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Ecological Risk Assessment for the Effects of Fishing

Report for the Southern and Eastern Scalefish and Shark Fishery (Gillnet Hook and Trap Sector): Scalefish Automatic Longline Sub-fishery 2015-2019

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June 2021

Report for the Australian Fisheries Management Authority

[Commercial in confidence]

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Citation

Bulman, C.M., Sporcic, M., Fuller, M. (2021). Ecological Risk Assessment for the Effects of Fishing. Report for Southern and Eastern Scalefish and Shark Fishery (Gillnet Hook and Trap Sector): Scalefish Automatic Longline Sub-fishery 2015-2019. Report for the Australian Fisheries Management Authority. 146 pp.

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Important disclaimer

<u>Notes to this document:</u>

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 pp. (Commonwealth of Australia, Canberra).

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Acknowledgments

We thank Sally Weekes (AFMA, Manager) and Max Bayly (AFMA) for providing initial species lists, scoping and subsequent information and analyses on SESSF Scalefish Automatic Longline management and fishery operations and comments on the draft report. Finally, thanks to Eric Woehler (BirdLife Tasmania) for helpful discussion on marine birds within the jurisdiction.

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 automatic longline sector of theSouthern and Eastern Scalefish and Shark (SESSF) 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 assessment of the SESSF Commonwealth Gillnet Hook and Trap Sector: Scalefish Hook (automatic longline) consists of the following:

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

Fishery Description and comparison with previous assessment period

Gear:	Automatic longline
Area:	All waters off South Australia, Victoria and Tasmania from 3 nm to the extent of the Australian Fishing Zone. It also includes waters off southern Queensland (south of Sandy Cape) and New South Wales from approximately the 4000m depth contour (60-80 nm from the coast) to the extent of the AFZ
Depth range:	9-2221 (2016-2019; average 460m)
Fleet size:	5-7
Effort:	2.4-3.7 million hooks (292-363 operations)
Landings:	3091 tonnes (2015-2019)
Discard rate:	19.4% overall, 743 tonnes (2015-219)
Commercial species (ERA classification):	Pink ling and blue eye trevalla
Management:	Quota management system across species/stocks
Observer program:	AFMA Observer program and EMS (~10% coverage of all operations)

Ecological Units Assessed

Table ES1.1. Ecological units assessed in 2021 and 2006.

ECOLOGICAL COMPONENT	2021#	2006
Key/secondary commercial species	2 C1	2
Byproduct and bycatch species	15 & 208	66 & 26
Protected species	36	212
Habitats	13 demersal, 6 pelagic	149*
Communities	24 demersal, 8 pelagic	39

*these habitats are not comparable with current assessment

A total of 263 species across the three ecological components were assessed in this ERAEF compared to 306 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 taxonomic 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

As a result of this SICA, only the habitat ecological component scored a moderate or higher risk, associated with fishing either directly or indirectly, and disturbing physical processes (Table ES1.2).

Significant external risks were associated with fishing in all ecological components. And from coastal development on bycatch/byproduct

As the Habitats are unable to be assessed at Level 2 in this assessment, there are no components to be assessed at Level 2.

Table ES1.2. Outcomes of assessments for ecological components in 2021 and 2006. Number of fishing activities scoring moderate or higher risk for each component requiring further analysis at Level 2.

ECOLOGICAL COMPONENT	2021	2006
Key/secondary commercial species	0	3
Byproduct and bycatch species	0	2
Protected species	0	1
Habitats	3#	2*
Communities	0	1*

not assessed at L2 in this assessment
*triggered but due to lack of methodology available in 2006 but was not assessed at L2.

Summary

There were no high risks identified for any components, except for habitats which are not able to be assessed at a higher level, from internal activities but the external activities of other fisheries and coastal development did have significant impacts on all or one ecological component, respectively.

Pink Ling and Blue-eye Trevalla are the target species in this fishery and have AFMA stock assessments at Tier 1, or Tiers 4 and 5 depending on the stock, respectively, therefore are not required to be further assessed from the direct impacts from fishing. There were no other significant risks for these species from other internal activities. Similarly, for other byproduct or bycatch species where a current stock assessment exists, no further assessment for risk from fishing was required.

Historically, longline fisheries have presented serious threats to seabirds, particularly albatrosses (Baker *et al.* 2007). This fishery has a specific Bycatch and Discarding Workplan which incorporates a Threat Abatement Plan for Seabirds. Consequently, a variety of mitigation measures such as bycatch reduction devices (tori lines, brickle curtains, bycatch trigger limits, caps on hooks per boat are in place and bycatch is continually monitored. Over the 5 year assessment period, only two Shy Albatrosses were killed despite being one of the most abundant species sighted—in their hundreds—around fishing operations by AFMA observers. White-chinned petrels were also abundant around fishing vessels; at least 19 were killed but over 50 prions and petrels birds were unidentified to species so white-chinned petrel mortality would probably be higher. It should be noted that the seabird interactions triggered the bycatch limit rule of 0.01 birds captured per 1000 hooks over consecutive summers up to and including 2016/17 (AFMA 2018) but this rate is still considered low (Baker *et al.* 2007) or even negligible (Collins *et al.* 2021).

About half the catch of shortfin mako was retained while the rest "discarded" which implies that they were alive on release. The total number of makos caught over the assessment period was 89 of which nearly half were released. Three Grey Nurse shark totalling 8 kg were captured and discarded (presumably released alive) and probably juveniles. Both species were considered less vulnerable than Shy Albatross for this assessment.

The greatest risk identified from autolonglining was to the habitats. This fishery has a low level of reporting of sessile fauna bycatch (observer logs only) but studies of similar fisheries elsewhere suggest that longlines impact vulnerable communities (Muñoz *et al.* 2011). The majority of sets were in the Tasmanian bioregion between 200-700 m but effort occurs across the broader spatial scale. Some faunal groups in these depths will take a long time to recover but given the narrow footprint of the gear and intensive, highly localised fishing effects compared to trawl, this gear has been considered as a moderate risk. However, if they are used more intensively in areas of high ecological importance or risk, they could have a higher impact for the vulnerable assemblages in those habitats.

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.

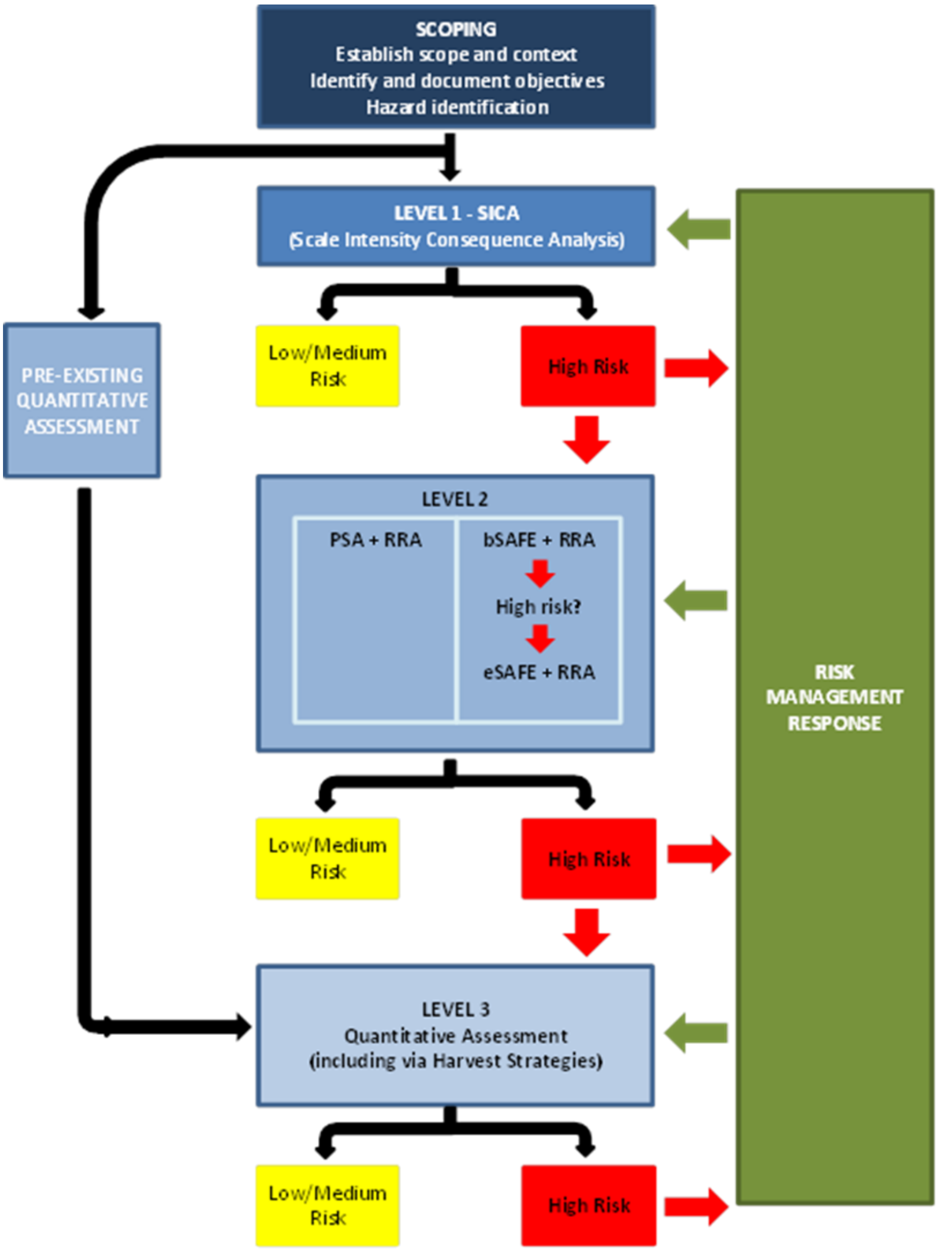

Figure 1.1. Structure of the 3 level hierarchical ERAEF methodology. SICA – Scale Intensity Consequence Analysis; PSA – Productivity Susceptibility Analysis; SAFE – Sustainability Assessment for Fishing Effects; RRA – Residual Risk Analysis. T1 – Tier 1. eSAFE may be used for species classified as high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

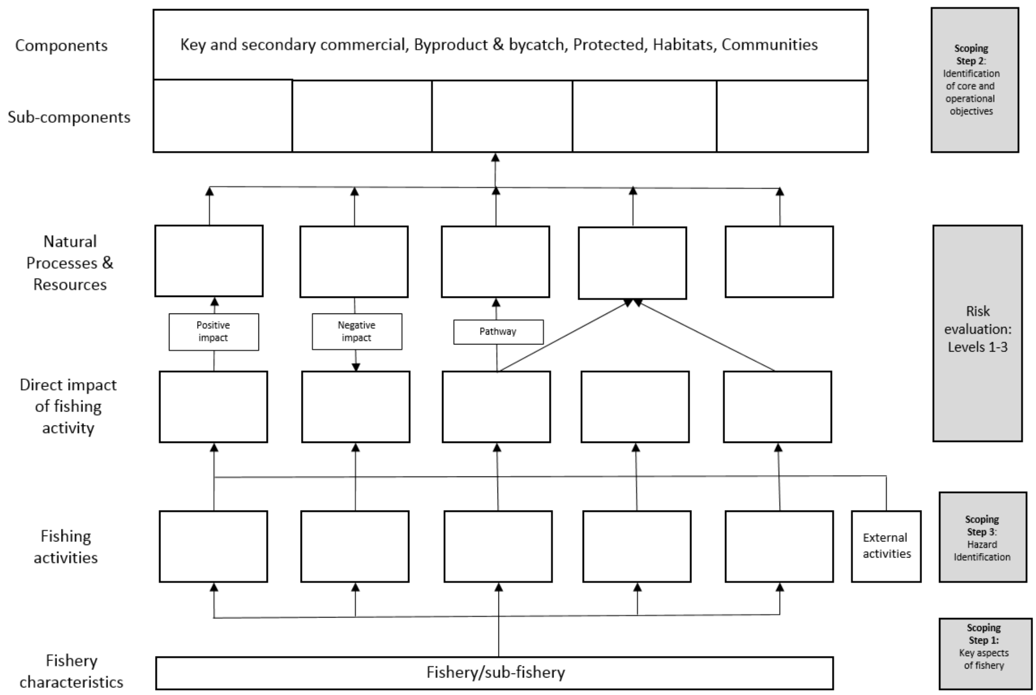

Figure 1.2. Generic conceptual model used in ERAEF.

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

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

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

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

PSA (Productivity Susceptibility Analysis)

Details of the PSA method are described in the accompanying ERAEF Methods Document and summarised in Section 4.8.3 of the AFMA ERM Guide (AFMA (2017)). Stakeholders can provide input and suggestions on appropriate attributes, including novel ones, for evaluating risk in the specific fishery. Attribute values for many of the units (e.g. age at maturity, depth range, mean trophic level) can be obtained from published literature and other resources (e.g. scientific experts) without initial stakeholder involvement. Stakeholder input is required after preliminary attribute values are obtained. In particular, where information is missing, expert opinion can be used to derive the most "reasonable" conservative estimate. For example, if species attribute values for annual fecundity have been categorized as low, medium or high on the set (<5, 5-500, >500), estimates for species with no data can still be made. Also, estimated fecundity of a broadcast-spawning fish species with unknown fecundity is still likely to be greater than the high fecundity category (>500). Susceptibility attribute estimates, such as "fraction alive when landed", can also be made based on input from experts such as scientific observers. Feedback to stakeholders regarding comments received during the preliminary PSA consultations is considered crucial. The final PSA is completed by scientists and results are presented to the relevant stakeholder group (e.g. RAG and/or MAC) before decisions regarding Level 3 analysis are considered. The stakeholder group may also decide on priorities for analysis at Level 3.

Residual Risk Analysis

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

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

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

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

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

SAFE (Sustainability Assessment for Fishing Effects)

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

bSAFE

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

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

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

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

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

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

- **F_{MSY}** – instantaneous fishing mortality rate that corresponds to the maximum number of fish in the population that can be killed by fishing in the long term. The latter is the maximum sustainable fishing mortality (MSM) at B_{MSM}, similar to target species MSY.
- **F_{LIM}** – instantaneous fishing mortality rate that corresponds to the limit biomass B_{LIM} where B_{LIM} is 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 suggest that there is less “bias” in the method, but that both false negatives and false positives can arise.
- SAFE analyses retain some of the key precautionary elements of the PSA method, including assumptions that fisheries are impacting local stocks (within the jurisdictional area of the fishery).
- Although the bSAFE analyses provide direct estimates of uncertainty in both the exploitation rate and associated reference points, they are less explicit about uncertainties arising from key assumptions in the method, including spatial distribution and movement of stocks.
- The method assumes there would be no local depletion effects from repeat trawls at the same location (i.e.: populations rapidly mix between fished and unfished areas). The fishing mortality will likely be overestimated if this assumption is not satisfied (ERA TWG 2015)[4].
- The method also assumes that the mean fish density does not vary between fished area and non-fished area within their distributional range. Hence, the level of risk would be over-estimated for species found primarily in non-fished habitat, while risk would be under-estimated for species that prefer fished habitat (ERA TWG 2015).
- The SAFE methodology makes greater assumptions than Tier 1 stock assessments in coming to its F estimates (due to a lack of the data relative to that used in a Tier 1 assessment) and it is not capable of measuring risk of a stock being already overfished (so the type of risk it measures relates only to overfishing, which may then lead to 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 results in a final risk assessment report for the individual fishery according to the ERAEF methods. It is envisaged that the completed assessment would 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 Agriculture, Water and Environment.

1.1.8 Subsequent risk assessment iterations for a fishery

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

Fishery re-assessments for byproduct and bycatch species under the ERAEF will be undertaken every five years[5] or sooner if triggered by re-assessment triggers. The five year timeframe is based on a number of factors including:

- 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, so as to detect any changes (increase or decrease) in the level of risk posed by the fishery to any species. Where indicators exceed specified trigger levels, AFMA will investigate the causes and provide opportunity for RAG comment/advice during that process. Pending outcomes of that review, and RAG advice, AFMA can if necessary, request a species specific or full fishery re-assessment (i.e. prior to the scheduled re-assessment dates).

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

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

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

- The data upon which the indicator is based must be sufficiently representative of actual changes in catch, effort, area, gear or mitigation methods. Consideration should be given to the level of uncertainty associated with the data underpinning any prospective indicator.
- The trigger level chosen should not be overly sensitive to the normal inter-annual variance that is typical of the indicator and independent of fishing pressure, assuming such variance is unlikely to relate to a significant change in the risk posed by the fishery to any or all species.
- 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 Automatic longline sector of the Southern and Eastern Scalefish and Shark Fishery (SESSF) A full description of the ERAEF method is provided in the methodology document (Hobday *et al.* 2007; Hobday *et al.* 2011b). This fishery report contains figures and tables with numbers that correspond to this methodology document. Thus, table and figure numbers within this fishery ERAEF report are not sequential, as not all figures and tables are relevant to the fishery risk assessment results.

2.1 Stakeholder Engagement

Table 2.1. Summary Document SD1. Summary of stakeholder involvement for sub-fishery: SESSF Autolongline 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	Emails	Nov/Dec2020. April, May, 2021	Max Bayly AFMA	Species list, data and Fisheries Characteristic table provided to CSIRO
	Phone email	May, June 2021	Max Bayly AFMA	Additional information sought and provided

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 (Gillnet Hook and Trap Sector) – Scalefish Automatic Longline Sub-fishery
Assessment date: June 2021
Assessor: Authors of this report (CSIRO) & AFMA

Table 2.2. General fishery characteristics

General Fishery Characteristics	
Fishery Name	Southern and Eastern Scalefish and Shark Fishery (SESSF)

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)
	  ○ Otter trawl
	  ○ Danish seine
	• Gillnet Hook and Trap (GHAT) Sector
	  ○ Scalefish Hook – demersal longline
	  ○ Scalefish Hook – automatic 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 Scalefish Hook - automatic longline sub-fishery (autolongline sub-fishery) of the Commonwealth Gillnet Hook and Trap Sector of the SESSF.
Start date/ history	Hook and line methods have been used since the early 1900s to catch fish over shelf waters. Prior to 1985 there were few restrictions on the method of fishing. The number of vessels was unregulated and there were 2000 licensees in the fishery. In 1985 the Commonwealth began to limit entry by placing a freeze on new permits. In 1992, ITQ's were introduced to the Commonwealth Trawl Sector for 16 species groups providing effective management for these species. However, operators were able to target some of these species without quota, using non-trawl methods which had the potential to undermine the management aims for the 16 quota species groups. Also, in 1992, a single Commonwealth permit was issued to allow the first automatic longline vessel to begin operating in the fishery, mainly targeting ling around the west coast of Tasmania. The hook and line part of the fishery was not formally managed until 1994. From 1995 onwards, restrictions were introduced to regulate the scalefish catch by hook and line methods. In 1995, interim gear restrictions were placed on these methods south of 40° S because of concerns regarding catches of blue eye in the area. In 1998, ITQs were introduced in the Southern and eastern non-trawl fishery (SENTF) for three key species: ling, blue-eye and blue warehou. On 1 January 2001, ITQ management arrangements were applied to the remaining 13 species groups. Initially all quota, except for blue-eye trevalla could be freely traded between the trawl and non- sector sectors. Trade in blue-eye quota was limited to 10% of the total blue eye quota. Most restrictions on auto-longlining were removed but automatic longliners were not permitted to fish on the Cascade Plateau and a limit of 15,000 hooks was imposed to minimize seabird interactions. In 2002, 14 additional automatic longline permits were approved by the AFMA board. This fishing method was seen as efficient and allowed effective utilization of the resource. The number of permits was capped at 14 pending a review of the method in 2003. There were some concerns that the gear may have an impact on seabirds and the sustainability of particular stocks. However, it was felt that there may be more effective options for addressing these concerns than simply limiting number of permits. On 7 October 2003 the management plan for the new combined SESSF was gazetted. Also, in 2003, a review of automatic longlining in the GHATF was undertaken, and recommendations from this review were circulated for comment in March 2004. Several concerns were raised in response to this draft. These concerns included possible impact on school sharks and gulper sharks. Subsequently the AFMA board restricted autolongliners to their existing area of operations, preventing these vessels from expanding into new grounds in the Great Australian Bight from 129 - 136° E, apart from an area between 132 -133° E (Ceduna Patch). This was an interim measure pending further advice on management of deepwater sharks and quotas for target species. In August 2004, a year-round area closure for automatic longline vessels was implemented south of Kangaroo Island to protect school sharks. When the order expired on 31 December 2004, it was replaced with a seasonal closure for all gear types during April and May. Automatic longline vessels working in the area now require additional observer coverage. Several new management arrangements were introduced in 2005. A voluntary area closure for all gear types was introduced to protect spawning ling off western Tasmania during springtime. In May 2005, additional ITQ management measures were introduced for Ribaldo and a basket group of deep-water sharks including black shark (*Dalatias licha*), lantern sharks (*Etmopterus* spp.) brier sharks (*Deania* spp.) and smallspine sharks (*Centroscymnus* spp.). Output controls were not seen as a suitable option for managing gulper sharks because of their extremely low productivity

Geographic extent of fishery	 **Figure 2.1. Area of the Scalefish Hook sector.** The Scalefish Hook (automatic longline) sub-fishery includes all waters off South Australia, Victoria and Tasmania from 3 nm to the extent of the Australian Fishing Zone. It also includes waters off southern Queensland (south of Sandy Cape) and New South Wales from approximately the 4000m depth contour (60-80 nm from the coast) to the extent of the AFZ. Waters inside this line off the New South Wales and Queensland coasts, and inside 3 nm around South Australia, Victoria and Tasmania, are managed by the State governments.
Regions or Zones within the fishery	n/a
Fishing season	Fishing occurs throughout the year. The fishing season for all sectors of the SESSF runs from 1 May in a year to 30 April the following year. Seasonal closures occur off Kangaroo Is (April, May) and voluntary closures of west Tasmania in spring.
Key-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 commercial species for this sector have been defined as the species (or species groups) which contribute a significant proportion of the total landed catch. For the scalefish hook (automatic longline) sector of the SESSF these are pink ling and blue eye trevalla. Stock status determinations for both pink ling and blue eye trevalla are considered not subject to overfishing and not overfished (Patterson *et al.* 2019).
Bait collection and usage	Scalefish Hook (automatic longline) fishers use primarily mackerel, squid or Pacific saury (*Cololabis saira)* for bait. No bait collection occurs in this sub-fishery.
Current entitlements	During the period of 2015-2019 there were nine Scalefish Hook (automatic longline) fishing entitlements, with between 4-6 of these active in any one calendar year.

Current and recent TACs, quota trends by method

Quota exist for the main species and Total Allowable Catches (TACs) apply to all fishing methods in the SESSF.

Table S1. Total Allowable Catches (TACs) for quota species in the SESSF fishing seasons (1 May – 30 April) 2010-11 to 2019-20. Undercatch and overcatch not included. The key commercial species in Scalefish Hook (automatic longline) are highlighted in in blue.

	AGREED TAC (KG)									
QUOTA SPECIES	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**
Alfonsino	500000	750000	750000	1125000	1017000	1016000	1017000	1017000	1017000	1017000
Bight Redfish	1653000	1556000	2334000	2358000	2358000	2358000	800000	800000	800000	600000
Blue Eye Trevalla	428000	326000	387000	388000	335000	335000	410000	458000	462000	458000
Blue Grenadier	4700000	4700000	4998000	5208000	6800000	8796000	8810000	8765000	8810000	12183000
Blue Warehou	183000	133000	118000	118000	118000	118000	118000	118000	118000	118000
Deepwater Flathead	1100000	1650000	1560000	1150000	1150000	1150000	1150000	1128000	1128000	1128000
Deepwater shark (eastern)	85000	85000	80000	85000	47000	47000	47000	46000	23000	24000
Deepwater shark (western)	95000	143000	215000	215000	215000	215000	215000	215000	264000	235000
Elephant Fish	65000	89000	89000	109000	109000	163000	92000	114000	114000	114000
Flathead	2750000	2750000	2741000	2750000	2878000	2860000	2882000	2712000	2507000	2468000
Gemfish (Eastern)	100000	100000	100000	100000	100000	100000	100000	100000	100000	100000
Gemfish (Western)	109000	94000	141000	199000	199000	183000	247000	199000	200000	200000
Gummy Shark	1717000	1717000	1714000	1836000	1836000	1836000	1836000	1774000	1763000	1785000
Jackass Morwong	450000	450000	565000	568000	568000	598000	474000	513000	505000	469000
John Dory	221000	221000	220000	221000	221000	169000	167000	175000	263000	395000
Mirror Dory	718000	718000	1077000	1616000	808000	437000	325000	235000	253000	188000
Ocean Perch	300000	300000	230000	195000	195000	166000	190000	190000	241000	241000
Orange Roughy (Albany and Esperance)	50000	50000	50000	50000	50000	50000	50000	50000	50000	50000
Orange Roughy (Cascade Plateau)	500000	500000	500000	500000	500000	500000	500000	500000	500000	500000

Orange Roughy (Eastern)	25000	25000	25000	25000	25000	465000	465000	465000	698000	900000
Orange Roughy (Southern)	35000	35000	35000	35000	35000	66000	66000	66000	84000	94000
Orange Roughy (Western)	60000	60000	60000	60000	60000	60000	60000	60000	60000	60000
Oreodory	188000	113000	111000	132000	132000	128000	128000	128000	185000	185000
Pink Ling	1200000	1200000	996000	834000	996000	980000	1144000	1154000	1117000	1288000
Redfish	551000	276000	275000	276000	138000	100000	100000	100000	100000	50000
Ribaldo	131000	168000	167000	168000	252000	355000	355000	355000	430000	422000
Royal Red Prawn	400000	303000	302500	303000	344000	386000	387000	384000	381000	409000
Saw Shark	255000	226000	226000	339000	459000	482000	433000	442000	430000	430000
School Shark	216000	176000	150000	215000	215000	215000	215000	215000	215000	189000
School Whiting	844000	641000	640000	809000	809000	747000	868000	986000	820000	788000
Silver Trevally	360000	540000	677000	781000	615000	602000	588000	613000	307000	292000
Silver Warehou	2566000	2566000	2541000	2329000	2329000	2417000	1209000	605000	600000	450000
Smooth oreodory (Cascade Plateau)	150000	150000	150000	150000	150000	150000	150000	150000	150000	150000
Smooth oreodory (other)	45000	45000	23000	23000	23000	23000	90000	90000	90000	90000

Current and recent fishery effort trends by method

Scalefish Hook (automatic longline) effort (total shots and number of hooks) are provided in table S2.

