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Ecological Risk Assessment for the Effects of Fishing

Report for the Southern and Eastern Scalefish and Shark Fishery (Commonwealth Trawl Sector): Otter trawl sub-fishery 2012-2016

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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

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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 Southern and Eastern Scalefish and Shark (SESSF) Commonwealth Trawl Sector (CTS) otter trawl sub-fishery was undertaken using the ERAEF method version 9.2, with some additional modifications developed with AFMA (Australian Fisheries Management Authority 2017). This revised ERAEF provides a hierarchical framework for a comprehensive assessment of the ecological risks arising from fishing, with impacts assessed against five new ecological components –key commercial and secondary commercial species; byproduct and bycatch species; protected species; habitats; and (ecological) communities.

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 (PSA – Productivity Susceptibility Analysis); 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 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 2012-2016 assessment of the Southern and Eastern Scalefish and Shark (SESSF) Commonwealth Trawl Sector (CTS) otter trawl sub-fishery includes the following:

- Scoping
- Level 1 results for all components
- Level 2 PSA and bSAFE results
- Residual risk analysis for high-risk PSA and extreme/high risk bSAFE species

Fishery Description

Gear:	Otter trawl
Area:	Commonwealth Trawl Sector: Southern and Eastern Scalefish and Shark Fishery
Depth range:	40 - 1300 m
Fleet size:	33 to 40 vessels
Effort:	67192-54463 hours trawled
Landings:	6393-7728 t
Discard rate:	Species specific
Key commercial species (ERA classification):	10 primary: blue grenadier, pink ling, orange roughy, mirror dory, tiger flathead, jackass morwong, silver warehou, Gould's squid, ocean jacket, southern frostfish 9 secondary: royal red prawn, redfish, king dory, reef ocean perch, red gurnard, latchet, eastern school whiting, silver trevally, gemfish
Management:	Input controls: limited entry gear restrictions, spatial closures. Output controls: ITQ for 35 species/stocks and TACs, trigger, trip and catch limits
Observer program:	AFMA Observer Program. Average coverage rate ~2% over 2012-2016. Note: Electronic monitoring required on gillnet and demersal longline only.

Ecological Units Assessed

Table ES1.1. Ecological units assessed in 2018 (data to 2016) and 2006.

ECOLOGICAL COMPONENT	UNITS ASSESSED IN 2018	UNITS ASSESSED IN 2006
Key/secondary commercial species	10 (C1), 9 (C2)	28
Byproduct and bycatch species	119 (BP), 283 (BC)	271
Protected species	103	201
Habitats	25* (20 demersal, 5 pelagic)	158
Communities	33 (28 demersal, 5 pelagic)	33

*habitats were assessed using a different unit of analysis structure

A total of 524 species across the three ecological components were assessed in this ERAEF compared to 500 species in 2006 (Table ES1.3). The difference in the number of protected species between assessments is mainly due to the inclusion of species that interacted in this sub-fishery (apart from any expansion of species groups identified from AFMA logbook, Observer data).

Level 1 Results and Summary

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

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

- Fishing (direct and indirect impacts on all five ecological components)
- Fishing (indirect impacts on key/secondary, on habitats and communities)
- Fishing through physical disturbance (impact on habitats)

Only habitats were rated at severe risk (score 5) from direct and indirect impacts from primary fishing operations and physical disturbance. Significant external hazards included other fisheries in the region, which presented a major risk (risk score 4) to all components.

As a result of direct capture by fishing, the most vulnerable commercial species was Gould's squid, a key commercial species with no reliable stock assessment either within this fishery or its dedicated fishery, the Southern Squid Jig.

The most vulnerable bycatch/byproduct species was Endeavour dogfish by direct capture. This species was EPBC listed as conservation dependent in 2013. It has low fecundity and populations will take a long time to recover (estimated mean generation time of 28.5 years). It is now partially protected by a variety of closures in Upper Slope Dogfish Management Strategy implemented in 2012 (Australian Fisheries Management Authority 2012).

Also of possible concern is the bycatch of species under quota in other overlapping fisheries such as jack mackerel and redbait in the SPF, and of other conservation-dependent species such as southern bluefin tuna. The catches of these species should be considered in assessments to account for cumulative fishing pressure but might not always be included in the assessment. Most, if not all, are considered in the overall management by subtracting incidental catches from other fisheries from the TAC of the "assessing" fishery. External impacts from other fisheries were identified as risks in this assessment.

Of the protected species, the Australian furseal was considered at most risk from capture. This species had the greatest mortality as a result of capture although about 20% were released or escaped. The population was last estimated at about 110,000 individuals in 2007-8 —similar to that of 2002 estimates— (Kirkwood et al. 2010) but the latest estimate of pup production in 2013-14 was slightly lower than previous estimates (McIntosh et al. 2014). This may indicate a plateau of population growth but wider colonisation (Kirkwood et al. 2010). They are all considered to be the same population (Lancaster et al. 2010). There is little new information on current population trends overall or within colonies which is variable. Albatrosses were also at risk however new mandatory mitigation measures such as bird bafflers introduced post-assessment have already seen a decline in interaction.

Information on the actual damage that vulnerable habitat types are incurring within the assemblages is unknown and therefore remain at high risk.

A previous Level 2 analysis of communities showed that the highly trawled communities were at greatest risk (Hobday et al. 2011a) and probably continues to be the case. While effort has

declined across the fishery in general, indications of declining fish length in species indicates that a size structural change has occurred but the effect on the community size structure overall is unknown.

An obvious and significant difference between the assessments of 2006 and 2018 is the greater application of management strategies with a clear direction to sustainably manage resources both for commercial species and for the preservation of threatened species, habitats and communities. A variety of spatial closures and fishery closures now protect many of these components. There has been a significant decline in effort (average annual ~ 100, 000 *cf* ~ 60,000 hours) and a similar decline in catches although this is harder to compare directly due to changing targets and management practices.

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

- Key/secondary commercial
- Byproduct/bycatch
- Protected species
- Habitats
- Communities

Level 2 analysis for habitats and communities was not possible at this time (Table ES1.2).

Table ES1.2 Outcomes of assessments for ecological components conducted in 2018 and 2006.

ECOLOGICAL COMPONENT	2006 (PREVIOUS)	2018 (CURRENT)
Key/secondary commercial species	Level 2^	Level 2
Byproduct and bycatch	Level 2^	Level 2
Protected species	Level 2^	Level 2
Habitats	Level 2#	Level 2#
Communities	Level 2*	Level 2#

* conducted in Hobday et al 2011a. # not assessed at L2 in this assessment.
^SAFE analysis was also performed on species (Zhou et al. 2012). Risk category are not directly comparable with this assessment.

Level 2 Results and Summary

Under the revised ERAEF (AFMA 2017), key commercial species that undergo tiered assessments are not assessed at Level 2, however Tier 4 or 5 species should be assessed in this ERA as Tier 4/5 assessments are considered to be data poor (i.e. rely on catch/effort or catch data only) and the validity of assumptions have broken down for some species.

PSA

Key/secondary commercial species

The only key commercial species assessed as high risk was a non-tiered invertebrate, Gould's squid *Nototodarus gouldi* which remained high risk following a residual risk analysis.

Byproduct species

A total of 16 byproduct species were assessed by this method including six teleost species that were unassessable in bSAFE. Overall, eight species were assessed as high risk. Two chondrichthyans: sandy skate *Pavoraja arenaria* and Ogilby's ghostshark *Chimaera ogilbyi* and three invertebrates: cuttlefish *Sepia braggi*, southern bailer shell *Melo miltoni* and Maori octopus *Pinnoctopus cordiformis* all remained high risk following a residual risk analysis due to high number of missing attributes and in the case of Maori octopus potentially higher than reported catch.

Bycatch species

A total of 55 bycatch species were assessed in this PSA, including 36 fish species that were unassessable in bSAFE. Nineteen species were assessed as high risk (14 teleosts and five invertebrates) due to a combination of missing attributes and high susceptibility for the teleosts and a very high number of missing attributes for invertebrates. No species remained at high risk following a residual risk analysis.

Protected species

Of the 55 protected species assessed in this PSA, one species a marine bird Salvin's prion *Pachyptila salvini* was assessed as high risk due to a very high number of missing attributes (nine out of 10) and the Indian bottlenose dolphin *Tursiops aduncus* was also high risk. Also, 21 species were medium risk (10 marine birds and 11 marine mammals) and 32 species were low risk, the latter consisting of one marine mammal species the common dolphin *Delphinus delphis* and 31 marine birds. Following a residual risk analysis, the high-risk scores for the Salvin's prion was reduced to low due to its large population size (>12 million birds), while the Indian bottlenose dolphin *Tursiops aduncus* was reduced to medium risk given it was expanded from Delphinidae, is mostly found in shallow waters along the coast and unlikely to occur in the area of fishery operations.

bSAFE

Key/secondary commercial species:

All five bSAFE species assessed at low risk.

Byproduct species

A total of 109 byproduct species were assessed of which six were unassessable and therefore assessed in a PSA (see above). Of the remaining 103 species, none were extreme risk, two remained at high risk following a residual risk analysis which included the Tier 4 longsnout dogfish *Deania quadrispinosa*, five were medium risk and 96 species were low risk. Of the 16 Tier 4 species, one was high risk, one was medium risk (Black shark *Dalatias licha*) and the remaining 14 were low risk.

Bycatch species

A total of 264 bycatch species were assessed of which 36 were unassessable and therefore assessed in a PSA. Of the remaining 228 assessable species, three were extreme risk, none were high risk, five were medium risk and 220 were low risk.

All three extreme risk species were chondrichthyans: Leafscale gulper shark *Centrophorus squamosus*, Southern dogfish *Centrophorus zeehaani* and Endeavour dogfish *Centrophorus moluccensis*. These three extreme risk species remained at extreme risk following a residual risk analysis.

Of the five medium risk species four were chondrichthyans (Plunket's dogfish *Scymnodon plunketi* (Tier 4 deepwater shark species), Harrison's dogfish *Centrophorus harrissoni,* sandtiger shark *Odontaspis ferox,* sharpnose sevengill shark *Heptranchias perlo*) and one was a teleost (giant sawbelly *Hoplostethus gigas*).

The other Tier 4 species were all assessed at low risk: the *southern lanternshark Etmopterus baxteri,* blackbelly lanternshark *Etmopterus lucifer*, smooth lanternshark *Etmopterus bigelowi,* golden dogfish *Centroselachus crepidater,* warty oreodory *Allocyttus verrucosus*, black oreodory *Allocyttus niger*, rough oreodory *Neocyttus psilorhynchus* and southern sawshark *Pristiophorus nudipinnis*.

Protected species

A total of 48 protected species were assessed at low risk comprising six chondrichthyans and 42 teleosts (syngnathiformes).

Summary

Of the species assessed as potential high or extreme risk, 11 remained at extreme or high following a residual risk analysis (Table ES1.3). These were four invertebrates and seven chondrichthyans.

Gould's squid *Nototodarus gouldi* was assessed as high risk. It is managed by the Southern Squid Jig Fishery primarily but by effort controls within this fishery. Also, a combined trigger limit (2000 t) exists across both the SESSF-GABT and this sub-fishery. The potential risk to this species should be further assessed. Other high-risk molluscs such as the southern bailer shell *Melo miltonis* and Maori octopus *Pinnoctopus cordiformis* are currently not managed by quota. Uncertainty of identification of the cuttlefish species i.e. *Sepia* sp. hinders further discussion of *S. braggi* but 50 or 500 kg trip limits combining "shellfish" and "other molluscs" apply for State waters.

Of the seven chondrichthyan species at high or extreme risk following a residual risk analysis, nearly all risk scores were due to factors such as: low productivity, high overlap of occurrence with within fishery range, high encounterability by the trawl gear and high selectivity by the gear used. Various upper-slope dogfish closures were put in place throughout the SESSF to protect dogfish, specifically Harrison's and southern dogfish and some protection for other dogfish species including Endeavour dogfish *Centrophorus moluccensis* and greeneye spurdog *Squalus chloroculus*, in addition to a zero retention rule applying to these four species. However, lack of taxonomic resolution of catches is an issue. In the worst case, potentially high removals might be occurring if catches from group codes were attibuted to specific species, and so the risk scores were not reduced for these species. The Tier 4 high risk species Longsnout dogfish *Deania quadrispinosa* (part of a basket deepwater shark species) should be considered further with respect to sustainability, given the validity of assumption that CPUE indexes abundance in Tier 4 assessments is questionable. The remaining byproduct and bycatch chondrichthyan species not subject to quota or mitigation measures, should also be assessed further.

A lack of taxonomic resolution of catches for the two high risk skate species is also an issue, as potentially high removals might also be occurring if catches from group codes were attibuted to specific species.

Table ES1.3. Extreme or high-risk PSA or bSAFE species following a residual risk (RR) analysis in the SESSF CTS Otter trawl sub-fishery. x: risk score following RR analysis. #: unassessable in bSAFE. CH: chondrichthyan; TEL: teleost; INV: invertebrate; MM: marine mammal; MB: marine bird. No. Missing: Number of missing attributes in PSA analysis. Grey shading: expanded species from group code. ^: at risk from Zhou et al. (2012). BC: bycatch; BP: byproduct; PS: Protected. * Upper-slope dogfish closures exist. T4: Tier 4 species.

LEVEL 2 ANALYSIS	ERA CLASSIFICATION	TAXA	NO. MISSING	SCIENTIFIC NAME	COMMON NAME	EXTREME RISK	HIGH RISK
PSA	C1	INV	1	*Nototodarus gouldi*	Gould's squid		x
	BP#	CH	6	*Chimaera ogilbyi*	Ogilby's ghostshark^		x
		CH	6	*Pavoraja arenaria*	Sandy skate		x
	BP	INV	10	*Melo miltonis*	Southern bailer shell		x
		INV	10	*Sepia braggi*	Cuttlefish		x
		INV	5	*Pinnoctopus cordiformis*	Maori octopus		x
bSAFE	BP	CH	-	*Dipturus gudgeri*	Bight skate^		x
		CH[T4]	-	*Deania quadrispinosa*	Longsnout dogfish		x
	BC	CH	-	*Centrophorus squamosus*	Leafscale gulper shark^	x	
		CH*	-	*Centrophorus zeehaani*	Southern dogfish	x	
		CH*	-	*Centrophorus moluccensis*	Endeavour dogfish	x	

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.

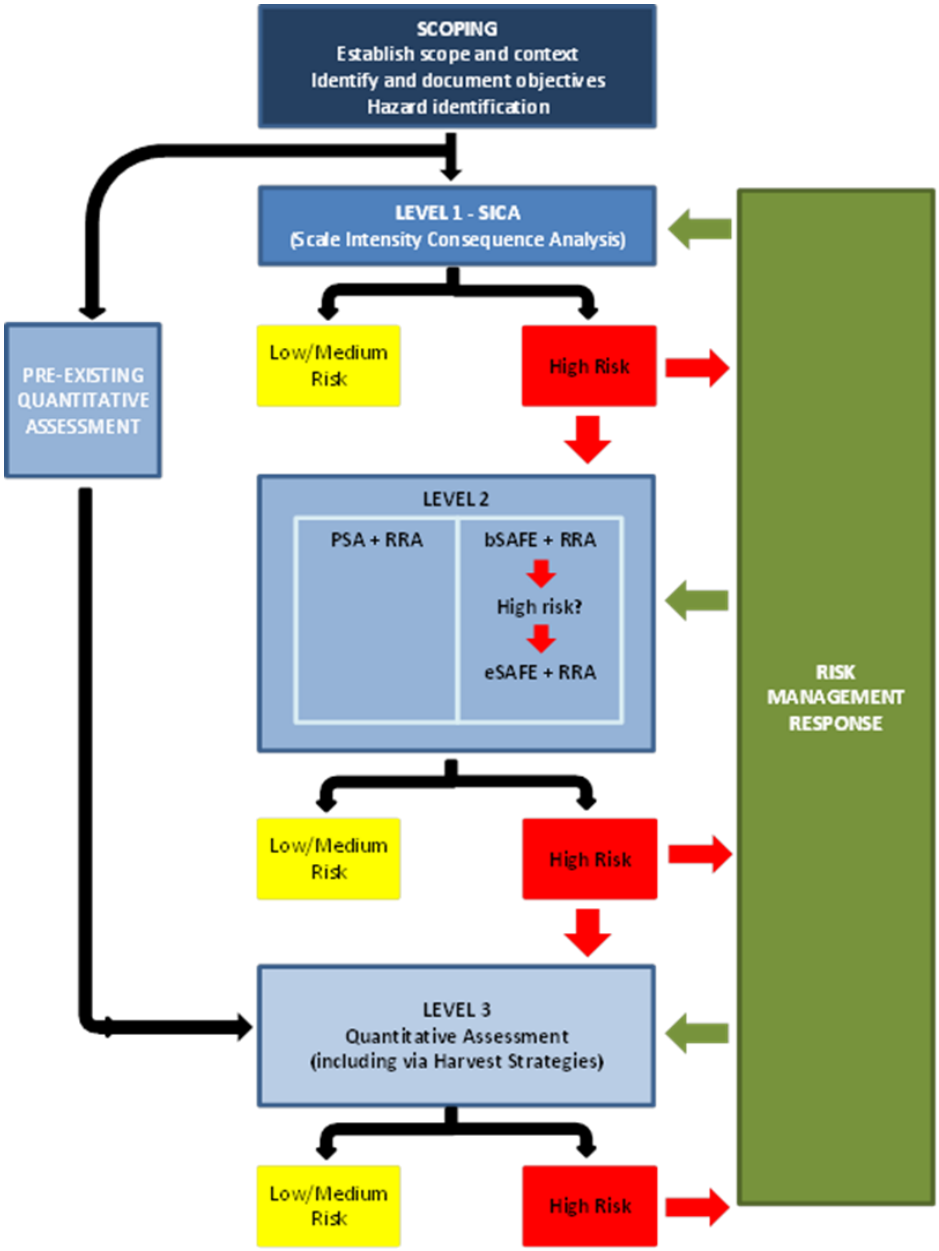


Figure 1.1. Structure of the 3 level hierarchical ERAEF methodology. SICA – Scale Intensity Consequence Analysis; PSA – Productivity Susceptibility Analysis; SAFE – Sustainability Assessment for Fishing Effects; RRA – Residual Risk Analysis. T1 – Tier 1. eSAFE may be used for species classified as high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

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 components 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.

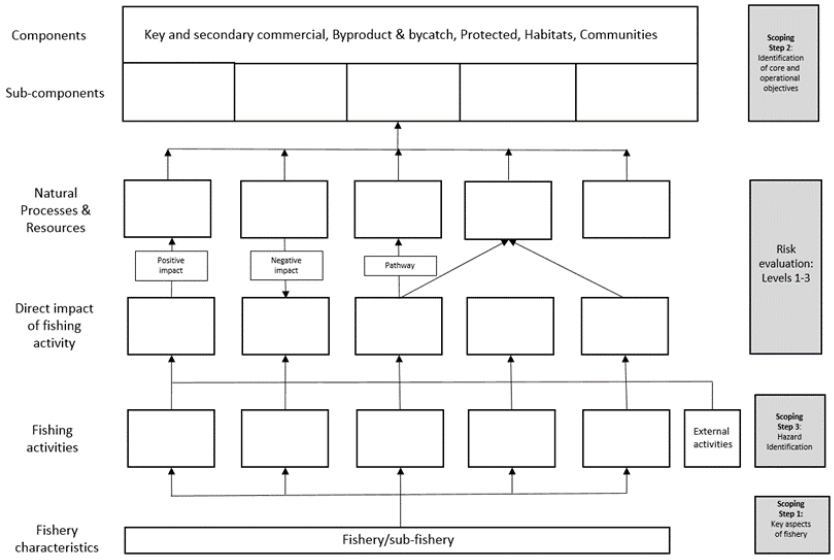


Figure 1.2. Generic conceptual model used in ERAEF.

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

[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).

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 considers 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).

1.1.2 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.

1.1.3 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 ERAEF is that of ensuring populations are maintained at biomass levels above which recruitment failure is likely, as stated in Chapter 2 (ERM Guide; AFMA 2017). 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 (e.g. 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.

1.1.4 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 ERAEF 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.

1.1.5 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

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

2.5 or 3 risk assessment methods, which comprise semi-quantitative or rapid simple 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 4.8.3 of AFMA ERM Guide, AFMA 2017), however a more quantitative method called the Sustainability Assessment for Fishing Effects (SAFE) (see Chapter 4.8.4 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 chondrichthyan 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 (i.e. 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 several 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 quantify uncertainty more precisely.

PSA (Productivity Susceptibility Analysis)

Details of the PSA method are described in the accompanying ERAEF Methods Document and 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.

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 (see below) 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 several 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 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.

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 outperforms 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 (e.g. 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:

- 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.

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 suggests 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 (i.e. populations rapidly mix between fished and unfished areas). The fishing mortality will likely be overestimated if this assumption is not satisfied (ERA TWG 2015)[4].
- 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

[4] ERA Technical Working Group, September 2015

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.

1.1.6 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.

1.1.7 Conclusion and final risk assessment report

The conclusion of the stakeholder consultation process has resulted 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 Energy.

1.1.8 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 re-evaluated, 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[5] or sooner if triggered by re-assessment triggers. The five-year timeframe is based on a number of factors including:

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

- 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 Fisheries Management Strategy (FMS).

For byproduct and bycatch species, in the periods between scheduled five-year ERA reviews[6], 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 (i.e. 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.
- 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.

[6] 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 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 (i.e. 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 Table 8 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)[7]. 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.

[7] ERA TWG recommendation, September 2015

2 Results

The focus of analysis is the fishery as identified by the responsible management authority. 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 based on 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 demersal otter trawl sub-fishery of the Southern and Eastern Scalefish and Shark Fishery (SESSF). 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: SESSF CTS otter trawl 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	Feb. 2018	Dan Corrie (AFMA), Giverny Rodgers (AFMA)	-
Level 1 (SICA)	Phone calls and emails	March 2018	Dan Corrie (AFMA), Giverny Rodgers (AFMA)	-
Draft report	Submitted to AFMA	March 2018	AFMA, SERAG members	-
Draft report	Presentation of ERA assessment results at SERAG meeting	Sep. 2018; Nov. 2018	Dan Corrie (AFMA), Giverny Rodgers (AFMA), SERAG members and invited participants	Level 1, Level 2 and residual risk categories presented
Draft final report	Submitted to AFMA	March 2019	AFMA, SERAG members	-
Updated methodology report	Submitted to AFMA; Presentation of updated methodology results	August 2019	AFMA, SESSFRAG members	Supplement on updated methodology presented
Updated methodology report	Presentation of results at SERAG meeting	October 2019	AFMA, SERAG members	Updated methodology accepted
Updated methodology report	-	February 2020	AFMA, SEMAC members	Additional consultation on report
Final report	Submitted to AFMA	April 2021	Dan Corrie (AFMA)	Final report submitted
Final report	Submitted to AFMA	June 2021	Dan Corrie (AFMA)	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 based on 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: Southern and Eastern Scalefish and Shark Fishery (Commonwealth Trawl Sector)-Otter Trawl

Assessment date: February 2018

Assessor: AFMA and authors of this report (CSIRO)

Table 2.2. General fishery characteristics.

GENERAL FISHERY CHARACTERISTICS	
Fishery Name	Southern and Eastern Scalefish and Shark Fishery
Sub-fisheries	In 2003 four Commonwealth fisheries in the southern region were amalgamated into the Southern and Eastern Scalefish and Shark Fishery (SESSF) under a common set of management objectives. The component sectors of the SESSF are: Commonwealth Trawl Sector (previously South East Trawl Fishery (SETF)) • Otter trawl • Danish seine Gillnet Hook and Trap Sector • Scalefish Hook – demersal longline • Scalefish Hook – auto-longline • Scalefish Hook – dropline

	• Scalefish trap • Shark gillnet • Shark Hook – demersal longline Great Australian Bight Trawl Sector East Coast Deepwater Trawl Sector
Sub-fisheries assessed	The sub-fishery being assessed is the otter board trawl method in the Commonwealth Trawl Sector (CTS) of the Southern and Eastern Scalefish and Shark Fishery (SESSF).
Start date/ history	The CTS, one of Australia's oldest commercial fisheries, began as a trawl fishery in 1915. Between 1915 and 1950, the fishery was dominated by steam trawlers operating on the continental shelf in waters off New South Wales, fishing mainly for flathead and then jackass morwong and redfish. The early 1950s saw the use of Danish seine vessels by many operators but, from about 1970 on, otter board trawlers became the main type of boat used, as the Fishery expanded southwards and outwards to waters deeper than 200 metres. From 1976 onwards gemfish was the species most landed by operators in the Eastern Sector. The late 1970s saw the Fishery expand further into what became known as the South West Sector, in the waters off western Victoria and around Tasmania. Until the discovery of orange roughy in the early 80s, however, most landings still came from the waters off NSW and in eastern Bass Strait (Smith and Wayte 2002, AFMA website). The fishery underwent a structural adjustment in 2007 where eight of the 18 concessions were removed from the fishery. Catches in the CTS went from between 20,000-30,000 t annually, to between 10,000-15,000 t annually since the adjustment. More recently, the fishery consists of an otter board trawl fleet extending south from Sydney, NSW, along the southeast Australian coast, including Tasmania, to Portland in western Victoria, as well as a Danish seine fleet based predominantly out of Lakes Entrance in eastern Victoria. Main target species are tiger flathead, school whiting, blue grenadier, pink ling, and silver warehou. Orange roughy has recently become a targeted species again after reopening the eastern spawning grounds and the Pedra Branca Hill off the southern coast of Tasmania.
Geographic extent of fishery	The Commonwealth Trawl Sector extends south from Barrenjoey Point, NSW, along the southeastern Australian coast, including Tasmania, and west to Cape Jervis in South Australia.  Source: AFMA
Regions or Zones within the fishery	There are distinct management zones for orange roughy, as there are considered to be separate populations in certain zones. A number of quota species are managed as eastern and western stocks: gemfish and deepwater sharks caught in the western zone (generally west of longitude 147°) are managed separately from those caught in the east. Pink ling are assessed as eastern and western stocks; however the TAC applies across both stocks.
Fishing season	The fishing season for all sectors of the Southern and Eastern Scalefish and Shark Fishery runs from 1 May to 30 April each year.
Key/second-ary commercial	The SESSF is a multi-species fishery that catches over 100 species of commercial value. For the purposes of this analysis the key (C1) and secondary commercial species (C2) for the otter trawl

species and stock status

sector have been defined as the species (or species groups) which contribute a significant proportion of the total landed catch.

For the otter trawl sector of the SESSF these are:

Blue grenadier (C1), tiger flathead (C1), flatheads (C1), pink ling (C1), silver warehou (C1), Gould's squid (C1), orange roughy (east; C1), mirror dory (C1), frostfish (C1), jackass morwong (C1), royal red prawn (C2), ocean jacket (C1), reef ocean perch (C2), latchet (C2), king dory (C2), silver trevally (C2), gemfish (west; C2), red gurnard (C2), eastern school whiting (C2) and redfish (C2).

A list of key and secondary commercial species and their stock status is included in **Appendix A**.

Bait collection and usage

Not applicable.

Current entitlements

QUOTA YEAR	NO. OF VCW^ CONCESSION HOLDERS*	NO. OF SFR^^ CONCESSION HOLDERS*	NO. OF VCW PERMITS	NO. OF TRAWL BOAT SFRS	NO. OF ACTIVE OTTER TRAWL VESSELS**	NO. OF INACTIVE VESSELS/ CONCESSIONS***
2008/09	20	53	23	59	39	21
2009/10	21	53	23	59	36	21
2010/11	22	53	23	59	35	21
2011/12	21	53	23	59	40	21
2012/13	20	52	22	57	33	18
2013/14	24	51	22	57	37	18
2014/15	19	52	21	57	35	17
2015/16	18	52	21	57	38	17

^ VCW: Victorian Coastal Waters; ^^ SFR: Statutory Fishing Rights
*All permits and SFRs can be used for either otter board or Danish seine methods. VCW permits are more often used for Danish seine. Includes permits that were not nominated to a vessel.

** VCW and CTS SFR boats. Otter trawl operators only. VCW boats were only active in otter board trawling in 2011/12 (2 boats) and 2012/13 (1 boat).

*** Number of trawl boat concessions (VCW and SFRs) minus active trawl and Danish seine operators. Inactive SFRs have the potential to be used for otter trawl or Danish seine methods.

Source: AFMA

Current and recent TACs, quota trends by method

Agreed Total Allowable Catch (TAC (t)) for quota species in the SESSF. TACs apply to all fishing methods in the SESSF. Research quota included in these TACs.

	FISHING SEASON						
SPECIES	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**
Alfonsino	750	750	1125	1017	1016	1017	1017
Bight Redfish	1556	2334	2358	2358	2358	800	800
Blue Eye Trevalla	326	387	388	335	335	410	458
Blue Grenadier	4700	4998	5208	6800	8796	8810	8765
Blue Warehou	133	118	118	118	118	118	118
Deepwater Flathead	1650	1560	1150	1150	1150	1150	1128
Deepwater shark (Eastern)	85	80	85	47	47	47	46

Deepwater shark (Western)	143	215	215	215	215	215	215
Elephant Fish	89	89	109	109	163	92	114
Flathead	2750	2741	2750	2878	2860	2882	2712
Gemfish (Eastern)	100	100	100	100	100	100	100
Gemfish (Western)	94	141	199	199	183	247	199
Gummy Shark	1717	1714	1836	1836	1836	1836	1774
Jackass Morwong	450	565	568	568	598	474	513
John Dory	221	220	221	221	169	167	175
Mirror Dory	718	1077	1616	808	437	325	235
Ocean Perch	300	230	195	195	166	190	190
Orange Roughy (Albany and Esperance)	50	50	50	50	50	50	50
Orange Roughy (Cascade Plateau)	500	500	500	500	500	500	500
Orange Roughy (Eastern)	25	25	25	25	465	465	465
Orange Roughy (Southern)	35	35	35	35	66	66	66
Orange Roughy (Western)	60	60	60	60	60	60	60
Oreodory	113	111	132	132	128	128	128
Pink Ling	1200	996	834	996	980	1144	1154
Redfish	276	275	276	138	100	100	100
Ribaldo	168	167	168	252	355	355	355
Royal Red Prawn	303	302.5	303	344	386	387	384
Saw Shark	226	226	339	459	482	433	442
School Shark	176	150	215	215	215	215	215
School Whiting	641	640	809	809	747	868	986
Silver Trevally	540	677	781	615	602	588	613
Silver Warehou	2566	2541	2329	2329	2417	1209	605
Smooth oreodory (Cascade Plateau)	150	150	150	150	150	150	150
Smooth oreodory (other)	45	23	23	23	23	90	90

Source: AFMA

Current and recent TACs for all key and secondary species with % of TAC caught are provided in **Appendix B**.

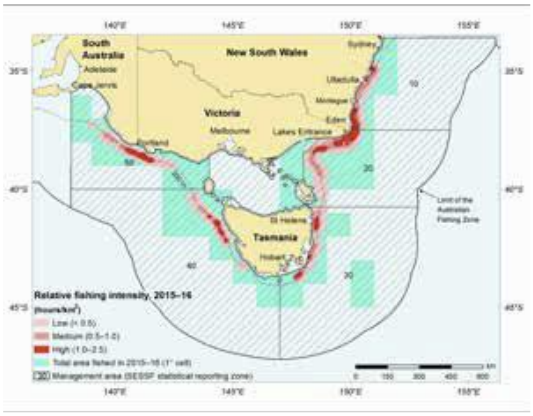
Current and recent fishery effort trends by method

Fishing effort (hours trawled and number of shots) by otter board trawlers for 2011-2016 inclusive.

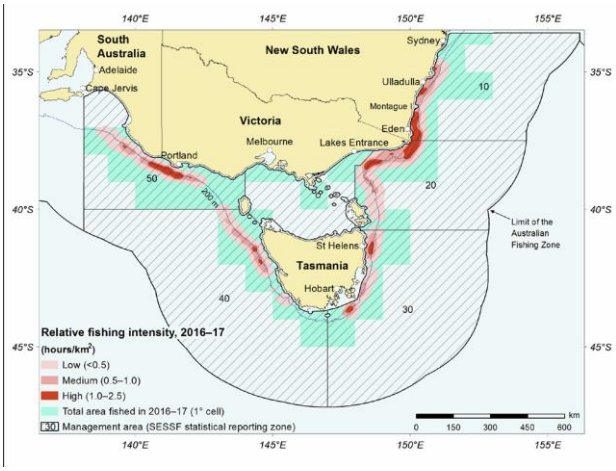
YEAR	2011	2012	2013	2014	2015	2016
Hours trawled	67192	59476	54480	55809	54463	52926
No. of shots	16162	15209	14073	14219	13758	13426

	Source: AFMA
Current and recent fishery catch trends by method	**Total catch (t) of the main species caught by otter board trawl.** Source: AFMA Logbook data

YEAR	2012	2013	2014	2015	2016
Blue Grenadier	813	2435	1194	1254	1188
Tiger Flathead	1385	925	1012	1160	977
Silver Warehou	759	580	356	339	276
Pink Ling	653	501	553	468	460
Other	4118	3980	3278	3655	3799
Total	**7728**	**8421**	**6393**	**6876**	**6700**



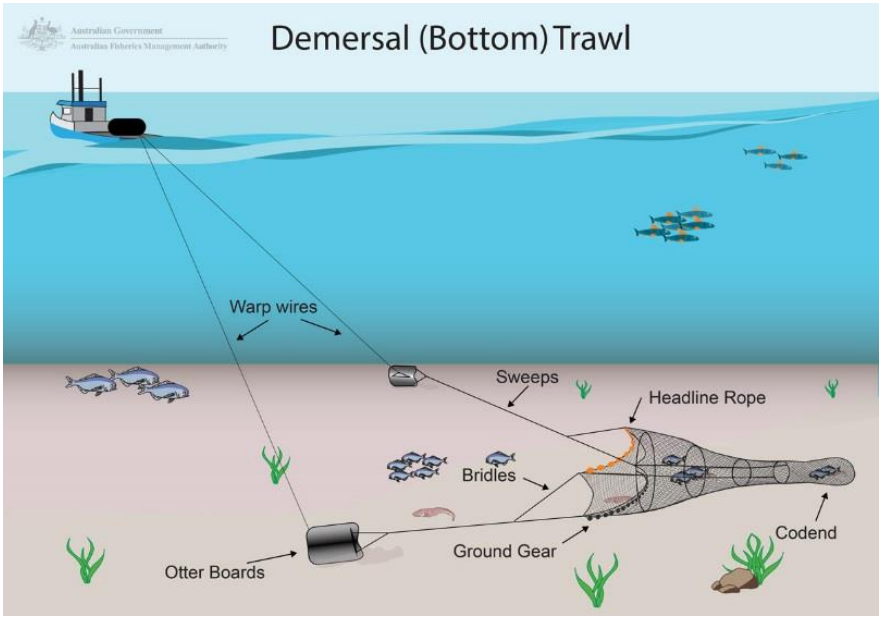
Relative fishing intensity in the Commonwealth Trawl Sector for the 2015-16 fishing season. Source: Georgeson et al. (2016).



Relative fishing intensity in the Commonwealth Trawl Sector for the 2016-17 fishing season. Source: Helidoniotis et al. (2017)

Current and recent value of fishery ($)	The current and recent value for this sub-fishery is confidential and withheld in this report. See ABARES Fishery Status Report 2017 (Patterson et al. 2017).

Relationship with other fisheries	Non-trawl fisheries operate in same area as the CTS and take many of the same species. Also, recreational catches may be significant for some species (e.g. flathead and silver trevally). 1. The following fisheries operate in the area coved by this fishery, either under Commonwealth jurisdiction or Joint jurisdiction between the Commonwealth and States: • Bass Straight Central Zone Scallop fishery, • East Coast Tuna and Billfish fishery, • Small Pelagic fishery, • Southern Bluefin Tuna fishery, • Southern and Western Tuna and Billfish fishery and • Southern Squid Jig fishery. 2. The following fisheries operate under Queensland jurisdiction in waters adjacent to the East Coast Deepwater Trawl Zone (ECDWZ) of this fishery: • East Coast Trawl fishery and • Sub-tropical Inshore Finfish fishery. 3. The following fisheries operate under New South Wales jurisdiction in waters overlapping or adjacent to this fishery: • Abalone fishery, • Fish Trawl fishery, • Lobster fishery, • Ocean Haul fishery, • Ocean Trap and • Line fishery. 4. The following fisheries operate under Victorian jurisdiction in waters overlapping or adjacent to this fishery: • Abalone fishery, • Rock Lobster fishery, • Victorian Inshore Prawn Trawl fishery, • Victorian Scallop fishery and • Ocean Access fishery. 5. The following fisheries operate under Tasmania jurisdiction in waters overlapping or adjacent to the south east trawl, south east non trawl and southern shark sectors of this fishery: • Abalone fishery, • Rock Lobster fishery, • Scalefish fishery, • Tasmania Scallop fishery and • Giant Crab fishery. 6. The following fisheries operate under South Australian jurisdiction in waters overlapping or adjacent to this fishery: • Marine Scalefish fishery and • Rock Lobster fishery
Gear	
Fishing methods and gear	Demersal trawling is the term used to describe the fishing method where a net is towed along, or just above, the ocean floor in depths of water ranging from a few metres to ~1300 metres. A trawl net is attached to the vessel by two long wires, called warps which are attached to an otter board either side of the net. The net opening (mouth) is spread horizontally by the outward force acting on the otter boards as they are towed through the water. The bottom of the net opening is called the footrope and is heavier than the headline and normally in contact with the bottom. The footrope is often rigged with rubber rollers to minimise the damage to the seafloor and allow it to

	move across the substrate without becoming snagged. The top of the mouth (headline) is lifted vertically by a series of floats. Otter trawling relies on the principle of herding fish inward from the otter boards and the sweep (wire from otter board to the headline and footrope) towards the mouth of the trawl net. Fish have a natural tendency to swim away from the otter boards, sweeps and net wings and fall backwards, towards the codend. The codend is the end of the net where the fish are caught. The size of the mesh in the codend is one of the most important factors in the size and shape of fish which are caught and those that escape. A trawl shot involves the net being deployed from the stern of the vessel by way of winches. The net is then towed along the bottom, usually at about three knots for a period of time before being hauled up toward the vessel. The fish are contained in the codend, which is fastened with a rope to release the catch on the vessel deck.  Source: AFMA Feb. 2018, http://www.afma.gov.au/portfolio-item/trawling/
Fishing gear restrictions	SESSF operators are only permitted to fish using the gear/methods specified on their boat statutory fishing right (SFR) and/or fishing permit. Mesh requirements: • Must not be less than 90 mm at any part of net. • 115 mm mesh in net mouth and wings (scalefish otter trawl only) Codend requirements: • At least 90 mm single twine mesh or at least 102 mm double twine mesh; or at least 90 mm double twine mesh with one or more bycatch devices Bycatch Reduction Devices (BRDs): • Single square mesh (≥ 90 mm) panel in upper side of codend bag (15 x 20 bars) or a large rotated mesh (T90) (≥ 90 mm) in upper codend (15 x 18 meshes). Source: AFMA; SESSF Management Arrangements Booklet 2017
Selectivity of fishing methods	The mesh size in the cod-end is restricted to a minimum of 90 mm for single twine and 102mm for double twine. This optimises the catch and allows undersized target and non-target species to escape. No other trawl net specifications were available.

Spatial gear zone set	Otter board demersal trawling occurs along the continental shelf, shelf break, and continental slope to depths of ~1300 m. Deepwater closures are in place along the 700 m depth contour. Limited deepwater areas are open to fishing.
Depth range gear set	Otter board trawling occurs in depths ranging from approximately 40 m to 1300 m.
How gear set	The net is deployed from the stern of the vessel by way of winches. The net is then towed along the bottom, usually at about 3 knots for a period of time (highly variable, 4-6 hours but may be shorter or longer dependant on location or target species) before being hauled up toward the vessel. Demersal trawlers tow a net along the ocean floor, in depths up to about 1300 m. The net is towed behind the vessel by long wires (the warps) and is deployed and retrieved from the stern of the vessel by winches. The net opening (the mouth) is spread horizontally by the outward force acting on the otter boards as they are towed through the water. The bottom of the net opening, the footrope, is weighted bringing the net opening close to the bottom and has ground gear, principally bobbins commonly known as "rockhopper" gear, attached to enable the gear to be towed across the substrate with minimal hook-ups. The top of the mouth, the headline, is lifted vertically by floats. Vessels are generally equipped with electronic units to allow the proximity of the nets to the seabed to be monitored. Demersal trawling relies on herding fish inward toward the path of the oncoming net mouth, rather than the speed of the tow. As the fish swim away from the warps and the net wings, they are enclosed and fall back towards the tapered body of the net. As the gear is hauled up toward the vessel the fish are contained in the end section of the net, the codend, which is fastened with a rope to release the catch into the vessel's fish pound. Source: AFMA; http://www.afma.gov.au/portfolio-item/trawling/ accessed 9 Mar 2018.
Area of gear impact per set or shot	This varies considerably as a function of tow duration, towing speed, and net width.
Capacity of gear	Not available. Net size is not recorded for otter board trawling. It is possible that a requirement to collect this information could be added to observer duties in the future. Source: AFMA
Effort per annum all boats	See "Current and recent fishery effort trends by method"
Lost gear and ghost fishing	Whole or parts of nets are occasionally lost however no quantitative data is available. Gear retrieval depends on circumstances however ghost fishing is not considered to be a significant issue with this gear.
Issues	
Key/second-ary commercial species issues and Interactions	There remains uncertainty about the stock structure of blue-eye trevalla in southeastern Australia. Williams et al. (2017) provided evidence for stock structure within the broad southern Australian distribution of Blue-eye Trevalla. A workshop is scheduled for early 2018 to consider these findings and the implications to the stock assessment and management of blue-eye trevalla. Stock assessments are in place for each of the commercial species under quota in the SESSF. The status of species relevant to the Commonwealth Trawl Sector, an overview of stock status and fishing mortality is available in the ABARES Fishery Status Report 2017 (Patterson et al. 2017). The South East Resource Assessment Group identified the need to update the understanding of key species biology (growth, age at maturity etc.). This is currently a research priority on the SESSF Research Statement.
Byproduct and bycatch	Byproduct species are defined as species which do not make a significant contribution to the overall catch but are sometimes landed for sale. Bycatch species are defined as species which are caught as

issues and interactions	part of fishing activities but are rarely landed. The ERA is the primary assessment tool to assess the impact on these species. The Upper-slope Dogfish Management Strategy has been implemented since the last ERA was undertaken. This strategy provides a level of protection for two species of gulper sharks: Harrison's dogfish (*Centrophorus harrissoni*) and Southern dogfish (*C. zeehaani*). The management actions provide some protection for other dogfish species including Endeavour Dogfish (*C. moluccensis*) and Greeneye Spurdog (*Squalus chloroculus*).
Protected species issues and interactions	Operators are required to report all interactions with protected species in their logbooks and AFMA reports quarterly to the Department of Environment and Energy. **Recorded wildlife interactions from the AFMA Logbook database for the period 2012-2016 inclusive. A: alive; D: dead.**

COMMON NAME	2012		2013		2014		2015		2016		TOTAL A	TOTAL D
	A	D	A	D	A	D	A	D	A	D		
Albatrosses (unclassified)	2	8	2	14		14	2	17	10	6	16	59
Shy albatross	1			15	2	4		3			3	22
Buller's albatross									1	1	1	1
Grey-headed albatross										1	0	1
Pacific Gull				1							0	1
Petrels, Prions and Shearwaters	1		1	10	1	1		1			3	12
Short tailed shearwater					1						1	0
Cape petrel					1						1	0
White-chinned petrel									1		1	0
Antarctic fur seal					1	3		1			1	4
Australian Fur Seal	11	84	57	55	15	76	11	62	9	64	103	341
New Zealand Fur Seal		4		1	3	1	1	1	1		5	7
Seals (unclassified)	16	71	20	101	16	32	6	8	2	11	60	223
Seahorses and pipefish	99	236		81							99	317
Porbeagle		1									0	1
White shark	2	1	2						1		5	1
Dolphin (unclassified)	1			1		3					1	4
Common dolphin										1	0	1
Shortfin mako		12		4	1	3		12			1	31
Longfin mako		1									0	1
Basking shark								1			0	1
Grand Total	133	418	82	283	41	137	20	106	25	84	301	1028

^: 10 of these 15 caught in AFMA mitigation experiments

#: 40 seals caught and released alive in one operation

	Source: AFMA and AFMA Wildlife Interaction Reports http://www.afma.gov.au/sustainability-environment/protected-species-management/protected-species-interaction-reports/ Overall, there were 1329 protected species interactions within this assessment period (301 alive; 1028 dead), and most of the interactions were with Australian fur seals, and unidentified seals, most likely to have also been Australian fur seals. Interactions with fur seals occurred at the rate of nearly 150 per year. About a third of the interactions were with seahorses and pipefishes, all occurring in the early part of the assessment period. These were all as a result of entanglement with the gear. Most bird interactions were with albatrosses, commonly Shy, and commonly fatal. The records indicate that these interactions were sometimes a result of collision with the gear and vessel rather than entanglement. The rate of interaction with birds was about 25 per year. Interactions with other protected species such as sharks, mako, porbeagle, were reported infrequently i.e. ~1 interaction per year or 1 interaction per 5 years. In the 2006 ERAEF assessment, it was estimated that 201 protected species occur within the area of the Commonwealth Trawl Sector. However, in this assessment, otter trawl operators have interacted with only 21 taxa: five chondrichthyan species, one teleost, six marine mammal taxa (four species and two unresolved to species level) and 10 marine bird taxa (seven species and three taxa unresolved to species level) at a rate of about 270 interactions per year. Since 2017, all board trawlers were required to use one of three seabird mitigation devices which have been proven effective at reducing seabird interactions.
Habitat issues and interactions	Due to the nature of board trawling and the species targeted, there are interactions with the seabed as part of fishing. Removal, modification or disturbance of seabed flora and fauna by this method does occur. Pitcher et al. (2016) estimated that on average approximately 7.6 % of the available trawl grounds between 0-1500 m are trawled annually but it is unknown how much of the most vulnerable assemblages is impacted. However, there are substantial closures in place which afford protection to large areas of vulnerable midslope and deep-water habitats such those supporting fragile deepwater corals.
Community issues and interactions	Removing one species or size range of the population, in addition, to changes to the community structure from which it is removed, will also change food web dynamics and energy transfer in the system. Over the past decade, it has become evident that climate change is affecting the water temperatures and probably salinities and other water properties. This effect on species could cause changes in distribution and there is increasingly species are being more regularly sighted beyond previous known distributions. Some species might not be able to disperse or extend their range so readily and populations may decline as a result of their inability to adapt to new environmental conditions. While ecosystem models do account to some extent for cumulative pressures, the way in which they interact might not be linear and is currently the focus of research. Irrespective, whole of ecosystem-based advice is being sought and accepted by fishery management.
Discarding	The level of discarding varies based on which area of the fishery a vessel is operating in and which species they are targeting. For example, discards are relatively low when fishing spawning aggregations of blue grenadier and orange roughy because operators target large spawning aggregations and there are typically few other species. In contrast, fishing on the continental shelf for mixed species means operators will catch non-target species including undersized (non-marketable) target species. Estimated discard rates vary by species; ocean perch 19.6 %, mirror dory west 0.9 %, pink ling 9.6 % (Castillo-Jordán et al. 2018). Most of the discarded catch usually consists of non-quota species such as barracouta, southern frostfish and jack mackerel, which may have some commercial value, and non-commercial species including New Zealand dory, whiptails, skates, catsharks and dogfish.
Management: planned and those implemented	
Manage-ment objectives	The objectives of the Southern and Eastern Scalefish and Shark Fishery Management Plan 2003 are as follows:

	a) to implement efficient and cost-effective fisheries management of the fishery on behalf of the Commonwealth; b) 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 non-target species and the long-term sustainability of the marine environment; c) to maximise economic efficiency in the exploitation of scalefish and shark resources within the fishery; d) to ensure AFMA's accountability to the fishing industry and to the Australian community in the management of the resources of the fishery; e) to reach Government targets for the recovery of the costs of AFMA in relation to the fishery; f) to ensure, through proper conservation and management, that the living resources of the fishery are not endangered by over-exploitation; g) to ensure the best use of the living resources of the fishery; h) to ensure that conservation and management measures in the fishery implement Australia's obligations under international agreements that deal with fish stocks, and other relevant international agreements; i) to ensure, as far as practicable, that measures adopted in pursuit of these objectives are not inconsistent with the preservation, conservation, and protection of all whale species.
Fishery management plan	The SESSF, which includes the CTS, is managed under the *Southern and Eastern Scalefish and Shark Fishery Management Plan 2003*. The 2017 SESSF Management Arrangements Booklet describes the current arrangements. Thirty-one species or species groups in the CTS have Total Allowable Catches (TACs) set which are allocated to fishers as quota Statutory Fishing Rights. The management plan incorporates under a single umbrella at least seven fisheries (i.e., Commonwealth (Shark) Gillnet sector; Commonwealth Scalefish hook sector; Commonwealth Shark hook sector; Commonwealth South East Trawl sector; GAB Trawl sector; Trap sector and East Coast Deepwater Trawl sector) with overlapping fishing entitlements, gear types and capture species. Managing the four fisheries under a single management plan provides the opportunity to manage the combined effects of the fishery on the ecosystem, including target species, bycatch and the broader environment. **AFMA 2016 Southern and Eastern Scalefish and Shark Fishery Five Year Strategic Research Plan 2016-2020**: https://www.afma.gov.au/sites/default/files/uploads/2017/06/SESSF-Five-Year-Strategic-Research-Plan-2016-2020.pdf?acsf_files_redirect **Commonwealth Trawl Sector Bycatch and Discard Workplan**: https://www.afma.gov.au/sites/default/files/uploads/2014/11/Bycatch-and-Discarding-Workplan-CTS-2014.pdf?acsf_files_redirect **Guide to AFMA's Ecological Risk Management 2017:** https://www.afma.gov.au/sites/default/files/uploads/2017/08/Final-ERM-Guide_June-2017.pdf **Southern and Eastern Scalefish and Shark Fishery Management Plan 2003 (updated 4 May 2016):** https://www.legislation.gov.au/Series/F2005B02463 **Stock rebuilding strategies for conservation dependent species**: a. Orange roughy rebuilding strategy b. Eastern gemfish rebuilding strategy c. Redfish rebuilding strategy d. Blue warehou rebuilding strategy e. School shark rebuilding strategy

	f. Upper Slope dogfish Management Strategy http://www.afma.gov.au/sustainability-environment/protected-species-management-strategies/
Input controls	A vessel must have a boat Statutory Fishing Right (SFR) allowing a vessel to trawl. This SFR will entitle a vessel to use trawl gear in a specific area of water. Other input controls include minimum mesh size in the codend to prevent the capture of juvenile fish and closures. Gear requirements are detailed earlier in this report. Closures are legislated under the *Southern and Eastern Scalefish and Shark Fishery and Small Pelagic Fishery (Closures) Direction 2016*, *Southern and Eastern Scalefish and Shark Fishery (Closures) Direction No. 11 2013*, *Southern and Eastern Scalefish and Shark Fishery (Closures) Direction No. 6 2013, Southern and Eastern Scalefish and Shark Fishery (Closures) Direction No. 2 2015* and under SFR conditions (see **Appendix C**). Australia's South-east Commonwealth Marine Reserves Network stretches from the far south coast of New South Wales, around Tasmania and Victoria and west to Kangaroo Island off South Australia. The reserves cover an area of 388 464 km^2 with a depth of 40 m - 4600 m. The network includes 14 Commonwealth Marine Reserves, ranging in size from 537 to 162 000 km^2. Zoning and maps for each of the 14 marine reserves are available from the Department of Environment and Energy website: http://www.environment.gov.au/topics/marine/marine-reserves/south-east. The Temperate East Network covers 383 352 km^2 and includes eight marine parks. The network includes important offshore reef habitat at Elizabeth and Middleton Reefs, Lord Howe Island and at Norfolk Island. Several significant seamount ridges run parallel to the coast in this region. Zoning and maps for each of the eight marine parks are available from the Department of Environment and Energy website: http://www.environment.gov.au/topics/marine/marine-reserves/temperate-east.
Output controls	All major target and byproduct species in the CTS of the SESSF are managed under quota. Quota is issued in the form of 'quota' SFRs and an operator must hold both the appropriate boat SFR and Quota SFRs to fish for quota species. Quota SFRs are tradable among sectors. There are also State trip limits in place for some byproduct species (see **Appendix D**).
Technical measures	A holder must not take flathead less than 280 millimetres in length when measured from the point of the snout to the tip of the tail. Additional technical measures are discussed in other sections.
Regulations	The Fisheries Management Regulations 1992 prescribes detail on the management arrangements implemented in Commonwealth fisheries. These have since been superceded by the Fisheries Management Regulations 2019, which is outside this assessment period. Specifically, they cover bans on vessels over 130 m, administration of and standard conditions for fishing concessions including VMS operation, carrying observers, processing fish, marine environment impacts, payments and fees, registers and administration and allocation of statutory fishing rights (SFRs), discarding offal at sea (not attributed to this fishery). Additional regulations were introduced regarding navigation in closures. Additional rules are contained in the Management Plan and SFR conditions. Under the EPBC Act 1999, interactions with a protected species must be reported within seven days of the incident occurring to the Department of Environment and Energy. A Memorandum of Understanding between AFMA and the Department for the Reporting of Fisheries Interactions with Protected Species (Reporting MOU) streamlines those reporting requirements (DoE 2015). AFMA reports its protected species interactions to the Department on a quarterly basis. Amendments to the International Maritime Organisation's International Convention for the Prevention of Pollution from Ships (MARPOL) Annex V which came into force on 1 January 2013 prohibit the discharge of all garbage, from all ships, into the sea (except as provided otherwise, under specific circumstances). Fishers are encouraged to record loss of gear in vessel logbooks; however it is only compulsory for vessels operating in the Southern Ocean under the management of the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR).
Initiatives, strategies and incentives	The SESSF Management Arrangements Booklet 2017 documents all management requirements. Bycatch and Discarding Workplans document planned actions to minimize the risk of interactions with bycatch and protected species.

	All board trawl vessels are required to have an AFMA-approved Seabird Management Plan (VMP) which details vessel-specific approaches to mitigating interactions with seabirds. Operators must use one of three mitigation devices which have been proven effective at reducing interactions with seabirds. Compliance is directed via targeted surveillance. Trawl net bycatch reduction devices are also required in the form of a single square mesh (≥ 90 mm) panel in upper side of codend bag (15 x 20 bars) or a large rotated mesh (T90) (≥ 90 mm) in upper codend (15 x 18 meshes). Industry codes of conduct include: - Industry Code of Practice for Responsible Fishing 2006 - Industry Code of Practice for Responsible Fishing reducing seal interactions 2007 Industry Code of Practice for minimising catches of snapper in waters adjacent to Victoria.
Enabling processes	AFMA is responsible for data collection and monitoring in this fishery. Commonwealth scientific log books have been compulsory in the south east trawl sector since 1985, and electronic logbooks will be compulsory for all full time trawl operators as of 1 May 2018. Prior to 1997, shark and non-trawl operators completed State logbooks. This data has been collated and is used in assessments. Landings are also recorded through the quota monitoring system by catch disposal records. The collection of age-length data for scalefish was conducted by State agencies and often sporadic or duplicated prior to 1991. The Central Aging Facility (CAF) was established in 1991 to conduct age estimation for these fisheries. Fish Ageing Services now provides ageing services for the main quota species in the SESSF. The Integrated Scientific Monitoring Program (ISMP) was implemented in 1997 to replace the Scientific Monitoring Program in the SETF. It provides statistically rigorous port-based and at sea monitoring in the south-east trawl, south east non-trawl and GAB trawl sectors of this fishery. ISMP provides important information on discards, non-commercial species, and non-quota commercial species. Fishery independent trawl surveys (FIS) have been carried out since 2006. They were original planned as an annual summer and winter survey, however, are now carried out during the winter of every second year in the GABT and CTS. These surveys provide an independent index of abundance, as well as other important biological and environmental data, some of which are used in current stock assessments. The assessment group structure comprises: - SESSF Resource Assessment Group (SESSFRAG - an umbrella assessment group for the whole SESSF) - South East Resource Assessment Group (formerly Shelf and Slope RAG) - Shark Resource Assessment Group (SharkRAG) - Great Australian Bight Assessment Group (GABRAG) SERAG, SharkRAG and GABRAG are responsible for undertaking stock assessments for a suite of key species, and for reporting on the status of those species to SESSFAG. SERAG is responsible for the assessment of scalefish species and SharkRAG is responsible for assessments of all shark and ray species taken by all sectors of the SESSF. The Great Australian Bight Assessment Group is responsible for assessment of a suite of species taken in the GAB trawl sector of the SESSF. **Summary of SESSF Harvest Strategy including assessments and harvest control rules.**

TIER LEVEL	REFERENCE POINT	REFERENCE POINT FUNCTION	INFORMATION REQUIREMENTS	CONTROL RULE
Tier 1	B_{20}	Limit	Catch, effort, discards, age, length, relative abundance, biomass information from: - Logbooks - ISMP - FIS	$<B_{20}$: No targeted fishing, rebuild strategy required

		B_{35}	HCR inflection	As above	<B_{35}: TACs are set at levels that allow stock to rebuild to target
		B_{48}	Target	As above	<B_{48}: Rebuild towards B_{48} > B_{48}: Fish at F_{48}
	Tier 3	F_{20}	Limit	Catch, discards, age, length, information from: - Logbooks and CDRs - ISMP	<F_{20}: No targeted fishing, rebuild strategy required
		F_{40}	MSY Proxy	As above	<F_{40}: TACs are set at levels that allow stock to rebuild to target
		F_{48}	Target	As above	<F_{48}: Rebuild towards F_{48} >F_{48}: Fish at F_{48}
	Tier 4	$CPUE_{20}$	Limit	Catch, effort, discards information from: - Logbooks - ISMP	<$CPUE_{20}$: No targeted fishing, rebuild strategy required
		$CPUE_{40}$	MSY Proxy	As above	<$CPUE_{40}$: TACs are set at levels that allow stock to rebuild to target
		$CPUE_{48}$	Target	As above	<$CPUE_{48}$: Rebuild towards $CPUE_{48}$ >$CPUE_{48}$: Fish at F_{48}

Other initiatives or agreements

Relevant to the CTS, Offshore Constitutional Settlements (OCS) are in place between the Commonwealth and the States of New South Wales, Victoria, Tasmania and South Australia. These OCS agreements define who has jurisdiction for which species stock and puts trip limits in place where necessary.

In addition, there are a few national and international initiatives in place which impact management of the fishery. These include:

- Oceans Policy 1998
- National Plan of Action for the Conservation and Management of Sharks 2012
- United Nations Convention Law of the Sea
- FAO Code of Conduct for Responsible Fisheries
- United Nations Fish Stocks Agreement
- Declaration of the Harvest Operations of the Southern and Eastern Scalefish and shark Fishery as an approved wildlife trade operation, February 2016
- Environment Protection and Biodiversity Conservation Act 1999
- Stock rebuilding strategies for conservation dependent species:
    a. Orange roughy rebuilding strategy
    b. Eastern gemfish rebuilding strategy
    c. Redfish rebuilding strategy
    d. Blue warehou rebuilding strategy
    e. School shark rebuilding strategy
    f. Upper Slope dogfish Management Strategy
- Bycatch and discarding work plans for each sector of the fishery

Data

Logbook data

Catch and effort data and all interactions with protected species are recorded on a shot-by-shot basis in Daily Logbooks. Data has been compiled into a centralised database by AFMA and is updated annually to CSIRO.

