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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): Danish seine 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. 130 p. (Commonwealth of Australia, Canberra).

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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) Danish seine sub-fishery was undertaken using the ERAEF method version 9.2, with some additional modifications currently in final stages of development 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 (ERM Guide; AFMA, 2017).

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 SESSF Commonwealth Trawl Sector (CTS): Danish seine sub-fishery consists of the following:

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

Fishery Summary

Gear:	Danish Seine
Area:	Commonwealth Trawl Sector of the Southern and Eastern Scalefish and Shark Fishery: south from Barrenjoey Point, NSW, along the southeastern Australian coast, including Tasmania, and west to Cape Jervis in South Australia
Depth range:	1 - 1216 m; mean: 54.9 m; median: 52 m; 99% of shots < 150 m
Fleet size:	19 vessels *cf* 18 vessels active in 2005
Effort:	Average 9525 shots per year (7925-10876) *cf* 8000 shots per year (previous assessment)
Landings:	10253.3 t
Discard rate:	Tiger flathead (2014: 9%, 2015: 5%, 2016: 2%) Eastern school whiting (2014: 5%, 2015: 4%, 2016: 6%)
Commercial species (ERA classification):	Tiger flathead (key) and eastern school whiting (secondary)
Management:	Quota management system across species/stocks
Observer program:	AFMA Observer program; coverage: 0.9-1.53% over assessment period

Ecological Units Assessed

Table ES1.1. Ecological units assessed in 2018 and 2006.

ECOLOGICAL COMPONENT	2018#	2006
Key/secondary commercial species	1 key; 1 secondary	6^
Byproduct and bycatch species	35 byproduct; 166 bycatch	31 byproduct; 116 bycatch
Protected species	63	198
Habitats	20 demersal, 2 pelagic	79 demersal*, 3 pelagic
Communities	16 demersal[1], 5 pelagic[1]	11 demersal, 2 pelagic

* these habitats are not comparable with current assessment
# based on assessment period: 2012-2016
^ corresponds to target species
[1] likely that some of these records in deep water have been incorrectly attributed to Danish seine fishery

A total of 266 species across the three ecological components were assessed in this ERAEF compared to 351 species in 2006 (Table ES1.1). The decrease in the number of protected species between assessments is due to only including species that were recorded as interacting with this sub-fishery (apart from expanding species recorded at a higher taxanomic level i.e. genus, family identified from AFMA logbook and/or Observer data to include all potential species within that taxon).

Level 1 Results and Summary

Three ecological components were eliminated at Level 1 (i.e. no components with risk scores of 3 (moderate) or above).

Most hazards (fishing activities) were eliminated at Level 1 (i.e. no components with risk scores of 3 (moderate) or above). Those that remaining were:

- Fishing (capture impacts on two ecological components; byproduct/bycatch and habitats)
- Fishing (non-capture impacts on one ecological component; habitats)
- External hazards from other fisheries (on all five comonents)

As a result of direct capture by fishing, the most vulnerable bycatch species whitefin swellshark *Cephaloscyllium albipinnum* that are mostly discarded (AFMA Logbooks) were assessed at moderate risk. This was due to its unknown population size. However, the family to which whitefin swellsharks belong (Scyliorhinidae) has a relatively high chance of post-capture survival if released alive but we considered this may not be great enough to reduce the risk to this species without further evidence.

The impact of fishing represented a moderate risk to habitats largely due to the concentration of effort on the shelf where highly vulnerable fauna occurs but this actual impact is unknown but could be relatively low if fishing is conducted largely on soft sediments.

Significant external hazards included other fisheries in the region on all five ecological components. Only external fisheries were rated at major or above risk (scores 4) on byproduct/bycatch and communities.

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:

- Byproduct/bycatch

A Level 2 analysis for the Habitat component 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	2018 (CURRENT)	2006 (PREVIOUS)
Key/secondary commercial species	Level 1	Level 2^
Byproduct and bycatch species	Level 2	Level 2^
Protected species	Level 1	Level 2^
Habitats	Level 2#	Level 2*
Communities	Level 1	Level 2*

not assessed at L2 in this assessment
* triggered but due to lack of methodology available in 2006 this component was not assessed at L2 in the ERA process.
^SAFE analysis was also performed on species 2007-2010 (Zhou et al. 2012). Risk categories for L2 are not directly comparable with 2018 assessment.

Level 2 Results and Summary

PSA

Byproduct species

A total of nine invertebrate species were assessed: six at high risk and three at medium risk. Following a residual risk analysis, five species remained at high risk. These were cuttlefishes: *Sepia braggi*, *Sepia grahami*, and *Sepia rosella*; pale octopus *Octopus pallidus* and Gould's squid *Nototodarus gouldi*. The *Sepia* species were added from the generic group code *Sepia* spp. (Table ES1.3).

It is uncertain whether the high-risk scores for the *Sepia* species should remain since it is unknown which species contributed to the total of 14.6 t catch but if any one species contributed to the entire catch and was low in abundance, then this removal might impact that species. By contrast, if the catch was distributed across all species, any impact is less likley to be significant.

Gould's squid has no tiered or formal assessment in this fishery or the Southern Squid Jig (SSJ) fishery, but the SSJ assessment group consider this species to be sustainable i.e. not overfished and not subject to overfishing. Furthermore, the trigger limit of 2000 t in the Commonwealth Trawl Sector (CTS) suggests that the catch of 24.5 t (or 30 t if "Squid" is attributed to this species) is not particulary significant by itself.

In the case of pale octopus *Octopus pallidus,* very little was caught and discarded but if ~72 t of unidentified Octipodidae were attributed to this species and given the lack of abundance infomation, the risk remains that the population might be impacted.

Bycatch species

A total of 26 species were assessed, including 15 species that were unassessable in bSAFE, comprising three chondrichthyans and 12 teleosts. Five of the 15 species were high risk (one chondrichthyan and four teleosts), seven species were medium risk, and three species were low risk. Following a residual risk analysis, three of the five high risk species were reduced to medium risk and two species redcued to low risk, leaving none at high risk.

Of the 11 invertebrate species assessed, three were high risk, six medium risk and two low risk. All three high risk invertebrates were reduced to low risk following a residual risk analysis because of low captures/interaction with this sub-fishery, leaving none at high risk.

bSAFE

Byproduct species

There were 26 byproduct species assessed in the bSAFE and all fell below the three reference points (low risk).

Bycatch species

There were 155 species originally considered a bSAFE of which 15 were unassessable due to missing biological attributes employed in this method. Of the remaining 140 species, one species was assessed at extreme risk, none were high risk, one was medium risk and 139 were low risk. Catches of the extreme risk species, short-tail torpedo ray *Tetronarce nobiliana* were

very low during the assessment period and the risk was reduced to low. No species remained at high risk.

Summary

Five invertebrate species remained at high risk following a residual risk analysis (Table ES1.3). The three *Sepia* species were expanded from a generic group code "*Sepia* spp", so identity is uncertain, missing attributes were high and consequently risk remained high. Pale octopus *Octopus pallidus* is also high risk due to the possibility that the unidentified Octopodidae might be attributable to this species combined with unknown population status. Gould's squid *Nototodarus gouldi* has no formal assessment and while it is considered to be sustainable, it has a low productivity score and high susceptibility and perhaps should be more closely examined with respect to potential risk from cumulative fishing pressure from multiple sectors.

Table ES1.3. High risk PSA or bSAFE species following a residual risk (RR) analysis in the SESSF Danish seine 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. BC: bycatch; BP: byproduct; PS: Protected.

LEVEL 2 ANALYSIS	ERA CLASSIFICATION	TAXA	No. MISSING	SCIENTIFIC NAME	COMMON NAME	HIGH RISK
PSA	BP	INV	10	*Sepia braggi*	Cuttlefish	x
		INV	5	*Sepia grahami*	Cuttlefish	x
		INV	5	*Sepia rozella*	Rosecone cuttlefish	x
		INV	5	*Octopus pallidus*	Pale octopus	x
		INV	1	*Nototodarus gouldi*	Gould's squid; Arrow squid	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.

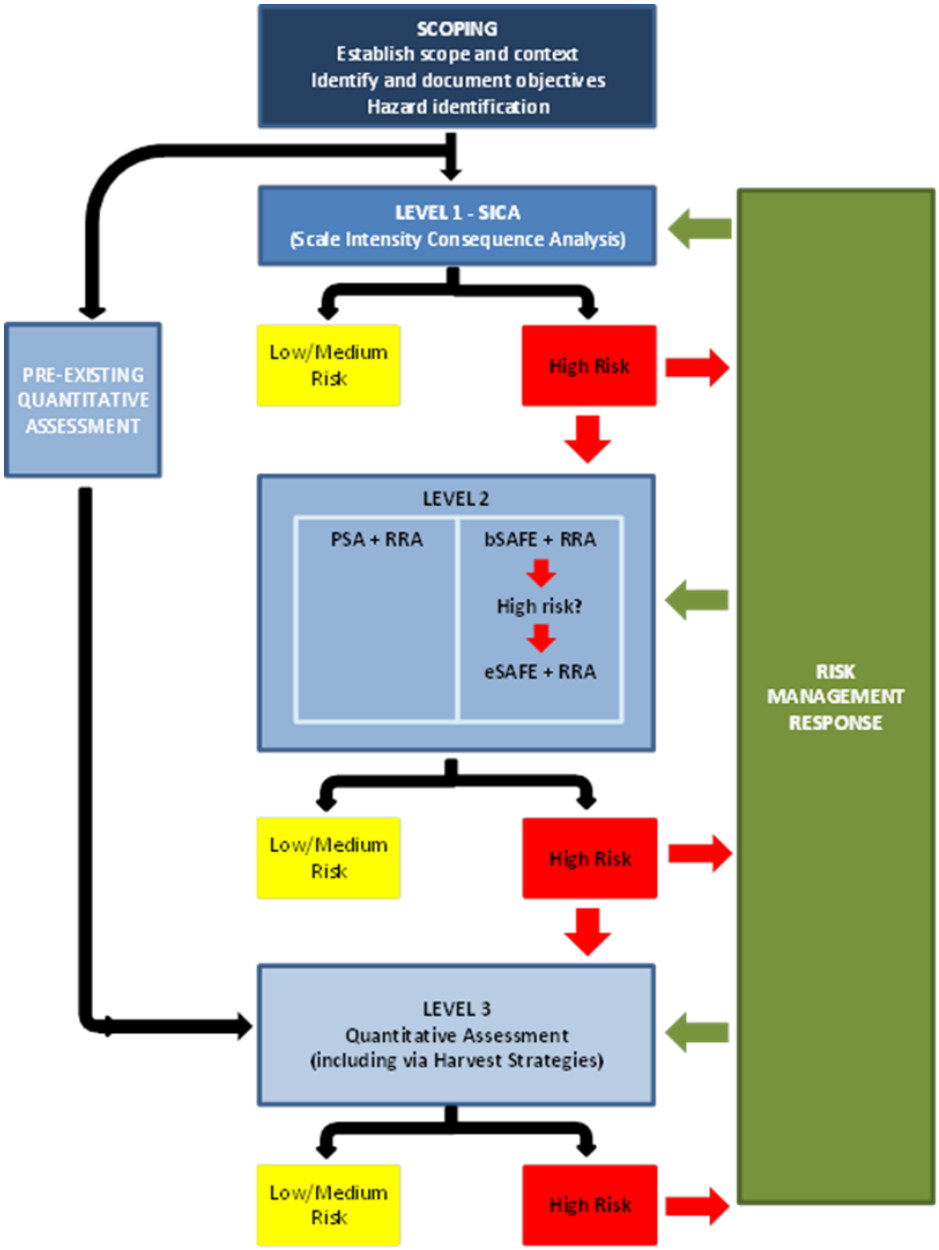


Figure 1.1. Structure of the 3 level hierarchical ERAEF methodology. SICA – Scale Intensity Consequence Analysis; PSA – Productivity Susceptibility Analysis; SAFE – Sustainability Assessment for Fishing Effects; RRA – Residual Risk Analysis. T1 – Tier 1. eSAFE may be used for species classified as high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

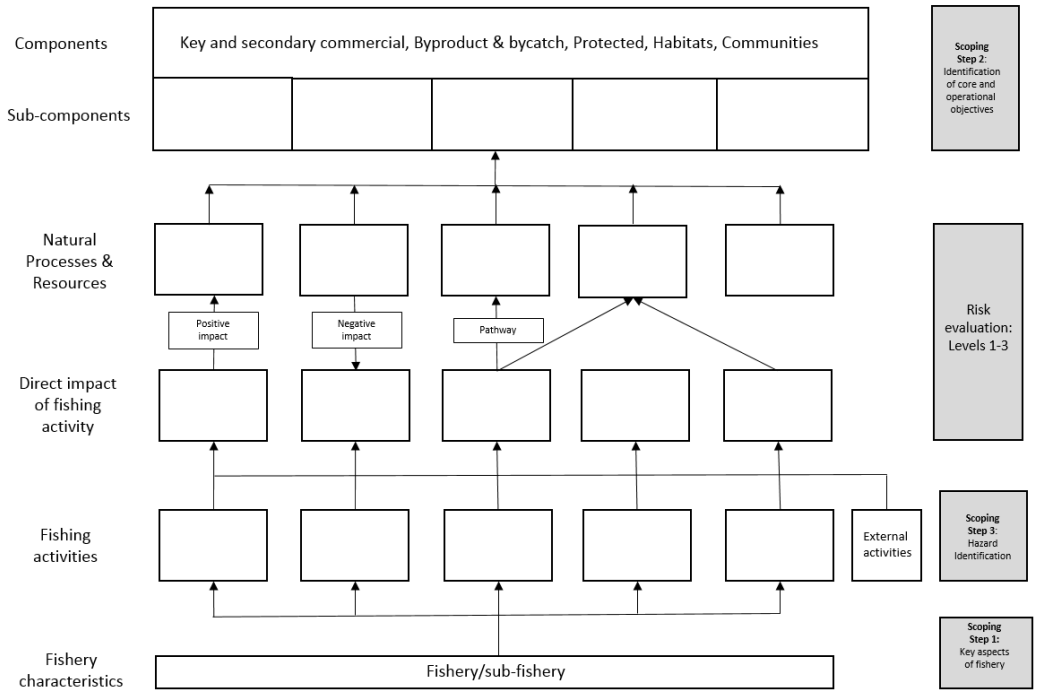


Figure 1.2. Generic conceptual model used in ERAEF.

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 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

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

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

It is also recognised that 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 considered 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, 2011):

- is a more quantitative approach (analogous to stock assessment) that can 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,
- can 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 (eg: some sea snakes) with sufficient data.

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

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

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

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

- $\mathbf{F_{MSY}}$ – instantaneous fishing mortality rate that corresponds to the maximum number of fish in the population that can be killed by fishing in the long term. The latter is the maximum sustainable fishing mortality (MSM) at B_{MSM}, similar to target species MSY.
- $\mathbf{F_{LIM}}$ – 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 can 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 (ie: populations rapidly mix between fished and unfished areas). The fishing mortality will likely be overestimated if this assumption is not satisfied (ERA TWG 2015)[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 future overfished state). The limitations of SAFE with respect to measuring overfished risks are the same essentially as for PSA.

[4] ERA Technical Working Group, September 2015

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 several factors including:

- The time it takes to implement risk management measures; for populations to respond to those measures to a degree detectable by monitoring processes; and to collect sufficient data to determine the effectiveness of those measures.

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

- 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, 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.
- 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.

[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 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 SESSF Danish seine sub-fishery of the Southern and Eastern Scalefish and Shark Fishery (SESSF) Commonwealth Trawl Sector (CTS). 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 Danish seine 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	Various	Dan Corrie (AFMA), Giverny Rodgers (AFMA); David Schubert (AFMA Observer)	Discussion of species list and Scoping
Draft final report	Submitted to AFMA	May 2018	Dan Corrie (AFMA)	-
Draft final report	SERAG meeting	Sep. 2018, Nov. 2018	Dan Corrie (AFMA), RAG members and invited participants	Discussion of species list; Level 1 and 2 and residual risk analysis results presented
Draft final report	Submitted to AFMA	March 2019	Dan Corrie (AFMA)	-
Updated methodology report	Submitted to AFMA; Presentation of updated methodology results	August 2019	SESSFRAG	Supplement on updated methodology presented
Updated methodology report	Presentation of results at SERAG meeting	October 2019	SERAG	Updated methodology accepted
Updated methodology report	-	February 2020	SEMAC	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, and 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).

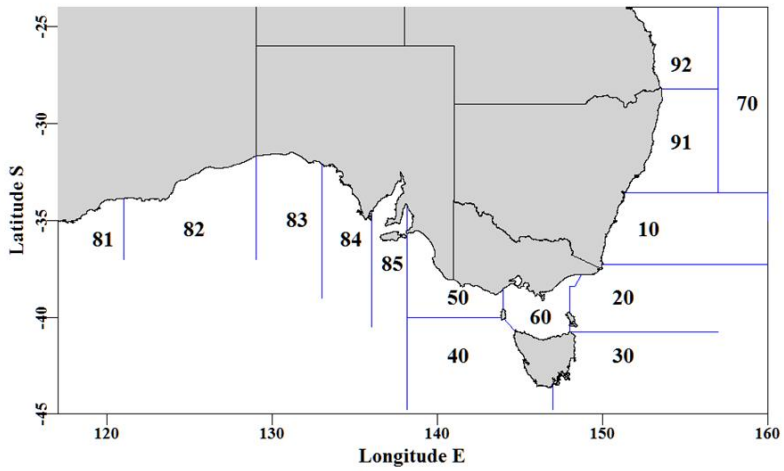
The information used to complete this step came from a range of documents such as the Fishery's Management Plan, Assessment Reports, Bycatch Action Plans, and any other relevant background documents.

Scoping Document S1 General Fishery Characteristics

Fishery Name: Southern and Eastern Scalefish and Shark Fishery (Commnwealth Trawl Sector) – Danish seine sub-fishery
Assessment date: April 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	This report covers the the Danish seine trawl method in the Commonwealth Trawl Sector (CTS) of the Southern and Eastern Scalefish and Shark Fishery (SESSF).

Start date/ history	The Danish Seine operates in the area of the CTS, one of Australia's oldest commercial fisheries that 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 Danish seine fishery started in the 1930s and was the main method of catching tiger flathead during the 1950s and 1960s. But during the 1970s otter board trawlers became the main type of boat used, as the Fishery expanded southwards and outwards to waters deeper than 200 metres, consequently Danish seine fishery contracted. The fishery underwent a structural adjustment in 2007 where 8 of the 18 concessions were removed from the fishery. Danish seine fleet based predominantly out of Lakes Entrance in eastern Victoria. The main target species are tiger flathead and school whiting.
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.
Regions or Zones within the fishery	There are distinct statistical reporting zones in the SESSF (see Figure below).  Excerpt from Sporcic and Haddon (2017).
Fishing season	Fishing occurs throughout the year. The fishing season for all sectors of the SESSF is from 1 May to 30 April each year.
Key/second-ary commercial species and stock status	The SESSF is a multi-species fishery that catches over 100 species of commercial value. For the purposes of this analysis the key and secondary species for the Danish seine sector have been defined as the species (or species groups) which contribute a significant proportion of the total landed catch. For the Danish seine sector of the SESSF these are tiger flathead and eastern school whiting. A full list of primary and secondary species and their stock status is included in **Appendix A.**
Bait collection and usage	Not applicable.
Current entitlements	

Concession holders by fishing season and number of vessels.

QUOTA YEAR	NO. OF VCW CONCESSION HOLDERS*	NO. OF SFR CONCESSION HOLDERS*	NO. OF VCW PERMITS	NO. OF TRAWL BOAT SFRS	NO. OF ACTIVE DANISH SEINE VESSELS**	NO. OF INACTIVE CONCESSIONS***
2008/09	20	53	23	59	22	21
2009/10	21	53	23	59	21	21
2010/11	22	53	23	59	20	21
2011/12	21	53	23	59	21	21
2012/13	20	52	22	57	20	18
2013/14	24	51	22	57	22	18
2014/15	19	52	21	57	18	17
2015/16	18	52	21	57	19	17
2016/17	17	56	21	57	19	17

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

** VCW and CTS SFR boats. Danish seine operators only.

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

Current and recent TACs, quota trends by method

Quotas exist for the main species and Total Allowable Catches (TACs) apply to all fishing methods in the SESSF. Research quotas are included in these figures.

Agreed Total Allowable Catch (t) for main shark quota species in the SESSF for assessment period and current. Fishing season-01 May to 30 April.

	AGREED TAC									
QUOTA SPECIES	**2008/09**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**
Alfonsino	500	500	500	750	750	1125	1017	1016	1017	1017
Bight Redfish	2000	2000	1653	1556	2334	2358	2358	2358	800	800
Blue Eye Trevalla	560	560	428	326	387	388	335	335	410	458
Blue Grenadier	4088	4700	4700	4700	4998	5208	6800	8796	8810	8765
Blue Warehou	365	183	183	133	118	118	118	118	118	118
Deepwater Flathead	1400	1400	1100	1650	1560	1150	1150	1150	1150	1128
Deepwater shark (eastern)	50	75	85	85	80	85	47	47	47	46
Deepwater shark (western)	50	63	95	143	215	215	215	215	215	215
Elephant Fish	94	94	65	89	89	109	109	163	92	114
Flathead	2850	2850	2750	2750	2741	2750	2878	2860	2882	2712

Gemfish (Eastern)	100	100	100	100	100	100	100	100	100	100
Gemfish (Western)	167	125	109	94	141	199	199	183	247	199
Gummy Shark	1717.2	1717.2	1717	1717	1714	1836	1836	1836	1836	1774
Jackass Morwong	560	450	450	450	565	568	568	598	474	513
John Dory	190	190	221	221	220	221	221	169	167	175
Mirror Dory	634	718	718	718	1077	1616	808	437	325	235
Ocean Perch	500	400	300	300	230	195	195	166	190	190
Orange Roughy (Albany and Esperance)	25	50	50	50	50	50	50	50	50	50
Orange Roughy (Cascade Plateau)	600	500	500	500	500	500	500	500	500	500
Orange Roughy (Eastern)	25	25	25	25	25	25	25	465	465	465
Orange Roughy (Southern)	25	35	35	35	35	35	35	66	66	66
Orange Roughy (Western)	50	60	60	60	60	60	60	60	60	60
Oreodory	150	188	188	113	111	132	132	128	128	128
Pink Ling	1080	800	1200	1200	996	834	996	980	1144	1154
Redfish	850	678	551	276	275	276	138	100	100	100
Ribaldo	165	165	131	168	167	168	252	355	355	355
Royal Red Prawn	400	400	400	303	302.5	303	344	386	387	384
Saw Shark	312	312	255	226	226	339	459	482	433	442
School Shark	240	240	216	176	150	215	215	215	215	215
School Whiting	750	1125	844	641	640	809	809	747	868	986
Silver Trevally	296	360	360	540	677	781	615	602	588	613
Silver Warehou	3227	3000	2566	2566	2541	2329	2329	2417	1209	605
Smooth oreodory (Cascade Plateau)	80	100	150	150	150	150	150	150	150	150
Smooth oreodory (other)	40	30	45	45	23	23	23	23	90	90

Source: AFMA
Species Oreo include Spikey, Warty, Black and Rough Oreo.

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

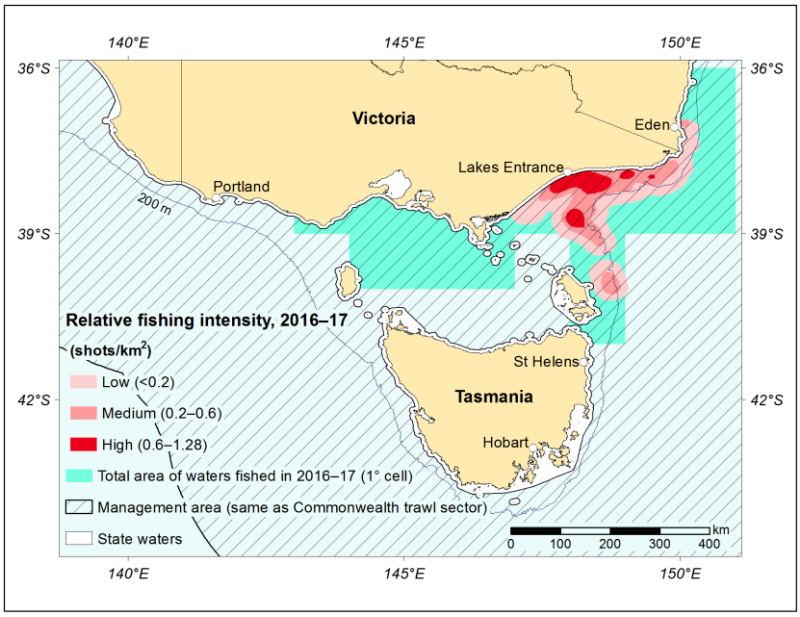
Current and recent fishery effort trends by method

Trawl effort (hours trawled and number of shots) decreased in 2007 with the structural adjustment of the SESSF which saw several vessels leave the fishery. Since then, hours trawled have shown a decreasing trend however number of shots has remained relatively stable.

Danish seine effort (total hours and number of shots) since the last ERA assessment.

YEAR	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Hours trawled	3,536	3,879	4,114	3,806	3,647	2,514	2,121	2,025	596	461
No. of shots	6,688	7,383	7,649	8,133	7,925	8,876	9,912	10,876	10,038	8,465

Source: AFMA logbook database.



Source: ABARES; Patterson et al. (2017).

Current and recent fishery catch trends by method

The main caught species by Danish seine were tiger flathead and eastern school whiting.

Total catch (t) of the main species caught by Danish seine.

COMMON NAME	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Tiger flathead	1158.6	1310.6	1220.2	1237.8	1234.4	1105.4	1269.9	1418.0	1463.7	1087.9
Eastern school whiting	420.7	426.9	323.5	298.3	448.0	458.7	699.4	654.2	646.2	597.8
All other	222.2	217.9	184.4	207.9	175.6	172.1	206.6	224.8	291.9	198.3

Source: AFMA

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).

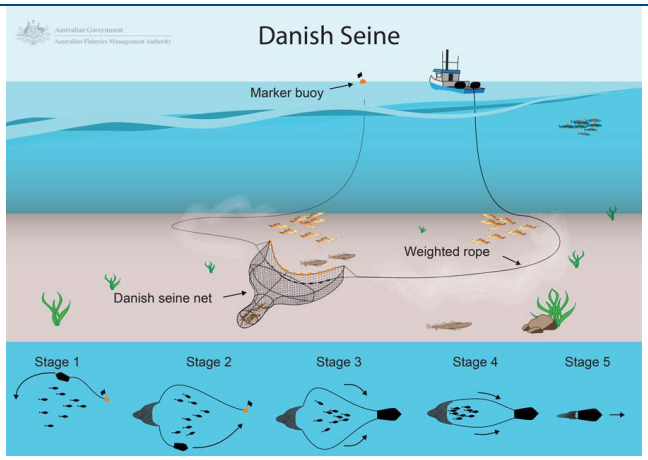
Relationship with other fisheries

Non-trawl fisheries operate in same area as the CTS and take many of the same species. Recreational catches may be significant for some species (e.g. flathead and silver trevally).

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/ Western Tuna and Billfish Fishery • Southern Squid Jig Fishery **The following fisheries operate under Queensland jurisdiction in waters adjacent to the ECDWZ of this fishery:** • East Coast Trawl Fishery • Sub-tropical Inshore Finfish Fishery **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 **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 • Ocean Access Fishery **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 • Giant Crab Fishery **The following fisheries operate under South Australian jurisdiction in waters overlapping or adjacent to this fishery:** • Marine Scalefish Fishery • Rock Lobster Fishery
GEAR	
Fishing methods and gear	Demersal trawling is the term used to describe the fishing method where gear is deployed with one end of a weighted rope attached to an anchor buoy. As the vessel sweeps in a large circle the rope is deployed sinking to the bottom, followed by the Danish seine net and another weighted rope until the vessel returns to the anchor buoy. Once a full circle has been made the gear is towed for approximately 30 minutes until the ropes come together. The towing operation then ceases, and the net is winched back onto the vessel scooping up fish that have been herded into its path by the ropes coming together on the bottom. The operation takes approximately 1 hour and 20 minutes.

	 Source: AFMA
Fishing gear restrictions	SESSF operators are only permitted to fish using the gear/methods specified on their boat statutory fishing right and/or fishing permit. Mesh requirements – Danish seine gear in the Southern and Eastern Scalefish and Shark Fishery must not have any net mesh size less than 38 mm at any part of the net, and the mesh net must be less than or equal to 165 mm in width. Source: AFMA Management Arrangements Booklet 2017
Selectivity of fishing methods	Mesh size is restricted to a minimum of 38 mm. This optimises the catch and allows undersized target and non-target species to escape.
Spatial gear zone set	Fishing with Danish seine trawl occurs along the continental shelf, shelf break, and continental slope.
Depth range gear set	Danish seine trawling occurs in depths ranging from depths from a few metres down to 250 m. The depth range within the assessment period is 1 - 1216 m. The average depth fished is 54.9 m. Also, 99% of shots < 150 m.
How gear set	Gear is deployed with one end of a weighted rope attached to an anchor buoy. As the vessel sweeps in a large circle the rope is deployed sinking to the bottom, followed by the Danish seine net and another weighted rope until the vessel returns to the anchor buoy. Once a full circle has been made the gear is towed for approximately 30 minutes until the ropes come together. The towing operation then ceases, and the net is winched back onto the vessel scooping up fish that have been herded into its path by the ropes coming together on the bottom.
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	Net size is not recorded for Danish seine trawling. It is possible that a requirement to collect this information could be added to observer duties, however the data is not currently collected.
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	Stock assessments are in place for each of the commercial species under quota in the SESSF. The status of For 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. The South East Resource Assessment Group have raised questions relating to the stock structure of flathead in eastern Tasmania and eastern school whiting on the east coast of Australia. If or how these stocks are split requires further investigation.

	The Resource Assessment group have also identified the need to better describe NSW state catches of whiting. An assumed ratio is currently used to estimate catches of stout and eastern school whiting based on the location of catches.
Byproduct and bycatch issues and interactions	There are currently no identified significant byproduct or bycatch related issues for Danish seine.
Protected species issues and interactions	As part of the previous ERA, it was estimated that 201 protected species occur within the area of the Commonwealth Trawl Sector. However, Danish seine operators interact with very few of these. Operators are required to report all interactions with protected species in their logbooks and AFMA reports quarterly to the Department of Environment and Energy. The highest number of interactions within the reference period occurred with syngnathids and seals. **Recorded wildlife interactions from the AFMA Logbook database for the period 2012-2016 inclusive. A: alive; D: dead.**
Habitat issues and interactions	Due to the nature of Danish seine and the species targeted, there are interactions with the seabed as part of fishing. Removal, modification or disturbance of seabed flora and fauna by these methods does occur. However, there are substantial closures in place which afford protection to large areas. Pitcher et al. (2016) showed that on average approximately 7.6 % of the available trawl grounds between 0-1500 m are trawled annually.
Community issues and interactions	By removing one species or size range of the population, in addition to changes to the community from which it is removed, there is a possibility that food web dynamics may change, for example increased prey populations, displacement by competing species, or predators having to find alternative food sources. Removals of particular species do drive changes to the ecosystem. For example, Klaer (2001) reported increases in the catch of some species by steam trawlers between 1918 and 1957 and decreases of other species.
Discarding	The level of discarding varies based on which area of the fishery a vessel is operating in and which species they are targeting. Fishing on the continental shelf for mixed species means operators will catch non-target species including undersized (non-marketable) target species. Discard rates in Danish seine are generally low for quota species, but high for non-quota species.
MANAGEMENT: PLANNED AND THOSE IMPLEMENTED	
Management objectives	The objectives of the Southern and Eastern Scalefish and Shark Fishery Management Plan 2003 (updated 4 May 2016) 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;

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	2012 A	2012 D	2013 A	2013 D	2014 A	2014 D	2015 A	2015 D	2016 A	2016 D	TOTAL A	TOTAL D
41131000	Otariidae - undifferentiated	Seal (unclassified)	3	6	3	6	1		4	3	1	5	12	20
37282000	Syngnathidae - undifferentiated	Seahorses and pipefish		70									0	70
37010001	*Isurus oxyrinchus*	Shortfin Mako		2		2		1				1	0	6
40041000	Procellariidae - undifferentiated	Petrels, Prions and Shearwaters			2	1							2	1
41131003	*Arctocephalus pusillus doriferus*	Australian Fur Seal					5		1		1	4	7	4

Source: AFMA and AFMA Wildlife Interaction Reports http://www.afma.gov.au/sustainability-environment/protected-species-management/protected-species-interaction-reports/

	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. 31 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 (i.e. Danish seine and otter trawl); 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. Other relevant management documents are: 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 AFMA 2017 Southern and Eastern Scalefish and Shark Fishery Management Arrangements Booklet: www.afma.gov.au/wp-content/uploads/2014/08/SESSF-Management-Arrangements-Booklet-2017.pdf 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): www.legislation.gov.au/Series/F2005B02463 Stock rebuilding strategies for conservation dependent species: a. School shark rebuilding strategy b. Upper Slope dogfish Management Strategy 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 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 (**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 8 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 8 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 the 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 trip limits in place for some byproduct species (**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. 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 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 *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act 1999), interactions with a protected species must be reported within seven days of the incident occurring to the Department of the Environment and Energy. A Memorandum of Understanding between AFMA and the Department for the Reporting of Fisheries Interactions with Protected Species streamlines those reporting requirements (2005 Reporting MOU). AFMA reports its protected species interactions to the Department of the Environment and Energy 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 the marine environment.

The Plans are updated every two years to ensure that they are kept current. These Plans outline some actions that have been incorporated in management arrangements. The SESSF CTS Bycatch and Discard Workplan is available at www.afma.gov.au/sustainability-environment/bycatch-discarding/bycatch-discard-workplans/

Another initiative is the 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 logbooks 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 South East Trawl Fishery. It provides port-based and at sea monitoring in the south-east trawl, south east non-trawl and Great Australian Bight 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 originally planned as a yearly summer and winter survey, however, have been carried during the winter of every second year in the Great Australian Bight Trawl and Commonwealth Trawl Sector. These surveys aim to provide an independent abundance index, 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 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 shark species taken by all sectors of the SESSF. GABRAG 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	$<B_{20}$: No targeted fishing, rebuild strategy required

				- FIS	
		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 several 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 Oceans and Atmosphere.

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 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.

Observer data

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 AFZ.

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.
- 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. **Observer coverage (%) in the CTS Danish seine sub-fishery by fishing season.** SESSF FISHING SEASON / NUMBER OF BOAT DAYS / NUMBER OF OBSERVED DAYS / OBSERVER COVERAGE (%) 2010-11 / 1554 / 22 / 1.42 2011-12 / 1572 / 24 / 1.53 2012-13 / 1561 / 14 / 0.90 2013-14 / 1694 / 24 / 1.42 2014-15 / 1970 / 22 / 1.12 2015-16 / 2127 / 20 / 0.94 2016-17 / 2006 / 25 / 1.25
Other data	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.
Legislative instruments and directions	Declaration of the Harvest Operations of the Southern and Eastern Scalefish and Shark Fishery as an approved wildlife trade operation, February 2016 www.environment.gov.au/biodiversity/wildlife-trade/trading/commercial/operations Environment Protection and Biodiversity Conservation Act 1999 www.legislation.gov.au/Series/C2004A00485 FAO Code of Conduct for Responsible Fisheries 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* *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
Management plans	**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:** 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/

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:	1 (C1); 1 (C2)
Byproduct and bycatch species:	35 (BP); 166 (BC)
Protected species:	63
Habitats:	22 (20 demersal, 2 pelagic)
Communities:	21 (16 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 Danish seine sub-fishery. AFMA: refers to AFMA Logbook and/or Observer data.

ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
C1	Teleost	Platycephalidae	37296001	*Platycephalus richardsoni*	Tiger flathead	AFMA
C2	Teleost	Sillaginidae	37330014	*Sillago flindersi*	Eastern school whiting	AFMA. Apportioned 37330000 to this species.

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 was obtained by reviewing available fishery literature where applicable (i.e. sharks, skates and rays: Last and Stevens 2009; Last et al. 2016), AFMA Logbook data and AFMA Observer data.

Table 2.4. Byproduct (BP) species list for the SESSF Danish seine sub-fishery. AFMA: refers to AFMA Logbook and/or Observer data.

ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
BP	Invertebrate	Sepiidae	23607002	*Sepia cultrata*	Cuttlefish	Added from Sepia spp (BP) recorded in logbooks
BP	Invertebrate	Sepiidae	23607005	*Sepia novaehollandiae*	Cuttlefish	Added from Sepia spp (BP) recorded in logbooks
BP	Invertebrate	Sepiidae	23607014	*Sepia braggi*	Cuttlefish	Added from Sepia spp (BP) recorded in logbooks
BP	Invertebrate	Sepiidae	23607021	*Sepia hedleyi*	Cuttlefish	Added from Sepia spp (BP) recorded in logbooks
BP	Invertebrate	Sepiidae	23607010	*Sepia rozella*	Rosecone cuttlefish	Added from Sepia spp (BP) recorded in logbooks
BP	Invertebrate	Sepiidae	23607036	*Sepia grahami*	Cuttlefish	Added from Sepia spp (BP) recorded in logbooks
BP	Invertebrate	Loliginidae	23617005	*Sepioteuthis australis*	Southern calamari	AFMA. Changed from BC after apportioning "Squids" catch
BP	Invertebrate	Ommastrephidae	23636004	*Nototodarus gouldi*	Gould's squid	AFMA
BP	Invertebrate	Octopodidae	23659004	*Octopus pallidus*	Pale octopus	AFMA. Apportioned Octopodidae to this species. This species changed from BC to BP.
BP	Chondrichthyan	Triakidae	37017001	*Mustelus antarcticus*	Gummy shark	AFMA. Apportioned 37017000 to this species.
BP	Chondrichthyan	Pristiophoridae	37023001	*Pristiophorus nudipinnis*	Southern sawshark	AFMA. Changed from BC after apportioning "sawsharks" catch
BP	Chondrichthyan	Pristiophoridae	37023002	*Pristiophorus cirratus*	Common sawshark	AFMA. Apportioned sawsharks to this species.
BP	Chondrichthyan	Squatinidae	37024001	*Squatina australis*	Australian angelshark	AFMA. Apportioned Angelsharks (37024000) catch to this species.
BP	Chondrichthyan	Rajidae	37031003	*Dentiraja cerva*	White-spotted skate	Now *Dentiraja cerva*. Apportioned skates group code to this species and 5 other species. Also apportioned "skates and rays" and 37990030 (Rajiformes) to this species.
BP	Chondrichthyan	Rajidae	37031005	*Dentiraja confusa*	Skate sp A	Now *Dentiraja confusa*. Updated from Dipturus confusus in 2016. Apportioned skates group code to this species and 5 other species. Also, apportioned 37990030 (Rajiformes) to this species.

ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
BP	Chondrichthyan	Rajidae	37031006	*Spiniraja whitleyi*	Melbourne skate	Apportioned skates group code to this species and 5 other species. Also apportioned "skates and rays" and 37990030 (Rajiformes) to this species.
BP	Chondrichthyan	Rajidae	37031007	*Dentiraja lemprieri*	Thornback skate	Apportioned skates group code to this species and 5 other species. Also apportioned "skates and rays" and 37990030 (Rajiformes) to this species.
BP	Chondrichthyan	Arhynchobatidae	37031009	*Pavoraja nitida*	Peacock skate	BP (species added as in depth range within fishery area apportioned added from Skates-37031000). Also, apportioned 37990030 (Rajiformes) to this species.
BP	Chondrichthyan	Rajidae	37031028	*Dipturus canutus*	Grey skate	Apportioned skates group code to this species and 5 other species. Also apportioned "skates and rays" and 37990030 (Rajiformes) to this species.
BP	Chondrichthyan	Myliobatidae	37039001	*Myliobatis australis*	Southern eagle ray	AFMA
BP	Chondrichthyan	Callorhinchidae	37043001	*Callorhinchus milii*	Elephantfish	AFMA
BP	Teleost	Ophidiidae	37228002	*Genypterus blacodes*	Pink ling	AFMA. Apportioned 37228999 (now 37228961- Ophidiidae - undifferentiated) to this species.
BP	Teleost	Zeidae	37264003	*Zenopsis nebulosus*	Mirror dory	AFMA
BP	Teleost	Zeidae	37264004	*Zeus faber*	John dory	AFMA
BP	Teleost	Triglidae	37288001	*Chelidonichthys kumu*	Red gurnard	AFMA. Apportioned from 37288000 and 37990084.
BP	Teleost	Triglidae	37288006	*Pterygotrigla polyommata*	Latchet	AFMA
BP	Teleost	Triglidae	37288007	*Lepidotrigla modesta*	Cocky gurnard	AFMA. Apportioned Lepidotrigla spp (Butterfly gurnard (mixed)) to this and two other L. spp. ERA classification for this species changed from BC to BP.
BP	Teleost	Sparidae	37353001	*Chrysophrys auratus*	Snapper	AFMA
BP	Teleost	Mullidae	37355001	*Upeneichthys lineatus*	Bluestriped goatfish	AFMA. Apportioned "Mullidae" to this species.
BP	Teleost	Cheilodactylidae	37377003	*Nemadactylus macropterus*	Jackass morwong	AFMA
BP	Teleost	Scombridae	37441001	*Scomber australasicus*	Blue mackerel	AFMA. Changed from BC to BP. Added 37441911 (Scombida)
BP	Teleost	Centrolophidae	37445005	*Seriolella brama*	Blue warehou	AFMA
BP	Teleost	Monacanthidae	37465006	*Nelusetta ayraudi*	Ocean jacket	AFMA. Apportioned Moncanthidae/Balistidae catch to this species.
BP	Chondrichthyan	Dasyatidae	37035001	*Bathytoshia brevicaudata*	Short-tail stingray	Apportioned "skates and rays" to this spp. No change from BC. Also, apportioned "Dasyatidae: 37035000 to this species.
BP	Chondrichthyan	Dasyatidae	37035002	*Bathytoshia lata*	Thorntail stingray	Apportioned "skates and rays" to this spp. Also, apportioned "Dasyatidae: 37035000 to this species.

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 Danish seine sub-fishery. AFMA: refers to AFMA Logbook and/or Observer data.

ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
BC	Invertebrate	Pectinidae	23270006	*Mimachlamys asperrima*	Doughboy scallop	AFMA
BC	Invertebrate	Volutidae	24207001	*Livonia mammilla*	False bailer shell	AFMA. Apportioned "shells" to this species and 24207072
BC	Invertebrate	Volutidae	24207072	*Melo miltonis*	Southern bailer shell	AFMA. Apportioned "shells" to this species and 24207001
BC	Invertebrate	Asterodiscididae	25128001	*Asterodiscides truncatus*	Firebrick seastar	AFMA
BC	Invertebrate	Penaeidae	28711052	*Melicertus plebejus*	Eastern king prawn	AFMA
BC	Invertebrate	Solenoceridae	28714005	*Haliporoides sibogae*	Royal red prawn	AFMA
BC	Invertebrate	Palinuridae	28820001	*Jasus edwardsii*	Southern rocklobster	AFMA
BC	Invertebrate	Scyllaridae	28821003	*Ibacus novemdentatus*	Balmain bug	AFMA. Apportioned 28821000 to this species and to eastern Balmain bug.
BC	Invertebrate	Scyllaridae	28821004	*Ibacus peronii*	Eastern Balmain bug	AFMA. Apportioned 28821000 to this species and to Balmain bug.
BC	Invertebrate	Polybiidae	28911003	*Ovalipes australiensis*	Common sand crab	AFMA
BC	Invertebrate	Menippidae	28915002	*Pseudocarcinus gigas*	Giant crab	AFMA
BC	Chondrichthyan	Hexanchidae	37005001	*Heptranchias perlo*	Sharpnose sevengill shark	AFMA. Apportioned 37005000 to this species and two other species.
BC	Chondrichthyan	Hexanchidae	37005002	*Notorynchus cepedianus*	Broadnose shark	AFMA. Apportioned 37005000 to this species and two other species.
BC	Chondrichthyan	Hexanchidae	37005005	*Hexanchus griseus*	Bluntnose sixgill shark	Added this species from Hexanchidae (37005000). Also apportioned hexanchidae to existing 2 species within list
BC	Chondrichthyan	Heterodontidae	37007001	*Heterodontus portusjacksoni*	Port Jackson shark	AFMA
BC	Chondrichthyan	Alopiidae	37012001	*Alopias vulpinus*	Thresher shark	Added from 37012901
BC	Chondrichthyan	Alopiidae	37012002	*Alopias superciliosus*	Bigeye thresher	Added from 37012901

ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
BC	Chondrichthyan	Parascylliidae	37013002	*Parascyllium collare*	Collared carpetshark	Apportion 37013000 to this species and one other existing species within list. Also added 4 new species that occur under this CAAB group code
BC	Chondrichthyan	Orectolobidae	37013003	*Orectolobus maculatus*	Spotted wobbegong	Added from 37013000
BC	Chondrichthyan	Parascylliidae	37013004	*Parascyllium variolatum*	Varied carpetshark	Added from 37013000
BC	Chondrichthyan	Parascylliidae	37013005	*Parascyllium ferrugineum*	Rusty carpetshark	Apportion 3701300 to this species and one other existing species within list. Also added 4 new species that occur under this group CAAB code
BC	Chondrichthyan	Stegostomatidae	37013006	*Stegostoma fasciatum*	Zebra shark	Added from 37013000
BC	Chondrichthyan	Orectolobidae	37013020	*Orectolobus halei*	Gulf wobbegong	Added from 37013000
BC	Chondrichthyan	Scyliorhinidae	37015001	*Cephaloscyllium laticeps*	Draughtboard shark	AFMA. Apportioned 37015906 to this species. Also, apportioned 37015000 to this species.
BC	Chondrichthyan	Scyliorhinidae	37015003	*Asymbolus vincenti*	Gulf catshark	Apportioned 37015000 to this species. No change to ERA classification.
BC	Chondrichthyan	Scyliorhinidae	37015013	*Cephaloscyllium albipinnum*	Whitefin swellshark	AFMA. Apportioned 37015906 to this species. Also, apportioned 37015000 to this species.
BC	Chondrichthyan	Scyliorhinidae	37015024	*Asymbolus rubiginosus*	Orange spotted catshark	Apportioned 37015000 to this species. No change to ERA classification.
BC	Chondrichthyan	Scyliorhinidae	37015027	*Asymbolus analis*	Australian spotted catshark	Apportioned 37015000 to this species. No change to ERA classification.
BC	Chondrichthyan	Triakidae	37017008	*Galeorhinus galeus*	School shark	AFMA. Apportioned 37017000 to this species. No change to ERA classification.
BC	Chondrichthyan	Carcharhinidae	37018001	*Carcharhinus brachyurus*	Bronze whaler	AFMA
BC	Chondrichthyan	Carcharhinidae	37018021	*Carcharhinus leucas*	Bull shark	AFMA
BC	Chondrichthyan	Carcharhinidae	37018022	*Galeocerdo cuvier*	Tiger shark	AFMA
BC	Chondrichthyan	Sphyrnidae	37019004	*Sphyrna zygaena*	Smooth hammerhead	AFMA
BC	Chondrichthyan	Squalidae	37020006	*Squalus megalops*	Piked spurdog	AFMA. Apportioned 37020000, 37020901, 37020923 and 37990071 to this species.
BC	Chondrichthyan	Squalidae	37020008	*Squalus acanthias*	Whitespotted spurdog	Apportioned 37020000, 37020901, 37020923 and 37990071 to this species.
BC	Chondrichthyan	Squalidae	37020048	*Squalus chloroculus*	Greeneye spurdog	AFMA. Apportioned 37020000, 37020901, 37020923 and 37990071 to this species.
BC	Chondrichthyan	Squatinidae	37024004	*Squatina albipunctata*	Squatina sp A	AFMA. Apportioned Angelsharks (37024000) catch to this species.
BC	Chondrichthyan	Trygonorrhinidae	37027001	*Aptychotrema vincentiana*	Western shovelnose ray	AFMA

ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
BC	Chondrichthyan	Trygonorrhinidae	37027006	*Trygonorrhina fasciata*	Eastern fiddler ray	AFMA. Apportioned 37027906 to this species and to southern fiddler ray.
BC	Chondrichthyan	Trygonorrhinidae	37027011	*Trygonorrhina dumerilii*	Southern fiddler ray	Apportioned 37027906 to this species and to eastern fiddler ray.
BC	Chondrichthyan	Narcinidae	37028002	*Narcine tasmaniensis*	Tasmanian numbfish	AFMA
BC	Chondrichthyan	Torpedinidae	37028003	*Tetronarce nobiliana*	Short-tail torpedo ray	AFMA
BC	Chondrichthyan	Urolophidae	37038001	*Urolophus bucculentus*	Sandyback stingaree	Apportioned "skates and rays" to this species.
BC	Chondrichthyan	Urolophidae	37038002	*Urolophus cruciatus*	Crossback stingaree	Apportioned "skates and rays" to this species.
BC	Chondrichthyan	Urolophidae	37038004	*Urolophus paucimaculatus*	Sparsely spotted stingaree	Apportioned "skates and rays" to this species.
BC	Chondrichthyan	Urolophidae	37038005	*Urolophus sufflavus*	Yellowback stingaree	Apportioned "skates and rays" to this species.
BC	Chondrichthyan	Urolophidae	37038006	*Trygonoptera testacea*	Common stingaree	Apportioned "skates and rays" to this species.
BC	Chondrichthyan	Urolophidae	37038007	*Urolophus viridis*	Greenback stingaree	Apportioned "skates and rays" to this species.
BC	Teleost	Congridae	37067001	*Conger wilsoni*	Eastern conger	Added from 37067000
BC	Teleost	Congridae	37067007	*Conger verreauxi*	Southern conger	Added from 37067001
BC	Teleost	Clupeidae	37085002	*Sardinops sagax*	Australian sardine	AFMA
BC	Teleost	Aulopidae	37117001	*Aulopus purpurissatus*	Sergeant baker	AFMA
BC	Teleost	Synodontidae	37118002	*Trachinocephalus trachinus*	Snakefish	AFMA
BC	Teleost	Paraulopidae	37120001	*Paraulopus nigripinnis*	Blacktip cucumberfish	AFMA
BC	Teleost	Gonorynchidae	37141001	*Gonorynchus greyi*	Beaked salmon	AFMA
BC	Teleost	Plotosidae	37192001	*Cnidoglanis macrocephalus*	Estuary cobbler	AFMA
BC	Teleost	Ogcocephalidae	37212001	*Halieutaea brevicauda*	Shortfin seabat	AFMA
BC	Teleost	Moridae	37224003	*Pseudophycis barbata*	Bearded rock cod	AFMA. Apportioned 37224900 catch to this species and 4 other species.
BC	Teleost	Moridae	37224005	*Lotella rhacina*	Largetooth beardie	Added species from 37224900
BC	Teleost	Moridae	37224006	*Pseudophycis bachus*	Red cod	AFMA. Apportioned 37224900 catch to this species and 4 other species.
BC	Teleost	Moridae	37224011	*Pseudophycis breviuscula*	Bastard red cod	Added species from 37224900
BC	Teleost	Moridae	37224023	*Lotella phycis*	Slender beardie	Added species from 37224900
BC	Teleost	Macruronidae	37227001	*Macruronus novaezelandiae*	Blue grenadier	AFMA
BC	Teleost	Ophidiidae	37228008	*Genypterus tigerinus*	Rock ling	AFMA. Apportioned 37228999 (now 37228961- Ophidiidae - undifferentiated) to this species.
BC	Teleost	Carapidae	37229003	*Echiodon rendahli*	Messmate fish	AFMA

ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
BC	Teleost	Macrouridae	37232001	*Coelorinchus australis*	Southern whiptail	Apportioned 37232000 to this species.
BC	Teleost	Berycidae	37258002	*Beryx splendens*	Alfonsino	AFMA
BC	Teleost	Berycidae	37258003	*Centroberyx affinis*	Redfish	AFMA
BC	Teleost	Berycidae	37258004	*Centroberyx gerrardi*	Bight redfish	AFMA
BC	Teleost	Cyttidae	37264001	*Cyttus traversi*	King dory	AFMA
BC	Teleost	Cyttidae	37264002	*Cyttus australis*	Silver dory	AFMA
BC	Teleost	Cyttidae	37264005	*Cyttus novaezealandiae*	New Zealand dory	AFMA
BC	Teleost	Zeidae	37264010	*Cyttopsis rosea*	Rosy dory	AFMA
BC	Teleost	Oreosomatidae	37266001	*Neocyttus rhomboidalis*	Spikey oreodory	AFMA
BC	Teleost	Oreosomatidae	37266005	*Allocyttus niger*	Black oreodory	AFMA
BC	Teleost	Lampridae	37268001	*Lampris guttatus*	Opah	Added from 37268900
BC	Teleost	Fistulariidae	37278001	*Fistularia commersonii*	Smooth flutemouth	Added from 37278000, as no species within list to account catch
BC	Teleost	Fistulariidae	37278002	*Fistularia petimba*	Rough flutemouth	Added from 37278000, as no species within list to account catch
BC	Teleost	Macroramphosidae	37279002	*Macroramphosus scolopax*	Common bellowsfish	AFMA. Apportioned catch from 37279000.
BC	Teleost	Sebastidae	37287001	*Helicolenus percoides*	Reef ocean perch	AFMA
BC	Teleost	Neosebastidae	37287005	*Neosebastes scorpaenoides*	Common gurnard perch	AFMA
BC	Teleost	Neosebastidae	37287006	*Neosebastes thetidis*	Thetis fish	AFMA
BC	Teleost	Neosebastidae	37287007	*Maxillicosta scabriceps*	Little gurnard perch	Apportioned from 37288000 and 37990084.
BC	Teleost	Scorpaenidae	37287008	*Scorpaena papillosa*	Southern red scorpionfish	Apportioned 37287904 and 37990084 to this species.
BC	Teleost	Tetrarogidae	37287048	*Centropogon australis*	Eastern fortescue	AFMA
BC	Teleost	Sebastidae	37287093	*Helicolenus barathri*	Bigeye ocean perch	AFMA
BC	Teleost	Triglidae	37288002	*Lepidotrigla papilio*	Spiny gurnard	Added from 37990084
BC	Teleost	Triglidae	37288003	*Lepidotrigla vanessa*	Butterfly gurnard	Apportioned *Lepidotrigla* spp (Butterfly gurnard (mixed)) to this and two other *L.* spp. Also, apportioned from 37288000 and 37990084.
BC	Teleost	Triglidae	37288005	*Pterygotrigla andertoni*	Painted latchet	AFMA
BC	Teleost	Triglidae	37288008	*Lepidotrigla mulhalli*	Roundsnout gurnard	Apportioned *Lepidotrigla* spp (Butterfly gurnard (mixed)) to this and two other *L.* spp. Also, apportioned from 37288000 and 37990084.
BC	Teleost	Peristediidae	37288012	*Satyrichthys cf moluccense*	Blackfin armour gurnard	AFMA. Apportioned 37288000 and 37990084.

ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
BC	Teleost	Triglidae	37288032	*Lepidotrigla argus*	Eye gurnard	Added from 37990085
BC	Teleost	Platycephalidae	37296002	*Platycephalus conatus*	Deepwater flathead	AFMA
BC	Teleost	Platycephalidae	37296003	*Platycephalus bassensis*	Southern sand flathead	AFMA
BC	Teleost	Platycephalidae	37296004	*Platycephalus fuscus*	Dusky flathead	AFMA
BC	Teleost	Platycephalidae	37296007	*Platycephalus caeruleopunctatus*	Bluespotted flathead	AFMA
BC	Teleost	Platycephalidae	37296035	*Platycephalus aurimaculatus*	Toothy flathead	AFMA
BC	Teleost	Platycephalidae	37296036	*Platycephalus longispinis*	Longspine flathead	AFMA
BC	Teleost	Platycephalidae	37296037	*Platycephalus speculator*	Southern bluespotted flathead	AFMA
BC	Teleost	Platycephalidae	37296038	*Platycephalus marmoratus*	Marbled flathead	AFMA
BC	Teleost	Hoplichthyidae	37297001	*Hoplichthys haswelli*	Deepsea flathead	AFMA
BC	Teleost	Serranidae	37311001	*Lepidoperca pulchella*	Eastern orange perch	AFMA
BC	Teleost	Serranidae	37311002	*Caesioperca lepidoptera*	Butterfly perch	AFMA
BC	Teleost	Serranidae	37311003	*Caesioperca rasor*	Barber perch	AFMA
BC	Teleost	Polyprionidae	37311006	*Polyprion oxygeneios*	Hapuku	AFMA
BC	Teleost	Serranidae	37311022	*Epinephelus rivulatus*	Chinaman rockcod	Apportioned 2658 kg to this species (from 37311901) and one other species. This code also includes *Epinephelus* genus.
BC	Teleost	Acropomatidae	37311053	*Apogonops anomalus*	Three-spined cardinalfish	AFMA
BC	Teleost	Serranidae	37311077	*Epinephelus daemelii*	Black rockcod	Apportioned 2658 kg to this species (from 37311901) and one other species. This code also includes *Epinephelus* genus.
BC	Teleost	Sillaginidae	37330001	*Sillaginodes punctata*	King George whiting	AFMA. Apportioned 37330000 to this species.
BC	Teleost	Sillaginidae	37330002	*Sillago bassensis*	Southern school whiting	Added from 37330000
BC	Teleost	Sillaginidae	37330005	*Sillago robusta*	Stout whiting	Added from 37330003
BC	Teleost	Sillaginidae	37330010	*Sillago ciliata*	Sand whiting	Added from 37330001
BC	Teleost	Sillaginidae	37330015	*Sillago maculata*	Trumpeter whiting	Added from 37330002
BC	Teleost	Carangidae	37337002	*Trachurus declivis*	Common Jack mackerel	AFMA
BC	Teleost	Carangidae	37337003	*Trachurus novaezelandiae*	Yellowtail scad	AFMA
BC	Teleost	Carangidae	37337006	*Seriola lalandi*	Yellowtail kingfish	AFMA

ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
BC	Teleost	Carangidae	37337062	*Pseudocaranx georgianus*	Silver trevally	AFMA
BC	Teleost	Arripidae	37344002	*Arripis trutta*	Eastern Australian salmon	Added from 37344900
BC	Teleost	Arripidae	37344004	*Arripis truttaceus*	Western Australian salmon	Added from 37344900
BC	Teleost	Gerreidae	37349001	*Parequula melbournensis*	Silverbelly	Added 37349000.
BC	Teleost	Mullidae	37355029	*Upeneichthys vlamingii*	Bluespotted goatfish	Apportioned Mullidae to this species.
BC	Teleost	Pentacerotidae	37367002	*Paristiopterus labiosus*	Giant boarfish	AFMA. Apportioned Boarfishes to this species and three other species within list.
BC	Teleost	Pentacerotidae	37367003	*Pentaceropsis recurvirostris*	Longsnout boarfish	AFMA
BC	Teleost	Pentacerotidae	37367004	*Pentaceros decacanthus*	Bigspine boarfish	AFMA
BC	Teleost	Pentacerotidae	37367005	*Zanclistius elevatus*	Blackspot boarfish	AFMA
BC	Teleost	Oplegnathidae	37369002	*Oplegnathus woodwardi*	Knifejaw	AFMA
BC	Teleost	Cheilodactylidae	37377002	*Nemadactylus douglasii*	Grey morwong	AFMA
BC	Teleost	Cheilodactylidae	37377004	*Nemadactylus valenciennesi*	Blue morwong	AFMA
BC	Teleost	Latridae	37378001	*Latris lineata*	Striped trumpeter	AFMA. Apportioned 37378900 to this species.
BC	Teleost	Latridae	37378002	*Latridopsis forsteri*	Bastard trumpeter	AFMA. Apportioned 37378900 to this species.
BC	Teleost	Sphyraenidae	37382002	*Sphyraena novaehollandiae*	Snook	BC. Added from 37382901
BC	Teleost	Odacidae	37385009	*Haletta semifasciata*	Blue weed whiting	AFMA
BC	Teleost	Pinguipedidae	37390001	*Parapercis allporti*	Barred grubfish	AFMA
BC	Teleost	Uranoscopidae	37400001	*Xenocephalus armatus*	Bulldog stargazer	AFMA
BC	Teleost	Uranoscopidae	37400003	*Kathetostoma laeve*	Common stargazer	AFMA
BC	Teleost	Uranoscopidae	37400018	*Kathetostoma canaster*	Speckled stargazer	AFMA
BC	Teleost	Callionymidae	37427001	*Foetorepus calauropomus*	Common stinkfish	AFMA
BC	Teleost	Gempylidae	37439001	*Thyrsites atun*	Barracouta	AFMA. Apportioned *Thyrsites* spp. To this species.
BC	Teleost	Gempylidae	37439002	*Rexea solandri*	Gemfish	AFMA
BC	Teleost	Trichiuridae	37440002	*Lepidopus caudatus*	Frostfish	AFMA. Apportioned 3744000 to this species.
BC	Teleost	Centrolophidae	37445001	*Hyperoglyphe antarctica*	Blue-eye trevalla	AFMA
BC	Teleost	Centrolophidae	37445006	*Seriolella punctata*	Silver warehou	AFMA

ROLE IN FISHERY	TAXA NAME	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
BC	Teleost	Bothidae	37460001	*Lophonectes gallus*	Crested flounder	Apportioned 37990009 to this species and 3 other species.
BC	Teleost	Paralichthyidae	37460009	*Pseudorhombus arsius*	Largetooth flounder	Apportioned 37990009 to this species and 3 other species.
BC	Teleost	Pleuronectidae	37461001	*Ammotretis rostratus*	Longsnout flounder	Apportioned 37990009 to this species and 3 other species.
BC	Teleost	Pleuronectidae	37461003	*Rhombosolea tapirina*	Greenback flounder	Apportioned 37990009 to this species and 3 other species.
BC	Teleost	Soleidae	37462010	*Zebrias scalaris*	Manyband sole	Apportioned catch of 3799015 to this species and two other new species (family Soleidae; 37462017).
BC	Teleost	Soleidae	37462017	*Brachirus nigra*	Black sole	Added species from 37990015 (Cynogloddidae and Soleidae). Apportioned catch from 37990015 to this species and 37462010.
BC	Teleost	Monacanthidae	37465002	*Acanthaluteres vittiger*	Toothbrush leatherjacket	Apportioned Moncanthidae/Balistidae catch to this species.
BC	Teleost	Monacanthidae	37465003	*Eubalichthys mosaicus*	Mosaic leatherjacket	Apportioned Moncanthidae/Balistidae catch to this species.
BC	Teleost	Monacanthidae	37465005	*Meuschenia scaber*	Velvet leatherjacket	Apportioned Moncanthidae/Balistidae catch to this species.
BC	Teleost	Monacanthidae	37465007	*Scobinichthys granulatus*	Rough leatherjackets	Apportioned Moncanthidae/Balistidae catch to this species.
BC	Teleost	Monacanthidae	37465034	*Eubalichthys gunnii*	Gunn's leatherjacket	Apportioned Moncanthidae/Balistidae catch to this species.
BC	Teleost	Monacanthidae	37465036	*Meuschenia freycineti*	Sixspine leatherjacket	Apportioned Moncanthidae/Balistidae catch to this species.
BC	Teleost	Monacanthidae	37465037	*Thamnaconus degeni*	Bluefin leatherjacket	Apportioned Moncanthidae/Balistidae catch to this species.
BC	Teleost	Ostraciidae	37466001	*Aracana ornata*	Ornate cowfish	AFMA
BC	Teleost	Ostraciidae	37466002	*Anoplocapros inermis*	Eastern smooth boxfish	AFMA
BC	Teleost	Ostraciidae	37466003	*Aracana aurita*	Shaw's cowfish	AFMA
BC	Teleost	Ostraciidae	37466004	*Lactoria cornuta*	Longhorn cowfish	AFMA
BC	Teleost	Tetraodontidae	37467001	*Contusus richei*	Barred toadfish	Apportioned 37467000 to this species and two others.
BC	Teleost	Tetraodontidae	37467005	*Arothron firmamentum*	Starry toado	Apportioned 37467000 to this species and two others.
BC	Teleost	Tetraodontidae	37467044	*Contusus brevicaudus*	Prickly toadfish	Apportioned 37467000 to this species and two others.
BC	Teleost	Diodontidae	37469001	*Diodon nicthemerus*	Globefish	AFMA
BC	Teleost	Diodontidae	37469002	*Allomycterus pilatus*	Deepwater burrfish	AFMA
BC	Teleost	Diodontidae	37469013	*Dicotylichthys punctulatus*	Three-barred porcupinefish	AFMA
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 and SAFE (chondrichthyans) 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); marine birds: Menkhorst et al. (2017), Reid et al. (2002); 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 2.6. Protected species (PS) list for the SESSF Danish seine sub-fishery. AFMA: refers to AFMA Logbook and/or Observer data.

ROLE IN FISHERY	TAXA	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
PS	Chondrichthyan	Lamnidae	37010001	*Isurus oxyrinchus*	Shortfin mako	AFMA
PS	Teleost	Solenostomidae	37281002	*Solenostomus paradoxus*	Harlequin ghost pipefish, Ornate ghost pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282001	*Phycodurus eques*	Leafy seadragon	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282002	*Phyllopteryx taeniolatus*	Weedy seadragon, Common seadragon	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282008	*Urocampus carinirostris*	Hairy pipefish	Expanded from Syngnathidae - undifferentiated

[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).

ROLE IN FISHERY	TAXA	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
PS	Teleost	Syngnathidae	37282009	*Lissocampus runa*	Javelin pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282010	*Hippocampus bleekeri*	pot bellied seahorse	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282011	*Histiogamphelus briggsii*	Briggs' crested pipefish, Briggs' pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282012	*Hypselognathus rostratus*	Knife-snouted pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282013	*Leptoichthys fistularius*	Brushtail pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282014	*Kaupus costatus*	Deep-bodied pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282015	*Mitotichthys semistriatus*	Half-banded pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282016	*Lissocampus caudalis*	Australian smooth pipefish, Smooth pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282017	*Stigmatopora argus*	Spotted pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282018	*Stigmatopora nigra*	Wide-bodied pipefish, Black pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282019	*Stipecampus cristatus*	Ring-backed pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282021	*Pugnaso curtirostris*	Pug-nosed pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282022	*Mitotichthys mollisoni*	Mollison's pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282023	*Vanacampus phillipi*	Port Phillip pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282024	*Vanacampus poecilolaemus*	Australian long-snout pipefish, long-snouted pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282025	*Mitotichthys tuckeri*	Tucker's pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282026	*Hippocampus breviceps*	Short-head seahorse, Short-snouted seahorse	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282029	Solegnathus spinosissimus	Spiny pipehorse	AFMA
PS	Teleost	Syngnathidae	37282055	*Cosmocampus howensis*	Lord Howe pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282061	*Festucalex cinctus*	Girdled pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282064	*Filicampus tigris*	Tiger pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282071	*Heraldia nocturna*	Upside-down pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282075	*Hippichthys penicillus*	Beady pipefish, Steep-nosed pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282083	*Kimblaeus bassensis*	Trawl pipefish, Kimbla pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282085	*Maroubra perserrata*	Sawtooth pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282095	*Notiocampus ruber*	Red pipefish	Expanded from Syngnathidae - undifferentiated

ROLE IN FISHERY	TAXA	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
PS	Teleost	Syngnathidae	37282102	*Vanacampus margaritifer*	Mother-of-pearl pipefish	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282105	*Hippocampus minotaur*	Bullneck seahorse	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282120	*Hippocampus abdominalis*	Big-bellied / southern potbellied seahorse	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282127	*Idiotropiscis lumnitzeri*	Sydney's pygmy pipehorse	Expanded from Syngnathidae - undifferentiated
PS	Teleost	Syngnathidae	37282130	*Heraldia sp. 1* [in Kuiter, 2009]	Western upsidedown pipefish	Expanded from Syngnathidae - undifferentiated
PS	Marine bird	Procellariidae	40041004	*Fulmarus glacialoides*	Southern fulmar	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041005	*Halobaena caerulea*	Blue petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041007	*Macronectes giganteus*	Southern giant-petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041008	*Macronectes halli*	Northern giant-petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041009	*Pachyptila belcheri*	Slender-billed prion	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041011	*Pachyptila desolata*	Antarctic prion	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041012	*Pachyptila salvini*	Salvin's prion	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041013	*Pachyptila turtur*	Fairy prion	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041017	*Pelecanoides urinatrix*	Common diving-petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041018	*Procellaria aequinoctialis*	White-chinned Petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041019	*Procellaria cinerea*	Grey Petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041028	*Pterodroma inexpectata*	Mottled petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041029	*Pterodroma lessonii*	White-headed petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041030	*Pterodroma leucoptera*	Gould's petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041031	*Pterodroma macroptera*	Great-Winged Petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041032	*Pterodroma mollis*	Soft-plumaged petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041035	*Pterodroma solandri*	Providence petrel	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041036	*Puffinus assimilis*	Little shearwater	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041037	*Puffinus bulleri*	Buller's shearwater	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041038	*Puffinus carneipes*	Flesh-footed shearwater	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041040	*Puffinus gavia*	Fluttering shearwater	Expanded from Procellaridae - undifferentiated

ROLE IN FISHERY	TAXA	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
PS	Marine bird	Procellariidae	40041042	*Puffinus griseus*	Sooty shearwater	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041043	*Puffinus huttoni*	Hutton's shearwater	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041045	*Puffinus pacificus*	Wedge-tailed shearwater	Expanded from Procellaridae - undifferentiated
PS	Marine bird	Procellariidae	40041047	*Puffinus tenuirostris*	Short Tailed shearwater	AFMA
PS	Marine mammal	Otariidae	41131001	*Arctocephalus forsteri*	Longnosed fur seal	AFMA
PS	Marine mammal	Otariidae	41131003	*Arctocephalus pusillus doriferus*	Australian fur seal	AFMA

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; Pitcher et al. 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. The temporal range of the fishery effort data of Pitcher et al. (2016) was from 1985 -~2012 is immediately prior to this current assessment period and was considered very relevant. The new data and methodology are not directly mappable to the original analyses but these assessments are more comprehensive than the previous one, and will therefore be used in preference to the original scoping of habitats.