Table S2: Scalefish Hook (automatic longline) effort (total shots and number of hooks) since the 2010, as reported in logbooks.

CALENDAR YEAR	NUMBER OF HOOKS SET	NO. OF SHOTS
2010	4,876,500	540
2011	4,736,910	629
2012	4,934,935	718
2013	3,213,820	409
2014	2,959,614	387
2015	2,357,500	286
2016	2,602,806	308
2017	3,688,605	363
2018	3,157,465	348

	2019	3,617,274	361

Current and recent fishery catch trends by method	**Table S3 Scalefish Hook (automatic longline) annual recorded logbook catches (tonnes) of main species caught.**

CALENDAR YEAR	PINK LING	BLUE EYE TREVALLA	RIBALDO	OTHER
2010	311	237	51	123
2011	374	267	47	112
2012	362	217	58	139
2013	242	188	50	95
2014	273	223	67	104
2015	220	184	35	95
2016	264	190	25	51
2017	282	250	37	62
2018	283	218	48	62
2019	271	224	46	78

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 2019 (Patterson *et al.* 2019).

Relationship with other fisheries

There are other Commonwealth, State and recreational fisheries that overlap this sub-fishery.

1. The following fisheries operate in the area coved by this sub-fishery, either under Commonwealth jurisdiction or Joint jurisdiction between the Commonwealth and States:

- Bass Straight Central Zone Scallop fishery
- East Coast Tuna and Billfish fishery
- Small Pelagic fishery
- Southern Bluefin Tuna fishery
- Southern and Western Tuna and Billfish fishery
- Southern Squid Jig fishery.

2. The following fisheries operate under Queensland jurisdiction adjacent to this fishery:

- East Coast Trawl fishery and
- Sub-tropical Inshore Finfish fishery.

3. The following fisheries operate under New South Wales jurisdiction in waters overlapping or adjacent to this fishery:

- Abalone fishery
- Fish Trawl fishery
- Lobster fishery
- Ocean Haul fishery
- Ocean Trap and Line fishery.

4. The following fisheries operate under Victorian jurisdiction in waters overlapping or adjacent to this fishery:

- Abalone fishery
- Rock Lobster fishery
- Victorian Inshore Prawn Trawl fishery
- Victorian Scallop fishery
- Ocean Access fishery.

<table>
<tr><td></td><td>5. The following fisheries operate under Tasmania jurisdiction in waters overlapping or adjacent to the south east trawl, south east non trawl and southern shark sectors of this fishery:

Abalone fishery
Rock Lobster fishery
Scalefish fishery
Tasmania Scallop fishery
Giant Crab fishery.

6. The following fisheries operate under South Australian jurisdiction in waters overlapping or adjacent to this fishery:

Marine Scalefish fishery
Rock Lobster fishery.

</td></tr>
<tr><td colspan="2">Gear</td></tr>
<tr><td>Fishing methods and gear</td><td>Automatic longline fishing is a type of bottom longlining, where gear is set horizontally along the ocean floor and held in place using anchors. The primary difference between automatic longline and demersal longline fishing is that hooks are baited by a machine rather than by hand. When set, the longline can be many kilometres in length, incorporating up to 15 000 hooks.

Automatic longlines are used to catch fish that live on or near the sea floor primarily along Australia's Continental shelf break in 200 to 800m of water.

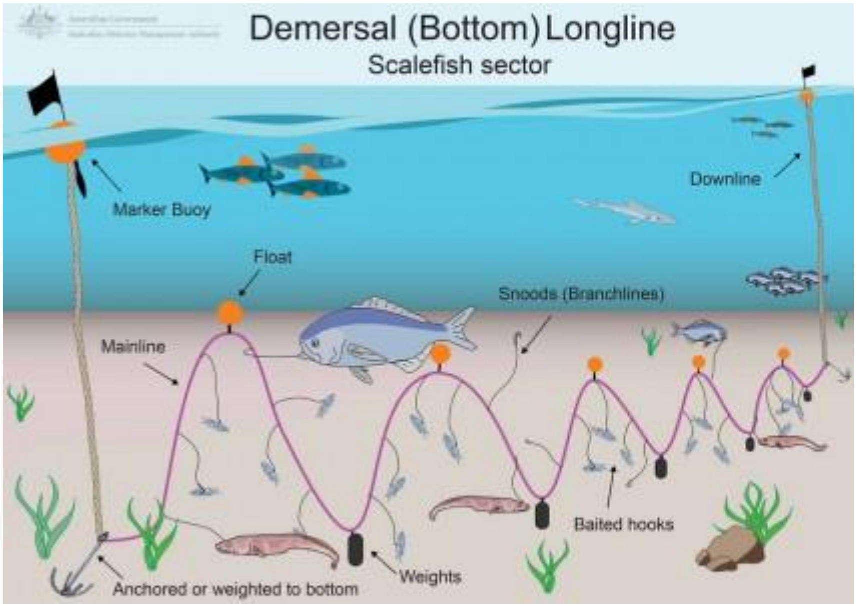

Figure 2.2. Diagram of a demersal (bottom) longline (automatic longline)

Automatic longline gear typically consists of a rope mainline with hooks spaced every 1.3m on 40cm monofilament or braided cord lines ('snoods'). The mainline is attached at both ends to downlines which have a large buoy on the surface for locating gear, and anchors at the bottom to hold the gear in place. The main line is lowered the stern of the vessel where tori lines are used to deter birds from diving on the baits. In this fishery only the Mustad autoline system has been approved for use. The Mustad system is an efficient baiting system in which 95% of the hooks are baited and very few loose baits fall to the water. Each line is normally left to 'soak' for around 6 to 8 hours before being hauled. Hauling is done using hydraulic winches which are fixed to the deck of the boat. The gear can be hauled from either end by retrieving the downline. During hauling a deck hand gaffs and removes captured fish from successful hooks, while the system cleans any remaining bait from unsuccessful hooks and stacks the hooks on a storage magazine. To use auto-</td></tr>
</table>

	longlining in this sub-fishery, operators must comply with requirements under the Australian Antarctic Division's *Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations* (2018) (the TAP) and AFMA's Upper-Slope Dogfish Management Strategy (see 'technical measures' for further details).
Fishing gear restrictions	Operators in the Scalefish Hook (automatic longline) sub-fishery are only permitted to fish using the gear/methods specified on their boat statutory fishing right (SFR) and/or fishing permit. Specific fishing gear restrictions for automatic longline include: • An Auto Longline Fishing Permit must be used in conjunction with a Scalefish Hook Boat SFR. • No more than a total of 15 000 hooks may be used, stowed and/or secured on the nominated boat. • Mandatory seabird management plans and minimum seabird mitigation requirements (see 'technical measures' for further details). • Operators must not allow any species of the family *Centrophoridae* (excluding *Deania* sp.) or *Squalidae* to pass through the hauler or de-hooker (see 'technical measures' for further details).
Selectivity of fishing methods	The Scalefish Hook (automatic longline) sub-fishery is a relatively low volume, high quality and discrete target (Williams *et al.* 2016) fishery. The fishing gear is selective and only removes some parts of the demersal community.
Spatial gear zone set	Fishing with automatic longline gear in the Scalefish Hook sub-fishery is restricted to waters deeper than 183m.
Depth range gear set	Automatic longlining effort has primarily been target between 350 - 550m. There is very little effort between 600 - 750m, with small peak in effort around 800m.
How gear set	Automatic longline gear typically consists of a rope mainline with hooks spaced every 1.3m on 40cm monofilament or braided cord lines ('snoods'). The mainline is attached at both ends to downlines which have a large buoy on the surface for locating gear, and anchors at the bottom to hold the gear in place. Each line is normally left to 'soak' for around 6 to 8 hours before being hauled. Hauling is done using hydraulic winches which are fixed to the deck of the boat. The gear can be hauled from either end by retrieving the downline. Most vessels typically set 3 fleets of 3000 - 4000 hooks in the late afternoon and retrieve them the following morning.
Area of gear impact per set or shot	All fishing gear used in the GHAT sector is passive gear that has minimal effect on habitat. Gillnets, automatic longlines and traps are all in contact with the benthos but are thought not to significantly damage it. The area of impact of the gear is proportional to the number of hooks set. Based on 5000 hook per set (the average magazine limit), the area of impact of the gear would be approximately 2 100 m2, based on using 300 mm length snoods, connected approximately 1.4 m apart and one longline (AFMA Automatic Longline Trial data; Knuckey *et al.* (2014)).
Capacity of gear	No more than a total of 15 000 hooks may be used, stowed and/or secured on the nominated boat. Most vessels typically set 3 fleets of 3000 - 5000 hooks per day.
Effort per annum all boats	See 'Current and recent fishery effort trends by method'.
Lost gear and ghost fishing	Scalefish automatic longline fishing causes very little damage to the seafloor and has only a very limited level of bycatch. Gear can become snagged on the bottom (e.g. during a strong tide) and get broken off, although this is not a common occurrence. After most break-offs, the line is then hauled from the other end in a cautious manner. For experienced skippers, it is rare to break off the line at both ends. Even when the gear is broken at both ends it may be possible to retrieve the gear by grappling. The inflated swim-bladders of teleosts may bring a broken line to the surface if the line has been set in an area that has yielded a commercial catch. Fish which have been caught are brought to the surface slowly, and are often alive when they reach the boat, which greatly increases their chance of survival when returned to the water. All attempts are made to avoid

	losing gear during each fishing operation. The impact of ghost fishing is likely to be minimal after a few days. The gear cannot capture fish once bait has been removed from hooks.
Issues	
Key commercial species issues and Interactions	Stock assessments are undertaken for each of the species managed under quota in the SESSF. An assessment of stock status and fishing mortality for quota species relevant to the Scalefish Hook sub-fishery, is available in the ABARES Fishery Status Report 2019 (Patterson *et al.* 2019). There remains some uncertainty about the stock structure of blue eye trevalla in south eastern Australia. Williams *et al.* (2016) provided evidence for stock structure within the broad southern Australian distribution of blue eye trevalla. As such, AFMA now manage blue eye trevalla as two stocks, the slope and eastern seamount stocks. Clear and persistent differences in size and age composition and differences in trends in catch rates indicate the existence of different stocks of pink ling east and west of South Cape, Tasmania (147° east) (Morison *et al.* 2013). Pink ling is managed under a global (east and west) TAC of 1,310 tonnes for the 2020-21 season. Within this TAC, no more than 446 tonnes can be taken from the east. 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. A research project has also been funded by AFMA in 2020-21 to explore the application of the close kin mark recapture genetics methodology to this species.
Byproduct and bycatch issues and interactions	Byproduct species are defined as species which do not make a significant contribution to the overall catch but are sometimes landed for sale. Bycatch species are defined as species which are caught as part of fishing activities but are rarely landed. Most byproduct species in this sub-fishery are managed under quota (e.g. ribaldo, ocean perch, school and gummy shark, gemfish, jackass morwong, blue grenadier and alfonsino). Bycatch in this sub-fishery is low, with the average annual catch of these species below 1 tonne per annum. School shark is managed under the School Shark Stock Rebuilding Strategy. Under the School Shark Rebuilding Strategy, targeted fishing for school shark is not permitted. The incidental catch TAC is determined annually to cover unavoidable bycatch only. To ensure school shark is not targeted, a catch ratio of school shark to gummy shark was implemented in the 2011-12 season. The catch ratio rule means that a gillnet or shark hook operator (holders of a Shark Hook Boat SFR concession, Gillnet Boat SFR concession, South Australian Coastal Waters Fishing Permit, Tasmanian Coastal Waters Fishing Permit, Tasmanian Rock Lobster Fishing Permit or Gillnet to Hook Fishing Permit) cannot catch an amount of school shark that exceeds 20 per cent of their gummy shark quota holdings. In addition, holders of a Scalefish Hook Boat SFR concession are not permitted to take school shark and gummy shark in excess of 100 kilograms combined weight per trip. This condition does not apply if the boat is also nominated to an Automatic Longline Fishing Permit, Gillnet to Hook Fishing Permit as these vessels have electronic monitoring on board or Shark Hook Boat SFR concession. All catches are still ocovered by quota. All school shark caught alive must be returned to the water alive. This is included as a condition on your fishing concession and applies to all methods in the SESSF. Any school shark that has been returned to the water (discarded) must be reported in your daily fishing logbooks or equivalent elog. All retained dead school shark must be reported.
Protected species issues and interactions	Operators are required to report all interactions with protected species in their logbooks and AFMA reports quarterly to the Department of Agriculture, Water and the Environment. Recorded wildlife interactions from the AFMA Logbook database for the period 2015-2019 are outlined below (Table S4).

Table S4. Summary of Protected Species Interactions in the Scalefish Hook (automatic longline) 2015 - 2019

YEAR	COMMON NAME	SCIENTIFIC NAME	NO. ALIVE	NO. DEAD	NO. UNKNOWN
2015	Australian fur seal	Arctocephalus pusillus doriferus	1		
2015	Longfin Mako	Isurus paucus		57	
2015	Petrels and Shearwaters - unspecified	Procellariidae - undifferentiated	3	11	
2015	Porbeagle	Lamna nasus		3	
2015	Shortfin Mako	Isurus oxyrinchus		12	
2015	Shy Albatross	Thalassarche cauta	2	1	
2015	White Chinned Petrel	Procellaria aequinoctialis	4	5	
2016	Black Browed Albatross	Thalassarche melanophrys		1	
2016	Flesh Footed Shearwater	Ardenna (was Puffinus) carneipes		8	
2016	Killer Whale (Orca)	Orcinus orca		1	
2016	Petrels and Shearwaters - unspecified	Procellariidae - undifferentiated		24	
2016	Porbeagle	Lamna nasus		11	6
2016	Shortfin Mako	Isurus oxyrinchus		13	4
2016	Shy Albatross	Thalassarche cauta	3		
2016	White Chinned Petrel	Procellaria aequinoctialis	3	4	
2017	Longfin Mako	Isurus paucus			4
2017	Petrels and Shearwaters - unspecified	Procellariidae - undifferentiated		14	
2017	Porbeagle	Lamna nasus		1	3
2017	Seals	Otariidae and Phocidae	1	2	
2017	Shortfin Mako	Isurus oxyrinchus		9	13
2017	Shy Albatross	Thalassarche cauta	2		
2017	White Chinned Petrel	Procellaria aequinoctialis	1	4	
2018	Australian fur seal	Arctocephalus pusillus doriferus	1	1	
2018	Grey Nurse Shark	Carcharias taurus			2
2018	Longfin Mako	Isurus paucus	3	2	

2018	Petrels and Shearwaters - unspecified	Procellariidae - undifferentiated		3	
2018	Porbeagle	Lamna nasus	7	11	
2018	Seals	Otariidae and Phocidae	1	1	
2018	Shearwaters (mixed old AFMA code))	Puffinus spp.	17	26	
2018	Shortfin Mako	Isurus oxyrinchus	4	9	6
2018	Shy Albatross	Thalassarche cauta		1	
2018	White Chinned Petrel	Procellaria aequinoctialis	3	4	
2019	Australian fur seal	Arctocephalus pusillus doriferus	1		
2019	Birds	Avian	3		
2019	Longfin Mako	Isurus paucus	8	8	
2019	Porbeagle	Lamna nasus	3	7	
2019	Shortfin Mako	Isurus oxyrinchus	1	19	
2019	Shy Albatross	Thalassarche cauta	1		
2019	White Chinned Petrel	Procellaria aequinoctialis		2	

Seabirds

Interactions with seabirds occur in this sub-fishery. Primarily these interactions are with shearwater and petrel species, although interactions with albatross species have also been recorded. A number of seabird mitigation measures have been implemented consistent with requirements under the TAP (see 'technical measures' for details).

The bycatch limit of 0.01 birds caught per 1000 hooks was exceeded in the summers of 2015, 2016 and 2018, necessitating the fishers to only set at night (AFMA data).

Chondrichthyans

Porbeagles, longfin and shortfin makos are interacted with in this sub-fishery, with all interactions between 2015 – 2019 for the period recorded as dead. AFMA monitors interactions with these species to ensure the catch does not increase significantly.

The Upper-slope Dogfish Management Strategy has been implemented since the last ERA was undertaken. This strategy provides a level of protection for two conservation dependent species of gulper sharks: Harrison's dogfish (*Centrophorus harrissoni*) and Southern dogfish (*C. zeehaani*). The management actions provide some protection for other dogfish species including Endeavour Dogfish (*C. moluccensis*) and Greeneye Spurdog (*Squalus chloroculus*).

AFMA reports annually on the stock status of School Shark and performance against the goals of the School Shark Stock Rebuilding Strategy (2015) to the Department of Environment. AFMA also reports on the level of observer coverage and industry compliance with this Strategy.

Cetaceans

The sub-fishery has a code of practice to minimise interactions with cetaceans. Killer whales regularly interact with automatic longline gear by removing the catch but are too large to be hooked by the gear. There has been one record of an interaction in this sub-fishery where the killer whale had become entangled in the mainline. Pilot whales are commonly seen moving

	through the fishing grounds but do not approach the boat or the fishing gear. Dolphins are often seen around the vessel, particularly bow-riding but do not approach the gear. **Pinnipeds** Australian fur seals often follow automatic longliners. They regularly remove catch from the lines without being entangled. Populations of Australian fur seals are regularly monitored and there are no concerns with population status (McIntosh *et al.* 2018). Populations of long-nosed fur seals are extensively monitored and have found to be increasing (Shaughnessy 2015).
Habitat issues and interactions	The gear has an intermediate footprint and is thought to have a lower impact on the bottom. It is not clear what impact a line under tension may have on benthic fauna. All fishing gear used in the GHAT sector is passive gear that has minimal effect on habitat. Gillnets, longlines and traps all contact the benthos, but are thought not to significantly damage it.
Community issues and interactions	The GHAT sector is a relatively low volume, high quality fishery. The fishing gear is selective and only removes some parts of the demersal community. It is unclear what effect this has on community species composition and/or structure, but any effects of the broader SESSF need to be considered as whole as there is substantial overlap with trawling methods.
Discarding	Since the introduction of electronic monitoring, logbook recorded discards of quota species in this sub-fishery have become more reliable. Discard rates of key commercial species are low. Most of the discarded catch usually consists of non-quota species such as swellsharks, whiptails, catsharks, skates and dogfish.
Management: planned and those implemented	
Management objectives	The management objectives for the SESSF are outlined in the *Southern and Eastern Scalefish and Shark Fishery Management Plan 2003* (the Management Plan): a) to implement efficient and cost-effective fisheries management of the fishery on behalf of the Commonwealth b) to ensure that the exploitation of the resources of the fishery and the carrying on of any related activities are conducted in a manner consistent with the principles of ecologically sustainable development and the exercise of the precautionary principle and, in particular, the need to have regard to the impact of fishing activities on non-target species and the long-term sustainability of the marine environment c) to maximise economic efficiency in the exploitation of scalefish and shark resources within the fishery d) to ensure AFMA's accountability to the fishing industry and to the Australian community in the management of the resources of the fishery e) to reach Government targets for the recovery of the costs of AFMA in relation to the fishery f) to ensure, through proper conservation and management, that the living resources of the fishery are not endangered by over-exploitation g) to ensure the best use of the living resources of the fishery h) to ensure that conservation and management measures in the fishery implement Australia's obligations under international agreements that deal with fish stocks, and other relevant international agreements i) to ensure, as far as practicable, that measures adopted in pursuit of these objectives are not inconsistent with the preservation, conservation and protection of all whale species.
Fishery management plan	The SESSF, which includes this sub-fishery is managed in accordance with the Management Plan available at www.legislation.gov.au/Series/F2005B02463. This sub-fishery is managed through a suite of input and output controls including TAC limits. A TAC is set for each quota species and some non-quota species (to cover incidental unavoidable catch).

The Management Plan incorporates under a single umbrella four sub-fisheries or sectors, these being the Commonwealth Trawl sector, GHAT sector (which includes the Scalefish Hook (automatic longline) sub-fishery), Great Australian Bight Trawl sector and East Coast Deepwater Trawl sector. These sectors have overlapping fishing entitlements, gear types and capture species. Managing these sectors 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.

Input controls

An operator must hold a boat Statutory Fishing Right (SFR) to gain permission to operate a vessel in the SESSF. This SFR will entitle a vessel to use specific gear, to target specific species in a specific area of water. To operate in the Scalefish Hook (automatic longline) sub-fishery, an operator must hold both a Scalefish Hook SFR and an Automatic Longline Fishing Permit.

Other input controls include restrictions on the number of hooks used and closures. Gear requirements are detailed earlier in this report.

Fisheries closures are legislated under the *Southern and Eastern Scalefish and Shark Fishery and Small Pelagic Fishery (Closures) Direction 2016* and under concession conditions. An indicative map of these spatial closures is at Figure 3. Further information on these closures is detailed in AFMA's *2020 Southern and Eastern Scalefish and Shark Fishery Management Arrangements Booklet* (see 'Management Plans' for details on how to access this document).

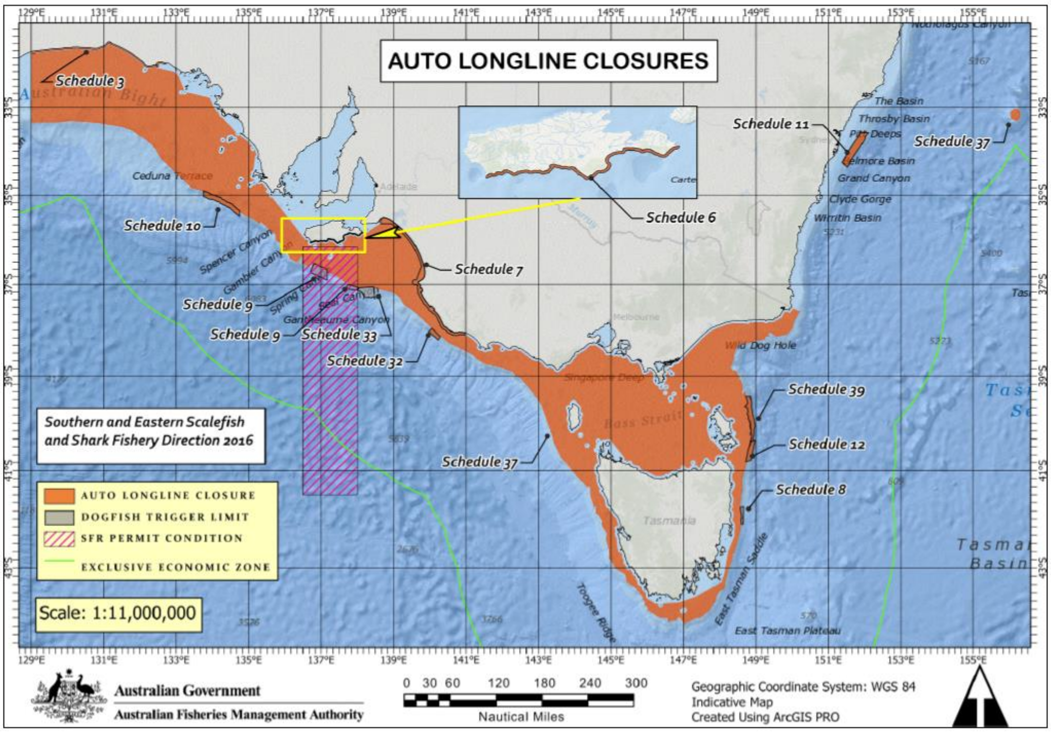

Figure 2.3. Scalefish Hook (automatic longline) fisheries closures.

In addition to fisheries closures, there are also a range of Commonwealth Marine Reserves that overlap with this sub-fishery as follows.

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 km2 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 Parks Australia website at: https://parksaustralia.gov.au/marine/parks/south-east/.