Electronic logbooks (e-logs) are an electronic alternative to submitting traditional paper logbooks. E-logs allow data to be received by AFMA in near real time, closer to actual fishing events. From 1

<table>
<tr><td></td><td>May 2018 it will be compulsory for all trawl vessels that have fished more than 50 days in the current or previous fishing season to have transitioned to e-logs.</td></tr>
<tr><td>Observer data</td><td>The purpose of the Observer Program is to “provide fisheries managers, research organizations, environmental agencies, the fishing industry and the wider community with independent, reliable, verified and accurate information on the fishing catch, effort and practice of a wide range of boats operating inside, and periodically outside, the Australian Fishing Zone” (AFMA http://www.afma.gov.au/fisheries-services/observer-services/: accessed 29 June 2016).
AFMA observers are highly experienced in fishery observer work in Australia. They:
collect data on independent boat activity and catch data (not recorded in official logbooks);
collect data and samples for research programs, supporting marine management and other issues relevant to environmental awareness and fisheries management and
monitor compliance of the boat with its fishing concession.
Observer data is collated in AFMA's centralised database and data have been made available outside AFMA in the form of observer trip reports and as raw data.
Percentage of observer coverage in the CTS otter board trawl sector by fishing season.
<table><tr><th>FISHING SEASON</th><th>NUMBER OF BOAT DAYS</th><th>NUMBER OF OBSERVED DAYS</th><th>PERCENTAGE OBSERVER COVERAGE</th></tr><tr><td>2010-11</td><td>5457</td><td>169</td><td>3.10</td></tr><tr><td>2011-12</td><td>5539</td><td>125</td><td>2.26</td></tr><tr><td>2012-13</td><td>4962</td><td>119</td><td>2.40</td></tr><tr><td>2013-14</td><td>4916</td><td>139</td><td>2.83</td></tr><tr><td>2014-15</td><td>4702</td><td>128</td><td>2.72</td></tr><tr><td>2015-16</td><td>4653</td><td>145</td><td>3.12</td></tr><tr><td>2016-17</td><td>4478</td><td>130</td><td>2.90</td></tr></table>Source: AFMA</td></tr>
<tr><td>Other data</td><td>Additional data is obtained via Fishery Independent Surveys every second year in the CTS.
The Southern and Eastern Scalefish and Shark Fishery Five Year Strategic Research Plan 2016-2020 (AFMA 2016) identifies the research priorities for the fishery over the next five years to assist with the pursuit of the management objectives for the SESSF and to enable the effective implementation and appraisal of management arrangements.</td></tr>
<tr><td>Legislative instruments and directions</td><td>Declaration of the Harvest Operations of the Southern and Eastern Scalefish and shark Fishery as an approved wildlife trade operation, February 2016.
http://www.environment.gov.au/biodiversity/wildlife-trade/trading/commercial/operations
Environment Protection and Biodiversity Conservation Act 1999.
https://www.legislation.gov.au/Series/C2004A00485.
FAO Code of Conduct for Responsible Fisheries.
http://www.fao.org/docrep/005/v9878e/v9878e00.htm.
National Plan of Action for the Conservation and Management of Sharks 2012 Shark-plan 2. Licensed from the Commonwealth of Australia under a Creative Commons Attribution 3.0 Australia Licence. http://www.daff.gov.au/sharkplan2/.
Oceans Policy 1998. Commonwealth of Australia 1998, ISBN 0 642 54592 8.
Southern and Eastern Scalefish and Shark Fishery and Small Pelagic Fishery (Closures) Direction 2016
Southern and Eastern Scalefish and Shark Fishery (Closures) Direction No. 6 2013
Southern and Eastern Scalefish and Shark Fishery (Closures) Direction No. 11 2013
Southern and Eastern Scalefish and Shark Fishery (Closures) Direction No. 2 2015</td></tr>
</table>

	Southern and Eastern Scalefish and Shark Fishery Management Plan 2003 **United Nations Convention Law of the Sea**. http://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf. **United Nations Fish Stocks Agreement.** http://www.un.org/Depts/los/convention_agreements/texts/fish_stocks_agreement/CONF164_37.htm

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/bycatch 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:	10 (C1), 9 (C2)
Byproduct and bycatch species:	119 (BP) 283 (BC)
Protected species:	103
Habitats:	25 (20 demersal, 5 pelagic)
Communities:	33 (28 demersal, 5 pelagic)

Scoping Document S2A. Species

Each species identified during the scoping is added to the ERAEF database used to run the Level 2 analyses. 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.cmar.csiro.au/caab/

Key commercial/secondary commercial species

- *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 secondary commercial (C2) species list for the SESSF CTS otter trawl sub-fishery.

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
11	C1	Invertebrate	Ommastrephidae	23636004	*Nototodarus gouldi*	Gould's squid	AFMA
982	C1	Teleost	Macruronidae	37227001	*Macruronus novaezelandiae*	Blue Grenadier	AFMA
933	C1	Teleost	Ophidiidae	37228002	*Genypterus blacodes*	Pink Ling	AFMA
561	C1	Teleost	Trachichthyidae	37255009	*Hoplostethus atlanticus*	Orange Roughy	AFMA
1097	C1	Teleost	Zeidae	37264003	*Zenopsis nebulosus*	Mirror Dory	AFMA
1037	C1	Teleost	Platycephalidae	37296001	*Platycephalus richardsoni*	Tiger Flathead	AFMA
1012	C1	Teleost	Cheilodactylidae	37377003	*Nemadactylus macropterus*	Jackass Morwong	AFMA
208	C1	Teleost	Trichiuridae	37440002	*Lepidopus caudatus*	Southern Frostfish; Frostfish	AFMA
1069	C1	Teleost	Centrolophidae	37445006	*Seriolella punctata*	Silver Warehou	AFMA
233	C1	Teleost	Monacanthidae	37465006	*Nelusetta ayraud*	Ocean Jacket	AFMA
17	C2	Invertebrate	Solenoceridae	28714005	*Haliporoides sibogae*	Royal red prawn	AFMA
332	C2	Teleost	Berycidae	37258003	*Centroberyx affinis*	Redfish	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
71	C2	Teleost	Cyttidae	37264001	*Cyttus traversi*	King Dory	AFMA
941	C2	Teleost	Sebastidae	37287001	*Helicolenus percoides*	Reef Ocean Perch	AFMA
539	C2	Teleost	Triglidae	37288001	*Chelidonichthys kumu*	Red Gurnard	AFMA
109	C2	Teleost	Triglidae	37288006	*Pterygotrigla polyommata*	Latchet	AFMA
145	C2	Teleost	Sillaginidae	37330014	*Sillago flindersi*	Eastern School Whiting	AFMA
150	C2	Teleost	Carangidae	37337062	*Pseudocaranx georgianus*	Silver Trevally	AFMA
1066	C2	Teleost	Gempylidae	37439002	*Rexea solandri*	Gemfish	AFMA

Byproduct species

List the byproduct species of the 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 is obtained by reviewing all available fishery literature, including logbooks, observer reports and discussions with stakeholders.

Table 2.4. Byproduct (BP) species list for the SESSF CTS otter trawl sub-fishery.

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
60	BP	Chondrichthyan	Hexanchidae	37005002	*Notorynchus cepedianus*	Broadnose Shark	AFMA
179	BP	Chondrichthyan	Alopiidae	37012001	*Alopias vulpinus*	Common Thresher	AFMA
462	BP	Chondrichthyan	Alopiidae	37012002	*Alopias superciliosus*	Bigeye Thresher Shark	AFMA
1197	BP	Chondrichthyan	Orectolobidae	37013003	*Orectolobus maculatus*	Spotted Wobbegong	AFMA
493	BP	Chondrichthyan	Scyliorhinidae	37015001	*Cephaloscyllium laticeps*	Draughtboard Shark	AFMA
495	BP	Chondrichthyan	Scyliorhinidae	37015013	*Cephaloscyllium albipinnum*	Whitefin Swellshark	AFMA
999	BP	Chondrichthyan	Triakidae	37017001	*Mustelus antarcticus*	Gummy Shark	AFMA
936	BP	Chondrichthyan	Triakidae	37017008	*Galeorhinus galeus*	School Shark	AFMA
535	BP	Chondrichthyan	Carcharhinidae	37018001	*Carcharhinus brachyurus*	Bronze Whaler	AFMA
590	BP	Chondrichthyan	Dalatiidae	37020002	*Dalatias licha*	Black Shark	AFMA
604	BP	Chondrichthyan	Centrophoridae	37020003	*Deania calceus*	Brier Shark	AFMA
609	BP	Chondrichthyan	Centrophoridae	37020004	*Deania quadrispinosa*	Longsnout Dogfish	AFMA
1078	BP	Chondrichthyan	Squalidae	37020006	*Squalus megalops*	Piked Spurdog; Spikey Dogfish	AFMA
491	BP	Chondrichthyan	Somniosidae	37020019	*Centroscymnus owstonii*	Owston's Dogfish	AFMA
809	BP	Chondrichthyan	Somniosidae	37020025	*Centroscymnus coelolepis*	Portuguese Dogfish	AFMA
257	BP	Chondrichthyan	Somniosidae	37020036	*Somniosus antarcticus*	Southern Sleeper Shark	AFMA
1040	BP	Chondrichthyan	Pristiophoridae	37023002	*Pristiophorus cirratus*	Common Sawshark	AFMA
660	BP	Chondrichthyan	Squatinidae	37024001	*Squatina australis*	Australian Angel Shark	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
668	BP	Chondrichthyan	Squatinidae	37024002	*Squatina tergocellata*	Ornate Angelshark	AFMA
505	BP	Chondrichthyan	Squatinidae	37024004	*Squatina albipunctata*	Eastern Angelshark	AFMA
694	BP	Chondrichthyan	Rhinobatidae	37027006	*Trygonorrhina fasciata*	Eastern Fiddler Ray	AFMA
709	BP	Chondrichthyan	Rhinobatidae	37027009	*Aptychotrema rostrata*	Eastern Shovelnose Ray	AFMA
687	BP	Chondrichthyan	Rhinobatidae	37027011	*Trygonorrhina dumerilii*	Southern fiddler ray	AFMA
714	BP	Chondrichthyan	Hypnidae	37028001	*Hypnos monopterygius*	Coffin Ray	AFMA
436	BP	Chondrichthyan	Rajidae	37031002	*Dentiraja australis* (was *Dipturus australis*)	Sydney Skate	AFMA
812	BP	Chondrichthyan	Rajidae	37031003	*Dentiraja cerva* (was *Dipturus cerva*)	Whitespotted Skate	AFMA
1063	BP	Chondrichthyan	Rajidae	37031005	*Dentiraja confusus* (was *Dipturus confusus*)	Longnose Skate	AFMA
1065	BP	Chondrichthyan	Rajidae	37031006	*Spiniraja whitleyi*	Melbourne Skate	AFMA
760	BP	Chondrichthyan	Rajidae	37031007	*Dentiraja lemprieri*	Thornback Skate	AFMA
761	BP	Chondrichthyan	Arhynchobatidae	37031009	*Pavoraja nitida*	Peacock Skate	AFMA
1062	BP	Chondrichthyan	Rajidae	37031010	*Dipturus gudgeri*	Bight Skate	AFMA
763	BP	Chondrichthyan	Arhynchobatidae	37031018	*Notoraja azurea*	Blue Skate	AFMA
6317	BP	Chondrichthyan	Arhynchobatidae	37031023	*Pavoraja arenaria*	Sandy skate	AFMA
1064	BP	Chondrichthyan	Rajidae	37031028	*Dipturus canutus*	Grey Skate	AFMA
353	BP	Chondrichthyan	Rajidae	37031029	*Dipturus grahami*	Graham's Skate	AFMA
65	BP	Chondrichthyan	Rajidae	37031035	*Dipturus acrobelus*	Deepwater Skate	AFMA
6173	BP	Chondrichthyan	Rajidae	37031040	*Rajella challengeri*	Challenger skate	AFMA
764	BP	Chondrichthyan	Dasyatidae	37035001	*Dasyatis brevicaudata*	Smooth Stingray	AFMA
767	BP	Chondrichthyan	Dasyatidae	37035002	*Dasyatis thetidis*	Black Stingray	AFMA
771	BP	Chondrichthyan	Urolophidae	37038001	*Urolophus bucculentus*	Sandyback Stingaree	AFMA
772	BP	Chondrichthyan	Urolophidae	37038002	*Urolophus cruciatus*	Banded Stingaree	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
774	BP	Chondrichthyan	Urolophidae	37038004	*Urolophus paucimaculatus*	Sparsely-spotted Stingaree	AFMA
23	BP	Chondrichthyan	Urolophidae	37038005	*Urolophus sufflavus*	Yellowback Stingaree	AFMA
775	BP	Chondrichthyan	Urolophidae	37038006	*Trygonoptera testacea*	Common Stingaree	AFMA
777	BP	Chondrichthyan	Urolophidae	37038007	*Urolophus viridis*	Greenback Stingaree	AFMA
784	BP	Chondrichthyan	Myliobatidae	37039001	*Myliobatis tenuicaudatus*	Southern Eagle Ray	AFMA
956	BP	Chondrichthyan	Chimaeridae	37042001	*Chimaera ogilbyi, was Hydrolagus ogilbyi*	Ogilby's Ghostshark	AFMA
286	BP	Chondrichthyan	Callorhinchidae	37043001	*Callorhinchus milii*	Elephantfish	AFMA
1280	BP	Invertebrate	Loliginidae	23617005	*Sepioteuthis australis*	Southern calamari	AFMA
2267	BP	Invertebrate	Octopodidae	23659003	*Pinnoctopus cordiformis*	Maori octopus	AFMA
867	BP	Teleost	Paraulopidae	37120001	*Paraulopus nigripinnis*	Blacktip Cucumberfish	AFMA
12	BP	Invertebrate	Volutidae	24207001	*Livonia mammilla*	False bailer shell	AFMA
6307	BP	Invertebrate	Volutidae	24207072	*Melo miltonis*	Southern bailer shell	AFMA
	BP	Invertebrate	Sepiidae	23607036	*Sepia grahami*	Cuttlefish	Expanded from Sepia spp. Expert consulted
	BP	Invertebrate	Sepiidae	23607021	*Sepia hedleyi*	Cuttlefish	Expanded from Sepia spp. Expert consulted
	BP	Invertebrate	Sepiidae	23607010	*Sepia rozella*	Rosecone cuttlefish	Expanded from Sepia spp. Expert consulted
	BP	Invertebrate	Sepiidae	23607014	*Sepia braggi*	Cuttlefish	Expanded from Sepia spp. Expert consulted
	BP	Invertebrate	Sepiidae	23607002	*Sepia cultrata*	Cuttlefish	Expanded from Sepia spp. Expert consulted
	BP	Invertebrate	Sepiidae	23607005	*Sepia novaehollandiae*	Cuttlefish	Expanded from Sepia spp. Expert consulted
997	BP	Teleost	Moridae	37224002	*Mora moro*	Ribaldo	AFMA
906	BP	Teleost	Moridae	37224003	*Pseudophycis barbata*	Bearded Rock Cod	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
916	BP	Teleost	Moridae	37224006	*Pseudophycis bachus*	Red Cod	AFMA
742	BP	Teleost	Moridae	37224011	*Pseudophycis breviuscula*	Bastard Red Cod	AFMA
592	BP	Teleost	Ophidiidae	37228001	*Dannevigia tusca*	Tusk	AFMA
921	BP	Teleost	Ophidiidae	37228008	*Genypterus tigerinus*	Rock Ling	AFMA
977	BP	Teleost	Macrouridae	37232004	*Lepidorhynchus denticulatus*	Toothed Whiptail	AFMA
282	BP	Teleost	Berycidae	37258002	*Beryx splendens*	Alfonsino	AFMA
214	BP	Teleost	Cyttidae	37264002	*Cyttus australis*	Silver Dory	AFMA
72	BP	Teleost	Zeidae	37264004	*Zeus faber*	John Dory	AFMA
1013	BP	Teleost	Oreosomatidae	37266001	*Neocyttus rhomboidalis*	Spikey Oreodory	AFMA
76	BP	Teleost	Oreosomatidae	37266002	*Oreosoma atlanticum*	Oxeye Oreodory	AFMA
631	BP	Teleost	Oreosomatidae	37266003	*Pseudocyttus maculatus*	Smooth Oreodory	AFMA
86	BP	Teleost	Trachipteridae	37271001	*Trachipterus arawatae*	Southern Ribbonfish	AFMA
96	BP	Teleost	Neosebastidae	37287006	*Neosebastes thetidis*	Thetis Fish	AFMA
940	BP	Teleost	Sebastidae	37287093	*Helicolenus barathri*	Bigeye Ocean Perch	AFMA
106	BP	Teleost	Triglidae	37288003	*Lepidotrigla vanessa*	Butterfly Gurnard	AFMA
110	BP	Teleost	Triglidae	37288007	*Lepidotrigla modesta*	Cocky Gurnard	AFMA
111	BP	Teleost	Triglidae	37288008	*Lepidotrigla mulhalli*	Roundsnout Gurnard	AFMA
113	BP	Teleost	Platycephalidae	37296002	*Platycephalus conatus*	Deepwater Flathead	AFMA
115	BP	Teleost	Platycephalidae	37296003	*Platycephalus bassensis*	Southern Sand Flathead	AFMA
116	BP	Teleost	Platycephalidae	37296004	*Platycephalus fuscus*	Dusky Flathead	AFMA
117	BP	Teleost	Platycephalidae	37296006	*Platycephalus laevigatus*	Rock Flathead	AFMA
2765	BP	Teleost	Platycephalidae	37296007	*Platycephalus caeruleopunctatus*	Bluespotted Flathead	AFMA
6214	BP	Teleost	Platycephalidae	37296011	*Ratabulus diversidens*	Orange-freckled Flathead	AFMA
1211	BP	Teleost	Platycephalidae	37296033	*Platycephalus australis*	Bartail Flathead	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
6363	BP	Teleost	Platycephalidae	37296036	*Platycephalus longispinis*	Longspine Flathead	AFMA
118	BP	Teleost	Platycephalidae	37296037	*Platycephalus speculator*	Southern Bluespotted Flathead	AFMA
119	BP	Teleost	Platycephalidae	37296038	*Platycephalus marmoratus*	Marbled Flathead	AFMA
6364	BP	Teleost	Platycephalidae	37296045	*Thysanophrys cirronasa*	Tasselsnout Flathead	AFMA
120	BP	Teleost	Hoplichthyidae	37297001	*Hoplichthys haswelli*	Deepsea Flathead	AFMA
1038	BP	Teleost	Polyprionidae	37311006	*Polyprion oxygeneios*	Hapuku	AFMA
139	BP	Teleost	Dinolestidae	37327002	*Dinolestes lewini*	Longfin Pike	AFMA
1088	BP	Teleost	Carangidae	37337002	*Trachurus declivis*	Common Jack Mackerel	AFMA
540	BP	Teleost	Carangidae	37337003	*Trachurus novaezelandiae*	Yellowtail Scad	AFMA
148	BP	Teleost	Carangidae	37337006	*Seriola lalandi*	Yellowtail Kingfish	AFMA
155	BP	Teleost	Emmelichthyidae	37345001	*Emmelichthys nitidus*	Redbait	AFMA
658	BP	Teleost	Emmelichthyidae	37345002	*Plagiogeneion macrolepis*	Bigscale Rubyfish	AFMA
596	BP	Teleost	Emmelichthyidae	37345003	*Plagiogeneion rubiginosum*	Cosmopolitan Rubyfish	AFMA
158	BP	Teleost	Sparidae	37353001	*Chrysophrys auratus*	Snapper	AFMA
170	BP	Teleost	Pentacerotidae	37367003	*Pentaceropsis recurvirostris*	Longsnout Boarfish	AFMA
175	BP	Teleost	Oplegnathidae	37369002	*Oplegnathus woodwardi*	Knifejaw	AFMA
177	BP	Teleost	Cheilodactylidae	37377002	*Nemadactylus douglasii*	Grey Morwong	AFMA
192	BP	Teleost	Uranoscopidae	37400001	*Xenocephalus armatus*	Bulldog Stargazer	AFMA
194	BP	Teleost	Uranoscopidae	37400003	*Kathetostoma laeve*	Common Stargazer	AFMA
195	BP	Teleost	Uranoscopidae	37400005	*Pleuroscopus pseudodorsalis*	Scaled Stargazer	AFMA
965	BP	Teleost	Uranoscopidae	37400018	*Kathetostoma canaster*	Speckled Stargazer	AFMA
1087	BP	Teleost	Gempylidae	37439001	*Thyrsites atun*	Barracouta	AFMA
210	BP	Teleost	Scombridae	37441001	*Scomber australasicus*	Blue Mackerel	AFMA
958	BP	Teleost	Centrolophidae	37445001	*Hyperoglyphe antarctica*	Blue-Eye Trevalla	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
215	BP	Teleost	Centrolophidae	37445004	*Centrolophus niger*	Rudderfish	AFMA
1068	BP	Teleost	Centrolophidae	37445005	*Seriolella brama*	Blue Warehou	AFMA
217	BP	Teleost	Centrolophidae	37445011	*Seriolella caerulea*	White Warehou	AFMA
231	BP	Teleost	Monacanthidae	37465003	*Eubalichthys mosaicus*	Mosaic Leatherjacket	AFMA
232	BP	Teleost	Monacanthidae	37465005	*Meuschenia scaber*	Velvet Leatherjacket	AFMA
234	BP	Teleost	Monacanthidae	37465007	*Scobinichthys granulatus*	Rough leatherjacket	AFMA
235	BP	Teleost	Monacanthidae	37465008	*Meuschenia australis*	Brownstriped Leatherjacket	AFMA
1182	BP	Teleost	Monacanthidae	37465024	*Paramonacanthus filicauda*	Threadfin Leatherjacket	AFMA
237	BP	Teleost	Monacanthidae	37465036	*Meuschenia freycineti*	Sixspine Leatherjacket	AFMA
238	BP	Teleost	Monacanthidae	37465059	*Meuschenia trachylepis*	Yellowfin Leatherjacket	AFMA

Bycatch (discard) species

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

Table 2.5. Bycatch (BC) species list for the SESSF CTS otter trawl.

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
	BC	Chondrichthyan	Hexanchidae	37005001	*Heptranchias perlo*	Sharpnose sevengill shark	AFMA
363	BC	Chondrichthyan	Hexanchidae	37005004	*Hexanchus nakamurai*	Bigeye sixgill shark	AFMA
365	BC	Chondrichthyan	Hexanchidae	37005005	*Hexanchus griseus*	Bluntnose sixgill shark	AFMA
66	BC	Chondrichthyan	Chlamydoselachidae	37006001	*Chlamydoselachus anguineus*	Frill shark	AFMA
260	BC	Chondrichthyan	Heterodontidae	37007001	*Heterodontus portusjacksoni*	Port Jackson shark	AFMA
317	BC	Chondrichthyan	Odontaspididae	37008003	*Odontaspis ferox*	Sandtiger shark	AFMA
6041	BC	Chondrichthyan	Mitsukurinidae	37009002	*Mitsukurina owstoni*	Goblin shark	AFMA
368	BC	Chondrichthyan	Parascylliidae	37013002	*Parascyllium collare*	Collar carpetshark	AFMA
369	BC	Chondrichthyan	Parascylliidae	37013005	*Parascyllium ferrugineum*	Rusty carpetshark	AFMA
391	BC	Chondrichthyan	Scyliorhinidae	37015003	*Asymbolus vincenti*	Gulf catshark	AFMA
932	BC	Chondrichthyan	Scyliorhinidae	37015009	*Figaro boardmani*	Australian sawtail catshark; Sawtail catshark	AFMA
6185	BC	Chondrichthyan	Scyliorhinidae	37015014	*Apristurus sinensis*	*Apristurus sp* A	AFMA
6180	BC	Chondrichthyan	Scyliorhinidae	37015020	*Apristurus australis*	*Apristurus sp* G	AFMA
4821	BC	Chondrichthyan	Scyliorhinidae	37015024	*Asymbolus rubiginosus*	Orange spotted catshark	AFMA
460	BC	Chondrichthyan	Scyliorhinidae	37015027	*Asymbolus analis*	Grey spotted catshark	AFMA
6312	BC	Chondrichthyan	Scyliorhinidae	37015031	*Cephaloscyllium variegatum*	Northern draughtboard shark	AFMA
490	BC	Chondrichthyan	Triakidae	37017003	*Furgaleus macki*	Whiskery shark	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
458	BC	Chondrichthyan	Triakidae	37017006	*Hypogaleus hyugaensis*	Pencil shark	AFMA
808	BC	Chondrichthyan	Carcharhinidae	37018003	*Carcharhinus obscurus*	Dusky whaler	AFMA
1039	BC	Chondrichthyan	Carcharhinidae	37018004	*Prionace glauca*	Blue shark	AFMA
629	BC	Chondrichthyan	Carcharhinidae	37018007	*Carcharhinus plumbeus*	Sandbar shark	AFMA
621	BC	Chondrichthyan	Carcharhinidae	37018008	*Carcharhinus falciformis*	Silky shark	AFMA
469	BC	Chondrichthyan	Carcharhinidae	37018021	*Carcharhinus leucas*	Bull shark	AFMA
551	BC	Chondrichthyan	Carcharhinidae	37018022	*Galeocerdo cuvier*	Tiger shark	AFMA
475	BC	Chondrichthyan	Carcharhinidae	37018029	*Negaprion acutidens*	Lemon shark	AFMA
476	BC	Chondrichthyan	Carcharhinidae	37018030	*Carcharhinus amblyrhynchos*	Grey reef shark	AFMA
880	BC	Chondrichthyan	Sphyrnidae	37019001	*Sphyrna lewini*	Scalloped hammerhead shark	AFMA
552	BC	Chondrichthyan	Sphyrnidae	37019004	*Sphyrna zygaena*	Smooth hammerhead shark	AFMA
371	BC	Chondrichthyan	Centrophoridae	37020001	*Centrophorus moluccensis*	Endeavour dogfish	AFMA
838	BC	Chondrichthyan	Etmopteridae	37020005	*Etmopterus lucifer*	Blackbelly Lanternshark	AFMA
1077	BC	Chondrichthyan	Squalidae	37020008	*Squalus acanthias*	Whitespotted dogfish	AFMA
603	BC	Chondrichthyan	Centrophoridae	37020009	*Centrophorus squamosus*	Leafscale Gulper shark	AFMA
364	BC	Chondrichthyan	Centrophoridae	37020010	*Centrophorus harrissoni*	Harrisson's dogfish	AFMA
5194	BC	Chondrichthyan	Centrophoridae	37020011	*Centrophorus zeehaani*	Southern dogfish	AFMA
489	BC	Chondrichthyan	Somniosidae	37020012	*Centroselachus crepidater*	Golden dogfish	AFMA
633	BC	Chondrichthyan	Somniosidae	37020013	*Scymnodon plunketi*	Plunket's dogfish	AFMA
963	BC	Chondrichthyan	Dalatiidae	37020014	*Isistius brasiliensis*	Smalltooth cookiecutter shark	AFMA
653	BC	Chondrichthyan	Etmopteridae	37020021	*Etmopterus baxteri*	Southern lanternshark; Rough deep-sea shark	AFMA
1541	BC	Chondrichthyan	Etmopteridae	37020022	*Etmopterus unicolor*	Bristled lanternshark	AFMA
497	BC	Chondrichthyan	Centrophoridae	37020023	*Centrophorus granulosus*	Gulper shark	AFMA
642	BC	Chondrichthyan	Etmopteridae	37020027	*Etmopterus bigelowi*	Smooth lanternshark	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
905	BC	Chondrichthyan	Somniosidae	37020042	*Zameus squamulosus*	Velvet dogfish	AFMA
6192	BC	Chondrichthyan	Squalidae	37020047	*Squalus montalbani*	Philippine spurdog	This species was added from superceded species *S. mitsukurii*; AFMA
6315	BC	Chondrichthyan	Squalidae	37020048	*Squalus chloroculus*	Greeneye spurdog	This species was added from *S. mitsukurii*; AFMA
655	BC	Chondrichthyan	Oxynotidae	37021001	*Oxynotus bruniensis*	Prickly dogfish	AFMA
6160	BC	Chondrichthyan	Echinorhinidae	37022002	*Echinorhinus cookei*	Prickly shark	AFMA
656	BC	Chondrichthyan	Pristiophoridae	37023001	*Pristiophorus nudipinnis*	Southern sawshark	AFMA
744	BC	Chondrichthyan	Narcinidae	37028002	*Narcine tasmaniensis*	Tasmanian numbfish	AFMA
747	BC	Chondrichthyan	Torpedinidae	37028003	*Torpedo macneilli*	Short-tail torpedo ray	AFMA
341	BC	Chondrichthyan	Narcinidae	37028005	*Narcine westraliensis*	Banded numbfish	AFMA
6318	BC	Chondrichthyan	Urolophidae	37038014	*Trygonoptera imitata*	Shovelnose stingaree	AFMA
6320	BC	Chondrichthyan	Urolophidae	37038018	*Urolophus kapalensis*	Kapala stingaree	AFMA
786	BC	Chondrichthyan	Chimaeridae	37042005	*Chimaera fulva*	Southern chimaera	AFMA
6152	BC	Chondrichthyan	Chimaeridae	37042008	*Chimaera lignaria*	Giant chimaera	AFMA
794	BC	Chondrichthyan	Rhinochimaeridae	37044001	*Harriotta raleighana*	Bigspine spookfish	AFMA
796	BC	Chondrichthyan	Rhinochimaeridae	37044002	*Rhinochimaera pacifica*	Pacific spookfish	AFMA
6308	BC	Invertebrate	Asterodiscididae	25128001	*Asterodiscides truncatus*	Firebrick seastar	AFMA
2	BC	Invertebrate	Holothuriidae	25416002	*Actinopyga mauritiana*	Surf redfish (sea cucumber)	AFMA
7	BC	Invertebrate	Penaeidae	28711052	*Melicertus plebejus*	Eastern king prawn	AFMA
15	BC	Invertebrate	Aristeidae	28712001	*Aristaeomorpha foliacea*	Red prawn	AFMA
16	BC	Invertebrate	Aristeidae	28712008	*Aristaeopsis edwardsiana*	Giant scarlet prawn	AFMA
6309	BC	Invertebrate	Solenoceridae	28714009	*Solenocera alfonso*	Deepwater prawn	AFMA
1331	BC	Invertebrate	Pandalidae	28770007	*Heterocarpus woodmasoni*	Red carid	AFMA
20	BC	Invertebrate	Palinuridae	28820001	*Jasus edwardsii*	Southern rock lobster	AFMA

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21	BC	Invertebrate	Palinuridae	28820002	*Sagmariasus verreauxi*	Eastern rock lobster	AFMA
1339	BC	Invertebrate	Scyllaridae	28821001	*Ibacus alticrenatus*	Whitetail bug	AFMA
6310	BC	Invertebrate	Scyllaridae	28821003	*Ibacus novemdentatus*	Balmain bug	AFMA
1806	BC	Invertebrate	Scyllaridae	28821004	*Ibacus peronii*	Eastern Balmain bug	AFMA
6311	BC	Invertebrate	Scyllaridae	28821019	*Ibacus chacei*	Smooth bug	AFMA
29	BC	Invertebrate	Homolidae	28860001	*Dagnaudus petterdi*	Antlered crab	AFMA
1347	BC	Invertebrate	Geryonidae	28910001	*Chaceon bicolor*	Crystal crab	AFMA
30	BC	Invertebrate	Portunidae	28911005	*Portunus armatus*	Blue swimmer crab	AFMA
31	BC	Invertebrate	Polybiidae	28911020	*Ovalipes molleri*	A swimmer crab	AFMA
465	BC	Invertebrate	Pseudocarcinus	28915002	*Pseudocarcinus gigas*	Giant crab	AFMA
1352	BC	Invertebrate	Hypothalassiidae	28916002	*Hypothalassia armata*	Champagne crab	AFMA
797	BC	Teleost	Anguillidae	37056001	*Anguilla australis*	Southern shortfin eel	AFMA
801	BC	Teleost	Muraenesocidae	37063003	*Muraenesox bagio*	Common pike eel	AFMA
6322	BC	Teleost	Congridae	37067002	*Gnathophis longicaudus*	Little conger	AFMA
554	BC	Teleost	Congridae	37067007	*Conger verreauxi*	Southern conger	AFMA
811	BC	Teleost	Congridae	37067012	*Bassanago bulbiceps*	Swollenhead conger	AFMA
1477	BC	Teleost	Congridae	37067013	*Bassanago hirsutus*	Deepsea conger	AFMA
6323	BC	Teleost	Congridae	37067016	*Gnathophis umbrellabius*	Umbrella conger	AFMA
6324	BC	Teleost	Congridae	37067027	*Gnathophis macroporis*	Largepore conger	AFMA
626	BC	Teleost	Synaphobranchidae	37070001	*Diastobranchus capensis*	Basketwork eel	AFMA
823	BC	Teleost	Halosauridae	37081002	*Halosaurus pectoralis*	Australian halosaur	AFMA
824	BC	Teleost	Notacanthidae	37083001	*Notacanthus sexspinis*	Southern spineback	AFMA
36	BC	Teleost	Notacanthidae	37083002	*Notacanthus chemnitzii*	Cosmopolitan spineback	AFMA
825	BC	Teleost	Clupeidae	37085002	*Sardinops sagax*	Australian sardine	AFMA

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6326	BC	Teleost	Clupeidae	37085005	*Hyperlophus vittatus*	Sandy sprat	AFMA
2473	BC	Teleost	Clupeidae	37085014	*Sardinella albella*	White sardinella	AFMA
872	BC	Teleost	Clupeidae	37085018	*Sardinella lemuru*	Scaly mackerel	AFMA
6327	BC	Teleost	Clupeidae	37085019	*Nematalosa erebi*	Australian river gizzard shad	AFMA
6328	BC	Teleost	Clupeidae	37085023	*Herklotsichthys castelnaui*	Southern herring	AFMA
2189	BC	Teleost	Clupeidae	37085790	*Clupea harengus*	Herring	AFMA
831	BC	Teleost	Engraulidae	37086001	*Engraulis australis*	Australian anchovy	AFMA
6329	BC	Teleost	Engraulidae	37086002	*Encrasicholina punctifer*	Buccaneer anchovy	AFMA
6330	BC	Teleost	Argentinidae	37097001	*Argentina australiae*	silverside	AFMA
37	BC	Teleost	Bathylagidae	37098002	*Bathylagus antarcticus*	Antarctic deepsea smelt	AFMA
1705	BC	Teleost	Chauliodontidae	37111001	*Chauliodus sloani*	Sloane's viperfish	AFMA
6331	BC	Teleost	Idiacanthidae	37113002	*Idiacanthus atlanticus*	Common black dragonfish	AFMA
855	BC	Teleost	Alepocephalidae	37114013	*Alepocephalus cf antipodianus*	Antipodean slickhead	AFMA
6332	BC	Teleost	Alepocephalidae	37114023	*Rouleina eucla*	Eucla slickhead	AFMA
6333	BC	Teleost	Alepocephalidae	37114024	*Rouleina guentheri*	Bordello slickhead	AFMA
856	BC	Teleost	Alepocephalidae	37114503	*Talismania longifilis*	*Talismania longifilis*	AFMA
859	BC	Teleost	Aulopidae	37117001	*Latropiscis purpurissatus*	Sergeant baker	AFMA
863	BC	Teleost	Synodontidae	37118001	*Saurida undosquamis*	Largescale saury	AFMA
1246	BC	Teleost	Synodontidae	37118002	*Trachinocephalus myops*	Painted grinner	AFMA
6336	BC	Teleost	Paraulopidae	37120008	*Paraulopus melanostomus*	Cucumberfish 1	AFMA
870	BC	Teleost	Neoscopelidae	37121001	*Neoscopelus macrolepidotus*	Largescale neoscopelid	AFMA
6338	BC	Teleost	Myctophidae	37122001	*Diaphus danae*	Dana lanternfish	AFMA
271	BC	Teleost	Myctophidae	37122018	*Gymnoscopelus piabilis*	Southern blacktip lanternfish	AFMA
874	BC	Teleost	Gonorynchidae	37141001	*Gonorynchus greyi*	Beaked salmon	AFMA

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4907	BC	Teleost	Chanidae	37142001	*Chanos chanos*	Milkfish	AFMA
6339	BC	Teleost	Plotosidae	37192001	*Cnidoglanis macrocephalus*	Estuary cobbler	AFMA
890	BC	Teleost	Ogcocephalidae	37212001	*Halieutaea brevicauda*	Shortfin seabat	AFMA
891	BC	Teleost	Himantolophidae	37215001	*Himantolophus appelii*	Prickly footballfish	AFMA
892	BC	Teleost	Euclichthyidae	37224001	*Euclichthys polynemus*	Eucla cod	AFMA
910	BC	Teleost	Moridae	37224004	*Tripterophycis gilchristi*	Chiseltooth Grenadier Cod	AFMA
6340	BC	Teleost	Moridae	37224007	*Notophycis marginata*	Dwarf codling	AFMA
276	BC	Teleost	Moridae	37224009	*Halargyreus johnsonii*	Slender Cod	AFMA
277	BC	Teleost	Moridae	37224010	*Lepidion microcephalus*	Smallhead Cod	AFMA
6341	BC	Teleost	Moridae	37224012	*Physiculus luminosa*	Luminous Cod	AFMA
6342	BC	Teleost	Moridae	37224013	*Laemonema globiceps*	Fathead Cod	AFMA
6343	BC	Teleost	Moridae	37224017	*Lepidion schmidti*	Schmidt's Cod	AFMA
6305	BC	Teleost	Moridae	37224018	*Lepidion inosimae*	Giant Cod	AFMA
545	BC	Teleost	Merlucciidae	37227002	*Merluccius australis*	Southern Hake	AFMA
923	BC	Teleost	Carapidae	37229003	*Echiodon rendahli*	Messmate Fish	AFMA
543	BC	Teleost	Macrouridae	37232001	*Coelorinchus australis*	Southern Whiptail	AFMA
544	BC	Teleost	Macrouridae	37232002	*Coelorinchus fasciatus*	Banded Whiptail	AFMA
924	BC	Teleost	Macrouridae	37232003	*Coelorinchus mirus*	Gargoyle Fish	AFMA
925	BC	Teleost	Macrouridae	37232007	*Malacocephalus laevis*	Softhead grenadier; Smooth Whiptail	AFMA
927	BC	Teleost	Macrouridae	37232014	*Coelorinchus innotabilis*	Notable Whiptail	AFMA
281	BC	Teleost	Macrouridae	37232015	*Coryphaenoides serrulatus*	Serrulate Whiptail	AFMA
284	BC	Teleost	Macrouridae	37232016	*Coryphaenoides subserrulatus*	Longray Whiptail	AFMA
323	BC	Teleost	Macrouridae	37232017	*Coelorinchus matamua*	Blueband Whiptail	AFMA
6345	BC	Teleost	Macrouridae	37232029	*Cetonurus globiceps*	Globehead Whiptail	AFMA

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6346	BC	Teleost	Bathygadidae	37232030	*Bathygadus cottoides*	Codhead Rat Tail	AFMA
334	BC	Teleost	Macrouridae	37232031	*Coelorinchus kaiyomaru*	Kaiyomaru Whiptail	AFMA
44	BC	Teleost	Macrouridae	37232035	*Mesovagus antipodum*	Black Whiptail	AFMA
48	BC	Teleost	Macrouridae	37232042	*Coelorinchus acanthiger*	Spottyface Whiptail	AFMA
6347	BC	Teleost	Macrouridae	37232045	*Coelorinchus maurofasciatus*	Falseband Whiptail	AFMA
6348	BC	Teleost	Macrouridae	37232047	*Coelorinchus gormani*	Little whiptail	AFMA
6350	BC	Teleost	Macrouridae	37232063	*Macrouroides inflaticeps*	Inflated Whiptail	AFMA
6351	BC	Teleost	Macrouridae	37232080	*Coelorinchus trachycarus*	Rough-head Whiptail	AFMA
6352	BC	Teleost	Macrouridae	37232104	*Coelorinchus amydrozosterus*	Faintbanded Whiptail	AFMA
848	BC	Teleost	Diretmidae	37254001	*Diretmichthys parini*	Black Spinyfin	AFMA
849	BC	Teleost	Trachichthyidae	37255001	*Hoplostethus intermedius*	Blacktip Sawbelly	AFMA
887	BC	Teleost	Trachichthyidae	37255003	*Paratrachichthys macleayi*	Sandpaper Fish	AFMA
888	BC	Teleost	Trachichthyidae	37255004	*Gephyroberyx darwinii*	Darwin's Roughy	AFMA
901	BC	Teleost	Trachichthyidae	37255005	*Hoplostethus gigas*	Giant Sawbelly	AFMA
6353	BC	Teleost	Trachichthyidae	37255007	*Optivus agastos*	Violet Roughy	AFMA
6354	BC	Teleost	Trachichthyidae	37255012	*Aulotrachichthys pulsator*	Golden Roughy	AFMA
6355	BC	Teleost	Anoplogastridae	37257001	*Anoplogaster cornuta*	Fangtooth	AFMA
279	BC	Teleost	Berycidae	37258001	*Beryx decadactylus*	Imperador	AFMA
68	BC	Teleost	Berycidae	37258004	*Centroberyx gerrardi*	Bight Redfish	AFMA
69	BC	Teleost	Berycidae	37258005	*Centroberyx lineatus*	Swallowtail	AFMA
70	BC	Teleost	Monocentrididae	37259001	*Cleidopus gloriamaris*	Australian Pineapplefish	AFMA
74	BC	Teleost	Cyttidae	37264005	*Cyttus novaezealandiae*	New Zealand Dory	AFMA
2190	BC	Teleost	Zeidae	37264010	*Cyttopsis rosea*	Rosy Dory	AFMA
6356	BC	Teleost	Grammicolepididae	37265001	*Grammicolepis brachiusculus*	Thorny Tinselfish	AFMA

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75	BC	Teleost	Grammicolepididae	37265003	*Xenolepidichthys dalgleishi*	Spotted Tinselfish	AFMA
81	BC	Teleost	Oreosomatidae	37266004	*Allocyttus verrucosus*	Warty Oreodory	AFMA
82	BC	Teleost	Oreosomatidae	37266005	*Allocyttus niger*	Black Oreodory	AFMA
6357	BC	Teleost	Oreosomatidae	37266006	*Neocyttus psilorhynchus*	Rough Oreodory	AFMA
562	BC	Teleost	Regalecidae	37272002	*Regalecus glesne*	Oarfish (king of herrings)	AFMA
88	BC	Teleost	Fistulariidae	37278001	*Fistularia commersonii*	Smooth Flutemouth	AFMA
89	BC	Teleost	Fistulariidae	37278002	*Fistularia petimba*	Rough Flutemouth	AFMA
91	BC	Teleost	Macroramphosidae	37279001	*Centriscops humerosus*	Banded Bellowsfish	AFMA
90	BC	Teleost	Macroramphosidae	37279002	*Macroramphosus scolopax*	Common Bellowsfish	AFMA
92	BC	Teleost	Macroramphosidae	37279003	*Notopogon lilliei*	Crested Bellowsfish	AFMA
6358	BC	Teleost	Macroramphosidae	37279005	*Notopogon xenosoma*	Orange Bellowsfish	AFMA
94	BC	Teleost	Neosebastidae	37287003	*Neosebastes pandus*	Bighead Gurnard Perch	AFMA
95	BC	Teleost	Neosebastidae	37287005	*Neosebastes scorpaenoides*	Common Gurnard Perch	AFMA
97	BC	Teleost	Scorpaenidae	37287008	*Scorpaena papillosa*	Southern Red Scorpionfish	AFMA
102	BC	Teleost	Sebastidae	37287046	*Trachyscorpia eschmeyeri*	Deepsea Ocean Perch	AFMA
2327	BC	Teleost	Scorpaenidae	37287086	*Scorpaenopsis venosa*	Raggy Scorpionfish	AFMA
6360	BC	Teleost	Tetrarogidae	37287094	*Centropogon latifrons*	Western Fortescue	AFMA
2174	BC	Teleost	Sebastidae	37287103	*Trachyscorpia carnomagula*	deepsea scorpionfish	AFMA
107	BC	Teleost	Peristediidae	37288004	*Peristedion picturatum*	Robust Amour Gurnard	AFMA
108	BC	Teleost	Triglidae	37288005	*Pterygotrigla andertoni*	Painted Latchet	AFMA
686	BC	Teleost	Peristediidae	37288012	*Satyrichthys cf moluccense*	Blackfin Armour Gurnard	AFMA
6361	BC	Teleost	Aploactinidae	37290001	*Aploactisoma milesii*	Southern Velvetfish	AFMA
6362	BC	Teleost	Pataecidae	37292001	*Pataecus fronto*	Red indian fish	AFMA
121	BC	Teleost	Psychrolutidae	37305001	*Psychrolutes marcidus*	Smooth-head Blobfish	AFMA

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123	BC	Teleost	Serranidae	37311001	*Lepidoperca pulchella*	Eastern Orange Perch	AFMA
124	BC	Teleost	Serranidae	37311002	*Caesioperca lepidoptera*	Butterfly Perch	AFMA
125	BC	Teleost	Serranidae	37311003	*Caesioperca rasor*	Barber Perch	AFMA
750	BC	Teleost	Serranidae	37311014	*Epinephelus fasciatus*	Blacktip Rockcod	AFMA
437	BC	Teleost	Serranidae	37311017	*Epinephelus sexfasciatus*	Sixbar Grouper	AFMA
129	BC	Teleost	Acropomatidae	37311053	*Apogonops anomalus*	Threespine Cardinalfish	AFMA
131	BC	Teleost	Callanthiidae	37311055	*Callanthias australis*	Splendid Perch	AFMA
133	BC	Teleost	Serranidae	37311095	*Caprodon longimanus*	Longfin Perch	AFMA
415	BC	Teleost	Serranidae	37311147	*Epinephelus ergastularius*	Banded Rockcod	AFMA
6365	BC	Teleost	Ostracoberycidae	37311161	*Ostracoberyx paxtoni*	Spinycheek Seabass	AFMA
6367	BC	Teleost	Banjosidae	37322001	*Banjos banjos*	Banjofish	AFMA
136	BC	Teleost	Priacanthidae	37326001	*Priacanthus macracanthus*	Spotted Bigeye	AFMA
6368	BC	Teleost	Priacanthidae	37326008	*Heteropriacanthus cruentatus*	Blotched Bigeye	AFMA
138	BC	Teleost	Epigonidae	37327001	*Epigonus lenimen*	Bigeye Deepsea Cardinalfish	AFMA
140	BC	Teleost	Epigonidae	37327010	*Epigonus denticulatus*	White Deepsea Cardinalfish	AFMA
141	BC	Teleost	Epigonidae	37327018	*Epigonus robustus*	Robust Deepsea Cardinalfish	AFMA
6369	BC	Teleost	Epigonidae	37327035	*Epigonus telescopus*	Black Deepsea Cardinalfish	AFMA
142	BC	Teleost	Sillaginidae	37330001	*Sillaginodes punctatus*	King George Whiting	AFMA
146	BC	Teleost	Pomatomidae	37334002	*Pomatomus saltatrix*	Tailor	AFMA
149	BC	Teleost	Carangidae	37337007	*Seriola hippos*	Samsonfish	AFMA
1122	BC	Teleost	Carangidae	37337014	*Seriolina nigrofasciata*	Blackbanded Amberjack	AFMA
1123	BC	Teleost	Carangidae	37337016	*Caranx bucculentus*	Bluespotted Trevally	AFMA
591	BC	Teleost	Carangidae	37337025	*Seriola dumerili*	Amberjack	AFMA
664	BC	Teleost	Carangidae	37337039	*Caranx sexfasciatus*	Bigeye Trevally	AFMA

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661	BC	Teleost	Carangidae	37337052	*Seriola rivoliana*	Highfin Amberjack	AFMA
662	BC	Teleost	Carangidae	37337053	*Caranx lugubris*	Black Trevally	AFMA
814	BC	Teleost	Coryphaenidae	37338001	*Coryphaena hippurus*	Dolphin Fish; Mahi Mahi	AFMA
152	BC	Teleost	Bramidae	37342001	*Brama brama*	Ray's Bream	AFMA
882	BC	Teleost	Bramidae	37342003	*Taractichthys longipinnis*	Bigscale Pomfret	AFMA
511	BC	Teleost	Arripidae	37344001	*Arripis georgianus*	Australian Herring	AFMA
153	BC	Teleost	Arripidae	37344002	*Arripis trutta*	Eastern Australian Salmon	AFMA
736	BC	Teleost	Lutjanidae	37346006	*Lutjanus quinquelineatus*	Fiveline Snapper	AFMA
600	BC	Teleost	Lutjanidae	37346014	*Etelis carbunculus*	Ruby Snapper	AFMA
156	BC	Teleost	Gerreidae	37349001	*Parequula melbournensis*	Silverbelly	AFMA
674	BC	Teleost	Lethrinidae	37351006	*Lethrinus laticaudis*	Grass Emperor	AFMA
691	BC	Teleost	Sparidae	37353002	*Dentex spariformis*	Yellowback Bream	AFMA
159	BC	Teleost	Sparidae	37353003	*Acanthopagrus butcheri*	Black bream	AFMA
161	BC	Teleost	Sparidae	37353013	*Rhabdosargus sarba*	Tarwhine	AFMA
162	BC	Teleost	Sciaenidae	37354001	*Argyrosomus japonicus*	Mulloway	AFMA
164	BC	Teleost	Sciaenidae	37354020	*Atractoscion aequidens*	Teraglin	AFMA
165	BC	Teleost	Mullidae	37355001	*Upeneichthys lineatus*	Bluestriped Goatfish	AFMA
6293	BC	Teleost	Mullidae	37355029	*Upeneichthys vlamingii*	Bluespotted Goatfish	AFMA
166	BC	Teleost	Pempheridae	37357001	*Pempheris multiradiata*	Bigscale Bullseye	AFMA
605	BC	Teleost	Kyphosidae	37361003	*Tilodon sexfasciatus*	Moonlighter	AFMA
606	BC	Teleost	Kyphosidae	37361007	*Girella tricuspidata*	Luderick	AFMA
607	BC	Teleost	Scorpididae	37361009	*Scorpis lineolata*	Silver Sweep	AFMA
169	BC	Teleost	Pentacerotidae	37367001	*Paristiopterus gallipavo*	Yellowspotted Boarfish	AFMA
1	BC	Teleost	Pentacerotidae	37367002	*Paristiopterus labiosus*	Giant Boarfish	AFMA

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171	BC	Teleost	Pentacerotidae	37367004	*Pentaceros decacanthus*	Bigspine Boarfish	AFMA
172	BC	Teleost	Pentacerotidae	37367005	*Zanclistius elevatus*	Blackspot Boarfish	AFMA
173	BC	Teleost	Pentacerotidae	37367009	*Pseudopentaceros richardsoni*	Pelagic Armourhead	AFMA
174	BC	Teleost	Pentacerotidae	37367010	*Parazanclistius hutchinsi*	Short Boarfish	AFMA
608	BC	Teleost	Cheilodactylidae	37377001	*Cheilodactylus nigripes*	Magpie Perch	AFMA
178	BC	Teleost	Cheilodactylidae	37377004	*Nemadactylus valenciennesi*	Blue Morwong	AFMA
610	BC	Teleost	Cheilodactylidae	37377005	*Dactylophora nigricans*	Dusky Morwong	AFMA
611	BC	Teleost	Cheilodactylidae	37377006	*Cheilodactylus spectabilis*	Banded Morwong	AFMA
976	BC	Teleost	Latridae	37378001	*Latris lineata*	Striped Trumpeter	AFMA
181	BC	Teleost	Latridae	37378002	*Latridopsis forsteri*	Bastard Trumpeter	AFMA
185	BC	Teleost	Labridae	37384001	*Bodianus vulpinus*	Western Pigfish	AFMA
1168	BC	Teleost	Labridae	37384014	*Xiphocheilus typus*	Bluetooth Tuskfish	AFMA
188	BC	Teleost	Labridae	37384023	*Pseudolabrus rubicundus*	Rosy Wrasse	AFMA
189	BC	Teleost	Labridae	37384035	*Bodianus flavipinnis*	Yellowfin Pigfish	AFMA
615	BC	Teleost	Labridae	37384043	*Achoerodus viridis*	Eastern Blue Groper	AFMA
190	BC	Teleost	Labridae	37384061	*Bodianus unimaculatus*	Eastern Pigfish	AFMA
6294	BC	Teleost	Odacidae	37385009	*Haletta semifasciata*	Blue Weed Whiting	AFMA
191	BC	Teleost	Pinguipedidae	37390001	*Parapercis allporti*	Barred Grubfish	AFMA
6295	BC	Teleost	Pinguipedidae	37390007	*Parapercis mimaseana;* now *Parapercis striolata*	Banded Grubfish	AFMA
201	BC	Teleost	Callionymidae	37427001	*Foetorepus calauropomus*	Common Stinkfish	AFMA
204	BC	Teleost	Gempylidae	37439003	*Ruvettus pretiosus*	Oilfish	AFMA
845	BC	Teleost	Gempylidae	37439008	*Lepidocybium flavobrunneum*	Escolar	AFMA
209	BC	Teleost	Trichiuridae	37440004	*Trichiurus lepturus*	Largehead Hairtail	AFMA
64	BC	Teleost	Scombridae	37441003	*Katsuwonus pelamis*	Skipjack Tuna	AFMA

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255	BC	Teleost	Scombridae	37441004	*Thunnus maccoyii*	Southern Bluefin Tuna	AFMA
895	BC	Teleost	Scombridae	37441005	*Thunnus alalunga*	Albacore	AFMA
620	BC	Teleost	Scombridae	37441007	*Scomberomorus commerson*	Spanish Mackerel	AFMA
211	BC	Teleost	Scombridae	37441020	*Sarda australis*	Australian bonito	AFMA
213	BC	Teleost	Xiphiidae	37442001	*Xiphias gladius*	Broadbill Swordfish; Swordfish	AFMA
884	BC	Teleost	Istiophoridae	37444002	*Kajikia audax*	Striped Marlin	AFMA
776	BC	Teleost	Centrolophidae	37445002	*Tubbia tasmanica*	Tasmanian Rudderfish	AFMA
6297	BC	Teleost	Nomeidae	37446013	*Cubiceps whiteleggii*	Coastal cubehead	AFMA
220	BC	Teleost	Tetragonuridae	37449001	*Tetragonurus cuvieri*	Smalleye Squaretail	AFMA
307	BC	Teleost	Bothidae	37460001	*Lophonectes gallus*	Crested Flounder	AFMA
221	BC	Teleost	Paralichthyidae	37460002	*Pseudorhombus jenynsii*	Smalltooth Flounder	AFMA
1204	BC	Teleost	Paralichthyidae	37460009	*Pseudorhombus arsius*	Largetooth Flounder	AFMA
6298	BC	Teleost	Paralichthyidae	37460031	*Pseudorhombus tenuirastrum*	Slender flounder	AFMA
223	BC	Teleost	Pleuronectidae	37461002	*Azygopus pinnifasciatus*	Banded-fin Flounder	AFMA
26	BC	Teleost	Soleidae	37462010	*Zebrias scalaris*	Manyband Sole	AFMA
240	BC	Teleost	Ostraciidae	37466002	*Anoplocapros inermis*	Eastern Smooth Boxfish	AFMA
241	BC	Teleost	Ostraciidae	37466003	*Aracana aurita*	Shaw's Cowfish	AFMA
1199	BC	Teleost	Ostraciidae	37466004	*Lactoria cornuta*	Longhorn Cowfish	AFMA
243	BC	Teleost	Tetraodontidae	37467002	*Omegophora armilla*	Ringed Toadfish	AFMA
244	BC	Teleost	Tetraodontidae	37467003	*Tetractenos glaber*	Smooth Toadfish	AFMA
246	BC	Teleost	Tetraodontidae	37467005	*Arothron firmamentum*	Starry Toadfish	AFMA
4928	BC	Teleost	Tetraodontidae	37467023	*Lagocephalus lagocephalus*	Oceanic puffer; Ocean Puffer	AFMA
6299	BC	Teleost	Tetraodontidae	37467065	*Lagocephalus cheesemanii*	Cheeseman's Puffer	AFMA
249	BC	Teleost	Diodontidae	37469001	*Diodon nicthemerus*	Globefish	AFMA

ERA SPECIES ID	ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
250	BC	Teleost	Diodontidae	37469002	*Allomycterus pilatus*	Australian Burrfish	AFMA
6304	BC	Teleost	Diodontidae	37469013	*Dicotylichthys punctulatus*	Three-barred porcupinefish	AFMA
1533	BC	Teleost	Molidae	37470001	*Mola ramsayi*	Short Sunfish	AFMA

Protected species

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. A list of protected species has been generated for this sub-fishery and included in the PSA workbook species list. This list was initially provided by AFMA which was further validated and reviewed using information on EPBC Act List of Threatened Fauna website; http://www.environment.gov.au/cgi-bin/sprat/public/publicthreatenedlist.pl and available literature on protected species occurrence and distribution such as Expert Panel on a Declared Commercial Fishing Activity (2014); birds: Menkhorst et al. (2017), Reid et al. (2002), Marchant and Higgins (1990); marine mammals: Woinarski et al.(2014), Jefferson et al. (2015); teleosts: Atlas of Living Australia Fishmap http://fish.ala.org.au/ , CAAB http://www.cmar.csiro.au/caab/index.html, Fishes of Australia http://fishesofaustralia.net.au/). Species from higher order family categories that were considered to have potential to interact with fishery (based on geographic range and proven/perceived susceptibility to the fishing gear/methods and examples from other similar fisheries across the globe) were also included.

Table 2.5. Protected species (PS) list for the SESSF CTS otter trawl sub-fishery.