Although the new assessment was conducted for the trawl fisheries, the identification of vulnerable habitats within assemblages is also relevant when assessing other fishing methods in the region. By overlaying the fishery footprint over the assemblage distribution maps, we identified those containing vulnerable habitats that may be at particular risk. For the Danish seine fishery, we used the SET otter trawl region (

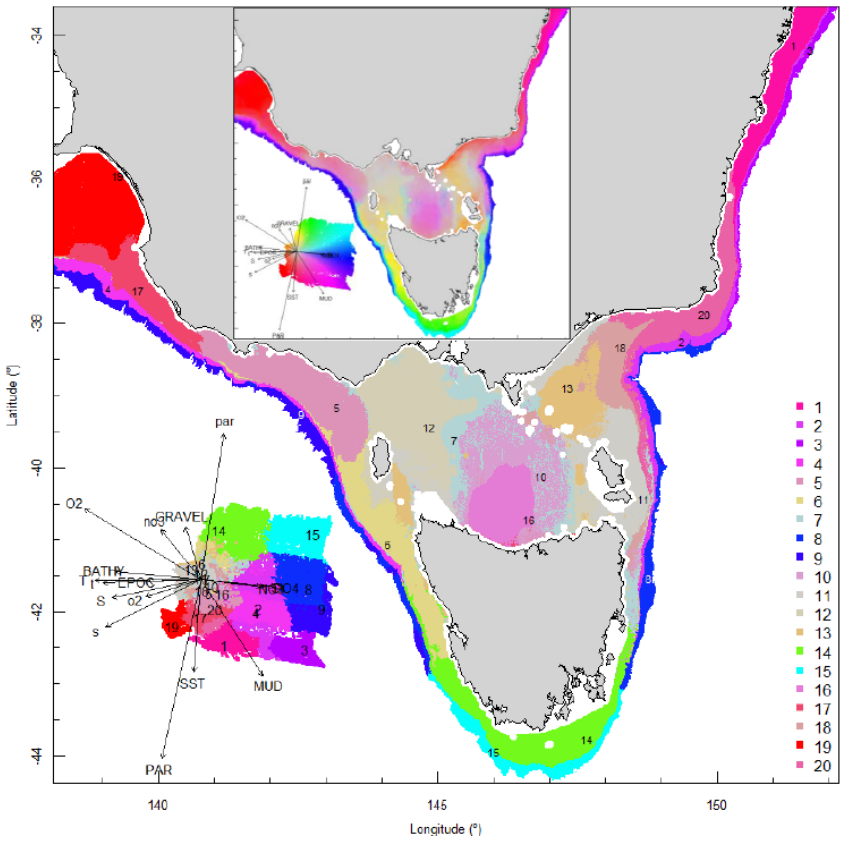


Figure 2.1).

The most vulnerable types of habitats were identified in Williams et al. 2011 and Pitcher et al. 2016 and their locations were identified by A. Williams (CSIRO) (pers. comm. 19 Feb 2018) as follows:

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

The lack of evidence to prove direct impact from Danish seining 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.

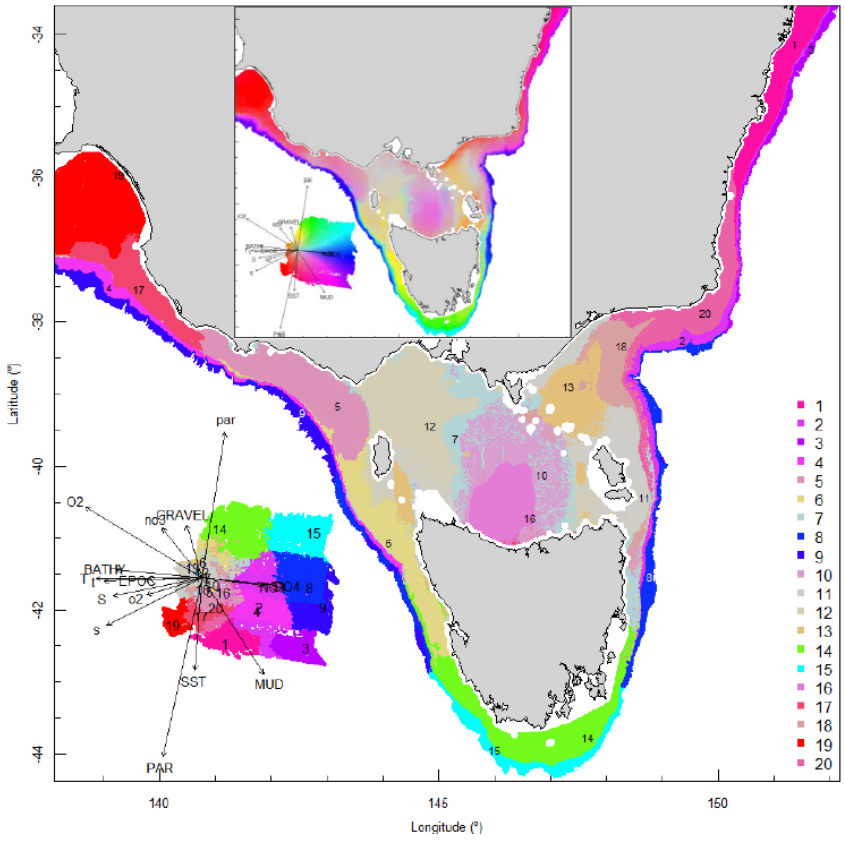


Figure 2.1. Map of the SESSF otter trawl region showing the 20 assemblages derived by Pitcher et al. 2016 (Excerpt from Pitcher et al. 2016). Each of the assemblages are now used as proxies for habitat in the assessment.

The previous ERAEF assessment of the Danish seine fishery (Wayte at al. 2006) found that the outer shelf habitats were most at risk. High risk habitats on the outer shelf were hard bottom types covered with erect or delicate epifauna and soft bottom habitats covered with large, erect or delicate epifauna (Williams et al. 2011). Epifauna were sponges, crinoids, octocorals, sedimentary animals or mixed fauna (Williams et al. 2011). The effort data for the Danish seine fishery indicated that the greatest concentration of fishing was in the eastern Bass Strait, on whole continental shelf off Gippsland around to Eden and on the outer shelf/shelf break of Canyons and east of Flinders Island. These areas correlate to primarily SET assemblages 18, 20 and potentially 2 (Table 2.7). Asemblages 20 and 2 contain vulnerable habitats. Fishing also occurred west of Wilson's Promonotry into the western Bass Strait within assemblages 12 and 7 but at lower intensity than in the east. Pitcher et al. (2016) did not characterise any vulnerable habitats in those assemblages.

Table 2.7. Benthic habitats that occur within the jurisdictional boundary of the SESSF Danish seine sub-fishery. The details of these assemblages were not available at the time of assessment. While records suggest Danish seine operations occurred across some of these assemblages (shaded) it was not possible to determine exactly the overlap with these assemblages.

BIOME	ASSEMBLAGE	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	
	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 Danish seine 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 Communities (1), (2), and (3)	ERA pelagic habitat database based on pelagic communities definitions
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

ERAEF PELAGIC HABITAT NO.	PELAGIC HABITAT TYPE	DEPTH (M)	COMMENTS	SOURCE
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 Northeastern 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 based on the spatial overlap with effort in the fishery. The spatial boundaries for demersal communities are based on IMCRA boundaries for the shelf, and on slope bioregionalisations for the slope (IMCRA 1998; Last et al. 2005). The spatial boundaries for the pelagic communities are based on pelagic bioregionalisations and on oceanography (Condie et al. 2003; Lyne and Hayes 2004). Fishery and region specific modifications to these boundaries are described in detail in Hobday et al. (2007) and briefly outlined in the footnotes to the community Tables below.

Table 2.9. Demersal communities that underlie the pelagic communities in which fishing activity occurred in the SESSF Danish seine sub-fishery (x). Shaded cells indicate all communities within the province. Bold crosses refer to communities where fishing actually occurred in the SESSF Danish seine 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										
Outer Shelf 110 – 250m [1,2,]					x	x		x											
Upper Slope 250 – 565m [3]						x		x											
Mid–Upper Slope 565 – 820m[3]						x													
Mid Slope 820 – 1100m[3]						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																			

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 820 – 1100m																			
Seamount 1100 – 3000m																			
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.

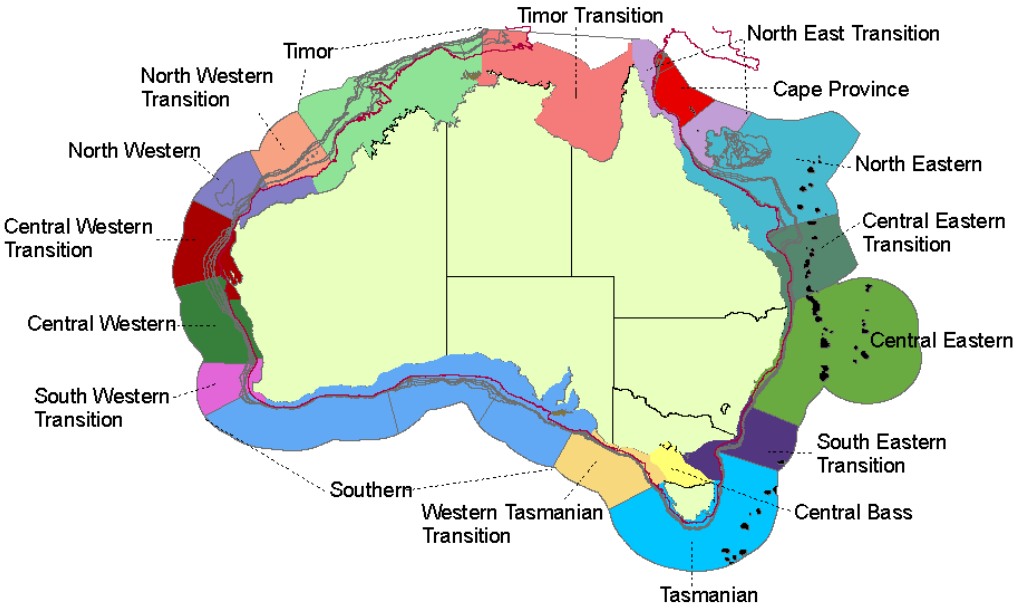
Scoping Document S2C2. Pelagic Communities

Table 2.10. Pelagic communities in which fishing activity occurs in the SESSF Danish seine 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								
Oceanic (2) >600m								
Seamount oceanic (1) 0 – 600m								
Seamount oceanic (2) 600–3000m								
Oceanic (1) 0 – 200m			x					
Oceanic (2) 200-600m			x					
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)

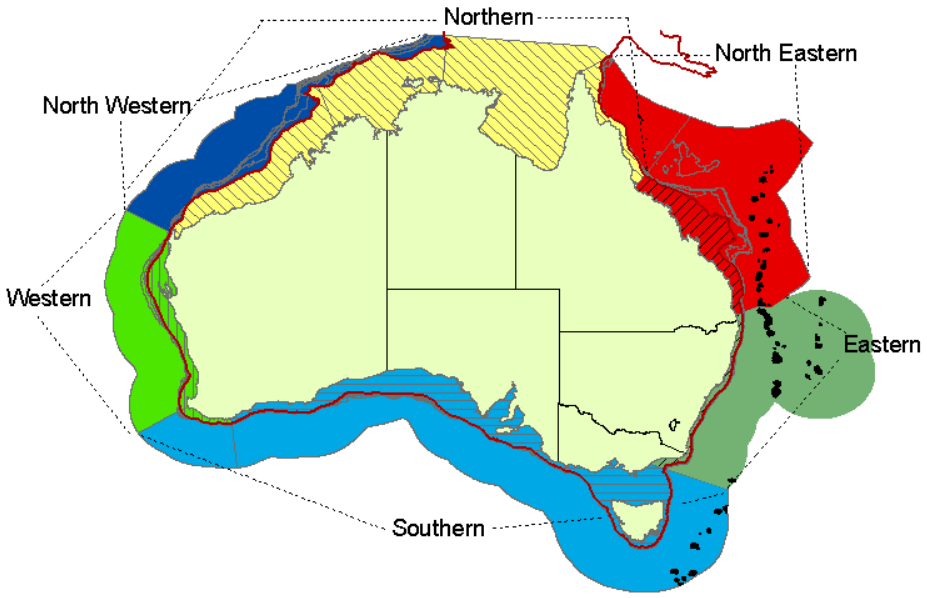


Figure 2.2 (a) Demersal communities around mainland Australia based on bioregionalisation schema. Some inshore (0-110 m) communities comprise more than one community e.g. Timor Transition comprises 4 distinct communities. (b) Australian pelagic provinces. Hatched areas indicate coastal epipelagic zones 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 Management 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 commerical 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)). In general these objectives underlie the sustainable management of the Fishery, for both target bait and target species.
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity does not change outside acceptable bounds	Presence of population across the known distribution range	2.1 Not currently monitored. No specific management objective based on the geographic range of key/secondary commercial species.
		3. Genetic structure	3.1 Genetic diversity does not change outside acceptable bounds	Frequency of genotypes in the population, effective population size (N_e), number of spawning units	3.1 Not currently monitored. No specific management objective based on the geographic range of key/secondary commercial 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 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.
		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 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.

COMPONENT	CORE OBJECTIVE	SUB-COMPONENT	EXAMPLE OPERATIONAL OBJECTIVES	EXAMPLE INDICATORS	RATIONALE
			2 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. Changes to behaviour that are deleterious to the species and populations are to be avoided. Covered by 1.2 EMO and AMO.
Byproduct and Bycatch	Avoid recruitment failure of the byproduct and bycatch species Avoid negative consequences for species or population sub-components	1. Population size	1.1 No trend in biomass 1.2 Species do not approach extinction or become extinct 1.3 Maintain biomass above a specified level 1.4 Maintain catch at specified level	Biomass, numbers, density, CPUE, yield	1.1 Increases in biomass of the bycatch/byproduct 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. Use of 'move on provisions' to limit exploitation of bycatch stocks in localised areas. 1.4. This is a general objective for all AFMA fisheries as per Fisheries Management Act 1991 (objective (b)). Maintaining bycatch/byproduct levels not a specific objective. The protection of bycatch by TACs based on precautionary principles is the preferred method. "Move on provisions" are enforced if bycatch exceeds set limits.
		2. Geographic range	2.1 Geographic range of the population, in terms of size and continuity does not change outside acceptable bounds	Presence of population across space	2.1 Not currently monitored. No specific management objective based on the geographic range of byproduct/bycatch species. No specific management objective based on the geographic range of bycatch/byproduct 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 Not currently monitored. No reference levels established. No specific management objective based on the genetic structure of bycatch species.

COMPONENT	CORE OBJECTIVE	SUB-COMPONENT	EXAMPLE OPERATIONAL OBJECTIVES	EXAMPLE INDICATORS	RATIONALE
		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 species or population sub-components	1. Population size	1.1 Species do not further approach extinction or become extinct 1.2 No trend in biomass 1.3 Maintain biomass above a specified level 1.4 Maintain catch at specified level	Biomass, numbers, density, CPUE, yield	1.1 EMO - The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species. 1.2 A positive trend in biomass is desirable for protected species. 1.3 Maintenance of protected species biomass above specified levels not currently a fishery operational objective. 1.4 The above EMO states '.must avoid mortality/injury to protected species.
	Avoid negative impacts on the population from fishing	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	Frequency of genotypes in	3.1 Because population size of protected species is often small, protected species are

COMPONENT	CORE OBJECTIVE	SUB-COMPONENT	EXAMPLE OPERATIONAL OBJECTIVES	EXAMPLE INDICATORS	RATIONALE
			not change outside acceptable bounds	the population, effective population size (N_e), number of spawning units	sensitive to loss of genetic diversity. Genetic monitoring may be an effective approach to measure possible fishery impacts.
		4. Age/size/sex structure	4.1 Age/size/sex structure does not change outside acceptable bounds (e.g. more than X% from reference structure)	Biomass, numbers or relative proportion in age/size/sex classes Biomass of spawners Mean size, sex ratio	4.1 Monitoring the age/size/sex structure of protected species populations is a useful management tool allowing the identification of possible fishery impacts and that cross-section of the population most at risk.
		5. Reproductive capacity	5.1 Fecundity of the population does not change outside acceptable bounds (e.g. more than X% of reference population fecundity) Recruitment to the population does not change outside acceptable bounds	Egg production of population Abundance of recruits	5.1 The reproductive capacity of protected species is of concern to this fishery because potential fishery induced changes in reproductive ability (e.g. reduction in prey items may critically affect seabird brooding success) may have immediate impact on the population size of protected species.
		6. Behaviour /movement	6.1 Behaviour and movement patterns of the population do not change outside acceptable bounds	Presence of population across space, movement patterns within the population (e.g. attraction to bait, lights)	6.1 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. Fishery interactions	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	1. Water quality	1.1 Water quality does not change outside acceptable bounds	Water chemistry, noise levels, debris levels, turbidity levels, pollutant concentrations,	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.

COMPONENT	CORE OBJECTIVE	SUB-COMPONENT	EXAMPLE OPERATIONAL OBJECTIVES	EXAMPLE INDICATORS	RATIONALE
	Avoid reduction in the amount and quality of habitat			light pollution from artificial light	
		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, seining operations not believed to strongly influence air quality.
		3. Substrate quality	3.1 Sediment quality does not change outside acceptable bounds	Sediment chemistry, stability, particle size, debris, pollutant concentrations	3.1 EMO – The fishery is conducted, in a manner that minimises the impact of fishing operations on benthic habitat.
		4. Habitat types	4.1 Relative abundance of habitat types does not vary outside acceptable bounds	Extent and area of habitat types, % cover, spatial pattern, landscape scale	4.1 Seining activities may result in changes to the local habitat types on fishing grounds. The current MPA and conservation areas reserve large areas of the known habitat types from fishing disturbance.
		5. Habitat structure and function	5.1 Size, shape and condition of habitat types does not vary outside acceptable bounds	Size structure, species composition and morphology of biotic habitats	5.1 Seining activities may result in local disruption to pelagic and benthic processes.
Communities	Avoid negative impacts on the composition/function/distribution/structure of the community	1. Species composition	1.1 Species composition of communities does not vary outside acceptable bounds	Species presence/absence, species numbers or biomass (relative or absolute) Richness Diversity indices Evenness indices	1.1 EMO – The fishery is conducted, in a manner that minimises the impact of fishing operations on the ecosystem generally.
		2. Functional group composition	2.1 Functional group composition does not change outside acceptable bounds	Number of functional groups, species per functional group (e.g. autotrophs, filter feeders, herbivores, omnivores, carnivores)	2.1 The presence/abundance of 'functional group' members may fluctuate widely, however in terms of maintenance of ecosystem processes it is important that the aggregate effect of a functional group is maintained.
		3. Distribution of the community	3.1 Community range does not vary outside	Geographic range of the community, continuity of	3.1 Demersal trawling operations have unknown impacts on the benthos in the fishing grounds. The current MPA and

COMPONENT	CORE OBJECTIVE	SUB-COMPONENT	EXAMPLE OPERATIONAL OBJECTIVES	EXAMPLE INDICATORS	RATIONALE
			acceptable bounds	range, patchiness	conservation areas reserve large areas of the known habitat types from fishing disturbance.
		4. Trophic/size structure	4.1 Community size spectra/trophic structure does not vary outside acceptable bounds	Size spectra of the community Number of octaves, Biomass/ number in each size class Mean trophic level Number of trophic levels	4.1 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

The below 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 (CTS Sector)

Sub-fishery name: Danish seine

Date completed: April 2018

Table 2.12. Hazard identification, score and rationale(s) for the SESSF Danish seine 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 species resulting from deployment and retrieval of gillnet 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	Fishing 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.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	SCORE (0/1)	DOCUMENTATION OF RATIONALE
	Gear loss	1	Major gear loss reported rarely and no information on minor components but likely to occur.
	Anchoring/mooring	0	Does not occur.
	Navigation/steaming	1	Steaming/navigation to fishing grounds 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	0	No bait used and vessel travel relatively constrained and no known reports.
	On board processing	0	Does not occur.
	Discarding catch	1	Discarding is common.
	Stock enhancement	0	Does not occur.
	Provisioning	0	Does not occur.
	Organic waste disposal	1	If uncontaminated, food wastes may be discharged into the sea while the fishing vessel is in transit, if the waste is discharged subject to location-specific conditions. MARPOL regulations via Protection of the Sea (Prevention of Pollution from Ships) Act 1983 prohibits food waste if contaminated by any other garbage types.
Addition of non-biological material	Debris	0	MARPOL regulations via Protection of the Sea (Prevention of Pollution from Ships) Act 1983 prohibits rubbish generated during general fishing vessel operations to be discharged at sea. Rubbish must be collected onboard and disposed of ashore.
	Chemical pollution	0	MARPOL regulations via Protection of the Sea (Prevention of Pollution from Ships) Act 1983 prohibits domestic and operational waste discharge from vessels. Leakage of substances such as fuel, oil, bilge discharges, natural decay of antifouling agents may occur in normal course of operations.
	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	Vessels navigate to and from fishing grounds introduces noise and visual stimuli into the environment. 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	Fishing may disturb seabed sediments and structure.
	Boat launching	0	Not applicable. Vessels in fishery come from designated ports.
	Anchoring/mooring	0	Does not occur.
	Navigation/steaming	1	Fishing operations involve navigating to and from fishing grounds. Navigation/steaming introduces noise, water turbulence 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 SESSF fisheries operating in the gillnet jurisdictions: CTS otter trawl; GHAT gillnet, Scalefish Hook – demersal longline, auto-longline, dropline; trap; Shark demersal longline; Great Australian Bight Trawl. Also overlapping tuna fisheries- SBT, ETBF; squid jig; Bass Strait scallop; recreational, and state fisheries.
	Aquaculture	1	Mollusc (oyster/abalone) aquaculture more broadly along the eastern seaboard. May change the water chemistry by adding nutrients and attract predators to the local regions.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	SCORE (0/1)	DOCUMENTATION OF RATIONALE
	Coastal development	1	Sewage discharge, agricultural runoff, pollution from ports and coastal towns could impact shelf fisheries and may affect breeding grounds and nursery areas for some of the species in the fishery.
	Other extractive activities	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).
	Other non-extractive activities	1	Major coastal shipping activity from Syd-Melb-Adelaide including defence. Submarine cables (Basslink) 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 crtptic 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 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.
	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.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	EXAMPLES OF ACTIVITIES INCLUDE
		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:

- Management Plan and Regulation Guidelines
- Bycatch Action Plans
- Data Summary Reports (Logbook and Observer)

Other publications that provided information include

- ABARES Fishery Status Reports
- Strategic Plans

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

Any hazards that are identified at Step 4 Hazard Identification as occurring in the fishery are carried forward for analysis at Level 1. In this case, 18 activities out of 32 possible activities were identified as occurring in this sub-fishery, comprised of 12 internal and six external activities. Thus, a total of 18 activity-component scenarios were considered at Level 1. This resulted in 89 (excluding the key commercial x direct impact by capture activity) 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.

Step 1. 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.

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	4	6	Population size						There are no key or secondary commercial species that are not assessed. No further action required for this activity.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	4	6	Population size	Tiger flathead	1.2	3	2	1	Flathead may suffer injury/mortality as a result of passing through the Danish seine net is expected to have the highest potential risk for the population size sub-component. This species was chosen because small ones could pass through the net. Intensity: moderate as small fish escaping the net may occur over broad spatial scale. Consequence: minor as unlikely to affect recruitment dynamics or population size. Confidence: low due to lack of data on mortality of this species after they have escaped the net.
	Incidental behaviour	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
	Gear loss	1	1	3	Population size	Tiger flathead	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 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.).
	Anchoring/mooring	0									
	Navigation/steaming	1	4	6	Population size	Tiger flathead	1.2	3	1	2	This activity is widespread within the SESSF. Direct impact (damage or mortality) without capture due to navigation/steaming was considered to affect population size. Intensity: moderate, as this activity is a large component of fishing operations.Consequence: negligible. Confidence: high because it is considered unlikely for these to be strong interactions between navigation/steaming and damage or mortality to this species.
Addition/ movement of biological material	Translocation of species	0									
	On board processing	0									
	Discarding catch	1	4	6	Population size	Tiger flathead	1.2	3	2	1	Discarding is common, over the SESSF and occurs frequently most likely < 150 m (99% of operations occur in waters < 150 m). The addition of discards of any species to the water not likely to affect this target species. Intensity: moderate, as this species is widespread. Consequence: minor, as impact is likely to be minimal. Confidence: low, due to lack of data on movement behaviour of this species based on this activity.
	Stock enhancement	0									
	Provisioning	0									
	Organic waste disposal	1	4	6	Population size	Tiger flathead	1.2	1	1	2	If uncontaminated, food wastes may be discharged into the sea while the fishing vessel is in transit (MARPOL regulations). This is likely to occur

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
											daily. Disposal of organic waste occurs over small spatial scale. Intensity: negligible as impact area is only within metres of the vessel. Consequence: negligible - unlikely to affect the population size of this species. Confidence: high, logical consideration.
Addition of non-biological material	Debris	0									
	Chemical pollution	0									
	Exhaust	1	4	6	Behaviour/ movement	Tiger flathead	6.1	1	1	2	Fishing activity hence exhaust emissions occur over the SESSF. Exhaust emission is expected to pose the greatest potential risk for the behaviour/movement of this species resulting in repulsion. Intensity: moderate this hazard occurs over a large range/scale. Consequence: negligible as most exhaust fumes enters the atmosphere, or immediately below the water from engines, dissolved gases and particulates not believed to greatly affect water and hence this demersal target species. Consequence: high, as to demersal target species. Confidence: high due to localised exhaust unlikely to impact the behaviour/movement of this species.
	Gear loss	1	1	3	Population size	Tiger flathead	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: negligible, considered unlikely to be measurable at the scale of this stock. Confidence: high because it is known that very little gear is lost, and interaction with species is considered unlikely.

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	4	6	Behaviour/ movement	Tiger flathead	6.1	3	1	1	Navigation/steaming of fishing vessels was expected to pose greatest potential risk for the behaviour/movement of target species resulting in disruption to feeding by introducing noise to the environment. Intensity: moderate, as activity occurs over a broad spatial scale. Consequence: negligible, as introduction of noise from navigation/steaming considered unlikely to impact bottom-dwelling species or 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	4	6	Behaviour/ movement	Tiger flathead	6.1	3	2	1	Presence of vessels on water may change the behaviour, as vessels do attract or deter animals. Intensity: moderate as occurs over a broad spatial area. Consequence: minor-possible detectable change in behaviour/movement but minimal impact on population dynamics. Time to return to original behaviour/movement on the scale of days. Confidence: low because available data on acoustic disturbance from vessels on spawning on the behaviour/movement of this species is unknown.
Disturb physical processes	Bait collection	0									
	Fishing	1	4	6	Population size	Tiger flathead	1.2	3	2	1	Flathead are bottom-dwellers and fishing may disturb sediments. Intensity: moderate as disturbance of sediments may occur over broad spatial area. Consequence: minor as sediment disturbance not likely to affect population size of this species. Confidence: low because little information is available
	Boat launching	0									
	Anchoring/mooring	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
	Navigation/steaming	1	4	6	Behaviour/ movement	Tiger flathead	6.1	3	1	2	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. Intensity: moderate as the hazard was considered over a large range/scale, but 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 (specify the particular example within each activity area)	Other fisheries: SESSF-Otter trawl; GAB trawl; State fisheries	1	6	6	Population size	Tiger flathead	1.2	4	3	2	Other fisheries operating over the same grounds with potential to impact this species include, otter trawl, gillnet, autolongline, dredge, and to a lesser degree trap, demersal longline, and ocassionally midwater trawl gears. Fishing activity of these fisheries occurs over a large spatial range, over which there can be daily fishing activity. SESSF otter trawl sub-fishery takes more flathead than the Danish seine sub-fishery. Intensity: major as fishing pressure has been fairly significant. Consequence: moderate as flathead are considered to be fully fished, but not over-exploited, and indicators of stock status appear stable. Catches are seasonal and may be correlated with environmental conditions. Confidence: high as this species is assessed via a Tier 1 stock assessment.
	Aquaculture	1	5	6	Behaviour/ movement	Tiger flathead	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. Mollusc aquaculture more frequent on mainland coast and has a nutrient depletion effect. This species selected as both juveniles and adults 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

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
											species. Confidence: low as there is little data on the co-location of aquaculture sites and juvenile tiger flathead.
	Coastal development	1	5	6	Behaviour/ movement	Tiger flathead	6.1	3	2	1	Coastal development occurs throughout the SESSF. Most likely to affect behaviour/movement of target species. This species selected they occur along the areas where coastal development exists. Intensity: moderate, both broad coastal development and localised centres. Consequence: minor as coastal development expected to have minimal impact on tiger flathead behaviour/movement. Confidence: low as there is little data available.
	Other extractive activities	1	4	6	Behaviour/ movement	Tiger flathead	6.1	2	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: minor - local effects are potentially severe but confined to small area. Consequence: minor as effect on behaviour/movement 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	Ongoing shipping, naval activities and ocean dumping is likely to have minor effects on the movement and behaviour of this species. Intensity: moderate, as activity occurs over a broad spatial scale. Consequence: minor, as detectability is considered to be rare. Confidence: low, little information on potential effects.
	Other anthropogenic activities	1	5	6	Behaviour/ movement	Tiger flathead	6.1	2	2	1	Tourism, recreational boating are likely to have minor effects on the behaviour/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

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
											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	4	6	Population size	Whitefin swellshark	1.2	3	3	1	Fishing occurs throughout the year over the SESSF. This species was chosen because it is endemic to southeastern Australia and is mostly discarded. There has been a decrease in catch rates in Australia (Observer Program), with catch rates decreasing >30% between 1967-77 and 1996-97 though estimates within this period are unavailable. Intensity: moderate as this activity occurs over broad spatial scale. Consequence: moderate, as this activity may cause a reduction in recruitment dynamics or population size. Confidence: low, as stock status is unknown, but there has been a decrease in catch rates.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	4	6	Population size	Latchet; red gurnard	1.2	3	2	1	Fishing occurs throughout the year over the 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. These species chosen as units of analysis because small ones are known to pass through nets (AFMA Observer, pers. comm). Intensity: moderate, as small fish escape the net and activity occurs over a broader spatial scale. Consequence: minor 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.
	Incidental behaviour	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
	Gear loss	1	1	3	Population size	Cocky gurnard	1.2	2	1	2	Gear loss rarely occurs. This species was chosen as it is the most discarded and if gear is lost it is likely to occur nearby fishery operations. Lost gear resulting in damage/mortality most likely to affect population size of ths species. Intensity: minor as lost gear is considered rare and localized. 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 retrieved (AFMA Observer manager, pers. comm.) and interaction with this species is considered unlikely.
	Anchoring/mooring	0									
	Navigation/steaming	1	4	6	Population size	Gould's squid	1.2	3	1	2	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. Juveniles are more often found in shallow coastal waters, so may be close to surface. Intensity: moderate, navigation/ steaming is a large component of the 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	0									
	On board processing	0									
	Discarding catch	1	4	6	Behaviour/ movement	Barracouta	6.1	3	2	1	Discarding is common over SESSF and occurs frequently and is most likely to affect behaviour/movement of this species if scavengers are attracted. This species considered most likely species that could be attracted to discards. Intensity: moderate because discarding occurs over broad spatial scale and this species is widespread. Consequence

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
											scored as 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									
	Provisioning	0									
	Organic waste disposal	1	4	6	Population size	Cocky gurnard	1.2	1	1	2	If uncontaminated, food wastes may be discharged into the sea while the fishing vessel is in transit (MARPOL regulations). This is likely to occur daily. This species was chosen since it was discarded the most. Disposal of organic waste occurs over small spatial scale. Intensity: negligible as impact area is only within metres of the vessel. Consequence: negligible, unlikely to affect the population size of this species. Confidence: high, logical consideration.
Addition of non-biological material	Debris	0									
	Chemical pollution	0									
	Exhaust	1	4	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. Most exhaust enters the atmosphere, or immediately below the water from engines, dissolved gases and particulates not believed to be of consequence to benthic species. However, this species considered most vulnerable as juveniles are more often found in shallow waters. 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.