The Temperate East Network covers 383 339 km^2. 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 marine parks are available from the Parks Australia website at: https://parksaustralia.gov.au/marine/parks/temperate-east/.
Output controls	All the major target and byproduct species in this sub-fishery are managed under quota. Quota is issued in the form of quota SFRs and an operator must hold both the appropriate boat SFR, fishing permit and quota SFRs to fish for quota species. Quota SFRs are tradable among sectors. There are some size limits on quota species (see 'technical measures'). There are also trip limits in place for State managed byproduct species. Also, operators must not carry or possess any shark (Class Chondrichthyes) dorsal, pectoral, caudal, pelvic or anal fins on board their boat that are not attached to the shark's carcass.
Technical measures	Under AFMA's *School Shark (Galeorhinus galeus) Stock Rebuilding Strategy* (2015), there is a five tonne school shark trigger limit implemented in this sub-fishery. This is designed to prevent auto longline fishers operating in the scalefish hook sector of the SESSF targeting school shark whilst still allowing incidentally caught school shark to be landed. If the five-tonne school shark limit is exceeded, AFMA consults with SharkRAG and SEMAC to determine whether further management action is required. Gummy and school shark must be at least 45 cm in length when measured from the rearmost gill slit to the ventral insertion of the caudal fin. In 2011 an additional measure was implemented to reduce instances of School Shark targeting. The ratio of School Shark to Gummy Shark catches was limited to 20% on the basis that School Shark catches above this level would suggest the operator was targeting. In 2015, AFMA also implemented a condition that if any school shark are taken alive, they must be returned to the water alive. This was implemented to minimise overall fishing mortality until the stock has rebuilt to above 20 percent of the unfished levels. AFMA's Upper-Slope Dogfish Management Strategy implements a range of technical measures in addition to closures to assist rebuilding of Harrisson's and Southern Dogfish. These are: • Significant area closures • Zero retention of dogfishes of the following species: Harrisson's Dogfish (*Centrophorus harrissoni*), Southern Dogfish (*C. zeehaani*), Endeavour Dogfish (*C. moluccensis*) and Greeneye Spurdog (*Squalus chloroculus*). Dogfishes of these species that are taken alive must be returned to the water carefully and quickly. • Handling practices to minimise post-release mortality of all Dogfish being of the family Centrophoridae (excluding *Deania* sp.) or Squalidae, including; adjusting the hauling rate where a dogfish is identified; stopping the hauler so the dogfish's weight is supported by water; not allowing the dogfish to pass through the hauler or de-hooker; and returning all dogfish to the water as quickly and carefully as possible. • move-on provisions with a vessel interaction limit of three Harrisson's Dogfish and/or Southern Dogfish when fishing inside a dogfish closure, associated with a 12 month ban from the closure for the vessel reaching the limit. Under Scalefish SFR concession conditions, SFR holders must not take more than 200 kg of pink ling (*Genypterus blacodes*) east of longitude 147° East per trip unless AFMA has been notified by the South East Trawl Fishing Industry Association (SETFIA) that the concession holder has entered into an agreement with SETFIA to take a specified amount of pink ling east of Longitude 147° East during a fishing year. In November 2019, in response to concerns about the status of its snapper stocks, the South Australian Government introduced management measures to return its snapper fishery to sustainable levels. These measures included: • a total snapper closure, including the take and possession, applies in waters in the West Coast, Spencer Gulf and Gulf St Vincent regions from 1 November 2019 to 31 January 2023. • an annual seasonal snapper closure, including the take and possession, applies in waters in the South East region from 1 November to 31 January each year.

	To support South Australia's rebuilding efforts for snapper, AFMA introduced additional snapper management measures to mirror those implemented by the State. Under these arrangements, Commonwealth fishers in the south-east region are permitted to retain 50 kilograms of snapper per trip between 1 February and 31 October each year. Fishers in the West Coast, Spencer Gulf and Gulf St Vincent regions are currently prohibited from retaining any snapper
	
	The following seabird mitigation measures are in place for this sub-fishery.
	• An AFMA approved Seabird Management Plan must be on the vessel at all times.
	• Tori lines must be deployed when setting. The tori line must:
	    o be at least 150 m in length.
	    o be set from a position on the boat that allows for at least 100 m aerial coverage, using a drogue.
	    o have the streamer pair nearest to the boat positioned not more than 10 m from the boat (measured horizontally).
	    o have all other streamer pairs positioned no more than 7 m apart.
	    o have streamers maintained to ensure their lengths are as close to the water surface as possible, a bird excluder device (brickle curtain) must be deployed during the haul.
	• Setting only at night for the remainder of a TAP season if the interaction rate with seabirds exceeds 0.01 birds per 1,000 hooks.
	• Lines must be weighted so sink rates exceed 0.3 meters/second.
	• All baits used must be non-frozen.
	• Offal must not be discharged while setting or hauling.

Regulations	The *Fisheries Management Regulations 2019* prescribe 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. Additional regulations were introduced regarding navigation in closures. Additional rules are contained in the Management Plan and conditions on fishing concessions. Under the *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act), interactions with a protected species must be reported within seven days of the incident occurring to the Department of Agriculture, Water and the Environment. The *Memorandum of Understanding between AFMA and the Department for the Reporting of Fisheries Interactions with Protected Species* (2005 Reporting MOU) streamlines those reporting requirements. AFMA reports its protected species interactions to the Department on a quarterly basis and makes these reports publicly available on the AFMA website. 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	Bycatch Action Plans contain a list of actions designed to minimise the impact of fisheries interactions with bycatch species 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 Automatic Longline Bycatch and Discard Workplan is available at www.afma.gov.au/sustainability-environment/bycatch-discarding/bycatch-discard-workplans/.
Enabling processes	AFMA is responsible for data collection and monitoring in this sub-fishery. Commonwealth scientific logbooks have been compulsory in the south east trawl sector since 1985, and electronic logbooks are compulsory for all full-time 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 (CDRs). 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 statistically rigorous 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 conducted in the SESSF since 2006. These surveys provide an independent index of abundance, as well as other important biological and environmental data, some of which are used in current stock assessments.

In 2015, electronic monitoring systems were introduced in this sub-fishery to provide accurate verification of fishers' logbook data and reduce reliance on the ISMP (see 'other data').

The assessment group structure comprises:

- SESSF Resource Assessment Group (SESSFRAG - an umbrella assessment group for the whole SESSF),
- South East Resource Assessment Group (SERAG - formerly Shelf and Slope RAG),
- Shark Resource Assessment Group (SharkRAG).

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 SESSFRAG.

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.

Table S5. Summary of SESSF Harvest Strategy including assessments and harvest control rules

TIER LEVEL	REFERENCE POINT	REFERENCE POINT FUNCTION	INFORMATION REQUIREMENTS	CONTROL RULE
Tier 1	B_{20}	Limit	Catch, effort, discards, age, length, relative abundance, biomass information from: - Logbooks - ISMP - FIS	<B_{20}: No targeted fishing, rebuild strategy required
	B_{35}	HCR inflection	As above	<B_{35}: TACs are set at levels that allow stock to rebuild to target
	B_{48}	Target	As above	<B_{48}: Rebuild towards B_{48} > B_{48}: Fish at F_{48}
Tier 3	F_{20}	Limit	Catch, discards, age, length, information from: - Logbooks & 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 this sub-fishery, 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 and puts controls (e.g. trip limits) in place where necessary.

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

- Australia's 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
- Fisheries Management Act 1991
- Fisheries Administration Act 1991
- Environment Protection and Biodiversity Conservation Act 1999
- Declaration of the Harvest Operations of the Southern and Eastern Scalefish and Shark Fishery as an approved wildlife trade operation, 2019
- the Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (2018)
- Seabird Bycatch Operational Guidelines for Commonwealth Fisheries, 2018
- Commonwealth Fisheries Policy Statement, 2017
- Commonwealth Fisheries Bycatch Policy: Framework for managing the risk of fishing-related impacts on bycatch species in Commonwealth fisheries, 2018
- Guidelines for the Implementation of the Commonwealth Fisheries Bycatch Policy, 2018
- Upper-Slope Dogfish Management Strategy, 2012
- Fishery Management Paper Number 15: AFMA Bycatch Strategy. Mitigating protected species interactions and general bycatch: 2017-2022
- Fisheries Management Paper 14: AFMA's Ecological Risk Management, 2017
- Commonwealth Fisheries Harvest Strategy Policy: Framework for applying an evidence-based approach to setting harvest levels in Commonwealth fisheries, 2018
- Guidelines for the Implementation of the Commonwealth Fisheries Harvest Strategy Policy, 2018
- Stock rebuilding strategies for conservation dependent species:
    - Orange roughy rebuilding strategy
    - Eastern gemfish rebuilding strategy
    - Redfish rebuilding strategy

	• Blue warehou rebuilding strategy • School shark rebuilding strategy • Upper-Slope Dogfish Management Strategy • Bycatch and discarding work plans for each sector of the SESSF
Data	
Logbook data	Catch and effort data and all interactions with protected species are recorded on a shot by shot basis in Daily Fishing Logbooks. Data has been compiled into a centralised database by AFMA and is updated annually to CSIRO. Electronic logbooks (e-logs) are an electronic alternative to submitting traditional paper logbooks. E-logs allow data to be received by AFMA in near real time, closer to actual fishing events. It is compulsory for all SESSF boats that have fished more than 50 days in the current or previous fishing season to be using e-logs. See 'Other data' for information on electronic monitoring.
Observer data	The purpose of the independent Observer Program is to provide fisheries managers, research organisations, 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 has ceased in this sector since the implementation of electronic monitoring and an industry-led biological data collection program was introduced in 2018 (see 'Other data'). Observers have covered on average 17% of operations.
Other data	Electronic monitoring (EM) is a system of video cameras and sensors capable of monitoring and recording fishing activities, which can be reviewed later to verify what fishers report in their daily fishing logbooks. EM systems are compulsory for fulltime vessels in the gillnet and longline sectors of the SESSF. EM is used to verify that: • fishers accurately report the amount and type of fish they catch • fishers report all interactions they may have with threatened, endangered and protected species. During the 2014-15 financial year, AFMA commenced the implementation of EM in the SESSF. Automatic longline boats that fish for more than 50 days in the previous or current fishing season are required to operate an EM system. EM systems must be working for operators to go fishing. Archipelago Asia Pacific (AAP) review a random selection of shots (fishers are unaware which shots will be reviewed). AAP send vessel feedback summary forms to AFMA and operators that compares the logbook data with the EM data. Since 2016, an average of 11% of operations recorded by EM have been reviewed and assessed. In 2018 an industry-led data collection program, supported by electronic monitoring, was implemented through co-management with AFMA to better meet the biological data collection needs in the GHAT sector of the SESSF. The program relies on commercial fishers tagging retained fish at sea so they can be sampled in port. The *Southern and Eastern Scalefish and Shark Fishery Five Year Strategic Research Plan 2016-2020* (AFMA 2016) identifies the research priorities for the SESSF 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 2019** 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 **Fisheries Administrations Act 1991** https://www.legislation.gov.au/Details/C2017C00373 **Fisheries Management Act 1991** https://www.legislation.gov.au/Details/C2017C00363 **Memorandum of Understanding between the Australian Fisheries Management Authority and the Department of the Environment and Heritage for the reporting of fisheries interactions with protected species under the Environment Protection and Biodiversity Conservation Act 1999** https://www.afma.gov.au/sites/g/files/net5531/f/uploads/2010/06/mou.pdf **Threat Abatement Plan for the incidental catch (or bycatch) of seabirds during oceanic longline fishing operations (2018)** http://www.antarctica.gov.au/environment/plants-and-animals/threat-abatement-plan-seabirds **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.agriculture.gov.au/fisheries/environment/sharks/sharkplan-2 **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** www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf **United Nations Fish Stocks Agreement** 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 **AFMA 2020 Southern and Eastern Scalefish and Shark Fishery Management Arrangements Booklet:** https://www.afma.gov.au/sites/default/files/2020_southern_and_eastern_scalefish_and_shark_fishery_management_arrangements_booklet.pdf**Automatic longline Sector Bycatch and Discard Workplan**:

	https://www.afma.gov.au/sustainability-environment/bycatch-discarding/bycatch-discard-workplans **Guide to AFMA's Ecological Risk Management:** https://www.afma.gov.au/sustainability-environment/ecological-risk-management-strategies **Southern and Eastern Scalefish and Shark Fishery Management Plan 2003:** 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 School-Shark-Rebuilding-Strategy.pdf (afma.gov.au) f. Upper Slope Dogfish Management Strategy g. www.afma.gov.au/sustainability-environment/protected-species-management-strategies/
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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 species:	2(C1)
Byproduct and bycatch species:	15 BP, 208 BC
Protected species:	36
Habitats:	13 demersal, 6 pelagic
Communities:	24 demersal, 8 pelagic

Scoping Document S2A. Species

Each species identified during the scoping is added to the ERAEF database used to run the Level 2 analyses if required . A CAAB code (Code for Australian Aquatic Biota) is required to input the information. The CAAB codes for each species may be found at http://www.marine.csiro.au/caab/

Key commercial/secondary commercial species

- *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) species list for the SESSF Scalefish Autolongline sub-fishery. AFMA: refers to AFMA Logbook and/or Observer data.

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Teleost	C1	Ophidiidae	37228002	*Genypterus blacodes*	Pink Ling	AFMA
Teleost	C1	Centrolophidae	37445001	*Hyperoglyphe antarctica*	Blue-eye Trevalla	AFMA

Byproduct species

Byproduct species refers to any species that are retained for sale but comprise a minor component of the fishery catch (>1 tonne) and economic return. Byproduct are commercial species under the Commonwealth Policy on Fisheries Bycatch 2000. This list was obtained from AFMA Logbook data and AFMA Observer data.

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

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Chondrichthyes	BP	Triakidae	37017001	*Mustelus antarcticus*	Gummy Shark	AFMA
Chondrichthyes	BP	Triakidae	37017008	*Galeorhinus galeus*	School Shark	AFMA
Chondrichthyes	BP	Polyprionidae	37020006	*Squalus megalops*	Piked Spurdog	AFMA
Teleost	BP	Moridae	37224002	*Mora moro*	Ribaldo	AFMA
Teleost	BP	Macrouronidae	37227001	*Macruronus novaezelandiae*	Blue Grenadier	AFMA
Teleost	BP	Berycidae	37258001	*Beryx decadactylus*	Imperador	AFMA
Teleost	BP	Berycidae	37258002	*Beryx splendens*	Alfonsino	AFMA
Teleost	BP	Sebastidae	37287001	*Helicolenus percoides*	Reef Ocean Perch	AFMA
Teleost	BP	Sebastidae	37287093	*Helicolenus barathri*	Bigeye Ocean Perch	AFMA
Teleost	BP	Polyprionidae	37311006	*Polyprion oxygeneios*	Hapuku	AFMA
Teleost	BP	Polyprionidae	37311170	*Polyprion americanus*	Bass Groper	AFMA expanded from group code
Teleost	BP	Carangidae	37337006	*Seriola lalandi*	Yellowtail Kingfish	AFMA
Teleost	BP	Oplegnathidae	37369002	*Oplegnathus woodwardi*	Knifejaw	AFMA
Teleost	BP	Cheilodactylidae	37377003	*Nemadactylus macropterus*	Jackass Morwong	AFMA
Teleost	BP	Gempylidae	37439002	*Rexea solandri*	Gemfish	AFMA

Bycatch species

Bycatch species are species that are either <1 tonne retained or 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. This list was obtained from AFMA Logbook data and AFMA Observer data.

Table 2.5. Bycatch (BC) species list for the SESSF Scalefish Autolongline sub-fishery. AFMA: refers to AFMA Logbook and/or Observer data.

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Invertebrate	BC	Ommastrephidae	23636004	*Nototodarus gouldi*	Gould's Squid	Expanded from previous catch history
Invertebrate	BC	Asteriidae	25154011	*Coscinasterias muricata*	Eleven-arm seastar	AFMA
Invertebrate	BC	Lithodidae	28836003	*Lithodes longispina*	Spiny king crab	Expanded from previous catch history
Invertebrate	BC	Menippidae	28915002	*Pseudocarcinus gigas*	Giant Crab	AFMA
Chondrichthyes	BC	Myxinidae	37004001	*Eptatretus longipinnis*	Longfin Hagfish	Expanded from previous catch history
Chondrichthyes	BC	Hexanchidae	37005001	*Heptranchias perlo*	Sharpnose Sevengill Shark	AFMA
Chondrichthyes	BC	Hexanchidae	37005002	*Notorynchus cepedianus*	Broadnose Shark	AFMA
Chondrichthyes	BC	Hexanchidae	37005004	*Hexanchus nakamurai*	Bigeyed Sixgill Shark	AFMA
Chondrichthyes	BC	Hexanchidae	37005005	*Hexanchus griseus*	Bluntnose Sixgill shark	AFMA
Chondrichthyes	BC	Heterodontidae	37007001	*Heterodontus portusjacksoni*	Port Jackson Shark	AFMA
Chondrichthyes	BC	Alopiidae	37012001	*Alopias vulpinus*	Thresher Shark	AFMA
Chondrichthyes	BC	Alopiidae	37012003	*Alopias pelagicus*	Pelagic Thresher	AFMA
Chondrichthyes	BC	Orectolobidae	37013020	*Orectolobus halei*	Gulf Wobbegong	AFMA
Chondrichthyes	BC	Orectolobidae	37013001	*Orectolobus ornatus*	Ornate Wobbegong	Expanded from previous catch history

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Chondrichthyes	BC	Orectolobidae	37013003	*Orectolobus maculatus*	Spotted wobbegong	Expanded from previous catch history
Chondrichthyes	BC	Parascylliidae	37013005	*Parascyllium ferrugineum*	Rusty Carpetshark	Expanded from previous catch history
Chondrichthyes	BC	Brachaeluridae	37013007	*Brachaelurus waddi*	Blind Shark	Expanded from previous catch history
Chondrichthyes	BC	Ginglymostomatidae	37013010	*Nebrius ferrugineus*	Tawny Shark	Expanded from previous catch history
Chondrichthyes	BC	Scyliorhinidae	37015001	*Cephaloscyllium laticeps*	Draughtboard Shark	AFMA
Chondrichthyes	BC	Pentanchidae	37015009	*Figaro boardmani*	Australian Sawtail Catshark	AFMA
Chondrichthyes	BC	Scyliorhinidae	37015013	*Cephaloscyllium albipinnum*	Whitefin Swellshark	AFMA
Chondrichthyes	BC	Pentanchidae	37015027	*Asymbolus analis*	Australian Spotted Catshark	AFMA
Chondrichthyes	BC	Scyliorhinidae	37015031	*Cephaloscyllium variegatum*	Northern Draughtboard Shark	AFMA
Chondrichthyes	BC	Pseudotriakidae	37016001	*Pseudotriakis microdon*	False Catshark	AFMA
Chondrichthyes	BC	Triakidae	37017003	*Furgaleus macki*	Whiskery Shark	AFMA
Chondrichthyes	BC	Triakidae	37017007	*Iago garricki*	Longnose Houndshark	AFMA
Chondrichthyes	BC	Triakidae	37017006	*Hypogaleus hyugaensis*	Pencil Shark	Expanded from previous catch history
Chondrichthyes	BC	Carcharhinidae	37018001	*Carcharhinus brachyurus*	Bronze Whaler	AFMA
Chondrichthyes	BC	Carcharhinidae	37018003	*Carcharhinus obscurus*	Dusky Whaler	Split from aggregate code
Chondrichthyes	BC	Carcharhinidae	37018004	*Prionace glauca*	Blue Shark	AFMA
Chondrichthyes	BC	Carcharhinidae	37018005	*Loxodon macrorhinus*	Sliteye Shark	Expanded from previous catch history
Chondrichthyes	BC	Carcharhinidae	37018007	*Carcharhinus plumbeus*	Sandbar Shark	Expanded from previous catch history

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Chondrichthyes	BC	Carcharhinidae	37018021	*Carcharhinus leucas*	Bull Shark	Expanded from previous catch history
Chondrichthyes	BC	Carcharhinidae	37018022	*Galeocerdo cuvier*	Tiger Shark	AFMA
Chondrichthyes	BC	Carcharhinidae	37018030	*Carcharhinus amblyrhynchos*	Grey Reef Shark	AFMA
Chondrichthyes	BC	Carcharhinidae	37018038	*Triaenodon obesus*	Whitetip Reef Shark	AFMA
Chondrichthyes	BC	Sphyrnidae	37019004	*Sphyrna zygaena*	Smooth Hammerhead	AFMA
Chondrichthyes	BC	Centrophoridae	37020001	*Centrophorus moluccensis*	Endeavour Dogfish	AFMA
Chondrichthyes	BC	Dalatiidae	37020002	*Dalatias licha*	Black Shark	AFMA
Chondrichthyes	BC	Centrophoridae	37020003	*Deania calcea*	Brier Shark	AFMA
Chondrichthyes	BC	Centrophoridae	37020004	*Deania quadrispinosa*	Longsnout Dogfish	AFMA
Chondrichthyes	BC	Etmopteridae	37020005	*Etmopterus lucifer*	Blackbelly Lanternshark	AFMA
Chondrichthyes	BP	Squalidae	37020006	*Squalus megalops*	Piked Spurdog	AFMA
Chondrichthyes	BC	Squalidae	37020007	*Squalus mitsukurii*	Greeneye Dogfish	AFMA
Chondrichthyes	BC	Squalidae	37020008	*Squalus acanthias*	Whitespotted Spurdog	AFMA
Chondrichthyes	BC	Centrophoridae	37020010	*Centrophorus harrissoni*	Harrisson's Dogfish	AFMA
Chondrichthyes	BC	Centrophoridae	37020011	*Centrophorus zeehaani*	Southern Dogfish	AFMA
Chondrichthyes	BC	Somniosidae	37020012	*Centroselachus crepidater*	Golden Dogfish	AFMA
Chondrichthyes	BC	Somniosidae	37020013	*Scymnodon plunketi*	Plunket's Dogfish	AFMA
Chondrichthyes	BC	Somniosidae	37020019	*Centroscymnus owstonii*	Owston's Dogfish	AFMA
Chondrichthyes	BC	Somniosidae	37020025	*Centroscymus coelolepis*	Portuguese Dogfish	Expanded from genus
Chondrichthyes	BC	Etmopteridae	37020021	*Etmopterus baxteri*	Southern Lanternshark	AFMA
Chondrichthyes	BC	Centrophoridae	37020023	*Centrophorus granulosus*	Gulper Shark	AFMA
Chondrichthyes	BC	Etmopteridae	37020027	*Etmopterus bigelowi*	Smooth Lanternshark	AFMA

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Chondrichthyes	BC	Etmopteridae	37020032	*Etmopterus brachyurus*	Short-tail Lanternshark	AFMA
Chondrichthyes	BC	Somniosidae	37020042	*Zameus squamulosus*	Velvet Dogfish	AFMA
Chondrichthyes	BC	Squalidae	37020048	*Squalus chloroculus*	Greeneye Spurdog	AFMA
Chondrichthyes	BC	Squalidae	37020049	*Cirrhigaleus australis*	Mandarin Shark	AFMA
Chondrichthyes	BC	Centrophoridae	37020009	*Centrophorus squamosus*	Leafscale Gulper Shark	Expanded from catch history
Chondrichthyes	BC	Dalatiidae	37020014	*Isistius brasiliensis*	Smalltooth Cookiecutter Shark	Expanded from catch history
Chondrichthyes	BC	Etmopteridae	37020028	*Etmopterus fusus*	Pygmy Lanternshark	Expanded from catch history
Chondrichthyes	BC	Etmopteridae	37020033	*Etmopterus molleri*	Moller's Lanternshark	Expanded from catch history
Chondrichthyes	BC	Dalatiidae	37020043	*Isistius plutodus*	Largetooth Cookiecutter Shark	Expanded from catch history
Chondrichthyes	BC	Pristiophoridae	37023001	*Pristiophorus nudipinnis*	Southern Sawshark	AFMA
Chondrichthyes	BC	Pristiophoridae	37023002	*Pristiophorus cirratus*	Common Sawshark	AFMA
Chondrichthyes	BC	Pristidae	37025001	*Pristis zijsron*	Green Sawfish	AFMA
Chondrichthyes	BC	Trygonorrhinidae	37027011	*Trygonorrhina dumerilii*	Southern Fiddler Ray	AFMA
Chondrichthyes	BC	Rajidae	37031003	*Dipturus cerva*	White-spotted skate	AFMA
Chondrichthyes	BC	Rajidae	37031005	*Dipturus confusus*	Skate sp. A	AFMA
Chondrichthyes	BC	Rajidae	37031006	*Spiniraja whitleyi*	Melbourne Skate	AFMA
Chondrichthyes	BC	Rajidae	37031010	*Dipturus gudgeri*	Bight Skate	AFMA
Chondrichthyes	BC	Arhynchobatidae	37031020	*Notoraja sticta*	Blotched skate	AFMA
Chondrichthyes	BC	Rajidae	37031028	*Dipturus canutus*	Grey Skate	AFMA
Chondrichthyes	BC	Rajidae	37031035	*Dipturus acrobelus*	Deepwater Skate	AFMA
Chondrichthyes	BC	Dasyatidae	37035002	*Dasyatis thetidis*	Thorntail stingray	AFMA
Chondrichthyes	BC	Gymnuridae	37037001	*Gymnura australis*	Australian butterfly ray	AFMA