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
964	PS	Chondrichthyan	Lamnidae	37010001	*Isurus oxyrinchus*	Shortfin mako	AFMA
370	PS	Chondrichthyan	Lamnidae	37010002	*Isurus paucus*	Longfin mako	AFMA
315	PS	Chondrichthyan	Lamnidae	37010003	*Carcharodon carcharias*	White shark	AFMA
972	PS	Chondrichthyan	Lamnidae	37010004	*Lamna nasus*	Porbeagle	AFMA
346	PS	Chondrichthyan	Cetorhinidae	37011001	*Cetorhinus maximus*	Basking Shark	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 (PS)” 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	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
63	PS	Chondrichthyan	Myliobatidae	37041004	*Mobula birostris* (was *Manta birostris*)	(Giant) manta ray	AFMA
1032	PS	Marine bird	Diomedeidae	40040001	*Thalassarche bulleri*	Buller's albatross	AFMA
1033	PS	Marine bird	Diomedeidae	40040002	*Thalassarche cauta*	Shy albatross	AFMA
1035	PS	Marine bird	Diomedeidae	40040004	*Thalassarche chrysostoma*	Grey-headed albatross	AFMA
753	PS	Marine bird	Diomedeidae	40040005	*Diomedea epomophora*	Southern Royal albatross	Added from Diomedeidae - undifferentiated
451	PS	Marine bird	Diomedeidae	40040006	*Diomedea exulans*	Wandering albatross	AFMA
1085	PS	Marine bird	Diomedeidae	40040007	*Thalassarche melanophrys*	Black-browed albatross	AFMA
1008	PS	Marine bird	Diomedeidae	40040008	*Phoebetria fusca*	Sooty albatross	Added from Diomedeidae - undifferentiated
1009	PS	Marine bird	Diomedeidae	40040009	*Phoebetria palpebrata*	Light-mantled albatross; Light-mantled Sooty albatross	Added from Diomedeidae - undifferentiated
755	PS	Marine bird	Diomedeidae	40040010	*Diomedea gibsoni*	Gibson's albatross	Added from Diomedeidae - undifferentiated
628	PS	Marine bird	Diomedeidae	40040011	*Diomedea antipodensis*	Antipodean albatross	Added from Diomedeidae - undifferentiated
799	PS	Marine bird	Diomedeidae	40040012	*Diomedea sanfordi*	Northern Royal albatross	Added from Diomedeidae - undifferentiated
1084	PS	Marine bird	Diomedeidae	40040013	*Thalassarche impavida*	Campbell albatross	Added from Diomedeidae - undifferentiated
1031	PS	Marine bird	Diomedeidae	40040014	*Thalassarche carteri*	Indian yellow-nosed albatross	Added from Diomedeidae - undifferentiated
595	PS	Marine bird	Procellariidae	40041003	*Daption capense*	Cape petrel	AFMA
314	PS	Marine bird	Procellariidae	40041004	*Fulmarus glacialoides*	Southern fulmar	Added from Procellariidae - undifferentiated
939	PS	Marine bird	Procellariidae	40041005	*Halobaena caerulea*	Blue petrel	Added from Procellariidae - undifferentiated
73	PS	Marine bird	Procellariidae	40041007	*Macronectes giganteus*	Southern giant-petrel	Added from Procellariidae - undifferentiated
981	PS	Marine bird	Procellariidae	40041008	*Macronectes halli*	Northern giant-petrel	Added from Procellariidae - undifferentiated
487	PS	Marine bird	Procellariidae	40041009	*Pachyptila belcheri*	Slender-billed prion	Added from Procellariidae - undifferentiated
488	PS	Marine bird	Procellariidae	40041011	*Pachyptila desolata*	Antarctic prion	Added from Procellariidae - undifferentiated
6091	PS	Marine bird	Procellariidae	40041012	*Pachyptila salvini*	Salvin's prion	Added from Procellariidae - undifferentiated
1003	PS	Marine bird	Procellariidae	40041013	*Pachyptila turtur*	Fairy prion	Added from Procellariidae - undifferentiated

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
1006	PS	Marine bird	Procellariidae	40041017	*Pelecanoides urinatrix*	Common diving-petrel	Added from Procellariidae - undifferentiated
1041	PS	Marine bird	Procellariidae	40041018	*Procellaria aequinoctialis*	White-chinned petrel	AFMA
494	PS	Marine bird	Procellariidae	40041019	*Procellaria cinerea*	Grey petrel	Added from Procellariidae - undifferentiated
503	PS	Marine bird	Procellariidae	40041028	*Pterodroma inexpectata*	Mottled petrel	Added from Procellariidae - undifferentiated
504	PS	Marine bird	Procellariidae	40041029	*Pterodroma lessonii*	White-headed petrel	Added from Procellariidae - undifferentiated
1046	PS	Marine bird	Procellariidae	40041030	*Pterodroma leucoptera*	Gould's petrel	Added from Procellariidae - undifferentiated
1047	PS	Marine bird	Procellariidae	40041031	*Pterodroma macroptera*	Great-winged petrel	Added from Procellariidae - undifferentiated
1048	PS	Marine bird	Procellariidae	40041032	*Pterodroma mollis*	Soft-plumaged petrel	Added from Procellariidae - undifferentiated
1051	PS	Marine bird	Procellariidae	40041035	*Pterodroma solandri*	Providence petrel	Added from Procellariidae - undifferentiated
1055	PS	Marine bird	Procellariidae	40041038	*Puffinus carneipes*	Flesh-footed shearwater	AFMA
1056	PS	Marine bird	Procellariidae	40041040	*Puffinus gavia*	Fluttering shearwater	Added from Puffinus spp. - undifferentiated
1057	PS	Marine bird	Procellariidae	40041042	*Puffinus griseus*	Sooty shearwater	Added from Puffinus spp. - undifferentiated
1058	PS	Marine bird	Procellariidae	40041043	*Puffinus huttoni*	Hutton's shearwater	Added from Puffinus spp. - undifferentiated
1059	PS	Marine bird	Procellariidae	40041045	*Puffinus pacificus*	Wedge-tailed shearwater	Added from Puffinus spp. - undifferentiated
1060	PS	Marine bird	Procellariidae	40041047	*Puffinus tenuirostris*	Short-tailed shearwater	Added from Puffinus spp. - undifferentiated
1433	PS	Marine bird	Sulidae	40047004	*Sula dactylatra*	Masked booby	AFMA
975	PS	Marine bird	Laridae	40128014	*Larus pacificus*	Pacific gull	AFMA
612	PS	Marine mammal	Delphinidae	41116001	*Delphinus delphis*	Common dolphin	AFMA
902	PS	Marine mammal	Delphinidae	41116002	*Feresa attenuata*	Pygmy killer whale	Added from Delphinidae - undifferentiated
935	PS	Marine mammal	Delphinidae	41116004	*Globicephala melas*	Long-finned pilot whale	Added from Delphinidae - undifferentiated
937	PS	Marine mammal	Delphinidae	41116005	*Grampus griseus*	Risso's dolphin	Added from Delphinidae - undifferentiated
61	PS	Marine mammal	Delphinidae	41116009	*Lissodelphis peronii*	Southern right whale dolphin	Added from Delphinidae - undifferentiated
1002	PS	Marine mammal	Delphinidae	41116011	*Orcinus orca*	Killer whale	Added from Delphinidae - undifferentiated
1044	PS	Marine mammal	Delphinidae	41116013	*Pseudorca crassidens*	False killer whale	Added from Delphinidae - undifferentiated

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
1083	PS	Marine mammal	Delphinidae	41116018	*Steno bredanensis*	Rough-toothed dolphin	Added from Delphinidae - undifferentiated
1091	PS	Marine mammal	Delphinidae	41116019	*Tursiops truncatus*	Common Bottlenose dolphin	AFMA
1494	PS	Marine mammal	Delphinidae	41116020	*Tursiops aduncus*	Indian Ocean bottlenose dolphin	Added from Delphinidae - undifferentiated
216	PS	Marine mammal	Otariidae	41131001	*Arctocephalus forsteri*	New Zealand fur seal	AFMA
253	PS	Marine mammal	Otariidae	41131003	*Arctocephalus pusillus doriferus*	Australian fur Seal	AFMA
263	PS	Marine mammal	Otariidae	41131004	*Arctocephalus tropicalis*	Subantarctic fur seal	Added from Otariidae - undifferentiated
1000	PS	Marine mammal	Otariidae	41131005	*Neophoca cinerea*	Australian sea lion	Added from Otariidae - undifferentiated
295	PS	Marine mammal	Phocidae	41136001	*Hydrurga leptonyx*	Leopard seal	Added from Otariidae and Phocidae
993	PS	Marine mammal	Phocidae	41136004	*Mirounga leonina*	Southern elephant seal	Added from Otariidae and Phocidae
6303	PS	Teleost	Syngnathidae	6303	*Hippocampus kelloggi*	Kellogg's seahorse	Added from Syngnathidae - undifferentiated
1010	PS	Teleost	Syngnathidae	37282001	*Phycodurus eques*	Leafy seadragon	Added from Syngnathidae - undifferentiated
1011	PS	Teleost	Syngnathidae	37282002	*Phyllopteryx taeniolatus*	Common seadragon	AFMA
1089	PS	Teleost	Syngnathidae	37282006	*Trachyrhamphus bicoarctatus*	Bentstick pipefish	Added from Syngnathidae - undifferentiated
1092	PS	Teleost	Syngnathidae	37282008	*Urocampus carinirostris*	Hairy pipefish	Added from Syngnathidae - undifferentiated
980	PS	Teleost	Syngnathidae	37282009	*Lissocampus runa*	Javelin pipefish	AFMA
946	PS	Teleost	Syngnathidae	37282010	*Hippocampus bleekeri*	Potbelly seahorse	Added from Syngnathidae - undifferentiated
953	PS	Teleost	Syngnathidae	37282011	*Histiogamphelus briggsii*	Crested pipefish	Added from Syngnathidae - undifferentiated
961	PS	Teleost	Syngnathidae	37282012	*Hypselognathus rostratus*	Knifesnout pipefish	Added from Syngnathidae - undifferentiated
978	PS	Teleost	Syngnathidae	37282013	*Leptoichthys fistularius*	Brushtail pipefish	Added from Syngnathidae - undifferentiated
966	PS	Teleost	Syngnathidae	37282014	*Kaupus costatus*	Deepbody pipefish	Added from Syngnathidae - undifferentiated
995	PS	Teleost	Syngnathidae	37282015	*Mitotichthys semistriatus*	Halfbanded pipefish	Added from Syngnathidae - undifferentiated
979	PS	Teleost	Syngnathidae	37282016	*Lissocampus caudalis*	Smooth pipefish	Added from Syngnathidae - undifferentiated
1026	PS	Teleost	Syngnathidae	37282017	*Stigmatopora argus*	Spotted pipefish	Added from Syngnathidae - undifferentiated

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
1027	PS	Teleost	Syngnathidae	37282018	*Stigmatopora nigra*	Widebody pipefish	Added from Syngnathidae - undifferentiated
1028	PS	Teleost	Syngnathidae	37282019	*Stipecampus cristatus*	Ringback pipefish	Added from Syngnathidae - undifferentiated
1061	PS	Teleost	Syngnathidae	37282021	*Pugnaso curtirostris*	Pugnose pipefish	Added from Syngnathidae - undifferentiated
994	PS	Teleost	Syngnathidae	37282022	*Mitotichthys mollisoni*	Mollison's pipefish	Added from Syngnathidae - undifferentiated
1094	PS	Teleost	Syngnathidae	37282023	*Vanacampus phillipi*	Port Phillip pipefish	Added from Syngnathidae - undifferentiated
1095	PS	Teleost	Syngnathidae	37282024	*Vanacampus poecilolaemus*	Longsnout pipefish	Added from Syngnathidae - undifferentiated
996	PS	Teleost	Syngnathidae	37282025	*Mitotichthys tuckeri*	Tucker's pipefish	Added from Syngnathidae - undifferentiated
947	PS	Teleost	Syngnathidae	37282026	*Hippocampus breviceps*	Shorthead seahorse	Added from Syngnathidae - undifferentiated
952	PS	Teleost	Syngnathidae	37282027	*Hippocampus whitei*	White's seahorse	Added from Syngnathidae - undifferentiated
1073	PS	Teleost	Syngnathidae	37282029	*Solegnathus spinosissimus*	Spiny pipehorse	AFMA
105	PS	Teleost	Syngnathidae	37282034	*Idiotropiscis australe*	Southern pygmy pipehorse	Added from Syngnathidae - undifferentiated
580	PS	Teleost	Syngnathidae	37282055	*Cosmocampus howensis*	Lord Howe pipefish	Added from Syngnathidae - undifferentiated
904	PS	Teleost	Syngnathidae	37282061	*Festucalex cinctus*	Girdled pipefish	Added from Syngnathidae - undifferentiated
914	PS	Teleost	Syngnathidae	37282064	*Filicampus tigris*	Tiger pipefish	Added from Syngnathidae - undifferentiated
942	PS	Teleost	Syngnathidae	37282071	*Heraldia nocturna*	Upside-down pipefish	Added from Syngnathidae - undifferentiated
945	PS	Teleost	Syngnathidae	37282075	*Hippichthys penicillus*	Beady pipefish	Added from Syngnathidae - undifferentiated
967	PS	Teleost	Syngnathidae	37282083	*Kimblaeus bassensis*	Trawl pipefish	Added from Syngnathidae - undifferentiated
983	PS	Teleost	Syngnathidae	37282085	*Maroubra perserrata*	Sawtooth pipefish	Added from Syngnathidae - undifferentiated
1001	PS	Teleost	Syngnathidae	37282095	*Notiocampus ruber*	Red pipefish	Added from Syngnathidae - undifferentiated
1070	PS	Teleost	Syngnathidae	37282098	*Solegnathus dunckeri*	Duncker's pipehorse	Added from Syngnathidae - undifferentiated
1029	PS	Teleost	Syngnathidae	37282100	*Syngnathoides biaculeatus*	Double-end pipehorse	Added from Syngnathidae - undifferentiated
1093	PS	Teleost	Syngnathidae	37282102	*Vanacampus margaritifer*	Mother-of-pearl pipefish	Added from Syngnathidae - undifferentiated
950	PS	Teleost	Syngnathidae	37282105	*Hippocampus minotaur*	Bullneck seahorse	Added from Syngnathidae - undifferentiated
1591	PS	Teleost	Syngnathidae	37282107	*Halicampus boothae*	Booth's pipefish	Added from Syngnathidae - undifferentiated

ERA SPECIES ID	ROLE IN FISHERY	TAXA	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
1602	PS	Teleost	Syngnathidae	37282117	*Hippocampus tristis*	Sad seahorse	Added from Syngnathidae - undifferentiated
1664	PS	Teleost	Syngnathidae	37282120	*Hippocampus abdominalis*	Bigbelly seahorse	Added from Syngnathidae - undifferentiated
6359	PS	Teleost	Syngnathidae	37282127	*Idiotropiscis lumnitzeri*	Sydney's pygmy pipehorse	Added from Syngnathidae - undifferentiated
1548	PS	Teleost	Syngnathidae	37282130	*Heraldia sp. 1* [in Kuiter, 2000]	Western upsidedown pipefish	Added from Syngnathidae - undifferentiated

Scoping Document S2B1. Benthic Habitats

Since the previous assessments over a decade ago, there has been considerable research and habitat identification and modelling of demersal habitats around Australia and specifically in the SESSF region (Hobday et al. 2011a; Pitcher et al. 2015, 2016; Williams et al. 2009, 2010a, b, c, 2011). This has culminated in Pitcher et al. 2016 in an FRDC –funded project, redefined much of the Australian seafloor based on meso-scale surrogates collated from data from biological surveys, environmental data, protected area/fishery closure data. Assemblages (=habitat) types were predicted, mapped (Figure 2.1) and overlaid with the footprint of the fishery being assessed.

The new data and new methodology is not directly mappable to the original analyses but these assessments are more comprehensive than the previous assessments, and will therefore be used in preference to the original SICA. The temporal range of the fishery effort data of Pitcher et al. (2016) was from 1985 -~2012 is immediately prior to this assessment period. Since 2012 the effort has declined slightly while fishery footprint has not changed significantly therefore it was considered a relevant assessment and superior to the previous. Importantly, the new method of trawl footprint assessment used combined with the large reduction in fishery effort and increase in areas closed to trawling, often resulted in a smaller footprint than previous assessments (Figure 2.2).

From that assessment, assemblage 20 on the Vic/NSW shelf and assemblage 4 on the Bonney coast upper slope had the highest exposure to trawling (43.7% footprint and 76.3% swept area; 36.3% footprint and 80.6% swept area respectively; Table 2.6). Other assemblages exposed to trawling at an 'intermediate' level were 1 and 2 on the NSW shelf and outer shelf, effectively sandwiching assemblage 20. While these areas are heavily exposed, we needed to consider which of these assemblages contained the most vulnerable types of habitats and were potentially exposed to trawling. The most vulnerable types of habitats were identified in Williams et al. (2011) and their locations were identified by A. Williams (CSIRO) (pers. comm. 19 Feb 2018) as follows and as in Table 2.7:

- Sub-cropping friable sandstone supporting sponge gardens (in assemblage 20)
- Relict stalked crinoid on shelf breaks (in assemblage 2)
- Bryozoans on shelf edge (in assemblages 4, 14, 9)
- Tree-forming octocorals and black corals in steep upper-slope banks (in assemblage 2, 8).

Consequently, assemblages 20 and 4 were considered the most vulnerable assemblages in the SESSF SET based on the knowledge that they contained vulnerable habitat types and were the most heavily trawled. However, there is no actual evidence to show that these habitats have actually been impacted by trawling over the past decade.

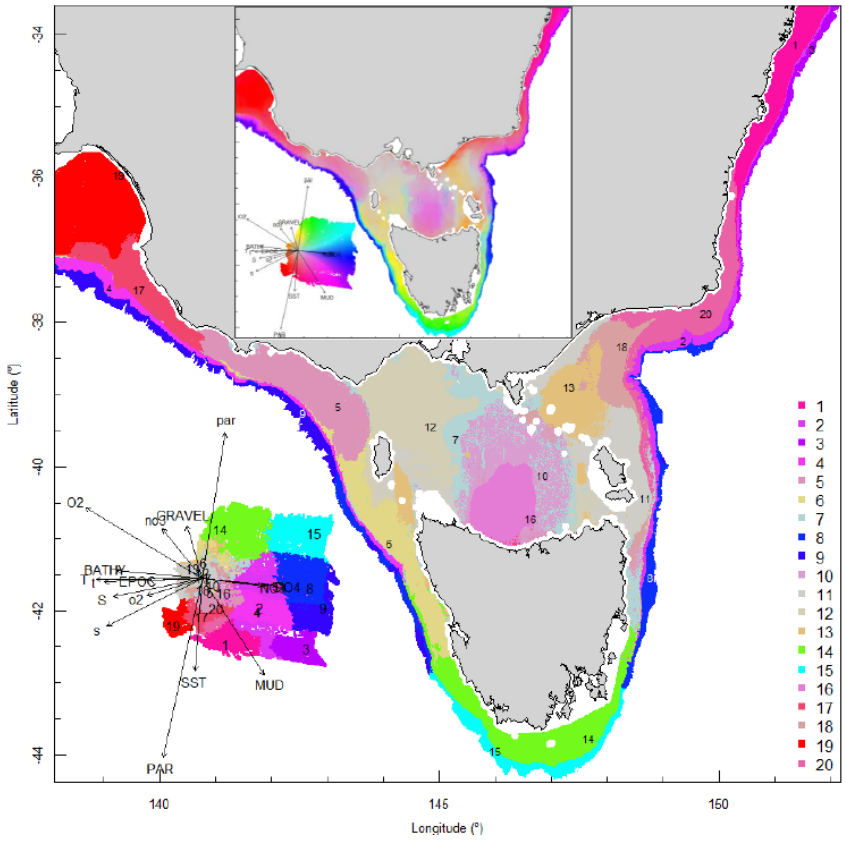


Figure 2.1. Map of the SESSF otter trawl region showing the 20 assemblages derived by Pitcher et al. 2016. Each of the assemblages are now used as proxies for habitat in the assessment (Excerpt from Pitcher et al. 2016).

Table 2.6. Overlap of trawl fishery with assemblages in SESSF. (Excerpt from Pitcher 2016).

Assemblage	Grid count	Area(km²)	CMR_IA	CMR_II	CMR_VI	CMRs	% CMR	MPAs	Closures	%Closed	Any Clsd	Total%Clsd	Grounds	Uniform	Random	% Trawled	Trl Swept	% Swept
1	9,139	9,271			264	264	2.9	0	999	10.8	1,258	13.6	7,676	2,816	2,313	24.9	4,557	49.2
2	7,040	6,792		18	371	389	5.7	0	2,234	32.9	2,281	33.6	5,449	1,827	1,463	21.5	2,706	39.8
3	3,068	3,097			518	518	16.7	0	2,001	64.6	2,128	68.7	1,178	43	42	1.4	43	1.4
4	5,846	5,655			72	72	1.3	0	1,510	26.7	1,547	27.4	4,773	2,495	2,051	36.3	4,556	80.6
5	17,656	16,943			1,056	1,056	6.2	0	1,529	9.0	2,586	15.3	5,630	1,003	885	5.2	2,467	14.6
6	13,051	12,158		12	856	867	7.1	0	73	0.6	902	7.4	5,048	517	467	3.8	1,338	11.0
7	15,985	15,140		163	1,115	1,278	8.4	0	6,728	44.4	7,944	52.5	1,788	551	452	3.0	907	6.0
8	8,338	7,796	586	102	398	1,086	13.9	0	4,659	59.8	4,678	60.0	3,803	342	299	3.8	362	4.6
9	8,111	7,790			242	242	3.1	0	5,130	65.8	5,130	65.8	3,641	251	228	2.9	251	3.2
10	16,138	15,261		7	616	623	4.1	0	12,102	79.3	12,679	83.1	752	242	187	1.2	283	1.9
11	16,214	15,383			938	938	6.1	0	10,880	70.7	11,546	75.1	1,807	60	57	0.4	60	0.4
12	24,508	23,388			825	825	3.5	0	11,427	48.9	11,801	50.5	1,796	184	165	0.7	222	0.9
13	12,247	11,690			1,631	1,631	14.0	0	5,352	45.8	6,963	59.6	262	21	19	0.2	49	0.4
14	15,064	13,507	691	23	2,625	3,339	24.7	0	30	0.2	3,346	24.8	6,570	2,089	1,709	12.7	3,268	24.2
15	5,690	5,069	9		1,813	1,822	35.9	0	1,967	38.8	2,093	41.3	1,402	73	69	1.4	74	1.5
16	9,965	9,353				0	0.0	0	9,340	99.9	9,340	99.9	13	5	4	0.0	5	0.1
17	8,834	8,652				0	0.0	0	3,945	45.6	3,945	45.6	3,209	799	686	7.9	1,551	17.9
18	9,116	8,761			601	601	6.9	0	1,204	13.7	1,768	20.2	4,653	748	629	7.2	963	11.0
19	17,471	17,367			3,583	3,583	20.6	0	12,150	70.0	13,522	77.9	186	3	3	0.0	3	0.0
20	13,319	12,970			13	13	0.1	0	112	0.9	122	0.9	12,112	7,386	5,665	43.7	9,899	76.3
	236,800	**226,043**	**1,286**	**326**	**17,537**	**19,148**	**8.5**	**0**	**93,372**	**41.3**	**105,579**	**46.7**	**71,747**	**21,456**	**17,393**	**7.7**	**33,565**	**14.8**

The lack of evidence to prove direct impact from trawling impedes further analysis. Furthermore using the more recent assessments by Pitcher et al. 2016 ideally need to be incorporated into the ERAEF protocol. Consequently the SICA is preliminary and further assessment at Level 2 is not possible at this time.

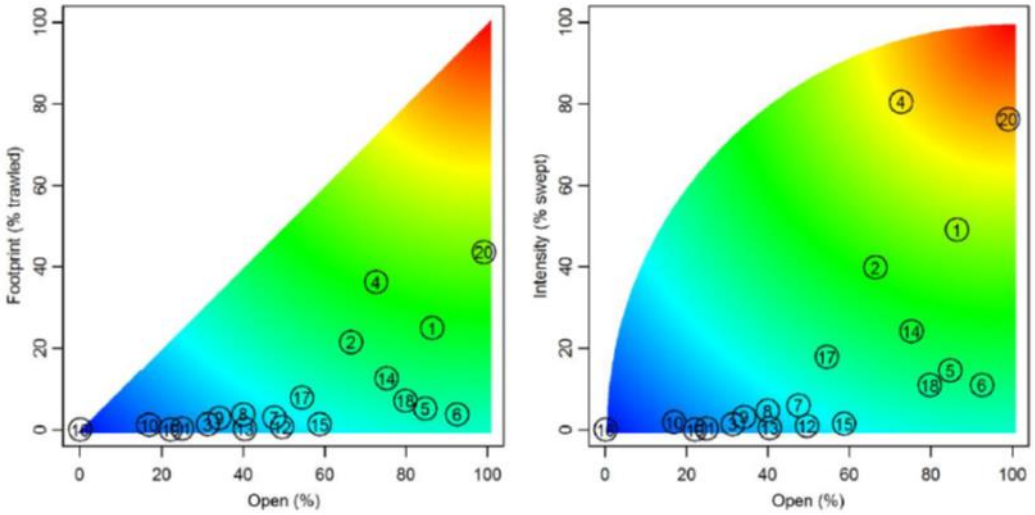


Figure 2.2. Area of area of assemblage open to potential trawling against actual exposure derived from trawl footprint (%) and area swept by in the SESSF trawl sector. The assemblages potentially at higher risk are therefore those towards the top right of the graphs (Excerpt from Pitcher et al. 2016).

Table 2.7. Benthic habitats that occur within the jurisdictional boundary of the SESSF CTS otter trawl sub-fishery. Further details of these assemblages were not available.

Biome	ERAEF Assemblage Number	Habitat type
SET	1	
	2	Relict stalked crinoid on shelf breaks, Tree-forming octocorals and black corals in steep upper-slope banks
	3	
	4	Bryozoans on shelf edge
	5	
	6	
	7	
	8	Tree-forming octocorals and black corals in steep upper-slope banks
	9	Bryozoans on shelf edge
	10	
	11	
	12	
	13	
	14	Bryozoans on shelf edge
	15	

Biome	ERAEF Assemblage Number	Habitat type
	16	
	17	
	18	
	19	
	20	Sub-cropping friable sandstone supporting sponge gardens

Scoping Document S2B2. Pelagic Habitats

Table 2.8. Pelagic habitats for the SESSF CTS otter trawl sub-fishery. Shading denotes habitats occurring within the jurisdictional boundary of the fishery. Bolded text refers to pelagic habitats where fishing effort has occurred.

ERAEF Pelagic Habitat No.	Pelagic Habitat type	Depth (m)	Comments	Source
P1	Eastern Pelagic Province - Coastal	0 – 200		ERA pelagic habitat database based on pelagic communities definitions
P2	Eastern Pelagic Province - Oceanic	0 – > 600	this is a compilation of the range covered by Oceanic Community (1) and (2)	ERA pelagic habitat database based on pelagic communities definitions
P3	Heard/ McDonald Islands Pelagic Provinces - Oceanic	0 - >1000	this is a compilation of the range covered by Oceanic Community (1) and (2)	ERA pelagic habitat database based on pelagic communities definitions
P4	North Eastern Pelagic Province - Oceanic	0 – > 600	this is a compilation of the range covered by Oceanic Community (1) and (2)	ERA pelagic habitat database based on pelagic communities definitions
P5	Northern Pelagic Province - Coastal	0 – 200		ERA pelagic habitat database based on pelagic communities definitions
P6	North Western Pelagic Province - Oceanic	0 – > 800	this is a compilation of the range covered by Oceanic Community (1) and (2)	ERA pelagic habitat database based on pelagic communities definitions
P7	Southern Pelagic Province - Coastal	0 – 200	this is a compilation of the range covered by Coastal pelagic Tas and GAB	ERA pelagic habitat database based on pelagic communities definitions
P8	Southern Pelagic Province - Oceanic	0 – > 600	this is a compilation of the range covered by Oceanic Communities (1, 2 and 3)	ERA pelagic habitat database based on pelagic communities definitions
P9	Southern Pelagic Province - Seamount Oceanic	0 – > 600	this is a compilation of the range covered by Seamount Oceanic	ERA pelagic habitat database based on pelagic communities definitions

ERAEF Pelagic Habitat No.	Pelagic Habitat type	Depth (m)	Comments	Source
			Communities (1), (2), and (3)	
P10	Western Pelagic Province - Coastal	0 – 200		ERA pelagic habitat database based on pelagic communities definitions
P11	Western Pelagic Province - Oceanic	0 – > 400	this is a compilation of the range covered by Oceanic Community (1) and (2)	ERA pelagic habitat database based on pelagic communities definitions
P12	Eastern Pelagic Province - Seamount Oceanic	0 – > 600	this is a compilation of the range covered by Seamount Oceanic Communities (1) and (2)	ERA pelagic habitat database based on pelagic communities definitions
P13	Heard/ McDonald Islands Pelagic Provinces - Plateau	0 -1000	this is a the same as community Heard Plateau 0-1000m	ERA pelagic habitat database based on pelagic communities definitions
P14	North Eastern Pelagic Province - Coastal	0 – 200		ERA pelagic habitat database based on pelagic communities definitions
P15	North Eastern Pelagic Province - Plateau	0 – > 600	this is a compilation of the range covered by the North Eastern Seamount Oceanic (1) and (2)	ERA pelagic habitat database based on pelagic communities definitions
P16	North Eastern Pelagic Province - Seamount Oceanic	0 – > 600		ERA pelagic habitat database based on pelagic communities definitions
P17	Macquarie Island Pelagic Province - Oceanic	0 – 250		ERA pelagic habitat database based on pelagic communities definitions
P18	Macquarie Island Pelagic Province - Coastal	0 - > 1500	this is a compilation of the range covered by Oceanic Community (1) and (2)	ERA pelagic habitat database based on pelagic communities definitions

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 bioregionalisation for the slope (IMCRA 1998; Last et al. 2005). The spatial boundaries for the pelagic communities are based on pelagic bioregionalisation 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 occur in the SESSF CTS otter trawl sub-fishery (x). Shaded cells indicate all communities within the province. Bold crosses refer to communities where fishing actually occurred in the SESSF CTS otter trawl sub-fishery.

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 and McDonald Is	Macquarie Is
Inner Shelf 0 – 110m [1,2]					x	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										
Mid–Upper Slope 565 – 820m[3]					x	x		x	x										
Mid Slope 820 – 1100m[3]					x	x		x	x										
Lower slope/ Abyssal > 1100m[6]					x	x		x	x										
Reef 0 -110m[7, 8]																			
Reef 110-250m[8]																			
Seamount 0 – 110m																			
Seamount 110- 250m																			
Seamount 250 – 565m																			
Seamount 565 – 820m																			
Seamount 820 – 1100m																			

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 and McDonald Is	Macquarie Is
Seamount 1100 – 3000m								x											
Plateau 0 – 110m																			
Plateau 110- 250m[4]																			
Plateau 250 – 565m[4]																			
Plateau 565 – 820m[5]																			
Plateau 820 – 1100m[5]																			

[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 and 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.

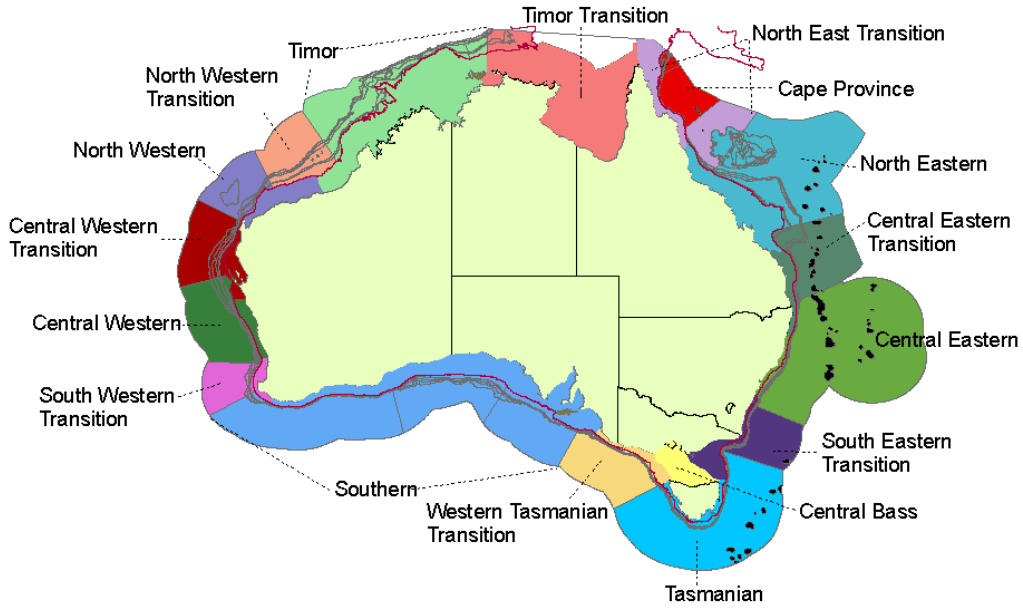
Scoping Document S2C2. Pelagic Communities

Table 2.10. Pelagic communities in which fishing activity occurs in the SESSF CTS otter trawl sub-fishery (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					
Oceanic (1) 0 – 600m		x						
Oceanic (2) >600m		x						
Seamount oceanic (1) 0 – 600m								
Seamount oceanic (2) 600–3000m								
Oceanic (1) 0 – 200m								
Oceanic (2) 200-600m								
Oceanic (3) >600m			x					
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								
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 m.

(a)



(b)

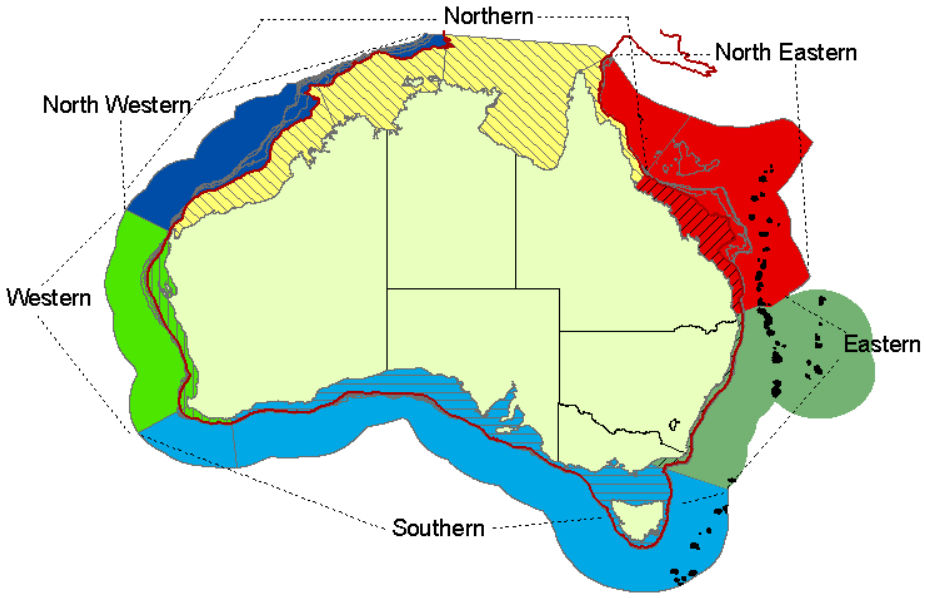


Figure 2.3 (a) Demersal communities around mainland Australia based on bioregionalisation schema. Some inshore (0-110 m) communities comprise more than one community e.g. Timor Transition comprises 4 distinct communities. b) Australian pelagic provinces. Hatched areas indicate coastal epipelagic zones overlying the shelf. Offshore (oceanic) provinces comprise two or more overlaying pelagic zones as indicated in Table 2.10. Seamounts (black) and plateaux (light green) are illustrated in their demersal or pelagic provinces.

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 (target, 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; EMOs), those should be used (e.g. Strategic Assessment Reports). 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
Key Commercial and secondary commercial species	Avoid recruitment failure of the key/secondary commercial 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 commercial species would be acceptable. 1.2. To ensure that population at acceptable level by the assessment. 1.3. TAC levels are specified. 1.4. This is a general objective for all AFMA fisheries as per Fisheries Management Act 1991 (objective (b): ensuring that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of ecologically sustainable development).
		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.
		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 Covered in general by 1.2 EMO and AMO. The size range of species suggests that the fishery is not targeting recruitment or spawning grounds.

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
		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 to behaviour that are deleterious to the species and populations are to be avoided.
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 byproduct and bycatch species would be acceptable. 1.2. To ensure that population at acceptable level by the assessment. Covered by EMO and AMO that ensures the fishery does not threaten bycatch species. 1.3. TAC levels are specified. EMO/AMO - annual reviews of all information on bycatch species with the aim of developing species specific bycatch limits. 1.4. This is a general objective for all AFMA fisheries as per Fisheries Management Act 1991 (objective (b): and mentions specifically non-target species and the long term sustainability of the marine environment.)
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity does not change outside	Presence of population across space	2.1 Not currently monitored. No specific management objective based on the geographic range of byproduct/bycatch species.

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
			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 Not currently monitored. No reference levels established. No specific management objective based on the genetic structure of bycatch species.
		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 EMO – move on provisions require that if bycatch in any one haul exceeds set limits then the vessel must not use that fishing method within 5 nm of that site for at least 5 days.
		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 Trawling does not appear to attract bycatch species or alter their behaviour and movement patterns, resulting in the attraction of species to fishing grounds.
Protected species	Avoid recruitment failure of protected species Avoid negative consequences for protected	1. Population size	1.1 Species do not further approach extinction or become extinct 1.2 No trend in biomass	Biomass, numbers, density, CPUE, yield	1.1 EMO – This is a general objective for all AFMA fisheries as per Fisheries Management Act 1991 objective (1b): ensuring that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of ecologically sustainable development); and objective (2):

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
	species or population sub-components Avoid negative impacts on the population from fishing		1.3 Maintain biomass above a specified level 1.4 Maintain catch at specified level		ensuring, through proper conservation and management measures, that the living resources of the AFZ are not endangered by over-exploitation; Therefore 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 does not change outside acceptable bounds	Presence of population across space, i.e. the Southern Ocean	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.
		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)	Egg production of population Abundance of recruits	5.1 The reproductive capacity of protected species is of concern because potential fishery induced changes in reproductive ability may have immediate impact on the population size of protected species.

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
			Recruitment to the population does not change outside acceptable bounds		
		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 Trawling 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 or its ability to recover	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.
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, trawling 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 – General objective for all AFMA fisheries as per Fisheries Management Act 1991 (objective 1b): ensuring that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of ecologically sustainable development. The fishery is conducted, in a manner that minimises the impact of fishing operations on benthic habitat.
		4. Habitat types	4.1 Relative abundance of habitat types does not vary outside	Extent and area of habitat types, % cover, spatial pattern, landscape scale	4.1 Trawling activities may result in changes to the local habitat types on fishing grounds.

Component	Core Objective	Sub-component	Example Operational Objectives	Example Indicators	Rationale
			acceptable bounds		
		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 Trawling 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 – General objective for all AFMA fisheries as per Fisheries Management Act 1991 (objective 1b): ensuring that the exploitation of fisheries resources and the carrying on of any related activities are conducted in a manner consistent with the principles of ecologically sustainable development) in particular the need to have regard to the impact of fishing activities on non-target species and the long term sustainability of the marine environment.
		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 of the community	3.1 Community range does not vary outside acceptable bounds	Geographic range of the community, continuity of range, patchiness	3.1 Demersal trawling operations have unknown impacts on the benthos in the fishing grounds. The current MPA and 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 Trawling 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 but other activities might e.g. aquaculture.

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: Southern Eastern Shark and Scalefish Fishery (Commonwealth Trawl Sector)
Sub-fishery name: Otter trawl
Date completed: February 2018

Table 2.12. Hazard identification, score and rationale(s) for the SESSF CTS otter trawl sub-fishery.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	SCORE (0/1)	DOCUMENTATION OF RATIONALE
Capture	Bait collection	0	Not required by this fishery method.
	Fishing	1	Actual fishing, i.e. capture of small pelagic species resulting from deployment and retrieval of midwater trawl net including key commercial, bycatch, byproduct and protected species caught but not landed.
	Incidental behaviour	0	Activities such as recreational fishing are not permitted or occur rarely.
Direct impact without capture	Bait collection	0	Not required for this fishery method.
	Fishing	1	Trawling is most likely to impact benthic habitats and animals as the gear contacts seafloor. Unknown mortality on fish arising from net escapement. Birds, seals and dolphins may also interact with gear at times resulting in injury or mortality.
	Incidental behaviour	0	Activities such as recreational fishing are not permitted or occur rarely.
	Gear loss	1	Major gear loss reported rarely and no information on minor components.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	SCORE (0/1)	DOCUMENTATION OF RATIONALE
	Anchoring/ mooring	1	Vessels may anchor inshore occasionally when not fishing but most fishing grounds too deep to anchor.
	Navigation/steaming	1	Steaming/navigation to find aggregations of fish may result in collisions (e.g. seabirds or whales vessel interactions), seabird collisions with night-time lights/navigation lights.
Addition/ movement of biological material	Translocation of species	1	No bait used but vessels travel throughout the Fishery potentially translocation via hull, or net-cleaning but no known reports
	On board processing	1	Factory vessels operated in early part of assessment period. FMP generally prohibits processing at sea unless specifically authorised and all fish must be landed whole or gilled, headed and gutted, with special conditions for sharks and rays. Offal and offcuts would be discharged when appropriate.
	Discarding catch	1	Discarding is common.
	Stock enhancement	0	None occurs
	Provisioning	0	None occurs
	Organic waste disposal	0	Disposal of organic wastes should not occur under MARPOL regulations
Addition of non-biological material	Debris	0	Rubbish generated during general fishing vessel operations usually disposed of ashore..
	Chemical pollution	0	Waste discharge from vessels should not occur under MARPOL regulations.
	Exhaust	1	Vessel introduces exhaust into the environment.
	Gear loss	1	Major gear losses of whole nets rare and usually retrieved. no information on minor components loss
	Navigation/ steaming	1	Trawling operations involves vessel navigating to and from fishing grounds. Introducing noise and visual stimuli. Depth sounders/ acoustic net positioning systems have potential to disturb marine species.
	Activity/ presence on water	1	Vessel introduces noise and visual stimuli into the environment.
Disturb physical processes	Bait collection	0	Bait not required by fishery.
	Fishing	1	Trawling may disturb seabed sediments and structure.
	Boat launching	0	Not applicable. Vessels in fishery come from designated ports.
	Anchoring/ mooring	1	Anchoring/mooring may affect the physical processes in the area where anchors and anchor chains contact the seafloor.
	Navigation/ steaming	1	Trawling operations involves navigating to and from fishing grounds. Navigation/steaming introduces noise to environment. Depth sounders/ acoustic net positioning systems have potential to disturb marine species.
External Hazards (specify the particular example within each activity area)	Other capture fishery methods	1	Other fisheries operating in the CTS: - Danish seine. Also operating in the same area are fisheries in the GHAT sector: Scalefish Hook – demersal longline, auto-longline, dropline; trap; Shark gillnet; Shark demersal longline; tuna fisheries- the SBT, ETBF; squid jig; Bass Strait scallop; recreational, and state fisheries operate in adjacent waters.
	Aquaculture	1	Salmon and mollusc aquaculture occurs in inshore (state waters) in Tasmania and more broadly along the eastern seaboard respectively. May change the water chemistry by adding nutrients and attract predators to the local regions.
	Coastal development	1	Sewage discharge, agricultural runoff, pollution from ports and coastal towns could impact shelf fisheries and may affect

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	SCORE (0/1)	DOCUMENTATION OF RATIONALE
			breeding grounds and nursery areas for some of the species in the fishery
	Other extractive activities	1	Petroleum/gas exploration and associated activities e.g. seismic and drilling occurs in Bass Strait/GAB.
	Other non-extractive activities	1	Defence and major coastal shipping activity, submarine cables occurs in the fishery.
	Other anthropogenic activities	1	Tourist activities and charter fishing occurs in the fishery.

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.
	Fishing	Fishing activities 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
	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:

- SESSF Management Plan
- SESSF Management Arrangements Booklet 2017
- Harverst Strategy Framework. https://www.afma.gov.au/sites/default/files/uploads/2017/03/SESSF-Harvest-Strategy-Framework-2017-final.pdf

Other publications that may have provided information include:

- Rebuilding Strategies
- ABARES Fishery Status Reports
- Previous risk assessments and residual risk assessments;
    - http://www.afma.gov.au/wp-content/uploads/2014/11/GABT-Otter-Board-Trawl-Residual-Risk-2012.pdf;
    - http://www.afma.gov.au/wp-content/uploads/2014/11/Otter-Trawl-Residual-Risk-Assessment-2014.pdf;
    - http://www.afma.gov.au/wp-content/uploads/2014/11/SESSF-ERM-Strategy-2015.pdf

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, 15 out of 26 possible internal activities were identified as occurring in this sub-fishery. Six out of six external scenarios were also identified. Thus, a total of 21 activity-component scenarios will be considered at Level 1. This results in 125 total scenarios (of 160 possible) to be developed and evaluated using the unit lists (Key commercial/secondary, byproduct/bycatch, protected 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/secondary commercial; 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 1.2) (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 (Table 2.17).

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 (see description; Table 2.18).

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

2.3.10 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 Table above).

Level 1 (SICA) Document L1.1 Key commercial/secondary commercial species.

Note: The direct impact of fishing hazard (i.e. Capture: Fishing) for key/seondary commercial species that have stock assessments is no longer assessed at L1.

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	0									
	Fishing	1	6	6	Population size	Gould's squid	1.1, 1.3, 1.4	4	3	1	Fishing occurs throughout the year over the SESSF. Population size likely to be affected before major changes in other sub-components. Gould's squid is within the top 70% of the total catch in the SESSF within this assessment period. It is not currently assessed within the SESSF fishery and therefore has no formal stock assessment. Intensity: major as occurs over broader spatial scale and reasonbly often. Consequence: moderate as stock status is unknown and not managed under the quota system. Confidence: low as biomass estimates are unknown.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	6	6	Population size	Latchet; red gurnard	1.2	4	3	1	Fishing occurs throughout the year over the entire SESSF. Injury/mortality to this species as a result of passing through the net is expected to have highest potential risk for the population size sub-component. This species chosen as units of analysis because small ones are known to pass through nets (AFMA Observer, pers. comm). Intensity: major as small fish escape the net. Consequence: moderate as impact unlikely to affect long-term recruitment dynamics, but could affect population size. Confidence: low because of lack of data on mortality of these fish species after they have escaped net.

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	0									
	Gear loss	1	1	3	Population size	Gould's squid	1.2	2	1	2	Gear loss rarely occurs. Lost gear resulting in damage/mortality most likely to affect population size of this species. Intensity: minor - lost gear is considered to be rare. Consequence: negligible as impact considered unlikely to be measurable at the scale of this stock. Confidence: high because it is known that very little gear is lost, and if so, most are retrieved (AFMA Observer, pers. comm.) and interaction with this species is considered unlikely.
	Anchoring/ mooring	1	3	4	Population size	Gould's squid	1.2	2	1	2	Anchoring/mooring possible over this scale although probably only in bays. Direct impact (damage or mortality) that occurs when anchoring or mooring most likely to affect population size of this species. Juveniles enter coastal bays and adults to spawn. Therefore, this species is considered most vulnerable to impact. Intensity: minor - occurs in restricted locations. Consequence: negligible, unlikely to detect impact on this species. Confidence: high because it is considered very unlikely for there to be damage or mortality to this species associated with anchoring/mooring.
	Navigation/ steaming	1	6	6	Population size	Gould's squid	1.2	3	1	2	Fishing activity hence navigation/steaming occurs throughout the year over the SESSF. Direct impact (damage or mortality) without capture due to navigation/steaming was considered most likely to affect population size of this species. Gould's squid may be close to surface if attracted by lights on the vessel. . Intensity: moderate- navigation/steaming is a large component of the SESSF operations. Consequence: negligible, as unlikely to be measurable. Confidence: high because it was considered unlikely for there to be strong interactions between navigation/steaming and damage or mortality of Gould's squid.

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/ movement of biological material	Translocation of species	1	6	6	Population size	Gould's squid	1.2	1	1	1	Translocation of species could occur throughout the year over the entire SESSF. Translocation of species was considered most likely to affect population size of this species possibly through transmission of disease. Squid are pelagic so may be closer to the surface than other species. Intensity: negligible as detection of impact was considered to have remote likelihood. Consequence: negligible; unlikely to be measurable. Confidence: low, based on lack of information on translocation of species by trawlers in the SESSF.
	On board processing	1	6	6	Behaviour/ movement	Tiger flathead; Pink ling	6.1	3	2	2	Some onboard processing occurs in the fishery with factory vessels. However, on-board processing on smaller vessels occurs by discarding of organic waster overboard (head and gutted fish). This is most likely to affect behaviour/movement of this species if scavengers are attracted. This species is not known to feed on materials processed onboard. However, it is considered most likely of the unlikely species that could be a scavenger, as these species are highly piscivorous and voracious. Intensity: moderate because onboard processing is common (AFMA Observer database; AFMA Observer, pers.comm.). Consequence: minor as impact is likely to be minimal. Confidence: high as onboard processing is considered widespread.
	Discarding catch	1	6	6	Behaviour/ movement	Tiger flathead; Pink ling	6.1	3	2	1	Discarding is common over the SESSF and occurs frequently mostly likely along the shelf. This activity will most likely affect behaviour/movement of this species if scavengers are attracted. These species is considered most likely that could scavenge and feed on discarded catch as they are piscivorous and vivacious. Intensity: moderate because these species are widespread. Consequence: minor as impact is likely to be minimal. Confidence: low due to lack of available data on movement behaviour of these species based on this activity.
	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	0									
	Organic waste disposal	0									
Addition of non-biological material	Debris	0									
	Chemical pollution	0									
	Exhaust	1	6	6	Behaviour/ movement	Gould's squid	6.1	1	1	2	Fishing activity hence exhaust emissions occur over SESSF. Exhaust emission is expected to pose greatest potential risk for the behaviour/movement of this species due to repulsion. This species considered most vulnerable as juveniles are pelagic. Intensity: negligible because although the hazard occurs over a large range/scale, impact area is only within metres of the vessel. Consequence: negligible fumes do not effect water. Confidence: high because localised exhaust unlikely to impact on behaviour/movement of this species.
	Gear loss	1	1	3	Population size	Gould's squid	1.2	2	1	2	Fishing occurs throughout the year over the SESSF. Gear loss believed to occur rarely. Lost gear not resulting in damage/mortality most likely to affect population size of this species. Intensity: minor because lost gear–species interactions (if they occur) are considered to be rare. Consequence: considered unlikely to be measurable at the scale of squid stocks. Confidence: high because it is known that very little gear is lost, and interaction with species is considered unlikely.
	Navigation/ steaming	1	6	6	Behaviour/ movement	Gould's squid	6.1	4	1	1	Fishing activity hence navigation/steaming occurs throughout the year over the SESSF. Navigation/steaming of fishing vessels was expected to pose greatest potential risk for the behaviour/movement of this species resulting in disruption to feeding and/or movement by introducing noise into the environment. This species considered most vulnerable as stock status is unknown and juveniles are pelagic. Intensity: major the hazard was considered over a large range/scale. Consequence: negligible with any

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
											consequence of navigation/steaming impacts unlikely to be measurable for this species. Confidence: low because addition of non-biological material due to navigation/steaming to impact and have consequences for the behaviour/movement of this species is unlikely, but not known.
	Activity/ presence on water	1	6	6	Behaviour/ movement	Gould's squid	6.1	4	2	1	Fishing occurs throughout the year over the SESSF therefore vessels activity/present on water. Vessels in the area do attract (or avoid) animals. This species could have an avoidance reaction to acoustic signals, and could use echo-location. Intensity: major. Consequence: minor as any spawning aggregations could be disturbed. Confidence: low because available data on acoustic disturbance on a spawning on the behaviour/movement of this species is unknown.
Disturb physical processes	Bait collection	0	0	0							
	Fishing	1	6	6	Population size	Blue grenadier	1.2	4	2	1	Fishing activity hence disturbance of physical processes occurs throughout the year over the SESSF. Disturbance of physical processes due to fishing considered most likely to affect population size of this species. This species considered most likely to be affected as they are bottom-dwellers and fishing may disturb sediments. Intensity: major as disturbance of sediment may occur often over broad spatial scale. Consequence: minor as sediment disturbance not likely to affect population size or dynamics of this species. Confidence: low because little information is available.
	Boat launching	0									
	Anchoring/ mooring	1	3	4	Behaviour/ movement	Gould's squid	6.1	2	1	2	Fishing occurs throughout the year over the SESSF. Anchoring/mooring possible over this scale although probably only in bays. Disruption of the sediments may occur from anchoring through the contact with the bottom. Disturbance to physical processes from anchoring or mooring most likely to affect behaviour/movement of this species. Juveniles enter

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
											coastal bays so considered most vulnerable to impact. Intensity: minor - occurs in restricted locations.. Consequence: negligible. Confidence: high because it is considered very unlikely for there to be strong interactions between this species and disturbance to physical processes from anchoring/mooring.
	Navigation/ steaming	1	6	6	Behaviour/ movement	Gould's squid	6.1	1	1	2	Navigation/steaming occurs throughout the year over the SESSF. Disturbance to physical processes due to Navigation/steaming of fishing vessels was expected to pose greatest potential risk for the Behaviour/movement of this species resulting in disruption to feeding. This species considered most vulnerable as population status is unknown and juveniles are pelagic. Intensity: negligible because although the hazard was considered over a large range/scale, navigation/steaming considered to only impact a small area (< 1 nm). Consequence: negligible with any impact of navigation/steaming unlikely to be measurable for this species. Confidence: high because navigation/steaming unlikely to impact and have consequences for the behaviour/movement of this species.
External impacts	Other fisheries	1	6	6	Population size	Gould's squid	1.2	3	4	1	Fishing occurs throughout the year over the SESSF. Capture of fish from non-trawl fishery (squid jigs in the SSJ and state fisheries) most likely to affect population size of this species. The population status of this species in the SESSF is unknown and currently is not subject to quota limits. Intensity: moderate as there is potential for severe impacts on population size if all quota is caught from this fishery. Consequence: major as population may not recover if overfished. Confidence: low because there is no current accepted quantitative assessment for this species within the SESSF.
	Aquaculture	1	3	6	Behaviour/ movement	Gould's squid	6.1	2	2	1	Aquaculture occurs at sites throughout SE Australian in harbours, bays and estuaries (out of jurisdiction) adjacent to inner shelf habitats. Salmon aquaculture in Tasmanain waters could affect behaviour/movement of this species. This species selected as both juveniles and adults are known to occur in large marine embayments which could coincide with

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
											aquaculture sites. Intensity: minor as co-location of aquaculture sites and juveniles could occur rarely. Consequence: minor, as aquaculture expected to have minimal impact on Gould's squid behaviour/movement. Confidence: low as there is little data on the co-location of aquaculture sites and juvenile Gould's squid
	Coastal development	1	6	6	Behaviour/ movement	Gould's squid	6.1	3	2	1	Coastal development occurs throughout the SESSF. Most likely to affect behaviour/movement of target species as available habitat is occupied. This species selected as the sub-adults and adults are known to occur in large marine embayments which could coincide with coastal development. Intensity: moderate, both broad coastal development and localised centres. Consequence: minor as coastal development expected to have minimal impact on Gould's squid behaviour/movement. Confidence: low as there is little data available.
	Other extractive activities	1	4	6	Behaviour/ movement	Gould's squid	6.1	3	2	1	Ongoing development and expansion of oil and gas pipelines, oil and gas exploration and extraction drilling, and seismic survey for further oil and gas exploration occurs across southern Australia (e.g. Bass Strait). Most likely to affect behaviour/movement of this species. The auditory and lateral line sensory acuity of this species could be affected by seismic survey. Intensity: moderate as local effects may be severe. Consequence: minor as effect on population dynamics expected to be minimal. Confidence: low as potential effects are unknown for this species.
	Other non extractive activities	1	5	6	Behaviour/ movement	Tiger flathead	6.1	3	2	1	Major shipping routes, naval activities is likely to have minor effects on the movement and behaviour of this species. Intensity: moderate. Consequence: minor, as impact on behaviour/movement of this species is considered to be minimal. 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	5	6	Behaviour/ movement	Tiger flathead	6.1	2	1	1	Tourism, recreational boating 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, as restricted area rare event short term effects. Confidence: low, limited available 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	0									
	Fishing	1	6	6	Population size	Endeavour dogfish	1.1 1.3 1.4	4	3	2	Fishing occurs throughout the year over the SESSF. Population size likely to be affected before major changes in other sub-components.This species was EPBC listed as conservation dependent in 2013. It has low fecundity and populations will take a long time to recover (estimated mean generation time of 28.5 years). Intensity: major as mostly caught along the upper slope along southeastern Australia (within the SESSF). Consequence: moderate as stock is protected based on spatial closures introduced (see: Upper slope Dogfish Management Strategy implemented in 2012). Confidence: high as there is consistent evidence for a declining resource.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	6	6	Population size	Bigeye ocean perch	1.2	3	2	1	Fishing occurs throughout the year over the SESSF. Injury/mortality to bycatch species as a result of passing through the net is expected to have highest potential risk for the population size sub-component.This species was chosen as unit of analysis because it is believed to be a common species to pass through nets. Intensity: major, as small fish escaping the net occurs at broader spatial scale or locally severe (mainly fished in waters 250-500 m depth along South Eastern Transition region). Consequence: moderate as post-escapement mortality rate unlikely to affect long-term recruitment dynamics.

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
											Confidence: low – no data onpost-escapement mortality for this species.
	Incidental behaviour	0									
	Gear loss	1	1	3	Population size	Bigeye ocean perch	1.2	2	1	2	Fishing occurs throughout the year over the SESSF. Gear loss occurs rarely and any lost gear resulting in damage/mortality most likely to affect population size of this species. This species occur near rocky reefs where gear most likely to be lost. Intensity: minor because gear loss is rare. Consequence considered unlikely to be measurable at the scale of bigeye ocean perch stocks. Confidence: high because it is known that very little gear is lost, and if so, most are retrieved (AFMA Observer, pers. comm.) and interaction with this species is considered unlikely.
	Anchoring/ mooring	1	3	4	Population size	Southern eagle ray	1.2	2	1	2	Fishing occurs throughout the year over the SESSF. Anchoring/ mooring possible over this scale although probably only in bays. Direct impact (damage or mortality) that occurs when anchoring or mooring most likely to affect population size of this benthic species. This species inhabits coastal bays so considered most vulnerable to impact. Intensity: minor. Consequence: negligible, unlikey that this species coming into direct contact with anchors and impactunlikley to be detectable. Confidence: high because it is considered very unlikely for there to be damage or mortality to this species associated with this activity.
	Navigation/ steaming	1	6	6	Population size	Jack mackerel	1.2	4	1	2	Navigation/steaming occurs throughout the year over the entire SESSF. Direct impact (damage or mortality) without capture due to navigation/steaming was considered most likely to affect population size of this species. This speciesis pelagic so may be close to surface. Intensity; moderate- navigation/steaming is a large component of the

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
											SESSF operations. Consequence: negligible as it is unlikely to be measurable. Confidence: high because it was considered unlikely for there to be strong interactions between navigation/steaming and damage or mortality of this species.
Addition/ movement of biological material	Translocation of species	1	6	6	Population size	Jack mackerel	1.2	1	1	1	Fishing activity hence Translocation of species could occur throughout the year over the SESSF. Translocation of species was considered most likely to affect population size of this species possibly through transmission of disease. Jack mackerel are pelagic so may be closer to the surface than other species. Intensity: negligible as detection of impact was considered to have remote likelihood. Consequence: negligible as unlikely to be measurable. Confidence: low because there is no inforamtion on translocation of species by trawlers in the SESSF.
	On board processing	1	6	6	Behaviour/ movement	Gummy shark; Brier shark	6.1	3	2	2	Onboard processing only occurs in parts of the fishery where animals are head and gutted and/or trunked. This is most likely to affect behaviour/movement of this speciesshould they scavenge for such oragnic matter. This species considered most likely species that could be a scavenger.Intensity: moderate because onboard processing is common. Consequence: minor as impact is likely to be minimal. Confidence: high as onboard processing is known to occur (AFMA Observer pers. com. and AFMA Observer database).
	Discarding catch	1	6	6	Behaviour/ movement	Gummy shark; Brier shark	6.1	3	2	1	Discarding is common over entire SESSF and occurs frequently. It is most likely to affect behaviour/movement of speciesshould they be attracted to the discards.This species is considered most likely byproduct species that could be a scavenger. Intensity: moderate because this species is widespread. Consequence: minor as impact is likely to be minimal. Confidence: ow due to lack of available data on movement behaviour of these species based on this activity.