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
	Gear loss	1	1	3	Population size	Cocky gurnard	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: negligible, considered unlikely to be measurable at the scale of this stock. Confidence: high because it is known that very little gear is lost, and interaction with species is considered unlikely.
	Navigation/steaming	1	4	6	Behaviour/ movement	Cocky gurnard	6.1	3	1	1	Navigation/steaming of fishing vessels was expected to pose greatest potential risk for the behaviour/movement of species resulting in disruption to feeding and/or movement. Introduction of noise from navigation/steaming considered unlikely to impact bottom-dwelling species. Intensity: moderate as this activity occurs over a broader spatial scale. Consequence: negligible as impact of navigation/steaming unlikely to be measurable. 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	4	6	Behaviour/ movement	Gould's squid	6.1	3	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 echolocation. Intensity: moderate as presence of vessels occurs over broad spatial scale within the SESSF. 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.
	Bait collection	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
Disturb physical processes	Fishing	1	4	6	Population size	Whitefin swellshark	1.2	3	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: moderate 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	0									
	Navigation/steaming	1	4	6	Behaviour/ movement	Gould's squid	6.1	3	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 juveniles are pelagic. Intensity: moderate because the hazard was considered over a broad 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 (specify the particular example	Other fisheries	1	6	6	Population size	Gould's squid	1.2	4	4	2	Fishing occurs throughout the year over the SESSF. Capture of this species from non-trawl fishery (squid jigs in the SSJ), State fisheries (Ocean Trawl Fishery in NSW; Scalefish fishery in Tasmania) as well as the SESSF trawl and SESSF-GAB trawl fisheries most likely to affect population size of this species. In some years, more Gould's squid 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
within each activity area)											caught by the CTS than the SSJ (e.g. 2015). The population status of this species in the SESSF is unknown and currently is not subject to quota limits. Also, there is no formal stock assessment available for this biological stock in Australia. Intensity: major, fishing activity occurs throughout SET shelf. 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	5	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. Mollusc aquaculture more frequent on mainland coast and has a nutrient depletion effect. This species selected as both juveniles and adults 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 juvenile tiger flathead.
	Coastal development	1	5	6	Behaviour/ movement	Gould's squid	6.1	3	2	1	Coastal development occurs throughout the SESSF. Most likely to affect behaviour/movement of this 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	Whitefin swellshark	6.1	2	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

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
											Strait). The auditory and lateral line sensory acuity of this species could be affected by seismic survey. Intensity: minor. Consequence: minor -possible detectable change in behaviour/ movement but minimal impact on population dynamics. Time to return to original behaviour/movement on the scale of days to weeks. Confidence: low, no data.
	Other non extractive activities	1	5	6	Behaviour/ movement	Cocky gurnard	6.1	3	2	1	Ongoing shipping, naval activities and ocean dumping is likely to have minor effects on the movement and behaviour of this species. Intensity: moderate, as activity occurs over a broad spatial scale. Consequence: minor, as detectability is considered to be rare. Confidence: low, little information on potential effects.
	Other anthropogenic activities	1	5	6	Behaviour/ movement	Cocky gurnard	6.1	2	2	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	4	6	Population size	Spiny Pipehorse *Solegnathus spinosissimus*	1.1	3	2	1	Fishing occurs on the South East Transition (SET) shelf with majority of shots in <120m throughout the year. Spiny pipehorse occur throughout whole depth range of shelf (Gomon et al 2004, Fishes of Australia). They are brooders rather than broadcast spawners and consequently have low fecundity compared with other teleosts, and due to low population size are at risk of population decline. Taken as incidental bycatch in dredges, trawls, seines and in crayfish pots (Fishes of Australia) but syngnathids were only reported in one year during this reporting period. Intensity: moderate, fishing occurs throughout the SET shelf. Consequence: minor, reported in only one year. Confidence: low, no population and little biological informationon this species.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	4	6	Fishery interactions	Australian fur seal	7.2	3	2	2	Fishing occurs on the South East Transition (SET) shelf with majority of shots in <120m on inner shelf and in close proximity to major colonies of Australian fur seals. No reports of damage to seals from interacting with gear without being caught. Intensity: moderate, fur seals are central placed foragers and their distribution relatively restricted by colony placement. 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.
	Incidental behaviour	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
	Gear loss	1	1	3	Population size	Spiny Pipehorse *Solegnathus spinosissimus*	1.1	2	1	2	Fishing occurs on the South East Transition (SET) shelf with majority of shots in <120m on inner shelf. Gear loss is rare and all efforts to retrieve gear are made. Only minor gear components such as bouys, could be lost, which would not interact with benthic animals or small amounts of rope that might. Intensity: minor, gear loss is rare. Consequence: negligible, unlikely to detect impact. Confidence: high, all major gear loss is required to be recorded.
	Anchoring/mooring	0									
	Navigation/steaming	1	4	6	Population size	Procellaridae	1.1	3	1	2	Fishing, thus navigation and steaming, occurs on the South East Transition (SET) shelf with majority of shots in <120m throughout the year. Olefactory birds follow vessels and may interact with gear in the water while setting/hauling. Intensity: moderate. Consequence: negligible, only 3 interacted during assessment period. Confidence: high, interactions with protected species is recorded.
Addition/ movement of biological material	Translocation of species	0									
	On board processing	0									
	Discarding catch	1	4	6	Behaviour/ movement	Australian fur seal	6.1	3	2	2	Fishing occurs on the South East Transition (SET) shelf with majority of shots in <120m on inner shelf and in close proximity to major colonies of Australian fur seals. Discarding attract birds and seals in response to discarded catch. Intensity: moderate. Consequence: minor, despite evidence of habituation to noise of fishing operations unlikely to detect or differentiate impact. Confidence: high; all PS interactions reported to AFMA/DoEE although long-lasting or adverse effects on behaviour not well known.
	Stock enhancement	0									
	Provisioning	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
	Organic waste disposal	1	4	6	Behaviour/ movement	Procellaridae, Australian fur seal	6.1	1	2	2	Fishing occurs on the South East Transition (SET) shelf with majority of shots in <120m throughout the year and in close proximity to major colonies of Australian fur seals. Discarding of food waste might attract birds with high olefactory sensing and seals and may alter patterns of behaviour. Intensity: negligible, while disposal may occur broadly, the volume would be trivial. Consequence: minor, temporary disruption of normal movement patterns but disperse within hours. Confidence: high, logical.
Addition of non-biological material	Debris	0									
	Chemical pollution	0									
	Exhaust	1	4	6	Behaviour/ movement	Procellaridae	6.1	1	1	2	Fishing, thus exhaust, occurs on the South East Transition (SET) shelf with majority of shots in <120m throughout the year. Exhaust confined to immediate vicinity of vessel. Intensity: negligible, fishing occurs throughout SET shelf but area of impact dispersed quickly and birds can avoid. Consequence: negligible. Confidence: high, logical.
	Gear loss	1	1	3	Population size	Spiny Pipehorse *Solegnathus spinosissimus*	1.1	2	1	2	Fishing occurs on the South East Transition (SET) shelf with majority of shots in <120m throughout the year. Lost gear not resulting in damage/mortality most likely to affect population size of this species. Gear loss is rare and all efforts to retrieve gear are made. Only minor gear components such as bouys, could be lost, which would not interact with benthic animals or small amounts of rope that might. Intensity: minor, gear loss is rare. Cosequence: negligible, unlikely to detect impact on spiny pipehorse. Confidence: high, all major gear loss is required to be recorded.
	Navigation/steaming	1	4	6	Behaviour/ movement	Procellaridae	6.1	3	1	2	Fishing, thus navigation and steaming, occurs on the South East Transition (SET) shelf with majority of shots in <120m throughout the year. Seabirds known to follow fishing vessels and collide with superstructure. Intensity: moderate,

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
											activity occurs broadly but collisions occur infrequently. Consequence: negligible, unlikely to have a measurable impact. Confidence: high (logic)
	Activity/presence on water	1	4	6	Behaviour/ movement	Procellaridae	6.1	3	1	2	Fishing, thus activity and presence on the water, occurs on the South East Transition (SET) shelf with majority of shots in <120m throughout the year. Vessel introduces noise and visual stimuli into the environment. Olefactory birds attracted to fishing vessels. Intensity: moderate. Consequence: negligible-unlikely to detect impact. Confidnece: high, logical.
Disturb physical processes	Bait collection	0									
	Fishing	1	4	6	Population size	Spiny Pipehorse *Solegnathus spinosissimus*	1.1	3	2	1	Fishing occurs on the South East Transition (SET) shelf with majority of shots in <120m throughout the year. Sponge garden and deep reef habitats preferred by syngnathids and are vulnerable to disturbance. Syngnathids are sedentary, with a limited geographic range and specific habitat preferences, and are considered susceptible to physical habitat modification (Foster and Vincent 2004; Kuiter 2009). Intensity; moderate. Consequence: minor, Danish seine considered to have low impact on seafloor. Confidence: low.
	Boat launching	0									
	Anchoring/mooring	0									
	Navigation/steaming	1	4	6	Population size	Spiny Pipehorse *Solegnathus spinosissimus*	6.1	3	1	2	Fishing, thus navigation and steaming occurs on the South East Transition (SET) shelf with majority of shots in <120m throughout the year. Navigation/steaming introduces noise, water turbulence to environment. Intensity: moderate, as activity occurs over broad scale. Consequence; negligible, impact undetectable, impact only in immediate vicinity of vessel and not in range of syngnathids. Confidence: high (logical).

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
External Impacts (specify the particular example within each activity area)	Other fisheries	1	6	6	Population size	Australian fur seals	1.1	4	3	2	Other SESSF fisheries trawl, gillnet, shark, auto-longline, SPF occur on the SET inner shelf and 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. Consequence: moderate, cumulative effects could be large but not taken by all fisheries. Confidence: high logical to consider cumulative effects of variety of fishing methods.
	Aquaculture	1	5	6	Behaviour/ movement	Spiny Pipehorse *Solegnathus spinosissimus*	6.1	2	2	2	Mollusc aquaculture on mainland coast and has a nutrient depletion effect affecting the water and substrate quality leading to alteration of bio-geochemical cycles locally. Management implement fallowing protocols although recovery rates not well-known. Intensity: minor - local effects quickly dispersed and unlikley to be detected against natural variability. Consequence: minor as impacts on syngnathids unlikley to detectable variability against natural variability except where seagrass habitat important to different life stages of a variety species-no evidence. Confidence: high, e.g studies of nutrient inputs of D'entrecasteaux Channel, Huon River into Derwent Estuary are quickly dispersed into Storm Bay but impacts if any difficult to measure against other anthopogenic sources (Wild-Allen and Andrewartha 2016).
	Coastal development	1	5	6	Population size	Spiny Pipehorse *Solegnathus spinosissimus*	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 from pollution, toxins, agricultural run-off, and sewage even at small spatial scales could have obvious impact on the syngnathids. Intensity: moderate, moderate both broad coastal development and localised centres. Consequence: moderate, greatest impacts likely to be inshore including waters less than 25 m, but unlikely to extend to entire shelf area. Confidence: low because of a lack of data.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
	Other extractive activities	1	4	6	Behaviour/ movement	Australian fur seal	6.1	2	1	1	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 and western area SET shelf) most likely to affect behaviour and movement of the fur seals causing them to move away. Effect of seismic surveys on scallops found. Intensity: minor as local effects are potentially severe but spatially or temporally confined. Consequence: negligible, unlikely to be detectable at all. Confidence: low, no data on furseal.
	Other non extractive activities	1	5	6	Behaviour/ movement	Australian fur seal	6.1	3	2	1	Shipping occurs throughout the area daily and considerd to impact fur seal behaviour or movement by attracting them to noise of vessels. Intensity: moderate, east coast shipping routes are busy. Consequence: minor no known interactions with general shipping and any effects likely undetectable. Confidence: low because of a lack of information on shipping-animal interactions.
	Other anthropogenic activities	1	5	6	Behaviour/ movement	Australian fur seal	6.1	2	2	1	Fur seals may be disturbed by charter boats associated with general recreational activities, and tourism (e.g. whale watching, fishing tours, anchoring, recreational diving). Most common off SET and Central East shelf. Intensity: minor, smaller vessels confined to immediate coastal area where colonies are found. Consequence: minor, unlikley to detect impacts. 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									
	Fishing	1	4	6	Habitat structure and function	Friable sandstone (20)	5.1	3	3	1	Danish seine fishers deploy the gear over areas of 'smooth' sandy seafloor, moving to another area if sponges are encountered in high densities. Hard rocky, high relief seabed is also avoided to preserve gear. Habitat is patchy, and sediment patches which feature erect, rugose, delicate and or, inflexible fauna, could be removed or damaged as gear passes over. Habitats (assemblages) most vulnerable to impact by highest levels of effort were chosen from Pitcher et al. (2014). Intensity: moderate, localised impacts. Consequence: moderate, regeneration of sponges may take between months to years if large or more complex. 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	4	6	Habitat structure and function	Friable sandstone (20)	5.1	3	3	1	Most vulnerable habitats in assemblage 20 potentially impacted from highest levels of effort were chosen from Pitcher et al. (2014). If encountered by gear, damage and/or removal of large, tall, rugose, delicate, inflexible fauna, is likely to occur as gear passes over. Areas of large sponges and mixed faunal communities vulnerable to breakage with unnatural force are at risk. Intensity: moderate, highly localised. Consequence: moderate, regeneration of sponges may take between months to years if large or more complex. Sponges in these depths may be expected to be fairly resilient to disturbance. Effect of fishing on

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
											habitat structure is correlated with depth. Confidence low due to lack of data that shows actual impact
	Incidental behaviour	0									
	Gear loss	1	1	3	Habitat structure and function	Friable sandstone (20)	5.1	2	1	2	Fishing occurs on the South East Transition (SET) shelf with majority of shots in <120m on inner shelf. Gear loss is rare and all efforts to retrieve gear are made. Only minor gear components such as bouys, could be lost, which would not interact with benthic habitat or small amounts of rope that might. Intensity: minor, gear loss is rare. Cosequence: negligible, unlikely to detect impact. Confidence: high, all major gear loss is required to be recorded.
	Anchoring/mooring	0									
	Navigation/steaming	1	4	6	Water quality	Eastern Pelagic provinces-coastal P1	1.1	3	1	2	Steaming/navigation to fishing grounds may result in disruption of water quality from introduction of pollutants or chemicals, noise, light and cahanges to water chemistry or turbidity. Intensity: moderate, broad spatial scale. Consequence: negligible because it was considered unlikely that there would be detectable impacts. Confidence: high, logical considerations.
Addition/ movement of biological material	Translocation of species	0									
	On board processing	0									
	Discarding catch	1	4	6	Substrate quality	Shelf assemblages of fine sediments esp friable sandstone (20)	3.1	3	2	2	Discarding occurs regulalry throughout the fishery. Substrate quality on the shelf assemblages was considered most likely to be impacted because discarding of catch may result in accumulation of carcasses, leading to altered sediment chemistry in and above substrate, fine sediments can be disturbed, and bioturbators and filter feeders

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
											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	1	4	6	Water quality	Eastern Pelagic provinces-coastal P1	1.1	1	1	2	Discharge of organic waste (e.g. uncontaminated food waste) likely to occur daily although relatively small amounts. Intensity: negligible over area. Consequence: negligible, volume likely to be small and quickly dispersed through the water column. Confidence: high, localised short term increases in nutrient not expected to adversely affect water column.
Addition of non-biological material	Debris	0									
	Chemical pollution	0									
	Exhaust	1	4	6	Air quality	Eastern Pelagic provinces-coastal P1	2.1	1	1	2	Exhaust from running engines may impact the air quality within Southern Oceanic Pelagic habitat. Intensity: negligible because although the hazard occurs over a larger 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 undetectable over very short time frames. Confidence: high because effect of exhaust was considered to be very localised.

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
	Gear loss	1	1	3	Habitat structure and function	Friable sandstone (20)	5.1	2	1	2	Fishing occurs throughout the year over theSET shelf. 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 smotheirng damaging exisitng vulnerable types particualry 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	4	6	Water quality	Assemblage 20, 18	1.1	3	1	2	Steaming/navigation to fishing grounds may result in disruption of water quality from introduction noise, light and changes to water chemistry or turbidity. Intensity: moderate, over broad spatial scale. Consequence: negligible because it was considered unlikely that there would be detectable impacts. Confidence: high, logical considerations.
	Activity/ presence on water	1	4	6	Water quality	Southern Oceanic Pelagic provinces	1.1	3	1	2	Fishing occurs throughout the fishery and birds and seals may be attracted to fishing operations. No preceivable impact on the pelagic environment (nor on demersal or air habitat). Intensity: moderate, broad spatial scale. Consequence: negligible. Confidence: high logical consideration.
Disturb physical processes	Bait collection	0									
	Fishing	1	4	6	Substrate quality	Friable sandstone (20)	3.1	3	2	1	Most vulnerable habitats in assemblage 20 from Pitcher et al (2014) were chosen as potentially impacted where highest levels of effort although there is no data that shows actual impact. Danish seine nets are deployed over sandy sediments which may support large/tall erect sponges and other suspension feeding sessile invertebrates in patches. Seine trawling may cause suspension of fine sediment layers which settle out on filter feeding organisms smothering ability to function

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
											normally, in a way that is greater than expected from wave/ current action alone. Intensity: moderate. Consequence: minor, Danish seine considered to have little direct impact on seafloor. Confidence: high, however, the area fished is a highly dynamic zone, much of its fauna is adapted to mobile sediments from natural disturbance, but fishing may occur at greater frequency than these natural events.
	Boat launching	0									
	Anchoring/ mooring	0									
	Navigation/ steaming	1	4	6	Water quality	Eastern Pelagic provinces-coastal P1	1.1	3	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: moderate, occurs over broad spatial scale. Consequence: negligible, remote likelihood of detection of impact against natural variation. Confidence: high, logical.
External Impacts (specify the particular example within each activity area)	Other fisheries	1	6	6	Habitat type, structure and function	Friable sandstone (20)	4.1, 5.1	4	3	1	Other fisheries operating over the same grounds with potential to impact the benthos include, otter trawl, gillnet, autolongline, dredge, and to a lesser degree trap, demersal longline, and ocassionally 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 >100 m 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:

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
											moderate as majority of gears have very small footprint. Confidence: low; little data is available on the age, growth, and regeneration rates of temperate sponge habitats in depths 100-200 m nor on damage attributable to fishing methods.
	Aquaculture	1	5	6	Water quality, substrate quality	Inner shelf sediments e.g adjacent to assemblage 20	1.1, 3.1	2	1	2	Aquaculture occurs at sites throughout southeastern Australia in harbours, bays, and estuaries (State waters) adjacent to inner shelf habitats. Mollusc aquaculture more frequent on mainland coast and has a nutrient depletion effect. Intensity: minor, local effects quickly dispersed and unlikley to be detected against natural variability. Consequence: negligible, impacts unlikley to be detectable against natural variability except where seagrass habitat important to different life stages of a variety species. Confidence: high, studies on nutrient inputs into estuaries are quickly dispersed but impacts if any difficult to measure against other anthopogenic sources (Wild-Allen and Andrewartha 2016).
	Coastal development	1	5	6	Water quality, substrate quality	Inner shelf sediments e.g. Assemblages 1, 20	1.1, 3.1	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 water and substrate quality. Intensity: moderate, 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 25 m (not within fishery boundary) but detection further out onto the inner shelf unknown. Confidence: low little data on the cumulative effects.
	Other extractive activities	1	4	6	Substrate quality	Assemblage 13,18	3.1	2	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 but probably less in Bass Strait Assemblages 13, 18). Infrasctructure impacts seafloor locally but oil leaks/spills may impact water and substrate quality in immeditate

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
											area. Intensity: minor, pollution, and disturbance from existing infrastructure. Consequence: minor, localised impacts. Confidence: low little information on effects of pipelines on surrounding habitats although modeling suggests much 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 routes 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, area of disturabnces confined to immediate area of vessels, and unlikley to detect impact. Confidence: low, little information on effects.
	Other anthropogenic activities	1	5	6	Water and air quality, substrate quality, habitat types, structure and function	Inner shelf Assemblages 1, 20	1.1, 2.1 3.1, 4.1, 5.1	2	2	2	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, unlikely to detect impacts although no information to assess cumulative effects. Confidence: high, logical.

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									
	Fishing	1	4	6	Functional group composition	SET inner and outer shelf	2.1	3	2	1	Fishing most likely to affect functional group composition affecting the trophodynamics of community foodweb. SET inner and outer shelf chosen because these communities have the highest proportion of area fished. Intensity: moderate as fishing occurs broadly over shelf. Consequence: minor, while DS accounts for 50% of flathead TAC and ~90% school whiting TAC expect minor changes in relative abundance of community constituents (< 5%). Confidence: low, flathead stock assessements indicates increasing abundance and some other species stable.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	4	6	Species composition	SET inner and outer shelf	1.1	3	2	1	Direct impact without capture most likely to affect species composition from post-capture mortality. SET outer shelf has the highest proportion of area fished, highest average catch amd logically highest escapement and post-capture mortality. Intensity: moderate as fishing occurs in broadly across the shelf. Consequence: minor as most key populations are stable and further impact from post-capture mortality undetectable. Confidence: low, cannot demonstrate changes due to post-escapement mortality.
	Incidental behaviour	0									
	Gear loss	1	1	3	Species composition	SET inner and outer shelf	1.1	2	1	2	SET outer shelf as most gear loss is likely to occur there. Dropped nets might contain catch which would be lost. Intensity: minor, rarely that gear is lost. Consequence: negligible as any effect on communities due to gear loss immeasurable. Confidence: high, any gear loss must be reported.

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	0									
	Navigation/steaming	1	4	6	Distribution of the community	SET inner and outer shelf	1.1	3	1	2	SET inner and outer shelf because these communities have the highest proportion of area fished. Navigation and steaming may impact behaviour of species by disturbance through noise. Intensity: moderate as fishing occurs over the shelf. Consequence: negligible it is unlikely to detect any measurable effect on communities. Confidence: high, logic.
Addition/ movement of biological material	Translocation of species	0									
	On board processing	0									
	Discarding catch	1	4	6	Distribution of the community	SET inner and outer shelf	3.1	3	2	1	Discarding catch could affect distribution of community if scavengers are attracted to discards. SET outer and inner shelf communities chosen as most effort occurs there. Intensity: moderate as discarding is common. 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	1	4	6	Distribution of the community	SET inner and outer shelf	3.1	1	1	2	Organic waste disposal most likely to attract scavengers thus affecting distribution of community temporarily. Intensity: negligible as each disposal event highly localised to vessel vicinity. Consequence: negligible as effect considered unlikely to be measurable. Confidence: high, logic.
	Debris	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
Addition of non-biological material	Chemical pollution	0									
	Exhaust	1	4	6	Distribution of the community	SET inner and outer shelf	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 inner and outer shelf chosen as most fishing occurs there. Intensity: minor, exhaust emissions occur over a large range, but impact area is only within metres of the vessel. Consequence: negligible as ehaust is rapidly dissipated and unlikley to affect birdlife. Confidence: high, logic.
	Gear loss	1	1	3	Species composition	SET inner and outer shelf	1.1	2	1	2	Fishing occurs throughout the year over the SET shelf. 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. Lost gear may create new structure providing new refuge for species. Intensity: minor, rarely that gear is lost. Consequence: negligible as any effect on communities due to gear loss immeasurable. Confidence: high, any gear loss must be reported.
	Navigation/steaming	1	4	6	Distribution of the community	SET inner and outer shelf	3.1	3	1	1	Navigation/steaming introduces noise such as engine noise and echosounding during fishing and considered to have most potential effect on distribution of communities by disturbing fish. Intensity: moderate, echosounders and engines of vesels would be running for duration of fishing trips and shelf communities constantly fished. Consequence: negligible as disturbance unlikely to be detected against other factors. Confidence: low not known whether disturbance of aggregations caused by echosounding.
	Activity/presence on water	1	4	6	Distribution of the community	SET inner and outer shelf	3.1	3	1	1	Activity/ presence on water of fishing vessels widespread on SET inner and outer shelf. May effect the distribution of community by changing behaviour of cetaceans, scavengers, marine mammals. Intensity: moderate, vessels in fished areas constantly present over braod spatial scale. Consequence: negligible, any change to community distribution would be undetectable

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
											against background variation except for short duration of fishing operation. Confidence: low.
Disturb physical processes	Bait collection	0									
	Fishing	1	4	6	Distribution of the community	SET inner and outer shelf	3.1	3	1	1	Removal of habitat (structure) can disrupt underpinning physical processes) and sediments could be disturbed changing distribution of species in the community. Intensity: moderate as fishing occurs broadly across shelf. Consequence: negligible as any effect on communities unlikely to be measurable. Confidence: low no information.
	Boat launching	0									
	Anchoring/mooring	0									
	Navigation/steaming	1	4	6	Bio- and geo-chemical cycles	SET inner and outer shelf	5.1	3	1	2	Navigation/steaming occurred on the continental shelf and shelf break of SET inner and outer shelf. Possible Impact on bio- and geo-chemical cycles of pelagic waters by disturbing mixed depth layer. Intensity: moderate, navigation/steaming is a large component of the trawling operations. Consequence: negligible, localised impact within immediate vicinity of the vessel and 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 inner and outer shelf	4.1	4	4	2	Other SESSF 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	5	6	Bio- and geo-chemical cycles	SET inner shelf	5.1	2	1	2	Mollusc aquaculture on mainland coast and has a nutrient depletion effect affecting the water and substrate quality leading to alteration of bio-geochemical cycles locally. Management implement fallowing protocols

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
											although recovery rates not well-known. Intensity: minor, local effects quickly dispersed and unlikley to be detected against natural variability. Consequence: negligible as impacts on community unlikley 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 studies of nutrient inputs of D'entrecasteaux Channel, Huon River into Derwent Estuary are quickly dispersed into Storm Bay but impacts if any difficult to measure against other anthopogenic sources (Wild-Allen and Andrewartha 2016).
	Coastal development	1	5	6	Species composition	Central Eastern Province inner shelf	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, the impacts should be local and their consequences only minor to the communities. Intensity: moderate, moderate at broader spatial scale, or severe but local. Consequence: moderate, greatest impacts likely to be inshore including waters less than 25 m, 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	2	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: minor 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

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 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 considerd 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	5	6	Distribution of the community	SET outer shelf; Central east shelf	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, unlikley to detect direct and indirect impacts on pelagic or demersal communities. Consequence: minor. 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	2	3	2
	Incidental behaviour	0	0	0	0	0
Direct impact without capture	Bait collection	0	0	0	0	0
	Fishing	2	2	2	3	2
	Incidental behaviour	0	0	0	0	0
	Gear loss	1	1	1	1	1
	Anchoring/mooring	0	0	0	0	0
	Navigation/steaming	1	1	1	1	1
Addition/ movement of biological material	Translocation of species	0	0	0	0	0
	On board processing	0	0	0	0	0
	Discarding catch	2	2	2	2	2
	Stock enhancement	0	0	0	0	0
	Provisioning	0	0	0	0	0
	Organic waste disposal	1	1	2	1	1
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	1	1	1
	Activity/ presence on water	2	2	1	1	1
Disturb physical processes	Bait collection	0	0	0	0	0
	Fishing	2	2	2	2	1
	Boat launching	0	0	0	0	0
	Anchoring/mooring	0	0	0	0	0
	Navigation/ steaming	1	1	1	1	1
External Impacts	Other fisheries	3	4	3	3	4
	Aquaculture	2	2	2	1	1
	Coastal development	2	2	2	2	2
	Other extractive activities	2	2	1	2	2
	Other non-extractive activities	2	2	2	2	2
	Other anthropogenic activities	2	2	2	2	2

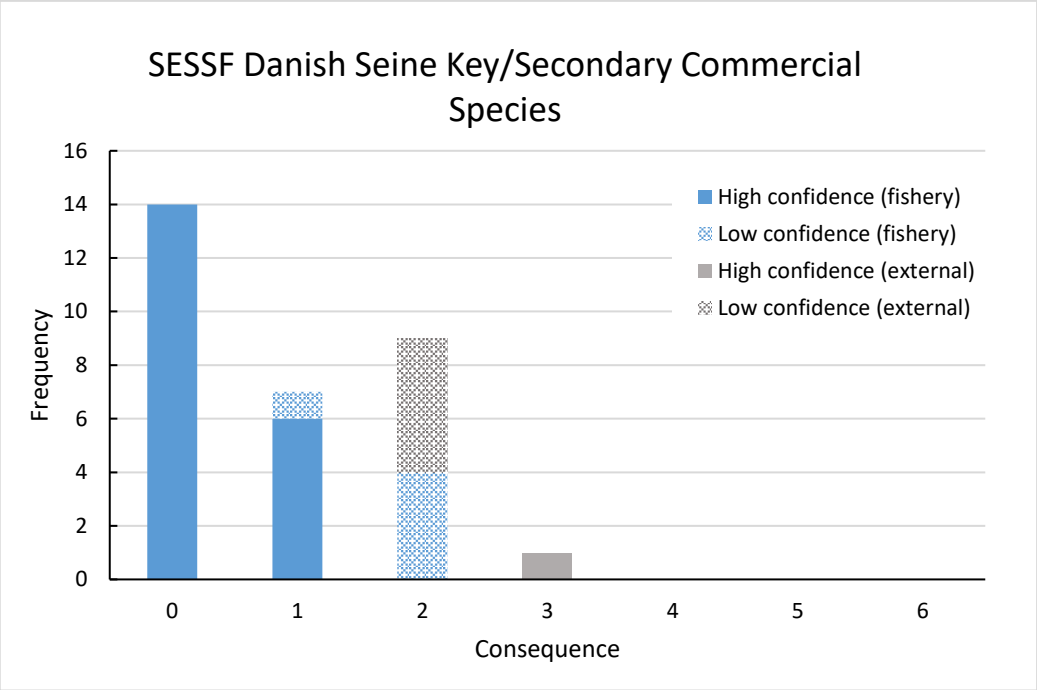


Figure 2.3. Key/secondary commercial species: Frequency of consequence score by high and low confidence.

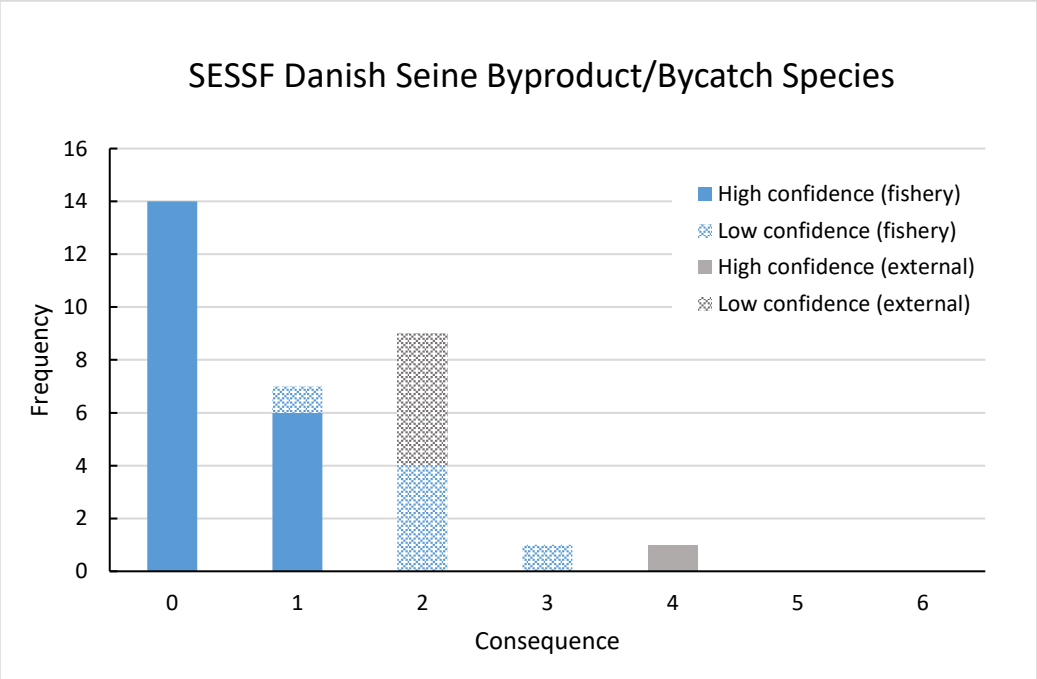


Figure 2.4. Byproduct and bycatch species: Frequency of consequence score by high and low confidence.

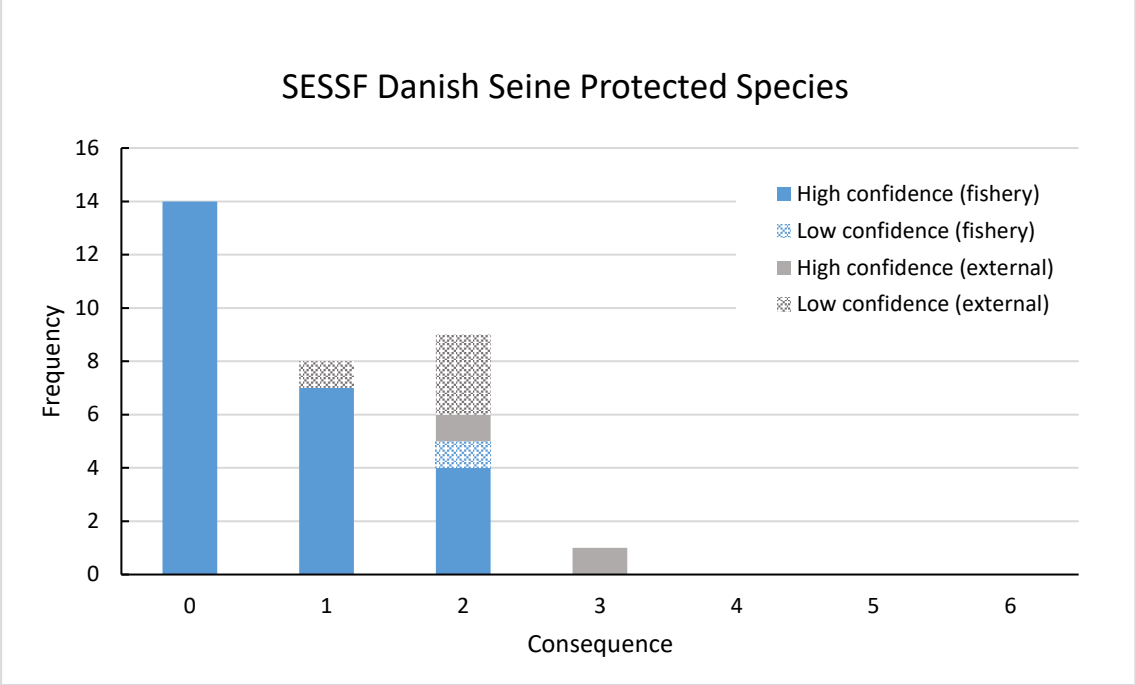


Figure 2.5. Protected species: Frequency of consequence score by high and low confidence.

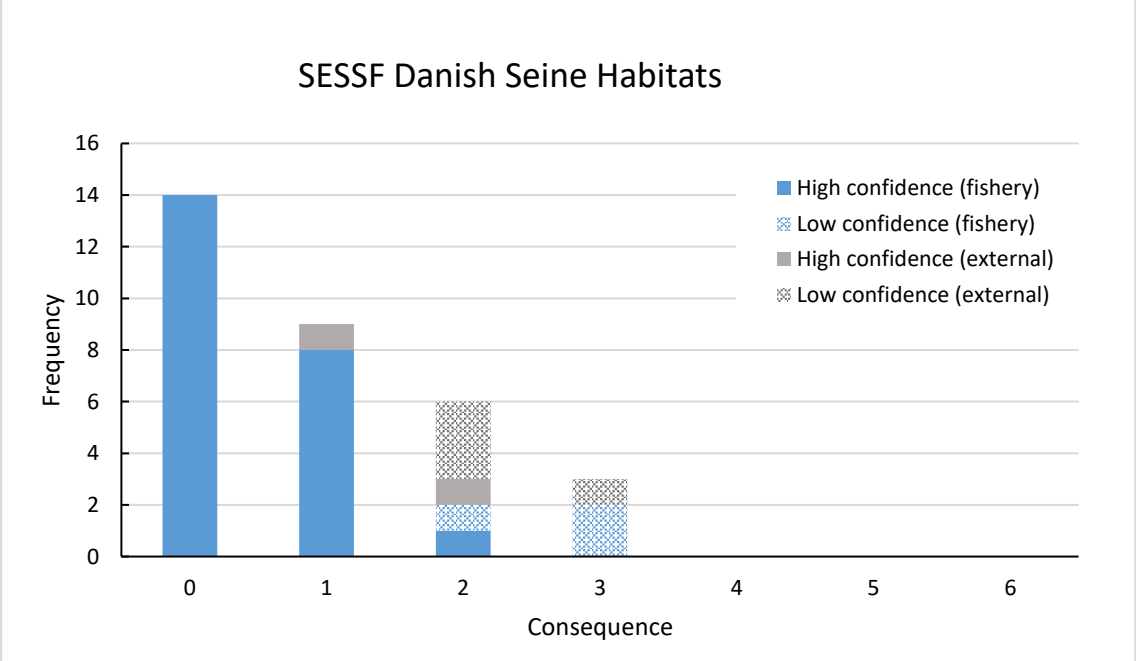


Figure 2.6. Habitats: Frequency of consequence score by high and low confidence.

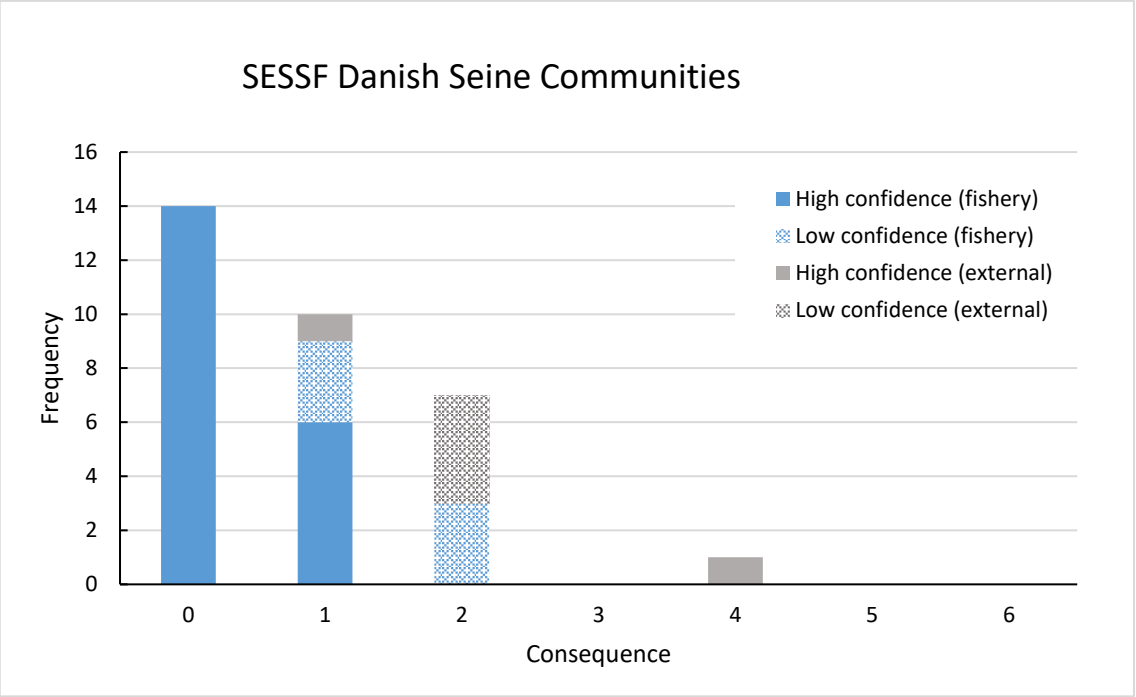


Figure 2.7 Communities: Frequency of consequence score by high and low confidence.