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Chondrichthyes	BC	Urolophidae	37038003	*Urolophus gigas*	Spotted stingaree	AFMA
Chondrichthyes	BC	Myliobatidae	37039001	*Myliobatis australis*	Southern Eagle Ray	AFMA
Chondrichthyes	BC	Chimaeridae	37042001	*Chimaera ogilbyi*	Ogilby's Ghostshark	AFMA
Chondrichthyes	BC	Chimaeridae	37042005	*Chimaera fulva*	Southern Chimaera	AFMA
Chondrichthyes	BC	Callorhinchidae	37043001	*Callorhinchus milii*	Elephantfish	AFMA
Teleost	BC	Congridae	37067012	*Bassanago bulbiceps*	Swollenhead conger	AFMA
Teleost	BC	Congridae	37067013	*Bassanago hirsutus*	Deepsea conger	AFMA
Teleost	BC	Congridae	37067007	*Conger verreauxi*	Southern Conger	Expanded from aggregate code
Teleost	BC	Congridae	37067002	*Gnathophis longicauda*	Little Conger	Expanded from aggregate code
Teleost	BC	Congridae	37067027	*Gnathophis macroporis*	Larepore Conger	Expanded from aggregate code
Teleost	BC	Congridae	37067017	*Gnathophis umbrellabia*	Umbrella Conger	Expanded from aggregate code
Teleost	BC	Synaphobranchidae	37070008	*Synaphobranchus kaupii*	Kaup's Cut-throat Eel	AFMA
Teleost	BC	Chirocentridae	37087001	*Chirocentrus dorab*	Dorab Wolf Herring	AFMA
Teleost	BC	Aulopidae	37117001	*Aulopus purpurissatus*	Sergeant Baker	AFMA
Teleost	BC	Paraulopidae	37120001	*Paraulopus nigripinnis*	Blacktip Cucumberfish	AFMA
Teleost	BC	Moridae	37224003	*Pseudophycis barbata*	Bearded Rock Cod	AFMA
Teleost	BC	Moridae	37224006	*Pseudophycis bachus*	Red Cod	AFMA
Teleost	BC	Moridae	37224009	*Halargyreus johnsonii*	Slender Cod	AFMA
Teleost	BC	Moridae	37224005	*Lotella rhacina*	Largetooth Beardie	Expanded from aggregate code
Teleost	BC	Moridae	37224010	*Lepidion microcephalus*	Smallhead Cod	Expanded from aggregate code
Teleost	BC	Moridae	37224017	*Lepidion scmidti*	Schmidt’s Cod	Expanded from aggregate code
Teleost	BC	Merlucciidae	37227002	*Merluccius australis*	Southern Hake	AFMA

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Teleost	BC	Ophidiidae	37228001	*Dannevigia tusca*	Tusk	AFMA
Teleost	BC	Ophidiidae	37228008	*Genypterus tigerinus*	Rock ling	AFMA
Teleost	BC	Macrouridae	37232001	*Coelorinchus australis*	Southern Whiptail	AFMA
Teleost	BC	Macrouridae	37232002	*Coelorinchus fasciatus*	Banded whiptail	AFMA
Teleost	BC	Macrouridae	37232004	*Lepidorhynchus denticulatus*	Toothed Whiptail	AFMA
Teleost	BC	Macrouridae	37232045	*Coelorinchus maurofasciatus*	Falseband Whiptail	AFMA
Teleost	BC	Macrouridae	37232036	*Macrourus carinatus*	Ridgescale Whiptail	Expanded from aggregate code
Teleost	BC	Trachichthyidae	37255001	*Hoplostethus intermedius*	Blacktip sawbelly	AFMA
Teleost	BC	Trachichthyidae	37255003	*Paratrachichthys macleayi*	Sandpaper fish	AFMA
Teleost	BC	Trachichthyidae	37255004	*Gephyroberyx darwinii*	Darwin's roughy	AFMA
Teleost	BC	Berycidae	37258003	*Centroberyx affinis*	Redfish	AFMA
Teleost	BC	Berycidae	37258004	*Centroberyx gerrardi*	Bight Redfish	AFMA
Teleost	BC	Berycidae	37258005	*Centroberyx lineatus*	Swallowtail	AFMA
Teleost	BC	Cyttidae	37264002	*Cyttus australis*	Silver Dory	AFMA
Teleost	BC	Cyttidae	37264001	*Cyttus traversi*	King Dory	Expanded from aggregate code
Teleost	BC	Cyttidae	37264005	*Cyttus novaezealandiae*	New Zealand Dory	Expanded from aggregate code
Teleost	BC	Zeidae	37264003	*Zenopsis nebulosus*	Mirror Dory	AFMA
Teleost	BC	Zeidae	37264004	*Zeus faber*	John Dory	AFMA
Teleost	BC	Oreosomatidae	37266001	*Neocyttus rhomboidalis*	Spikey Oreodory	AFMA
Teleost	BC	Oreosomatidae	37266002	*Oreosoma atlanticum*	Oxeye Oreodory	AFMA
Teleost	BC	Oreosomatidae	37266003	*Pseudocyttus maculatus*	Smooth Oreodory	AFMA
Teleost	BC	Oreosomatidae	37266005	*Allocyttus niger*	Black Oreodory	AFMA

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Teleost	BC	Oreosomatidae	37266006	*Neocyttus psilorhynchus*	Rough Oreodory	Expanded from aggregate code
Teleost	BC	Neosebastidae	37287004	*Neosebastes bougainvillii*	Gulf Gurnard Perch	AFMA
Teleost	BC	Neosebastidae	37287005	*Neosebastes scorpaenoides*	Common Gurnard Perch	AFMA
Teleost	BC	Neosebastidae	37287006	*Neosebastes thetidis*	Thetis Fish	AFMA
Teleost	BC	Scorpaenidae	37287008	*Scorpaena papillosa*	Southern Red Scorpionfish	AFMA
Teleost	BC	Sebastidae	37287046	*Trachyscorpia eschmeyeri*	Deepsea Ocean Perch	AFMA
Teleost	BC	Triglidae	37288001	*Chelidonichthys kumu*	Red Gurnard	AFMA
Teleost	BC	Triglidae	37288006	*Pterygotrigla polyommata*	Latchet	AFMA
Teleost	BC	Triglidae	37288007	*Lepidotrigla modesta*	Cocky Gurnard	AFMA
Teleost	BC	Triglidae	37288003	*Lepidotrigla vanessa*	Butterfly Gurnard	Expanded from aggregate code
Teleost	BC	Triglidae	37288008	*Lepidotrigla mulhalli*	Roundsnout Gurnard	Expanded from aggregate code
Teleost	BC	Triglidae	37288002	*Lepidotrigla papilio*	Spiny Gurnard	Expanded from aggregate code
Teleost	BC	Platycephalidae	37296001	*Platycephalus richardsoni*	Tiger Flathead	AFMA
Teleost	BC	Platycephalidae	37296002	*Platycephalus conatus*	Deepwater Flathead	AFMA
Teleost	BC	Platycephalidae	37296003	*Platycephalus bassensis*	Southern Sand Flathead	AFMA
Teleost	BC	Platycephalidae	37296006	*Platycephalus laevigatus*	Rock Flathead	AFMA
Teleost	BC	Platycephalidae	37296035	*Platycephalus aurimaculatus*	Toothy Flathead	Expanded from aggregate code
Teleost	BC	Platycephalidae	37296035	*Platycephalus grandispinis*	Longspine Flathead	Expanded from aggregate code
Teleost	BC	Platycephalidae	37296053	*Thysanophrys papillaris*	Smallknob Flathead	AFMA
Teleost	BC	Hoplichthyidae	37297001	*Hoplichthys haswelli*	Deepsea Flathead	AFMA
Teleost	BC	Serranidae	37311045	*Cephalopholis sonnerati*	Tomato Rockcod	AFMA

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Teleost	BC	Serranidae	37311095	*Caprodon longimanus*	Longfin Perch	AFMA
Teleost	BC	Serranidae	37311147	*Hyporthodus ergastularius*	Banded Rockcod	Expanded from aggregate code
Teleost	BC	Apogonidae	37327035	*Epigonus telescopus*	Black Deepsea Cardinalfish	Expanded from aggregate code
Teleost	BC	Dinolestidae	37327002	*Dinolestes lewini*	Longfin Pike	Expanded from aggregate code
Teleost	BC	Carangidae	37337025	*Seriola dumerili*	Amberjack	AFMA
Teleost	BC	Carangidae	37337062	*Pseudocaranx georgianus*	Silver Trevally	AFMA
Teleost	BC	Carangidae	37337002	*Trachurus declivis*	Common Jack Mackerel	Expanded from aggregate code
Teleost	BC	Carangidae	37337003	*Trachurus novazelandiae*	Yellowtail Scad	Expanded from aggregate code
Teleost	BC	Carangidae	37337077	*Trachurus murphyi*	Peruvian Jack Mackerel	Expanded from aggregate code
Teleost	BC	Bramidae	37342001	*Brama brama*	Ray's Bream	AFMA
Teleost	BC	Bramidae	37342010	*Brama australis*	Southern Ray's Bream	Expanded from aggregate code
Teleost	BC	Lutjanidae	37346001	*Aphareus rutilans*	Rusty Jobfish	AFMA
Teleost	BC	Lutjanidae	37346032	*Pristipomoides filamentosus*	Rosy Snapper	AFMA
Teleost	BC	Lutjanidae	37346038	*Etelis coruscans*	Flame Snapper	AFMA
Teleost	BC	Lutjanidae	37346056	*Pristipomoides zonatus*	Oblique-banded Snapper	AFMA
Teleost	BC	Lethrinidae	37351009	*Lethrinus miniatus*	Redthroat Emperor	AFMA-not in area?
Teleost	BC	Emmelichthyidae	37345002	*Plagiogeneion macrolepis*	Bigscale Rubyfish	Expanded from aggregate code
Teleost	BC	Emmelichthyidae	37345003	*Plagiogeneion rubiginosum*	Cosmopolitan Rubyfish	Expanded from aggregate code
Teleost	BC	Sparidae	37353001	*Chrysophrys auratus*	Snapper	Expanded from aggregate code
Teleost	BC	Sparidae	37352006	*Agyrops spinifer*	Frypan Bream	Expanded from aggregate code
Teleost	BC	Sparidae	37352002	*Dentex spariformes*	*Yellowback Bream*	Expanded from aggregate code
Teleost	BC	Scorpididae	37361003	*Tilodon sexfasciatus*	Moonlighter	AFMA

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Teleost	BC	Pentacerotidae	37367002	*Paristiopterus labiosus*	Giant Boarfish	AFMA
Teleost	BC	Pentacerotidae	37367003	*Pentaceropsis recurvirostris*	Longsnout boarfish	AFMA
Teleost	BC	Pentacerotidae	37367004	*Pentaceros decacanthus*	Bigspine Boarfish	AFMA
Teleost	BC	Pentacerotidae	37367009	*Pseudopentaceros richardsoni*	Pelagic Armourhead	AFMA
Teleost	BC	Pentacerotidae	37367010	*Parazanclistius hutchinsi*	Short Boarfish	AFMA
Teleost	BC	Cheilodactylidae	37377004	*Nemadactylus valenciennesi*	Blue Morwong	AFMA
Teleost	BC	Cheilodactylidae	37377005	*Dactylophora nigricans*	Dusky Morwong	AFMA
Teleost	BC	Cheilodactylidae	37377014	*Nemadactylus sp. [see Smith et al, 1996]*	King Morwong	AFMA
Teleost	BC	Cheilodactylidae	37377002	*Nemadactylus douglasii*	Grey Morwong	Expanded from aggregate code
Teleost	BC	Cheilodactylidae	37377006	*Cheilodactylus spectabilis*	Banded Morwong	Expanded from aggregate code
Teleost	BC	Latridae	37378001	*Latris lineata*	Striped Trumpeter	Expanded from aggregate code
Teleost	BC	Latridae	37378002	*Latridopsis forsteri*	Bastard Trumpeter	Expanded from aggregate code
Teleost	BC	Labridae	37384001	*Bodianus vulpinus*	Western Blackspot Pigfish	AFMA
Teleost	BC	Labridae	37384003	*Notolabrus tetricus*	Bluethroat Wrasse	AFMA
Teleost	BC	Labridae	37384061	*Bodianus unimaculatus*	Eastern blackspot pigfish	AFMA
Teleost	BC	Labridae	37384007	*Bodianus perditio*	Goldspot Pigfish	Expanded from aggregate code
Teleost	BC	Labridae	37384010	*Choerodon schoenleinii*	Blackspot tuskfish	Expanded from aggregate code
Teleost	BC	Labridae	37384014	*Xiphocheilus typus*	Bluetooth Tuskfish	Expanded from aggregate code
Teleost	BC	Labridae	37384035	*Bodianus flavipinnis*	Yellowfin Pigfish	Expanded from aggregate code
Teleost	BC	Labridae	37384043	*Achoerodus viridis*	Eastern Blue Groper	Expanded from aggregate code
Teleost	BC	Labridae	37384044	*Cheilinus trilobatus*	Tripletail Maori Wrasse	Expanded from aggregate code
Teleost	BC	Uranoscopidae	37400003	*Kathetostoma laeve*	Common stargazer	AFMA

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Teleost	BC	Uranoscopidae	37400007	*Uranoscopus cf bicinctus*	Marbled Stargazer	Expanded from aggregate code
Teleost	BC	Uranoscopidae	37400008	*Uranoscopus cognatus*	Yellowtail Stargazer	Expanded from aggregate code
Teleost	BC	Uranoscopidae	37400018	*Kathetostoma canaster*	Speckled Stargazer	Expanded from aggregate code
Teleost	BC	Gempylidae	37439001	*Thyrsites atun*	Barracouta	AFMA
Teleost	BC	Gempylidae	37439003	*Ruvettus pretiosus*	Oilfish	AFMA
Teleost	BC	Trichiuridae	37440002	*Lepidopus caudatus*	Frostfish	AFMA
Teleost	BC	Scombridae	37441002	*Thunnus albacares*	Yellowfin Tuna	AFMA
Teleost	BC	Scombridae	37441003	*Katsuwonus pelamis*	Skipjack Tuna	AFMA
Teleost	BC	Scombridae	37441004	*Thunnus maccoyii*	Southern Bluefin Tuna	AFMA
Teleost	BC	Xiphiidae	37442001	*Xiphias gladius*	Swordfish	AFMA
Teleost	BC	Centrolophidae	37445004	*Centrolophus niger*	Rudderfish	AFMA
Teleost	BC	Centrolophidae	37445005	*Seriolella brama*	Blue Warehou	AFMA
Teleost	BC	Centrolophidae	37445006	*Seriolella punctata*	Silver Warehou	AFMA
Teleost	BC	Centrolophidae	37445011	*Seriolella caerulea*	White Warehou	AFMA
Teleost	BC	Centrolophidae	37445014	*Schedophilus labyrinthicus*	Ocean Blue-eye Trevalla	AFMA
Teleost	BC	Monacanthidae	37465006	*Nelusetta ayraudi*	Ocean Jacket	Expanded from aggregate code
Teleost	BC	Balistidae	37465011	*Abalistes stellatus*	Starry Triggerfish	Expanded from aggregate code
Teleost	BC	Balistidae	37465061	*Odonus niger*	Redtooth Triggerfish	Expanded from aggregate code
Teleost	BC	Tetraodontidae	37467002	*Omegophora armilla*	Ringed toadfish	Expanded from aggregate code
Teleost	BC	Tetraodontidae	37467007	*Lagocephalus sceleratus*	Silver Toadfish	Expanded from aggregate code
Teleost	BC	Triodontidae	37468001	*Triodon macropterus*	Threetooth puffer	Expanded from aggregate code
Teleost	BC	Diodontidae	37469002	*Allomycterus pilatus*	Deepwater burrfish	AFMA

TAXA NAME	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE
Teleost	BC	Diodontidae	37469001	*Diodon nicthemerus*	Globefish	AFMA

Protected species

Protected species that occur in the sub-fishery. A protected species[2] refers to all species listed/covered under the EPBC Act 1999, which include Protected[3] species (listed threatened species i.e. vulnerable, endangered or critically endangered), cetaceans, listed migratory species and listed marine species. Protected species 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 lists. 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), Atlas of Living Australia http://fish.ala.org.au/; marine mammals: Woinarski *et al.*(2014), Jefferson *et al.* (2015). Higher order family categories were expanded to include species that were considered to have potential to interact with fishery (based on geographic range and proven/perceived susceptibility to the fishing gear/methods).

Table 2.6. Protected species (PS) list for the Scalefish Autolongline sub-fishery. AFMA: refers to AFMA catch logbook and wildlife observation and abundance logs.

TAXA	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
Chondrichthyes	PS	Carchariidae	37008001	*Carcharias taurus*	Greynurse Shark	AFMA
Chondrichthyes	PS	Lamnidae	37010001	*Isurus oxyrinchus*	Shortfin Mako	AFMA

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

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

TAXA	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
Chondrichthyes	PS	Lamnidae	37010002	*Isurus paucus*	Longfin Mako	AFMA
Chondrichthyes	PS	Lamnidae	37010003	*Carcharodon carcharias*	White Shark	AFMA
Chondrichthyes	PS	Lamnidae	37010004	*Lamna nasus*	Porbeagle	AFMA
Aves	PS	Diomedeidae	40040002	*Thalassarche cauta*	Shy Albatross	AFMA
Aves	PS	Diomedeidae	40040007	*Thalassarche melanophrys*	Black Browed Albatross	AFMA
Aves	PS	Procellariidae	40041003	*Daption capense*	Cape Petrel	Expanded from family code
Aves	PS	Procellariidae	40041004	*Fulmarus glacialoides*	Southern Fulmar	Expanded from family code
Aves	PS	Procellariidae	40041005	*Halobaena caerulea*	Blue Petrel	Expanded from family code
Aves	PS	Procellariidae	40041006	*Lugensa brevirostris*	Kerguelan Petrel	Expanded from family code
Aves	PS	Procellariidae	40041007	*Macronectes gianteus*	Southern Giant Petrel	Expanded from family code
Aves	PS	Procellariidae	40041008	*Macronectes halli*	Northern Giant Petrel	Expanded from family code
Aves	PS	Procellariidae	40041009	*Pachyptila belcheri*	Slender-billed Prion	Expanded from family code
Aves	PS	Procellariidae	40041011	*Pachyptila desolata*	Antarctic Prion	Expanded from family code
Aves	PS	Procellariidae	40041013	*Procellaria cinerea*	Grey Petrel	Expanded from family code
Aves	PS	Procellariidae	40041018	*Procellaria aequinoctialis*	White Chinned Petrel	Expanded from genus
Aves	PS	Procellariidae	40041019	*Pachyptila turtur*	Fairy Prion	Expanded from family code
Aves	PS	Procellariidae	40041020	*Procellaria parkinsoni*	Black petrel	Expanded from family code
Aves	PS	Procellariidae	40041028	*Pterodroma inexpectata*	Mottled Petrel	Expanded from family code
Aves	PS	Procellariidae	40041029	*Pterodroma lessoni*	White-headed Petrel	Expanded from family code
Aves	PS	Procellariidae	40041030	*Pterodroma leucoptera*	Gould Petrel	Expanded from family code
Aves	PS	Procellariidae	40041031	*Pterodroma macroptera*	Great-winged Petrel	Expanded from family code
Aves	PS	Procellariidae	40041032	*Pterodroma mollis*	Soft-plumaged Petrel	Expanded from family code

TAXA	ROLE IN FISHERY	FAMILY NAME	CAAB CODE	SCIENTIFIC NAME	COMMON NAME	SOURCE(S)
Aves	PS	Procellariidae	40041035	*Pterodroma solandri*	Providence Petrel	Expanded from family code
Aves	PS	Procellariidae	40041038	*Ardenna carneipes*	Flesh Footed Shearwater	AFMA
Aves	PS	Procellariidae	40041040	*Ardenna grisea*	Sooty Shearwater	Expanded from genus (*Puffinus)*
Aves	PS	Procellariidae	40041047	*Puffinus tenuirostris*	Short-tailed Shearwater	Expanded from genus (*Puffinus)*
Aves	PS	Procellariidae	40041040	*Puffinus gavia*	Fluttering Shearwater	Expanded from genus (*Puffinus)*
Aves	PS	Procellariidae	40041043	*Puffinus huttoni*	Hutton's Shearwater	Expanded from genus (*Puffinus)*
Aves	PS	Procellariidae	40041045	*Ardenna pacifica*	Wedge-tailed Shearwater	Expanded from genus (*Puffinus)*
Aves	PS	Procellariidae	40041036	*Puffinus assimilis*	Little Shearwater	Expanded from genus (*Puffinus)*
Mammalia	PS	Delphinidae	41116011	*Orcinus orca*	Killer Whale (Orca)	AFMA
Mammalia	PS	Otariidae	41131003	*Arctocephalus pusillus doriferus*	Australian fur-seal	AFMA
Mammalia	PS	Otariidae	41131001	*Arctocephalus forsteri*	Long-nosed fur-seal	Expanded from family code
Mammalia	PS	Otariidae	41131005	*Neophoca cinerea*	Australian sea lion	Expanded from family code

Scoping Document S2B1. Benthic Habitats

The first ERAEF assessment of the Autolongline scalefish fishery (Daley *et al.* 2007) used detailed data to define habitats in the GHAT fishery resulting in 149 different habitat types being identified and assessed. They found that two outer shelf habitats were at high risk, 21 as medium risk, and 50 as low risk. On the upper slope, 15 habitats were classified as high risk, 13 at medium and 11 upper slope at low risk. Habitats at mid-slope depths were considered at low risk. However, Daley *et al.* (2007) considered that "these detailed habitat types could be readily aggregated into a smaller number of general categories for interpretation because many types are similar, differing in only one respect of substratum or geomorphology or dominant fauna, and therefore attracting similar PSA scores and the same risk rankings".

Since the previous assessment 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, 2018; Williams *et al.* 2009; 2010a, b; 2011). This has culminated in a redefinition of much of the Australian seafloor based on meso-scale surrogates collated from data from biological surveys, environmental data, protected area/fishery closure data by Pitcher *et al.* (2018). They used fishery effort data from 1985- 2012 which is immediately prior to this current assessment period and their habitat assessment was very relevant and more comprehensive than the previous ones. Therefore, we chose to use the new categorisation by Pitcher *et al*. 2018 to scope vulnerable habitats in preference to the original scoping of habitats. Consequently, the new habitat data and methodology we use here are not directly mappable to the original ERAEF habitat definition nor directly comparable to the original analyses.

The habitat assessment of Pitcher *et al.* (2018) was conducted primarily for trawl fisheries but the identification of the vulnerable habitats within assemblages is relevant to any of the other fishing methods in the region (Figure 2.4) . By overlaying the footprint of the fishery to be assessed over the assemblage distribution maps of Pitcher *et al.* (2018), we could identify those containing vulnerable habitats that might be at particular risk (see Table 2.2).

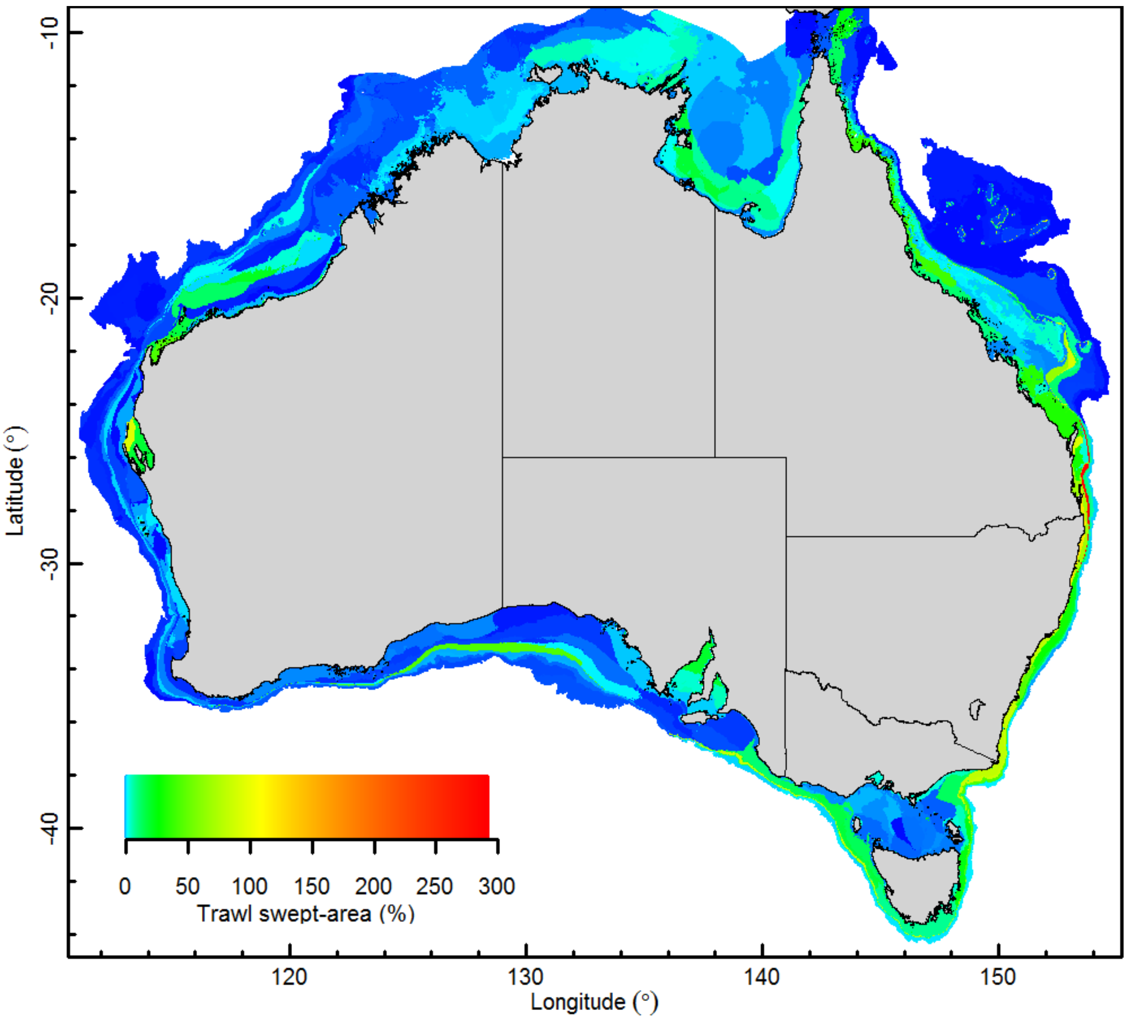


Figure 2.4. Map of assemblages from 0-1500m indicating average annual swept-area by trawling (%) within each assemblage. This is an indicator of relative intensity of trawling. (Taken from Pitcher *et al.* 2018).