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
	Stock enhancement	0									
	Provisioning	0									
	Organic waste disposal	0									
Addition of non-biological material	Debris	0									
	Chemical pollution	0									
	Exhaust	1	6	6	Behaviour/ movement	Jack mackerel	6.1	1	1	2	Fishing activity hence exhaust emissions occur over SESSF. Exhaust emission is expected to pose greatest potential risk for the behaviour/movement of this species due to repulsion. This species considered most vulnerable as juveniles are pelagic. Intensity: negligible because although the hazard occurs over a large range/scale, impact area is only within metres of the vessel. Consequence: negligible as any consequence on this species unlikely to be measurable. Confidence: high because localised exhaust unlikely to impact on behaviour/movement of this species.
	Gear loss	1	1	3	Population size	Bigeye ocean perch	1.2	2	1	2	Fishing occurs throughout the year over the SESSF. Gear loss believed to occur rarely. Lost gear not resulting in damage/mortality most likely to affect population size of this species. Intensity: minor. Consequence: considered unlikely to be measurable at the scale of squid stocks. Confidence: high because it is known that very little gear is lost, and interaction with species is considered unlikely.
	Navigation/ steaming	1	6	6	Behaviour/ movement	Jack mackerel	6.1	4	1	1	Fishing activity hence navigation/steaming occurs throughout the year over the SESSF. Navigation/steaming of fishing vessels was expected 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
											pose greatest potential risk for the behaviour/movement of this species resulting in disruption to feeding and/or movement by introducing noise into the environment. This species considered most vulnerable as stock status is unknown and juveniles are pelagic. Intensity: major. Consequence: negligible with any consequence of navigation/steaming impacts unlikely to be measurable for this species. Confidence: low because addition of non-biological material due to navigation/steaming to impact and have consequences for the behaviour/movement of this species is unlikely, but not known.
	Activity/ presence on water	1	6	6	Behaviour/ movement	Gummy shark	6.1	4	2	1	Activity/presence on water occurs over the SESSF. Vessels in the area do attract (or avoid) animals. This species could have an avoidance reaction to acoustic signals, and could use echo-location. Intensity: major as presence of vessels occurs throughout. Consequence: minor as any spawning aggregations could be disturbed. Confidence: low because available data on acoustic disturbance on a spawning on the behaviour/movement of this species is unknown.
Disturb physical processes	Bait collection	0	0	0							
	Fishing	1	6	6	Population size	Gummy shark	1.2	4	2	1	Fishing activity hence disturbance of physical processes occurs throughout the year over the SESSF. Disturbance of physical processes due to fishing considered most likely to affect population size of this species, as it is most likely to be affected as they are bottom-dwellers and fishing may disturb sediments. Intensity: moderate as disturbance of sediment may often occur. Consequence: minor as sediment disturbance not likely to affect population size or dynamics of this species. Confidence: low due to lack of available information.
	Boat launching	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
	Anchoring/ mooring	1	3	4	Behaviour/ movement	School shark	6.1	2	1	2	Fishing occurs throughout the year over the SESSF. Anchoring/mooring possible over this scale although probably only in bays. Disruption of the sediments may occur from anchoring through the contact with the bottom. Disturbance to physical processes from anchoring or mooring most likely to affect behaviour/movement of this species. This species enter coastal bays to spawn so considered most vulnerable to impact and is EPBC listed as Conservation Dependent. Intensity: minor, given that anchoring/mooring. Consequence: negligible. Confidence: high because it is considered very unlikely for there to be strong interactions between this species and disturbance to physical processes from anchoring/mooring.
	Navigation/ steaming	1	6	6	Behaviour/ movement	Jack mackerel	6.1	1	1	2	Navigation/steaming occurs throughout the year over the SESSF. Disturbance to physical processes due to Navigation/steaming of fishing vessels was expected to pose greatest potential risk for the Behaviour/movement of this species resulting in disruption to feeding. This species considered most vulnerable as population status is unknown and juveniles are pelagic. Intensity: negligible because although the hazard was considered over a large range/scale, navigation/steaming considered to only impact a small area (< 1 nm). Consequence: negligible with any impact of navigation/steaming unlikely to be measurable for this species. Confidence: high because navigation/steaming unlikely to impact and have consequences for the behaviour/movement of this species.
External impacts	Other fisheries	1	6	6	Behaviour/ movement	Endeavour dogfish	1.2	4	4	1	Fishing occurs throughout the year over the SESSF. Capture of fish from non-trawl fishery (SESSF scalefish hook; GHAT hook) most likely to affect population size of this species. This species considered to be most vulnerable The population status of this species in the SESSF is uncertain, with depletion estimates between 11-31% overall (AFMA 2012). The Endeavour Dogfish closure outside Sydney prohibits fishing

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
											by all fishing methods. However, there are annual trigger limits of 4.5 t in other areas within the SESSF. Intensity: severe as there is potential for severe impacts on population size if trigger limit is reached. Consequence: major as population may not recover if overfished. Confidence: low, because there are no biomass estimates for this species within the SESSF.
	Aquaculture	1	3	6	Behaviour/ movement	Jack mackerel	6.1	2	2	1	Aquaculture occurs at sites throughout SE Australian in harbours, bays and estuaries (out of jurisdiction) adjacent to inner shelf habitats. Salmon aquaculture in Tasmanain waters could affect behaviour/movement of this species. This species selected as juveniles are known to occur in large marine embayments which could coincide with aquaculture sites. Intensity: minor as co-location of aquaculture sites and juveniles could occur rarely. Consequence: minor, as aquaculture expected to have minimal impact on behaviour/movement of this species. Confidence: low as there is little data on the co-location of aquaculture sites and juveniles.
	Coastal development	1	6	6	Behaviour/ movement	School shark	6.1	3	2	1	Coastal development occurs throughout the SESSF. Most likely to affect behaviour/movement of target species as available habitat is occupied. This species selected as the spawning adults are known to occur in large marine embayments which could coincide with coastal development. Intensity: moderate, both broad coastal development and localised centres. Consequence: minor as coastal development expected to have minimal impact on behaviour/movement of this species. Confidence: low as there is little data available.
	Other extractive activities	1	4	6	Behaviour/ movement	Gummy shark;	6.1	3	2	1	Ongoing development and expansion of oil and gas pipelines, oil and gas exploration and extraction drilling, and seismic survey for further oil and gas exploration occurs across southern Australia (e.g. Bass

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
						Endeavour dogfish					Strait). Most likely to affect behaviour/movement of these species. The auditory and lateral line sensory acuity of this species could be affected by seismic survey. Intensity: moderate as local effects are potentially severe. Consequence: minor as effect on population dynamics expected to be minimal. Confidence: low as potential effects are unknown for this species.
	Other non-extractive activities	1	5	6	Behaviour/ movement	Gummy shark; Endeavour dogfish	6.1	3	2	1	Ongoing shipping, naval activities and ocean dumping is likely to have minor effects on the movement and behaviour of these species. Intensity: minor, as detectability is considered to be rare. Consequence: moderate. Confidence: low, little information on potential effects.
	Other anthropogenic activities	1	5	6	Behaviour/ movement	Jack mackerel	6.1	2	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, as restricted area rare event short term effects. Confidence: low, limited available information.

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	0									
	Fishing	1	6	6	Population size	Australian fur seal	1.1	4	3	2	Fishing occurred daily on the shelf and shelf break predominantly but throughout most of jurisdiction. Over 700 Interactions with or sightings of fur seals with majority being Australian fur seal. Of these, ~80% fatal, i.e 560 across 5 years (annual average of 112). Intensity: major, fur seals are central placed foragers and their distribution relatively restricted by colony placement therefore fishery footprint overlaps seal distribution. Consequence: moderate, possible impact on individul colonies if all mortlaites from one colony however on total population impact probably small - 112 mortalities p.a. from population est 120,000 and unlikely to detect difference against background population variability. Confidence: high; all PS interactions reported to AFMA/DoEE published on website but population estimates uncertain but not declining.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	6	6	Interactions with fishery	Australian fur seal	7.1	4	2	2	Fishing occurred daily on the shelf and shelf break predominantly but throughout most of jurisdiction. Fishing represents greatest risk to Australian fur seals behaviour and movement as they attracted to all fishing activities to net feed. Intensity: major, fur seals are central placed foragers and their distribution relatively restricted by colony placement and fishery footprint overlaps distribution. Consequence: minor, unlikely to have had more than minimal impact on stock although evidence of habituation to noise of fishing operations leading to physical interactions. Confidence: high; all PS interactions reported to AFMA/DoEE.

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	0									
	Gear loss	1	1	3	Interactions with fishery	Australian fur seal	7.1	2	1	1	Gear loss occurs rarely (~1 per year) but not verified and is usually retrieved. Major gear loss may modify furseal behaviour by attracting them to lost catches and/or entangle them however minor losses not likely to impact. Intensity: minor but gear loss not reported. Consequence: negligible if gear loss is rare. Confidence: low, major gear losses not reported.
	Anchoring/ mooring	1	3	4	Behaviour/ movement	Syngnathids	6.1	2	1	2	Anchoring/ mooring may occur in SET inner shelf where fishing effort highest but probably most occurs in sheltered bays in state waters. Some syngnathids may be disturbed or displaced from habitat by anchoring of vessel in shallow waters and distributions may be disrupted briefly. Intensity: minor, occurs in a few restricted locations. Consequence: negligible. Confidence: high because very unlikely for there to be lasting effect from anchoring/ mooring logical.
	Navigation/ steaming	1	6	6	Population size	Albatrosses	6.1	3	2	2	Vessels navigate and steam throughout the SESSF and year. Albatrosses may be attracted to the vessel and strike superstructure causing death or injury. Intensity: moderate, navigation/steaming is a large component of the SESSF operations. Consequence: minor, all strikes recorded. Confidence: high - all interactions must be recorded.
Addition/ movement of biological material	Translocation of species	1	6	6	Population size	Syngnathids	1.1	1	1	1	Translocation of species such as introduced habitat-modifying invasive species, might affect habitat-dependent species such as syngnathids or juveniles. Potentially species may be moved relatively short distances within geographical range in sediments and discards from fishing operations as nets are cleaned. No known evidence of pathogens from fishing vessels. Intensity: negligible as unlikely to be detected. Consequence: negligible, no known pathogen transmitted however introductions and range extensions of invasive species such as NZ screw shell, *Centrostephanus*, starfish, have occurred but not attibuted. Confidence: low, no evidence.

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/ movement	Albatrosses, Australian Fur seals	6.1	3	2	2	On board processing attracts birds and seals in response to discarded offal. Intensity: moderate, onboard processing is common. Consequence: minor, change in behaviour temporary. Confidence: high, logic.
	Discarding catch	1	6	6	Behaviour/ movement	Albatrosses, Australian Fur seals	6.1	3	2	2	Discarding attract birds and seals in response to discarded catch. Intensity: moderate, common throughout the fishery. Consequence: minor, changes inbehaviour temporary. Confidence: high, logic.
	Stock enhancement	0									
	Provisioning	0									
	Organic waste disposal	0									
Addition of non-biological material	Debris	0									
	Chemical pollution	0									
	Exhaust	1	6	6	Population size	Albatrosses	1.1	2	1	1	Exhaust emitted throughout the fishery daily. Birds most likely to be imacted by fumes. Intensity: negligible because although the hazard occurs over a large range/scale, impact area is only within metres of the vessel. Consequence: negligible, effect on free-flying birds impossible to detect. Confidence: low.
	Gear loss	1	1	3	Behaviour/ movement	Syngnathids-Trawl Pipefish, Duncker's Pipehorse,Spiny Pipehorse, Big-bellied Seahorse	6.1	2	1	1	Gear loss occurs rarely (~1 per year) on fishing grounds and is usually retrieved. Abandoned gear may modify fish behaviour by attracting them to structure but few Syngnathids occur inthese depths. Intensity: minor. Consequence: negligible, unlikely to detect variation in behaviour. Confidence: low, gear losses not reported. Few Syngnathids occur in depths that might occur in fishing grounds.

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	Behaviour/ movement	Australian fur seals	6.1	4	2	1	Noise and echosounding from fishing operations represents greatest risk to Australian fur seals behaviour and movement as they become habitutated to fishing vessels. Intensity: major, fur seals are central placed foragers and their distribution relatively restricted by colony placement and fishery footprint overlaps distribution. Consequence: minor, unlikely to have had more than minimal impact on stock although evidence of habituation to noise of fishing operations leading to physical interactions. Confidence: low, protected species interactions reported to AFMA/DoEE but not all observable and unknown effects.
	Activity/ presence on water	1	6	6	Behaviour/ movement	Albatrosses	6.1	4	2	2	Potential for collision of birds with superstructure of vessel. Intensity: major. Consequence: minor, collisions with vessels are reported and minor cause of fatal interaction. Confidence: high, all interactions with protected species are recorded.
Disturb physical processes	Bait collection	0									
	Fishing	1	6	6	Geographic range	Syngnathids	2.1	4	2	1	Trawling occurs on inner shelf area where fishing effort high possiibly disrupting benthic structure and processes. A few syngnathids may occur within fishery footprint and may be disturbed or displaced. Intensity: major, but unknown how much overlap between fishery effort and distribution. Consequence: minor, unlikely to detect variation in distribution. Confidence: low, no data on syngnathid distributions in fishery footprint.
	Boat launching	0									
	Anchoring/ mooring	1	3	4	Population size	Syngnathids	1.1	2	1	1	Anchoring/ mooring may occur in SET inner shelf where fishing effort highest but probably mostly occurs in sheltered bays in state waters. Benthic processes may be disturbed from anchoring altering critical habitat e.g. some syngnathids may be displaced if site-specific habitat altered. Intensity: minor occurs in a few restricted locations. Consequence: negligible, unlikely to detect. Confidence:

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
											high because very unlikely for there to be lasting effect from anchoring/ mooring, logical.
	Navigation/steaming	1	6	6	Behaviour/ movement	Common Dolphins	6.1	1	2	1	Navigation / steaming producing bow waves modifies dolphin behaviour as they ride bow waves and may strike the vessel causing death or injury. Intensity: negligible, localised effect. Consequence: minor, normal behaviour/ movement would return to normal on the scale of hours and no strikes recorded. Confidence: low, all interactions must be recorded but unlikely bow-riding is recorded.
External impacts	Other fisheries	1	6	6	Population size	Australian fur seals	1.1	4	4	2	Other SESSF fisheries - gillnet, shark, auto-longline; SPF interact with fur seals and therefore likely to have had a severe impact on population size. Intensity: major as occurs often at a broad scale. Consequence: major as cumulative effects should be considered. Confidence: high, logical considering cumulative effects.
	Aquaculture	1	3	6	Behaviour/ movement	Australian fur seals	6.1	2	2	2	Aquaculture occurs at sites throughout SE Australian in harbours, bays and estuaries (out of jurisdiction) adjacent to inner shelf habitats. Salmon aquaculture in Tasmanian waters known to attract seals. Mollusc aquaculture more frequent on mainland coast but unattractive to seals. Intensity: minor, habituation possible locally. Consequence: minor. Confidence: high.
	Coastal development	1	6	6	Population size	Australian fur seals	1.1	3	3	1	Coastal development occurs across the range of the fishery but most likely to affect Central Eastern Province inner shelf community due to large population in this area. Frequent, local impacts from pollution, toxins, agricultural run-off, and sewage even at small spatial scales could have obvious impact on the health of fur seals. Intensity: moderate, moderate both broad coastal development and localised centres. Consequence: moderate, greatest impacts likely to be inshore including waters less than 25m, and unlikely to extend to entire coastal demersal/pelagic communities however evidence suggests fur seals suffering

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
											from accumulation of toxic chemical pollutants. Confidence: low due to a lack of data.
	Other extractive activities	1	4	6	Behaviour/ movement	Australian fur seals	6.1	3	2	1	Ongoing development and expansion of oil and gas pipelines, oil and gas exploration and extraction drilling, and seismic survey for further oil and gas exploration occurs across southern Australia (notably Bass Strait) most likely to affect distribution of the Fur seals as sounds from air guns used in seismic surveys may affect distribution and behaviour. Intensity: moderate as local effects are potentially severe but confined to small area. Consequence: minor as long-term effect on expected to be minimal if detectable at all. Confidence: low as effects are unknown.
	Other non-extractive activities	1	5	6	Behaviour/ movement	Common Dolphins	6.1	3	2	1	Shipping occurs throughout the area daily and considered to impact distribution of small cetaceans such as dolphins. Intensity: moderate, east coast shipping routes are busy. Consequence: minor as long-term effects on dolphins undetectable. Confidence: low because of a lack of information on shipping-animal interactions.
	Other anthropogenic activities	1	4	6	Behaviour/ movement	Common Dolphins	6.1	2	2	1	Small cetaceans such as dolphins may be disturbed by charter boats associated with general recreational activities, and tourism (e.g. whale watching, fishing tours, anchoring, recreational diving etc.). Most common off SET and Central East shelf. Intensity: minor as most activities are relatively close to coasts and unlikely to detect long-term impacts. Consequence: minor. Confidence: low, no information.

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

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	0	0	0							
	Fishing	1	6	6	Habitat structure and function	Friable sandstone (20) , stalked crinoids (2), bryozoans(4, 14, 9), treefroming octocorals and black corals (2,8)	5.1	4	5	1	In the process of trawling for target species, habitat is impacted directly, resulting in either removal (capture) or severe damage to structural elements. Habitats (assemblages) most vulnerable to impact by highest levels of effort were chosen from Pitcher et al. (2014). Although there is no data that shows actual impact. Potentially there will be complete loss of habitat and species with extended recovery times for both substrate and associated fauna, if at all, especially on seamount and in mid-slope depths. Intensity: major as trawling is widespread, frequent and locally severe particularly in assemblage 20. Consequence: severe because habitats on these features may be completely removed by fishing gear, and recovery at mid slope depths can be expected to be protracted, if at all, given fishing intensity. Confidence: low because it is not known what proportion of the vulnerable habitat types are damaged, and recovery time is not known.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	6	6	Habitat structure and function	Friable sandstone (20), stalked crinoids (2), bryozoans (4, 14, 9), treefroming	5.1	4	5	1	In the process of trawling, habitat structure and function is impacted indirectly by trawl gear coming into contact with the seabed, and possibly overturning or damaging structural components that provide attachment points for fragile epifauna. Most vulnerable habitats (assemblages) potentially impacted from highest levels of effort were

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
						octocorals and black corals (2,8)					chosen from Pitcher et al. (2014) although there is no data that shows actual impact. Potentially there will be damage to habitat and species with extended recovery times for both substrate and associated fauna, if at all, especially on seamount and in mid-slope depths. Intensity: major as trawling is widespread, frequent and locally severe particularly in assemblage 20. Consequence: severe because habitats on these features may be completely removed by fishing gear, and recovery at mid slope depths can be expected to be protracted, if at all, given fishing intensity. Confidence: low because it is not known what proportion of this habitat type is irrevocably damaged, and recovery time is not known.
	Incidental behaviour										
	Gear loss	1	1	3	Habitat structure and function	Stalked crinoids (2), bryozoans (4, 14, 9), treefroming octocorals and black corals (2,8)	5.1	2	2	2	Fishing occurs throughout the year over the entire SESSF. Fishery management plan requires operators to take all reasonable steps to minimise loss of gear, but gear lost very occasionally, and retrieval may be impossible. Trawl gear most likely to be lost by being caught up on rocky outcrops such as in assemblages 2 containing stalked crinoids. Lost gear may change habitat structure by virtue of creating new structure, which remains to eventually become habitat. Intensity: minor, gear lost rarely and usually retrieved. Consequence: minor as lost gear may cause localised long-term change to rare, vulnerable habitats. Confidence: high- lost gear reported.
	Anchoring/ mooring	1	3	4	Habitat structure and function	Inner shelf soft sediments e.g. friable sandstone (20)	5.1	2	1	2	Fishing occurs throughout the year over the entire SESSF therefore anchoring/ mooring possible over this scale although probably mostly in sheltered bays and further offshore weekly. Direct damage or mortality that occurs when anchoring or mooring most likely to affect habitat structure and function. Inner-shelf sponge beds in assemblage 20 most likely to be damaged by physical contact with anchor. Intensity: minor as anchoring/mooring more likely to occur on soft bottom. Consequence: negligible as anchoring considered to affect only a very small percentage

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
											of the area of the habitat, that has a reasonably rapid regenerative capacity and impossible to detect. 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.
	Navigation/ steaming	1	6	6	Water quality	Southern Oceanic Pelagic provinces	1.1	3	1	2	Navigation/steaming occurs throughout the year over the entire SESSF. Navigation/steaming was considered to influence water quality by disrupting the water column. Intensity: moderate, broad spatial scale. Consequence: negligible because it was considered unlikely that there would be detectable impacts on pelagic habitat water quality. Confidence: high because negative interactions between navigation and steaming and pelagic habitat were considered very unlikely.
Addition/ movement of biological material	Translocation of species	1	6	6	Habitat structure and function	Fine sediments of inner shelf assemblage 1, 20, 18	5.1	1	1	1	Fishing activity occurs throughout the year over the entire SESSF. Translocation of species could occur if species or sediments retained in gear and discarded elsewhere, e.g. introduced NZ screw shell prefer the fine sediments and mud such as on the inner shelf and assemblages 1, 18, 20 therefore chosen as vulnerable assemblages. Intensity: negligible, as unlikely to be detectable. Consequence: negligible but there is the potential for impacts to be very large. Confidence: low as it not known to what extent trawling in the SESSF contributes to the spread of the species.
	On board processing	1	6	6	Substrate quality	Friable sandstone (20), stalked crinoids (2), bryozoans (4, 19)	3.1	3	1	1	Onboard processing only occurs on some vessels within parts of the fishery but spread throughout. Substrate quality was considered most likely to be impacted because discarding of fish parts may result in accumulation of discarded material on the benthos leading to altered sediment chemistry. The outer shelf, large epifauna habitat of assemblages 20, 2, 4, 19) was determined most at risk because discarded material is more likely to reach the seabed than in deeper

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
											waters, where scavenging may remove material before it settles. Intensity: moderate as onboard processing heading and gutting common. Consequence: negligible as any effects undetectable. Confidence: high because onboard processing is limited.
	Discarding catch	1	6	6	Substrate quality	Shelf assemblages of fine sediments e.g. friable sandstone (20), stalked crinoids (2), bryozoans (4, 19)	3.1	3	2	2	Discarding occurs regularly throughout the fishery. Substrate quality on the shelf assemblages was considered most likely to be impacted because discarding of catch may result in benthic accumulation of carcasses, leading to altered sediment chemistry in and above substrate, fine sediments can be disturbed, and bioturbators and filter feeders smothered. Intensity: moderate over the scale of the fishery, waste expected to be taken up quickly by opportunistic scavengers. Consequence: minor because measurable impacts were considered to only be detectable at localised scales. Confidence: high because operators generally discard waste over the course of fishing operations leading to no localised accumulations of waste.
	Stock enhancement	0									
	Provisioning	0									
	Organic waste disposal	0									
Addition of non-biological material	Debris	0									
	Chemical pollution	0									
	Exhaust	1	6	6	Air quality	Southern Oceanic Pelagic provinces	2.1	1	1	2	Exhaust from running engines may impact the air quality of the species within Southern Oceanic Pelagic habitat (e.g. birds). Intensity: negligible because although the hazard occurs over a large range/scale, impact area is only within metres of the vessel. Consequence: negligible due to rapid dispersal of pollutants in winds, and likely to be physically

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
											undetectable over very short time frames. Confidence: high because effect of exhaust was considered to be very localised.
	Gear loss	1	1	3	Habitat structure and function	Friable sandstone (20), stalked crinoids (2), bryozoans (4, 14, 9), treefroming octocorals and black corals (2,8)	5.1	2	1	2	Fishing occurs throughout the year over the entire SESSF. Fishery management plan requires operators to take all reasonable steps to minimise loss of gear, though evidence of gear loss does exist, and retrieval may be impossible. Trawl gear most likely to be lost by being caught up on rocky outcrops. Lost gear may change habitat structure by creating new structure or smothering damaging existing vulnerable types particularly in the assemblages of (2, 4, 9, 14, and 20). Intensity: minor, gear loss rare. Consequence: negligible as caught up gear likely to become habitat over time. Confidence: high as lost gear events are usually recorded.
	Navigation/ steaming	1	6	6	Habitat structure and function	Inner shelf assemblages	1.1	4	1	2	Fishing activity throughout fishery introduces noise from navigation/steaming into habitat. Studies show seismic activity may have consequences on benthic fauna composition on seabed however no evidence to show that normal navigation of fishing vessels has deleterious effects. Shallow habitats where activity greatest and noise most likely chosen e.g. assemblage 1, 18, 20. Intensity: major as fishing occurs in 84-89% of 1km grids over the shelf and slope respectively and navigation/steaming is a large component of SESSF operations. Consequence: negligible. Confidence: high, logical.
	Activity/ presence on water	1	6	6	Water quality	Southern Oceanic Pelagic provinces	1.1	4	1	2	Fishing occurs throughout the fishery and birds and seals may be attracted to fishing operations. No impact on the demersal environment and that on pelagic environment and air unlikely to be detectable. Intensity: major as fishing occurs in 84-89% of 1km grids over the shelf and slope respectively and navigation/steaming is a large component of

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
											SESSF operations. Consequence: negligible unlikely to have any impact. Confidence: high, logical.
Disturb physical processes	Bait collection	0									
	Fishing	1	6	6	Habitat structure and function	Friable sandstone (20), stalked crinoids (2), bryozoans (4, 14, 9), treefroming octocorals and black corals (2,8)	5.1	4	5	1	Habitat structure and function, hence processes supporting function, considered subject to significant modification through contact with fishing gear. Substratum supporting faunal communities may be removed, altering substratum processes. Faunal component of habitat may be removed; delicate stalked crinoids on subcropping rock at the shelf-break (2) are considered most vulnerable to removal and subcropping slabs being overturned. Similarly, fragile bryozoan crusts in these regions can be converted from hard to soft grounds with substratum disturbance (4, 14, 9), altering the way the habitat may be utilised by fauna. Intensity: major as trawling occurs often on some areas of this habitat type. Consequence: severe as physical processes around damaged reefs may be permanently altered. Confidence: low due to lack of data on age, growth rates and reestablishment of normal functions after disturbance.
	Boat launching	0									
	Anchoring/ mooring	1	3	4	Habitat structure and function	Friable sandstone (20)	5.1	2	1	2	Fishing occurs throughout the year over the entire SESSF therefore anchoring/mooring possible although probably only in bays on weekly temporal scale. Direct impact (damage or mortality) that occurs when anchoring or mooring most likely to affect habitat structure and function. Inner-shelf sponge beds most likely to be damaged by physical contact with anchor (20). Intensity: minor as anchoring/mooring is not daily, and more likely to occur on soft bottom. Consequence: negligible as anchoring considered to affect only a very small percentage of the area of the habitat, that has a reasonably rapid regenerative capacity

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
											and impossible to detect. Confidence: high because it is considered very unlikely for there to be lasting damage to a significant areas of inner-shelf habitat from anchoring/ mooring.
	Navigation/steaming	1	6	6	Water quality	Southern Oceanic Pelagic provinces	1.1	1	1	2	Fishing activity hence navigation/ steaming occurs throughout the year over the entire SESSF. Disturbance of physical processes will occur during the normal course of steaming throughout the fishing zone. Turbulence and disturbance of pelagic water quality is unlikely to affect normal water column processes for long. Any disruption to these processes can therefore be expected to alter habitat function only briefly. Intensity: negligible as the localised effect. Consequence: negligible due to remote likelihood of detection at any spatial or temporal scale, and interactions that may be occurring are not detectable against natural variation. Confidence: high, logical.
External impacts	Other fisheries	1	6	6	Habitat type, structure and function	Friable sandstone (20), stalked crinoids (2), bryozoans (4, 14, 9), treefroming octocorals and black corals (2,8)	4.1, 5.1	4	3	1	Other fisheries operating over the same grounds with potential to impact the benthos include, Danish seine, gillnet, auto longline, dredge, and to a lesser degree trap, demersal longline, and occasionally midwater trawl gears. Fishing activity of these fisheries occurs over a large spatial range, over which there can be daily fishing activity. Cumulative effects on Habitat type and Habitat structure and function are a concern for all habitats, but particularly those at depths>100m which may be trawled or netted. Sediment-based habitats supporting large sponges are likely to be most subject to effort (20). Intensity: major as all methods work over these grounds. Consequence: moderate as majority of gears have very small seafloor footprint. Confidence: low; little data is available on the age, growth and regeneration rates of temperate sponge habitats in depths 100-200m nor on damage attributable to fishing methods.

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
	Aquaculture	1	3	6	Water quality, substrate quality	Inner shelf sediments e.g. adjacent to assemblage 6, 14, 20	1.1, 3.1	2	1	2	Aquaculture occurs at sites throughout SE Australian in harbours, bays and estuaries (out of jurisdiction) adjacent to inner shelf habitats. Salmon aquaculture in Tasmanian waters known to impact local habitat from input of waste affecting the water and substrate quality leading to impacts on habitat type and structure and function. Management implement fallowing protocols although recovery rates not well-known. Mollusc aquaculture more frequent on mainland coast and has a nutrient depletion effect. Intensity: minor - local effects quickly dispersed and unlikely to be detected against natural variability. Consequence: negligible as impacts unlikely to detect variability against natural variability except where seagrass habitat important to different life stages of a variety species-no evidence. Confidence: high, e.g. nutrient inputs of D'entrecasteaux Channel, Huon into Derwent estuaries are quickly dispersed into Storm Bay but impacts if any difficult to measure against other anthropogenic sources (Wild-Allen and Andrewartha 2016).
	Coastal development	1	6	6	Water quality, substrate quality, habitat types, habitat structure and function	Inner shelf sediments e.g. Assemblages 1, 20	1.1, 2.1 3.1, 4.1, 5.1	3	2	1	Coastal development can affect inner shelf habitats such as assemblage 1, 20 where the largest population centres occur. Frequent, local impacts at small spatial scales are likely to have most obvious impact on the habitat composition, structure and function, water quality and substratum state. Intensity: moderate, both broad coastal development and localised centres and range of activities likely to have local effects such as removal or degradation of inshore habitats, particularly nursery habitats. Consequence: minor, greatest impacts likely to be inshore including waters less than 25m (not within fishery boundary) but detection further out onto the inner shelf unknown. Confidence: low, little data on the cumulative affects

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	4	6	Substrate quality, habitat types, habitat structure and function	Outer shelf mud in Assemblage 11	2.1, 3.1, 4.1, 5.1	3	2	1	Ongoing development and expansion of oil and gas pipelines, oil and gas exploration and extraction drilling, and seismic survey for further oil and gas exploration occurs across southern Australia (notably Bass Strait). Infrastructure impacts seafloor locally but oil leaks/spills may impact water and substrate quality in immediate area. Intensity: moderate, may be pollution and disturbance during development and operational stages. Consequence: minor as localised but extensive and through zones of high biodiversity. Confidence: low little information on effects of pipelines on surrounding habitats although modelling suggests contracted impact area.
	Other non-extractive activities	1	5	6	Water quality	Southern and Eastern Oceanic Pelagic provinces	1.1	3	2	1	Major shipping activity throughout fishery daily and considered to impact the water quality of the pelagic habitat through turbulence, leaking of pollutants, etc. Intensity: moderate, east coast shipping routes busy. Consequence: minor, spatial areas very small and unlikely to detect variability. Confidence: low, little information on effects.
	Other anthropogenic activities	1	4	6	Water and air quality, substrate quality, habitat types, structure and function	shelf: inner, outer, and break (assemblages 1,20,12,17,5,12,7,10, 16,13,18)	1.1, 2.1 3.1, 4.1, 5.1	2	2	1	Tourism and recreational activity could increase noise, pollutants, into the pelagic habitat particularly. Some activities could impact habitats such as recreational fishing/diving with certain gear. Intensity: minor although difficult to assess cumulative effects. Consequence: minor restricted area rare event short term effects although no information to assess cumulative effects. Confidence: low, limited information.

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	0	0	0							
	Fishing	1	6	6	Trophic size/structure	SET outer shelf; SET upper slope	4.1	4	3	2	Capture by fishing most likely to affect trophic structure and size of communities as some species may be showing evidence of change in size structure e.g. tiger flathead which may affect the trophodynamics of the community foodweb. SET outer shelf and upper slope chosen because these communities have the highest proportion of area fished, smallest area of heavily fished, the second highest average catch. Intensity: major as fishing occurs in 84-89% of 1km grids over the shelf and slope respectively. Consequence: moderate as most key species populations appear to be sustainable or improving over past decade after decrease in effort. Confidence: high as many annual stock assessments conducted on the key commercial and bycatch species.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	6	6	Trophic size/structure	SET outer shelf	4.1	4	3	1	Direct impact without capture most likely to affect trophic size/structure from post-capture mortality. SET outer shelf and upper slope chosen because these communities have the highest proportion of area fished, smallest area of heavily fished, the second highest average catch and logically highest escapement and post-capture mortality. Intensity: major as fishing occurs in 84-89% of 1km grids over the shelf and slope respectively. Consequence: moderate as most key species populations are becoming stable or improving over past decade after decrease in effort and now considered sustainable. Confidence: low cannot demonstrate changes due to post-escapement mortality.

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	0									
	Gear loss	1	1	3	Species composition	SET outer shelf; SET upper slope	1.1	2	1	2	SET outer shelf and upper slope chosen as most gear loss is likely to occur there. Dropped nets might contain catch which would be lost. Intensity: minor as little gear is lost and usually retrieved. Consequence: negligible as any effect on communities due to gear loss immeasurable. Confidence: high gear loss reported.
	Anchoring/ mooring	1	3	4	Distribution of the community	SET inner shelf	3.1	2	1	2	Anchoring/ mooring may occur in SET inner shelf where fishing effort highest but probably most occurs in sheltered bays in state waters. Some sedentary fish may be disturbed by presence of vessel in very shallow waters and distributions may be disrupted briefly. Intensity: minor occurs in a few restricted locations. Consequence: negligible. Confidence: high because very unlikely for there to be lasting effect from anchoring/ mooring logical.
	Navigation/ steaming	1	6	6	Species composition	SET outer shelf; SET upper slope	1.1	4	1	2	SET outer shelf and upper slope chosen because these communities have the highest proportion of area fished, smallest area of heavily fished, the second highest average catch. Intensity: major as fishing occurs in 84-89% of 1km grids over the shelf and slope respectively and navigation/steaming is a large component of SESSF operations. Consequence: negligible it is unlikely to detect any measurable effect on communities. Confidence: high (logic).
Addition/ movement of biological material	Translocation of species	1	6	6	Species composition	SET inner shelf	1.1	1	1	1	Translocation of species most likely to affect species composition of the community if new species are added. SET inner shelf chosen as translocation of species most likely to occur there close to ports. Intensity: negligible no impacts detectable. Consequence: negligible - no evidence of translocations although potential for impacts to be very large. Confidence: low as there is no data on current translocation of species by trawlers in the SESSF.

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	Distribution of the community	SET outer shelf; SET upper slope	3.1	3	1	2	SET outer shelf and upper slope chosen as onboard processing most likely to occur there and likely to attract scavengers temporarily changing the distribution of the community. Intensity: moderate, onboard processing (heading and gutting) common. Consequence: negligible as impact on communities is unlikely to be measurable against natural variation and not persistent. Confidence: high as onboard processing is not widespread.
	Discarding catch	1	6	6	Trophic size/structure	SET outer and inner shelf	4.1	3	2	1	Discarding catch could affect energy flow through the community foodweb if scavengers are heavily dependent on discards. SET outer and inner shelf communities chosen as most effort occurs there. Intensity: moderate as discarding is common over SESSF. Consequence: minor as localized accumulations of waste rapidly dispersed so species are unlikely to become habituated to using discards as a food source as they are opportunistic. Confidence: low due to lack of data.
	Stock enhancement	0									
	Provisioning	0									
	Organic waste disposal	0									
Addition of non-biological material	Debris	0									
	Chemical pollution	0									
	Exhaust	1	6	6	Distribution of the community	SET outer shelf; SET upper slope	3.1	1	1	2	Exhaust emissions most likely to affect distributions of communities by affecting distribution of birds in the vicinity of vessels. SET outer shelf and upper slope chosen as most fishing occurs there. Intensity: negligible as although exhaust emissions occur over a large range, impact area is only

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
											within metres of the vessel. Consequence: negligible as exhaust is rapidly dissipated and unlikely to be detectable. Confidence: high (logic).
	Gear loss	1	1	3	Distribution of the community	SET outer shelf; SET upper slope	3.1	2	1	2	SET outer shelf and upper slope chosen as most fishing occurs there. Lost gear may alter the immediate habitat and consequently the immediate distribution of species. Intensity: minor as lost gear is rare. Consequence: negligible as any effect on communities unlikely to be measurable. Confidence: high, gear loss is reported.
	Navigation/ steaming	1	6	6	Distribution of the community	SET outer shelf; SET upper slope; Tasmanian mid-slope	3.1	4	2	1	Navigation/steaming introduces noise such as engine noise and echo sounding during fish finding/trawling considered to have most effect on distribution of communities by disturbing fish. SET upper slope, outer shelf and Tasmanian mid-slope chosen as these areas most intensely fished and where aggregating species maybe most vulnerable to disturbance (e.g. orange roughy on St. Helens hill, blue grenadier on west coast). Intensity: major, echo sounders and engines of vessels would be running for duration of fishing trips and shelf communities constantly fished; less on deeper water communities such as localized grenadier and roughy aggregations. Consequence: minor as disturbance unlikely to be detected against other factors and unlikely to detect disturbance in deeper water. Confidence: low not known whether disturbance of aggregations caused by echo sounding.
	Activity/ presence on water	1	6	6	Distribution of the community	SET outer shelf; SET upper slope	3.1	4	2	1	Activity/ presence on water of fishing vessels widespread on SET upper slope, outer shelf where most intensely fished. May effect the functional group composition by changing behaviour and distribution of cetaceans, scavengers, marine mammals. Intensity. Intensity: major, vessels in heavily fished areas constantly present. Consequence: minor, any change to community distribution would be undetectable against background variation except for short duration of fishing operation. Confidence: 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
Disturb physical processes	Bait collection	0									
	Fishing	1	6	3	Distribution of the community	Tasmanian midslope; Tasmanian seamount 565-820;	3.1	2	2	2	Removal of habitat (structure) can disrupt underpinning physical processes e.g. removal of corals on heavily fished seamounts caused significant changes to species composition and distribution of the seamount community (Koslow and Gowlett-Holmes 1998). Seamounts on the Tasmanian midslope, Cascade Plateau are particularly vulnerable to effects of fishing as species are generally long-lived, slow-growing, easily depleted and have a localized distribution. Intensity: minor, fishing in deep water habitats has declined; many of the seamounts are partially protected by MPAs and deepwater fishery closures have stopped fishing occurring on vulnerable habitats supporting communities. Consequence: minor as any impact probably not detectable against previous damage and assessment. Confidence: high, impact on benthic communities believed to be significant (Koslow and Gowlett-Holmes 1998) and recovery rates believed to be slow in disturbed communities (Bruce et al. 2002).
	Boat launching	0									
	Anchoring/ mooring	1	3	4	Distribution of the community	SET inner shelf	3.1	2	1	2	Anchoring/ mooring may occur in SET inner shelf where fishing effort highest but probably most occurs in sheltered bays in state waters. Some sedentary fish may be disturbed by anchor disturbance of sediments smothering some community components. Intensity: minor occurs in a few restricted locations. Consequence: negligible impossible to detect. Confidence: high because very unlikely for there to be lasting effect from anchoring/ mooring logical.
	Navigation/ steaming	1	6	6	Bio- and geo-chemical cycles	SET upper slope	5.1	1	1	2	Navigation /steaming occurred on the continental shelf and shelf break throughout the whole jurisdiction but more concentrated SET upper slope, outer shelf and Tasmanian mid-slope chosen as these areas most intensely fished. Possible Impact on bio- and geo-chemical cycles of pelagic waters

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
											by disturbing mixed depth layer. Intensity: negligible - navigation/steaming is a large component of the trawling operations but localised impact within immediate vicinity of the vessel. Consequence: negligible because impact considered likely undetectable against natural levels of mixing and re-mixing. Confidence: high-logical consideration.
External impacts	Other fisheries	1	6	6	Species composition	SET outer shelf	4.1	4	4	2	Other SESSF fisheries - gillnet, shark, auto-longline; SPF; state and recreational fisheries affect the same communities and therefore likely to have had a severe impact on species composition. Intensity: major as occurs often at a broad scale. Consequence: major as cumulative effects could be large. Confidence: high logical to consider cumulative effects of variety of fishing methods.
	Aquaculture	1	3	6	Bio- and geo-chemical cycles	Tasmanian inner shelf	5.1	2	1	2	Salmon aquaculture in Tasmanian waters input of waste affecting the water and substrate quality leading to alteration of bio-geochemical cycles locally. Management implement fallowing protocols although recovery rates not well-known. Mollusc aquaculture more frequent on mainland coast and has a nutrient depletion effect. Intensity: minor, local effects quickly dispersed and unlikely to be detected against natural variability. Consequence: negligible as impacts on community unlikely to detect variability against natural variability except where seagrass habitat important to different life stages of a variety species-no evidence. Confidence: high, e.g. nutrient inputs of D'Entrecasteaux Channel, Huon into Derwent estuaries are quickly dispersed into Storm Bay but impacts if any difficult to measure against other anthropogenic sources (Wild-Allen and Andrewartha 2016).
	Coastal development	1	6	6	Species composition	Central Eastern Province inner shelf, Eastern pelagic-coastal	1.1	3	2	1	Coastal development occurs across the range of the fishery but most likely to affect Central Eastern Province inner shelf community due to large population in this area. Frequent, local impacts at small spatial scales should have most obvious impact on the species composition of the areas affected,

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
											the impacts should be local and their consequences only minor to the communities. Intensity: moderate, moderate both broad coastal development and localised centres. Consequence: minor - greatest impacts likely to be inshore including waters less than 25m, and unlikely to extend to entire coastal demersal/pelagic communities. Confidence: low because of a lack of data.
	Other extractive activities	1	4	6	Distribution of the community	Central Bass inner shelf; Southern coastal	3.1	3	2	1	Ongoing development and expansion of oil and gas pipelines, oil and gas exploration and extraction drilling, and seismic survey for further oil and gas exploration occurs across southern Australia (notably Bass Strait) most likely to affect distribution of the community as sounds from air guns used in seismic surveys thought to affect fish behaviour possibly causing them to migrate out of fishing grounds. Effect of seismic surveys on scallops found. Intensity: moderate as local effects are potentially severe but confined to small area. Consequence: minor as long-term effect on communities expected to be minimal if detectable at all. Confidence: low as effects are unknown.
	Other non-extractive activities	1	5	6	Distribution of the community	Central Bass inner shelf; Southern coastal	3.1	3	2	1	Shipping occurs throughout the area daily and considered to impact distribution of pelagic communities through disturbance particularly on marine mammals. Intensity: moderate as local effects but temporary. Consequence: minor as long-term effects on communities undetectable. Confidence: low because of a lack of information on shipping-animal interactions.
	Other anthropogenic activities	1	4	6	Distribution of the community	SET outer shelf; SET upper slope; Central East	3.1	2	2	1	Communities may be disturbed by charter boats associated with general recreational activities, and tourism (e.g. whale watching, fishing tours, anchoring, recreational diving etc.). Most common off SET and Central East shelf. Intensity: minor unlikely to detect direct and indirect impacts on pelagic or demersal communities. Consequence: minor but Confidence: low no information.

2.3.11 Summary of SICA results

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 blue and bolded if high confidence. * existing stock assessment –assessment not required. Note: external hazards are not considered at Level 2.

DIRECT IMPACT	ACTIVITY	KEY/SECONDARY COMMERCIAL SPECIES	BYPRODUCT AND BYCATCH SPECIES	PROTECTED SPECIES	HABITATS	COMMUNITIES
Capture	Bait collection	0	0	0	0	0
	Fishing	3	**3**	**3**	5	3
	Incidental behaviour	0	0	0	0	0
Direct impact without capture	Bait collection	0	0	0	0	0
	Fishing	3	2	2	5	3
	Incidental behaviour	0	0	0	0	0
	Gear loss	1	1	1	2	1
	Anchoring/ mooring	1	1	1	1	1
	Navigation/ steaming	1	1	2	1	1
Addition/ movement of biological material	Translocation of species	1	1	1	1	1
	On board processing	2	2	2	1	1
	Discarding catch	2	2	2	2	2
	Stock enhancement	0	0	0	0	0
	Provisioning	0	0	0	0	0
	Organic waste disposal	0	0	0	0	0
Addition of non-biological material	Debris	0	0	0	0	0
	Chemical pollution	0	0	0	0	0
	Exhaust	1	1	1	1	1
	Gear loss	1	1	1	1	1
	Navigation/ steaming	1	1	2	1	2
	Activity/ presence on water	2	2	2	1	2
Disturb physical processes	Bait collection	0	0	0	0	0
	Fishing	2	2	2	5	2
	Boat launching	0	0	0	0	0
	Anchoring/mooring	1	1	1	1	1
	Navigation/ steaming	1	1	2	1	1
External Impacts	Other fisheries	4	4	**4**	**3**	**4**
	Aquaculture	2	2	2	1	1
	Coastal development	2	2	3	2	2
	Other extractive activities	2	2	2	2	2
	Other non-extractive activities	2	2	2	2	2
	Other anthropogenic activities	1	1	2	2	2

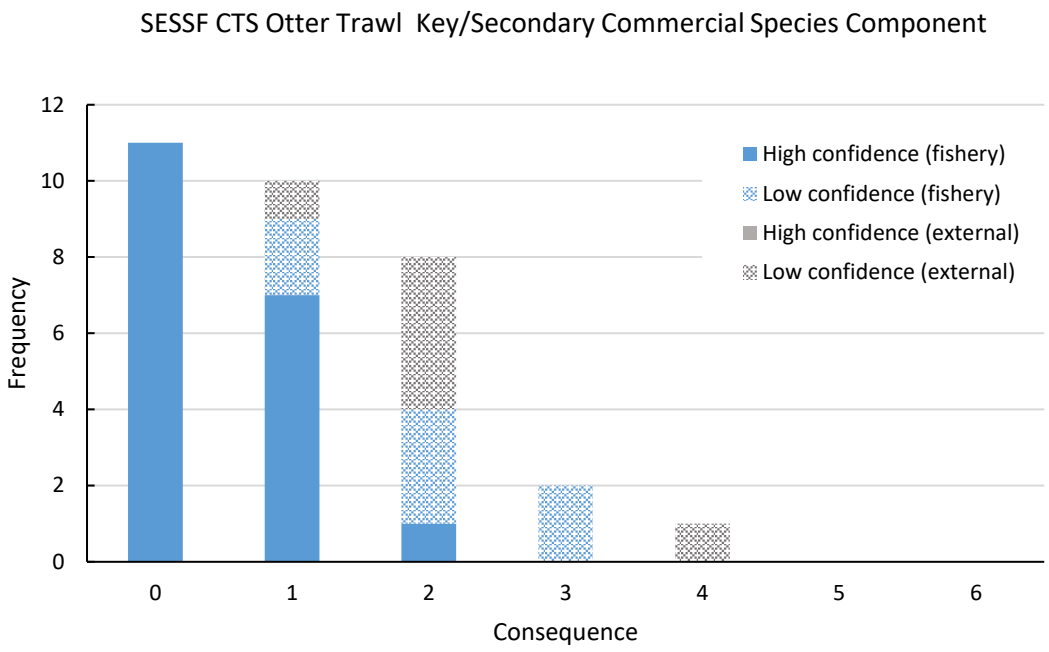


Figure 2.4. Key/secondary commercial species: Frequency of consequence score by high and low confidence.

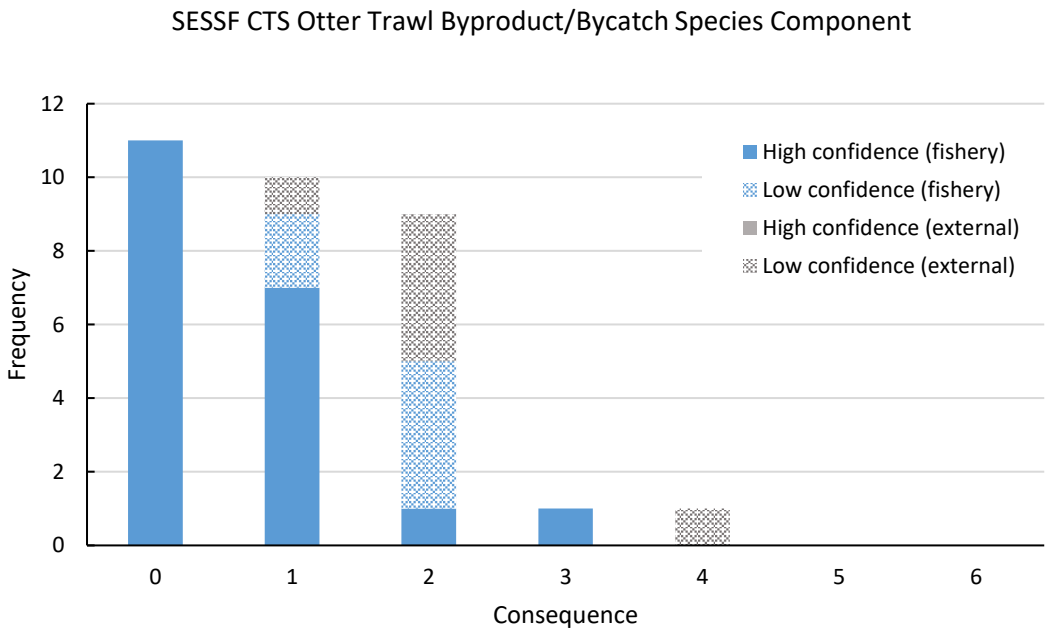


Figure 2.5. Byproduct and bycatch species: Frequency of consequence score by high and low confidence.

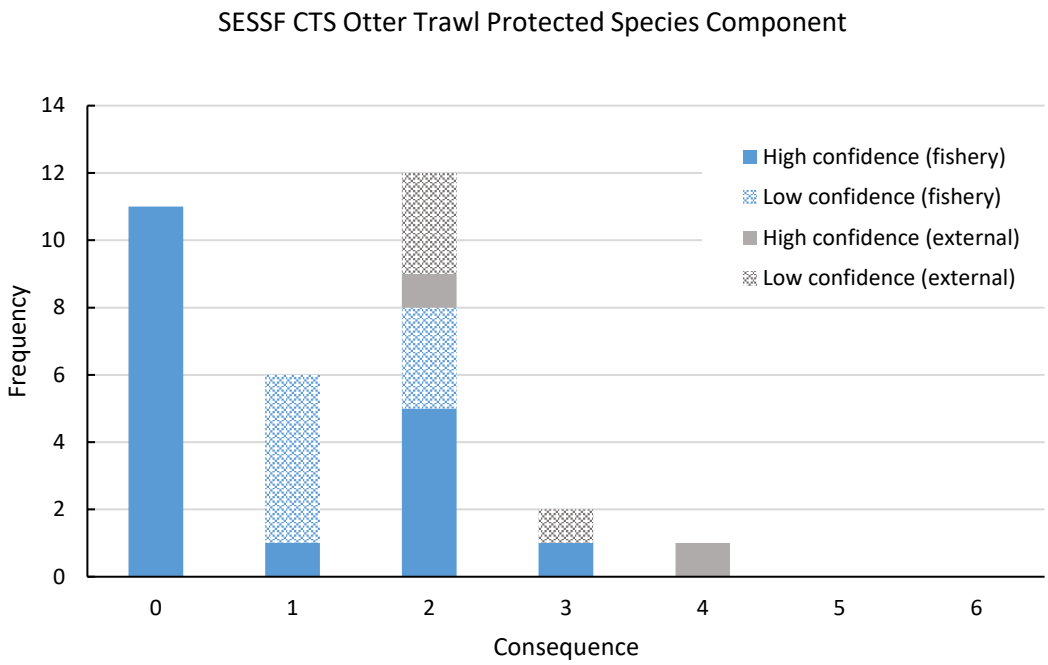


Figure 2.6. Protected species: Frequency of consequence score by high and low confidence.

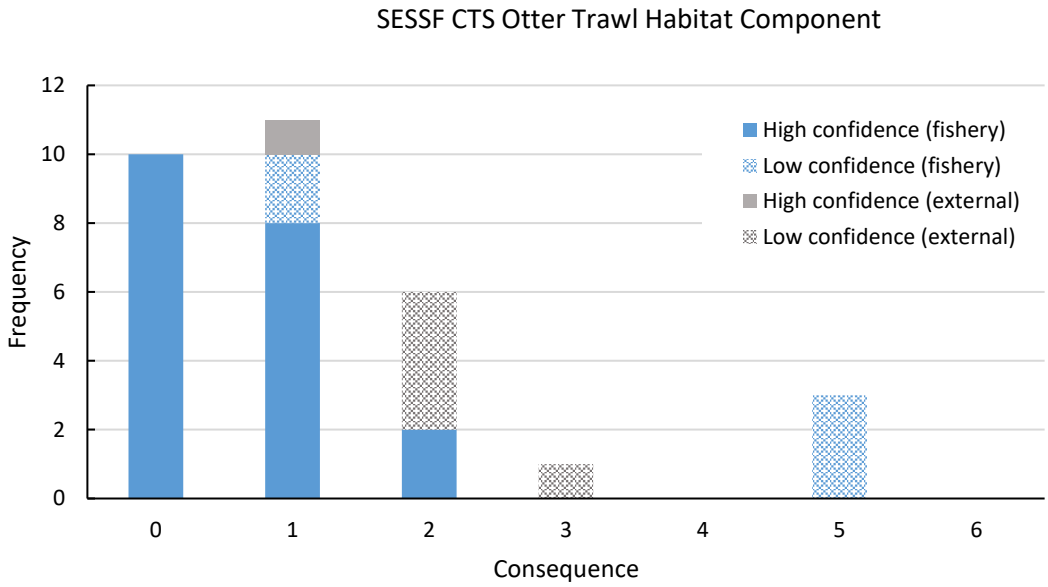


Figure 2.7. Habitat: Frequency of consequence score by high and low confidence.

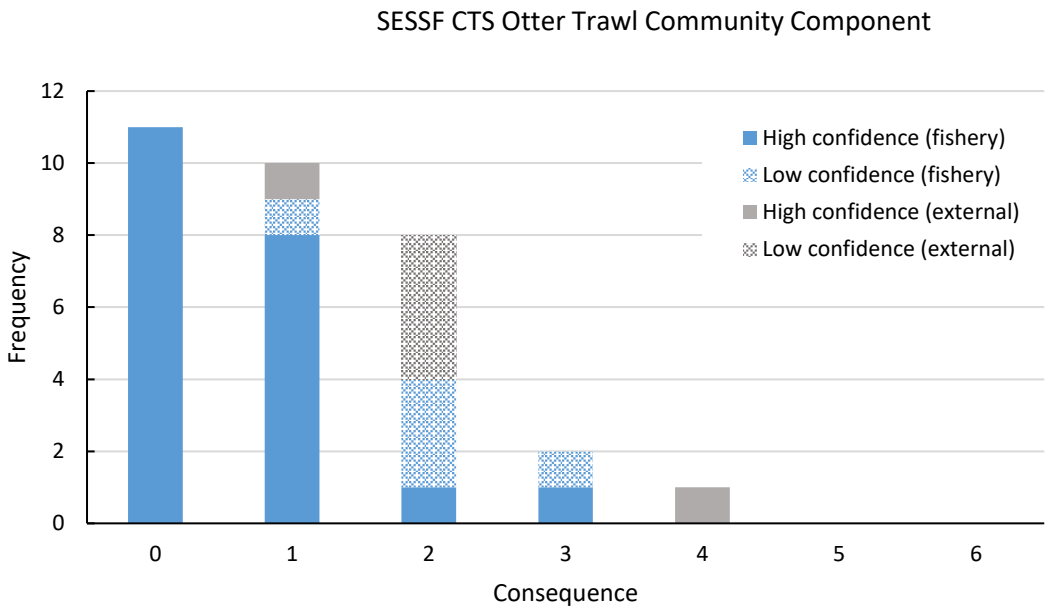


Figure 2.8. Communities: Frequency of consequence score by high and low confidence.

2.3.12 Evaluation/discussion of Level 1

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

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

- Fishing (direct and indirect impacts on all 5 ecological components)
- Fishing (indirect impacts on key/secondary, on habitats and communities)
- Fishing through physical disturbance (impact on habitats)

Significant external hazards included other fisheries in the region, which presented a major risk (risk score 4) to all components.

Only habitats were rated at severe risk (score 5) from direct and indirect impacts from primary fishing operations and physical disturbance.

As a result of direct capture by fishing, the most vulnerable commercial species was Gould's squid, a key commercial species with no stock assessment (in this sub-fishery) and the most vulnerable bycatch/byproduct species was Endeavour dogfish. Of the protected species the Australian furseal was at most risk. This species had the greatest mortality as a result of capture although about 20% were released or escaped.

While the populations of Australian fur seals have been recovering since severe exploitation in the previous century, the increase is possibly slowing (McIntosh et al. 2014) although their

distribution is expanding (Kirkwood et al. 2010). Current estimates are about 110 000 individuals (Kirkwood et al. 2010) but they are all considered to be the same population (Lancaster et al. 2010).

Similarly, detailed habitat information on the actual damage vulnerable habitat types are incurring within the assemblages is unknown and therefore remain at high risk.

A previous Level 2 analysis of communities showed that the highly trawled communities were at greatest risk (Hobday et al. 2011) and probably continues to be the case. While effort has declined across the fishery in general, indications of declining fish length in species indicates that a size structural change has occurred but the effect on the community size structure overall is unknown.

2.3.13 Components to be examined at Level 2

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:

- Key/secondary commercial
- Byproduct/bycatch
- Protected species
- Habitats
- Communities

Note: Level 2 analysis of habitats and communities but will not be possible at this time.

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 susceptibility.

	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)

	ATTRIBUTE
	Selectivity considers the potential of the gear to capture or retain species
	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
Susceptibility			

ASPECT	ATTRIBUTE	CONCEPT	RATIONALE
Availability	General depth range (Biome)	Spatial overlap of sub-fishery with habitat defined at biomic scale	Habitat occurs within the management area
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, e.g. 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 2006 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)

Table 2.22. Species/species groups/taxa excluded from the PSA and SAFE 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 observations 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.