2.3.12 Evaluation/discussion of Level 1

Three ecological components were eliminated at Level 1 (i.e. no components with risk scores of 3 (moderate) or above).

Most hazards (fishing activities) were eliminated at Level 1 (i.e. no components with risk scores of 3 (moderate) or above (Table 2.19; Figure 2.3 - Figure 2.7). Those that remaining were:

- Fishing (capture impacts on two ecological components; byproduct/bycatch and habitats)
- Fishing (non-capture impacts on one ecological component; habitats)
- External hazards from other fisheries (on all five comonents)

As a result of direct capture by fishing, the most vulnerable bycatch species whitefin swellshark (*Cephaloscyllium albipinnum*) that are mostly discarded (AFMA Logbooks) were assessed at moderate risk largely due to unknown population size within this assessment period. Also, this species is classified as 'near threatened' on the IUCN red list. However, a review of capture mortalities of elasmobranchs found that the Scyliorhinids (catsharks) were regarded as robust to capture and post release survival rates were high particualry for shelf-living species (Ellis et al. 2017). Also, the at-vessel mortality (AVM) in trawls was <5% (Braccini et al. 2012), while no capture mortality was recorded for gillnets (Lyle et al. 2014). Therefore, we assume that discarded whitefin swell sharks have a relatively high chance of survival if discarded but possibly not great enough to reduce their risk.

The impact of fishing represented a moderate risk to habitats largely due to the concentration of effort on the shelf where highly vulnerable fauna occur but this actual impact is unknown but could be relatively low if fishing is conducted largely on soft sediments.

Significant external hazards included other fisheries in the region on all five components. Only external fisheries were rated at major or above risk (scores 4) on byproduct/bycatch and community components (Table 2.19).

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:

- Byproduct/bycatch
- Habitat

Therefore, a Level 2 examiniation is required. The Level 2 byproduct/bycatch component was assessed (PSA and bSAFE). However, the habitat component was not assessed in this report.

2.4 Level 2 Productivity and Susceptibility Analysis (PSA)

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

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

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

Species

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

Table 2.20. Attributes that measure productivity and suscepability.

	ATTRIBUTE
Productivity	Average age at maturity
	Average size at maturity
	Average maximum age
	Average maximum size
	Fecundity
	Reproductive strategy
	Trophic level
Susceptibility	Availability considers overlap of fishing effort with a species distribution
	Encounterability considers the likelihood that a species will encounter fishing gear that is deployed within the geographic range of that species (based on two attributes: adult habitat and bathymetry)
	Selectivity considers the potential of the gear to capture or retain species

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

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

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

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

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

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

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

Habitats

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

Table 2.21. Description of susceptibility attributes for habitats.

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

Communities

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

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

2.4.1 Units excluded from analysis (Step 1)

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. NA: not applicable.

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC			Nothing was caught/observed	No catch or interaction		Insufficiently taxonomically resolved
BC	Benthos		Porifera - undifferentiated	Sponges	10000000	Benthos
BC	Invertebrate	Spongiidae	Spongiidae - undifferentiated	Spongiid sponges	10114000	Insufficiently taxonomically resolved
BC	Invertebrate		Scyphozoa spp - undifferentiated	Jellyfish	11120000	Insufficiently taxonomically resolved
BC	Benthos		Order Scleractinia - undifferentiated	Stony corals	11290000	Benthos
BC	Invertebrate	Pteriidae	*Pinctada* spp.	Pearl oysters and Pearl shell	23236901	Insufficiently taxonomically resolved
BC	Invertebrate	Pectinidae	Pectinidae - undifferentiated	Scallops	23270000	Apportion to 23270006.
BC	Invertebrate	Loliginidae	Loliginidae - undifferentiated	Calamari	23617000	Apportion to southern calamari. ERA classification changed from BC to BP for southern calamari
BC	Invertebrate		Order Octopoda - undifferentiated	Octopoda	23650000	Insufficiently taxonomically resolved
BC	Invertebrate		Class Gastropoda - undifferentiated	Gastropods	24000000	Insufficiently taxonomically resolved
BC	Invertebrate	Volutidae	Volutidae - undifferentiated	Bailer Shells	24207000	Apportion to 2427001.
BC	Invertebrate		Order Nudibranchia - undifferentiated	Nudibranchs	24420000	Insufficiently taxonomically resolved
BC	Invertebrate		Echinodermata - undifferentiated	Echinoderms	25000000	Insufficiently taxonomically resolved

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Invertebrate		Class Asteroidea - undifferentiated	Starfish	25102000	Insufficiently taxonomically resolved
BC	Invertebrate		Class Echinoidea - undifferentiated	Sea urchins	25200000	Insufficiently taxonomically resolved
BC	Invertebrate		Clypeasteridae - undifferentiated	Sand dollars	25262000	Insufficiently taxonomically resolved
BC	Invertebrate		Class Holothuroidea - undifferentiated	Holothurians	25400000	Insufficiently taxonomically resolved
BC	Invertebrate		Order Stomatopoda - undifferentiated	Mantis shrimps	28030000	Insufficiently taxonomically resolved
BC	Invertebrate	Scyllaridae	Scyllaridae - undifferentiated	Bugs - Shovel nosed and slipper lobsters	28821000	Apportion to 28821004.
BC	Invertebrate	Scyllaridae	*Thenus* spp	Moreton Bay bugs	28821903	Apportion to 28821004.
BC	Invertebrate		Infraorder Anomura - undifferentiated	Anomurans	28825000	Insufficiently taxonomically resolved
BC	Invertebrate	Diogenidae	Diogenidae - undifferentiated	Hermit crabs (left handed)	28827000	No species within same family to apportion catch to.
BC	Invertebrate		Brachyura - undifferentiated	Crabs	28850000	Insufficiently taxonomically resolved
BC	Invertebrate	Homolidae	Homolidae - undifferentiated	Spider crabs (Homolidae)	28860000	No species within same family to apportion catch to.
BC	Invertebrate	Raninidae	Raninidae - undifferentiated	Spanner crabs	28865000	Insufficiently taxonomically resolved.
BC	Invertebrate	Majidae	Majidae and related families - undifferentiated	Spider crabs (All families)	28880000	No species within same family to apportion catch to.
BC	Invertebrate	Portunidae	Portunidae - undifferentiated	Swimming crabs	28911000	No Portunidae to attribute to attribute catch to.
BC	Chondrichthyan	Hexanchidae	Hexanchidae - undifferentiated	Sixgill and sevengill sharks - unspecified	37005000	Apportioned to 37005001 and 37005002. Also added 37005005.
BC	Chondrichthyan	Alopiidae	*Alopias* spp.	Thresher sharks (mixed)	37012901	No species within list to apportion catch to. So, added 37012001 and 37012002

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Chondrichthyan	Brachaeluridae	Brachaeluridae and related families - undifferentiated	Wobbegongs blind nurse carpet and zebra sharks	37013000	Apportioned to two other carpet shark species within list. Also added 5 new species to list.
BC	Chondrichthyan	Scyliorhinidae	Scyliorhinidae - undifferentiated	Catsharks	37015000	Apportioned to 5 species within list with same family name.
BC	Chondrichthyan	Scyliorhinidae	*Cephaloscyllium* spp.	Draughtboard sharks (mixed)	37015906	Apportion to 37015001 and 37015013.
BC	Chondrichthyan	Triakidae	Triakidae - undifferentiated	Hound Sharks	37017000	Apportioned to gummy shark and school shark.
BC	Chondrichthyan	Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae	Centrophoridae, Dalatiidae, Squalidae, Somniosidae and Etmopteridae - undifferentiated	Gulper Sharks, Sleeper Sharks, Dogfishes	37020000	Apportioned to 3 species within list.
BC	Chondrichthyan	Squalidae	*Squalus* spp	Greeneye dogfishes (mixed)	37020901	Apportioned to 3 species within list.
BC	Chondrichthyan	Squalidae	Squalidae - undifferentiated	Dogfishes (mixed)	37020923	Apportioned to 3 species within list.
BC	Chondrichthyan	Squatinidae	Squatinidae - undifferentiated	Angel sharks	37024000	Apportion to Aust. Angelshark (37024001).
BC	Teleost	Rhinidae	Rhinidae - undifferentiated	Guitarfishes unspecified	37026000	Misidentification: outside fishery range
BC	Teleost	Rhinidae	*Rhynchobatus australiae*	Whitespotted guitarfish	37026005	Misidentification: outside fishery range
BC	Chondrichthyan	Trygonorrhinidae	*Trygonorrhina* spp.	Fiddler rays unspecified	37027999	Apportioned to eastern and southern fiddler rays within list
BC	Chondrichthyan	Torpedinidae, Narcinidae, Hypnidae	Torpedinidae, Narcinidae, Hypnidae - undifferentiated	Torpedo rays, Coffin rays and Numbfishes	37028000	Apportion to families within list.
BC	Chondrichthyan	Rajidae	*Raja* spp.	Skate (mixed)	37031900	Apportion to Skate species within list.
BC	Chondrichthyan	Dasyatidae	Dasyatidae - undifferentiated	Stingrays	37035000	Apportioned to two species within same family. Chaged from BC to BP
BC	Chondrichthyan	Urolophidae, Plesiobatidae	Urolophidae, Plesiobatidae - undifferentiated	Stingarees and giant stingarees	37038000	Apportion to Stingarees within list.
BC	Teleost	Congridae, Colocongridae	Congridae, Colocongridae - undifferentiated	Conger eels	37067000	Added 37067001 and 37067007.
BC	Teleost	Clupeidae	*Dussumieria elopsoides*	Slender rainbow sardine	37085010	Misidentification: outside fishery range
BC	Teleost	Clupeidae	*Sardinops sagax*	Australian sardine	37085794	Superseded code. It is now 37085002. This species is already within list

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Teleost	Chlorophthalmidae, Paraulopidae, Bathysauroididae, Bathysauropsidae	Chlorophthalmidae, Paraulopidae, Bathysauroididae, Bathysauropsidae - undifferentiated	Cucumberfishes, greeneyes and lizardfishes	37120000	Insufficiently taxonomically resolved. No logbook catch to apportion to.
BC	Teleost	Melanonidae, Moridae, Euclichthyidae	Melanonidae, Moridae, Euclichthyidae - undifferentiated	Pelagic morid and eucla cods	37224000	Apportion to exsiting Moridae species within list. Other species outside fishery depth range.
BC	Teleost	Moridae	*Mora moro*	Ribaldo	37224002	Misidentification: outside fishery depth range
BC	Teleost	Moridae	*Lotella* and *Pseudophycis* spp	Southern rock cod	37224900	Apportion to 37224003, 37224006. Also apportion to 3 new species to list: 37224005, 37224023, 37224011. All BC.
BC	Teleost	Ophidiidae	Ophidiidae spp.	Cusk eels (mixed)	37228999	Apportioned catch of this group code to pink king and rock ling
BC	Teleost	Macrouridae, Bathygadidae	Macrouridae and Bathygadidae - undifferentiated	Whiptails	37232000	Apportioned to one species (37232001) within list.
BC	Teleost	Berycidae	*Centroberyx australis*	Yelloweye redfish	37258006	Misidentification: outside fishery range
BC	Teleost	Lampridae	*Lampris guttatus* and *Lampris immaculatus*	Moonfish (mixed)	37268900	Added new species. *A. guttatus* to list
BC	Teleost	Fistulariidae	Fistulariidae - undifferentiated	Flutemouths	37278000	No species to apportion catch to.Two species added 37278001 and 37278002. Both BC
BC	Teleost	Macroramphosidae	Macroramphosidae - undifferentiated	Bellowfish	37279000	MS added 37279002- common bellowfish to list. No other bellowfish species within list.
BC	Teleost	Synbranchidae	Synbranchidae - undifferentiated	Swamp eels	37285000	Insufficiantly taxonomically resolved. Of the eel species, all are outside fishery area.
BC	Teleost	Sebastidae	*Trachyscorpia carnomagula*	Ocean perch (*T. carnomagula*)	37287103	Possible Misidentification: outside fishery depth range >700m
BC	Teleost	Scorpaenidae	Scorpaenidae	Coral perch	37287900	Apportioned to 37287008.
BC	Teleost	Scorpaenidae	*Scorpaena* spp	Scorpionfishes - Scorpaenid	37287904	Apportioned to 37287008.
BC	Teleost	Triglidae, Peristediidae	Triglidae and Peristediidae - undifferentiated	Searobins and armour gurnards	37288000	Apportioned to existing species in list (6). Also added two other species

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Teleost	Triglidae	*Pterygotrigla elicryste*	Dwarf gurnard	37288009	Misidentification: outside fishery range
BC	Teleost	Triglidae	Triglidae	Searobins	37288900	Accounted for in species list. Oberver data
BC	Teleost	Triglidae	*Lepidotrigla modesta* and *Lepidotrigla mulhalli*	Cocky gurnard (mixed)	37288903	Apportion to *L. mulhalli*.
BC	Teleost	Hoplichthyidae	*Hoplichthys filamentosus*	Longray ghost flathead	37297005	Possible misidentification: outside fishery depth range
BC	Teleost	Serranidae	*Aethaloperca* and *Anyperodon* spp	Rockcod (Aethaloperca and Anyperodon)	37311901	No genus within list to apportion catch to. This code also incluses Epinephelus genus. There are two species within fishery range. This catch was apportioned to these two species. i.e., 37311077, 37011022.
BC	Teleost	Priacanthidae	Priacanthidae - undifferentiated	Bigeyes	37326000	No species within same family to apportion catch to. Possible misidentifcation, outside fishery range
BC	Teleost	Apogonidae, Dinolestidae	Apogonidae, Dinolestidae - undifferentiated	Cardinalfishes	37327000	No species within same family to apportion catch to.
BC	Teleost	Apogonidae	*Apogon semilineatus*	Half-lined cardinal	37327004	Misidentification: outside fishery range
BC	Teleost	Sillaginidae	Sillaginidae - undifferentiated	Whitings	37330000	Apportioned to 37330014 and 37330001. Also added 4 new species corresponding to this family group code.
BC	Teleost	Carangidae	*Caranx bucculentus*	Bluespotted trevally	37337016	Misidentification: outside fishery range
BC	Teleost	Carangidae	*Decapterus tabl*	Rough-ear scad	37337060	Misidentification: outside fishery range
BC	Teleost	Carangidae	*Trachurus declivis* and *Trachurus murphyi*	Jack mackerels	37337912	No species within same family to apportion catch to.
BC	Teleost	Arripidae	*Arripis trutta* and *Arripis truttaceus*	Australian salmon	37344900	Added both species to list.
BC	Teleost	Lutjanidae	*Etelis coruscans*	Flame snapper	37346038	Misidentification: outside fishery range
BC	Teleost	Gerreidae	Gerreidae - undifferentiated	Silverbiddies	37349000	Apportioned to 37349001.
BC	Teleost	Mullidae	Mullidae - undifferentiated	Goatfishes	37355000	Apportioned to 2 species.
BC	Teleost	Pomacanthidae	*Centropyge eibli*	Eibl's angelfish	37365024	Misidentification: outside fishery range
BC	Teleost	Pentacerotidae	*Paristiopterus gallipavo*	Yellowspotted boarfish	37367001	Misidentification: outside fishery range
BC	Teleost	Latridae	*Latridopsis* spp	Trumpeters	37378900	Apportioned to 2 species within list.

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Teleost	Sphyraenidae	*Sphyraena* spp	Barracudas	37382901	Added 37382002.
BC	Teleost	Uranoscopidae	Uranoscopidae - undifferentiated	Stargazers	37400000	Apportion to 3 stargazer species within list (37400001, 37400003, 37400018). No change to ERA classification of these three species.
BC	Teleost	Channichthyidae	*Channichthys rhinoceratus*	Unicorn icefish	37407792	Misidentification: outside fishery range
BC	Teleost	Gobiidae	*Bathygobius fuscus*	Dusky frillgoby	37428068	Misidentification: outside fishery range
BC	Teleost	Gempylidae	*Thyrsites* spp.	Barracoutas (mixed)	37439914	Apportioned to 37439001.
BC	Teleost	Trichiuridae	Trichiuridae - undifferentiated	Ribbonfishes and cutlassfishes	37440000	Apportioned to 37440002.
BC	Teleost	Scombridae	Scombridae - undifferentiated	Mackerels	37441000	No species within same family to apportion catch to.
BC	Teleost	Bothidae, Achiropsettidae, Paralichthyidae	Bothidae, Achiropsettidae, Paralichthyidae - undifferentiated	Lefteye flounders	37460000	No species within same family to apportion catch to.
BC	Teleost	Pleuronectidae	Pleuronectidae - undifferentiated	Righteye flounders	37461000	Apportined to 3746001 and 37461003.
BC	Teleost	Soleidae	Soleidae - undifferentiated	Soles	37462000	Apportioned to 37462010 (*M. freycineti*).
BC	Teleost	Monacanthidae	*Meuschenia* spp	Reef leatherjacket	37465902	Apportioned to 37465036.
BC	Invertebrate	Monacanthidae	Monacanthidae	Leatherjacket	37465903	Apportion to existing Monocanthidae within list.
BC	Teleost	Tetraodontidae	Tetraodontidae - undifferentiated	Toadfishes unspecified	37467000	Apportioned to 37467001, 37467005 and 37467044.
BC	Teleost	Diodontidae	Diodontidae - undifferentiated	Porcupine fish	37469000	Apportioned to 37469001.
BC	Chondrichthyan		Sharks - other	Sharks (mixed)	37990003	Insufficiently taxonomically resolved.
BC	Teleost	Bothidae, Psettodidae, Pleuronectidae	Bothidae, Psettodidae and Pleuronectidae (all spp)	Flounders (mixed all types)	37990009	Apportioned to 4 flounder species within existing list.

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BC	Teleost	Cynoglossidae, Soleidae	Cynoglossidae and Soleidae spp	Sole (mixed)	37990015	Apportion to 37462010 and two new species of Soleidae (37462017 and 37462040). BC classification of all species, new and existing.
BC	Teleost		Fish oceanic (mixed)	Fish oceanic (mixed)	37990020	Insufficiently taxonomically resolved
BC	Chondrichthyan		Order Rajiformes - undifferentiated	Skates and rays (mixed)	37990030	Apportioned to 6 skate (Rajiforme) species within list.
BC	Chondrichthyan	Squalidae	Squaliformes	Dogfish sharks	37990071	Apportioned to 3 species within list.
BC	Teleost	Scorpaenidae, Triglidae, Peristediidae	Scorpaenidae, Triglidae and Peristediidae - undifferentiated	Scorpionfishes, Gurnards and Latchets	37990084	Apportioned to existing species in list (6). Also added two other species
BC			Phaeophyceae	Brown algae	54000000	Benthos
BC	Benthos		Various bits of the sea floor which may be alive	Benthos	99000001	Benthos
BC			Substrate or rocks that are non-living	Substrate or rocks	99000002	Benthos
BP	Invertebrate	Sepiidae	*Sepia* spp	Cuttlefish (mixed)	23607901	No Sepia genus to apportion catch to within existing species list. Therefore chosen species is sepia apama (2367001): Giant cuttlefish
BP	Invertebrate		Order Teuthoidea - undifferentiated	Squids	23615000	Apportion to Gould's squid. No change to ERA classificiation of Gould's squid
BP	Invertebrate	Octopodidae	Octopodidae - undifferentiated	Octopuses	23659000	Apportioned to pale octopus within list. Both species changed ERA classification from BC to BP.
BP	Invertebrate		Shells	Shells	23999999	Apportioned to 24207001 and 24207072
BP	Chondrichthyan	Pristiophoridae	Pristiophoridae - undifferentiated	Sawsharks	37023000	Apportioned to common and southern sawshark
BP	Chondrichthyan	Rajidae	Rajidae - undifferentiated	Skates	37031000	Apportioned to 5 existing skate species within list, and two others: 37031009 and 37031010. Resulting 7 species are now BP (5 from BC; 2 new BPs)
BP	Teleost	Triglidae	*Lepidotrigla* spp	Butterfly gurnard (mixed)	37288901	Apportion to 3 other L. species within existing list. The cocky gurnard changed from BC to BP. The other two L. species remained BC.

ROLE IN FISHERY	TAXA	FAMILY NAME	SCIENTIFIC NAME	COMMON NAME	CAAB CODE	RATIONALE
BP	Teleost	Platycephalidae	Platycephalidae - undifferentiated	Flatheads	37296000	Apportion to Tiger flathead.
BP	Teleost	Pentacerotidae	Pentacerotidae - undifferentiated	Boarfishes	37367000	Apportion to 37367002, 37367003, 37367004, 37367005. No change to ERA classification, i.e. BC
BP	Teleost	Scombridae	Scombridae spp (tribes Scomberomorini and Scombrini)	Mackerel (mixed)	37441911	Apportion to Blue mackerel. Blue mackerel changed classification from BC to BP.
BP	Teleost	Balistidae, Monacanthidae	Balistidae, Monacanthidae - undifferentiated	Leatherjackets	37465000	Apportioned to existing 8 Monacanthidae/Balistidae within list.
BP	Chondrichthyan		Skates and rays, unspecified	Skates and rays	37990018	Apportion to 20 skate and ray species within list.
BP	Teleost		Mixed reef fish	Fish (mixed)	37999999	Insufficient taxonomic resolution.
PS	Syngnathid	Syngnathidae	Syngnathidae - undifferentiated	Seahorses and pipefishes	37282000	Expanded in PS species list
PS	Marine bird	Procellariidae	Procellariidae - undifferentiated	Petrels prions and shearwaters	40041000	Expanded in PS species list
PS	Marine mammal	Otariidae and Phocidae	Otariidae and Phocidae	Seals	41132999 Now: 41131000	Expanded in PS species list

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

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

Summary of Habitat PSA results

The Habitat component was not assessed at Level 2.

Summary of Community PSA results

The Community component was eliminated at Level 1.

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

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

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

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

2.4.4 Uncertainty analysis ranking of overall risk (Step 5)

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

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

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

2.4.5 PSA results and discussion

a) Key/secondary commercial species

Under the revised ERAEF (AFMA 2017), key/secondary commercial species that undergo Tier stock assessments are not assessed at Level 2 with respect to the direct impact of capture of fishing hazard. This component was eliminated at Level 1 for other hazards and therefore not assessed at Level 2.

b) Commercial bait species

There are no commercial bait species in this sub-fishery.

c) Byproduct species

There were nine invertebrate byproduct species considered in this PSA. Six species were assessed at high risk and three at medium risk (Table 2.23, Figure 2.8). The high-risk scores were largely due to five or more missing attributes, while one species was due to low productivity and high susceptibility - Gould's squid *Nototodarus gouldi.*

A residual risk analysis was conducted on the six high risk species (see Section 2.9).

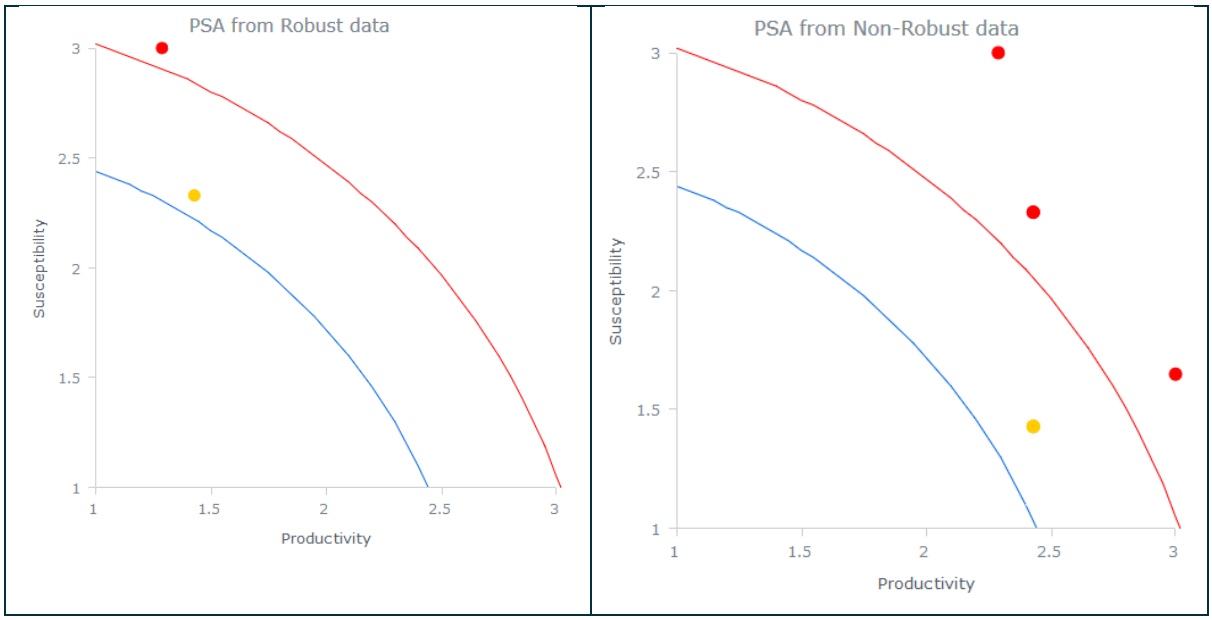


Figure 2.8. PSA plot for byproduct species in the SESSF Danish seine sub-fishery for a) robust [left] and (b) data deficient [right] species. Note many species fall on some points.

Table 2.23. Summary of the PSA scores on the set of productivity and susceptibility attributes for byproduct species and residual risk (RR) for high risk species. Note: Key commercial, secondary commercial, byproduct and bycatch component PSAs not examined for this sub-fishery, if the overall risk score was not extreme. Productivity attributes (P1-P7) are listed in Table 2.25 (in report). Susceptibility attributes (S1-S4) are listed in Susceptibility attributes Table 2.26 (in report). Missing attributes are highlighted (red). Productivity score (Prod. score); Susceptibility score (Susc. score). No. interactions or catch (No. Int. or catch (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. R: retained. NE: not entered.

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	P1	P2	P3	P4	P5	P6	P7	S1	S2	S3	S4	PROD. SCORE	SUSC. SCORE	MISSING ATTRIB-UTES	PSA 2D	RISK CATEGORY	NO. INT. OR CATCH(2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
23607005	*Sepia novaehollandiae*	Cuttlefish	3	3	3	1	1	3	3	3	3	2	3	2.43	2.33	5	3.37	High	Added species from *Sepia* spp: 14.6 t ret., 0 kg dis. (Log). 168.2 kg ret., 12.7 kg dis. (Obs).	This species is rare and typically not in the area of fishing effort. Risk score reduced to medium.	Medium
23607014	*Sepia braggi*	Cuttlefish	3	3	3	3	3	3	3	1	3	3	3	3	1.65	7	3.42	High	Added species from *Sepia* spp: 14.6 t ret., 0 kg dis. (Log). 168.2 kg ret., 12.7 kg dis. (Obs).	Catch is likely to be higher if a portion of the unidentified component is included. Risk remains high	High
23607036	*Sepia grahami*	Cuttlefish	3	3	3	1	1	3	3	3	3	2	3	2.43	2.33	5	3.37	High	Added species from *Sepia* spp: 14.6 t ret., 0 kg dis. (Log). 168.2 kg	Catch is likely to be higher if a portion of the unidentified component is included.	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 CATEGORY	NO. INT. OR CATCH(2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																			ret., 12.7 kg dis. (Obs).	Risk remains high	
23607010	*Sepia rozella*	Rosecone cuttlefish	3	3	3	1	1	3	3	3	3	2	3	2.43	2.33	5	3.37	High	Added species from *Sepia* spp: 14.6 t ret., 0 kg dis. (Log). 168.2 kg ret., 12.7 kg dis. (Obs).	Catch is likely to be higher if a portion of the unidentified component is included. Risk remains high	High
23659004	*Octopus pallidus*	Pale octopus	3	3	3	1	1	2	3	3	3	3	3	2.29	3	5	3.77	High	0 kg ret., 60 kg dis. (Log). Also, Octopodidae: 71.9 t ret., 46 kg dis. (Log). Also, 1.2 t ret., 6 kg dis. (Obs).	Catch is likely to be higher if a portion of the unidentified component is included. Risk remains high	High
23636004	*Nototodarus gouldi*	Gould's squid; Arrow squid	1	1	1	1	1	2	2	3	3	3	3	1.29	3	1	3.27	High	24.5 t ret., 1 kg dis. (Log). Also, 297.3 kg ret., 26.8 kg dis. (Obs). Also, 5.6 t ret., 1 kg dis. (Log). 42.5 kg ret. (Obs) of Squids:	No existing tiered or formal assessment in this fishery nor SSJ fishery, but current SSJ assessment group consider population not	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 CATEGORY	NO. INT. OR CATCH(2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																			23615000: Order Tuethoidea	overfished and not subject to overfishing. Population status unknown. A combined trigger of 2000 t for the SESSF-SESSF-GABT and SESF-OT sectors are in place.	
23607002	*Sepia cultrata*	Cuttlefish	3	3	3	1	1	3	3	1	3	2	3	2.43	1.43	4	2.82	Medium	NE	No RR required	Medium
23607021	*Sepia hedleyi*	Cuttlefish	3	3	3	1	1	3	3	1	3	2	3	2.43	1.43	4	2.82	Medium	NE	No RR required	Medium
23617005	*Sepioteuthis australis*	Southern calamari	1	1	2	1	1	2	2	3	3	2	3	1.43	2.33	1	2.73	Medium	NE	No RR required	Medium

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) Bycatch species

There was a total of 26 bycatch species assessed in this PSA (Table 2.24). Fifteen of these species comprising 3 chondrichthyans and 12 teleosts were unassessable in bSAFE. Of these 15 species, five were high risk (one chondrichthyan and four teleosts), seven were medium risk and three were low risk. The high-risk species all had at least five missing attributes (Table 2.24, Figure 2.9b). A further 11 invertebrate species were assessed resulting in three species at high risk (all with 10 missing attributes), six species at medium risk and two species at low risk (Table 2.24). A residual risk analysis was performed on the eight high risk species (see Section 2.9).

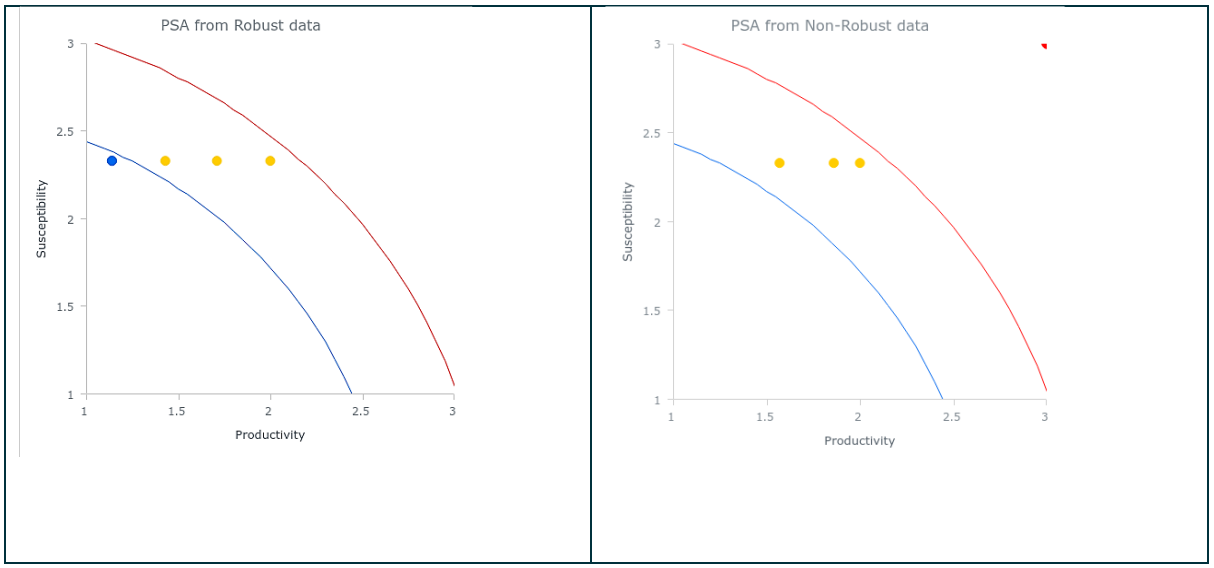


Figure 2.9. PSA plot for bycatch species in the SESSF Danish seine sub-fishery for a) robust [left] and (b) data deficient [right] species. Note many species fall on some points.

Table 2.24. Summary of the PSA scores on the set of productivity and susceptibility attributes for bycatch species and residual risk (RR) for high risk species. Note: Key commercial, secondary commercial, byproduct and bycatch component PSAs not examined for this sub-fishery, if the overall risk score was not extreme. Productivity attributes (P1-P7) are listed in Table 2.25 (in report). Susceptibility attributes (S1-S4) are listed in Susceptibility attributes Table 2.26 (in report). Missing attributes are highlighted (red). Productivity score (Prod. score); Susceptibility score (Susc. score). No. interactions or catch (No. Int. or catch (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. R: retained. NE: not entered.