The effort data for the Autolongline sub-fishery indicated that the greatest concentration of fishing was spread throughout the jurisdiction from eastern Bass Strait around Tasmania, and to the west of the Gulfs in the GAB. For this assessment of the Autolongline sub-fishery, we assessed habitats within regions 7 (Great Australian Bight shelf and slope, GAB) (

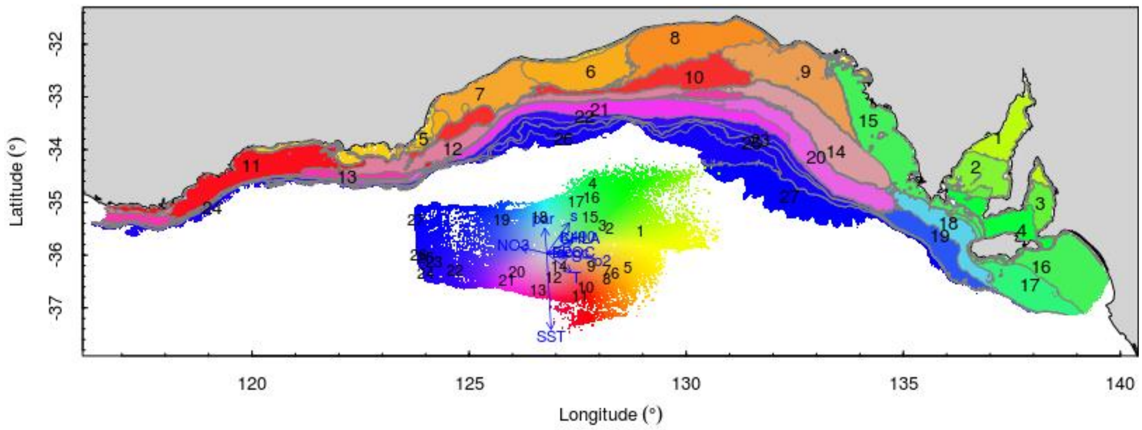


Figure 2.5) and 8 (Southeast Australian shelf and slope colloquially known as the SE trawl area, SET) (Figure 2.6) as characterised by Pitcher *et al.* (2018). The actual footprint of the Autolongline sub-fishery is relatively small being confined to the outer shelf -shelf break and upper slope compared to the whole fishery jurisdiction. Assemblages already highly exposed to trawling (and therefore potentially other forms of fishing) were assemblage 21 in the GAB (45% swept area), and in the SET, assemblages 16, 17 and 22 (82-85% swept area) and to a lesser extent assemblage 21 (45% swept area).

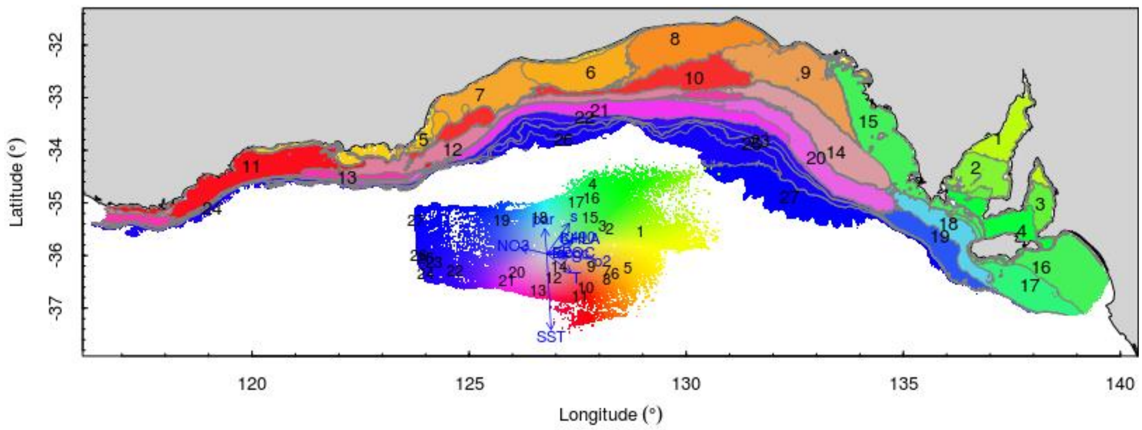


Figure 2.5. Map of the Southern Australian shelf and slope trawl region in the Great Australian Bight #7 showing the 27 assemblages derived by Pitcher *et al.*2018. Each of the assemblages are now used as proxies for habitat in the assessment. (Taken from Pitcher et al. 2018).

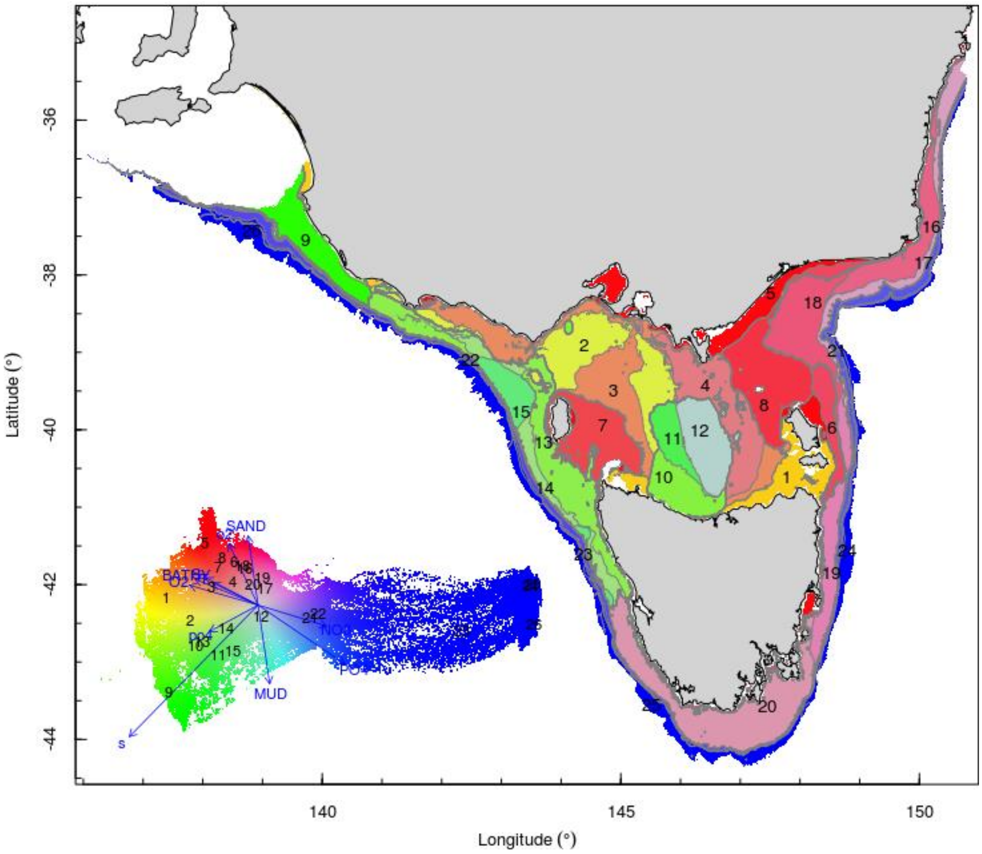


Figure 2.6. Map of the Southeast Australian shelf and slope region #8 showing the 26 assemblages derived by Pitcher *et al.* 2018. Each of the assemblages are now used as proxies for habitat in the assessment. (Taken from Pitcher et al. 2018).

Vulnerable habitat types or "sensitive habitat-forming biological components" in these two regions are described as:

- habitat–forming benthos in the GAB (assemblage 21)
- bryozoans and sponges from the eastern part of the SET area (assemblage 21)
- sub-cropping friable sandstone supporting large habitat-forming gorgonians and sponges within exposed mid-shelf assemblages (SET assemblage 17)
- aggregations of relict stalked crinoid *Metacrinus cyaneus* restricted within a few exposed shelf-break assemblages (in SET assemblage 21)
- ribbons of delicate bryozoan communities restricted to a narrow depth range within many shelf-edge assemblages, some of which are exposed (in SET assemblages 20, 22,23,25,26)
- tree-forming octocorals and black corals restricted to high flow, steep banks in some exposed upper-slope assemblages (in SET assemblage 21, 24).

These habitats are listed in Table 2.7. 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).

In addition, there are seamount habitats that are not covered by the recent studies of Pitcher at al 2018. Previous ERAEF assessment identified a group of four mid-slope habitats of sedimentary rock outcrops with encrustors or sedentary fauna, and unrippled rock with encrustors or no fauna. These are added to the list of habitats in which the autolongline sub-fishery occurs (Table 2.7).

These vulnerable types are potentially accessible to trawling (and other fishing methods) and may be at risk (Williams *et al.* 2011) but an assessment of the exposure of the sensitive biological components (to trawling) has not been completed (Pitcher *et al.* 2018). The risk from other forms of fishing method is also unknown. The lack of evidence to prove direct impact from auto-longlining impedes further analysis. Ideally, ERAEF habitat protocols and assessment need to be updated to integrate the assessments by Pitcher *et al.* 2018 to enable thorough analysis. Consequently, this SICA is preliminary and further assessment at Level 2 is not possible now.

Table 2.7. Benthic habitats that occur within the jurisdictional boundary of the Scalefish Autolongline sub-fishery. Habitats in which the fishing effort occurs are highlighted in blue (n=13).

REGION	ASSEMBLAGE	HABITAT TYPE
7 GAB	10	
	11	
	12	
	13	
	14	
	15	
	16	
	17	
	18	
	19	
	20	
	21	Sensitive habitat forming biological components e.g. sponges and bryozoans
	22	
	23	
	24	
	25	
	26	
	27	
8 SET	17	Sub-cropping friable sandstone supporting large habitat-forming gorgonians and sponges within exposed mid-shelf assemblages
	18	Sub-cropping friable sandstone supporting sponge gardens
	19	
	20	Bryozoans on shelf edge
	21	Relict stalked crinoid on shelf breaks, tree-forming octocorals and black corals in steep upper-slope banks
	22	Bryozoans on shelf edge
	23	Bryozoans on shelf edge
	24	Tree-forming octocorals and black corals in steep upper-slope banks
	25	Bryozoans on shelf edge
	26	Bryozoans on shelf edge
Seamount		Midslope, sedimentary rock, outcrop, encrustors
		Midslope, sedimentary rock, outcrop, sedentary fauna
		Midslope, sedimentary rock, unrippled, encounters
		Midslope, sedimentary rock, unrippled, no fauna

Scoping Document S2B2. Pelagic Habitats

Table 2.8. Pelagic habitats for the Scalefish Autolongline sub-fishery. Shaded cells habitats fall within the jurisdictional boundary of the fishery. Fishing occurs in all shaded habitats.

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
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

ERAEF PELAGIC HABITAT NO.	PELAGIC HABITAT TYPE	DEPTH (M)	COMMENTS	SOURCE
P14	North Eastern Pelagic Province - Coastal	0 – 200		ERA pelagic habitat database based on pelagic communities definitions
P15	North Eastern Pelagic Province - Plateau	0 – > 600	this is a compilation of the range covered by the North Eastern Seamount Oceanic (1) and (2)	ERA pelagic habitat database based on pelagic communities definitions
P16	North Eastern Pelagic Province - Seamount Oceanic	0 – > 600		ERA pelagic habitat database based on pelagic communities definitions
P17	Macquarie Island Pelagic Province - Oceanic	0 – 250		ERA pelagic habitat database based on pelagic communities definitions
P18	Macquarie Island Pelagic Province - Coastal	0 - > 1500	this is a compilation of the range covered by Oceanic Community (1) and (2)	ERA pelagic habitat database based on pelagic communities definitions

Scoping Document S2C1. Demersal Communities

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

Table 2.9. Demersal communities in which fishing activity occurred in the SESSF Scalefish Autolongline sub-fishery (x). Shaded cells indicate all communities within the fishery jurisdiction. Bold cross indicates greatest effort.

DEMERSAL COMMUNITY	CAPE	NORTH EASTERN TRANSITION	NORTH EASTERN	CENTRAL EASTERN TRANSITION	CENTRAL EASTERN	SOUTH EASTERN TRANSITION	CENTRAL BASS	TASMANIAN	WESTERN TAS TRANSITION	SOUTHERN	SOUTH WESTERN TRANSITION	CENTRAL WESTERN	CENTRAL WESTERN TRANSITION	NORTH WESTERN	NORTH WESTERN TRANSITION	TIMOR	TIMOR TRANSITION	HEARD & MCDONALD IS	MACQUARIE IS
Inner Shelf 0 – 110m [1,2]						x	x	x		x									
Outer Shelf 110 – 250m [1,2,]						x		x	x	x									
Upper Slope 250 – 565m [3]						x		**x**	x	x									
Mid–Upper Slope 565 – 820m [3]						x		x	x	x									
Mid Slope 820 – 1100m [3]								x		x									
Lower slope/ Abyssal > 1100m [6]					x			x	x	x									
Reef 0 -110m [7, 8]																			
Reef 110-250m [8]																			
Seamount 0 – 110m																			
Seamount 110- 250m																			
Seamount 250 – 565m																			
Seamount 565 – 820m																			
Seamount 820 – 1100m																			
Seamount 1100 – 3000m					x			x											
Plateau 0 – 110m																			
Plateau 110- 250m [4]																			
Plateau 250 – 565m [4]																			
Plateau 565 – 820m [5]																			
Plateau 820 – 1100m [5]																			

[1] Four inner shelf communities occur in the Timor Transition (Arafura, Groote, Cape York and Gulf of Carpentaria) and three inner shelf communities occur in the Southern (Eyre, Eucla and South West Coast). At Macquarie Is: [2]inner & 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.

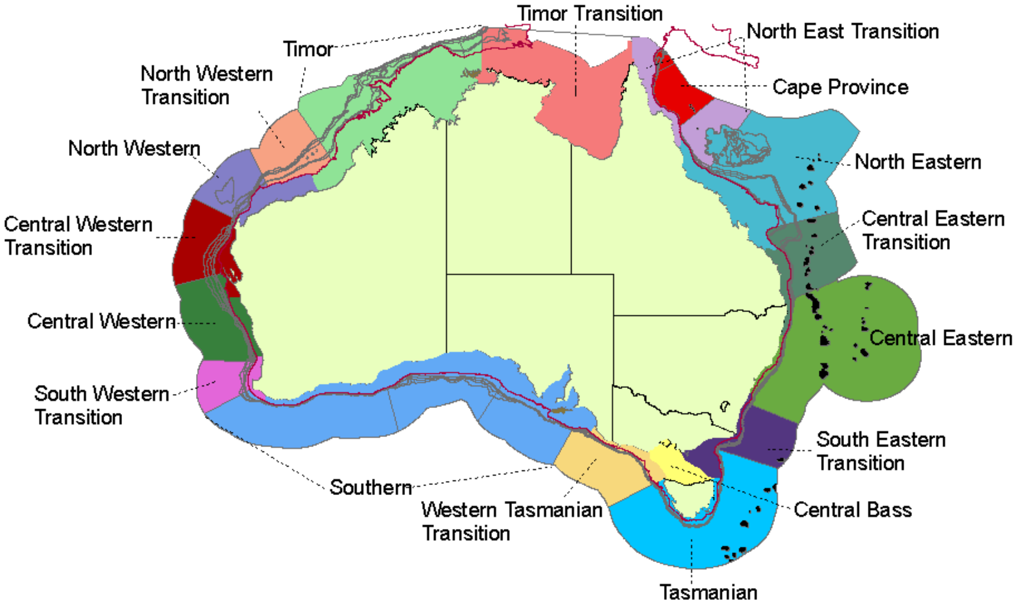
Scoping Document S2C2. Pelagic Communities

Table 2.10. Pelagic communities in which fishing activity occurs in the SESSF Scalefish Autolongline sub-fishery (black; x). Shaded cells indicate all communities that exist in the fishery jurisdiction. Bold cross indicates greatest effort.

PELAGIC COMMUNITY	NORTHEASTERN	EASTERN	SOUTHERN	WESTERN	NORTHERN	NORTHWESTERN	HEARD AND MCDONALD IS2	MACQUARIE IS
Coastal pelagic 0-200m[1,2]		x	x					
Oceanic (1) 0 – 600m								
Oceanic (2) >600m		x						
Seamount oceanic (1) 0 – 600m								
Seamount oceanic (2) 600–3000m		x						
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			x					
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)

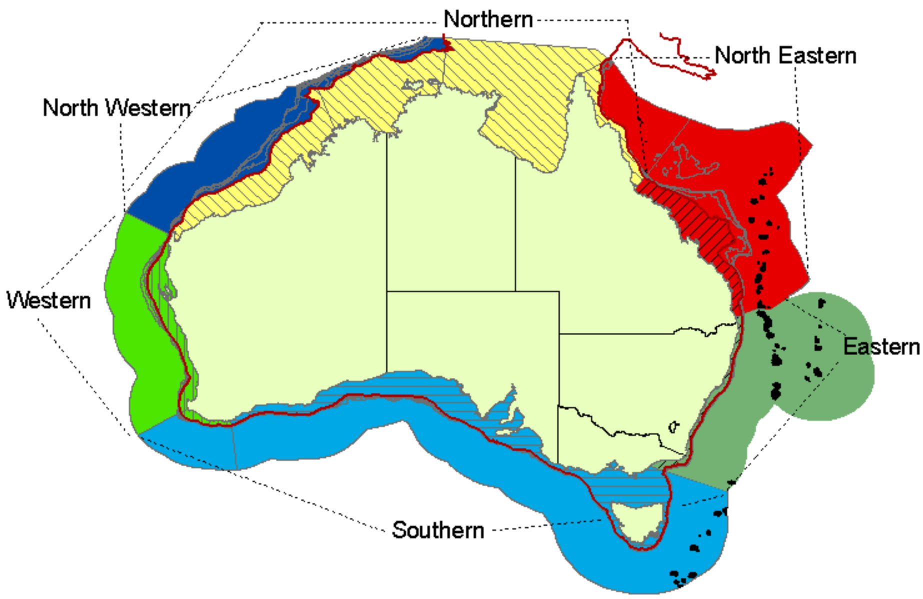


Figure 2.7 (a) Demersal communities around mainland Australia based on bioregionalisation schema. Some inshore (0-110 m) communities comprise more than one community e.g. Timor Transition comprises 4 distinct communities. (b) Australian pelagic provinces. Hatched areas indicate coastal epipelagic zones 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 commercial species would be acceptable. 1.2. To ensure that population at acceptable level by the assessment. 1.3. TAC levels are specified. 1.4. This is a general objective for all AFMA fisheries as per Fisheries Management Act 1991 (objective (b)). 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
		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
		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 5.2

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.
Byproduct and Bycatch	Avoid recruitment failure of the byproduct and bycatch species Avoid negative consequences for species or population sub-components	1. Population size	1.1 No trend in biomass 1.2 Species do not approach extinction or become extinct 1.3 Maintain biomass above a specified level 1.4 Maintain catch at specified level	Biomass, numbers, density, CPUE, yield	1.1 Increases in biomass of the key/secondary commercial 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
		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
		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 Fishing might 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 Avoid negative impacts on the population from fishing	1. Population size	1.1 Species do not further approach extinction or become extinct 1.2 No trend in biomass 1.3 Maintain biomass above a specified level 1.4 Maintain catch at specified level	Biomass, numbers, density, CPUE, yield	1.1 EMO - The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species. 1.2 A positive trend in biomass is desirable for protected species. 1.3 1.4
		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.

COMPONENT	CORE OBJECTIVE	SUB-COMPONENT	EXAMPLE OPERATIONAL OBJECTIVES	EXAMPLE INDICATORS	RATIONALE
		3. Genetic structure	3.1 Genetic diversity does not change outside acceptable bounds	Frequency of genotypes in the population, effective population size (N_e), number of spawning units	3.1 Because population size of protected species is often small, protected species are sensitive to loss of genetic diversity. Genetic monitoring may be an effective approach to measure possible fishery impacts.
		4. Age/size/sex structure	4.1 Age/size/sex structure does not change outside acceptable bounds (e.g. more than X% from reference structure)	Biomass, numbers or relative proportion in age/size/sex classes Biomass of spawners Mean size, sex ratio	4.1 Monitoring the age/size/sex structure of protected species populations is a useful management tool allowing the identification of possible fishery impacts and that cross-section of the population most at risk.
		5. Reproductive Capacity	5.1 Fecundity of the population does not change outside acceptable bounds (e.g. more than X% of reference population fecundity) Recruitment to the population does not change outside acceptable bounds	Egg production of population Abundance of recruits	5.1
		6. Behaviour /movement	6.1 Behaviour and movement patterns of the population do not change outside acceptable bounds	Presence of population across space, movement patterns within the population (e.g. attraction to bait, lights)	6.1 Longlining operations may attract protected species particularly seabirds 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	Water chemistry, noise levels, debris levels,	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		acceptable bounds	turbidity levels, pollutant concentrations, 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, 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 Longlining 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 Longlining activities may result in local disruption to pelagic and benthic processes.
Communities	Avoid negative impacts on the composition/function/distribution/structure of the community	1. Species composition	1.1 Species composition of communities does not vary outside acceptable bounds	Species presence/absence, species numbers or biomass (relative or absolute) Richness Diversity indices Evenness indices	1.1 EMO – The fishery is conducted, in a manner that minimises the impact of fishing operations on the ecosystem generally.
		2. Functional group composition	2.1 Functional group composition does not change outside acceptable bounds	Number of functional groups, species per functional group (e.g. autotrophs, filter feeders, herbivores, omnivores, carnivores)	2.1 The presence/abundance of 'functional group' members may fluctuate widely, however in terms of maintenance of ecosystem processes it is important that the aggregate effect of a functional group is maintained.
		3. Distribution	3.1 Community range does not	Geographic range of the	3.1 Not likely to monitor

COMPONENT	CORE OBJECTIVE	SUB-COMPONENT	EXAMPLE OPERATIONAL OBJECTIVES	EXAMPLE INDICATORS	RATIONALE
		of the community	vary outside acceptable bounds	community, continuity of range, patchiness	
		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 Longlining 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 Longlining 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

Sub-fishery name: Scalefish Autolongline

Date completed: June 2021

Table 2.12. Hazard identification, score and rationale(s) for the SESSF Scalefish Autolongline sub-fishery.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	SCORE (0/1)	DOCUMENTATION OF RATIONALE
Capture	Bait collection	0	Does not occur. Bait is purchased from commercial suppliers, sourced from various suppliers in Australia and New Zealand.
	Fishing	1	Fishing i.e. capture of species resulting from deployment and retrieval of longline including key commercial, bycatch, byproduct and protected species caught but not landed.
	Incidental behaviour	0	Recreational fishing not permitted or may occur rarely.
Direct impact without capture	Bait collection	0	Does not occur
	Fishing	1	Fishing is most likely to impact benthic habitats and animals as the gear contacts seafloor. Unknown mortality

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	SCORE (0/1)	DOCUMENTATION OF RATIONALE
			on fish arising from escapement. Birds and seals may also interact with gear at times resulting in injury or mortality.
	Incidental behaviour	0	Activities such as recreational fishing occur rarely.
	Gear loss	1	Major gear loss reported rarely and no information on minor components but likely to occur. The fishery management plan requires operators to take all reasonable steps to minimise loss of gear. If break offs occur, the line is generally retrieved by hauling from other end, without substantial loss of gear, although not always successful; once the bait is gone the gear does not continue to fish. The effects of lost gear is likely to be low as the gear does 'ball up'.
	Anchoring/ mooring	1	Anchoring/mooring occurs occasionally inshore and might cause damage to benthic habitat, fauna and flora.
	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	1	Frozen bait of local species used mostly but risk of transfer from imported bait
	On board processing	1	FMP generally prohibits processing at sea unless specifically authorised and all fish must be landed whole or gilled, headed and gutted, with special conditions for sharks and rays. Offal and offcuts would be discharged when appropriate (not while hauling or setting gear).
	Discarding catch	1	Discarding is common.
	Stock enhancement	0	Does not occur.
	Provisioning	0	Does not occur. Automatic baiting is extremely efficient and does not lose baits often.
	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	1	May occur. 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	1	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 lines rare.
	Navigation/ steaming	1	Vessels navigate to and from fishing grounds introduces noise and visual stimuli into the environment. Depth

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	SCORE (0/1)	DOCUMENTATION OF RATIONALE
			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	Does not occur
	Fishing	1	Fishing may disturb seabed sediments and structure by lines and weights coming into contact with benthos.
	Boat launching	0	Does not occur.
	Anchoring/ mooring	1	Anchoring does occur and the mainline is weighted. Could influence benthic fauna but unlikely to disturb physical processes significantly.
	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 jurisdiction: CTS otter trawl; GHAT gillnet, Scalefish Hook – demersal 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. Some of these fisheries' footprints may not overlap the autolongline fishery
	Aquaculture	1	Aquaculture activities occur inshore whereas this fishery occurs largely offshore
	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 and minor routes to Tasmania. Submarine cables (Basslink) occurs in the fishery.
	Other anthropogenic activities	1	Tourist activities and charter fishing occurs throughout the fishery and may .