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Benthos		Porifera - undifferentiated	Sponges	10000000	Insufficient taxonomic resolution
BC	Benthos	Spongiidae	Spongiidae - undifferentiated	Sponges	10114000	Insufficient taxonomic resolution
BC	Benthos		Order Scleractinia - undifferentiated	Stony corals	11290000	Insufficient taxonomic resolution
BC	Benthos		Various bits of the sea floor which may be alive	Benthos	99000001	Insufficient taxonomic resolution
BC	Benthos		Substrate or rocks that are non-living	Substrate or rocks	99000002	Insufficient taxonomic resolution
BC	Chondrichthyan	Hexanchidae	Hexanchidae - undifferentiated	Sixgill and sevengill sharks unspecified	37005000	Insufficient taxonomic resolution
BC	Chondrichthyan	Orectolobidae	Orectolobidae	Wobbegong (mixed)	37013900	Insufficient taxonomic resolution
BC	Chondrichthyan	Scyliorhinidae	Cephaloscyllium spp.	Draughtboard sharks (mixed)	37015906	Insufficient taxonomic resolution
BC	Chondrichthyan	Triakidae	Triakidae - undifferentiated	Hound sharks	37017000	Insufficient taxonomic resolution
BC	Chondrichthyan	Carcharhinidae, Hemigaleidae	Carcharhinidae, Hemigaleidae - undifferentiated	Whaler and weasel sharks	37018000	Insufficient taxonomic resolution
BC	Chondrichthyan	Carcharhinidae	*Carcharhinus,* Loxodon and Rhizoprionodon spp	Blacktip shark (mixed)	37018901	Insufficient taxonomic resolution
BC	Chondrichthyan	Carcharhinidae	*Carcharhinus brachyurus* and *Carcharhinus obscurus*	Bronze whaler shark	37018902	Insufficient taxonomic resolution
BC	Chondrichthyan	Sphyrnidae	Sphyrnidae - undifferentiated	Hammerhead sharks	37019000	Insufficient taxonomic resolution
BC	Chondrichthyan	Squalidae	*Squalus* spp	Greeneye dogfishes (mixed)	37020901	Insufficient taxonomic resolution
BC	Chondrichthyan	Etmopteridae	*Etmopterus* spp	Lantern sharks (mixed)	37020907	Insufficient taxonomic resolution
BC	Chondrichthyan	Centrophoridae	*Centrophorus* spp	Gulper sharks (mixed)	37020908	Insufficient taxonomic resolution
BC	Chondrichthyan	Squalidae	Squalidae - undifferentiated	Dogfishes (mixed)	37020923	Insufficient taxonomic resolution
BC	Chondrichthyan	Pristiophoridae	*Pristiophorus* spp	Sawshark (mixed)	37023900	Insufficient taxonomic resolution
BC	Chondrichthyan	Squatinidae	*Squatina* spp	Angel shark (mixed)	37024900	Insufficient taxonomic resolution

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Chondrichthyan	Rhinobatidae	Rhinobatidae - undifferentiated	Shovelnose rays	37027000	Insufficient taxonomic resolution
BC	Chondrichthyan	Torpedinidae, Narcinidae, Hypnidae	Torpedinidae, Narcinidae, Hypnidae - undifferentiated	Torpedo rays coffin rays and numbfishes	37028000	Insufficient taxonomic resolution
BC	Chondrichthyan	Rajidae	Raja spp.	Skate (mixed)	37031900	Insufficient taxonomic resolution
BC	Chondrichthyan	Dasyatidae	Dasyatidae - undifferentiated	Stingrays	37035000	Insufficient taxonomic resolution
BC	Chondrichthyan	Dasyatidae	Dasyatis spp	Pelagic stingrays	37035999	Insufficient taxonomic resolution
BC	Chondrichthyan	Urolophidae, Plesiobatidae	Urolophidae, Plesiobatidae - undifferentiated	Stingarees and giant stingarees	37038000	Insufficient taxonomic resolution
BC	Chondrichthyan	Chimaeridae	*Hydrolagus* spp	Ghostsharks	37042901	Insufficient taxonomic resolution
BC	Chondrichthyan	Rhinochimaeridae	Rhinochimaeridae - undifferentiated	Spookfishes	37044000	Insufficient taxonomic resolution
BC	Chondrichthyan	Dasyatidae, Gymnuridae, Myliobatidae, Urolophidae	Dasyatidae, Gymnuridae, Myliobatidae and Urolophidae spp	Rays	37990001	Insufficient taxonomic resolution
BC	Chondrichthyan		Chimaeriformes	Chimaeras	37990028	Insufficient taxonomic resolution
BC	Chondrichthyan		Order Rajiformes - undifferentiated	Skates and rays (mixed)	37990030	Insufficient taxonomic resolution
BC	Chondrichthyan		Squaliformes	Dogfish sharks	37990071	Insufficient taxonomic resolution
BC	Invertebrate		*Scyphozoa* spp - undifferentiated	Jellyfish	11120000	Insufficient taxonomic resolution
BC	Invertebrate		Subclass Octocorallia - undifferentiated	Octocorals - soft corals	11169000	Insufficient taxonomic resolution
BC	Invertebrate		Order Pennatulacea - undifferentiated	Seapens	11208000	Insufficient taxonomic resolution
BC	Invertebrate		Order Actinaria - undifferentiated	Sea anemones	11229000	Insufficient taxonomic resolution
BC	Invertebrate		Class Cephalopoda - undifferentiated	Cephalopods	23590000	Insufficient taxonomic resolution
BC	Invertebrate	Sepiidae	Sepiidae - undifferentiated	Cuttlefishes	23607000	Insufficient taxonomic resolution
BC	Invertebrate	Bathyteuthidae	Bathyteuthidae - undifferentiated	Deepsea squids	23632000	Insufficient taxonomic resolution
BC	Invertebrate		Order Octopoda - undifferentiated	Octopoda	23650000	Insufficient taxonomic resolution
BC	Invertebrate		Class Gastropoda - undifferentiated	Gastropods	24000000	Insufficient taxonomic resolution
BC	Invertebrate		Order Nudibranchia - undifferentiated	Nudibranchs	24420000	Insufficient taxonomic resolution
BC	Invertebrate		Echinodermata - undifferentiated	Echinoderms	25000000	Insufficient taxonomic resolution

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Invertebrate		Crinoidea - undifferentiated	Crinoids	25001000	Insufficient taxonomic resolution
BC	Invertebrate		Class Asteroidea - undifferentiated	Starfish	25102000	Insufficient taxonomic resolution
BC	Invertebrate		Class Ophiuroidea - undifferentiated	Brittlestars	25160000	Insufficient taxonomic resolution
BC	Invertebrate	Euryalidae	Euryalidae - undifferentiated	Snakestars	25170000	Insufficient taxonomic resolution
BC	Invertebrate	Ophiuridae	Ophiuridae - undifferentiated	Ophiuridae	25176000	Insufficient taxonomic resolution
BC	Invertebrate		Class Echinoidea - undifferentiated	Sea urchins	25200000	Insufficient taxonomic resolution
BC	Invertebrate		Clypeasteridae - undifferentiated	Sand dollars	25262000	Insufficient taxonomic resolution
BC	Invertebrate		Class Holothuroidea - undifferentiated	Holothurians	25400000	Insufficient taxonomic resolution
BC	Invertebrate		Subclass Malacostraca - undifferentiated	Crabs, lobsters, prawns	28000000	Insufficient taxonomic resolution
BC	Invertebrate		Order Stomatopoda - undifferentiated	Mantis shrimps	28030000	Insufficient taxonomic resolution
BC	Invertebrate	Squillidae	Squillidae - undifferentiated	Squilla mantis shrimps	28051000	Insufficient taxonomic resolution
BC	Invertebrate		Penaeoidea and Caridea - undifferentiated	Prawns (mixed)	28710000	Insufficient taxonomic resolution
BC	Invertebrate	Penaeidae	Penaeidae - undifferentiated	Penaeid prawns	28711000	Insufficient taxonomic resolution
BC	Invertebrate	Penaeidae	King prawns - *Melicertus latisulcatus*, *Melicertus plebejus* and *Melicertus longisty*	King prawns (mixed)	28711910	Insufficient taxonomic resolution
BC	Invertebrate	Aristeidae	Aristeidae - undifferentiated	Deep sea prawns	28712000	Insufficient taxonomic resolution
BC	Invertebrate		Infraorder Caridea - undifferentiated	Carid prawns	28730000	Insufficient taxonomic resolution
BC	Invertebrate	Oplophoridae	Oplophoridae - undifferentiated	Oplophorid carid prawns	28734000	Insufficient taxonomic resolution
BC	Invertebrate	Palinuridae	Palinuridae - undifferentiated	Spiny lobsters	28820000	Insufficient taxonomic resolution
BC	Invertebrate	Scyllaridae	*Thenus* spp	Moreton Bay bugs	28821903	Insufficient taxonomic resolution
BC	Invertebrate	Scyllaridae	*Ibacus* and *Thenus* spp	Bugs (*Ibacus* and *Thenus*)	28821904	Insufficient taxonomic resolution
BC	Invertebrate		Infraorder Anomura - undifferentiated	Anomurans	28825000	Insufficient taxonomic resolution
BC	Invertebrate	Diogenidae	Diogenidae - undifferentiated	Hermit crabs (left handed)	28827000	Insufficient taxonomic resolution
BC	Invertebrate	Lithodidae	Lithodidae - undifferentiated	King crabs	28836000	Insufficient taxonomic resolution
BC	Invertebrate	Lithodidae	*Lithodes* spp	King crabs (mixed)	28836900	Insufficient taxonomic resolution
BC	Invertebrate	Galatheidae	Galatheidae - undifferentiated	Squat lobsters	28840000	Insufficient taxonomic resolution
BC	Invertebrate	Homolidae	Homolidae - undifferentiated	Spider crabs (Homolidae)	28860000	Insufficient taxonomic resolution

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Invertebrate	Majidae	Majidae and related families - undifferentiated	Spider crabs (All families)	28880000	Insufficient taxonomic resolution
BC	Invertebrate	Majidae	Majidae - undifferentiated	Spider crabs (Majidae)	28880911	Insufficient taxonomic resolution
BC	Invertebrate	Portunidae	Portunidae - undifferentiated	Swimming crabs	28911000	Insufficient taxonomic resolution
BC	Invertebrate	Hypothalassidae	Hypothalassia spp	Champagne crabs (mixed)	28916901	Insufficient taxonomic resolution
BC	Invertebrate		Ascidiacea - undifferentiated	Ascidians	35000000	Insufficient taxonomic resolution
BC	Invertebrate	Salpidae	Salpidae - undifferentiated	Salpid salps	35103000	Insufficient taxonomic resolution
BC	Phaeophyceae		Phaeophyceae	Brown algae	54000000	Insufficient taxonomic resolution
BC	Phaeophyceae		Domain Eukaryota - undifferentiated	Algae	99000006	Insufficient taxonomic resolution
BC	Teleost	Myxinidae	Myxinidae - undifferentiated	Hagfishes	37004000	Insufficient taxonomic resolution
BC	Teleost	Scyliorhinidae	Scyliorhinidae - undifferentiated	Catsharks	37015000	Insufficient taxonomic resolution
BC	Teleost	Muraenidae	Muraenidae - undifferentiated	Moray eels	37060000	Insufficient taxonomic resolution
BC	Teleost	Congridae	*Conger verreauxi* and *Conger wilsoni*	Conger eel (mixed)	37067900	Insufficient taxonomic resolution
BC	Teleost	Gonostomatidae, Phosichthyidae	Gonostomatidae, Phosichthyidae - undifferentiated	Bristlemouths and lightfishes	37106000	Insufficient taxonomic resolution
BC	Teleost	Sternoptychidae	Sternoptychidae - undifferentiated	Hatchetfishes	37107000	Insufficient taxonomic resolution
BC	Teleost	Alepocephalidae	Alepocephalidae - undifferentiated	Slickheads	37114000	Insufficient taxonomic resolution
BC	Teleost	Alepocephalidae	*Rouleina* spp	Slickhead (mixed)	37114900	Insufficient taxonomic resolution
BC	Teleost	Chlorophthalmidae, Paraulopidae, Bathysauroididae, Bathysauropsidae	Chlorophthalmidae, Paraulopidae, Bathysauroididae, Bathysauropsidae - undifferentiated	Cucumberfishes, greeneyes and lizardfishes	37120000	Insufficient taxonomic resolution
BC	Teleost	Mctophidae	*Electrona* spp	Lanternfishes - Electronid	37122901	Insufficient taxonomic resolution
BC	Teleost	Ateleopodidae	Ateleopodidae - undifferentiated	Jellynose fishes	37136000	Insufficient taxonomic resolution
BC	Teleost	Lophiidae	Lophiidae - undifferentiated	Goosefishes	37208000	Insufficient taxonomic resolution
BC	Teleost	Antennariidae, Tetrabrachiidae, Lophichthyidae	Antennariidae, Tetrabrachiidae, Lophichthyidae - undifferentiated	Frogfishes, doublefin and straightback frogfish	37210000	Insufficient taxonomic resolution
BC	Teleost	Chaunacidae	Chaunacidae - undifferentiated	Coffinfishes	37211000	Insufficient taxonomic resolution
BC	Teleost	Ogcocephalidae	Ogcocephalidae - undifferentiated	Seabats	37212000	Insufficient taxonomic resolution

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Teleost	Moridae	*Lepidion* spp	Pelagic cods - Lepidid	37224902	Insufficient taxonomic resolution
BC	Teleost	Moridae	Moridae - undifferentiated	Moridae	37224903	Insufficient taxonomic resolution
BC	Teleost	Ophidiidae	Ophidiidae spp	Cusk eels (mixed)	37228999	Insufficient taxonomic resolution
BC	Teleost	Macrouridae	*Coelorinchus* spp	Whiptails - Coelorinchid	37232900	Insufficient taxonomic resolution
BC	Teleost	Macrouridae	*Macrourus* spp	Whiptails - Macrourid	37232901	Insufficient taxonomic resolution
BC	Teleost	Macrouridae	Coryphaenoides spp	Whiptails - Coryphaenoid	37232902	Insufficient taxonomic resolution
BC	Teleost	Trachichthyidae	Trachichthyidae - undifferentiated	Roughies	37255000	Insufficient taxonomic resolution
BC	Teleost	Berycidae	Berycidae - undifferentiated	Alfonsinos	37258000	Insufficient taxonomic resolution
BC	Teleost	Zeidae, Cyttidae	Zeidae, Cyttidae - undifferentiated	Dories and lookdown dories	37264000	Insufficient taxonomic resolution
BC	Teleost	Grammicolepididae	Grammicolepididae - undifferentiated	Scaly dories	37265000	Insufficient taxonomic resolution
BC	Teleost	Oreosomatidae	Oreosomatidae - undifferentiated	Oreodories	37266000	Insufficient taxonomic resolution
BC	Teleost	Lampridiidae	*Lampris guttatus* and *Lampris immaculatus*	Moonfish (mixed)	37268900	Insufficient taxonomic resolution
BC	Teleost	Trachipteridae	Trachipteridae - undifferentiated	Ribbonfishes	37271000	Insufficient taxonomic resolution
BC	Teleost	Fistulariidae	Fistulariidae - undifferentiated	Flutemouths	37278000	Insufficient taxonomic resolution
BC	Teleost	Macroramphosidae	Macroramphosidae - undifferentiated	Bellowfish	37279000	Insufficient taxonomic resolution
BC	Teleost	Synbranchidae	Synbranchidae - undifferentiated	swamp eels	37285000	Insufficient taxonomic resolution
BC	Teleost	Apistidae, Neosebastidae, Pteroidae, Scorpaenidae, Sebastidae, Setarchidae	Apistidae, Neosebastidae, Pteroidae, Scorpaenidae, Sebastidae, Setarchidae	Scorpionfishes	37287000	Insufficient taxonomic resolution
BC	Teleost	Scorpaenidae	Scorpaenidae	Coral perch	37287900	Insufficient taxonomic resolution
BC	Teleost	Scorpaenidae	Scorpaena spp	Scorpionfishes - Scorpaenid	37287904	Insufficient taxonomic resolution
BC	Teleost	Triglidae, Peristediidae	Triglidae and Peristediidae - undifferentiated	Searobins and armour gurnards	37288000	Insufficient taxonomic resolution
BC	Teleost	Triglidae	Triglidae	Searobins	37288900	Insufficient taxonomic resolution
BC	Teleost	Triglidae	*Lepidotrigla modesta* and *Lepidotrigla mulhalli*	Cocky gurnard (mixed)	37288903	Insufficient taxonomic resolution
BC	Teleost	Hoplichthyidae	Hoplichthyidae - undifferentiated	Ghost flatheads	37297000	Insufficient taxonomic resolution

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Teleost	Psychrolutidae	Psychrolutidae - undifferentiated	Blobfishes	37305000	Insufficient taxonomic resolution
BC	Teleost	Percichthyidae, Serranidae	Percichthyidae, Serranidae - undifferentiated	Temperate basses and rockcods	37311000	Insufficient taxonomic resolution
BC	Teleost	Serranidae	*Aethaloperca* and *Anyperodon* spp	Rockcod (*Aethaloperca* and *Anyperodon*)	37311901	Insufficient taxonomic resolution
BC	Teleost	Polyprionidae	*Polyprion americanus* and *Polyprion oxygeneios*	Hapuku and bass groper	37311902	Insufficient taxonomic resolution
BC	Teleost	Serranidae	*Epinephelus ergastularius* and *Epinephelus septemfasciatus*	Bar rockcod	37311910	Insufficient taxonomic resolution
BC	Teleost	Priacanthidae	*Priacanthus* spp	Bigeyes (mixed)	37326901	Insufficient taxonomic resolution
BC	Teleost	Apogonidae	*Siphamia versicolor*	Urchin cardinalfish	37327021	Misidentification: Outside fishery range
BC	Teleost	Apogonidae	*Apogon melas*	Black cardinalfish	37327133	Misidentification: Outside fishery range
BC	Teleost	Epigonidae	Epigonus spp	Deepsea cardinalfish	37327900	Insufficient taxonomic resolution
BC	Teleost	Sillaginidae	Sillaginidae - undifferentiated	Whitings	37330000	Insufficient taxonomic resolution
BC	Teleost	Carangidae	*Selaroides leptolepis*	Yellowstripe scad	37337015	Misidentification: Outside fishery range
BC	Teleost	Carangidae	*Decapterus macrosoma*	Shortfin scad	37337017	Misidentification: Outside fishery range
BC	Teleost	Carangidae	*Decapterus russelli*	Indian scad	37337023	Misidentification: Outside fishery range
BC	Teleost	Carangidae	*Elagatis bipinnulata*	Rainbow runner	37337029	Misidentification: Outside fishery range
BC	Teleost	Carangidae	*Trachurus* spp	Mackerel scads	37337907	Insufficient taxonomic resolution
BC	Teleost	Carangidae	*Trachurus declivis* and *Trachurus murphyi*	Jack mackerels	37337912	Insufficient taxonomic resolution
BC	Teleost	Arripidae	*Arripis trutta* and *Arripis truttaceus*	Australian salmon	37344900	Insufficient taxonomic resolution
BC	Teleost	Emmelichthyidae	Emmelichthyidae - undifferentiated	Bonnetmouths	37345000	Insufficient taxonomic resolution
BC	Teleost	Lutjanidae	*Lutjanus* spp	Sea perch	37346905	Insufficient taxonomic resolution
BC	Teleost	Gerreidae	Gerreidae - undifferentiated	Silverbiddies	37349000	Insufficient taxonomic resolution
BC	Teleost	Haemulidae	*Pomadasys* spp	Grunter bream (mixed)	37350902	Insufficient taxonomic resolution
BC	Teleost	Mullidae	Mullidae - undifferentiated	Goatfishes	37355000	Insufficient taxonomic resolution
BC	Teleost	Mullidae	*Parupeneus* spp	Red mullets (Parupeneus)	37355900	Insufficient taxonomic resolution
BC	Teleost	Ephippidae, Drepaneidae	Ephippidae, Drepaneidae - undifferentiated	Batfish	37362000	Insufficient taxonomic resolution

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Teleost	Chaetodontidae	Chaetodontidae - undifferentiated	Butterflyfishes	37365900	Insufficient taxonomic resolution
BC	Teleost	Pentacerotidae	*Paristiopterus gallipavo* and *Paristiopterus labiosus*	Giant boarfish	37367901	Insufficient taxonomic resolution
BC	Teleost	Oplegnathidae	Oplegnathidae - undifferentiated	Knifejaws	37369000	Insufficient taxonomic resolution
BC	Teleost	Cheilodactylidae	*Nemadactylus macropterus* and *Nemadactylus* sp	Morwong (mixed)	37377901	Insufficient taxonomic resolution
BC	Teleost	Latridae	*Latridopsis* spp	Trumpeters	37378900	Insufficient taxonomic resolution
BC	Teleost	Pinguipedidae	Pinguipedidae - undifferentiated	Grubfishes	37390000	Insufficient taxonomic resolution
BC	Teleost	Gempylidae	*Thyrsites* spp	Barracoutas (mixed)	37439914	Insufficient taxonomic resolution
BC	Teleost	Trichiuridae	Trichiuridae - undifferentiated	Ribbonfishes and cutlassfishes	37440000	Insufficient taxonomic resolution
BC	Teleost	Scombridae	Scombridae - undifferentiated	Mackerels	37441000	Insufficient taxonomic resolution
BC	Teleost	Centrolophidae	Centrolophidae - undifferentiated	Trevallas	37445000	Insufficient taxonomic resolution
BC	Teleost	Nomeidae	Nomeidae - undifferentiated	Driftfishes	37446000	Insufficient taxonomic resolution
BC	Teleost	Ariommatidae	Ariommatidae - undifferentiated	Eyebrow fishes	37447000	Insufficient taxonomic resolution
BC	Teleost	Bothidae, Achiropsettidae, Paralichthyidae	Bothidae, Achiropsettidae, Paralichthyidae - undifferentiated	Lefteye flounders	37460000	Insufficient taxonomic resolution
BC	Teleost	Pleuronectidae	Pleuronectidae - undifferentiated	Righteye flounders	37461000	Insufficient taxonomic resolution
BC	Teleost	Soleidae	Soleidae - undifferentiated	Soles	37462000	Insufficient taxonomic resolution
BC	Teleost	Monacanthidae	Monacanthidae	Leatherjacket	37465903	Insufficient taxonomic resolution
BC	Teleost	Ostraciidae	Ostraciidae - undifferentiated	Boxfishes	37466000	Insufficient taxonomic resolution
BC	Teleost	Tetraodontidae	Tetraodontidae - undifferentiated	Toadfishes - unspecified	37467000	Insufficient taxonomic resolution
BC	Teleost	Tetraodontidae	*Lagocephalus* spp	Toadfishes - Lagocephalid	37467900	Insufficient taxonomic resolution
BC	Teleost	Diodontidae	Diodontidae - undifferentiated	Porcupine Fish	37469000	Insufficient taxonomic resolution
BC	Teleost	Bothidae, Psettodidae, Pleuronectidae	Bothidae, Psettodidae and Pleuronectidae	Flounders (mixed all types)	37990009	Insufficient taxonomic resolution
BC	Teleost	Cynoglossidae, Soleidae	Cynoglossidae and Soleidae spp	Sole (mixed)	37990015	Insufficient taxonomic resolution
BC	Teleost		Fish oceanic (mixed)	Fish oceanic (mixed)	37990020	Insufficient taxonomic resolution
BC	Teleost		Order Zeiformes - undifferentiated	Dories (mixed)	37990077	Insufficient taxonomic resolution

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Teleost	Scorpaenidae, Triglidae, Peristediidae	Scorpaenidae, Triglidae and Peristediidae - undifferentiated	Scorpionfishes, gurnards and latchets	37990084	Insufficient taxonomic resolution
BC	Unknown		Nothing was caught/observed	No catch or interaction	0	Insufficient taxonomic resolution
BC	Unknown		Human attributed objects (e.g. pipeline) or garbage	Human attributed objects	99000003	Insufficient taxonomic resolution
BC	Unknown		Trees or driftwood	Trees or driftwood	99000004	Insufficient taxonomic resolution
BP	Chondrichthyan	Alopidae	*Alopias* spp.	Thresher sharks (mixed)	37012901	Insufficient taxonomic resolution
BP	Chondrichthyan	Brachaeluridae	Brachaeluridae and related families - undifferentiated	Wobbegongs blind nurse carpet and zebra shark	37013000	Insufficient taxonomic resolution
BP	Chondrichthyan	Centrophoridae, Dalatiidae, Squalidae, Somniosidae, Etmopteridae	Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae - undifferentiated	Gulper sharks, sleeper sharks, dogfishes	37020000	Insufficient taxonomic resolution
BP	Chondrichthyan	Somniosidae, Centrophoridae,	*Centroscymnus* and *Deania* spp	Roughskin dogfishes (mixed)	37020904	Insufficient taxonomic resolution
BP	Chondrichthyan	Centrophoridae	*Deania calcea* and *Deania quadrispinosa*	Platypus sharks (mixed)	37020905	Insufficient taxonomic resolution
BP	Chondrichthyan	Somniosidae	*Centroscymnus* spp	Sleeper sharks (mixed)	37020906	Insufficient taxonomic resolution
BP	Chondrichthyan	Pristiophoridae	Pristiophoridae - undifferentiated	Sawsharks	37023000	Insufficient taxonomic resolution
BP	Chondrichthyan	Squatinidae	Squatinidae - undifferentiated	Angel sharks	37024000	Insufficient taxonomic resolution
BP	Chondrichthyan	Rhinidae	Rhinidae - undifferentiated	Guitarfishes unspecified	37026000	Insufficient taxonomic resolution
BP	Chondrichthyan	Rhinobatidae	*Trygonorrhina* spp	Fiddler rays Unspecified	37027999	Insufficient taxonomic resolution
BP	Chondrichthyan	Rajidae	Rajidae - undifferentiated	Skates	37031000	Insufficient taxonomic resolution
BP	Chondrichthyan	Chimaeridae	Chimaeridae - undifferentiated	Ghostsharks	37042000	Insufficient taxonomic resolution
BP	Chondrichthyan		Sharks - other	Sharks (mixed)	37990003	Insufficient taxonomic resolution
BP	Chondrichthyan		Skates and rays - unspecified	Skates and rays	37990018	Insufficient taxonomic resolution
BP	Invertebrate	Sepidae	Sepia spp	Cuttlefish (mixed)	23607901	Insufficient taxonomic resolution
BP	Invertebrate		Order Teuthoidea - undifferentiated	Squids	23615000	Insufficient taxonomic resolution
BP	Invertebrate	Loliginidae	Loliginidae - undifferentiated	Calamari	23617000	Insufficient taxonomic resolution
BP	Invertebrate	Octopodidae -	Octopodidae - undifferentiated	Octopuses	23659000	Insufficient taxonomic resolution
BP	Invertebrate		Shells	Shells	23999999	Insufficient taxonomic resolution

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BP	Invertebrate	Volutidae	Volutidae - undifferentiated	Bailer shells	24207000	Insufficient taxonomic resolution
BP	Invertebrate	Scyllaridae	Scyllaridae - undifferentiated	Bugs - shovel nosed and slipper lobsters	28821000	Insufficient taxonomic resolution
BP	Invertebrate		Brachyura - undifferentiated	Crabs	28850000	Insufficient taxonomic resolution
BP	Teleost	Congridae, Colocongridae	Congridae, Colocongridae - undifferentiated	Conger eels	37067000	Insufficient taxonomic resolution
BP	Teleost	Myctophidae	Myctophidae - undifferentiated	Lanternfishes	37122000	Insufficient taxonomic resolution
BP	Teleost	Melanonidae, Moridae, Euclichthyidae	Melanonidae, Moridae, Euclichthyidae - undifferentiated	Pelagic morid and eucla cods	37224000	Insufficient taxonomic resolution
BP	Teleost	Moridae	*Lotella* and *Pseudophycis* spp	Southern rock cod	37224900	Insufficient taxonomic resolution
BP	Teleost	Ophidiidae	*Genypterus* spp	Ling (mixed)	37228901	Insufficient taxonomic resolution
BP	Teleost	Macrouridae, Bathygadidae	Macrouridae and Bathygadidae - undifferentiated	Whiptails	37232000	Insufficient taxonomic resolution
BP	Teleost	Oreosomatidae	*Neocyttus rhomboidalis*, *N. psilorhynchus*, *Allocyttus niger* and *A. verrucosus*	Oreodories (mixed)	37266902	Insufficient taxonomic resolution
BP	Teleost	Triglidae	*Lepidotrigla* spp	Butterfly gurnard (mixed)	37288901	Insufficient taxonomic resolution
BP	Teleost	Glaucosomatidae	*Glaucosoma* spp	Pearl perch	37320901	Insufficient taxonomic resolution
BP	Teleost	Apogonidae, Dinolestidae	Apogonidae, Dinolestidae - undifferentiated	Cardinalfishes	37327000	Insufficient taxonomic resolution
BP	Teleost	Carangidae	Carangidae - undifferentiated	Trevallies and scads	37337000	Insufficient taxonomic resolution
BP	Teleost	Emmelichthyidae	*Plagiogeneion* spp	Rubyfish (mixed)	37345900	Insufficient taxonomic resolution
BP	Teleost	Emmelichthyidae	*Emmelichthys* spp	Redbait (mixed)	37345901	Insufficient taxonomic resolution
BP	Teleost	Pentacerotidae	Pentacerotidae - undifferentiated	Boarfishes	37367000	Insufficient taxonomic resolution
BP	Teleost	Scombridae	Scombridae spp (tribes Scomberomorini and Scombrini)	Mackerel (mixed)	37441911	Insufficient taxonomic resolution
BP	Teleost		Mixed reef fish	Fish (mixed)	37999999	Insufficient taxonomic resolution
BP	Chondrichthyan	Arhynchobatidae	*Notoraja sticta*	Blotched skate	37031020	Misidentification: Outside fishery range
BP	Chondrichthyan	Squatinidae	*Squatina pseudocellata*	Western angelshark	37024005	Misidentification: Outside fishery range
BP	Chondrichthyan	Urolophidae	*Urolophus expansus*	Wide stingaree	37038008	Misidentification: Outside fishery range
BP	Chondrichthyan	Urolophidae	*Trygonoptera personata*	Masked stingaree	37038017	Misidentification: Outside fishery range
BP	Teleost	Triglidae	*Lepidotrigla punctipectoralis*	Finspot gurnard	37288027	Misidentification: Outside fishery range

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BP	Teleost	Uranoscopidae	*Kathetostoma nigrofasciatum*	Deepwater stargazer	37400004	Misidentification: Outside fishery range
BP	Teleost	Uranoscopidae	*Xenocephalus cribratus*	Ringed stargazer	37400019	Misidentification: Outside fishery range
BP	Teleost	Platycephalidae	*Kumococius rodericensis*	Whitefin flathead	37296019	Misidentification: Outside fishery range
BP	Chondrichthyan	Chimaeridae	*Hydrolagus lemures*	Blackfin ghostshark	37042003	Superseded taxon in 2018; Now *H. ogilbyi*
C1	Teleost	Balistidae, Monacanthidae	Balistidae, Monacanthidae - undifferentiated	Leatherjackets	37465000	Insufficient taxonomic resolution
C2	Teleost	Platycephalidae	Platycephalidae - undifferentiated	Flatheads	37296000	Insufficient taxonomic resolution
C2	Teleost	Uranoscopidae	Uranoscopidae - undifferentiated	Stargazers	37400000	Insufficient taxonomic resolution
BC	Chondrichthyan	Scyliorhinidae	*Cephaloscyllium speccum*	Speckled swellshark	37015033	Misidentification: Outside fishery range
BC	Chondrichthyan	Scyliorhinidae	*Triodon macropterus*	Threetooth puffer	37468001	Misidentification: Outside fishery range
BC	Teleost	Triodontidae	*Pseudocheilinus evanidus*	Pinstripe wrasse	37384142	Misidentification: Outside fishery range
BC	Teleost	Labridae	*Lethrinus lentjan*	Redspot emperor	37351007	Misidentification: Outside fishery range
BC	Teleost	Lethrinidae	*Hapalogenys kishinouyei*	Lined javelinfish	37350001	Misidentification: Outside fishery range
BC	Teleost	Haemulidae	*Lutjanus rivulatus*	Maori snapper	37346016	Misidentification: Outside fishery range
BC	Teleost	Lutjanidae	*Sillago lutea*	Mud whiting	37330007	Misidentification: Outside fishery range
BC	Teleost	Sillaginidae	*Cephalopholis sonnerati*	Tomato rockcod	37311045	Misidentification: Outside fishery range
BC	Teleost	Serranidae	*Cephalopholis miniata*	Coral rockcod	37311083	Misidentification: Outside fishery range
BC	Teleost	Serranidae	*Cephalopholis cyanostigma*	Bluespotted rockcod	37311136	Misidentification: Outside fishery range
BC	Teleost	Serranidae	*Syncomistes kimberleyensis*	Kimberley grunter	37321029	Misidentification: Outside fishery range
BC	Teleost	Terapontidae	*Monopterus albus*	Belut	37285001	Misidentification: Outside fishery range
BC	Teleost	Synbranchidae	*Cetonurichthys subinflatus*	Smallpore whiptail	37232048	Misidentification: Outside fishery range
BC	Teleost	Macrouridae	*Paraulopus sp. [slender]*	Cucumberfish 2	37120016	Misidentification: Outside fishery range
BC	Teleost	Paraulopidae	*Paraulopus spp*	Yellow spotted cucumber fish	37120003	Misidentification: Outside fishery range
BC	Teleost	Paraulopidae	*Bathysauroides gigas*	Pale deepsea lizardfish	37120007	Misidentification: Outside fishery range
BC	Teleost	Bathysauroididae	*Pisodonophis cancrivorus*	Longfin snake-eel	37068002	Misidentification: Outside fishery range
BC	Teleost	Ophichthidae	*Squalus nasutus*	Western longnose spurdog	37020040	Misidentification: Outside fishery range

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Teleost	Anguillidae	*Anguilla bicolor*	Indonesian shortfin eel	37056003	Misidentification: Outside fishery range
BC	Teleost	Ophidiidae	*Ophidion muraenolepis*	Blackedge cusk	37228006	Misidentification: Outside fishery range
BC	Chondrichthyan	Squalidae	*Squalus altipinnis*	Western highfin spurdog	37020018	Misidentification: Outside fishery range
PS	Marine bird	Diomedeidae	Diomedeidae - undifferentiated	Albatrosses	40040000	Insufficient taxonomic resolution
PS	Marine bird	Procellariidae	Procellariidae - undifferentiated	Petrels prions and shearwaters	40041000	Insufficient taxonomic resolution
PS	Marine bird	Procellariidae	Puffinus spp - undifferentiated	Shearwaters	40041050	Insufficient taxonomic resolution
PS	Marine bird	Procellariidae	Puffinus spp	Shearwaters (mixed old AFMA code)	40041999	Insufficient taxonomic resolution
PS	Marine bird	Laridae	Terns - AFMA Observer Code	Terns	40128999	Insufficient taxonomic resolution
PS	Marine mammal	Delphinidae	Delphinidae - undifferentiated	Dolphins	41116000	Insufficient taxonomic resolution
PS	Marine mammal	Otariidae	Otariidae - undifferentiated	Eared seals	41131000	Insufficient taxonomic resolution
PS	Teleost	Syngnathidae	Syngnathidae - undifferentiated	Seahorses and pipefishes	37282000	Insufficient taxonomic resolution

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 “Comments” 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

A Level 2 analysis for the Habitat component was not conducted in this assessment.

Summary of Community PSA results

A Level 2 analysis for the Community component was not conducted in this assessment.

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), any key/secondary commercial species that undergo a Tier assessment are not assessed at ERA Level 2, however we consider that Tier 4 or 5 species are data poor and should be assessed in this ERA. The royal red prawn is a Tier 4 species, so has been included in this PSA. The only non-tiered (invertebrate) key commercial species was Gould's squid *Nototodarus gouldi* (Table 2.23). Neither of these two species assessed were missing many data attributes and were considered as having robust data (Figure 2.9).

Only the Gould's squid *Nototodarus gouldi* was assessed as high risk and a residual risk analysis was required (see Section 2.9).

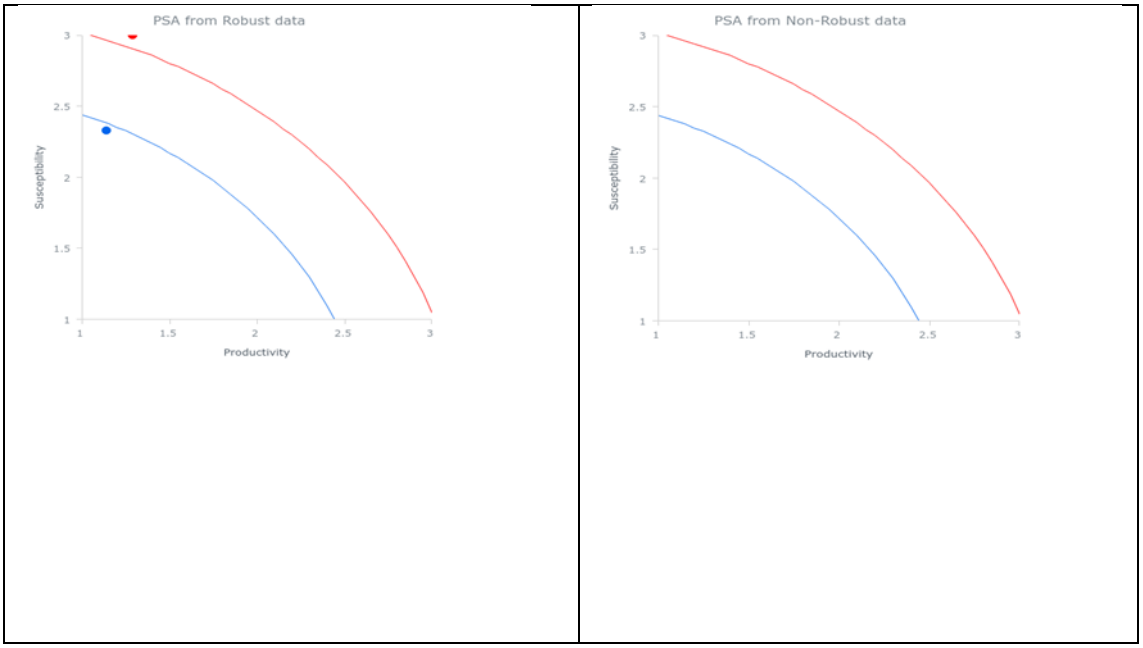


Figure 2.9. PSA plot for key/secondary commercial species in the SESSF Otter trawl sub-fishery for (a) robust [left] and (b) data deficient [right] species.

Table 2.23. Summary of the PSA scores on the set of productivity and susceptibility attributes for key/secondary commercial species and residual risk 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 2.27 (in report). Susceptibility attributes (S1-S4) are listed in Table 2.28 (in report). Missing attributes are highlighted (red). Productivity score (Prod score); Susceptibility score (Susc score). No. interactions (No. Int. 2012-2016) reported for high risk scores only (source: 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. 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 CAT-EGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
23636004	*Nototodarus gouldi*	Gould's squid	1	1	1	1	1	2	2	3	3	3	3	1.29	3	1	3.27	High	OBS: ~25.5 t ret.; 1.6 t dis.	Not assessed in this fishery. No Tiered assessment (SSJ fishery). 4 –effort and catch management arrangements for this species do not appear to exist. Population status unknown – no formal Tier assessment in SSJ and not assessed in this fishery. A combined catch limit of 2000 t for the SESSF-SESSF-GABT and SESF-OT sectors are in place.	High
28714005	*Haliporoides sibogae*	Royal red prawn	1	1	1	1	1	2	1	3	3	2	3	1.14	2.33	1	2.59	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

b) Byproduct species

An additional six byproduct teleost species were assessed in this PSA because they were unassessable in bSAFE, making a total of 16 species assessed by this method. Overall, eight species were assessed as high risk: two chondrichthyans - sandy skate *Pavoraja arenaria* and Olgilby's ghostshark *Chimaera olgilbyi ;* two teleosts - deepsea flathead *Hoplichthys haswelli* and thetis fish *Neosebastes thetidis* and four invertebrate species - two cuttlefishes *Sepia braggi* and *Sepia novaehollandiae,* southern bailer shell (*Melo miltonis*) and the Maori octopus *Pinnoctopus cordiformis* (Table 2.24).The two teleosts had low productivity scores contributing to their high risk scores while the other species were missing a high number of attributes (5 or more) combined with high susceptibility (Table 2.24, Figure 2.10a, b).

Residual risk analyses were performed for each of the eight high risk species (see Section 2.9).

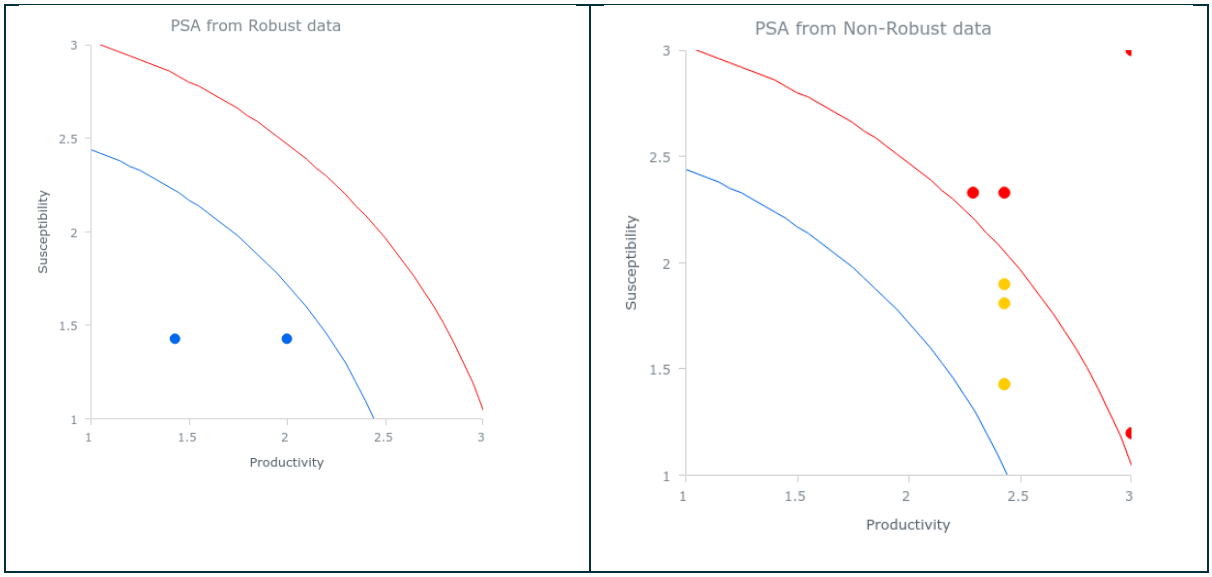


Figure 2.10. PSA plot for byproduct species in the SESSF Otter trawl sub-fishery for (a) robust [left] and (b) data deficient [right] species. Note many species may fall on some points.

Table 2.24. Summary of the PSA scores on the set of productivity and susceptibility attributes for byproduct species and residual risk (RR) for high risk species. Productivity attributes (P1-P7) are listed in Table 2.27 (in report). Susceptibility attributes (S1-S4) are listed in Table 2.28 (in report). Missing attributes are highlighted (red). Productivity score (Prod. score); Susceptibility score (Susc. score). No. interactions (No. Int. 2012-2016) reported for high risk scores only (source: 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	P1	P2	P3	P4	P5	P6	P7	S1	S2	S3	S4	PROD. SCORE	SUSC. SCORE	MISSING ATTRIB-UTES	PSA 2D	RISK CAT-EGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
Following 6 BP species unassessable in SAFE:																					
37031023	*Pavoraja arenaria*	Sandy skate	3	3	3	3	1	3	3	3	3	3	3	2.71	3	6	4.64	High	12.3 kg dis. (Obs). However, 186.3 t ret., 42.4 t dis. (Log) of skates and rays; 37990018. Apportioned to this and 25 other species.	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 3 – interaction/capture. Five productivity and one susceptibility attributes not available. Based on interaction rate, risk category remains high	High

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 CAT-EGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37042001	*Chimaera ogilbyi*	Ogilby's Ghostshark	3	3	3	3	2	3	3	3	3	3	3	2.86	3	6	4.14	High	655 kg ret. (Obs); 797.13 kg dis. (Obs). Of *Hydrolagus ogilby* (prior to 2018). Is now *C. ogilbyi* Also, Chimaeridae-undiiferentiated (37042000): 15.7 t ret. (log), 1.38 t dis. (Log); 0.27 t ret. (Obs), 0.096 t dis. (Obs).	This species was un-assessable in SAFE, and high risk in PSA. 3- At risk in regards to level of capture due to unknown component of Ogilby ghostshark in 37042000. Risk remains high.	High
37297001	*Hoplichthys haswelli*	Deepsea flathead	3	3	3	1	2	1	3	3	3	3	3	2.29	3	3	3.77	High	678 kg ret. (Log). 361.5 kg ret., 8.3 t dis. (Obs).	This species was un-assessable in SAFE, and high risk in PSA. Depth – 140-700 m over shelf and slope. 3- Low/interaction/capture. Therefore risk is	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 CAT-EGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				reduced to medium	
37287006	*Neosebastes thetidis*	Thetis fish	3	3	3	1	1	1	3	3	3	3	3	2.14	3	3	3.69	High	6.6 t ret., 20.9 t dis (Log). 205 kg ret., 1.02 t dis (Obs).	This species was un-assessable in SAFE, and high risk in PSA. Depth range 45-288 m, usually below 100 m. 3-Low/interaction/capture. Therefore risk is reduced to medium	Medium
37271001	*Trachipterus arawatae*	Southern ribbonfish	3	3	1	2	2	1	2	1	3	3	3	2	1.65	2	2.59	Low	NE	This species was un-assessable in SAFE, and low risk in PSA. No RR required.	Low
37327002	*Dinolestes lewini*	Longfin pike	3	3	3	1	2	1	3	1	1	3	3	2.29	1.2	3	2.59	Low	NE	This species was un-assessable in SAFE, and low risk in	Low

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 CAT-EGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				PSA. No RR required.	
Other BP species:																					
23607014	*Sepia braggi*	Cuttlefish	3	3	3	3	3	3	3	1	1	3	3	3	1.2	7	3.23	High	185.5 t ret. 118 kg dis. (Log) of *Sepia spp.* 2.9 t ret., 0.34 t dis. (Obs) of *Sepia spp*. Also 5 kg ret. (Obs) of Sepiidae This species was expanded from *Sepia spp*.	1 – Risk rating due to missing information Six productivity and one susceptibility attributes are not available. Existing trip limits are in place. Based on this and interaction rate, risk remains high. ~2% Observer Coverage.	High
23607005	*Sepia novaehollandiae*	Cuttlefish	3	3	3	1	1	3	3	3	3	2	3	2.43	2.33	5	3.37	High	185.5 t ret. 118 kg dis. (Log) of *Sepia spp.* 2.9 t ret., 0.34 t dis. (Obs) of *Sepia spp.*	1 – Risk rating due to missing information Four productivity and one susceptibility attributes	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 CAT-EGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																			Also 5 kg ret. (Obs) of Sepiidae This species was expanded from *Sepia spp*.	are not available. Existing trip limits are in place. This species is rare, so risk reduced to medium. ~2% Observer Coverage.	
24207072	*Melo miltonis*	Southern bailer shell	3	3	3	3	3	3	3	3	3	3	3	3	3	10	4.24	High	~1.8 t ret., 41.7 kg dis. (Obs). Also, 42.8 t ret., and 0.6 t dis. (Log) of Balier shells (Volutidae). 148.5 kg ret., 24.77 kg dis. (Obs) of Balier shells (Volutidae). ~16 t ret., 0.17 t dis. (Log) of shells (23999999). ~0.15 t ret., ~0.03 t dis.	1. Risk rating due to missing information. Seven productivity and three susceptibility attributes are not available. Based on missing information and interaction rate, risk category remains high. ~2% Observer coverage.	High

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 CAT-EGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																			(Log) of shells (23999999).	50 kg trip limit each in Tasmania, Vic; and SA.	
23659003	*Pinnoctopus cordiformis*	Maori octopus	3	3	3	1	1	2	3	3	3	2	3	2.29	2.33	5	3.27	High	175 kg ret. (Log). Also, 123.4 t ret., 49 kg dis. (Log). [Includes Obs: 3.9 t ret., 1.9 t dis.] of 23659000 – Octopodiae	3 – Low interaction/capture. Four productivity and one susceptibility attributes are not available. Catch is likely to be higher if a portion of the unidentified component is included. Depth 330-730 m – high effort in this depth range. Risk remains high.	High
23607002	*Sepia cultrata*	Cuttlefish	3	3	3	1	1	3	3	1.9	3	2	3	2.43	1.81	4	3.03	Medium	NE	No RR required	Medium
23607010	*Sepia rozella*	Rosecone cuttlefish	3	3	3	1	1	3	3	3	1	2	3	2.43	1.43	5	2.82	Medium	NE	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 CAT-EGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
23607021	*Sepia hedleyi*	Cuttlefish	3	3	3	1	1	3	3	2.1	3	2	3	2.43	1.9	4	3.08	Medium	NE	No RR required	Medium
23607036	*Sepia grahami*	Cuttlefish	3	3	3	1	1	3	3	3	1	2	3	2.43	1.43	5	2.82	Medium	NE	No RR required	Medium
24207001	*Livonia mammilla*	False bailer shell	3	3	3	1	1	2	1	3	1	2	3	2	1.43	2	2.46	Low	NE	Not required	Low
23617005	*Sepioteuthis australis*	Southern calamari	1	1	2	1	1	2	2	3	1	2	3	1.43	1.43	1	2.02	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

c) Bycatch species

A total of 55 species were assessed in this PSA, comprising 36 fish species that were unassessable in bSAFE. A total of 19 species were assessed at high risk (14 teleosts and five invertebrates), 27 at medium risk (18 teleosts and nine inverterates) and 9 at low risk (four teleosts and five invertebrates) (Table 2.25). A combination of missing attributes and high susceptibility generally contributed to the high risk scores of the teleosts while a very high number of missing attributes caused the invertebrates high risk scores (see high risk values in robust to non-robust data plots; Figure 2.11a, b). A residual risk analysis was performed on all 19 high risk species (Section 2.9).

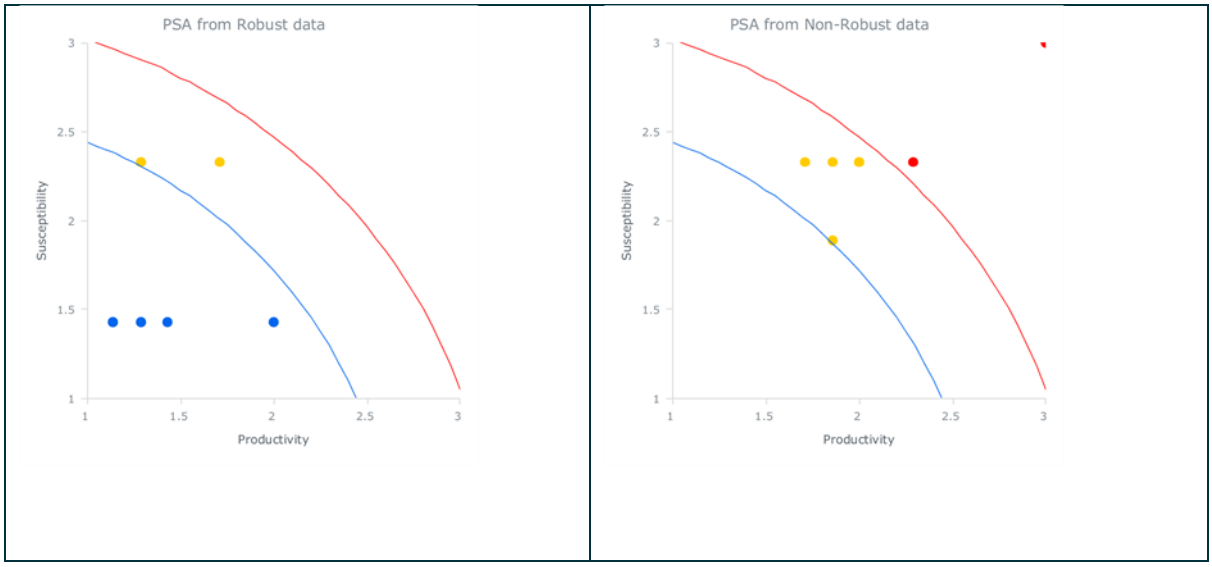


Figure 2.11. PSA plot for bycatch species in the SESSF Otter trawl sub-fishery for (a) robust [left] and (b) data deficient [right] species. Note many species fall on some points.

Table 2.25. Summary of the PSA scores on the set of productivity and susceptibility attributes for bycatch species and residual risk (RR) for high risk species. Productivity attributes (P1-P7) are listed in Table 2.27 (in report). Susceptibility attributes (S1-S4) are listed in Table 2.28 (in report). Missing attributes are highlighted (red). Productivity score (Prod. score); Susceptibility score (Susc. score). No. interactions (No. Int. 2012-2016) reported for high risk scores only (source: 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	P1	P2	P3	P4	P5	P6	P7	S1	S2	S3	S4	PROD. SCORE	SUSC. SCORE	MISSING ATTRIB-UTES	PSA 2D	RISK CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
Following 36 BC species unassessable in SAFE:																					
37265001	*Grammicolepis brachiusculus*	Thorny tinselfish	3	3	3	3	2	3	3	3	3	3	3	2.86	3	6	4.14	High	1 kg ret., 13.5 kg dis (Obs).	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 3 – Low interaction/capture. 5 productivity and 1 susceptibility attributes are not available. Based on low interaction rate, risk category is reduced to low.	Low
37006001	*Chlamydoselachus anguineus*	Frill shark	3	3	3	2	2	3	3	3	3	3	3	2.71	3	2	4.04	High	11 kg dis (Obs).	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required.	Low

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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				3 – Low interaction/capture. 2 productivity attributes are not available. Based on low interaction rate, risk category is reduced to low.	
37120008	*Paraulopus melanostomus*	Cucumberfish 1	3	3	3	3	1	3	3	3	3	3	3	2.71	3	8	4.04	High	3 kg dis (Obs). Also, 377.6 kg dis (Obs) of 37120000.	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 5 productivity and 3 susceptibility attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to low.	Low
37288012	*Satyrichthys cf moluccense*	Blackfin armour gurnard	3	3	3	1	1	3	3	3	3	3	3	2.43	3	5	3.86	High	83 kg dis (Log).	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 4 productivity and 1	Low

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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				susceptibility attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to low.	
37288004	*Peristedion picturatum*	Robust armour gurnard	3	3	3	1	1	1	2	3	3	3	3	2	3	3	3.61	High	73.3 kg dis (Obs).	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 3 productivity attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to low.	Low
37009002	*Mitsukurina owstoni*	Goblin shark	3	3	3	3	3	3	3	2.84	3	1	3	3	1.61	3	3.4	High	153 kg ret (Log). 35 kg ret, 82.4 kg dis (Obs).	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 3 productivity	Low

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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to low.	
37022002	*Echinorhinus cookei*	Prickly shark	3	3	2	3	3	3	3	1.0	3	3	3	2.86	1.65	4	3.3	High	7 kg dis (Obs). Also, 218 kg dis (Log) – Squaliformes 37990071	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 3 productivity and 1 susceptibility attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to low.	Low
37067027	*Gnathophis macroporis*	Largepore conger	3	3	3	1	2	3	3	1.58	3	3	3	2.57	2.04	5	3.28	High	0.6 kg dis (Obs).	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 4 productivity and 1	Low

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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				susceptibility attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to low.	
37114023	*Rouleina eucla*	Eucla slickhead	3	3	3	1	1	3	3	2.86	3	2	3	2.43	2.18	4	3.26	High	3.1 kg dis. (Obs). Also, 10.2 kg dis. (Obs) of 37114900 - Rouleina spp	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 4 productivity attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to low.	Low
37311161	*Ostracoberyx paxtoni*	Spinycheek seabass	3	3	3	3	1	3	3	3	3	3	3	2.71	3	6	4.04	High	0.2 kg dis. (Obs)	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 5 productivity and 1	Low

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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				susceptibility attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to low.	
37114024	*Rouleina guentheri*	Bordello slickhead	3	3	3	1	1	3	3	3	3	2	3	2.43	2.33	4	3.37	High	5 kg dis. (Obs). Also, 10.2 kg dis. (Obs) of 37114900 - Rouleina spp	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 4 productivity attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to low.	Low
37021001	*Oxynotus bruniensis*	Prickly dogfish	3	3	3	1	2	3	3	3	3	3	3	2.57	3	2	3.95	High	28.87 kg dis. (Obs).	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 2 productivity	Low

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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to low.	
37224001	*Euclichthys polynemus*	Eucla cod	3	3	3	1	1	1	3	3	3	3	3	2.14	3	3	3.69	High	17.16 kg dis. (Obs) 14.4 t ret., 4.4 t dis. (Log) of 37224000 - Melanonidae, Moridae, Euclichthyidae	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 3 productivity attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to medium.	Medium
37083001	*Notacanthus sexspinis*	Southern spineback	3	3	3	1	2	1	2	3	3	3	3	2.14	3	3	3.69	High	4.82 kg dis. (Obs)	This species was un-assessable in SAFE and high in PSA. So, a RR analysis is required. 3 productivity	Low

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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				attributes are not available. 3 – Low interaction/capture. Based on low interaction rate, risk category is reduced to low.	
37290001	*Aploactisoma milesii*	Southern velvetfish	3	3	3	3	1	3	3	1	3	3	3	2.71	1.65	7	3.17	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37013002	*Parascyllium collare*	Collar carpetshark	3	3	3	1	2	2	3	2.97	1.43	3	3	2.43	1.94	2	3.11	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37067016	*Gnathophis umbrellabius*	Umbrella conger	3	3	3	1	2	3	3	1.28	3	3	3	2.57	1.84	4	3.16	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37265003	*Xenolepidichthys dalgleishi*	Spotted tinselfish	3	3	3	1	1	1	3	3	3	2	3	2.14	2.33	3	3.16	Medium	NE	This species was un-assessable in SAFE, and medium risk in	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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				PSA. No RR required.	
37292001	*Pataecus fronto*	Red Indian fish	3	3	3	3	1	3	3	3	1	3	3	2.71	1.65	6	3.17	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37083002	*Notacanthus chemnitzii*	Cosmopolitan spineback	3	3	3	2	2	1	3	1.34	3	3	3	2.43	1.88	3	3.07	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37067002	*Gnathophis longicaudus*	Little conger	3	3	3	1	2	3	3	1	1	3	3	2.57	1.2	4	2.84	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	3	1	3	2.57	1.2	3	2.84	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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37215001	*Himantolophus appelii*	Prickly footballfish	3	3	3	1	2	1	3	1	3	3	3	2.29	1.65	3	2.82	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37254001	*Diretmichthys parini*	Black spinyfin	3	3	3	1	2	1	3	1	3	3	3	2.29	1.65	3	2.82	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37113002	*Idiacanthus atlanticus*	Common black dragonfish	3	3	3	1	2	3	3	1	1	2	3	2.57	1.13	4	2.81	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37278001	*Fistularia commersonii*	Smooth flutemouth	3	3	3	2	2	1	3	3	1	3	3	2.43	1.65	3	2.94	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37013005	*Parascyllium ferrugineum*	Rusty carpetshark	3	3	3	1	2	2	3	1	1	3	3	2.43	1.2	2	2.71	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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37278002	*Fistularia petimba*	Rough flutemouth	3	3	3	2	2	1	3	3	1	3	3	2.43	1.65	3	2.94	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37070001	*Diastobranchus capensis*	Basketwork eel	3	3	1	2	2	1	3	1.04	3	3	3	2.14	1.68	2	2.72	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37466002	*Anoplocapros inermis*	Eastern smooth boxfish	3	3	3	1	1	1	3	1.59	3	3	3	2.14	2.05	3	2.96	Medium	NE	This species was un-assessable in SAFE, and medium risk in PSA. No RR required.	Medium
37305001	*Psychrolutes marcidus*	Smooth-head blobfish	3	3	3	1	1	1	3	3	3	2	3	2.14	2.33	3	3.16	Medium	NE	This species was un-assessable in SAFE, and low risk in PSA. No RR required.	Medium
37466004	*Lactoria cornuta*	Longhorn Cowfish	3	3	3	1	1	3	3	3	1	3	3	2.43	1.65	4	2.94	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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37287005	*Neosebastes scorpaenoides*	Common gurnard perch	3	3	3	1	2	1	3	1	1	3	3	2.29	1.2	3	2.59	Low	NE	This species was un-assessable in SAFE, and low risk in PSA. No RR required.	Low
37229003	*Echiodon rendahli*	Messmate fish	3	3	3	1	1	1	3	3	1	2	3	2.14	1.43	3	2.57	Low	NE	This species was un-assessable in SAFE, and low risk in PSA. No RR required.	Low
37466003	*Aracana aurita*	Shaw's cowfish	3	3	3	1	1	1	3	1.1 9	1	2	3	2.14	1.15	3	2.43	Low	NE	This species was un-assessable in SAFE, and low risk in PSA. No RR required.	Low
37141001	*Gonorynchus greyi*	Beaked salmon	3	3	3	1	2	1	1	1.2 1	1	3	3	2	1.25	3	2.36	Low	NE	This species was un-assessable in SAFE, and low risk in PSA. No RR required.	Low
Following 19 BC species in PSA:																					
28821019	*Ibacus chacei*	Smooth bug	3	3	3	3	3	3	3	3	3	3	3	3	3	10	4.24	High	6 kg ret. (Obs). Also, 46.3 kg ret. 4 kg dis. (Obs) of *Ibacus* and *Thenus* spp (28821904)	3 – Low interaction/capt ure. 7 productivity and 3 susceptibility attributes are not available. Based on low interaction rate, risk category is	Low

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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				reduced to low. ~2% Observer coverage.	
28821003	*Ibacus novemdentatus*	Balmain bug	3	3	3	3	3	3	3	3	3	3	3	3	3	10	4.24	High	2 kg ret., 4.7 kg dis. (Obs). Also, 46.3 kg ret., 4 kg dis. (Obs) of *Ibacus* and *Thenus* spp (28821904)	3 – Low interaction/capture. 7 productivity and 3 susceptibility attributes are not available. Based on low interaction rate, risk category is reduced to low. ~2% Observer coverage.	Low
28714009	*Solenocera alfonso*	Deepwater prawn	3	3	3	3	3	3	3	3	3	3	3	3	3	10	4.24	High	1.2 kg ret. (Obs).	3 – Low interaction/capture. 7 productivity and 3 susceptibility attributes are not available. Based on low interaction rate, risk category is reduced to low. ~2% Observer coverage.	Low
25128001	*Asterodiscides truncatus*	Firebrick seastar	3	3	3	3	3	3	3	3	3	3	3	3	3	10	4.24	High	5 kg dis. (Obs).	3 – Low interaction/capture. 7 productivity and 3	Low

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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				susceptibility attributes are not available. Based on low interaction rate, risk category is reduced to low. ~2% Oberver coverage.	
28916002	*Hypothalassia armata*	Champagne crab	3	3	3	1	1	2	3	3	3	2	3	2.29	2.33	5	3.27	High	15.6 kg dis. (Obs).	3 – Low interaction/capture. 4 productivity and 1 susceptibility attributes are not available. Based on low interaction rate, risk category is reduced to low. ~2% Oberver coverage.	Low
28860001	*Dagnaudus petterdi*	Antlered crab	3	3	3	1	1	2	1	3	3	2	3	2	2.33	4	3.07	Medium	NE	No RR required	Medium
28911020	*Ovalipes molleri*	[a swimmer crab]	3	3	3	1	1	2	1	3	3	2	3	2	2.33	4	3.07	Medium	NE	No RR required	Medium
28910001	*Chaceon bicolor*	Crystal crab	3	3	3	1	1	2	1	3	3	2	3	2	2.33	4	3.07	Medium	NE	No RR required	Medium
28821001	*Ibacus alticrenatus*	Whitetail bug	3	3	2	1	1	2	1	3	3	2	3	1.86	2.33	3	2.98	Medium	NE	No RR required	Medium
28770007	*Heterocarpus woodmasoni*	Red carid	1	1	3	1	1	2	3	3	3	2	3	1.71	2.33	3	2.89	Medium	NE	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 CAT-EGORY	NO. INT. OR CATCH (KG) (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
28915002	*Pseudocarcinus gigas*	Giant crab	2	3	1	1	1	2	2	3	3	2	3	1.71	2.33	2	2.89	Medium	NE	No RR required	Medium
28712001	*Aristaeomorpha foliacea*	Red prawn	1	1	3	1	1	1	1	3	3	2	3	1.29	2.33	2	2.66	Medium	NE	No RR required	Medium
28712008	*Aristaeopsis edwardsiana*	Giant scarlet prawn	1	1	3	1	1	1	1	3	3	2	3	1.29	2.33	2	2.66	Medium	NE	No RR required	Medium
28821004	*Ibacus peronii*	Eastern Balmain bug	3	3	2	1	1	2	1	3	2.02	2	3	1.86	1.89	3	2.65	Medium	NE	No RR required	Medium
28911005	*Portunus armatus*	Blue swimmer crab	1	1	1	1	1	3	2	3	1	2	3	1.43	1.43	1	2.02	Low	NE	No RR required	Low
28820001	*Jasus edwardsii*	Southern rock lobster	2	2	1	1	1	2	1	3	1	2	3	1.43	1.43	1	2.02	Low	NE	No RR required	Low
28820002	*Sagmariasus verreauxi*	Eastern rock lobster	1	2	1	1	1	2	1	3	1	2	3	1.29	1.43	1	1.93	Low	NE	No RR required	Low
28711052	*Melicertus plebejus*	Eastern king prawn	1	1	1	1	1	2	1	3	1	2	3	1.14	1.43	1	1.83	Low	NE	No RR required	Low
25416002	*Actinopyga mauritiana*	Surf redfish (sea cucumber)	1	2	1	1	1	1	1	3	1	2	3	1.14	1.43	1	1.83	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

d) Protected species

Of the 103 protected species, 55 species were assessed in this PSA (Table 2.26, Figure 2.12a, b). Two species were assessed at high risk, 21 were medium risk (10 marine birds and 11 marine mammals) and 32 were low risk (Table 2.26). One marine mammal species was assessed at low risk, common dolphin (*Delphinus delphis*) while 31 marine birds were assessed as low risk.