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	P1	P2	P3	P4	P5	P6	P7	S1	S2	S3	S4	PROD. SCORE	SUSC. SCORE	MISSING ATTRIB-UTES	PSA 2D	RISK CATEGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
Following 15 BC species were unssessable in bSAFE and analysed in PSA:																					
37118002	*Trachinocephalus trachinus*	Snakefish	3	3	3	3	3	3	3	3	3	3	3	3	3	10	4.24	High	0.5 kg ret., 0 kg dis. (Obs)	3- low capture/interaction. Risk 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	2.4 t ret., 0 kg dis. (Log). Also, 37288000: 0 kg ret., 470 kg dis. (Obs). Also, 37990084: 0 kg ret., ~12 t dis. (Log).	Population status unknown. Depth range and distribution in fishery dubious due to taxonomic uncertainty. 3 – low/interaction capture. Risk reduced to medium.	Medium
37013004	*Parascyllium variolatum*	Varied carpetshark	3	3	3	3	2	3	3	1	3	3	3	2.86	1.65	7	3.30	High	Added species from 37013000: 56 kg ret., 0 kg dis. (Log)	Endemic to southern Australia. Occurs at depths to 180 m. Unknown population size. Only small part of its range overlaps with effort.	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 CATEGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
																				3 – low interaction/capture. Risk reduced to low.	
37462017	*Brachirus nigra*	Black sole	3	3	3	3	3	3	3	1	3	3	3	3	1.65	9	3.42	High	Added species from 37990015: 2 t ret., 0 kg dis. (Log). Also apportioned this catch to two other species in list.	Population status unknown. Occurs at depths to 200m. 3 – low interaction/capture. Risk reduced to medium.	Medium
37287007	*Maxillicosta scabriceps*	Little gurnard perch	3	3	3	3	1	3	3	1	3	3	3	2.71	1.65	7	3.17	High	0 kg ret., 925.7 kg dis. (Log). Also, 37288000: 0 kg ret., 470 kg dis. (Obs). Also, 37990084: 0 kg ret., ~12 t dis. (Log).	Unknown population size. Depth range 2-46 m. Only small part of its range overlaps with effort. Risk reduced to medium	Medium
37013002	*Parascyllium collare*	Collar carpetshark	3	3	3	1	2	2	3	1	3	3	3	2.43	1.65	2	2.94	Medium	NE	No RR required	Medium
37278002	*Fistularia petimba*	Rough flutemouth	3	3	3	2	2	1	3	1	3	3	3	2.43	1.65	3	2.94	Medium	NE	No RR required	Medium
37013005	*Parascyllium ferrugineum*	Rusty carpetshark	3	3	3	1	2	2	3	1	3	3	3	2.43	1.65	2	2.94	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 CATEGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37287005	*Neosebastes scorpaenoides*	Common gurnard perch	3	3	3	1	2	1	3	1	3	3	3	2.29	1.65	3	2.82	Medium	NE	No RR required	Medium
37297001	*Hoplichthys haswelli*	Deepsea flathead	3	3	3	1	2	1	3	1	3	3	3	2.29	1.65	3	2.82	Medium	NE	No RR required	Medium
37287006	*Neosebastes thetidis*	Thetis fish	3	3	3	1	1	1	3	1	3	3	3	2.14	1.65	3	2.7	Medium	NE	No RR required	Medium
37466002	*Anoplocapros inermis*	Eastern smooth boxfish	3	3	3	1	1	1	3	1	3	3	3	2.14	1.65	3	2.7	Medium	NE	No RR required	Medium
37141001	*Gonorynchus greyi*	Beaked salmon	3	3	3	1	2	1	1	1	3	3	3	2	1.65	3	2.59	Low	NE	No RR required	Low
37229003	*Echiodon rendahli*	Messmate fish	3	3	3	1	1	1	3	1	3	2	3	2.14	1.43	3	2.57	Low	NE	No RR required	Low
37466003	*Aracana aurita*	Shaw's cowfish	3	3	3	1	1	1	3	1	3	2	3	2.14	1.43	3	2.57	Low	NE	No RR required	Low
Other BC species:																					
24207072	*Melo miltonis*	Southern bailer shell	3	3	3	3	3	3	3	3	3	3	3	3	3	10	4.24	High	1 kg ret., 0 kg dis. (Obs)	3- low interaction/capture. Risk reduced to low.	Low
28821003	*Ibacus novemdentatus*	Balmain bug	3	3	3	3	3	3	3	3	3	3	3	3	3	10	4.24	High	3 kg ret., 1.3 kg dis. (Obs)	3- low interaction/capture. Risk reduced to low.	Low
25128001	*Asterodiscides truncatus*	Firebrick seastar	3	3	3	3	3	3	3	3	3	3	3	3	3	10	4.24	High	0 kg ret., 7 kg dis. (Obs)	3- low interaction/capture. Risk reduced to low.	Low
24207001	*Livonia mammilla*	False bailer shell	3	3	3	1	1	2	1	3	3	2	3	2	2.33	2	3.07	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 CATEGORY	NO. INT. OR CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
28911003	*Ovalipes australiensis*	Common sand crab	3	3	3	1	1	2	1	3	3	2	3	2	2.33	4	3.07	Medium	NE	No RR required	Medium
28821004	*Ibacus peronii*	Eastern Balmain 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
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
23270006	*Mimachlamys asperrima*	Doughboy scallop	3	3	1	1	1	1	1	3	3	2	3	1.57	2.33	3	2.81	Medium	NE	No RR required	Medium
28820001	*Jasus edwardsii*	Southern rock lobster	2	2	1	1	1	2	1	3	3	2	3	1.43	2.33	1	2.73	Medium	NE	No RR required	Medium
28711052	*Melicertus plebejus*	Eastern king 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
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

e) Protected species

The protected species component was eliminated at Level 1. Therefore, no Level 2 analysis was required.

Productivity attributes

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

ATTRIBUTE NUMBER	ATTRIBUTE NAME	LOW PRODUCTIVITY (RISK SCORE: 3)	MEDIUM PRODUCTIVITY (RISK SCORE: 2)	HIGH PRODUCTIVITY (RISK SCORE: 1)
P1	Average age at maturity	> 15 years	5 – 15 years	< 5 years
P2	Average max age	> 25 years	10-25 years	< 10 years
P3	Fecundity	< 100 eggs per years	100-20,000 eggs per year	> 20,000 eggs per year
P4	Average max size	> 300 cm	100-300 cm	< 100 cm
P5	Average size at Maturity	> 200 cm	40-200 cm	< 40 cm
P6	Reproductive strategy	Taxa is “Marine bird" or "Marine mammal"	Family is : "Syngnathidae" or "Solenostomidae" Or Reproductive Strategy is: “Demersal Spawner” Or “Brooder”	Reproductive Strategy is “Broadcast Spawner”
P7	Trophic level	> 3.25	2.75-3.25	< 2.75

Susceptibility attributes

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

ATTRIBUTE NUMBER	ATTRIBUTE NAME	LOW SUSCEPTIBILITY (RISK SCORE: 1)	MEDIUM SUSCEPTIBILITY (RISK SCORE: 2)	HIGH SUSCEPTIBILITY (RISK SCORE: 3)
S1	Availability	< 10% overlap	Continuous [1,3]	> 30% overlap
S2	Encounterability (habitat and bathymetry based)	Fishery Specific	Fishery Specific	Fishery Specific
S3	Selectivity (size based)	Fishery Specific	Fishery Specific	Fishery Specific
S4	Post-Capture Mortality (role in fishery based, protected Species based)	Some Protected (Live)	Byproduct or bycatch Some protected (generally alive)	Key or secondary commercial Some protected (likely to be dead)

Post Capture Mortality

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

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

Table 2.27. Post capture mortality attribute risk score for the Danish seine 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/trapped	L	1

2.5 bSAFE results and discussion

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

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

MSM	LIM	CRASH	OVERALL RISK
Below	Below	Below	Low
Above	Below	Below	Medium
Above	Above	Below	High
Above	Above	Above	Extreme

2.5.1 bSAFE – Key/secondary commercial species

Under the revised ERAEF (AFMA 2017), key/secondary commercial species that undergo Tier stock assessments are not assessed at Level 2 with respect to the direct impact of capture of fishing hazard. This component was eliminated at Level 1 for other hazards and therefore not assessed at Level 2.

2.5.2 bSAFE - Commercial bait species

There were no commercial bait species in this sub-fishery.

2.5.3 bSAFE - Byproduct species

A total of 26 byproduct species comprising 10 chondrichthyans and 16 teleosts were assessed in this bSAFE (Table 2.29). All these species were below the three reference points resulting in an overall low risk (Figure 2.10).

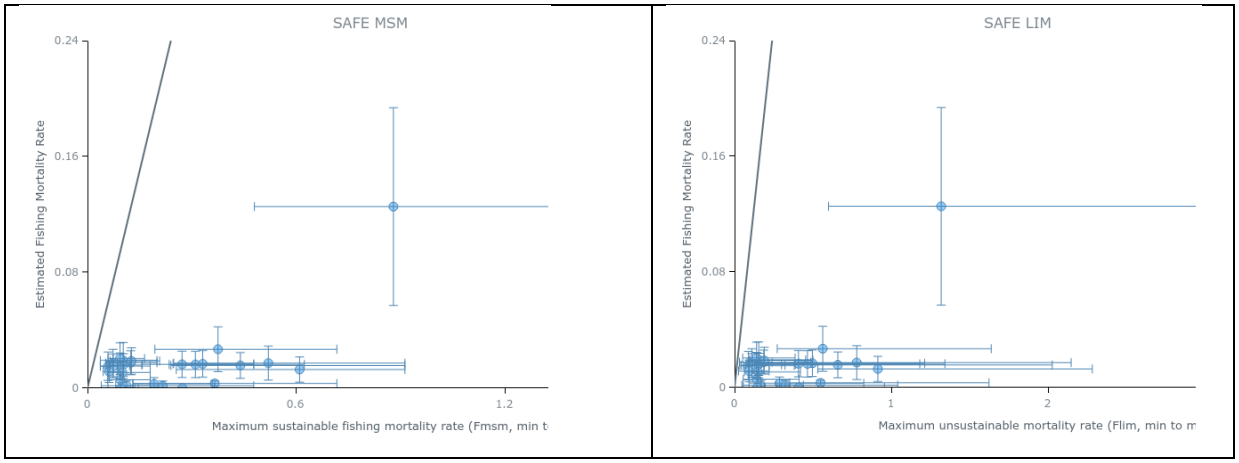


Figure 2.10. SAFE plot for Byproduct species in the SESSF Danish seine sub-fishery for (a) SAFE-MSM reference point [left] and (b) SAFE limit (LIM) reference point [right].

Table 2.29. 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 from Commonwealth logbook (Log) and observer (Obs) databases. Residual risk guidelines drawn from document "Revision of residual risk guidelines to reflect updated Ecological Risk Assessment Methodology – version Oct 12, 2016. See numbers at the foot of this table. NE: not entered. Ret: retained; dis: discarded. ^: Tiered species in this sub-fishery.

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
37024001	*Squatina australis*	Australian angel shark	0.018	0.07	Below	0.11	Below	0.15	Below	Low	NE	No RR required	Low
37031003	*Dentiraja cerva*	Whitespotted skate	0.019	0.1	Below	0.15	Below	0.21	Below	Low	NE	No RR required	Low
37031005	*Dentiraja confusa*	Longnose skate	0.021	0.09	Below	0.14	Below	0.19	Below	Low	NE	No RR required	Low
37031006	*Spiniraja whitleyi*	Melbourne skate	0.015	0.06	Below	0.09	Below	0.12	Below	Low	NE	No RR required	Low
37031007	*Dentiraja lemprieri*	Thornback skate	0.015	0.07	Below	0.11	Below	0.15	Below	Low	NE	No RR required	Low
37031009	*Pavoraja nitida*	Peacock skate	0.002	0.11	Below	0.17	Below	0.23	Below	Low	NE	No RR required	Low
37031028	*Dipturus canutus*	Grey Skate	0.000	0.1	Below	0.14	Below	0.19	Below	Low	NE	No RR required	Low
37035001	*Bathytoshia brevicaudata*	Short-tail stingray	0.011	0.11	Below	0.16	Below	0.21	Below	Low	NE	No RR required	Low
37035002	*Bathytoshia lata*	Brown stingray/ Black Stingray	0.006	0.10	Below	0.16	Below	0.21	Below	Low	NE	No RR required	Low
37039001	*Myliobatis tenuicaudatus*	New Zealand eagle ray; Southern eagle ray	0.012	0.07	Below	0.11	Below	0.14	Below	Low	NE	No RR required	Low
37288001	*Chelidonichthys kumu*	Red gurnard	0.017	0.52	Below	0.78	Below	1.04	Below	Low	NE	No RR required	Low
37288006	*Pterygotrigla polyommata*	Latchet	0.016	0.44	Below	0.65	Below	0.87	Below	Low	NE	No RR required	Low
37288007	*Lepidotrigla modesta*	Cocky gurnard	0.013	0.61	Below	0.91	Below	1.21	Below	Low	NE	No RR required	Low
37353001	*Chrysophrys auratus*	Snapper	0.017	0.28	Below	0.41	Below	0.55	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
37355001	*Upeneichthys lineatus*	Bluestriped goatfish	0.125	0.88	Below	1.32	Below	1.76	Below	Low	NE	No RR required	Low
37441001	*Scomber australasicus*	Blue mackerel	0.003	0.37	Below	0.55	Below	0.73	Below	Low	NE	No RR required	Low
37465006	*Nelusetta ayraud*	Ocean jacket	0.027	0.38	Below	0.56	Below	0.75	Below	Low	NE	No RR required	Low
37017001	*Mustelus antarcticus*	Gummy shark^	0.016	0.1	Below	0.15	Below	0.21	Below	Low	NE	No RR required	Low
37023001	*Pristiophorus nudipinnis*	Southern sawshark^	0.018	0.12	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37023002	*Pristiophorus cirratus*	Common sawshark^	0.016	0.09	Below	0.14	Below	0.19	Below	Low	NE	No RR required	Low
37043001	*Callorhinchus milii*	Elephantfish^	0.019	0.13	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37228002	*Genypterus blacodes*	Pink ling^	0.003	0.19	Below	0.29	Below	0.38	Below	Low	NE	No RR required	Low
37264003	*Zenopsis nebulosus*	Mirror dory^	0.000	0.27	Below	0.40	Below	0.54	Below	Low	NE	No RR required	Low
37264004	*Zeus faber*	John dory^	0.017	0.33	Below	0.50	Below	0.67	Below	Low	NE	No RR required	Low
37377003	*Nemadactylus macropterus*	Jackass morwong^	0.002	0.22	Below	0.32	Below	0.43	Below	Low	NE	No RR required	Low
37445005	*Seriolella brama*	Blue warehou^	0.016	0.31	Below	0.47	Below	0.62	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

There were 155 bycatch species considered in this SAFE (Table 2.30) of which 15 were unassessable due to missing biological attributes employed and were assessed by PSA (see **Error! Reference source not found.**). Of the remaining 140 species, one was extreme risk, n one were high risk, one was medium risk and 139 were low risk. The extreme risk species, short-tail torpedo ray *Tetronarce nobiliana* was further analysed in a residual risk analysis (see Section 2.9).

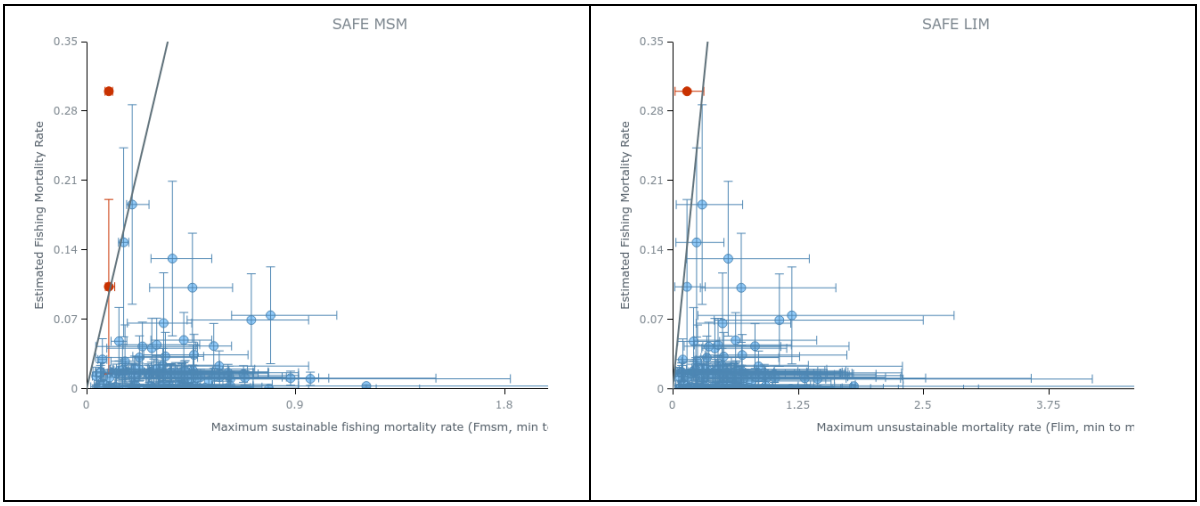


Figure 2.11. SAFE plot for Bycatch species in the SESSF Danish seine sub-fishery for (a) SAFE-MSM reference point [left] and (b) SAFE limit (LIM) reference point [right].

Table 2.30. 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 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. ^: Tiered species in this sub-fishery.

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPTIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
The following 15 bycatch species have been analysed in the PSA (see Table 2.24):													
37466003	*Aracana aurita*	Shaw's cowfish	0.011	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37466002	*Anoplocapros inermis*	Eastern smooth boxfish	0.02	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37462017	*Brachirus nigra*	Black sole	0.088	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37297001	*Hoplichthys haswelli*	Deepsea flathead	0.000	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37288012	*Satyrichthys cf moluccense*	Blackfin armour gurnard	0.000	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37287007	*Maxillicosta scabriceps*	Little gurnard perch	0.001	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37287006	*Neosebastes thetidis*	Thetis fish	0.014	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37287005	*Neosebastes scorpaenoides*	Common gurnard perch	0.018	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37278002	*Fistularia petimba*	Rough flutemouth	0.082	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37229003	*Echiodon rendahli*	Messmate fish	0.012	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37141001	*Gonorynchus greyi*	Beaked salmon	0.017	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37118002	*Trachinocephalus trachinus*	Snakefish	0.078	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37013005	*Parascyllium ferrugineum*	Rusty carpetshark	0.015	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37013004	*Parascyllium variolatum*	Varied carpetshark	0.002	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
37013002	*Parascyllium collare*	Collar carpetshark	0.042	-	NA	-	NA	-	NA	NA	-	-	See Table 2.24
Other BC species:													
37028003	*Tetronarce nobiliana*	Short-tail torpedo ray	0.3	0.09	Above	0.14	Above	0.19	Above	Extreme	46.35 kg dis. (Obs)	Unknown population size and trend.	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPTIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
												3- low interaction/ capture. Risk score reduced to low.	
37337062	*Pseudocaranx georgianus*	Silver trevally^	0.015	0.27	Below	0.40	Below	0.53	Below	Low	NE	No RR required	Low
37027006	*Trygonorrhina fasciata*	Eastern fiddler ray	0.103	0.1	Above	0.14	Below	0.19	Below	Medium	NE	No RR required	Medium
37024004	*Squatina albipunctata*	Eastern angelshark	0.005	0.07	Below	0.11	Below	0.15	Below	Low	NE	No RR required	Low
37005001	*Heptranchias perlo*	Sharpnose sevengill shark	0.000	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37005002	*Notorynchus cepedianus*	Broadnose shark	0.012	0.1	Below	0.15	Below	0.2	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
37007001	*Heterodontus portusjacksoni*	Port Jackson shark	0.017	0.07	Below	0.10	Below	0.14	Below	Low	NE	No RR required	Low
37012001	*Alopias vulpinus*	Common thresher	0.000	0.08	Below	0.12	Below	0.16	Below	Low	NE	No RR required	Low
37012002	*Alopias superciliosus*	Bigeye thresher shark	0.000	0.06	Below	0.09	Below	0.11	Below	Low	NE	No RR required	Low
37013003	*Orectolobus maculatus*	Spotted wobbegong	0.03	0.07	Below	0.10	Below	0.14	Below	Low	NE	No RR required	Low
37013006	*Stegostoma fasciatum*	Zebra shark	0.000		Below		Below		Below	Low	NE	No RR required	Low
37013020	*Orectolobus halei*	Gulf wobbegong	0.019	0.14	Below	0.21	Below	0.28	Below	Low	NE	No RR required	Low
37015001	*Cephaloscyllium laticeps*	Draughtboard shark	0.015	0.1	Below	0.16	Below	0.21	Below	Low	NE	No RR required	Low
37015003	*Asymbolus vincenti*	Gulf catshark	0.018	0.13	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37015013	*Cephaloscyllium albipinnum*	Whitefin swellshark	0.001	0.12	Below	0.18	Below	0.24	Below	Low	NE	No RR required	Low
37015024	*Asymbolus rubiginosus*	Orange spotted catshark	0.048	0.14	Below	0.21	Below	0.28	Below	Low	NE	No RR required	Low
37015027	*Asymbolus analis*	Grey spotted catshark	0.028	0.13	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37017008	*Galeorhinus galeus*	School shark^	0.017	0.06	Below	0.09	Below	0.13	Below	Low	NE	No RR required	Low
37018001	*Carcharhinus brachyurus*	Bronze whaler	0.013	0.04	Below	0.06	Below	0.08	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPTIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37018021	*Carcharhinus leucas*	Bull shark	0.000	0.06	Below	0.08	Below	0.11	Below	Low	NE	No RR required	Low
37018022	*Galeocerdo cuvier*	Tiger shark	0.005	0.07	Below	0.11	Below	0.14	Below	Low	NE	No RR required	Low
37019004	*Sphyrna zygaena*	Smooth hammerhead shark	0.002	0.09	Below	0.13	Below	0.17	Below	Low	NE	No RR required	Low
37020006	*Squalus megalops*	Piked spurdog; Spikey dogfish	0.002	0.06	Below	0.09	Below	0.12	Below	Low	NE	No RR required	Low
37020008	*Squalus acanthias*	Whitespotted dogfish	0.016	0.06	Below	0.09	Below	0.12	Below	Low	NE	No RR required	Low
37020048	*Squalus chloroculus*	Greeneye spurdog	0.000	0.06	Below	0.09	Below	0.12	Below	Low	NE	No RR required	Low
37027001	*Aptychotrema vincentiana*	Western shovelnose ray	0.000	0.11	Below	0.16	Below	0.21	Below	Low	NE	No RR required	Low
37027011	*Trygonorrhina dumerilii*	Southern fiddler ray	0.001	0.1	Below	0.15	Below	0.2	Below	Low	NE	No RR required	Low
37028002	*Narcine tasmaniensis*	Tasmanian numbfish	0.015	0.68	Below	1.01	Below	1.35	Below	Low	NE	No RR required	Low
37038001	*Urolophus bucculentus*	Sandyback stingaree	0.017	0.15	Below	0.23	Below	0.31	Below	Low	NE	No RR required	Low
37038002	*Urolophus cruciatus*	Banded stingaree	0.02	0.16	Below	0.23	Below	0.31	Below	Low	NE	No RR required	Low
37038004	*Urolophus paucimaculatus*	Sparsely-spotted stingaree	0.017	0.2	Below	0.29	Below	0.39	Below	Low	NE	No RR required	Low
37038005	*Urolophus sufflavus*	Yellowback stingaree	0.018	0.15	Below	0.23	Below	0.31	Below	Low	NE	No RR required	Low
37038006	*Trygonoptera testacea*	Common stingaree	0.148	0.16	Below	0.24	Below	0.32	Below	Low	NE	No RR required	Low
37038007	*Urolophus viridis*	Greenback stingaree	0.019	0.15	Below	0.23	Below	0.31	Below	Low	NE	No RR required	Low
37067001	*Conger wilsoni*	Eastern conger	0.000	0.23	Below	0.34	Below	0.45	Below	Low	NE	No RR required	Low
37067007	*Conger verreauxi*	Southern conger	0.017	0.23	Below	0.34	Below	0.45	Below	Low	NE	No RR required	Low
37085002	*Sardinops sagax*	Australian sardine	0.012	0.49	Below	0.74	Below	0.98	Below	Low	NE	No RR required	Low
37117001	*Latropiscis purpurissatus*	Sergeant baker	0.017	0.31	Below	0.46	Below	0.62	Below	Low	NE	No RR required	Low
37120001	*Paraulopus nigripinnis*	Blacktip cucumberfish	0.008	0.53	Below	0.79	Below	1.05	Below	Low	NE	No RR required	Low
37192001	*Cnidoglanis macrocephalus*	Estuary cobbler	0.002	0.36	Below	0.54	Below	0.72	Below	Low	NE	No RR required	Low
37212001	*Halieutaea brevicauda*	Shortfin seabat	0.019	0.46	Below	0.69	Below	0.92	Below	Low	NE	No RR required	Low
37224003	*Pseudophycis barbata*	Bearded rock cod	0.017	0.39	Below	0.58	Below	0.78	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPTIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37224005	*Lotella rhacina*	Largetooth beardie	0.016	0.33	Below	0.50	Below	0.67	Below	Low	NE	No RR required	Low
37224006	*Pseudophycis bachus*	Red cod	0.016	0.42	Below	0.62	Below	0.83	Below	Low	NE	No RR required	Low
37224011	*Pseudophycis breviuscula*	Bastard red cod	0.017	0.55	Below	0.55	Below	0.73	Below	Low	NE	No RR required	Low
37224023	*Lotella phycis*	Slender beardie	0.000	0.25	Below	0.37	Below	0.50	Below	Low	NE	No RR required	Low
37227001	*Macruronus novaezelandiae*	Blue grenadier^	0.000	0.25	Below	0.37	Below	0.50	Below	Low	NE	No RR required	Low
37228008	*Genypterus tigerinus*	Rock ling	0.015	0.20	Below	0.30	Below	0.41	Below	Low	NE	No RR required	Low
37232001	*Coelorinchus australis*	Southern whiptail	0.018	0.29	Below	0.44	Below	0.58	Below	Low	NE	No RR required	Low
37258002	*Beryx splendens*	Alfonsino^	0.000	0.34	Below	0.52	Below	0.69	Below	Low	NE	No RR required	Low
37258003	*Centroberyx affinis*	Redfish^	0.041	0.28	Below	0.42	Below	0.56	Below	Low	NE	No RR required	Low
37258004	*Centroberyx gerrardi*	Bight redfish	0.018	0.28	Below	0.42	Below	0.56	Below	Low	NE	No RR required	Low
37264001	*Cyttus traversi*	King dory	0.000	0.50	Below	0.75	Below	1	Below	Low	NE	No RR required	Low
37264002	*Cyttus australis*	Silver dory	0.016	0.37	Below	0.55	Below	0.73	Below	Low	NE	No RR required	Low
37264005	*Cyttus novaezealandiae*	New Zealand dory	0.002	0.43	Below	0.65	Below	0.87	Below	Low	NE	No RR required	Low
37264010	*Cyttopsis rosea*	Rosy dory	0.001	0.35	Below	0.53	Below	0.71	Below	Low	NE	No RR required	Low
37266001	*Neocyttus rhomboidalis*	Spikey oreodory^	0.000	0.16	Below	0.25	Below	0.33	Below	Low	NE	No RR required	Low
37266005	*Allocyttus niger*	Black oreodory^	0.000	0.12	Below	0.19	Below	0.25	Below	Low	NE	No RR required	Low
37268001	*Lampris guttatus*	Spotted moonfish; Opah	0.000	0.23	Below	0.35	Below	0.47	Below	Low	NE	No RR required	Low
37278001	*Fistularia commersonii*	Smooth flutemouth	0.000		Below		Below		Below	Low	NE	No RR required	Low
37279002	*Macroramphosus scolopax*	Common bellowsfish	0.01	0.96	Below	1.45	Below	1.93	Below	Low	NE	No RR required	Low
37287001	*Helicolenus percoides*	Reef ocean perch^	0.02	0.23	Below	0.35	Below	0.46	Below	Low	NE	No RR required	Low
37287008	*Scorpaena papillosa*	Southern red scorpionfish	0.01	0.40	Below	0.6	Below	0.81	Below	Low	NE	No RR required	Low
37287048	*Centropogon australis*	Eastern fortescue	0.000	0.4	Below	0.6	Below	0.8	Below	Low	NE	No RR required	Low
37287093	*Helicolenus barathri*	Bigeye ocean perch^	0.000	0.2	Below	0.3	Below	0.4	Below	Low	NE	No RR required	Low
37288002	*Lepidotrigla papilio*	Spiny gurnard	0.01	0.62	Below	0.92	Below	1.23	Below	Low	NE	No RR required	Low

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37288003	*Lepidotrigla vanessa*	Butterfly gurnard	0.016	0.61	Below	0.91	Below	1.21	Below	Low	NE	No RR required	Low
37288005	*Pterygotrigla andertoni*	Painted latchet	0.001	0.48	Below	0.73	Below	0.97	Below	Low	NE	No RR required	Low
37288008	*Lepidotrigla mulhalli*	Roundsnout gurnard	0.014	0.61	Below	0.91	Below	1.22	Below	Low	NE	No RR required	Low
37288032	*Lepidotrigla argus*	Eye gurnard	0.003	0.62	Below	0.92	Below	1.23	Below	Low	NE	No RR required	Low
37296002	*Platycephalus conatus*	Deepwater flathead	0.000	0.29	Below	0.44	Below	0.59	Below	Low	NE	No RR required	Low
37296003	*Platycephalus bassensis*	Southern sand flathead	0.019	0.43	Below	0.64	Below	0.85	Below	Low	NE	No RR required	Low
37296004	*Platycephalus fuscus*	Dusky flathead	0.004	0.40	Below	0.60	Below	0.80	Below	Low	NE	No RR required	Low
37296007	*Platycephalus caeruleopunctatus*	Bluespotted flathead	0.131	0.35	Below	0.56	Below	0.74	Below	Low	NE	No RR required	Low
37296035	*Platycephalus aurimaculatus*	Toothy flathead	0.017	0.36	Below	0.54	Below	0.72	Below	Low	NE	No RR required	Low
37296036	*Platycephalus longispinis*	Longspine flathead	0.102	0.46	Below	0.68	Below	0.91	Below	Low	NE	No RR required	Low
37296037	*Platycephalus speculator*	Southern bluespotted flathead	0.000	0.38	Below	0.56	Below	0.75	Below	Low	NE	No RR required	Low
37296038	*Platycephalus marmoratus*	Marbled flathead	0.049	0.42	Below	0.63	Below	0.84	Below	Low	NE	No RR required	Low
37311001	*Lepidoperca pulchella*	Eastern orange perch	0.033	0.34	Below	0.51	Below	0.69	Below	Low	NE	No RR required	Low
37311002	*Caesioperca lepidoptera*	Butterfly perch	0.016	0.21	Below	0.32	Below	0.42	Below	Low	NE	No RR required	Low
37311003	*Caesioperca rasor*	Barber perch	0.003	0.21	Below	0.32	Below	0.42	Below	Low	NE	No RR required	Low
37311006	*Polyprion oxygeneios*	Hapuku	0.000	0.13	Below	0.20	Below	0.26	Below	Low	NE	No RR required	Low
37311022	*Epinephelus rivulatus*	Chinaman rockcod	0.004	0.34	Below	0.50	Below	0.67	Below	Low	NE	No RR required	Low
37311053	*Apogonops anomalus*	Threespine cardinalfish	0.001	0.44	Below	0.65	Below	0.87	Below	Low	NE	No RR required	Low
37311077	*Epinephelus daemelii*	Black rockcod	0.186	0.20	Below	0.30	Below	0.40	Below	Low	NE	No RR required	Low
37330001	*Sillaginodes punctatus*	King George whiting	0.016	0.42	Below	0.63	Below	0.84	Below	Low	NE	No RR required	Low
37330002	*Sillago bassensis*	Southern school whiting	0.000	0.54	Below	0.82	Below	1.09	Below	Low	NE	No RR required	Low
37330005	*Sillago robusta*	Stout whiting	0.074	0.79	Below	1.19	Below	1.59	Below	Low	NE	No RR required	Low
37330010	*Sillago ciliata*	Sand whiting	0.023	0.57	Below	0.86	Below	1.14	Below	Low	NE	No RR required	Low

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37330015	*Sillago maculata*	Trumpeter whiting	0.07	0.71	Below	1.07	Below	1.42	Below	Low	NE	No RR required	Low
37337002	*Trachurus declivis*	Common jack mackerel	0.003	0.47	Below	0.71	Below	0.95	Below	Low	NE	No RR required	Low
37337003	*Trachurus novaezelandiae*	Yellowtail scad	0.015	0.46	Below	0.69	Below	0.92	Below	Low	NE	No RR required	Low
37337006	*Seriola lalandi*	Yellowtail kingfish	0.015	0.44	Below	0.66	Below	0.88	Below	Low	NE	No RR required	Low
37344002	*Arripis trutta*	Eastern Australian salmon	0.034	0.46	Below	0.69	Below	0.93	Below	Low	NE	No RR required	Low
37344004	*Arripis truttaceus*	Western Australian salmon	0.001	0.51	Below	0.77	Below	1.02	Below	Low	NE	No RR required	Low
37349001	*Parequula melbournensis*	Silverbelly	0.003	1.21	Below	1.81	Below	2.41	Below	Low	NE	No RR required	Low
37355029	*Upeneichthys vlamingii*	Bluespotted goatfish	0.011	0.88	Below	1.32	Below	1.76	Below	Low	NE	No RR required	Low
37367002	*Paristiopterus labiosus*	Giant boarfish	0.045	0.3	Below	0.45	Below	0.6	Below	Low	NE	No RR required	Low
37367003	*Pentaceropsis recurvirostris*	Longsnout boarfish	0.016	0.2	Below	0.3	Below	0.4	Below	Low	NE	No RR required	Low
37367004	*Pentaceros decacanthus*	Bigspine boarfish	0.000	0.27	Below	0.4	Below	0.53	Below	Low	NE	No RR required	Low
37367005	*Zanclistius elevatus*	Blackspot boarfish	0.015	0.27	Below	0.4	Below	0.53	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	0.043	0.24	Below	0.36	Below	0.48	Below	Low	NE	No RR required	Low
37377004	*Nemadactylus valenciennesi*	Blue morwong	0.032	0.23	Below	0.34	Below	0.46	Below	Low	NE	No RR required	Low
37378001	*Latris lineata*	Striped trumpeter	0.02	0.3	Below	0.45	Below	0.6	Below	Low	NE	No RR required	Low
37378002	*Latridopsis forsteri*	Bastard trumpeter	0.02	0.21	Below	0.31	Below	0.41	Below	Low	NE	No RR required	Low
37382002	*Sphyraena novaehollandiae*	Snook	0.005	0.41	Below	0.62	Below	0.83	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	0.014	0.46	Below	0.69	Below	0.91	Below	Low	NE	No RR required	Low
37400001	*Xenocephalus armatus*	Bulldog stargazer	0.024	0.33	Below	0.49	Below	0.66	Below	Low	NE	No RR required	Low
37400003	*Kathetostoma laeve*	Common stargazer	0.017	0.32	Below	0.48	Below	0.56	Below	Low	NE	No RR required	Low
37400018	*Kathetostoma canaster*	Speckled stargazer	0.016	0.36	Below	0.55	Below	0.73	Below	Low	NE	No RR required	Low

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37427001	*Foetorepus calauropomus*	Common stinkfish	0.011	0.68	Below	1.02	Below	1.37	Below	Low	NE	No RR required	Low
37439001	*Thyrsites atun*	Barracouta	0.003	0.36	Below	0.54	Below	0.71	Below	Low	NE	No RR required	Low
37439002	*Rexea solandri*	Gemfish^	0.003	0.28	Below	0.41	Below	0.55	Below	Low	NE	No RR required	Low
37440002	*Lepidopus caudatus*	Southern frostfish; Frostfish	0.002	0.36	Below	0.54	Below	0.71	Below	Low	NE	No RR required	Low
37445001	*Hyperoglyphe antarctica*	Blue-eye trevalla^	0.003	0.21	Below	0.32	Below	0.43	Below	Low	NE	No RR required	Low
37445006	*Seriolella punctata*	Silver warehou^	0.016	0.33	Below	0.5	Below	0.66	Below	Low	NE	No RR required	Low
37460001	*Lophonectes gallus*	Crested flounder	0.012	0.57	Below	0.86	Below	1.15	Below	Low	NE	No RR required	Low
37460009	*Pseudorhombus arsius*	Largetooth flounder	0.000	0.42	Below	0.63	Below	0.85	Below	Low	NE	No RR required	Low
37461001	*Ammotretis rostratus*	Longsnout flounder	0.011	0.22	Below	0.34	Below	0.45	Below	Low	NE	No RR required	Low
37461003	*Rhombosolea tapirina*	Greenback flounder	0.011	0.49	Below	0.73	Below	0.97	Below	Low	NE	No RR required	Low
37462010	*Zebrias scalaris*	Manyband sole	0.066	0.35	Below	0.52	Below	0.69	Below	Low	NE	No RR required	Low
37465002	*Acanthaluteres vittiger*	Toothbrush leatherjacket	0.011	0.44	Below	0.65	Below	0.87	Below	Low	NE	No RR required	Low
37465003	*Eubalichthys mosaicus*	Mosaic leatherjacket	0.017	0.41	Below	0.61	Below	0.82	Below	Low	NE	No RR required	Low
37465005	*Meuschenia scaber*	Velvet leatherjacket	0.016	0.41	Below	0.61	Below	0.82	Below	Low	NE	No RR required	Low
37465007	*Scobinichthys granulatus*	Rough leatherjacket	0.001	0.41	Below	0.61	Below	0.82	Below	Low	NE	No RR required	Low
37465034	*Eubalichthys gunnii*	Gunn's leatherjacket	0.000	0.41	Below	0.61	Below	0.82	Below	Low	NE	No RR required	Low
37465036	*Meuschenia freycineti*	Sixspine leatherjacket	0.016	0.39	Below	0.59	Below	0.79	Below	Low	NE	No RR required	Low
37465037	*Thamnaconus degeni*	Bluefin leatherjacket	0.001	0.6	Below	0.9	Below	1.2	Below	Low	NE	No RR required	Low
37466001	*Aracana ornata*	Ornate cowfish	0.000		Below		Below		Below	Low	NE	No RR required	Low
37466004	*Lactoria cornuta*	Longhorn cowfish	0.000		Below		Below		Below	Low	NE	No RR required	Low
37467001	*Contusus richei*	Barred toadfish	0.013	0.55	Below	0.83	Below	1.1	Below	Low	NE	No RR required	Low
37467005	*Arothron firmamentum*	Starry toadfish	0.018	0.42	Below	0.63	Below	0.84	Below	Low	NE	No RR required	Low
37467044	*Contusus brevicaudus*	Prickly toadfish	0.000	0.79	Below	1.18	Below	1.57	Below	Low	NE	No RR required	Low

CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SUSCEPTIBILITY	F MSM	F MSM RISK	F LIM	F LIM RISK	F CRASH	F CRASH RISK	F OVERALL RISK	CATCH (2012-2016)	RISK SCORE FOLLOWING RESIDUAL RISK	FINAL RISK SCORE
37469001	*Diodon nicthemerus*	Globefish	0.01	0.45	Below	0.68	Below	0.9	Below	Low	NE	No RR required	Low
37469002	*Allomycterus pilatus*	Australian burrfish	0.015	0.45	Below	0.68	Below	0.9	Below	Low	NE	No RR required	Low
37469013	*Dicotylichthys punctulatus*	Three-barred porcupinefish	0.043	0.55	Below	0.82	Below	1.1	Below	Low	NE	No RR required	Low
37470001	*Mola ramsayi*	Short sunfish	0.002	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

The protected species component was eliminated at Level 1. Therefore, no Level 2 bSAFE analysis was required.