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

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

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	EXAMPLES OF ACTIVITIES INCLUDE
Addition/ movement of biological material	Translocation of species (boat movements, ballasting)	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.
	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)

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	EXAMPLES OF ACTIVITIES INCLUDE
	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. 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	Defence, 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.

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

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

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

Step1: Record the hazard identification score (absence (0) presence (1) scores) identified at Step 3 at the scoping level (Scoping Document S3) onto the SICA table

Step 2: Score spatial scale of the activity

Step 3: Score temporal scale of the activity

Step 4: Choose the sub-component most likely to be affected by activity

Step 5: Choose the most vulnerable unit of analysis for the component e.g. species, habitat type or community assemblage

Step 6: Select the most appropriate operational objective

Step 7: Score the intensity of the activity for that sub-component

Step 8: Score the consequence resulting from the intensity for that sub component

Step 9: Record confidence/uncertainty for the consequence scores

Step 10: Document rationale for each of the above steps

Step 11: Summary of SICA results

Step 12: Evaluation/discussion of Level 1

Step 13: Components to be examined at Level 2

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

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

2.3.2 Score spatial scale of activity (Step 2)

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

Table 2.14. Spatial scale score of activity.

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

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

2.3.3 Score temporal scale of activity (Step 3)

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

Table 2.15. Temporal scale score of activity.

DECADAL (1 DAY EVERY 10 YEARS OR SO)	EVERY SEVERAL YEARS (1 DAY EVERY SEVERAL YEARS)	ANNUAL (1-100 DAYS PER YEAR)	QUARTERLY (100-200 DAYS PER YEAR)	WEEKLY (200-300 DAYS PER YEAR)	DAILY (300-365 DAYS PER YEAR)
1	2	3	4	5	6

It may be more logical for some activities to consider the aggregate number of days that an activity occurs. For example, if the activity “fishing” was undertaken by 10 boats during the same 150 days of the year, the score is 4. If the same 10 boats each spend 30 non-overlapping days fishing, the temporal scale of the activity is a sum of 300 days, indicating that a score of 6 is appropriate. In the case where the activity occurs over many days, but only every 10 years, the number of days by the number of years in the cycle is used to determine the score. For example, 100 days of an activity every 10 years averages to 10 days every year, so that a score of 3 is appropriate.

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

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

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

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

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

2.3.6 Select the most appropriate operational objective (Step 6)

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

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

The score for intensity of an activity considers the direct impacts in line with the categories shown in the conceptual model (Figure 1.2) (capture, direct impact without capture, addition/movement of biological material, addition of non-biological material, disturbance to physical processes, external hazards). The intensity of the activity is judged based on the scale of the activity, its nature and extent. Activities are scored as per intensity scores below.

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

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

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

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

The consequence of the activity is a measure of the likelihood of not achieving the operational objective for the selected sub-component and unit of analysis. It considers the flow on effects of the direct impacts from Step 7 for the relevant indicator (e.g. decline in biomass below the selected threshold due to direct capture). Activities are scored as per consequence scores defined below. A more detailed description of the consequences at each level for each component (key/secondary commercial, bycatch and byproduct, protected species, habitats, and communities) is provided as a guide for scoring the consequences of the activities in the description of consequences table (Table 2.17).

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

LEVEL	SCORE	DESCRIPTION
Negligible	1	Impact unlikely to be detectable at the scale of the stock/habitat/community
Minor	2	Minimal impact on stock/habitat/community structure or dynamics
Moderate	3	Maximum impact that still meets an objective (e.g. sustainable level of impact such as full exploitation rate for a target species).
Major	4	Wider and longer term impacts (e.g. long-term decline in CPUE)

LEVEL	SCORE	DESCRIPTION
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.

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

Table 2.19. SICA analysis for 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	6		Population size	Pink Ling *Genypterus blacodes* & Blue Eye Trevalla *Hyperoglyphe antarctica*	1.2, 1.3	3			Fishing occurs daily throughout the fishery. Both ling and blue-eye trevalla are managed as two stocks. Originally the east stock for ling was considerd overfished and now only 446 t can be taken from this stock. Ling stock assessment suggests that ling is increasing (Tier 1: Cordue 2018) and possibly stable for Blue eye (Tier 4: Sprocic 2018). Neither will be assessed further for this activity in this ERA.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	6	6	Behaviour/move ment	Pink Ling	6.1	3	1	1	The bait plume might attract fish but would disperse quickly returning to normal behaviour. Intensity: moderate, 2.4-3.7 million baited hooks deployed per year but localised effect. Consequence: negligible - behaviour would return to normal as soon as bait is removed or gear retrieved. Confidence: low, no data.
	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	6	3	Population size	Pink Ling	1.2	2	1	2	The fishery management plan requires operators to take all reasonable steps to minimise loss of gear. Major gear loss reported rarely and no information on minor components but likely to occur. Lines could continue to ghost fish but once the bait is gone the gear does not continue to fish and 'ball up'. Intensity: minor. Consequence: negligible unlikely to be detectable. Confidence: high, data loss reported.
	Anchoring/mooring	1	6	3	Behaviour/move ment	Pink Ling	6.1	2	1	2	Anchoring occurs in inshore bays occasionally (and only five or less vessels) and might attract scavengers if refuse is discarded. Unlikely to affect ling in fishing grounds. Intensity: minor, discarding controlled under MARPOL regulations. Consequence: negligible, on ling offshore. Confidence: high, logical ling too deep to be affected.
	Navigation/steaming	1	6	6	Behaviour/move ment	Pink Ling	6.1	1	1	2	Navigation and steaming occurs throughout and might affect behaviour (attraction/repulsion) but unlikely to affect deep demersal species. Intensity: minor and consequence: negligible. Confidence: high, logical.
Addition/ movement of biological material	Translocation of species	1	6	6	Population size	Pink Ling	1.2	2	1	2	Primarily mackerel, squid or Pacific saury (Cololabis saira) used for bait probably some imported therefore there is a risk of associated pathogen. Intensity: minor, might occur rarely but detection unlikely. Consequence: negligible. Confidence: high, no evidence of disease.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
	On board processing	1	6	6	Behaviour/movement	Pink Ling	6.1	2	1	1	Fish may be gutted and headed but discharge of offal and waste does not occur while setting/hauling. Intensity; minor. Consequence: negligible, discharge of offal likely whilst steaming, and if on fishing grounds ling could be attracted but return to normal behaviour within hours. Confidence: low, no data.
	Discarding catch	1	6	6	Behaviour/movement	Pink Ling	6.1	3	1	1	Fishing and therefore discarding occurs daily with ~19% of catch discarded. Ling may scavenge on discard if it reaches the bottom. Intensity: moderate. Consequence: negligble, return to normal behaviour within hours. Confidence: low, no data.
	Stock enhancement	0									
	Provisioning	0									
	Organic waste disposal	1	6	6	Population size	Pink Ling	1.2	1	1	2	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. Organic waste may be discarded if uncontaminated. Ling might scavenge if it accessible but unlikely to reach depth. Intensity: negligible. Consequence: negligible. Confidence: high, regulated discharge, logical.
Addition of non-	Debris	1	6	6	Population size	Pink Ling	1.2	1	1	2	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. Debris might

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
biological material											be discarded accidentally but unlikely to reach depth. Intensity and consequence: negligible. Confidence: high, logical.
	Chemical pollution	1	6	5	Population size	Pink Ling	1.2	1	1	2	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 but unlikely to reach depth. Intensity and Consequence: negligible. Confidence: high, logical.
	Exhaust	1	6	6	Population size	Pink Ling	1.2	1	1	2	Exhaust cannot reach depth. Intensity and consequence: negligible. Confidence: high, logical.
	Gear loss	1	6	3	Population size	Pink Ling	1.2	2	1	2	Gear might ball up but unlikely to attract a predator such as ling unless baited. Intensity: minor. Consequence: negligible. Confidence: high, gear loss is to be reported.
	Navigation/steaming	1	6	6	Behaviour/move ment	Pink Ling	6.1	1	1	2	Navigation /steaming might affect behaviour of fish. Five or less vessels in fishery and unlikely to affect ling at depth. Intensity and consequence: negligible. Confidence: high, logical.
	Activity/presence on water	1	6	6	Behaviour/move ment	Pink Ling	6.1	2	1	2	Activity/presence on water might affect fish. Five or less vessels in fishery and would not affect ling at depth. Intensity: minor. Consequence: negligible. Confidence: high, logical.
	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	6	6	Behaviour/movement	Pink Ling	6.1	3	1	2	Longlines and weights might impact the structural components of habitat but footprint of longline is smaller than other demersal methods. Studies of similar fisheries elsewhere suggest impact on vulnerable communities (Muñoz et al 2011). Intensity: moderate but unlikely to be detectable. Consequence: negligible, ling not dependent on benthos or benthic structure. Confidence: high, ling is a piscivorous predator not dependent on sessile epifauna (diet studies).
	Boat launching	0									
	Anchoring/mooring	1	6	3	Behaviour/movement	Pink Ling	6.1	1	1	2	Anchoring occurs inshore and has no effect on ling at depth. Intensity and consequence: negligible. Confidence: high, logical.
	Navigation/steaming	1	6	6	Behaviour/movement	Pink Ling	6.1	1	1	2	Navigation /steaming effects through water turbulence or quality would not affect ling at depth. Intensity: and consequence: negligible, five or less vessels in the fishery and unlikely to detect impact at any scale. Confidence: high, logical.
External Impacts (specify the example within each activity area)	Other fisheries: SESSF-Otter trawl; GAB trawl; State fisheries	1	6	6	Population size	Pink Ling	1.2	4	3	2	Ling is fished in several trawl and demersal longline fisheries throughout southern Australia on the shelf and upper slope. Intensity: major. Consequence: moderate, ling is managed under Commonwealth TAC and last assessed in 2018. Ling stock assessment suggests that ling is increasing (Tier 1: Cordue 2018). Classified as not subject to overfishing and not overfished (AFMA 2021). Stocks are improving (Cordue 2018). Confidence: high.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
	Aquaculture	1	6	6	Behaviour/movement	Pink Ling	6.1	2	2	1	Aquaculture operations inshore may affect juvenile ling by attracting them to feed. Intensity: minor as farming occurs in restricted areas. Consequence: minor, unlikely to have detectable change on dynamics. Confidence: low, no data
	Coastal development	1	6	6	Behaviour/movement	Pink Ling	6.1	3	2	1	Coastal developments inshore may affect juvenile ling by degrading habitat. Intensity: moderate. Consequence: minor, ling ontogenetically migrate to deep water so unlikely to have detectable change on dynamics. Confidence: low, no data
	Other extractive activities	1	6	6	Behaviour/movement	Pink Ling	6.1	2	1	2	Extractive activities such as oil and gas fields occur in Bass Strait. Intensity: minor, occurs in restricted locations not in fishing grounds. Consequence: negligible, fishing grounds for ling too deep to be affected. Confidence: high, logical.
	Other non-extractive activities	1	6	6	Behaviour/movement	Pink Ling	6.1	3	1	2	Seismic surveys and shipping noise might affect behaviour of species. Intensity: moderate, but very localised. Consequence: negligible, ling at depth on fishing grounds unlikely to be affected although juveniles inshore if in Bass Strait might be affected. Confidence: high, logical.
	Other anthropogenic activities	1	6	5	Behaviour/movement	Pink Ling	6.1	2	1	2	Activates such as tourism, whale-watching occur on the shelf. Intensity: minor. Consequence: negligible, would not affect ling at depth. Confidence: high, logical.

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

Table 2.20. SICA analysis for byproduct/bycatch components

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
Capture	Bait collection	0						0			
	Fishing	1	6	6	Population size	Spikey dogfish *Squalus megalops*	1.2	3	2	2	Several species including school and gummy shark are landed in this fishery but as they all have current stock assessments or are under Stock Rebuilding Strategies (school shark), they will not be assessed for this activity in this ERA. Therefore, S. megalops is considered the most vulnerable of non-tier assessed bycatch species Catches were nearly 29 tonne per annum; just over 1 tonne retained and the rest discarded representing 3.8% of total catch or 0.2% of retained landings. Intensity: moderate, catches are low. Consequence: minor, however increasing hook fishing is a risk to this species (Walker et al. 2021) and increased effort in this fishery could impact this and several other bycatch chondrichthyan species.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	6	6	Behaviour/ movement	School shark *Galeorhinus galeus*	6.1	3	1	1	School shark are classified as Vulnerable by the IUCN Red List of Threatened Species, listed as Conservation Dependent under the EPBC Act and managed under AFMA's School Shark Rebuilding Strategy. The bait plume from longlines affects

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
											chondrichthyans particularly and might attract school shark to bait and to hooked fish without being hooked themselves. Shark would disperse quickly once gear and bait removed therefore return to normal behaviour within hours. Intensity: moderate and consequence: negligible - unlikely to be detectable. Confidence: low, no data.
	Incidental behaviour	0									
	Gear loss	1	6	3	Population size	School shark	1.2	2	1	2	Major gear loss reported rarely and no information on minor components but likely to occur. The fishery management plan requires operators to take all reasonable steps to minimise loss of gear. Lines could continue to ghost fish until bait is gone but lines tend to 'ball up'. Intensity: minor. Consequence: negligible unlikely to be detectable. Confidence: high, all gear lost must be reported.
	Anchoring/mooring	1	6	3	Behaviour/ movement	School shark	6.1	2	1	2	Anchoring occurs in inshore bays occasionally (and only five or less vessels) therefore might attract scavengers e.g. juveniles if in nursery area. Intensity: minor, discarding controlled under MARPOL regulations. Consequence: negligible, undetectable. Confidence: high, logical.
	Navigation/steaming	1	6	6	Behaviour/ movement	School shark	6.1	1	1	2	Navigation and steaming occurs throughout but unlikely to affect behaviour of demersal species. Intensity: minor and consequence: negligible. 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
Addition/ movement of biological material	Translocation of species	1	6	6	Population size	School shark	1.2	2	1	2	Primarily mackerel, squid or Pacific saury (Cololabis saira) used for bait probably some imported therefore there is a risk of associated pathogen. No evidence of disease. Intensity: minor, might occur rarely but detection unlikely. Consequence: negligible. Confidence: high, no evidence of disease.
	On board processing	1	6	6	Behaviour/ movement	School shark	6.1	2	1	1	Fish may be gutted and head but discharge of offal and waste does not occur while setting/hauling. Intensity: minor. Consequence: negligible, discharge of offal more likely whilst steaming, and if on fishing grounds sharks could be attracted but return to normal behaviour within hours. Confidence: low, no data.
	Discarding catch	1	6	6	Behaviour/ movement	School shark	6.1	3	1	1	Sharks may scavenge on discarded if it reaches the bottom. Fishing and therefore discarding occurs daily with ~19% of catch discarded. Intensity: moderate. consequence: negligible, scavengers could be attracted but return to normal behaviour within hours. Confidence: low, no data.
	Stock enhancement	0									
	Provisioning	0									
	Organic waste disposal	1	6	6	Behaviour/ movement	School shark	6.1	1	1	2	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. Organic waste may be discarded if uncontaminated. Sharks might scavenge if it accessible but unlikely to reach

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
											depth. Intensity: minor. Consequence: negligible. Confidence: high, regulated discharge, logical.
Addition of non-biological material	Debris	1	6	6	Behaviour/ movement	School shark	6.1	1	1	2	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. Debris might be discarded accidentally but unlikely to reach depth. Intensity and consequence: negligible. Confidence: high, logical.
	Chemical pollution	1	6	5	Population size	School shark	1.2	1	1	2	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 but unlikely to reach depth. Intensity and consequence: negligible. Confidence: high, logical.
	Exhaust	1	6	6	Population size	School shark	1.2	1	1	2	Exhaust cannot reach depth. Intensity and consequence: negligible. Confidence: high, logical.
	Gear loss	1	6	3	Population size	School shark	1.2	2	1	2	Gear might ball up but unlikely to attract a school shark unless still baited. Intensity: minor, occurs rarely and unlikely to detect. Consequence: negligible. Confidence: high, gear loss is to 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
	Navigation/steaming	1	6	6	Behaviour/ movement	School shark	6.1	1	1	2	Navigation /steaming effects unlikely to affect chondrichthyans at depth, potentially if midwater. Intensity and consequence: negligible, disruption of sensory navigation behaviour would return to normal rapidly. Confidence: high, studies chondrichthyan behaviour.
	Activity/presence on water	1	6	6	Behaviour/ movement	School shark	6.1	2	1	2	Activity/presence on water would not affect chondrichthyans at depth. Intensity; minor and consequence: negligible. Confidence: high, logical.
Disturb physical processes	Bait collection	0									
	Fishing	1	6	6	Population size	School shark	1.2	3	1	2	Longlines and weights might impact the structural components of habitat but footprint of longline is smaller than other demersal methods. Very low level of reporting of sessile fauna bycatch (observer logs only) but studies of similar fisheries elsewhere suggest impact on vulnerable communities (Muñoz et al 2011). Intensity: moderate effort occurs over a broad spatial scale, although footprint is small for this gear type. Consequence: negligible, school shark not dependent on benthos or benthic structure, prey on pelagic species such as sardine, barracouta, jack mackerel and arrow squid (Walker 2001). Confidence: high, diet studies.
	Boat launching	0									

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
	Anchoring/mooring	1	6	3	Behaviour/ movement	School shark	6.1	1	1	2	Anchoring occurs inshore occasionally (and only five or less vessels) and might affect habitat if nursery area. Intensity and consequence: negligible. Confidence: high, logical.
	Navigation/steaming	1	6	6	Behaviour/ movement	School shark	6.1	1	1	2	Navigation /steaming effects through water turbulence or quality would not affect sharks at depth. Intensity and consequence: negligible, five or less vessels in the fishery and unlikely to detect impact at any scale. Confidence: high, logical.
External Impacts (specify the example within each activity area)	Other fisheries	1	6	6	Population size	School shark	1.2	4	5	2	School shark is fished in State and Commonwealth trawl, gillnet and demersal longline fisheries throughout southern Australia on the shelf and upper slope. It is considered <20% B0, has been subject to a rebuilding strategy for some years but still has not recovered. Recreational line fishing is increasing due to closures. Intensity: major. Consequence: severe but rebuilding strategy in place. Confidence: high.
	Aquaculture	1	6	6	Behaviour/ movement	School shark	6.1	2	2	1	Aquaculture operations inshore may affect juveniles and pups if in, or close to, nursery areas by attracting them to food. Intensity: minor as farming occurs in restricted areas. Consequence: minor, possible detectable change in movement. Confidence: low, no data.
	Coastal development	1	6	6	Reproductive capacity	School shark	5.1	3	4	2	Coastal developments inshore degrade nursery areas. Evidence suggests that some nursery areas have not recovered from reduced river inputs (Walker et al 2021). Intensity:

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, coastal development. Consequence: major, loss of nursery areas adversely affecting long-term recruitment dynamics. Confidence: high, studies by Parry & Hirst, 2016, Walker 2001, Walker et al 2021.
	Other extractive activities	1	6	6	Behaviour/ movement	School shark	6.1	2	1	2	Extractive activities such as oil and gas fields might produces loud noise, seismic surveys that might disrupt navigation responses of sharks therefore affecting behaviour/movement of sharks (ntensity: minor, occurs in restricted locations not in fishing grounds. Consequence: negligible, behaviour/movement returns to normal rapidly. Confidence: high, studies by Walker 2001.
	Other non-extractive activities	1	6	6	Behaviour/ movement	School shark	6.1	3	1	2	Seismic surveys, pipelines, cables (e.g. Basslink). Strong electric currents repel chondrichthyans. Since 20-30% of school sharks migrate across the Basslink their navigation responses may be disrupted temporarily but expected to be minimal as they are less epibenthic than other chondrichthyans (Walker 2001). Intensity: moderate, but very localised. Consequence: negligible. Confidence: high, studies by Walker 2001.
	Other anthropogenic activities	1	6	5	Behaviour/ movement	School shark	6.1	2	1	1	Activities such as tourism, whale-watching might disrupt sharks if inshore particularly fishing activities but less likely to affect school shark offshore. Intensity: minor. Consequence: negligible. Confidence: low, no data.

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

Table 2.21. SICA analysis for protected species components

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
Capture	Bait collection	0									
	Fishing	1	6	6	Population size	Shy Albatross *Thalassarche cauta*	1.1, 1.4	3	2	2	Observer sightings of albatrosses, giant petrels, shearwaters, small petrels and prions around fishing operations are abundant of which the majority were shy albatross and white chinned petrels (AFMA Wildlife Abundance logs). Over the 5-year reporting period, an average of 20 birds per year were caught and killed; shy albatross accounted for a total of 10 interactions resulting in 2 deaths. Shy Albatross are an endemic species breeding only on 3 Tasmanian islands; population last estimated over 14 000 breeding pairs, declining (Phillips et al 2016), classified as endangered under EPBC Act; cf white chinned petrels are more abundant >1million breeding pairs and global distribution. Atypical among albatrosses, shy albatross is a central-placed forager and remains within 300km of their colony (except as juveniles); feed on discards from vessels accounting for a significant portion of the diet (Brothers et al. 1998; Gales 1988), therefore, considered most vulnerable to autolonglining. Intensity: moderate, if considering immediate vicinity sightings. Consequence: minor, 2 fatalities unlikely to be detectable. (Special Note: the by-catch trigger rule of 0.01 birds per 1000 hooks, a rate that is considered as "low impact" by Baker et al

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
											2007 & "negligible" interaction rate by Collins et al. 2021, was triggered in 2016/17(AFMA)).
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	6	6	Behaviour/movement	Shy albatross; White Chinned Petrel *Procellaria aequinoctialis*	6.1	3	2	2	Seabirds including albatross are highly olfactory and are attracted to fishing operations including baited longlines. Most sightings around fishing ops were shy albatross and white chinned petrels (AFMA Wildlife Abundance logs). Intensity: moderate. Consequence: minor, behaviour returns to normal within hours. Confidence: high.
	Incidental behaviour	0									
	Gear loss	1	6	3	Population size	Short Fin Mako *Isurus oxyrinchus*	1.2	2	1	2	Shortfin mako may be attracted to free-floating baited gear (ghost fishing) but not once bait has gone and lines ball-up. Major gear loss is rare (AFMA) but minor gear loss is unknown. Intensity: minor if major gear loss. Consequence: negligible, unlikely to detect any impact. Confidence: high, major gear losses are meant to be reported.
	Anchoring/mooring	1	6	3	Behaviour/movement	Shy albatross, White	6.1	2	1	1	Seabirds and particularly albatross are highly olfactory and are attracted to fishing operations. Some birds may be attracted to anchored vessels briefly. Intensity: minor, anchoring occurs inshore

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
						Chinned Petrel					rarely (five or fewer vessels in fishery). Consequence: negligible, unlikely to affect albatross inshore. Confidence: low, no data.
	Navigation/steaming	1	6	6	Behaviour/movement	Shy albatross, White Chinned Petrel	6.1	1	1	2	Seabirds and particularly albatross are highly olfactory and are attracted to fishing operations. Some birds may be attracted to vessels and may fly into superstructure. Intensity: minor, five or fewer vessels in fishery. Consequence: negligible, albatross may follow vessels but returns to normal within hours. Confidence: high, logical, birds interactions must be reported.
Addition/ movement of biological material	Translocation of species	1	6	6	Population size	Shy albatross, White Chinned Petrel	1.2	2	1	2	Seabirds and particularly albatross are highly olfactory and are attracted to fishing operations. Shy albatross feed on discards including bait from vessels accounting for a significant portion of the diet (Brothers et al. 1998; Gales 1988). Primarily mackerel, squid or Pacific saury (Cololabis saira) used for bait probably some imported therefore there is a risk of associated pathogen. No evidence of disease in birds and mitigation devices to prevent birds taking bait while setting are used. Intensity: minor, no evidence of translocation of species. Consequence: negligible, no evidence of disease in seabirds Confidence: high, logical.
	On board processing	1	6	6	Behaviour/movement	Shy albatross, White Chinned Petrel	6.1	2	1	1	Seabirds and particularly albatross are highly olfactory and are attracted to fishing operations. Shy albatross feed on discards from vessels accounting for a significant portion of the diet (Brothers et al. 1998; Gales 1988). Most sightings around fishing ops were shy albatross and white chinned petrels (AFMA Wildlife Abundance logs). MARPOL regulations via Protection of the Sea (Prevention of Pollution

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
											from Ships) Act 1983 prohibits domestic and operational waste discharge from vessels. Intensity: minor. Consequence: negligible, behaviour returns to normal within hours. Confidence: low, no data
	Discarding catch	1	6	6	Behaviour/movement	Shy albatross, White Chinned Petrel	6.1	3	1	1	Seabirds and particularly albatross are highly olfactory and are attracted to fishing operations. Shy albatross feed on discards from vessels accounting for a significant portion of the diet (Brothers et al. 1998; Gales 1988). Most sightings around fishing ops were shy albatross and white chinned petrels (AFMA Wildlife Abundance logs). MARPOL regulations via Protection of the Sea (Prevention of Pollution from Ships) Act 1983 prohibits domestic and operational waste discharge from vessels. Intensity: moderate. Consequence: negligible, behaviour returns to normal within hours. Confidence: low, no data.
	Stock enhancement	0									
	Provisioning	0									
	Organic waste disposal	1	6	6	Behaviour/movement	Shy albatross, White Chinned Petrel	6.1	1	1	2	Seabirds and particularly albatross are highly olfactory and are attracted to fishing operations. Shy albatross feed on discards from vessels accounting for a significant portion of the diet (Brothers et al. 1998; Gales 1988). Most sightings around fishing ops were shy albatross and white chinned petrels (AFMA Wildlife Abundance logs). MARPOL regulations via Protection of the Sea (Prevention of Pollution from Ships) Act 1983 prohibits domestic and operational waste discharge from vessels. Intensity: negligible, five or fewer vessels in