The high risk species was a marine bird Salvin's prion *Pachyptila salvini* and marine mammal Indian Ocean bottlenose dolphin *Tursipos aduncus* (Table 2.26) and a residual risk analysis was performed on these species (see Section 2.9).

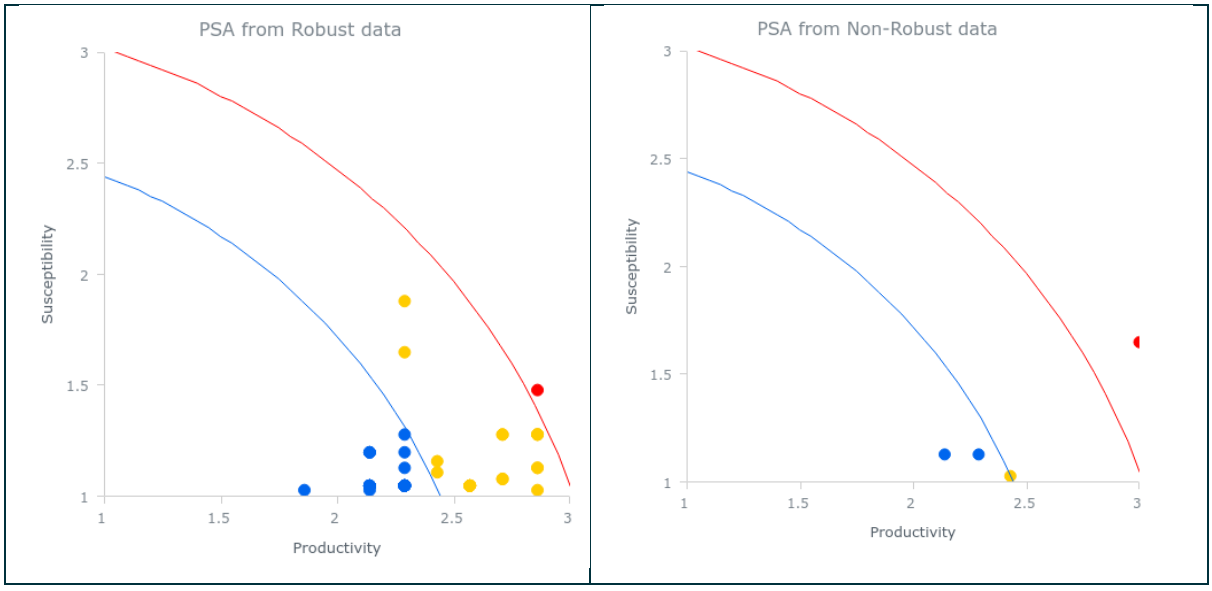


Figure 2.12. PSA plot for protected species in the SESSF Otter trawl sub-fishery for (a) robust [left] and (b) data deficient [right] species. Note many species fall on some points.

Table 2.26. Summary of the PSA scores on the set of productivity and susceptibility attributes for protected species and residual risk (RR) for high risk species. Productivity attributes (P1-P7) are listed in Table 2.27 (in report). Susceptibility attributes (S1-S4) are listed in Table 2.28 (in report). Missing attributes are highlighted (red). Productivity score (Prod. score); Susceptibility score (Susc. score). No. interactions (No. Int. 2012-2016) reported for high risk scores only (source: 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	P1	P2	P3	P4	P5	P6	P7	S1	S2	S3	S4	PROD. SCORE	SUSC. SCORE	MISSING ATTRIB-UTES	PSA 2D	RISK CATE-GORY	NO. INT. OR CATCH (KG) (2012-2016)	TENTATIVE RISK SCORE FOLLOWING RESIDUAL RISK	TENTATIVE FINAL RISK SCORE
40041012	*Pachyptila salvini*	Salvin's prion	3	3	3	3	3	3	3	3	3	3	1	3	1.65	9	3.42	High	3 alive; 12 dead animals (Log) of Petrels, Prions and Shearwaters Species expanded from Procellariidae	Population large and assumed stable at 12 million (BirdLIfe International 2017). Risk reduced to low.	Low
41116020	*Tursiops aduncus*	Indian Ocean bottlenose dolphin	2	3	3	3	3	3	3	1.69	3	2	2	2.86	1.48	0	3.22	High	Added from Delphinidae (1 alive and 4 dead; AFMA verified data).	This species has been expanded from Delphinidae. Population status is data deficient. It is mostly found in shallow waters generally near the coast and most likely not within fishery operations. Risk reduced to medium.	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 CATE-GORY	NO. INT. OR CATCH (KG) (2012-2016)	TENTATIVE RISK SCORE FOLLOWING RESIDUAL RISK	TENTATIVE FINAL RISK SCORE
41116002	*Feresa attenuata*	Pygmy killer 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
41116019	*Tursiops truncatus*	Bottlenose dolphin	2	3	3	3	3	3	3	1	3	2	2	2.86	1.28	0	3.13	Medium	NE	No RR required	Medium
41116005	*Grampus griseus*	Risso's dolphin	2	3	3	3	3	3	3	1	3	2	2	2.86	1.28	0	3.13	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
41116004	*Globicephala melas*	Long-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
41116013	*Pseudorca crassidens*	False killer whale	2	3	3	3	3	3	3	1	1	1	2	2.86	1.03	1	3.04	Medium	NE	No RR required	Medium
41136001	*Hydrurga leptonyx*	Leopard seal	1	3	3	3	3	3	3	3	1	2	2	2.71	1.28	1	3	Medium	NE	No RR required	Medium
41136004	*Mirounga leonina*	Southern elephant seal	2	2	3	3	3	3	3	1	3	2	2	2.71	1.28	0	3	Medium	60 alive and 223 dead of seals unclassified	No RR required	Medium
41131003	*Arctocephalus pusillus doriferus*	Australian fur seal	1	2	3	2	2	3	3	3	3	2	2	2.29	1.88	1	2.96	Medium	103 alive, 341 dead. Also, 60 alive and 223 dead of seals unclassified	No RR required	Medium
41116009	*Lissodelphis peronii*	Southern right whale dolphin	2	3	3	2	3	3	3	1	1	2	2	2.71	1.08	1	2.92	Medium	NE	No RR required	Medium
41116018	*Steno bredanensis*	Rough-toothed dolphin	2	3	3	2	3	3	3	1	1	2	2	2.71	1.08	0	2.92	Medium	NE	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 CATE-GORY	NO. INT. OR CATCH (KG) (2012-2016)	TENTATIVE RISK SCORE FOLLOWING RESIDUAL RISK	TENTATIVE FINAL RISK SCORE
40041004	*Fulmarus glacialoides*	Southern fulmar	2	3	3	1	1	3	3	3	3	3	1	2.29	1.65	2	2.82	Medium	NE	No RR required	Medium
40040005	*Diomedea epomophora*	Southern Royal albatross	2	3	3	2	2	3	3	1.05	1	3	1	2.57	1.05	1	2.78	Medium	NE	No RR required	Medium
40040013	*Thalassarche impavida*	Campbell albatross	2	3	3	2	2	3	3	1	1	3	1	2.57	1.05	1	2.78	Medium	NE	No RR required	Medium
40040012	*Diomedea sanfordi*	Northern Royal albatross	2	3	3	2	2	3	3	1.05	1	3	1	2.57	1.05	1	2.78	Medium	NE	No RR required	Medium
40040011	*Diomedea antipodensis*	Antipodean albatross	2	3	3	2	2	3	3	1	1	3	1	2.57	1.05	1	2.78	Medium	NE	No RR required	Medium
40040010	*Diomedea gibsoni*	Gibson's albatross	2	3	3	2	2	3	3	1	1	3	1	2.57	1.05	1	2.78	Medium	NE	No RR required	Medium
40040006	*Diomedea exulans*	Wandering albatross	2	3	3	2	2	3	3	1	1	3	1	2.57	1.05	1	2.78	Medium	NE	No RR required	Medium
41131005	*Neophoca cinerea*	Australian sea lion	2	2	3	2	2	3	3	1	1.84	2	2	2.43	1.16	0	2.69	Medium	NE	No RR required	Medium
41131001	*Arctocephalus forsteri*	New Zealand Fur seal	2	2	3	2	2	3	3	1	1.30	2	2	2.43	1.11	0	2.67	Medium	Also, 60 alive and 223 dead of seals unclassified	No RR required	Medium
40041005	*Halobaena caerulea*	Blue petrel	3	3	3	1	1	3	3	1.04	1	2	1	2.43	1.03	3	2.64	Medium	NE	No RR required	Medium
41116001	*Delphinus delphis*	Common dolphin	1	2	3	2	2	3	3	1.06	2.86	2	2	2.29	1.28	0	2.62	Low	NE	No RR required	Low
40041028	*Pterodroma inexpectata*	Mottled petrel	2	2	3	1	2	3	3	3	1	3	1	2.29	1.2	2	2.59	Low	NE	No RR required	Low

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 CATE-GORY	NO. INT. OR CATCH (KG) (2012-2016)	TENTATIVE RISK SCORE FOLLOWING RESIDUAL RISK	TENTATIVE FINAL RISK SCORE
40041009	*Pachyptila belcheri*	Slender-billed prion	2	3	3	1	1	3	3	3	1	2	1	2.29	1.13	3	2.55	Low	NE	No RR required	Low
41131004	*Arctocephalus tropicalis*	Subantarctic fur seal	1	2	3	2	2	3	3	1	1	3	2	2.29	1.13	0	2.55	Low	Also, 60 alive and 223 dead of seals unclassified	No RR required	Low
40040001	*Thalassarche bulleri*	Buller's albatross	2	3	3	1	1	3	3	1	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low
40128014	*Larus pacificus*	Pacific gull	2	2	3	1	2	3	3	1	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low
40041047	*Puffinus tenuirostris*	Short-tailed shearwater	2	3	3	1	1	3	3	1	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low
40041035	*Pterodroma solandri*	Providence petrel	2	2	3	1	2	3	3	1	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low
40041032	*Pterodroma mollis*	Soft-plumaged petrel	2	2	3	1	2	3	3	1.06	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low
40041031	*Pterodroma macroptera*	Great-winged petrel	2	2	3	1	2	3	3	1	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low
40041030	*Pterodroma leucoptera*	Gould's petrel	2	2	3	1	2	3	3	1.03	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low
40041029	*Pterodroma lessonii*	White-headed petrel	2	2	3	1	2	3	3	1	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low
40040009	*Phoebetria palpebrata*	Light-mantled albatross	2	3	3	1	1	3	3	1	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low
40040007	*Thalassarche melanophrys*	Black-browed albatross	2	3	3	1	1	3	3	1	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low

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 CATE-GORY	NO. INT. OR CATCH (KG) (2012-2016)	TENTATIVE RISK SCORE FOLLOWING RESIDUAL RISK	TENTATIVE FINAL RISK SCORE
40040004	*Thalassarche chrysostoma*	Grey-headed albatross	2	3	3	1	1	3	3	1.03	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low
40040002	*Thalassarche cauta*	Shy albatross	2	3	3	1	1	3	3	1	1	3	1	2.29	1.05	1	2.52	Low	NE	No RR required	Low
40041018	*Procellaria aequinoctialis*	White-chinned petrel	1	3	3	1	1	3	3	3	1	3	1	2.14	1.2	2	2.45	Low	NE	No RR required	Low
40041043	*Puffinus huttoni*	Hutton's shearwater	1	3	3	1	1	3	3	3	1	3	1	2.14	1.2	2	2.45	Low	NE	No RR required	Low
40041040	*Puffinus gavia*	Fluttering shearwater	1	3	3	1	1	3	3	3	1	3	1	2.14	1.2	2	2.45	Low	NE	No RR required	Low
40041011	*Pachyptila desolata*	Antarctic prion	1	3	3	1	1	3	3	3	1	2	1	2.14	1.13	3	2.42	Low	NE	No RR required	Low
40040008	*Phoebetria fusca*	Sooty albatross	2	2	3	1	1	3	3	1	1	3	1	2.14	1.05	1	2.38	Low	NE	No RR required	Low
40047004	*Sula dactylatra*	Masked booby	1	3	3	1	1	3	3	1	1	3	1	2.14	1.05	1	2.38	Low	NE	No RR required	Low
40041045	*Puffinus pacificus*	Wedge-tailed shearwater	1	3	3	1	1	3	3	1	1	3	1	2.14	1.05	1	2.38	Low	NE	No RR required	Low
40041042	*Puffinus griseus*	Sooty shearwater	1	3	3	1	1	3	3	1	1	3	1	2.14	1.05	1	2.38	Low	NE	No RR required	Low
40041038	*Puffinus carneipes*	Flesh-footed shearwater	1	3	3	1	1	3	3	1	1	3	1	2.14	1.05	1	2.38	Low	NE	No RR required	Low
40041019	*Procellaria cinerea*	Grey petrel	2	2	3	1	1	3	3	1	1	3	1	2.14	1.05	1	2.38	Low	NE	No RR required	Low
40041008	*Macronectes halli*	Northern giant-petrel	1	3	3	1	1	3	3	1	1	3	1	2.14	1.05	1	2.38	Low	NE	No RR required	Low

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 CATE-GORY	NO. INT. OR CATCH (KG) (2012-2016)	TENTATIVE RISK SCORE FOLLOWING RESIDUAL RISK	TENTATIVE FINAL RISK SCORE
40041007	*Macronectes giganteus*	Southern giant-petrel	1	3	3	1	1	3	3	1	1	3	1	2.14	1.05	1	2.38	Low	NE	No RR required	Low
40041003	*Daption capense*	Cape petrel	2	2	3	1	1	3	3	1	1	3	1	2.14	1.05	1	2.38	Low	NE	No RR required	Low
40040014	*Thalassarche carteri*	Indian yellow-nosed albatross	1	3	3	1	1	3	3	1	1	3	1	2.14	1.05	1	2.38	Low	NE	No RR required	Low
40041013	*Pachyptila turtur*	Fairy prion	1	3	3	1	1	3	3	1	1	2	1	2.14	1.03	2	2.37	Low	NE	No RR required	Low
40041017	*Pelecanoides urinatrix*	Common diving-petrel	1	1	3	1	1	3	3	1	1	2	1	1.86	1.03	1	2.13	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 2.27. 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 2.28. 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 2.29):

- 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
    - syngnathids: score is 1

Table 2.29. Post capture mortality attribute risk score for the SESSF Otter trawl sub-fishery 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. syngnathids, 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 2.30). If all reference points are categorised as 'Below', then the overall risk is low. The intensity of fishing effort and gear affected area were used to estimate F, instead of gridded effort.

Table 2.30 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 that undergo tiered assessments are not assessed at Level 2, however we consider that Tier 4 or 5 species are data poor and should be assessed in this ERA. Therefore, from 19 commercial species (10 C1; 9 C2), two key commercial (southern frostfish, ocean jacket) and three secondary commercial species (king dory, red gurnard, latchet), were assessed in this bSAFE (Figure 2.13a, b). Gould's squid (*Nototodarus gouldi*), the remaining non-tiered species was assessed in a PSA (see Table 2.23). All five species assessed in this SAFE were below the MSM (SAFE-MSM) and limit (SAFE-LIM) reference points and therefore at low risk (Table 2.31).

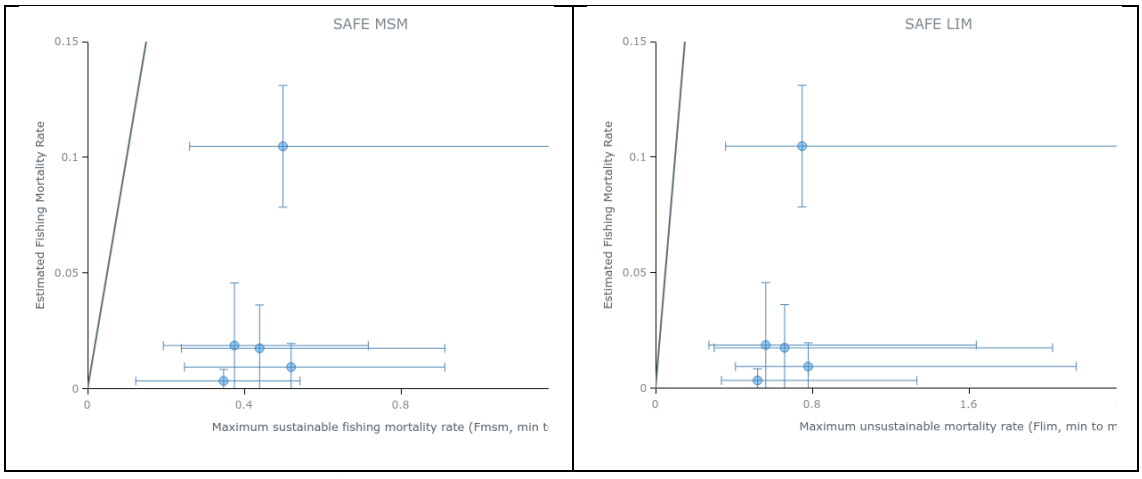


Figure 2.13. SAFE plot for key/secondary commercial species in the SESSF Otter trawl sub-fishery for (a) SAFE-MSM reference point [left] and (b) SAFE limit (LIM) reference point [right].

Table 2.31. bSAFE risk categories for commercial species ecological component for F_MSM, F_Lim and F_Crash.

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK
Key commercial species:										
37440002	*Lepidopus caudatus*	Southern frostfish; frostfish	0.004	0.36	Below	0.54	Below	0.71	Below	Low
37465006	*Nelusetta ayraud*	Ocean jacket	0.019	0.38	Below	0.56	Below	0.75	Below	Low
Secondary commercial species:										
37264001	*Cyttus traversi*	King dory	0.105	0.5	Below	0.75	Below	1	Below	Low
37288001	*Chelidonichthys kumu*	Red gurnard	0.01	0.52	Below	0.78	Below	1.04	Below	Low
37288006	*Pterygotrigla polyommata*	Latchet	0.018	0.44	Below	0.65	Below	0.87	Below	Low

2.5.2 bSAFE - Commercial bait species

There were no commercial bait species considered in this SAFE.

2.5.3 bSAFE - Byproduct species

Under the revised ERAEF (AFMA 2017), key commercial species that undergo tiered assessments are not assessed at Level 2, however Tier 4 or 5 species should be assessed in this ERA as Tier 4/5 assessments are considered to be data poor (i.e., rely on catch/effort or catch data only) and the validity of assumptions have broken down for some species. Therefore, longsnout dogfish, black shark, brier shark, Owston's dogfish, Portuguese dogfish, bigeye ocean perch, common sawshark, spikey oreodory, smooth oreodory, oxeye oreodory, elephantfish, alfonsino, ribaldo, John dory, blue-eye trevalla and blue warehou were all included here.

Of the 109 byproduct species considered overall in this SAFE, six species were unassessable due to missing biological attributes required in the bSAFE method (Table 2.32). These consisted of two chondrichthyans (sandy skate *Pavoraja arenaria* and Olgilby's ghostshark *Chimaera olgilbyi*) and four teleosts which were then assessed in a PSA (see Section 2.4.5, Table 2.24).

Of the remaining 103 species, none were extreme risk, two were high risk (i.e. above the SAFE-MSM and SAFE-LIM but below SAFE-CRASH reference points) which included the Tier 4 longsnout dogfish, five were medium risk (i.e., above the SAFE-MSM but other reference points) and 96 species were low risk (i.e., below all three reference points) (Table 2.32, Figure 2.14). Of the 16 Tier 4 species, one was high risk, one was medium risk and the remaining 14 were low risk.

Residual risk analyses were conducted for the two high risk species (see Section 2.9).

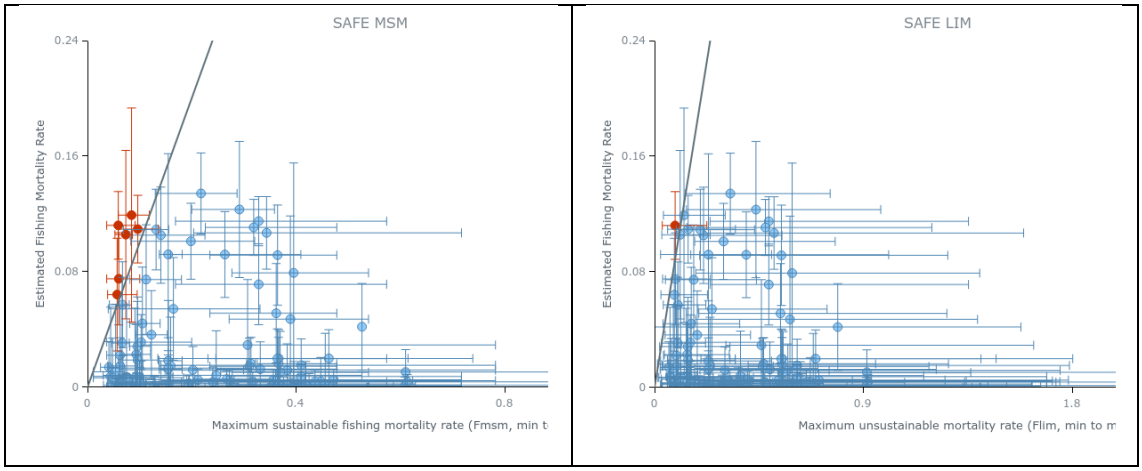


Figure 2.14. SAFE plot for byproduct species in the SESSF Otter trawl sub-fishery for (a) SAFE-MSM reference point [left] and (b) SAFE limit (LIM) reference point [right].

Table 2.32. 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. NA: not assessable. Ret: retained; dis: discarded. ^: Tier 4 species. #: Tier 1 species.

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
Following 6 BP species unassessable in SAFE:													
37031023	*Pavoraja arenaria*	Sandy skate	0.192	-	NA	-	NA	-	NA	NA	-	-	see Table 2.24
37271001	*Trachipterus arawatae*	Southern ribbonfish	0.004	-	NA	-	NA	-	NA	NA	-	-	see Table 2.24
37287006	*Neosebastes thetidis*	Thetis fish	0.05	-	NA	-	NA	-	NA	NA	-	-	see Table 2.24
37297001	*Hoplichthys haswelli*	Deepsea flathead	0.104	-	NA	-	NA	-	NA	NA	-	-	see Table 2.24
37327002	*Dinolestes lewini*	Longfin pike	0.000	-	NA	-	NA	-	NA	NA	-	-	see Table 2.24
37042001	*Chimaera ogilbyi*	Ogilby's Ghostshark	0.059	-	NA	-	NA	-	NA	NA	-	-	see Table 2.24
Other BP species:													
37017008	*Galeorhinus galeus*	School shark#	0.015	0.06	Below	0.09	Below	0.13	Below	Low	NE	No RR required	Low
37020002	*Dalatias licha*	Black shark^	0.075	0.07	Above	0.11	Below	0.14	Below	Medium	NE	No RR required	Medium
37020003	*Deania calceus*	Brier shark^	0.031	0.06	Below	0.09	Below	0.13	Below	Low	NE	No RR required	Low
37020004	*Deania quadrispinosa*	Longsnout dogfish^	0.057	0.06	Above	0.09	Above	0.12	Below	High	Log : ~99 t ret., 37.5 t dis. [includes Obs: ~7.9 t ret., 4.3 t dis.] Plus an unidentified proportion of group code 37020905 (D. calcea and D. quadrispinosa) i.e.,	Tier 4 species 150-1360 m [usually 400-820m]. 4-Effort and catch management arrangements exist: deepwater closure (700 m) and TAC for basket deepwater sharks exist which includes this species.	High

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
											205 t ret. 5 t dis. (Log). [includes Obs: 3 t ret. and 0.9 t dis.] Plus an unidentified proportion of group code 37020000 i.e., 30.8 t ret. 15.8 t dis. (Log). [includes Obs: 51 kg ret. and 1.2 t dis.]	Reported catch of basket species are significantly below TAC (east + west). Standardized CPUE in west increasing but not in the east (Sporcic 2018). Given uncertainty in population status, risk category remains high.	
37020019	*Centroscymnus owstonii*	Owston's dogfish^	0.011	0.05	Below	0.08	Below	0.1	Below	Low	NE	No RR required	Low
37020025	*Centroscymnus coelolepis*	Portuguese dogfish^	0.008	0.04	Below	0.06	Below	0.08	Below	Low	NE	No RR required	Low
37023002	*Pristiophorus cirratus*	Common sawshark^	0.023	0.09	Below	0.14	Below	0.19	Below	Low	NE	No RR required	Low
37024004	*Squatina albipunctata*	Eastern angelshark	0.106	0.07	Above	0.11	Below	0.15	Below	Medium	NE	No RR required	Medium
37031010	*Dipturus gudgeri*	Bight skate	0.112	0.06	Above	0.09	Above	0.12	Below	High	593 kg dis. (Log); ~80 kg ret. (Obs), ~3.1 t dis. (Obs). Also, an unidentified proportion of skates and rays unspecified: 186.33 t ret., 42.38 t dis. (Log). Apportioned to this and 25 other species. Also, an unidentified proportion of	3- At risk in regards to level of capture Catch is likely to be higher if a portion of the unidentified component is included. Depth 160-700 m – high effort in this depth range. Risk remains high.	High

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
											Rajidae: 185.65 t ret., 25 t dis. (Log).		
37031028	*Dipturus canutus*	Grey skate	0.107	0.1	Above	0.14	Below	0.19	Below	Medium	18.2 t ret. (Log). [Obs: 0.541 t ret., 1.62 t dis.] Also, an unidentified proportion of skates and rays: 186.33 t ret., 42.38 t dis. (Log). Apportioned to this and 25 other species. Also, an unidentified proportion of Rajidae: 185.65 t ret., 25 t dis. (Log).	No RR required	Medium
37031029	*Dipturus grahami*	Graham's skate	0.11	0.08	Above	0.13	Below	0.17	Below	Medium	NE	No RR required	Medium
37015013	*Cephaloscyllium albipinnum*	Whitefin swellshark	0.119	0.12	Below	0.18	Below	0.24	Below	Low	NE	No RR required	Low
37020036	*Somniosus antarcticus*	Southern sleeper shark	0.105	0.03	Below	0.04	Below	0.05	Below	Low	NE	No RR required	Low
37038005	*Urolophus sufflavus*	Yellowback stingaree	0.007	0.15	Below	0.23	Below	0.31	Below	Low	NE	No RR required	Low
37287093	*Helicolenus barathri*	Bigeye ocean perch^	0.092	0.2	Below	0.3	Below	0.4	Below	Low	NE	No RR required	Low
37020006	*Squalus megalops*	Piked spurdog; Spikey dogfish	0.101	0.06	Above	0.09	Below	0.12	Below	Medium	NE	No RR required	Medium
37031009	*Pavoraja nitida*	Peacock skate	0.064	0.11	Below	0.17	Below	0.23	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37027009	*Aptychotrema rostrata*	Eastern shovelnose ray	0.044	0.11	Below	0.16	Below	0.21	Below	Low	NE	No RR required	Low
37028001	*Hypnos monopterygius*	Coffin ray	0.036	0.12	Below	0.18	Below	0.25	Below	Low	NE	No RR required	Low
37031002	*Dentiraja australia*	Sydney skate	0.022	0.06	Below	0.09	Below	0.13	Below	Low	NE	No RR required	Low
37031003	*Dentiraja cerva*	Whitespotted skate	0.031	0.1	Below	0.15	Below	0.21	Below	Low	197 kg ret., 6.3 t dis. (Obs). Also, an unidentified proportion of 185.7 t ret., and ~42.4 t dis. (Log) of 37990018 – skates and rays. Apportioned to this and 25 other species. Also, an unidentified proportion of 186 t ret., and ~25.1 t dis. (Log); [Includes Obs: 0.54 t ret., 17.4 t dis.] of 37031000 – Rajidae -skates. Also, an unidentified proportion of 700 kg ret., 70.1 t dis (Log) of 37990030 – Rajiformes. Also, an unidentified proportion of 50 kg ret., 159.6 kg dis.	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
											(Obs) of 37031900 – *Raja* spp.		
37031018	*Notoraja azurea*	Blue skate	0.007	0.09	Below	0.14	Below	0.18	Below	Low	29.7 kg dis. (Obs). Also, an unidentified proportion of 185.7 t ret., and ~42.4 t dis. (Log) of 37990018 – skates and rays. Apportioned to this and 25 other species. Also, an unidentified proportion of 700 kg ret., 70.1 t dis (Log) of 37990030 – Rajiformes. Also, an unidentified proportion of 50 kg ret., 159.6 kg dis. (Obs) of 37031900 – Raja spp.	No RR required	Low
37031035	*Dipturus acrobelus*	Deepwater skate	0.019	0.1	Below	0.14	Below	0.19	Above	Low	~2.8 t dis. (Obs). Also, an unidentified proportion of 185.7 t ret., and ~42.4 t dis. (log) of 37990018 – skates and rays. Apportioned to this and 25 other species. Also, an unidentified proportion of 700 kg ret., 70.1 t dis (Log)	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
											of 37990030 – Rajiformes. Also, 186 t ret., and ~25.1 t dis. (Log); 0.54 t ret., 17.4 t dis. (Obs) of 37031000 – Rajidae -skates.		
37232004	*Lepidorhynchus denticulatus*	Toothed whiptail	0.092	0.26	Below	0.4	Below	0.53	Below	Low	14.7 t ret., 169 t dis. (Log). [Includes Obs: 1.2 t ret., 69.5 t dis.]	250-1200 m depth. Possible misidentification. Abundant and frequently caught as bycatch in commercial fisheries off Tasmania and Victoria; http://fishesofaustralia.net.au/home/species/4355#moreinfo	Low
37228001	*Dannevigia tusca*	Tusk	0.134	0.23	Below	0.34	Below	0.46	Below	Low	NE	No RR required	Low
37266001	*Neocyttus rhomboidalis*	Spikey oreodory^	0.054	0.16	Below	0.25	Below	0.33	Below	Low	~218 t ret., 11.1 t dis. (Log). [Includes Obs: ~29.9 t ret., 7.8 t dis.] Plus an unidentified proportion of group code 37266902 (*N. rhomboidalis*, *N. psilorhynchus*, *Allocyttus niger* and *A. verrucosus*): 285.1 t ret., 4.9 t dis. (Log).	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37266003	*Pseudocyttus maculatus*	Smooth oreodory^	0.013	0.16	Below	0.23	Below	0.31	Below	Low	~53.9 t ret. 17.5 t dis. (Log). [Includes Obs: ~4.4 t ret., 0.16 t dis.]	No RR required	Low
37311006	*Polyprion oxygeneios*	Hapuku	0.109	0.13	Below	0.20	Below	0.26	Below	Low	NE	No RR required	Low
37031040	*Rajella challengeri*	Challenger skate	0.007	0.07	Below	0.11	Below	0.15	Below	Low	23.9 kg dis. (Obs). Also, an unidentified proportion of 185.7 t ret., and ~42.4 t dis. (Log) of 37990018 – skates and rays. Apportioned to this and 25 other species. Also, an unidentified proportion of 700 kg ret., 70.1 t dis (Log) of 37990030 – Rajiformes. Also, an unidentified proportion of 186 t ret., and ~25.1 t dis. (Log); 0.54 t ret., 17.4 t dis. (Obs) of 37031000 – Rajidae -skates.	No RR required	Low
37445011	*Seriolella caerulea*	White warehou	0.111	0.32	Below	0.48	Below	0.64	Below	Low	NE	No RR required	Low
37027006	*Trygonorrhina fasciata*	Eastern fiddler ray	0.028	0.1	Below	0.14	Below	0.19	Below	Low	614.6 kg ret., 1.14 t dis. (Obs). Also, an unidentified proportion of 135 kg	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
											ret. (Log) and 10 kg ret. (Obs) of 37027000 – Rhinobatidae. Also, an unidentified proportion of 186 t ret., and ~42.4 t dis. (log) of 37990018 – skates and rays. Apportioned to this and 25 other species.		
37258002	*Beryx splendens*	Alfonsino^	0.107	0.34	Below	0.52	Below	0.61	Below	Low	NE	No RR required	Low
37400005	*Pleuroscopus pseudodorsalis*	Scaled stargazer	0.115	0.33	Below	0.49	Below	0.66	Below	Low	34 kg ret., 72.25 kg dis. (Obs). Also, an unidentified proportion of 380.5 t ret., ~4.4 t dis. (Log) and 735.8 kg ret., 670.36 kg dis. (Obs) of 37400000 - Uranoscopidae	No RR required	Low
37345002	*Plagiogeneion macrolepis*	Bigscale rubyfish	0.092	0.36	Below	0.55	Below	0.73	Below	Low	677 kg ret., 154.29 kg dis. (Obs). Also, an unidentified proportion of 15.8 t ret., 0.94 t dis. (Log) of 37345900 - *Plagiogeneion* spp.	No RR required	Low
37031005	*Dentiraja confusa*	Longnose skate	0.007	0.09	Below	0.14	Below	0.19	Below	Low	NE	No RR required	Low
37038006	*Trygonoptera testacea*	Common stingaree	0.015	0.16	Below	0.24	Below	0.32	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37224002	*Mora moro*	Ribaldo^	0.029	0.31	Below	0.46	Below	0.61	Below	Low	NE	No RR required	Low
37296002	*Platycephalus conatus*	Deepwater flathead	0.123	0.29	Below	0.44	Below	0.59	Below	Low	NE	No RR required	Low
37345001	*Emmelichthys nitidus*	Redbait	0.004	0.43	Below	0.66	Below	0.87	Below	Low	NE	No RR required	Low
37005002	*Notorynchus cepedianus*	Broadnose shark	0.007	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37012001	*Alopias vulpinus*	Common thresher	0.001	0.08	Below	0.12	Below	0.16	Below	Low	NE	No RR required	Low
37012002	*Alopias superciliosus*	Bigeye thresher shark	0.003	0.06	Below	0.08	Below	0.11	Below	Low	NE	No RR required	Low
37013003	*Orectolobus maculatus*	Spotted wobbegong	0.006	0.07	Below	0.1	Below	0.14	Below	Low	NE	No RR required	Low
37015001	*Cephaloscyllium laticeps*	Draughtboard shark	0.0002	0.1	Below	0.16	Below	0.21	Below	Low	NE	No RR required	Low
37017001	*Mustelus antarcticus*	Gummy shark#	0.002	0.1	Below	0.15	Below	0.21	Below	Low	NE	No RR required	Low
37018001	*Carcharhinus brachyurus*	Bronze whaler	0.014	0.04	Below	0.06	Below	0.08	Below	Low	NE	No RR required	Low
37024001	*Squatina australis*	Australian angel shark	0.003	0.07	Below	0.11	Below	0.15	Below	Low	NE	No RR required	Low
37024002	*Squatina tergocellata*	Ornate angelshark	0	0.07	Below	0.11	Below	0.15	Below	Low	NE	No RR required	Low
37031006	*Spiniraja whitleyi*	Melbourne skate	0.0003	0.06	Below	0.09	Below	0.12	Below	Low	NE	No RR required	Low
37031007	*Dentiraja lemprieri*	Thornback skate	0.0002	0.07	Below	0.11	Below	0.15	Below	Low	NE	No RR required	Low
37027011	*Trygonorrhina dumerilii*	Southern fiddler ray	0.0002	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low

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37035001	*Bathytoshia brevicaudata; was Dasyatis brevicaudata*	Short-tail stingray; was: Smooth stingray	0.003	0.11	Below	0.16	Below	0.21	Below	Low	NE	No RR required	Low
37035002	*Bathytoshia lata; was: Dasyatis thetidis*	Black stingray	0.004	0.1	Below	0.16	Below	0.22	Below	Low	NE	No RR required	Low
37038001	*Urolophus bucculentus*	Sandyback stingaree	0.018	0.15	Below	0.23	Below	0.31	Below	Low	NE	No RR required	Low
37038002	*Urolophus cruciatus*	Banded stingaree	0.003	0.16	Below	0.23	Below	0.31	Below	Low	NE	No RR required	Low
37038004	*Urolophus paucimaculatus*	Sparsely-spotted stingaree	0.003	0.2	Below	0.29	Below	0.39	Below	Low	NE	No RR required	Low
37038007	*Urolophus viridis*	Greenback stingaree	0.013	0.15	Below	0.23	Below	0.31	Below	Low	NE	No RR required	Low
37039001	*Myliobatis tenuicaudatus*	Southern eagle ray	0.002	0.07	Below	0.11	Below	0.14	Below	Low	NE	No RR required	Low
37043001	*Callorhinchus milii*	Elephantfish^	0.001	0.13	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37120001	*Paraulopus nigripinnis*	Blacktip cucumberfish	0.042	0.53	Below	0.79	Below	1.05	Below	Low	NE	No RR required	Low
37224003	*Pseudophycis barbata*	Bearded rock cod	0.012	0.39	Below	0.58	Below	0.78	Below	Low	NE	No RR required	Low
37224006	*Pseudophycis bachus*	Red cod	0.015	0.42	Below	0.62	Below	0.83	Below	Low	NE	No RR required	Low
37224011	*Pseudophycis breviuscula*	Bastard red cod	0.005	0.37	Below	0.55	Below	0.73	Below	Low	NE	No RR required	Low
37228008	*Genypterus tigerinus*	Rock ling	0.001	0.20	Below	0.30	Below	0.41	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37264002	*Cyttus australis*	Silver dory	0.016	0.37	Below	0.55	Below	0.73	Below	Low	NE	No RR required	Low
37264004	*Zeus faber*	John dory^	0.013	0.33	Below	0.50	Below	0.67	Below	Low	NE	No RR required	Low
37266002	*Oreosoma atlanticum*	Oxeye oreodory^	0.008	0.25	Below	0.37	Below	0.49	Below	Low	NE	No RR required	Low
37288003	*Lepidotrigla vanessa*	Butterfly gurnard	0.001	0.61	Below	0.91	Below	1.21	Below	Low	NE	No RR required	Low
37288007	*Lepidotrigla modesta*	Cocky Gurnard	0.011	0.61	Below	0.91	Below	1.21	Below	Low	NE	No RR required	Low
37288008	*Lepidotrigla mulhalli*	Roundsnout gurnard	0.004	0.61	Below	0.91	Below	1.22	Below	Low	NE	No RR required	Low
37296003	*Platycephalus bassensis*	Southern sand flathead	0.001	0.43	Below	0.64	Below	0.85	Below	Low	NE	No RR required	Low
37296004	*Platycephalus fuscus*	Dusky flathead	0.00002	0.4	Below	0.6	Below	0.8	Below	Low	NE	No RR required	Low
37296006	*Platycephalus laevigatus*	Rock flathead	0.0001	0.35	Below	0.52	Below	0.7	Below	Low	NE	No RR required	Low
37296007	*Platycephalus caeruleopunctatus*	Bluespotted flathead	0.01	0.37	Below	0.56	Below	0.74	Below	Low	NE	No RR required	Low
37296011	*Ratabulus diversidens*	Orange-freckled flathead	0.079	0.39	Below	0.59	Below	0.79	Below	Low	NE	No RR required	Low
37296033	*Platycephalus australis*	Bartail flathead	0.047	0.39	Below	0.59	Below	0.79	Below	Low	NE	No RR required	Low
37296036	*Platycephalus longispinis*	Longspine flathead	0.002	0.46	Below	0.68	Below	0.91	Below	Low	NE	No RR required	Low
37296037	*Platycephalus speculator*	Southern bluespotted flathead	0.0001	0.38	Below	0.56	Below	0.75	Below	Low	NE	No RR required	Low
37296038	*Platycephalus marmoratus*	Marbled flathead	0.002	0.42	Below	0.63	Below	0.84	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37296045	*Thysanophrys cirronasa*	Tasselsnout flathead	0.0003	0.39	Below	0.59	Below	0.79	Below	Low	NE	No RR required	Low
37337002	*Trachurus declivis*	Common jack mackerel	0.005	0.47	Below	0.71	Below	0.95	Below	Low	NE	No RR required	Low
37337003	*Trachurus novaezelandiae*	Yellowtail scad	0.02	0.46	Below	0.69	Below	0.92	Below	Low	NE	No RR required	Low
37337006	*Seriola lalandi*	Yellowtail kingfish	0.02	0.44	Below	0.66	Below	0.88	Below	Low	NE	No RR required	Low
37345003	*Plagiogeneion rubiginosum*	Cosmopolitan rubyfish	0.051	0.36	Below	0.54	Below	0.72	Below	Low	NE	No RR required	Low
37353001	*Chrysophrys auratus*	Snapper	0.005	0.28	Below	0.41	Below	0.55	Below	Low	NE	No RR required	Low
37367003	*Pentaceropsis recurvirostris*	Longsnout boarfish	0.012	0.2	Below	0.3	Below	0.4	Below	Low	NE	No RR required	Low
37369002	*Oplegnathus woodwardi*	Knifejaw	0.016	0.31	Below	0.47	Below	0.63	Below	Low	NE	No RR required	Low
37377002	*Nemadactylus douglasii*	Grey morwong	0.004	0.24	Below	0.36	Below	0.48	Below	Low	NE	No RR required	Low
37400001	*Xenocephalus armatus*	Bulldog stargazer	0.071	0.33	Below	0.49	Below	0.66	Below	Low	NE	No RR required	Low
37400003	*Kathetostoma laeve*	Common stargazer	0.004	0.32	Below	0.48	Below	0.63	Below	Low	NE	No RR required	Low
37400018	*Kathetostoma canaster*	Speckled stargazer	0.02	0.36	Below	0.55	Below	0.73	Below	Low	NE	No RR required	Low
37439001	*Thyrsites atun*	Barracouta	0.005	0.36	Below	0.54	Below	0.71	Below	Low	NE	No RR required	Low
37441001	*Scomber australasicus*	Blue mackerel	0.002	0.37	Below	0.55	Below	0.73	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37445001	*Hyperoglyphe antarctica*	Blue-eye trevalla^	0.005	0.21	Below	0.32	Below	0.42	Below	Low	NE	No RR required	Low
37445004	*Centrolophus niger*	Rudderfish	0.006	0.30	Below	0.46	Below	0.61	Below	Low	NE	No RR required	Low
37445005	*Seriolella brama*	Blue warehou^	0.015	0.31	Below	0.47	Below	0.62	Below	Low	NE	No RR required	Low
37465003	*Eubalichthys mosaicus*	Mosaic leatherjacket	0.005	0.41	Below	0.61	Below	0.82	Below	Low	NE	No RR required	Low
37465005	*Meuschenia scaber*	Velvet leatherjacket	0.008	0.41	Below	0.61	Below	0.82	Below	Low	NE	No RR required	Low
37465007	*Scobinichthys granulatus*	Rough leatherjacket	0.00004	0.41	Below	0.61	Below	0.82	Below	Low	NE	No RR required	Low
37465008	*Meuschenia australis*	Brownstriped leatherjacket	0.0001	0.41	Below	0.61	Below	0.82	Below	Low	NE	No RR required	Low
37465024	*Paramonacanthus filicauda*	Threadfin leatherjacket	0.004	0.44	Below	0.65	Below	0.87	Below	Low	NE	No RR required	Low
37465036	*Meuschenia freycineti*	Sixspine leatherjacket	0.001	0.39	Below	0.59	Below	0.79	Below	Low	NE	No RR required	Low
37465059	*Meuschenia trachylepis*	Yellowfin leatherjacket	0.000	0.41	Below	0.61	Below	0.82	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

2.5.4 bSAFE - Bycatch species

Under the revised ERAEF (AFMA 2017), key commercial species that undergo tiered assessments are not assessed at Level 2, however Tier 4 or 5 species should be assessed in this ERA as Tier 4/5 assessments are considered to be data poor (i.e. rely on catch/effort or catch data only) and the validity of assumptions have broken down for some species. Therefore, Plunket's dogfish, southern lanternshark, blackbelly lanternshark, smooth lanternshark, golden dogfish, warty oreodory, black oreodory, rough oreodory and southern sawshark and were assessed.

A total of 264 bycatch species were assessed in this bSAFE (Figure 2.15a, b). Of these, 36 species were found to be unassessable due to missing biological attributes employed in this method (Table 2.33, classified as NA; unassessable) and therefore assessed in a PSA (see Table 2.25). Of the remaining 228 assessable species, three were extreme risk, none were high risk, five were medium risk and 220 were low risk (Table 2.33).

All three extreme risk species were chondrichthyans: Leafscale gulper shark *Centrophorus squamosus*, Southern dogfish *Centrophorus zeehaani* and Endeavour dogfish *Centrophorus moluccensis.* A residual risk analysis was conducted on these three extreme risk species (see Section 2.9).

Of the five medium risk species four were chondrichthyans (Plunket's dogfish *Scymnodon plunketi* (Tier 4 deepwater shark species), Harrison's dogfish *Centrophorus harrissoni,* sandtiger shark *Odontaspis ferox,* sharpnose sevengill shark *Heptranchias perlo*) and one was a teleost (giant sawbelly *Hoplostethus gigas*).

The other Tier 4 species (southern lanternshark *Etmopterus baxteri,* blackbelly lanternshark *Etmopterus lucifer*, smooth lanternshark *Etmopterus bigelowi,* golden dogfish *Centroselachus crepidater,* warty oreodory *Allocyttus verrucosus*, black oreodory *Allocyttus niger*, rough oreodory *Neocyttus psilorhynchus* and southern sawshark *Pristiophorus nudipinnis*) were assessed at low risk.

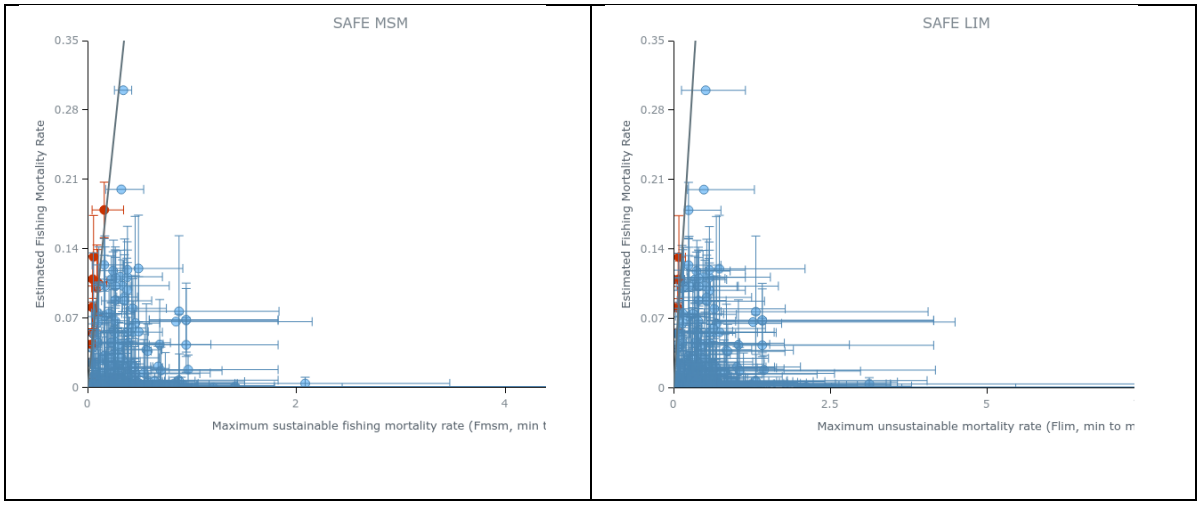

Figure 2.15. SAFE plot for Bycatch species in the SESSF Otter trawl sub-fishery for (a) SAFE-MSM reference point [left] and (b) SAFE limit (LIM) reference point [right].

Table 2.33. 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. NA: not assessable. Ret: retained; dis: discarded. ^: Tier 4 species.

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
Following 36 BC species unassessable in bSAFE:													
37466004	*Lactoria cornuta*	Longhorn cowfish	0.047	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37466003	*Aracana aurita*	Shaw's cowfish	0.003	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37466002	*Anoplocapros inermis*	Eastern smooth boxfish	0.018	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37311161	*Ostracoberyx paxtoni*	Spinycheek seabass	0.103	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37305001	*Psychrolutes marcidus*	Smooth-head blobfish	0.031	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37292001	*Pataecus fronto*	Red Indian fish	0.046	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37290001	*Aploactisoma milesii*	Southern velvetfish	0.000	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37288012	*Satyrichthys cf moluccense*	Blackfin armour gurnard	0.092	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37288004	*Peristedion picturatum*	Robust amour gurnard	0.124	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37287005	*Neosebastes scorpaenoides*	Common gurnard perch	0.000	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37278002	*Fistularia petimba*	Rough flutemouth	0.018	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37278001	*Fistularia commersonii*	Smooth flutemouth	0.035	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37272002	*Regalecus glesne*	Oarfish ("king of herrings")	0.001	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37265003	*Xenolepidichthys dalgleishi*	Spotted tinselfish	0.052	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37265001	*Grammicolepis brachiusculus*	Thorny tinselfish	0.063	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37254001	*Diretmichthys parini*	Black spinyfin	0.004	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37229003	*Echiodon rendahli*	Messmate fish	0.01	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37224001	*Euclichthys polynemus*	Eucla cod	0.162	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37215001	*Himantolophus appelii*	Prickly footballfish	0.004	-	NA		NA		NA	NA			see Table 2.25
37141001	*Gonorynchus greyi*	Beaked salmon	0.004	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37120008	*Paraulopus melanostomus*	Cucumberfish 1	0.109	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37114024	*Rouleina guentheri*	Bordello slickhead	0.009	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37114023	*Rouleina eucla*	Eucla slickhead	0.012	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37113002	*Idiacanthus atlanticus*	Common black dragonfish	0.001	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37083002	*Notacanthus chemnitzii*	Cosmopolitan spineback	0.009	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37083001	*Notacanthus sexspinis*	Southern spineback	0.014	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37070001	*Diastobranchus capensis*	Basketwork eel	0.004	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37067027	*Gnathophis macroporis*	Largepore conger	0.019	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37067016	*Gnathophis umbrellabius*	Umbrella conger	0.041	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37067002	*Gnathophis longicaudus*	Little conger	0.001	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37022002	*Echinorhinus cookei*	Prickly shark	0.008	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37021001	*Oxynotus bruniensis*	Prickly dogfish	0.117	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37013005	*Parascyllium ferrugineum*	Rusty carpetshark	0.002	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37013002	*Parascyllium collare*	Collar carpetshark	0.044	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37009002	*Mitsukurina owstoni*	Goblin shark	0.024	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
37006001	*Chlamydoselachus anguineus*	Frill shark	0.04	-	NA	-	NA	-	NA	NA	-	-	see Table 2.25
Other BC species:													
37020048	*Squalus chloroculus*	Greeneye spurdog	0.053	0.06	Below	0.09	Below	0.12	Below	Low	0.955 t ret. (Log), 0.2 t dis. (Log). [Includes Obs: 1.39 t ret., 2.68 t dis.] Note *S. mitsukirii* is a synomym of this species. *S. mitsukirii*: 14 t ret., 63 t dis. (Log). [Includes Obs: 52.5 kg ret.] of *S. mitsukirii*. Also, an unidentified proportion of 218 kg dis. (Log) – Squaliformes 37990071. Also, an unidentified proportion of 0.25 t ret. (Log), 252.4 t dis. (Log) of Squalidae. Also, an unidentified proportion of 30.8 t ret. (Log), 15.8 t dis. (Log); 0.051 t ret. (obs), 1.22 t dis. (Obs) of 37020000: Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37015031	*Cephaloscyllium variegatum*	Northern draughtboard shark	0.072	0.13	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37015020	*Apristurus australis*	Apristurus sp G	0.026	0.13	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37008003	*Odontaspis ferox*	Sandtiger shark	0.101	0.07	Above	0.11	Below	0.15	Below	Medium	NE	No RR required	Medium
37020001	*Centrophorus moluccensis*	Endeavour dogfish	0.132	0.05	Above	0.07	Above	0.09	Above	Extreme	344.3 t ret., 100.5 t dis. (Log). [Includes Obs: 15 kg ret., 20 kg dis.] An unidentified proportion of 218 kg dis (Log) of dogfish sharks – Squaliformes 37990071. Also, an unidentified proportion of 30.8 t ret., 15.8 t dis. (Log). [Includes Obs: 0.051 t ret., 1.22 t dis.] of Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae	3- At risk in regards to high level of interaction/capture. Catch is likely to be higher if unidentified proportion of this species is included. Zero retention limit and spatial closures apply (Upper Slope Dogfish Management Strategy-2012). The population status of this species in the SESSF is uncertain, with depletion estimates between 11-31% overall (AFMA 2012). The Endeavour Dogfish closure outside Sydney prohibits fishing by all fishing methods. However, there are annual trigger limits of 4.5 t	Extreme

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
												in other areas within the SESSF. Risk category remains extreme	
37020009	*Centrophorus squamosus*	Leafscale gulper shark	0.081	0.04	Above	0.06	Above	0.08	Above	Extreme	50 kg dis. (Obs). Also, an unidentified proportion of 218 kg dis (Log) of dogfish sharks – Squaliformes 37990071. Also, an unidentified proportion of 30.8 t ret. (log), 15.8 t dis. (Log); 0.051 t ret. (obs), 1.22 t dis. (Obs) of Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae	3- At risk in regards to level of interaction/capture. Spatial closures apply (Upper Slope Dogfish Management Strategy-2012). Therefore risk category remains extreme	Extreme
37020010	*Centrophorus harrissoni*	Harrisson's dogfish	0.055	0.05	Above	0.07	Below	0.1	Below	Medium	200 kg dis. (Log). 2 kg dis (Obs). Also, an unidentified proportion of 218 kg dis. (Log) of dogfish sharks – Squaliformes 37990071. Also, an unidentified proportion of 30.8 t ret. (Log), 15.8 t dis. (Log); 0.051 t ret. (Obs), 1.22 t dis. (Obs) of Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae	No RR required	Medium

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37020011	*Centrophorus zeehaani*	Southern dogfish	0.110	0.05	Above	0.07	Above	0.1	Above	Extreme	147 kg ret.; 12 kg dis. (Log). Also, an unidentified proportion of 218 kg dis (Log) of dogfish sharks – Squaliformes 37990071. Also, an unidentified proportion of 30.8 t ret., 15.8 t dis. (Log). [Includes Obs: 0.051 t ret., 1.22 t dis.] of Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae	3- At risk in regards to level of interaction/capture. Trigger limit (3), zero retention limit and spatial closures apply (Upper Slope Dogfish Management Strategy-2012). Endemic to Australia. It is long lived, has low fecundity and late to mature. Population trend and/or status is unknown, however there have been severe reductions due to fishing pressure in the SESSF over the upper slope. Fishes of Australia website. Therefore risk category remains extreme	Extreme
37020013	*Scymnodon plunketi*	Plunket's dogfish^	0.044	0.04	Above	0.06	Below	0.08	Below	Medium	90 kg ret. (Log). [Includes Obs: 100.7 kg ret. 20.3 kg dis.] Also, an unidentified proportion of 218 kg dis. (Log) of dogfish	No RR Required	Medium

