and function** No detectable change to the internal dynamics of habitat or populations of species making up the habitat. Time taken to recover to pre-disturbed state on the scale of hours to days.	**5. Habitat structure and function** Detectable impact on habitat structure and function. Time to recover from impact on the scale of days to months, regardless of spatial scale	**5. Habitat structure and function** Impact reduces habitat structure and function. For impacts on non-fragile habitat structure this may be for up to 50% of habitat affected, but for more fragile habitats, to stay in this category the % area affected needs to be smaller up to 20%. Time to recover from local impact on the scale of months to < one year, at larger spatial scales recovery time of months to < one year.	**5. Habitat structure and function** The level of reduction of internal dynamics of habitat may threaten ability to recover adequately, or it will cause strong downstream effects from loss of function. For impacts on non-fragile habitats this may be for up to 50% of habitat affected, but for more fragile habitats, to stay in this category the % area affected up to 25%. Time to recover from impact on the scale of > one year to < decadal timeframes.	**5. Habitat structure and function** Impact on habitat function resulting from severe changes to internal dynamics of habitats. Time to recover from impact likely to be > decadal.	**5. Habitat structure and function** The dynamics of the entire habitat is in danger of being changed in a catastrophic way which may not be reversible. Habitat losses occur. Some elements may remain but will require a long-term recovery period, on the scale of decades to centuries.

Table AC.5. Communities. Description of consequences for each component and each sub-component. Use table as a guide for scoring the level of consequence for communities (Modified from Fletcher et al. 2002).

Sub-component	Score/level 1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
Species composition	1. Species composition Interactions may be occurring which affect the internal dynamics of communities leading to change in species composition not detectable against natural variation.	1. Species composition Impacted species do not play a keystone role – only minor changes in relative abundance of other constituents. Changes of species composition up to 5%.	1. Species composition Detectable changes to the community species composition without a major change in function (no loss of function). Changes to species composition up to 10%.	1. Species composition Major changes to the community species composition (~25%) (involving keystone species) with major change in function. Ecosystem function altered measurably and some function or components are locally missing/declining/increasing outside of historical range and/or allowed/facilitated new species to appear. Recovery period measured in years.	1. Species composition Change to ecosystem structure and function. Ecosystem dynamics currently shifting as different species appear in fishery. Recovery period measured in years to decades.	1. Species composition Total collapse of ecosystem processes. Long-term recovery period required, on the scale of decades to centuries
Functional group composition	2. Functional group composition Interactions which affect the internal dynamics of communities leading to change in functional group composition not detectable against natural variation.	2. Functional group composition Minor changes in relative abundance of community constituents up to 5%.	2. Functional group composition Changes in relative abundance of community constituents, up to 10% chance of flipping to an alternate state/ trophic cascade.	2. Functional group composition Ecosystem function altered measurably and some functional groups are locally missing/declining/increasing outside of historical range and/or allowed/facilitated new species to appear. Recovery period measured in months to years.	2. Functional group composition Ecosystem dynamics currently shifting, some functional groups are missing and new species/groups are now appearing in the fishery. Recovery period measured in years to decades.	2. Functional group composition Ecosystem function catastrophically altered with total collapse of ecosystem processes. Recovery period measured in decades to centuries.
Distribution of the community	3. Distribution of the community Interactions which affect the distribution of communities unlikely to be	3. Distribution of the community Possible detectable change in geographic range of communities but minimal impact on community dynamics change in	3. Distribution of the community Detectable change in geographic range of communities with some impact on community dynamics Change in	3. Distribution of the community Geographic range of communities, ecosystem function altered measurably and some functional groups are locally	3. Distribution of the community Change in geographic range of communities, ecosystem function altered and some functional groups are currently	3. Distribution of the community Change in geographic range of communities, ecosystem function collapsed. Change in geographic range for >90%

Sub-component	Score/level 1 Negligible	2 Minor	3 Moderate	4 Major	5 Severe	6 Intolerable
	detectable against natural variation.	geographic range up to 5 % of original.	geographic range up to 10 % of original.	missing/declining/increasing outside of historical range. Change in geographic range for up to 25 % of the species. Recovery period measured in months to years.	missing and new groups are present. Change in geographic range for up to 50 % of species including keystone species. Recovery period measured in years to decades.	of species including keystone species. Recovery period measured in decades to centuries.
Trophic/size structure	4. Trophic/size structure Interactions which affect the internal dynamics unlikely to be detectable against natural variation.	4. Trophic/size structure Change in mean trophic level, biomass/ number in each size class up to 5%.	4. Trophic/size structure Changes in mean trophic level, biomass/ number in each size class up to 10%.	4. Trophic/size structure Changes in mean trophic level. Ecosystem function altered measurably and some function or components are locally missing/declining/increasing outside of historical range and/or allowed/facilitated new species to appear. Recovery period measured in years to decades.	4. Trophic/size structure Changes in mean trophic level. Ecosystem function severely altered and some function or components are missing and new groups present. Recovery period measured in years to decades.	4. Trophic/size structure Ecosystem function catastrophically altered as a result of changes in mean trophic level, total collapse of ecosystem processes. Recovery period measured in decades to centuries.
Bio-geochemical cycles	5. Bio- and geochemical cycles Interactions which affect bio- & geochemical cycling unlikely to be detectable against natural variation.	5. Bio- and geochemical cycles Only minor changes in relative abundance of other constituents leading to minimal changes to bio- & geochemical cycling up to 5%.	5. Bio- and geochemical cycles Changes in relative abundance of other constituents leading to minimal changes to bio- & geochemical cycling, up to 10%.	5. Bio- and geochemical cycles Changes in relative abundance of constituents leading to major changes to bio- & geochemical cycling, up to 25%.	5. Bio- and geochemical cycles Changes in relative abundance of constituents leading to Severe changes to bio- & geochemical cycling. Recovery period measured in years to decades.	5. Bio- and geochemical cycles Ecosystem function catastrophically altered as a result of community changes affecting bio- and geo- chemical cycles, total collapse of ecosystem processes. Recovery period measured in decades to centuries.

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