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
											fishery. Consequence: negligible, unlikely to detect. Confidence: high, regulated.
Addition of non-biological material	Debris	1	6	6	Population size	Shy albatross, White Chinned Petrel	1.1	1	1	2	Seabirds and particularly albatross are highly olfactory and are attracted to fishing operations. Most sightings around fishing ops were shy albatross and white chinned petrels (AFMA Wildlife Abundance logs). Birds may be attracted to debris causing death from plastic ingestion. 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 therefore Intensity: negligible, five or fewer vessels in fishery. Consequence: negligible. Confidence: high, regulated discharge, logical.
	Chemical pollution	1	6	5	Population size	Shy albatross, White Chinned Petrel	2.1	1	1	1	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. Birds may become sick or unable to feed if in contact with noxious chemicals or oiled. Intensity and consequence; negligible, very localised and birds would avoid. Confidence: high, major leakages report to AMSA.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
	Exhaust	1	6	6	Behaviour/movement	Shy albatross, White Chinned Petrel	6.1	1	1	2	Seabirds and particularly albatross are highly olfactory and are attracted to fishing operations. Most sightings around fishing ops were shy albatross and white chinned petrels (AFMA Wildlife Abundance logs). Birds may encounter exhaust but are able to avoid. Intensity: negligible, exhaust fumes only affect immediate area. Consequence: negligible, birds can avoid exhaust. Confidence: high logical.
	Gear loss	1	6	3	Population size	Short Fin Mako	1.2	2	1	2	Shortfin mako may be attracted to free-floating baited gear (ghost fishing) but not once bait has gone and lines ball-up. Major gear loss is rare (AFMA) but minor gear loss is unknown. Intensity: minor if major gear loss. Consequence: negligible. Confidence: high, major gear losses are meant to be reported.
	Navigation/steaming	1	6	6	Behaviour/movement	Short Fin Mako	6.1	1	1	2	Navigation /steaming effects unlikely to affect chondrichthyans at depth, potentially if midwater. Intensity and consequence: negligible, disruption of sensory navigation behaviour would return to normal rapidly. Confidence: high, studies chondrichthyan behaviour.
	Activity/presence on water	1	6	6	Behaviour/movement	Shy albatross, White Chinned Petrel	6.1	2	1	2	Seabirds and particularly albatross are highly olfactory and are attracted to fishing operations. Most sightings around fishing ops were shy albatross and white chinned petrels (AFMA Wildlife Abundance logs). Intensity: minor, five or fewer vessels in fishery. Consequence: negligible, behaviour returns to normal within hours. Confidence: high, logical.
	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	6	6	Population size	Short Fin Mako	1.2	3	1	2	Longlines and weights removes structural components of habitat but footprint of longline is smaller than other demersal methods. Intensity: moderate-but unlikely to be detectable. Consequence: negligible, shortfin mako sharks are aggressive predators that feed near the top of the food web on marine fishes such as bluefish, swordfish, tuna, marine mammals, and other sharks (NOAA 2021). Confidence: high, studies.
	Boat launching	0									
	Anchoring/mooring	1	6	3	Behaviour/movement	Australian Fur Seals	6.1	1	1	2	Anchoring occurs inshore occasionally and might attract fur seals if in vicinity of haul out. Intensity and consequence: negligible, behaviour returns to normal on departure of vessel. Confidence: high, logical.
	Navigation/steaming	1	6	6	Behaviour/movement	Dolphins	6.1	1	1	2	Navigation /steaming effects through water turbulence might affect marine mammals in vicinity. Intensity and consequence: negligible, unlikely to detect impact. Confidence: high, logical.
External Impacts (specify the example within each activity area)	Other fisheries	1	6	6	Population size	Shy albatross, White Chinned Petrel	1.2	4	3	2	Seabirds and particularly albatross are highly olfactory and are attracted to fishing operations. Shy albatross feed on discards from vessels accounting for a significant portion of the diet (Brothers et al. 1998; Gales 1988). Reported captures dead and alive of albatrosses over hindered per year, specifically shy albatross much lower. Intensity: major. Occurs often over whole SESSF. Consequence: moderate but may be higher if identifications were certain. Confidence: high, TEP interactions recorded.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
	Aquaculture	1	6	6	Behaviour/movement	Shy albatross, White Chinned Petrel	6.1	2	1	1	Seabirds and particularly albatross are highly olfactory and may be attracted to aquaculture installations if feeding but more likely to impact on coastal seabirds and gulls. Intensity: minor Consequence: negligible. Confidence: low no, data.
	Coastal development	1	6	6	Behaviour/movement	Shy albatross, White Chinned Petrel	6.1	3	1	2	Seabirds and particularly albatross are highly olfactory. Seabirds may be attracted to coastal development if feeding opportunities occur but more likely to impact on coastal seabirds and gulls. Intensity: moderate. Consequence: negligible. Confidence: high, logical.
	Other extractive activities	1	6	6	Population size	Short Fin Mako	2.1	2	1	2	Extractive activities such as oil and gas fields might affect school shark. Loud noise may disrupt their navigation responses. Intensity: minor, occurs in restricted locations not in fishing grounds. Consequence: negligible. Confidence: high, studies by Walker 2001.
	Other non-extractive activities	1	6	6	Population size	Short Fin Mako	2.1	3	1	2	Seismic surveys, pipelines, cables (e.g. Basslink). Strong electric currents repel chondrichthyans. Since 20-30% of school sharks migrate across the Basslink their navigation responses may be disrupted temporarily but expected to be minimal as they are less epibenthic than other chondrichthyans (Walker 2001). Intensity: moderate. Consequence: negligible. Confidence: high, studies by Walker 2001.
	Other anthropogenic activities	1	6	5	Behaviour/movement	Shy albatross, White Chinned Petrel	6.1	2	1	2	Seabirds and particularly albatross are highly olfactory and are attracted to fishing operations. Birds may be attracted to vessels of other types temporarily. Most sightings around fishing ops were shy albatross and white chinned petrels (AFMA Wildlife Abundance logs).

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
											Intensity: minor. Consequence: negligible, behaviour returns to normal within hours. Confidence: high.

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

Table 2.22. SICA analysis for habitat components

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
Capture	Bait collection	0									
	Fishing	1	6	6	Habitat structure and function	SET 24 (tree-forming octocorals and black corals) & 25(ribbons of delicate bryozoan communities)	5.1	3	3	1	Automatic longline is a bottom longline where the gear is set horizontally along the ocean floor and held in place using anchors - can be many kilometres in length, incorporating up to 15 000 hooks. Taut monofilament lines might cut across substrate removing soft or fragile faunal forms. Patches of aggregated fauna (e.g. on hard subcropping rock) may be unavoidably encountered by long lengths of line. Weights and anchors may crush fauna. Very low level of reporting of sessile fauna bycatch (observer logs only) but studies of similar fisheries elsewhere suggest impact on vulnerable communities (Muñoz et al 2011). Majority of sets in the Tasmanian bioregion between 200-700m corresponding to SET 24 & 25 sensu Pitcher et al 2018. Intensity: moderate effort occurs over a broad spatial scale, although footprint is small for this gear type. Consequence: moderate, while some faunal groups in these depths will take greater than a year to recover but given the narrow footprint of the gear and intensive, highly localised fishing effects, compared to trawl this gear has been reconsidered as moderate. If used intensively in some areas of high ecological importance or high risk they could have a higher

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
											impact in the localised area. Confidence low, no data about specific longline effects on seabed.
	Incidental behaviour										
Direct impact without capture	Bait collection										
	Fishing	1	6	6	Habitat structure and function	SET 24 (tree-forming octocorals and black corals) & 25(ribbons of delicate bryozoan communities)	5.1	3	3	1	Habitat may be damaged by normal operation of the gear. Automatic longline is a bottom longline where the gear is set horizontally along the ocean floor and held in place using anchors - can be many kilometres in length, incorporating up to 15 000 hooks. Taut monofilament lines may cut across substrate removing soft or fragile faunal forms. Patches of aggregated fauna (e.g. on hard subcropping rock) may be unavoidably encountered by long lengths of line. Weights and anchors may crush fauna. Very low level of reporting of sessile fauna bycatch (observer logs only) but studies of similar fisheries elsewhere suggest impact on vulnerable communities (Muñoz et al 2011). Majority of sets in the Tasmanian bioregion between 200-700m corresponding to SET 24 & 25 sensu Pitcher et al 2018. Intensity: moderate effort occurs over a broad spatial scale, although footprint is small for this gear type. Consequence: moderate, while some faunal groups in these depths will take greater than a year to recover but given the narrow footprint of the gear and intensive, highly localised fishing effects, compared to trawl this gear has been reconsidered as moderate. If used intensively in some areas of high ecological importance or high

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
											risk they could have a higher impact in the localised area. Confidence low, no data about specific longline effects on seabed but extensive data from trawling effects (Pitcher et al 2016, 2018).
	Incidental behaviour	0									
	Gear loss	1	6	3	Habitat structure and function	SET 24 (tree-forming octocorals and black corals) & 25(ribbons of delicate bryozoan communities)	5.1	2	2	1	Habitat may be damaged by normal operation of the gear particularly on unsuccessful retrieval. Line will eventually ball-up potentially snagging structure. Majority of sets in the Tasmanian bioregion between 200-700m corresponding to SET 24 & 25 sensu Pitcher et al 2018. Intensity: minor, major gear loss is rare although minor loss unknown. Consequence: minor. Confidence low, no data about specific effects of lost gear on habitats.
	Anchoring/mooring	1	6	3	Habitat structure and function	Inshore habitats not within fishery jurisdiction	5.1	2	1	1	Anchoring occurs occasionally inshore but not within fishery jurisdiction. Anchors may crush habitat or disturb or damage structures if dragged. Intensity; negligible, anchoring inshore occurs rarely. Consequence: minor. Confidence: low, no data
	Navigation/steaming	1	6	6	Water quality	P8 - Southern Pelagic Oceanic	1.1	1	1	2	Navigation/steaming most likely to affect pelagic habitats specifically water column characteristics. negligible: minor, only up to 5 vessels in the fishery. Consequence: negligible, turbulence not discernible from natural variability. 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
Addition/ movement of biological material	Translocation of species	1	6	6	Habitat structure and function	SET 24 (tree-forming octocorals and black corals) & 25(ribbons of delicate bryozoan communities)	5.1	2	1	1	Translocation of species on vessel hull or bilge water. MARPOL regulations via Protection of the Sea (Prevention of Pollution from Ships) Act 1983 prohibits domestic and operational waste discharge from vessels. Intensity: minor. Consequence: negligible, unlikely to detect. Confidence; low, no data
	On board processing	1	6	6	Water quality	P8 - Southern Pelagic Oceanic	1.1	2	1	1	MARPOL regulations via Protection of the Sea (Prevention of Pollution from Ships) Act 1983 prohibits domestic and operational waste discharge from vessels. Refuse from onboard processing most likely to be disposed while steaming and would affect pelagic zone as birds, seals and scavengers likely to account for majority before reaching the bottom. Intensity: minor-discarding etc strictly regulated by MARPOL. Consequence: negligible, unlikely to detect possible short term increase in productivity associated with additional nutrient. Confidence; low, no data.
	Discarding catch	1	6	6	Water quality	P8 - Southern Pelagic Oceanic	1.1	3	1	1	Discarding occurs daily with ~19% of catch discarded. MARPOL regulations via Protection of the Sea (Prevention of Pollution from Ships) Act 1983 prohibits domestic and operational waste discharge from vessels. Discards most likely to be disposed while steaming and would affect pelagic zone. Scavengers likely to account for majority. Intensity: moderate-discarding etc strictly regulated by MARPOL. Consequence: negligible, unlikely to

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
											detect possible short term increase in productivity associated with additional nutrient. Confidence; low, no data
	Stock enhancement	0									
	Provisioning	0									
	Organic waste disposal	1	6	6	Water quality	P8 - Southern Pelagic Oceanic	1.1	1	1	1	MARPOL regulations via Protection of the Sea (Prevention of Pollution from Ships) Act 1983 prohibits domestic and operational waste discharge from vessels. Discards most likely to be disposed while steaming and would affect pelagic zone. Scavengers likely to account for majority. Intensity: negligible - discarding etc strictly regulated by MARPOL. Consequence: negligible, unlikely to detect possible short term increase in productivity associated with additional nutrient. Confidence; low, no data
Addition of non-biological material	Debris	1	6	6	Water quality	P8 - Southern Pelagic Oceanic	1.1	1	1	2	MARPOL regulations via Protection of the Sea (Prevention of Pollution from Ships) Act 1983 prohibits domestic and operational waste discharge from vessels therefore any debris would be accidental. Plastics particularly present a problem for birds or marine mammals ingesting whole and from breakdown into micro-elements which are absorbed through the water into the food web. Intensity: negligible. Consequence: negligible, impact unlikely to be detectable. Confidence: high, regulated.
	Chemical pollution	1	6	5	Water quality	P8 - Southern Pelagic Oceanic	1.1	1	1	2	MARPOL regulations via Protection of the Sea (Prevention of Pollution from Ships) Act 1983 prohibits domestic and

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
											operational waste discharge from vessels therefore any large chemical spill would be accidental and localised. Intensity and consequence: negligible, localised and readily dispersed. Confidence: high, regulated.
	Exhaust	1	6	6	Air quality	P8 - Southern Pelagic Oceanic	2.1	1	1	2	Exhaust from engines might affect air quality but very localised and dispersed rapidly. Intensity; negligible, 5 or less vessels in fishery. Consequence: negligible. Confidence: high logical
	Gear loss	1	6	3	Habitat structure and function	SET 24 (tree-forming octocorals and black corals) & 25(ribbons of delicate bryozoan communities)	1.1	2	1	2	Occasionally line and hooks are lost. Gear will persist in the habitat as breakdown times can be expected to be extensive however volume likely to be low and dispersed particularly in high flow areas. Gear will ball-up. Intensity: minor. Consequence: negligible, unlikely to detect any impact. Confidence: high, reported loss of gear although minor gear loss uncertain.
	Navigation/ steaming	1	6	6	Water quality	P8 - Southern Pelagic Oceanic	1.1	1	1	2	Navigation and steaming introduces noise into the habitat. Intensity: negligible, 5 or less vessels in fishery and localised effect. Consequence: negligible, short term disturbance. Confidence: high, logical.
	Activity/ presence on water	1	6	6	Water quality	P8 - Southern Pelagic Oceanic	5.1	2	1	2	Navigation and steaming introduces noise and visual stimuli into the habitat. Intensity: minor, 5 or less vessels in fishery.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
											Consequence: negligible, short term disturbance, unlikely to have a detectable impact. Confidence: high, logical.
Disturb physical processes	Bait collection	0									
	Fishing	1	6	6	Habitat structure and function	SET 24 (tree-forming octocorals and black corals) & 25(ribbons of delicate bryozoan communities)	1.1	3	3	1	Automatic longline is a bottom longline where the gear is set horizontally along the ocean floor and held in place using anchors - can be many kilometres in length, incorporating up to 15 000 hooks. Taut monofilament lines may cut across substrate removing soft or fragile faunal forms. Patches of aggregated fauna (e.g. on hard subcropping rock) may be unavoidably encountered by long lengths of line. Weights and anchors may crush fauna. Very low level of reporting of sessile fauna bycatch (observer logs only) but studies of similar fisheries elsewhere suggest impact on vulnerable communities (Muñoz et al 2011). Majority of sets in the Tasmanian bioregion between 200-700m corresponding to SET 24 & 25 sensu Pitcher et al 2018. Intensity: moderate effort occurs over a broad spatial scale, although footprint is small for this gear type. Consequence: moderate, while some faunal groups in these depths will take greater than a year to recover but given the narrow footprint of the gear and intensive, highly localised fishing effects, compared to trawl this gear has been reconsidered as moderate. If used intensively in some areas of high ecological importance or high risk they could

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
											have a higher impact in the localised area. Confidence low, no data about specific longline effects on seabed.
	Boat launching	0									
	Anchoring/ mooring	1	6	3	Substrate quality	Inshore habitats	3.1	1	1	1	Anchoring occurs occasionally inshore by 5 or less vessels in fishery. Anchors may crush habitat or disturb or damage structures if dragged. Intensity; negligible, anchoring inshore occurs rarely. Consequence: negligible. Confidence: low, no data
	Navigation/ steaming	1	6	6	Water quality	P8 - Southern Pelagic Oceanic	1.1	1	1	1	Navigation and steaming introduces turbulence into the habitat. Intensity: negligible, unlikely to discern from natural variability. Consequence: negligible, short term disturbance. Confidence: high, logical.
External Impacts (specify the example within each activity area)	Other fisheries	1	6	6	Habitat structure and function	SET 24 (tree-forming octocorals and black corals) & 25 (ribbons of delicate bryozoan communities)	5.1	4	3	2	Demersal trawling impacts largest impact of gear types and has been assessed by Pitcher et al 2018. Intensity: moderate, trawling affected ~2% of habitat area (Pitcher et al. 2018) and other gear types less damaging. Consequence: major, some faunal groups could take years to recover but area affected likely to be <10% of area and unlikely to be fished. Confidence high, surveys by Pitcher et al 2018, Williams et al. 2011.
	Aquaculture	1	6	6	Substrate quality	Inshore habitats	1.1	2	1	1	Occurs at range of sites inshore of commonwealth fishery depth restriction and jurisdictional boundary. Unlikely that coastal

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
											aquaculture will impact habitats offshore in depths >25m but offshore aquaculture expanding. Intensity: minor, in restricted locations. Consequence: negligible, effects likely to be reasonably localised and unable to impact fishery grounds. Confidence: low, no data on connectivity.
	Coastal development	1	6	6	Water quality	P8 - Southern Pelagic Oceanic	1.1	3	2	1	Large and smaller centres on the coast, inshore of commonwealth fishery depth restriction and jurisdictional boundary likely to affect inshore benthic habitats but water quality most likely affected by discharges from towns and farms. Intensity: minor, effect further offshore unlikely to be detectable. Consequence: minor likely to be localised to regional centres. Confidence: low little data on the effects from coastal development in waters>25m
	Other extractive activities	1	6	6	Habitat structure and function	SET 5, 15,18	5.1	2	1	1	Oil and gas developments on shelf regions particularly off east and west Bass Strait, and west of Kangaroo Island in the GAB. Sessile fauna and benthos most likely to be affected by noise associated with seismic activity and extractive or associated shipping activities. Intensity: minor, may be pollution and disturbance during development and operational stages but not in fishery area. Consequence: unlikely to detect change to the internal dynamics of habitat or populations of species making up the habitat- time to recover hours to days Confidence > low – no data. Confidence: low, no 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 non-extractive activities	1	6	6	Habitat structure and function	SET 5, 15,18	5.1	3	2	1	Basslink cables across Bass Strait, gas pipelines. Sessile fauna and benthos most likely to be affected by noise associated with seismic activity and extractive or associated shipping activities. Intensity: moderate but very localised. Consequence: minor localised, possible detectable change in behaviour/movement but minimal impact on population dynamics. Confidence: low, no data.
	Other anthropogenic activities	1	6	5	Water quality	P8 - Southern Pelagic Oceanic	1.1	2	2	1	Major shipping routes, tourism, recreational fishing not likely to target or impact bottom directly unless focus of activity but may impact water quality from pollution or littering. Intensity: minor activities could impact habitats. Consequence: minor, localised possible detectable change in behaviour/movement but minimal impact on population dynamics. Confidence: low, no data.

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

Table 2.23. SICA analysis for community components

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										
	Fishing	1	6	6	Species composition	Tasmanian Upper Slope (250-565)	1.1	3	2	2	Fishing occurs daily throughout the fishery on upper slope and outer shelf with the major concentration in the Tasmanian Upper Slope (250-700m) community; targetting ling and blue-eye but most likely to affect species composition however ling stock assessment suggests that ling is increasing (Tier 1 : Cordue 2018) and that Blue-eye trevalla is possibly stable (Tier 4 analysis: Sporcic 2018). Intensity: moderate. Consequence: minor as key species populations appear to be stable or improving over past decade. Confidence: high, data exists.
	Incidental behaviour	0									
Direct impact without capture	Bait collection	0									
	Fishing	1	6	6	Distribution of community	Tasmanian Upper Slope (250-565)	3.1	3	1	1	Fish maybe attracted to bait plumes with or without out being caught but would return to normal as soon as bait or gear retrieved. Intensity: moderate, effect is localised but widespread. Consequence: negligible, distribution of fishes unlikely to detectable. Confidence: low no data but logical.
	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	6	3	Species composition	Tasmanian Upper Slope (250-565)	1.1	2	1	2	The fishery management plan requires operators to take all reasonable steps to minimise loss of gear. Major gear loss reported rarely and no information on minor components but likely to occur. Lines could continue to ghost fish but once the bait is gone the gear does not continue to fish and 'ball up'. Intensity: minor. Consequence: negligible if infrequent occurrence. Confidence: high, lost gear is reported.
	Anchoring/mooring	1	6	3	Distribution of community	SouthEast transition and Tasmanian Inner shelf (0-110m)	3.1	2	1	2	Anchoring occurs in inshore bays occasionally (and only five or less vessels in fishery). Fish may be attracted to vessel light or occasional discard of food scraps. Intensity: minor, does not occur often and in restricted locations. Consequence: negligible unlikely to detect. Confidence: high logical
	Navigation/steaming	1	6	6	Distribution of community	Tasmanian Upper Slope (250-565)	3.1	1	1	2	Steaming and navigation occur daily and may alter the distribution of pelagic or bird community by attraction to the vessel while present. Intensity: minor 5 or less vessels actively steaming and navigation occur daily. Consequence: negligible, distribution of demersal communities undetectable. Confidence: high, logical
Addition/ movement of biological material	Translocation of species	1	6	6	Species composition	Tasmanian Upper Slope (250-565)	1.1	2	1	2	Shy albatross feed on discards including bait from vessels accounting for a significant portion of the diet (Brothers et al. 1998; Gales 1988). Primarily mackerel, squid or Pacific saury (Cololabis saira) used for bait probably some imported therefore there is a risk of associated pathogen. No evidence of disease in birds and change in bird community and mitigation devices to prevent birds taking bait while setting are used. Invasive species could be transported

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
											on the hull or in bilge water if discharged. Intensity: minor, occurrences not reported. Consequence: negligible. Confidence: low, no evidence
	On board processing	1	6	6	Distribution of community	Tasmanian Upper Slope (250-565)	3.3	2	1	1	Discards of waste from on-board processing might affect distribution of scavengers temporarily. Waste expected to be taken up quickly by opportunistic scavengers. Intensity: minor, 5 or less vessels in fishery. Consequence: negligible unlikely to affect behaviour or movement. Confidence: low no data
	Discarding catch	1	6	6	Distribution of community	Tasmanian Upper Slope (250-565)	3.1	3	1	1	Discarding can attract scavengers affecting distribution of community species temporarily. Discarding occurs daily with ~19% of catch discarded. Intensity: moderate, discarding occurs daily but only 5 or less vessels. Consequence: negligible much of discarded catch returned to the water alive. Confidence: low no data
	Stock enhancement	0									
	Provisioning	0									
	Organic waste disposal	1	6	6	Distribution of community	Tasmanian Upper Slope (250-565)	3.1	1	1	2	Scavengers could be attracted to food scraps temporarily. 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. Organic waste may be discarded if uncontaminated. Intensity: negligible if MARPOL rules adhered to and only 5 vessels. Consequence: negligible any organic waste likely to break down quickly or consumed Confidence: high, regulated.