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
											sharks – Squaliformes 37990071. Also, an unidentified proportion of 30.8 t ret. (Log), 15.8 t dis. (Log). [Includes: Obs: 0.051 t ret., 1.22 t dis.] of 37020000 - Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae		
37020021	*Etmopterus baxteri*	Southern lanternshark^; Rough deep-sea shark^	0.011	0.05	Below	0.08	Below	0.11	Below	Low	20 kg ret., 22.9 kg dis. (Obs). Also, an unidentified proportion of 218 kg dis (Log) of dogfish sharks – Squaliformes 37990071. Also, an unidentified proportion of 30.8 t ret. (Log), 15.8 t dis. (Log). [Includes Obs: 0.051 t ret., 1.22 t dis.] of 37020000 - Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae	No RR required	Low
37020023	*Centrophorus granulosus*	Gulper shark	0.000	0.06	Below	0.08	Below	0.11	Below	Low	220 kg ret. (Log). Also, an unidentified proportion of 218 kg dis (Log) of dogfish sharks – Squaliformes 37990071.	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
											Also, an unidentified proportion of 30.8 t ret., 15.8 t dis. (Log). [Includes Obs: 0.051 t ret., 1.22 t dis.] of 37020000 - Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae		
37042008	*Chimaera lignaria*	Giant chimaera	0.005	0.04	Below	0.06	Below	0.08	Below	Low	NE	No RR required	Low
37044001	*Harriotta raleighana*	Bigspine spookfish	0.024	0.05	Below	0.08	Below	0.11	Below	Low	NE	No RR required	Low
37224007	*Notophycis marginata*	Dwarf codling	0.118	0.22	Below	0.33	Below	0.43	Below	Low	NE	No RR required	Low
37367009	*Pseudopentaceros richardsoni*	Pelagic armourhead	0.111	0.27	Below	0.41	Below	0.54	Below	Low	NE	No RR required	Low
37005001	*Heptranchias perlo*	Sharpnose sevengill shark	0.106	0.1	Above	0.15	Below	0.2	Below	Medium	NE	No RR required	Medium
37005004	*Hexanchus nakamurai*	Bigeye sixgill shark	0.046	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37015009	*Figaro boardmani*	Australian sawtail catshark; Sawtail catshark	0.103	0.12	Below	0.18	Below	0.25	Below	Low	NE	No RR required	Low
37020005	*Etmopterus lucifer*	Blackbelly lanternshark^	0.074	0.1	Below	0.16	Below	0.21	Below	Low	6.6 kg ret., 181.48 kg dis. (Obs). Also, an unidentified proportion of 218 kg dis. (Log) of dogfish sharks – Squaliformes 37990071. Also, an unidentified proportion of 30.8 t ret. (Log), 15.8 t dis. (Log). [Includes Obs: 0.051 t ret., 1.22 t dis.] of 37020000 -	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
											Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae		
37327001	*Epigonus lenimen*	Bigeye deepsea cardinalfish	0.075	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37020012	*Centroselachus crepidater*	Golden dogfish^	0.026	0.05	Below	0.07	Below	0.09	Below	Low	0.92 t ret., 1.4 t dis. (Obs). Also, an unidentified proportion of 218 kg dis. (Log) of dogfish sharks – Squaliformes 37990071. Also, an unidentified proportion of 30.8 t ret. (Log), 15.8 t dis. (Log). [Obs: 0.051 t ret., 1.22 t dis.] of 37020000 - Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae	No RR required	Low
37327035	*Epigonus telescopus*	Black deepsea cardinalfish	0.066	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37028003	*Torpedo macneilli*	Short-tail torpedo ray	0.103	0.11	Below	0.16	Below	0.22	Below	Low	6 kg ret., 0.24 t dis. (Obs) Also, an unidentified poroption of 186.3 t ret., 42.4 t dis. (Log) of skates and rays. Apportioned to this and 25 other species.	No RR required	Low
37018022	*Galeocerdo cuvier*	Tiger shark	0.007	0.07	Below	0.11	Below	0.14	Below	Low	NE	No RR required	Low
37020022	*Etmopterus unicolor*	Bristled lanternshark	0.012	0.08	Below	0.12	Below	0.16	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37042005	*Chimaera fulva*	Southern chimaera	0.015	0.08	Below	0.12	Below	0.16	Below	Low	NE	No RR required	Low
37044002	*Rhinochimaera pacifica*	Pacific spookfish	0.004	0.05	Below	0.08	Below	0.11	Below	Low	NE	No RR required	Low
37232001	*Coelorinchus australis*	Southern whiptail	0.039	0.29	Below	0.44	Below	0.58	Below	Low	NE	No RR required	Low
37232007	*Malacocephalus laevis*	Softhead grenadier; Smooth whiptail	0.103	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low
37232015	*Coryphaenoides serrulatus*	Serrulate whiptail	0.026	0.19	Below	0.28	Below	0.38	Below	Low	NE	No RR required	Low
37232104	*Coelorinchus amydrozosterus*	Faintbanded whiptail	0.119	0.38	Below	0.57	Below	0.77	Below	Low	NE	No RR required	Low
37255004	*Gephyroberyx darwinii*	Darwin's roughy	0.124	0.16	Below	0.24	Below	0.32	Below	Low	NE	No RR required	Low
37255005	*Hoplostethus gigas*	Giant sawbelly	0.179	0.16	Above	0.24	Below	0.32	Below	Medium	NE	No RR required	Medium
37258001	*Beryx decadactylus*	Imperador	0.112	0.31	Below	0.47	Below	0.63	Below	Low	NE	No RR required	Low
37266004	*Allocyttus verrucosus*	Warty oreodory^	0.01	0.11	Below	0.17	Below	0.23	Below	Low	2.9 t ret., 0.17 t dis. (Log). [Includes Obs: 0.25 t ret., 1.1 t dis.] Plus an unidentified proportion of group code 37266902 (*N. rhomboidalis*, *N. psilorhynchus*, *Allocyttus niger* and *A. verrucosus*): 285.1 t ret., 4.9 t dis. (Log).	No RR required	Low
37266005	*Allocyttus niger*	Black oreodory^	0.01	0.12	Below	0.19	Below	0.25	Below	Low	113 kg ret., 520 kg dis. (Log). [Includes: Obs: 0.2 kg dis.] Plus an unidentified proportion of group code 37266902 (*N. rhomboidalis*, *N. psilorhynchus*, *Allocyttus niger* and *A. verrucosus*): 285.1 t ret., 4.9 t dis. (Log).	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37287046	*Trachyscorpia eschmeyeri*	Deepsea ocean perch	0.013	0.21	Below	0.31	Below	0.42	Below	Low	NE	No RR required	Low
37287103	*Trachyscorpia carnomagula*	Deepsea scorpionfish	0.03	0.18	Below	0.28	Below	0.37	Below	Low	NE	No RR required	Low
37327010	*Epigonus denticulatus*	White deepsea cardinalfish	0.072	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37020027	*Etmopterus bigelowi*	Smooth lanternshark^	0.017	0.09	Below	0.14	Below	0.18	Below	Low	126 kg dis. (Obs). Also, an unidentified proportion of 218 kg dis. (Log) of dogfish sharks – Squaliformes 37990071. Also, an unidentified proportion of 30.8 t ret., 15.8 t dis. (Log). [Includes Obs: 0.051 t ret., 1.22 t dis.] of 37020000 - Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae	No RR required	Low
37227002	*Merluccius australis*	Southern hake	0.019	0.23	Below	0.34	Below	0.45	Below	Low	NE	No RR required	Low
37020008	*Squalus acanthias*	Whitespotted dogfish	0.001	0.06	Below	0.09	Below	0.12	Below	Low	NE	No RR required	Low
37067012	*Bassanago bulbiceps*	Swollenhead conger	0.11	0.23	Below	0.34	Below	0.45	Below	Low	NE	No RR required	Low
37232016	*Coryphaenoides subserrulatus*	Longray whiptail	0.011	0.19	Below	0.28	Below	0.38	Below	Low	NE	No RR required	Low
37264010	*Cyttopsis rosea*	Rosy dory	0.092	0.35	Below	0.53	Below	0.71	Below	Low	NE	No RR required	Low
37007001	*Heterodontus portusjacksoni*	Port Jackson shark	0.011	0.07	Below	0.1	Below	0.14	Below	Low	NE	No RR required	Low
37015027	*Asymbolus analis*	Grey spotted catshark	0.033	0.13	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37018021	*Carcharhinus leucas*	Bull shark	0.010	0.06	Below	0.08	Below	0.11	Below	Low	NE	No RR required	Low
37224004	*Tripterophycis gilchristi*	Chiseltooth grenadier cod	0.103	0.33	Below	0.5	Below	0.67	Below	Low	NE	No RR required	Low
37232002	*Coelorinchus fasciatus*	Banded whiptail	0.023	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37232003	*Coelorinchus mirus*	Gargoyle fish	0.103	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low
37232014	*Coelorinchus innotabilis*	Notable whiptail	0.046	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low
37232017	*Coelorinchus matamua*	Blueband whiptail	0.035	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low
37232047	*Coelorinchus gormani*	Little whiptail	0.112	0.38	Below	0.57	Below	0.77	Below	Low	NE	No RR required	Low
37311147	*Epinephelus ergastularius*	Banded rockcod	0.057	0.25	Below	0.37	Below	0.5	Below	Low	NE	No RR required	Low
37255001	*Hoplostethus intermedius*	Blacktip sawbelly	0.074	0.23	Below	0.34	Below	0.45	Below	Low	NE	No RR required	Low
37377004	*Nemadactylus valenciennesi*	Blue morwong	0.046	0.23	Below	0.34	Below	0.46	Below	Low	NE	No RR required	Low
37461002	*Azygopus pinnifasciatus*	Banded-fin flounder	0.075	0.22	Below	0.34	Below	0.45	Below	Low	NE	No RR required	Low
37015014	*Apristurus sinensis*	Apristurus sp A	0.007	0.13	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37038018	*Urolophus kapalensis*	Kapala stingaree	0.073	0.16	Below	0.24	Below	0.32	Below	Low	NE	No RR required	Low
37212001	*Halieutaea brevicauda*	Shortfin seabat	0.065	0.46	Below	0.69	Below	0.92	Below	Low	NE	No RR required	Low
37224009	*Halargyreus johnsonii*	Slender cod	0.006	0.35	Below	0.52	Below	0.69	Below	Low	NE	No RR required	Low
37081002	*Halosaurus pectoralis*	Australian halosaur	0.018	0.26	Below	0.39	Below	0.51	Below	Low	NE	No RR required	Low
37224013	*Laemonema globiceps*	Fathead cod	0.034	0.22	Below	0.33	Below	0.43	Below	Low	NE	No RR required	Low
37224017	*Lepidion schmidti*	Schmidt's cod	0.013	0.22	Below	0.33	Below	0.43	Below	Low	NE	No RR required	Low
37224018	*Lepidion inosimae*	Giant cod	0.014	0.22	Below	0.33	Below	0.43	Below	Low	NE	No RR required	Low
37232031	*Coelorinchus kaiyomaru*	Kaiyomaru whiptail	0.009	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low
37232035	*Mesovagus antipodum*	Black whiptail	0.018	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low
37232042	*Coelorinchus acanthiger*	Spottyface whiptail	0.011	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low
37232045	*Coelorinchus maurofasciatus*	Falseband whiptail	0.099	0.38	Below	0.57	Below	0.77	Below	Low	NE	No RR required	Low
37255012	*Aulotrachichthys pulsator*	Golden roughy	0.000	0.2	Below	0.3	Below	0.4	Below	Low	NE	No RR required	Low
37258004	*Centroberyx gerrardi*	Bight redfish	0.012	0.28	Below	0.42	Below	0.56	Below	Low	NE	No RR required	Low
37264005	*Cyttus novaezealandiae*	New Zealand dory	0.08	0.43	Below	0.65	Below	0.87	Below	Low	NE	No RR required	Low
37288005	*Pterygotrigla andertoni*	Painted latchet	0.12	0.48	Below	0.73	Below	0.97	Below	Low	NE	No RR required	Low
37311001	*Lepidoperca pulchella*	Eastern orange perch	0.027	0.34	Below	0.51	Below	0.69	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37311055	*Callanthias australis*	Splendid perch	0.017	0.29	Below	0.43	Below	0.58	Below	Low	NE	No RR required	Low
37327018	*Epigonus robustus*	Robust deepsea cardinalfish	0.007	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37337007	*Seriola hippos*	Samsonfish	0.088	0.45	Below	0.67	Below	0.9	Below	Low	NE	No RR required	Low
37337025	*Seriola dumerili*	Amberjack	0.056	0.38	Below	0.56	Below	0.75	Below	Low	NE	No RR required	Low
37378001	*Latris lineata*	Striped trumpeter	0.044	0.3	Below	0.45	Below	0.6	Below	Low	NE	No RR required	Low
37224012	*Physiculus luminosa*	Luminous cod	0.000	0.22	Below	0.33	Below	0.43	Below	Low	NE	No RR required	Low
37005005	*Hexanchus griseus*	Bluntnose sixgill shark	0.003	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37015003	*Asymbolus vincenti*	Gulf catshark	0.011	0.13	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37015024	*Asymbolus rubiginosus*	Orange spotted catshark	0.028	0.14	Below	0.21	Below	0.28	Below	Low	NE	No RR required	Low
37017003	*Furgaleus macki*	Whiskery shark	0.004	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37017006	*Hypogaleus hyugaensis*	Pencil shark	0.011	0.11	Below	0.16	Below	0.22	Below	Low	NE	No RR required	Low
37018003	*Carcharhinus obscurus*	Dusky shark; Dusky whaler	0.004	0.04	Below	0.06	Below	0.08	Below	Low	NE	No RR required	Low
37018004	*Prionace glauca*	Blue shark	0.003	0.08	Below	0.11	Below	0.15	Below	Low	NE	No RR required	Low
37018007	*Carcharhinus plumbeus*	Sandbar shark	0.000	0.05	Below	0.08	Below	0.11	Below	Low	NE	No RR required	Low
37018008	*Carcharhinus falciformis*	Silky shark	0.003	0.07	Below	0.1	Below	0.13	Below	Low	NE	No RR required	Low
37018029	*Negaprion acutidens*	Lemon shark	0.000	0.12	Below	0.17	Below	0.23	Below	Low	NE	No RR required	Low
37018030	*Carcharhinus amblyrhynchos*	Grey reef shark	0.014	0.08	Below	0.12	Below	0.15	Below	Low	NE	No RR required	Low
37019001	*Sphyrna lewini*	Scalloped hammerhead shark	0.003	0.06	Below	0.09	Below	0.12	Below	Low	NE	No RR required	Low
37019004	*Sphyrna zygaena*	Smooth hammerhead shark	0.001	0.08	Below	0.13	Below	0.18	Below	Low	NE	No RR required	Low
37020014	*Isistius brasiliensis*	Smalltooth cookiecutter shark	0.004	0.07	Below	0.1	Below	0.13	Below	Low	NE	No RR required	Low
37020042	*Zameus squamulosus*	Velvet dogfish	0.004	0.05	Below	0.07	Below	0.09	Below	Low	NE	No RR required	Low
37020047	*Squalus montalbani*	Philippine spurdog	0.004	0.05	Below	0.08	Below	0.11	Below	Low	NE	No RR required	Low
37023001	*Pristiophorus nudipinnis*	Southern sawshark^	0.001	0.12	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low

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37028002	*Narcine tasmaniensis*	Tasmanian numbfish	0.022	0.68	Below	1.01	Below	1.35	Below	Low	NE	No RR required	Low
37028005	*Narcine westraliensis*	Banded numbfish	0.000	0.68	Below	1.01	Below	1.35	Below	Low	NE	No RR required	Low
37038014	*Trygonoptera imitata*	Shovelnose stingaree	0.008	0.16	Below	0.24	Below	0.32	Below	Low	NE	No RR required	Low
37056001	*Anguilla australis*	Southern shortfin eel	0.005	0.18	Below	0.27	Below	0.36	Below	Low	NE	No RR required	Low
37063003	*Muraenesox bagio*	Common pike eel	0.000		Below		Below		Below	Low	NE	No RR required	Low
37067007	*Conger verreauxi*	Southern conger	0.003	0.23	Below	0.34	Below	0.45	Below	Low	NE	No RR required	Low
37067013	*Bassanago hirsutus*	Deepsea conger	0.028	0.23	Below	0.34	Below	0.45	Below	Low	NE	No RR required	Low
37085002	*Sardinops sagax*	Australian sardine	0.005	0.49	Below	0.74	Below	0.98	Below	Low	NE	No RR required	Low
37085005	*Hyperlophus vittatus*	Sandy sprat	0.004	0.66	Below	0.95	Below	1.26	Below	Low	NE	No RR required	Low
37085014	*Sardinella albella*	White sardinella	0.004	0.90	Below	1.35	Below	1.80	Below	Low	NE	No RR required	Low
37085018	*Sardinella lemuru*	Scaly mackerel	0.000	0.68	Below	1.03	Below	1.37	Below	Low	NE	No RR required	Low
37085019	*Nematalosa erebi*	Australian river gizzard shad	0.067	0.67	Below	1.01	Below	1.34	Below	Low	NE	No RR required	Low
37085023	*Herklotsichthys castelnaui*	Southern herring	0.017	0.63	Below	0.95	Below	1.23	Below	Low	NE	No RR required	Low
37085790	*Clupea harengus*	Herring	0.2	0.32	Below	0.49	Below	0.65	Below	Low	NE	No RR required	Low
37086001	*Engraulis australis*	Australian anchovy	0.004	0.83	Below	1.25	Below	1.66	Below	Low	NE	No RR required	Low
37086002	*Encrasicholina punctifer*	Buccaneer anchovy	0.004	2.11	Below	3.17	Below	4.22	Below	Low	NE	No RR required	Low
37097001	*Argentina australiae*	Silverside	0.006	0.42	Below	0.64	Below	0.85	Below	Low	NE	No RR required	Low
37098002	*Bathylagus antarcticus*	Antarctic deepsea smelt	0.002	0.36	Below	0.54	Below	0.72	Below	Low	NE	No RR required	Low
37111001	*Chauliodus sloani*	Sloane's viperfish	0.003	0.48	Below	0.72	Below	0.96	Below	Low	NE	No RR required	Low
37114013	*Alepocephalus cf antipodianus*	Antipodean slickhead	0.009	0.34	Below	0.51	Below	0.69	Below	Low	NE	No RR required	Low
37114503	*Talismania longifilis*	Talismania longifilis	0.3	0.34	Below	0.51	Below	0.69	Below	Low	NE	No RR required	Low
37117001	*Latropiscis purpurissatus*	Sergeant baker	0.012	0.31	Below	0.46	Below	0.62	Below	Low	NE	No RR required	Low
37118001	*Saurida undosquamis*	Largescale saury	0.038	0.54	Below	0.80	Below	1.07	Below	Low	NE	No RR required	Low
37118002	*Trachinocephalus myops*	Painted grinner	0.044	0.64	Below	0.95	Below	1.27	Below	Low	NE	No RR required	Low

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37121001	*Neoscopelus macrolepidotus*	Largescale neoscopelid	0.037	0.58	Below	0.87	Below	1.16	Below	Low	NE	No RR required	Low
37122001	*Diaphus danae*	Dana lanternfish	0.003	0.79	Below	1.19	Below	1.58	Below	Low	NE	No RR required	Low
37122018	*Gymnoscopelus piabilis*	Southern blacktip lanternfish	0.001	0.69	Below	1.03	Below	1.37	Below	Low	NE	No RR required	Low
37142001	*Chanos chanos*	Milkfish	0.006	0.46	Below	0.68	Below	0.98	Below	Low	NE	No RR required	Low
37192001	*Cnidoglanis macrocephalus*	Estuary cobbler	0.000	0.36	Below	0.54	Below	0.72	Below	Low	NE	No RR required	Low
37224010	*Lepidion microcephalus*	Smallhead cod	0.02	0.40	Below	0.59	Below	0.79	Below	Low	NE	No RR required	Low
37232029	*Cetonurus globiceps*	Globehead whiptail	0.002	0.38	Below	0.57	Below	0.77	Below	Low	NE	No RR required	Low
37232030	*Bathygadus cottoides*	Codhead rat tail	0.005	0.38	Below	0.57	Below	0.77	Below	Low	NE	No RR required	Low
37232063	*Macrouroides inflaticeps*	Inflated whiptail	0.000	0.38	Below	0.57	Below	0.77	Below	Low	NE	No RR required	Low
37232080	*Coelorinchus trachycarus*	Rough-head whiptail	0.011	0.38	Below	0.57	Below	0.77	Below	Low	NE	No RR required	Low
37255003	*Paratrachichthys macleayi*	Sandpaper fish	0.015	0.16	Below	0.24	Below	0.32	Below	Low	NE	No RR required	Low
37255007	*Optivus agastos*	Violet roughy	0.003	0.2	Below	0.3	Below	0.4	Below	Low	NE	No RR required	Low
37257001	*Anoplogaster cornuta*	Fangtooth	0.003	0.92	Below	1.37	Below	1.83	Below	Low	NE	No RR required	Low
37258005	*Centroberyx lineatus*	Swallowtail	0.007	0.29	Below	0.44	Below	0.58	Below	Low	NE	No RR required	Low
37259001	*Cleidopus gloriamaris*	Australian pineapplefish	0.02	0.41	Below	0.62	Below	0.83	Below	Low	NE	No RR required	Low
37266006	*Neocyttus psilorhynchus*	Rough oreodory^	0.007	0.18	Below	0.26	Below	0.35	Below	Low	NE	No RR required	Low
37279001	*Centriscops humerosus*	Banded bellowsfish	0.068	0.95	Below	1.42	Below	1.89	Below	Low	NE	No RR required	Low
37279002	*Macroramphosus scolopax*	Common bellowsfish	0.018	0.96	Below	1.45	Below	1.93	Below	Low	NE	No RR required	Low
37279003	*Notopogon lilliei*	Crested bellowsfish	0.043	0.95	Below	1.42	Below	1.89	Below	Low	NE	No RR required	Low
37279005	*Notopogon xenosoma*	Orange Bellowsfish	0.069	0.95	Below	1.42	Below	1.89	Below	Low	NE	No RR required	Low
37287003	*Neosebastes pandus*	Bighead gurnard perch	0.000		Below		Below		Below	Low	NE	No RR required	Low
37287008	*Scorpaena papillosa*	Southern red scorpionfish	0.000	0.40	Below	0.6	Below	0.81	Below	Low	NE	No RR required	Low
37287086	*Scorpaenopsis venosa*	Raggy scorpionfish	0.000	0.41	Below	0.62	Below	0.83	Below	Low	NE	No RR required	Low
37287094	*Centropogon latifrons*	Western fortescue	0.000	0.4	Below	0.6	Below	0.8	Below	Low	NE	No RR required	Low

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37311002	*Caesioperca lepidoptera*	Butterfly perch	0.001	0.21	Below	0.32	Below	0.42	Below	Low	NE	No RR required	Low
37311003	*Caesioperca rasor*	Barber perch	0.000	0.21	Below	0.32	Below	0.42	Below	Low	NE	No RR required	Low
37311014	*Epinephelus fasciatus*	Blacktip rockcod	0.000	0.22	Below	0.33	Below	0.42	Below	Low	NE	No RR required	Low
37311017	*Epinephelus sexfasciatus*	Sixbar grouper	0.000	0.33	Below	0.49	Below	0.66	Below	Low	NE	No RR required	Low
37311053	*Apogonops anomalus*	Threespine cardinalfish	0.056	0.44	Below	0.65	Below	0.87	Below	Low	NE	No RR required	Low
37311095	*Caprodon longimanus*	Longfin perch	0.088	0.27	Below	0.4	Below	0.54	Below	Low	NE	No RR required	Low
37322001	Banjos banjos	Banjofish	0.000		Below		Below		Below	Low	NE	No RR required	Low
37326001	*Priacanthus macracanthus*	Spotted bigeye	0.077	0.86	Below	1.3	Below	1.73	Below	Low	NE	No RR required	Low
37326008	*Heteropriacanthus cruentatus*	Blotched bigeye	0.000	0.86	Below	1.3	Below	1.73	Below	Low	NE	No RR required	Low
37330001	*Sillaginodes punctatus*	King George whiting	0.001	0.42	Below	0.63	Below	0.84	Below	Low	NE	No RR required	Low
37334002	*Pomatomus saltatrix*	Tailor	0.007	0.38	Below	0.57	Below	0.76	Below	Low	NE	No RR required	Low
37337014	*Seriolina nigrofasciata*	Blackbanded amberjack	0.000	0.56	Below	0.82	Below	1.82	Below	Low	NE	No RR required	Low
37337016	*Caranx bucculentus*	Bluespotted trevally	0.000	0.48	Below	0.72	Below	0.96	Below	Low	NE	No RR required	Low
37337039	*Caranx sexfasciatus*	Bigeye trevally	0.007	0.41	Below	0.62	Below	0.83	Below	Low	NE	No RR required	Low
37337052	*Seriola rivoliana*	Highfin amberjack	0.003	0.45	Below	0.67	Below	0.90	Below	Low	NE	No RR required	Low
37337053	*Caranx lugubris*	Black trevally	0.021	0.38	Below	0.57	Below	0.75	Below	Low	NE	No RR required	Low
37338001	*Coryphaena hippurus*	Dolphin fish; Mahi mahi	0.001	1.41	Below	2.12	Below	2.83	Below	Low	NE	No RR required	Low
37342001	*Brama brama*	Ray's bream	0.004	0.28	Below	0.42	Below	0.57	Below	Low	NE	No RR required	Low
37342003	*Taractichthys longipinnis*	Bigscale pomfret	0.004	0.28	Below	0.42	Below	0.56	Below	Low	NE	No RR required	Low
37344001	*Arripis georgianus*	Australian herring	0.007	0.64	Below	0.97	Below	1.29	Below	Low	NE	No RR required	Low
37344002	*Arripis trutta*	Eastern Australian salmon	0.012	0.46	Below	0.69	Below	0.93	Below	Low	NE	No RR required	Low
37346006	*Lutjanus quinquelineatus*	Fiveline snapper	0.045	0.37	Below	0.55	Below	0.74	Below	Low	NE	No RR required	Low
37346014	*Etelis carbunculus*	Ruby snapper	0.000	0.29	Below	0.44	Below	0.59	Below	Low	NE	No RR required	Low

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37349001	*Parequula melbournensis*	Silverbelly	0.000	1.21	Below	1.81	Below	2.41	Below	Low	NE	No RR required	Low
37351006	*Lethrinus laticaudis*	Grass emperor	0.000	0.34	Below	0.51	Below	0.68	Below	Low	NE	No RR required	Low
37353002	*Dentex spariformis*	Yellowback bream	0.02	0.39	Below	0.58	Below	0.78	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
37353013	*Rhabdosargus sarba*	Tarwhine	0.015	0.55	Below	0.82	Below	1.09	Below	Low	NE	No RR required	Low
37354001	*Argyrosomus japonicus*	Mulloway	0.002	0.21	Below	0.32	Below	0.42	Below	Low	NE	No RR required	Low
37354020	*Atractoscion aequidens*	Teraglin	0.026	0.29	Below	0.43	Below	0.58	Below	Low	NE	No RR required	Low
37355001	*Upeneichthys lineatus*	Bluestriped goatfish	0.006	0.88	Below	1.32	Below	1.76	Below	Low	NE	No RR required	Low
37355029	*Upeneichthys vlamingii*	Bluespotted goatfish	0.001	0.88	Below	1.32	Below	1.76	Below	Low	NE	No RR required	Low
37357001	*Pempheris multiradiata*	Bigscale bullseye	0.000	0.51	Below	0.76	Below	1.01	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
37361007	*Girella tricuspidata*	Luderick	0.000	0.32	Below	0.48	Below	0.64	Below	Low	NE	No RR required	Low
37361009	*Scorpis lineolata*	Silver sweep	0.000	0.35	Below	0.52	Below	0.7	Below	Low	NE	No RR required	Low
37367001	*Paristiopterus gallipavo*	Yellowspotted boarfish	0.000	0.28	Below	0.42	Below	0.56	Below	Low	NE	No RR required	Low
37367002	*Paristiopterus labiosus*	Giant boarfish	0.011	0.3	Below	0.45	Below	0.6	Below	Low	NE	No RR required	Low
37367004	*Pentaceros decacanthus*	Bigspine boarfish	0.043	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low
37367005	*Zanclistius elevatus*	Blackspot boarfish	0.068	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low
37367010	*Parazanclistius hutchinsi*	Short boarfish	0.055	0.32	Below	0.48	Below	0.64	Below	Low	NE	No RR required	Low
37377001	*Cheilodactylus nigripes*	Magpie perch	0.000	0.27	Below	0.40	Below	0.53	Below	Low	NE	No RR required	Low
37377005	*Dactylophora nigricans*	Dusky morwong	0.000	0.2	Below	0.3	Below	0.4	Below	Low	NE	No RR required	Low
37377006	*Cheilodactylus spectabilis*	Banded morwong	0.000	0.2	Below	0.31	Below	0.41	Below	Low	NE	No RR required	Low
37378002	*Latridopsis forsteri*	Bastard trumpeter	0.001	0.21	Below	0.31	Below	0.41	Below	Low	NE	No RR required	Low
37384001	*Bodianus vulpinus*	Western pigfish	0.000	0.64	Below	1.6	Below	1.28	Below	Low	NE	No RR required	Low
37384014	*Xiphocheilus typus*	Bluetooth tuskfish	0.000	0.53	Below	0.79	Below	1.05	Below	Low	NE	No RR required	Low
37384023	*Pseudolabrus rubicundus*	Rosy wrasse	0.000	0.4	Below	0.6	Below	0.79	Below	Low	NE	No RR required	Low
37384035	*Bodianus flavipinnis*	Yellowfin pigfish	0.03	0.33	Below	0.49	Below	0.65	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37384043	*Achoerodus viridis*	Eastern blue groper	0.002	0.75	Below	1.12	Below	1.49	Below	Low	NE	No RR required	Low
37384061	*Bodianus unimaculatus*	Eastern pigfish	0.002	0.33	Below	0.49	Below	0.65	Below	Low	NE	No RR required	Low
37385009	*Haletta semifasciata*	Blue weed whiting	0.000	0.36	Below	0.53	Below	0.71	Below	Low	NE	No RR required	Low
37390001	*Parapercis allporti*	Barred grubfish	0.005	0.46	Below	0.69	Below	0.91	Below	Low	NE	No RR required	Low
37390007	*Parapercis striolata*	Banded Grubfish	0.000		Below		Below		Below	Low	NE	No RR required	Low
37427001	*Foetorepus calauropomus*	Common stinkfish	0.001	0.68	Below	1.02	Below	1.37	Below	Low	NE	No RR required	Low
37439003	*Ruvettus pretiosus*	Oilfish	0.003	0.31	Below	0.51	Below	0.68	Below	Low	NE	No RR required	Low
37439008	*Lepidocybium flavobrunneum*	Escolar	0.004	0.34	Below	0.51	Below	0.68	Below	Low	NE	No RR required	Low
37440004	*Trichiurus lepturus*	Largehead hairtail	0.014	0.53	Below	0.79	Below	1.06	Below	Low	NE	No RR required	Low
37441003	*Katsuwonus pelamis*	Skipjack tuna	0.003	0.58	Below	0.87	Below	1.16	Below	Low	NE	No RR required	Low
37441004	*Thunnus maccoyii*	Southern bluefin tuna	0.003	0.17	Below	0.25	Below	0.33	Below	Low	NE	No RR required	Low
37441005	*Thunnus alalunga*	Albacore	0.004	0.19	Below	0.29	Below	0.39	Below	Low	NE	No RR required	Low
37441007	*Scomberomorus commerson*	Spanish mackerel	0.007	0.48	Below	0.72	Below	0.96	Below	Low	NE	No RR required	Low
37441020	*Sarda australis*	Australian bonito	0.008	0.43	Below	0.65	Below	0.87	Below	Low	NE	No RR required	Low
37442001	*Xiphias gladius*	Broadbill swordfish; swordfish	0.003	0.19	Below	0.29	Below	0.39	Below	Low	NE	No RR required	Low
37444002	*Kajikia audax*	Striped marlin	0.001	0.30	Below	0.46	Below	0.61	Below	Low	NE	No RR required	Low
37445002	*Tubbia tasmanica*	Tasmanian rudderfish	0.005	0.31	Below	0.46	Below	0.62	Below	Low	NE	No RR required	Low
37446013	*Cubiceps whiteleggii*	Coastal cubehead	0.003	0.88	Below	1.32	Below	1.76	Below	Low	NE	No RR required	Low
37449001	*Tetragonurus cuvieri*	Smalleye squaretail	0.004	0.2	Below	0.29	Below	0.39	Below	Low	NE	No RR required	Low
37460001	*Lophonectes gallus*	Crested flounder	0.005	0.57	Below	0.86	Below	1.15	Below	Low	NE	No RR required	Low
37460002	*Pseudorhombus jenynsii*	Smalltooth flounder	0.057	0.49	Below	0.74	Below	0.98	Below	Low	NE	No RR required	Low
37460031	*Pseudorhombus tenuirastrum*	Slender flounder	0.004	0.48	Below	0.73	Below	0.97	Below	Low	NE	No RR required	Low
37460009	*Pseudorhombus arsius*	Largetooth flounder	0.06	0.42	Below	0.64	Below	0.85	Below	Low	NE	No RR required	Low
37462010	*Zebrias scalaris*	Manyband sole	0.002	0.35	Below	0.52	Below	0.69	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPT -IBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37467002	*Omegophora armilla*	Ringed toadfish	0.003	0.42	Below	0.63	Below	0.84	Below	Low	NE	No RR required	Low
37467003	*Tetractenos glaber*	Smooth toadfish	0.000	0.42	Below	0.63	Below	0.84	Below	Low	NE	No RR required	Low
37467005	*Arothron firmamentum*	Starry toadfish	0.024	0.42	Below	0.63	Below	0.84	Below	Low	NE	No RR required	Low
37467023	*Lagocephalus lagocephalus*	Oceanic puffer; Ocean puffer	0.014	0.4	Below	0.6	Below	0.81	Below	Low	NE	No RR required	Low
37467065	*Lagocephalus cheesemanii*	Cheeseman's puffer	0.000	0.4	Below	0.6	Below	0.81	Below	Low	NE	No RR required	Low
37469001	*Diodon nicthemerus*	Globefish	0.004	0.45	Below	0.68	Below	0.9	Below	Low	NE	No RR required	Low
37469002	*Allomycterus pilatus*	Australian burrfish	0.021	0.45	Below	0.68	Below	0.9	Below	Low	NE	No RR required	Low
37469013	*Dicotylichthys punctulatus*	Three-barred porcupinefish	0.003	0.55	Below	0.82	Below	1.1	Below	Low	NE	No RR required	Low
37470001	*Mola ramsayi*	Short sunfish	0.004	0.12	Below	0.19	Below	0.25	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

Of the 103 protected species, 48 species were assessed in this SAFE (Table 2.34) while the other 55 were assessed in a PSA (Section 2.4.5 d). The species assessed here comprised six chondrichthyans and 42 teleosts (syngnathiformes). All species were below the MSM or LIM reference points (Figure 2.16) and their overall risk scores were low (Table 2.34). No residual risk analysis was required.

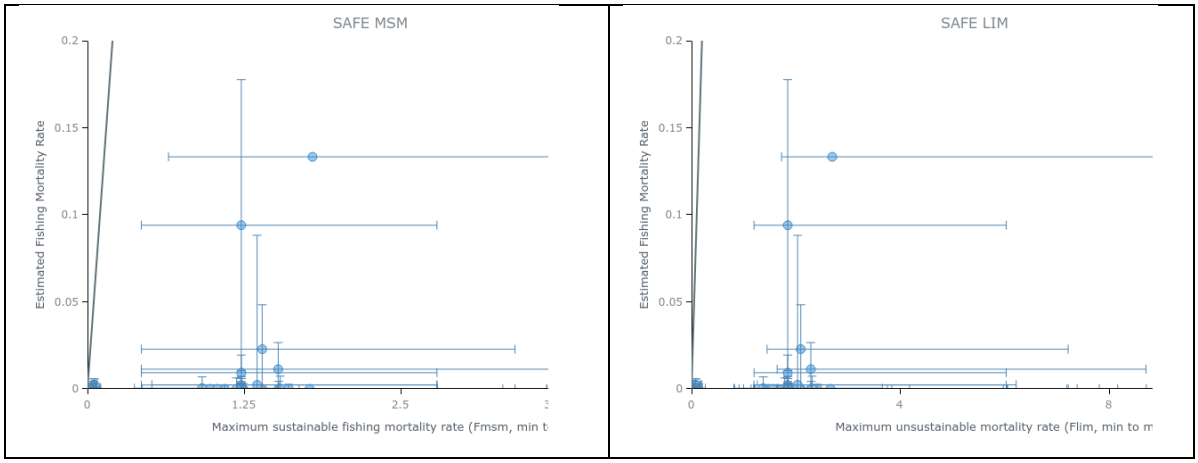

Figure 2.16. SAFE plot for protected species in the SESSF Otter trawl sub-fishery for (a) SAFE-MSM reference point and (b) SAFE limit [left] (LIM) reference point [right].

Table 2.34. bSAFE risk categories for protected species ecological component for F_MSM, F_Lim and F_Crash and overall risk. NA: not assessable.

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK
37010003	*Carcharodon carcharias*	White shark	0.001	0.04	Below	0.06	Below	0.08	Below	Low
6303	*Hippocampus kelloggi*	Kellogg's seahorse	0.133	1.58	Below	2.37	Below	3.16	Below	Low
37010001	*Isurus oxyrinchus*	Shortfin mako	0.0023	0.05	Below	0.08	Below	0.11	Below	Low
37010002	*Isurus paucus*	Longfin mako	0.002	0.05	Below	0.07	Below	0.10	Below	Low
37010004	*Lamna nasus*	Porbeagle	0.002	0.05	Below	0.08	Below	0.11	Below	Low
37011001	*Cetorhinus maximus*	Basking shark	0.001	0.03	Below	0.04	Below	0.06	Below	Low
37041004	*Mobula birostris (was Manta birostris)*	(Giant) manta ray	0.0003	0.08	Below	0.12	Below	0.15	Below	Low
37282001	*Phycodurus eques*	Leafy seadragon	0.0004	1.12	Below	1.68	Below	2.24	Below	Low
37282002	*Phyllopteryx taeniolatus*	Common seadragon	0.0029	0.92	Below	1.37	Below	1.83	Below	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK
37282006	*Trachyrhamphus bicoarctatus*	Bentstick pipefish	0.094	1.16	Below	1.74	Below	2.32	Below	Low
37282008	*Urocampus carinirostris*	Hairy pipefish	0.000	0.98	Below	1.47	Below	1.96	Below	Low
37282009	*Lissocampus runa*	Javelin pipefish	0.0004	1.17	Below	1.76	Below	2.35	Below	Low
37282010	*Hippocampus bleekeri*	Potbelly seahorse	0.0001	1.61	Below	2.41	Below	3.22	Below	Low
37282011	*Histiogamphelus briggsii*	Crested pipefish	0.0005	1.16	Below	1.74	Below	2.32	Below	Low
37282012	*Hypselognathus rostratus*	Knifesnout pipefish	0.0009	1.16	Below	1.74	Below	2.32	Below	Low
37282013	*Leptoichthys fistularius*	Brushtail pipefish	0.0009	1.16	Below	1.74	Below	2.32	Below	Low
37282014	*Kaupus costatus*	Deepbody pipefish	0.000	1.16	Below	1.74	Below	2.32	Below	Low
37282015	*Mitotichthys semistriatus*	Halfbanded pipefish	0.000	1.16	Below	1.74	Below	2.32	Below	Low
37282016	*Lissocampus caudalis*	Smooth pipefish	0.0004	1.17	Below	1.76	Below	2.35	Below	Low
37282017	*Stigmatopora argus*	Spotted pipefish	0.0005	1.16	Below	1.74	Below	2.32	Below	Low
37282018	*Stigmatopora nigra*	Widebody pipefish	0.0005	1.16	Below	1.74	Below	2.32	Below	Low
37282019	*Stipecampus cristatus*	Ringback pipefish	0.0004	1.16	Below	1.74	Below	2.32	Below	Low
37282021	*Pugnaso curtirostris*	Pugnose pipefish	0.0004	1.16	Below	1.74	Below	2.32	Below	Low
37282022	*Mitotichthys mollisoni*	Mollison's pipefish	0.0016	1.16	Below	1.74	Below	2.32	Below	Low
37282023	*Vanacampus phillipi*	Port Phillip pipefish	0.0003	1.16	Below	1.74	Below	2.32	Below	Low
37282024	*Vanacampus poecilolaemus*	Longsnout pipefish	0.000	1.16	Below	1.74	Below	2.32	Below	Low
37282025	*Mitotichthys tuckeri*	Tucker's pipefish	0.000	1.16	Below	1.74	Below	2.32	Below	Low
37282026	*Hippocampus breviceps*	Shorthead seahorse	0.0006	1.38	Below	2.07	Below	2.76	Below	Low
37282027	*Hippocampus whitei*	White's seahorse	0.000	1.4	Below	2.1	Below	2.8	Below	Low
37282029	*Solegnathus spinosissimus*	Spiny pipehorse	0.009	1.16	Below	1.74	Below	2.32	Below	Low
37282034	*Idiotropiscis australe*	Southern pygmy pipehorse	0.000	1.16	Below	1.74	Below	2.32	Below	Low
37282055	*Cosmocampus howensis*	Lord Howe pipefish	0.000	1.16	Below	1.74	Below	2.32	Below	Low
37282061	*Festucalex cinctus*	Girdled pipefish	0.000	1.16	Below	1.74	Below	2.32	Below	Low
37282064	*Filicampus tigris*	Tiger pipefish	0.0022	1.16	Below	1.74	Below	2.32	Below	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEP-TIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK
37282071	*Heraldia nocturna*	Upside-down pipefish	0.0003	1.16	Below	1.74	Below	2.32	Below	Low
37282075	*Hippichthys penicillus*	Beady pipefish	0.000	1.16	Below	1.74	Below	2.32	Below	Low
37282083	*Kimblaeus bassensis*	Trawl pipefish	0.002	1.16	Below	1.74	Below	2.32	Below	Low
37282085	*Maroubra perserrata*	Sawtooth pipefish	0.0003	1.1	Below	1.64	Below	2.19	Below	Low
37282095	*Notiocampus ruber*	Red pipefish	0.0003	1.16	Below	1.74	Below	2.32	Below	Low
37282098	*Solegnathus dunckeri*	Duncker's pipehorse	0.000	1.16	Below	1.74	Below	2.32	Below	Low
37282100	*Syngnathoides biaculeatus*	Double-end pipehorse	0.000	1.04	Below	1.56	Below	2.07	Below	Low
37282102	*Vanacampus margaritifer*	Mother-of-pearl pipefish	0.0005	1.16	Below	1.74	Below	2.32	Below	Low
37282105	*Hippocampus minotaur*	Bullneck seahorse	0.011	1.38	Below	2.07	Below	2.76	Below	Low
37282107	*Halicampus boothae*	Booth's pipefish	0.000	1.16	Below	1.74	Below	2.32	Below	Low
37282117	*Hippocampus tristis*	Sad seahorse	0.000	1.78	Below	2.66	Below	3.55	Below	Low
37282120	*Hippocampus abdominalis*	Bigbelly seahorse	0.023	1.4	Below	2.09	Below	2.79	Below	Low
37282127	*Idiotropiscis lumnitzeri*	Sydney's pygmy pipehorse	0.002	1.25	Below	1.87	Below	2.5	Below	Low
37282130	*Heraldia sp. 1 [in Kuiter, 2000]*	Western upsidedown pipefish	0.0006	1.54	Below	2.31	Below	3.08	Below	Low

Risk ranking guidelines:

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

2.6 Habitat Component

A Level 2 analysis for the Habitat component was not conducted in this assessment.

2.7 Community Component

A Level 2 analysis for the Community component was not conducted 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 2.30). 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 2.17) 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.

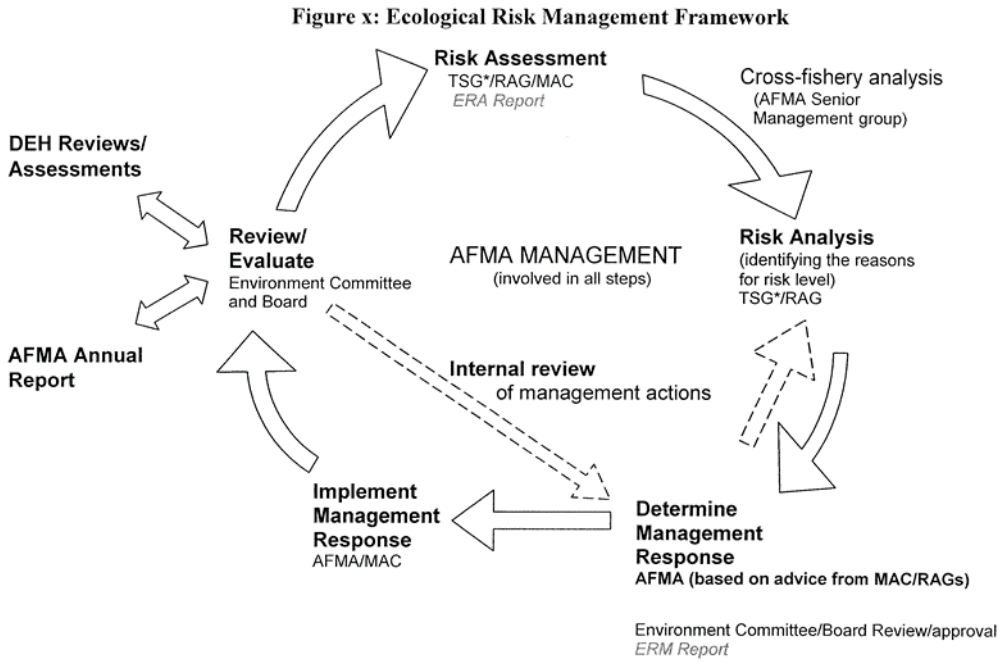

Figure 2.17. Schematic of of the Ecological risk management cycle. TSG – Technical Support Group.

2.9 Extreme and High risk categorisation (Step 8): update with Residual Risk information

PSA

Key/secondary commercial species

A residual risk analysis was performed on the species Gould's squid (*Nototodarus gouldi*). This species risk score remained high, based on the lack of formal tiered assessment in either this fishery or the Southern Squid Jig fishery and the lack of information of population status.

Byproduct species

Residual risk analyses were performed for eight high risk species (two chondrichthyans, two teleosts, and four invertebrate species) (see Section 2.4.5, Table 2.24). The two chondrichthyans -sandy skate *Pavoraja arenaria* and Ogilby's ghostshark *Chimaera ogilbyi* and three invertebrates - cuttlefish *Sepia braggi*, southern bailer shell *Melo miltoni*, and Maori octopus *Pinnoctopus cordiformis* all remained high risk due high numbers of missing attributes and in the case of Maori octopus potentially higher than reported catch rates (Table 2.27).

Bycatch species

Residual risk analyses were performed for 19 high risk species (see Section 2.4.5, Table 2.25) following which, no species remained at high risk.

Protected species

A residual risk analysis for one high risk species Salvin's prion reduced the risk score to low (see Section 2.4.5; Table 2.26) given that that it has rarely been sighted within this sub-fishery. Also, a

residual risk analysis for the Indian Ocean bottlenose dolphin recuded the risk score to medium given this species was expanded from Delphinidae, mostly found in shallow waters generally near the coast and unlikely to occur within fishery operations.

bSAFE

Byproduct species

A residual risk analysis was conducted for the two high risk species: longsnout dogfish *Deania quadrispinosa* and bight skate *Dipturus gudgeri*. These two species remained at high risk following a residual risk analysis.

Bycatch species

All three extreme risk species remained at extreme risk following a residual risk analysis.

3 General discussion and research implications

3.1 Level 1

Of the 32 possible activity (hazard) scenarios, 21 were identified as leading to some form of impact in each of the five ecological components assessed for the SESSF CTS otter trawl sub-fishery: 15 internal activities and six external.

All ecological components were assessed at risk from one or one activities (risk score of 3 or above). The three activities that were posing moderate or greater risk were all directly related to the fishing activity:

- Fishing - Direct impact from capture (on all 5 ecological components),
- Fishing - Direct impact without capture (on key commercial, habitats and communities)
- Fishing - Disturbance of physical processes by fishing (on habitats)

Only the habitat component was assessed at major or above risk (scores 4 or 5) from all three fishing activities (actual risk score 5). All other components were assessed at moderate risk (risk score 3). However, only the key commercial, byproduct and protected species were to be analysed at Level2.

All six external hazards were assessed but only other fisheries in the region posed moderate or major risk to all ecological components (risk score 3 or 4).

3.2 Level 2

3.2.1 Species at risk

A Level 2 analysis was conducted for key/secondary commercial species, byproduct/bycatch species, and protected species but not for habitats and communities. Of the 122 species assessed as potential high or extreme risk, 38 remained as extreme or high following a residual risk analysis (Table ES1.3).

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) 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 PSA 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, there will be a tendency to overestimate absolute levels of risk from fishing.

In moving from ERA to ERM, AFMA will focus scarce 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.

CSIRO and AFMA will continue to work together to include the broad set of management arrangements in Level 2 analyses, and these methods will be incorporated in future developments of the ERAEF framework. CSIRO has also undertaken some preliminary Level 3 analyses for bycatch species for several fisheries, and these or similar methods will also form part of the overall ERAEF framework into the future.

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Appendix A. Commercial species stock status

Commercial species stock status, assessment and tier status, and ERA classification for this sub-fishery (Otter trawl). NSTOF: Not subject to overfishing; NOF: Not overfished; OF: Overfished; UNC: uncertain. Note: Stock status is not assessed for non-quota species. NT: no Tier assessment within 2012-2016 (where known). Primary: C1; Secondary: C2; Byproduct: BP; Bycatch: BC. ^: based on ABARES classification. ^^ based on stock assessment.

COMMON NAME	SPECIES NAME	ERA CLASSIF-ICATION	FISHING MORTALITY^	BIOMASS^	STOCK STATUS^^	YEAR LAST ASSESSED	REFERENCE	TIER LEVEL ASSESS-MENT	COMMENT
Blue grenadier	*Macruronus novaezelandiae*	C1	NSTOF	NOF	Above limit reference	2013	Tuck 2013	1	
Tiger flathead	*Platycephalus richardsoni*	C1	NSTOF	NOF	Above limit reference	2016	Day 2016	1	
Pink ling	*Genypterus blacodes*	C1	NSTOF	NOF	Above limit reference	2015	Cordue 2015	1	
Silver warehou	*Seriolella punctata*	C1	NSTOF	NOF	Above limit reference	2015	Thompson et al. 2015	1	
Orange roughy (Albany and Esperance)	*Hoplostethus atlanticus*	C1	NSTOF	UNC	No commercial catch, no formal assessment	-	-	1	
Orange roughy (Cascade Plateau)			NSTOF	NOF	Above limit reference	2009	DeepRAG (2009)	1	
Orange roughy (Eastern)			NSTOF	NOF	Above limit reference	2016	Haddon 2017	1	
Orange roughy (Southern)			NSTOF	NOF	Negligible catches, no updated stock assessment	2000		1	
Orange roughy (Western)			NSTOF	OF	Negligible catches, no updated stock assessment	2002		1	
Jackass morwong	*Nemadactylus macropterus*	C1	NSTOF	NOF	Above limit reference	2015	Tuck et al. 2015	1	
Mirror dory	*Zenopsis nebulosus*	C1	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic 2017a	4	
Ocean jacket	*Nelusetta ayraudi*	C1	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic and (2017c)^	NT	
Gould's squid	*Nototodarus gouldi*	C1	NSTOF	NOF	Above limit reference	2015	Barnes et al. (2015).	NT	Based on assessment of southern squid jig fishery
Frostfish	*Lepidopus caudatus*	C1	-	-	-	-	-	NT	
Flatheads*	*Platycephalidae* - undifferentiated	C1	NSTOF	NOF	Above limit reference**	-	-		
Leatherjackets	*Balistidae, Monacanthidae* - undifferentiated	BP	-	-	-	-	-	NT	
Eastern school whiting	*Sillago flindersi*	C2	NSTOF	NOF	Above limit reference	2017	Day 2017	1	

COMMON NAME	SPECIES NAME	ERA CLASSIF-ICATION	FISHING MORTALITY^	BIOMASS^	STOCK STATUS^^	YEAR LAST ASSESSED	REFERENCE	TIER LEVEL ASSESS-MENT	COMMENT
Redfish	*Centroberyx affinis*	C2	UNC	OF	Below limit reference	2017	Tuck et al. 2017	1	
Gemfish (eastern)	*Rexea solandri*	C2	UNC	OF	Below limit reference	2011	Little and Rowling 2011	1	
Gemfish (western)		C2	NSTOF	NOF	Above limit reference	2016	Helidonioti s and Moore 2016	¼	
Royal red prawn	*Haliporoides sibogae*	C2	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic 2017a	4	
Reef ocean perch	*Helicolenus percoides*	C2	**NA**	**NA**	**NA**	2017	Haddon and Sporcic 2017a	4	
Silver trevally	*Pseudocaranx georgianus*	C2	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic 2017a	4	
Latchet	*Pterygotrigla polyommata*	C2	-	-	-	-	-	NT	
King dory	*Cyttus traversi*	C2	-	-	-	-	-	NT	
Red gurnard	*Chelidonichthys kumu*	C2	-	-	-	-	-	NT	
Gummy shark	*Mustelus antarcticus*	BP	NSTOF	NOF	Above limit reference	2016	Punt et al. 2016	1	
Deepwater flathead	*Platycephalus conatus*	BP	NSTOF	NOF	Above limit reference	2016	Haddon 2016	1	
School shark	*Galeorhinus galeus*	BP	UNC	OF	Uncertain if total mortality will allow recovery in required time frame.	2012 (re-ran the 2009 assessme nt with additiona l catch data 2009-12)	Thomson and Punt 2009; Thomson 2012	1	
Bight redfish	*Centroberyx gerrardi*	BC	NSTOF	NOF	Above limit reference	2015	Haddon 2015b	1	
Alfonsino	*Beryx splendens*	BP	NSTOF	NOF	Above limit reference	2013	Klaer 2013	3	
Ribaldo	*Mora moro*	BP	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic 2017a	4	
John dory	*Zeus faber*	BP	NSTOF	NOF	Above limit reference	2017	Castillo-Jordán 2017	3	
Blue-eye trevalla	*Hyperoglyphe antarctica*	BP	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic 2017b	4	
Blue warehou	*Seriolella brama*	BP	UNC	OF	No evidence to suggest rebuilding above the limit reference	2013	Haddon 2013	4	
Elephantfish	*Callorhinchus milii*	BP	NSTOF	NOF	Above limit reference	2018	Sporcic and Haddon 2018~	4	
Oreo (smooth Cascade)	*Pseudocyttus maculatus*	BP	NSTOF	NOF	Above limit reference	2015	Haddon 2015a	4	
Oreo (smooth other)			NSTOF	NOF	Above limit reference	2015	Haddon et al. 2015a	4	
Oreo basket	*Warty—Allocyttus verrucosus,*	BP	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic 2017a	4	

COMMON NAME	SPECIES NAME	ERA CLASSIF-ICATION	FISHING MORTALITY^	BIOMASS^	STOCK STATUS^^	YEAR LAST ASSESSED	REFERENCE	TIER LEVEL ASSESS-MENT	COMMENT
	spikey—Neocyttus rhomboidalis, rough—N. psilorhynchus, black—A. niger, other—Neocyttus spp.								
Sawshark	*Pristiophorus cirratus and Pristiophorus nudipinnis*	BP	NSTOF	NOF	Above limit reference	2018	Sporcic and Haddon 2018~	4	
Deepwater shark (east)	*Dogfish (*Squalidae*), brier shark (Deania calcea), platypus shark (D. quadrispinosa), Plunket's shark (Centroscymnus plunketi), roughskin shark (species of Centroscymnus and Deania), 'pearl shark' (D. calcea and D. quadrispinosa), black shark (Centroscymnus species), lantern shark (Etmopterus species)* and other sharks (Klaer et al. 2014).	BP and BC	NSTOF	UNC	Multispecies nature of stock makes CPUE potentially unreliable as the index of abundance .	2017	Haddon and Sporcic 2017a	4	
Deepwater shark (west)			NSTOF	UNC	Multispecies nature of stock makes CPUE potentially unreliable as the index of abundance	2017	Haddon and Sporcic 2017a	4	

^: Based on relative standardized CPUE; * Tiger flathead has a separate Tier 1 assessment. The group "flatheads (*Platycephalidae* – undifferentiated)" do not have an assessment. **: No formal assessment, but assumed to be mostly comprised of Tiger flathead, which has an assessment. ~data up to 2016.

Record of stock assessments during the ERA assessment period and their respective Tier levels (shaded). Tier 1 (blue); Tier 3 (orange); Tier 4(green).

COMMON NAME	2012	2013	2014	2015	2016
Alfonsino	3	3			
Bight Redfish				1	
Blue Eye Trevalla		4		4	4
Blue Grenadier		1			
Blue Warehou	4	4			
Deepwater Flathead	1	1			1
Deepwater shark east		4			
Deepwater shark west		4			
Elephant Fish	4	4	4	4	
Flathead	1				1
Gemfish - East					
Gemfish - west		1/4			1/4
Gummy Shark		1			1
Jackass Morwong	1	1		1	
John Dory	3	3	3		
Mirror Dory	3	4	4	4	4
Reef Ocean Perch	4	4			
Orange Roughy - south					
Orange Roughy - east			1		
Orange Roughy - west					
Orange Roughy - Cascade Plateau					
Orange Roughy - Albany and Esperance					
Oreo Smooth - Cascade					
Oreo Smooth - other					
Oreo Basket	4	4			
Pink Ling	1	1		1	
Redfish	3/4	3/4	1		
Ribaldo	4	4			
Royal Red Prawn	4	4			
Saw Shark	4	4	4	4	
School Shark					
School Whiting – Tier 1					
Silver Trevally	4	4			
Silver Warehou	1			1	
Tiger Flathead		1			1

Appendix B. Estimated Catch and % TAC caught

Estimated catch for bottom otter trawl (B.O.T) based on catch disposal records which do not do not specify gear type. Agreed TAC and TAC after over/undercatch are for the SESSF as a whole and are not gear specific.

COMMON NAME	2011/12				2012/13				2013/14				2014/15				2015/16				2016/17			
	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)
Blue grenadier	4700	5133	80	3558	4998	5368	70	728	5208	5704	68	2502	6800	7205	19	1286	8796	9411	19	1359	8810	9618	14	1229
Pink ling	1200	1275	96	672	996	1022	98	594	834	844	97	492	996	1016	95	566	980	1006	82	456	1144	1233	74	500
Silver warehou		2784	38	932	2541	2789	27	693	2329	2579	23	528	2329	2553	14	347	2417	2643	11	253	1209	1449	25	284
Gould's squid	NA	NA	NA	871	NA	NA	NA	644	NA	NA	NA	273	NA	NA	NA	303	NA	NA	NA	361	NA	NA	NA	244
Orange roughy (Albany and Esperance)	50	50	0	200	50	50	0	54	50	50	0	216	50	50	0	60	50	50	0	516	50	50	0	420
Orange roughy (Cascade Plateau)	500	545	1		500	543	1		500	550	0		500	550	0		500	550	0		500	550	0	
Orange roughy (Eastern)	25	25	100		25	25	12		25	25	54		25	25	26		465	465	94		465	494	70	
Orange roughy (Southern)	35	35	48		35	35	52		35	35	62		35	35	50		66	66	87		66	66	88	
Orange roughy (Western)	60	60	56		60	60	45		60	60	67		60	60	48		60	60	37		60	60	37	
Mirror dory	718	766	68	473	1077	1135	34	348	1616	1717	17	258	808	968	23	192	437	514	49	228	325	362	76	251
Frostfish	NA	NA	NA	187	NA	NA	NA	198	NA	NA	NA	194	NA	NA	NA	207	NA	NA	NA	240	NA	NA	NA	198
Jackass morwong	450	484	81	320	565	601	61	313	568	624	35	167	568	624	20	100	598	654	21	112	474	533	40	189

	2011/12				2012/13				2013/14				2014/15				2015/16				2016/17			
COMMON NAME	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)	AGREED TAC (T)	TAC AFTER OVER/ UNDER-CATCH (T)	%TAC CAUGHT (SESSF)	LOGBOOK CATCH B.O.T* (T)
Flatheads	2750	2930	96	1332	2741	2837	97	1273	2750	2835	81	933	2878	3143	90	1313	2860	3092	94	1268	2882	3031	95	1193
Leatherjackets	NA	NA	NA	166	NA	NA	NA	254	NA	NA	NA	159	NA	NA	NA	109	NA	NA	NA	105	NA	NA	NA	147

Appendix C. Commonwealth Trawl Closures

Closures legislated under the *Southern and Eastern Scalefish and Shark Fishery and Small Pelagic Fishery (Closures) Direction 2016.*

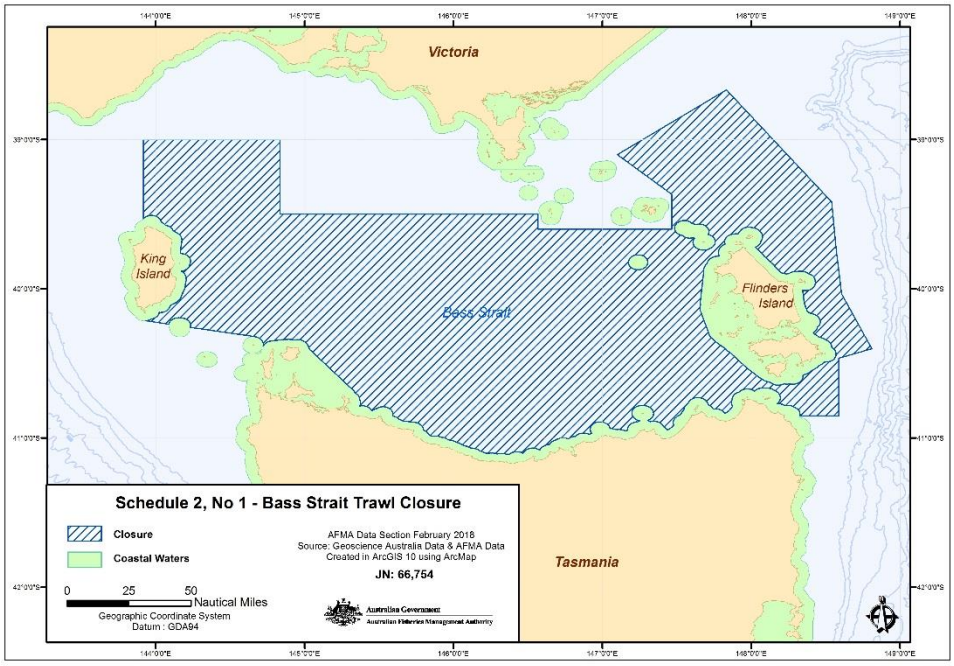
For exact coordinates of area closures refer to the relevant sections of the SESSF Closure Directions, as referenced by the map title.