2.6 Habitat Component

The Habitat component was not assessed in this report.

2.7 Community Component

The Community component was eliminated at Level 1.

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

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

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

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

At the conclusion of the Level 2 analysis, a fishery can decide to further investigate the risk of fishing to the species via a Level 3 assessment or implement a management response to mitigate the risk. To ensure all fisheries follow a consistent process in responding to the results of the risk assessment, AFMA has developed an ecological risk management framework. The

framework (Figure 2.12) 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.

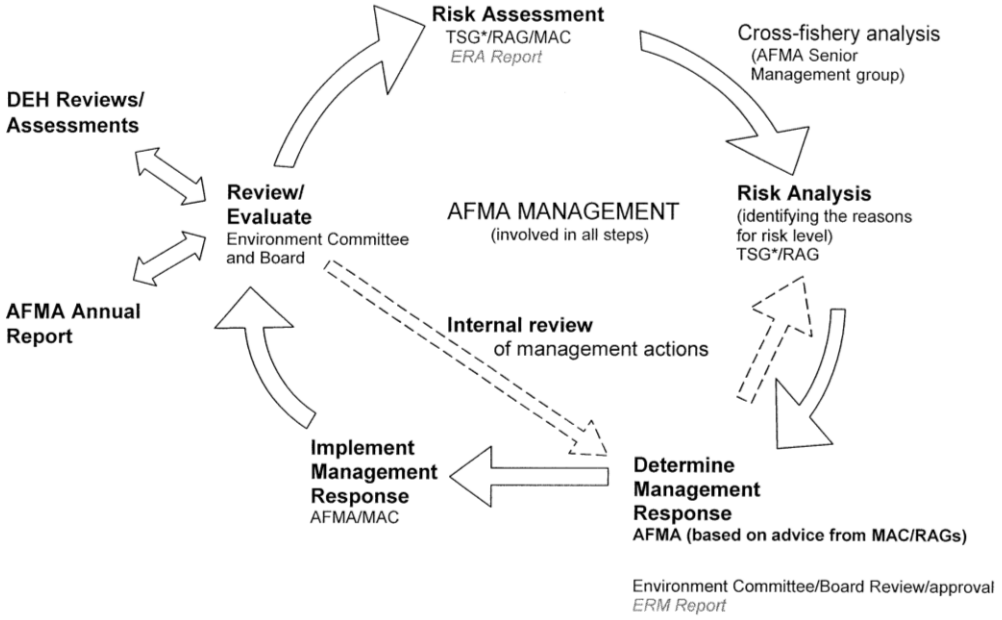

Figure 2.12. Schematic of the Ecological risk management cycle. TSG – Technical Support Group.

2.9 Extreme and high risk categorisation (Step 8) Update with Residual Risk information

PSA

Byproduct species

Six invertebrate species were assessed at high risk. Following a residual risk analysis, one species was reduced to medium risk, while the other five species remained at high risk (Table 2.23), comprising three cuttlefish species that had been expanded from the group "*Sepia* spp", Gould's squid *Nototodarus gouldi* and pale octopus *Octopus pallidus.* It is uncertain whether the high-risk ratings for the *Sepia* species should remain since there is no certainty of which species contributed to the total of 14.6 t but if any one species contributed to the entire catch and was low in abundance, then this removal might impact that species. By contrast, if the catch was distributed across all species, any impact is reduced and unlikely to be significant.

Gould's squid is not formally assessed, even in the Southern Squid Jig fishery, although it is not considered to be overfished or subject to overfishing. Furthermore, the trigger limit of 2000 t suggests the 24.5 t catch (or 30 t if "Squid" is attributed to this species) is not particualry significant by itself.

In the case of pale octopus *Octopus pallidus,* very little was caught and discarded, but if the ~72 t of unidentified Octopodidae were attributed to this species and given the lack of abundance information, the risk remains that the population might be impacted.

Bycatch species

A residual risk analysis was performed on the eight high risk species comprising one chondrichthyan, 4 teleosts that were unassessable in the bSAFE and three invertebrates. One teleost, the chondrichthyan and the three invertebrates were all reduced to low risk and a further three teleosts were reduced to medium risk due to the small number of interactions/capture within the assessment period.

bSAFE

Byproduct species

A residual risk analysis was not required as all SAFE species were low risk.

Bycatch species

Of the 140 bycatch species assessed by bSAFE, only one species, the short-tail torpedo ray *Tetronarce nobiliana,* was assessed at extreme risk and no species were high risk. This species was reduced to low risk due to low catch following residual risk analysis.

3 General discussion and research implications

3.1 Level 1

In this case, 18 activities out of 32 possible activities were identified as occurring in this sub-fishery, comprised of 12 internal and six external activities. Thus, a total of 18 activity-component scenarios were considered at Level 1. This resulted in 89 (excluding the key commercial x direct impact by capture activity) scenarios (of 160 possible) to be developed and evaluated using the unit lists (key commercial/secondary, byproduct/bycatch, protected species, habitats, communities).

3.2 Level 2

3.2.1 Species at risk

A Level 2 analysis was triggered for one ecological component: byproduct/bycatch species, as risk (consequence) scores were $\geq$3 in the Level 1 SICA analysis. It was also triggered for the Habitat component but was not assessed in this report.

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 and stock status

Commercial species stock status, assessment and tier status, and ERA classification for this sub-fishery (Danish seine). 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 IN THIS SUB-FISHERY	FISHING MORTALITY^	BIOMASS^	STOCK STATUS^^	YEAR LAST ASSESSED	REFERENCE	TIER LEVEL ASSESS-MENT	COMMENT
Blue grenadier	*Macruronus novaezelandiae*	BC	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*	BP	NSTOF	NOF	Above limit reference	2015	Cordue 2015	1	
Silver warehou	*Seriolella punctata*	BC	NSTOF	NOF	Above limit reference	2015	Thompson et al. 2015	1	
Orange roughy (Albany and Esperance)	*Hoplostethus atlanticus*		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*	BP	NSTOF	NOF	Above limit reference	2015	Tuck et al. 2015	1	
Mirror dory	*Zenopsis nebulosus*	BP	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic 2017a	4	
Ocean jacket	*Nelusetta ayraudi*	BP	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic and (2017)^	NT	
Gould's squid	*Nototodarus gouldi*	BP	NSTOF	NOF	Above limit reference	2015	Barnes et al. (2015).	NT	Based on assessment of southern squid jig fishery
Frostfish	*Lepidopus caudatus*	BC	-	-	-	-	-	NT	
Flatheads*	*Platycephalidae* - undifferentiated	BC	NSTOF	NOF	Above limit reference**	-	-		
Leatherjackets	*Balistidae, Monacanthidae* - undifferentiated	BC	-	-	-	-	-	NT	

COMMON NAME	SPECIES NAME	ERA CLASSIF-ICATION IN THIS SUB-FISHERY	FISHING MORTALITY^	BIOMASS^	STOCK STATUS^^	YEAR LAST ASSESSED	REFERENCE	TIER LEVEL ASSESS-MENT	COMMENT
Eastern school whiting	*Sillago flindersi*	C2	NSTOF	NOF	Above limit reference	2017	Day 2017	1	
Redfish	*Centroberyx affinis*	BC	UNC	OF	Below limit reference	2017	Tuck et al. 2017	1	
Gemfish (eastern)	*Rexea solandri*	BC	UNC	OF	Below limit reference	2011	Little and Rowling 2011	1	
Gemfish (western)		BC	NSTOF	NOF	Above limit reference	2016	Helidonioti s and Moore 2016	¼	
Royal red prawn	*Haliporoides sibogae*	BC	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic 2017a	4	
Reef ocean perch	*Helicolenus percoides*	BC	**NA**	**NA**	**NA**	2017	Haddon and Sporcic 2017a	4	
Silver trevally	*Pseudocaranx georgianus*	BC	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic 2017a	4	
Latchet	*Pterygotrigla polyommata*	BP	-	-	-	-	-	NT	
King dory	*Cyttus traversi*	BC	-	-	-	-	-	NT	
Red gurnard	*Chelidonichthys kumu*	BP	-	-	-	-	-	NT	
Gummy shark	*Mustelus antarcticus*	BP	NSTOF	NOF	Above limit reference	2016	Punt et al. 2016	1	
Deepwater flathead	*Platycephalus conatus*	BC	NSTOF	NOF	Above limit reference	2016	Haddon 2016	1	
School shark	*Galeorhinus galeus*	BC	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*	BC	NSTOF	NOF	Above limit reference	2013	Klaer 2013	3	
Ribaldo	*Mora moro*		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*	BC	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*		NSTOF	NOF	Above limit reference	2015	Haddon 2015a	4	

COMMON NAME	SPECIES NAME	ERA CLASSIF-ICATION IN THIS SUB-FISHERY	FISHING MORTALITY^	BIOMASS^	STOCK STATUS^^	YEAR LAST ASSESSED	REFERENCE	TIER LEVEL ASSESS-MENT	COMMENT
Oreo (smooth other)			NSTOF	NOF	Above limit reference	2015	Haddon et al. 2015a	4	
Oreo basket	Warty (*Allocyttus verrucosus*), spikey (*Neocyttus rhomboidalis*), rough (*N. psilorhynchus*), black (*A. niger*), other (*Neocyttus* spp.)	BC	NSTOF	NOF	Above limit reference	2017	Haddon and Sporcic 2017a	4	
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* spp), lantern shark *(Etmopterus species)* and other sharks *(Klaer et al. 2014).*		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. TAC and percent caught

		PRIMARY COMMERCIAL SPECIES	SECONDARY COMMERCIAL SPECIES
SESSF SEASON	TAC AND CATCH	TIGER FLATHEAD	EASTERN SCHOOL WHITING
2008-09	Agreed TAC	2850000	750000
	TAC after over/undercatch	3025642	841467
	% TAC caught (SESSF)	96%	56%
	Logbook catch Danish seine*	1158607	420677
2009-10	Agreed TAC	2850000	1125000
	TAC after over/undercatch	2959703	1191687
	% TAC caught (SESSF)	96%	41%
	Logbook catch Danish seine*	1310633	426932
2010-11	Agreed TAC	2750000	844000
	TAC after over/undercatch	2866400	952368
	% TAC caught (SESSF)	93%	41%
	Logbook catch Danish seine*	1220201	323517
2011-12	Agreed TAC	2750000	641000
	TAC after over/undercatch	2929968	718931
	% TAC caught (SESSF)	96%	50%
	Logbook catch Danish seine*	1237809	298255
2012-13	Agreed TAC	2741000	640000
	TAC after over/undercatch	2836535	695227
	% TAC caught (SESSF)	97%	73%
	Logbook catch Danish seine*	1234368	448016
2013-14	Agreed TAC	2750000	809000
	TAC after over/undercatch	2834741	865042
	% TAC caught (SESSF)	81%	64%
	Logbook catch Danish seine*	1105411	458697
2014-15	Agreed TAC	2878000	809000
	TAC after over/undercatch	3142662	872746
	% TAC caught (SESSF)	90%	91%
	Logbook catch Danish seine*	1269873	699429
2015-16	Agreed TAC	2860000	747000
	TAC after over/undercatch	3092226	789616
	% TAC caught (SESSF)	94%	93%
	Logbook catch Danish seine*	1418039	654225
2016-17	Agreed TAC	2882000	868000
	TAC after over/undercatch	3030559	911276
	% TAC caught (SESSF)	95%	79%
	Logbook catch Danish seine*	1463748	646166

Appendix C. Commonwealth Trawl Closures

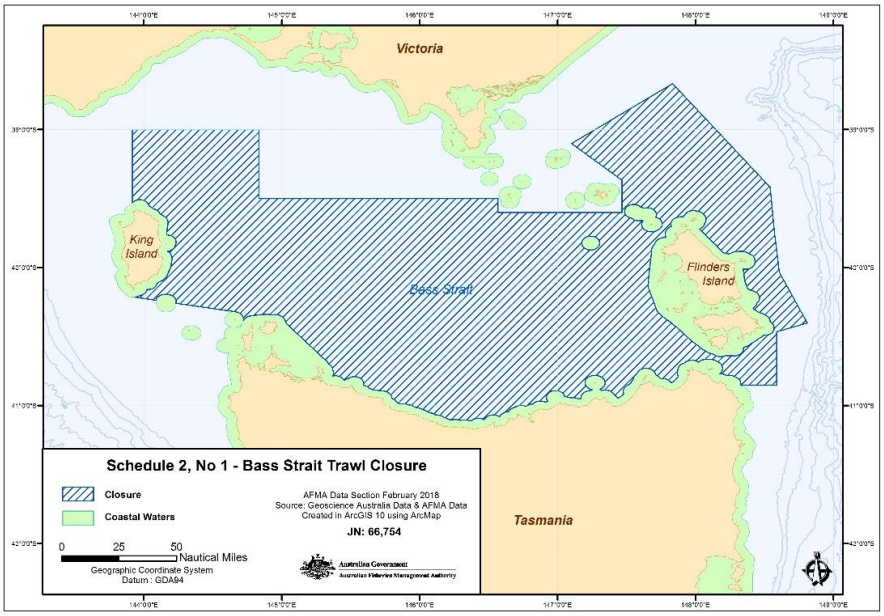
Closures legislated under the *Southern and Eastern Scalefish and Shark Fishery and Small Pelagic Fishery (Closures) Direction 2016.*

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

CLOSURE	DATE IMPLEMENTED
Bass Strait Trawl Closure	Jun-08
Head of the GAB	Aug-04
East Coast Deepwater Trawl Sector Exclusion Zone	Aug-04
South Australian Shark Closure – Kangaroo Island	Jun-07
South Australian Shark Closure –Victor Harbor to the Victorian Border	Jun-07
Freycinet Commonwealth Marine Reserve Closure	Aug-07
Murray Commonwealth Marine Reserves Closures	Aug-07
Commonwealth Gulper Shark Closure - Southern Dogfish	Jun-07
Gulper Shark Closure – Endeavour Dogfish	Jun-07
Gulper Shark Closure – Harrisson's Dogfish	Jun-07
South East Trawl Deep Water Closure	Jun-07
Eastern South Australia Trawl Closure	Jun-08
Portland Area Trawl Closure	Jun-08
Central East Zone	Jun-08
Salisbury Canyon	Jun-08
Far West	Jun-08
Albany	Jun-08
Bremer	Jun-08
Humdinger West	Jun-08
Humdinger/Magic	Jun-08
Lomvar Gully	Jun-08
United Nations	Jun-08
The Knob	Jun-08
Racetrack/Hamburger	Jun-08
Kangaroo Island Hill	Jun-08
Great Australian Bight Far West Gulper Shark Closure	Jun-10
Barcoo and Taupo Seamounts Closure	Jun-10
Queensland and Britannia Seamounts Closure	Feb-13
Derwent Hunter Seamount Closure	Feb-13
Port MacDonnell Closure	Feb-13
Murray Dogfish Closure	Feb-13
Pedra Branca orange roughy Management Area (ORMA)	Apr-15

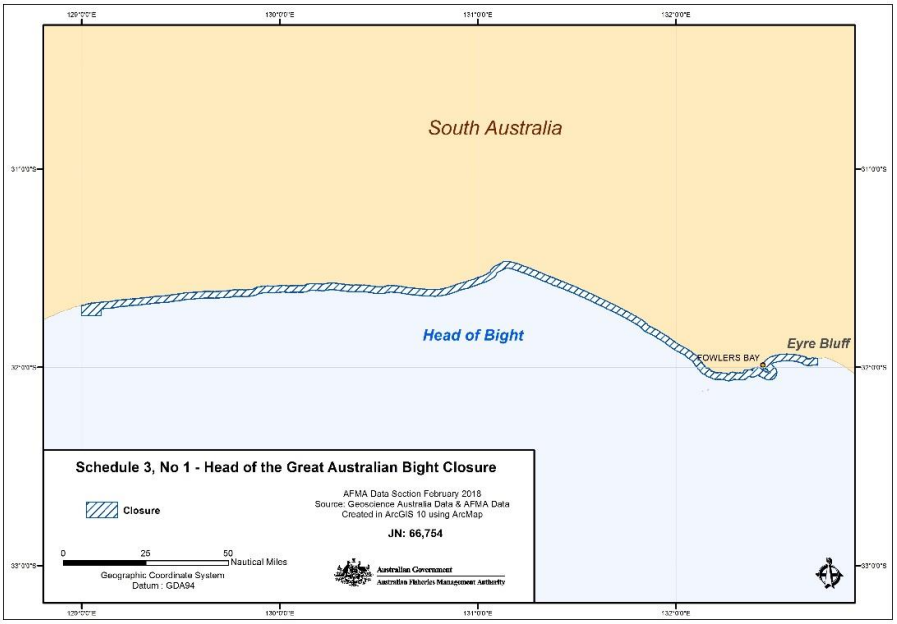
Schedule 2 - Bass Strait – Trawl Closure

Location: Bass Strait
Reason: Protect school and gummy shark habitat
Prohibited: Demersal otter trawl methods



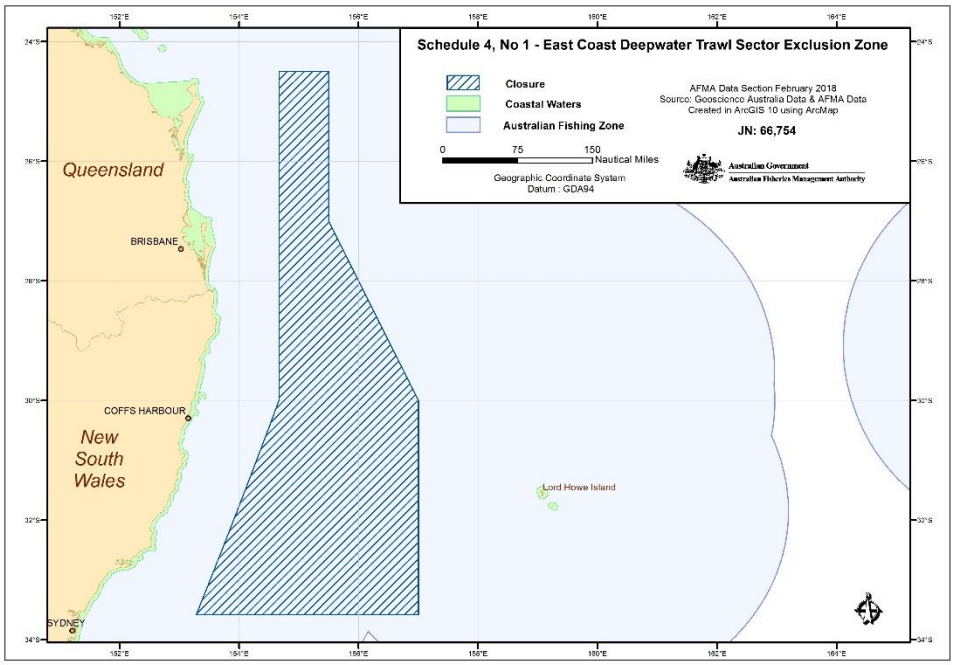
Schedule 3 - Head of the Great Australian Bight

Location: Great Australian Bight, South Australia
Reason: Protect breeding school shark and Australian sea lion populations
Prohibited: All fishing methods



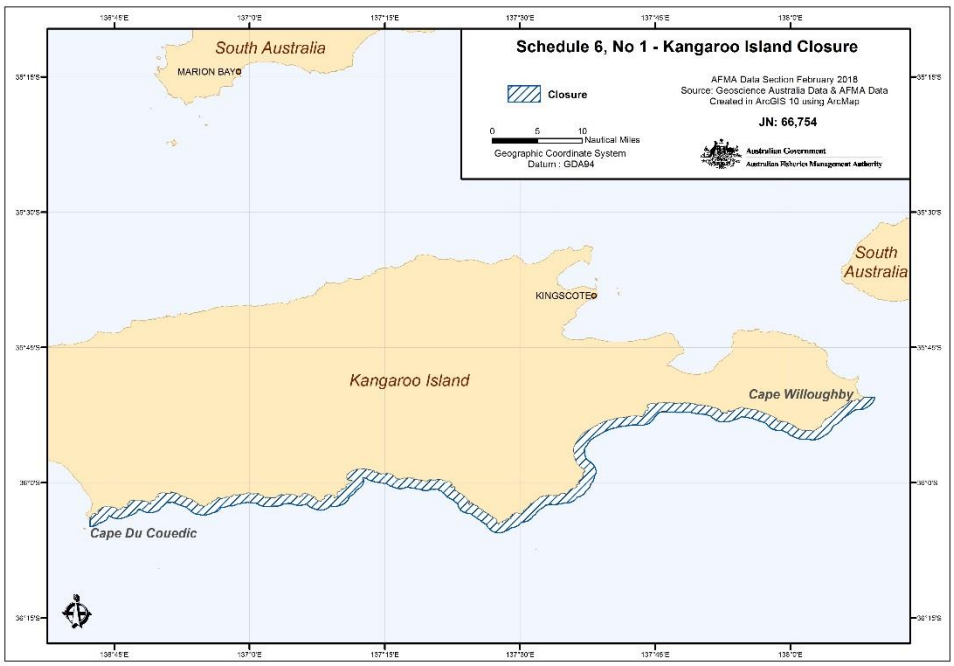
Schedule 4 - East Coast Deepwater Trawl Sector Exclusion Zone

Location: Offshore east coast of Australia
Reason: Protect benthic habitats
Prohibited: Trawl methods



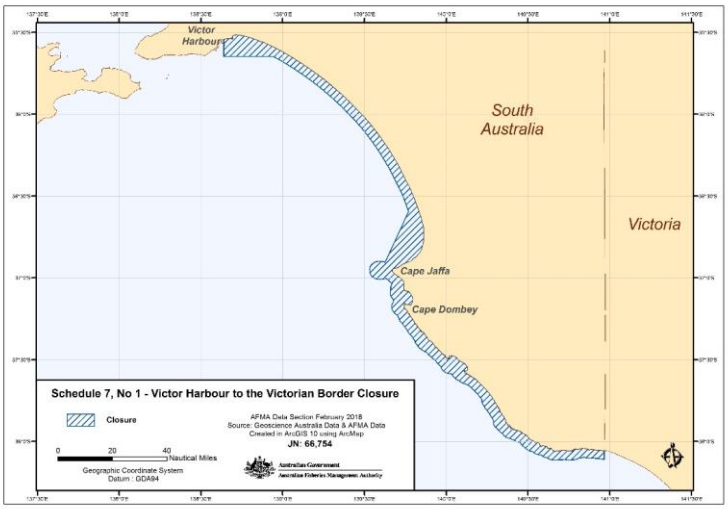
Schedule 6 - South Australian Shark Closure – Kangaroo Island

Location: Kangaroo Island, South Australia
Reason: Protect breeding school shark and Australian sea lion populations
Prohibited: All fishing methods



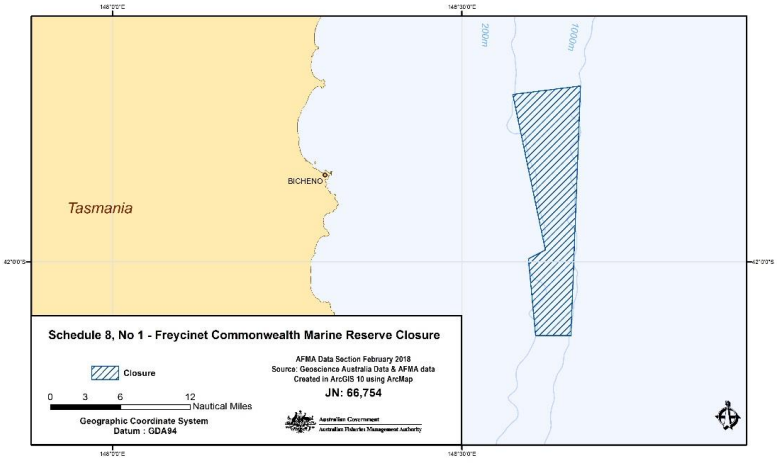
Schedule 7 - South Australian Shark Closure –Victor Harbor to the Victorian Border

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.

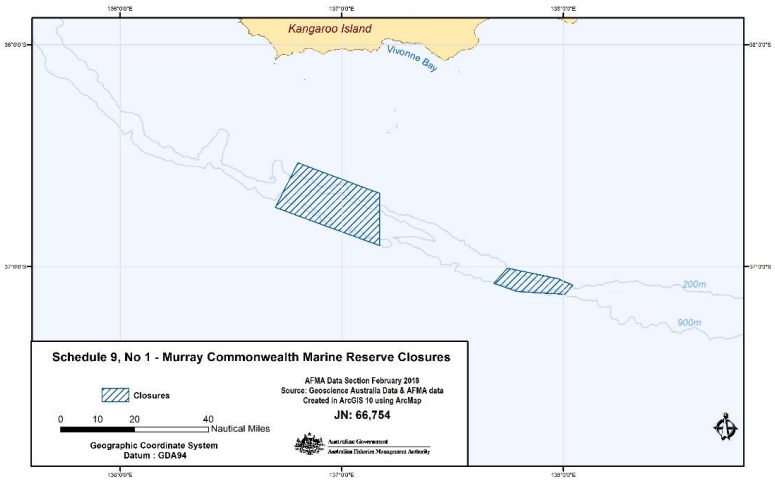


Schedule 9 - Murray Commonwealth Marine Reserves Closures

Location: Area off Kangaroo Island

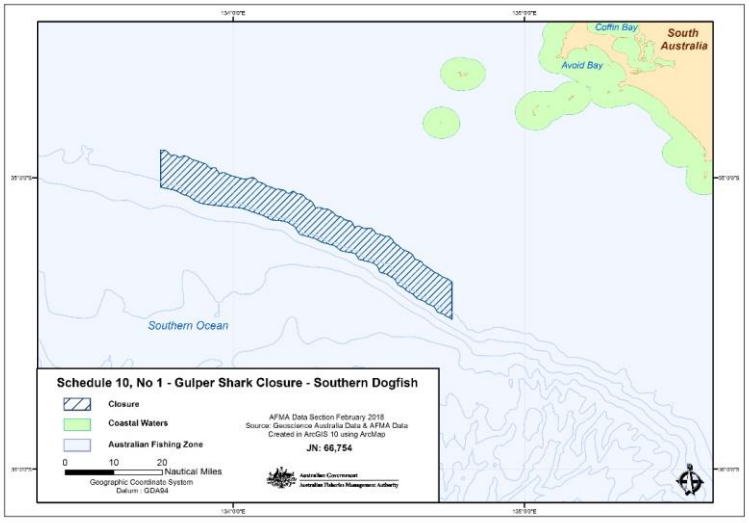
Reason: Protect Upper-Slope dogfish

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.



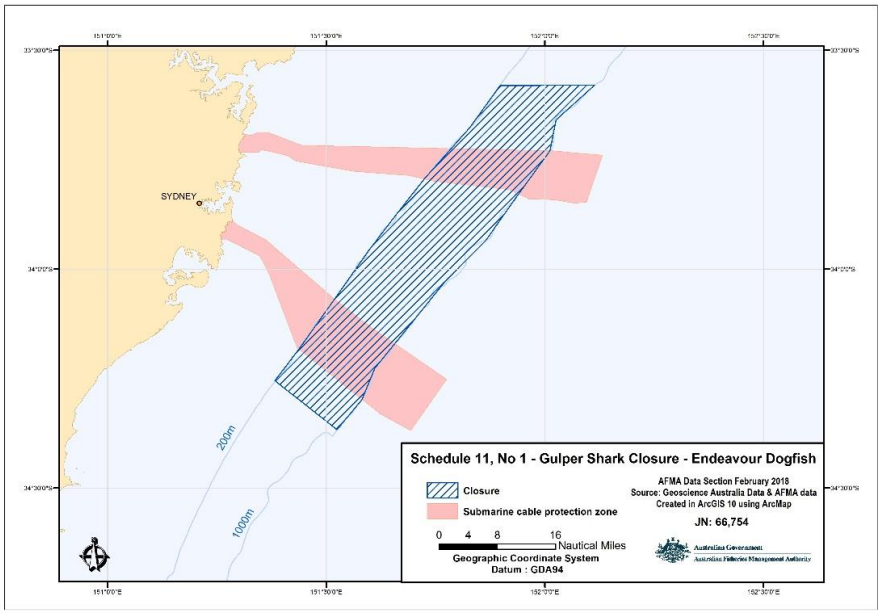
Schedule 10 - Commonwealth Gulper Shark Closure - Southern Dogfish

Location: South Australia
Reason: Protect Upper-Slope dogfish
Prohibited: Hook and Trawl methods



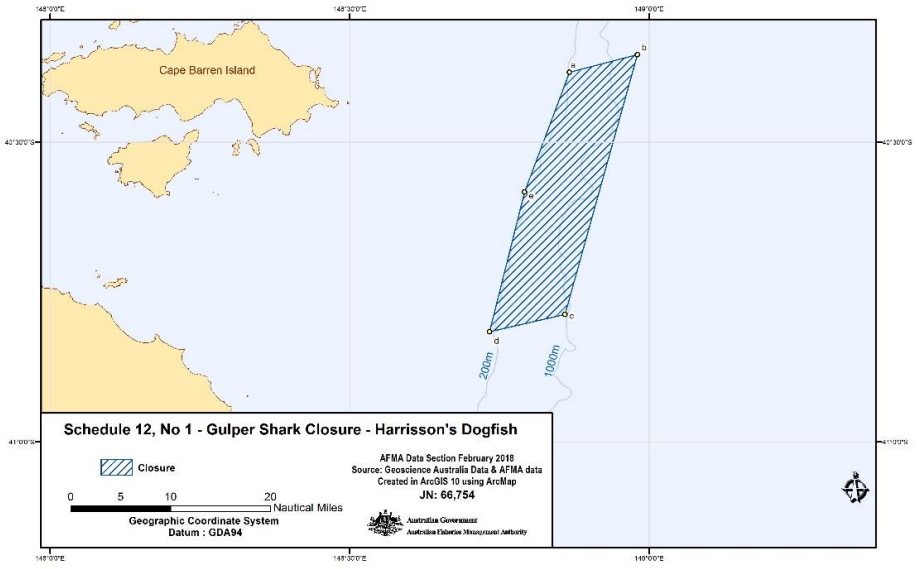
Schedule 11 - Gulper Shark Closure – Endeavour Dogfish

Location: Waters off Sydney in the area of the submarine cable protection zones
Reason: Protect Upper-Slope dogfish
Prohibited: All fishing methods



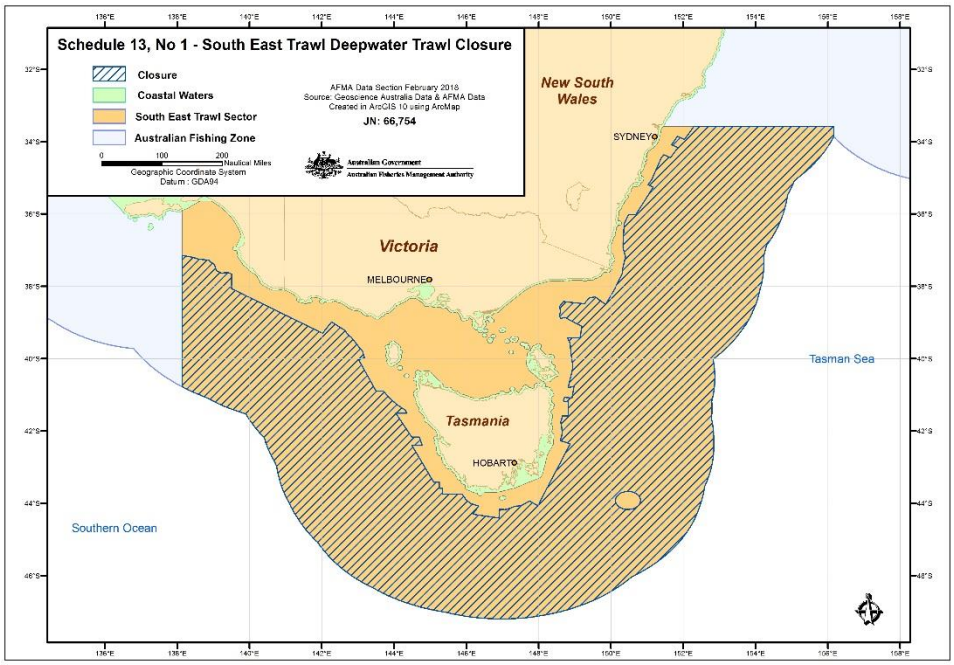
Schedule 12 - Gulper Shark Closure – Harrisson's Dogfish

Location: East Bass Strait
Reason: Protect Upper-Slope dogfish
Prohibited: All fishing methods



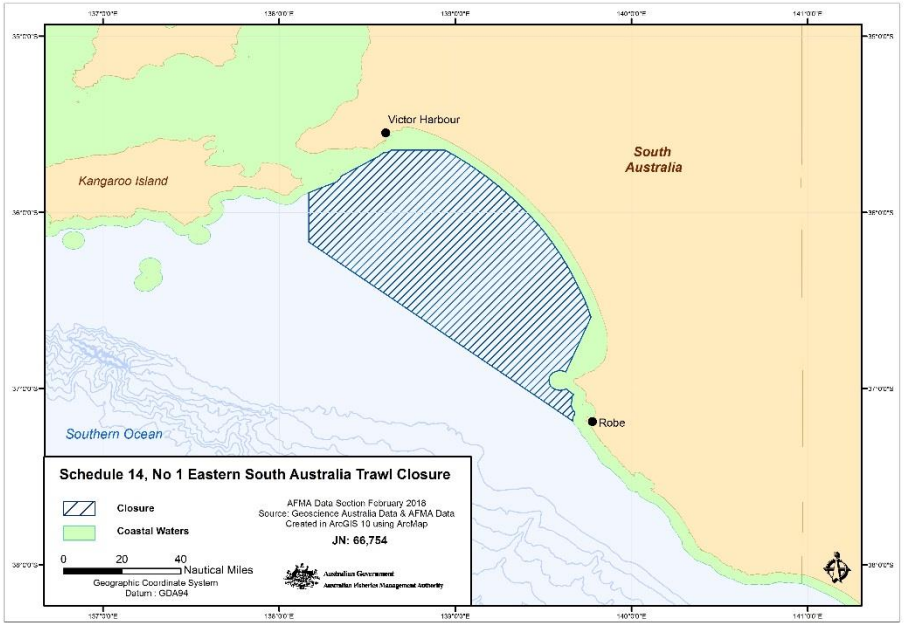
Schedule 13 - South East Trawl Deep Water Closure