DIRECT IMPACT OF FISHING	FISHING ACTIVITY	PRESENCE (1) ABSENCE (0)	SPATIAL SCALE OF HAZARD (1-6)	TEMPORAL SCALE OF HAZARD (1-6)	SUB-COMPONENT	UNIT OF ANALYSIS	OPERATIONAL OBJECTIVE (S2.1)	INTENSITY SCORE (1-6)	CONSEQUENCE SCORE (1-6)	CONFIDENCE SCORE (1-2)	RATIONALE
Addition of non-biological material	Debris	1	6	6	Distribution of community	Tasmanian Upper Slope (250-565)	3.1	1	1	2	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. Intensity: negligible if MARPOL rules adhered to Consequence: negligible because debris by this fishery expected to be accidental not routine Confidence: high, regulated.
	Chemical pollution	1	6	5	Species composition	Southern Coastal pelagic 0-200m	1.1	1	1	2	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. Might cause mortality affecting species composition. Intensity: minor unless there is a major spill. Consequence: negligible as minimal localized impact only Confidence: high, regulated.
	Exhaust	1	6	6	Distribution of community	Southern Coastal pelagic 0-200m	3.1	1	1	2	Might repel birds temporarily but few vessels. Intensity: negligible, detection of exhaust remote. Consequence: negligible communities not likely to be affected Confidence: high logical.
	Gear loss	1	6	3	Distribution of community	Tasmanian Upper Slope (250-565)	3.1	2	1	1	Fishery management plan requires operators to take all reasonable steps to minimize loss of gear. According to AFMA review of automatic longlining (2003) if break offs occur line is generally retrieved by hauling from other end, without substantial loss of gear, although not always successful; and once bait gone does not continue to fish, effect of lost gear is likely to be low as gear does ball up. Intensity: minor. Consequence: negligible if infrequent occurrence Confidence: high, 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
	Navigation/steaming	1	6	6	Distribution of community	Southern Coastal pelagic 0-200m	3.1	1	1	1	Navigation/steaming introduces noise and visual stimuli to environment might affect distribution by attracting birds to vessels. Intensity: negligible 5 or less vessels operating, unlikely to be detectable. Consequence: negligible impact on communities Confidence: low no data.
	Activity/presence on water	1	6	6	Distribution of community	Southern Coastal pelagic 0-200m	3.1	2	1	2	Noise and visual stimuli might affect distribution of species temporarily particularly birds that are highly visual and olfactory. Intensity: minor 5 or less vessels unlikely to be detectable. Consequence: negligible. Confidence: high, logical.
Disturb physical processes	Bait collection	0									
	Fishing	1	6	6	Distribution of community	Tasmanian Upper Slope (250-565)	3.1	3	2	1	Longlines and weights might impact the structural components of habitat but footprint of longline is smaller than other demersal methods. Very low level of reporting of sessile fauna bycatch (observer logs only) but studies of similar fisheries elsewhere suggest impact on vulnerable communities (Muñoz et al 2011). Intensity: moderate. Consequence: minor, unlikely to be detectable. Confidence: low no data.
	Boat launching	0									
	Anchoring/mooring	1	6	3	Distribution of community	SouthEast transition and Tasmanian	3.1	1	1	2	Vessels might anchor at night or when broken down and anchoring may damage benthic structure and therefore community. Intensity: minor, unlikely to be detectable. Consequence: negligible, very localised disturbance and occurs rarely. 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
						Inner shelf (0-110m)					
	Navigation/steaming	1	6	6	Distribution of community	Southern Coastal pelagic 0-200m	3.1	1	1	2	Steaming and navigation occur daily and may alter the turbulence in water column and pelagic communities. Intensity: minor, 5 or less vessels actively steaming and navigation occur daily but localised effect. Intensity: negligible unlikely to detectable impact. Consequence: negligible impact to communities unlikely Confidence: high unlikely any foreseeable impact
External Impacts	Other fisheries	1	6	6	Species composition	SouthEast Transition Upper Slope (250-565); Tasmanian Upper Slope (250-565)	1.1	4	3	2	Area of high fishing activity from multi gears might demersal community. Intensity: major. Consequence: Detectable changes to the community species composition without a major change in function (no loss of function). Changes to species composition up to 10%. Confidence: high, stock assessments and modelling studies.
	Aquaculture	1	6	6	Biogeochemical cycles	Tasmanian Inner shelf (0-110m)	5.1	2	1	1	Occurs in coastal locations throughout the whole SESSF area but not impacting the upper slope where fishing is occurring. Salmon farming probably has the highest impact by the addition of high nutrient fish feed and consequent enrichment of sediments affecting bio-geochemical cycles. Intensity: negligible. Consequence: negligible. Confidence: low, little data.
	Coastal development	1	6	6	Species composition	SouthEast transition and Tasmanian	1.1	3	2	2	Large and smaller centres on the coast might change/degrade habitat supporting communities. Intensity: moderate, restricted locations. Consequence: minor, Confidence: high, some studies

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
						Inner shelf (0-110m)					show severe effects on chondrichthyans from coastal/inland development and run-offs (Walker 2001).
	Other extractive activities	1	6	6	Distribution of community	Central Bass & Southeast transition inner shelves 0-110m	3.1	2	1	1	Oil and gas developments on shelf regions particularly off east and west Bass Strait, and south east of Kangaroo Island in the GAB. Sessile fauna and (mobile) benthos most likely to be affected by noise associated with seismic activity and extractive or associated shipping activities. Intensity: minor, unlikely to be detectable. Consequence: negligible. Confidence: low no data
	Other non-extractive activities	1	6	6	Distribution of community	SouthEast Transition Upper Slope (250-565); Tasmanian Upper Slope (250-565)	3.1	3	2	1	Basslink cables across Bass Strait, gas pipelines. Sessile fauna and benthos most likely to be affected by noise associated with seismic activity or associated shipping activities. Intensity: moderate, shipping lanes occur on upper slope frequently. Consequence: minor. Confidence: low, no data.
	Other anthropogenic activities	1	6	5	Distribution of community	Southern Coastal pelagic 0-200m	3.1	2	2	1	Major shipping routes, tourism, some recreational fishing may occur on the upper slope and interaction with pelagic communities most likely. Intensity: minor activities could impact wide range species Consequence: minor restricted area rare event short term effects not expected to impact communities Confidence: low, no data.

2.3.11 Summary of SICA results

Level 1 (SICA) Document L1.6

Table 2.24. 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 & BYCATCH SPECIES	PROTECTED SPECIES	HABITATS	COMMUNITIES
Capture	Bait collection	0	0	0	0	0
	Fishing	*	2	2	3	2
	Incidental behaviour	0	0	0	0	0
Direct impact without capture	Bait collection	0	0	0	0	0
	Fishing	1	1	2	3	1
	Incidental behaviour	0	0	0	0	0
	Gear loss	1	1	1	2	1
	Anchoring/ mooring	1	1	1	2	1
	Navigation/ steaming	1	1	1	1	1
Addition/ movement of biological material	Translocation of species	1	1	1	1	1
	On board processing	1	1	1	1	1
	Discarding catch	1	1	1	1	1
	Stock enhancement	0	0	0	0	0
	Provisioning	0	0	0	0	0
	Organic waste disposal	1	1	1	1	1
Addition of non-biological material	Debris	1	1	1	1	1
	Chemical pollution	1	1	1	1	1
	Exhaust	1	1	1	1	1
	Gear loss	1	1	1	1	1
	Navigation/ steaming	1	1	1	1	1
	Activity/ presence on water	1	1	1	1	1
Disturb physical processes	Bait collection	0	0	0	0	0
	Fishing	1	1	1	3	2
	Boat launching	0	0	0	0	0
	Anchoring/mooring	1	1	1	1	1
	Navigation/ steaming	1	1	1	1	1
External Impacts	Other fisheries	**3**	**5**	**3**	4	3
	Aquaculture	2	2	1	1	1
	Coastal development	2	**4**	1	2	2
	Other extractive activities	1	1	1	2	1
	Other non-extractive activities	1	1	1	2	2
	Other anthropogenic activities	1	1	1	2	2

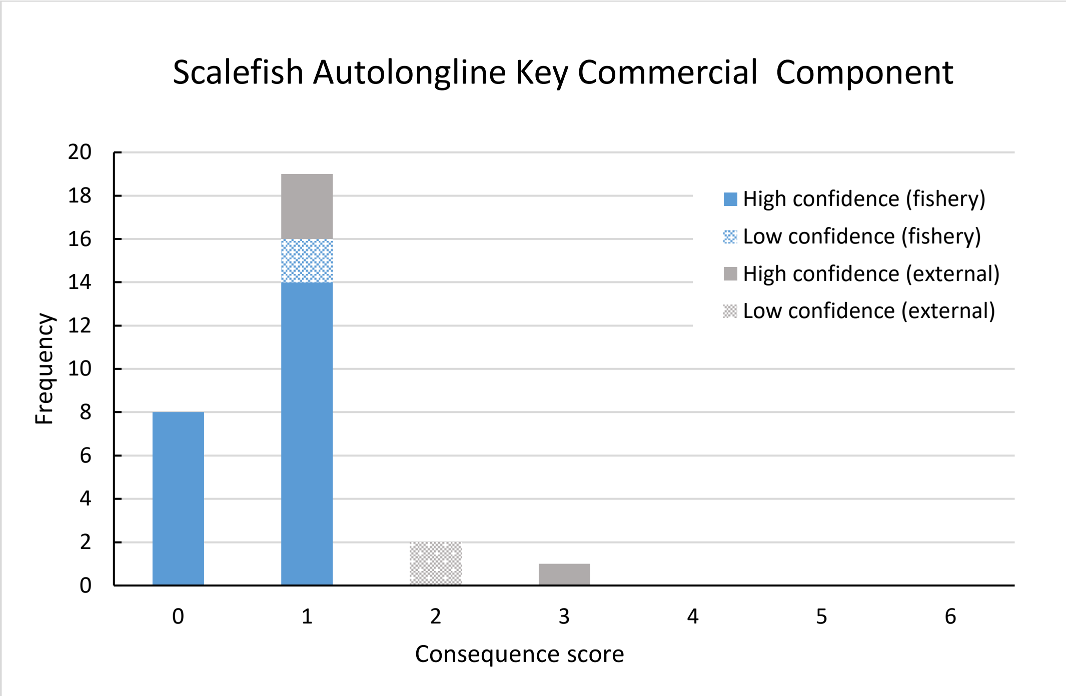


Figure 2.8. Key/secondary commercial species: Frequency of consequence score by high and low confidence.

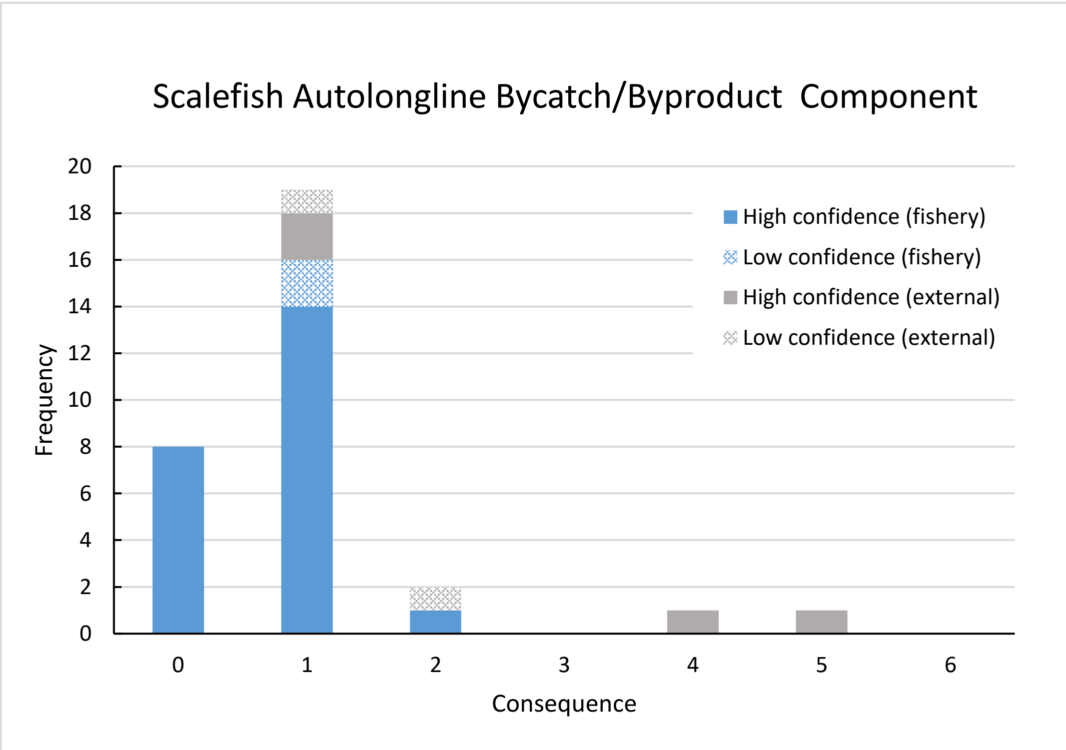


Figure 2.9. Byproduct and bycatch species: Frequency of consequence score by high and low confidence.

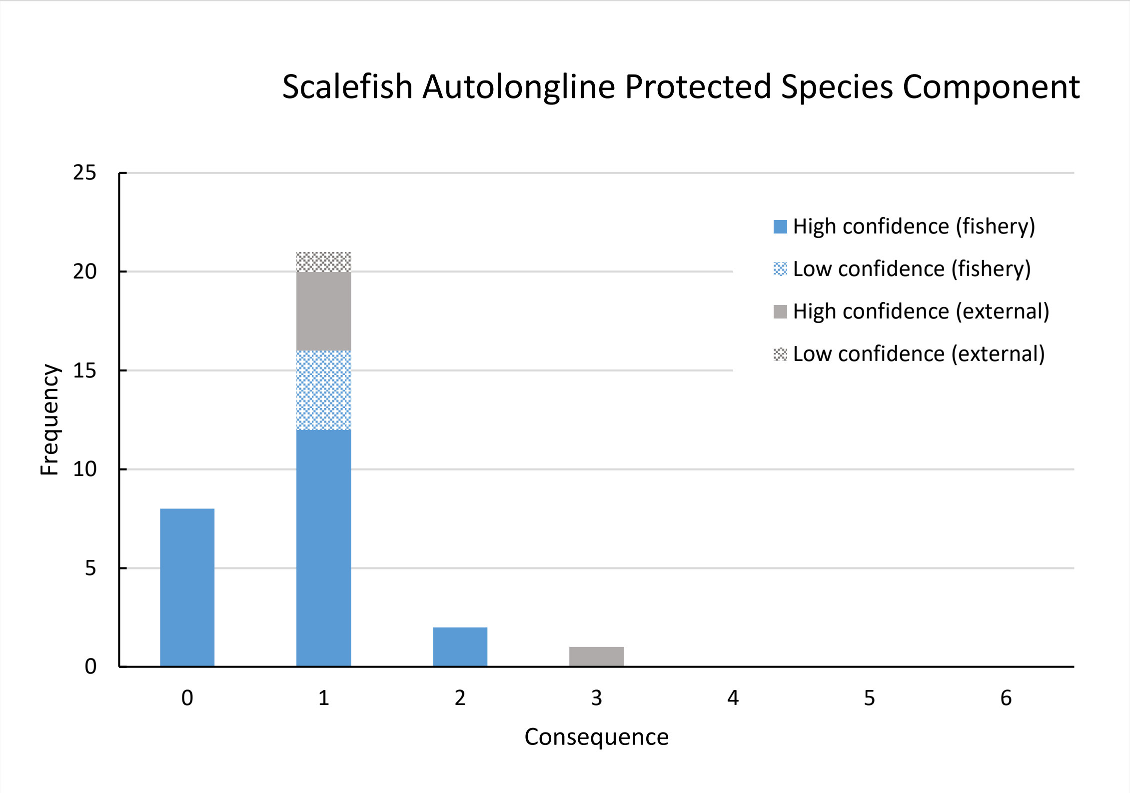


Figure 2.10. Protected species: Frequency of consequence score by high and low confidence.

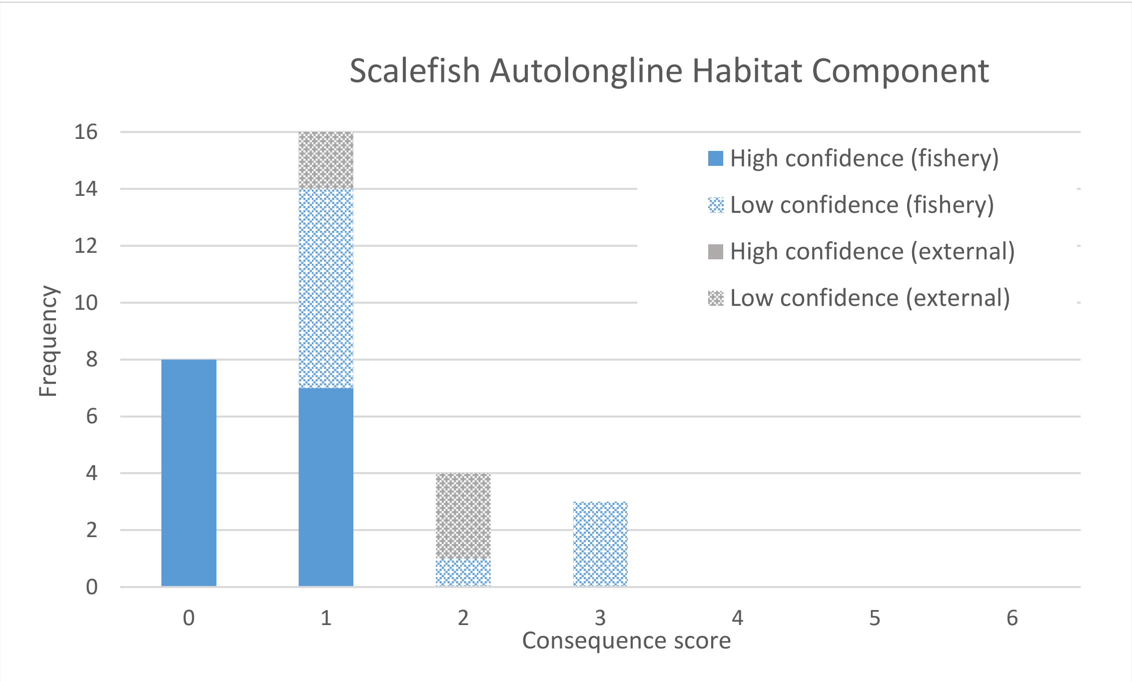


Figure 2.11. Habitats: Frequency of consequence score by high and low confidence.

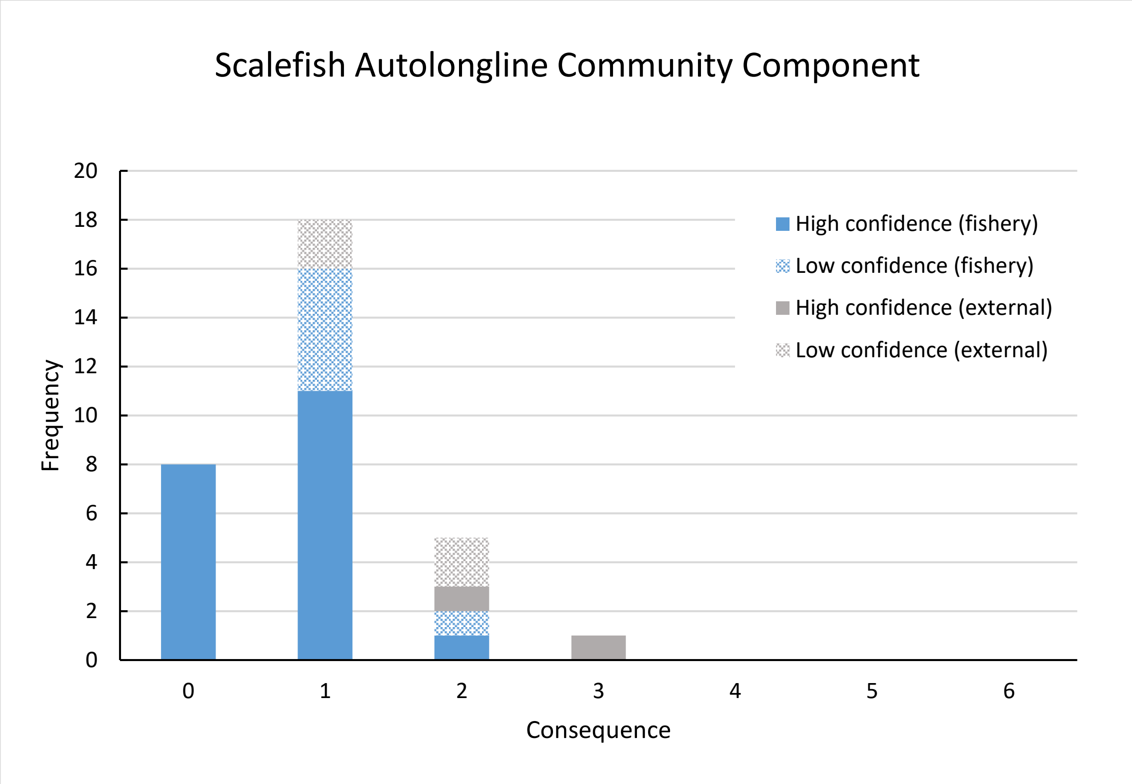


Figure 2.12 Communities: Frequency of consequence score by high and low confidence.

2.3.12 Evaluation/discussion of Level 1

Of the 32 possible activities (hazards), 24 were identified as occurring in the autolongline - 18 internal and 6 external. A total of 124 scenarios were scored – 23 activities for key commercial species (see Table 2.25; 17 internal; 6 external) and 14 (18 internal; 6 external) for each of the other four components.

Four ecological components key commercial, byproduct/bycatch and protected species and communities 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 2.24; Figure 2.8 - Figure 2.12). Those that remaining were:

- Fishing (capture impacts on habitats)
- Fishing (non-capture impacts on habitats)
- Disturbing physical processes (fishing on habitat)
- External hazards (other fisheries on all five components)
- External hazard (coastal development on habitats)

The impacts of fishing represented a moderate risk to habitats largely due to the concentration of effort on the shelf where highly vulnerable fauna occur but the actual impact is unknown.

Pink Ling and Blue eye trevalla are the target species in this fishery but have AFMA stock assessments either at Tier 1 or Tier 4 respectively, and therefore were not assessed from the direct impacts from fishing. There were no other significant risks for these species from other internal activities.

Similarly, for byproduct or bycatch species, if stock assessments existed, they were not further assessed for risk from fishing. Therefore, species such as ribaldo, school and gummy sharks, ocean perch, gemfish, blue grenadier, jackass morwong which were amongst the most important byproduct species landed by weight, were all excluded from further assessment from fishing. We considered Spikey dogfish the most vulnerable species, contributing 0.2% of catch, with an average annual landing of about 1 tonne and very little discarding. Given such a low catch rate, the Spikey dogfish was not found to be at risk.

Historically, longline and trawling fisheries have posed serious threats to seabirds, particularly albatrosses, with hundreds of thousands of seabirds killed each year globally (Baker *et al.* 2007). In Australia, seven longline fisheries including this one, were identified as having significant seabird bycatch problems and AFMA introduced measures that appear to have reduced those risks significantly. Bycatch is now required to be below 0.01 birds per 1000 hooks per season. This interaction rate is considered low by Baker *et al.* (2007) and "negligible" by Collins *et al.* 2021 but it was triggered in consecutive summers up to and including 2016/7 (AFMA 2018: longline_bycatch_and_discarding_workplan_2018-19.pdf (afma.gov.au)). Over the 5-year assessment period, a total of 79 birds were caught and killed from a total of 102 interactions. While on average the rate is low, the annual rates varied and the rule was triggered in consecutive summers up to and including 2016/7 (AFMA 2018: longline_bycatch_and_discarding_workplan_2018-19.pdf (afma.gov.au)) when larger numbers of “petrels, prions and shearwaters” were caught. Observers sighted albatrosses, giant petrels, shearwaters, small petrels and prions in abundance around fishing operations the majority of which were shy albatross and white chinned petrels (AFMA Wildlife Abundance logs).

Shy Albatross was considered most the vulnerable TEP species. They are an endemic species breeding only on 3 Tasmanian islands and population was last estimated at over 14 000 breeding pairs and declining (Phillips *et al.* 2016). Shy albatross has been classified as Endangered under EPBC Act. Atypical among albatrosses, the Shy is a central-placed forager and remains within 300km of their colony (except as juveniles which are subject to mortality from unregulated international fisheries). They feed on discards from vessels accounting for a significant portion of the diet (Brothers *et al.* 1998; Gales 1988) rendering them vulnerable to auto-longlining. Shy albatross accounted for 2 deaths (out of 10 interactions) over the 5 years. White-chinned Petrels are more abundant with a population estimated at >1 million breeding pairs and a global distribution, so were considered as less vulnerable than Shy Albatross although their interaction and mortality rates were higher.

Other TEP species considered were Shortfin Mako and Grey Nurse Shark. About half the catch of Shortfin Mako was retained while the rest were “discarded” which implies that they were alive on release (as per regulations). The total number of makos caught over the assessment period was 89 of which nearly half were released. Three Grey Nurse shark totalling 8 kg were captured and discarded (presumably released alive) and probably juveniles. Both species were considered less vulnerable than birds.

The greatest risk identified from autolonglining was to the habitats. Because the gear is set along the ocean floor and held in place with anchors, lines might cut across substrate removing soft or fragile faunal forms and weights and anchors might crush fauna. This fishery has a low level of reporting of sessile fauna bycatch (observer logs only) but studies of similar fisheries elsewhere suggest that longlines impact vulnerable communities (Muñoz *et al.* 2011). The majority of sets were in the Tasmanian bioregion between 200-700m but effort occurs across the broader spatial scale. Some faunal groups in these depths will take a long time to recover but given the narrow footprint of the gear and intensive, and highly localised fishing effects, compared to trawl, this gear has been considered a moderate risk. However, increased effort in areas of high ecological importance or high risk, could result in a much higher impact in the localised area. There is no data about specific effects of longlines.

Significant external hazards included the cumulative pressure from other fisheries in the region on all five components. External fisheries were rated a severe (5) risk on byproduct/bycatch (the school shark), and moderate (3) on all other components and coastal development was a major risk (4) to bycatch/byproduct (Table 2.24).

2.3.13 Components to be examined at Level 2

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

- Habitat

However, the Habitat component cannot be assessed in this report.

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Glossary of Terms

Assemblage	A subset of the species in the community that can be easily recognized and studied. For example, the set of sharks and rays in a community is the Chondrichthyan 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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