Schedule 2 - Bass Strait – Trawl Closure

Location: Bass Strait

Reason: Protect school and gummy shark habitat

Prohibited: Demersal otter trawl methods

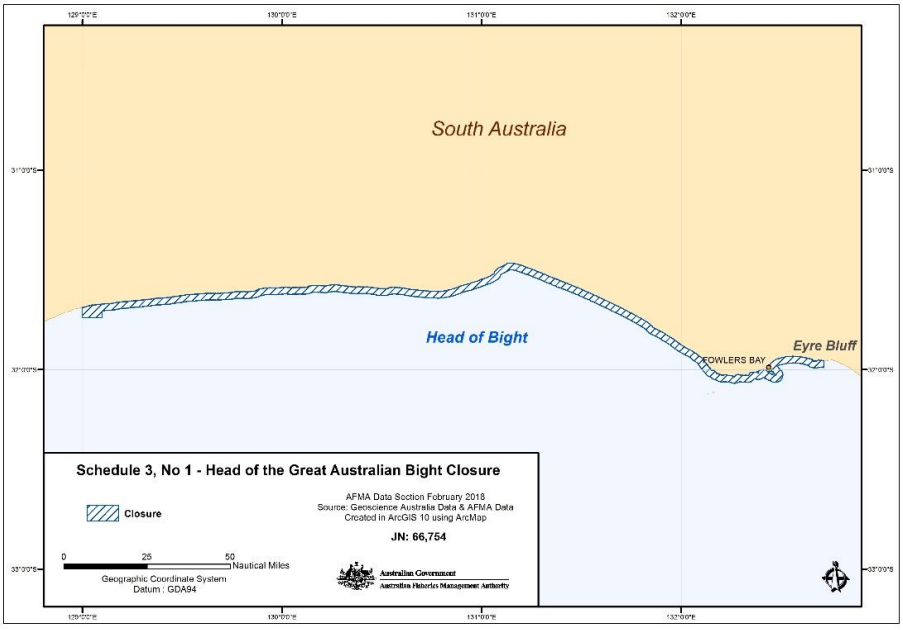


Schedule 3 - Head of the Great Australian Bight

Location: Great Australian Bight, South Australia

Reason: Protect breeding school shark and Australian sea lion populations

Prohibited: All fishing methods

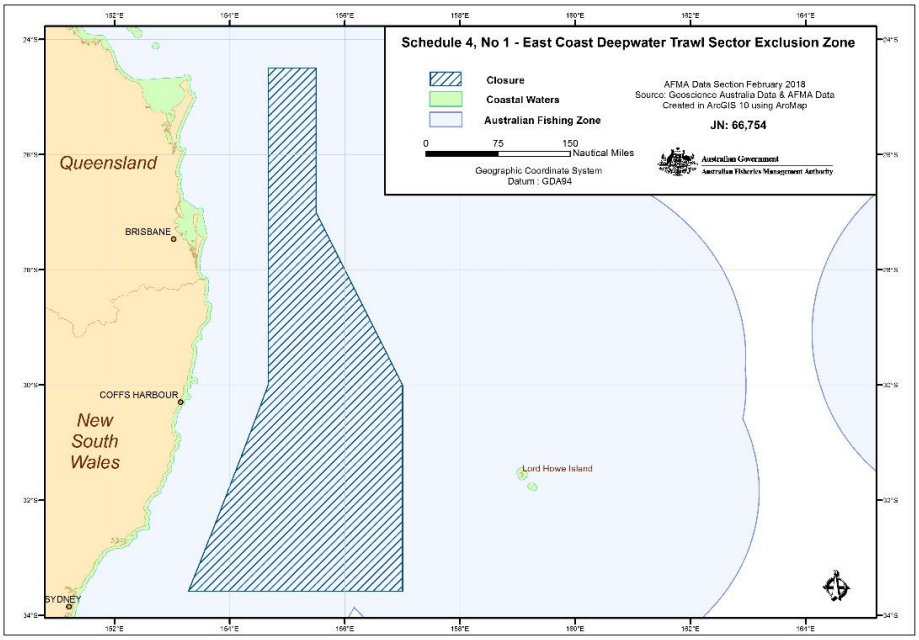


Schedule 4 - East Coast Deepwater Trawl Sector Exclusion Zone

Location: Offshore east coast of Australia

Reason: Protect benthic habitats

Prohibited: Trawl methods

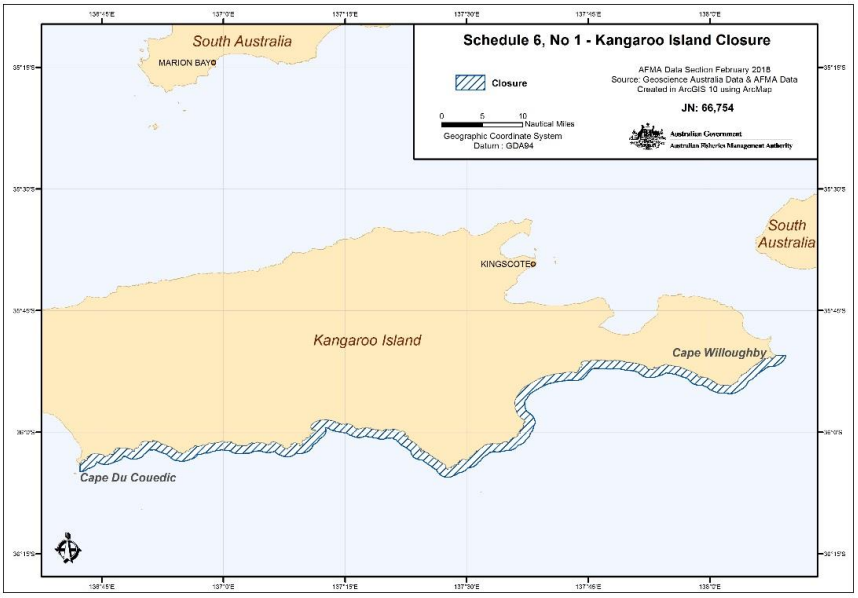


Schedule 6 - South Australian Shark Closure – Kangaroo Island

Location: Kangaroo Island, South Australia

Reason: Protect breeding school shark and Australian sea lion populations

Prohibited: All fishing methods

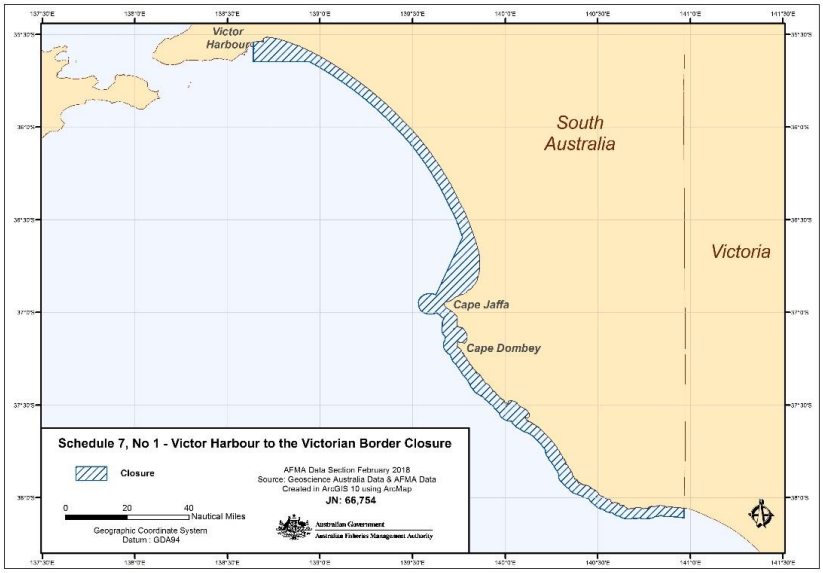


Schedule 7 - South Australian Shark Closure –Victor Harbor to the Victorian Border

Location: Inshore Victoria

Reason: Protect breeding school shark and Australian sea lion populations

Prohibited: All fishing methods

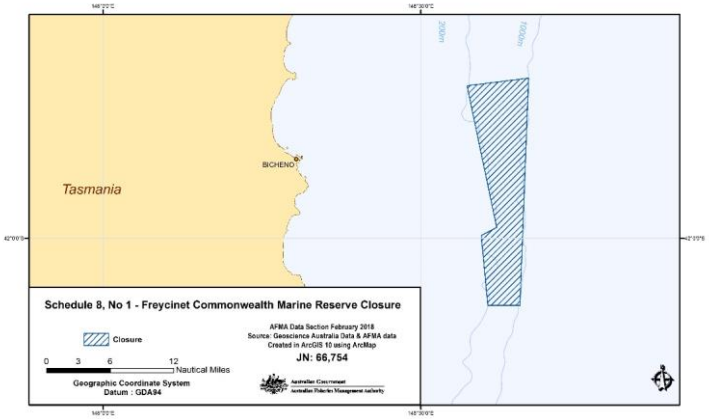


Schedule 8 - Freycinet Commonwealth Marine Reserve Closure

Location: Area off eastern Tasmania

Reason: Protect Upper-Slope dogfish

Prohibited: If the Harrisson's and southern dogfish triggers are met (refer to 6 (i) in the Direction) then all fishing methods (excluding hydraulic hand reel droplining) are prohibited for the concession holder for 12 months within this area. 100% observer coverage required. Please note that Demersal (bottom) Trawl, Danish Seine and Scallop Dredge are prohibited under the Commonwealth Marine Reserve Closure. Refer to http://www.environment.gov.au/topics/marine/marine-reserves for updated information on prohibited fishing methods.

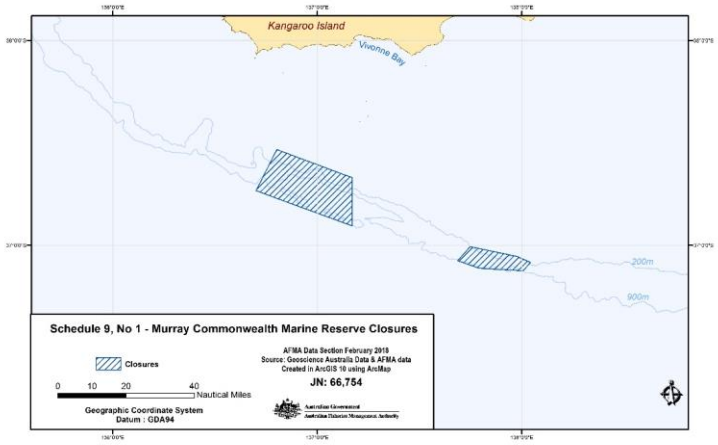


Schedule 9 - Murray Commonwealth Marine Reserves Closures

Location: Area off Kangaroo Island

Reason: Protect Upper-Slope dogfish

Prohibited: If the Harrisson's and southern dogfish triggers are met (refer to 6 (k) in the Direction) then all fishing methods (excluding hydraulic hand reel droplining) are prohibited for the concession holder for 12 months within this area. 100% observer coverage is required. Please note that Demersal (bottom) Trawl, Danish Seine and Scallop Dredge are prohibited under the Commonwealth Marine Reserve Closure. Refer to http://www.environment.gov.au/topics/marine/marine-reserves for updated information on prohibited fishing methods.

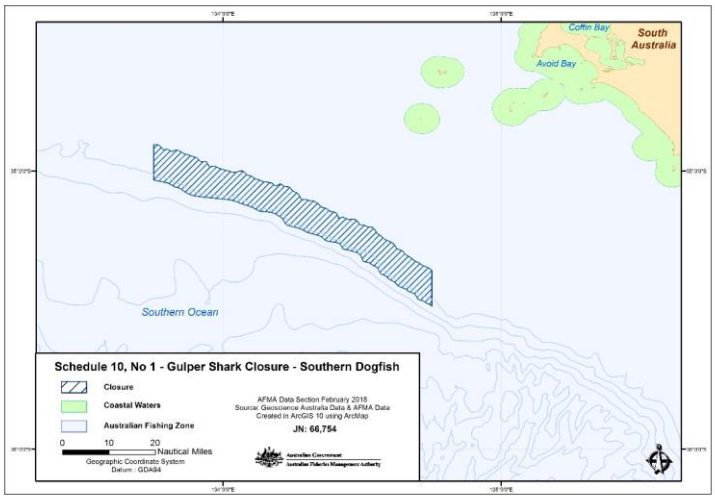


Schedule 10 - Commonwealth Gulper Shark Closure - Southern Dogfish

Location: South Australia

Reason: Protect Upper-Slope dogfish

Prohibited: Hook and Trawl methods

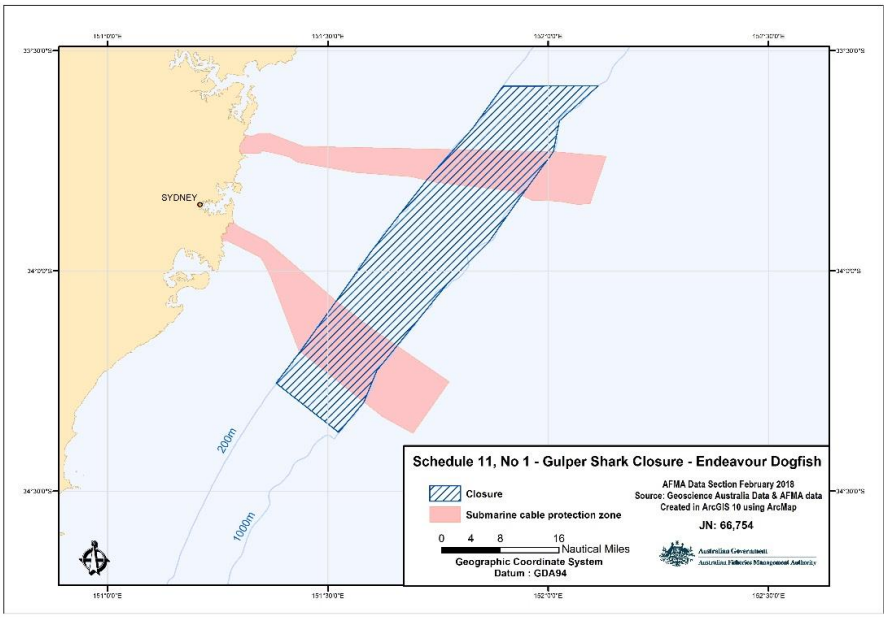


Schedule 11 - Gulper Shark Closure – Endeavour Dogfish

Location: Waters off Sydney in the area of the submarine cable protection zones

Reason: Protect Upper-Slope dogfish

Prohibited: All fishing methods

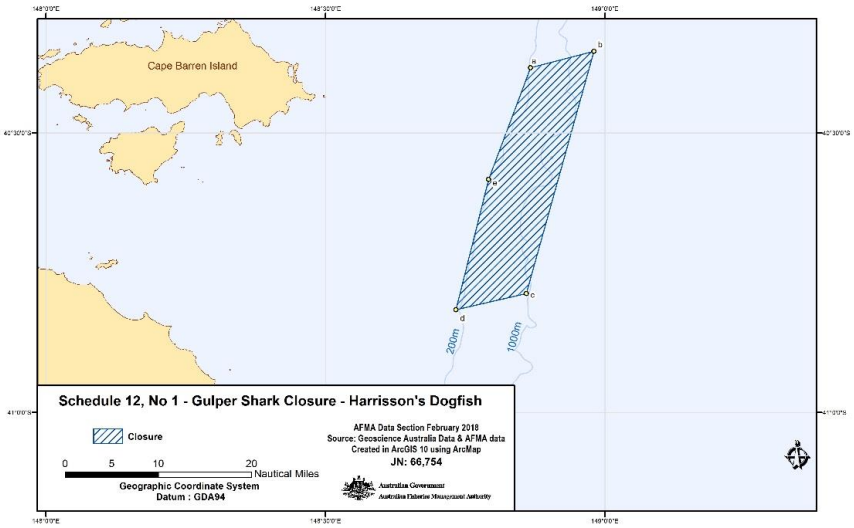


Schedule 12 - Gulper Shark Closure – Harrisson's Dogfish

Location: East Bass Strait

Reason: Protect Upper-Slope dogfish

Prohibited: All fishing methods

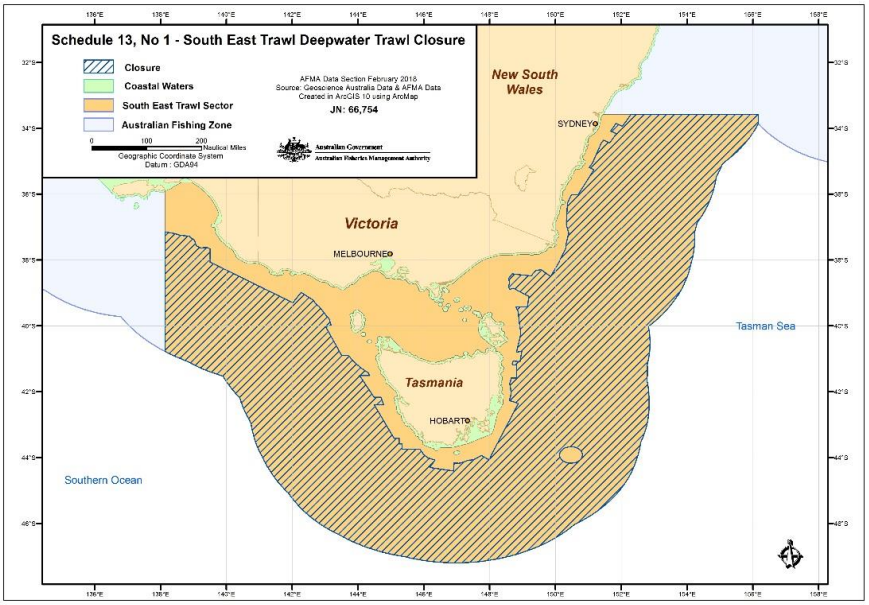


Schedule 13 - South East Trawl Deep Water Closure

Location: Area from New South Wales to South Australia

Reason: Protect orange roughy stocks

Prohibited: Trawl methods

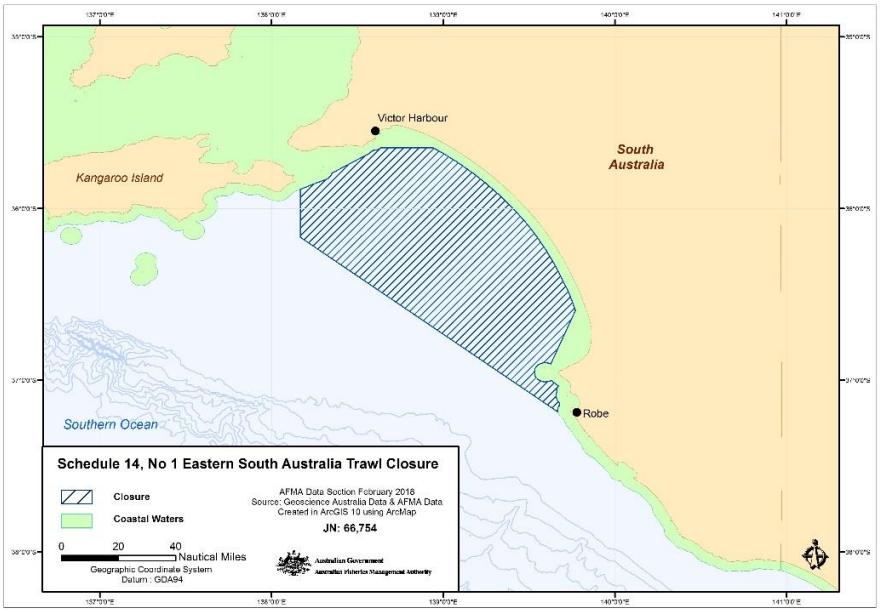


Schedule 14 - Eastern South Australia Trawl Closure

Location: Eastern South Australia

Reason: Reduce the catch of juvenile scalefish and protect structured benthic habitat

Prohibited: Demersal otter trawl method

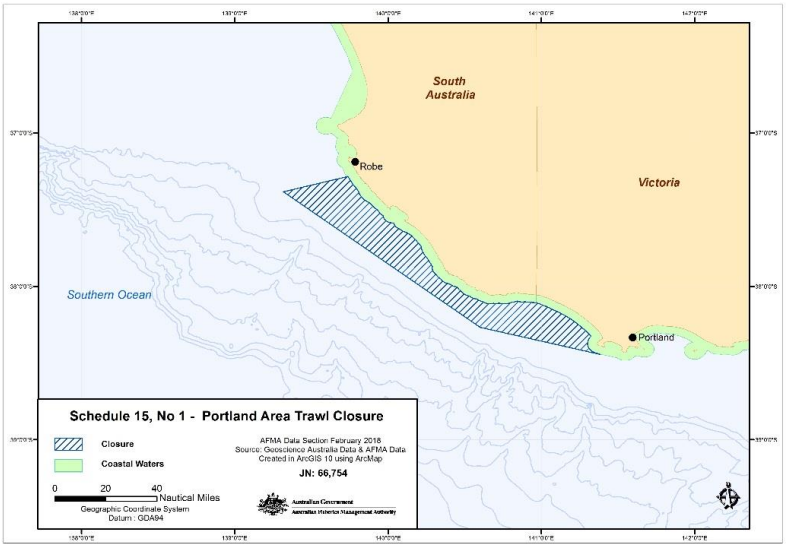


Schedule 15 - Portland Area Trawl Closure

Location: Coastal waters, west of Portland, South Australia

Reason: Reduce the catch of juvenile scalefish and protect structured benthic habitat

Prohibited: Demersal otter trawl methods



Schedule 16 - Central East Zone

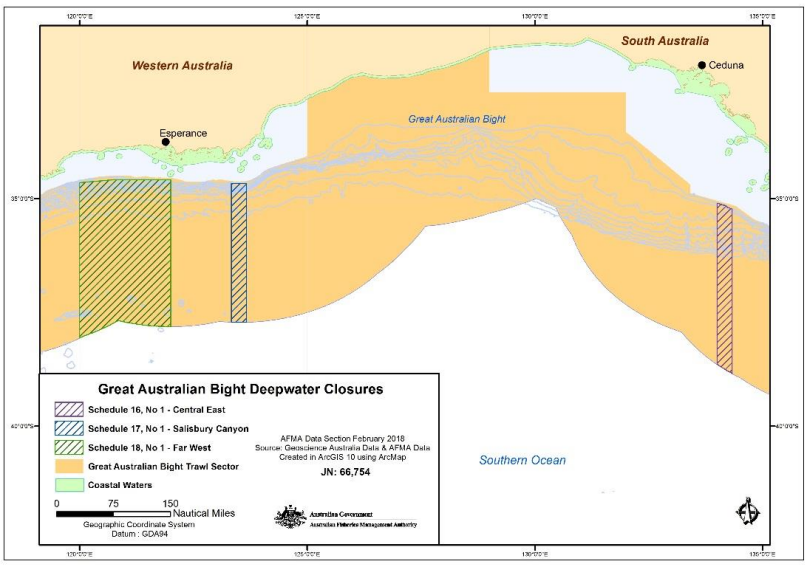
Schedule 17 - Salisbury Canyon

Schedule 18 - Far West

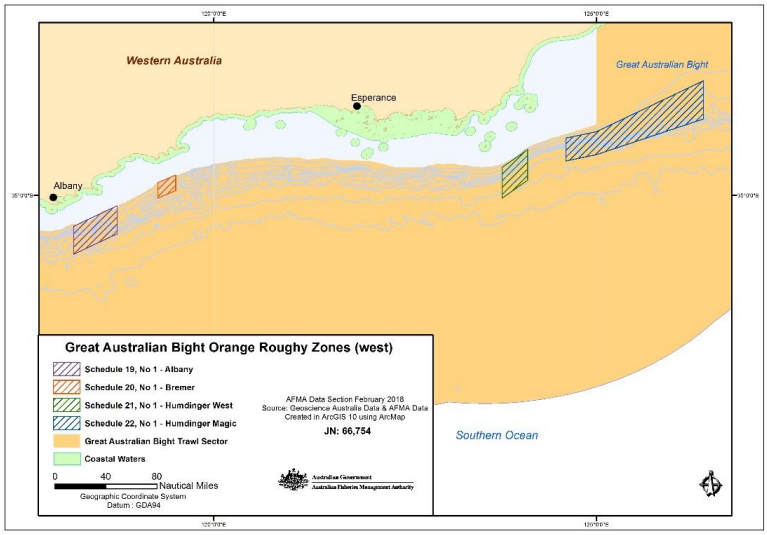
Location: Great Australian Bight, South Australia and Western Australia

Reason: Protect deep water species and orange roughy stocks

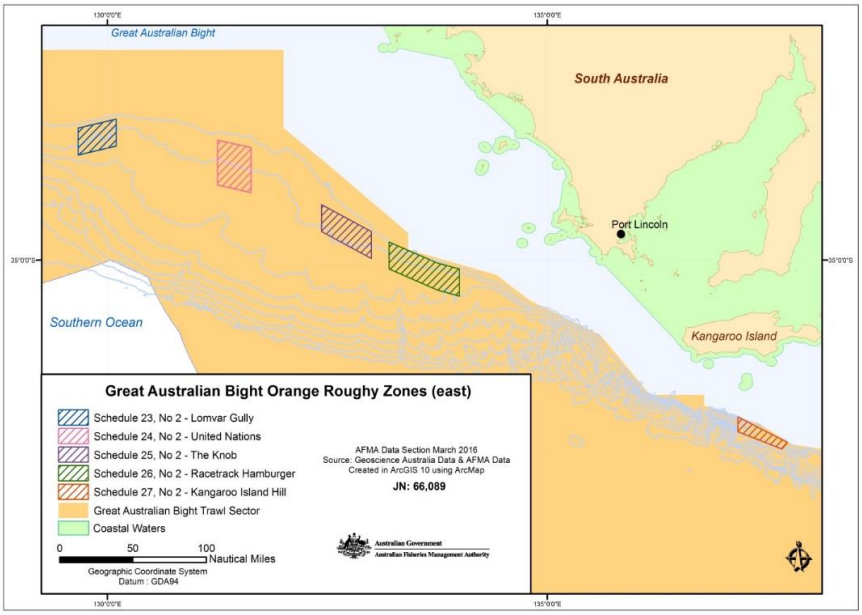
Prohibited: Demersal otter trawl methods



Schedule 19 - Albany
Schedule 20 - Bremer
Schedule 21 - Humdinger West
Schedule 22 - Humdinger/Magic
Location: Great Australian Bight (West), Western Australia
Reason: Protect orange roughy stocks
Prohibited: Trawl methods



Schedule 23 - Lomvar Gully
Schedule 24 - United Nations
Schedule 25 - The Knob
Schedule 26 - Racetrack/Hamburger
Schedule 27 - Kangaroo Island Hill
Location: Great Australian Bight (East), South Australia
Reason: Protect orange roughy stocks
Prohibited: Trawl methods

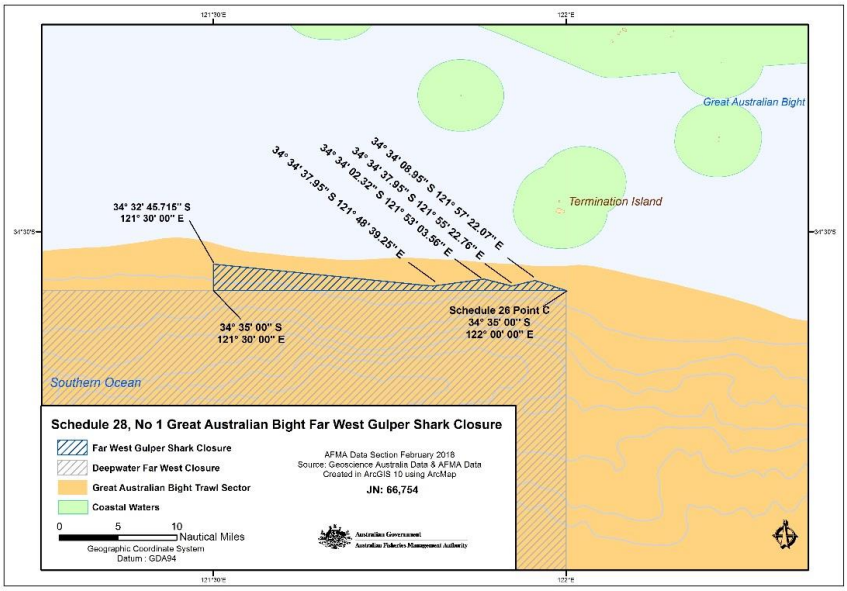


Schedule 28 - Great Australian Bight Far West Gulper Shark Closure

Location: Great Australian Bight (West), South Australia

Reason: Protect Upper-Slope dogfish

Prohibited: Trawl methods

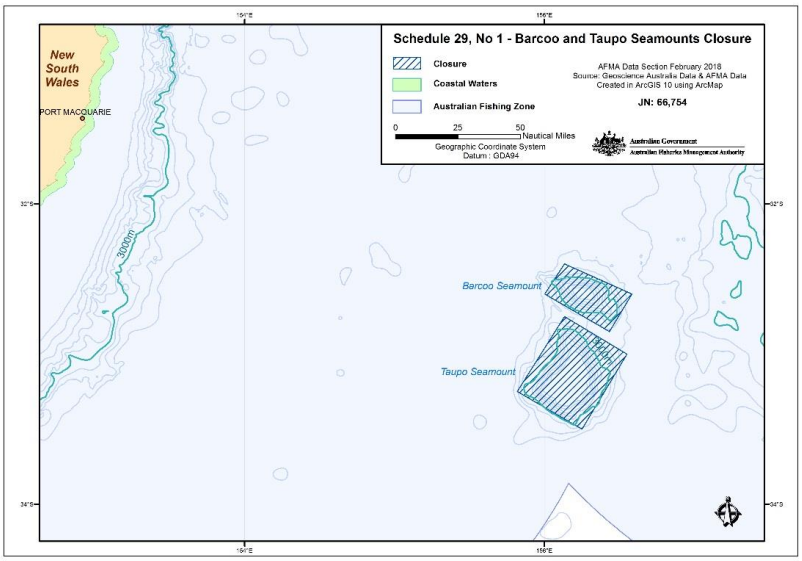


Schedule 29 - Barcoo and Taupo Seamounts Closure

Location: East coast of southern New South Wales

Reason: Protect Upper-Slope dogfish

Prohibited: Trawl methods and if the Harrisson's and southern dogfish triggers are met (refer to 6 (q) in the Direction) then all fishing methods (excluding hydraulic hand reel droplining) are prohibited for the concession holder for 12 months within this area. 100% observer coverage is required.

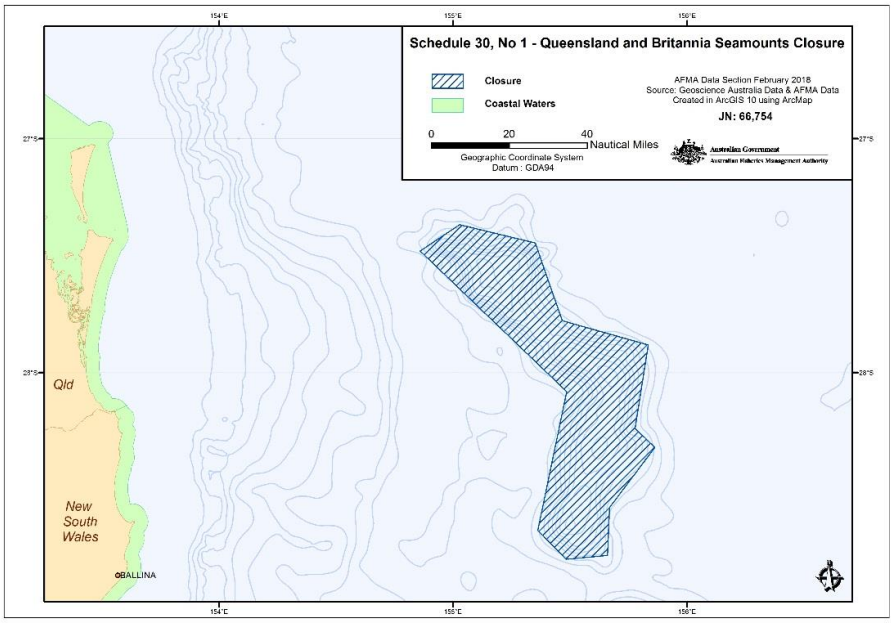


Schedule 30 - Queensland and Britannia Seamounts Closure

Location: Area off southern Queensland

Reason: Protect Upper-Slope dogfish

Prohibited: All fishing methods except hydraulic hand reel droplining.

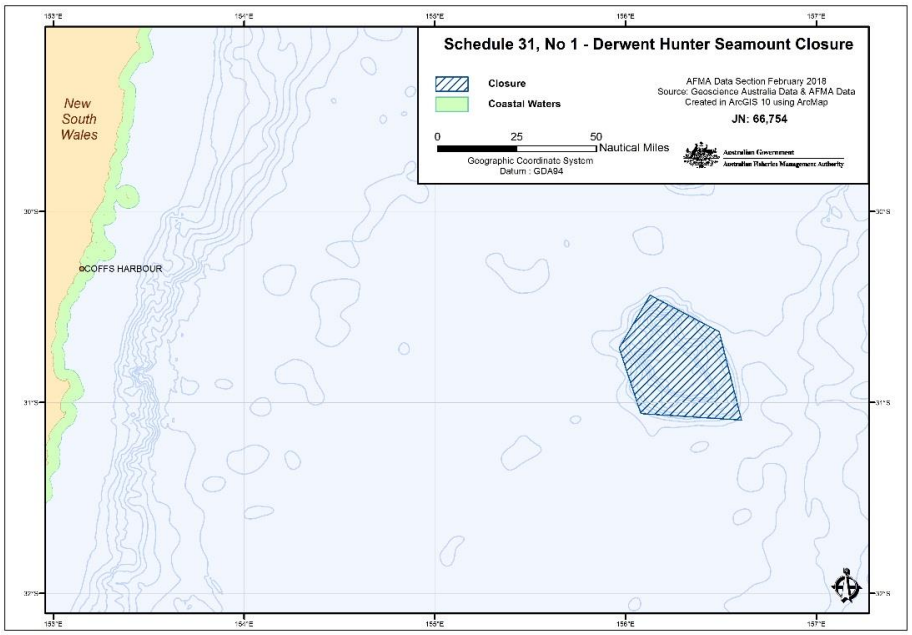


Schedule 31 - Derwent Hunter Seamount Closure

Location: Area off mid New South Wales

Reason: Protect Upper-Slope dogfish

Prohibited: All fishing methods

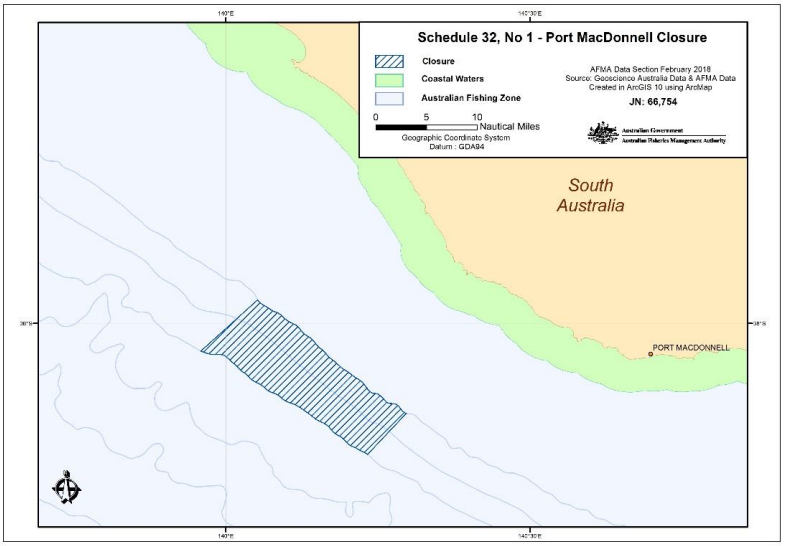


Schedule 32 - Port MacDonnell Closure

Location: Area off south eastern Australia

Reason: Protect Upper-Slope dogfish

Prohibited: All fishing methods

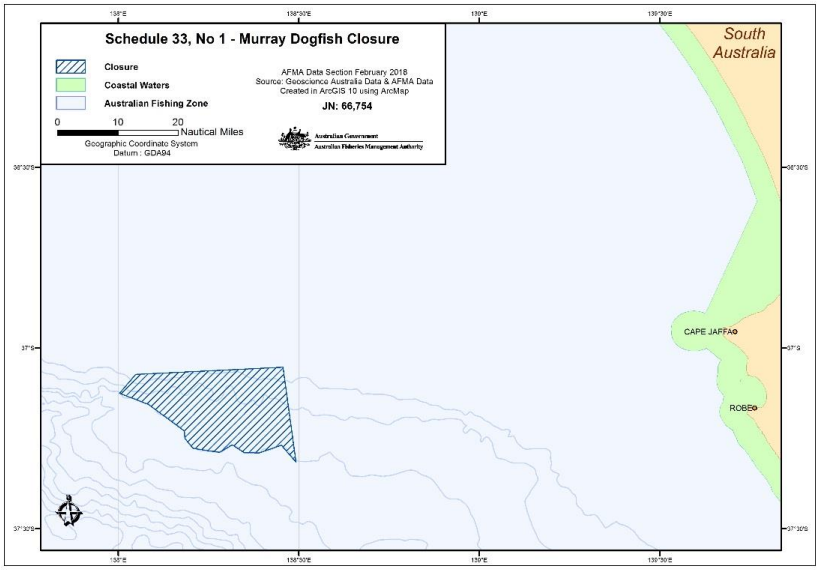


Schedule 33 - Murray Dogfish Closure

Location: Area off southeastern Australia

Reason: Protect Upper-Slope dogfish

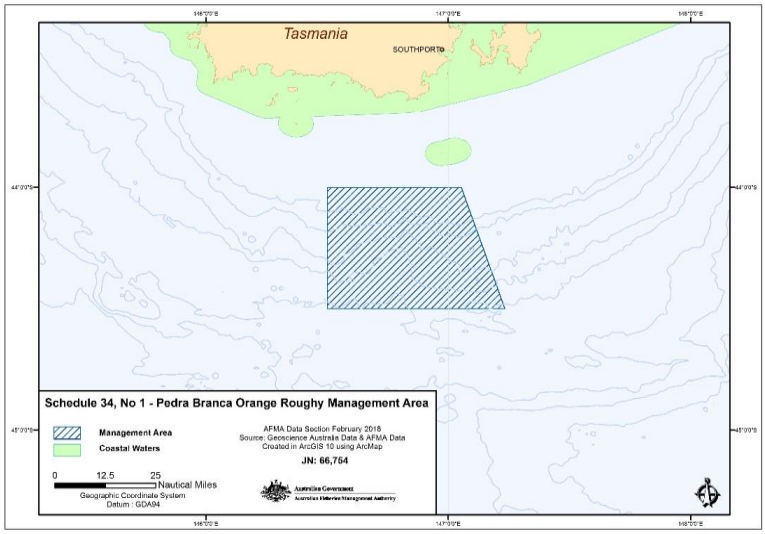
Prohibited: Trawl methods and if the Harrisson's and southern dogfish triggers are met (refer to 6 (u) in the Direction) then all fishing methods (excluding hydraulic hand reel droplining) are prohibited for the concession holder for 12 months within this area. 100% observer coverage is required.



Schedule 34 – Pedra Branca orange roughy Management Area

Location: Area off southern Tasmania

Reason: Allows for targeted fishing of orange roughy using trawl methods. 100% observer coverage is required during the period 1 June to 31 August of any year.



Closures legislated under the *Southern and Eastern Scalefish and Shark Fishery (Closures) Direction No. 11 2013.*

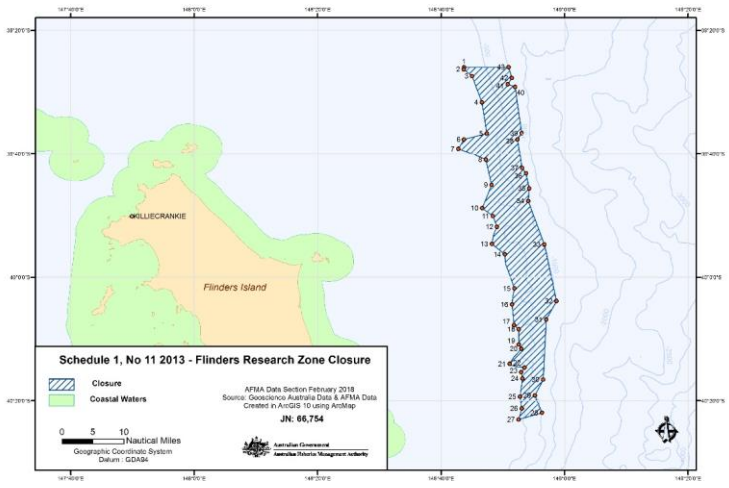
For exact coordinates of area closures refer to the relevant sections of the SESSF Closure Directions, as referenced by the map title.

Schedule 1 - Flinders Research Zone Closure

Location: Eastern Bass Strait

Reason: Protect Upper-Slope dogfish

Prohibited: All fishing methods



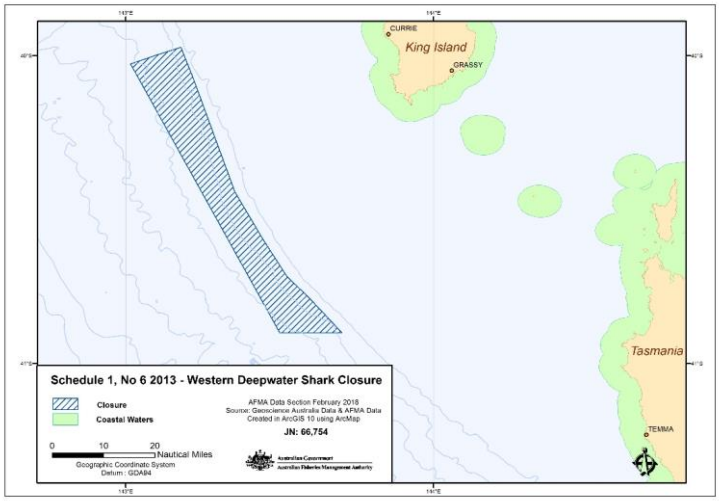
Closures legislated under the *Southern and Eastern Scalefish and Shark Fishery (Closures) Direction No. 6 2013.*

For exact coordinates of area closures refer to the relevant sections of the SESSF Closure Directions, as referenced by the map title.

Schedule 1 – Western Deepwater shark area – opening and trigger limit

Location: Area west of King Island and Tasmania

Reason: To provide access for otter trawl method to deepwater shark basket (west). However, if 25 tonnes of orange roughy (western) is taken during the fishing season, all trawl methods will be prohibited in this area for the remainder of that season.



Closures legislated under the *Southern and Eastern Scalefish and Shark Fishery (Closures) Direction No. 2 2015.*

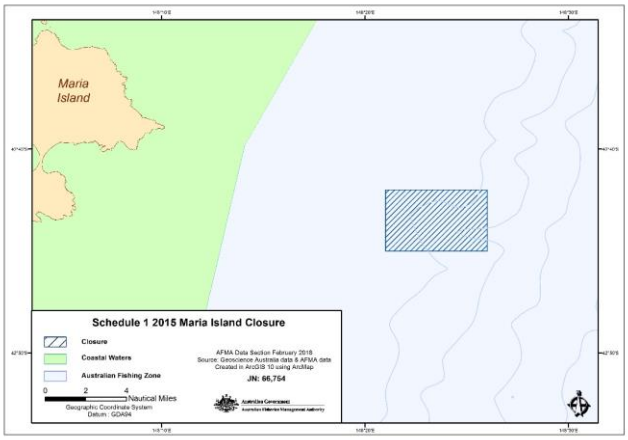
For exact coordinates of area closures refer to the relevant sections of the SESSF Closure Directions, as referenced by the map title.

Schedule 1 – Maria Island

Location: Area off eastern Tasmania

Reason: Protect pink ling stocks

Prohibited: All methods unless the holder is already subject to a condition to retain no more than 25 per cent of their total pink ling (Genypterus blacodes) quota (caught or uncaught) in waters east of Longitude 147° East at any time.

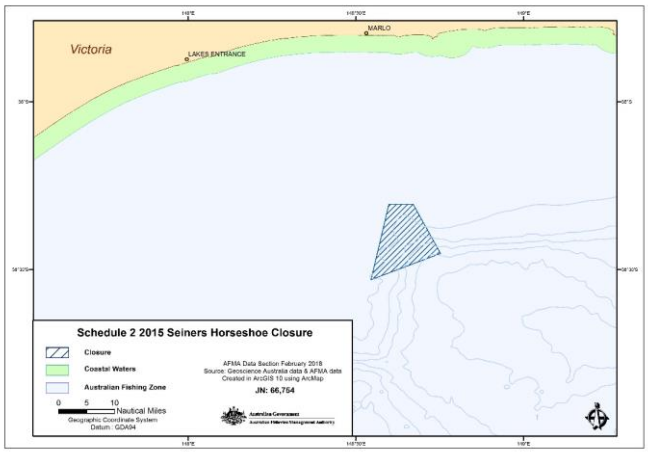


Schedule 2 – Seiner's Horseshoe

Location: Area off southeastern Australia

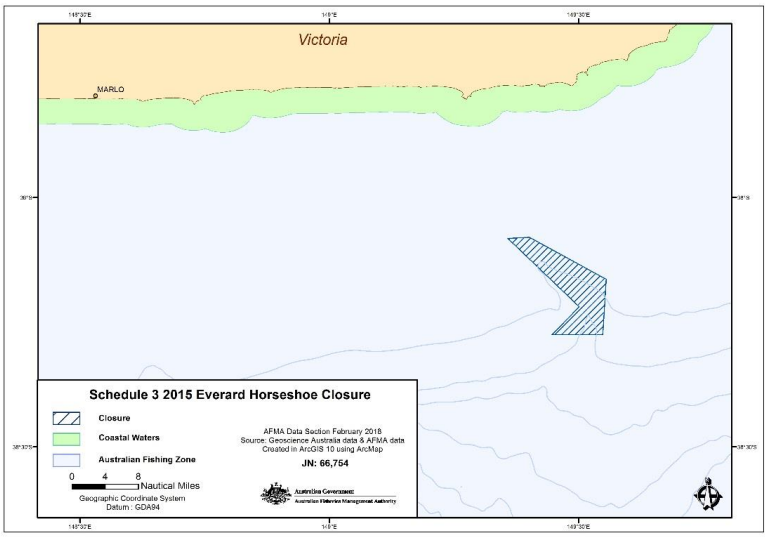
Reason: Protect pink ling stocks

Prohibited: All methods unless the holder is already subject to a condition to retain no more than 25 per cent of their total pink ling (Genypterus blacodes) quota (caught or uncaught) in waters east of Longitude 147° East at any time.



Schedule 3 – Everard Horseshoe

Location: Area off southeastern Australia
Reason: Protect pink ling stocks
Prohibited: All methods unless the holder is already subject to a condition to retain no more than 25 per cent of their total pink ling (Genypterus blacodes) quota (caught or uncaught) in waters east of Longitude 147° East at any time.

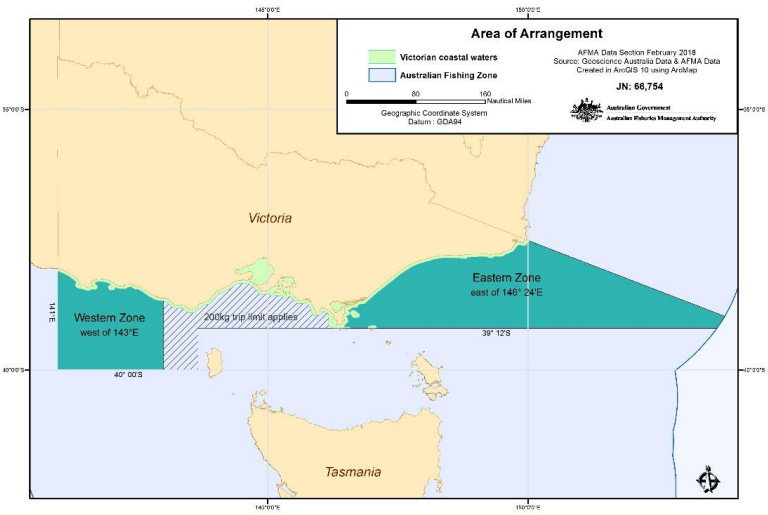


Closures legislated under the *Southern and Eastern Scalefish and Shark Fishery Statutory Fishing Right Conditions.*

For exact coordinates of area closures refer to the relevant sections of the SESSF SFR conditions, as referenced by the map title.

Commonwealth Trawl Sector Boat SFR Condition

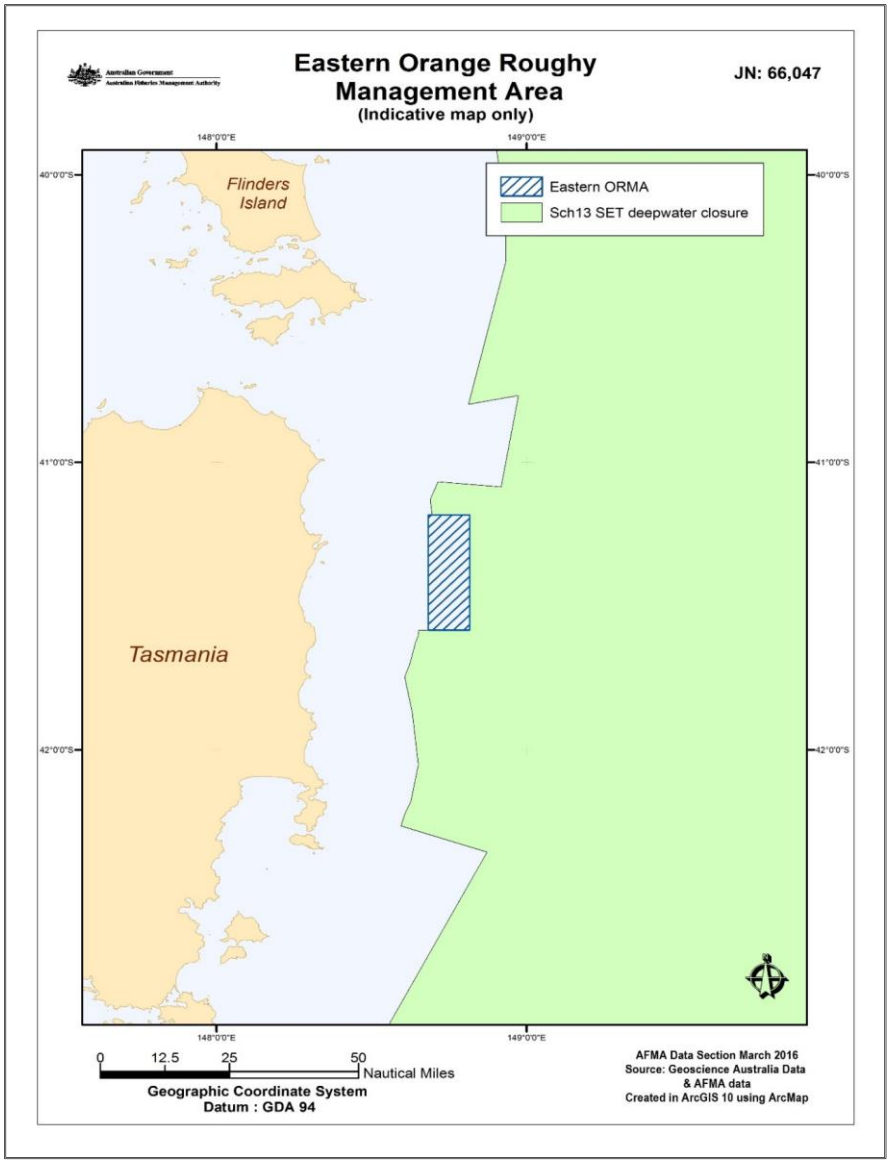
Location: Victoria
Reason: Special provision for snapper trip limit, 200 kg
Prohibited: Trawl (including Danish seine)



Eastern Orange roughy Management Area (ORMA)

Location: Eastern Tasmania

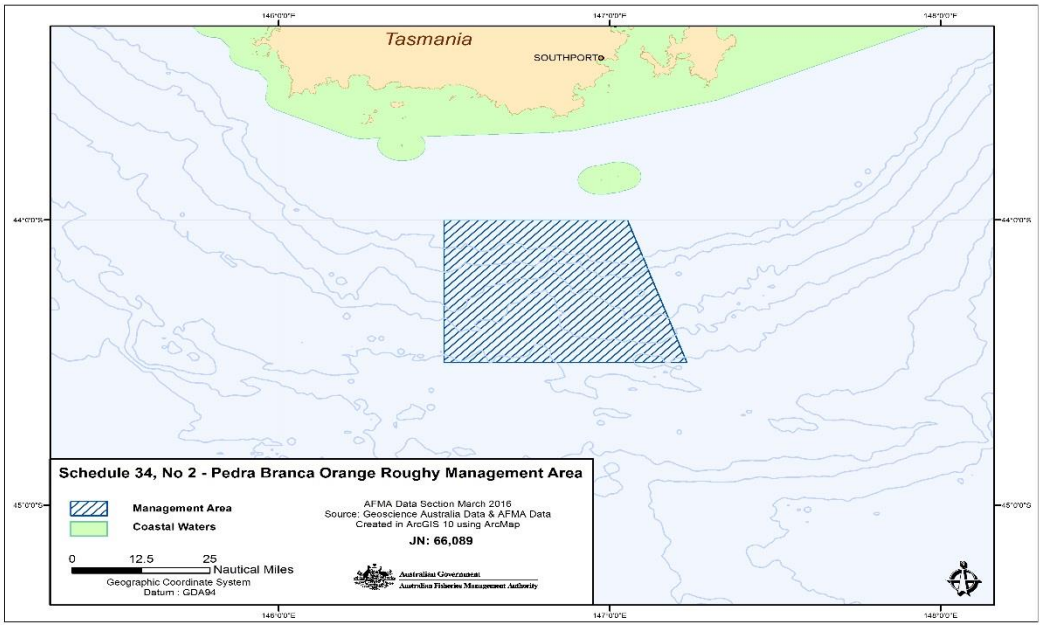
Reason: Special management arrangements for orange roughy



Pedra Branca Orange roughy Management Area (ORMA)

Location: Southern Tasmania

Reason: Special management arrangements for orange roughy



Area closures outside AFMA's jurisdiction

Commonwealth Marine Reserves Network

Some fishing methods are prohibited in Commonwealth marine reserves. This information can be found on the Department of the Environment and Energy's website at http://www.environment.gov.au/topics/marine/marine-reserves.

Tasmanian Coastal Shark Closures

The Tasmanian Government has declared specific coastal areas as Shark Refuge areas and Tasmanian state law prohibits fishing in these areas.

For further information on Tasmanian Shark Refuge areas please visit the Tasmanian Department of Primary Industries, Parks, Water and Environment website at http://dpipwe.tas.gov.au/.

State Marine Parks

Fishing is prohibited in many state based marine parks and reserves. For more information on these areas please contact the relevant state authority.

Appendix D. State trip limits

Trip Limits relevant to Victoria

FINFISH (Victoria, trawl methods)		
Snapper	200 kg. See AFMA/SETFIA Snapper management arrangement for incidental catch arrangements	
Black Cod	No take	
CRUSTACEANS (Victoria)		
Deepwater prawn Red prawn Prawn (Genus Aristeus) Royal red prawn Scarlet prawn Carid prawns (family Pandalidae)	Trip limits do not apply	
Eastern king prawn School prawns Rock lobster	No take	
Giant (king) crab (*Psuedocarincus*	5 individuals	Combined 50 kg trip limit
Bay bugs (family *Scyllaridae*)	10 kg	
Other crustaceans	50 kg trip limit	
MOLLUSCS (Victoria)		
Arrow squid Red ocean squid Southern ocean arrow squid Yellowback squid Scallops	Trip limits do not apply	
Abalone	No take	
Other molluscs	50 kg trip limit	

Trip limits relevant to South Australia

FINFISH (South Australia)	
Australian anchovy Australian salmon/Tommy ruff Banded morwong Black bream Black cod Blue sprat	No Take

FINFISH (South Australia)		
Dusky morwong		
Garfish		
Grassy (rock) flathead		
King gar		
King George whiting		
Luderick		
Magpie morwong		
Pilchard		
Red mullet		
Sea sweep		
Snook		
Sprat		
Wrasse		
Yelloweye mullet		
Yellow-finned whiting		
Bastard trumpeter	20 kg	Combined 200 kg trip limit
Blue Groper	50 kg	
Leatherjackets* (black reef, chinaman and rough)	200 kg	
Mulloway	100 kg	
Parrotfish* (knifejaw)	200 kg	
Striped trumpeter	20 kg	
Snapper	50 kg	
Yellowtail kingfish	10 individuals	
CRUSTACEANS (South Australia)		
Deepwater prawn	Trip limits do not apply	
Red prawn		
Prawn (Genus Aristeus)		
Royal red prawn		
Scarlet prawn		
Carid prawns (family Pandalidae)		
All other prawns	No take	
Rock lobster		
Bay bugs (family Scyllaridae)	200 kg	
Giant (king) crab (*Psuedocarincus gigas*)	5 individuals	Combined 50 kg trip limit
Other crustaceans	50 kg trip limit	
MOLLUSCS (South Australia)		
Arrow squid	Trip limits do not apply	
Red ocean squid		

FINFISH (South Australia)		
Southern ocean arrow squid		
Yellowback squid		
Scallops	No take	
Abalone		
Shells and Shellfish (Class *Gastropoda*)	50 kg trip limit	Combined 500 kg limit
Other molluscs	500 kg trip limit	

Trip limits relevant to Tasmania

FINFISH (Tasmania)	
Australian anchovy	No Take
Australian salmon/Tommy ruff	
Banded morwong	
Black bream	
Black cod	
Blue sprat	
Dusky morwong	
Garfish	
Grassy (rock) flathead	
Handfish (Family Brachionichthyidae)	
King gar	
King George whiting	
Luderick	
Mulloway	
Magpie morwong	
Pilchard	
Red mullet	
Sea sweep	
Seahorses and Pipefish (Family Syngnathidae)	
Snook	
Sprat	
Three finned blennies (Family Tripterygiidae)	
Wrasse	
Yelloweye mullet	
Yellow-finned whiting	
Bastard trumpeter	20 kg
Blue groper	50 kg
Striped trumpeter	
Snapper	

Yellowtail kingfish	Combined 250 kg of which no more than 150	
CRUSTACEANS (Tasmania)		
Deepwater prawn Red prawn Prawn (Genus Aristeus) Royal red prawn Scarlet prawn	Trip limits do not apply	
Other prawns Rock lobster	No take	
Giant (king) crab (*Psuedocarincus gigas)*	5 individuals	Combined 50 kg trip limit
Other crustaceans	50 kg trip limit	
MOLLUSCS (Tasmania)		
Arrow squid Red ocean squid Southern ocean arrow squid Yellowback squid Scallops	Trip limits do not apply	
Abalone Limpets or keyhole limpets	No take	
Shells and Shellfish (Class *Gastropoda*)	50 kg trip limit	Combined 500 kg trip limit
Other molluscs	500 kg trip limit	

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 and Eastern Scalefish and Shark Fishery - Otter trawl).
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”.

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We innovate for tomorrow and help improve today – for our customers, all Australians and the world.

Our innovations contribute billions of dollars to the Australian economy every year. As the largest patent holder in the nation, our vast wealth of intellectual property has led to more than 150 spin-off companies.

With more than 5,000 experts and a burning desire to get things done, we are Australia's catalyst for innovation.

CSIRO. WE IMAGINE. WE COLLABORATE. WE INNOVATE.

FOR FURTHER INFORMATION

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