Location: Area from New South Wales to South Australia
Reason: Protect orange roughy stocks
Prohibited: Trawl methods



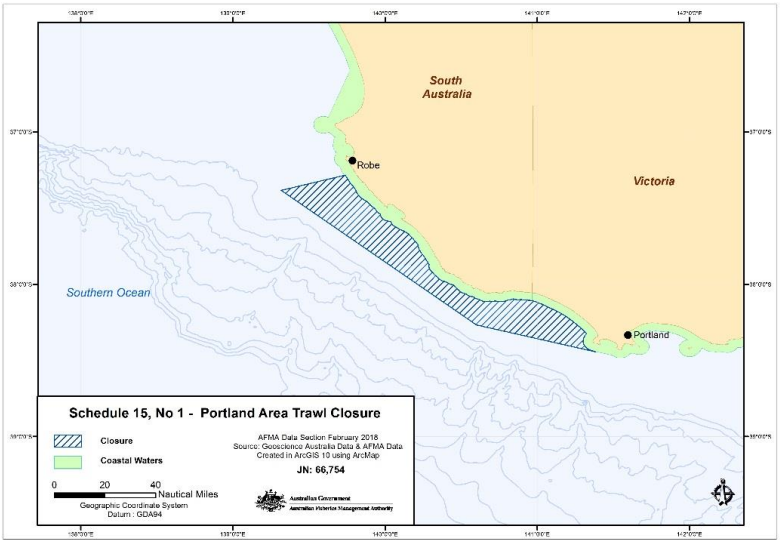
Schedule 14 - Eastern South Australia Trawl Closure

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

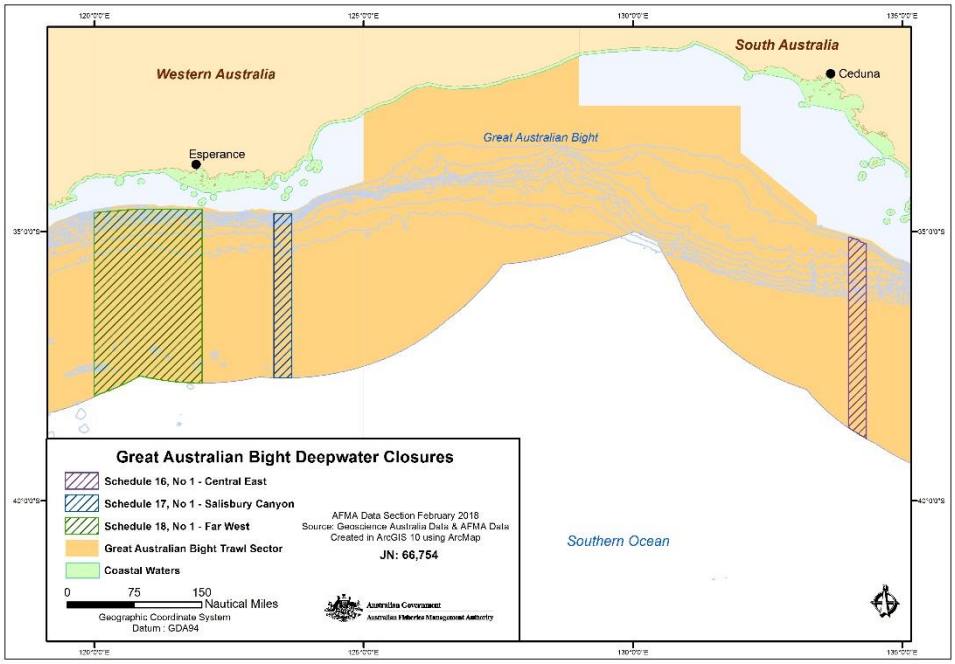


Schedule 16 - Central East Zone

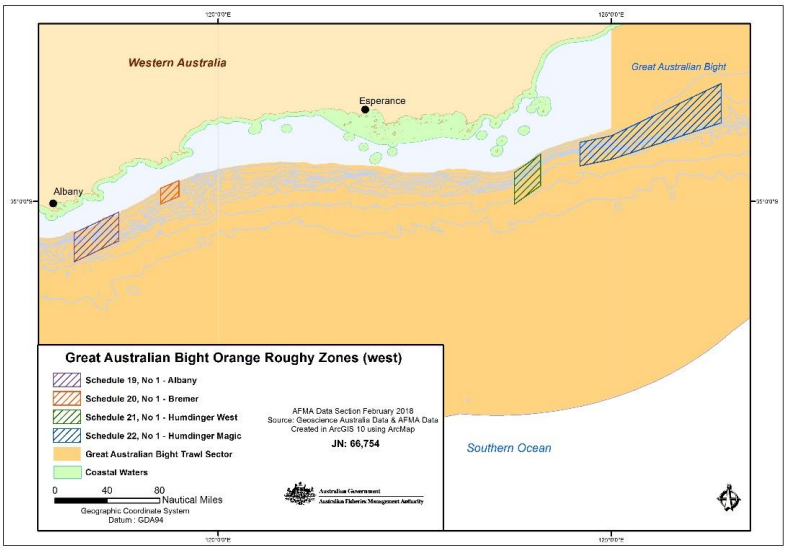
Schedule 17 - Salisbury Canyon

Schedule 18 - Far West

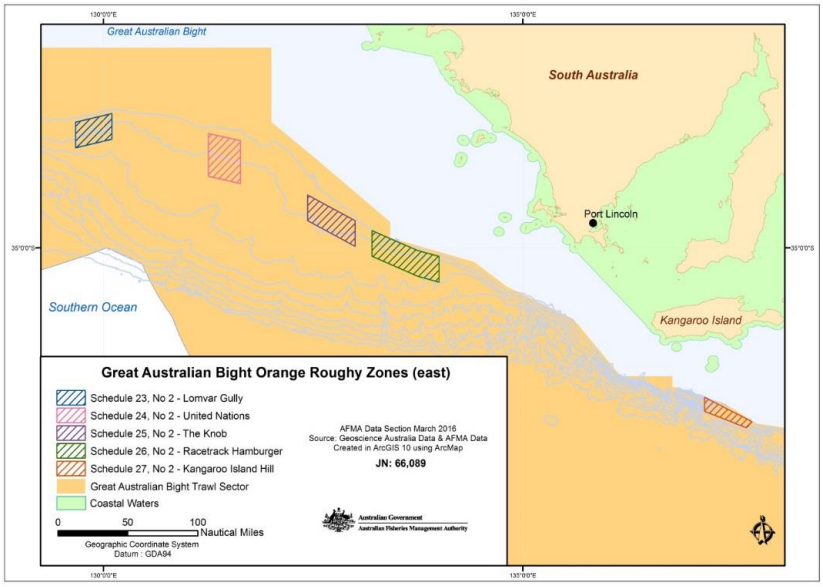
Location: Great Australian Bight, South Australia and Western Australia
Reason: Protect deep water species and orange roughy stocks
Prohibited: Demersal otter trawl methods



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

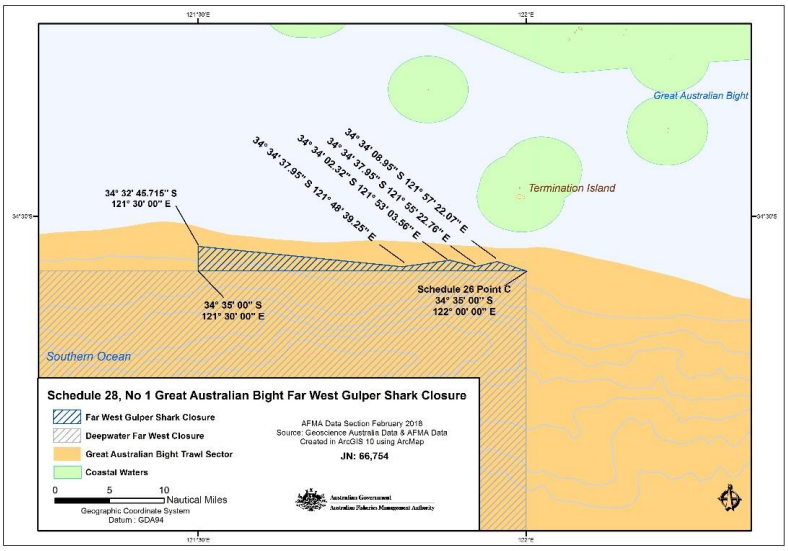


Schedule 23 - Lomvar Gully
Schedule 24 - United Nations
Schedule 25 - The Knob
Schedule 26 - Racetrack/Hamburger
Schedule 27 - Kangaroo Island Hill
Location: Great Australian Bight (East), South Australia
Reason: Protect orange roughy stocks
Prohibited: Trawl methods



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

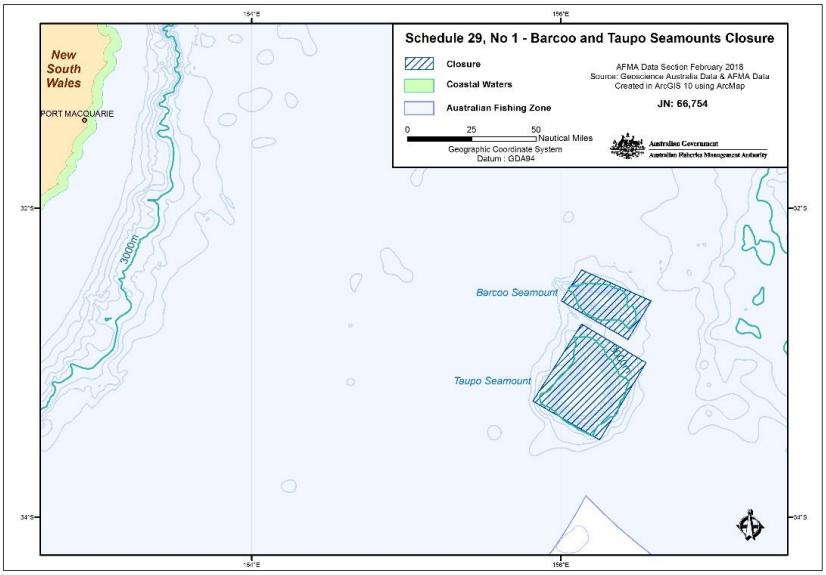


Schedule 29 - Barcoo and Taupo Seamounts Closure

Location: East coast of southern New South Wales

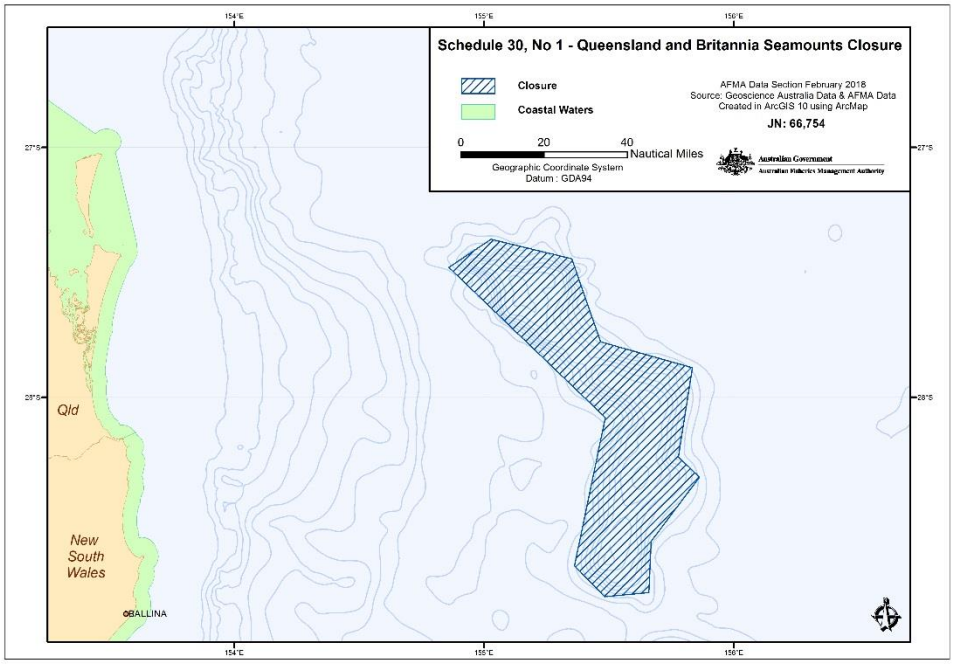
Reason: Protect Upper-Slope dogfish

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.



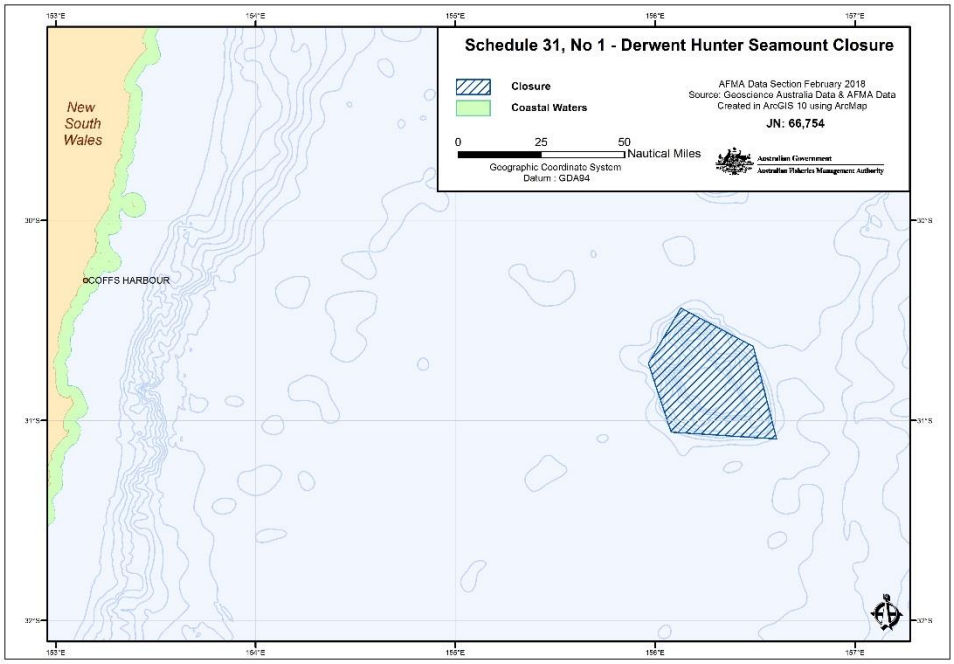
Schedule 30 - Queensland and Britannia Seamounts Closure

Location: Area off southern Queensland
Reason: Protect Upper-Slope dogfish
Prohibited: All fishing methods except hydraulic hand reel droplining.



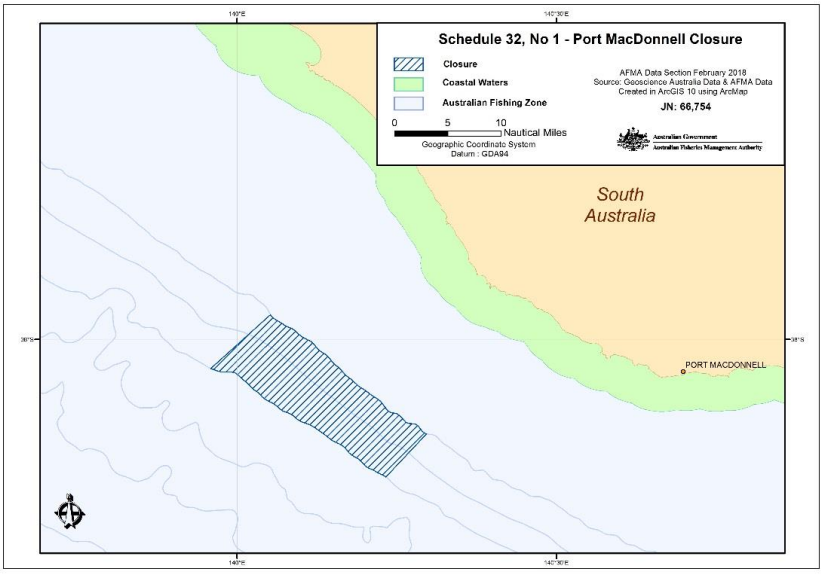
Schedule 31 - Derwent Hunter Seamount Closure

Location: Area off mid New South Wales
Reason: Protect Upper-Slope dogfish
Prohibited: All fishing methods



Schedule 32 - Port MacDonnell Closure

Location: Area off southeastern Australia
Reason: Protect Upper-Slope dogfish
Prohibited: All fishing methods

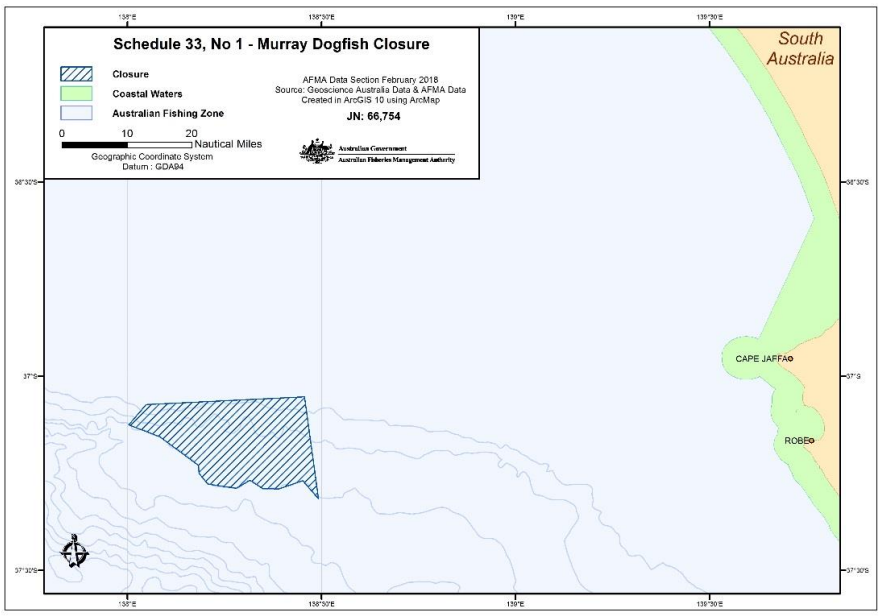


Schedule 33 - Murray Dogfish Closure

Location: Area off southeastern Australia

Reason: Protect Upper-Slope dogfish

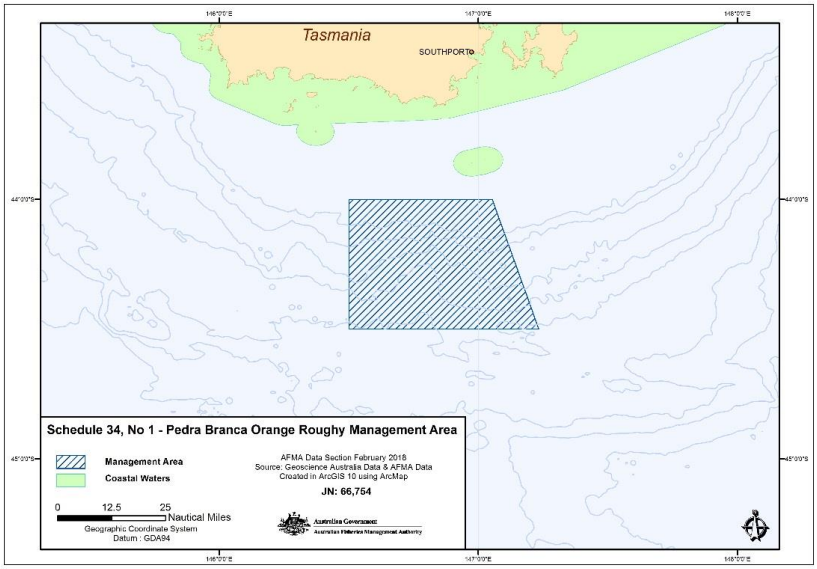
Prohibited: Trawl methods and if the Harrisson's and southern dogfish triggers are met (refer to 6 (u) in the Direction) then all fishing methods (excluding hydraulic hand reel droplining) are prohibited for the concession holder for 12 months within this area. 100% observer coverage is required.



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.



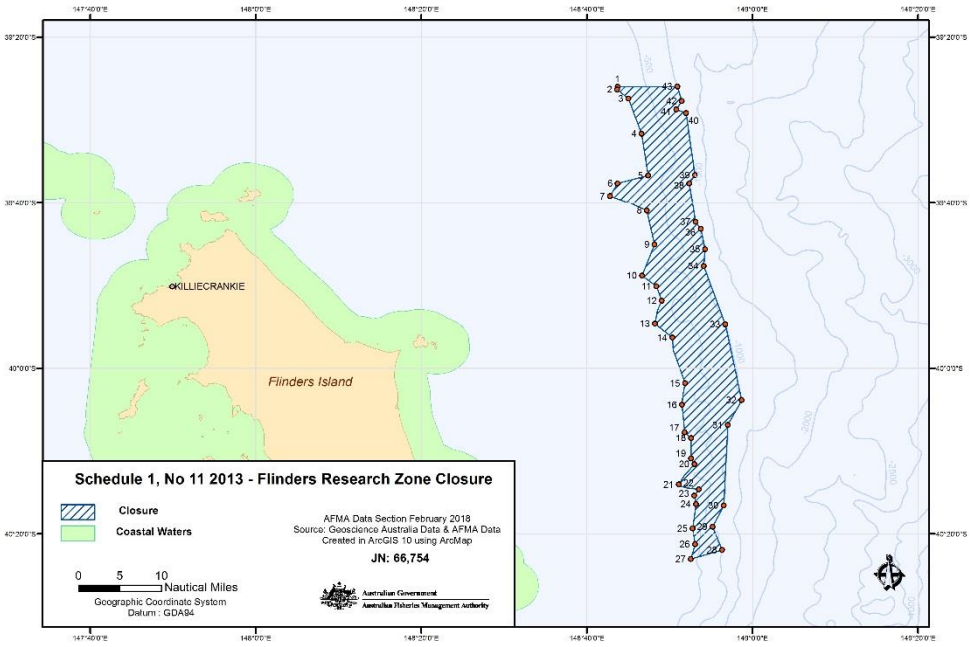
Closures legislated under the *Southern and Eastern Scalefish and Shark Fishery (Closures) Direction No. 11 2013.*

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

Closure	Date implemented
Flinders Research Zone Closure	Sep-13

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.*

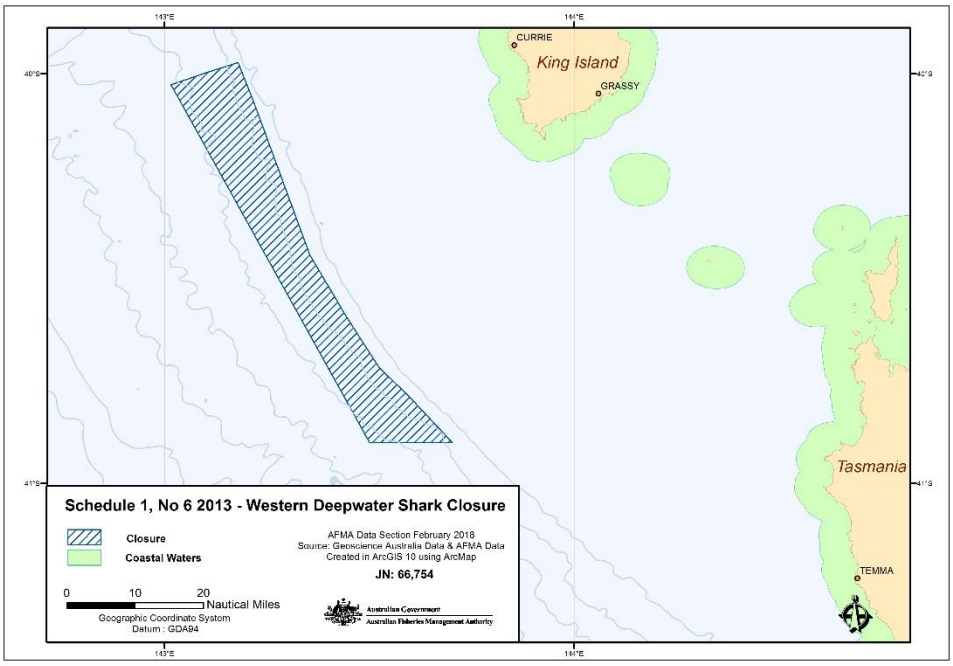
For exact coordinates of area closures refer to the relevant sections of the SESSF Closure Directions, as referenced by the map title.

Closure	Date implemented
Western Deepwater shark area – opening and trigger limit	Apr-13

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.



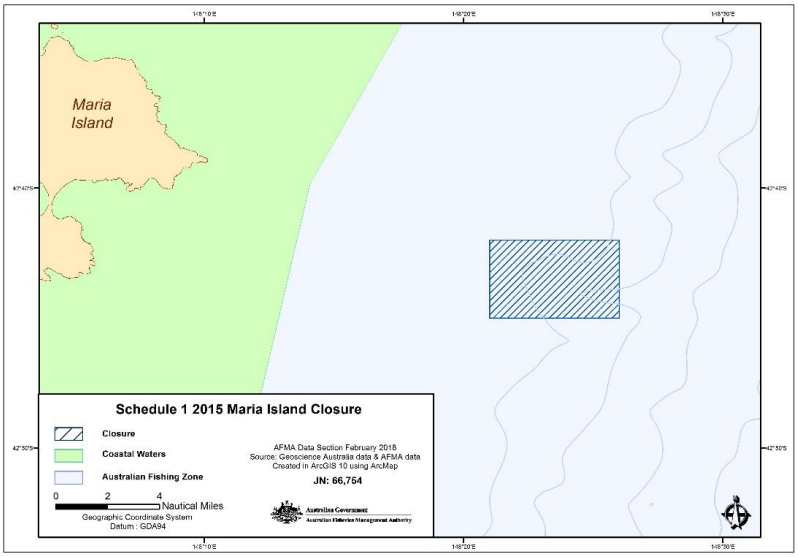
Closures legislated under the *Southern and Eastern Scalefish and Shark Fishery (Closures) Direction No. 2 2015.*

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

Closure	Date implemented
Maria Island	Aug-12
Seiner's Horseshoe	May-09
Everard Horseshoe	May-09

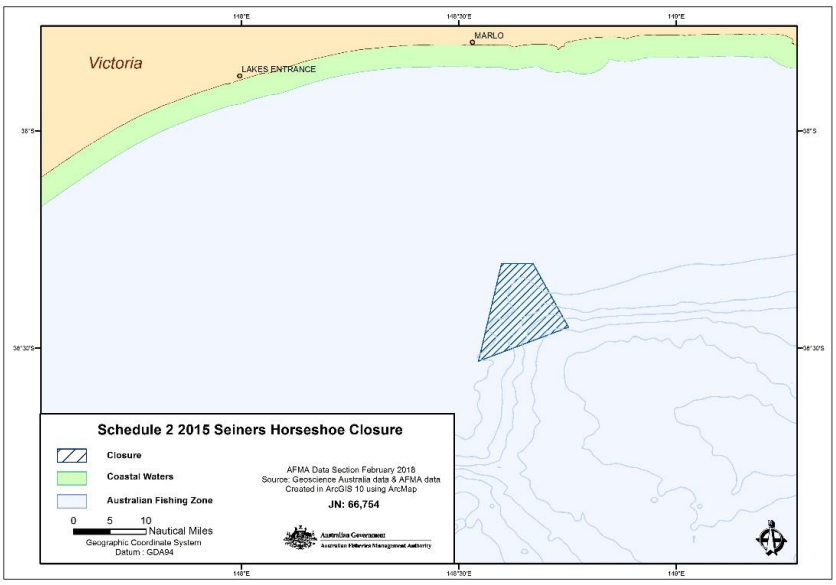
Schedule 1 – Maria Island

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.



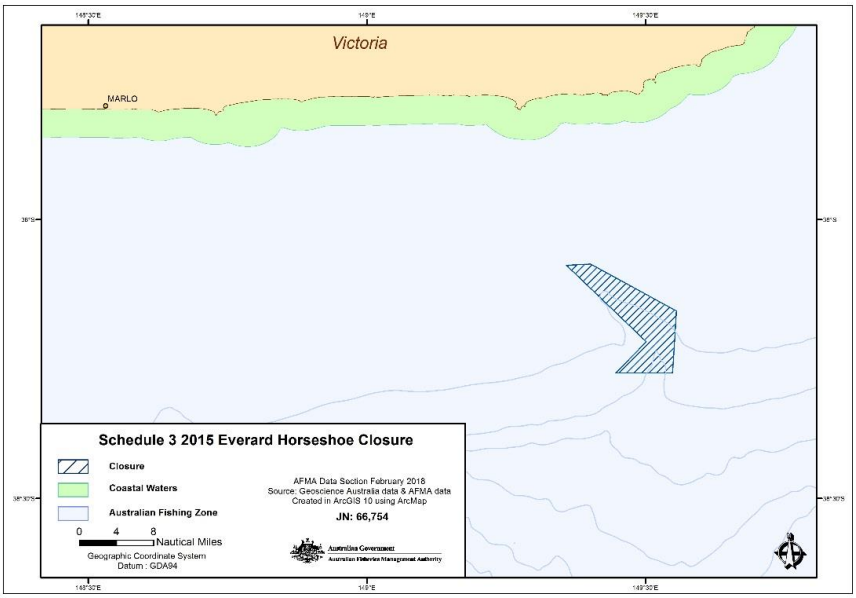
Schedule 2 – Seiner's Horseshoe

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.



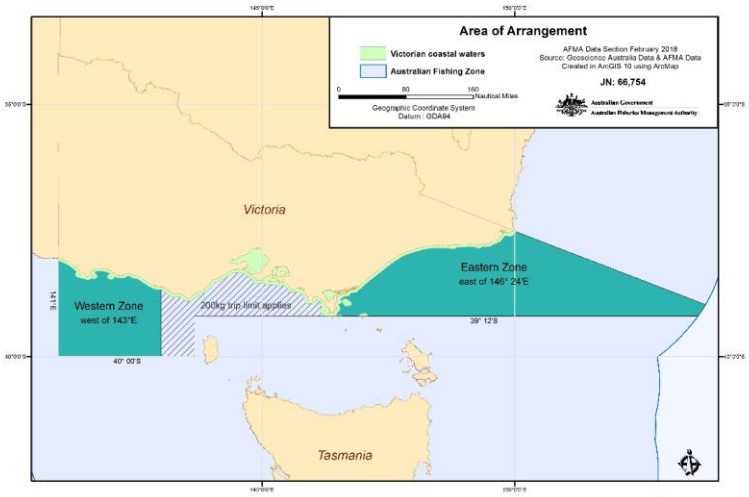
Closures legislated under the *Southern and Eastern Scalefish and Shark Fishery Statutory Fishing Right Conditions.*

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

Closure	Date implemented
Special provision for snapper trip limit, 200 kg	Dec-10
Eastern Orange roughy Management Area (ORMA)	Jun-16

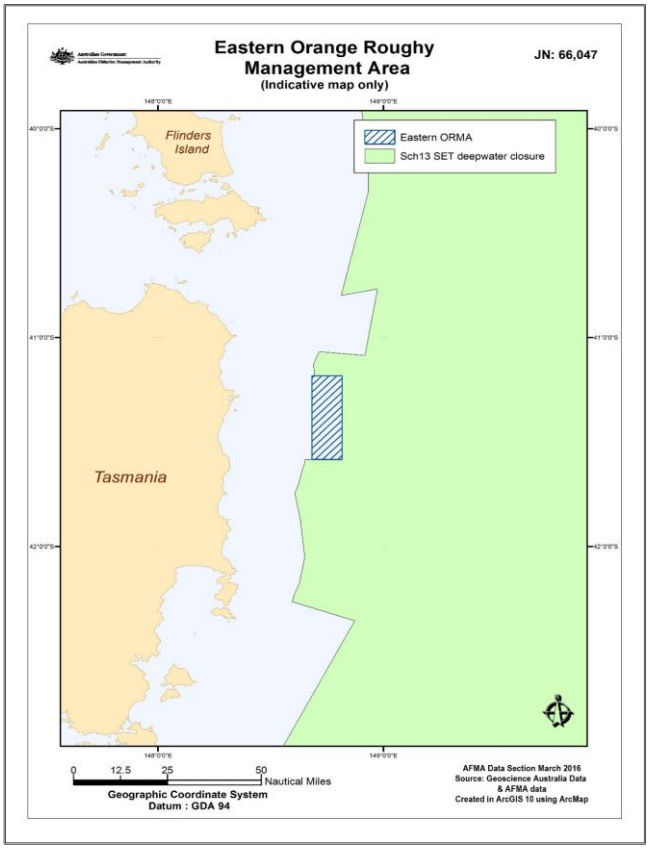
Commonwealth Trawl Sector Boat SFR Condition

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



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, NON-TRAWL METHODS)		
Australian anchovy	No take	
Australian salmon		
Blue sprat		
King George whiting		
Pilchard		
Sprat		
Wrasse		
Black cod		
Barracouta	200 kg	Combined 200 kg trip limit
Leatherjackets		
Striped trumpeter	20 kg	
Snapper	50 kg	
Yellowtail kingfish	10 individuals	
CRUSTACEANS (Victoria)		
Deepwater prawn	Trip limits do not apply	
Red prawn		
Prawn (Genus Aristeus)		
Royal red prawn		
Scarlet prawn		
Carid prawns (family Pandalidae)		
Eastern king prawn	No take	
School prawns		
Rock lobster		
Giant (king) crab (Psuedocarincus gigas)	5 individuals	Combined 50 kg trip limit
Bay bugs (family Scyllaridae)	10 kg	
Other crustaceans	50 kg trip limit	
MOLLUSCS (Victoria)		
Arrow squid	Trip limits do not apply	
Red ocean squid		
Southern ocean arrow squid		
Yellowback squid		
Scallops		
Abalone	No take	
Other molluscs	50 kg trip limit	

Trip limits relevant to South Australia

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

FINFISH (South Australia)		
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		
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	

FINFISH (Tasmania)		
Yelloweye mullet		
Yellow-finned whiting		
Bastard trumpeter	20 kg	
Blue groper	50 kg	
Striped trumpeter	Combined 250 kg of which no more than 150 kg can be striped trumpeter	
Snapper		
Yellowtail kingfish		
CRUSTACEANS (Tasmania)		
Deepwater prawn	Trip limits do not apply	
Red prawn		
Prawn (Genus Aristeus)		
Royal red prawn		
Scarlet prawn		
Other prawns	No take	
Rock lobster		
Giant (king) crab (*Psuedocarincus gigas)*	5 individuals	Combined 50 kg trip limit
Other crustaceans	50 kg trip limit	
MOLLUSCS (Tasmania)		
Arrow squid	Trip limits do not apply	
Red ocean squid		
Southern ocean arrow squid		
Yellowback squid		
Scallops		
Abalone	No take	
Limpets or keyhole limpets		
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. Southern and Eastern Scalefish and Shark Fishery).
F_MSM	Maximum sustainable fishing mortality
F_Lim	Limit fishing mortality which is half of the maximum sustainable fishing mortality
F_Crash	Minimum unsustainable fishing mortality rate that may lead to population extinction in the longer term
Habitat	The place where fauna or flora complete all or a portion of their life cycle.
Hazard identification	The identification of activities (hazards) that may impact the components of interest.

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

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